ON Semiconductor®

SG388/D
Rev. 9, May-2007

Selection. Service. Support.
Power Solutions from ON Semiconductor

Master Components Selector Guide

Including Pb-Free Leadframe Options

ON Semiconductor
Master Components Selector Guide

Power Management, Amplifiers and Comparators, Analog Switches, Thyristors, Diodes, Rectifiers, Bipolar Transistors, FETs, Circuit Protection, Clock and Data Management, Interface, and Standard Logic Devices

SG388/D
Rev. 9, May−2007

ON Semiconductor®

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NOTE: The **Tape & Reel Specification** information has been moved to its own publication. Please see ON Semiconductor brochure, BRD8011/D, for information on Tape & Reel.

Power Management

Power Management

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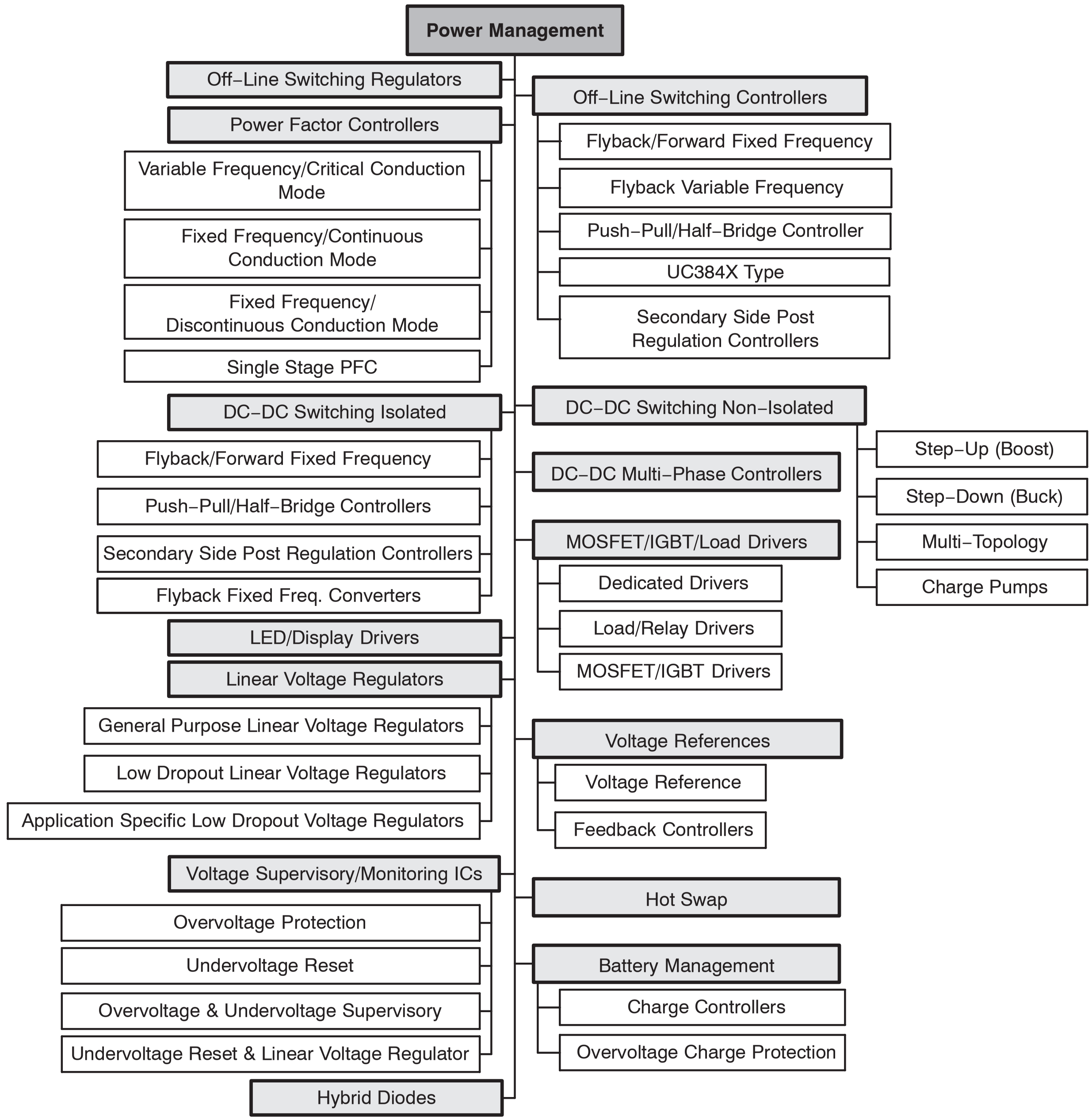
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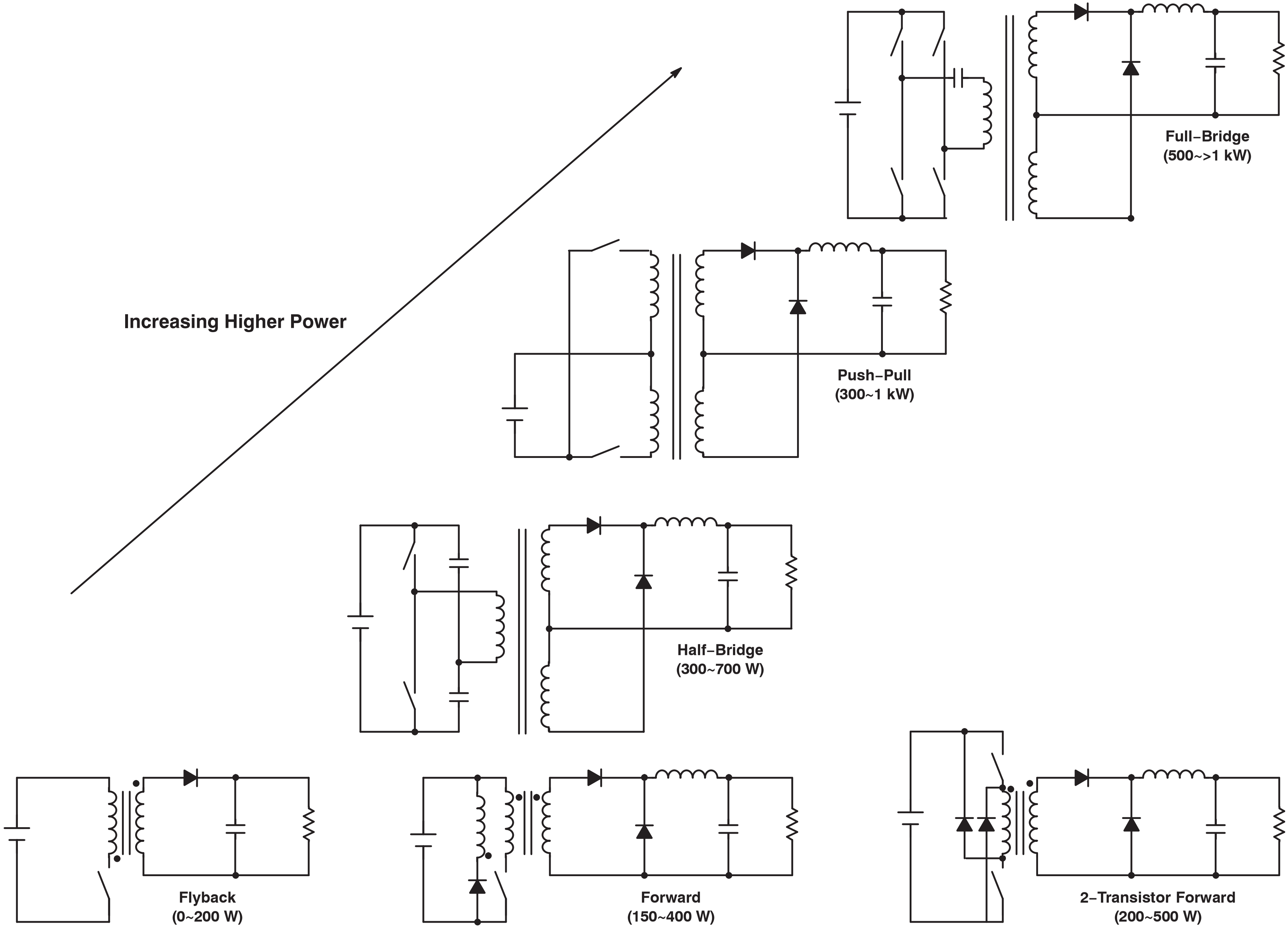
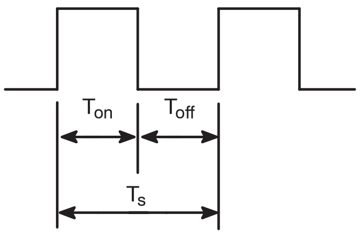
TOPOLOGIES OVERVIEW



TOPOLOGIES OVERVIEW (continued)

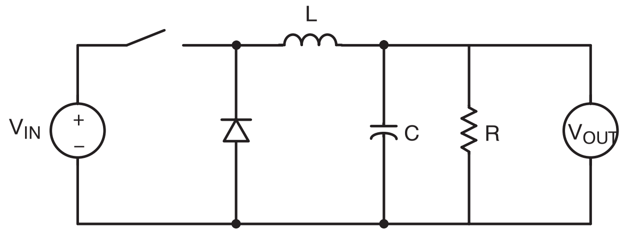


$$\text{Duty Cycle} = D = \frac{T_{on}}{T_{on} + T_{off}} = \frac{T_{on}}{T_s}$$

$$D' = 1 - D = \frac{T_{off}}{T_{on} + T_{off}} = \frac{T_{off}}{T_s}$$

NOTE: In all circuits, equations for V_{OUT} apply to the continuous conduction case.

Buck

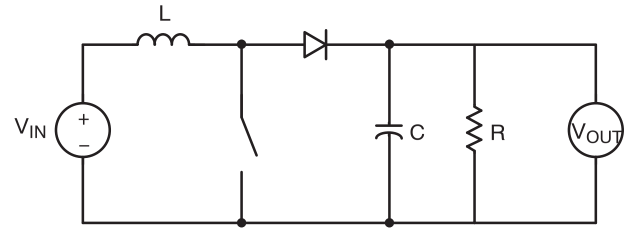


$$V_{out} = DV_{in}$$

Attributes:

Step down only
MOSFET stress = V_{IN}

Boost

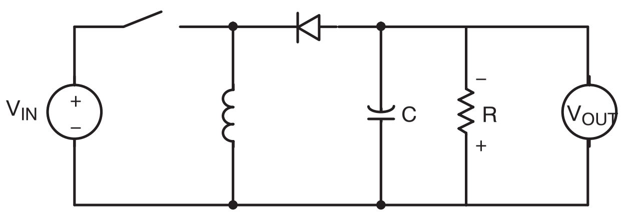


$$V_{out} = \frac{1}{D'} V_{in}$$

Attributes:

Step up only
Used for power factor correction
MOSFET stress = V_{OUT}

Buck–Boost

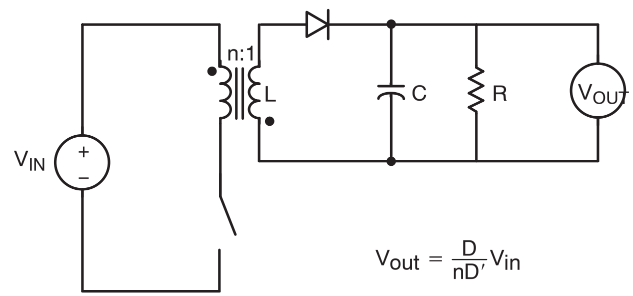


$$V_{out} = \frac{-D}{D'} V_{in}$$

Attributes:

Inverted output
Step up or step down
MOSFET stress = $V_{IN} - V_{OUT}$

Flyback



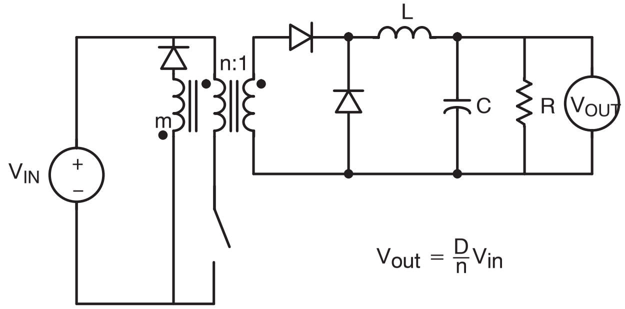
$$V_{out} = \frac{D}{nD'} V_{in}$$

Attributes:

Step up, step down, or inverting
Up to 100 W power level
MOSFET stress > V_{IN}

TOPOLOGIES OVERVIEW (continued)

Forward

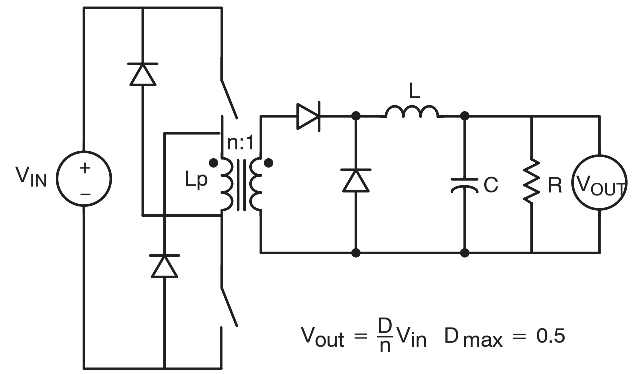


$V_{out} = \frac{D}{n} V_{in}$

Attributes:

Step up, step down, or inverting
More complex transformer
Reset winding is needed (m < n)
Potentially more than 50% duty cycle
Up to 200 W power level
MOSFET stress > V_{IN}

Two–Transistor Forward

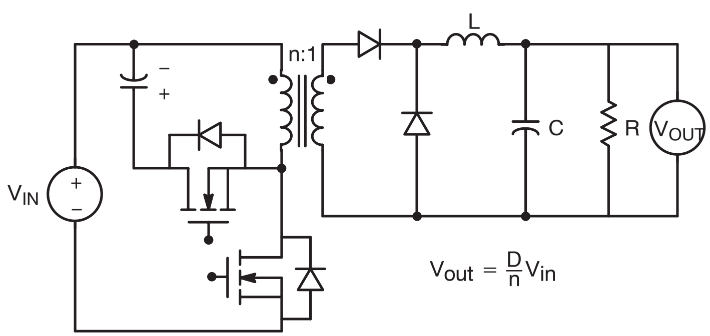


$V_{out} = \frac{D}{n} V_{in}$ $D_{max} = 0.5$

Attributes:

Step up, step down, or inverting
Up to 500 W power level
Simple transformer construction
Primary winding is also the reset winding, so duty cycle < 50%
MOSFET stress = V_{IN}

Active Clamp Forward

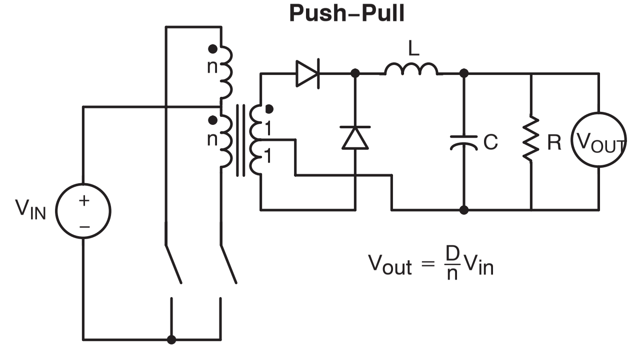


$V_{out} = \frac{D}{n} V_{in}$

Attributes:

Step up, step down, or inverting
Simple transformer construction
Potentially more than 50% duty cycle
Up to 500 W power level
MOSFET stress > V_{IN}

Push–Pull



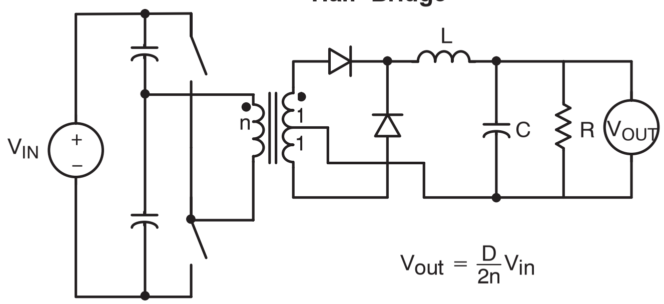
$V_{out} = \frac{D}{n} V_{in}$

Attributes:

Step up, step down, or inverting
Useful for low input voltage applications
Up to 1.0 kW power level
More complex transformer
Duty cycle < 50%
MOSFET stress = 2.0 V_{IN}

TOPOLOGIES OVERVIEW (continued)

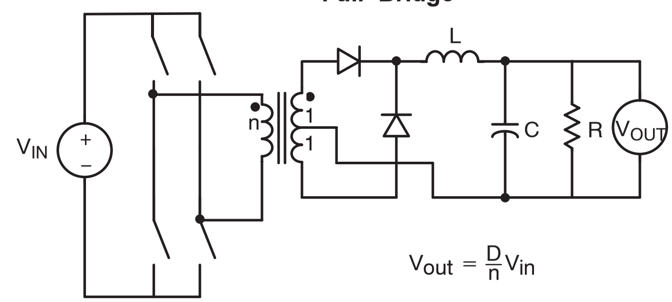
Half–Bridge



$V_{out} = \frac{D}{2n} V_{in}$

Attributes:
Step up, step down, or inverting
Alternative to 2–transistor forward
Up to 500 W power level
Duty cycle < 50%
MOSFET stress = V_{IN}

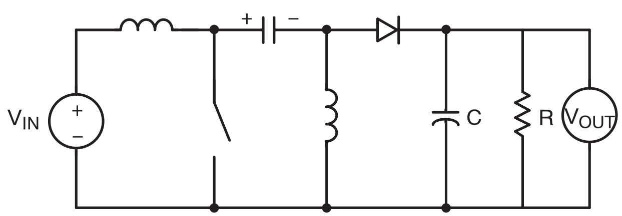
Full–Bridge



$V_{out} = \frac{D}{n} V_{in}$

Attributes:
High power applications
Step up, step down, or inverting
Up to 2.0 kW power level
Duty cycle < 50%
Phase–shifted version possible for high density
Current doubler version useful for very high output currents
MOSFET stress = V_{IN}

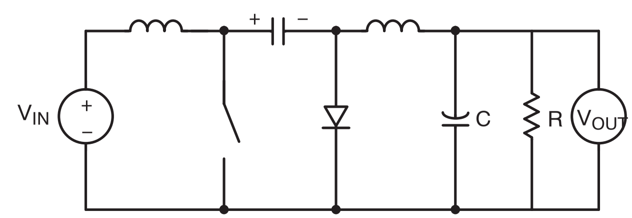
SEPIC (Single–Ended Primary Inductor Converter)



$V_{out} = \frac{D}{D'} V_{in}$

Attributes:
Step up or step down
MOSFET stress = $V_{IN} + V_{OUT}$

C′uk (By Slobodan C′uk)



$V_{out} = -\frac{D}{D'} V_{in}$

Attributes:
Inverted output
Step up or step down
MOSFET stress > V_{IN} and V_{OUT}

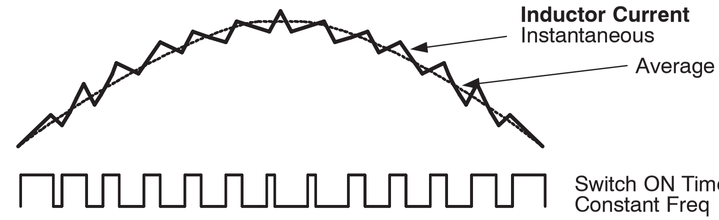
SUMMARY OF CHOOSING A TOPOLOGY

Power	Topology	Conversion	Isolated	Multi–Output	Output Ripple	MOSFET Stress	Isolation
Low	Buck	Step–down	No	No	Small	V_{IN}	Non–Isolated
	Boost	Step–up	No	No	Large	V_{OUT}	
	Buck–Boost	Inverting	No	No	Large	$V_{IN} - V_{OUT}$	
	Cuk	Inverting	No	No	Small	$> V_{IN}, > V_{OUT}$	
	Sepic	Up or Down	No	No	Large	$> V_{IN}, > V_{OUT}$	
	Flyback	Up or Down	Yes	Yes	Large	$< 2\ V_{IN}$	Isolated
	Forward	Up or Down	Yes	Yes	Small	$< 2\ V_{IN}$	
	2–Transistor Forward	Up or Down	Yes	Yes	Small	V_{IN}	
Medium	Half–Bridge	Up or Down	Yes	Yes	Small	V_{IN}	
High	Push–Pull	Up or Down	Yes	Yes	Small	$2\ V_{IN}$	
	Full–Bridge	Up or Down	Yes	Yes	Small	V_{IN}	

POWER FACTOR CORRECTION CONTROL MODES

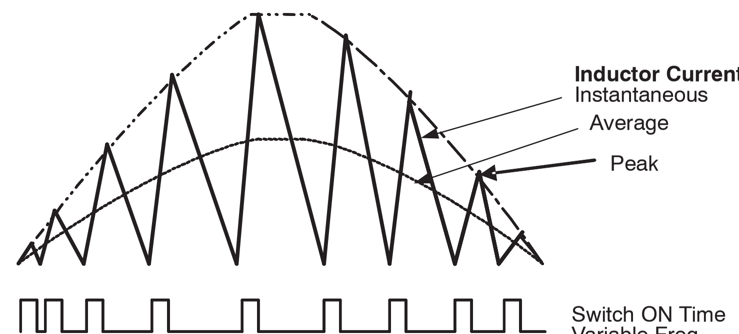
Continuous
Conduction Mode (CCM)
→ e.g. NCP1653

CCM Operation
Power Range 300 W – 1 kW+
+ Constant Frequency
+ Lowest Peak Current
– Turn–off Losses Because of Hard Switching
– Inductor Value is Largest



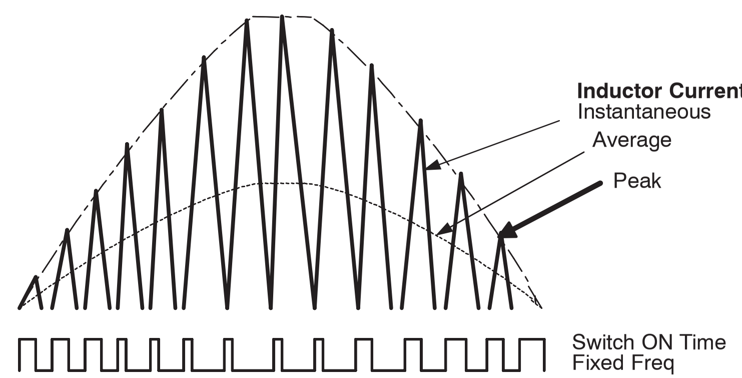
Critical
Conduction Mode (CRM)
→ e.g. NCP1601

CRM operation
Power Range: 75 W – 400 W
+ No Recovery Effect
+ Fewer External Components
– High Peak Current
– Variable Frequency



Discontinuous
Conduction Mode (DCM)
→ e.g. NCP1601

DCM operation
Power Range: 75 W – 400 W
+ Constant Frequency
+ No Recovery Effect
+ Best Stability
– Highest Peak Current



Power Management

Power Factor Controllers

Variable Frequency Critical Conduction Mode

MC33232
MC33260
MC33262, MC34262
MC33368
NCP1601
NCP1606

Fixed Frequency Continous Conduction Mode

NCP1653
NCP1653A
NCP1650
NCP1654*

Fixed Frequency Discontinuous Conduction Mode

NCP1601
NCP1603
NCP1605

Single Stage Power Factor Controllers

NCP1651
NCP1652*

*Coming Soon.

VARIABLE FREQUENCY / CRITICAL CONDUCTION MODE

Web Part	Control Mode	Topology	Freq Cla-mp Freq Max (kHz)	Min HV Startup Limit (V)	Under Voltage Lock–Out (V)	Max Startup Consumption (μA)	Current Limit Detection	Latch	Under Voltage Protection	In–Rush Detec-tion	Enable Capa-bility	Synchro-nization Capability	Max V_{CC} (V)	Drive Capability Source/ Sink (mA)	Temp (°C)	Pack-ages
MC33232	Voltage Mode	Boost	NO	N/A	10 to 16 Typ.	50	Current Sensing	NO	Fixed	NO	NO	NO	16	300 / 300	–20 to +85	SO–8, PDIP–8
MC33260	Voltage Mode	Boost and Follower Boost	NO	N/A	8.5 to 11 Typ.	250	Current Sensing	Fixed	Fixed	YES	YES	NO	16	500 / 500	–40 to +105	SO–8, PDIP–8
MC33262	Current Mode	Boost	NO	N/A	8 to 13 Typ.	400	Current Sensing	Fixed	NO	NO	YES	NO	30	500 / 500	–40 to +105	SO–8, PDIP–8
MC34262	Current Mode	Boost	NO	N/A	8 to 13 Typ.	400	Current Sensing	Fixed	NO	NO	YES	NO	30	500 / 500	0 to +85	SO–8, PDIP–8
MC33368	Current Mode	Boost	YES	YES	8.5 to 13 Typ.	N/A	Current Sensing	Fixed	NO	NO	YES	NO	16	1000 / 1000	–25 to +125	SO–16, PDIP–16
NCP1601	Voltage Mode	Boost	405	N/A	9 to 13.75 Typ. 9 to 10.5 Typ.	40	Negative Current Sensing	Fixed	Fixed	YES	N/A	YES	18	500 / 800	–40 to +125	SO–8, PDIP–8
NCP1606	Voltage Mode	Boost	600	N/A	9.5 to 12 Typ.	50	Current Sensing	Program–mable	Fixed	NO	YES	NO	20	500 / 800	–40 to +125	SO–8, PDIP–8

FIXED FREQUENCY / CONTINUOUS CONDUCTION MODE

Web Part	Control Mode	Topology	Switching Freq (kHZ)	Under Voltage Lock–Out (V)	Max Startup Con–sumption (μA)	Over Power Limitation	Current Limit Detection	Brown Out Protection	Latch	Under (Output) Voltage Prote-ction	In–Rush Detec-tion	Enable Capability	Max V_{CC} (V)	Drive Capability Source/ Sink (mA)	Temp (°C)	Pack–ages
NCP1653	Average Current Mode or Peak Current Mode	Boost and Follower Boost	67	8.7 to 13.25 Typ.	50	YES	Program-mable Negative Current Sensing	NO	Fixed	Fixed	YES	YES	18	1000 / 1000	–40 to +125	SO–8, PDIP–8
NCP1653A	Average Current Mode or Peak Current Mode	Boost and Follower Boost	100	8.7 to 13.25 Typ.	50	YES	Program-mable Negative Current Sensing	NO	Fixed	Fixed	YES	YES	18	1000 / 1000	–40 to +125	SO–8, PDIP–8
NCP1650	Average Current Mode	Boost	Adjustable 25 to 250	10 to 10.5 Typ.	80	NO	Negative Current Sensing	YES	Fixed	NO	NO	YES	20	1500 / 1500	–40 to +125	SO–16
NCP1654*	Average Current Mode	Boost	Adjustable 65 to 266	9 to 13.75 9 to 10.5	150	YES	Current Sensing	YES	YES	YES	YES	YES	25	1500 / 1500	–40 to +125	SO–8 PDIP–8

*Coming Soon.

FIXED FREQUENCY / DISCONTINUOUS CONDUCTION MODE

Web Part	Control Mode	Topology	Switching Freq (kHz)	Min HV Startup Limit (V)	Under Voltage Lock–Out (V)	Startup Con–sumption (μA)	Current Limit Detection	Latch	Under (Output) Voltage Protection	In–Rush Detection	Main PWM Turn On Signal	Enable Capability	Max V_{CC} (V)	Drive Ca-pability Source/ Sink (mA)	Temp (°C)	Pack–ages
NCP1601	Voltage Mode	Boost	58	N/A	9 to 13.75 Typ. 9 to 10.5 Typ.	40	Negative Current Sensing	Fixed	Fixed	YES	N/A	YES	18	500 / 800	–40 to +125	SO–8, PDIP–8
NCP1603	Voltage Mode	Boost	100	30	9 to 13.75 Typ.	80	Negative Current Sensing	Fixed	Fixed	YES	N/A	YES	18	500 / 800	–40 to +125	SO–16

SINGLE STAGE PFC

Web Part	Control Mode	Topology	Switching Freq (kHz)	Standby Mode Technique	Min HV Startup Limit (V)	Under Voltage Lock–Out (V)	Max Startup Con–sumption (mA)	Current Limit Detec-tion	Under (Output) Voltage Protec-tion	Enable Capability	Max V_{CC} (V)	Drive Capa-bility Source/ Sink (mA)	In–Rush Detec-tion	Temp (°C)	Pack–ages
NCP1651	Average Current Mode	Boost	Adjustable 25 to 250	N/A	N/A	9.8 to 10.8 Typ.	5.5	Current Sensing	YES	YES	18	1500 / 1500	N/A	–40 to +125	SO–16
NCP1652*	Average Current Mode	Boost	100	Adj Skip Mode	40	11 to 14 Typ.	100	Current Sensing	YES	YES	20	300 / 700	N/A	–40 to +125	SO–16

*Coming Soon.

Power Management

Off−Line Switching Controllers

Flyback Forward Fixed Frequency

CS51021A	NCP1200
CS51022A	NCP1201
CS51221	NCP1203
CS5124	NCP1212
MC33023	NCP1216A
MC33060A	NCP1216
MC34023	NCP1217A
MC34060A	NCP1217
MC44604	NCP1230
MC44605	NCP1271
MC44608	NCP1280
NCP1603	NCP1282
	NCP1562

Flyback Variable Frequency

MC33067	NCP1308
MC33364	NCP1377
MC34067	NCP1378
NCP1205	NCP1337
NCP1207A	NCP1381
NCP1215A	NCP1351

Push−Pull Half Bridge Controllers

MC33025	TL494
MC34025	TL594
NCV494	NCP1395A
SG3535A	NCP1395B
	NCP1396

UC384X Type

CS2841B	UC3844B
UC2842B	UC3845B
UC2843B	UC3842BV
UC2844B	UC3843BV
UC2845B	UC3844BV
UC3842B	UC3845BV
UC3843B	

Secondary Side Post Regulation Controllers

CS5101
NCP4330

FLYBACK / FORWARD FIXED FREQUENCY

Web Part	Control Mode	Switching Freq (kHz)	Freq Jittering (%)	Standby Mode Technique	Min HV Startup Limit (V)	Dynamic Self Supply (mA)	Undervoltage Lock–Out (V)	Short Circuit Protection	Over Power Compensation	Brown–Out Protection	Latch	Soft–Start (ms)	Max V_{CC} (V)	Drive Capability Source/ Sink (mA)	Temp (°C)	Packages	Additional Features
CS51021A	Current Mode	Adjustable	N/A	NO	NO	NO	YES	YES	NO	NO	Via the Latch / Demag	Adj	20	1,000	–40 to +85	SO–16	Bidirectional Synchronization
CS51022A	Current Mode	Adjustable	N/A	NO	NO	NO	YES	YES	NO	NO	Via the Latch / Demag	Adj	20	1,000	–40 to +85	TSSOP–16, SO–16	100 µA Max Sleep Current
CS51221	Voltage Mode	Adjustable	N/A	NO	NO	NO	YES	YES	NO	NO	Via the Latch / Demag	Adj	15	1,000	–40 to +85	SO–16	
CS5124	Current Mode	400	N/A	NO	NO	NO	YES	YES	NO	NO	NO	Adj	20	200	–40 to +105	SO–8	
MC33023	Voltage or Current	Adjustable	N/A	NO	NO	NO	YES	YES	NO	NO	NO	Adj	30	200	–40 to +105	SO–16 WB	
MC34023	Voltage or Current	Adjustable	N/A	NO	NO	NO	YES	YES	NO	NO	NO	Adj	30	200	0 to +70	PDIP–16	
MC33060A	Voltage Mode	200	N/A	NO	NO	NO	YES	YES	NO	NO	NO	Adj	42	200	–40 to +85	SO–14, PDIP–14	
MC34060A	Voltage Mode	200	N/A	NO	NO	NO	YES	YES	NO	NO	NO	Adj	42	200	0 to +70	SO–14, PDIP–14	
MC44604	Current Mode	250	N/A	YES	14.5	NO	YES	NO	NO	NO	Via the Latch / Demag	Adj	18	750	–25 to +85	PDIP–16	
MC44605	Current Mode	250	N/A	NO	14.5	NO	YES	NO	NO	NO	Via the Latch / Demag	Adj	18	750	–25 to +85	PDIP–16	
MC44608	Voltage Mode	100, 40, 75	N/A	Secondary Reconfig.	50	NO	10 to 13.1 Typ.	NO	YES	NO	Via the Latch / Demag	NO	16	800 / 800	–25 to +85	PDIP–8	
NCP1200	Current Mode	100, 40, 60	±0.7	Adj Skip Mode	30	4	N/A	When DSS is used	NO	NO	NO	NO	16	250 / 250	–25 to +125	SO–8, PDIP–8	
NCP1201	Current Mode	100, 60	0.82	Adj Skip Mode	30	5.3	10.5 to 12.5 Typ.	When DSS is used	NO	YES	NO	NO	16	250 / 250	–25 to +125	SO–8, PDIP–8	
NCP1203	Current Mode	100, 40, 60	N/A	Adj Skip Mode	30	NO	7.8 to 12.8 Typ.	NO	NO	NO	NO	NO	16	250	–40 to +125	SO–8, PDIP–8	
NCP1212	Current Mode	Adj	N/A	Adj Skip Mode	NO	NO	10 to 25 Typ.	YES	NO	YES	Via the Latch / Demag	NO	28	100 / 300	–25 to +125	SO–8, PDIP–8	
NCP1216A	Current Mode	133, 100, 65	±4	Adj Skip Mode	30	8	NO	When DSS is used	NO	NO	NO	1.00	16	500	0 to +125	SO–8, PDIP–7	Limited Duty Cycle to 50%
NCP1216	Current Mode	133, 100, 65	±4	Adj Skip Mode	30	8	NO	When DSS is used	NO	NO	NO	NO	16	500	0 to +125	SO–8, PDIP–7	

FLYBACK / FORWARD FIXED FREQUENCY (continued)

Web Part	Con-trol Mode	Switching Freq (kHz)	Freq Jittering (%)	Standby Mode Tech-nique	Min HV Startup Limit (V)	Dynamic Self Supply (mA)	Under-voltage Lock–Out (V)	Short Circuit Protec-tion	Over Power Com-pensa-tion	Brown–Out Protec-tion	Latch	Soft–Start (ms)	Max V_{CC} (V)	Drive Capa-bility Source/ Sink (mA)	Temp (°C)	Packages	Additional Features
NCP1217A	Current Mode	133, 100, 65	N/A	Adj Skip Mode	30	NO	7.6 to 12.8 Typ.	NO	NO	NO	Via the Latch / Demag	1.00	16	500	0 to +125	SO–8, PDIP–7	Limited Du-ty–Cycle to 50%
NCP1217	Current Mode	133, 100, 65	N/A	Adj Skip Mode	30	NO	7.6 to 12.8 Typ.	NO	NO	NO	Via the Latch / Demag	NO	16	500	0 to +125	SO–8, PDIP–7	
NCP1230	Current Mode	133, 100, 65	±6.4	Adj Skip Mode	20	NO	7.7 to 12.6 Typ.	YES	NO	NO	Via the Latch / Demag	2.50	18	500 / 800	–40 to +125	SO–8, PDIP–7	
NCP1280	Voltage Mode	Adjustable	NO	NO	25	13.8	YES	NO	NO	NO	Via the Latch / Demag	Adj	16	95 / 200	–40 to +125	SO–16	
NCP1271	Current Mode	65, 100	± 7.5	Adj Skip Mode with Transient Load Detection	20	NO	12.6 to 20 Typ.	YES	NO	NO	Via the Latch / Demag	4	20	500 / 800	–40 to +125	SO–7	
NCP1282	Voltage Mode	230	N/A	NO	NO	NO	8.5 to 11 Typ.	NO	NO	NO	Line UVOV detectors	Adj	20	1000 / 2000	–40 to +125	SO–16	HV Startup up to 500V
NCP1603	Voltage Mode	100	±6.4	Adj Skip Mode	30	NO	9 to 10.5 Typ.	YES	NO	NO	Via the Latch / Demag	2.5	18	100 / 100	–40 to +125	SO–16	
NCP1562	Voltage Mode	230	N/A	NO	NO	NO	7 to 10.3 Typ.	NO	NO	NO	Line UVOV detectors	Adj	20	1000 / 2000	–40 to +125	SO–16	HV Startup up to 100V

FLYBACK VARIABLE FREQUENCY

Web Part	Control Mode	Freq Clamp Max On Time (μs)	Freq Clamp Min Off Time (μs)	Standby Mode Technique	Min HV Start–Up Limit (V)	Dynamic Self Supply (mA)	Undervoltage Lock–Out (V)	Short Circuit Protection	Over Power Compensation	Brown–Out Protection	Latch	Soft–Start (ms)	Max V_{CC} (V)	Drive Capability Source/Sink (mA)	Temp (°C)	Packages
MC33067	Voltage Mode	Adj	Adj	NO	NO	NO	9 to 16 Typ.	YES	NO	NO	NO	Adj	20	200 / 200	–40 to +85	SO–16, PDIP–16
MC34067	Voltage Mode	Adj	Adj	NO	NO	NO	9 to 16 Typ.	YES	NO	NO	NO	Adj	20	200 / 200	0 to +70	SO–16, PDIP–16
MC33364	Current Mode	NO	6.9	Freq Clamp	40	NO	7.6 to 15 Typ.	NO	NO	NO	NO	NO	16	220 / 600	–25 to +125	SO–8, SO–16
NCP1205	Current Mode	NO	NO	Frequency Foldback	40	NO	7.2 to 15 Typ.	YES	NO	NO	Adj	NO	30	300 / 300	–25 to +125	SO–16, PDIP–14, PDIP–8
NCP1207A	Current Mode	NO	8	Adj Skip Mode	40	7	9.8 to 10.4 Typ.	YES	NO	NO	Via the Latch / Demag	1	16	500 / 500	–40 to +125	SO–8, PDIP–8
NCP1215A	Quasi Fixed Ton	Fixed Ton	Variable Toff	Frequency Foldback	NO	NO	9 to 15 Typ.	NO	NO	NO	NO	NO	18	30 / 30	0 to +105	SO–8, TSOP–6
NCP1308	Current Mode	NO	10	Adj Skip Mode	40	7	9.8 to 12 Typ.	YES	NO	NO	Fixed on the V_{CC}	1	16	500 / 500	0 to +125	SO–8
NCP1377	Current Mode	NO	3, 8	Adj Skip Mode	40	NO	7.6 to 12.8 Typ.	NO	NO	NO	Via the Latch / Demag	1	16	500 / 500	0 to +125	SO–7, PDIP–7
NCP1378	Current Mode	NO	8	Adj Skip Mode	40	NO	7.6 to 8.5 Typ.	NO	NO	NO	Via the Latch / Demag	1	16	500 / 500	0 to +125	SO–8, PDIP–7
NCP1337	Current Mode	67	35	Soft–Ripple Mode	55	9.5	10 to 12 Typ.	YES	YES	YES	Via the Latch / Demag	4	20	500 / 500	0 to +125	SO–8, PDIP–7
NCP1381	Current Mode	45	8	Adj Skip Mode	NO	NO	10 to 15 Typ.	YES	YES	YES	Via the Latch / Demag	5	20	500 / 800	0 to +125	SO–14
NCP1351	Current Mode	Fixed Ton	Variable Toff	Adj Skip Mode	NO	NO	8.5 to 15 Typ.	YES	NO	NO	NO	NO	20	300 / 150	0 to +125	SO–8, PDIP–8

PUSH–PULL / HALF–BRIDGE CONTROLLERS

Web Part	Control Mode	Switching Freq (kHz)	Standby Mode Technique	Max Duty Cycle (%)	Under-voltage Lock–Out (V)	Short Circuit Protec-tion	Latch	Internal Ref Voltage (V)	Enable Capa-bility	Soft–Start (ms)	Max V_{CC} (V)	Drive Capability Source/ Sink (mA)	Temp (°C)	Packages	Additional Features
MC33025	Voltage & Current mode	1000	NO	45	9.2 & 4.2	YES	NO	5.1	NO	Adj	30	200 / 200	−40 to +105	SO−16, PDIP−16	
MC34025	Voltage & Current mode	1000	NO	45	9.2 & 4.2	YES	NO	5.1	NO	Adj	30	200 / 200	0 to +70	SO−16, PDIP−16	
NCV494	Voltage	200	NO	48	6.43	NO	NO	5	NO	Ad	40	500 / 500	−40 to +125	SO−16	Auto qualified
TL494	Voltage	200	NO	48	6.43	NO	NO	5	NO	Adj	40	500 / 500	−40 to +125 0 to +70 −40 to +85	SO−16, PDIP−16	
SG3525A	Voltage	400	NO	49	7	NO	NO	5.1	YES	Adj	40	400 / 400	0 to +70	SO−16, PDIP−16	
TL594	Voltage	300	NO	50	5.2	NO	NO	5	NO	Adj	42	500 / 500	−40 to +85	SO−16, PDIP−16, TSSOP−16	
NCP1395A	Voltage	1000	Adj Skip Mode	52	9.3	NO	YES	2	YES	Adj	20	180/180	0 to +125	SO−16, PDIP−16	Consumer Applications
NCP1395B	Voltage	1000	Adj Skip Mode	52	9.3	NO	YES	2	YES	Adj	20	180/180	0 to +125	SO−16, PDIP−16	Industrial Applications

UC384X TYPE

Web Part	Control Mode	Switching Freq (kHz)	Standby Mode Technique	Max Duty Cycle (%)	Undervoltage Lock–out (V)	Short Circuit Protection	Latch	Internal Ref Voltage (V)	Soft–Start (ms)	Max V_{CC} (V)	Drive Capability Source/Sink (mA)	Temp (°C)	Packages
CS2841B	Current Mode	52	NO	50	7.4 to 8 Typ.	YES	N/A	5	NO	40	200 / 200	−40 to +85	SO−14, PDIP−8
UC2842B	Current Mode	52	NO	96	10 to 16 Typ.	YES	N/A	5	NO	30	200 / 200	−25 to +85	SO−14, SO−8, PDIP−8
UC2843B	Current Mode	52	NO	96	7.6 to 8.5 Typ.	YES	N/A	5	NO	30	200 / 200	−25 to +85	SO−14, SO−8, PDIP−8
UC2844B	Current Mode	52	NO	48	10 to 16 Typ.	YES	N/A	5	NO	30	200 / 200	−25 to +85	SO−14, SO−8. PDIP−8
UC2845B	Current Mode	52	NO	48	7.6 to 8.5 Typ.	YES	N/A	5	NO	30	200 / 200	−25 to +85	SO−14, SO−8, PDIP−8
UC3842B	Current Mode	52	NO	96	10 to 16 Typ.	YES	N/A	5	NO	30	200 / 200	0 to +70	SO−14, SO−8, PDIP−8
UC3843B	Current Mode	52	NO	96	7.6 to 8.5 Typ.	YES	N/A	5	NO	30	200 / 200	0 to +70	SO−14, SO−8, PDIP−8
UC3844B	Current Mode	52	NO	50	10 to 16 Typ.	YES	N/A	5	NO	25	200 / 200	0 to +70	SO−14, SO−8, PDIP−8
UC3845B	Current Mode	52	NO	50	7.6 to 8.5 Typ.	YES	N/A	5	NO	25	200 / 200	0 to +70	SO−14, SO−8, PDIP−8
UC3842BV	Current Mode	52	NO	96	10 to 16 Typ.	YES	N/A	5	YES	30	200 / 200	−40 to +105	SO−14, SO−8
UC3843BV	Current Mode	52	NO	96	7.6 to 8.5 Typ.	YES	N/A	5	YES	30	200 / 200	−40 to +105	SO−14, SO−8
UC3844BV	Current Mode	52	NO	50	10 to 16 Typ.	YES	N/A	5	YES	25	200 / 200	−40 to +105	SO−14, SO−8
UC3845BV	Current Mode	52	NO	50	7.6 to 8.5 Typ.	YES	N/A	5	YES	25	200 / 200	−40 to +105	SO−14, SO−8

SECONDARY SIDE POST REGULATION CONTROLLERS

IC Operating Voltage	Converter Input Voltage	Output Voltage	Output Driver	Freq.	Temp. (T_A)	Package	Part No.	Features
ULVO: 7.0/8.0 V Max: 45 V	(V_{gate} max: 75 V)	(V_{REF} = 2.0 V)	1.5 A	SYNC	−40 to +85°C	SO−16L	CS5101EDW16	• Voltage mode • Configured as either buck or boost with external NFET • Externally programmable overcurrent protection • 5.0 V 2% reference pin
						DIP−14	CS5101EN14	

SYNCHRONOUS BUCK POST REGULATOR CONTROLLER – FORWARD TOPOLOGIES

Temp. (T_J)	Package	Part No.
−40 to +125°C	SO−8	NCP4330DR2

Power Management

Off−Line Switching Regulators

MC33363	NCP1050
NCP1000	NCP1051
NCP1001	NCP1052
NCP1002	NCP1053
NCP1010	NCP1054
NCP1011	NCP1055
NCP1012	NCP1027
NCP1013	NCP1028
NCP1014	

OFF–LINE SWITCHING REGULATORS

Web Part	Control Mode	Switching Freq (kHz)	Freq Jittering (%)	Standby Mode Tech-nique	$R_{DS(on)}$ Typ (Ω)	Max Break-down Voltage (V)	Max Internal Current Set Point (mA)	Min HV Startup Limit (V)	Dynamic Self Supply (mA)	Under-voltage Lock–out (V)	Short Circuit Protec-tion	Over Power Com-pensa-tion	Brown –Out Protec-tion	Latch	Temp (°C)	Pack-ages	Com ments
MC33363	Voltage Mode	285	N/A	NO	14	700	400	9	NO	9.5 to 15.2 Typ.	NO	NO	NO	NO	–25 to +150	SO–16, PDIP–16	
NCP1000	Voltage Mode	100	N/A	Skip Mode	18	700	500	20	NO	7.5 to 8.5 Typ.	NO	NO	NO	NO	–40 to +125	PDIP–8	
NCP1001	Voltage Mode	100	N/A	Skip Mode	9	700	1000	20	NO	7.5 to 8.5 Typ.	NO	NO	NO	NO	–40 to +125	PDIP–8	
NCP1002	Voltage Mode	100	N/A	Skip Mode	6	700	1500	20	NO	7.5 to 8.5 Typ.	NO	NO	NO	NO	–40 to +125	PDIP–8	
NCP1010	Current Mode	65, 100, 130	± 3.3	Skip Mode	22	700	100	30	8.5	7.5 to 8.5 Typ.	When DSS is used	NO	NO	YES	0 to +125	PDIP–7, SOT–223	
NCP1011	Current Mode	65, 100, 130	± 3.3	Skip Mode	22	700	250, 450	30	8.5	7.5 to 8.5 Typ.	When DSS is used	NO	NO	YES	0 to +125	PDIP–7, PDIP–7 SMT. SOT–223	
NCP1012	Current Mode	65, 100, 130	±3.3	Skip Mode	11	700	250	30	8	7.5 to 8.5 Typ.	When DSS is used	NO	NO	YES	0 to +125	PDIP–7, PDIP–7 SMT, SOT–223	
NCP1013	Current Mode	65, 100, 130	±3.3	Skip Mode	11	700	350	30	8	7.5 to 8.5 Typ.	When DSS is used	NO	NO	YES	0 to +125	PDIP–7, SOT–223	
NCP1014	Current Mode	65, 100, 130	±3.3	Skip Mode	11	700	450	30	8	7.5 to 8.5 Typ.	When DSS is used	NO	NO	YES	0 to +125	PDIP–7, PDIP–7 SMT. SOT–223	
NCP1050	Gated Oscillator	45.5, 103, 140	±5.0	Skip Mode	30	700	100	20	6.3	7.5 to 8.5 Typ.	YES	NO	NO	YES	–40 to +150	PDIP–7, SOT–223	
NCP1051	Gated Oscillator	45.5, 103, 140	±5.0	Skip Mode	30	700	200	20	6.3	7.5 to 8.5 Typ.	YES	NO	NO	YES	–40 to +150	PDIP–7, SOT–223	
NCP1052	Gated Oscillator	45.5, 103, 140	±5.0	Skip Mode	30	700	300	20	6.3	7.5 to 8.5 Typ.	YES	NO	NO	YES	–40 to +150	PDIP–7, SOT–223	
NCP1053	Gated Oscillator	45.5, 103, 140	±5.0	Skip Mode	15	700	400	20	6.3	7.5 to 8.5 Typ.	YES	NO	NO	YES	–40 to +150	PDIP–7, SOT–223	
NCP1054	Gated Oscillator	45.5, 103, 140	±5.0	Skip Mode	15	700	530	20	6.3	7.5 to 8.5 Typ.	YES	NO	NO	YES	–40 to +150	PDIP–7, SOT–223	
NCP1055	Gated Oscillator	45.5, 103, 140	±5.0	Skip Mode	15	700	680	20	6.3	7.5 to 8.5 Typ.	YES	NO	NO	YES	–40 to +150	PDIP–7, SOT–223	
NCP1027	Current Mode	65,100	±6.0	Skip Mode	5.6	700	800	30	N/A	7.2 to 8.5 Typ.	YES	YES	YES	YES	0 to +125	PDIP–7	
NCP1028	Current Mode	65,100	±6.0	Skip Mode	5.6	700	800	30	N/A	7.2 to 8.5 Typ.	YES	YES	YES	YES	0 to +125	PDIP–7	No OVP on V_{CC} Pin

Power Management

DC−DC Switching Non−Isolated

- **Buck Switcher (Step−Down)**
  - Synchronous Rectification: NCP1595A, NCP1501, NCP1526, NCP1510, NCP1521, NCP1522, NCP1523, NCP1519*, NCP1529*
  - Non−Synchronous Rectification: CS51411, CS51412, CS51413, CS51414, NCV51411, LM2574, LM2575, LM2576, NCP1500, NCP1530
- **Charge Pumps**: MAX828, NCP5603, MAX829, MAX1720, NCP1729
- **Buck Controller (Step−Down)**
  - Synchronous Rectification: NCP5211, NCP1580, NCP1582/A*, NCP1583*, NCP1571, NCP1575, NCP5422, NCP5423, NCP5424, NCP5425
  - Non−Synchronous Rectification: CS51031, CS51033, SG3525, NCP1550
- **Boost Switcher (Step−Up)**
  - Synchronous: NCP1410, NCP1423, NCP1421, NCP1422, NCP5030*
  - Non−Synchronous: NCP1403, NCP1406, NCP1400, NCP1402, CS5171, CS5172, CS5173, CS5174
- **Multi−Topology**: MC34063, MC33063, NCV33063, NCP3063, CS5171, CS5172, CS5173, CS5174, MC34166, MC33166, MC34163, NCP3163, MC34167, MC33167
- **Boost Controller (Step−Up)**: NCP1450

*Coming Soon.

BUCK SWITCHING REGULATOR – (INTERNAL SWITCH)

Device	V_{IN} (V) Min	V_{IN} (V) Max	V_{OUT} Options (Adj Range)	I_{OUT} (A)	F_{SW} (kHz)	Mode	Enable	Soft–Start	Comments	Temp Range (°C)	Package
CS51411	4.5	40	Down to 1.276 V	1.5 A	260	Voltage	√	√	Sync capability;Pin–Compatible with LT1375 and LT1376	–40 to +85	SO–8 / DFN–8
CS51412	4.5	40	Down to 1.276 V	1.5 A	260	Voltage	√	√	External Bias; Pin–Compatible with LT1375 and LT1376	–40 to +85	SO–8 / DFN–8
CS51413	4.5	40	Down to 1.276 V	1.5 A	520	Voltage	√	√	Sync capability; Pin–Compatible with LT1375 and LT1376	–40 to +85	SO–8 / DFN–8
CS51414	4.5	40	Down to 1.276 V	1.5 A	520	Voltage	√	√	External Bias; Pin–Compatible with LT1375 and LT1376	–40 to +85	SO–8 / DFN–8
NCV51411	4.5	40	Down to 1.276 V	1.5 A	260	Voltage	√	√	Automotive version	–40 to +125	SO–8 / DFN–8
LM2574	4.75	40	3.3,5,12,15, Adj(1.23 to 37 V)	0.5 A	52	Voltage	√		No external compensation required	–40 to +125	D2PAK / TO–220
LM2575	4.75	40	3.3,5,12,15, Adj(1.23 to 37 V)	1.0 A	52	Voltage	√		No external compensation required	–40 to +125	D2PAK / TO–220
LM2576	4.75	40	3.3,5,12,15, Adj(1.23 to 37 V)	3.0 A	52	Voltage	√		No external compensation required	–40 to +125	D2PAK / TO–220
NCP1595A	4.0	5.5	Down to 0.8 V	1.5 A	1200	Current	√	√	Internal compensation; Synchronous Rectification	0 to +85	DFN–6
MC34166	7.5	40	Down to 5.0 V	3.0 A	72	Voltage			Cycle–by–Cycle current limit	0 to +70	D2PAK / TO–220
MC33166	7.5	40	Down to 5.0 V	3.0 A	72	Voltage			Internal thermal shutdown	–40 to +85	D2PAK / TO–220
MC33167	7.0	40	Down to 5.0 V	5.0 A	72	Voltage			Large 5.0 A output capability	–40 to +85	D2PAK / TO–220
MC34167	7.0	40	Down to 5.0 V	5.0 A	72	Voltage			Standby Mode < 36 μA	0 to +70	D2PAK / TO–220
NCP1500	2.7	5.4	1.0, 1.3, 1.5, 1.8 V	300 mA	270 – 630	Voltage			PWM or Linear mode. Can be programmed to work in Linear LDO Regulator mode. External Sync.	–40 to +85	Micro8™
NCP1501	2.7	5.2	1.05, 1.35, 1.57, 1.8 V	300 mA	450–1000	Voltage			Synchronous Rectification. Can be programmed to work in Linear LDO Regulator mode. External Sync.	–40 to +85	Micro8™
NCP1526	2.7	5.5	PWM – 1.2V ; LDO – 2.8 V Other Options Available	PWM: 400 mA LDO: 150 mA	3000	Voltage	√	√	Dual output: PWM + LDO. Synchronous Rectification	–40 to +85	Thin DFN–10
NCP1510	2.5	5.2	1.05, 1.35, 1.57, 1.8 V	500 mA	450–1000	Voltage	√	√	Synchronous Rectification. Can be programmed to work in Low Iq (14 μA) Pulsed mode at light loads. External Sync.	–40 to +85	Micro–Bump–9
NCP1530	2.7	5	2.5, 2.7, 3.0, 3.3 V	600 mA	600 – 1200	Voltage	√	√	Automatic PWM/PFM mode. External Synchronization up to 1.2 MHz	–40 to +85	Micro8™
NCP1521	2.7	5.5	0.9 – 3.3 V	600 mA	1500	Voltage	√	√	Auto PWM/ PFM mode. Synchronous Rectification	–40 to +85	Thin SOT–23–5, Thin DFN–6
NCP1522	2.7	5.5	0.9 – 3.3 V	600 mA	3000	Voltage	√	√	Auto PWM/ PFM mode. Synchronous Rectification	–40 to +85	Thin SOT–23–5
NCP1523	2.7	5.5	0.9 – 3.3 V	600 mA	3000	Voltage	√	√	Auto PWM/ PFM mode. Synchronous Rectification	–40 to +85	Micro–Bump–8
NCP1519*	2.7	5.5	1.2,1.5,1.8, Adj(0.9–3.3 V)	600 mA	1700	Voltage	√	√	Auto PWM/ PFM mode. Synchronous Rectification	–40 to +85	Thin SOT–23–5
NCP1529*	2.7	5.5	1.2, 1.5, 1.8, Adj(0.9–3.3 V)	1 A	1700	Voltage	√	√	Auto PWM/ PFM mode. Synchronous Rectification	–40 to +85	Thin SOT–23–5

*Coming Soon.

BOOST SWITCHING REGULATOR – (INTERNAL SWITCH)

Device	V_{IN} (V) Min	V_{IN} (V) Max	V_{OUT} Options (Adj Range)	I_{OUT} (A)	F_{SW} (kHz)	Mode	Enable	Soft–Start	Comments	Temp Range (°C)	Package
NCP1403	1.2	5.5	up to 15 V	50 mA	300	Voltage	√	√	PFM mode	–40 to +85	Thin SOT–23–5
NCP1406	1.4	5.5	up to 25 V	50 mA	1000	Voltage	√	√	PFM mode	–40 to +85	Thin SOT–23–5
NCP1400	0.8	5.5	1.8–5.0 V	100 mA	180	Voltage	√	√	PWM mode	–40 to +85	Thin SOT–23–5
NCP1402	0.8	5.5	1.8–5.0 V	200 mA	180	Voltage	√	√	PFM mode	–40 to +85	Thin SOT–23–5
NCP1410	1.0	5.5	1.5–5.5 V	250 mA	600	Voltage	√		PFM mode. Synchronous Rectification, Low–battery detect	–40 to +85	Micro8™
NCP1423	0.8	5.5	1.8–5.5 V	400 mA	600	Voltage	√	√	PFM mode. Synchronous Rectification, True–cutoff, Low–battery detect	–40 to +85	Micro–10
NCP1421	1.0	5.0	1.5–5.0 V	600 mA	1200	Voltage	√	√	PFM Sync–rect, True–cutoff, Low–battery detect	–40 to +85	Micro8™
NCP1422	1.0	5.0	1.5–5.0 V	800 mA	1200	Voltage	√	√	PFM mode. Synchronous Rectification, True–cutoff, Low–battery detect	–40 to +85	DFN–10
NCP5030*	2.7	5.5	2.2–5.5 V	1.2 A	1000	Current	√	√	Buck/ Boost Converter – can supply either regulated current or regulated output voltage	–40 to +85	DFN–12
CS5171	2.7	30	1.276 to 40 V	1.5 A	280	Current		√	LT1372/1373 Compatible	–40 to +85	SO–8
CS5172	2.7	30	–2.5 to 40 V	1.5 A	280	Current		√	Flyback & SEPIC	–40 to +85	SO–8
CS5173	2.7	30	1.276 to 40 V	1.5 A	560	Current		√	Easy External Synchronization	–40 to +85	SO–8
CS5174	2.7	30	–2.5 to 40 V	1.5 A	560	Current		√	Negative feedback polarity	–40 to +85	SO–8

*Coming Soon.

MULTI–TOPOLOGY (STEP–UP, STEP–DOWN, INVERTING) SWITCHING REGULATOR – (INTERNAL SWITCH)

Device	V_{IN} (V) Min	V_{IN} (V) Max	V_{OUT} Options (Adj Range)	I_{OUT} (A)	F_{SW} (kHz)	Enable	Mode	Step–Up	Step–Down	Step–Up/ Step–Down	Inv	Comments	Temp Range (°C)	Package
MC34063	3.0	40	Down to 2.5 V	1.5	up to 100	√	Hysteresis	√	√	√	√	Simple and flexible regulator	0 to +70	SO–8 / PDIP–8
MC33063	3.0	40	Down to 2.5 V	1.5	up to 100	√	Hysteresis	√	√	√	√	Minimal number of external components	−40 to +85	SO–8 / PDIP–8
NCV33063	3.0	40	Down to 2.5 V	1.5	up to 100	√	Hysteresis	√	√	√	√	Automotive version	−40 to +125	SO–8
NCP3063	3.0	40	Down to 2.5 V	1.5	up to 250	√	Hysteresis	√	√	√	√	Higher F_{SW} for optimized size and efficiency	0 to +70	PDIP/SO–8/DFN
NCP3063B	3.0	40	Down to 2.5 V	1.5	up to 250	√	Hysteresis	√	√	√	√		−40 to +85	PDIP/SO–8/DFN
CS5171	2.7	30	1.276 to 40 V	1.5	280		Current	√			√	LT1372/1373 Compatible	−40 to +85	SO–8
CS5172	2.7	30	−2.5 to 40 V	1.5	280		Current	√			√	Flyback and SEPIC	−40 to +85	SO–8
CS5173	2.7	30	1.276 to 40 V	1.5	560		Current	√			√	Easy External Synchronization	−40 to +85	SO–8
CS5174	2.7	30	−2.5 to 40 V	1.5	560		Current	√			√	Negative feedback polarity	−40 to +85	SO–8
MC34166	7.5	40	Down to 5.0 V	3.0	72		Voltage		√	√	√	Cycle–by–Cycle current limit	0 to +70	D2PAK / TO–220
MC33166	7.5	40	Down to 5.0 V	3.0	72		Voltage		√	√	√	Internal thermal shutdown	−40 to +85	D2PAK / TO–220
MC34163	2.5	40	Down to 1.25 V	3.4	up to 100	√	Hysteresis	√	√	√	√	Simple & Flexible regulator	0 to +70	SO–16W / PDIP
MC33163	2.5	40	Down to 1.25 V	3.4	up to 100	√	Hysteresis	√	√	√	√	Minimal number of external components	−40 to +85	SO–16W / PDIP
NCP3163	2.5	40	Down to 1.25 V	3.4	up to 300	√	Hysteresis	√	√	√	√	Higher F_{SW} for optimized size and efficiency	0 to +70	SO–16WEP
NCP3163B	2.5	40	Down to 1.25 V	3.4	up to 300	√	Hysteresis	√	√	√	√		−40 to +85	SO–16WEP
MC34167	7.0	40	Down to 5.0 V	5.0	72		Voltage		√	√	√	Large 5.0A output capability	0 to +70	D2PAK/TO–220
MC33167	7.0	40	Down to 5.0 V	5.0	72		Voltage		√	√	√	Standby Mode < 36 μA	−40 to +85	D2PAK/TO–220

BUCK SWITCHING CONTROLLERS (EXTERNAL SWITCH)

Device	V_{IN} (V) Min	V_{IN} (V) Max	V_{OUT} Options (Adj Range)	V_{OUT} Accuracy	F_{SW} (kHz)	Mode	Enable	Soft–Start	Synchronous	Comments	Temp Range (°C)	Package
NCP5211	4.5	14	Down to 1.0 V	1.5%	150 – 750	Voltage	√	√	√	1.5 A drive capability	0 to +70	SO–14
NCP5211B	4.5	14	Down to 1.0 V	1.5%	150 – 750	Voltage	√	√	√	1.5 A drive capability	–40 to +85	SO–14
CS51031	4.5	16	Down to 1.25 V	2%	200 – 700	Hysteresis		√		No compensation required ; PFET	–40 to +85	SO–8
CS51033	3.3	5.0	Down to 1.25 V	2%	200 – 700	Hysteresis		√		No compensation required ; PFET	–40 to +85	SO–8
SG3525	8.0	35	Down to 5.1 V	1%	100 – 400	Voltage	√	√		Flexible configurations; ST Compatible	0 to +70	SO–16W
NCP1580	4.5	15	Down to 0.8 V	1.5%	350	Voltage		√	√	1.5 A gate drive; 90% duty cycle	–40 to +85	SO–8
NCP1582/A	4.5	15	Down to 0.8 V	1.5%	350	Voltage	√	√	√	0.7 A gate drive; Short Circuit Protection	–40 to +85	SO–8
NCP1583	4.5	15	Down to 0.8 V	1.5%	300	Voltage	√	√	√	0.7 A gate drive; Short Circuit Protection	–40 to +85	SO–8
NCP1571	2.0	12	Down to 0.980 V	1.0%	200	Voltage	√	√	√	12 V bias supply	0 to +125	SO–8
NCP1575	2.0	12	Down to 0.980 V	1.0%	200 – 500	Voltage		√	√	12 V bias supply	0 to +125	SO–8
NCP1550	2.5	5.5	1.8–3.3 V (factory prefixed)	2.0%	600	Voltage	√	√		Auto PWM/ PFM mode.	–40 to +85	Thin SOT–23–5

DUAL BUCK SWITCHING CONTROLLERS (EXTERNAL SWITCH)

Device	V_{IN} (V) Min	V_{IN} (V) Max	V_{OUT} Options (Adj Range)	V_{OUT} Accuracy	F_{SW} (kHz)	Mode	Enable	Soft–Start	Synchronous	Comments	Temp Range (°C)	Package
NCP5422	10.8	13.2	Down to 1.0 V	2.0%	150 – 600	Voltage	√	√	√	Hiccup mode overcurrent protection	0 to +70	SO–16
NCP5423	10.8	13.2	Down to 1.0 V	1.0%	150 – 600	Voltage	√	√	√	1% Voltage reference	0 to +70	SO–16
NCP5424	10.8	13.2	Down to 1.0 V	2.0%	150 – 600	Voltage	√	√	√	Hiccup & cycle–by–cycle overcurrent	0 to +70	SO–16
NCP5425	4.6	13.2	Down to 0.8 V	1.0%	150 – 750	Voltage	√	√	√	1.5 A peak drive capability	0 to +125	TSSOP–20

BOOST SWITCHING CONTROLLERS (External Switch)

Device	V_{IN} (V) Min	V_{IN} (V) Max	V_{OUT} Options (Adj Range)	V_{OUT} Accuracy	F_{SW} (kHz)	Mode	Enable	Soft–Start	Synchronous	Comments	Temp Range (°C)	Package
NCP1450	0.9	5.5	1.8–5.0 V (Factory Prefixed)	2.5%	180	Voltage	√	√		PFM mode	–40 to +85	Thin SOT–23–5

Power Management

DC–DC Switching Isolated

Flyback/Forward Fixed Freq Controllers

CS51021A	NCP1200
CS51022A	NCP1201
CS51221	NCP1203
CS5124	NCP1212
MC33023	NCP1216A
MC34023	NCP1216
MC33060A	NCP1217A
MC34060A	NCP1217
MC44604	NCP1230
MC44605	NCP1271
MC44608	NCP1280
NCP1603	NCP1282
	NCP1562

Please see Flyback/Forward Fixed Frequency Controllers Table Page 23.

Push–Pull Half–Bridge Controllers

MC33025	TL494
MC34025	TL594
NCV494	NCP1395A
SG3535A	NCP1395B
	NCP1396

Please see Push–Pull/Half–Bridge Controller Table Page 26.

Secondary Side Post Regulation Controllers

CS5101
NCP4330

Please see Secondary Side Post Regulation Controllers Table Page 28.

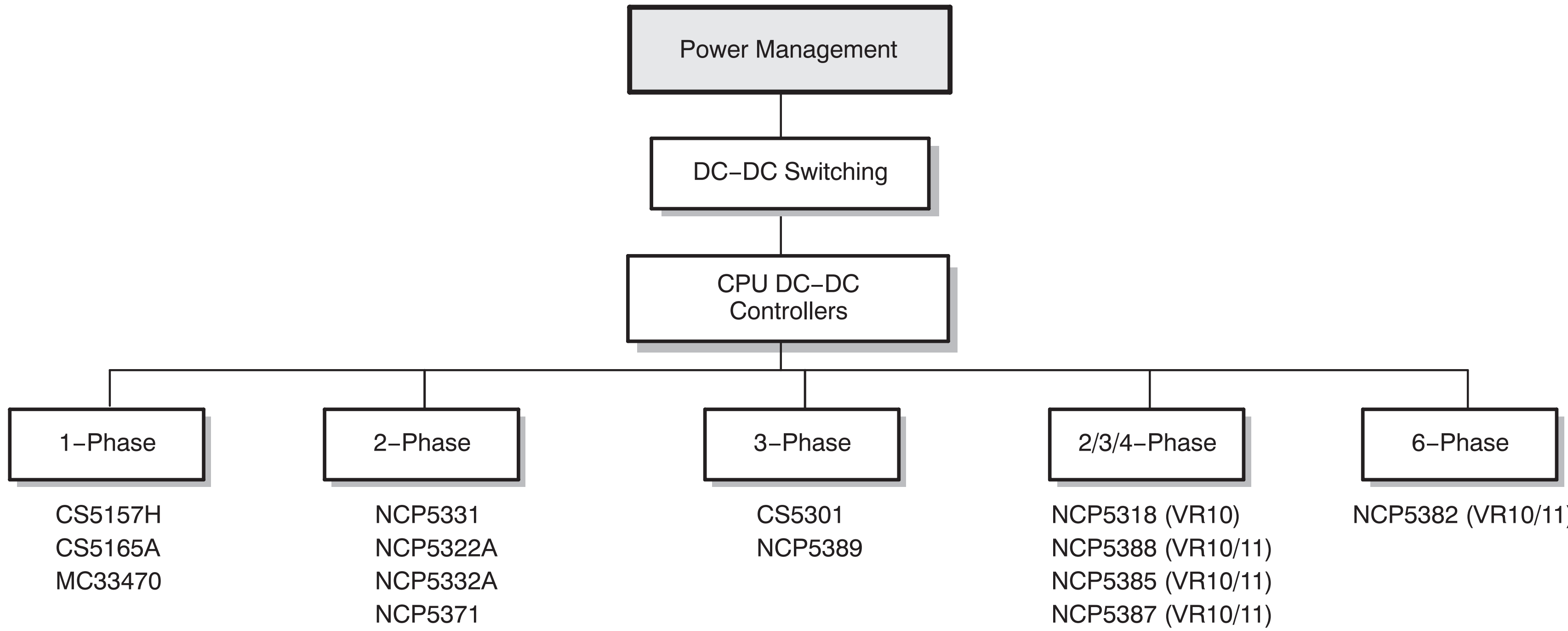
Flyback Fixed Frequency Converters

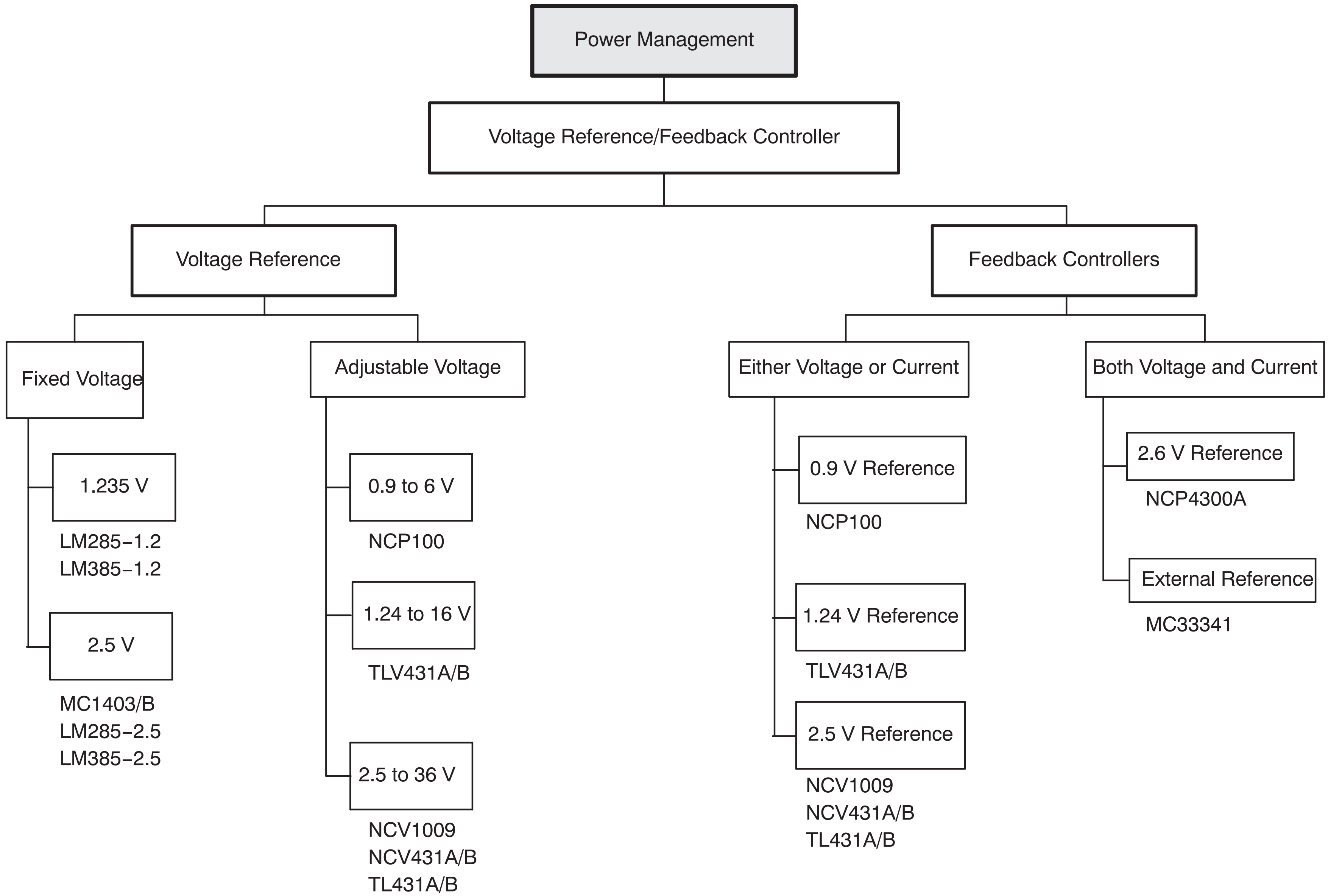
NCP1030
NCP1031

*Coming Soon.

SWITCHING CONTROLLERS FOR STEP–DOWN ISOLATED TOPOLOGIES

Device	V_{IN} (V)		V_{OUT} Options (Adj Range)	V_{OUT} Accuracy	F_{SW} (kHz)	Mode	Enable	Soft–Start	Synchronous	Comments	Temp Range (°C)	Package
	Min	Max										
CS5124	7.7	75	External	–	400	Current Mode	√	√		Small PCB footprint; Bias for startup	–40 to +105	SO–8
CS51221	3.3	72	Down to 1.26 V	2%	up to 1000	Voltage Mode		√		Programmable features; Bias for startup	–40 to +85	SO–16/TSSOP–16
CS51021	3.3	72	Down to 5.0 V	1%	200 – 1000	Current Mode		√		Synch; Bias for startup	–40 to +85	SO–16/TSSOP–16
CS51022	3.3	72	Down to 5.0 V	1%	200 – 1000	Current Mode		√		Sleep mode; Bias for startup	–40 to +86	SO–16/TSSOP–16
NCP1030	10	200	2.5 up to V_{IN}	2%	up to 1000	Voltage Mode	√	√		PoE applications; Integrated Switch	–40 to +125	Micro8™
NCP1031	10	200	2.5 up to V_{IN}	2%	up to 1000	Voltage Mode	√	√		PoE applications; Integrated Switch	–40 to +125	SO–8


Power Management
DC–DC Switching
CPU DC–DC Controllers
1–Phase
CS5157H
CS5165A
MC33470
2–Phase
NCP5331
NCP5322A
NCP5332A
NCP5371
3–Phase
CS5301
NCP5389
2/3/4–Phase
NCP5318 (VR10)
NCP5388 (VR10/11)
NCP5385 (VR10/11)
NCP5387 (VR10/11)
6–Phase
NCP5382 (VR10/11)


Power Management
Voltage Reference/Feedback Controller
Voltage Reference
Feedback Controllers
Fixed Voltage
1.235 V
LM285−1.2
LM385−1.2
2.5 V
MC1403/B
LM285−2.5
LM385−2.5
Adjustable Voltage
0.9 to 6 V
NCP100
1.24 to 16 V
TLV431A/B
2.5 to 36 V
NCV1009
NCV431A/B
TL431A/B
Either Voltage or Current
0.9 V Reference
NCP100
1.24 V Reference
TLV431A/B
2.5 V Reference
NCV1009
NCV431A/B
TL431A/B
Both Voltage and Current
2.6 V Reference
NCP4300A
External Reference
MC33341

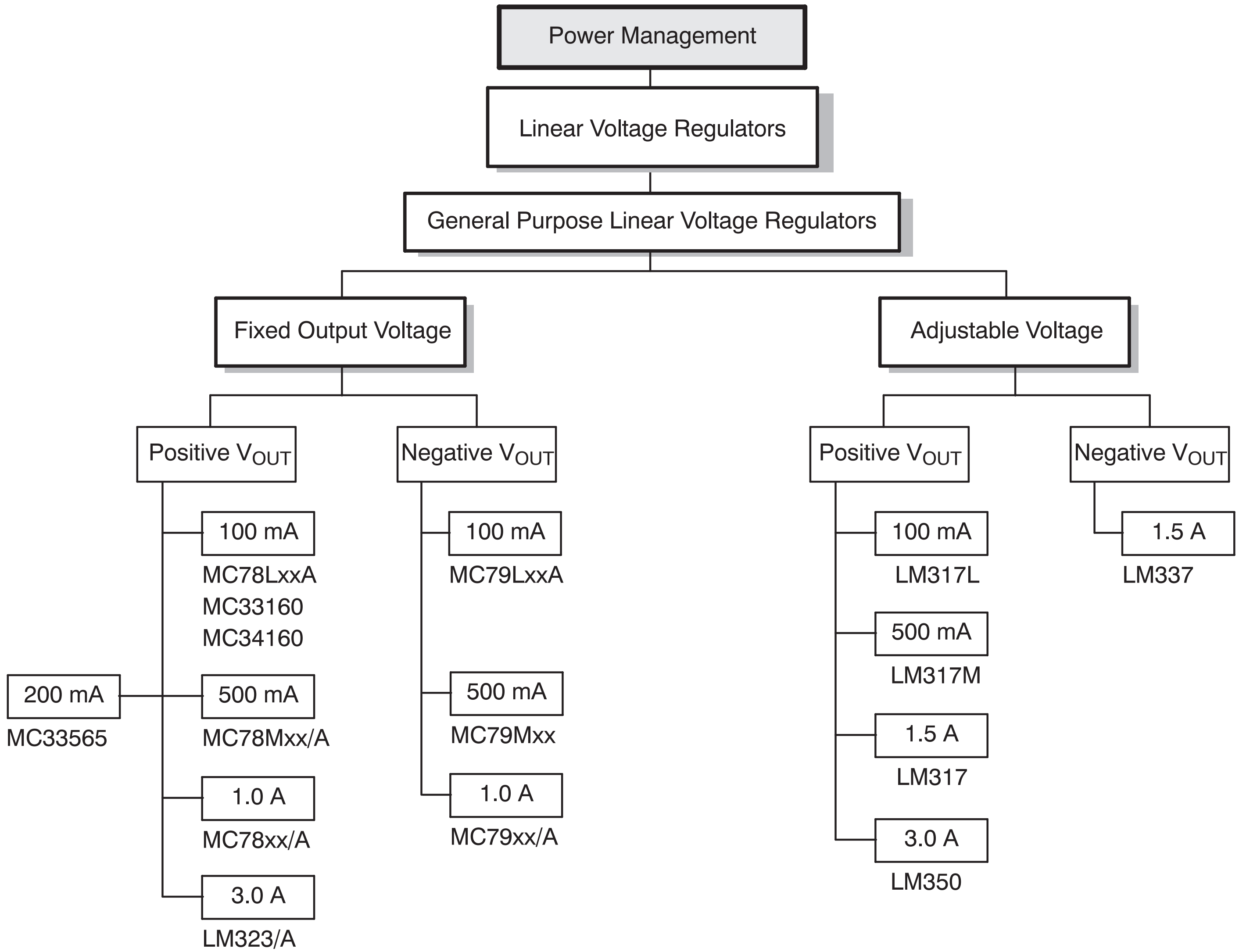
SERIES VOLTAGE REFERENCES

Part Number	Reference Voltage (V)	Tolerance ± (%)	Typical Temperature Coefficient (ppm/°C)	Typical Quiescent Current (mA)	Package		Operating Temperature Range (°C)
					SO−8	PDIP	
MC1403	2.500	1.0	10	1.200	√	√	0 to +70
MC1403B	2.500	1.0	10	1.200	√	√	−40 to +85

SHUNT VOLTAGE REFERENCES

Part Number	Reference Voltage (V)	Tolerance ± (%)	Typical Temperature Coefficient (ppm/°C)	Minimum Operating Current (mA)	Package						Operating Temperature Range (°C)
					SO−8	TO−92	Micro8	TSOP−5*	PDIP	SOT23−3	
LM285−1.2	1.235	1.0	80	0.010	√	√					−40 to +85
LM385−1.2	1.235	2.0	80	0.015	√	√					0 to +70
LM285−2.5	2.500	1.5	80	0.020	√	√					0 to +70
LM385−2.5	2.500	3.0	80	0.020	√	√					0 to +70
LM385B−1.2	1.235	1.0	80	0.020	√	√					0 to +70
LM385B−2.5	2.500	1.5	80	0.020	√	√					0 to +70
NCV1009	2.500	0.2	–	–	√	√					−40 to +125
NCP100	Adjustable 0.9 to 6 V	1.0	25	0.100				√			−40 to +85
TLV431A	Adjustable 1.24 to 16 V	1.0	–	0.050		√		√			−40 to +85
TLV431B	Adjustable 1.24 to 16 V	0.5	–	0.050		√		√		√	−40 to +85
TL431C	Adjustable 2.495 to 36 V	2.2	50	0.500	√	√	√		√	√	0 to +70
TL431I	Adjustable 2.495 to 36 V	2.2	50	0.500	√	√	√		√	√	−40 to +85
TL431AC	Adjustable 2.495 to 36 V	1.0	50	0.500	√	√	√		√	√	0 to +70
TL431A	Adjustable 2.495 to 36 V	1.0	50	0.500	√	√	√		√	√	−40 to +85
TL431BC	Adjustable 2.495 to 36 V	0.4	50	0.500	√	√	√		√	√	0 to +70
TL431BI	Adjustable 2.495 to 36 V	0.4	50	0.500	√	√	√		√	√	−40 to +85
NCV431A	Adjustable 2.495 to 36 V	1.0	50	0.500	√		√				−40 to +125
NCV431B	Adjustable 2.495 to 36 V	0.4	50	0.500			√				−40 to +125

*TSOP−5 – Also known as Thin SOT23−5.


Power Management
Linear Voltage Regulators
General Purpose Linear Voltage Regulators
Fixed Output Voltage
Adjustable Voltage
Positive VOUT
Negative VOUT
Positive VOUT
Negative VOUT
100 mA
MC78LxxA
MC33160
MC34160
200 mA
MC33565
500 mA
MC78Mxx/A
1.0 A
MC78xx/A
3.0 A
LM323/A
100 mA
MC79LxxA
500 mA
MC79Mxx
1.0 A
MC79xx/A
100 mA
LM317L
500 mA
LM317M
1.5 A
LM317
3.0 A
LM350
1.5 A
LM337

GENERAL PURPOSE LINEAR VOLTAGE REGULATORS

Output Current	Part Number	Nominal Output Voltage: Positive	Negative	Adjustable	3.3 V	5.0 V	5.2 V	6.0 V	8.0 V	9.0 V	12 V	15 V	18 V	20 V	24 V	Tolerance (%)	Drop Out Voltage (Typical)	Maximum Input Voltage (Vdc)	Package: SOP–8	SO–16	DPAK	DIP–16	D^2PAK	SOT–223	TO–92	TO–220	Micro8™
100 mA	MC78LxxA Series	√				√			√	√	√	√	√		√	5.0	1.7 V @ 40 mA	5.0 to 18 V Version = 30V 12 to 18 V Version = 35 V 24 V Version = 40 V	√						√		
100 mA	MC79LxxA Series		√			√					√	√	√		√	5.0	1.7 V @ 40 mA	–5.0 V Version = –30 V –12 to –18 V Version = –35 V –24 V Version = –40 V	√						√		
100 mA	LM317Lxx Series	√		√												4.0	1.9 V @ 100 mA	$V_I - V_O = 40$ V	√						√		
100 mA	MC33160	√				√										5.0	2.0 V @ 100 mA	40 V		√		√					
100 mA	MC34160	√				√										5.0	2.0 V @ 100 mA	40 V		√		√					
200 mA	MC33565	√			√	√										2.0	2.3 V @ 100 mA	$V_I - V_O = 7.0$ V	√								√
500 mA	MC78Mxx Series	√				√		√	√	√	√	√	√	√	√	4.0	1.9 V @ 500 mA	5.0 to 18 V Version = 35 V 20 to 24 V Version = 40 V			√					√	
500 mA	MC78MxxA Series	√				√			√		√	√				2.0	1.9 V @ 500 mA	5.0 to 18 V Version = 35 V 20 to 24 V Version = 40 V			√					√	
500 mA	MC79Mxx Series		√			√			√		√	√				4.0	1.1 V @ 500 mA	–35 V			√					√	
500 mA	LM317Mxx Series	√		√												4.0	2.1 V @ 500 mA	$V_I - V_O = 40$ V			√			√		√	
500 mA	LM317MxxA Series	√		√												2.0	2.1 V @ 500 mA	$V_I - V_O = 40$ V			√			√		√	
1.0 A	MC78xx Series	√				√		√	√	√	√	√	√		√	4.0	2.0 V @ 500 mA	5.0 to 18 V Version = 35 V 24 V Version = 40 V					√			√	
1.0 A	MC78xxA Series	√				√		√	√	√	√	√	√		√	2.0	2.0 V @ 500 mA	5.0 to 18 V Version = 35 V 24 V Version = 40 V					√ 4			√	
1.0 A	MC79xx Series		√			√	√	√	√		√	√	√		√	4.0	2.0 V @ 1.0 A	–5.0 to –18 V Version = –35 V –24 V Version = –40 V					√			√	
1.0 A	MC79xxA Series		√			√			√		√	√				2.0	2.0 V @ 1.0 A	–5.0 to –18 V Version = –35 V –24 V Version = –40 V					√ 4			√	

‘xx’ indicates nominal voltage

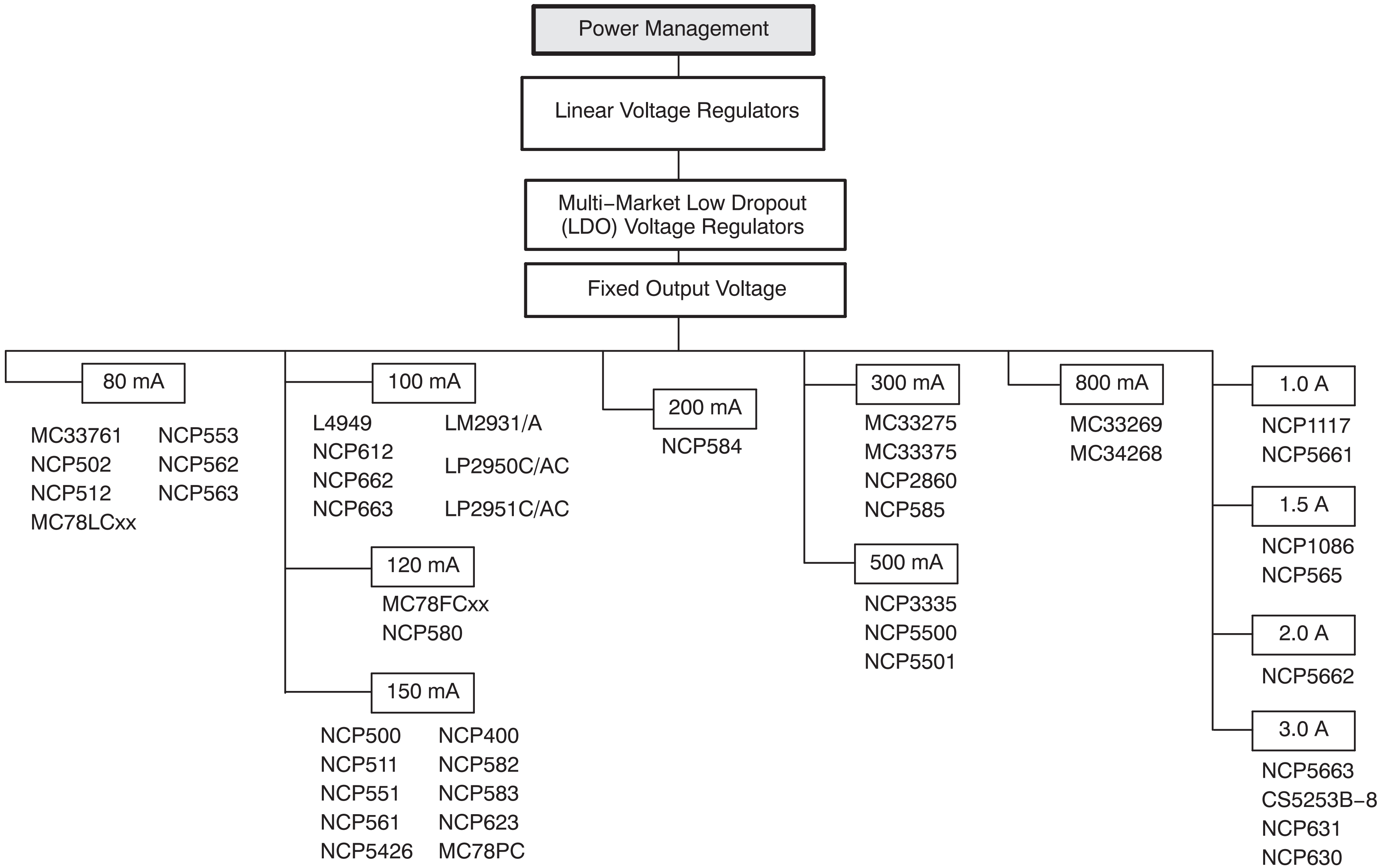
1. Available in select packages only; contact your local ON Semiconductor sales office for information.
2. Available for select voltage options only; contact your local ON Semiconductor sales office for information.

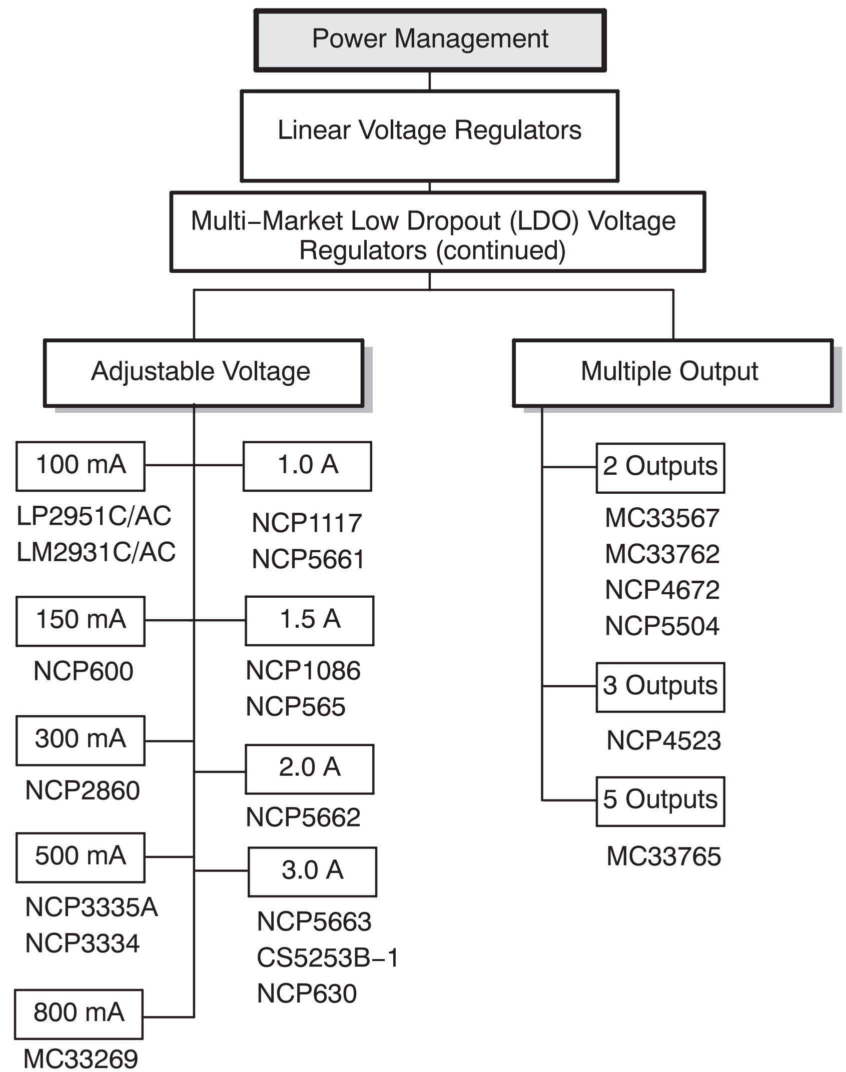
GENERAL PURPOSE LINEAR VOLTAGE REGULATORS (continued)

Output Current	Part Number	Nominal Output Voltage: Positive	Negative	Adjustable	5.0 V	5.2V	6.0 V	8.0 V	9.0 V	12.0 V	15.0 V	18.0 V	20.0 V	24.0 V	Tolerance (%)	Drop Out Voltage (Typical)	Maximum Input Voltage (Vdc)	Package: SOP–8	DPAK	D^2PAK	SOT–223	TO–92	TO–220
1.5 A	LM317	√		√											4.0	2.25 V @ 1.5 A	$V_I - V_O$ = 40 V			√			√
1.5 A	LM337		√	√											4.0	2.2 V @ 1.5 A	$V_I - V_O$ = 40 V			√			√
3.0 A	LM323	√			√										4.0	2.0 V @ 3.0 A	20 V						√
3.0 A	LM323A	√			√										2.0	2.0 V @ 3.0 A	20 V						√
3.0 A	LM350	√		√											4.0	2.7 V @ 3.0 A	$V_I - V_O$ = 35 V						√

‘xx’ indicates nominal voltage

3. Available in select packages only; contact your local ON Semiconductor sales office for information.
4. Available for select voltage options only; contact your local ON Semiconductor sales office for information.


Power Management
Linear Voltage Regulators
Multi–Market Low Dropout (LDO) Voltage Regulators
Fixed Output Voltage
80 mA
MC33761
NCP502
NCP512
MC78LCxx
NCP553
NCP562
NCP563
100 mA
L4949
NCP612
NCP662
NCP663
LM2931/A
LP2950C/AC
LP2951C/AC
120 mA
MC78FCxx
NCP580
150 mA
NCP500
NCP511
NCP551
NCP561
NCP5426
NCP400
NCP582
NCP583
NCP623
MC78PC
200 mA
NCP584
300 mA
MC33275
MC33375
NCP2860
NCP585
500 mA
NCP3335
NCP5500
NCP5501
800 mA
MC33269
MC34268
1.0 A
NCP1117
NCP5661
1.5 A
NCP1086
NCP565
2.0 A
NCP5662
3.0 A
NCP5663
CS5253B–8
NCP631
NCP630


Power Management
Linear Voltage Regulators
Multi−Market Low Dropout (LDO) Voltage Regulators (continued)
Adjustable Voltage
100 mA
LP2951C/AC
LM2931C/AC
150 mA
NCP600
300 mA
NCP2860
500 mA
NCP3335A
NCP3334
800 mA
MC33269
1.0 A
NCP1117
NCP5661
1.5 A
NCP1086
NCP565
2.0 A
NCP5662
3.0 A
NCP5663
CS5253B−1
NCP630
Multiple Output
2 Outputs
MC33567
MC33762
NCP4672
NCP5504
3 Outputs
NCP4523
5 Outputs
MC33765

MULTI–MARKET LOW DROPOUT VOLTAGE REGULATORS

Output Current	Part Number	Output Voltage																							
		Adjustable	1.3 V	1.5 V	1.8 V	2.2 V	2.5 V	2.6 V	2.7 V	2.8 V	2.85 V	2.9 V	3.0 V	3.2 V	3.3 V	3.5 V	3.6 V	3.8 V	4.0 V	4.75 V	5.0 V	8.0 V	10 V	12 V	See Note
80 mA	MC33761						√			√		√	√								√				
80 mA, 80 mA	MC33762						√, √			√, √			√, √												
80 mA	NCP502			√	√		√		√	√			√		√	√	√				√				
80 mA	NCP512		√	√	√	√	√		√	√			√		√						√				
80 mA	NCP562			√	√		√		√	√			√		√						√				
80 mA	NCP553			√	√		√		√	√			√		√						√				
80 mA	NCP563			√	√		√		√	√			√		√						√				
80 mA	MC78LCxx Series			√	√		√		√	√			√		√				√		√				
100 mA	L4949																				√				
100 mA	LM2931/A																				√				
100 mA	LM2931C/AC	√																							
100 mA	LP2950C/AC												√		√						√				
100 mA	LP2951C/AC	√											√		√						√				

Part Number	Tolerance (%)	Drop Out Voltage	Input Voltage		Package																Additional Features
			Min.	Max.	SC–70	SC–82AB	SOT–23	SOT–89	SO–8	SO(W)	DIP–8	Micro8	DPAK	D^2PAK	SOT–223	TO–92	TO–220	QFN	TSSOP16	PDIP	
MC33761	1.5	0.16 V @ 80 mA	–	12			√														w/ ENABLE, Ultra Low Noise
MC33762	–	0.16 V @ 80 mA, 0.16 V @ 80 mA	–	12								√									Dual, w/ ENABLE, Ultra Low Noise
NCP502	2.0	0.8 V @ 80 mA	–	12	√																Low Iq, High PSRR, ENABLE
NCP512	2.0	0.25 V @ 80 mA	–	6.0	√																w/ ENABLE
NCP562	2.0	0.25 V @ 80 mA	–	6.0		√															Ultra Low Iq, ENABLE
NCP553	2.0	0.7 V @ 80 mA	–	12		√															Ultra Low Iq
NCP563	2.0	0.25 V @ 80 mA	–	6.0		√															Ultra Low Iq
MC78LCxx Series	3.0	1.0 V @ 80 mA	2.5	12			√	√													Ultra Low Iq
L4949	1.0	0.2 V @ 50 mA	5.0	28					√		√										Power–On Reset, Input Voltage Sense
LM2931/A	5.0, 3.8	0.16 V @ 100 mA	–	40					√				√	√		√	√				–
LM2931C/AC	5.0, 2.0	0.16 V @ 100 mA	–	40					√								√				–
LP2950C/AC	1.0/0.5	0.38 V @ 100 mA	–	30									√			√					–
LP2951C/AC	1.0/0.5	0.38 V @ 100 mA	–	30					√		√	√									–

5. Output voltages from 2.0 V to 6.0 V, in 0.1 V increments, are available on request.

MULTI–MARKET LOW DROPOUT VOLTAGE REGULATORS (continued)

Output Current	Part Number	Output Voltage																						Tolerance (%)	Drop Out Voltage	Input Voltage		Package																	Additional Features
		Adjustable	1.3 V	1.5 V	1.8 V	1.85 V	2.5 V	2.6 V	2.7 V	2.8 V	2.85 V	3.0 V	3.1 V	3.2 V	3.3 V	3.8 V	4.0 V	4.75 V	5.0 V	8.0 V	10 V	12 V	See Note			Min.	Max.	SC–70	SC–82AB	SOT–23	SOT–89	SO–8	SO(W)	DIP–8	Flip–Chip	Micro8	DPAK	D²PAK	SOT–223	TO–92	TO–220	QFN	TSSOP16	PDIP	
100 mA	NCP612			√	√		√		√	√		√	√		√				√					2.0	200 mV @ 100 mA	–	6.0	√																	ENABLE
100 mA	NCP662			√	√		√		√	√		√			√				√					2.0	230 mV @ 100 mA	–	6.0		√																ENABLE, Ultra Low Iq
100 mA	NCP663			√	√		√		√	√		√			√				√					2.0	230 mV @ 100 mA	–	6.0		√																Ultra Low Iq
120 mA	MC78FCxx											√			√		√		√				6	2.5	0.5 V @ 40 mA	2.0	10				√														–
120 mA	NCP580			√	√		√			√		√			√									3.0	180 mV @ 120 mA	2.2	6.5		√																ENABLE
150 mA	MC78PCxx				√		√			√		√			√				√					2.0	0.2 V @ 100 mA	–	8.0			√															w/ ENABLE
150 mA	NCP623						√			√		√			√		√		√					2.0	0.18 V @ 150 mA	–	12									√						√			w/ ENABLE, Ultra Low Noise
150 mA	NCP500				√	√	√	√	√	√		√			√				√					2.5	0.165 V @ 150 mA	–	6.0			√												√			w/ Shutdown
150 mA	NCP511			√	√		√		√	√		√			√				√					3.0	0.170 V @ 150 mA	–	6.0			√															w/ Shutdown
150 mA	NCP551			√	√		√		√	√		√		√	√				√					3.0	40 mV @ 10 mA	–	12			√															w/ Shutdown, Ultra Low Iq
150 mA	NCP561			√	√		√		√	√		√			√				√					3.0	0.15 V @ 150 mA	–	6.0			√															Ultra Low Iq
150 mA	NCP5426		√																					3.0	0.15 V @ 150 mA	–	12			√															w/ ENABLE
150 mA	NCP400				√																			2.0	160 mV @ 100 mA	1.8	5.0								√										ENABLE, Reset

6. Output voltages from 2.0 V to 6.0 V, in 0.1 V increments, are available on request.

MULTI–MARKET LOW DROPOUT VOLTAGE REGULATORS (continued)

Output Current	Part Number	Output Voltage: Adjustable	0.9 V	1.2 V	1.5 V	1.8 V	2.5 V	2.6 V	2.7 V	2.8 V	2.85 V	2.9 V	3.0 V	3.1 V	3.2 V	3.3 V	3.8 V	4.0 V	4.75 V	5.0 V	8.0 V	10 V	12 V	See Note
150 mA	NCP582				√	√	√			√		√	√			√								
150 mA	NCP583				√	√	√			√		√	√			√								
150 mA	NCP600	√			√	√				√			√			√				√				
200 mA	NCP584		√	√	√	√	√	√					√	√		√								
300 mA	MC33275						√						√			√				√				
300 mA	MC33375					√	√						√			√				√				
300 mA	NCP2860	√							√															
300 mA	NCP585		√	√		√	√						√			√								
500 mA	NCP5501				√															√				
500 mA	NCP3335A	√					√				√					√				√				
500 mA	NCP3334	√																						

Part Number	Tolerance (%)	Drop Out Voltage	Input Voltage Min.	Input Voltage Max.	Package: SC–70	SC–82AB	SOT–23	SOT–23–5	SOT–89	SOT–563	SO–8	SO(W)	DIP–8	HSON–6	Micro8	DPAK	D^2PAK	SOT–223	TO–92	TO–220	QFN	TSSOP16	PDIP	Additional Features
NCP582	3.0	220 mV @ 150 mA	2.0	6.5		√				√														ENABLE
NCP583	3.0	250 mV @ 150 mA	1.7	6.5		√				√														ENABLE, Ultra Low Quiescent Current
NCP600	2.0	100 mV	−0.3	6.0			√																	ENABLE, Fast Turn−ON
NCP584	3.0	200 mV @ 200 mA	1.4	6.5			√																	ENABLE, Tri−Mode
MC33275	2.0	0.26 V @ 300 mA	–	12							√					√		√			√			–
MC33375	2.0	0.26 V @ 300 mA	–	12							√							√						w/ ENABLE
NCP2860	2.0	0.150 V @ 300 mA	–	6.0											√									Low Noise 60 μV, FAULT Indicator, ENABLE
NCP585	3.0	310 mV @ 300 mA	1.4	6.5				√						√										ENABLE, Tri−Mode
NCP5501	2.9	300 mV	−7.0	18												√								Low Noise
NCP3335A	0.9	340 mV (max)	−0.3	16											√						√			ENABLE, High Accuracy
NCP3334	0.9	340 mV (max)	−0.3	16							√													ENABLE, High Accuracy

7. Output voltages from 2.0 V to 6.0 V, in 0.1 V increments, are available on request.

MULTI−MARKET LOW DROPOUT VOLTAGE REGULATORS (continued)

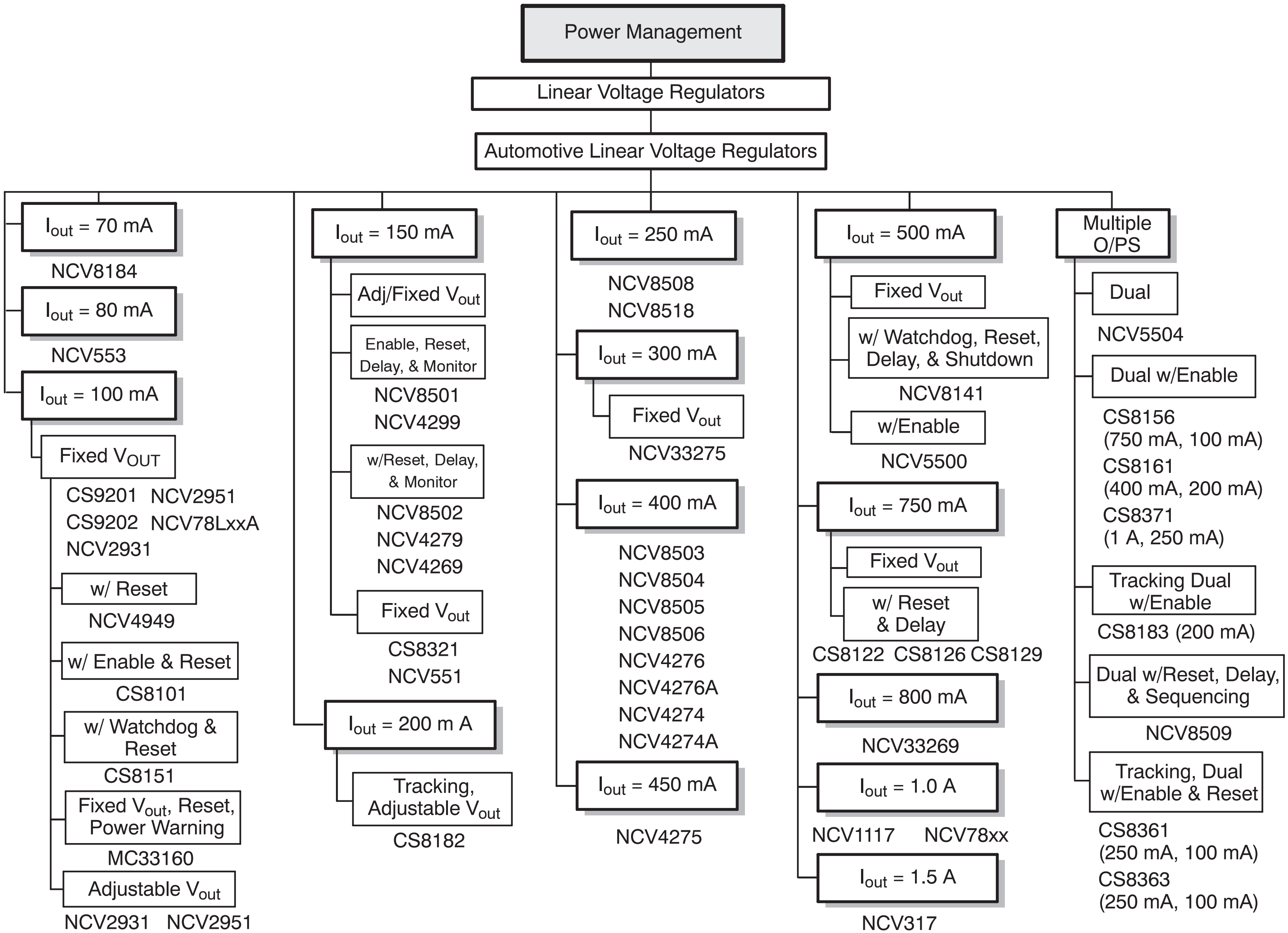
Output Current	Part Number	Output Voltage																						Tolerance (%)	Drop Out Voltage	Input Voltage		Package															Additional Features
		Adjustable	1.2 V	1.5 V	1.8 V	1.9 V	2.0 V	2.5 V	2.7 V	2.8 V	2.85 V	3.0 V	3.2 V	3.3 V	3.47 V	3.8 V	4.0 V	4.75 V	5 V	8 V	10 V	12 V	See Note			Min.	Max.	SC−70	SOT−23	SOT−89	SO−8	SO(W)	DIP−8	Micro8	DPAK	D^2PAK	SOT−223	TO−92	TO−220	QFN	TSSOP16	PDIP	
800 mA	MC33269	√												√					√			√		1.0	1.1 V @ 800 mA	–	20				√				√		√		√				–
800 mA	MC34268										√													1.4	1.1 V @ 800 mA	–	15				√				√		√						For SCSI−2 Active Termination
1.0 A	NCP1117	√		√	√	√	√	√			√			√					√			√		1.0	1.07 V @ 800 mA	2.7	20								√		√						Safe Area Compensation
1.0 A	NCP5661	√	√											√										1.0	–	2.0	18								√					√			ENABLE, Ultra Fast Transient
3.0 A	NCP630	√													√									1.5	1.0 V	–	12									√							ENABLE, Fast Turn−ON, High PSRR
500 mA	NCP5500	√		√															√					5.0	20 mV @ 1.0 mA	2.6	16								√								Enable, Reverse Battery Protection
1.5 A	NCP565	√	√											√										2.0	900 mV @ 1.5 A	2.4	9.0									√	√			√			Ultra Fast Transient Response
1.5 A	NCP1086	√												√										1.5	1.05 V @ 1.5	2.75	7.0									√	√		√				Fast Response
3.0 A	CS5253B−1	√																						1.0	0.4 V @ 3.0 A	–	6.0									√							w/ Control and Sense
3.0 A	CS5253B−8							√																1.5	0.4 V @ 3.0 A	–	6.0									√							w/ Control and Sense
3.0 A	NCP5663	√		√																				1.0	1.0 V @ 3.0 A	2.0	9.0									√							ENABLE, Ultra Fast Transient Response
30 mA 40 mA 50 mA 150 mA 60 mA	MC33765									√														3.0 3.0 3.0 3.0 3.0	110 mV 110 mV 110 mV 170 mV 110 mV	3.0	5.3														√		5 Outputs w/ENABLE

8. Output voltages from 2.0 V to 6.0 V, in 0.1 V increments, are available on request.

MULTI–MARKET LOW DROPOUT VOLTAGE REGULATORS (continued)

Output Current	Part Number	Output Voltage																										Tolerance (%)	Drop Out Voltage	Input Voltage		Package																Additional Features
		Adjustable	1.2 V	1.5 V	1.515 V	1.8 V	1.818 V	2.0 V	2.3 V	2.35 V	2.5 V	2.7 V	2.8 V	2.85 V	3.0 V	3.2 V	3.3 V	3.47 V	3.5 V	3.8 V	4.0 V	4.75 V	5 V	8 V	10 V	12 V	See Note			Min.	Max.	SC–70	SOT–23	SOT–89	SO–8	SSOP–8	SO(W)	DIP–8	Micro8	DPAK	D2PAK	SOT–223	TO–92	TO–220	QFN	TSSOP16	PDIP	
150 mA 80 mA 80 mA	NCP4523									√			√		√													4.0 4.0 4.0	350 mV 300 mV 220 mV	3.35	7.0					√												3 Outputs w/ENABLE
Aux. Drive	MC33567		√		√		√		√																			5.0 5.0	110 mV	9.0	12.5				√													Dual, ENABLE
30 mA 80 mA	NCP4672					√													√									4.0 4.0	150 mV @ 30 mA	–	18				√													Dual, Reset, Delay
2.0 A	NCP5662	√		√													√											1.0	1.0 V @ 2.0 A	2.0	18										√				√			ENABLE, Ultra Fast Transient Response
3.0 A	NCP631																	√										1.0	0.4 V @ 300 mA	–	9.0										√							Soft–Start
250 mA 250 mA	NCP5504	√															√											2.0 2.0	250 mV (max) @ 250 mA	–	18									√								Dual, Fast Dynamic Response, Low Iq

9. Output voltages from 2.0 V to 6.0 V, in 0.1 V increments, are available on request.


Power Management
Linear Voltage Regulators
Automotive Linear Voltage Regulators
I_{out} = 70 mA
NCV8184
I_{out} = 80 mA
NCV553
I_{out} = 100 mA
Fixed V_{OUT}
CS9201 NCV2951
CS9202 NCV78LxxA
NCV2931
w/ Reset
NCV4949
w/ Enable & Reset
CS8101
w/ Watchdog & Reset
CS8151
Fixed V_{out}, Reset, Power Warning
MC33160
Adjustable V_{out}
NCV2931 NCV2951
I_{out} = 150 mA
Adj/Fixed V_{out}
Enable, Reset, Delay, & Monitor
NCV8501
NCV4299
w/Reset, Delay, & Monitor
NCV8502
NCV4279
NCV4269
Fixed V_{out}
CS8321
NCV551
I_{out} = 200 m A
Tracking, Adjustable V_{out}
CS8182
I_{out} = 250 mA
NCV8508
NCV8518
I_{out} = 300 mA
Fixed V_{out}
NCV33275
I_{out} = 400 mA
NCV8503
NCV8504
NCV8505
NCV8506
NCV4276
NCV4276A
NCV4274
NCV4274A
I_{out} = 450 mA
NCV4275
I_{out} = 500 mA
Fixed V_{out}
w/ Watchdog, Reset, Delay, & Shutdown
NCV8141
w/Enable
NCV5500
I_{out} = 750 mA
Fixed V_{out}
w/ Reset & Delay
CS8122 CS8126 CS8129
I_{out} = 800 mA
NCV33269
I_{out} = 1.0 A
NCV1117 NCV78xx
I_{out} = 1.5 A
NCV317
Multiple O/PS
Dual
NCV5504
Dual w/Enable
CS8156
(750 mA, 100 mA)
CS8161
(400 mA, 200 mA)
CS8371
(1 A, 250 mA)
Tracking Dual w/Enable
CS8183 (200 mA)
Dual w/Reset, Delay, & Sequencing
NCV8509
Tracking, Dual w/Enable & Reset
CS8361
(250 mA, 100 mA)
CS8363
(250 mA, 100 mA)

AUTOMOTIVE LINEAR VOLTAGE REGULATORS

	Performances																				Protections					Packages												
		Output Voltage																																				
Part Number	Output Current (mA)	Adj	Tracking	1.5 V	1.8 V	2.5 V	2.6 V	2.7 V	2.8 V	3.0 V	3.1 V	3.2 V	3.3 V	5.0 V	8.0 V	10 V	12 V	Tolerance (%)	Typ Dropout (mV) @ Load Current (mA)	Max Sleepmode Current (μA)	Reverse Polarity (V)	Thermal Shutdown	Current Limit	Overvoltage Shutdown	Peak Transients (V)	SOT−23	SC82−AB	SOT−89	SC−70−5 or SC−88A or SOT−353	SOIC−8 (Std or Epad)	SOIC−14 (Std or Fused)	SOIC−16 (Std, Fused or Epad)	SOIC−20 (Std or Fused)	SOT−223	DPAK	D2PAK	TO−220	DIP
NCV8184	70		√															±5 mV	350 @ 60	20	−15	√	√		42					√					√			
NCV553	80													√				±3	470 @ 80	–	0	√	√		12		√											
CS8101	100													√				±2	400 @ 100	50	−15	√	√	√	60					√			√					
CS8151	100													√				±2	400 @ 100	–	−15	√	√	√	60							√						√
CS9201	100													√				±2	400 @ 100	–	−15	√	√	√	60					√								
CS9202	100												√					±2	–	–	−15	√	√	√	60					√								
NCV2931A	100	√												√				±3.8	160 @ 100	1000	−50	√	√	√	60					√				√				
NCV2931	100	√												√				±5	160 @ 100	1000	−50	√	√	√	60					√					√	√		
NCV4949	100													√				±2	300 @ 100	–	**	√	√		40					√			√					
NCV2951	100	√											√	√				±2.4	350 @ 100	**	**	√	√		32					√								
NCV2951A	100	√											√	√				±1.5	350 @ 100	**	**	√	√		32					√								
NCV78LxxA	100													√			√	±4	1.7 @ 40	–	**	√	√		30					√								
NCV612	100			√	√	√		√	√	√	√		√	√				±3	160 @ 100	1	**	√	√		6				√									
NCV662	100			√	√	√		√	√	√			√	√				±4	170 @ 100	1	**	√	√		6		√											
NCV663	100			√	√	√		√	√	√			√	√				±4	170 @ 100	–	**	√	√		6		√											
CS8321	150													√				±2	300 @ 150	–	−15		√		45											√		
NCV551	150			√	√	√		√	√	√	√	√	√	√				±3	40 @ 150	1	0	√	√		12	√												
NCV4264	150													√				±2	275 @ 100	–	−42	√	√		45									√				
NCV4264−2	150													√				±2	270 @ 100	–	−42	√	√		45									√				
NCV8664	150													√				±2	315 @ 150	–	−42	√	√		45									√	√			
NCV4269	150													√				±2	250 @ 100	–	−40	√	√		60					√	√		√					
NCV4279	150													√				±2	250 @ 100	–	−40	√	√		60					√	√							
NCV4299	150												√	√				±2	220 @ 100	1	−40	√	√		60					√	√							
NCV8501	150	√				√							√	√	√	√		±2	400 @ 150	30	−15	√	√		60					√		√						

** Not specified

AUTOMOTIVE LINEAR VOLTAGE REGULATORS

Part Number	Performances																				Protections					Packages												
		Output Voltage																																				
	Output Current (mA)	Adj	Tracking	1.5 V	1.8 V	2.5 V	2.6 V	2.7 V	2.8 V	3.0 V	3.1 V	3.2 V	3.3 V	5.0 V	8.0 V	10 V	12 V	Tolerance (%)	Typ Dropout (mV) @ Load Current (mA)	Max Sleepmode Current (µA)	Reverse Polarity (V)	Thermal Shutdown	Current Limit	Overvoltage Shutdown	Peak Transients (V)	SOT−23	SC82−AB	SOT−89	SC−70−5 or SC−88A or SOT−353	SOIC−8 (Std or Epad)	SOIC−14 (Std or Fused)	SOIC−16 (Std, Fused or Epad)	SOIC−20 (Std or Fused)	SOT−223	DPAK	D2PAK	TO−220	DIP
NCV8502	150	√				√							√	√	√	√		±2	400 @ 150	–	−15	√	√		60					√		√						
NCV8512	150													√				±2	400 @ 150	–	−15	√	√		60							√						
CS8182	200		√															±10 mV	350 @ 200	55	−15	√	√		45					√					√	√		
NCV8508	250													√				±3	450 @ 150	–	−0.3	√	√		45					√		√				√		
NCV8518	250													√				±2	425 @ 150	1	−0.3	√	√		45					√		√						
NCV33275	300													√				±2	260 @ 300	–	0	√	√		13									√				
NCV8503	400	√				√							√	√				±2	400 @ 400	1	−15	√	√		60								√					
NCV8504	400	√				√							√	√				±2	400 @ 400	–	−15	√	√		60								√					
NCV8505	400	√				√							√	√				±2	400 @ 400	1	−15	√	√		60											√		
NCV8506	400	√				√							√	√				±2	400 @ 400	–	−15	√	√		60											√		
NCV4274	400					√							√	√				±4	250 @ 250	–	−42	√	√		60									√	√	√		
NCV4274A	400					√							√	√				±2	250 @ 250	–	−42	√	√		60									√	√	√		
NCV4276	400	√			√	√							√	√				±4	250 @ 250	10	−42	√	√		45									√	√			
NCV4276A	400	√											√	√				±2	250 @ 250	10	−42	√	√		45									√	√			
NCV4275	450													√				±2	250 @ 300	–	−42	√	√		45									√	√			
NCV8141	500													√				±4	1250 @ 500	50	−0.5	√	√	√	60											√		
NCV5500	500	√		√										√				±5	300 @ 500	50	−7	√	√		18										√			
NCV5501	500			√										√				±5	300 @ 500	–	−7	√	√		18										√			
CS8126−1	750													√				±3	350 @ 500	–	−50	√	√	√	60											√		
CS8129	750													√				±3	350 @ 500	–	−50	√	√	√	60							√						
NCV33269	800	√											√				√	±2	1100 @ 800	–	0	√	√		20										√			
NCV78xx	1000													√	√		√	±5	2000 @ 1 A	–	**	√	√		35											√	√	
NCV1117	1000	√		√	√	√							√	√			√	±2	1007 @ 800	–	**	√	√		20									√	√			
NCV317	1500	√																±4	2250 @ 1.5 A	–	**	√	√		40											√	√	

** Not specified

AUTOMOTIVE LINEAR VOLTAGE REGULATORS

	Performances																				Protections					Packages												
		Output Voltage																																				
Part Number	Output Current (mA)	Adj	Tracking	1.5 V	1.8 V	2.5 V	2.6 V	2.7 V	2.8 V	3.0 V	3.1 V	3.2 V	3.3 V	5.0 V	8.0 V	10 V	12 V	Tolerance (%)	Typ Dropout (mV) @ Load Current (mA)	Max Sleepmode Current (μA)	Reverse Polarity (V)	Thermal Shutdown	Current Limit	Overvoltage Shutdown	Peak Transients (V)	SOT−23	SC82−AB	SOT−89	SC−70−5 or SC−88A or SOT−353	SOIC−8 (Std or Epad)	SOIC−14 (Std or Fused)	SOIC−16 (Std, Fused or Epad)	SOIC−20 (Std or Fused)	SOT−223	DPAK	D2PAK	TO−220	DIP
CS8361	100 250		√											√				±2 ±25 mV	400 @ 100 400 @ 250	200	−50	√	√	√	60							√				√		
CS8363	100 250		√										√					±2 ±25 mV	** @ 100 400 @ 250	200	−50	√	√	√	60											√		
NCV8509	115 100					√								√				±2 ±2	400 @ 100 **	–	−0.3	√	√		50							√						
	115 100						√							√				±2 ±2	400 @ 100 **	–	−0.3	√	√		50							√						
	115 100				√								√					±2 ±2	400 @ 100 **	–	−0.3	√	√		50							√						
NCV5504	250 250	√											√					±2 ±2	250 @ 250 250 @ 250	–	**	√	√		18										√			
CS8183	200 200		√ √															±10 mV ±10 mV	350 @ 200 350 @ 200	55	−10	√	√		45								√					

** Not specified

- Power Management
  - Voltage Supervisory
    - Overvoltage Protection
      - Fixed Threshold
        - 6.85 V
          - NCP345
        - 5.5 V
          - NCP346SN2
        - 4.45 V
          - NCP346SN1
      - Programmable Threshold
        - OVP by Turn Off Series Transistor
          - NCP3712A
        - OVP by Turn On Paralleled SCR
          - MC3423
    - Overvoltage and Undervoltage Indications
      - 3 Mode Selection
        - MC33161
        - MC34161
        - NCV33161*
    - Undervoltage Reset
      - without Delay
        - MC33064/MC34064/NCV33064*
        - MC33164/MC34164/NCV33164*
        - NCP300/NCP301/NCV300*/NCV301*
        - NCP304/NCP305
      - with Programmable Delay
        - NCP112
        - NCP302/NCP303/NCV302*/NCV303*
      - with Reset Timeout Delay
        - MAX809/MAX810
        - NCP803
      - with Reset Timeout Delay & Manual Reset
        - MAX708
    - Supervisory with Voltage Regulator
      - MC33160
      - MC34160
      - NCP400

*Automotive

VOLTAGE SUPERVISORY

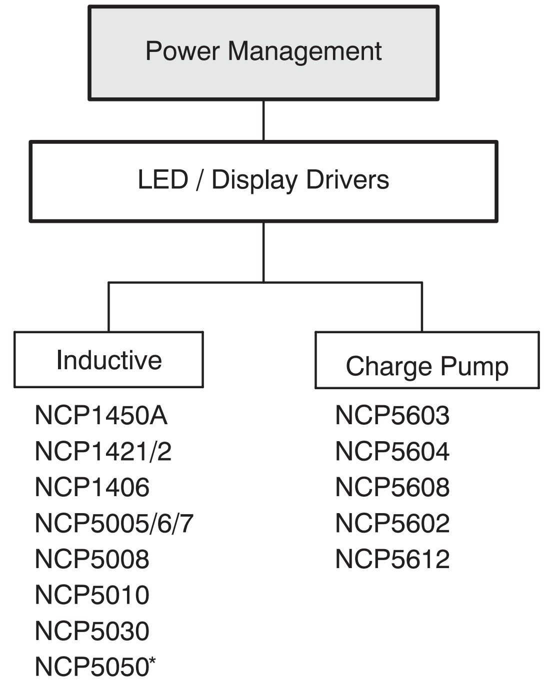
Description	Typical Threshold Voltage (V_{th}) (V)	Supply Voltage Range (V)	Typical Supply Current (μA)	Maximum Supply Current (μA)	Threshold Hysteresis (Typ) (mV)	Operating Temp. Range (°C)	Package	Description	Time Delay (Typ)
MAX809	4.90, 4.63, 4.55, 4.38, 4.00, 3.08, 2.93, 2.63, 2.32, 1.60 *	1.0 to 5.5	0.5	2.0	–	−40 to +105	SOT23	3−Pin Microprocessor Reset Monitors	240 msec
MAX810	4.63, 4.38, 3.08, 2.93, 2.63 *	1.0 to 5.5	0.5	2.0	–	−40 to +105	SOT23	3−Pin Microprocessor Reset Monitors	240 msec
MC33064	4.60	1.0 to 6.5	390	500	20	−40 to +85	SO−8, Micro8, TO−92	Undervoltage Sensing Circuit	Ext. Capacitor Dependent
MC34064	4.60	1.0 to 6.5	390	500	20	0 to +70	SO−8, Micro8, TO−92	Undervoltage Sensing Circuit	Ext. Capacitor Dependent
MC33161	1.27	2.0 to 40 (Pos Sensing) 4.0 to 40 (Neg Sensing)	560	900	25	−40 to +85	SO−8, DIP−8	Universal Voltage Monitor	Ext. Capacitor Dependent
MC34161	1.27	2.0 to 40 (Pos Sensing) 4.0 to 40 (Neg Sensing)	560	900	25	0 to +70	SO−8, DIP−8	Universal Voltage Monitor	Ext. Capacitor Dependent
MC33164	2.71 (V_{IN} Increasing) 2.65 (V_{IN} Decreasing)	1.0 to 10	24	40	60	−40 to +125	SO−8, Micro8, TO−92	Micropower Undervoltage Sensing Circuits	Ext. Capacitor Dependent
MC34164	2.71 (V_{IN} Increasing) 2.65 (V_{IN} Decreasing)	1.0 to 10	24	40	60	0 to +70	SO−8, Micro8, TO−92	Micropower Undervoltage Sensing Circuits	Ext. Capacitor Dependent
MC3423	2.6	4.5 to 40	6.0 mA	10 mA	–	0 to +70	SO−8, DIP−8	Overvoltage Crowbar Sensing Circuit	0.5 μsec
NCP300/1	0.9, 1.8, 2.0, 2.7, 3.0, 4.5, 4.7	0.8 to 10	0.20 to 0.34**	1.2 to 1.4**	45 to 235 Depends on Threshold Voltage	−40 to +125	Thin SOT23−5	Voltage Detector Series NCP300−CMOS, NCP301−Open Drain	High to Low 45−97** μsec Low to High 77−130** μsec

*Voltages from 1.6 to 4.9 V by steps of 0.1 V are available upon request.
**Depends on the voltage threshold of the part.

VOLTAGE SUPERVISORY (continued)

Description	Typical Threshold Voltage (V_{th}) (V)	Supply Voltage Range (V)	Typical Supply Current (μA)	Maximum Supply Current (μA)	Threshold Hysteresis (Typ) (mV)	Operating Temp. Range (°C)	Package	Description	Time Delay (Typ)
NCP302/3	0.9, 1.8, 2.0, 2.7, 3.0, 4.5, 4.7	0.8 to 10	0.20 to 0.34**	1.2 to 1.4**	45 to 235 Depends on Threshold Voltage	−40 to +125	Thin SOT23−5	Voltage Detector Series with Programmable Delay NCP302−CMOS, NCP303−Open Drain	Ext. Capacitor Dependent
NCP304/5	0.9, 1.8, 2.0, 2.7, 3.0, 4.5, 4.7	0.8 to 10	0.8 to 1.1**	3.0 to 3.9**	45 to 235 Depends on Threshold Voltage	−40 to +125	SC−82AB	Voltage Detector Series NCP304−CMOS, NCP305−Open Drain	High to Low 10−18** μsec Low to High 6−21** μsec
NCP345	6.85	3.0 to 25	750	1000	100	−40 to +85	Thin SOT23−5	Overvoltage Protection IC	10 μsec
NCP346	4.45, 5.5	3.0 to 25	750	1000	50	−40 to 85	Thin SOT23−5	Overvoltage Protection IC	1.8 msec Turn−On 0.5 μsec Turn−Off
NCP803	4.63, 4.38, 3.08, 2.93, 2.63, 2.32, 1.60	1.0 to 5.5	0.5	2.0	–	−40 to +105	SOT−23	3 Pin Microprocessor, Reset Monitors	240 ms
NCP112	3.3, 5.0, 12	4.5 to 16	3.0 mA	5.0 mA	–	0 to +85	SO−14 PDIP−14	Triple Supervisor for Desktop Power Supply Monitoring	Programmable ON/OFF, Power Good, Undervoltage Blocking

**Depends on the voltage threshold of the part.

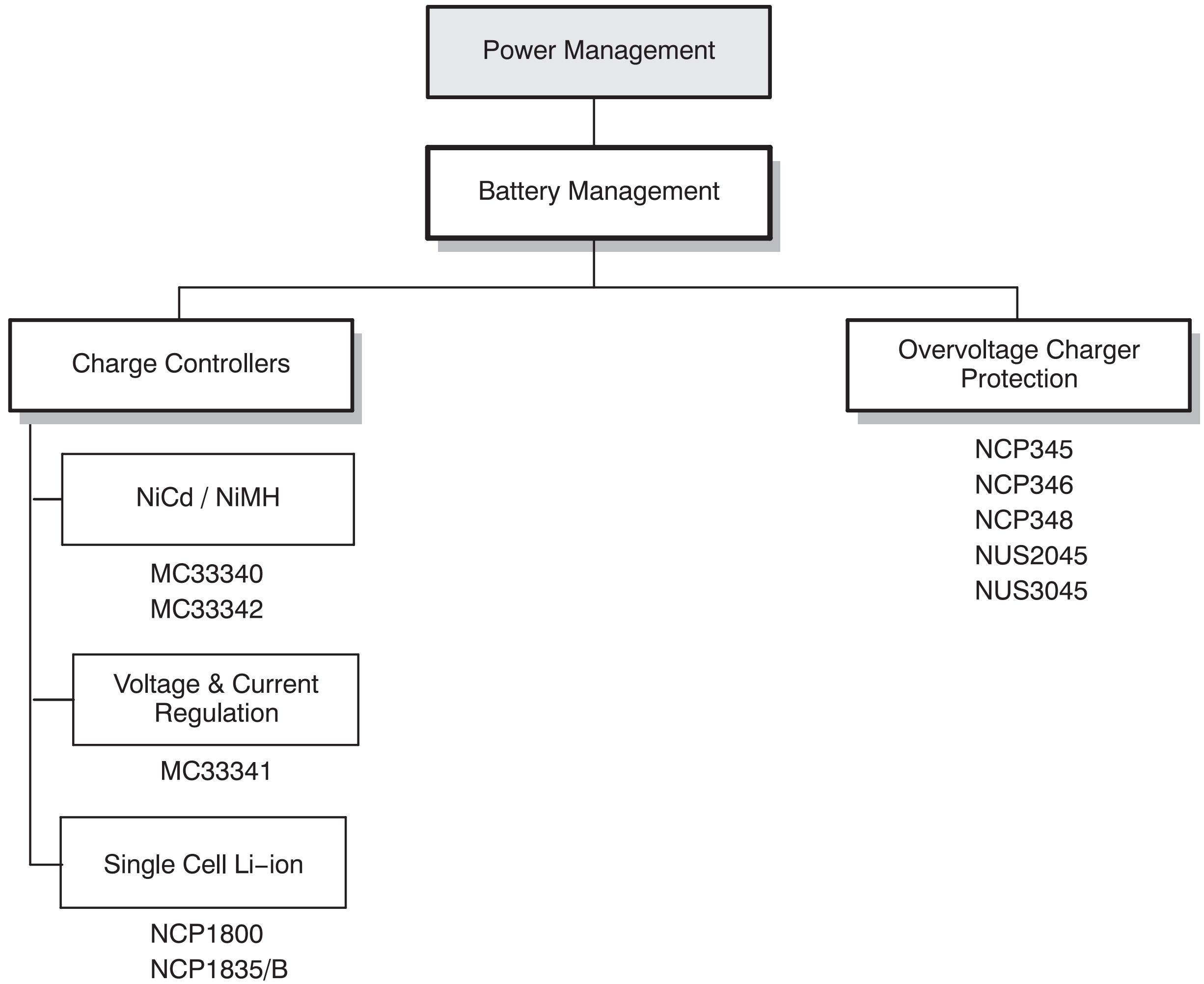

Power Management
LED / Display Drivers
Inductive
Charge Pump
NCP1450A
NCP1421/2
NCP1406
NCP5005/6/7
NCP5008
NCP5010
NCP5030
NCP5050*
NCP5603
NCP5604
NCP5608
NCP5602
NCP5612

*Coming Soon.

LED/DISPLAY DRIVERS

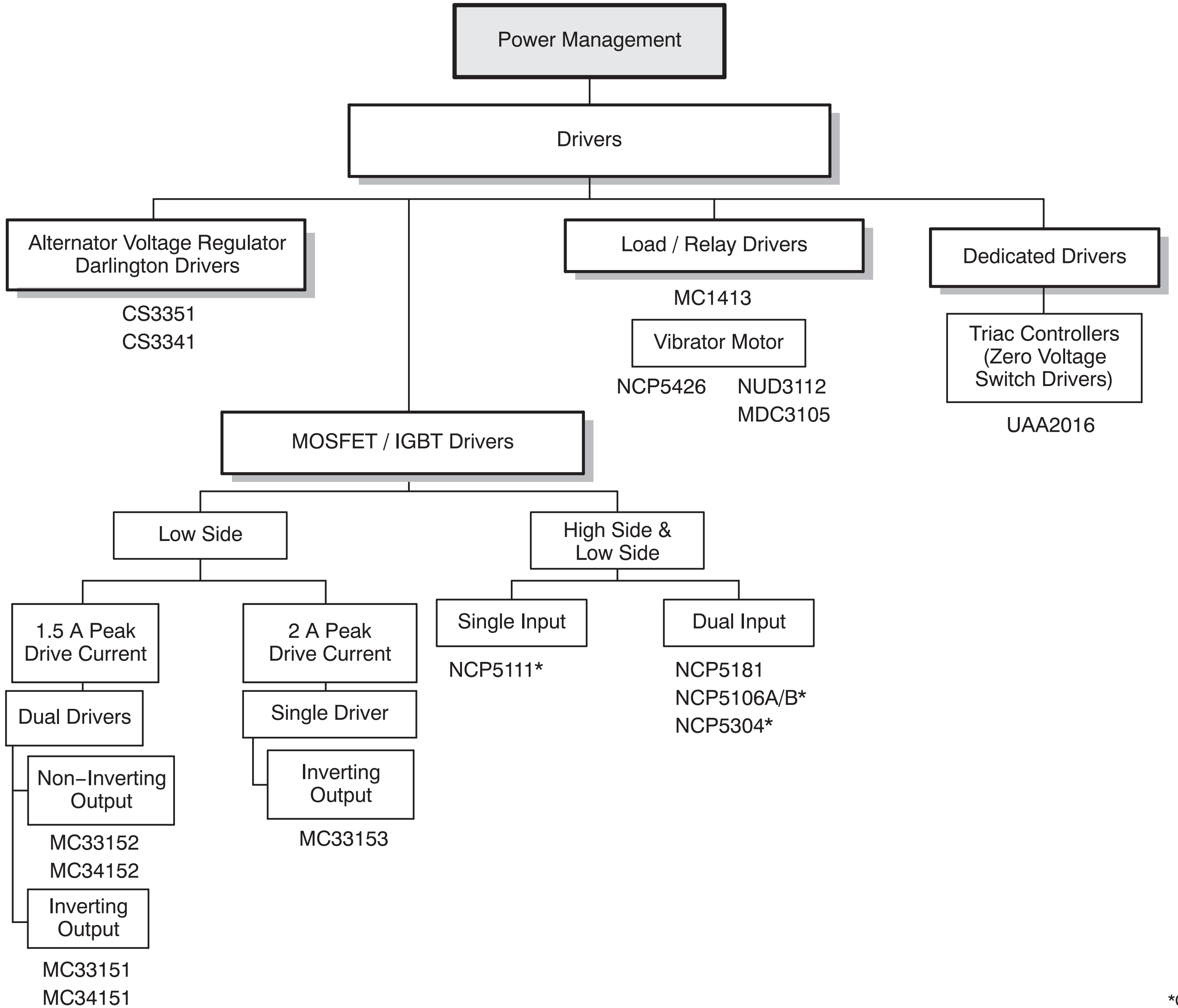
Application	WLED Type	Number of LED/ Connection	Converter Topology	ON Solution	Key Features
Display Backlighting	Standard, 10 mA – 25 mA	2 – 5 LED/Series	Inductive	NCP5006/5007: Up to 92% efficiency, PFM, Boost, 21 V / 1 W output, Thin SOT23−5	Simple
		3 – 5 LED/Series	Inductive	NCP5005: Enhanced version of NCP5006. High EMI immunity.	Simple
		4 – 5 LED/Series	Inductive	NCP5010: 1 MHz PWM Boost, 22 V/0.5 W output integrated rectifier and true−cutoff, Micro−Bump−8 (1.7 x 1.7 mm)	Highly Integrated Driver
		2 LEDs/Parallel	Charge Pump	NCP5602: 90% peak efficiency, 2 outputs (25 mA each); 2% current matching, I2C, LLGA 12 (2 x 2 mm)	ICON Model I2C Dimming Control
		2 LEDs/Parallel	Charge Pump	NCP5612: 2 outputs (25 mA each); I2C, LLG 12 (2 x 2 mm)	S−Wire Link Dimming Control
		2 – 6 LEDs/Series	Inductive	NCP1406: Up to 90% efficiency, PFM (up to 1 MHz), 25 V/0.5 W output, Thin SOT23−5 (3 x 3 mm)	Can Operate from 1 or 2 Alkaline or NI−based Cells
		3 or 4 LEDs/Parallel	Charge Pump	NCP5064A/B: Consistence 90% efficiency, 3 or 4 outputs (25 mA each); 0.5% current matching, TQFN16 (3 x 3 x 0.8 mm)	NCP5604A: Drives 4 LEDs NCP5604B: Drives 3 LEDs
Flash (Torch)	Low Current – Up to 50 mA for 1 Cell / 100 mA for 2 Cell	Single LED	Inductive	NCP1400ASN50: Fixed frequency PWM micropower boost converter, Thin SOT23−5 (3 x 3 mm)	Can Operate from 1 or 2 Alkaline or NI−based Cells
	Medium Current / Multi−die LED, 100 mA – 350 mA	Single or (Multiple in Parallel)	Charge Pump	NCP5603: 200 mA cont./350 mA pulsed, voltage regulated output, 4.5 V or 5 V, 75% eff., DFN (3 x 3 mm)	High−Current Single Output Charge Pump
	Medium Current Up to 50 mA for 2 Cells and 100 mA for 3 Cells	2 – 6 LEDs/Series	Inductive	NCP1406: Up to 90% efficiency, PFM (up to 1 MHz) 25 V/0.5 W output, Thin SOT23−5 (3 x 3 mm)	Simple, Low Cost
	High Current LED, Up to 600 mA	Single or (Multiple in Parallel)	Inductive	NCP1421: PFM Boost (up to 1.2 MHz), Sync−rect, Output up to 5 V, 600 mA cont. 94% eff., true−cutoff, 50 nA shutdown current, Micro8 (3 x 4.9 mm)	Synchronous Rectification
	High Current LED, Up to 800 mA	Single or (Multiple in Parallel)	Inductive	NCP1422: PFM Boost (up to 1.2 MHz), Sync−rect, Output up to 5 V, 800 mA cont. 94% eff., true−cutoff, 50 nA shutdown current, DFN10 (3 x 3 mm)	Synchronous Rectification
	High Current LED, Up to 1 A	2 – 5 LEDs/Series	Inductive	NCP5050*: 23 V/4.5 W output, PWM, 1.7 MHz, DFN−10	Integrated Switch for 2 Adjustable Output Current Levels
Single Driver for Backlight & Flash	LED (10 mA – 25 mA), Flash LED (100 mA – 300 mA)	4 LED + Flash LED	Charge Pump	NCP5608: Consistent 90% efficiency, 8 outputs (4 @ 25 mA each + 4 @ 100 mA each); 0.5% current matching, TQFN24 (4 x 4 mm)	One Chip Lighting Solution
OLDED Driver Supply	–	–	Inductive	NCP1406: Up to 90% efficiency, PFM (up to 1 MHz), 25 V/0.5 W output, Thin SOT23−5 (3 x 3 mm)	Can Operate from 1 or 2 Alkaline or NI−based Cells

*Coming Soon.


Power Management
Battery Management
Charge Controllers
NiCd / NiMH
MC33340
MC33342
Voltage & Current Regulation
MC33341
Single Cell Li–ion
NCP1800
NCP1835/B
Overvoltage Charger Protection
NCP345
NCP346
NCP348
NUS2045
NUS3045

BATTERY MANAGEMENT

Device	Description	Package	Key Features
NCP1800	Single−Cell Lithium Ion CCCV Battery Charger	Micro8™	• Industry Leading Standby Current 0.5 µA • Adjustable Charge Current Limit
MC33340/2	Nickel Chemistry Battery Cradle Charger	SO−8	• Peak Voltage Detection
NCP345	Overvoltage Protection IC	SOT23−5	• 30 V Capability, 6.85 V Detect Threshold • 1 µS Overvoltage Disconnect Time
NCP346	Adjustable Overvoltage Protection IC	SOT23−5	• 30 V Capability, 4.4 V and 5.5 V Detect Threshold • 1 µS Overvoltage Disconnect Time
NCP348	Positive overvoltage protection controller with internal low R_{ON} N−MOSFET and status flat.	DFN−10	• No External MOSFET
NCP1835	Up to 1 A Single−Cell Lithium−ion/Polymer Integrated CCCV Battery Charger	DFN−10	• No External MOSFET
NCP1835B	Up to 300 mA Single−Cell Lithium−ion/Polymer Integrated CCCV Battery Charger	DFN−10	• No External MOSFET
NUS2045	Overvoltage Protection IC with Integrated 20 V P−Channel Power MOSFET	DFN−8	• Integrated NCP345 + 20 V P−Channel MOSFET
NUS3045	Overvoltage Protection IC with Integrated 30 V P−Channel Power MOSFET	DFN−8	• Integrated NCP345 + 30 V P−Channel MOSFET
MC33341	Power Supply Battery Charger Regulation Control Unit	SO−8 DIP−8	• Operating Voltage Range of 2.3 V to 16 V


Power Management
Drivers
Alternator Voltage Regulator Darlington Drivers
CS3351
CS3341
MOSFET / IGBT Drivers
Low Side
1.5 A Peak Drive Current
Dual Drivers
Non–Inverting Output
MC33152
MC34152
Inverting Output
MC33151
MC34151
2 A Peak Drive Current
Single Driver
Inverting Output
MC33153
High Side & Low Side
Single Input
NCP5111*
Dual Input
NCP5181
NCP5106A/B*
NCP5304*
Load / Relay Drivers
MC1413
Vibrator Motor
NCP5426
NUD3112
MDC3105
Dedicated Drivers
Triac Controllers (Zero Voltage Switch Drivers)
UAA2016

*Coming Soon.

MOSFET/IGBT DRIVERS

Part No.	Configuration	Peak Output Current	Typical Output Voltage Risetime (ns) (From 10% to 90% with 1 nF Load)	Typical Output Voltage Falltime (ns) (From 90% to 10% with 1 nF Load)	Typical Input/Output Delay (ns)	Typical Propagation Delay Matching @ 25°C (ns)	Maximum Bridge Voltage (V)	Maximum Supply Voltage (V)	Package
NCP5111	Single Input	220 mA Source, 680 mA Sink	150 (Note 1)	50 (Note 1)	750/100	20	600	20	PDIP−8 SOIC−8
NCP5181	Dual Inputs	1.1 A Source, 2.4 A Sink	40 (Note 1)	20 (Note 1)	100/100	20	600	20	PDIP−8 SOIC−8
NCP5106A/B	Dual Inputs	220 mA Source, 680 mA Sink	150 (Note 1)	50 (Note 1)	100/100	20	600	20	PDIP−8 SOIC−8
NCP5304	Dual Inputs	220 mA Source, 680 mA Sink	150 (Note 1)	50 (Note 1)	100/100	20	600	20	PDIP−8 SOIC−8
MC33153	Single, Inverting Protection Circuits for IGBTs	1.0 A Source, 2.0 A Sink	17 (Note 1)	17 (Note 1)	80/120	–	–	20	PDIP−8 SOIC−8
MC33151	Dual, Inverting Extended Operating Temperature	1.5 A	17 (Note 2)	17 (Note 2)	80/120	–	–	20	PDIP−8 SOIC−8
MC34151	Dual, Inverting	1.5 A	17 (Note 2)	17 (Note 2)	80/120	–	–	20	PDIP−8 SOIC−8
MC33152	Dual, Non−Inverting Extended Operating Temperature	1.5 A	14 (Note 2)	15 (Note 2)	55/40	–	–	20	PDIP−8 SOIC−8
MC34152	Dual, Non−Inverting	1.5 A	14 (Note 2)	15 (Note 2)	55/40	–	–	20	PDIP−8 SOIC−8

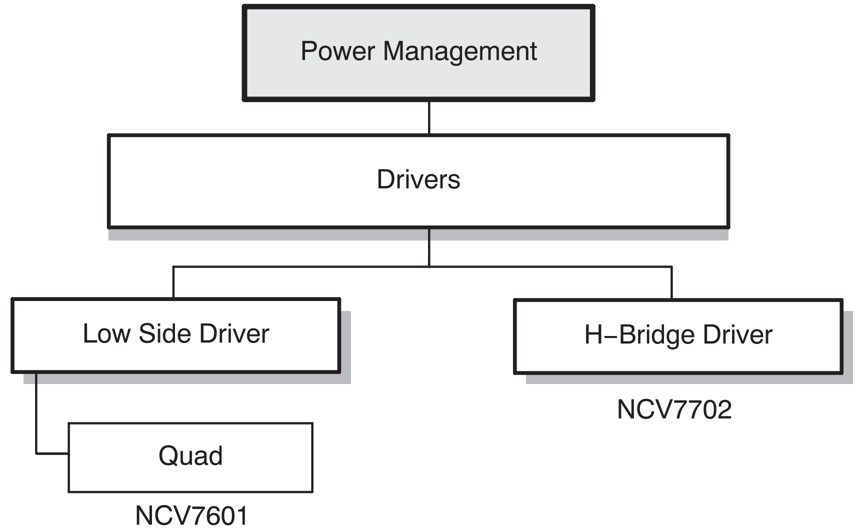
1. V_{CC} = 15 V
2. V_{CC} = 12 V

ALTERNATOR VOLTAGE REGULATOR DARLINGTON DRIVERS

					Features				Protection			
Part Number	Description	Input Supply Voltage	Peak Transient	Supply Current (Enabled)	Compensated Regulation Voltage	Lamp Output Pin	Sense Pin	Stator Powerup	Overtemperature	Overvoltage	Short Circuit	Package
CS3341	Alternator Voltage Regulator Darlington Driver	27 V	80 V	25 mA	√	√	√		√	√	√	SOIC−14
CS3351	Alternator Voltage Regulator Darlington Driver	8.0 V	80 V	25 mA	√	√	√		√	√	√	SOIC−14

DEDICATED DRIVERS

				Features								
Part Number	Description	Input Supply Voltage	Supply Current	Zero Voltage Switch for Triacs	Direct AC Line Operation	Programmable Temp Reduction	Sensor Failsafe	Adj Hysteresis	Sense Pin	Proportional Temp Reg Over ±1°C	Stator Powerup	Package
UAA2016	Zero Voltage Switch Power Controller	−9.0 V	1.5 mA	√	√	√	√	√	√	√	√	SOIC−8, PDIP−8


Power Management
Drivers
Low Side Driver
H−Bridge Driver
Quad
NCV7601
NCV7702

SMART DRIVERS (HIGH–SIDE, LOW–SIDE & H–BRIDGE)

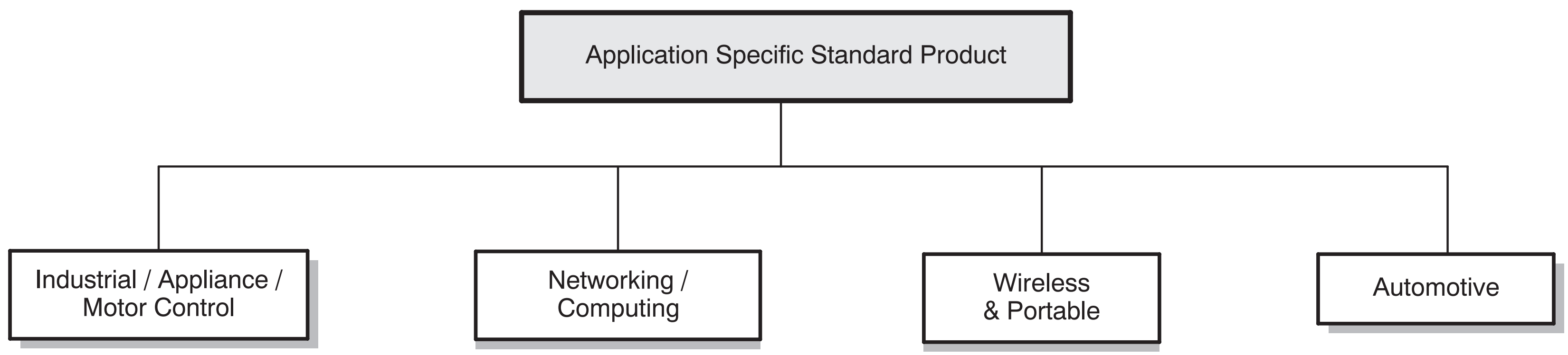
Part		Output		Features								Protection				
Number	Description	Current	$R_{DS(on)}$ @ 25°C	On–Chip Flyback Diode	Active Output Clamp	Parallel Inputs	Serial Interface	Fault Reporting	Undervoltage Lockout	Open Load Detection	Power On Reset	Current Limit	Overvoltage	Over Temperature	Low Duty Cycle Over Current Mode	Peak Transient
NCV7702B	Configurable Dual H–Bridge Driver	750 mA		√		√		√				√	√	√	√	30 V

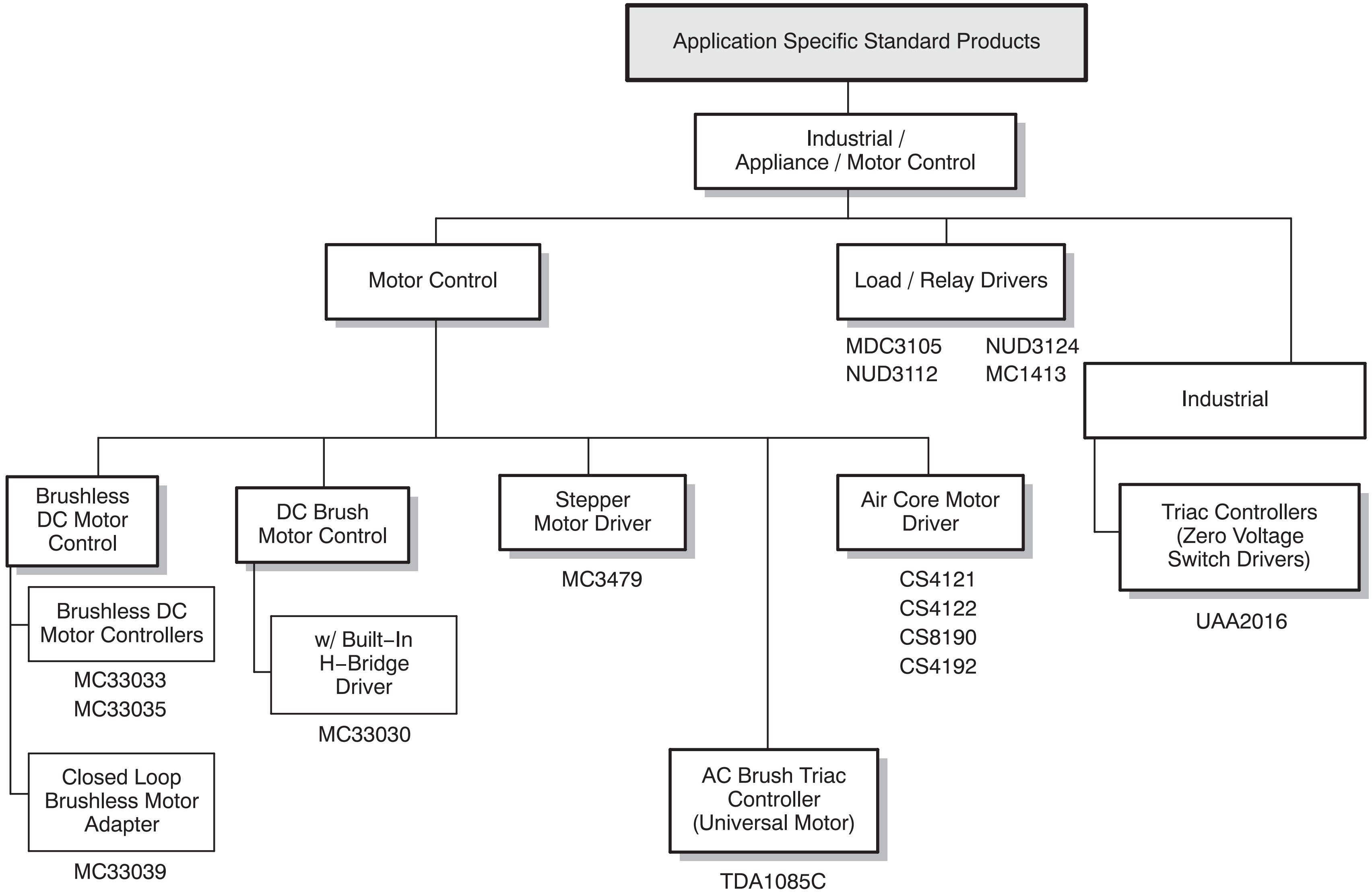
LS QUAD DRIVER

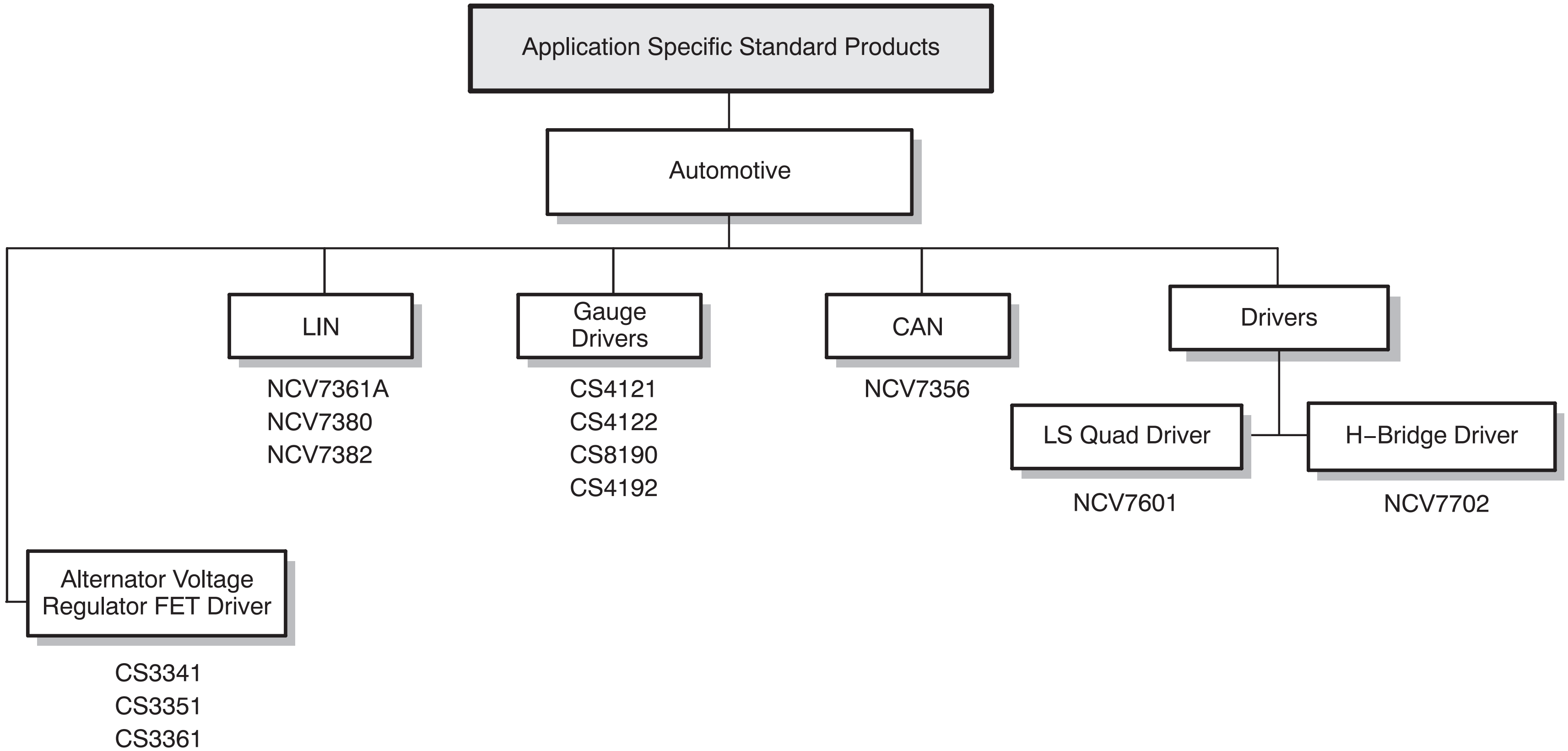
Part Number	Description	Input Supply Voltage	Drivers: Sus-taining	Saturation Voltage	Output Clamping Diodes	Compatible Inputs	Package
NCV7601	LS Quad Driver	7.0 V	40 V	650 mV (max)	√	TTL/DTL/CMOS	DIP–16

LS PRE–DRIVER

Part Number	Description	Number of Channels	Output Current (mA)	Compatibility	Parallel Inputs	Serial Inputs	PowerOn Reset	Current Limit	Short to Ground	Open Load	Shorted to Load
NCV7513	Hex Low–Side Pre–Driver	6	1.9 – 5.25	3.3 V/5 V	√	√	√	√	√	√	√


Application Specific Standard Product
Industrial / Appliance / Motor Control
Networking / Computing
Wireless & Portable
Automotive


Application Specific Standard Products
Industrial / Appliance / Motor Control
Motor Control
Load / Relay Drivers
MDC3105
NUD3112
NUD3124
MC1413
Industrial
Brushless DC Motor Control
Brushless DC Motor Controllers
MC33033
MC33035
Closed Loop Brushless Motor Adapter
MC33039
DC Brush Motor Control
w/ Built–In H–Bridge Driver
MC33030
Stepper Motor Driver
MC3479
AC Brush Triac Controller (Universal Motor)
TDA1085C
Air Core Motor Driver
CS4121
CS4122
CS8190
CS4192
Triac Controllers (Zero Voltage Switch Drivers)
UAA2016


Application Specific Standard Products
Automotive
LIN
NCV7361A
NCV7380
NCV7382
Gauge Drivers
CS4121
CS4122
CS8190
CS4192
CAN
NCV7356
Drivers
LS Quad Driver
NCV7601
H−Bridge Driver
NCV7702
Alternator Voltage Regulator FET Driver
CS3341
CS3351
CS3361

SMART DRIVERS (HIGH–SIDE, LOW–SIDE & H–BRIDGE)

Part		Output		Features								Protection				
Number	Description	Current	$R_{DS(on)}$ @ 25°C	On–Chip Flyback Diode	Active Output Clamp	Parallel Inputs	Serial Interface	Fault Reporting	Undervoltage Lockout	Open Load Detection	Power On Reset	Current Limit	Overvoltage	Over Temperature	Low Duty Cycle Over Current Mode	Peak Transient
NCV7702	Configurable Dual H–Bridge Driver	750 mA		√		√		√				√	√	√	√	30 V

LIN TRANSCEIVERS

Part Number	Operating Range		Supply Current (Recessive)		Supply Current (Dominant)		Supply Current (Sleep Mode)	BUS Short Ckt Current	LIN Compatibility
	Min	Max	Is	I_{CC}	Is	I_{CC}			
NCV7380	7.0	18 V	10 μA	14 μA	1.0 mA	0.8 mA	–	120 mA	LIN 1.3/2.0
NCV7382	7.0	18 V	25 μA	50 μA	0.9 mA	0.6 mA	6.5 μA	120 mA	LIN 1.3/2.0
NCV7361A	5.25	18 V	–	110 μA (max)	–	–	35 μA	40 mA	LIN 1.3/2.0 & SAE J2602

CAN TRANSCEIVERS

Part Number	Description	Operating Range		Supply Current (Recessive)		Supply Current (Dominant)		Supply Current (Sleep Mode)
		Min	Max	Normal Mode	High Speed Mode	Normal Mode	High Speed Mode	
NCV7356	Single Wire Can Transceiver	5.0	27 V	5.0 mA	8.0 mA (max)	30 mA	70 mA	30 μA

DC BRUSH MOTOR CONTROL

				Features					Protection			
Part Number	Description	Input Supply Voltage	Power H−Switch	On−Chip Op Amp	Window Comparator	Self Centering Reference Input	Drive & Brake Logic w/Direction Memory	Temp Compensated Regulation Voltage	Programmable Overcurrent Detector	Programmable Shutdown Delay	Overvoltage	Package
MC33030	DC Servo Motor Controller/Driver	36 V	1.0 A	√	√	√	√	√	√	√	√	SO−14

LS QUAD DRIVER

Part Number	Description	Input Supply Voltage	Drivers: Sustaining	Saturation Voltage	Output Clamping Diodes	Compatible Inputs	Package
NCV7601	LS Quad Driver	7.0 V	40 V	650 mV (max)	√	TTL/DTL/CMOS	DIP−16

CLOSED LOOP BRUSHLESS MOTOR ADAPTER

						Features					
Part Number	Description	Input Supply Voltage	Supply Current	Constant Speed Operation	Internal Shunt Regulator	Sensor Electrical Phasing	TTL Compatible Inputs w/Hysteresis	Programmable Monostable	Digital Edge Detectors	Inverter Output	Package
MC33039	Designed Primarily for use w/MC33035 Brushless Motor	5.5 V	5.0 mA	Down to 100 RPM	8.25 V	60°/300° and 120°/240°	√	√	√	√	SO−8, DIP−8

ALTERNATOR VOLTAGE REGULATOR FET DRIVERS

					Features				Protection			
Part Number	Description	Input Supply Voltage	Peak Transient	Supply Current (Enabled)	Compensated Regulation Voltage	Lamp Output Pin	Sense Pin	Stator Powerup	Overtemperature	Overvoltage	Short Circuit	Package
CS3341	Alternator Voltage Regulator Darlington Driver	27 V	80 V	25 mA	√	√	√		√	√	√	SO–14
CS3351	Alternator Voltage Regulator Darlington Driver	8.0 V	80 V	25 mA	√	√	√		√	√	√	SO–14
CS3361	Alternator Voltage Regulator FET Driver	27 V	80 V	10 mA	√	√	√	√	√	√	√	SO–14

TRIAC CONTROLLERS

				Features								
Part Number	Description	Input Supply Voltage	Supply Current	Zero Voltage Switch for Triacs	Direct AC Line Operation	Programmable Temp Reduction	Sensor Failsafe	Adj Hysteresis	Sense Pin	Proportional Temp Reg Over ±1°C	Stator Powerup	Package
UAA2016	Zero Voltage Switch Power Controller	–9.0 V	1.5 mA	√	√	√	√	√	√	√	√	SO–8, PIP–8

STEPPER MOTOR DRIVER

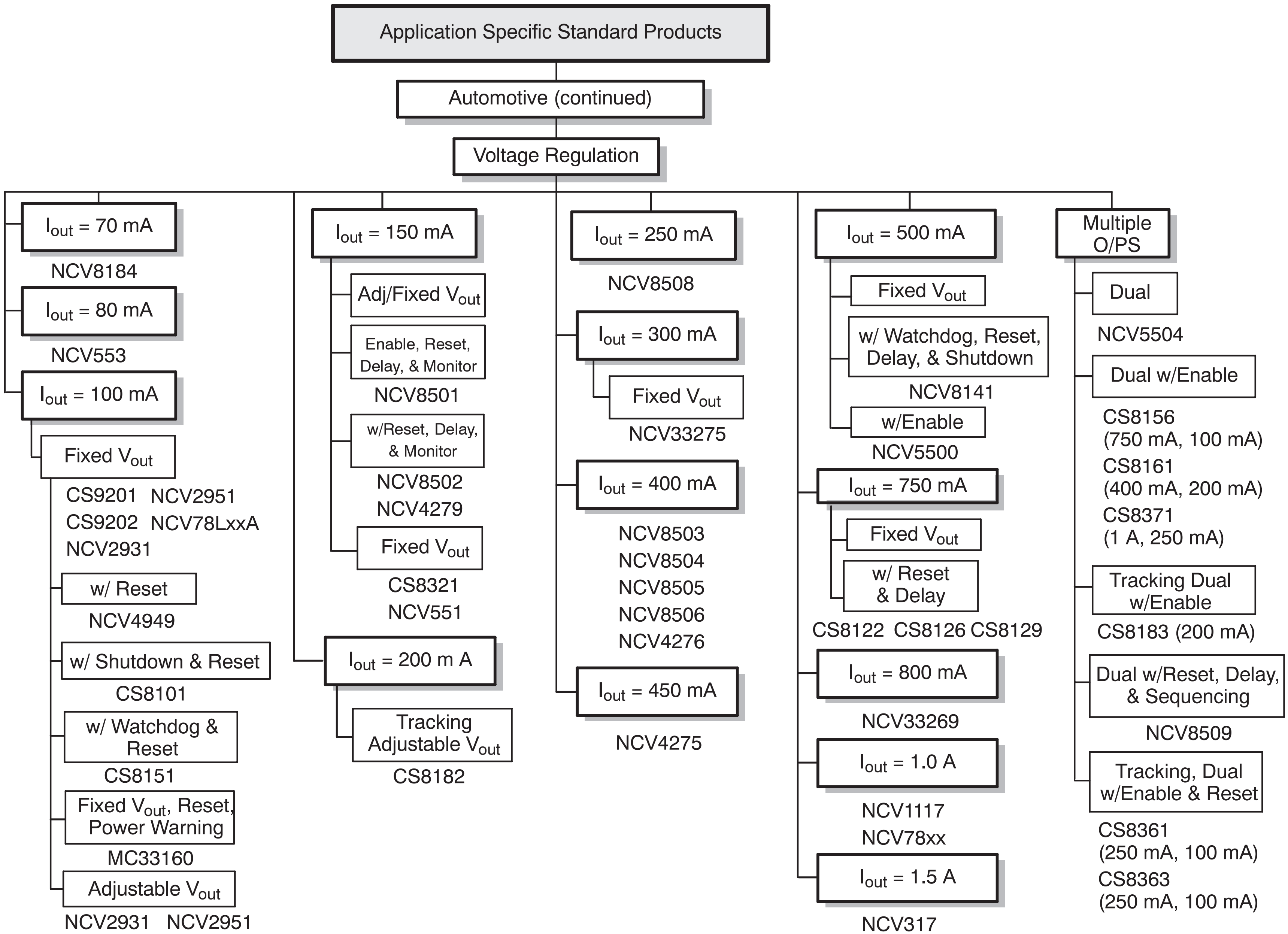
						Features					
Part Number	Description	Input Supply Voltage	Drive Capability	Input Hysteresis	Output Driver	TTL/CMOS Compatible Inputs	Back–EMF Suppression	Selectable High/Low Output Impedance	Full/Half Step Operation	Allows Revering Rotation of Motor	Package
MC3479	Drives a 2–Phase Stepper Motor in the Bipolar Mode	7.2 to 16.5 V	350 mA	400 mV (min)	Open–Collector	√	√	√	√	√	PDIP–16

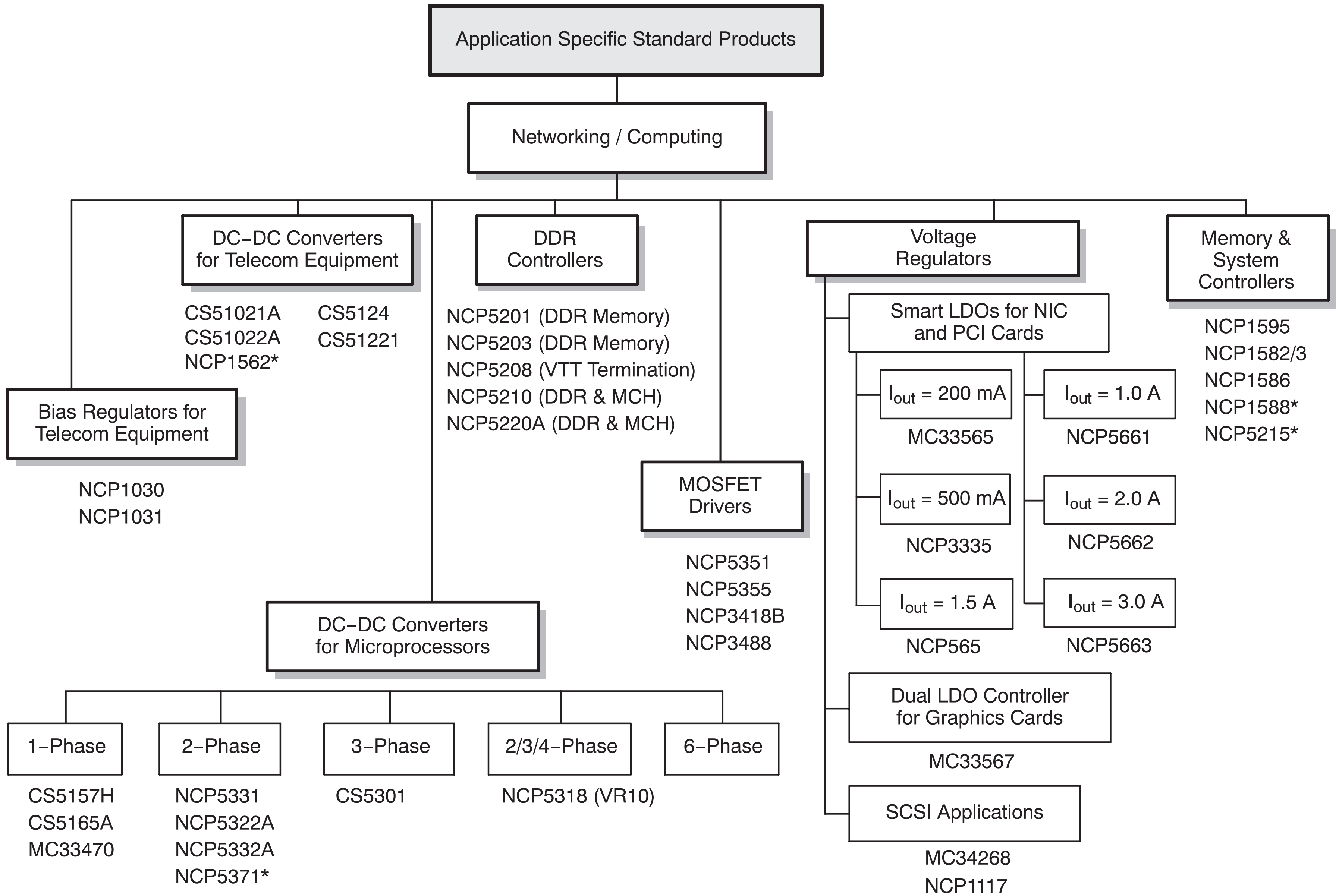
BRUSHLESS DC MOTOR CONTROLLERS

Device	Operating Voltage Range (V)		Undervoltage Lockout	Internal Thermal Shutdown	Fwd/Rev Control	Sensor Electrical Phasing	Output Enable	Output Drivers		6.25 V Reference Output	Current Sense Comparator Input(s)	Error Amplifier	$\overline{\text{FAULT}}$ Output	Separate Drive V_C	Brake Input	Package
	V_{CC}	V_C						Totem Pole (Bottom)	Open Collector (Top)							
MC33033	10 – 30	–	√	√	√	60°/300° and 120°/240°	√	√	√	√	Noninv. Only	√	–	–	–	DIP−20, SO−20L
MC33035	10 – 40	10 – 30	√	√	√		√	√	√	√	Noninv. and Inv.	√	√	√	√	DIP−24, SO−24L

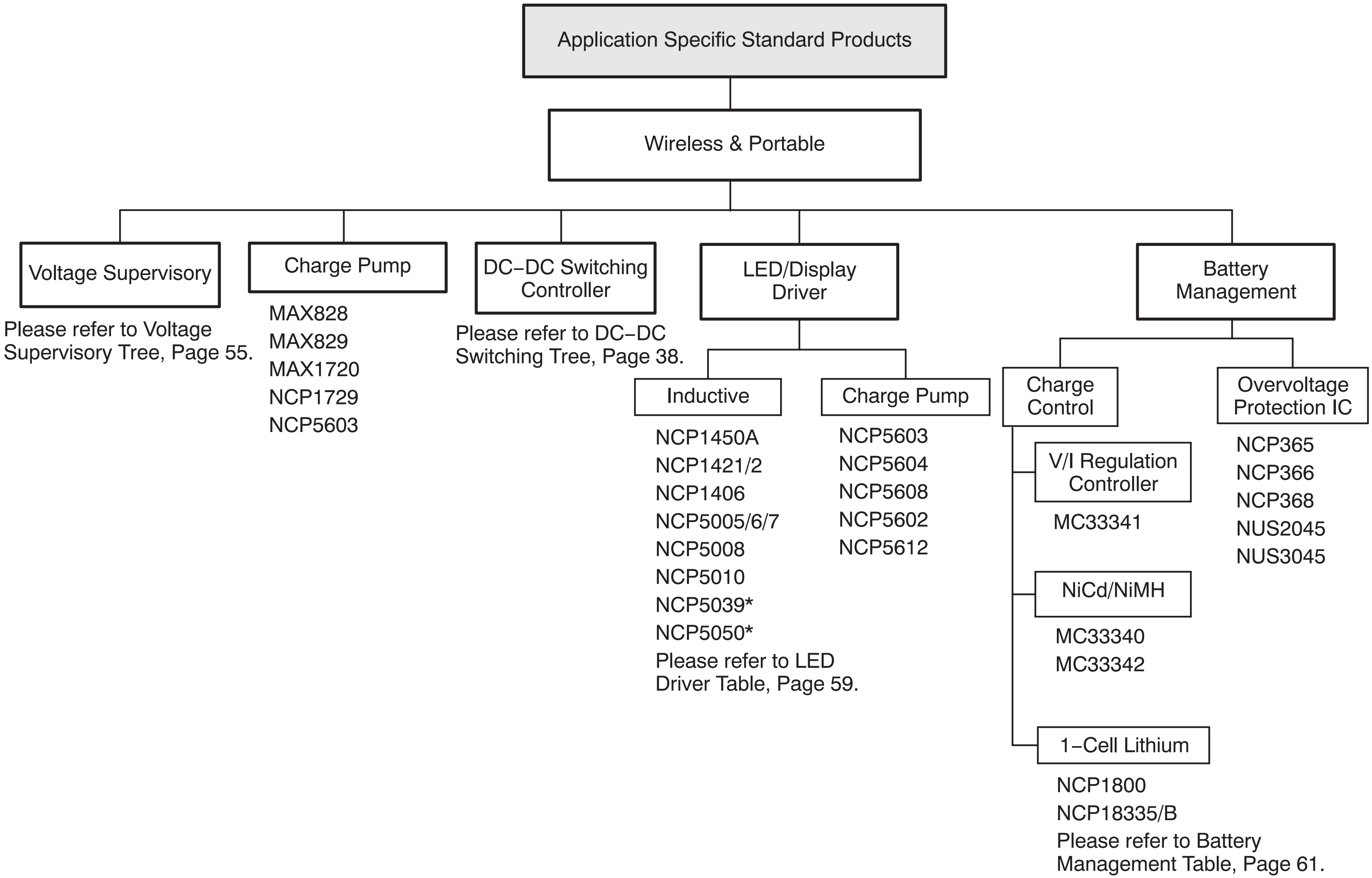
AIR CORE MOTOR DRIVERS/GAUGE DRIVERS

Part Number	Gauges Driven		Input			Output		Features			Protection			
	Major	Minor	Freq.	PWM	SPI	Current	Method	Return to Zero	UVLO	Regulator Output	Current Limit	Over voltage	Over Temp.	Peak Transient
CS4121	1		√			33 mA	Differential			√		√		60 V
CS4122	1	2	√		√	80 mA	Differential				√	√	√	18 V
CS8190	1		√			33 mA	Differential	√	√			√		60 V
CS4192	1		√		√	70 mA	Differential				√	√	√	16 V


Application Specific Standard Products
Automotive (continued)
Voltage Regulation
Iout = 70 mA
NCV8184
Iout = 80 mA
NCV553
Iout = 100 mA
Fixed Vout
CS9201 NCV2951
CS9202 NCV78LxxA
NCV2931
w/ Reset
NCV4949
w/ Shutdown & Reset
CS8101
w/ Watchdog & Reset
CS8151
Fixed Vout, Reset, Power Warning
MC33160
Adjustable Vout
NCV2931 NCV2951
Iout = 150 mA
Adj/Fixed Vout
Enable, Reset, Delay, & Monitor
NCV8501
w/Reset, Delay, & Monitor
NCV8502
NCV4279
Fixed Vout
CS8321
NCV551
Iout = 200 m A
Tracking Adjustable Vout
CS8182
Iout = 250 mA
NCV8508
Iout = 300 mA
Fixed Vout
NCV33275
Iout = 400 mA
NCV8503
NCV8504
NCV8505
NCV8506
NCV4276
Iout = 450 mA
NCV4275
Iout = 500 mA
Fixed Vout
w/ Watchdog, Reset, Delay, & Shutdown
NCV8141
w/Enable
NCV5500
Iout = 750 mA
Fixed Vout
w/ Reset & Delay
CS8122 CS8126 CS8129
Iout = 800 mA
NCV33269
Iout = 1.0 A
NCV1117
NCV78xx
Iout = 1.5 A
NCV317
Multiple O/PS
Dual
NCV5504
Dual w/Enable
CS8156
(750 mA, 100 mA)
CS8161
(400 mA, 200 mA)
CS8371
(1 A, 250 mA)
Tracking Dual w/Enable
CS8183 (200 mA)
Dual w/Reset, Delay, & Sequencing
NCV8509
Tracking, Dual w/Enable & Reset
CS8361
(250 mA, 100 mA)
CS8363
(250 mA, 100 mA)


Application Specific Standard Products
Networking / Computing
Bias Regulators for Telecom Equipment
NCP1030
NCP1031
DC–DC Converters for Telecom Equipment
CS51021A
CS51022A
NCP1562*
CS5124
CS51221
DDR Controllers
NCP5201 (DDR Memory)
NCP5203 (DDR Memory)
NCP5208 (VTT Termination)
NCP5210 (DDR & MCH)
NCP5220A (DDR & MCH)
MOSFET Drivers
NCP5351
NCP5355
NCP3418B
NCP3488
DC–DC Converters for Microprocessors
1–Phase
CS5157H
CS5165A
MC33470
2–Phase
NCP5331
NCP5322A
NCP5332A
NCP5371*
3–Phase
CS5301
2/3/4–Phase
NCP5318 (VR10)
6–Phase
Voltage Regulators
Smart LDOs for NIC and PCI Cards
I_{out} = 200 mA
MC33565
I_{out} = 500 mA
NCP3335
I_{out} = 1.5 A
NCP565
I_{out} = 1.0 A
NCP5661
I_{out} = 2.0 A
NCP5662
I_{out} = 3.0 A
NCP5663
Dual LDO Controller for Graphics Cards
MC33567
SCSI Applications
MC34268
NCP1117
Memory & System Controllers
NCP1595
NCP1582/3
NCP1586
NCP1588*
NCP5215*

*Coming Soon.


Application Specific Standard Products
Wireless & Portable
Voltage Supervisory
Please refer to Voltage Supervisory Tree, Page 55.
Charge Pump
MAX828
MAX829
MAX1720
NCP1729
NCP5603
DC–DC Switching Controller
Please refer to DC–DC Switching Tree, Page 38.
LED/Display Driver
Inductive
NCP1450A
NCP1421/2
NCP1406
NCP5005/6/7
NCP5008
NCP5010
NCP5039*
NCP5050*
Please refer to LED Driver Table, Page 59.
Charge Pump
NCP5603
NCP5604
NCP5608
NCP5602
NCP5612
Battery Management
Charge Control
V/I Regulation Controller
MC33341
NiCd/NiMH
MC33340
MC33342
1–Cell Lithium
NCP1800
NCP18335/B
Please refer to Battery Management Table, Page 61.
Overvoltage Protection IC
NCP365
NCP366
NCP368
NUS2045
NUS3045

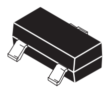
*Coming Soon.

LED/DISPLAY DRIVERS

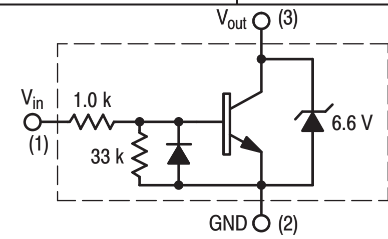
Application	WLED Type	Number of LED/ Connection	Converter Topology	ON Solution	Key Features	Availability
Display Backlighting	Standard, 10 mA – 25 mA	2 – 5 LED/Series	Inductive	NCP5006/5007: Up to 92% efficiency, PFM, Boost, 21 V / 1 W output, Thin SOT23–5	Simple	Now
		3 – 5 LED/Series	Inductive	**NCP5005**: Enhanced version of NCP5006. High EMI immunity.	Simple	Now
		4 – 5 LED/Series	Inductive	**NCP5010**: 1 MHz PWM Boost, 22 V/0.5 W output integrated rectifier and true–cutoff, Micro–Bump–8 (1.7 x 1.7 mm)	Highly Integrated Driver	Now
		2 LEDs/Parallel	Charge Pump	**NCP5602**: 90% peak efficiency, 2 outputs (25 mA each); 2% current matching, I2C, LLGA 12 (2 x 2 mm)	ICON Model I2C Dimming Control	Now
		2 LEDs/Parallel	Charge Pump	**NCP5612**: 2 outputs (25 mA each); I2C, LLG 12 (2 x 2 mm)	S–Wire Link Dimming Control	3Q06
		2 – 6 LEDs/Series	Inductive	NCP1406: Up to 90% efficiency, PFM (up to 1 MHz), 25 V/0.5 W output, Thin SOT23–5 (3 x 3 mm)	Can Operate from 1 or 2 Alkaline or NI–based Cells	Now
		3 or 4 LEDs/Parallel	Charge Pump	**NCP5064A/B**: Consistence 90% efficiency, 3 or 4 outputs (25 mA each); 0.5% current matching, TQFN16 (3 x 3 x 0.8 mm)	NCP5604A: Drives 4 LEDs NCP5604B: Drives 3 LEDs	Now
Flash (Torch)	Low Current – Up to 50 mA for 1 Cell / 100 mA for 2 Cell	Single LED	Inductive	NCP1400ASN50: Fixed frequency PWM micropower boost converter, Thin SOT23–5 (3 x 3 mm)	Can Operate from 1 or 2 Alkaline or NI–based Cells	Now
	Medium Current / Multi–die LED, 100 mA – 350 mA	Single or (Multiple in Parallel)	Charge Pump	**NCP5603**: 200 mA cont./350 mA pulsed, voltage regulated output, 4.5 V or 5 V, 75% eff., DFN (3 x 3 mm)	High–Current Single Output Charge Pump	Now
	Medium Current Up to 50 mA for 2 Cells and 100 mA for 3 Cells	2 – 6 LEDs/Series	Inductive	NCP1406: Up to 90% efficiency, PFM (up to 1 MHz) 25 V/0.5 W output, Thin SOT23–5 (3 x 3 mm)	Simple, Low Cost	Now
	High Current LED, Up to 600 mA	Single or (Multiple in Parallel)	Inductive	NCP1421: PFM Boost (up to 1.2 MHz), Sync–rect, Output up to 5 V, 600 mA cont. 94% eff., true–cutoff, 50 nA shutdown current, Micro8 (3 x 4.9 mm)	Synchronous Rectification	Now
	High Current LED, Up to 800 mA	Single or (Multiple in Parallel)	Inductive	NCP1422: PFM Boost (up to 1.2 MHz), Sync–rect, Output up to 5 V, 800 mA cont. 94% eff., true–cutoff, 50 nA shutdown current, DFN10 (3 x 3 mm)	Synchronous Rectification	Now
	High Current LED, Up to 1 A	2 – 5 LEDs/Series	Inductive	**NCP5050**: 23 V/4.5 W output, PWM, 1.7 MHz, DFN–10	Integrated Switch for 2 Adjustable Output Current Levels	4Q06
Single Driver for Backlight & Flash	LED (10 mA – 25 mA), Flash LED (100 mA – 300 mA)	4 LED + Flash LED	Charge Pump	**NCP5608**: Consistent 90% efficiency, 8 outputs (4 @ 25 mA each + 4 @ 100 mA each); 0.5% current matching, TQFN24 (4 x 4 mm)	One Chip Lighting Solution	Now
OLDED Driver Supply	–	–	Inductive	NCP1406: Up to 90% efficiency, PFM (up to 1 MHz), 25 V/0.5 W output, Thin SOT23–5 (3 x 3 mm)	Can Operate from 1 or 2 Alkaline or NI–based Cells	Now

*__BOLD__ denotes a new device.

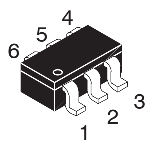
Relay Drivers



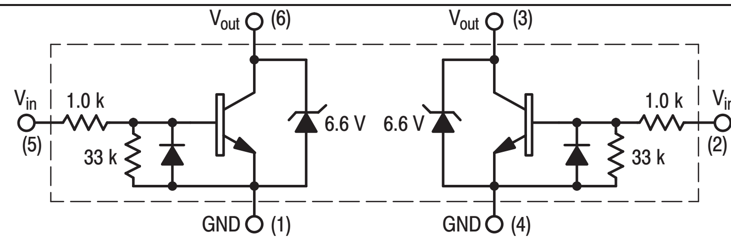
CASE 318
SOT−23



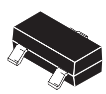
Device	V_{BR} Max (V)	I_D (mA)	E_z (mJ)
MDC3105L	6.0	500	50



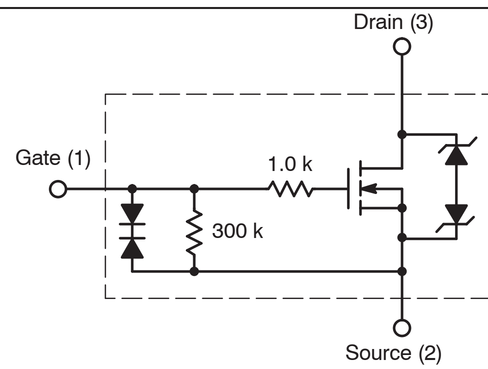
CASE 318F
SC−74



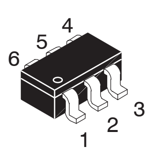
Device	V_{BR} Max (V)	I_D (mA)	E_z (mJ)
MDC3105DM	6.0	500	50



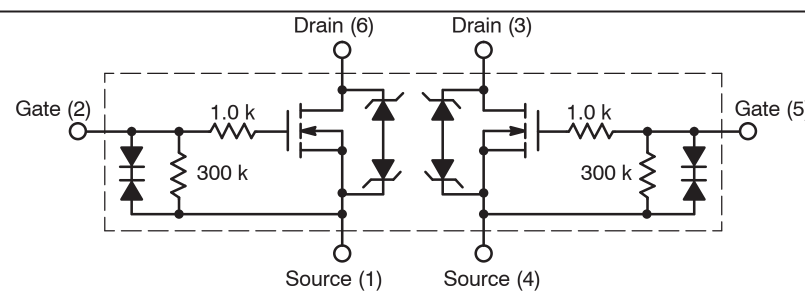
CASE 318
SOT−23



Device	V_{BR} Max (V)	I_D (mA)	E_z (mJ)
NUD3105L	6.0	500	50

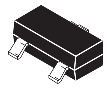


CASE 318F
SC−74

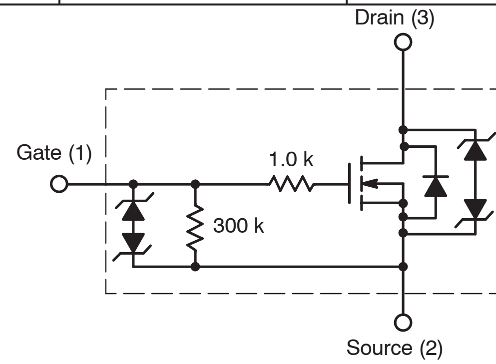


Device	V_{BR} Max (V)	I_D (mA)	E_z (mJ)
NUD3105DM	6.0	500	50

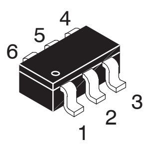
Relay Drivers (continued)



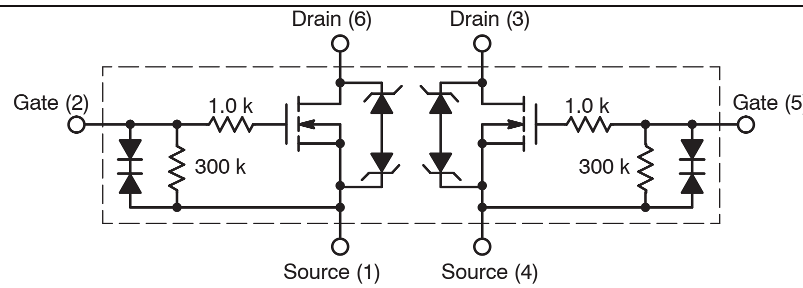
CASE 318
SOT−23



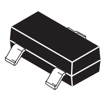
Device	V_{DS} Max (V)	I_D (mA)	E_z (mJ)
NUD3112L	14	500	50



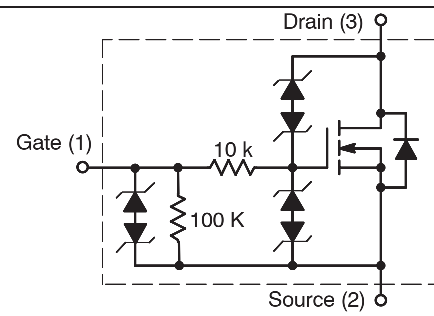
CASE 318F
SC−74



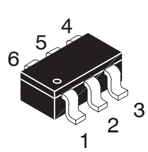
NUD3112DM	14	500	50



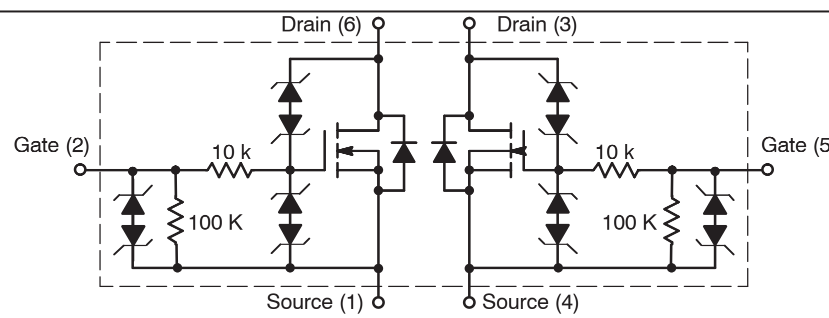
CASE 318
SOT−23



NUD3124L	28	150	250

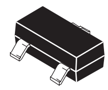
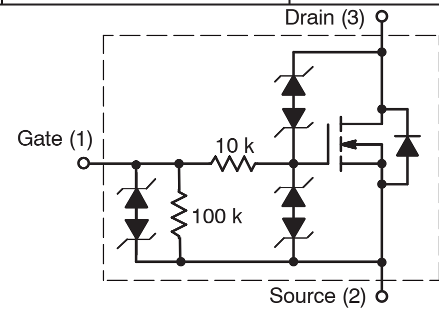


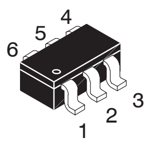
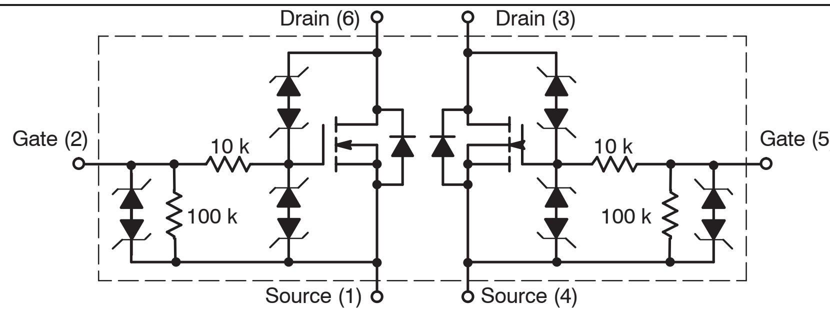
CASE 318F
SC−74



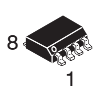
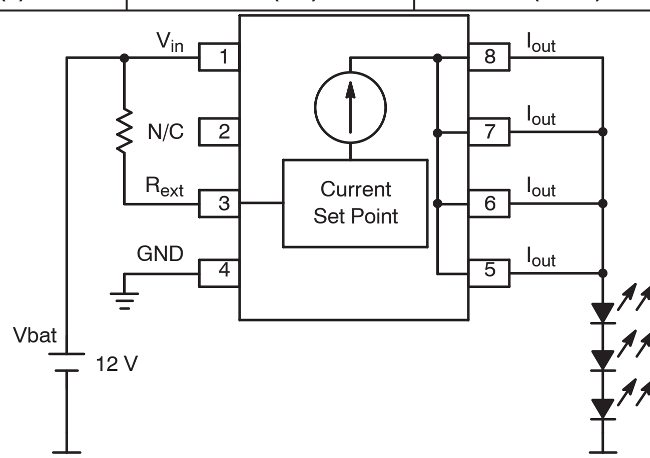
NUD3124DM	28	150	250

Relay Drivers (continued)

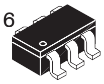
Device	V_{DS} Max (V)	I_D (mA)	E_z (mJ)
	**CASE 318 SOT−23**		
NUD3160L	60	150	250

	**CASE 318F SC−74**		
NUD3160DM	60	150	250

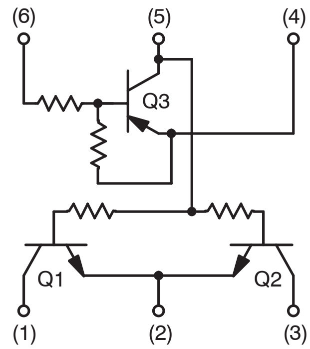
LED Drivers

Device	VMax (V)	IMax (mA)	P (Watts)
	**CASE 751 SO−8**		
NUD4001DR2	30	500	1.13
NUD4011DR2	200	70	1.13

Integrated PNP/NPN Digital Transistor Array



CASE 318F
SC−74



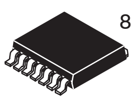
Device	V_{CE} (V)	hfe	V_{BR} (V)	P_D (mW)
NUS2401SN	0.25	60 & 350	50	350

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

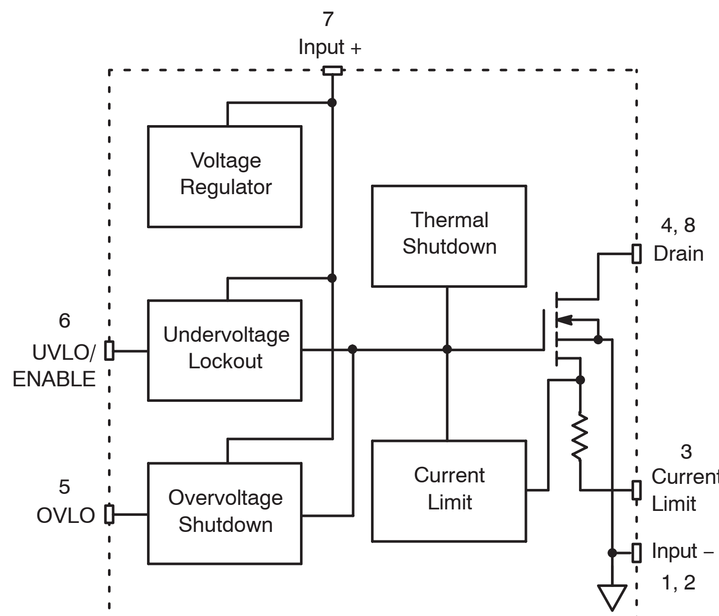
Inrush Current Limiter

SMART HotPlug™ – Low Side

- Integrated Power Device
- Temperature Sensing Diode in Power MOSFET
- Adjustable Current Limit
- Adjustable UVLO and OVLO

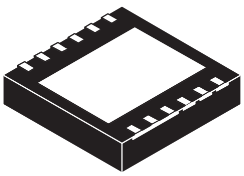


CASE 553AA
S−PAK
EX SUFFIX

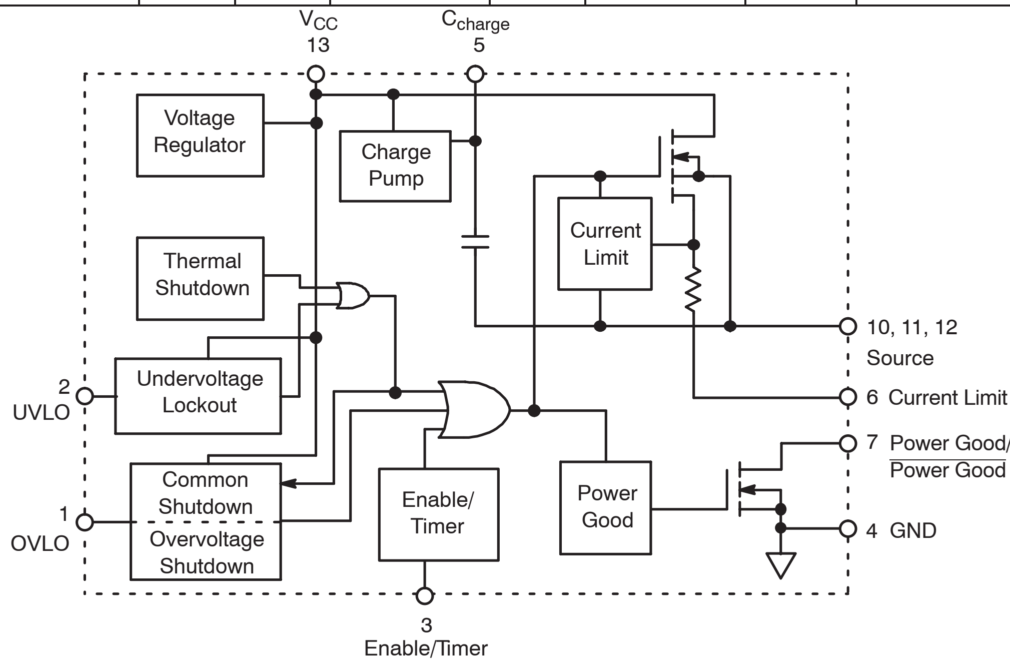


Package	Device	V_{in} (V)		$R_{DS(on)}$ (mΩ)	I_D Avg (A)	Thermal Option	Thermal Limit	Thermal Limit Hysteresis
		Min	Max	Typ	Max		Typ °C	Typ °C
SPAK	NIS5101E1T1	18	110	43	6.5	Latch Off	135	40
SPAK	NIS5101E2T1	18	110	43	6.5	Auto−Retry	135	40
SPAK	NIS5101E1T1G	18	110	43	6.5	Latch Off	135	40
SPAK	NIS5101E2T1G	18	110	43	6.5	Auto−Retry	135	40

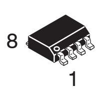
SMART HotPlug™ − High Side



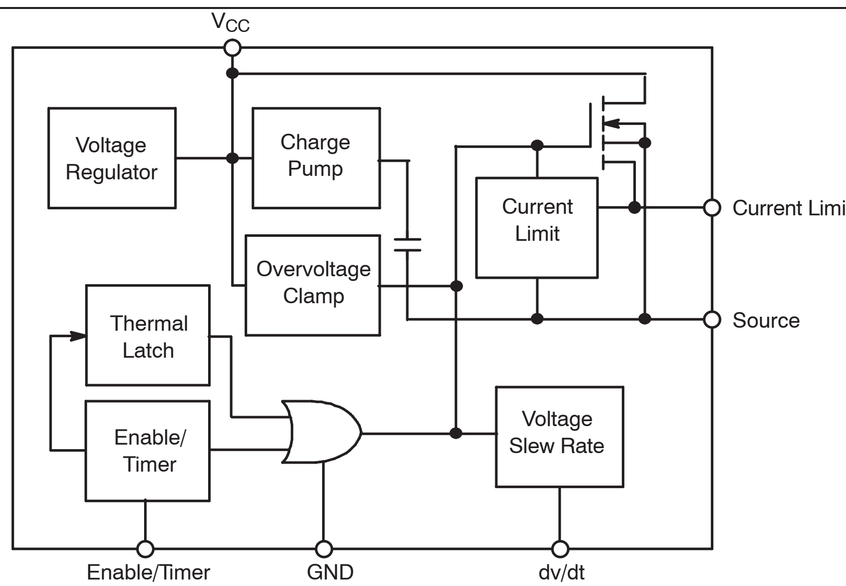
CASE 488AB
9x9 MM, 12 PIN PLLP



Package	Device	V_{in} (V)		$R_{DS(on)}$ (mΩ)	I_D Avg (A)	Thermal Option	Thermal Limit	Thermal Limit Hysteresis
		Min	Max	Typ	Max		Typ °C	Typ °C
QFN 9x9	NIS5102QP1HG	9	18	10	10	Latch Off	135	40
QFN 9x9	NIS5102QP2HG	9	18	10	10	Auto−Retry	135	40



CASE 751
SOIC−8 NB



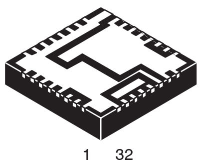
SO−8	NIS5112D1R2G	9.0	18	30	3.0	Latch Off	135	40
SO−8	NIS5112D2R2G	9.0	18	30	3.0	Auto−Retry	135	40

Hybrid Diode IC

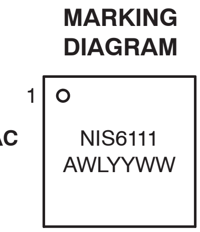
Better Efficiency Rectification System, BERS™ IC

- Integrated Power Device
- Low Forward Drop
- Can be used in High Side and Low Side Configurations
- Gate Drive Available to Parallel Additional MOSFETs

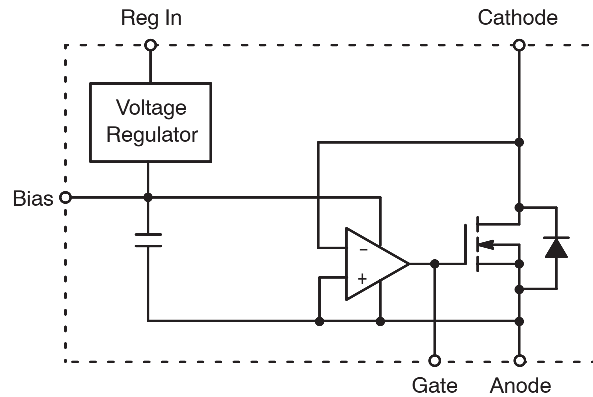
Device	V_{in} (V) Typ	V_{in} (V) Max	IFAV Avg (A) Max	$R_{DS(on)}$ V_{GS} = 5.0 V I_D = 10 A (mΩ)	Fet Turn−On Time I_{max} = 3.0 A, I_{rev} = 1.0 A, V_{rev} = 5.0 V Typ (nsec)	Turnoff Propagation Delay Time V_{DS} = V_{offset} to I_D = 0 A Typ (nsec)
NIS6111QP	0.8	24	30	3.7	45	35



CASE 488AC
PLLP32

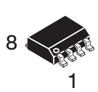


NIS6111 = Specific Device Code
A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week

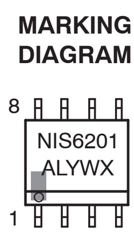


Floating, Regulated Charge Pump

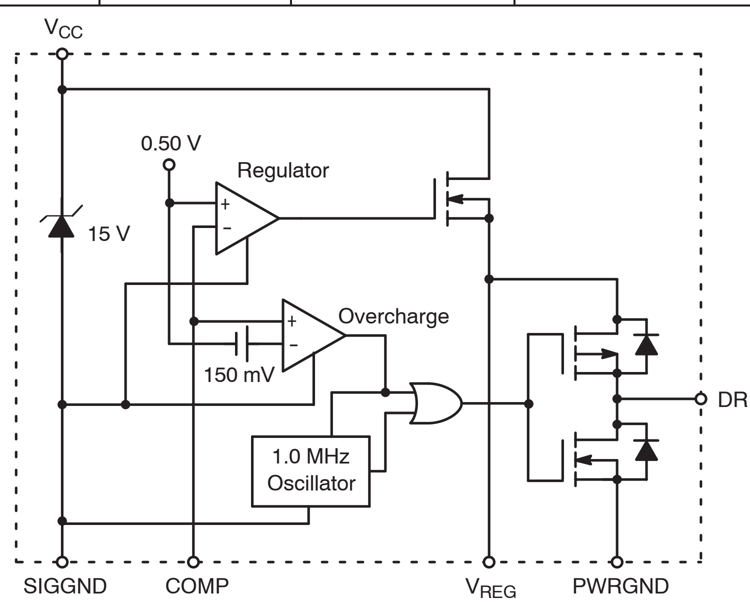
Device	V_{CC} (V)	Idavg, Drive Current Max (A)	Oscillator Frequency f_{osc} Typ (MHz)	$R_{DS(on)}$ High Side FET (Typ) Ω	$R_{DS(on)}$ Low Side FET (Typ) Ω
NIS6201	−0.3 to 18	0.05	1.0	20	20



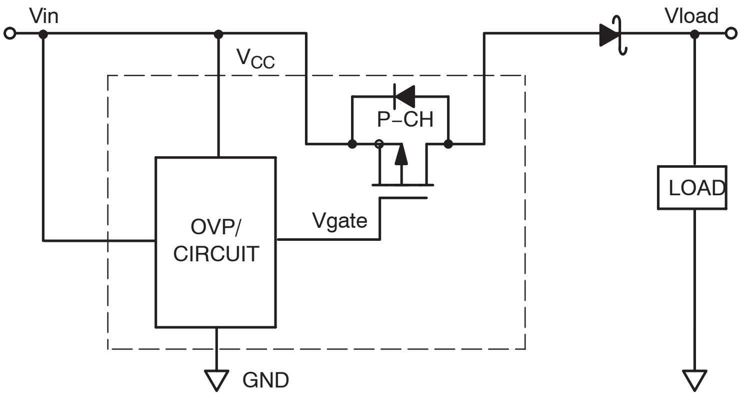
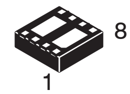
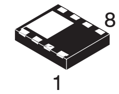
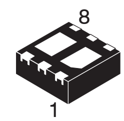
CASE 751
SOIC−8 NB



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week



Overvoltage Protection IC with Integrated P−Channel MOSFET

Device	V_{CC} (V)	V_{DSS} (V) Max	I_D (A), Steady State	$R_{DS(on)}$ (mΩ) Typ V_{GS} = −4.5 V I_D (Note 3)	V_{th} (V) Typ	Package and Dimensions
					  	**CASE 506AL DFN8** **CASE 517AH UDFN8** **CASE 506AN WDFN6** (Package Drawings Not to Scale)
NUS2045MN	2.8 to 20	20	−1.0	71	6.85	DFN8 3.3x3.3x0.85 mm
NUS3045MN	2.8 to 30	30	−1.0	66	6.85	DFN8 3.3x3.3x0.85 mm
NUS3046MN	2.5 to 30	30	−1.0	66	5.5	DFN8 3.3x3.3x0.85 mm
NUS3055MN	2.8 to 30	30	−1.0	66	6.85	TLLGA 2.5x3.0x0.55 mm
NUS1204MN	12	12	−0.6	75	4.725	WDFN6 2.0x2.0x0.85 mm

3. ID = −1.0 A

Amplifiers and Comparators

Amplifiers and Comparators

Table of Contents

SINGLE OPERATIONAL AMPLIFIERS

Device Name	V_{CC} (min) (V)	V_{CC} (max) (V)	GBW (typ) (MHz)	Slew Rate (typ) (V/us)	V_{IO} (max @ 25°C, Vs = 5.0 V) (mV)	I_{IB} (typ) (nA)	I_D (typ) (mA)	Temp Range (°C)	CMR (typ) (dB)	e_n (typical) $\left(nV/\sqrt{Hz}\right)$ @ f = 1.0 kHz	Number of Channels	Supply Type	Package	Description
LM201A	±3.0	±22	1.0	0.5	2.0	30	1.8	–25 to +85	96	–	1	Split	DIP–8, SO–8	General Purpose, Precision Non Compensated
LM201AV	±3.0	±22	1.0	0.5	2.0	30	1.8	–40 to +105	96	–	1	Split	DIP–8, SO–8	General Purpose, Precision Non Compensated
LM301A	±3.0	±18	1.0	0.5	7.5	70	1.8	0 to 70	90	–	1	Split	DIP–8, SO–8	General Purpose, Non Compensated
MC33071	3.0 or ±1.5	44	4.5	13*	5.0	100	1.6	–40 to +85	97	32	1	Single, Split	DIP–8, SO–8	High SR, Wide BW, Single Supply, *Av = –1.0
MC33071A	3.0 or ±1.5	44	4.5	13*	3.0	100	1.6	–40 to +85	97	32	1	Single, Split	DIP–8, SO–8	High SR, Wide BW, Single Supply, *Av = –1.0
MC33171	3.0 or ±1.5	44 or ±22	1.8	2.1	5.0	20	0.18	–40 to +85	90	32	1	Single, Split	DIP–8, SO–8	Low Power, Single Supply, Two Voltage Ranges
MC33201	1.8 or ±0.9	12	2.2	1.0	6.0	80	0.9	–40 to +105	90	20	1	Single, Split	DIP–8, SO–8	Low Voltage, Rail–to–Rail
MC33201V	1.8 or ±0.9	12	2.2	1.0	6.0	80	0.9	–55 to +125	90	20	1	Single, Split	DIP–8, SO–8	Low Voltage, Rail–to–Rail, Extended Temp. Range
MC33501	1.0 or ±0.5	7.0 or ±3.5	4 @ V_S = 5	3.0	5.0	0.04 pA	1.2 @ Vs = 1 V	–40 to +105	75	30	1	Single, Split	TSOP–5*	One Volt SMARTMOS™, Rail–to–Rail
MC33503	1.0 or ±0.5	7.0 or ±3.5	4 @ V_S = 5	3.0	5.0	0.04 pA	1.2 @ Vs = 1 V	–40 to +105	75	30	1	Single, Split	TSOP–5*	One Volt SMARTMOS, Rail–to–Rail

*TSOP–5 – Also known as Thin SOT23–5.

SINGLE OPERATIONAL AMPLIFIERS (continued)

Device Name	V_{CC} (min) (V)	V_{CC} (max) (V)	GBW (typ) (MHz)	Slew Rate (typ) (V/us)	V_{IO} (max @ 25°C, Vs = 5.0 V) (mV)	I_{IB} (typ) (nA)	I_D (typ) (mA)	Temp Range (°C)	CMR (typ) (dB)	e_n (typical) $(nV/\sqrt{Hz})$ @ f = 1.0 kHz	Number of Channels	Supply Type	Package	Description
MC34071	3.0 or ±1.5	44	4.5	13*	5.0	100	1.6	0 to 70	97	32	1	Single, Split	DIP−8, SO−8	High SR, Wide BW, Single Supply, *Av = −1.0
MC34071A	3.0 or ±1.5	44	4.5	13*	3.0	100	1.6	0 to 70	97	32	1	Single, Split	DIP−8, SO−8	High SR, Wide BW, Single Supply, *Av = −1.0
NCS2001	0.9 or ±0.45	7.0 or ±3.5	1.4	1.6	6.0	10 pA	.80	−40 to +105	70	100	1	Single, Split	TSOP−5*, SC70−5	One Volt, CMOS Rail−to−Rail
NCS2002	0.9 or ±0.45	7.0 or ±3.5	0.8	1.2	6.0	10 pA	.80	−40 to +105	82	100	1	Single, Split	TSOP−6*	One Volt, CMOS Rail−to−Rail with Enable
NCS7101	1.8 or ±0.9	10 or ±5.0	1.0	1.2	7.0	1.0 pA	1.1	−40 to +85	65 (min)	140	1	Single, Split	TSOP−5*	Low Voltage, Rail−to−Rail
NCV2002	0.9 or ±0.45	7.0 or ±3.5	0.8	1.2	6.0	10 pA	.80	−40 to +125	82	100	1	Single, Split	TSOP−6*	One Volt, CMOS Rail−to−Rail with Enable
NE5230	±0.9 or 1.8	±7.5 or 15	0.6	0.25	3.0	40	0.6	0 to 70	95	30	1	Single, Split	SO−8, PDIP−8	Single Low Voltage Op Amp
NE5534	±3.0	±20	10	13	4.0*	500	4.0	0 to 70	100	4.0	1	Single, Split	SO−8, PDIP−8	Single Low Noise Op Amp
NE5534A	±3.0	±20	10	13	4.0*	500	4.0	0 to 70	100	3.5	1	Single, Split	SO−8, PDIP−8	Single Low Noise Op Amp
SA5230	±0.9 or 1.8	±7.5 or 15	0.6	0.25	3.0	40	0.6	−40 to 85	95	30	1	Single, Split	SO−8, PDIP−8	Single Low Voltage Op Amp
SA5534	±3.0	±20	10	13	4.0*	500	4.0	−40 to 85	100	4.0	1	Single, Split	PDIP−8	Single Low Noise Op Amp
SA5534A	±3.0	±20	10	13	4.0*	500	4.0	−40 to 85	100	3.5	1	Single, Split	SO−8, PDIP−8	Single Low Noise Op Amp
SE5534	±3.0	±20	10	13	2.0*	400	4.0	−55 to 125	100	4.0	1	Single, Split	PDIP−8	Single Low Noise Op Amp
SE5534A	±3.0	±20	10	13	2.0*	400	4.0	−55 to 125	100	3.5	1	Single, Split	PDIP−8	Single Low Noise Op Amp

*TSOP−5 − Also known as Thin SOT23−5.

DUAL OPERATIONAL AMPLIFIERS

Device Name	V_{CC} (min) (V)	V_{CC} (max) (V)	GBW (typ) (MHz)	Slew Rate (typ) (V/us)	V_{IO} (max @ 25°C, Vs = 5.0 V) (mV)	I_{IB} (typ) (nA)	I_D* (typ) (mA)	Temp Range (°C)	CMR (typ) (dB)	e_n (typical) $\left(nV/\sqrt{Hz}\right)$ @ f = 1.0 kHz	Number of Channels	Supply Type	Package	Description
LM258	3.0 or ±1.5	32 or ±18	1.0	0.6	5.0	45	0.7	−25 to +85	85	–	2	Single, Split	DIP−8, SO−8, Micro8	Low Noise
LM358	3.0 or ±1.5	32 or ±18	1.0	0.6	7.0	45	0.7	0 to 70	70	–	2	Single, Split	DIP−8, SO−8, Micro8	Low Noise
LM833	±2.5	36	15	7.0	5.0	300	4.0	−40 to +85	100	4.5	2	Single, Split	DIP−8, SO−8	Low Noise
LM2904	3.0 or ±1.5	26 or ±13	1.0	0.6	7.0	45	0.7	−40 to +105	70	–	2	Single, Split	DIP−8, SO−8, Micro8	Low Power
LM2904V	3.0 or ±1.5	26 or ±13	1.0	0.6	7.0	45	0.7	−40 to +125	70	–	2	Single, Split	DIP−8, SO−8, Micro8	Low Power
MC33072	3.0 or ±1.5	44 or ±22	4.5	13*	5.0	100	3.2	−40 to +85	97	32	2	Single, Split	DIP−8, SO−8	High SR, Wide BW, Single Supply, *Av = −1.0
MC33072A	3.0 or ±1.5	44 or ±22	4.5	13*	3.0	100	3.2	−40 to +85	97	32	2	Single, Split	DIP−8, SO−8	High SR, Wide BW, Single Supply, *Av = −1.0
MC33077	±2.5	±18	37	11	1 @ V_S = ±15 V	280	3.5	−40 to +85	107	4.4	2	Split	DIP−8, SO−8	Low Noise
MC33078	±5.0	±18	16	7.0	2.0	300	4.1	−40 to +85	100	4.5	2	Split	DIP−8, SO−8	Low Noise
MC33172	3.0 or ±1.5	44 or ±22	1.8	2.1	5.0	20	0.36	−40 to +85	90	32	2	Single, Split	DIP−8, SO−8	Low Power, Single Supply, Two Voltage Ranges
MC33172V	3.0 or ±1.5	44 or ±22	1.8	2.1	5.0	20	0.36	−40 to +105	90	32	2	Single, Split	SO−8	Low Power, Single Supply, Two Voltage Ranges, Extended Temp. Range
MC33178	±2.0	±18	5.0	2.0	3.0	100	0.85	−40 to +85	110	7.5	2	Split	DIP−8, SO−8	High Output Current, Low Power, Low Noise

*I_D typical for total device (all channels)

DUAL OPERATIONAL AMPLIFIERS (continued)

Device Name	V_{CC} (min) (V)	V_{CC} (max) (V)	GBW (typ) (MHz)	Slew Rate (typ) (V/us)	V_{IO} (max @ 25°C, Vs = 5.0 V) (mV)	I_{IB} (typ) (nA)	I_D* (typ) (mA)	Temp Range (°C)	CMR (typ) (dB)	e_n (typical) $\left(nV/\sqrt{Hz}\right)$ @ f = 1.0 kHz	Number of Channels	Supply Type	Package	Description
MC33202	1.8 or ±0.9	12 or ±6	2.2	1.0	8.0	80	1.8	–40 to +105	90	20	2	Single, Split	DIP–8, SO–8, Micro8™	Low Voltage, Rail–to–Rail
MC33202V	1.8 or ±0.9	12 or ±6	2.2	1.0	8.0	80	1.8	–55 to +125	90	20	2	Single, Split	DIP–8, SO–8	Low Voltage, Rail–to–Rail, Extended Temp. Range
MC33272A	3.0 or ±1.5	36 or ±18	24	10	1 @ V_S = ±15 V 2 @ V_S = 5.0 V	300	4.30	–40 to +85	100	18	2	Single, Split	DIP–8, SO–8	Single Supply, High SR, Low Input Offset Voltage
MC33502	1.0	7.0	5.0	3.0	5.0	0.04 pA	3.3	–40 to +105	75	30	2	Single, Split	DIP–8, SO–8	One Volt SMARTMOS, Rail–to–Rail
MC34072	3.0 or ±1.5	44 or ±22	4.5	13*	5.0	100	3.2	0 to 70	97	32	2	Single, Split	DIP–8, SO–8	High SR, Wide BW, Single Supply, *Av = –1.0
MC34072A	3.0 or ±1.5	44 or ±22	4.5	13*	3.0	100	3.2	0 to 70	97	32	2	Single, Split	DIP–8, SO–8	High SR, Wide BW, Single Supply, *Av = –1.0
MC34072V	3.0 or ±1.5	44 or ±22	4.5	13*	5.0	100	3.2	–40 to +125	97	32	2	Single, Split	DIP–8, SO–8	High SR, Wide BW, Single Supply, Extended Temp. Range, *Av = –1.0
NE592	–8.0	+8.0	90	–	–	9.0 μA	18	0–70	86	–	2	–	SO–8, 14 PDIP–8, 14	Video Amplifier
NE5532/A	±3.0	±20	10	9.0	4.0 @ ±15 V	200	8.0	0 to 70	100	8.0	2	Split	DIP–8, SO–8, SO–16W	Low Noise
SA5532	±3.0	±20	10	9.0	4.0 @ ±15 V	200	8.0	–40 to 85	100	8.0	2	Split	DIP–8	Low Noise
SE5532/A	±3.0	±20	10	9.0	2.0 @ ±15 V	200	8.0	–55 to 125	100	8.0	2	Split	DIP–8, SO–8	Low Noise
TCA0372	5.0 or ±2.5	40 or ±20	1.4	1.4	15 @ ±15 V	100	5.0	–40 to +125	90	22	2	Single, Split	SOP (12+2+2) DIP–8, DIP–16	Power, High Current
TCA0372B	5.0 or ±2.5	40 or ±20	1.4	1.4	15 @ ±15 V	100	5.0	–40 to +125	90	22	2	Single, Split	DIP–8, SO–16W	Power, High Current

*I_D typical for total device (all channels)

QUAD OPERATIONAL AMPLIFIERS

Device Name	V_{CC} (min) (V)	V_{CC} (max) (V)	GBW (typ) (MHz)	Slew Rate (typ) (V/us)	V_{IO} (max @ 25°C, Vs = 5.0 V) (mV)	I_{IB} (typ) (nA)	I_D* (typ) (mA)	Temp Range (°C)	CMR (typ) (dB)	e_n (typical) $\left(nV/\sqrt{Hz}\right)$ @ f = 1.0 kHz	Number of Channels	Supply Type	Package	Description
LM224	3.0 ±1.5	32 ±16	1.0	0.6	5.0	90	–	–25 to +85	85	–	4	Single, Split	DIP−14, SO−14	Low Power
LM324	3.0 ±1.5	32 ±16	1.0	0.6	7.0	90	–	0 to 70	70	–	4	Single, Split	DIP−14, SO−14	Low Power
LM324A	3.0 ±1.5	32 ±16	1.0	0.6	3.0	45	0.7	0 to 70	70	–	4	Single, Split	DIP−14, SO−14	Low Power
LM2902	3.0 ±1.5	26 ±13	1.0	0.6	7.0	90	–	–40 to +105	70	–	4	Single, Split	DIP−14, SO−14	Low Power
LM2902V	3.0 ±1.5	26 ±13	1.0	0.6	7.0	90	–	–40 to +125	70	–	4	Single, Split	DIP−14, SO−14	Low Power, Extended Temp. Range
MC3303	3.0 ±1.5	36 ±18	1.0	0.6	8.0	200	2.8	–40 to +85	90	–	4	Single, Split	DIP−14, SO−14	Low Power
MC33074	3.0 or ±1.5	44 or ±22	4.5	13*	5.0	100	6.4	–40 to +85	97	32	4	Single, Split	DIP−14, SO−14, TSSOP−14	High SR, Wide BW, Single Supply, *AV = –1.0
MC33074A	3.0 or ±1.5	44 or ±22	4.5	13*	3.0	100	6.4	–40 to +85	97	32	4	Single, Split	DIP−14, SO−14, TSSOP−14	High SR, Wide BW, Single Supply, *AV = –1.0
MC33079	±5.0	±18	16	7.0	2.5	300	8.4	–40 to +85	100	4.5	4	Split	DIP−14, SO−14	Low Noise
MC33174	3.0 or ±1.5	44 or ±22	1.8	2.1	5.0	20	0.72	–40 to +85	90	32	4	Single, Split	DIP−14, SO−14, TSSOP−14	Low Power, Single Supply, Two Voltage Ranges
MC33174V	3.0 or ±1.5	44 or ±22	1.8	2.1	5.0	20	0.72	–40 to +105	90	32	4	Single, Split	DIP−14, SO−14	Low Power, Single Supply, Two Voltage Ranges, Extended Temp. Range
MC33179	±2.0	±18	5.0	2.0	3.0	100	1.7	–40 to +85	110	7.5	4	Split	DIP−14, SO−14	High Output Current, Low Power, Low Noise

*I_D typical for total device (all channels)

QUAD OPERATIONAL AMPLIFIERS (continued)

Device Name	V_{CC} (min) (V)	V_{CC} (max) (V)	GBW (typ) (MHz)	Slew Rate (typ) (V/us)	V_{IO} (max @ 25°C, Vs = 5.0 V) (mV)	I_{IB} (typ) (nA)	I_D* (typ) (mA)	Temp Range (°C)	CMR (typ) (dB)	e_n (typical) $\left(nV/\sqrt{Hz}\right)$ @ f = 1.0 kHz	Number of Channels	Supply Type	Package	Description
MC33204	1.8 or ±0.9	12 or ±6.0	2.2	1.0	10	80	3.6	–40 to +105	90	20	4	Single, Split	DIP–14, SO–14, TSSOP–14	Low Voltage, Rail–to–Rail
MC33204V	1.8 or ±0.9	12 or ±6.0	2.2	1.0	10	80	3.6	–55 to +125	90	20	4	Single, Split	DIP–14, SO–14	Low Voltage, Rail–to–Rail, Extended Temp. Range
MC33274A	3.0 or ±1.5	36 or ±18	24	10	1.0 @ Vs = ±15 V 2.0 @ Vs = 5.0 V	300	8.6	–40 to +85	100	18	4	Single, Split	DIP–14, SO–14	Single Supply, High SR, Low Input Offset Voltage
MC3403	3.0 ±1.5	36 ±18	1.0	0.6	10	200	2.8	0 to 70	90	–	4	Single, Split	DIP–14, SO–14	Low Power
MC34074	3.0 or ±1.5	44 or ±22	4.5	13*	5.0	100	6.4	0 to 70	97	32	4	Single, Split	DIP–14, SO–14	High SR, Wide BW, Single Supply, *AV = –1.0
MC34074A	3.0 or ±1.5	44 or ±22	4.5	13*	3.0	100	6.4	0 to 70	97	32	4	Single, Split	DIP–14, SO–14	High SR, Wide BW, Single Supply, *AV = –1.0
MC34074V	3.0 or ±1.5	44 or ±22	4.5	13*	5.0	100	6.4	–40 to +125	97	32	4	Single, Split	DIP–14, SO–14	High SR, Wide BW, Single Supply, *AV = –1.0
NCV33274A	3.0 or ±1.5	36 or ±18	24	10	3.5 @ Vs = ±15 V 2.0 @ Vs = ±5.0 V	300	8.6	–40 to +125	100	18	4	Single, Split	DIP–14, SO–14	Single Supply, High SR, Low Input Offset Voltage

*I_D typical for total device (all channels)

SINGLE COMPARATORS

Device Name	V_{CC} (min)	V_{CC} (max)	V_{IO} (max) (mV)	I_{IO} (max) (nA)	I_{IB} (typ) (nA)	Iq (typ) (mA)	Temp Range (°C)	Response Time (ns)	Supply Type	Number of Channels	Package	Description
LM211	5.0 or ±2.5	36 or ±15	3.0	10	45	2.4	–25 to +85	200	Single Split	1	SO–8	Highly Flexible Voltage
LM311	5.0 or ±2.5	36 or ±15	7.5	50	45	2.4	0 to 70	200	Single Split	1	SO–8 DIP–8	Highly Flexible Voltage
NCS2200	0.85 or ±0.425	6.0 or ±3.0	+8.0	–	1.0 pA	10	–40 to 105	700	Single Split	1	SOT23–5 QFN 2x2.2	Low Voltage CMOS
NCS2201	0.85 or ±0.425	6.0 or ±3.0	+8.0	–	1.0 pA	10	–40 to 105	700	Single Split	1	SOT23–6	Low Voltage CMOS with Enable
NCS2202	0.85 or ±0.425	6.0 or ±3.0	+8.0	–	1.0 pA	10	–40 to 105	700	Single Split	1	SOT23–5	Low Voltage CMOS
NCS2203	0.85 or ±0.425	6.0 or ±3.0	+8.0	–	1.0 pA	10	–40 to 105	700	Single Split	1	SOT23–6	Low Voltage CMOS with Enable

DUAL COMPARATORS

Device Name	V_{CC} (min)	V_{CC} (max)	V_{IO} (max) (mV)	I_{IO} (max) (nA)	I_{IB} (typ) (nA)	Iq* (typ) (mA)	Temp Range (°C)	Response Time (ns)	Supply Type	Number of Channels	Package	Description
LM293	2.0 or ±1.0	36 or ±18	5.0	50	25	0.4	–25 to +85	1300	Single Split	2	SO–8	Low Offset Voltage
LM393	2.0 or ±1.0	36 or ±18	5.0	50	25	0.4	0 to 70	1300	Single Split	2	SO–8 DIP–8	Low Offset Voltage
LM2903	2.0 or ±1.0	36 or ±18	7.0	50	25	0.4	–40 to +105	1500	Single Split	2	SO–8 DIP–8	Low Offset Voltage
LM2903V	2.0 or ±1.0	36 or ±18	7.0	50	25	0.4	–40 to +125	1500	Single Split	2	SO–8 DIP–8	Low Offset Voltage

*Iq typical for total device (all channels)

QUAD COMPARATORS

Device Name	V_{CC} (min)	V_{CC} (max)	V_{IO} (max) (mV)	I_{IO} (max) (nA)	I_{IB} (typ) (nA)	Iq* (typ) (mA)	Temp Range (°C)	Response Time (ns)	Supply Type	Number of Channels	Package	Description
LM239	3.0 or ±1.5	36 or ±18	5.0	50	25	0.8	−25 to +85	1300	Single Split	4	SO−14 DIP−14	TTL and CMOS Compatible
LM339	3.0 or ±1.5	36 or ±18	5.0	50	25	0.8	0 to 70	1300	Single Split	4	SO−14 DIP−14	TTL and CMOS Compatible
LM2901	3.0 or ±1.5	36 or ±18	7.0	50	25	0.8	−40 to +105	1300	Single Split	4	SO−14 DIP−14	TTL and CMOS Compatible
LM2901V	3.0 or ±1.5	36 or ±18	7.0	50	25	0.8	−40 to +125	1300	Single Split	4	SO−14 DIP−14	TTL and CMOS Compatible
MC3302	3.0 or ±1.5	30 or ±15	20	100	25	0.8	−40 to +85	1300	Single Split	4	SO−14 DIP−14	TTL and CMOS Compatible

*Iq typical for total device (all channels)

AUDIO AMPLIFIERS

Audio Output/ Application	Class	Topology/ Features	Output Power	PSRR @ 217 Hz	Efficiency	THD + N	Turn–On Time (typ)	Iq (typ)	Shutdown Current (typ)	Package	Device Solutions
Mono Speaker – Basic Telephone Operations and Polyphonic Ringtones	AB	BTL	1 W+	–73 dB	63%	0.02%	285 ms	1.5 mA	10 nA	Micro8™ Microbump–9	NCP2890
	AB	BTL	1 W+	–73 dB	63%	0.02%	100 ms	1.5 mA	10 nA	Micro8™ Microbump–9	NCP2892A
	AB	Differential	1 W+	–80 dB	64%	0.006%	140 ms	1.9 mA	20 nA	Microbump–9 DFN–10	NCP4894
Stereo Headphones – MP3 Players, Bluetooth Headsets	AB	Virtual Ground No Output Cap	135 mW/Ch	–82 dB	63%	0.003%	285 ms	1.54 mA	10 nA	Micro10	NCP2809
	AB	Differential	150 mW/Ch	–80 dB	64%	0.006%	140 ms	1.9 mA	20 nA	Microbump–9 DFN10	NCP4894
Mono Speaker/Earpiece – Low Cost Integrated Solution	AB	Single–End/ Differential	1 W to Speaker; 250 mW to Earpiece	–70 dB	64%	SE 0.003% BTL 0.01%	140 ms	1.7 mA	20 nA	Microbump–9	NCP4896
Mono Speaker – Handsfree Speaker Phone	D	Filterless, Gain Select by Resistor	2 W+	–65 dB	90%	0.05%	9 ms	2.2 mA	300 nA	Microbump–9 DFN–8	NCP2820
Stereo Speakers – Offer Stereo Sound Quality to Play Video/Music on Demand, MP3	D	Filterless, Gain Selection by Resistor	2W+ per Channel	–65 dB	90%	0.05%	9 ms	4.4 mA	600 nA	Microbump–9	2x NCP2820
Mono Speaker – Handsfree Speaker Phone	D	Filterless Integrated Gain. Selectable Gain of 6 dB or 12 dB on External Pin.	2.65W	–65 dB	90%	0.05%	9 ms	2.5 mA	500 nA	Microbump–9	NCP2821

TRANSCONDUCTANCE AMPLIFIERS

Device Name	Channels	V_{CC} (typ) (V)	T_A (min) (°C)	T_A (max) (°C)	g_M (typ) (μmho)	V_{IO} (typ) (mV)	I_{IB} (typ) (μA)	S_R (typ) (V/μs)	B_W (typ) (MHz)	e_n (typ) (pA/Hz)	**THD** (typ) (%)	Package
AU5517	2	44	–40	125	9600	0.4	0.4	50	2	25	0.5	SOIC–16
NE5517A	2	44	0	70	9600	0.4	0.4	50	2	25	0.5	PDIP–16
NE5517	2	44	0	70	9600	0.4	0.4	50	2	25	0.5	SOIC–16, PDIP–16

VIDEO AMPLIFERS

Device Name	Channels	g_{BW} (typ) (MHz)	V_{CC} (max) (V)	I_D (typ) (mA)	T_A (min) (°C)	T_A (max) (°C)	Package
NE592D14	1	90	8	18	0	70	SOIC−14
NE592D8	1	40	8	18	0	70	SOIC−8
NE592N14	1	90	8	18	0	70	PDIP−14
NE592N8	1	40	8	18	0	70	PDIP−8

COMPANDORS

Device Name	Channels	V_{CC} (min) (V)	V_{CC} (max) (V)	I_{CC} (max) (V)	THD (typ) (%)	e_n (typ) (µV)	V_{REF} (V)	T_A (min) (°C)	T_A (max) (°C)	Package
NE570	2	6	24	4.3	0.3	20	1.8	0	70	SO−16 WB
SA571	2	6	18	4.3	0.5	20	1.8	−40	85	SO−16 WB, PDIP−16
SA572D	2	6	22	6.3	0.05	6	2.5	−40	85	SO−16 WB, TSSOP−16, PDIP−16
SA575D	2	3	7	4.2	0.12	6		−40	85	SOIC−20 WB, TSSOP−20, PDIP−20

Analog Switches

Table of Contents

ANALOG SWITCHES

Device	Description	Temperature Range (°C)	Operating Voltage (V)
AUDIO ANALOG SWITCHES			
NLAS3699	Dual DPDT Analog Switch	−55 to +125	1.65 to 3.6
NLAS3699B	Dual DPDT Analog Switch	−55 to +125	1.65 to 4.3
NLAS3799	Dual DPDT Ultra−Low Ron Analog Switch	−55 to +125	1.65 to 3.6
NLAS3799B	Dual DPDT Analog Switch	−55 to +125	1.65 to 4.3
NLAS4157	SPDT 1 Ω Analog Switch	−55 to +125	1.65 to 5.5
NLAS4684	Dual SPDT .5 Ω Analog Switch	−55 to +125	1.8 to 5.5
NLAS4783B	Triple SPDT 1 Ω Analog Switch	−55 to +125	1.65 to 4.3
NLAS5123	SPDT Low Ron Analog Switch	−55 to +125	1.65 to 5.5
NLAS5223	Dual SPDT Ultra−Low Ron Switch	−55 to +125	1.65 to 3.6
NLAS5223B	Dual SPDT Ultra−Low Ron Switch	−55 to +125	1.65 to 4.3
DATA ANALOG SWITCHES			
NLAS4717	Dual SPDT High Bandwidth USB 2.0 Compliant Analog Switch	−55 to +125	1.8 to 5.5
NLAS4717EP	Dual SPDT High Bandwidth USB 2.0 Compliant Analog Switch	−55 to +125	1.8 to 5.5
NLAS7222A	USB 2.0 High Speed Analog Switch	−55 to +125	3.0 to 3.6
GENERAL PURPOSE ANALOG SWITCHES			
M74VHC1GT66	Single Supply Analog Switch	−55 to +125	2 to 5.5
MC14016B	Quad Analog Switch/Quad Multiplexer	−40 to +85	3 to 18
MC14051B	Analog Multiplexer/Demultiplexer	−40 to +85	3 to 18
MC14052B	Analog Multiplexer/Demultiplexer	−40 to +85	3 to 18
MC14053B	Analog Multiplexer/Demultiplexer	−40 to +85	3 to 18
MC14066B	Quad Analog Switch/Quad Multiplexer	−40 to +85	3 to 18
MC14067B	Analog Multiplexer/Demultiplexer	−40 to +85	3 to 18
MC14551B	Quad 2−Channel Analog Multiplexer/Demultiplexer	−40 to +85	3 to 18
MC74HC4051	Analog Multiplexer/Demultiplexer	−55 to +125	2 to 6
MC74HC4052	Analog Multiplexer/Demultiplexer	−55 to +125	2 to 6
MC74HC4053	Analog Multiplexer/Demultiplexer	−55 to +125	2 to 6
MC74HC4066	Quad Analog Switch/Multiplexer/Demultiplexer	−40 to +85	2 to 12
MC74HC4316	Quad Analog Switch/Multiplexer/Demultiplexer	−55 to +125	2 to 6
MC74HC4851	Analog Multiplexers/Demultiplexers with Injection Current Effect Control	−55 to +125	2 to 6
MC74HC4852	Analog Multiplexers/Demultiplexers with Injection Current Effect Control	−55 to +125	2 to 6
MC74LVX4066	Quad Analog Switch/Multiplexer/Demultiplexer	−55 to +125	2 to 6
MC74LVX8051	Analog Multiplexer/Demultiplexer	−40 to +85	2 to 6
MC74LVX8053	Analog Multiplexer/Demultiplexer	−40 to +85	2 to 6
MC74LVXT4066	Quad Analog Switch/Multiplexer/Demultiplexer	−40 to +85	2 to 5.5
MC74LVXT8051	8 Channel Analog Switch	−40 to +85	2 to 5.5
MC74LVXT8053	Analog Multiplexer/Demultiplexer	−40 to +85	2 to 5.5
MC74VHC1G66	Single Supply Analog Switch	−55 to +125	2 to 5.5

ANALOG SWITCHES

Device	Description	Temperature Range (°C)	Operating Voltage (V)
GENERAL PURPOSE ANALOG SWITCHES			
MC74VHC1GT6	Single Supply Analog Switch	−55 to +125	2 to 5.5
MC74VHC4051	Analog Multiplexer/Demultiplexer	−55 to +125	2 to 6
MC74VHC4066	Quad Analog Switch/Multiplexer/Demultiplexer	−40 to +85	2 to 12
NLAS1053	2:1 Mux/Demux Analog Switches	−55 to +125	2 to 5.5
NLAS2066	Dual SPST Analog Switch, OVT Inputs	−55 to +125	1.65 to 5.5
NLAS3158	Dual SPDT Analog Switch	−55 to +125	1.65 to 5.5
NLAS323	Dual SPST Analog Switch, Single Supply	−55 to +125	2 to 5.5
NLAS324	Dual SPST Analog Switch, Single Supply	−55 to +125	2 to 5.5
NLAS325	Dual SPST Analog Switch, Single Supply	−55 to +125	2 to 5.5
NLAS3799	Dual DPDT Ultra−Low Ron Analog Switch	−55 to +125	1.65 to 3.6
NLAS4051	Analog Multiplexer/Demultiplexer	−55 to +125	2.5 to 5.5
NLAS4053	Triple 2:1 Analog Switch − Multiplexer	−55 to +125	2.5 to 5.5
NLAS44599	Dual DPDT Analog Switch	−55 to +125	2 to 5.5
NLAS4501	Single SPST Analog Switch	−55 to +125	2 to 5.5
NLAS4599	Single SPDT Analog Switch Single Supply	−55 to +125	2 to 5.5
NLAS9431	Dual DPDT Analog Switch	−55 to +125	2 to 5.5
NLASB3157	Single SPDT Analog Switch	−55 to +125	1.65 to 5.5
NLAST4051	Analog Multiplexer/Demultiplexer	−55 to +125	2.5 to 5.5
NLAST44599	Dual DPDT Analog Switch,TTL Level	−55 to +125	2 to 5.5
NLAST4501	Single SPST Analog Switch,TTL Level	−55 to +125	2 to 5.5
NLAST4599	Single SPDT Analog Switch Single Supply, TTL Level	−55 to +125	2 to 5.5
NLAST9431	Dual DPDT Analog Switch	−55 to +125	2 to 5.5
NLVHC1G66	Single Supply Analog Switch	−55 to +125	2 to 5.5
NLVHC1GT66	Single Supply Analog Switch	−55 to +125	2 to 5.5

Thyristors

Thyristors

Table of Contents

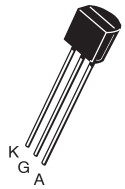
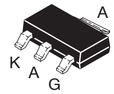
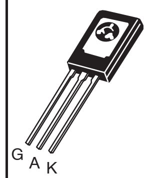
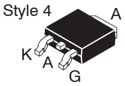
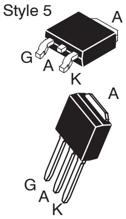
In Brief...

ON Semiconductor's broad line of Thyristors includes...

- A full line of Silicon Controlled Rectifiers (SCR's) covering a forward current range of 0.8 A to 25 A and blocking voltages from 30 V to 800 V. Available in a choice of six different plastic packages in both through hole and surface mount, for space saving requirements.
- An extensive line of Triacs (bidirectional devices) from 0.6 A to 16 A with blocking voltages from 200 V to 800 V. Like the SCR's, the Triacs are available in a choice of six different plastic packages.
- A new line of Thyristor Surge Suppressors in the surface mount SMB package covering surge currents of 50 A and 100 A, with break over voltages from 77 V to 400 V.
- Trigger devices, including Sidacs and PUT's (Programmable Unijunction Transistors). Trigger devices are available in both the axial lead and TO−92 packages.

SCRs

SILICON CONTROLLED RECTIFIERS

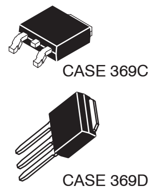
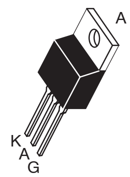
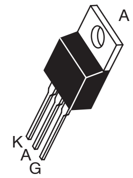
					Style 4  Style 5 			
On−State RMS Current IT(RMS) (Amps)	**Blocking Voltage VDRM, VRRM (Volts)**	**TO−92** (Note 1) **(TO−226AA)** Case 029 Style 10	**SOT−223** Case 318E Style 10	**TO−225AA (TO−126)** Case 077 Style 2	**D−PAK** Case 369C Style 4 & 5 Case 369D Style 5	**Surge Current ITSM (Amps) 60 Hz**	**Max IGT (mA)**	**Max VGT (Volts)**
0.8	30	**2N5060**				10	0.2	0.8
	60	**2N5061**						
	100	**2N5062**						
	200	**2N5064**						
	100	**MCR100−3**						
	200	**MCR100−4**						
	400	**MCR100−6**						
	600	**MCR100−8**						
	200		**MCR08B**			8.0	0.2	0.8
	600		**MCR08M**					
1.5	400	**MCR22−6**				15	0.2	0.8
	600	**MCR22−8**						
4.0	200			**C106B**		20	0.2	0.8
	400			**C106D**				
				C106D1				
	600			**C106M**				
				C106M1				
	400			**MCR106−6**		25	0.2	1.0
	600			**MCR106−8**				
	100				**MCR703A** (Note 2)	25	0.1	0.8
	400				**MCR706A** (Note 2)			
	600				**MCR708A** (Note 2)			
					MCR708A1 (Note 2 & 4)			
	400				**MCR716** (Note 3)			
	600				**MCR718** (Note 3)			

1. See TO−92 data sheets for complete device suffix packaging ordering options.
   RLRA, RLRE, RL, & RL1 suffixes: Radial Tape and Reel
   RLRM & ZL1 suffixes: Radial Tape and Ammo Pack
2. Denotes pkg style 5
3. Denotes pkg style 4
4. Denotes straight lead package

Lead Identification
A = Anode
K = Cathode
G = Gate

Shaded devices denote sensitive gate SCR's

SCRs (continued)

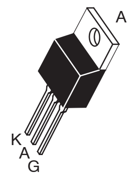
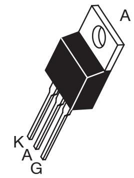
							
On−State RMS Current IT(RMS) (Amps)	**Blocking Voltage VDRM, VRRM (Volts)**	**D−PAK** Case 369C −001 = Case 369D Style 4	**TO−220AB** Case 221A−09 Style 3	**TO−220AB** Case 221A−07 Style 3	**Surge Current ITSM (Amps) 60 Hz**	**Max IGT (mA)**	**Max VGT (Volts)**
8.0	600	**MCR8DCM**			80	15	1.0
	800	**MCR8DCN**					
	400		**MCR8SD**		80	0.2	1.0
	600		**MCR8SM**				
	800		**MCR8SN**				
	800		**MCR8N**		80	15	1.0
	50			**C122F1**	90	25	1.5
	600	**MCR8DSM**			90	0.2	1.0
	800	**MCR8DSN**					
	100			**MCR72−3**	100	0.2	1.5
	400			**MCR72−6**			
	600			**MCR72−8**			
	50			**MCR218−2**	100	25	1.5
	200			**MCR218−4**			
	400			**MCR218−6**			
10	400		**MCR12LD**		100	8.0	0.8
	600		**MCR12LM**				
	800		**MCR12LN**				
	800			**MCR310−10**	100	0.2	1.5
12	600	**MCR12DSM**			100	0.2	1.0
	800	**MCR12DSN**					
	800	**MCR12DSN−001**					
	600	**MCR12DCM**			100	20	1.0
	800	**MCR12DCN**					
	400		**MCR12D**				
	600		**MCR12M**				
	800		**MCR12N**				
	50			**MCR68−2**	100	30	1.5

UL logo indicates UL Recognized File #E69369

Shaded devices denote sensitive gate SCR’s

Lead Identification
- A = Anode
- K = Cathode
- G = Gate

SCRs (continued)

						
On−State RMS Current IT(RMS) (Amps)	**Blocking Voltage VDRM, VRRM (Volts)**	**TO−220AB** Case 221A−09 Style 3	**TO−220AB** Case 221A−07 Style 3	**Surge Current ITSM (Amps) 60 Hz**	**Max IGT (mA)**	**Max VGT (Volts)**
12	50		**2N6394**	100	30	1.5
	100		**2N6395**			
	400		**2N6397**			
	800		**2N6399**			
16	800	**MCR16N**		160	20	1.0
	50		**2N6400**	160	30	1.5
	100		**2N6401**			
	200		**2N6402**			
	400		**2N6403**			
	600		**2N6404**			
	800		**2N6405**			
25	400	**MCR25D**		300	30	1.0
	600	**MCR25M**				
	800	**MCR25N**				
	50		**2N6504**	300	30	1.5
	100		**2N6505**			
	400		**2N6507**			
	600		**2N6508**			
	800		**2N6509**			
	50		**MCR69−2**			
	100		**MCR69−3**			

UL logo indicates UL Recognized File #E69369

Lead Identification
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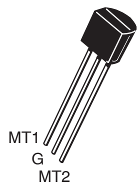
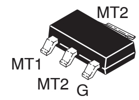
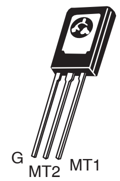
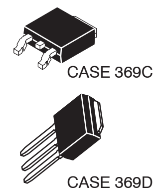
TRIACs (Bidirectional Devices)

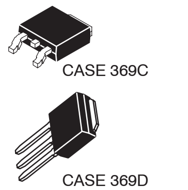
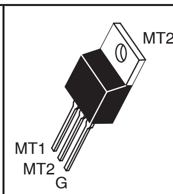
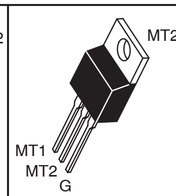
										
							Max IGT (mA)			
On−State RMS Current IT(RMS) (Amps)	**Blocking Voltage VDRM, VRRM (Volts)**	**TO−92** (Note 5) **(TO−226AA)** Case 029 Style 12	**SOT−223** Case 318E Style 11	**TO−225AA (TO−126)** Case 077 Style 5	**D−PAK** Case 369C −001 = Case 369D Style 6	**Surge Current ITSM (Amps) 60 Hz**	**Q1**	**Q2**	**Q3**	**Q4**
0.6	200	**MAC97A4**				8.0	5.0	5.0	5.0	7.0
	400	**MAC97A6**								
	600	**MAC97A8**								
0.8	400	**MAC997A6**								
		MAC997B6					3.0	3.0	3.0	5.0
	600	**MAC997A8**					5.0	5.0	5.0	7.0
		MAC997B8					3.0	3.0	3.0	5.0
	200		**MAC08B**				10	10	10	10
	600		**MAC08M**							
2.5	200			**T2322B**		25	10	10	10	10
4.0	200			**2N6071A**		30	5.0	5.0	5.0	10
				2N6071B			3.0	3.0	3.0	5.0
	400			**2N6073A**			5.0	5.0	5.0	10
				2N6073B			3.0	3.0	3.0	5.0
	600			**2N6075A**			5.0	5.0	5.0	10
				2N6075B			3.0	3.0	3.0	5.0
					MAC4DLM (Note 6)	40	3.0	3.0	3.0	5.0
					MAC4DLM−1 (Note 7)					
					MAC4DHM (Note 6)		5.0	5.0	5.0	10
					MAC4DHM−1 (Note 7)					

5. See TO−92 data sheets for complete device suffix packaging ordering options.
   RLRA, RLRE, RL, & RL1 suffixes: Radial Tape and Reel
   RLRM & ZL1 suffixes: Radial Tape and Ammo Pack
6. Denotes SMT package
7. Denotes straight lead package

Lead Identification
MT1 = Main Terminal 1
MT2 = Main Terminal 2
G = Gate

Shaded devices denote sensitive gate Triacs

TRIACs (Bidirectional Devices) (continued)

									
						Max IGT (mA)			
On−State RMS Current IT(RMS) (Amps)	**Blocking Voltage VDRM, VRRM (Volts)**	**D−PAK** Case 369C −001 = Case 369D Style 6	**TO−220AB** Case 221A−09 Style 4	**TO−220AB** Case 221A−07 Style 4	**Surge Current ITSM (Amps) 60 Hz**	**Q1**	**Q2**	**Q3**	**Q4**
4.0	600	**MAC4DSM** (Note 8)			40	10	10	10	–
		MAC4DSM−1 (Note 9)							
	800	**MAC4DSN** (Note 8)							
		MAC4DSN−1 (Note 9)							
	600	**MAC4DCM** (Note 8)			40	35	35	35	–
		MAC4DCM−1 (Note 9)							
	800	**MAC4DCN** (Note 8)							
		MAC4DCN−1 (Note 9)							
6.0	400			**T2500D**	60	25	60	25	60
8.0	400		**MAC8SD**		70	5.0	5.0	5.0	–
	600		**MAC8SM**						
	800		**MAC8SN**						
	400		**MAC8D**		80	35	35	35	–
	600		**MAC8M**						
	800		**MAC8N**						
	400		**MAC9D**			50	50	50	–
	600		**MAC9M**						
	800		**MAC9N**						
	200			**MAC228A4**		5.0	5.0	5.0	10
	400			**MAC228A6**					
	600			**MAC228A8**					
	800			**MAC228A10**					
	600			**2N6344**	100	50	75	50	75
	400			**T2800D**		25	60	25	60

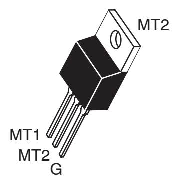
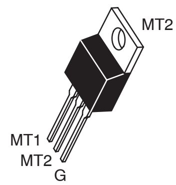
8. Denotes SMT package
9. Denotes straight lead package

UL logo indicates UL Recognized File #E69369

Shaded devices denote sensitive gate Triacs

Lead Identification
MT1 = Main Terminal 1
MT2 = Main Terminal 2
G = Gate

TRIACs (Bidirectional Devices) (continued)

								
					Max IGT (mA)			
On−State RMS Current IT(RMS) (Amps)	**Blocking Voltage VDRM, VRRM (Volts)**	**TO−220AB** Case 221A−09 Style 4	**TO−220AB** Case 221A−07 Style 4	**Surge Current ITSM (Amps) 60 Hz**	**Q1**	**Q2**	**Q3**	**Q4**
10	600		**MAC210A8**	100	50	50	50	75
	800		**MAC210A10**					
12	600	**MAC12SM**		90	5.0	5.0	5.0	–
	800	**MAC12SN**						
	400	**MAC12HCD**		100	50	50	50	–
	600	**MAC12HCM**						
	800	**MAC12HCN**						
	400	**MAC12D**			35	35	35	–
	600	**MAC12M**						
	800	**MAC12N**						
	600		**MAC212A8**		50	50	50	75
	800		**MAC212A10**					
	600		**2N6344A**		50	75	50	75
	600		**2N6348A**					
	800		**2N6349A**					
15	400	**MAC15SD**		120	5.0	5.0	5.0	–
	600	**MAC15SM**						
	800	**MAC15SN**						
	600	**MAC15M**		150	35	35	35	–
	800	**MAC15N**						
	400		**MAC15A6**		50	50	50	75
	600		**MAC15A8**					
	800		**MAC15A10**					
16	400	**MAC16D**			50	50	50	–
	600	**MAC16M**						
	800	**MAC16N**						
	600	**MAC16CM**			35	35	35	–
	800	**MAC16CN**						

UL logo indicates UL Recognized File #E69369

Shaded devices denote sensitive gate Triacs

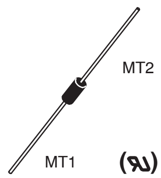
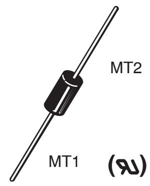
Lead Identification
MT1 = Main Terminal 1
MT2 = Main Terminal 2
G = Gate

Surge Suppressors and Triggers

THYRISTOR SURGE SUPPRESSORS (Bidirectional Devices)

					
Surge Current IPPS1 10 x 1000 μsec (Amps)	**Maximum Off–State Voltage (Volts)**	**SMB** Case 403C	**Maximum Breakover Voltage VBO (Volts)**	**Minimum Holding Current IH (mA)**	**General Description**
50	58	**NP0640SA**	77	150	These Thyristor Surge Protector Devices (TSPD) protect telecommunication circuits such as central office, access, and customer premises equipment from overvoltage conditions. These arebidirectional devices so they are able to have functionality of 2 devices in one package, saving valuable space on board layout. These devices will act as a crowbar when overvoltage occurs and will divert the energy away from circuit or device that is being protected. Use of the NP Series in equipment will help meet various regulatory requirements including: GR–1089–CORE, EC 61000–4–5, ITU K.20/21/45, IEC 60950, TIA–968–A, FCC Part 68, EN 60950,UL 1950.
	65	**NP0720SA**	88		
	75	**NP0900SA**	98		
	90	**NP1100SA**	130		
	120	**NP1300SA**	160		
	140	**NP1500SA**	180		
	170	**NP1800SA**	220		
	180	**NP2100SA**	240		
	190	**NP2300SA**	260		
	220	**NP2600SA**	300		
	275	**NP3100SA**	350		
	320	**NP3500SA**	400		
80	58	**NP0640SB**	77	150	
	65	**NP0720SB**	88		
	75	**NP0900SB**	98		
	90	**NP1100SB**	130		
	120	**NP1300SB**	160		
	140	**NP1500SB**	180		
	170	**NP1800SB**	220		
	180	**NP2100SB**	240		
	190	**NP2300SB**	260		
	220	**NP2600SB**	300		
	275	**NP3100SB**	350		
	320	**NP3500SB**	400		
100	58	**NP0640SC**	77	150	
	65	**NP0720SC**	88		
	75	**NP0900SC**	98		
	90	**NP1100SC**	130		
	120	**NP1300SC**	160		
	140	**NP1500SC**	180		
	170	**NP1800SC**	220		
	180	**NP2100SC**	240		
	190	**NP2300SC**	260		
	220	**NP2600SC**	300		
	275	**NP3100SC**	350		
	320	**NP3500SC**	400		

High Voltage Bidirectional Triggers: Sidacs

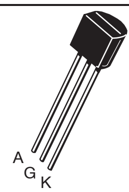
					
On−State RMS Current IT(RMS) (Amps)	**DO−41** Case 059A	**Surmetic 50** Case 267 Style 2	**Breakover Voltage Range VBO (Volts)**	**Surge Current ITSM (Amps) 60 Hz**	**General Description**
0.9	**MKP1V120**		110−130	4.0	High voltage trigger devices similar in operation to triacs. Upon reaching the breakover voltage in either direction, the devices switch to a low voltage on state.
	MKP1V130		120−140		
	MKP1V160		150−170		
	MKP1V240		220−250		
1.0		**MKP3V120** **MKP3V240**	220−250	20	

Lead Identification: Suppressor/Sidac
MT1 = Main Terminal 1
MT2 = Main Terminal 2

Lead Identification: PUT
A = Anode
K = Cathode
G = Gate

Surge Suppressors and Triggers (continued)

THYRISTOR TRIGGERS: PROGRAMMABLE UNIJUNCTION TRANSISTORS (PUT's)

					
IP			**IV**		
RG = 10KΩ (μ Amps max.)	**RG = 1MΩ (μ Amps max.)**	**TO−92** (Note 10) **(TO−226AA)** Case 029 Style 16	**RG = 10KΩ (μ Amps min.)**	**RG = 1MΩ (μ Amps max.)**	**General Description**
5.0	2.0	**2N6027**	70	50	Similar to unijunction transistors, except that IP, IV, and intrinsic voltage are programmable (adjustable) by means of external voltage divider.
1.0	0.15	**2N6028**	25	25	

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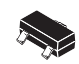
10. See TO−92 data sheets for complete device suffix packaging ordering options.
    RLRA, RLRE, RL, & RL1 suffixes: Radial Tape and Reel
    RLRM & ZL1 suffixes: Radial Tape and Ammo Pack

Diodes

Table of Contents

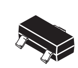
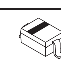
Tuning and Switching Diodes

TUNING DIODES – ABRUPT JUNCTION

Device	V_R Volts	C_T @ V_R = 4.0 V, 1.0 MHz pF Min	pF Nominal	pF Max	Cap Ratio Min	Q @ 4.0 V 50 MHz Typ	Package
MV2105	30	13.5	15	16.5	2.5	400	 TO–226AC, TO–92 2–Lead Case 182–06
MV2109	30	29.7	33	36.3	2.5	200	
MMBV2105L	30	13.5	15	16.5	2.5	400	 TO–236AB, SOT–23 Case 318–08
MMBV2109L	30	29.7	33	36.3	2.5	200	
MMBV2101L	30	6.1	6.8	7.5	2.5	450	
MMBV3102L	30	20	–	25	4.5	200	

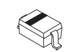
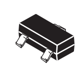
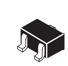
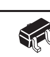
Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

TUNING DIODES – HYPER–ABRUPT JUNCTION

Device	V_R Volts	C_T (f = 1.0 MHz) pF Min	pF Max	Volts	Cap Ratio Min	Max	Volts	Q 3.0 V Min	Type	Package
MV209	30	26	32	3.0	5.0	6.5	3.0/25	200	Single	 TO–226AC, TO–92 2–Lead Case 182–06
MV104	32	37	42	3.0	2.5	2.8	–	100	Single	
MMBV105GL	30	1.5	2.8	25	4.0	6.5	3.0/25	200	Single	 TO–236AB, SOT–23 Case 318–08
MMBV109L	30	26	32	3.0	5.0	6.5	3.0/25	200	Single	
MMBV409L	20	26	32	3.0	1.5	1.9	3.0/8.0	200	Single	
MMBV809L	20	4.5	6.1	2.0	1.8	2.6	2.0/8.0	300	Single	
MMBV432L	14	43	48	2.0	1.5	2.0	–	100@ 2.0V	Single	
MMBV609L	20	26	32	3.0	1.8	2.4	3/8	250	Dual Common Cathode	
MMVL109	30	26	32	3	5.0	6.5	3.0/25	200	Single	 SOD–323 Case 477–02

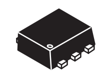
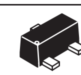
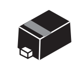
Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

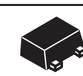
SCHOTTKY DIODES

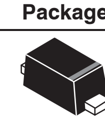
Device	V_R Volts	C_T @ V		V_F Volts Max	I_R @ V		Type	Package
		pF Max	Volts		nA Max	Volts		
MBD701	70	1.0	20	1.0	200	35	Single	 TO–226AC, TO–92 2–Lead Case 182–06
MBD301	30	1.5	15	0.6	200	25	Single	
MMSD701	70	1.0	20	1.0	200	35	Single	 SOD–123 Case 425–04
BAT54	30	10	1.0	0.4	2000	25	Single	
MMSD301	30	1.5	15	0.6	200	25	Single	
MMDL770	70	1.0	20	1.0	200	35	Single	 SOD–323 Case 477–02
BAT54H	30	10	1.0	0.4	2000	25	Single	
MMDL301	30	1.5	15	0.6	200	25	Single	
RB751V40	30	2.5	1.0	0.37	500	30	Single	
MMDL101	7.0	1.0	0	0.6	250	3.0	Single	
NSR0320MW2	23	35	5.0	0.27	1000	15	Single	
BAS70L	70	2.0	0	0.75	100	50	Single	 TO–236AB, SOT–23 Case 318–08
BAS70–04L	70	2.0	0	0.75	100	50	Dual Series	
MMBD701L	70	1.0	20	1.0	200	35	Single	
BAS40L	40	5.0	1.0	0.5	1000	25	Single	
BAS40–04L	40	5.0	1.0	0.5	1000	25	Dual Series	
BAS40–06L	40	5.0	1.0	0.5	1000	25	Dual Common Anode	
BAT54CL	30	10	1.0	0.4	2000	25	Dual Common Cathode	
BAT54L	30	10	1.0	0.4	2000	25	Single	
BAT54AL	30	10	1.0	0.4	2000	25	Dual Common Anode	
BAT54SL	30	10	1.0	0.4	2000	25	Dual Series	
MMBD301L	30	1.5	15	0.6	200	25	Single	
MMBD452L	30	1.5	15	0.6	200	25	Dual Series	
MMBD101L	7.0	1.0	0	0.6	250	3.0	Single	
MMBD352L	7.0	1.0	0	0.6	250	3.0	Dual Series	
MMBD353L	7.0	1.0	0	0.6	250	3.0	Dual Series	
MMBD354L	7.0	1.0	0	0.6	250	3.0	Dual Common Cathode	
MMBD355L	7.0	1.0	0	0.6	250	3.0	Dual Common Anode	
MMBD770	70	1.0	20	1.0	200	35	Single	 SC–70, SOT–323 Case 419–04
BAT54AW	30	10	1.0	0.4	2000	25	Dual Common Anode	
BAT54CW	30	10	1.0	0.4	2000	25	Dual Common Cathode	
BAT54W	30	10	1.0	0.4	2000	25	Single	
BAT54SW	30	10	1.0	0.4	2000	25	Dual Series	
MMBD330	30	1.5	15	0.6	200	25	Single	
MMBD717L	20	2.5	1.0	0.37	1000	10	Dual Common Anode	
MMBD352W	7.0	1.0	0	0.6	250	3.0	Dual Series	
BAT54CT	30	10	1.0	0.4	2000	25	Dual Common Cathode	 SOT–416, SC–75, SC–90 Case 463–01

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

SCHOTTKY DIODES

Device	V_R Volts	C_T @ V pF Max	C_T @ V Volts	V_F Volts Max	I_R @ V nA Max	I_R @ V Volts	Type	Package
MBD770DW	70	1.0	0	0.5	200	35	Dual Isolated	 SC−88, SOT−363 Case 419B−02
MBD54DW	30	1.0	0	0.32	2000	25	Dual Isolated	
MBD330DW	30	1.5	0	0.4	200	25	Dual Isolated	
NSR15TW1T2	15	1.0	0	0.415	50	1.0	Triple	
NSR0320XV6	23	35	5.0	0.27	1000	15	Single	 SOT−563 Case 463A−01
NSR15ADXV6	15	1.0	0	0.415	50	1.0	Dual Isolated	
BAT54CXV3	30	10	1.0	0.4	2000	25	Dual Common Cathode	 SC−89 Case 463C−03
RB751S40	40	2.5	1.0	0.37	500	30	Single	 SOD−523 Case 502−01
BAT54XV2	30	10	1.0	0.4	2000	25	Single	
RB520S30	30	–	–	0.5	1000	10	Single	
RB521S30	30	–	–	0.6	30000	10	Single	

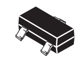
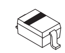
Device	Technology	V_R Volts	C_T @ V pF Max	C_T @ V Volts	V_F Max Volts	I_R @ V nA Max	I_R @ V Volts	T_{RR} nS	Package
NSR30CM3	Schottky	30	10	1.0	0.8	2.0	25	5	 SOT−723 Case 631AA−01

Device	V_R Volts	C_T @ V pF Max	C_T @ V Volts	V_F Max Volts Max	I_R @ V μA Max	I_R @ V Volts	Type	Package
NSR0130P2	30	–	–	0.385	0.350	10	Single	 SOD−923 Case 514AA−01
NSR0140P2	40	2.5	1.0	0.350	0.500	30	Single	
NSR0230P2	30	–	–	0.325	10	10	Single	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Switching Diodes

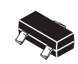
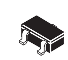
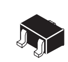
PIN SWITCHING DIODES

Device	V_R Volts Min	C_T @ V pF Max	Volts	Resistance Ω Max	I_R μA Max	Type	Package
MMBV3700L	200	1.0	20	1.0	0.1	Single	
MMBV3401L	35	1.0	20	0.7	0.1	Single	**TO–236AB, SOT–23 Case 318–08**
MMVL3401	35	1.0	20	0.7	0.1	Single	 **SOD–323 Case 477–02**

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Switching Diodes

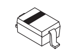
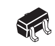
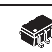
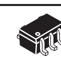
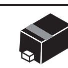
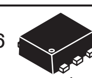
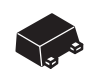
GENERAL−PURPOSE SIGNAL AND SWITCHING DIODES

Device	V_R Min Volts	I_R Max μA	V_F		C_T Max pF	t_{rr} Max ns	Type	Package
			Min Volts	Max Volts				
BAS21L	250	0.1	–	1.0	5.0	50	Single	
BAS21SL	250	0.1	–	1.0	5.0	50	Dual Series	
MMBD914L	100	5.0	–	1.0	4.0	4.0	Single	
BAS16L	75	1.0	–	1.0	2.0	6.0	Single	
MMBD6050L	70	0.1	0.85	1.1	2.5	4.0	Single	
BAL99L	70	2.5	–	1.0	1.5	6.0	Single	
BAS116L	75	0.005	–	0.9	2.0	3000	Single	
MMBD7000L	100	1.0	0.75	1.1	1.5	4.0	Dual Series	
MMBD2836L	75	0.1	–	1.0	4.0	4.0	Dual Common Anode	
MMBD2838L	75	0.1	–	1.0	4.0	4.0	Dual Common Cathode	
BAV70L	70	5.0	–	1.0	1.5	6.0	Dual Common Cathode	**TO−236AB, SOT−23**
BAV99L	70	2.5	–	1.0	1.5	4.0	Dual Series	**Case 318−08**
BAW56L	70	2.5	–	1.0	2.0	6.0	Dual Common Anode	
MMBD6100L	70	0.1	0.85	1.1	2.5	4.0	Dual Common Cathode	
BAV74L	50	0.1	–	1.0	2.0	4.0	Dual Common Cathode	
MMBD2835L	35	0.1	–	1.0	4.0	4.0	Dual Common Anode	
MMBD2837L	35	0.1	–	1.0	4.0	4.0	Dual Common Cathode	
BAV199L	70	0.005	–	0.9	2.0	3000	Dual Series	
BAS20L	200	0.1	–	1.0	5.0	50	Single	
BAS19L	120	0.1	–	1.0	5.0	50	Single	
M1MA151K	40	0.1	–	1.2	2.0	3.0	Single	
M1MA152K	80	0.1	–	1.2	2.0	3.0	Single	
M1MA151WA	40	0.1	–	1.2	15	10	Dual Common Anode	
M1MA151WK	40	0.1	–	1.2	2.0	3.0	Dual Common Cathode	**SC−59**
M1MA152WA	80	0.1	–	1.2	15	10	Dual Common Anode	**Case 318D−04**
M1MA152WK	80	0.1	–	1.2	2.0	3.0	Dual Common Cathode	
BAS16W	75	1.0	–	1.25	2.0	6.0	Single	
M1MA141K	40	0.1	–	1.2	2.0	3.0	Single	
M1MA174	100	5.0	–	1.0	4.0	4.0	Single	
M1MA142WK	80	0.1	–	1.2	2.0	3.0	Dual Common Cathode	
M1MA142WA	80	0.1	–	1.2	15	10	Dual Common Anode	
BAW56W	70	2.5	–	1.0	2.0	6.0	Dual Common Anode	**SC−70, SOT−323**
BAV70W	70	5.0	–	1.0	1.5	6.0	Dual Common Cathode	**Case 419−04**
BAV99W	70	2.5	–	1.0	1.5	6.0	Dual Series	
BAV99RW	70	2.5	–	1.0	1.5	6.0	Dual Series	
M1MA141WA	40	0.1	–	1.2	15	10	Dual Common Anode	
MMSD914	100	5.0	–	1.0	4.0	4.0	Single	
MMSD103	250	100	–	1.0	5.0	50	Single	**SOD−123**
MMSD4148	100	5.0	–	1.0	4.0	4.0	Single	**Case 425−04**

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Switching Diodes

GENERAL–PURPOSE SIGNAL AND SWITCHING DIODES

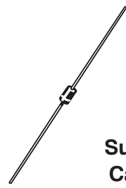
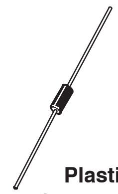
Device	V_R Min Volts	I_R Max μA	V_F Min Volts	V_F Max Volts	C_T Max pF	t_{rr} Max ns	Type	Package
BAS16H	75	1.0	–	1.0	2.0	6.0	Single	 **SOD–323 Case 477–02**
BAS20H	200	0.1			5.0	50	Single	
BAS21H	250	0.1	–	1.0	5.0	50	Single	
MMDL914	100	5.0	–	1.0	4.0	4.0	Single	
MMDL6050	70	0.1	0.85	1.1	2.5	4.0	Single	
BAS16T	75	1.0	–	1.0	2.0	6.0	Single	 **SOT–416, SC–75, SC–90 Case 463–01**
DA121T	80	1.0			2.0	6.0	Single	
DAP222	80	0.1	–	1.2	3.5	4.0	Dual Common Anode	
BAW56T	70	2.5	–	1.0	2.0	6.0	Dual Common Anode	
DAN222	80	0.1	–	1.2	3.5	4.0	Dual Common Cathode	
BAV70T	70	5.0	–	1.0	1.5	6.0	Dual Common Cathode	
HN2D02FUTW1	85	0.1	–	1.2	2.0	3.0	Triple Isolated	 **SC–88 Case 419B–02**
BAS21DW5	250	0.1	–	1.0	5.0	50	Dual Isolated	 **SC–88A Case 419A–02**
1SS400	100	0.1	–	1.2	3.0	4.0	Single	 **SOD–523 Case 502–01**
BAS16XV2	75	1.0	–	1.0	2.0	6.0	Single	
NSD914XV2	100	–	–	1.0	4.0	4.0	Single	
NSDEMP11XV6	70	0.01	–	1.2	3.5	4.0	Two Dual Common Anode	 **SOT–563 Case 463A–01**
BAS16DXV6	75	0.001	–	1.25	2.0	6.0	Dual Isolated	
DAN222M3	80	0.1	–	1.2	3.5	4.0	Dual Common Cathode	 **SOT–723 Case 631AA–01**
DAP222M3	80	0.1	–	1.2	3.5	4.0	Dual Common Anode	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

1. Devices in **bold**, samples starting Oct. 2002, production starting Dec. 2002.
2. Remainder of devices, 4 to 8 weeks after receipt of request based on note 1 timetable.

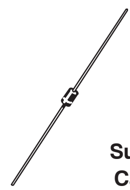
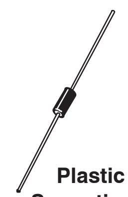
Zener Diodes – Regulation in Axial Leads

Table 1. AXIAL LEADED – 3, 5 WATT

Nominal Zener Breakdown Voltage	3 Watt Cathode = Polarity Band		5 Watt Cathode =Polarity Band
Volts	 Plastic Surmetic 30 Case 59-10 (DO-41)		 Plastic Surmetic 40 Case 17
1.8			
2.0			
2.2			
2.4			
2.5			
2.7			
2.8			
3.0			
3.3		1N5913B	1N5333B
3.6	MZP4729A		1N5334B
3.9			1N5335B
4.3			1N5336B
4.7		1N5917B	1N5337B
5.1			1N5338B
5.6		1N5919B	1N5339B
6.0			1N5340B
6.2	MZP4735A	1N5920B	1N5341B
6.8		1N5921B	1N5342B
7.5			1N5343B
8.2		1N5923B	1N5344B
8.7			
9.1		1N5924B	1N5346B
10		1N5925B	1N5347B
11			1N5348B
12		1N5927B	1N5349B
13			1N5350B
14			1N5351B
15		1N5929B	1N5352B
16	3EZ16D		1N5353B
17	MZP4746A		1N5354B
18	3EZ18D	1N5931B	1N5355B
19			1N5356B
20		1N5932B	1N5357B
22			1N5358B
24	MZP4749A	1N5934B	1N5359B

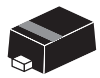
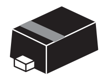
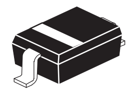
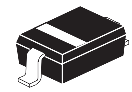
Zener Diodes – Regulation in Axial Leads (continued)

Table 1. AXIAL LEADED – 3, 5 WATT (continued)

Nominal Zener Breakdown Voltage	3 Watt Cathode = Polarity Band		5 Watt Cathode =Polarity Band
Volts	 Plastic Surmetic 30 Case 59-10 (DO-41)		 Plastic Surmetic 40 Case 17
25			1N5360B
27	MZP4750A	1N5935B	1N5361B
28			1N5362B
30			1N5363B
33		1N5937B	1N5364B
36		1N5938B	1N5365B
39			1N5366B
43		1N5940B	1N5367B
47		1N5941B	1N5368B
51		1N5942B	1N5369B
56			1N5370B
60			1N5371B
62			1N5372B
68			1N5373B
75		1N5946B	1N5374B
82			1N5375B
87			
91		1N5948B	1N5377B
100			1N5378B
110			
120			1N5380B
130			1N5381B
140			
150		1N5953B	1N5383B
160			1N5384B
170			
180		1N5955B	1N5386B
190			***1N5387***
200		1N5956B	1N5388B

Zener Diodes − Regulation in Surface Mount

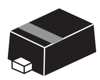
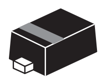
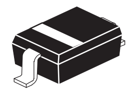
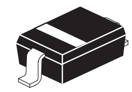
Table 2. SURFACE MOUNT PACKAGES − 0.2 WATT

Nominal Zener Breakdown Voltage	200 mW Standard Tolerance SOD−523	200 mW Tight Tolerance SOD−523	200 mW Standard Tolerance SOD−323	200 mW Tight Tolerance SOD−323
Volts	 **Case 502**	 **Case 502**	 **Case 477 Style 1**	 **Case 477 Style 1**
1.8				
2.0				
2.2				
2.4	MM5Z2V4	MM5Z2V4S	MM3Z2V4	
2.5				
2.7	MM5Z2V7		MM3Z2V7	
2.8				
3.0	MM5Z3V0		MM3Z3V0	
3.3	MM5Z3V3		MM3Z3V3	MM3Z3V3S
3.6	MM5Z3V6		MM3Z3V6	
3.7				
3.9			MM3Z3V9	MM3Z3V9S
4.0				
4.3			MM3Z4V3	MM3Z4V3S
4.7	MM5Z4V7	MM5Z4V7S	MM3Z4V7	MM3Z4V7S
5.1	***MM5Z5V1***	***MM5Z5V1S***	***MM3Z5V1***	***MM3Z5V1S***
5.6	***MM5Z5V6***	***MM5Z5V6S***	***MM3Z5V6***	***MM3Z5V6S***
6.0				
6.2		MM5Z6V2S	MM3Z6V2	MM3Z6V2S
6.8	***MM5Z6V8***	***MM5Z6V8S***	***MM3Z6V8***	***MM3Z6V8S***
7.5	MM5Z7V5		MM3Z7V5	MM3Z7V5S
8.2	MM5Z8V2	MM5Z8V2S	MM3Z8V2	MM3Z8V2S
8.7				
9.1	MM5Z9V1	MM5Z9V1S	MM3Z9V1	MM3Z9V1S
10	MM5Z10V		MM3Z10V	MM3Z10VS
11			MM3Z11V	
12	***MM5Z12V***		***MM3Z12V***	***MM3Z12VS***
13			MM3Z13V	
14				
14.5				
15	***MM5Z15V***		***MM3Z15V***	***MM3Z15V5***
16	***MM5Z16V***		***MM3Z16V***	***MM3Z16VS***
17				
18			***MM3Z18V***	***MM3Z18VS***
19				
20			MM3Z20V	
22			MM3Z22V	
24			MM3Z24V	
25				
27	MM5Z27V		MM3Z27V	
28				
30	MM5Z30V			
33	MM5Z33V		MM3Z33V	

Devices listed in **bold**, *italic* are ON Semiconductor preferred devices.

Zener Diodes – Regulation in Surface Mount

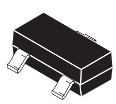
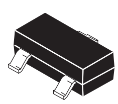
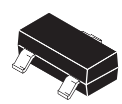
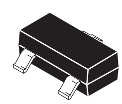
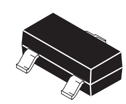
Table 2. SURFACE MOUNT PACKAGES – 0.2 WATT (continued)

Nominal Zener Breakdown Voltage	200 mW Standard Tolerance SOD−523	200 mW Tight Tolerance SOD−523	200 mW Standard Tolerance SOD−323	200 mW Tight Tolerance SOD−323
Volts	 **Case 502**	 **Case 502**	 **Case 477 Style 1**	 **Case 477 Style 1**
36	***MM5Z36V***		MM3Z36V	
39			MM3Z39V	
43			MM3Z43V	
47	***MM5Z47V***			
51				

Devices listed in **bold**, *italic* are ON Semiconductor preferred devices.

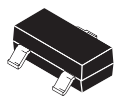
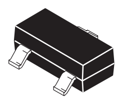
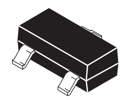
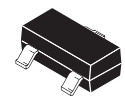
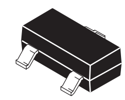
Zener Diodes – Regulation in Surface Mount

Table 3. SURFACE MOUNT PACKAGES – 0.225 WATT

Nominal Zener Breakdown Voltage	225 mW Standard Tolerance SOT−23	225 mW Tight Tolerance SOT−23	225 mW Energy Rated SOT−23	225 mW Standard Tolerance SOT−23	225 mW Energy Rated SOT−23
Volts	 **Case 318**	 **Case 318**	 **Case 318**	 **Case 318**	 **Case 318**
1.8					
2.0					
2.2					
2.4	BZX84C2V4L			MMBZ5221BL	
2.5				MMBZ5222BL	
2.7	BZX84C2V7L			MMBZ5223BL	
2.8					
3.0	BZX84C3V0L			MMBZ5225BL	
3.3	BZX84C3V3L		BZX84C3V3E	MMBZ5226BL	
3.6	BZX84C3V6L			MMBZ5227BL	MMBZ5227EL
3.7					
3.9	BZX84C3V9L		BZX84C3V9E	MMBZ5228BL	
4.0					
4.3	BZX84C4V3L			MMBZ5229BL	
4.7	***BZX84C4V7L***		***BZX84C4V7E***	MMBZ5230BL	
5.1	***BZX84C5V1L***	***BZX84B5V1L***	***BZX84C5V1E***	***MMBZ5231BL***	***MMBZ5231EL***
5.6	***BZX84C5V6L***	***BZX84B5V6L***	***BZX84C5V6E***	***MMBZ5232BL***	***MMBZ5232EL***
6.0				MMBZ5233BL	
6.2	***BZX84C6V2L***	***BZX84B6V2L***	***BZX84C6V2E***	***MMBZ5234BL***	***MMBZ5234EL***

Zener Diodes – Regulation in Surface Mount (continued)

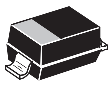
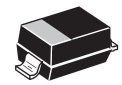
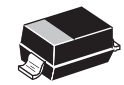
Table 3. SURFACE MOUNT PACKAGES – 0.225 WATT (continued)

Nominal Zener Breakdown Voltage	225 mW Standard Tolerance SOT–23	225 mW Tight Tolerance SOT–23	225 mW Energy Rated SOT–23	225 mW Standard Tolerance SOT–23	225 mW Energy Rated SOT–23
Volts	 Case 318	 Case 318	 Case 318	 Case 318	 Case 318
6.8	BZX84C6V8L	***BZX84B6V8L***		***MMBZ5235BL***	
7.5	BZX84C7V5L	***BZX84B7V5L***		MMBZ5236BL	
8.2	BZX84C8V2L	***BZX84B8V2L***	BZX84C8V2E	MMBZ5237BL	MMBZ5237EL
8.7				MMBZ5238BL	
9.1	BZX84C9V1L	***BZX84B9V1L***	BZX84C9V1E	MMBZ5239BL	
10	BZX84C10L			***MMBZ5240BL***	***MMBZ5240EL***
11	BZX84C11L			MMBZ5241BL	
12	***BZX84C12L***			***MMBZ5242BL***	***MMBZ5242EL***
13	BZX84C13L		BZX84C13E	MMBZ5243BL	MMBZ5243EL
14				MMBZ5244BL	MMBZ5244EL
15	BZX84C15L			***MMBZ5245BL***	***MMBZ5245EL***
16	BZX84C16L	***BZX84B16L***		MMBZ5246BL	MMBZ5246EL
17				MMBZ5247BL	
18	***BZX84C18L***	***BZX84B18L***	***BZX84C18E***	***MMBZ5248BL***	***MMBZ5248EL***
19				MMBZ5249BL	
20	BZX84C20L			***MMBZ5250BL***	MMBZ5250EL
22	BZX84C22L			MMBZ5251BL	
24	BZX84C24L			MMBZ5252BL	MMBZ5252EL
25				MMBZ5253BL	
27	BZX84C27L			***MMBZ5254BL***	
28				MMBZ5255BL	
30	BZX84C30L			MMBZ5256BL	
33	BZX84C33L			***MMBZ5257BL***	MMBZ5257EL
36	BZX84C36L		BZ84C36E	MMBZ5258BL	
39	BZX84C39L			MMBZ5259BL	
43	BZX84C43L				
47	BZX84C47L			MMBZ5261BL	MMBZ5261EL
51	BZX84C51L			MMBZ5262BL	
56	BZX84C56L			MMBZ5263BL	
60				MMBZ5264BL	
62	BZX84C62L			MMBZ5265BL	
68	BZX84C68L				
75	BZX84C75L				
82				MMBZ5268BL	
87					
91				MMBZ5270BL	

Devices listed in **bold**, ***italic*** are ON Semiconductor preferred devices.

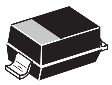
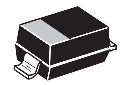
Zener Diodes − Regulation in Surface Mount (continued)

Table 4. SURFACE MOUNT PACKAGES − 0.5 WATT

Nominal Zener Breakdown Voltage	500 mW SOD−123	500 mW Energy Rated SOD−123	500 mW SOD−123	500 mW Energy Rated SOD−123	500 mW SOD−123	500 mW Energy Rated SOD−123
Volts	 Case 425	 Case 425	 Case 425	 Case 425	 Case 425	 Case 425
1.8			MMSZ4678			
2.0			MMSZ4679			
2.2			***MMSZ4680***			
2.4	MMSZ2V4		MMSZ4681		***MMSZ5221B***	***MMSZ5221E***
2.5					***MMSZ5222B***	
2.7	MMSZ2V7	MMSZ2V7E	MMSZ4682		MMSZ5223B	***MMSZ5223E***
2.8						
3.0	MMSZ3V0		MMSZ4683		***MMSZ5225B***	
3.3	MMSZ3V3		MMSZ4684	MMSZ4684E	MMSZ5226B	MMSZ5226E
3.6	MMSZ3V6		***MMSZ4685***		MMSZ5227B	
3.7						
3.9	MMSZ3V9		MMSZ4686		MMSZ5228B	
4.0						
4.3	MMSZ4V3		MMSZ4687		***MMSZ5229B***	
4.7	MMSZ4V7		MMSZ4688	MMSZ4688E	***MMSZ5230B***	
5.1	***MMSZ5V1***		MMSZ4689	MMSZ4689E	***MMSZ5231B***	
5.6	***MMSZ5V6***		***MMSZ4690***	***MMSZ4690E***	***MMSZ5232B***	
6.0					MMSZ5233B	
6.2	***MMSZ6V2***		MMSZ4691		***MMSZ5234B***	
6.8	MMSZ6V8		MMSZ4692		MMSZ5235B	MMSZ5235E
7.5	MMSZ7V5		MMSZ4693		MMSZ5236B	
8.2	MMSZ8V2	MMSZ8V2E	MMSZ4694		MMSZ5237B	MMSZ5237E
8.7			MMSZ4695		MMSZ5238B	
9.1	MMSZ9V1		MMSZ4696		MMSZ5239B	
10	MMSZ10		MMSZ4697		***MMSZ5240B***	***MMSZ5240E***
11	MMSZ11		MMSZ4698		MMSZ5241B	
12	MMSZ12		MMSZ4699		***MMSZ5242B***	MMSZ5242E
13	MMSZ13		MMSZ4700		MMSZ5243B	
14			MMSZ4701	MMSZ4701E	MMSZ5244B	MMSZ5244E
15	MMSZ15	MMSZ15E	MMSZ4702	MMSZ4702E	***MMSZ5245B***	***MMSZ5245E***
16	MMSZ16		MMSZ4703		***MMSZ5246B***	***MMSZ5246E***
17			MMSZ4704	MMSZ4704E	MMSZ5247B	
18	***MMSZ18***	***MMSZ18E***	MMSZ4705		***MMSZ5248B***	***MMSZ5248E***
19			MMSZ4706		MMSZ5249B	
20	MMSZ20		MMSZ4707		MMSZ5250B	MMSZ5250E
22	MMSZ22		MMSZ4708		MMSZ5251B	
24	MMSZ24		MMSZ4709		***MMSZ5252B***	***MMSZ5252E***
25			MMSZ4710		MMSZ5253B	
27	MMSZ27		MMSZ4711		MMSZ5254B	MMSZ5254E
28	MMSZ30				MMSZ5255B	
30			MMSZ4713		MMSZ5256B	MMSZ5256E
33	MMSZ33		MMSZ4714		MMSZ5257B	MMSZ5257E

Zener Diodes − Regulation in Surface Mount (continued)

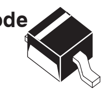
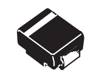
Table 4. SURFACE MOUNT PACKAGES − 0.5 WATT (continued)

Nominal Zener Breakdown Voltage	500 mW SOD−123	500 mW Energy Rated SOD−123	500 mW SOD−123	500 mW Energy Rated SOD−123	500 mW SOD−123	500 mW Energy Rated SOD−123
Volts	 Case 425	 Case 425	 Case 425	 Case 425	 Case 425	 Case 425
36	MMSZ36		MMSZ4715		MMSZ5258B	
39	***MMSZ39***				MMSZ5259B	MMSZ5259E
43	MMSZ43		MMSZ4717		MMSZ5260B	MMSZ5260E
47					***MMSZ5261B***	
51	MMSZ51				MMSZ5262B	
56	MMSZ56				MMSZ5263B	
60					MMSZ5264B	
62					MMSZ5265B	
68					MMSZ5266B	
75					MMSZ5267B	
82					MMSZ5268B	
87						
91					MMSZ5270B	
100						
110					MMSZ5272B	

Devices listed in **bold**, ***italic*** are ON Semiconductor preferred devices.

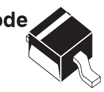
Zener Diodes – Regulation in Surface Mount (continued)

Table 5. SURFACE MOUNT PACKAGES – 1.5, 3 WATT

Nominal Zener Breakdown Voltage	1.5 Watt SMA	1.5 Watt SMA	3 Watt POWERMITE®	3 Watt SMB
Volts	 Plastic Case 403B Cathode = Notch	 Plastic Case 403B Cathode = Notch	 Plastic Case 457	 Plastic Case 403A
1.8				
2.0				
2.2				
2.4				
2.5				
2.7				
2.8				
3.0				
3.3	1SMA5913B			1SMB5913B
3.6	1SMA5914B			1SMB5914B
3.9	1SMA5915B			1SMB5915B
4.3	1SMA5916B			1SMB5916B
4.7	1SMA5917B			1SMB5917B
5.1	1SMA5918B			1SMB5918B
5.6	1SMA5919B			1SMB5919B
6.0				
6.2	1SMA5920B		1PMT5920B	1SMB5920B
6.8	1SMA5921B		1PMT5921B	1SMB5921B
7.5	1SMA5922B		1PMT5922B	1SMB5922B
8.2	1SMA5923B			1SMB5923B
8.7				
9.1	1SMA5924B		1PMT5924B	1SMB5924B
10	1SMA5925B			1SMB5925B
11				1SMB5926B
12	1SMA5927B		1PMT5927B	1SMB5927B
13	1SMA5928B			1SMB5928B
14			1PMT5929B	1SMB5929B
15	1SMA5929B	BZG03C15		
16	1SMA5930B			1SMB5930B
17				
18	1SMA5931B			1SMB5931B
19				
20	1SMA5932B			1SMB5932B
22	1SMA5933B		1PMT5933B	1SMB5933B
24	1SMA5934B		1PMT5934B	1SMB5934B
25				
27	1SMA5935B			1SMB5935B
28				
30	1SMA5936B			1SMB5936B
33	1SMA5937B			1SMB5937B

Zener Diodes – Regulation in Surface Mount (continued)

Table 5. SURFACE MOUNT PACKAGES – 1.5, 3 WATT (continued)

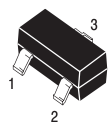
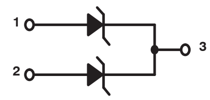
Nominal Zener Breakdown Voltage	1.5 Watt SMA	1.5 Watt SMA	3 Watt POWERMITE®	3 Watt SMB
Volts	 **Plastic Case 403B Cathode = Notch**	 **Plastic Case 403B Cathode = Notch**	 **Cathode** **Anode** **Plastic Case 457**	 **Plastic Case 403A**
36	1SMA5938B			1SMB5938B
39	1SMA5939B			1SMB5939B
43	1SMA5940B			1SMB5940B
47	1SMA5941B		1PMT5941B	1SMB5941B
51	1SMA5942B			1SMB5942B
56	1SMA5943B			1SMB5943B
60				
62				1SMB5944B
68	1SMA5945B			1SMB5945B
75				1SMB5946B
82				1SMB5947B
87				
91				1SMB5948B
100				1SMB5949B
110				
120				1SMB5951B
130				1SMB5952B
150		BZG03C150		1SMB5953B
160				1SMB5954B
180				1SMB5955B
200				1SMB5956B

Dual Zeners – Duals in Surface Mount

MMBZ15VDLT1 – Common Cathode Series

Table 6. SOT–23 DUAL COMMON CATHODE ZENER; 40 WATTS PEAK POWER (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
BIDIRECTIONAL (Circuit tied to Pins 1 and 2)
(V_F = 0.9 V Max @ I_F = 10 mA)

Device	Breakdown Voltage V_{BR} (Note 1) (V) Min	Nom	Max	@ I_T (mA)	Reverse Voltage Working Peak V_{RWM} (V)	Max Reverse Leakage Current I_R (nA)	Max Reverse Surge Current I_{PP} (A)	Max Reverse Voltage @ I_{PP} (Clamping Voltage) V_C (V)	Maximum Temperature Coefficient of V_{BR} (mV/°C)
 CASE 318–08 TO–236AB LOW PROFILE SOT–23 									
MMBZ15VDL	14.3	15	15.8	1.0	12.8	100	1.9	21.2	12

(V_F = 1.1 V Max @ I_F = 200 mA)

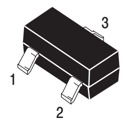
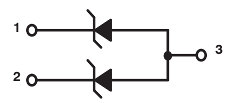
Device	Min	Nom	Max	@ I_T (mA)	V_{RWM} (V)	I_R (nA)	I_{PP} (A)	V_C (V)	(mV/°C)
MMBZ27VCL	25.65	27	28.35	1.0	22	50	1.0	38	26

1. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

MMBZ5V6ALT1 – Common Anode Series

Table 7. SOT–23 DUAL COMMON ANODE ZENER; 24 WATTS PEAK POWER (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
UNIDIRECTIONAL (Circuit tied to Pins 1 and 3 or Pins 2 and 3)
(V_F = 0.9 V Max @ I_F = 10 mA)

Device	Breakdown Voltage V_{BR} (Note 2) (V) Min	Nom	Max	@ I_T (mA)	Max Reverse Leakage Current I_R (μA)	@ V_R (V)	Max Zener Impedance (Note 3) Z_{ZT} (Ω)	@ I_{ZT} (mA)	Z_{ZK} (Ω)	@ I_{ZK} (mA)	Max Reverse Surge Current I_{PP} (A)	Max Reverse Voltage @ I_{PP} (Clamping Voltage) V_C (V)	Max Temp Coefficient of V_{BR} (mV/°C)
 CASE 318–08 STYLE 12 LOW PROFILE SOT–23 PLASTIC 													
MMBZ5V6AL	5.32	5.6	5.88	20	5.0	3.0	11		1600	0.25	3.0	8.0	1.26
MMBZ6V2AL	5.89	6.2	6.51	1.0	0.5	3.0	–		–	–	2.76	8.7	2.80
MMBZ6V8AL	6.46	6.8	7.14	1.0	0.5	4.5	–		–	–	2.5	9.6	3.40
MMBZ9V1AL	8.65	9.1	9.56	1.0	0.3	6.0	–		–	–	1.7	14	7.50

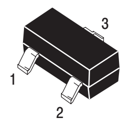
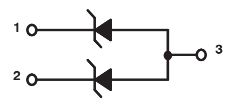
2. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.
3. Z_{ZT} and Z_{ZK} are measured by dividing the AC voltage drop across the device by the AC current supplied. The specified limits are $I_{Z(AC)}$ = 0.1 $I_{Z(DC)}$, with AC frequency = 1 kHz.

Dual Zeners – Duals in Surface Mount (continued)

MMBZ5V6ALT1 – Common Anode Series

Table 8. SOT–23 DUAL COMMON ANODE ZENER; 40 WATTS PEAK POWER (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
UNIDIRECTIONAL (Circuit tied to Pins 1 and 3 or Pins 2 and 3)
(V_F = 0.9 V Max @ I_F = 10 mA)

Device	Breakdown Voltage				Reverse Voltage Working Peak V_{RWM} (Volts)	Max Reverse Leakage Current I_R (nA)	Max Reverse Surge Current I_{PP} (A)	Max Reverse Voltage @ I_{PP} (Clamping Voltage) V_C (V)	Maximum Temperature Coefficient of V_{BR} (mV/°C)
	V_{BR} (Note 4) (V)			@ I_T (mA)					
	Min	Nom	Max						
 CASE 318–08 STYLE 12 LOW PROFILE SOT–23 PLASTIC 									
MMBZ12VAL	11.40	12	12.60	1.0	8.5	200	2.35	17	7.50
MMBZ15VAL	14.25	15	15.75	1.0	12.0	50	1.9	21	12.30
MMBZ18VAL	17.10	18	18.90	1.0	14.5	50	1.6	25	15.30
MMBZ20VAL	19.00	20	21.00	1.0	17.0	50	1.4	28	17.20
MMBZ27VAL	25.65	27	28.35	1.0	22.0	50	1.0	40	24.30
MMBZ33VAL	31.35	33	34.65	1.0	26.0	50	0.87	46	30.40

4. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

Rectifiers

Rectifiers

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In Brief...

Continuing investment in research and development for discrete products has created a rectifier manufacturing facility that matches the precision and versatility of the most advanced integrated circuits. As a result, ON Semiconductor's silicon rectifiers span all high tech applications with quality levels capable of passing the most stringent environmental tests . . . including those for automotive under−hood applications.

Product Highlights:

- Surface Mount Devices – A major thrust has been the development and introduction of a broad range of power rectifiers, Schottky and Ultrafast, 1/2 A to 40 A, 10 to 600 V.
- Application Specific Rectifiers –
  - Schottky rectifiers having lower forward voltage drop (0.3 V to 0.6 V) for use in low voltage SMPS outputs and as "OR"ing diodes.
  - MEGAHERTZ™ series for high frequency power supplies and power factor correction.
  - Ultrasoft rectifiers for high speed rectification.
  - Energy rated rectifiers with guaranteed energy handling capability.
  - Automotive transient suppressors.
- Ultrafast rectifiers having reverse recovery times as low as 25 ns to complement the Schottky devices for higher voltage requirements in high frequency applications.
- A wide variety of package options to match virtually any potential requirement.

The rectifier selector section that follows has generally been arranged by package and technology. The individual tables have been sorted by voltage and current with the package types for the devices listed shown above each table. The Application Specific Rectifiers are also included in their respective tables.

Application Specific Rectifiers

Table 1. Low V_F Schottky Rectifiers

Device	I_O (A)	V_{RRM} (V)	Max V_F @ Rated I_O and T_C = 25°C (V)	Max I_R @ Rated V_{RRM} and T_C = 25°C (mA)	Package
MBR0520L	0.5	20	0.385	0.25	SOD-123
MBR120LSF	1.0	20	0.45	0.4	SOD−123 Flat Lead
MBR120VLSF	1.0	20	0.34	0.6	SOD−123 Flat Lead
MBR130LSF	1.0	30	0.38	1.0	SOD−123 Flat Lead
MBRM110L	1.0	10	0.365	0.5	POWERMITE®
MBRA210L	2.0	10	0.35	0.7	SMA
MBRS130L	1.0	30	0.395	1.0	SMB
MBRS230L	2.0	30	0.50	1.0	SMB
MBRS410L	4.0	10	0.33	5.0	SMC
MBRD835L	8.0	35	0.51	1.4	DPAK
MBRD1035CTL	10	35	0.56	2.0	DPAK
MBR2030CTL	20	30	0.58	5.0	TO-220AC
MBRB2535CTL	25	35	0.55	10	D^2PAK
MBR2535CTL	25	35	0.55	5.0	TO-220AC
MBRB2515L	25	15	0.45	15	D^2PAK
MBR2515L	25	15	0.45	15	TO-220AC
MBRB3030CTL	30	30	0.51	2.0	D^2PAK
MBR4015LWT	40	15	0.50	5.0	TO-247
MBR10H100CTG⋆	10	100	0.85	0.0035	TO-220AB
MBR20H100CTG⋆	20	100	0.88	0.0045	TO-220AB
MBRF20H100CTG⋆	20	100	0.88	0.0045	FULL PACK
MBR30H100CTG⋆	30	100	0.93	0.0045	TO-220AB
MBR40H100WTG⋆	40	100	0.9	0.01	TO-247
MBR41H100CTG⋆	40	100	0.9	0.01	TO-220AB
MBRB41H100CT−1G⋆	40	100	0.9	0.01	I^2PAK
MBR60H100CTG⋆	60	100	0.98	0.01	TO-220AB
MBRB30H30CT−1G⋆	30	30	0.55	0.8	I^2PAK
MBR3045ST⋆	30	45	0.76	0.2	TO-220AB
MBRB3045CT−1G⋆	30	45	0.76	0.2	I^2PAK
MBRB30H60CT−1G⋆	30	60	0.78	0.3	I^2PAK
*MBRF30H60CTG**	30	60	0.78	0.3	FULL PACK
MBR60L45CT	60	45	0.73	1.2	TO−220AB
MBR60L45WT	60	45	0.73	1.2	TO−247

Table 2. Low Leakage Schottky Rectifiers

Device	I_O (A)	V_{RRM} (V)	Max V_F @ Rated I_O and T_C = 25°C (V)	Max I_R @ Rated V_{RRM} and T_C = 25°C (mA)	Package
MBR120ESF	1.0	20	0.53	0.01	SOD−123 FLAT LEAD
MBRM110E	1.0	10	0.53	0.001	POWERMITE®
MBRM120E	1.0	20	0.53	0.01	POWERMITE®
MBRA120E	1.0	20	0.53	0.01	SMA
MBRA210E	2.0	10	0.5	0.015	SMA
MBRS410E	4.0	10	0.5	0.15	SMC

Table 3. High Voltage Schottky Rectifiers

Device	I_O (A)	V_{RRM} (V)	Max V_F @ Rated I_O and T_C = 25°C (V)	Max I_R @ Rated V_{RRM} and T_C = 25°C (mA)	Package
MBRS3200	3.0	200	0.84	1.0	SMB
MBRS3201	3.0	200	0.84	1.0	SMC
MBRS4201	4.0	200	0.86	1.0	SMC
MBRB20200CT	20	200	1.0	1.0	D^2PAK
MBR20200CT	20	200	1.0	1.0	TO−220AB

⋆ New Product
All devices listed are ON Semiconductor preferred devices

Application Specific Rectifiers (continued)

Table 4. High Voltage Schottky Rectifiers (continued)

Device	I_O (A)	V_{RRM} (V)	Max V_F @ Rated I_O and T_C = 25°C (V)	Max I_R @ Rated V_{RRM} and T_C = 25°C (mA)	Package
MBRF20200CT	20	200	1.0	1.0	FULL PAK
MBR40250	40	250	0.97	0.03	TO−220AC
MBR40250T	40	250	0.97	0.03	TO−220AB
MBRF40250T	40	250	0.97	0.03	FULL PAK

Table 5. MEGAHERTZ™ Rectifiers

Device	I_O (A)	V_{RRM} (V)	Max V_F @ Rated I_F and T_C = 25°C (V)	Max I_R @ Rated V_{RRM} and T_C = 25°C (mA)	t_{rr} (ns)	Package
MURH840CT	8.0	400	2.2	0.01	28	TO−220AB
MURHB840CT	8.0	400	2.2	0.01	28	TO−220AB
MURHS160	1.0	600	2.4	0.02	35	SMB
MURHD560	5.0	600	2.7	0.01	30	DPAK
MURH860CT	8.0	600	2.8	0.01	35	TO−220AB
MURHB860CT	8.0	600	2.8	0.01	35	TO−220AB
MURHF860CT	8.0	600	2.8	0.01	35	TO−220AB

Table 6. UltraSoft Rectifiers (For High Speed Rectification)

Device	I_O (A)	V_{RRM} (V)	Max V_F @ I_F and T_C = 25°C (V)	Max t_{rr} (ns)	T_JMax (°C)	Package
MSRD620CT	6.0	200	1.35 @ 6.0 A	55	175	DPAK
MSR860	8.0	600	1.7 @ 8.0 A	120	150	TO−220AC
MSR1560	15	600	1.8 @ 15 A	45	150	TO−220AC

Table 7. Energy Rated Rectifiers

Device	I_O (A)	V_{RRM} (V)	Max V_F @ I_F Rated and T_C = 25°C (V)	Max I_R @ Rated V_{RRM} and T_C = 125°C (μA)	Avalanche Energy (mJ)	Package
MUR180E	1.0	800	1.75	10	10	DO−41
MUR1100E	1.0	1000	1.75	10	10	DO−41
MUR480E	4.0	800	1.85	25	20	DO−201AD
MUR4100E	4.0	1000	1.85	25	20	DO−201AD
MUR880E	8.0	800	1.8	25	20	TO−220AC
MUR8100E	8.0	1000	1.8	25	20	TO−220AC

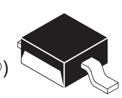
Table 8. Automotive Transient Suppressors

Device	I_O (A)	V_{RRM} (V)	Max V_F @ Rated I_F and T_C = 25°C (V)	I_{RSM} (A)	T_JMax (°C)	Package
MR2535L	6.0	20	1.1 @ 100 A	62 @ 10 mS	150	Axial Lead Button
MR2835SK	32	23	1.1 @ 100 A	62 @ 10 mS	175	Top Can
TRA2532	32	23	1.18 @ 100 A	80 @ 10 mS	175	Micro Button

★ New Product
All devices listed are ON Semiconductor preferred devices

SCHOTTKY Rectifiers

Table 9. Surface Mount Schottky Rectifiers

V_{RRM} (V)	I_O(1) (A)	I_O Rating Condition	Device	Max V_F @ I_F T_C = 25°C (V)	I_{FSM} (A)	T_J Max (°C)	Max I_R(2) T_J = 25°C (mA)	Max I_R(3) (mA)	Package
20	0.5	T_L = 90°C	***MBR0520L*** ***MBR0520L***	0.300 @ 0.1 A 0.385 @ 0.5 A	5.5	125	.075 @ 10 V .250 @ 20 V	5.0 @ 10 V 8.0 @ 20 V	**CASE 425-04** (SOD-123) Cathode = Band 
30	0.5	T_L = 100°C	***MBR0530*** ***MBR0530***	0.375 @ 0.1 A 0.430 @ 0.5 A	5.5	125	.020 @ 15 V .130 @ 30 V	–	
40	0.5	T_L = 110°C	***MBR0540*** ***MBR0540***	0.51 @ 0.5 A	5.5	150	.010 @ 20 V .020 @ 40 V	–	
30	1.0	T_L = 65°C	***MBR130*** ***MBR130***	0.51 @ 1.0 A	5.5	125	60 μA	–	
20	1.0	T_L = 140°C	***MBR120ESF*** ***MBR120ESF***	0.53 @ 1.0 A	40	150	.010	1.6 @ 100°C	**CASE 498–01** (SOD-123FL) 
20	1.0	T_L = 115°C	***MBR120LSF*** ***MBR120LSF***	0.45 @ 1.0 A	50	125	0.4	25 @ 85°C	
20	1.0	T_L = 119°C	***MBR120VLSF*** ***MBR120VLSF***	0.340 @ 1.0 A	45	125	0.6	15 @ 85°C	
30	1.0	T_L = 117°C	***MBR130LSF***	0.38 @ 1.0 A	40	125	1.0	25 @ 100°C	
40	1.0	T_L = 112°C	***MBR140SF*** ***MBR140SF***	0.55 @ 1.0 A	30	125	0.5	25 @ 85°C	
10	1.0	T_C = 100°C	***MBRM110E*** ***MBRM110E***	0.53 @ 1.0 A	50	150	0.001	0.5 @ 100°C	**CASE 457–04** (POWERMITE®) 
10	1.0	T_C = 115°C	***MBRM110L*** ***MBRM110L***	0.365 @ 1.0 A	50	125	0.5	60 @ 100°C	
20	1.0	T_C = 130°C	***MBRM120E*** ***MBRM120E***	0.530 @ 1.0 A 0.455 @ 0.1 A	50	150	0.010 @ 20 V	1.6 @ 20 V	
20	1.0	T_{tab} ≤ 100°C	***MBRM120L*** ***MBRM120L***	0.45 @ 1.0 A 0.34 @ 0.1 A	50	125	0.4 @ 20 V	N/A	
30	1.0	T_C = 135°C	***MBRM130L*** ***MBRM130L***	0.38 @ 1.0 A	50	125	0.41	N/A	
40	1.0	T_{tab} ≤ 100°C	***MBRM140***	0.36 @ 0.1 A 0.55 @ 1.0 A	50	125	0.5 @ 40 V	N/A	
20	1.0	T_L = 125°C	***MBRA120E***	0.530 @ 1.0 A	40	150	0.010	1.6 @ 100°C	**CASE 403D-02** (SMA) Cathode = Notch or Polarity Band 
30	1.0	T_C ≤ 105°C	***MBRA130L***	0.41 @ 1.0 A 0.47 @ 2.0 A	25	125	1.0 @ 30 V 0.4 @ 15 V	25 @ 30 V	
40	1.0	T_C ≤ 100°C	***MBRA140***	0.55 @ 1.0 A 0.71 @ 2.0 A	30	125	0.5 @ 40 V 0.1 @ 20 V	10 @ 40 V	
60	1.0	T_L = 105°C	***MBRA160***	0.51 @ 1.0 A	60	125	0.2	10 @ 125°C	
60	1.0	T_L = 105°C	***SS16***	0.51 @ 1.0 A	40	150	0.2	10 @ 125°C	
10	2.0	T_L = 125°C	***MBRA210E***	0.50 @ 2.0 A	100	150	0.015	0.2 @ 100°C	
10	2.0	T_L = 110°C	***MBRA210L***	0.35 @ 2.0 A	160	125	0.70	60 @ 100°C	
40	3.0	T_C = 100°C	***MBRA340***	0.45 @ 3.0 A	100	150	0.3	15 @ 40 V	

(1)I_O is total device current capability.
(2)At V_{RRM} unless noted
(3)At V_{RRM}, T_J = 100°C unless noted
All devices listed are ON Semiconductor preferred devices

SCHOTTKY Rectifiers (continued)

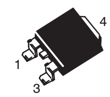
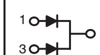
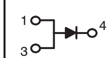
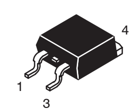
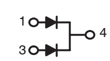
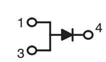
Table 10. Surface Mount Schottky Rectifiers (continued)

V_{RRM} (V)	I_O(1) (A)	I_O Rating Condition	Device	Max V_F @ I_F T_C = 25°C (V)	I_{FSM} (A)	T_J Max (°C)	Max I_R(2) T_J = 25°C (mA)	Max I_R(3) (mA)	Package
20	1.0	T_L = 115°C	***MBRS120***	0.6 @ 1.0 A	40	125	1.0	10	
30	1.0	T_L = 120°C	***MBRS130L***	0.395 @ 1.0 A	40	125	1.0	10	
30	1.0	T_L = 115°C	***MBRS130***	0.6 @ 1.0 A	40	125	1.0	10	
40	1.0	T_L = 115°C	***MBRS140***	0.6 @ 1.0 A	40	125	1.0	10	
40	1.0	T_C = 110°C	***MBRS140L***	0.5 @ 1.0 A	40	125	0.4	10	
90	1.0	T_L = 120°C	***MBRS190***	0.75 @ 1.0 A	50	175	0.5	5.0	
100	1.0	T_L = 120°C	***MBRS1100***	0.75 @ 1.0 A	50		0.5	5.0	
40	1.5	T_C = 100°C	***MBRS1540***	0.54 @ 1.5 A	40	125	0.8	5.7	
30	2.0	T_C = 110°C	***MBRS230L***	0.5 @ 2.0 A	40	125	1.0	75 @ 125°C	**CASE 403A-03**
40	2.0	$T_C \leq$ 95°C	***MBRS240L***	0.43 @ 2.0 A 0.53 @ 4.0 A	25	125	2.0 @ 40 V 0.5 @ 20 V	60 @ 40 V 40 @ 20 V	(SMB) Cathode = Notch or Polarity Band 
40	2.0	T_C = 103°C	***MBRS2040L***	0.43 @ 2.0 A 0.50 @ 4.0 A	70	125	0.80 @ 40 V 0.10 @ 20 V	20 @ 40 V 6.0 @ 20 V	
60	2.0	T_L = 95°C	***MBRS260***	0.63 @ 2.0 A	60	125	0.2	10 @ 125°C	
20	2.0	T_C = 100°C	***SS22***	0.5 @ 2.0 A	75	150	0.4	5.7 @ 100°C	
40	2.0	T_C = 100°C	***SS24***	0.5 @ 2.0 A	75	150	0.4	5.7 @ 100°C	
60	2.0	T_L = 95°C	***SS26***	0.63 @ 2.0 A	40	150	0.2	10 @ 125°C	
200	3.0	T_L = 120°C	***MBRS3200***	0.84 @ 3.0 A	100	150	1.0	5.0 @ 200 V	
20	3.0	T_L = 110°C	***MBRS320***	0.50 @ 3.0 A	80	125	2.0	20	
30	3.0	T_L = 110°C	***MBRS330***	0.50 @ 3.0 A	80	125	2.0	20	
40	3.0	T_L = 110°C	***MBRS340***	0.5 @ 3.0 A	80	125	2.0	20	
60	3.0	T_L = 137°C	***MBRS360T3***	0.74 @ 3.0 A	125	175	0.15	10	
100	3.0	T_L = 100°C	***MBRS3100***	0.79 @ 3.0 A	130	175	0.05	5.0 @ 125°C	**CASE 403-03**
200	3.0	T_C = 70°C	***MBRS3201***	0.840 @ 3.0 A	100	150	1.0	5.0 @ 150°C	(SMC) Cathode = Notch 
10	4.0	T_L = 130°C	***MBRS410E***	0.50 @ 4.0 A	250	150	0.15	4.0 @ 100°C	
10	4.0	T_L = 110°C	***MBRS410L***	0.33 @ 4.0 A	150	125	5.0	200 @ 100°C	
200	4.0	T_L = 70°C	***MBRS4201***	0.860 @ 4.0 A	100	150	1.0	5.0 @ 150°C	
40	5.0	T_C = 105°C	***MBRS540***	0.5 @ 5.0 A	190	150	0.3	15 @ 40 V	

(1) I_O is total device current capability.
(2) At V_{RRM} unless noted
(3) At V_{RRM}, T_J = 100°C unless noted
All devices listed are ON Semiconductor preferred devices

SCHOTTKY Rectifiers (continued)

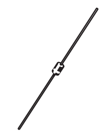
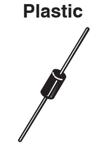
Table 10. Surface Mount Schottky Rectifiers (continued)

V_{RRM} (V)	I_O(1) (A)	I_O Rating Condition	Device	Max V_F @ I_F T_C = 25°C (V)	I_{FSM} (A)	T_J Max (°C)	Max I_R(2) T_J = 25°C (mA)	Max I_R(3) (mA)	Package	
20	3.0	T_C = 125°C	***MBRD320***	0.60 @ 3.0 A	75	175	0.2	20 @ 125°C	**CASE 369A-13** (DPAK) 	 "CT" Suffix  **Non-"CT" Suffix**
30	3.0	T_C = 125°C	***MBRD330***	0.60 @ 3.0 A	75	175	0.2	20 @ 125°C		
40	3.0	T_C = 125°C	***MBRD340***	0.60 @ 3.0 A	75	175	0.2	20 @ 125°C		
50	3.0	T_C = 125°C	***MBRD350***	0.60 @ 3.0 A	75	175	0.2	20 @ 125°C		
60	3.0	T_C = 125°C	***MBRD360***	0.60 @ 3.0 A	75	175	0.2	20 @ 125°C		
20	6.0	T_C = 130°C	***MBRD620CT***	0.70 @ 3.0 A	75	175	0.1	15 @ 125°C		
30	6.0	T_C = 130°C	***MBRD630CT***	0.70 @ 3.0 A	75	175	0.1	15 @ 125°C		
40	6.0	T_C = 130°C	***MBRD640CT***	0.70 @ 3.0 A	75	175	0.1	15 @ 125°C		
50	6.0	T_C = 130°C	***MBRD650CT***	0.70 @ 3.0 A	75	175	0.1	15 @ 125°C		
60	6.0	T_C = 130°C	***MBRD660CT***	0.70 @ 3.0 A	75	175	0.1	15 @ 125°C		
35	8.0	T_C = 88°C	***MBRD835L***	0.40 @ 3.0 A 0.51 @ 8.0 A	75	150	1.4	35		
35	10	T_C = 115°C	***MBRD1035CTL***	0.56 @ 10 A	50	150	2.0	130 @ 125°C		
45	10	T_C = 135°C	***MBRD1045T4G***	0.84 @ 20 A	70	175	0.1	15 @ 125°C		
45	10	T_C = 135°C	***MBRB1045***	0.84 @ 20 A	150	175	0.1	15 @ 125°C	**CASE 418B-04** (D^2PAK) 	 "CT" Suffix  **Non-"CT" Suffix**
45	15	T_C = 105°C	***MBRB1545CT***	0.84 @ 15 A	150	175	0.1	15 @ 125°C		
45	16	T_C = 125°C	***MBRB1645***	0.63 @ 16 A	150	150	0.2	40 @ 125°C		
60	20	T_C = 110°C	***MBRB2060CT***	0.95 @ 20 A	150	175	0.15	135 @ 125°C		
100	20	T_C = 110°C	***MBRB20100CT***	0.85 @ 10 A 0.95 @ 20 A	150	175	0.1	6.0 @ 125°C		
200	20	T_C = 134°C	***MBRB20200CT***	1.0 @ 20 A	150	150	1.0	50 @ 125°C		
15	25	T_C = 90°C	***MBRB2515L***	0.45 @ 25 A	150	100	15	200 @ 70°C		
35	25	T_C = 110°C	***MBRB2535CTL***	0.47 @ 12.5 A 0.55 @ 25 A	150	125	10	500 @ 125°C		
45	30	T_C = 130°C	***MBRB2545CT***	0.82 @ 30 A	150	175	0.2	25 @ 125°C		
30	30	T_C = 134°C	***MBRB3030CT***	0.54 @ 15 A 0.67 @ 30 A	200	175	0.6	145 @ 150°C 46 @ 10 V, 150°C		
30	30	T_C = 115°C	***MBRB3030CTL***	0.44 @ 15 A 0.51 @ 30 A	300	125	2.0	195 @ 125°C 75 @ 10 V, 125°C		
30	40	T_C = 115°C	***MBRB4030***	0.46 @ 20 A 0.55 @ 40 A	300	175	0.35	150 @ 125°C		

(1)I_O is total device current capability.
(2)At V_{RRM} unless noted
(3)At V_{RRM}, T_J = 100°C unless noted
All devices listed are ON Semiconductor preferred devices

SCHOTTKY Rectifiers (continued)

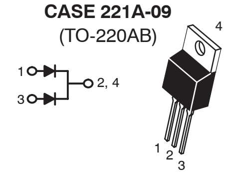
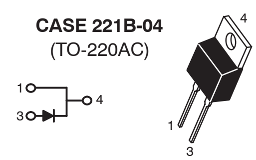
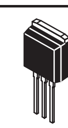
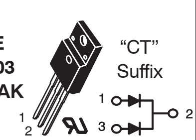
Table 10. Axial Lead Schottky Rectifiers

V_{RRM} (V)	I_O (A)	I_O Rating Condition	Device	Max V_F @ I_F T_C = 25°C (V)	I_{FSM} (A)	T_J Max (°C)	Max I_R(2) T_L = 25°C (mA)	Max I_R(3) (mA)	Package
20	1.0	T_A = 55°C $R_{\theta JA}$ = 80°C/W	***1N5817***	0.45 @ 1.0 A	25	125	1.0	10	**CASE 59–10 (DO–41) Plastic**  Cathode = Polarity Band
30	1.0	T_A = 55°C $R_{\theta JA}$ = 80°C/W	***1N5818***	0.55 @ 1.0 A	25	125	1.0	10	
40	1.0	T_A = 55°C $R_{\theta JA}$ = 80°C/W	***1N5819***	0.60 @ 1.0 A	25	125	1.0	10	
50	1.0	T_A = 55°C	***MBR150***	0.75 @ 1.0 A	25	150	0.5	5.0	
60	1.0	T_A = 55°C $R_{\theta JA}$ = 80°C/W	***MBR160***	0.75 @ 1.0 A	25	150	0.5	5.0	
100	1.0	T_A = 120°C $R_{\theta JA}$ = 50°C/W	***MBR1100***	0.79 @ 1.0 A	50	175	0.5	5.0	
20	3.0	T_A = 76°C $R_{\theta JA}$ = 28°C/W	***1N5820***	0.457 @ 3.0 A	80	125	2.0	20	**CASE 267-05 (DO–201AD) Plastic**  Cathode = Polarity Band
30	3.0	T_A = 71°C $R_{\theta JA}$ = 28°C/W	***1N5821***	0.500 @ 3.0 A	80	125	2.0	20	
40	3.0	T_A = 61°C $R_{\theta JA}$ = 28°C/W	***1N5822***	0.525 @ 3.0 A	80	125	2.0	20	
40	3.0	T_A = 65°C $R_{\theta JA}$ = 28°C/W	***MBR340***	0.74 @ 3.0 A	80	175	0.6	20	
50	3.0	T_A = 65°C	***MBR350RL***	0.600 @ 3.0 A	80	150	0.6	20	
60	3.0	T_A = 65°C $R_{\theta JA}$ = 28°C/W	***MBR360RL***	0.740 @ 3.0 A	80	150	0.6	20	
100	3.0	T_A = 100°C $R_{\theta JA}$ = 28°C/W	***MBR3100***	0.79 @ 3.0 A	150	175	0.6	20	
45	8.0	T_L = 75°C	***80SQ045N***	0.55 @ 8.0 A	140	125	1.0	50 @ 100°C	

(1) I_O is total device current capability.
(2) At V_{RRM} unless noted
(3) At V_{RRM}, T_J = 100°C unless noted
All devices listed are ON Semiconductor preferred devices

SCHOTTKY Rectifiers (continued)

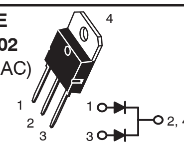
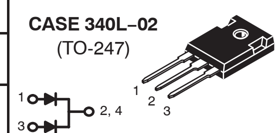
Table 11. TO-220 and I^2PAK Thru−Hole Schottky Rectifiers

V_{RRM} (V)	I_O (A)	I_O Rating Condition	Device	Max V_F @ I_F T_C = 25°C (V)	I_{FSM} (A)	T_J Max (°C)	Max I_R(2) T_C = 25°C (mA)	Max I_R(3) (mA)	Package
35	15	T_C = 165°C	***MBR1535CT***	0.84 @ 15 A	150	175	0.1	15 @ 125°C	**CASE 221A-09** (TO-220AB) 
45	15	T_C = 165°C	***MBR1545CT***	0.84 @ 15 A	150	175	0.1	15 @ 125°C	
100	16	T_C = 133°C	***MBR16100CT***	0.84 @ 16 A	150	175	0.1	5.0 @ 125°C	
30	20	T_C = 137°C	***MBR2030CTL***	0.52 @ 10 A 0.58 @ 20 A	150	150	5.0	40	
45	20	T_C = 135°C	***MBR2045CT***	0.84 @ 20 A	150	150	0.1	15 @ 125°C	
60	20	T_C = 133°C	***MBR2060CT***	0.85 @ 10 A 0.95 @ 20 A	150	150	0.1	6.0 @ 125°C	
80	20	T_C = 133°C	***MBR2080CT***	0.95 @ 20 A	150	175	0.1	6.0 @ 125°C	
90	20	T_C = 133°C	***MBR2090CT***	0.95 @ 20 A	150	150	0.1	6.0 @ 125°C	
100	10	T_C = 168°C	***MBR10H100CTG***	0.85 @ 10 A	180	175	0.0035	4.5 @ 125°C	
100	20	T_C = 162°C	***MBR20H100CTG***	0.88 @ 20 A	250	175	0.0045	6.0 @ 125°C	
100	30	T_C = 155°C	***MBR30H100CTG***	0.93 @ 30 A	250	175	0.0045	6.0 @ 125°C	
100	40	T_C = 150°C	***MBR41H100CTG***	0.9 @ 40 A	350	175	0.01	10 @ 125°C	
100	60	T_C = 133°C	***MBR60H100CTG***	0.98 @ 60 A	350	175	0.01	10 @ 125°C	
100	20	T_C = 133°C	***MBR20100CT***	0.85 @ 10 A 0.95 @ 20 A	150	175	0.1	6.0 @ 125°C	
200	20	T_C = 125°C	***MBR20200CT***	1.0 @ 20 A	150	150	1.0	50 @ 125°C	
35	25	T_C = 95°C	***MBR2535CTL***	0.55 @ 25 A	150	125	5.0	500 @ 125°C	
45	25	T_C = 130°C	***MBR2545CT***	0.82 @ 25 A	150	150	0.2	40 @ 125°C	
45	30	T_C = 130°C	***MBR3045ST***	0.76 @ 30 A	150	175	0.2	40 @ 125°C	
15	40	T_C = 105°C	***MBR4015CTL***	0.54 @ 25 A	150	125	1.0	400 @ 125°C	
250	40	T_C = 82°C	***MBR40250T***	0.097 @ 40 A	150	150	0.03	30 @ 125°C	
45	60	T_C = 145°C	***MBR60L45CT***	0.73 @ 60 A	200	175	1.2	255 @ 125°C	
35	7.5	T_C = 170°C	***MBR735***	0.8 @ 15 A	150	175	0.1	15 @ 125°C	**CASE 221B-04** (TO-220AC) 
45	7.5	T_C = 170°C	***MBR745***	0.84 @ 15 A	150	175	0.1	15 @ 125°C	
35	10	T_C = 135°C	***MBR1035***	0.84 @ 20 A	150	150	0.1	15 @ 125°C	
45	10	T_C = 135°C	***MBR1045***	0.84 @ 20 A	150	150	0.1	15 @ 125°C	
60	10	T_C = 133°C	***MBR1060***	0.80 @ 10 A	150	150	0.1	6.0 @ 125°C	
80	10	T_C = 133°C	***MBR1080***	0.80 @ 10 A	150	150	0.1	6.0 @ 125°C	
90	10	T_C = 133°C	***MBR1090***	0.8 @ 10 A	150	150	0.1	6.0 @ 125°C	
100	10	T_C = 133°C	***MBR10100***	0.80 @ 10 A	150	150	0.1	6.0 @ 125°C	
35	16	T_C = 125°C	***MBR1635***	0.63 @ 16 A	150	175	0.2	40 @ 125°C	
45	16	T_C = 125°C	***MBR1645***	0.63 @ 16 A	150	175	0.2	40 @ 125°C	
15	25	T_C = 90°C	***MBR2515L***	0.45 @ 25 A	150	100	15	200 @ 70°C	
250	40	T_C = 82°C	***MBR40250***	0.097 @ 40 A	150	150	0.03	30 @ 125°C	
30	30		***MBRB30H30CT−1G***	0.6 @ 30 A	260	150	0.5	45 @ 125°C	**CASE 418D−01 I^2PAK** (TO−262) 
45	30	T_C = 130°C	***MBRB3045CT−1G***	0.76 @ 30 A	150	175	0.2	40 @ 125°C	
60	30	T_C = 159°C	***MBRB30H60CT−1G***	0.78 @ 30 A	260	175	0.3	45 @ 125°C	
100	40	T_C = 150°C	***MBRB41H100CT−1G***	0.9 @ 40 A	350	175	0.01	10 @ 125°C	
60	20	T_C = 133°C	UL ***MBRF2060CT***	0.95 @ 20 A	150	150	0.15	15 @ 125°C	**CASE 221D-03 FULL PAK**  “CT” Suffix
100	20	T_C = 133°C	UL ***MBRF20100CT***	0.95 @ 20 A	150	150	0.15	15 @ 125°C	
200	20	T_C = 125°C	UL ***MBRF20200CT***	1.0 @ 20 A	150	150	1.0	50 @ 125°C	
45	25	T_C = 125°C	UL ***MBRF2545CT***	0.82 @ 25 A	150	150	0.2	40 @ 125°C	
60	30	T_C = 159°C	***MBRF30H60CTG***	0.79 @ 30 A	260	175	0.3	45 @ 125°C	
250	40	T_C = 46°C	UL ***MBRF40250T***	0.097 @ 40 A	150	150	0.03	30 @ 125°C	

(2)At V_{RRM} unless noted
(3)At V_{RRM}, T_J = 100°C unless noted
UL Indicates UL Recognized − File #E69369

SCHOTTKY Rectifiers (continued)

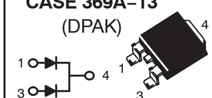
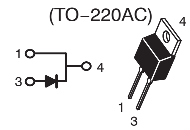
Table 12. TO-218 and TO-247 Schottky Rectifiers

V_{RRM} (V)	I_O (A)	I_O Rating Condition	Device	Max V_F @ I_F T_C = 25°C (V)	I_{FSM} (A)	T_J Max (°C)	Max I_R(2) T_C = 25°C (mA)	Max I_R(3) (mA)	Package
45	30	T_C = 105°C	***MBR3045PT***	0.76 @ 30 A	200	150	1.0	100 @ 125°C	**CASE 340D-02** (TO-218AC) 
45	40	T_C = 125°C	***MBR4045PT***	0.70 @ 20 A 0.80 @ 40 A	400	175	1.0	50 @ 125°C	
45	60	T_C = 125°C	***MBR6045PT***	0.62 @ 30 A 0.75 @ 60 A	500	150	1.0	50	
45	30	T_C = 105°C	***MBR3045WT***	0.76 @ 30 A	200	150	1.0	100 @ 125°C	**CASE 340L−02** (TO-247) 
15	40	T_C = 125°C	***MBR4015LWT***	0.42 @ 20 A 0.50 @ 40 A	400	100	5.0	150 @ 75°C	
45	40	T_C = 125°C	***MBR4045WT***	0.70 @ 20 A 0.80 @ 40 A	400	150	1.0	50	
45	60	T_C = 125°C	***MBR6045WT***	0.62 @ 30 A 0.75 @ 60 A	500	175	1.0	50	
30	70	T_C = 100°C	***MBR7030WT***	0.72 @ 70 A	500	150	5.0	250 @ 100°C	
100	40	T_C = 150°C	***MBR40H100WT***	0.9 @ 40 A	200	175	0.01	10 @ 125°C	
45	60	T_C = 165°C	***MBR60L45WT***	0.73 @ 60 A	200	175	1.2	275 @ 125°C	

(2)At V_{RRM} unless noted
(3)At V_{RRM}, T_J = 100°C unless noted

UltraSoft Rectifiers

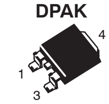
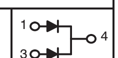
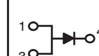
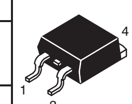
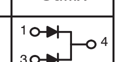
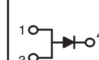
Table 13. UltraSoft Rectifiers (For High Speed Rectification)

V_{RRM} (V)	I_O(1) (A)	I_O Rating Condition	Device	Max V_F @ I_F T_C = 29°C (V)	t_{rr} (ns)	T_J Max (°C)	Max I_R(2) T_C = 25°C (μA)	Max I_R(3) (μA)	Package
200	6.0	T_C = 137°C	***MSRD620CT***	1.35 @ 6.0 A	55	175	5.0	200	**CASE 369A−13** (DPAK) 
600	8.0	T_C = 125°C	***MSR860***	1.7 @ 8.0 A	120	150	10	1000	**CASE 221B−04** (TO−220AC) 
600	15	T_C = 125°C	***MSR1560***	1.8 @ 15 A	45	150	15	5000	

(1)I_O is total device current capability.
(2)At V_{RRM} unless noted
(3)At V_{RRM}, T_J = 150°C unless noted

Ultrafast Rectifiers (continued)

Table 14. Surface Mount Ultrafast Rectifiers

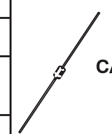
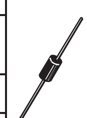
V_{RRM} (V)	I_O(1) (A)	I_O Rating Condition	Device	Max t_{rr} (ns)	Max V_F @ I_F T_C = 25°C (V)	I_{FSM} (A)	T_J Max (°C)	Max I_R(2) T_J = 25°C (μA)	Max I_R(4) (μA)	Package
50	1.0	T_L = 155°C	***MURA105***	30	0.875 @ 1.0 A	50	175	2.0	50	**CASE 403D–02 SMA**  Cathode = Polarity Band
100	1.0	T_L = 155°C	***MURA110***	30	0.875 @ 1.0 A	50	175	2.0	50	
150	1.0	T_L = 155°C	***MURA115***	35	0.875 @ 1.0 A	40	175	2.0	50	
200	1.0	T_L = 155°C	***MURA120***	35	0.875 @ 1.0 A	40	175	2.0	50	
300	1.0	T_L = 150°C	***MURA130***	35	1.1 @ 1.0 A	35	175	5.0	150	
400	1.0	T_L = 150°C	***MURA140***	35	1.1 @ 1.0 A	35	175	5.0	150	
600	1.0	T_L = 145°C	***MURA160***	75	1.25 @ 1.0 A	30	175	5.0	150	
600	1.0	T_L = 145°C	***MURHS160***	35	2.4 @ 1.0 A	15	175	20	200 @ 125°C	
50	2.0	T_L = 135°C	***MURA205***	30	0.94 @ 2.0 A	50	175	2.0	50	
100	2.0	T_L = 135°C	***MURA210***	30	0.94 @ 2.0 A	50	175	2.0	50	
150	2.0	T_L = 135°C	***MURA215***	35	0.95 @ 2.0 A	40	175	2.0	50	
200	2.0	T_L = 135°C	***MURA220***	35	0.95 @ 2.0 A	40	175	2.0	50	
300	2.0	T_L = 125°C	***MURA230***	65	1.3 @ 2.0 A	35	175	5.0	150	
400	2.0	T_L = 125°C	***MURA240***	65	1.3 @ 2.0 A	35	175	5.0	150	
600	2.0	T_L = 110°C	***MURA260***	75	1.45 @ 2.0 A	30	175	5.0	150	
50	1.0	T_L = 155°C	***MURS105***	35	0.875 @ 1.0 A	40	175	2.0	50	**CASE 403A–03 SMB**  Cathode = Polarity Band
100	1.0	T_L = 155°C	***MURS110***	35	0.875 @ 1.0 A	40	175	2.0	50	
150	1.0	T_L = 155°C	***MURS115***	35	0.875 @ 1.0 A	40	175	2.0	50	
200	1.0	T_L = 155°C	***MURS120***	35	0.875 @ 1.0 A	40	175	2.0	50	
400	1.0	T_L = 150°C	***MURS140***	75	1.25 @ 1.0 A	35	175	5.0	150	
600	1.0	T_L = 150°C	***MURS160***	75	1.25 @ 1.0 A	35	175	5.0	150	
50	2.0	T_L = 125°C	***MURS205***	30	0.94 @ 2.0 A	50	175	2.0	50	
100	2.0	T_L = 125°C	***MURS210***	30	0.94 @ 2.0 A	50	175	2.0	50	
200	2.0	T_L = 145°C	***MURS220***	35	0.95 @ 2.0 A	40	175	2.0	50	
300	2.0	T_L = 125°C	***MURS230***	65	1.3 @ 2.0 A	35	175	5.0	150	
400	2.0	T_L = 125°C	***MURS240***	65	1.3 @ 2.0 A	35	175	5.0	150	
600	2.0	T_L = 125°C	***MURS260***	75	1.45 @ 2.0 A	35	175	5.0	150	
200	3.0	T_L = 140°C	***MURS320***	35	0.875 @ 3.0 A	75	175	5.0	150	**CASE 403–03 SMC**  Cathode = Notch
400	3.0	T_L = 130°C	***MURS340***	75	1.25 @ 3.0 A	75	175	10	250	
600	3.0	T_L = 130°C	***MURS360***	75	1.25 @ 3.0 A	75	175	10	250	
200	6.0	T_C = 140°C	***MURD620CT***	35	1.0 @ 3.0 A	50	175	5.0	250 @ 125°C	**DPAK**   "CT" Suffix  Non-"CT" Suffix
200	3.0	T_C = 158°C	***MURD320***	35	0.95 @ 3.0 A	75	175	5.0	500 @ 125°C	
300	3.0	T_C = 140°C	***MURD330***	50	1.15 @ 3.0 A	90	175	5.0	500	
300	3.0	T_C = 160°C	***MURD330***	50	1.15 @ 3.0 A	75	175	5.0	500	
400	3.0	T_C = 160°C	***MURD340***	50	1.15 @ 3.0 A	75	175	5.0	500	
600	5.0	T_C = 159°C	***MURHD560***	30	2.7 @ 5.0 A	50	175	10	70 @ 125°C	
400	8.0	T_C = 120°C	***MURHB840CT***	28	2.2 @ 4.0 A	100	175	10	500	**D^2PAK CASE 418B–04**   "CT" Suffix  Non-"CT" Suffix
600	8.0	T_C = 120°C	***MURHB860CT***	35	2.8 @ 4.0 A	100	175	10	500	
200	16	T_C = 150°C	***MURB1620CT***	35	0.975 @ 8.0 A	100	175	5.0	250	
600	16	T_C = 150°C	***MURB1660CT***	60	1.5 @ 8.0 A	100	175	10	500	

(1)I_O is total device current capability.
(2)At V_{RRM} unless noted
(4)At V_{RRM}, T_J = 150°C unless noted

All devices listed are ON Semiconductor preferred devices

Ultrafast Rectifiers (continued)

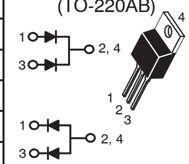
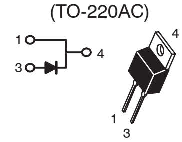
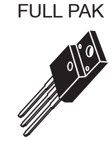
Table 15. Axial Lead Ultrafast Rectifiers

V_{RRM} (V)	I_O (A)	I_O Rating Condition	Device	Max t_{rr} (ns)	Max V_F @ I_F T_C = 25°C (V)	I_{FSM} (A)	T_J Max (°C)	Max I_R(2) T_J = 25°C (μA)	Max I_R(4) (μA)	Package
50	1.0	T_A = 130°C	***MUR105***	35	0.875 @ 1.0 A	35	175	2.0	50	 **CASE 59-10** (DO−41) Plastic Cathode = Polarity Band
100	1.0	T_A = 130°C	***MUR110***	35	0.875 @ 1.0 A	35	175	2.0	50	
150	1.0	T_A = 130°C	***MUR115***	35	0.875 @ 1.0 A	35	175	2.0	50	
200	1.0	T_A = 130°C $R_{\theta JA}$ = 50°C/W	***MUR120***	25	0.875 @ 1.0 A	35	175	2.0	50	
300	1.0	T_A = 120°C	***MUR130***	75	1.25 @ 1.0 A	35	175	5.0	150	
400	1.0	T_A = 120°C	***MUR140***	75	1.25 @ 1.0 A	35	175	5.0	150	
600	1.0	T_A = 120°C $R_{\theta JA}$ = 50°C/W	***MUR160***	75	1.25 @ 1.0 A	35	175	5.0	150	
800	1.0	T_A = 95°C	***MUR180E***	75	1.75 @ 1.0 A	35	175	10	600 @ 100°C	
1000	1.0	T_A = 95°C $R_{\theta JA}$ = 50°C/W	***MUR1100E***	75	1.75 @ 1.0 A	35	175	10	600 @ 100°C	
200	2.0	T_A = 90°C	***MUR220***	35	0.95 @ 2.0 A	35	175	2.0	50	
400	2.0	T_A = 85°C	***MUR240***	65	1.15 @ 2.0 A	35	175	5.0	150	
600	2.0	T_A = 60°C	***MUR260***	75	1.35 @ 2.0 A	35	175	5.0	150	
1000	2.0	T_A = 35°C	***MUR2100E***	100	2.2 @ 2.0 A	35	175	10	600	
50	4.0	T_A = 80°C	***MUR405***	35	0.89 @ 4.0 A	125	175	5.0	150	 **CASE 267-05** (DO−201AD) Plastic Cathode = Polarity Band
100	4.0	T_A = 80°C	***MUR410***	35	0.89 @ 4.0 A	125	175	5.0	150	
150	4.0	T_A = 80°C	***MUR415***	35	0.89 @ 4.0 A	125	175	5.0	150	
200	4.0	T_A = 80°C $R_{\theta JA}$ = 28°C/W	***MUR420***	35	0.88 @ 3.0 A	125	175	5.0	150	
400	4.0	T_A = 40°C	***MUR440***	75	1.28 @ 4.0 A	110	175	10	250	
600	4.0	T_A = 40°C $R_{\theta JA}$ = 28°C/W	***MUR460***	75	1.25 @ 3.0 A	110	175	10	250	
800	4.0	T_A = 35°C	***MUR480E***	75	1.75 @ 3.0 A	70	175	25	900	
1000	4.0	T_A = 35°C $R_{\theta JA}$ = 28°C/W	***MUR4100E***	75	1.75 @ 3.0 A	70	175	25	900	

(2)At V_{RRM} unless noted
(4)At V_{RRM}, T_J = 150°C unless noted

Ultrafast Rectifiers (continued)

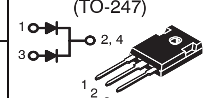
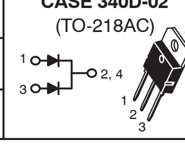
Table 16. TO-220 Ultrafast and MEGAHERTZ™ Rectifiers

V_{RRM} (V)	I_O[1] (A)	I_O Rating Condition	Device	Max t_{rr} (ns)	Max V_F @ I_F T_C = 25°C (V)	I_{FSM} (A)	T_J Max (°C)	Max I_R[2] T_C = 25°C (µA)	Max I_R[4] (µA)	Package
200	6.0	T_C = 130°C	***MUR620CT***	35	0.975 @ 3.0 A	75	175	5.0	250	**CASE 221A-09** (TO-220AB)  **MUR1620CTR Only**
400	8.0	T_C = 120°C	***MURH840CT***	28	2.2 @ 4.0 A	100	175	10	500	
600	8.0	T_C = 120°C	***MURH860CT***	35	2.8 @ 4.0 A	100	175	10	500	
100	16	T_C = 150°C	***MUR1610CT***	35	0.975 @ 8.0 A	100	175	5.0	250	
150	16	T_C = 150°C	***MUR1615CT***	35	0.975 @ 8.0 A	100	175	5.0	250	
200	16	T_C = 150°C	***MUR1620CT***	35	0.975 @ 8.0 A	100	175	5.0	250	
200	16	T_C = 160°C	***MUR1620CTR***	85	1.2 @ 8.0 A	100	175	5.0	500	
400	16	T_C = 150°C	***MUR1640CT***	60	1.30 @ 8.0 A	100	175	10	250	
600	16	T_C = 150°C	***MUR1660CT***	60	1.5 @ 8.0 A	100	175	10	500	
50	8.0	T_C = 150°C	***MUR805***	35	0.975 @ 8.0 A	100	175	5.0	250	**CASE 221B-04** (TO-220AC) 
100	8.0	T_C = 150°C	***MUR810***	35	0.975 @ 8.0 A	100	175	5.0	250	
150	8.0	T_C = 150°C	***MUR815***	35	0.975 @ 8.0 A	100	175	5.0	250	
200	8.0	T_C = 150°C	***MUR820***	35	0.975 @ 8.0 A	100	175	5.0	250	
400	8.0	T_C = 150°C	***MUR840***	60	1.30 @ 8.0 A	100	175	10	500	
600	8.0	T_C = 150°C	***MUR860***	60	1.50 @ 8.0 A	100	175	10	500	
800	8.0	T_C = 150°C	***MUR880E***	75	1.80 @ 8.0 A	100	175	25	500 @ 100°C	
1000	8.0	T_C = 150°C	***MUR8100E***	75	1.80 @ 8.0 A	100	175	25	500 @ 100°C	
100	15	T_C = 150°C	***MUR1510***	35	1.05 @ 15 A	200	175	10	500	
150	15	T_C = 150°C	***MUR1515***	35	1.05 @ 15 A	200	175	10	500	
200	15	T_C = 150°C	***MUR1520***	35	1.05 @ 15 A	200	175	10	500	
400	15	T_C = 150°C	***MUR1540***	60	1.25 @ 15 A	150	175	10	500	
600	15	T_C = 145°C	***MUR1560***	60	1.50 @ 15 A	150	175	10	1000	
200	20	T_C = 125°C	***MUR2020R***	95	1.10 @ 20 A	250	175	50	1000	
200	16	T_C = 150°C	***MURF1620CT***	35	0.975 @ 8.0 A	100	150	5.0	250	**CASE 221D-03** (TO−220) FULL PAK 
600	16	T_C = 150°C	***MURF1660CT***	60	1.5 @ 8.0 A	100	150	10	500	
600	8.0	$T_C \leq$ 120°C	***MURHF860CT***	35	2.8 @ 4.0 A	100	150	10	500	

(1) I_O is total device capability
(2) At V_{RRM} unless noted
(4) At V_{RRM}, T_J = 150°C unless noted

Indicates UL Recognized − File #E69369

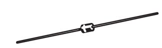
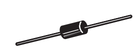
Table 17. TO-218 and TO-247 Ultrafast Rectifiers

V_{RRM} (V)	I_O (A)	I_O Rating Condition	Device	Max t_{rr} (ns)	Max V_F @ I_F T_C = 25°C (V)	I_{FSM} (A)	T_J Max (°C)	Max I_R[2] T_J = 25°C (µA)	Max I_R[4] (mA)	Package
200	30	T_C = 145°C	***MUR3020WT***	35	1.05 @ 15 A	200	175	10	0.5	**CASE 340L−02** (TO-247) 
600	30	T_C = 145°C	***MUR3060WT***	60	1.70 @ 15 A	150	175	10	1.0	
200	30	T_C = 150°C	***MUR3020PT***	35	1.05 @ 15 A	200	175	10	0.5	**CASE 340D-02** (TO-218AC) 
400	30	T_C = 150°C	***MUR3040PT***	60	1.25 @ 15 A	150	175	10	0.5	
600	30	T_C = 145°C	***MUR3060PT***	60	1.50 @ 15 A	150	175	10	1.0	

(2) At V_{RRM} unless noted
(4) At V_{RRM}, T_J = 150°C unless noted

Fast Recovery Rectifiers/General Purpose Rectifiers

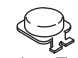
Table 18. Fast Recovery Rectifiers/General Purpose Rectifiers

V_{RRM} (V)	I_O (A)	I_O Rating Condition	Device	Max V_F @ I_F T_J = 25°C (V)	Max t_{rr} (ns)	I_{FSM} (A)	T_J Max (°C)	Max I_R[2] T_J = 25°C (μA)	Max I_R[3] (μA)	Package
400	1.5	T_L = 118°C	***MRS1504***	1.04 @ 1.5 A	–	50	150	1.0	340	**CASE 403A-03** **SMB** 
300	1.0	T_L = 150°C	***MRA4003G***	1.1 @ 1.0 A	–	30	175	10	50	**CASE 403B-02** **SMA**  Cathode = Notch
400	1.0	T_L = 150°C	***MRA4004G***	1.1 @ 1.0 A	–	30	175	10	50	
600	1.0	T_L = 150°C	***MRA4005G***	1.1 @ 1.0 A	–	30	175	10	50	
800	1.0	T_L = 150°C	***MRA4006G***	1.1 @ 1.0 A	–	30	175	10	50	
1000	1.0	T_L = 150°C	***MRA4007G***	1.1 @ 1.0 A	–	30	175	10	50	
50	1.0	T_A = 75°C	***1N4001RL***	1.1 @ 1.0 A	–	30	175	10	50	**CASE 59-10**[7] (DO−41) Plastic  Cathode = Polarity Band
100	1.0	T_A = 75°C	***1N4002RL***	1.1 @ 1.0 A	–	30	175	10	50	
200	1.0	T_A = 75°C	***1N4003RL***	1.1 @ 1.0 A	–	30	175	10	50	
400	1.0	T_A = 75°C	***1N4004RL***	1.1 @ 1.0 A	–	30	175	10	50	
600	1.0	T_A = 75°C	***1N4005RL***	1.1 @ 1.0 A	–	30	175	10	50	
800	1.0	T_A = 75°C	***1N4006RL***	1.1 @ 1.0 A	–	30	175	10	50	
1000	1.0	T_A = 75°C	***1N4007RL***	1.1 @ 1.0 A	–	30	175	10	50	
50	1.0	T_A = 75°C	***1N4933RL***	1.2 @ 1.0 A	200	30	150	5.0	100	
100	1.0	T_A = 75°C	***1N4934RL***	1.2 @ 1.0 A	200	30	150	5.0	100	
200	1.0	T_A = 75°C	***1N4935RL***	1.2 @ 1.0 A	200	30	150	5.0	100	
400	1.0	T_A = 75°C	***1N4936RL***	1.2 @ 1.0 A	200	30	150	5.0	100	
600	1.0	T_A = 75°C	***1N4937RL***	1.2 @ 1.0 A	200	30	150	5.0	100	
50	3.0	T_L = 105°C	***1N5400RL***	1.0 @ 3.0 A	–	200	170	10	100 @ 150°C	**CASE 267-05** (DO−201AD) Plastic  Cathode = Polarity Band
100	3.0	T_L = 105°C	***1N5401RL***	1.0 @ 3.0 A	–	200	170	10	100 @ 150°C	
200	3.0	T_L = 105°C	***1N5402RL***	1.0 @ 3.0 A	–	200	170	10	100 @ 150°C	
400	3.0	T_L = 105°C	***1N5404RL***	1.0 @ 3.0 A	–	200	170	10	100 @ 150°C	
600	3.0	T_L = 105°C	***1N5406RL***	1.0 @ 3.0 A	–	200	170	10	100 @ 150°C	
800	3.0	T_L = 105°C	***1N5407RL***	1.0 @ 3.0 A	–	200	170	10	100 @ 150°C	
1000	3.0	T_L = 105°C	***1N5408RL***	1.0 @ 3.0 A	–	200	170	10	100 @ 150°C	
200	3.0	T_A = 80°C[8]	***MR852RL***	1.25 @ 3.0 A	200	100	150	10	150	
400	3.0	T_A = 80°C[8]	***MR854RL***	1.25 @ 3.0 A	200	100	150	10	150	
600	3.0	T_A = 80°C[8]	***MR856RL***	1.25 @ 3.0 A	200	100	150	10	150	
50	6.0	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR750RL***	1.25 @ 100 A	–	400	175	25	1000	**CASE 194-04** Axial Lead Micro Button  Cathode indicated by diode symbol
100	6.0	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR751RL***	1.25 @ 100 A	–	400	175	25	1000	
200	6.0	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR752RL***	1.25 @ 100 A	–	400	175	25	1000	
400	6.0	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR754RL***	1.25 @ 100 A	–	400	175	25	1000	
600	6.0	T_A = 60°C $R_{\theta JA}$ = 25°C/W	***MR756RL***	1.25 @ 100 A	–	400	175	25	1000	
200	25	T_C = 150°C	***MR2502***	1.18 @ 78.5 A	–	400	175	100	500	**CASE 193-04** Micro Button  Cathode = Polarity Band
400	25	T_C = 150°C	***MR2504***	1.18 @ 78.5 A	–	400	175	100	500	

(2)At V_{RRM} unless noted
(3)At V_{RRM}, T_J = 100°C unless noted
(7)Package Size: 0.120” max diameter by 0.260” length.
(8)Must be derated for reverse power dissipation. See data sheet.
(9)Overvoltage Transient Suppressor: 24−32 volts avalanche voltage.

Fast Recovery Rectifiers/General Purpose Rectifiers (continued)

Table 19. Overvoltage Transient Suppressors

V_{RRM} (V)	V_{BR}(1) (V)	V_{BR} (V)	I_O (A)	Device	Max V_F @ I_F $T_J = 25°C$ (V)	I_{FSM} (A)	T_J Max (°C)	I_{RSM} (A)	Max I_R(6) (μA)	Package
20	24–32	40(2)	6.0 T_C = 125°C	***MR2535L***	1.1 I_F = 100A	400	175	62(5)	0.2	**CASE 194–04** Axial Lead Micro Button  Cathode = Diode Symbol
23	24–32	40(4)	32 T_C = 150°C	***TRA2532***	1.18 I_F = 100A	500	175	80(5)	10	**CASE 193-04** Micro Button  Cathode = Polarity Band
23	24–32	40(3)	32 T_C = 150°C	***MR2835SK***	1.1 I_F = 100A	400	150	62(5)	5.0 @ 20 V	**CASE 460–02** Top Can  Cathode = Terminal

(1)At Ir = 100 mA, 25°C
(2)At Ir = 90 A, Tc = 150°C, PW = 80 μS
(3)At Ir = 80 A, Tc = 85°C, PW = 80 μS
(4)At Ir = 80 A, Tc = 25°C, PW = 80 μS
(5)Time Constant = 10 mS, 25°C
(6)At V_{RRM}, T_j = 25°C unless noted

Bipolar Transistors

Bipolar Transistors

Table of Contents

In Brief...

Through ON Semiconductor's extensive process improvements and stringent quality control standards, we are proud to offer a broad line of bipolar power transistors that meet or exceed those of other suppliers. This portfolio consists of discrete and Darlington transistors in a variety of popular packages from the low power surface mount SOT−223 to the high power TO−3.

Product Highlights

Audio Transistors:

- Improved gain linearity, complementary pair gain matching and optimized die area for symmetrical characteristics in complementary configurations.
- Unsurpassed high voltage FBSOA performance.
- New state of the art 150 W and 180 W high frequency discrete transistors.
- ThermalTrak™ output transistors with internal bias control eliminate amplifier warm−up period, enable instant temperature adjustment, upgrade sound quality and improve bias stability.
- High voltage discrete audio output transistors that reach higher voltages than previously available.

Electronic Lamp Ballast:

- High frequency, high gain bipolar transistors that utilize monolithic collector/emitter diode tailored to meet the needs of lamp ballasts.
- Active anti−saturation network to provide short and highly reproducible collector current storage time.

Low $V_{CE(sat)}$ Transistors:

- Devices with combination of low saturation voltage and high gain are ideal for high speed switching applications where power savings is a concern.

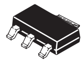
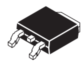
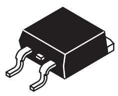
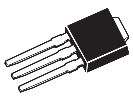
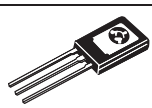
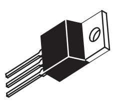
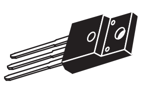
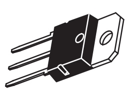
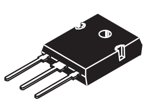
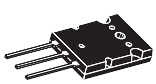
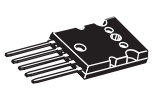
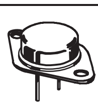
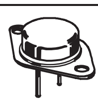
Ultra High Current Transistors:

- Dual matched die configurations up to 60 A.
- Working voltages from 60 V to 120 V.

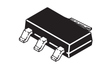
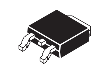
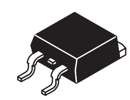
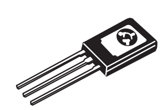
ON Semiconductor has a commitment to quality and total customer satisfaction. We will continue to demonstrate this in the new and innovative products we plan to announce in the coming year.

BIPOLAR TRANSISTORS SELECTOR GUIDE

SELECTION BY PACKAGE

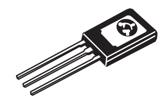
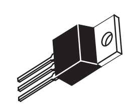
Package		I_C Range (Amps)	V_{CE} Range (Volts)	P_D (Watts)
	**SOT–223**	0.5–3.0	30–300	2.75–3.0
	**DPAK**	0.5-10	25-450	12.5-25
	**D²PAK**	6.0–10	80–350	50–75
	**DPAK**	0.5-10	25-450	12.5-25
	**TO-225AA**	0.3-5.0	25-500	12.5-50
	**TO-220AB**	0.5-15	32-400	30-150
	**Isolated TO-220**	1.0-10	60-450	28-45
	**TO–218**	10–25	60–350	80–150
	**TO–247**	8.0–30	150–250	100–200
	**TO-264**	15-20	250-350	200–250
	**TO-264 5–Lead**	15	260	200
	**TO-3 (TO-204AA) 40 Mil Pins**	4.0-30	40-250	115-250
	**TO–3 (TO-204AE) 60 Mil Pins**	40–60	60-250	150-300

DISCRETE TRANSISTORS

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type		h_{FE} Min/Max	@ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C	Package
		NPN	PNP					
0.5	300		MMJT350T1	30/240	0.05	30	2.75	 SOT−223
3.0	30	MMJT9410T1	MMJT9435T1	50	1.0	100 typ	3.0	
	40		NJT4030P	200/400	1.0	160 typ	2.0	
0.5	300	MJD340T4	MJD350T4	30/240	0.05	30	15	 DPAK
1.0	250	MJD47T4		30/150	0.3	10	15	
	350		MJD5731T4	10 min	1.0	10	15	
	400	MJD50T4		30/150	0.3	10	15	
2.0	45		MJD148T4	50 min	2.0	3.0	20	
	50	NJD2873T4		40 min	2.0	30	12.5	
	450	MJD18002D2T4		6.0 min	2.0	13 typ	25	
3.0	40	MJD31T4	MJD32T4	10 min	1.0	3.0	15	
	100	MJD31CT4	MJD32CT4	10 min	1.0	3.0	15	
4.0	100	MJD243T4	MJD253T4	40/180	0.2	40	12.5	
5.0	25	MJD200T4	MJD210T4	45/180	2.0	65	12.5	
6.0	100	MJD41CT4	MJD42CT4	15/75	3.0	3.0	20	
8.0	80	MJD44H11T4	MJD45H11T4	40 min	4.0	50 typ	20	
10	60	MJD3055T4	MJD2955T4	20/100	4.0	2.0	20	
6.0	100	MJB41CT4	MJB42CT4	15/75	3.0	3.0	65	 D^2PAK
8.0	80	MJB44H11T4	MJB45H11T4	40/100	4.0	40	50	
0.3	350	MJE3439		40/160	0.02	15	15	 TO−225AA
0.5	200	MJE344		30/300	0.05	15	20.8	
	250	2N5655		30/250	0.1	10	20	
	300	MJE340	MJE350	30/240	0.05	30	20.8	
	350	2N5657		30/250	0.1	10	20	
		BD159		30/240	0.05	30	20	
1.0	40	2N4921	2N4918	20/100	0.5	3.0	30	
	60	2N4922	2N4919	20/100	0.5	3.0	30	
	80	2N4923	2N4920	20/100	0.5	3.0	30	
1.5	45	BD135	BD136	40/250	0.15	50	12.5	
	60	BD137	BD138	40/250	0.15	50	12.5	
	80	BD139	BD140	40/250	0.15	50	12.5	
2.0	45		BD234	25 min	1.0	3.0	25	
	80	BD237		25 min	1.0	3.0	25	
3.0	40	MJE180	MJE170	50/250	0.1	50	12.5	
	60	MJE181	MJE171	50/250	0.1	50	12.5	
	80	BD179	BD180	40/250	0.15	3.0	25	
		MJE182	MJE172	50/250	0.1	50	12.5	
	500	BUH51 †		8.0 min	1.0	12 typ	50	

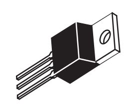
†Style 3.

DISCRETE TRANSISTORS (continued)

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type NPN	Device Type PNP	h_{FE} Min/Max	@ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C	Package
4.0	32	BD435	BD436	50 min	2.0	3.0	36	 TO−225AA
	40	MJE521	MJE371	40 min	1.0	3.0	40	
		2N5190		25 min	1.5	2.0	40	
	45	BD437	BD438	40 min	2.0	3.0	36	
	60	BD439	BD440	25 min	2.0	3.0	36	
		BD787	BD788	20 min	2.0	50	15	
		2N5191	2N5194	25/100	1.5	2.0	40	
	80	2N5192	2N5195	25/100	1.5	2.0	40	
		BD441	BD442	15 min	2.0	3.0	36	
	100	MJE243	MJE253	40/120	0.2	40	15	
5.0	25	MJE200	MJE210	45/180	2.0	65	15	
1.0	60	TIP29A		15/75	1.0	3.0	30	 TO−220AB
	80	TIP29B		15/75	1.0	3.0	30	
	100	TIP29C	TIP30C	15/75	1.0	3.0	30	
	250	TIP47		30/150	0.3	10	40	
	300	TIP48	MJE5730	30/150	0.3	10	40	
	350		MJE5731	30/150	0.3	10	40	
	375		MJE5731A	30/150	0.3	10	40	
	400	TIP50		30/150	0.3	10	40	
2.0	400/700	BUL44		14/36	0.4	13 typ	50	
	450/1000	BUX85		30	0.1	4.0	50	
		MJE18002		14/34	0.2	12 typ	40	
3.0	40	TIP31	TIP32	25 min	1.0	3.0	40	
	60	TIP31A	TIP32A	25 min	1.0	3.0	40	
	80		BD242B	25 min	1.0	3.0	40	
		TIP31B	TIP32B	25 min	1.0	3.0	40	
	100	BD241C	BD242C	25 min	1.0	3.0	40	
		TIP31C	TIP32C	25 min	1.0	3.0	40	
4.0	80	D44C12	D45C12	40/120	0.2	40 typ	30	
	350	MJE15034	MJE15035	10 min	2.0	30	50	
	400/700	MJE13005		6/30	3.0	4.0	60	
	500/800	BUH50		10 typ	2.0	4.0	50	
5.0	250	2N6497		10/75	2.5	5.0	80	
	400/700	BUL45		14/34	0.3	12 typ	75	
		BUL45D2*		22 min	0.8	13 typ	75	
	450/1000	MJE18004		14/34	0.3	13	75	
		MJE18004D2*		15 min	0.8	13	75	

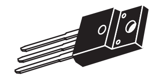
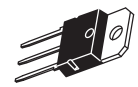
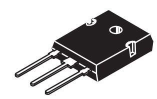
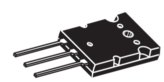
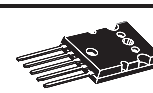
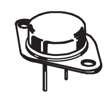
NOTE: When two voltages are given, the format is $V_{CEO(sus)}/V_{CES}$.
*D2 suffix indicates transistor with built−in C−E freewheeling diode and antisaturation network.

DISCRETE TRANSISTORS (continued)

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type NPN	Device Type PNP	h_{FE} Min/Max	@ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C	Package
6.0	40		TIP42	15/75	3.0	3.0	65	 TO−220AB
	60	TIP41A	TIP42A	15/75	3.0	3.0	65	
	80	TIP41B	TIP42B	15/75	3.0	3.0	65	
			BD244B	15 min	3.0	3.0	65	
	100	BD243C	BD244C	15 min	3.0	3.0	65	
		TIP41C	TIP42C	15/75	3.0	3.0	65	
	400/700	BUL146		14/34	0.5	14 typ	100	
	450/1000	MJE18006		14/34	0.5	14 typ	100	
7.0	30	2N6288	2N6111	30/150	3.0	4.0	40	
	50		2N6109	30/150	2.5	4.0	40	
	70	2N6292	2N6107	30/150	2.0	4.0	40	
	200	BU406		30 min	1.5	10	60	
8.0	120	MJE15028	MJE15029	20 min	4.0	30	50	
	150	MJE15030	MJE15031	20 min	4.0	30	50	
	250	MJE15032	MJE15033	10 min	2.0	30	50	
	300		MJE5850	15 min	2.0	30 typ	80	
	350		MJE5851	15 min	2.0	30 typ	80	
	400		MJE5852	15 min	2.0	30 typ	80	
		MJE13007		5/30	5.0	14 typ	80	
	450/1000	MJE18008		16/34	1.0	13 typ	125	
10	60	D44H8	D45H8	40 min	4.0	3.0	50	
		MJE3055T	MJE2955T	20/70	4.0	3.0	75	
	80	BD809	BD810	15 min	4.0	1.5	90	
		D44H11	D45H11	40 min	4.0	50 typ	50	
	400/700	BUH100		6.0 min	10	23 typ	100	
12	90	BUV26		12 min	12	30 typ	85	
	120	BUV27		12 min	8.0	30 typ	70	
	400/700	MJE13009		6/30	8.0	4.0	100	
15	60	2N6487	2N6490	20/150	5.0	5.0	75	
	80	2N6488	2N6491	20/150	5.0	5.0	75	
		D44VH10	D45VH10	20 min	4.0	50 typ	83	
	400/700	BUH150		4.0 min	20	23 typ	150	

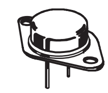
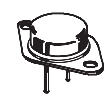
NOTE: When two voltages are given, the format is $V_{CEO(sus)}/V_{CES}$.

DISCRETE TRANSISTORS (continued)

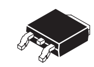
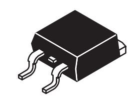
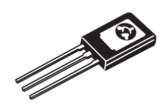
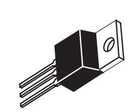
I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type		h_{FE} Min/Max	@ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C	Package
		NPN	PNP					
1.0	250	MJF47		30/150	0.3	10	28	 Isolated TO−220
3.0	100	MJF31C	MJF32C	10 min	1.0	3.0	28	
5.0	450/1000	MJF18004		14/34	0.3	13 typ	35	
6.0	400/700	BUL146F		14/34	0.5	14 typ	40	
8.0	150	MJF15030	MJF15031	40 min	3.0	30	35	
	450/1000	MJF18008		16/34	1.0	13 typ	45	
10	60	MJF3055	MJF2955	20/100	4.0	2.0	40	
	80	MJF44H11	MJF45H11	40/100	4.0	40	35	
10	100	TIP33C		20/100	3.0	3.0	80	 TO−218
15	60	TIP3055	TIP2955	5 min	10	2.5	80	
16	160	MJE4343	MJE4353	15 min	8.0	1.0	125	
25	60	TIP35A	TIP36A	15/75	15	3.0	125	
	100	TIP35C	TIP36C	15/75	15	3.0	125	
8.0	150	MJW21192	MJW21191	15 min	8.0	4.0	100	 TO−247
15	260	MJW0281A	MJW0302A	75/150	3.0	30	150	
		MJW3281A	MJW1302A	75/150	4.0	30	200	
16	250	MJW21194	MJW21193	20/60	8.0	4.0	200	
		MJW21196	MJW21195	20/60	8.0	4.0	200	
30	450/1000	MJW18020		14/35	3.0	13 typ	250	
15	260	MJL3281A	MJL1302A	75/150	4.0	30	200	 TO−264
		MJL0281A	MJL0302A	75/150	3.0	30	180	
	350	MJL4281A	MJL4302A	80/250	5.0	35	230	
16	250	MJL21194	MJL21193	25/75	8.0	4.0	200	
		MJL21196	MJL21195	25/75	8.0	4.0	200	
15	260	NJL0281D	NJL0302D	75/150	3.0	30	180	 TO−264 (5−Lead)
	260	NJL3281D	NJL1302D	75/150	4.0	30	200	
	350	NJL4281D	NJL4302D	75/150	5.0	30	250	
16	250	NJL21194D	NJL21193D	25/75	8.0	4.0	200	
10	140	2N3442		20/70	4.0	3.0	117	 TO−3 (TO−204AA)
	250	MJ15011		20/100	2.0	3.0	200	
15	60	2N3055	MJ2955	20/70	4.0	2.5	115	
		2N3055A		20/70	4.0	0.8	115	
	120	MJ15015	MJ15016	20/70	4.0	1.0	180	
	140	MJ15001	MJ15002	25/150	4.0	2.0	200	

NOTE: When two voltages are given, the format is $V_{CEO(sus)}/V_{CES}$.

DISCRETE TRANSISTORS (continued)

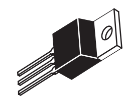
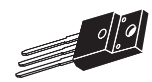
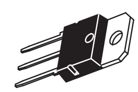
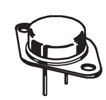
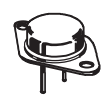
I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type NPN	Device Type PNP	h_{FE} Min/Max	@ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C	Package
16	140	2N3773		15/60	8.0	4.0	150	
	200	MJ15022	MJ15023	15/60	8.0	5.0	250	
	250	MJ15024	MJ15025	15/60	8.0	5.0	250	
		MJ21194	MJ21193	25/75	8.0	4.0	250	
		MJ21196	MJ21195	25/75	8.0	4.0	250	
20	60	2N3772		15/60	10	2.0	150	
	90	2N5038		20/100	12	60	140	
	140	MJ15003	MJ15004	25/150	5.0	2.0	250	
25	60	2N5885	2N5883	20/100	10	4.0	200	**TO–3 (TO–204AA)**
	80	2N5886	2N5884	20/100	10	4.0	200	
	100	2N6338		30/120	10	40	200	
	150	2N6341		30/120	10	40	200	
30	40	2N3771		15/60	15	2.0	150	
	60	2N5302		15/60	15	2.0	200	
	100	MJ802	MJ4502	25/100	7.5	2.0	200	
40	200	BUV21		10 min	25	8.0	150	
	250	BUV22		10 min	20	8.0	250	
50	80	2N5686	2N5684	15/60	25	2.0	300	
60	60		MJ14001	15/100	50	3.0	300	**TO–3 (TO–204AE)**
	80	MJ14002		15/100	50	3.0	300	

DARLINGTON TRANSISTORS

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type		h_{FE} Min/Max	@ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C	Package
		NPN	PNP					
2.0	100	MJD112T4	MJD117T4	1000 min	2.0	25	20	 DPAK
4.0	80	MJD6039T4		1k/2k	2.0	25	20	
	350	NJD35N04		2000 min	2.0	90	45	
8.0	100	MJD122T4	MJD127T4	1k/2k	4.0	4	20	
	120		MJD128T4	1k/2k	4.0	4	20	
10	80	MJD44E3T4		1k min	5.0		20	
10	350	BUB323Z		500/3400	5.0	2.0	75	 D^2PAK
2.0	100	MJE270†	MJE271†	1.5k min	0.12	6.0	15	 TO−225AA
4.0	40		2N6034	25 min	1.5	2.0	40	
	45	BD675	BD676	750	1.5	3.0	40	
		BD675A	BD676A	750	2.0	3.0	40	
	60	BD677	BD678	750 min	1.5		40	
		BD677A	BD678A	750 min	2.0		40	
		MJE800	MJE700	750 min	1.5	1.0	40	
		2N6038	2N6035	750/18k	2.0	25	40	
	80	BD679	BD680	750 min	1.5		40	
		BD679A	BD680A	750 min	2.0		40	
		MJE802	MJE702	750 min	1.5	1.0	40	
		MJE803	MJE703	750 min	2.0	1.0	40	
		2N6039	2N6036	750/18k	2.0	25	40	
	100	BD681	BD682	750 min	1.5		40	
2.0	60	TIP110	TIP115	500 min	2.0	25	50	 TO−220AB
	80	TIP111	TIP116	500 min	2.0	25	50	
	100	TIP112	TIP117	500 min	2.0	25	50	
5.0	60	TIP120	TIP125	1k min	3.0	4.0	65	
	80	TIP121	TIP126	1k min	3.0	4.0	65	
	100	TIP122	TIP127	1k min	3.0	4.0	75	
8.0	60	2N6043	2N6040	1k/10k	4.0	4.0	75	
		TIP100		1k/20k	3.0	4.0	80	
	80	BDX53B	BDX54B	750 min	3.0	4.0	60	
		TIP101	TIP106	1k/20k	3.0	4.0	80	
		TIP131		1k/15k	4.0		70	
	100	TIP132		1k/15k	4.0		70	
		2N6045	2N6042	1k/10k	3.0	4.0	75	
		BDX53C	BDX54C	750 min	3.0			
		TIP102	TIP107	1k/20k	3.0	4.0	80	
	400	MJE5742		200 min	4.0		80	

NOTE: When two voltages are given, the format is $V_{CEO(sus)}/V_{CES}$.
†Style 3.

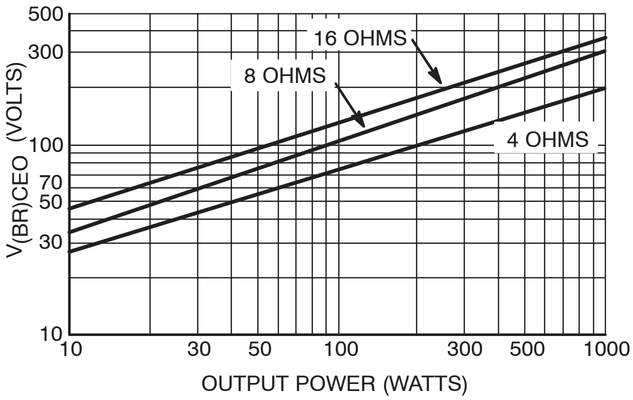
DARLINGTON TRANSISTORS (continued)

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type NPN	Device Type PNP	h_{FE} Min/Max	@ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C	Package
10	60	2N6387	2N6667	1k/20k	5.0	20	65	 TO−220AB
	80	BDX33B	BDX34B	750 min	3.0	3.0	70	
		2N6388		1k/20k	5.0	20	65	
	100	BDX33C	BDX34C	750 min	3.0	3.0	70	
15	80		BDW46	1k min	5.0	4.0	85	
	100	BDW42	BDW47	1k min	5.0	4.0	85	
5.0	100	MJF122	MJF127	2000 min	3.0	4.0	28	 Isolated TO−220
10	100	MJF6388	MJF6668	3k/20k	3.0	20	40	
10	60	TIP140		500 min	10	4.0	125	 TO−218
		TIP141		500 min	10	4.0	125	
	100	BDV65B	BDV64B	1k min	5.0		125	
		TIP142	TIP147	500 min	10	4.0	125	
	350	BU323Z		500/3400	5.0		150	
15	150		MJH11017	400/15k	10	3.0	150	
	200	MJH11020	MJH11019	400/15k	10	3.0	150	
	250	MJH11022	MJH11021	400/15k	10	3.0	150	
20	100	MJH6284	MJH6287	750/18k	10	4.0	125	
12	100		2N6052	750/18k	6.0	4.0	150	 TO−3 (TO−204AA)
15	250	MJ11022	MJ11021	100 min	15	3.0	175	
20	80		2N6286	750/18k	10	4.0	160	
	100	2N6284	2N6287	750/18k	10	4.0	160	
30	60	MJ11012		1k min	20	4.0	200	
	120	MJ11016	MJ11015	1k min	20	4.0	200	
	250	MJ11022	MJ11021	400/15k	10	3.0	200	
50	60	MJ11028		400 min	50		300	 TO−3 (TO−204AE)
	90	MJ11030		400 min	50		300	
	120	MJ11032	MJ11033	400 min	50		300	

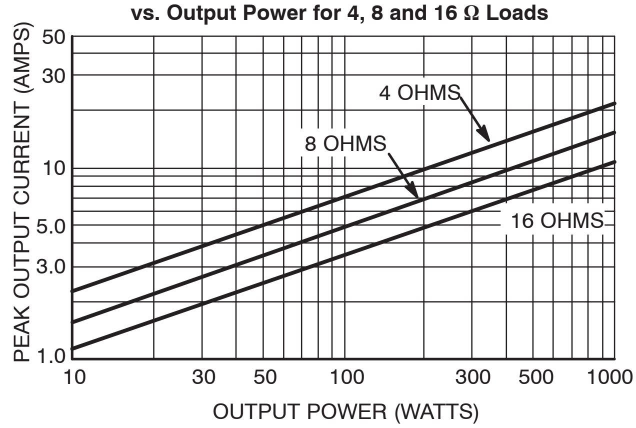
Audio

GENERAL DESIGN CURVES FOR POWER AUDIO OUTPUT STAGES

$V_{(BR)CEO}$ Required on Output and Driver Transistor vs. Output Power for 4, 8 and 18 Ω Loads



Output Transistor Peak Collector Current vs. Output Power for 4, 8 and 16 Ω Loads



Another important parameter that must be considered before selecting the output transistors is the safe−operating area these devices must withstand. For a complete discussion see Application Note AN485.

RECOMMENDED POWER TRANSISTORS FOR AUDIO/SERVO LOADS

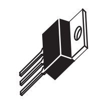
RMS Power Output	NPN	PNP	Package	P_D Watts @ 25°C	V_{CEO}	I_C Max	h_{FE} Min/Max	h_{FE} @ I_C Amps	f_T MHz Typ
To 25 W	MJE15030	MJE15031	TO−220	50	150	8.0	20 min	4.0	30
	MJE15032	MJE15033	TO−220	50	250	8.0	50 min	1.0	30
25 to 50 W	MJE15034	MJE15035	TO−220	50	350	4.0	50 min	1.0	30
	MJ15001	MJ15002	TO−3	200	140	15	25/150	4.0	3.0
50 to 100 W	MJ15003	MJ15004	TO−3	150	140	20	25/150	5.0	3.0
	MJ15015	MJ15016	TO−3	180	120	15	20/70	4.0	3.0
Over 100 W	MJW21192	MJW21191	TO−3	100	150	8.0	15 min	4.0	4.0
	MJW0281A	MJW0302A	TO−3	150	260	15	75/150	3.0	30
	MJL0281A	MJL0302A	TO−264	180	260	15	75/150	3.0	30
	NJL0281D	NJL0302D	TO−264 (5−Lead)	180	260	15	75/150	3.0	30
	MJL21194	MJL21193	TO−264	200	250	16	25/75	8.0	4.0
	MJL21196	MJL21195	TO−264	200	250	16	25/75	8.0	4.0
	MJW21194	MJW21193	TO−247	200	250	16	20/60	8.0	4.0
	MJW21196	MJW21195	TO−247	200	250	16	25/60	8.0	4.0
	MJL3281A	MJL1302A	TO−264	200	260	15	75/150	5.0	30

RECOMMENDED POWER TRANSISTORS FOR AUDIO/SERVO LOADS (continued)

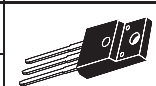
RMS Power Output	NPN	PNP	Package	P_D Watts @ 25°C	V_{CEO}	I_C Max	h_{FE} Min/Max	h_{FE} @ I_C Amps	f_T MHz Typ
	MJW3281A	MJW1302A	TO−247	200	260	15	75/150	5.0	30
	MJL4281A	MJL4302A	TO−264	200	350	15	80/200	5.0	35
	NJL3281D	NJL1302D	TO−264 (5−Lead)	200	260	15	75/150	7.0	30
	NJL4281D	NJL4302D	TO−264 (5−Lead)	250	350	15	75/150	5.0	30
	MJ15024	MJ15025	TO−3	250	250	16	15/60	8.0	4.0
	MJ21194	MJ21193	TO−3	250	250	16	25/75	8.0	4.0

The Power Transistors shown are provided for reference only and show device capability. The final choice of the Power Transistors used is left to the circuit designer and depends upon the particular safe−operating area required and the mounting and heat sinking configuration used.

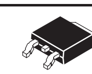
Bipolar Power Transistors for Electronic Lamp Ballasts

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	V_{CES} Volts Min	Device Type	I_C Operating Amps	h_{FE} min @ I_C Operating V_{CE} = 1.0 V	Inductive Switching @ I_C Operating t_{si}/t_{fi} Max (μs)	P_D (Case) Watts @ 25°C	Package
2.0	400	700	BUL44	1.0	8.0	2.75/0.175	50	 TO−220AB
	450	1000	MJE18002	1.0	6.0	2.75/0.175	50	
4.0	500	800	BUH50	2.0	8.0 typ	2.75/0.15	50	
5.0	400	700	BUL45	2.0	7.0	3.8/0.17	75	
		700	BUL45D2*	2.0	10	2.25/0.015	75	
	450	1000	MJE18004	2.0	6.0	2.5/0.175	75	
		1000	MJE18004D2*	2.0	6.0	2.4/0.15	75	
6.0	400	700	BUL146	3.0	8.0	2.5/0.15	100	
	450	1000	MJE18006	3.0	6.0	3.2/0.15	100	
8.0	450	1000	MJE18008	4.5	6.0	3.2/0.15	125	
10	400	700	BUH100	5.0	10 typ	3.5/0.15	100	
15	400	700	BUH150	10	8.0 typ	2.75/0.175	150	

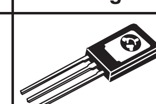
Isolated TO-220

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	V_{CES} Volts Min	Device Type	I_C Operating Amps	h_{FE} min @ I_C Operating V_{CE} = 1.0 V	Inductive Switching @ I_C Operating t_{si}/t_{fi} Max (μs)	P_D (Case) Watts @ 25°C	Package
5.0	450	1000	MJF18004	2.0	6.0	2.5/0.175	35	 Isolated TO−220
6.0	400	700	BUL146F	3.0	8.0	2.5/0.15	40	
8.0	450	1000	MJF18008	4.5	6.0	3.2/0.15	45	

DPAK

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	V_{CES} Volts Min	Device Type	I_C Operating Amps	h_{FE} min @ I_C Operating V_{CE} = 1.0 V	Inductive Switching @ I_C Operating t_{si}/t_{fi} Max (μs)	P_D (Case) Watts @ 25°C	Package
2.0	450	1000	MJD18002D2T4	1.0	6.0	1.2/0.150	25	 DPAK

TO−225AA (TO−126)

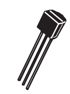
I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	V_{CES} Volts Min	Device Type	I_C Operating Amps	h_{FE} min @ I_C Operating V_{CE} = 1.0 V	Inductive Switching @ I_C Operating t_{si}/t_{fi} Max (μs)	P_D (Case) Watts @ 25°C	Package
3.0	500	800	BUH51†	1.0	8.0	3.75/0.3	50	 TO−225AA

BUH−Series are specified for Halogen applications.
*D2 suffix indicates transistor with built−in C−E freewheeling diode and antisaturation network.
†Style 3.

The isolated TO−220 is UL RECOGNIZED for its isolation feature and has been evaluated to 3500 volts RMS. Actual isolation rating depends on specific mounting position and maintaining required strike and creepage distances.

Bipolar Transistors

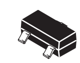
GENERAL−PURPOSE TRANSISTORS

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	NF dB Max	Package
MPS8099	***MPS8599***	80	500	100	300	150	–	
MPSA06	***MPSA56***	80	500	100	–	100	–	
	BC490	80	1000	60	400	200/150 (Typ)	0.3/0.5	
BC639	BC640	80	500	40	160	60	0.5	
BC489B	–	80	1000	160	400	100	0.5	
BC639−16	BC640−16	80	1000	100	250	60	0.5	
BC546B	BC556B	65	100	180	450	150	10	
MPSA05	MPSA55	60	500	100	–	100	–	
–	***MPS2907A***	60	600	100	300	200	–	
MPS651	***MPS751***	60	2000	75	–	75	0.5	
BC637		60	500	40	160	–	0.5	
–	***2N5087***	50	50	250	800	40	2.0	
BC182B	BC212B	50	100	200	500	200	10	
BC237B	BC307B	45	100	200	460	150	10	TO−226AA, TO−92
BC337	BC327	45	800	100	630	210 (Typ)	–	Case 29−11
BC337−16	BC327−16	45	800	100	250	260 (Typ)	–	
BC337−25	BC327−25	45	800	160	400	260 (Typ)	–	
BC337−40	BC327−40	45	800	250	630	260 (Typ)	–	
BC550C	BC560C	45	100	380	800	250 (Typ)	2.5	
BC547A	BC557A	45	100	120	220	150	10	
BC547B	BC557B	45	100	180	450	150	10	
BC547C	BC557C	45	100	380	800	150	10	
MPSA18	–	45	200	500	–	100	1.5	
MPSA20	–	40	100	40	400	125	–	
MPS2222A	–	40	600	100	300	300	–	
2N4401	***2N4403***	40	600	100	300	200	–	
	MPS6652	40	1000	50	–	100	–	
2N3904	***2N3906***	40	200	100	300	250	5.0	
–	MPS4250	40	–	250	800	–	2.0	
BC548B		30	100	200	450	300 (Typ)	10	
BC548C	BC558C	30	100	420	800	300	10	
BC549C	–	30	100	420	800	–	–	
MPS2222	–	30	600	100	300	250	–	
2N5088	–	30	50	350	–	50	3.0	
2N5089	–	25	50	450	–	50	2.0	
2N4124	–	25	200	120	360	300	–	TO−226AA, TO−92
MPS4124	–	25	200	120	360	170	5.0	Case 29−11
–	MPS4126	25	200	120	360	170	4.0	
MPS5172	–	25	100	100	500	–	–	
BC368	BC369	20	1000	60	–	65	0.5	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

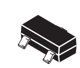
GENERAL–PURPOSE TRANSISTORS (continued)

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	NF dB Max	Package
MPSW06	***MPSW56***	80	500	80	–	50	–	 **TO–226AE** (1–WATT) **TO–92** **Case 29–10**
MPS6717	–	80	500	50	250	100	–	
MPSW05	MPSW55	60	500	60	–	50	250	
MPSW01A	***MPSW51A***	40	1000	50	–	50	–	
MPSW01	MPSW51	30	1000	50	–	50	–	
MPS6726	–	30	1000	50	250	–	–	
MMBT5550L	–	140	600	60	250	–	–	 **TO–236AB, SOT–23** **Case 318–08**
–	BSS63L	100	100	30	–	50	–0.25	
BSS64L	–	80	100	20	–	60	0.15	
MMBTA06L	***MMBTA56L***	80	500	100	–	100	–	
MMBT8099L	–	80	500	100	300	150	–	
BC846AL	–	65	100	110	220	100	10	
BC846BL	–	65	100	200	450	100	10	
–	***BC856AL***	65	100	125	250	100	10	
–	***BC856BL***	65	100	220	475	100	10	
–	***MMBT2907AL***	60	600	100	300	200	–	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

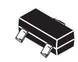
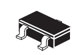
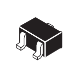
GENERAL−PURPOSE TRANSISTORS (continued)

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	NF dB Max	Package
MMBT2484L	–	60	50	250	–	–	3.0	
MMBTA05L	–	60	500	100	–	100	–	
–	MMBTA55L	60	500	100	–	50	–	
MMBT6428L	–	50	200	250	–	100	3.0 (Typ)	
–	***MMBT5087L***	50	50	250	–	40	2.0	
MMBT6429L	–	45	200	500	–	100	3.0 (Typ)	
BC817−16L	–	45	500	100	250	100	–	
BC817−25L	–	45	500	160	400	100	–	
BC817−40L	–	45	500	250	600	100	–	
–	BC807−16L	45	500	100	250	100	–	
–	***BC807−25L***	45	500	160	400	100	–	
–	***BC807−40L***	45	500	250	600	100	–	
BC847AL	–	45	100	110	220	100	10	
BC847BL	–	45	100	200	450	100	10	
BC847CL	–	45	100	420	800	100	10	
BC850BL	–	45	100	200	450	100	4.0	
BC850CL	–	45	100	420	800	100	4.0	
–	***BC857AL***	45	100	125	250	100	10	
–	***BC857BL***	45	100	220	475	100	10	
–	***BC857CL***	45	100	420	800	100	10	
–	BCW68GL	45	800	120	400	100	10	**TO−236AB, SOT−23 Case 318−08**
–	BCW70L	45	100	215	500	–	10	
BCW72L	–	45	100	200	450	300	10	
–	BCX17L	45	500	100	600	–	–	
BCX19L	–	45	500	100	600	–	–	
MMBT2222AL	–	40	600	100	300	300	4.0	
MMBT3904L	–	40	200	100	300	200	5.0	
–	***MMBT3906L***	40	200	100	300	250	4.0	
MMBT4401L	–	40	600	100	300	250	–	
–	***MMBT4403L***	40	600	100	300	200	–	
MMBT3416L	–	40	100	75	225	–	–	
–	MMBTA70L	40	100	40	400	125	–	
–	BCW30L	32	100	215	500	–	10	
BCW32L	–	32	100	200	450	–	10	
BCW65AL	–	32	800	100	250	100	10	
BCW65CL	–	32	100	250	630	100	10	
BC848AL	–	30	100	110	220	100	10	
BC848BL	–	30	100	200	450	100	10	
BC848CL	–	30	100	420	800	100	10	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

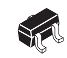
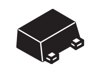
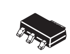
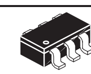
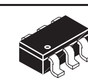
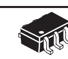
GENERAL–PURPOSE TRANSISTORS (continued)

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	NF dB Max	Package
BC849BL	–	30	100	200	450	100	4.0	
BC849CL	–	30	100	420	800	100	4.0	
MMBT489L	–	30	1000	300	900	100	–	
–	MMBT589L	30	1000	100	300	100	–	
–	***BC858AL***	30	100	125	250	100	10	
–	***BC858BL***	30	100	220	475	100	10	
–	***BC858CL***	30	100	420	800	100	10	
–	***BC859BL***	30	100	220	475	100	4.0	
MMBT5088L	–	30	50	300	900	5	3.0	**TO–236AB, SOT–23** **Case 318–08**
MMBT2222L	–	30	600	100	300	250	4.0	
MMBT6521L	–	25	100	300	600	–	–	
MMBT5089L	–	25	50	400	1200	50	2.0	
MMBT4124L	–	25	200	120	360	300	5.0	
BC818–40L	–	25	500	250	600	100	–	
–	MMBT4126L	25	200	120	300	250	4.0	
–	BC808–25L	25	500	160	400	100	–	
BCW33L	–	20	100	420	800	–	10	
MSD601–R	–	50	100	210	340	–	–	
MSD602–R	–	50	500	120	240	–	–	
MSC2712G	–	50	100	200	400	–	–	
–	***MSA1162G***	50	100	200	400	–	–	
MSC2712Y	–	50	100	120	240	–	–	
–	***MSA1162Y***	50	100	120	240	–	–	**SC–59** **Case 318D–04**
–	***MSB710–R***	50	500	120	240	–	–	
–	***MSB709–R***	45	100	210	340	–	–	
MSD1328–R	–	20	500	200	350	–	–	
MSD1328–S	–	20	500	300	500	–	–	
MMBTA06W	***MMBTA56W***	80	500	100	–	100	–	
BC846BW	–	65	100	200	450	100	10	
–	***BC856BW***	65	100	220	475	100	10	
–	***MMBT2907AW***	60	600	100	–	200	–	
MSD1819A–R	–	50	100	210	340	–	–	
BC847AW	–	45	100	110	220	100	10	
BC847BW	–	45	100	200	450	100	10	
BC847CW	–	45	100	420	800	100	4.0	
–	***BC857BW***	45	100	220	475	100	10	
–	***BC857CW***	45	100	420	800	100	10	
–	***MSB1218A–R***	45	100	210	340	–	–	
MMBT4401W	–	40	600	100	300	250	–	**SC–70, SOT–323** **Case 419–04**
–	MMBT4403W	40	600	100	300	200	–	
MMBT2222AW	–	40	600	100	300	300	4.0	
MMBT3904W	–	40	200	100	300	300	5.0	
–	***MMBT3906W***	40	200	100	300	250	4.0	
BC848BW	–	30	100	200	450	100	10	
BC848CW	–	30	100	420	800	100	4.0	
–	***BC858AW***	30	100	110	220	100	10	
–	***BC858BW***	30	100	200	450	100	10	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

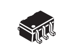
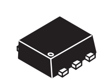
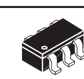
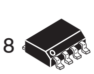
GENERAL−PURPOSE TRANSISTORS (continued)

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	NF dB Max	Package
2SC4617	–	50	100	120	560	180 (Typ)	–	 **SOT−416, SC−75, SC−90 Case 463−01**
–	***2SA1774***	50	100	120	560	140 (Typ)	–	
BC847BT	–	45	100	200	450	100	10	
BC847CT	–	45	100	420	800	100	4.0	
–	***BC857BT***	45	100	220	475	100	10	
MMBT3904T	–	40	200	100	300	300	5.0	
–	***MMBT3906T***	40	200	100	300	250	4.0	
MMBT2222AT	–	40	600	100	300	300	4.0	
–	2SA2029M3	50	100	120	560	140 (Typ)	–	 **SOT−723 Case 631AA−01**
–	BC856BM3	45	100	220	475	100	10	
–	MMBT2907AM3	60	600	100	–	200	–	
BC846BM3	–	65	100	200	450	100	10	
2SC5658M3	–	50	100	120	560	180 (Typ)	–	
BC847BM3	–	45	100	200	450	100	10	
–	–	40	600	100	300	300	4.0	
BCP56	***BCP53***	80	1000	40	250	50 (Typ)	–	 **SOT−223 Case 318E−04**
BCP56−10	***BCP53−10***	80	1000	63	160	50 (Typ)	–	
BCP56−16	***BCP53−16***	80	1000	100	250	50 (Typ)	–	
–	***PZT2907A***	60	600	100	300	200	–	
PZT651	***PZT751***	60	2000	75	–	75	–	
PZT2222A	–	40	600	100	300	300	–	
BCP68	***BCP69***	25	1000	85	375	60 (Typ)	–	
–	MMBT2131	30	700	150	–	–	–	 **SO−74 Case 318F−05**
–	MBT35200M	35	2000	100	400	100	–	 **TSOP−6 SINGLE Case 318G−02**
NST489AM	–	30	3000	300	900	200	–	
–	NSL12AW	12	2000	100	300	100	–	 **SC−88, SOT−363 Case 419B−02**

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

GENERAL−PURPOSE MULTIPLE TRANSISTORS

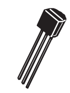
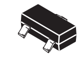
Device	Type	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	NF dB Max	Package
BC846BDW1	Dual NPN	65	100	200	450	100	10	 SC−88, SOT−363 Case 419B−02
BC856BDW1	Dual PNP	65	100	220	475	100	10	
BC846BPDW1	Dual Complementary	65	100	200	475	100	10	
BC847BDW1	Dual NPN	45	100	200	290	100	10	
BC847CDW1	Dual NPN	45	100	420	520	100	4.0	
BC857BDW1	Dual PNP	45	100	220	290	100	10	
BC857CDW1	Dual PNP	45	100	420	520	100	10	
BC847BPDW1	Dual Complementary	45	100	200	290	100	10	
MBT3904DW1	Dual NPN	40	200	100	300	300	5.0	
MBT3906DW1	Dual PNP	40	200	100	300	250	4.0	
MBT3946DW1	Dual Complementary	40	200	100	300	250	5.0/4.0	
MBT2222ADW1	Dual NPN	40	600	100	300	300	4.0	
MBT6429DW1	Dual NPN	45	200	500	1250	100	–	
UMZ1N	Dual Complementary	50	200	200	400	114 (Typ)	–	
BC848CDW1	Dual NPN	30	100	420	250	100	4.0	
BC848CPDW1	Dual Complementary	30	100	420	520	100	4.0/10	
BC847CDXV6	NPN	45	100	420	520	100	–	 SOT−563 Case 463A−01
EMT1DXV6	Dual PNP	60	100	120	560	140 (Typ)	–	
EMX1DXV6	Dual NPN	50	100	120	560	180 (Typ)	–	
EMX2DXV6	Dual NPN	50	100	120	560	180 (Typ)	–	
EMZ1DXV6	Complementary	60	100	120	560	140 (Typ)	–	
BC847BPDXV6	Complementary	45	100	200	290	100	–	
NST3904DXV6	Dual NPN	40	200	100	300	300	–	
NST3906DXV6	Dual PNP	40	200	100	300	250	–	
NST3946DXV6	Complementary	40	200	100	300	250	–	
NST30010MXV6	Matched Dual PNP	30	100	420	520	100	–	
BC858CDXV6	Dual PNP	30	100	420	520	100	–	
HN1B01FDW1	Complimentary	50	200	200	400	–	–	 SO−74 Case 318F−05
NSS40301MD08	Matched Dual NPN	40	3000	200	500	150	–	8  1 SOIC−8 Case 751 STYLE 16

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

1. Devices in **bold**, samples starting Oct. 2002, production starting Dec. 2002.
2. Remainder of devices, 4 to 8 weeks after receipt of request based on note 1 timetable.

Bipolar Transistors

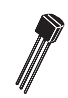
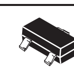
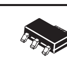
LOW NOISE AND GOOD H_{FE} LINEARITY

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	NF dB Max	Package
–	***2N5087***	50	50	250	800	40	2.0	 TO−226AA, TO−92 Case 29−11 (Note 1)
BC550C	BC560C	45	100	380	800	250 (Typ)	2.5	
MPSA18	–	45	200	500	–	100	1.5	
2N5088	–	30	50	350	–	50	3.0	
2N5089	–	25	50	450	–	50	2.0	
MMBT2484L	–	60	50	250	–	–	3.0	 TO−236AB, SOT−23 Case 318−08
MMBT6428L	–	50	200	250	–	100	3.0 (Typ)	
–	***MMBT5087L***	50	50	250	–	40	2.0	
MMBT6429L	–	45	200	500	–	100	3.0 (Typ)	
MMBT5088L	–	30	50	300	900	5	3.0	
MMBT5089L	–	25	50	400	–	50	2.0	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

1. N_F: Noise Figure at R_S = 2.0 kΩ, I_C = 200 μA, V_{CE} = 5.0 Volts. f = 30 Hz to 15 kHz.

DARLINGTON TRANSISTORS

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	NF dB Max	Package
MPSW45A	–	50	1000	25K	150K	100	1.5	 TO−226AE (1−WATT) TO−92 Case 29−10
MPSW45	–	40	1000	25K	150K	100	1.5	
–	MPSW63	30	500	10K	–	125	1.5	
MPSW13	–	30	1000	10K	–	125	1.5	
MPSA29	–	100	500	10K	–	125	1.5	 TO−226AA, TO−92 Case 29−11
BC372	–	100	1000	10K	160K	100	1.1	
BC373	–	80	1000	10K	160K	100	1.1	
MPSA27	MPSA77	60	500	10K	–	–	1.5	
BC618	–	55	1000	10K	50K	150	1.1	
–	MPSA75	40	500	10K	–	–	1.5	
2N6427	–	40	500	20K	200K	–	1.5	
2N6426	–	40	500	30K	300K	125	1.5	
MPSA14	***MPSA64***	30	500	20K	–	125	1.5	
MPSA13	MPSA63	30	500	10K	–	125	1.5	
BC517	–	30	1000	30K	–	200 (Typ)	1.0	
MMBT6427L	–	40	500	20000	200000	–	10	 TO−236AB, SOT−23 Case 318−08
MMBTA14L	***MMBTA64L***	30	300	20K	–	125	–	
MMBTA13L	–	30	300	10000	–	125	–	
–	MMBTA63L	30	500	10000	–	125	–	
BSP52	–	80	1000	2000	–	–	–	 SOT−223 Case 318E−04

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

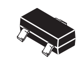
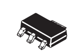
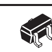
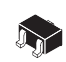
HIGH CURRENT TRANSISTORS (≥ 500 mA)

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	NF dB Max	Package
BC489	BC490	80	1000	60	400	200/150 (Typ)	0.3/0.5	
BC639	BC640	80	500	40	160	60	0.5	
BC489A		80	1000	100	250	100	0.5	
BC639−16	BC640−16	80	1000	100	250	60	0.5	
MPS8099	***MPS8599***	80	500	100	300	150	–	
MPSA06	***MPSA56***	80	500	100	–	100	–	
MPS651	***MPS751***	60	2000	75	–	75	0.5	
BC637		60	500	40	160	–	0.5	
MPSA05	MPSA55	60	500	100	–	100	–	
–	***MPS2907A***	60	600	100	300	200	–	
–	P2N2907A	60	600	100	300	200	–	
–	PN2907A	60	600	100	300	200	–	
BC337	BC327	45	800	100	630	210 (Typ)	–	
BC337−25	BC327−25	45	800	160	400	260 (Typ)	–	**TO−226AA, TO−92**
BC337−40	BC327−40	45	800	250	630	260 (Typ)	–	**Case 29−11**
MPS650	MPS750	40	2000	40	–	75	–	
MPS2222A	–	40	600	100	300	300	–	
2N4401	***2N4403***	40	600	100	300	200	–	
P2N2222A	–	40	600	100	300	300	–	
PN2222A	–	40	600	100	300	300	–	
	MPS6652	40	1000	50	–	100	–	
PN2222	–	30	600	100	300	250	–	
MPS2222	–	30	600	100	300	250	–	
MPS6560	–	25	500	50	200	60	–	
MPS6601	–	25	1000	50	–	100	–	
BC368	BC369	20	1000	60	–	65	0.5	
MPSW06	***MPSW56***	80	500	80	–	50	–	
MPS6717	–	80	500	50	250	100	–	
MPSW05	MPSW55	60	500	60	–	50	250	
MPSW01A	***MPSW51A***	40	1000	50	–	50	–	**TO−226AE** (1−WATT)
MPSW01	MPSW51	30	1000	50	–	50	–	**TO−92**
MPS6726	–	30	1000	50	250	–	–	**Case 29−10**

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

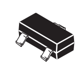
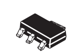
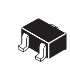
HIGH CURRENT TRANSISTORS (≥ 500 mA) (continued)

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE}		f_T MHz Min	NF dB Max	Package
				Min	Max			
MMBT5550L	–	140	600	60	250	–	–	
MMBTA06L	***MMBTA56L***	80	500	100	–	100	–	
MMBT8099L	–	80	500	100	300	150	–	
–	***MMBT2907AL***	60	600	100	300	200	–	
MMBTA05L	–	60	500	100	–	100	–	
–	MMBTA55L	60	500	100	–	50	–	
–	BCW68GL	45	800	120	400	100	10	
BCW66GL	–	45	800	160	400	100	10	**TO−236AB, SOT−23 Case 318−08**
–	BCX17L	45	500	100	600	–	–	
BCX19L	–	45	500	100	600	–	–	
MMBT2222AL	–	40	600	100	300	300	4.0	
MMBT4401L	–	40	600	100	300	250	–	
–	***MMBT4403L***	40	600	100	300	200	–	
BCW65AL	–	32	800	100	250	100	10	
MMBT2222L	–	30	600	100	300	250	4.0	
BCP56	***BCP53***	80	1000	40	250	50 (Typ)	–	
BCP56−10	***BCP53−10***	80	1000	63	160	50 (Typ)	–	
BCP56−16	***BCP53−16***	80	1000	100	250	50 (Typ)	–	
–	***PZT2907A***	60	600	100	300	200	–	**SOT−223 Case 318E−04**
PZT651	***PZT751***	60	2000	75	–	75	–	
PZT2222A	–	40	600	100	300	300	–	
BCP68	***BCP69***	25	1000	85	375	60 (Typ)	–	
MMBT2222AT	–	40	600	100	300	300	4.0	 **SOT−416, SC−75, SC−90 Case 463−01**
–	***MMBT2907AW***	60	600	100	–	200	–	
MMBT2222AW	–	40	600	100	300	300	4.0	**SC−70, SOT−323 Case 419−04**
–	MSB92ASW	300	500	120	200	50	–	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

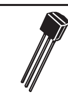
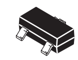
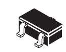
HIGH VOLTAGE TRANSISTORS (> 100 V)

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE}		f_T MHz Min	NF dB Max	Package
				Min	Max			
–	BF493S	350	500	40	–	50	20	 **TO–226AE** (1–WATT) **TO–92** **Case 29–10**
MPSW42	–	300	500	40	–	50	0.5	
–	***MPSW92***	300	500	25	–	50	0.5	
BF393	–	300	500	40	–	50	–	
2N5551	–	160	600	80	250	100	8.0	
–	***2N5401***	150	600	60	240	100	8.0	
MPSA44	–	400	300	50	200	–	–	 **TO–226AA, TO–92** **Case 29–11**
2N6517	***2N6520***	350	500	30	200	40	–	
MPSA42	–	300	500	40	–	50	0.5	
–	***MPSA92***	300	500	40	–	50	0.5	
BF422	BF423	250	500	50	–	60	–	
MPSA43	–	200	500	40	–	50	–	
–	MPSA93	200	500	25	–	50	–	
2N5550	–	160	600	80	–	100	0.15	
2N6515	–	250	500	50	300	40	0.3	
MMBT6517L	–	350	500	15	–	40	–	 **TO–236AB, SOT–23** **Case 318–08**
–	***MMBT6520L***	350	500	15	–	40	–	
MMBTA42L	–	300	500	40	–	50	–	
–	***MMBTA92L***	300	500	25	–	50	–	
MMBTA43L	–	200	500	40	–	50	–	
MMBT5551L	–	160	600	80	250	–	–	
–	***MMBT5401L***	150	500	50	–	100	8.0	
MMBT5550L	–	140	600	60	250	–	–	
PZTA96S	–	450	500	50	150	–	–	 **SOT–223** **Case 318E–04**
BSP19A	–	350	1000	40	–	70	–	
PZTA42	***PZTA92***	300	500	40	–	50	–	
–	PZTA96S	450	500	50	150	–	–	
–	***BSP16***	300	1000	30	120	15	–	
BF720	***BF721***	250	100	50	–	60	–	
MSD42W	–	300	150	40	–	–	–	 **SC–70, SOT–323** **Case 419–04**
–	***MSB92W***	300	500	25	–	50	–	
–	***MSB92AW***	300	500	120	200	50	–	
–	MSB92ASW	300	500	120	200	50	–	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

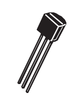
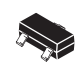
Bipolar Transistors

RF TRANSISTORS

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	Cap pF Max	Package
MPSH10	–	25	–	60	–	650	C_{RB} = 0.65	 TO–226AA, TO–92 Case 29–11
BF959	–	20	100	40	–	600	C_{RE} = 0.65 (Typ)	
MPSH17	–	15	–	25	250	800	C_{CB} = 0.9	
MMBTH10L	–	25	–	60	–	650	C_{CB} = 0.7	 TO–236AB, SOT–23 Case 318–08
MMBTH10–4L	–	25	–	120	240	800	C_{CB} = 0.7	
MMBT918L	–	15	50	20	–	600	C_{OBO} = 1.7	
BSV52L	–	12	100	40	120	400	–	
MSC2295–C	–	20	30	110	220	150	C_{RE} = 1.5	 SC–59 Case 318D–04

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

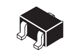
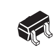
SWITCHING TRANSISTORS

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	T_{off} ns Max	Package
–	P2N2907A	60	600	100	300	200	110	 TO–226AA, TO–92 Case 29–11
–	***MPS2907A***	60	600	100	300	200	110	
2N4401	***2N4403***	40	600	100	300	200	–	
2N3904	***2N3906***	40	200	100	300	250	300	
P2N2222A	–	40	600	100	300	300	285	
MPS2222A	–	40	600	100	300	300	285	
–	***MMBT2907AL***	60	600	100	300	200	100	 TO–236AB, SOT–23 Case 318–08
MMBT2222AL	–	40	600	100	300	300	285	
MMBT3904L	–	40	200	100	300	300	250	
–	***MMBT3906L***	40	200	100	300	250	300	
MMBT4401L	–	40	600	100	300	250	255	
–	***MMBT4403L***	40	600	100	300	200	255	
MMBT2369L	–	15	200	40	120	–	18	
MMBT2369AL	–	15	200	40	120	–	18	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

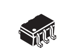
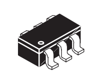
Bipolar Transistors

SWITCHING TRANSISTORS

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	T_{off} ns Max	Package
–	***MMBT2907AW***	60	600	100	300	200	100	 **SC–70, SOT–323 Case 419–04**
MMBT3904W	–	40	200	100	300	300	250	
–	***MMBT3906W***	40	200	100	300	250	300	
MMBT2222AW	–	40	600	100	300	300	285	
MMBT4401W	–	40	600	100	300	250	255	
–	***MMBT4403W***	40	600	100	300	200	255	
MMBT3904T	–	40	200	100	300	300	250	 **SOT–416, SC–75, SC–90 Case 463–01**
–	***MMBT3906T***	40	200	100	300	250	300	
MMBT2222AT	–	40	600	100	300	300	285	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

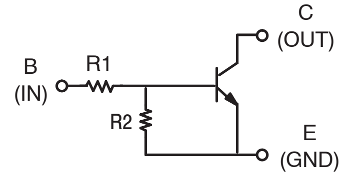
MULTIPLE SWITCHING TRANSISTORS

Device	Type	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	h_{FE} Max	f_T MHz Min	T_{off} ns Max	Package
MBT3904DW1	Dual NPN	40	200	100	300	300	250	 **SC–88, SOT–363 Case 419B–02**
MBT3906DW1	Dual PNP	40	200	100	300	250	300	
MBT3946DW1	Dual Complementary	40	200	100	300	250	250/300	
MBT2222ADW1	Dual NPN	40	600	100	300	300	285	
HN1B01FDW1	Dual Complementary	50	200	200	400	–	–	 **SC–74 Case 318F–05**

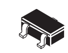
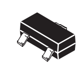
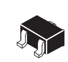
Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

DIGITAL TRANSISTORS (BIAS RESISTOR TRANSISTORS)



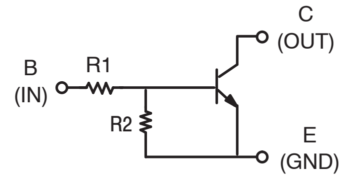
These devices include bias resistors on the semiconductor chip with the transistor. See the BRT diagram for orientation of resistors.

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	R1 Ω	R2 Ω	Package
MUN2211	***MUN2111***	50	100	35	10K	10K	 SC–59 Case 318D–04
MUN2212	***MUN2112***	50	100	60	22K	22K	
MUN2213	***MUN2113***	50	100	80	47K	47K	
MUN2214	***MUN2114***	50	100	80	10K	47K	
MUN2215		50	100	160	10K	∞	
MUN2216		50	100	160	4.7K	∞	
MUN2230		50	100	3.0	1.0K	1.0K	
MUN2232	***MUN2132***	50	100	15	4.7K	4.7K	
MUN2233		50	100	80	4.7K	47K	
MUN2234		50	100	80	22K	47K	
MUN2237		50	100	80	47K	22K	
MUN2240	–	50	100	160	47K	∞	
MMUN2211L	***MMUN2111L***	50	100	35	10K	10K	 TO–236AB, SOT–23 Case 318–08
MMUN2212L	***MMUN2112L***	50	100	60	22K	22K	
MMUN2213L	***MMUN2113L***	50	100	80	47K	47K	
MMUN2214L	***MMUN2114L***	50	100	80	10K	47K	
MMUN2215L	***MMUN2115L***	50	100	160	10K	∞	
MMUN2216L	***MMUN2116L***	50	100	160	4.7K	∞	
MMUN2231L		50	100	8.0	2.2K	2.2K	
MMUN2232L	***MMUN2132L***	50	100	15	4.7K	4.7K	
MMUN2233L	***MMUN2133L***	50	100	80	4.7K	47K	
MMUN2234L		50	100	80	22K	47K	
MMUN2238L	–	50	100	160	2.2K	∞	
MUN5211	***MUN5111***	50	100	35	10K	10K	 SC–70, SOT–323 Case 419–04
MUN5212	***MUN5112***	50	100	60	22K	22K	
MUN5213	***MUN5113***	50	100	80	47K	47K	
MUN5214	***MUN5114***	50	100	80	10K	47K	
MUN5215		50	100	160	10K	∞	
MUN5230		50	100	3.0	1.0K	1.0K	
	MUN5131	50	100	8.0	2.2K	2.2K	
MUN5232	***MUN5132***	50	100	15	4.7K	4.7K	
MUN5233	***MUN5133***	50	100	80	4.7K	47K	
MUN5235	***MUN5135***	50	100	80	2.2K	47K	

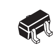
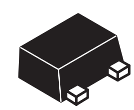
Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

DIGITAL TRANSISTORS (BIAS RESISTOR TRANSISTORS) (continued)



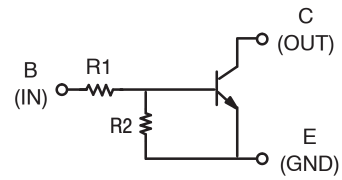
These devices include bias resistors on the semiconductor chip with the transistor. See the BRT diagram for orientation of resistors.

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	R1 Ω	R2 Ω	Package
DTC114EE	***DTA114EE***	50	100	35	10K	10K	 **SOT–416, SC–75, SC–90 Case 463–01**
DTC124EE		50	100	60	22K	22K	
DTC144EE	***DTA144EE***	50	100	80	47K	47K	
DTC114YE	***DTA114YE***	50	100	80	10K	47K	
DTC114TE	***DTA114TE***	50	100	160	10K	∞	
DTC143TE	***DTA143TE***	50	100	160	4.7K	∞	
DTC123EE		50	100	8.0	2.2K	2.2K	
DTC143EE	***DTA143EE***	50	100	15	4.7K	4.7K	
DTC143ZE	***DTA143ZE***	50	100	80	4.7K	4.7K	
DTC124XE	–	50	100	80	22K	47K	
DTC123JE		50	100	80	2.2K	47K	
DTC115EE	***DTA115EE***	50	100	80	100K	100K	
DTC114EM3	***DTA114EM3***	50	100	35	10K	10K	 **SOT–723 Case 631AA–01**
DTC124EM3	***DTA124EM3***	50	100	60	22K	22K	
DTC144EM3	***DTA144EM3***	50	100	80	47K	47K	
DTC114YM3	***DTA114YM3***	50	100	80	10K	47K	
DTC114TM3	***DTA114TM3***	50	100	160	10K	∞	
DTC143TM3	***DTA143TM3***	50	100	160	4.7K	∞	
DTC123EM3	***DTA123EM3***	50	100	8.0	2.2K	2.2K	
DTC143EM3	***DTA143EM3***	50	100	15	4.7K	4.7K	
DTC143ZM3	***DTA143ZM3***	50	100	80	4.7K	4.7K	
DTC124XM3	***DTA124XM3***	50	100	80	22K	47K	
DTC123JM3		50	100	80	2.2K	47K	
DTC115EM3	***DTA115EM3***	50	100	80	100K	100K	
DTC144WM3	***DTA144WM3***	50	100	80	47K	22K	
DTC144TM3	***DTA144TM3***	50	100	160	47K	∞	

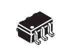
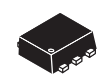
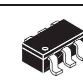
Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Bipolar Transistors

DUAL DIGITAL TRANSISTORS (BIAS RESISTOR TRANSISTORS)



These devices include bias resistors on the semiconductor chip with the transistor. See the BRT diagram for orientation of resistors.

NPN	PNP	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	R1 Ω	R2 Ω	Package
MUN5211DW1	***MUN5111DW1***	50	100	35	10K	10K	
MUN5212DW1		50	100	60	22K	22K	
MUN5213DW1	***MUN5113DW1***	50	100	80	47K	47K	
MUN5214DW1	***MUN5114DW1***	50	100	80	10K	47K	
MUN5215DW1	***MUN5115DW1***	50	100	160	10K	∞	
MUN5216DW1	***MUN5116DW1***	50	100	160	4.7K	∞	**SC−88, SOT−363 Duals Case 419B−02**
MUN5230DW1		50	100	3.0	1.0K	1.0K	
MUN5232DW1	***MUN5132DW1***	50	100	15	4.7K	4.7K	
MUN5233DW1	***MUN5133DW1***	50	100	80	4.7K	47K	
MUN5235DW1	***MUN5135DW1***	50	100	80	2.2K	47K	
NSBC114EDXV6	NSBA114EDXV6	50	100	35	10K	10K	
NSBC124EDXV6		50	100	60	22K	22K	
NSBC144EDXV6	NSBA144EDXV6	50	100	80	47K	47K	
NSBC114YDXV6	NSBA114YDXV6	50	100	80	10K	10K	
NSBC114TDXV6		50	100	160	10K	–	**SOT−563 Duals Case 463A−01**
NSBC143ZDXV6		50	100	80	4.7K	4.7K	
	NSBA123JDXV6	50	100	80	2.2K	47K	
NSBC115EDXV6	NSBA115EDXV6	50	100	80	100K	100K	
IMH20TR1	–	15	600	100	2.2K	–	 **SC−74 Case 318F−05**

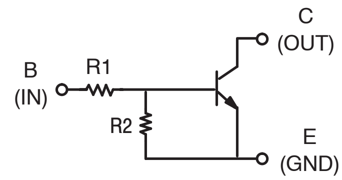
Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

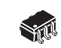
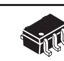
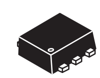
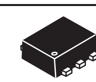
1. Devices in **bold**, samples starting Oct. 2002, production starting Dec. 2002.
2. Remainder of devices, 4 to 8 weeks after receipt of request based on note 1 timetable.

Bipolar Transistors

COMBINATIONAL DIGITAL TRANSISTORS (BIAS RESISTOR TRANSISTORS)

These devices include bias resistors on the semiconductor chip with the transistor. See the BRT diagram for orientation of resistors.



Device	Type	$V_{(BR)CEO}$	I_C mA Max	h_{FE} Min	Q1	Q2	Package
MUN5311DW1		50	100	35	MUN5211	MUN5111	
MUN5312DW1		50	100	60	MUN5212	MUN5112	
MUN5313DW1		50	100	80	MUN5213	MUN5113	
MUN5314DW1		50	100	80	MUN5214	MUN5114	
MUN5315DW1	Dual Complementary	50	100	160	MUN5215	MUN5115	**SC−88, SOT−363 Case 419B−02**
MUN5316DW1		50	100	160	MUN5216	MUN5116	
MUN5330DW1		50	100	3.0	MUN5230	MUN5130	
MUN5333DW1		50	100	80	MUN5233	MUN5133	
MUN5335DW1		50	100	80	MUN5235	MUN5135	
UMC3N	Dual Common Base Collector	50	100	35	4.7K/10K	47K/47K	
UMC5N	Dual Common Base Collector	50	100	20	47K/∞	47K/∞	**SC−88A, SOT−353 SC70−5 Case 419A−02**
NSB1706DMW5	Dual Common Emitter	50	100	80	4.7K/47K	4.7K/47K	
EMC3DXV5	Dual Common Base Collector	50	100	35	10K/10K	10K/10K	
EMC4DXV5	Dual Common Base Collector	50	100	80	10K/47K	4.7K/47K	
EMC5DXV5	Dual Common Base Collector	50	100	35	4.7K/10K	4.7K/47K	
EMG2DXV5	Dual Common Base, Common Emitter	50	100	80	4.7K/47K	4.7K/47K	**SOT−553 Case 463B−01**
NSB1010XV5	Dual Common Base Collector	50	100	–	4.7K/4.7K	10K/10K	
EMD4DXV6	Dual Complementary	50	100	80	10K/47K	47K/47K	
NSB1011XV6	Dual	50	100	–	2.2K/47K	10K/10K	**SOT−563 Case 463A−01**

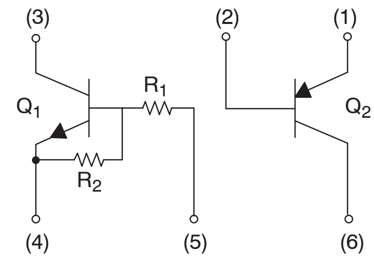
Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

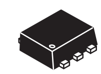
1. Devices in **bold**, samples starting Oct. 2002, production starting Dec. 2002.
2. Remainder of devices, 4 to 8 weeks after receipt of request based on note 1 timetable.

Bipolar Transistors

COMPLEX DIGITAL TRANSISTORS

These devices include bias resistors on the semiconductor chip with the transistor. See the BRT diagram for orientation of resistors.



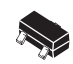
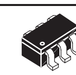
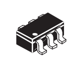
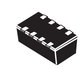
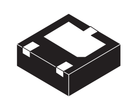
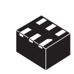
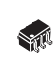
Device	Switching Transistor				Digital Transistor			Package
	$V_{(BR)CEO}$ V	I_C (mA) Max	h_{FE} Min	h_{FE} Max	h_{FE} Min	R1 Ω	R2 Ω	
EMF5XV6	12	500	270	680	80	47K	47K	
EMF18XV6	60	100	120	560	80	47K	47K	SOT−563 Case 463A−01

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

1. Devices in **bold**, samples starting Oct. 2002, production starting Dec. 2002.
2. Remainder of devices, 4 to 8 weeks after receipt of request based on note 1 timetable.

Bipolar Transistors

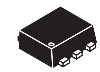
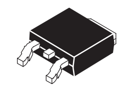
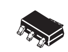
LOW SATURATION VOLTAGE TRANSISTORS

NPN	PNP	$V_{(BR)CEO}$	I_C DC A Max	I_C Peak A Max	h_{FE} @ 1.0 A Min	h_{FE} @ 1.0 A Max	f_t MHz Min	$V_{CE(sat)}$ @ 1.0 A Max	Package
NSS60201L		60	2	4	200	500	150	0.070	 **TO−236AB, SOT−23 Case 318−08 STYLE 6**
	NSS60200L	60	2	4	200	500	150	0.095	
NSS40201L	–	40	2	4	200	500	150	0.060	
–	NSS40200L	40	2	4	200	500	150	0.090	
NSS30101L		30	1	2	100	500	100	0.200	
–	NSS30100L	30	1	2	100	500	100	0.300	
NSS20201L	–	20	2	4	200	500	150	0.050	
–	NSS20200L	20	2	4	200	500	150	0.080	
NSS12201L	–	12	2	4	200	500	150	0.055	
–	NSS12200L	12	2	4	200	500	150	0.080	
NSS30071MR6	–	30	0.7	2	150	500	100	0.250	 **SC−74 Case 318F−05 STYLE 2**
–	NSS30070MR6	30	0.7	2	150	500	100	0.250	
–	NSS35200MR6	35	2	5	100	400	100	0.150	 **TSOP−6 Single Case 318G−02 STYLE 6**
NSS30201MR6	–	30	2	5	200	900	100	0.150	
NSS20201MR6	–	20	2	5	200	900	100	0.150	
–	NSS20300MR6	20	2	5	100	400	100	0.150	
NSS40601CF8	–	40	6	6	225	500	100	0.065	 **ChipFET™ Case 1206A−03 STYLE 4**
–	NSS40600CF8	40	6	6	220	500	100	0.065	
–	NSS35200CF8	35	2	7	100	400	100	0.150	
NSS20601CF8	–	20	6	6	250	500	100	0.050	
–	NSS20600CF8	20	6	6	220	500	100	0.060	
NSS12601CF8	–	12	6	6	250	500	100	0.050	
–	NSS12600CF8	12	6	6	210	500	100	0.060	
NSS40501UW3	–	40	5	6	250	500	100	0.045	 **WDFN3 Case 506AU−01**
–	NSS40500UW3	40	5	6	250	500	100	0.080	
NSS20501UW3		20	5	6	250	500	100	0.045	
–	NSS20500UW3	20	5	6	250	500	100	0.090	
NSS12501UW3	–	12	5	6	250	500	100	0.045	
–	NSS12500UW3	12	5	6	250	500	100	0.070	
–	NSS40200UW6	40	2	4	150	500	100	0.120	 **WDFN6 Case 506AS−01**
–	NSS12200MW6	12	1	2	200	500	150	0.280	 **SC−88, SOT−363 Case 419B−02 STYLE 20**
–	NSS12200W	12	2	3	100	300	100	0.290	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

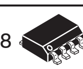
Bipolar Transistors

LOW SATURATION VOLTAGE TRANSISTORS (continued)

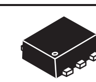
NPN	PNP	$V_{(BR)CEO}$	I_C DC A Max	I_C Peak A Max	h_{FE} @ 1.0 A Min	h_{FE} @ 1.0 A Max	f_t MHz Min	$V_{CE(sat)}$ @ 1.0 A Max	Package
–	NSS12100XV6	12	1	2	200	500	150	0.280	 **SOT−563 Case 463A−01**
NJD2873	–	50	2	3	120	360	65	0.300	 **DPAK Case 369C−01**
NSS40301MZ4	–	40	3	5	200	500	150	0.045	 **SOT−223 Case 318E−04**
–	NSS40300MZ4	40	3	5	200	500	150	0.050	
NSS60301MZ4	–	60	3	5	200	500	150	0.060	
–	NSS60300MZ4	60	3	5	200	500	150	0.065	
–	NSB9435	30	3	5	125	500	110	0.210	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

LOW SATURATION VOLTAGE MULTIPLE TRANSISTORS

Device	Type	$V_{(BR)CEO}$	I_C DC	I_C Peak	h_{FE} Min	h_{FE} Max	f_t	$V_{CE(sat)}$	Package
NSS40301MD08	Matched Dual NPN	40	3	4	200	500	150	0.044	8  1 **SOIC−8 Case 751**

LOAD SWITCH TRANSISTORS (Low Saturation Voltage Transistors with BRT Driver)

NPN	PNP	$V_{(BR)CEO}$	I_C DC A Max	I_C Peak A Max	h_{FE} @ 1.0 A Min	h_{FE} @ 1.0 A Max	f_t MHz Min	$V_{CE(sat)}$ @ 0.1 A Max	Package
–	EMF5XV6	12	0.1	0.5	270	680	–	0.250	 **SOT−563 Case 463A−01**
–	EMF18XV6	600	0.1	0.5	120	560	–	0.400	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

FETs

FETs

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In Brief...

Product Summary

Product	Description		Page
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		Through−Hole	200

What's New For . . .

Computing – MOSFETs for Desktop and Notebook PCs, Workstations, Graphic Cards, Hard Disk Drives, Game Consoles

ON Semiconductor has introduced an enhanced portfolio of 30 V MOSFETs utilizing our latest Trench technology providing up to a 54% reduction in R_G. These products are available in two packages: DPAK (including IPAK and IPAK with trimmed leads) and our leading edge SO−8FL flat lead power package.

The new 30 V DPAK devices include the NTD4809NH, NTD4810NH, NTD4813NH, and NTD4815NH.

The new 30 SO−8FL devices include the NTMFS4837NH, NTMFS4839NH, and NTMFS4841NH.

Digital Consumer − MOSFETS for Cell Phones, Digital Still Cameras, Media Players, PDAs, Portable Games, Battery Packs, MP3 Players, GPS, USB, Modems, Radio, Set−Top Boxes.

Addressing the industry's needs for thinner, smaller, faster, and cooler devices for portable devices, ON Semiconductor is pleased to announce the following 20 V NTGD3133P, 20 V NTGS3443T, and 30 V NTGS4111P additions to the TSOP−6 family.

ON Semiconductor has also expanded it's SOT−723 offering with the addition of the 20 V NTK3043N, NTK3134N, NTK3139P, and NTK3142P. The devices feature low $I_{GSS} < 1.0\ \mu A$, ESD protected gates, $R_{DS(on)}$ 1.5 V_{GS} rated, and an ultra−low profile of 0.50 mm for slim designs.

Automotive − MOSFETs for Entertainment, Power Train, Safety and Control, Comfort and Convenience, Body Electronics.

ON Semiconductor has released a line of 40 V low RDS(on) devices targeted for ABS applications including the NTB5404N, NTB5405N, NTD5406N, and NTD5407N.

How To Use This Selector Guide

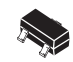
1. Choose the Product Type (MOSFET).
2. Choose the Package Type, i.e, DPAK, SOT−23.
3. Choose the Channel Polarity* (i.e., N, P, Complementary).
4. Choose the Voltage Level.
5. View the Elctrical Specifications and Find the Device Number.

*Configuration Codes: S = Single, D = Dual, C = Complementary, F = FETKY, L = Load Switch, Q = Quad

Junctional Field−Effect Transistors

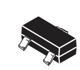
JFETs

HIGH−FREQUENCY AMPLIFIERS

N−Channel	$R_e\|Y_{fs}\|$ mmho Min	$R_e\|Y_{os}\|$ µmho Max	C_{iss} pF Max	C_{rss} pF Max	NF dB Max	V_{GSS} V_{GDO} Volts Min	$V_{GS(off)}$ Volts Min	$V_{GS(off)}$ Volts Max	I_{DSS} mA Min	I_{DSS} mA Max	Package
MPF102	1.6	200	7.0	3.0	–	25	–	8.0	2.0	20	 TO−226AA, TO−92 Case 29−11
2N5486	3.5	100	5.0	1.0	4.0	25	2.0	6.0	8.0	20	
J309	12 (Typ)	250 (Typ)	7.5	2.5	1.5 (Typ)	25	1.0	4.0	12	30	
J310	12 (Typ)	250 (Typ)	7.5	2.5	1.5 (Typ)	25	2.0	6.5	24	60	
MMBF5457L	1.0	50	7.0	3.0	4.0	25	0.5	6.0	1.0	5.0	 TO−236AB, SOT−23 Case 318−08
MMBF5484L	3.0	50	5.0	1.0	3.0	25	0.3	3.0	1.0	5.0	
MMBFJ309L	10	250	5.0	2.5	4.0	25	1.0	4.0	12	30	
MMBFJ310L	8.0	250	5.0	2.5	4.0	25	2.0	6.5	24	60	
MMBFU310L	10	250	5.0	2.5	4.0	25	2.5	6.0	24	60	
MMBF4416L	4.5	50	4.0	0.8	2.0	30	–	6.0	5.0	15	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

SWITCHES AND CHOPPERS

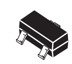
N−Channel	P−Channel	$R_{DS(on)}$ Ω Max	C_{iss} pF Max	C_{rss} pF Max	V_{GSS} V_{GDO} Volts Min	$V_{GS(off)}$ Volts Min	$V_{GS(off)}$ Volts Max	I_{DSS} mA Min	I_{DSS} mA Max	t_{on} ns Max	t_{off} ns Max	Package
J112	–	50	28	5.0	35	1.0	5.0	5.0	–	–	–	 TO−226AA, TO−92 Case 29−11
MPF4392	–	60	10	3.5	30	–	–	25	75	15	35	
2N5639	–	60	10	4.0	30	–	8.0 (Typ)	25	–	–	–	
MPF4393	–	100	10	3.5	30	–	12 (Typ)	5.0	30	15	55	
J110	–	18	–	–	25	0.5	4.0	10	–	–	–	
2N5638	–	30	10	4.0	30	–	–	50	–	4.0	5.0	
J111	–	30	28	5.0	35	3.0	10	20	–	–	–	
BSR58L	–	60	28	5.0	40	0.8	4.0	8.0	80	–	–	 TO−236AB, SOT−23 Case 318−08
MMBF4391L	–	30	10	3.5	30	4.0	10	50	150	–	–	
MMBF4392L	–	60	10	3.5	30	2.0	5.0	25	75	–	–	
MMBF4393L	–	100	10	3.5	30	0.5	3.0	5.0	30	–	–	
–	***MMBFJ175L***	125	11	5.5	30	3.0	6.0	7.0	60	–	–	
–	***MMBFJ177L***	300	–	–	30	0.8	2.5	1.5	20	–	–	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

Junctional Field−Effect Transistors

JFETs

LOW−FREQUENCY/LOW−NOISE

N−Channel	P−Channel	$R_e \lvert Y_{fs} \rvert$ @ 1 kHz mmho Min	$R_e \lvert Y_{os} \rvert$ @ 1 kHz μmho Max	C_{iss} pF Max	C_{rss} pF Max	V_{GSS} V_{GDO} Volts Min	$V_{GS(off)}$ Volts		I_{DSS} mA		Package
							Min	Max	Min	Max	
2N5457	–	1.0	50	7.0	3.0	25	0.5	6.0	1.0	5.0	 TO−226AA, TO−92 Case 29−11
2N5458	–	1.5	50	7.0	3.0	25	1.0	7.0	2.0	9.0	
–	***2N5460***	1.0	75	7.0	2.0	40	0.75	6.0	1.0	5.0	
–	***2N5461***	1.5	75	7.0	2.0	40	1.0	7.5	2.0	9.0	
–	***2N5462***	2.0	75	7.0	2.0	40	1.8	9.0	4.0	16	
BF256A	–	4.5	–	–	–	30	0.5	7.5	3.0	7.0	
–	***MMBF5460L***	1.0	75	7.0	2.0	40	0.8	6.0	1.0	5.0	 TO−236AB, SOT−23 Case 318−08
BFR30L	–	1.0	40	5.0	1.5	25	–	5.0	4.0	10	
BFR31L	–	1.5	20	5.0	1.5	25	–	2.5	1.0	5.0	

Devices listed in ***bold italic*** are ON Semiconductor preferred devices.

MOSFET – Surface Mount

V_{DSS} (V)	$R_{DS(on)}$ Max (Ω) @ V_{GS} = 10 V	4.5 V/ 5.0 V	2.5 V/ 2.7 V	1.8 V/ 1.65 V	Q_T Typ (nC) @ V_{GS} = 4.5 V (5.0 V)/10 V	Max Rating I_D (A)	P_D (W)	Device	Config.
SOT–723 – Case 631AA									
N–Channel									
20		3.4	4.5	10.0		0.255	0.4	**NTK3043N**	S
		0.4	0.5	0.7		0.890	0.5	**NTK3134N**	S
P–Channel									
20		0.5	0.7	1.0		0.780	0.5	**NTK3139P**	S
		0.3	0.5	10.0		0.260	0.4	**NTK3142P**	S
SOT–563 – Case 463A									
Complementary									
20		0.55/0.9	0.7/1.2	0.9/2.0	1.5/1.7	0.57/ 0.455	0.3	**NTZD3155C**	C
N–Channel									
20		0.55	0.07	0.90	1.5	0.570	0.3	**NTZD3154N**	D
P–Channel									
20		0.90	1.20	2.00	1.7	0.455	0.3	**NTZD3152P**	D
		0.15	0.20	0.24	5.6	0.950	0.2	**NTZS3151P**	S
SC–75 – Case 463									
N–Channel									
20		3.000	3.500			0.238	0.3	**NTA4001N**	S
		0.230	0.275	0.070	1.8	0.915	0.3	**NTA4153N**	S
30		7.000	7.500			0.154	0.3	**NTA7002N**	S
P–Channel									
20		0.360	0.450	1.000	2.1	0.760	0.3	**NTA4151P**	S
SC–89 – Case 463C									
N–Channel									
20		0.230	0.275	0.700	1.8	0.915	0.3	**NTE4153N**	S
P–Channel									
20		0.360	0.450	1.000	2.1	0.760	0.3	**NTE4151P**	S
WDFN6 2*2*.75 (μCool™) – Case 506AN									
Complementary									
20			0.065/ 0.100	.075/ 0.135	0.120/0.200	3.800	3.3	**NTLJD3119C**	C
FETKY® N–Channel									
20		0.065	0.075	0.120	3.7	3.800	1.5	**NTLJF3118N**	F
		0.070	0.090	0.125/ 0.250	5.4	4.600	1.5	**NTLJF4156N**	F
FETKY® P–Channel									
20		0.100	0.135	0.200	5.5	3.300	1.5	**NTLJF3117P**	F
N–Channel									
30		0.070	0.090	0.125/ 0.0250	5.4	4.600	1.5	**NTLJD4116N**	D
		0.035	0.045	0.055	8.5	7.800	1.9	**NTLJS4114N**	S
		0.035	0.045	0.055	12.1	7.800	1.9	**NTLJS4159N**	S

MOSFET – Surface Mount (continued)

V_{DSS} (V)	$R_{DS(on)}$ Max (Ω) @ V_{GS} = 10 V	4.5 V/ 5.0 V	2.5 V/ 2.7 V	1.8 V/ 1.65 V	Q_T Typ (nC) @ V_{GS} = 4.5 V (5.0 V)/10 V	Max Rating I_D (A)	P_D (W)	Device	Config.
WDFN6 2*2*.75 (μCool™) – Case 506AN									
P–Channel									
20		0.100	0.135	0.200	5.5	4.100	1.5	**NTLJD3115P**	D
		0.040	0.050	0.075/0.2	13.0	7.700	1.9	**NTLJS3113P**	S
P–Channel Load Switch									
20			0.050	0.060	0.1	4.300	1.6	**NTLJD2105L**	L
SC–88 (SOT–363) – Case 419B									
Complementary									
20 V/8 V		0.375/ 0.3	0.455/ 0.46	0.900	1.3/2.2	0.63/ 0.755	0.3	**NTJD4105C**	C
30 V/20 V		1.5/ 0.260	2.5/0.500			0.25/ 0.88	0.3	**NTJD4158C**	C
N–Channel									
20		0.375	0.445		1.3	0.630	0.3	**NTJD4401N**	D
		0.060	0.070	0.085	6.9	3.200	1.0	**NTJS3157N**	S
25		0.350	0.040		0.8	1.200	0.6	**NTJS4405N**	S
30		1.500	2.500		0.9	0.250	0.3	**NTJD4001N**	D
	0.060	0.085			2.8	2.600	1.0	**NTJS4160N**	S
P–Channel									
8		0.300	0.460	0.900	2.2	0.775	0.3	**NTJD2152P**	D
12		0.060	0.090	0.160	8.6	3.300	0.6	**NTJS3151P**	S
20		0.260	0.500	1.000	2.2	0.880	0.4	**NTJD4152P**	D
		0.060	0.085	0.205	10.0	4.200	1.0	**NTJS4151P**	S
P–Channel Load Switch									
8		0.175	0.220	0.320		1.300	0.4	**NTJD1155L**	L

MOSFET – Surface Mount (continued)

V_{DSS} (V)	$R_{DS(on)}$ Max (Ω) @ V_{GS} = 10 V	4.5 V/ 5.0 V	2.5 V/ 2.7 V	1.8 V	Q_T Typ (nC) @ V_{GS} = 4.5 V (5.0 V)/10 V	Max Rating I_D (A)	P_D (W)	Device	Config.
SC–70 – Case 419									
N–Channel									
20	1.00	1.40			1.4	0.300	0.2	**MMBF2201N**	S
25		0.35	0.40		1.2	0.700	0.3	**NTS4409N**	S
30		1.50	2.00		0.9	0.270	0.3	**NTS4001N**	S
P–Channel									
8		0.10	0.14	0.21	6.4	1.400	0.3	**NTS2101P**	S
20		0.12	0.16		6.4	1.370	0.3	**MMBF2202P**	S
	2.20	3.50			2.7	0.300	0.2	**NTS4101P**	S
TSOP–6 – Case 318G									
N–Channel									
20		0.045	0.055		8.0	5.100	1.0	**NTGS3446**	S
30	0.025	0.035			12.0	7.000	1.0	**NTGS4141N**	S
P–Channel									
12		0.075	0.095		7.0	3.300	1.0	**NTGS3433**	S
20		0.145	0.200		3.7	2.300	1.1	**NTGD3133P**	D
		0.170	0.280			2.000	1.0	**NTGD4161P**	D
		0.090	0.135		6.2	3.300	1.0	**NTGS3441**	S
		0.110	0.165		3.3	3.160	1.0	**NTGS3441P**	S
		0.065	1.000		7.5	4.400	1.0	**NTGS3443**	S
30	0.100	0.170			9.0	3.500	1.0	**NTGS3455**	S
	0.060	0.110			15.3	4.700	1.3	**NTGS4111P**	S
P–Channel Load Switch									
8		0.055	0.070	0.140		3.300	0.8	**NTGD1100L**	L
TSSOP–8 – Case 948S									
N–Channel									
20		0.030	0.038		1.3	6.900	2.0	**NTQD6866**	D
		0.022	0.030		12.5	7.000	1.8	**NTQD6968N**	D
SOT–23 – Case 318									
N–Channel									
20	0.090	0.130			6.0	0.750	0.4	**MGSF1N02L**	S
			0.085	0.115	3.5	2.800	1.3	**MGSF2N02EL**	S
	1.100	1.400			1.4	0.300	0.2	**MMBF0201NL**	S
		0.080	0.105		2.4	3.200	1.3	**NTR4501N**	S
30	0.100	0.145			6.0	2.100	0.7	**MGSF1N03L**	S
		1.500	2.000		1.2	0.560	0.8	**NTR4003N**	S
	0.110	0.140			3.6	2.500	0.7	**NTR4503N**	S
50		3.500	10.000			0.200	0.2	**BSS138L**	S
60	7.500					0.115	0.2	**2N7002L**	S
	5.000					0.500	0.2	**MMBF170L**	S
100	6.000					0.170	0.2	**BSS123L**	S
P–Channel									
8		0.052	0.072	0.120	12.0	3.700	1.0	**NTR2101P**	S

MOSFET – Surface Mount (continued)

V_{DSS} (V)	$R_{DS(on)}$ Max (Ω) @ V_{GS} =				Q_T Typ (nC) @ V_{GS} = 4.5 V (5.0 V)/10 V	Max Rating		Device	Config.
	10 V	4.5 V/ 5.0 V	2.5 V/ 2.7 V	1.8 V		I_D (A)	P_D (W)		
SOT–23 – Case 318									
P–Channel									
20	0.800	1.100			2.2	0.400	0.2	**NTR0202PL**	S
	0.180	0.280			2.5	1.000	0.4	**NTR1P02**	S
		0.200	0.350			1.300	0.4	**NTR1P02L**	S
		0.850	0.120	0.210	7.5	3.200	1.3	**NTR4101P**	S
30	0.200	0.350			6.0	1.950	1.3	**NTR4502P**	S
50		10.000			6.0	0.130	0.2	**BSS84L**	S
ChipFET™ – Case 1206A									
Complementary									
20		0.08/ 0.115	0.115/ 0.240		2.6/3.0	3.1/2.1	1.1	**NTHC5513**	C
		0.080	0.115/ 0.110		2.3/7.4	3.9/4.4	1.1	**NTHD3100C**	C
		0.045/ 0.080	0.050/ 0.110	0.070/ 0.15	7.9/8.9	5.5/4.2	1.1	**NTHD3102C**	C
FETKY® N–Channel									
20		0.080	0.115		2.6	2.700	1.1	**NTHD4N02F**	F
FETKY® P–Channel									
20		0.080	0.110	0.170	7.4	4.400	1.1	**NTHD3101F**	F
		0.155	0.240		3.0	4.400	1.1	**NTHD4P02F**	F
N–Channel									
20		0.075	0.115		2.6	4.100	1.1	**NTHD4508N**	D
		0.065	0.105		4.0	4.500	1.1	**NTHD5904N**	D
		0.030	0.045		12.0	7.200	1.3	**NTHS5404**	S
30	0.085	0.140			3.6	3.900	1.1	**NTHD4502N**	D
	0.038	0.050			9.1	6.700	1.3	**NTHS4501N**	S
P–Channel									
8		0.058	0.085	0.160	8.0	4.600	1.1	**NTHD2102P**	D
		0.025	0.036	0.048	15.0	7.500	1.3	**NTHS2101P**	S
20		0.080	0.110	0.170	7.6	4.100	1.1	**NTHD4102P**	D
		0.155	0.240		3.0	2.100	1.1	**NTHD4401P**	D
		0.155	0.260		3.7	3.000	1.1	**NTHD5903**	D
		0.034	0.040	0.052	25.0	6.700	1.3	**NTHS4101P**	S
			0.083		9.7	5.300	1.3	**NTHS5441**	S
		0.065	0.110		7.5	4.900	1.3	**NTHS5443**	S
Micro8™ – Case 846A									
FETKY® P–Channel									
20		0.090	0.150		10.0	3.300	1.4	**NTTD4401FR**	F
P–Channel									
20		0.090	0.130		10.0	3.200	1.4	**NTTS2P02**	S
30	0.085	0.135			15.0	3.750	1.8	**NTTS2P03**	S

MOSFET – Surface Mount (continued)

V_{DSS} (V)	$R_{DS(on)}$ Max (Ω) @ V_{GS} = 10 V	4.5 V/ 5.0 V	2.5 V/ 2.7 V	1.8 V	Q_T Typ (nC) @ V_{GS} = 4.5 V (5.0 V)/10 V	Max Rating I_D (A)	P_D (W)	Device	Config.
DFN 6 3*3*.85 (µCool™) – Case 506									
N–Channel									
20		0.090	0.120		2.1	4.600	1.7	**NTLGF3501N**	F
P–Channel									
20		0.140	0.225		3.8	3.900	1.6	**NTLGF3402P**	F
DFN 8 3.3*3.3 (EZFET™) – Case 846C									
N–Channel									
20		0.026	0.031		12.0	9.000	3.2	**NTLTD7900ZN**	D
SOT–223 – Case 318E									
N–Channel									
60	1.700				3.2	0.300	0.8	**MMFT960**	S
	0.110				10.6	3.000	2.1	**NTF3055–100**	S
60		0.120			7.6	3.000	2.1	**NTF3055L108**	S
60		0.175			5.1	2.000	2.1	**NTF3055L175**	S
P–Channel									
20		0.050	0.070		15.0	10.000	8.3	**NTF6P02**	S
30	0.100	0.150			15.0	5.200	3.1	**NTF5P03**	S
60	0.170				14.3	2.600	2.3	**NTF2955**	S
SO–8 (MiniMOS™) – Case 751									
Complementary									
20		.043/ 0.100	0.048/ 0.130		12.0/10.0	5.2/3.4	2.0	**NTMD2C02**	C
30	0.070/ 0.200	0.075/ 0.300			11.5/14.2	4.100	2.0	**MMDF2C03HD**	C
FETKY® N–Channel									
30	0.032	0.040			19.0	6.000	2.0	**NTMD6N03**	F
	0.032	0.040			19.0	6.000	2.0	**NTMSD6N303**	F
FETKY® P–Channel									
20		0.090	0.130			3.850	2.0	**NTMSD2P102**	F
		0.090	0.015		16.0	3.850	2.0	**NTMSD2P102L**	F
	0.085	0.125			16.0	3.860	2.0	**NTMSD3P102**	F
30	0.085	0.125			16.0	3.860	2.0	**NTMSD3P303**	F
N–Channel									
20	0.090	0.100			12.5	3.800	2.0	**MMDF3N02HD**	D
		0.035	0.048		12.0	6.500	2.0	**NTMD6N02**	D
		0.040	0.050		11.0	5.900	2.5	**NTMS4N01**	S
	0.023	0.028			26.0	6.500	2.5	**NTMS7N03**	S
25	0.100	0.200			10.6	3.600	2.0	**MMDF2N02E**	D
28	0.0080	0.0098			23.0	14.000	2.5	**NTMS4503N**	S
30	0.0600	0.0800			8.0	4.000	2.0	**NTMD4N03**	D
	0.0045	0.0055			45.0	18.000	2.5	**NTMS4107N**	S
	0.0100	0.0140			11.0	12.000	2.3	**NTMS4705N**	S
	0.0120	0.0150			10.0	10.300	2.2	**NTMS4706N**	S
40	0.080	0.100			13.9	3.400	2.0	**MMDF3N04HD**	D

MOSFET − Surface Mount (continued)

V_{DSS} (V)	$R_{DS(on)}$ Max (Ω) @ V_{GS} = 10 V	4.5 V/ 5.0 V	2.5 V/ 2.7 V	1.8 V	Q_T Typ (nC) @ V_{GS} = 4.5 V (5.0 V)/10 V	Max Rating I_D (A)	P_D (W)	Device	Config.
SO−8 (MiniMOS™) − Case 751									
N−Channel									
50	0.300	0.500	300.000		12.5	2.000	2.0	**MMDF1N05E**	D
P−Channel									
16		0.100	0.150		10.0	3.850	2.0	**NTMD2P01**	D
20	0.160	0.180			15.0	3.300	2.0	**MMDF2P02HD**	D
	0.075	0.095			33.0	5.600	2.5	**MMSF3P02HD**	S
		0.033	0.050		20.0	7.800	2.0	**NTMD6P02**	D
		0.014	0.020		48.0	10.000	2.5	**NTMS10P02**	S
		0.033	0.048		20.0	7.000	2.5	**NTMS5P02**	S
25	0.250	0.400			10.0	2.500	2.0	**MMDF2P02E**	D
30	0.035	0.050	35.000		37.9	7.000	2.5	**MMSF7P03HD**	S
	0.085	0.125			16.0	3.860	2.0	**NTMD3P03**	D
	0.085	0.115			16.0	3.860	2.3	**NTMS3P03**	S
SO−8FL − Case 488									
N−Channel									
30	0.0022	0.0034			47.0	35.000	6.3	**NTMFS4108N**	S
	0.0035	0.0048			37.0	30.000	6.1	**NTMFS4119N**	S
	0.0045	0.0055			33.0	31.000	6.9	**NTMFS4120N**	S
	0.0053	0.0070			24.0	29.000	6.6	**NTMFS4121N**	S
	0.0060	0.0085			23.0	23.000	5.8	**NTMFS4122N**	S
	0.0080	0.0110			11.0	12.300	2.3	**NTMFS4701N**	S
	0.0130	0.0170			7.5	10.200	2.3	**NTMFS4707N**	S
	0.0100	0.0140			10.0	11.500	2.2	**NTMFS4708N**	S
	0.0100	0.0140			10.0	11.000	2.2	**NTMFS4744N**	S
	0.0020	0.0030			39.0	191.000	125.0	**NTMFS4833N**	S
	0.0030	0.0040			32.0	130.000	86.2	**NTMFS4834N**	S
	0.0035	0.0050			22.0	104.000	62.5	**NTMFS4835N**	S
	0.0030	0.0060			20.0	90.000	55.6	**NTMFS4836N**	S
	0.0050	0.0075			14.2	74.000	47.2	**NTMFS4837N**	S
	0.0055	0.0095			13.0	66.000	41.7	**NTMFS4839N**	S
	0.0070	0.0114			11.5	57.000	41.7	**NTMFS4841N**	S
DPAK (TO−252) − Case 369X *									
N−Channel									
24	0.0046	0.0062			23.6	32.0	110.0	**NTD110N02**	S
	0.0145				14.4	30.0	75.0	**NTD30N02**	S
	0.0058	0.0090			30.0	80.0	75.0	**NTD80N02**	S
	0.0052				17.7	32.0	78.1	**NTD85N02R**	S
	0.0050	0.0080			21.0	32.0	86.0	**NTD95N02R**	S

MOSFET − Surface Mount (continued)

V_{DSS} (V)	$R_{DS(on)}$ Max (Ω) @ V_{GS} =				Q_T Typ (nC) @ V_{GS} = 4.5 V (5.0 V)/10 V	Max Rating		Device	Config.
	10 V	4.5 V/ 5.0 V	2.5 V/ 2.7 V	1.8 V		I_D (A)	P_D (W)		
DPAK (TO−252) − Case 369X *									
N−Channel									
25	0.0950	0.1300			1.8	14.0	20.8	**NTD14N03R**	S
	0.0450	0.0600			3.8	17.1	22.3	**NTD23N03R**	S
	0.0165	0.0230			5.8	32.0	50.0	**NTD40N03R**	S
	0.0140	0.0230			6.0	45.0	50.0	**NTD50N03R**	S
	0.0105	0.0125			9.5	32.0	58.0	**NTD60N02R**	S
	0.0084	0.0146			12.2	65.0	50.0	**NTD65N03R**	S
	0.0080	0.0130			13.2	32.0	62.5	**NTD70N03R**	S
	0.0060	0.0078			25.5	78.0	64.0	**NTD78N03**	S
30		0.0270			13.8	20.0	74.0	**NTD20N03L27**	S
	0.0100	0.0130			55.0	68.0	75.0	**NTD4302**	S
	0.0040	0.0055			30.0	117.0	93.8	**NTD4804N**	S
	0.0050	0.0074			20.5	88.0	66.0	**NTD4805N**	S
	0.0060	0.0094			15.0	76.0	60.0	**NTD4806N**	S
	0.0080	0.0124			11.3	63.0	54.6	**NTD4808N**	S
	0.0090	0.0140			10.7	58.0	52.0	**NTD4809N**	S
	0.0090	0.0125			12.5	58.0	52.0	**NTD4809NH**	S
	0.0100	0.0157			9.0	54.0	50.0	**NTD4810N**	S
	0.0100	0.0167			8.9	54.0	50.0	**NTD4810NH**	S
	0.0130	0.0240			6.9	40.0	35.3	**NTD4813N**	S
	0.0130	0.0259			7.1	40.0	35.3	**NTD4813NH**	S
	0.0150	0.0250			6.0	35.0	32.6	**NTD4815N**	S
	0.0150	0.0277			6.4	35.0	32.6	**NTD4815NH**	S
40	10.000	17.000			45.0	70.0	100.0	**NTD5406N**	S
	26.000	40.000			20.0	38.0	75.0	**NTD5407N**	S
60	0.060				15.3	18.0	55.0	**NTD18N06**	S
		0.065			11.0	18.0	55.0	**NTD18N06L**	S
	0.046				21.2	20.0	60.0	**NTD20N06**	S
		0.048			16.6	20.0	60.0	**NTD20N06L**	S
	0.042				24.0	24.0	62.5	**NTD24N06**	S
		0.045			16.0	24.0	62.5	**NTD24N06L**	S
	0.094				10.9	12.0	48.0	**NTD3055−094**	S
	0.150				7.1	9.0	28.8	**NTD3055−150**	S
		0.104			7.4	12.0	48.0	**NTD3055L104**	S
		0.170			4.7	9.0	28.5	**NTD3055L170**	S
	0.062				33.0	32.0	93.8	**NTD32N06**	S
		0.028			23.0	32.0	93.8	**NTD32N06L**	S
100	0.165				14.0	12.0	53.6	**NTD12N10**	S
	0.146				11.3	12.0	56.6	**NTD6600N**	S
150	0.300				15.0	6.0	20.0	**MTD6N15**	S
200	0.700				13.7	6.0	50.0	**MTD6N20E**	S
P−Channel									
30		0.072			15.0	25.0	75.0	**NTD25P03L**	S
		0.072			15.0	25.0	75.0	**NTD25P03L**	S

MOSFET – Surface Mount (continued)

V_{DSS} (V)	$R_{DS(on)}$ Max (Ω) @ V_{GS} = 10 V	4.5 V/ 5.0 V	2.5 V/ 2.7 V	1.8 V	Q_T Typ (nC) @ V_{GS} = 4.5 V (5.0 V)/10 V	Max Rating I_D (A)	P_D (W)	Device	Config.
DPAK (TO–252) – Case 369X *									
P–Channel									
60	0.450				12.0	5.0	40.0	**MTD5P06V**	S
		0.150			15.0	15.5	65.0	**NTD20P06L**	S
	0.180				15.0	12.0	55.0	**NTD2955**	S
D²PAK (TO–264) – Case 418B									
N–Channel									
24	0.0046	0.0062			23.6	125.0	113.6	**NTB125N02R**	S
	0.0105	0.0125			9.5	65.0	62.5	**NTB65N02R**	S
	0.0058	0.0090			29.0	90.0	85.0	**NTB90N02**	S
25	0.0450	0.0600			3.8	23.0	37.5	**NTB23N03R**	S
	0.0080	0.0130			13.2	75.0	74.4	**NTB75N03R**	S
28	0.0068				29.0	85.0	80.0	**NTB85N03**	S
	0.0093	0.0125			28.0	74.0	80.0	**NTB4302**	S
	0.0065				57.0	75.0	125.0	**NTB75N03–6**	S
		0.0080			57.0	75.0	125.0	**NTB75N03L09**	S
40	4.5000	7.0000			125.0	136.0	167.0	**NTB5404N**	S
	5.8000	8.0000			88.0	116.0	150.0	**NTB5405N**	S
60	0.0900				12.0	15.0	48.4	**NTB18N06**	S
		0.1000			7.3	15.0	48.4	**NTB18N06L**	S
	0.0420				23.4	27.0	88.2	**NTB30N06**	S
		0.0460			16.0	30.0	88.2	**NTB30N06L**	S
	0.0260				33.0	45.0	125.0	**NTB45N06**	S
		0.0280			23.0	45.0	125.0	**NTB45N06L**	S
	0.0140				62.0	60.0	150.0	**NTB60N06**	S
		0.0160			43.2	60.0	150.0	**NTB60N06L**	S
	0.0095				92.0	75.0	214.0	**NTB75N06**	S
		0.0110			66.0	75.0	214.0	**NTB75N06L**	S
100	0.1650				14.0	13.0	64.7	**NTB13N10**	S
	0.0300				72.0	52.0	178.0	**NTB52N10**	S
150	0.0500				70.0	37.0	178.0	**NTB35N15**	S
200	0.0810				75.0	30.0	214.0	**NTB30N20**	S
P–Channel									
30			25.000			50.0	125.0	**MTB50P03HDL**	S
60			80.000			30.0	125.0	**MTB30P06V**	S
60	0.075				33.0	27.5	120.0	**NTB25P06**	S
60		0.140			13.0	18.5	88.0	**NTB5605P**	S
500			6000.000			2.0	2.5	**MTB2P50E**	S

MOSFET – Through Hole

V_{DSS} (V)	$R_{DS(on)}$ Max (Ω) @ V_{GS} = 10 V	4.5 V/ 5.0 V	2.5 V/ 2.7 V	1.8 V/ 1.65 V	Q_T Typ (nC) @ V_{GS} = 4.5 V (5.0 V)/10 V	Max Rating I_D (A)	P_D (W)	Device	Config.
TO−92 – Case 29									
N−Channel									
60	5.000	6.000				0.200	0.35	**2N7000**	S
	5.000					0.500	0.35	**BS170**	S
	7.500					0.150	0.40	**VN2222LL**	S
200	14.000		28.000			0.250	0.35	**BS107**	S
	6.000					0.250	0.35	**BS107A**	S
			10.000			0.250	0.35	**BS108**	S
240	10.000					0.200	0.35	**VN2410L**	S
TO−220AB – Case 221A									
N−Channel									
24	0.0046	0.0062			23.6	125.0	113.6	**NTP125N02R**	S
	0.0105	0.0125			9.5	65.0	62.5	**NTP65N02R**	S
	0.0058	0.0090			29.0	90.0	85.0	**NTP90N02**	S
25	0.0080	0.0130			13.0	75.0	74.4	**NTP75N03R**	S
28	0.0068				29.0	85.0	80.0	**NTP85N03**	S
30	0.0065				57.0	75.0	125.0	**NTP75N03−6**	S
		0.0080			57.0	75.0	125.0	**NTP75N03L09**	S
60	0.0900				12.0	15.0	48.4	**NTP18N06**	S
		0.1000			7.3	15.0	48.4	**NTP18N06L**	S
	0.0460				21.2	27.0	88.2	**NTP27N06**	S
		0.0460			16.0	30.0	88.2	**NTP30N06L**	S
	0.0260				33.0	45.0	125.0	**NTP45N06**	S
		0.0280			23.0	45.0	125.0	**NTP45N06L**	S
	0.0140				62.0	60.0	150.0	**NTP60N06**	S
		0.0160			43.2	60.0	150.0	**NTP60N06L**	S
	0.0095				92.0	75.0	214.0	**NTP75N06**	S
100		0.2200			9.3	10.0	40.0	**MTP10N10EL**	S
	0.0300				72.0	52.0	214.0	**NTP52N10**	S
150	0.0500				70.0	37.0	178.0	**NTP35N15**	S
200	0.8100				75.0	30.0	214.0	**NTP30N20**	S
P−Channel									
30		0.025			74.0	50.0	125.0	**MTP50P03HDL**	S
60	0.120				38.0	23.0	90.0	**MTP23P06V**	S
	0.153				14.0	14.0	55.6	**NTP2955**	S
100	0.300				33.0	12.0	75.0	**MTP12P10**	S
500	6.000				19.0	2.0	75.0	**MTP2P50E**	S
TO−247 – Case 340K									
N−Channel									
200	0.075				85.0	32.000	180.0	**MTW32N20E**	S
TO−264 – Case 340G									
N−Channel									
100	0.010				200.0	123.000	313.0	**NTY100N10**	S

Product Replacements

Replacement parts are parts that are equivalent to older versions, but built in newer technologies.

PRODUCT REPLACEMENT TABLE

Part Number	Recommended New Part Numbers	New Part Status
2N7000ZL1	2N7000G	ACTIVE
BS107ARLRM	BS107AG	ACTIVE
BS107ARLRP	BS107AG	ACTIVE
BS107RL1	BS107AG	ACTIVE
BS107RLRA	BS107AG	ACTIVE
IRF510	MTP10N10ELG	ACTIVE
IRF520	MTP10N10ELG	ACTIVE
MGSF1N02ELT1	NTR4501NT1G	ACTIVE
MGSF1N02ELT1G	NTR4501NT1G	ACTIVE
MGSF1N02ELT3	NTR4501NT3G	ACTIVE
MGSF1P02ELT1	NTR1P02LT1G	ACTIVE
MGSF1P02ELT3	NTR1P02LT1G	ACTIVE
MGSF1P02LT1	NTR1P02T1G	ACTIVE
MGSF1P02LT1G	NTR1P02T1G	ACTIVE
MGSF1P02LT3	NTR1P02T3G	ACTIVE
MGSF1P02LT3	NTR1P02T3G	ACTIVE
MGSF1P02LT3G	NTR1P02T3G	ACTIVE
MGSF2P02HDT1	NTGS3441T1G	ACTIVE
MGSF3442VT1	NTGS3446T1G	ACTIVE
MGSF3454VT1	NTHS4501NT1G	ACTIVE
MMBF0202PLT1	NTR0202PLT1G	ACTIVE
MMBF0202PLT1G	NTR0202PLT1G	ACTIVE
MMDF2P01HDR2	NTMD3P03R2G	ACTIVE
MMDF2P03HDR2	NTMD3P03R2G	ACTIVE
MMDF3N03HDR2	NTMD4N03R2G	ACTIVE
MMDF4N01HDR2	NTMD6N02R2G	ACTIVE
MMDF4P03HDR2	NTMD3P03R2G	ACTIVE
MMDF6N02HDR2	NTMD6N02R2G	ACTIVE
MMDF6N03HDR2	NTMD6N03R2G	ACTIVE
MMDFS2P102R2	NTMSD3P102R2G	ACTIVE
MMDFS3P303R2	NTMSD3P303R2G	ACTIVE
MMDFS6N303R2	NTMSD6N303R2G	ACTIVE
MMFT2955ET1	NTF2955T1G	ACTIVE
MMFT2955ET1G	NTF2955T1G	ACTIVE
MMFT2955ET3	NTF2955T1G	ACTIVE
MMFT3055ET1	NTF3055−100T1G	ACTIVE
MMFT3055VLT1	NTF3055L108T1G	ACTIVE
MMFT3055VLT1G	NTF3055L108T1G	ACTIVE
MMFT3055VLT3	NTF3055L108T3G	ACTIVE

PRODUCT REPLACEMENT TABLE

Part Number	Recommended New Part Numbers	New Part Status
MMFT3055VLT3G	NTF3055L108T3G	ACTIVE
MMFT3055VLT3−LF	NTF3055L108T3LFG	ACTIVE
MMFT3055VT1	NTF3055−100T1G	ACTIVE
MMFT3055VT1G	NTF3055−100T1G	ACTIVE
MMFT3055VT3	NTF3055−100T3G	ACTIVE
MMFT3055VT3	NTF3055−100T3G	ACTIVE
MMFT3055VT3G	NTF3055−100T3G	ACTIVE
MMFT5P03HDT3	NTF5P03T3G	ACTIVE
MMSF2P02ER2	NTTS2P02R2G	ACTIVE
MMSF3P03HDR2	NTMS3P03R2G	ACTIVE
MMSF4N01HDR2	NTMS4N01R2G	ACTIVE
MMSF4P01HDR2	NTMS5P02R2G	ACTIVE
MMSF5N02HDR2	NTMS4N01R2G	ACTIVE
MMSF5P02HDR2	NTMS5P02R2G	ACTIVE
MPF9200	BS107G	ACTIVE
MTB1306	NTB75N03L09G	ACTIVE
MTB1306T4	NTB75N03L09T4G	ACTIVE
MTB20N20E	NTB30N20G	ACTIVE
MTB20N20ET4	NTB30N20T4G	ACTIVE
MTB23P06V	NTB25P06G	ACTIVE
MTB23P06VT4	NTB25P06T4G	ACTIVE
MTB29N15E	NTB35N15G	ACTIVE
MTB29N15E1	NTP35N15G	ACTIVE
MTB29N15ET4	NTB35N15T4G	ACTIVE
MTB29N15ET4	NTB35N15T4G	ACTIVE
MTB30N06VL	NTB30N06LT4G	ACTIVE
MTB30N06VLT4	NTB30N06LT4G	ACTIVE
MTB33N10E	NTB52N10G	ACTIVE
MTB33N10ET4	NTB52N10T4G	ACTIVE
MTB36N06V	NTB45N06T4G	ACTIVE
MTB36N06VT4	NTB45N06T4G	ACTIVE
MTB40N10E	NTB52N10T4G	ACTIVE
MTB40N10ET4	NTB52N10T4G	ACTIVE
MTB50N06V	NTB45N06G	ACTIVE
MTB50N06VL	NTB45N06LG	ACTIVE
MTB50N06VLT4	NTB45N06LT4G	ACTIVE
MTB50N06VT4	NTB45N06T4G	ACTIVE
MTB52N06V	NTB60N06G	ACTIVE
MTB52N06VL	NTB60N06LG	ACTIVE
MTB52N06VLT4	NTB60N06LT4G	ACTIVE
MTB52N06VT4	NTB60N06T4G	ACTIVE
MTB55N06Z	NTB75N06G	ACTIVE

PRODUCT REPLACEMENT TABLE

Part Number	Recommended New Part Numbers	New Part Status
MTB55N06ZT4	NTB75N06T4G	ACTIVE
MTB60N05HDL	NTB75N06LG	ACTIVE
MTB60N05HDLT4	NTB75N06LT4G	ACTIVE
MTB60N06HD	NTB60N06G	ACTIVE
MTB60N06HDT4	NTB60N06T4G	ACTIVE
MTB75N03HDL	NTB75N03L09G	ACTIVE
MTB75N03HDLT4	NTB75N03L09T4G	ACTIVE
MTB75N05HD	NTB75N06G	ACTIVE
MTB75N05HDG	NTB75N06T4G	ACTIVE
MTB75N05HDT4	NTB75N06T4G	ACTIVE
MTB75N05HDT4G	NTB75N06T4G	ACTIVE
MTB75N06HD	NTB75N06G	ACTIVE
MTB75N06HDT4	NTB75N06T4G	ACTIVE
MTD10N10EL	NTD6600NT4G	ACTIVE
MTD10N10ELT4	NTD6600NT4G	ACTIVE
MTD10N10ELT4G	NTD6600NT4G	ACTIVE
MTD1302	NTD4302G	ACTIVE
MTD1302T4	NTD4302T4G	ACTIVE
MTD1312T4	NTD20N03L27T4G	ACTIVE
MTD14N10ET4	NTD6600NT4G	ACTIVE
MTD15N06V	NTD18N06G	ACTIVE
MTD15N06V	NTD18N06G	ACTIVE
MTD15N06VL	NTD18N06LG	ACTIVE
MTD15N06VL	NTD18N06LG	ACTIVE
MTD15N06VL1	NTD18N06L−1G	ACTIVE
MTD15N06VLT4	NTD18N06LT4G	ACTIVE
MTD15N06VT4	NTD18N06T4G	ACTIVE
MTD20N03HDL	NTD20N03L27G	ACTIVE
MTD20N03HDL1	NTD20N03L27−1G	ACTIVE
MTD20N03HDLG	NTD20N03L27G	ACTIVE
MTD20N03HDLT4	NTD20N03L27T4G	ACTIVE
MTD20N03HDLT4G	NTD20N03L27T4G	ACTIVE
MTD20N06HD	NTD24N06G	ACTIVE
MTD20N06HD1	NTD24N06−1G	ACTIVE
MTD20N06HDL	NTD24N06LG	ACTIVE
MTD20N06HDL1	NTD24N06LG	ACTIVE
MTD20N06HDLT4	NTD24N06LT4G	ACTIVE
MTD20N06HDLT4G	NTD24N06LT4G	ACTIVE
MTD20N06HDT4	NTD24N06T4G	ACTIVE
MTD20N06HDT4G	NTD24N06T4G	ACTIVE
MTD20N06V	NTD20N06G	ACTIVE
MTD20P03HDLT4	NTD25P03LT4G	ACTIVE

PRODUCT REPLACEMENT TABLE

Part Number	Recommended New Part Numbers	New Part Status
MTD20P06HDLG	NTD20P06LG	ACTIVE
MTD20P06HDLT4	NTD20P06LT4G	ACTIVE
MTD20P06HDLT4G	NTD20P06LT4G	ACTIVE
MTD2955ET4	NTD2955T4G	ACTIVE
MTD2955V	NTD2955G	ACTIVE
MTD2955V1	NTD2955−001	ACTIVE
MTD2955V1G	NTD2955−1G	ACTIVE
MTD2955VG	NTD2955G	ACTIVE
MTD2955VT4	NTD2955T4G	ACTIVE
MTD2955VT4G	NTD2955T4G	ACTIVE
MTD3055ELT4	NTD3055L104T4G	ACTIVE
MTD3055V	NTD3055−094G	ACTIVE
MTD3055V1	NTD3055−094−1G	ACTIVE
MTD3055VL	NTD3055L104G	ACTIVE
MTD3055VL1	NTD3055L104−001	ACTIVE
MTD3055VLT4	NTD3055L104T4G	ACTIVE
MTD3055VT4	NTD3055−094T4G	ACTIVE
MTD3302	NTD4302G	ACTIVE
MTD3302T4	NTD4302T4G	ACTIVE
MTD9N10E	NTD12N10G	ACTIVE
MTD9N10E1	NTD12N10G	ACTIVE
MTD9N10ET4	NTD12N10T4G	ACTIVE
MTDF2N06HDR2	NTF3055−100T3G	ACTIVE
MTP10N10E	MTP10N10ELG	ACTIVE
MTP1302	NTP75N03L09G	ACTIVE
MTP15N06V	NTP18N06G	ACTIVE
MTP15N06VL	NTP18N06LG	ACTIVE
MTP20N06V	NTP45N06G	ACTIVE
MTP2955V	NTP2955G	ACTIVE
MTP2955VG	NTP2955G	ACTIVE
MTP29N15E	NTP35N15G	ACTIVE
MTP3055V	NTP18N06G	ACTIVE
MTP3055VL	NTP18N06LG	ACTIVE
MTP30N06VL	NTP30N06LG	ACTIVE
MTP33N10E	NTP52N10G	ACTIVE
MTP36N06V	NTP45N06G	ACTIVE
MTP40N10E	NTP52N10G	ACTIVE
MTP50N06V	NTP45N06G	ACTIVE
MTP50N06VL	NTP45N06LG	ACTIVE
MTP52N06V	NTP60N06G	ACTIVE
MTP52N06VL	NTP60N06LG	ACTIVE
MTP52N06VLG	NTP60N06LG	ACTIVE

PRODUCT REPLACEMENT TABLE

Part Number	Recommended New Part Numbers	New Part Status
MTP5P06V	MTP23P06VG	ACTIVE
MTP60N06HD	NTP60N06G	ACTIVE
MTP75N03HDL	NTP75N03L09G	ACTIVE
MTP75N06HD	NTP75N06G	ACTIVE
MTSF2P02HDR2	NTTS2P02R2G	ACTIVE
MTSF2P03HDR2	NTTS2P03R2G	ACTIVE
MTW35N15E	NTP35N15G	ACTIVE
MTW45N10E	NTP52N10G	ACTIVE
MTY100N10E	NTY100N10G	ACTIVE
NMFT3055AVLT1	NTF3055L108T1G	ACTIVE
NMFT3055AVLT3	NTF3055L108T1G	ACTIVE
NTB22N06	NTB18N06G	ACTIVE
NTB22N06L	NTB18N06G	ACTIVE
NTB22N06LT4	NTB18N06LT4G	ACTIVE
NTB22N06T4	NTB18N06T4G	ACTIVE
NTB23N03R	NTB23N03RG	ACTIVE
NTB27N06L	NTB30N06LG	ACTIVE
NTB27N06LT4	NTB30N06LT4G	ACTIVE
NTB75N06L	NTB75N06LG	ACTIVE
NTD18N06−001	NTD18N06−1G	ACTIVE
NTD20N06−001	NTD20N06−1G	ACTIVE
NTD24N06L−001	NTD24N06L−1G	ACTIVE
NTD3055L170−001	NTD3055L170−1G	ACTIVE
NTD32N06−001	NTD32N06−1G	ACTIVE
NTD32N06L−001	NTD32N06L−1G	ACTIVE
NTD40N03RT4	NTD40N03RT4G	ACTIVE
NTD4404NT4	NTD4404NT4G	ACTIVE
NTD60N03	NTD70N03RG	ACTIVE
NTD60N03−001	NTD70N03R−001	ACTIVE
NTD60N03T4	NTD70N03RT4G	ACTIVE
NTD85N02R	NTD85N02RG	ACTIVE
NTD85N02R−001	NTD85N02R−1G	ACTIVE
NTD95N02R	NTD95N02RG	ACTIVE
NTD95N02R−001	NTD95N02R−1G	ACTIVE
NTF3055−160T1	NTF3055−100T1G	ACTIVE
NTF3055−160T3	NTF3055−100T3G	ACTIVE
NTF3055−160T3LF	NTF3055−100T3G	ACTIVE
NTGS4111PT1	NTGS4111PT1G	ACTIVE
NTHD3100CT3	NTHD3100CT1G	ACTIVE
NTHD3100CT3G	NTHD3100CT1G	ACTIVE
NTHD3101FT3	NTHD3101FT1G	ACTIVE
NTHD3101FT3G	NTHD3101FT1G	ACTIVE

PRODUCT REPLACEMENT TABLE

Part Number	Recommended New Part Numbers	New Part Status
NTHD5902T1	NTHD4502NT1G	ACTIVE
NTHD5904NT3	NTHD5904NT1G	ACTIVE
NTHD5904NT3G	NTHD5904NT1G	ACTIVE
NTHD5904T1	NTHD4508NT1G	ACTIVE
NTHD5905T1	NTHD2102PT1G	ACTIVE
NTHS5402T1	NTHS4501NT1G	ACTIVE
NTHS5402T1G	NTHS4501NT1G	ACTIVE
NTHS5445T1	NTHS2101PT1G	ACTIVE
NTJD4105CT4G	NTJD4105CT2G	ACTIVE
NTJS4405NT4	NTJS4405NT4G	ACTIVE
NTMS4P01R2	NTMS5P02R2G	ACTIVE
NTMSD3P102R2	NTMSD3P102R2G	ACTIVE
NTP22N06	NTP18N06G	ACTIVE
NTP22N06L	NTP18N06LG	ACTIVE
NTP27N06L	NTP30N06LG	ACTIVE
NTP3055AV	NTP18N06G	ACTIVE
NTP30N06	NTP45N06G	ACTIVE
NTP75N06L	NTP75N06G	ACTIVE
NTP85N03	NTP85N03G	ACTIVE
NTQD6866R2	NTQD6866R2G	ACTIVE
NTQD6968NR2	NTQD6968NR2G	ACTIVE
NTQD6968R2	NTQD6968NR2G	ACTIVE
NTQD6968R2G	NTQD6968NR2G	ACTIVE
NTR4501NT3	NTR4501NT1G	ACTIVE
NTTD1P02R2	NTTD4401FR2	ACTIVE
NTTD1P02R2G	NTTD4401FR2G	ACTIVE
SBSS138LT3	BSS138LT3G	ACTIVE
SMBF1026LT1	MMBF170LT1G	ACTIVE
SMBF1034LT1	2N7002LT1G	ACTIVE
SMBF1034LT1G	2N7002LT1G	ACTIVE
SMBF1035LT3G	BSS123LT3G	ACTIVE
SMBF1046LT1	2N7002LT1G	ACTIVE
SMBF1049LT1	BSS123LT1G	ACTIVE
SMBF1057LT1	2N7002LT1G	ACTIVE
SMBF1062LT1	BSS123LT1G	ACTIVE
SMFT3355VLT3	NTF3055L108T1G	ACTIVE
SMTD10N10ELT4	NTD12N10T4G	ACTIVE
SMTD10N10ELT4	NTD12N10T4G	ACTIVE
SMTD20P03HDLT4	NTD25P03LT4G	ACTIVE
SMTD2955VT4	NTD2955T4G	ACTIVE
SPF3161KRLRP	2N7000G	ACTIVE
STB23P06VT4	NTB25P06T4G	ACTIVE

PRODUCT REPLACEMENT TABLE

Part Number	Recommended New Part Numbers	New Part Status
STB30N06VLT4	NTB45N06LT4G	ACTIVE
STB33N10E	NTB52N10T4G	ACTIVE
STB33N10ET4	NTB52N10T4G	ACTIVE
STB36N06VT4	NTB45N06T4G	ACTIVE
STB40N10ET4	NTB52N10T4G	ACTIVE
STB50N06ET4	NTB75N06T4G	ACTIVE
STB50N06VLT4	NTB45N06LT4G	ACTIVE
STB52N06VLT4	NTB60N06LT4G	ACTIVE
STB52N06VT4	NTB60N06T4G	ACTIVE
STB52N06VT4G	NTB60N06T4G	ACTIVE
STB60N06HDT4	NTB60N06G	ACTIVE
STB75N06HDT4	NTB75N06T4G	ACTIVE
STD1003T4	MTD5P06VT4G	ACTIVE
STD1009V−001	NTD3055−094−1G	ACTIVE
STD1009VT4	NTD3055−094T4G	ACTIVE
STD1010ET4	NTD12N10G	ACTIVE
STD1010V	NTD3055L104G	ACTIVE
STD1010VT4	NTD3055L104T4G	ACTIVE
STD1013T4	NTD3055L104T4G	ACTIVE
STD1028T4	NTD18N06T4G	ACTIVE
STD1030−001	NTD3055−150G	ACTIVE
STD1039T4	NTD2955T4G	ACTIVE
STD1040T4	NTD3055L104T4G	ACTIVE
STD1045T4	NTD2955T4G	ACTIVE
STD1057T4	NTB18N06T4G	ACTIVE
STD1066−001	NTD3055L104−001	ACTIVE
STD1068HDL−001	NTD20N06L−001	ACTIVE
STD1069T4	NTD3055−094G	ACTIVE
STD2000T4	NTD3055L104T4G	ACTIVE
STD2002T4	NTD3055−150G	ACTIVE
STD2004−001	NTD2955−001	ACTIVE
STD20P06HDLT4	NTD20P06LT4G	ACTIVE
STD3055VLT4	NTD3055L104T4G	ACTIVE
STD3055VLT4	NTD3055L104T4G	ACTIVE
STD5P06VT4	MTD5P06VT4G	ACTIVE
STD9N10ET4	NTD12N10G	ACTIVE
STDP7222VT4	MTD5P06VT4G	ACTIVE
STP20N06VLF	NTP45N06G	ACTIVE
STP3055VL	NTP18N06LG	ACTIVE
STP30N06EL	NTP30N06LG	ACTIVE
STP36N06V	NTP45N06G	ACTIVE
STP4119	NTD3055−150G	ACTIVE

PRODUCT REPLACEMENT TABLE

Part Number	Recommended New Part Numbers	New Part Status
STP4347	NTP60N06G	ACTIVE
STP4348	NTP60N06LG	ACTIVE
STP4384	NTP18N06LG	ACTIVE
STP4391	NTP18N06LG	ACTIVE
STP50N06V	NTP45N06G	ACTIVE
STP60N06HDLF	NTP60N06LG	ACTIVE
STP8023	NTP45N06LG	ACTIVE
STW1019	NTP35N15G	ACTIVE
VN2222LLRL	VN2222LLRLRAG	ACTIVE
VN2222LLRLRM	VN2222LLRLRAG	ACTIVE

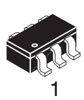
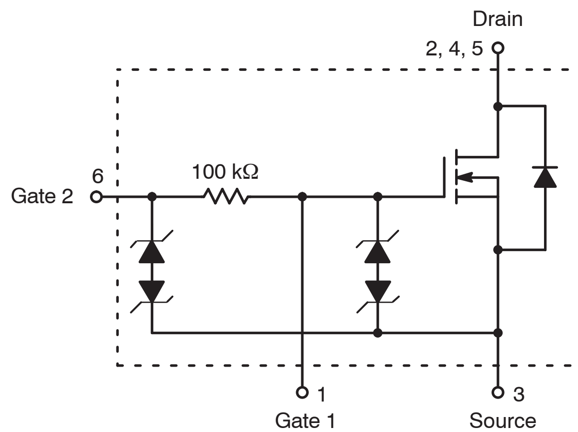
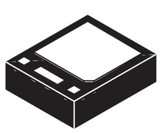
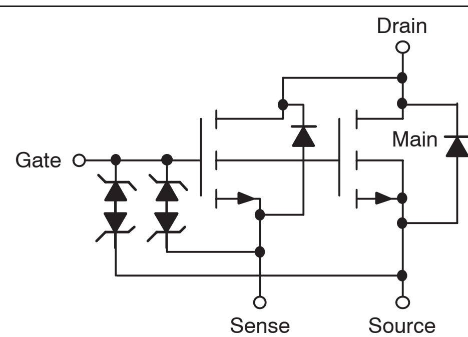
Automotive and Industrial – ON Semiconductor's HDPlus™ platform technology which incorporates various levels of protection features within a MOSFET. The device features can include:

- Short Circuit Protection
- Current Limit
- Thermal Shutdown with Automatic Restart
- Overvoltage Protection
- ESD Protection
- Gate−to−Source Protection
- Current Sense Output
- Pb−free Package

Applications

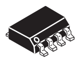
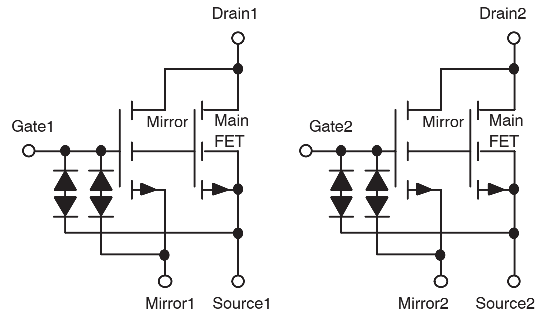
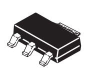
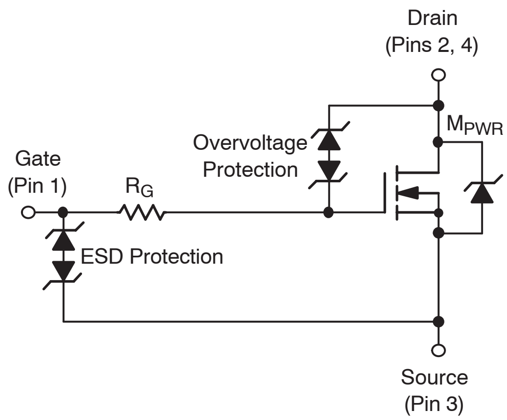
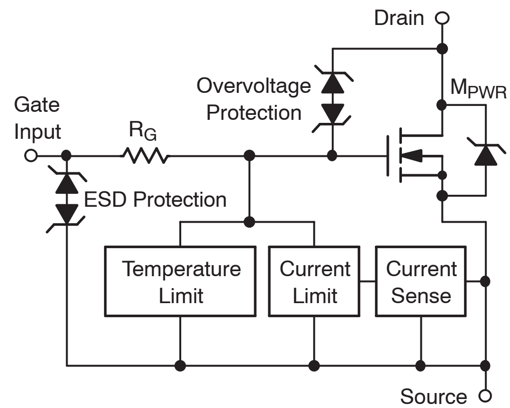
- Solenoid Driver
- Relay Driver
- Relay Replacement
- Load Switching

Protected MOSFETs (Automotive/Industrial)

Device	$V_{(BR)DSS}$ (V)	$R_{DS(ON)}$ (Ω) @ V_{GS} = 10 V	Integrated Protection					Max Rating
			Overvoltage	Overcurrent	Overtemperature	ESD	Current Sense Output	P_D (W)
		CASE 318G TSOP−6						
NUD3048M*	100	0.72	–	–	–	X	–	0.66
			CASE 508AA (Leadless) SO−8					
NILMS4501N*	24	0.013	–	–	–	X	X	2.7

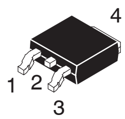
*Not Automotive Qualified.

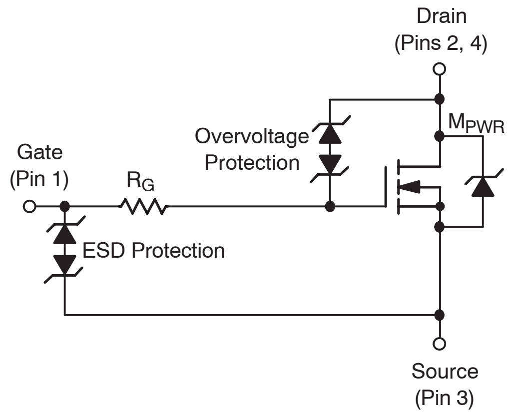
Protected MOSFETs (Automotive/Industrial) (continued)

Device	$V_{(BR)DSS}$ (V)	$R_{DS(ON)}$ (Ω) @ V_{GS} = 10 V	Integrated Protection					Max Rating
			Overvoltage	Overcurrent	Overtemperature	ESD	Current Sense Output	P_D (W)
8  1		CASE 751 SO–8 “Dual”						
NIMD6302R	30	0.05	–	–	–	X	X	1.3
CASE 318E SOT–223 			 NIF9N05CL			 NIF62514, NIF5002N, NIF5003N			
NIF9N05CL	55	0.125	X	–	–	X	–	1.69
NIF62514	42	0.1	X	X	X	X	–	1.7
NIF5002N	42	0.2	X	–	–	X	–	1.1
NIF5003N	42	0.068	X	X	X	X	–	1.9

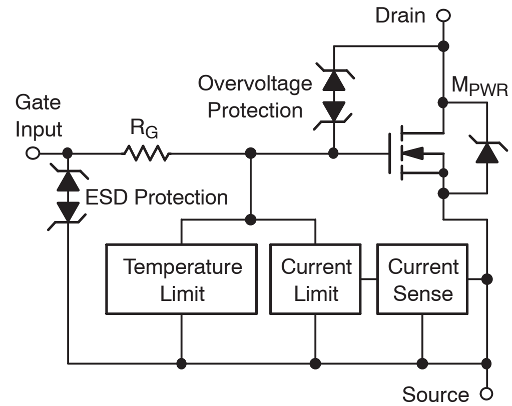
Protected MOSFETs (Automotive/Industrial) (continued)

CASE 369C
DPAK (TO−252)



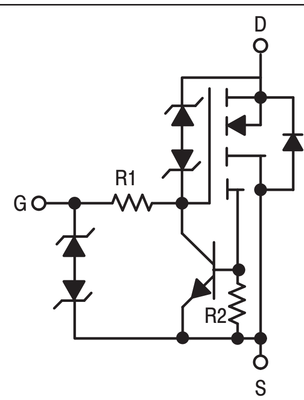


NID9N05CL



NID5001N, 5003N, 5004N, 6002N

Device	$V_{(BR)DSS}$ (V)	$R_{DS(ON)}$ (Ω) @ V_{GS} = 10 V	Integrated Protection					Max Rating
			Overvoltage	Overcurrent	Overtemperature	ESD	Current Sense Output	P_D (W)
NID9N05CL	55	0.09	X	–	–	X	–	28.8
NID5001N	42	0.029	X	–	–	X	–	64
NID5003N	42	0.05	X	–	–	X	–	1.3
NID6002N	60	0.21	X	–	–	X	–	1.3
NID5004N	40	0.15	X	–	–	X	–	1.3



MLD1N06CL, MLD2N06CL

MLD1N06CL	60	0.75 @ V_{GS} = 5.0 V	X	X	–	X	–	40
MLD1N06CL	62	0.4 @ V_{GS} = 5.0 V	X	X	–	X	–	40

Circuit Protection

Circuit Protection

Table of Contents

In Brief...

What's New for Integrated Functions

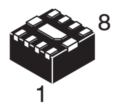
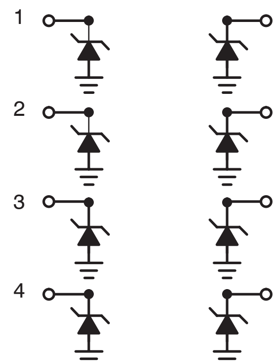
TVS Protection Arrays − ON Semiconductor miniaturizes its TVS array products by introducing the industry's smallest TVS array. The **NUP45V6** series in the ultra small SOT−953 package provides electrostatic discharge (ESD) protection of four data lines in wireless and portable applications. Other recently released products include the **NUP2202** and **NUP4202** low capacitance arrays for USB 2.0 applications.

EMI Filters – ON Semiconductor is the leading provider of integrated EMI Filter Products designed to suppress EMI radio frequency interference (RFI) noise and provide electrostatic discharge (ESD) Protection for advanced Wireless Cell Phones, Portable electronics and Computing applications. We have released more than 25 new products in miniature DFN/WDFN packages in 2005.

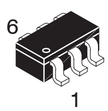
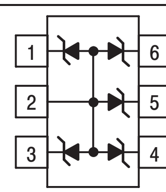
Our next generation EMI filter packages will be available in Low profile (typical 0.5 mm height) miniature μDFN includes 4−channel (**NUF4001MU**), 6−channel (**NUF6001MU**) and 8−channel (and **NUF8001MU**) provides superior filtering performance over traditional CSP or BGA Package due to low parasitic Inductance and reliability in terms of handling and solderability.

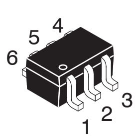
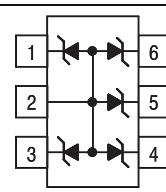
TVS Protection – Arrays in Surface Mount

- Human Body Model ESD Rating (>16 kV)
- IEC 61000−4−2 (ESD) 15 kV (air) 8 kV (contact)
- Eight Line Protection

Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 μsec) (Note 1)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(μA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
 CASE 506AK DFN8 											
NUP8010MN	5.3	5.6	5.9	1.0	1.0	3.3	13	17	1.6	13	20

- Five Line Protection

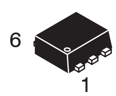
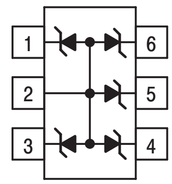
 CASE 318F STYLE 1 SC−74 PLASTIC 											
SMS05C	6.2	–	7.2	1.0	5.0	5.0	260	–	24	14.5	350
SMS12C	13.3	–	15	1.0	1.0	12	120	–	15	23	350
SMS15C	17	–	19	1.0	1.0	15	95	–	12	29	350
SMS24C	26.7	–	32	1.0	1.0	24	60	–	8.0	44	350

 CASE 419B SC−88 (SOT−363) 											
SMF05C	6.2	–	7.2	1.0	5.0	5.0	80	–	8.0	12.5	100
SMF12C	13.3	–	15	1.0	1.0	12	40	–	6.0	23	100
SMF15C	17	–	19	1.0	1.0	15	33	–	5.0	29	100
SMF24C	26.7	–	32	1.0	1.0	24	21	–	2.5	44	100

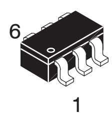
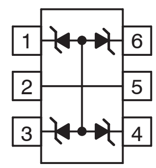
1. Surge waveform 8 x 20 μsec.

TVS Protection − Arrays in Surface Mount (continued)

- Human Body Model ESD Rating (>16 kV)
- IEC 61000−4−2 (ESD) 15 kV (air) 8 kV (contact)
- Five Line Protection

Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec) (Note 2)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
 CASE 463A SOT−563 											
NUP5120X6	6.2	6.8	7.2	1.0	0.5	3.0	54	–	–	–	90

- Four Line Protection

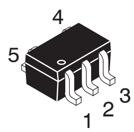
 CASE 318F STYLE 1 SC−74 PLASTIC 											
MMQA5V6	5.32	5.6	5.88	1.0	2.0	3.0	257	–	3.0	8.0	150
MMQA6V2	5.89	6.2	6.51	1.0	0.7	4.0	225	–	2.66	9.0	150
MMQA6V8	6.46	6.8	7.14	1.0	0.5	4.3	210	–	2.45	9.8	150
MMQA12V	11.4	12	12.6	1.0	0.075	9.1	117	–	1.39	17.3	150
MMQA13V	12.4	13	13.7	1.0	0.075	9.8	108	–	1.29	18.6	150
MMQA15V	14.3	15	15.8	1.0	0.075	11	93	–	1.1	21.7	150
MMQA18V	17.1	18	18.9	1.0	0.075	14	77	–	0.923	26	150
MMQA20V	19	20	21	1.0	0.075	15	69	–	0.84	28.6	150
MMQA22V	20.9	22	23.1	1.0	0.075	17	63	–	0.758	31.7	150
MMQA24V	22.8	24	25.2	1.0	0.075	18	58	–	0.694	34.6	150
MMQA27V	25.7	27	28.4	1.0	0.075	21	50	–	0.615	39	150
MMQA30V	28.5	30	31.5	1.0	0.075	23	40	–	0.554	43.3	150
MMQA33V	31.4	33	34.7	1.0	0.075	25	42	–	0.504	48.6	150
SMS05	6.0	–	7.2	1.0	20	5.0	300	400	23	15.5	350
SMS12	13.3	–	15	1.0	1.0	12	120	150	15	23	350
SMS15	16.7	–	18.5	1.0	1.0	15	100	125	12	29	350
SMS24	26.7	–	32	1.0	1.0	24	60	75	8.0	44	350

2. Surge waveform 8 x 20 µsec.

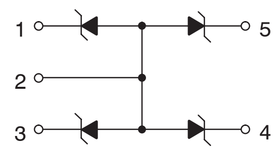
TVS Protection – Arrays in Surface Mount (continued)

- Human Body Model ESD Rating (>16 kV)
- IEC 61000−4−2 (ESD) 15 kV (air) 8 kV (contact)
- Four Line Protection

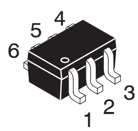
Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec) (Note 3)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts



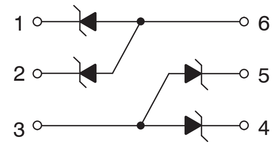
CASE 419A
SC−88A (SOT−353)



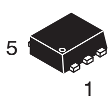
MSQA6V1W5	6.1	6.6	7.2	1.0	1.0	3.0	90	–	–	–	150
NSQA6V8AW5	6.4	6.8	7.1	1.0	1.0	5.0	12	15	1.6	13	20
NSQA12VAW5	11.4	12	12.7	5.0	0.05	9.0	7.0	15	0.9	23	20
SMF05	6.0	–	7.2	1.0	5.0	5.0	90	–	12	12.5	200



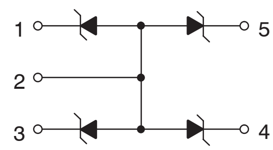
CASE 419B
SC−88 (SOT−363)



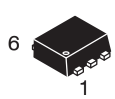
DF6A6.8FU	6.4	6.8	7.2	1.0	1.0	5.0	40	–	7.0	11.4	75



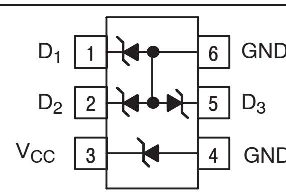
CASE 463B
SOT−553



NZQA5V6XV5	5.32	5.6	5.88	1.0	1.0	3.0	90	–	10	10.5	100
NZQA6V2XV5	5.89	6.2	6.51	1.0	0.5	4.0	80	–	9.0	11.5	100
NZQA6V8XV5	6.46	6.8	7.14	1.0	0.1	4.3	70	–	8.0	12.5	100
NZQA5V6AXV5	5.3	5.6	5.9	1.0	1.0	3.0	13	17	1.6	13	20
NZQA6V8AXV5	6.1	6.8	7.2	1.0	1.0	3.0	12	15	1.6	13	20



CASE 463A
SOT−563

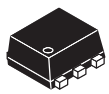
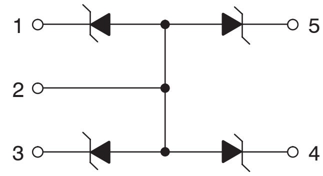


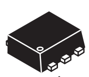
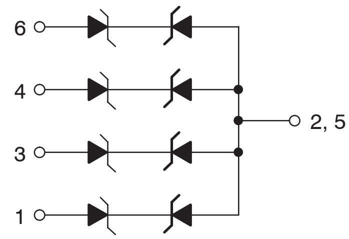
NUP4060AXV6 (D_1, D_2, and D_3)	6.2	6.8	7.2	1.0	0.5	3.0	7.0	10	1.6	13	20
NUP4060AXV6 (V_{CC})	15.3	16	17.1	5.0	0.05	11	105	–	–	–	0.200

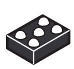
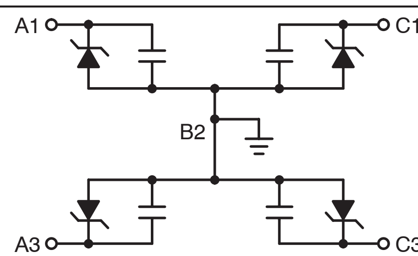
3. Surge waveform 8 x 20 µsec.

TVS Protection – Arrays in Surface Mount (continued)

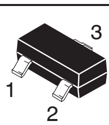
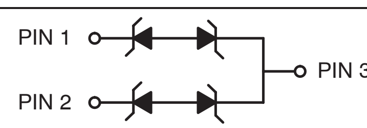
- Human Body Model ESD Rating (>16 kV)
- IEC 61000−4−2 (ESD) 15 kV (air) 8 kV (contact)
- Four Line Protection

Device	Breakdown Voltage V_{BR} @ 1 mA (V)			Leakage Current I_{RM} @ V_{RM}		Typ Capacitance @ 0 V (pF) (Note 4)		Typ Capactiance @ 3 V Bias (pF) (Note 4)	
	Min	Nom	Max	V_{RWM}	I_{RWM} (µA)	Typ	Max	Typ	Max
				CASE 526AB SOT−953					
NUP45V6P5	5.3	5.6	5.9	3.0	1.0	13	17	7.0	11.5
NUP46V8P5	6.47	6.8	7.14	4.3	1.0	12	15	6.7	9.5
NUP412VP5	11.4	12	12.7	9.0	1.0	6.5	10	3.5	5.0

Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec) (Note 4)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
6  1				CASE 463A SOT−563							
NUP4102XV6	13.6	–	17.8	1.0	0.1	12	13	15	3.0	25	75

				CASE 766AB 5 PIN FLIP−CHIP CSP							
NUP4103FC	6.0	7.0	8.0	1.0	0.1	3.3	47	–	–	–	–

- Two Line Protection

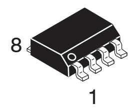
					CASE 318 SOT−23						
NUP2105L	26.2	–	32	1.0	0.1	24	30	–	8.0	44	350

4. Surge waveform 8 x 20 µsec.

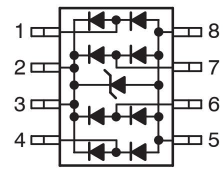
TVS Protection − Low Capacitance Surface Mount for USB 2.0 and 1.1

- ESD Protection Meeting IEC 61000−4−2, 4−4, 4−5

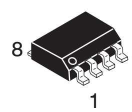
Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance* (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts



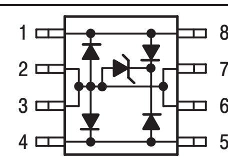
CASE 751
SO−8



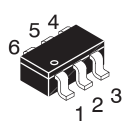
USB 2.0											
NUP4201DR2	6.0	–	–	1.0	10	5.0	2.5	5.0	10	12	500
SRDA05−4R2	6.0	–	–	1.0	10	5.0	4.0	8.0	10	12	500



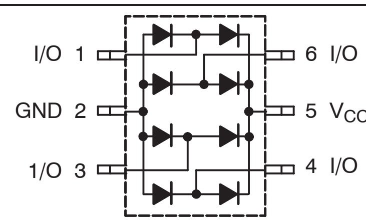
CASE 751
SO−8



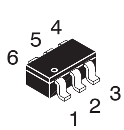
USB 1.1											
LC03−6	6.8	–	–	1.0	20	5.0	8.0	12	50	15	2000



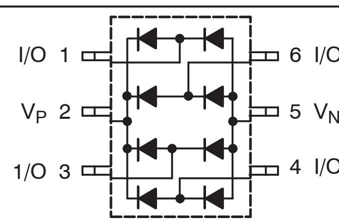
CASE 318G
TSOP−6



USB 2.0											
NUP4301MR6	70	–	–	0.1	2.5	–	0.8	1.5	–	–	–
NUP4302MR6	30	–	–	0.1	30	–	–	18	–	–	–



CASE 318F
TSOP−6



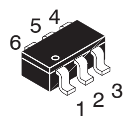
USB 2.0											
NUP4304MR6	70	–	–	0.1	2.5	–	0.8	1.5	–	–	–

*C_j = Between I/O pins

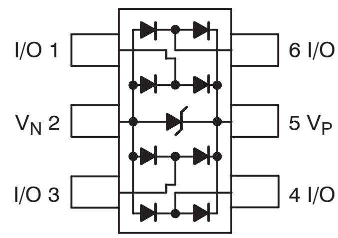
TVS Protection − Low Capacitance Surface Mount for USB 2.0 and 1.1 (continued)

- ESD Protection Meeting IEC 61000−4−2, 4−4, 4−5

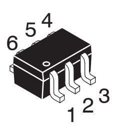
Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance* (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 μsec)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(μA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts



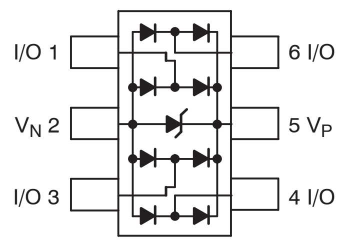
CASE 318G
TSOP−6



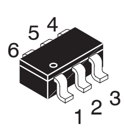
USB 2.0											
NUP4201MR6	6.0	–	–	1.0	5.0	5.0	3.0	5.0	25	20	500



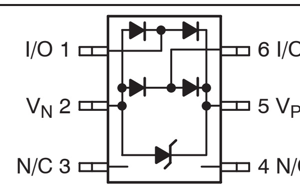
CASE 419B
SC−88



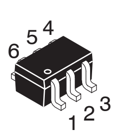
USB 2.0											
NUP4202W1	6.0	–	–	1.0	5.0	5.0	3.0	5.0	28	20	500



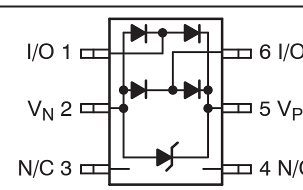
CASE 318G
TSOP−6



USB 2.0											
NUP2201MR6	6.0	–	–	1.0	5.0	5.0	3.0	5.0	25	20	500



CASE 419B
SC−88



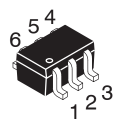
USB 2.0											
NUP2202W1	6.0	–	–	1.0	5.0	5.0	3.0	5.0	28	20	500

*C_j = Between I/O pin to ground

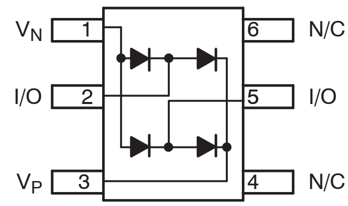
TVS Protection – Low Capacitance Surface Mount for USB 2.0 and 1.1 (continued)

- ESD Protection Meeting IEC 61000−4−2, 4−4, 4−5

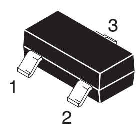
Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance* (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts



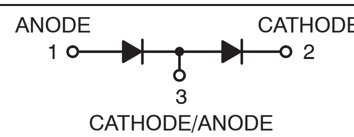
CASE 419B
SC−88



Device	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
USB 2.0											
NUP2301MW6	70	–	–	–	0.1	2.5	0.8	1.5	–	–	–



CASE 318
SOT−23



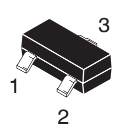
Device	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
USB 2.0											
NUP1301ML3	70	–	–	–	0.1	2.5	0.8	1.5	–	–	–

*C_j = Between I/O pins

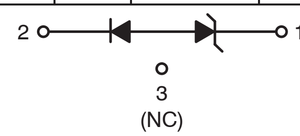
TVS Protection – Low Capacitance Surface Mount for High Speed Data Lines

- ESD Protection Meeting IEC 61000−4−2, 4−4, 4−5

Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} = 5 A (Clamping Voltage)	Peak Power Rating (8x20 µsec)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts



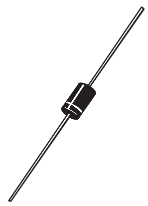
CASE 318
STYLE 26
SOT−23



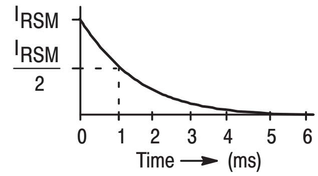
Device	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
SL05	6.0	–	8.0	1.0	20	5.0	3.5	5.0	17	11	300
SL15	16.7	–	18.5	1.0	1.0	15	3.5	5.0	10	30	300
SL24	26.7	–	29	1.0	1.0	24	3.5	5.0	5.0	55	300

TVS – in Axial Leads

Table 1. Peak Power Dissipation, 500 Watts @ 1 ms Surge (10 x 1000 μs) Case 59 – MiniMOSORB™



CASE 59 (MiniMOSORB™)
PLASTIC
Cathode = Polarity Band



Surge Current Characterisitcs

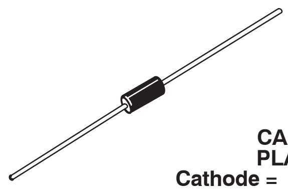
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) V_F = 3.5 V Max, I_F = 35 A Pulse (except bidirectional devices).

Working Peak Reverse Voltage V_{RWM} (Volts) (Note 1)	Device	Breakdown Voltage V_{BR} (Volts) Min (Note 2)	Breakdown Voltage V_{BR} (Volts) Max	Breakdown Voltage @ I_T Pulse (mA)	Maximum Reverse Leakage @ V_{RWM} I_R (μA)	Maximum Reverse Surge Current I_{RSM} (Amps) (Note 3)	Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)
5	SA5.0A	6.4	7	10	600	54.3	9.2
6	SA6.0A	6.67	7.37	10	600	48.5	10.3
7	SA7.0A	7.78	8.6	10	150	41.7	12
9	SA9.0A	10	11.1	1	1	32.5	15.4
10	SA10A	11.1	12.3	1	1	29.4	17
12	SA12A	13.3	14.7	1	1	25.1	19.9
13	SA13A	14.4	15.9	1	1	23.2	21.5
15	SA15A	16.7	18.5	1	1	20.6	24.4
16	SA16A	17.8	19.7	1	1	19.2	26
17	SA17A	18.9	20.9	1	1	18.1	27.6
18	SA18A	20	22.1	1	1	17.2	29.2
20	SA20A	22.2	24.5	1	1	15.4	32.4
24	SA24A	26.7	29.5	1	1	12.8	38.9
26	SA26A	28.9	31.9	1	1	11.9	42.1
28	SA28A	31.1	34.4	1	1	11	45.4
30	SA30A	33.3	36.8	1	1	10.3	48.4
33	SA33A	36.7	40.6	1	1	9.4	53.3
36	SA36A	40	44.2	1	1	8.6	58.1
51	SA51A	56.7	62.7	1	1	6.1	82.4
64	SA64A	71.1	78.6	1	1	4.9	103
170	SA170A	189	209	1	1	1.8	275

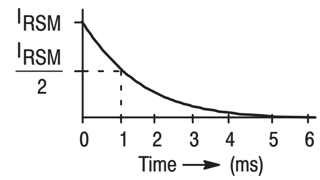
1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.

TVS – in Axial Leads (continued)

Table 1. Peak Power Dissipation, 500 Watts @ 1 ms Surge (10 x 1000 μs) Case 59 – MiniMOSORB™
(continued)



CASE 17
PLASTIC
Cathode = Polarity Band



Surge Current Characterisitcs

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) V_F = 3.5 V Max, I_F = 50 A Pulse (except bidirectional devices).

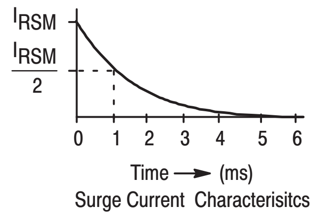
Breakdown Voltage (Note 2)						
V_{BR} (Volts) Nom	**@ I_T Pulse (mA)**	**Device**	**Working Peak Reverse Voltage V_{RWM} (Volts)** (Note 1)	**Maximum Reverse Leakage @ V_{RWM} I_R (μA)**	**Maximum Reverse Surge Current I_{RSM} (Amps)** (Note 3)	**Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)**
6.8	10	P6KE6.8A	5.8	1000	57	10.5
7.5	10	P6KE7.5A	6.4	500	53	11.3
10	1	P6KE10A	8.55	10	41	14.5
12	1	P6KE12A	10.2	5	36	16.7
13	1	P6KE13A	11.1	5	33	18.2
15	1	P6KE15A	12.8	5	28	21.2
16	1	P6KE16A	13.6	5	27	22.5
18	1	P6KE18A	15.3	5	24	25.2
20	1	P6KE20A	17.1	5	22	27.7
22	1	P6KE22A	18.8	5	20	30.6
24	1	P6KE24A	20.5	5	18	33.2
27	1	P6KE27A	23.1	5	16	37.5
30	1	P6KE30A	25.6	5	14.4	41.4
33	1	P6KE33A	28.2	5	13.2	45.7
36	1	P6KE36A	30.8	5	12	49.9
39	1	P6KE39A	33.3	5	11.2	53.9
43	1	P6KE43A	36.8	5	10.1	59.3
47	1	P6KE47A	40.2	5	9.3	64.8
51	1	P6KE51A	43.6	5	8.6	70.1
56	1	P6KE56A	47.8	5	7.8	77
62	1	P6KE62A	53	5	7.1	85
68	1	P6KE68A	58.1	5	6.5	92
75	1	P6KE75A	64.1	5	5.8	103
82	1	P6KE82A	70.1	5	5.3	113
100	1	P6KE100A	85.5	5	4.4	137
150	1	P6KE150A	128	5	2.9	207
160	1	P6KE160A	136	5	2.7	219
170	1	P6KE170A	145	5	2.6	234
180	1	P6KE180A	154	5	2.4	246
200	1	P6KE200A	171	5	2.2	274

1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.

TVS – in Axial Leads (continued)

Table 1. Peak Power Dissipation, 500 Watts @ 1 ms Surge (10 x 1000 μs) Case 59 – MiniMOSORB™
(continued)

CASE 41A
PLASTIC
Cathode = Polarity Band



ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) V_F = 3.5 V Max, I_F = 100 A Pulse)
(C suffix denotes standard back to back bidirectional versions. Test both polarities)

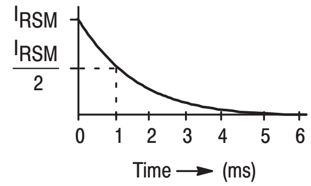
Max Reverse Stand-Off Voltage V_{RWM} (Volts) (Note 1)	JEDEC Device	Device	Breakdown Voltage		Maximum Reverse Leakage @ V_{RWM} I_R (μA)	Maximum Reverse Surge Current I_{RSM} (Volts) (Note 3)	Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)	Clamping Voltage	
			V_{BR} Volts Min (Note 2)	@ I_T Pulse (mA)				Peak Pulse Current @ I_{pp1} = 1 A V_{C1} (Volts max)	Peak Pulse Current @ I_{pp2} = 10 A V_{C2} (Volts max)
5	1N5908		6	1	300	120	8.5	7.6 @ 30 A	8 @ 60 A
5	1N6373	ICTE-5	6	1	300	160	9.4	7.1	7.5
12	1N6376	ICTE-12	14.1	1	2	70	21.2	16.1	16.5
15	1N6377	ICTE-15	17.6	1	2	60	25	20.1	20.6
18		ICTE-18	21.2	1	2	50	30	24.2	25.2
36	1N6380	ICTE-36	42.4	1	2	23	65.2	50.6	54.3

1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.

TVS – in Axial Leads (continued)

Table 2. Peak Power Dissipation, 1500 Watts @ 1 ms Surge (10 x 1000 μs) Case 41A – MOSORB

CASE 41A
PLASTIC
Cathode = Polarity Band



Surge Current Characterisitcs

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) V_F = 3.5 V Max, I_F = 100 A Pulse

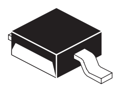
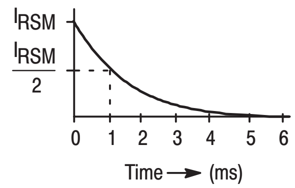
Breakdown Voltage (Note 2) V_{BR} Volts Nom	@ I_T Pulse (mA)	JEDEC Device	Device	Working Peak Reverse Voltage V_{RWM} (Volts) (Note 1)	Maximum Reverse Leakage @ V_{RWM} I_R (μA)	Maximum Reverse Surge Current I_{RSM} (Amps) (Note 3)	Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_{RSM} (Volts)
6.8	10	1N6267A	1.5KE6.8A	5.8	1000	143	10.5
8.2	10		1.5KE8.2A	7.02	200	124	12.1
10	1	1N6271A	1.5KE10A	8.55	10	103	14.5
11	1		1.5KE11A	9.4	5	96	15.6
12	1		1.5KE12A	10.2	5	90	16.7
13	1	1N6274A	1.5KE13A	11.1	5	82	18.2
15	1	1N6275A	1.5KE15A	12.8	5	71	21.2
16	1	1N6276A	1.5KE16A	13.6	5	67	22.5
18	1	1N6277A	1.5KE18A	15.3	5	59.5	25.2
20	1	1N6278A	1.5KE20A	17.1	5	54	27.7
22	1	1N6279A		18.8	5	49	30.6
24	1	1N6280A	1.5KE24A	20.5	5	45	33.2
27	1	1N6281A	1.5KE27A	23.1	5	40	37.5
30	1	1N6282A	1.5KE30A	25.6	5	36	41.4
33	1	1N6283A	1.5KE33A	28.2	5	33	45.7
36	1	1N6284A	1.5KE36A	30.8	5	30	49.9
39	1	1N6285A	1.5KE39A	33.3	5	28	53.9
43	1	1N6286A	1.5KE43A	36.8	5	25.3	59.3
47	1	1N6287A	1.5KE47A	40.2	5	23.2	64.8
51	1	1N6288A	1.5KE51A	43.6	5	21.4	70.1
56	1	1N6289A	1.5KE56A	47.8	5	19.5	77
62	1	1N6290A	1.5KE62A	53	5	17.7	85
68	1	1N6291A	1.5KE68A	58.1	5	16.3	92
75	1	1N6292A	1.5KE75A	64.1	5	14.6	103
82	1		1.5KE82A	70.1	5	13.3	113
91	1	1N6294A	1.5KE91A	77.8	5	12	125
100	1	1N6295A		85.5	5	11	137

1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.

TVS – in Surface Mount

Table 3. 1PMT Series Unidirectional Overvoltage Transient Suppressors, 200 Watts Peak Power @ 1 ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_L = 30°C unless otherwise noted) (V_F = 1.25 Volts @ 200 mA)

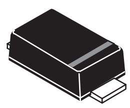
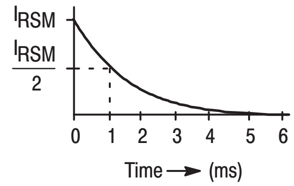
		V_{RWM} (V)	V_{BR} @ I_T (V) (Note 2)			I_T	I_R @ V_{RWM}	V_C @ I_{PP}	I_{PP} (A)
Device	**Marking**	(Note 1)	**Min**	**Nom**	**Max**	**(mA)**	**(μA)**	**(V)**	(Note 3)
	**POWERMITE® CASE 457 PLASTIC**					 Surge Current Characterisitcs			
1PMT5.0A	MKE	5.0	6.4	6.7	7.0	10	800	9.2	19
1PMT7.0A	MKM	7.0	7.78	8.2	8.6	10	500	12	14.6
1PMT12A	MLE	12	13.3	14	14.7	1.0	5.0	19.9	8.8
1PMT16A	MLP	16	17.8	18.75	19.7	1.0	5.0	26	7.0
1PMT22A	MLX	22	24.4	25.6	26.9	1.0	5.0	35.5	4.9
1PMT26A	MME	26	28.9	30.4	31.9	1.0	5.0	42.1	4.2
1PMT33A	MMM	33	36.7	38.7	40.6	1.0	5.0	53.3	3.3

1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.

TVS − in Surface Mount (continued)

Table 4. SMF Series Unidirectional Overvoltage Transient Suppressors, 200 Watts Peak Power @ 1 ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_L = 30°C unless otherwise noted) (V_F = 1.25 Volts @ 200 mA)

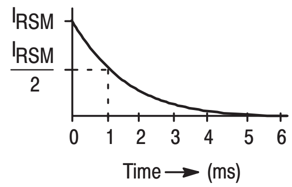
Device	Marking	V_{RWM} (V)	V_{BR} @ I_T (V) (Note 2)			I_T	I_R @ V_{RWM}	V_C @ I_{PP}	I_{PP} (A)
		(Note 1)	Min	Nom	Max	(mA)	(μA)	(V)	(Note 3)
		**SOD−123FL CASE 498 PLASTIC**					 Surge Current Characterisitcs		
SMF5.0A	KE	5.0	6.4	6.7	7.0	10	400	9.2	16.3
SMF6.0A	KG	6.0	6.67	7.02	7.37	10	400	10.3	14.6
SMF6.5A	KK	6.5	7.22	7.6	7.98	10	250	11.2	13.4
SMF7.0A	KM	7.0	7.78	8.2	8.6	10	100	12	12.5
SMF7.5A	KP	7.5	8.33	8.77	9.21	1.0	50	12.9	11.6
SMF8.0A	KR	8.0	8.89	9.36	9.83	1.0	25	13.6	11
SMF9.0A	KV	9.0	10	10.55	11.1	1.0	5.0	15.4	9.7
SMF10A	KX	10	11.1	11.7	12.3	1.0	2.5	17	8.8
SMF11A	KZ	11	12.2	12.85	13.5	1.0	2.5	18.2	8.2
SMF12A	LE	12	13.3	14	14.7	1.0	2.5	19.9	7.5
SMF13A	LG	13	14.4	15.15	15.9	1.0	1.0	21.5	7.0
SMF14A	LK	14	15.6	16.4	17.2	1.0	1.0	23.2	6.5
SMF15A	LM	15	16.7	17.6	18.5	1.0	1.0	24.4	6.1
SMF17A	LR	17	18.9	19.9	20.9	1.0	1.0	27.6	5.4
SMF18A	LT	18	20	21	22.1	1.0	1.0	29.2	5.1
SMF20A	LV	20	22.2	23.35	24.5	1.0	1.0	32.4	4.6
SMF22A	LX	22	24.4	25.6	26.9	1.0	1.0	35.5	4.2
SMF24A	LZ	24	26.7	28.1	29.5	1.0	1.0	38.9	3.9
SMF26A	ME	26	28.9	30.4	31.9	1.0	1.0	42.1	3.6
SMF28A	MG	28	31.1	32.8	34.4	1.0	1.0	45.4	3.3
SMF30A	MK	30	33.3	35.1	36.8	1.0	1.0	48.4	3.1
SMF33A	MM	33	36.7	38.7	40.6	1.0	1.0	53.3	2.8
SMF36A	MP	36	40	42.1	44.2	1.0	1.0	58.1	2.6
SMF40A	MR	40	44.4	46.8	49.1	1.0	1.0	64.5	2.3
SMF43A	MT	43	47.8	50.3	52.8	1.0	1.0	69.4	2.2
SMF45A	MV	45	50	52.65	55.3	1.0	1.0	72.7	2.1
SMF48A	MX	48	53.3	56.1	58.9	1.0	1.0	77.4	1.9
SMF51A	MZ	51	56.7	59.7	62.7	1.0	1.0	82.4	1.8
SMF54A	NE	54	60	63.15	66.3	1.0	1.0	87.1	1.7

1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform. TVS − in Surface Mount (continued)

TVS – in Surface Mount (continued)

Table 5. 1SMA Series Unidirectional Overvoltage Transient Suppressors; 400 Watts Peak Power @ 1 ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (V_F = 3.5 Volts @ I_F = 40 A for all types) (Note 4)

Device	Working Peak Reverse Voltage V_{RWM} (Volts) (Note 1)	Breakdown Voltage		Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_C (Volts)	Maximum Reverse Surge Current I_{PP} (Amps) (Note 3)	Maximum Reverse Leakage @ V_{RWM} I_R (μA)	Device Marking
		V_{BR} Volts (Min) (Note 2)	I_T mA				
	SMA CASE 403B PLASTIC			 Surge Current Characterisitcs			
1SMA5.0A	5.0	6.4	10	9.2	43.5	400	QE
1SMA6.0A	6.0	6.67	10	10.3	38.8	400	QG
1SMA6.5A	6.5	7.22	10	11.2	35.7	250	QK
1SMA8.0A	8.0	8.89	1	13.6	29.4	25	QR
1SMA8.5A	8.5	9.44	1	14.4	27.8	5.0	QT
1SMA9.0A	9.0	10	1	15.4	26.0	2.5	QV
1SMA10A	10	11.1	1	17.0	23.5	2.5	QX
1SMA11A	11	12.2	1	18.2	22.0	2.5	QZ
1SMA12A	12	13.3	1	19.9	20.1	2.5	RE
1SMA13A	13	14.4	1	21.5	18.6	2.5	RG
1SMA15A	15	16.7	1	24.4	16.4	2.5	RM
1SMA16A	16	17.8	1	26.0	15.4	2.5	RP
1SMA17A	17	18.9	1	27.6	14.5	2.5	RR
1SMA18A	18	20	1	29.2	13.7	2.5	RT
1SMA20A	20	22.2	1	32.4	12.3	2.5	RV
1SMA22A	22	24.4	1	35.5	11.3	2.5	RX
1SMA24A	24	26.7	1	38.9	10.3	2.5	RZ
1SMA26A	26	28.9	1	42.1	9.5	2.5	SE
1SMA28A	28	31.1	1	45.4	8.8	2.5	SG
1SMA30A	30	33.3	1	48.4	8.3	2.5	SK
1SMA33A	33	36.7	1	53.3	7.5	2.5	SM
1SMA36A	36	40	1	58.1	6.9	2.5	SP
1SMA40A	40	44.4	1	64.5	6.2	2.5	SR
1SMA43A	43	47.8	1	69.4	5.8	2.5	ST
1SMA45A	45	50	1	72.2	5.5	2.5	SV
1SMA48A	48	53.3	1	77.4	5.2	2.5	SX
1SMA54A	54	60	1	87.1	4.6	2.5	TE
1SMA58A	58	64.4	1	93.6	4.8	2.5	TG
1SMA70A	70	77.8	1	113.0	3.5	2.5	TP

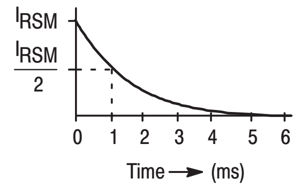
1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.
4. 1/2 sine wave (or equivalent square pulse, PW = 8.3 ms, duty cycle = 4 pulses per minute.

TVS – in Surface Mount (continued)

Table 6. 1SMA Series Bidirectional Zener Overvoltage Transient Suppressors; 400 Watts Peak Power @ 1 ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

SMA
CASE 403B
PLASTIC



Surge Current Characterisitcs

Device	Working Peak Reverse Voltage V_{RWM} (Volts) (Note 1)	Breakdown Voltage		Maximum Reverse Voltage @ I_{RSM} (Clamping Voltage) V_C (Volts)	Maximum Reverse Surge Current I_{PP} (Amps) (Note 3)	Maximum Reverse Leakage @ V_{RWM} I_R (μA)	Device Marking
		V_{BR} Volts (Min) (Note 2)	I_T mA				
1SMA10CA	10	11.1	1	17.0	23.5	2.5	QXC
1SMA13CA	13	14.4	1	21.5	18.6	2.5	RGC
1SMA15CA	15	16.7	1	24.4	16.4	2.5	RMC
1SMA16CA	16	17.8	1	26.0	15.4	2.5	RPC
1SMA18CA	18	20	1	29.2	13.7	2.5	RTC
1SMA20CA	20	22.2	1	32.4	12.3	2.5	RVC
1SMA24CA	24	26.7	1	38.9	10.3	2.5	RZC
1SMA26CA	26	28.9	1	42.1	9.5	2.5	SEC
1SMA30CA	30	33.3	1	48.4	8.3	2.5	SKC
1SMA33CA	33	36.7	1	53.3	7.5	2.5	SMC
1SMA36CA	36	40	1	58.1	6.9	2.5	SPC
1SMA40CA	40	44.4	1	64.5	6.2	2.5	SRC
1SMA48CA	48	53.3	1	77.4	5.2	2.5	SXC
1SMA58CA	58	64.4	1	93.6	4.3	2.5	TGC
1SMA60CA	60	66.7	1	96.8	4.1	2.5	TKC
1SMA70CA	70	77.8	1	113.0	3.5	2.5	TPC
1SMA78CA	78	86.7	1	126.0	3.2	2.5	TSC

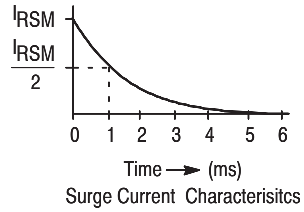
1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.

TVS – in Surface Mount (continued)

Table 7. 1SMB Series Unidirectional Overvoltage Transient Suppressors; 600 Watts Peak Power @ 1ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (V_F = 3.5 V Max @ I_F = 30 A) (Note 4)

SMB
CASE 403A
PLASTIC



Device	Working Peak Reverse Voltage V_{RWM} Volts (Note 1)	Breakdown Voltage V_{BR} @ I_T Volts (Min) (Note 2)	mA	Maximum Clamping Voltage V_C @ I_{pp} Volts	Peak Pulse Current I_{pp} Amps (Note 3)	Maximum Reverse Leakage @ V_R I_R μA	Device Marking
1SMB5.0A	***5.0***	***6.40***	***10***	***9.2***	***65.2***	***800***	***KE***
1SMB6.0A	***6.0***	***6.67***	***10***	***10.3***	***58.3***	***800***	***KG***
1SMB6.5A	6.5	7.22	10	11.2	53.6	500	KK
1SMB7.0A	7.0	7.78	10	12.0	50.0	200	KM
1SMB7.5A	7.5	8.33	1.0	12.9	46.5	100	KP
1SMB8.0A	8.0	8.89	1.0	13.6	44.1	50	KR
1SMB8.5A	8.5	9.44	1.0	14.4	41.7	10	KT
1SMB9.0A	9.0	10.0	1.0	15.4	39.0	5.0	KV
1SMB10A	10	11.1	1.0	17.0	35.3	5.0	KX
1SMB11A	11	12.2	1.0	18.2	33.0	5.0	KZ
1SMB12A	12	13.3	1.0	19.9	30.2	5.0	LE
1SMB13A	13	14.4	1.0	21.5	27.9	5.0	LG
1SMB14A	14	15.6	1.0	23.2	25.8	5.0	LK
1SMB15A	15	16.7	1.0	24.4	24.0	5.0	LM
1SMB16A	16	17.8	1.0	26.0	23.1	5.0	LP
1SMB17A	17	18.9	1.0	27.6	21.7	5.0	LR
1SMB18A	18	20.0	1.0	29.2	20.5	5.0	LT
1SMB20A	20	22.2	1.0	32.4	18.5	5.0	LV
1SMB22A	***22***	***24.4***	***1.0***	***35.5***	***16.9***	***5.0***	***LX***
1SMB24A	24	26.7	1.0	38.9	15.4	5.0	LZ
1SMB26A	26	28.9	1.0	42.1	14.2	5.0	ME
1SMB28A	28	31.1	1.0	45.4	13.2	5.0	MG
1SMB30A	30	33.3	1.0	48.4	12.4	5.0	MK
1SMB33A	33	36.7	1.0	53.3	11.3	5.0	MM
1SMB36A	36	40.0	1.0	58.1	10.3	5.0	MP
1SMB40A	40	44.4	1.0	64.5	9.3	5.0	MR
1SMB43A	43	47.8	1.0	69.4	8.6	5.0	MT
1SMB45A	45	50.0	1.0	72.7	8.3	5.0	MV
1SMB48A	48	53.3	1.0	77.4	7.7	5.0	MX
1SMB51A	51	56.7	1.0	82.4	7.3	5.0	MZ
1SMB54A	54	60.0	1.0	87.1	6.9	5.0	NE
1SMB58A	***58***	***64.4***	***1.0***	***93.6***	***6.4***	***5.0***	***NG***
1SMB60A	60	66.7	1.0	96.8	6.2	5.0	NK
1SMB64A	64	71.1	1.0	103	5.8	5.0	NM
1SMB70A	70	77.8	1.0	113	5.3	5.0	NP
1SMB75A	75	83.3	1.0	121	4.9	5.0	NR
1SMB85A	85	94.4	1.0	137	4.4	5.0	NV
1SMB90A	90	100	1.0	146	4.1	5.0	NX
1SMB100A	100	111	1.0	162	3.7	5.0	NZ

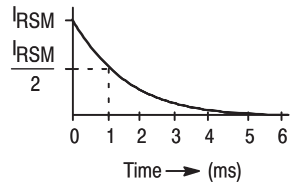
1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.
4. 1/2 sine wave (or equivalent square pulse, PW = 8.3 ms, duty cycle = 4 pulses per minute.

Devices listed in **bold**, ***italic*** are ON Semiconductor preferred devices.

TVS – in Surface Mount (continued)

Table 7. 1SMB Series Unidirectional Overvoltage Transient Suppressors; 600 Watts Peak Power @ 1ms Surge (10 x 1000 μs) (continued)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (V_F = 3.5 V Max @ I_F = 30 A) (Note 4)

Device	Working Peak Reverse Voltage V_{RWM} Volts (Note 1)	Breakdown Voltage V_{BR} @ I_T Volts (Min) (Note 2)	Breakdown Voltage V_{BR} @ I_T mA	Maximum Clamping Voltage V_C @ I_{pp} Volts	Peak Pulse Current I_{pp} Amps (Note 3)	Maximum Reverse Leakage @ V_R I_R μA	Device Marking
		SMB CASE 403A PLASTIC					
1SMB110A	110	122	1.0	177	3.4	5.0	PE
1SMB120A	120	133	1.0	193	3.1	5.0	PG
1SMB130A	130	144	1.0	209	2.9	5.0	PK
1SMB150A	150	167	1.0	243	2.5	5.0	PM
1SMB160A	160	178	1.0	259	2.3	5.0	PP
1SMB170A	170	189	1.0	275	2.2	5.0	PR

1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.
4. 1/2 sine wave (or equivalent square pulse, PW = 8.3 ms, duty cycle = 4 pulses per minute.

TVS – in Surface Mount (continued)

Table 8. 1SMB Series Bidirectional Overvoltage Transient Suppressors; 600 Watts Peak Power @ 1ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted).

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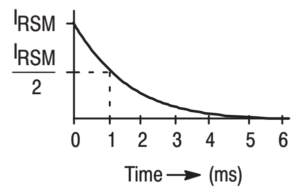
CASE 403A
PLASTIC



Surge Current Characterisitcs

Device	Working Peak Reverse Voltage V_{RWM} Volts (Note 1)	Breakdown Voltage V_{BR} @ I_T Volts (Min) (Note 2)	Breakdown Voltage V_{BR} @ I_T mA	Maximum Clamping Voltage V_C @ I_{pp} Volts	Peak Pulse Current I_{pp} Amps (Note 3)	Maximum Reverse Leakage @ V_R I_R μA	Device Marking
1SMB10CA	10	11.1	1.0	17.0	35.3	5.0	KXC
1SMB11CA	11	12.2	1.0	18.2	33.0	5.0	KZC
1SMB12CA	12	13.3	1.0	19.9	30.2	5.0	LEC
1SMB13CA	13	14.4	1.0	21.5	27.9	5.0	LGC
1SMB14CA	14	15.6	1.0	23.2	25.8	5.0	LKC
1SMB15CA	***15***	***16.7***	***1.0***	***24.4***	***24.0***	***5.0***	***LMC***
1SMB16CA	16	17.8	1.0	26.0	23.1	5.0	LPC
1SMB17CA	17	18.9	1.0	27.6	21.7	5.0	LRC
1SMB18CA	18	20.0	1.0	29.2	20.5	5.0	LTC
1SMB20CA	20	22.2	1.0	32.4	18.5	5.0	LVC
1SMB22CA	22	24.4	1.0	35.5	16.9	5.0	LXC
1SMB24CA	24	26.7	1.0	38.9	15.4	5.0	LZC
1SMB26CA	26	28.9	1.0	42.1	14.2	5.0	MEC
1SMB28CA	28	31.1	1.0	45.4	13.2	5.0	MGC
1SMB30CA	30	33.3	1.0	48.4	12.4	5.0	MKC
1SMB33CA	33	36.7	1.0	53.3	11.3	5.0	MMC
1SMB36CA	36	40.0	1.0	58.1	10.3	5.0	MPC
1SMB40CA	40	44.4	1.0	64.5	9.3	5.0	MRC
1SMB43CA	43	47.8	1.0	69.4	8.6	5.0	MTC
1SMB45CA	45	50.0	1.0	72.7	8.3	5.0	MVC
1SMB48CA	48	53.3	1.0	77.4	7.7	5.0	MXC
1SMB51CA	51	56.7	1.0	82.4	7.3	5.0	MZC
1SMB54CA	54	60.0	1.0	87.1	6.9	5.0	NEC
1SMB58CA	58	64.4	1.0	93.6	6.4	5.0	NGC
1SMB60CA	60	66.7	1.0	96.8	6.2	5.0	NKC
1SMB64CA	64	71.1	1.0	103	5.8	5.0	NMC
1SMB75CA	75	83.3	1.0	121	4.9	5.0	NRC

1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.

Devices listed in **bold**, ***italic*** are ON Semiconductor preferred devices.

TVS – in Surface Mount (continued)

Table 9. P6SMB Series Unidirectional Overvoltage Transient Suppressors; 600 Watts Peak Power @ 1 ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (V_F = 3.5 V Max, I_F = 50 A for all types) (Note 4)

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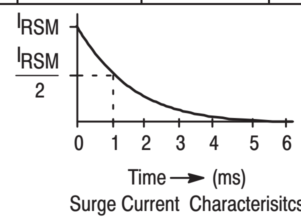


Device	Breakdown Voltage V_{BR} @ I_T Volts (Note 2) Min	Nom	Max	mA	Working Peak Reverse Voltage V_{RWM} Volts (Note 1)	Maximum Reverse Leakage @ V_{RWM} I_R μA	Maximum Reverse Surge Current I_{PP} Amps (Note 3)	Maximum Reverse Voltage @ I_{PP} (Clamping Voltage) V_C Volts	Maximum Temperature Coefficient of V_{BR} %/°C	Device Marking
P6SMB6.8A	***6.45***	***6.8***	***7.14***	***10***	***5.8***	***1000***	***57***	***10.5***	***0.057***	***6V8A***
P6SMB7.5A	***7.13***	***7.5***	***7.88***	***10***	***6.4***	***500***	***53***	***11.3***	***0.061***	***7V5A***
P6SMB8.2A	7.79	8.2	8.61	10	7.02	200	50	12.1	0.065	8V2A
P6SMB9.1A	8.65	9.1	9.55	1	7.78	50	45	13.4	0.068	9V1A
P6SMB10A	***9.5***	***10***	***10.5***	***1***	***8.55***	***10***	***41***	***14.5***	***0.073***	***10A***
P6SMB12A	11.4	12	12.6	1	10.2	5	36	16.7	0.078	12A
P6SMB13A	***12.4***	***13***	***13.7***	***1***	***11.1***	***5***	***33***	***18.2***	***0.081***	***13A***
P6SMB15A	***14.3***	***15***	***15.8***	***1***	***12.8***	***5***	***28***	***21.2***	***0.084***	***15A***
P6SMB16A	***15.2***	***16***	***16.8***	***1***	***13.6***	***5***	***27***	***22.5***	***0.086***	***16A***
P6SMB18A	***17.1***	***18***	***18.9***	***1***	***15.3***	***5***	***24***	***25.2***	***0.088***	***18A***
P6SMB20A	***19***	***20***	***21***	***1***	***17.1***	***5***	***22***	***27.7***	***0.09***	***20A***
P6SMB22A	***20.9***	***22***	***23.1***	***1***	***18.8***	***5***	***20***	***30.6***	***0.092***	***22A***
P6SMB24A	22.8	24	25.2	1	20.5	5	18	33.2	0.094	24A
P6SMB27A	***25.7***	***27***	***28.4***	***1***	***23.1***	***5***	***16***	***37.5***	***0.096***	***27A***
P6SMB30A	***28.5***	***30***	***31.5***	***1***	***25.6***	***5***	***14.4***	***41.4***	***0.097***	***30A***
P6SMB33A	31.4	33	34.7	1	28.2	5	13.2	45.7	0.098	33A
P6SMB36A	***34.2***	***36***	***37.8***	***1***	***30.8***	***5***	***12***	***49.9***	***0.099***	***36A***
P6SMB39A	***37.1***	***39***	***41***	***1***	***33.3***	***5***	***11.2***	***53.9***	***0.1***	***39A***
P6SMB43A	40.9	43	45.2	1	36.8	5	10.1	59.3	0.101	43A
P6SMB47A	44.7	47	49.4	1	40.2	5	9.3	64.8	0.101	47A
P6SMB51A	***48.5***	***51***	***53.6***	***1***	***43.6***	***5***	***8.6***	***70.1***	***0.102***	***51A***
P6SMB56A	53.2	56	58.8	1	47.8	5	7.8	77	0.103	56A
P6SMB62A	58.9	62	65.1	1	53	5	7.1	85	0.104	62A
P6SMB68A	64.6	68	71.4	1	58.1	5	6.5	92	0.104	68A
P6SMB75A	71.3	75	78.8	1	64.1	5	5.8	103	0.105	75A
P6SMB82A	77.9	82	86.1	1	70.1	5	5.3	113	0.105	82A
P6SMB91A	86.5	91	95.5	1	77.8	5	4.8	125	0.106	91A
P6SMB100A	95	100	105	1	85.5	5	4.4	137	0.106	100A
P6SMB110A	105	110	116	1	94	5	4	152	0.107	110A
P6SMB120A	114	120	126	1	102	5	3.6	165	0.107	120A
P6SMB130A	124	130	137	1	111	5	3.3	179	0.107	130A
P6SMB150A	143	150	158	1	128	5	2.9	207	0.108	150A
P6SMB160A	***152***	***160***	***168***	***1***	***136***	***5***	***2.7***	***219***	***0.108***	***160A***
P6SMB180A	171	180	189	1	154	5	2.4	246	0.108	180A
P6SMB200A	190	200	210	1	171	5	2.2	274	0.108	200A

Devices listed in **bold**, ***italic*** are ON Semiconductor preferred devices.

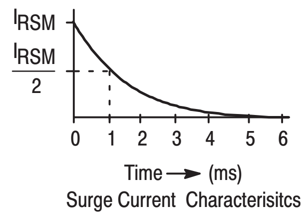
1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.
4. 1/2 sine wave (or equivalent square pulse, PW = 8.3 ms, duty cycle = 4 pulses per minute.

TVS – in Surface Mount (continued)

Table 10. P6SMB Series Bidirectional Overvoltage Transient Suppressors; 600 Watts Peak Power @ 1 ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

SMB
CASE 403A
PLASTIC



Device	Breakdown Voltage V_{BR} @ I_T Volts (Note 2)				Working Peak Reverse Voltage V_{RWM} Volts (Note 1)	Maximum Reverse Leakage @ V_{RWM} I_R μA	Maximum Reverse Surge Current I_{PP} Amps (Note 3)	Maximum Reverse Voltage @ I_{PP} (Clamping Voltage) V_C Volts	Maximum Temperature Coefficient of V_{BR} %/°C	Device Marking
	Min	Nom	Max	mA						
P6SMB11CA	10.5	11	11.6	1	9.4	5	38	15.6	0.075	11C
P6SMB12CA	11.4	12	12.6	1	10.2	5	36	16.7	0.078	12C
P6SMB15CA	14.3	15	15.8	1	12.8	5	28	21.2	0.084	15C
P6SMB16CA	15.2	16	16.8	1	13.6	5	27	22.5	0.086	16C
P6SMB18CA	17.1	18	18.9	1	15.3	5	24	25.2	0.088	18C
P6SMB20CA	19	20	21	1	17.1	5	22	27.7	0.09	20C
P6SMB22CA	20.9	22	23.1	1	18.8	5	20	30.6	0.092	22C
P6SMB24CA	22.8	24	25.2	1	20.5	5	18	33.2	0.094	24C
P6SMB27CA	25.7	27	28.4	1	23.1	5	16	37.5	0.096	27C
P6SMB30CA	28.5	30	31.5	1	25.6	5	14.4	41.4	0.097	30C
P6SMB33CA	***31.4***	***33***	***34.7***	***1***	***28.2***	***5***	***13.2***	***45.7***	***0.098***	***33C***
P6SMB36CA	34.2	36	37.8	1	30.8	5	12	49.9	0.099	36C
P6SMB39CA	37.1	39	41	1	33.3	5	11.2	53.9	0.1	39C
P6SMB43CA	40.9	43	45.2	1	36.8	5	10.1	59.3	0.101	43C
P6SMB47CA	44.7	47	49.4	1	40.2	5	9.3	64.8	0.101	47C
P6SMB51CA	48.5	51	53.6	1	43.6	5	8.6	70.1	0.102	51C
P6SMB56CA	53.2	56	58.8	1	47.8	5	7.8	77	0.103	56C
P6SMB62CA	58.9	62	65.1	1	53	5	7.1	85	0.104	62C
P6SMB68CA	64.6	68	71.4	1	58.1	5	6.5	92	0.104	68C
P6SMB82CA	77.9	82	86.1	1	70.1	5	5.3	113	0.105	82C

1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.

Devices listed in **bold**, ***italic*** are ON Semiconductor preferred devices.

TVS – in Surface Mount (continued)

Table 11. SMBJ12AON Series Bidirectional Overvoltage Transient Suppressors; 600 Watts Peak Power @ 1 ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Device	Breakdown Voltage V_{BR} @ I_T Volts (Note 2)				Working Peak Reverse Voltage V_{RWM} Volts (Note 1)	Maximum Reverse Leakage @ V_{RWM} I_R μA	Maximum Reverse Surge Current I_{PP} Amps (Note 3)	Maximum Reverse Voltage @ I_{PP} (Clamping Voltage) V_C Volts
	Min	Nom	Max	mA				
SMBJ12AON	13.2	13.75	14.3	1	12	5	17.5	15.6

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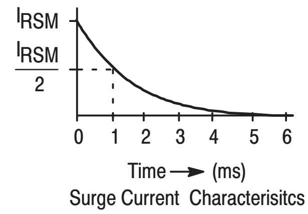
CASE 403A
PLASTIC

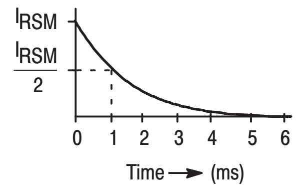


1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.

TVS – in Surface Mount (continued)

Table 12. 1SMC Series Unidirectional Overvoltage Transient Suppressors; 1500 Watts Peak Power @ 1 ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (V_F = 3.5 V Max @ I_F = 100 A) (Note 4)

Device	Working Peak Reverse Voltage V_R Volts (Note 1)	Breakdown Voltage V_{BR} @ I_T Volts (Min) (Note 2)	Breakdown Voltage V_{BR} @ I_T mA	Maximum Clamping Voltage V_C @ I_{pp} Volts	Peak Pulse Current I_{pp} Amps (Note 3)	Maximum Reverse Leakage @ V_R I_R μA	Device Marking
	SMC CASE 403B PLASTIC			 Surge Current Characterisitcs			
1SMC5.0A	5.0	6.40	10	9.2	163.0	1000	GDE
1SMC6.0A	6.0	6.67	10	10.3	145.6	1000	GDG
1SMC6.5A	6.5	7.22	10	11.2	133.9	500	GDK
1SMC7.0A	7.0	7.78	10	12.0	125.0	200	GDM
1SMC7.5A	7.5	8.33	1.0	12.9	116.3	100	GDP
1SMC8.0A	8.0	8.89	1.0	13.6	110.3	50	GDR
1SMC9.0A	9.0	10.0	1.0	15.4	97.4	10	GDV
1SMC10A	10	11.1	1.0	17.0	88.2	5.0	GDX
1SMC12A	12	13.3	1.0	19.9	75.3	5.0	GEE
1SMC13A	13	14.4	1.0	21.5	69.7	5.0	GEG
1SMC14A	14	15.6	1.0	23.2	64.7	5.0	GEK
1SMC15A	15	16.7	1.0	24.4	61.5	5.0	GEM
1SMC16A	16	17.8	1.0	26.0	57.7	5.0	GEP
1SMC17A	17	18.9	1.0	27.6	53.3	5.0	GER
1SMC18A	18	20.0	1.0	29.2	51.4	5.0	GET
1SMC20A	20	22.2	1.0	32.4	46.3	5.0	GEV
1SMC22A	22	24.4	1.0	35.5	42.2	5.0	GEX
1SMC24A	24	26.7	1.0	38.9	38.6	5.0	GEZ
1SMC26A	26	28.9	1.0	42.1	35.6	5.0	GFE
1SMC28A	28	31.1	1.0	45.4	33.0	5.0	GFG
1SMC30A	30	33.3	1.0	48.4	31.0	5.0	GFK
1SMC33A	33	36.7	1.0	53.3	28.1	5.0	GFM
1SMC36A	36	40.0	1.0	58.1	25.8	5.0	GFP
1SMC40A	40	44.4	1.0	64.5	23.2	5.0	GFR
1SMC43A	43	47.8	1.0	69.4	21.6	5.0	GFT
1SMC48A	48	53.3	1.0	77.4	19.4	5.0	GFX
1SMC51A	51	56.7	1.0	82.4	18.2	5.0	GFZ
1SMC54A	54	60.0	1.0	87.1	17.2	5.0	GGE
1SMC58A	***58***	***64.4***	***1.0***	***93.6***	***16.0***	***5.0***	***GGG***
1SMC60A	60	66.7	1.0	96.8	15.5	5.0	GGK
1SMC64A	64	71.1	1.0	103	14.6	5.0	GGM
1SMC70A	70	77.8	1.0	113	13.3	5.0	GGP
1SMC75A	75	83.3	1.0	121	12.4	5.0	GGR
1SMC78A	78	86.7	1.0	126	11.4	5.0	GGT

1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.
4. 1/2 sine wave (or equivalent square pulse, PW = 8.3 ms, duty cycle = 4 pulses per minute.

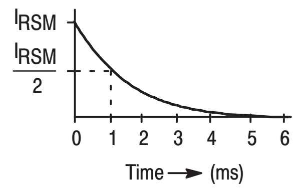
Devices listed in **bold**, ***italic*** are ON Semiconductor preferred devices.

TVS – in Surface Mount (continued)

Table 13. 1.5 SMC Series Unidirectional Overvoltage Transient Suppressors; 1500 Watts Peak Power @ 1 ms Surge (10 x 1000 μs)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (V_F = 3.5 V Max, I_F = 100 A for all types) (Note 4)

SMC
CASE 403
PLASTIC



Surge Current Characterisitcs

Device	Breakdown Voltage V_{BR} @ I_T Volts (Note 2) Min	Nom	Max	mA	Working Peak Reverse Voltage V_{RWM} Volts (Note 1)	Maximum Reverse Leakage @ V_{RWM} I_R μA	Maximum Reverse Surge Current I_{PP} Amps (Note 3)	Maximum Reverse Voltage @ I_{PP} (Clamping Voltage) V_C Volts	Maximum Temperature Coefficient of V_{BR} %/°C	Device Marking
1.5SMC6.8A	6.45	6.8	7.14	10	5.8	1000	143	10.5	0.057	6V8A
1.5SMC7.5A	7.13	7.5	7.88	10	6.4	500	132	11.3	0.061	7V5A
1.5SMC10A	9.5	10	10.5	1	8.55	10	103	14.5	0.073	10A
1.5SMC12A	11.4	12	12.6	1	10.2	5	90	16.7	0.078	12A
1.5SMC13A	12.4	13	13.7	1	11.1	5	82	18.2	0.081	13A
1.5SMC15A	***14.3***	***15***	***15.8***	***1***	***12.8***	***5***	***71***	***21.2***	***0.084***	***15A***
1.5SMC16A	15.2	16	16.8	1	13.6	5	67	22.5	0.086	16A
1.5SMC18A	17.1	18	18.9	1	15.3	5	59.5	25.2	0.088	18A
1.5SMC20A	19	20	21	1	17.1	5	54	27.7	0.09	20A
1.5SMC22A	20.9	22	23.1	1	18.8	5	49	30.6	0.092	22A
1.5SMC24A	***22.8***	***24***	***25.2***	***1***	***20.5***	***5***	***45***	***33.2***	***0.094***	***24A***
1.5SMC27A	25.7	27	28.4	1	23.1	5	40	37.5	0.096	27A
1.5SMC30A	28.5	30	31.5	1	25.6	5	36	41.4	0.097	30A
1.5SMC33A	***31.4***	***33***	***34.7***	***1***	***28.2***	***5***	***33***	***45.7***	***0.098***	***33A***
1.5SMC36A	***34.2***	***36***	***37.8***	***1***	***30.8***	***5***	***30***	***49.9***	***0.099***	***36A***
1.5SMC39A	***37.1***	***39***	***41***	***1***	***33.3***	***5***	***28***	***53.9***	***0.1***	***39A***
1.5SMC43A	***40.9***	***43***	***45.2***	***1***	***36.8***	***5***	***25.3***	***59.3***	***0.101***	***43A***
1.5SMC47A	***44.7***	***47***	***49.4***	***1***	***40.2***	***5***	***23.2***	***64.8***	***0.101***	***47A***
1.5SMC51A	48.5	51	53.6	1	43.6	5	21.4	70.1	0.102	51A
1.5SMC56A	53.2	56	58.8	1	47.8	5	19.5	77	0.103	56A
1.5SMC62A	58.9	62	65.1	1	53	5	17.7	85	0.104	62A
1.5SMC68A	64.6	68	71.4	1	58.1	5	16.3	92	0.104	68A
1.5SMC75A	***71.3***	***75***	***78.8***	***1***	***64.1***	***5***	***14.6***	***103***	***0.105***	***75A***
1.5SMC82A	77.9	82	86.1	1	70.1	5	13.3	113	0.105	82A
1.5SMC91A	86.5	91	95.5	1	77.8	5	12	125	0.106	91A

1. A transient suppressor is normally selected according to the Working Peak Reverse Voltage (V_{RWM}) which should be equal to or greater than the DC or continuous peak operating voltage level.
2. V_{BR} measured at pulse test current I_T at ambient temperature of 25°C.
3. 10 x 1000 μs exponential decay surge waveform.
4. 1/2 sine wave (or equivalent square pulse, PW = 8.3 ms, duty cycle = 4 pulses per minute.

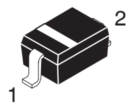
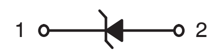
Devices listed in **bold**, ***italic*** are ON Semiconductor preferred devices.

TVS/ESD Protection – One Line

SD05 Series

Table 14. Single Line TVS/ESD in SOD–323; 350 Watts Peak Power (8 x 20 μs); Meets IEC61000–4–2, Level 4

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
UNIDIRECTIONAL

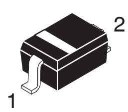
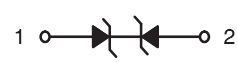
Device	Breakdown Voltage				Reverse Voltage Working Peak V_{RWM} (Volts)	Max Reverse Leakage Current I_R (μA)	Max Reverse Surge Current I_{PP} (A)	Max Reverse Voltage @ I_{PP} (Clamping Voltage) V_C (V)	Typical Capacitance (pF) Pin 1 to 2 @ 0 Volts
	V_{BR} (Note 5) (V)			@ I_T (mA)					
	Min	Nom	Max						
	CASE 477 STYLE 1 SOD–323								
SD05	6.2	6.75	7.3	1.0	5.0	10	24	14.5	350
SD12	13.3	14.5	15.75	1.0	12	1.0	15	25	150

5. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

SD12C

Table 15. Single Line TVS/ESD in SOD–323; 350 Watts Peak Power (8 x 20 μs); Meets IEC61000–4–2, Level 4

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
BIDIRECTIONAL

Device	Breakdown Voltage				Reverse Voltage Working Peak V_{RWM} (Volts)	Max Reverse Leakage Current I_R (μA)	Max Reverse Surge Current I_{PP} (A)	Max Reverse Voltage @ I_{PP} (Clamping Voltage) V_C (V)	Typical Capacitance (pF) Pin 1 to 2 @ 0 Volts
	V_{BR} (Note 6) (V)			@ I_T (mA)					
	Min	Nom	Max						
	CASE 477 STYLE 1 SOD–323								
SD12C	13.3	–	–	1.0	12	1.0	15	24	64

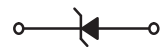
6. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

TVS/ESD Protection – One Line (continued)

ESD5Z Series

Table 16. Single Line TVS/ESD in SOD–523; 200 Watts Peak Power (8 x 20 μs); Meets IEC61000–4–2, Level 4

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
UNIDIRECTIONAL

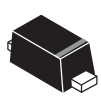
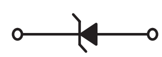
Device	Breakdown Voltage V_{BR} (Note 7) (V) Min	Nom	Max	@ I_T (mA)	Reverse Voltage Working Peak V_{RWM} (Volts)	Max Reverse Leakage Current I_R (μA)	Max Reverse Surge Current I_{PP} (A)	Max Reverse Voltage @ I_{PP} (Clamping Voltage) V_C (V)	Typical Capacitance (pF) Pin 1 to 2 @ 0 Volts
 2 1	CASE 502 SOD–523				1  2				
ESD5Z2.5	4.0	–	–	1.0	2.5	6.0	11	10.9	145
ESD5Z3.3	5.0	–	–	1.0	3.3	0.05	11.2	14.1	105
ESD5Z5.0	6.2	–	–	1.0	5.0	0.05	9.4	18.6	80
ESD5Z6.0	6.8	–	–	1.0	6.0	0.01	8.8	20.5	70
ESD5Z7.0	7.5	–	–	1.0	7.0	0.01	8.8	22.7	65
ESD5Z12	14.1	–	–	1.0	12	0.01	9.6	25	55

7. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

μESD Series

Table 17. Single Line TVS/ESD in SOD–723; 100 Watts Peak Power (8 x 20 μs); Meets IEC61000–4–2, Level 4

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
UNIDIRECTIONAL

Device	Breakdown Voltage V_{BR} (V) @ I_T (Note 8) Min	Nom	Max	@ I_T (mA)	Reverse Voltage Working Peak V_{RWM} (V)	Max Reverse Leakage Current I_R (μA)	Max Reverse Surge Current I_{PP} (A)	Max Reverse Voltage @ I_{PP} (Clamping Voltage) V_C (V)	Typical Capacitance (pF) Pin 1 to 2 @ 0 Volts
	CASE 509AA SOD–723				1  2				
μESD3.3S	5.0	–	–	1.0	3.3	2.5	10.4	10.9	80
μESD5.0S	6.2	–	–	1.0	5.0	1.0	8.8	13.3	65
μESD12S	13.5	–	–	1.0	12	1.0	5.4	23.7	30

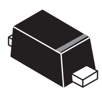
8. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

TVS/ESD Protection – One Line (continued)

ESD9X Series

Table 18. Single Line TVS/ESD in SOD–923; 100 Watts Peak Power (8 x 20 μs); Meets IEC61000–4–2, Level 4

ELECTRICAL CHARACTERISTICS **(T_A = 25°C unless otherwise noted)**
UNIDIRECTIONAL

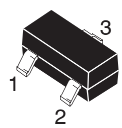
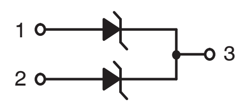
	Breakdown Voltage								
	V_{BR} (V) @ I_T (Note 9)				Reverse Voltage Working Peak	Max Reverse Leakage Current	Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Typical Capacitance (pF) Pin 1 to 2
Device	Min	Nom	Max	@ I_T (mA)	V_{RWM} (V)	I_R (μA)	I_{PP} (A)	V_C (V)	@ 0 Volts
 CASE 514AA SOD–923 									
ESD9X3.3S	5.0	–	–	1.0	3.3	2.5	9.8	10.4	80
ESD9X5.0S	6.2	–	–	1.0	5.0	1.0	8.7	13.3	65
ESD9X12S	13.5	–	–	1.0	12	1.0	5.9	23.7	30

9. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

NUP1105L – LIN Bus Protector

Table 19. Single Line TVS/ESD in SOT–23; 350 Watts Peak Power (8 x 20 μs); Meets IEC61000–4–2, Level 4

ELECTRICAL CHARACTERISTICS **(T_A = 25°C unless otherwise noted)**
BIDIRECTIONAL

	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
Device	Min	Nom	Max	(mA)	(μA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	(8x20 μsec) (Note 10)
 CASE 318 STYLE 27 SOT–23 											
NUP1105L	25.7	–	28.4	1.0	0.1	24	–	30	8.0	44	350

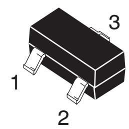
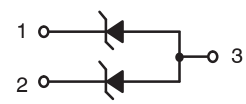
10. Surge waveform 8 x 20 μsec.

TVS/ESD Protection − Two Line

SM05 − Common Anode Series

Table 20. Two Line TVS/ESD in SOT−23; 300 Watts Peak Power (8 x 20 μs); Meets IEC61000−4−2, Level 4

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
UNIDIRECTIONAL

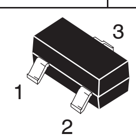
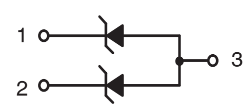
Device	Breakdown Voltage V_{BR} (Note 11) (V) Min	Nom	Max	@ I_T (mA)	Reverse Voltage Working Peak V_{RWM} (Volts)	Max Reverse Leakage Current I_R (μA)	Max Reverse Surge Current I_{PP} (A)	Max Reverse Voltage @ I_{PP} (Clamping Voltage) V_C (V)	Typical Capacitance (pF) Pin 1 to 3 @ 0 Volts
	CASE 318 STYLE 12 LOW PROFILE SOT−23 PLASTIC								
SM05	6.2	6.75	7.3	1.0	5.0	10	17	9.8	225
SM12	13.3	14.5	15.75	1.0	12	1.0	12	19	95

11. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

MA3075WAL

Table 21. Two Line TVS/ESD in SOT−23; Meets IEC61000−4−2, Level 4

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
UNIDIRECTIONAL
(V_F = 0.9 V Max @ I_F = 10 mA)

Device	Breakdown Voltage V_{BR} (Note 12) (V) Min	Nom	Max	@ I_T (mA)	Max Reverse Leakage Current I_R (μA @ 5 V)	Maximum Temperature Coefficient of V_{BR} (mV/°C)
	CASE 318 STYLE 12 LOW PROFILE SOT−23 PLASTIC					
MA3075WAL	7.2	7.5	7.9	5.0	1.0	5.3

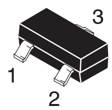
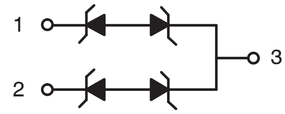
12. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

TVS/ESD Protection – Two Line (continued)

NUP2105L – CAN Bus Protector

Table 22. Two Line TVS/ESD in SOT−23; 350 Watts Peak Power (8 x 20 μs); Meets IEC61000−4−2, Level 4

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
BIDIRECTIONAL

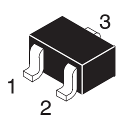
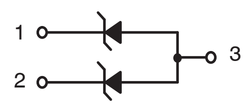
Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 μsec) (Note 13)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}			I_{PP}	V_C	
	Min	Nom	Max	(mA)	(μA)	(V)	Typ	Max	(A)	(V)	Watts
			CASE 318 SOT−23								
NUP2105L	26.2	–	32	1.0	0.1	24	30	–	8.0	44	350

13. Surge waveform 8 x 20 μsec.

DF3A6.8FU

Table 23. Two Line TVS/ESD in SC−70; 150 Watts Peak Power (8 x 20 μs); Meets IEC61000−4−2, Level 4

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
UNIDIRECTIONAL
(V_F = 0.9 V Max @ I_F = 10 mA)

Device	Breakdown Voltage				Max Reverse Leakage Current		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)
	V_{BR} (Note 14) (V)			@ I_T (mA)	I_R @ (μA)	V_R (V)	I_{PP} (A)	V_C (V)
	Min	Nom	Max					
			CASE 419 SC−70 (SOT−323)					
DF3A6.8FU	6.4	6.8	7.2	5.0	0.5	5.0	2.0	9.6

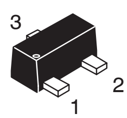
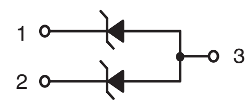
14. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

TVS/ESD Protection − Two Line (continued)

NZL5V6AXV Series

Table 24. Two Line ESD Protection in SC−89; Meets IEC61000−4−2, Level 4

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
UNIDIRECTIONAL
(V_F = 0.9 V Max @ I_F = 10 mA)

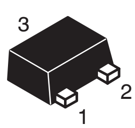
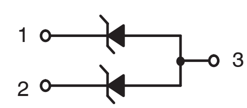
Device	Breakdown Voltage				Max Reverse Leakage Current	
	V_{BR} (Note 15) (V)			@ I_T (mA)	I_R (µA)	@ V_R (V)
	Min	Nom	Max			
	CASE 463C SC−89					
NZL5V6AXV3	5.32	5.6	5.88	5.0	5.0	3.0
NZL6V8AXV3	6.46	6.8	7.14	5.0	1.0	4.5
NZL7V5AXV3	7.12	7.5	7.88	5.0	1.0	5.0

15. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

µESD3.3D Series

Table 25. Two Line ESD Protection in SOT−723; Meets IEC61000−4−2, Level 4

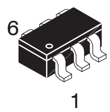
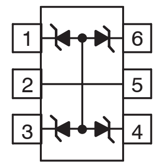
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)
UNIDIRECTIONAL
(V_F = 0.9 V Max @ I_F = 10 mA)

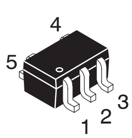
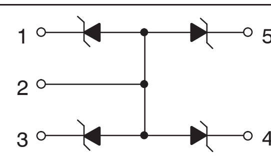
Device	Breakdown Voltage				Max Reverse Leakage Current I_R (µA) @ V_{RWM}
	V_{BR} (Note 16) (V)			@ I_T (mA)	
	Min	Nom	Max		
	CASE 631AA STYLE 4 SOT−723				
µESD3.3D	5.0	–	–	1.0	1.0
µESD5.0D	6.2	–	–	1.0	0.1
µESD6.0D	7.0	–	–	1.0	0.1

16. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

TVS/ESD Protection − Four Line

Table 26. Four Line TVS/ESD Protection; Meets IEC61000−4−2, Level 4

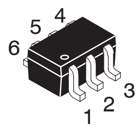
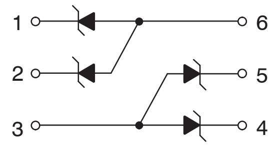
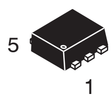
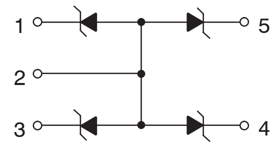
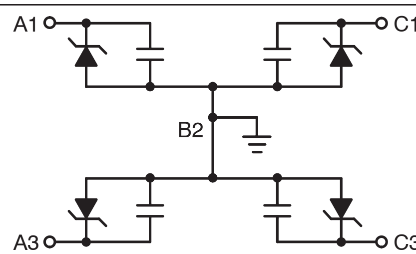
	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec) (Note 17)
	V_{BR} (V)			@ I_T	I_R	V_{RWM}					
Device	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
					CASE 318F STYLE 1 SC−74 PLASTIC						
MMQA5V6	5.32	5.6	5.88	1.0	2.0	3.0	257	–	3.0	8.0	150
MMQA6V2	5.89	6.2	6.51	1.0	0.7	4.0	225	–	2.66	9.0	150
MMQA6V8	6.46	6.8	7.14	1.0	0.5	4.3	210	–	2.45	9.8	150
MMQA12V	11.4	12	12.6	1.0	0.075	9.1	117	–	1.39	17.3	150
MMQA13V	12.4	13	13.7	1.0	0.075	9.8	108	–	1.29	18.6	150
MMQA15V	14.3	15	15.8	1.0	0.075	11	93	–	1.1	21.7	150
MMQA18V	17.1	18	18.9	1.0	0.075	14	77	–	0.923	26	150
MMQA20V	19	20	21	1.0	0.075	15	69	–	0.84	28.6	150
MMQA22V	20.9	22	23.1	1.0	0.075	17	63	–	0.758	31.7	150
MMQA24V	22.8	24	25.2	1.0	0.075	18	58	–	0.694	34.6	150
MMQA27V	25.7	27	28.4	1.0	0.075	21	50	–	0.615	39	150
MMQA30V	28.5	30	31.5	1.0	0.075	23	40	–	0.554	43.3	150
MMQA33V	31.4	33	34.7	1.0	0.075	25	42	–	0.504	48.6	150
SMS05	6.0	–	7.2	1.0	20	5.0	300	400	23	15.5	350
SMS12	13.3	–	15	1.0	1.0	12	120	150	15	23	350
SMS15	16.7	–	18.5	1.0	1.0	15	100	125	12	29	350
SMS24	26.7	–	32	1.0	1.0	24	60	75	8.0	44	350

					CASE 419A SC−88A (SOT−353)						
MSQA6V1W5	6.1	6.6	7.2	1.0	1.0	3.0	90	–	–	–	150
SMF05	6.0	–	7.2	1.0	5.0	5.0	90	–	12	12.5	200

17. Surge waveform 8 x 20 µsec.

TVS/ESD Protection − Four Line (continued)

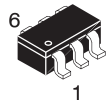
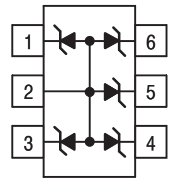
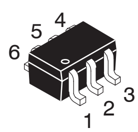
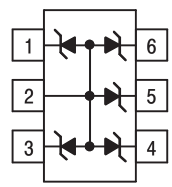
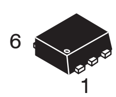
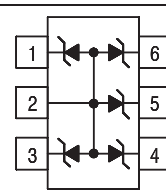
Table 26. Four Line TVS/ESD Protection; Meets IEC61000−4−2, Level 4 (continued)

Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec) (Note 18)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
				CASE 419B SC−88 (SOT−363)							
DF6A6.8FU	6.4	6.8	7.2	1.0	1.0	5.0	40	–	7.0	11.4	75
				CASE 463B SOT−553							
NZQA5V6XV5	5.32	5.6	5.88	1.0	1.0	3.0	90	–	10	10.5	100
NZQA6V2XV5	5.89	6.2	6.51	1.0	0.5	4.0	80	–	9.0	11.5	100
NZQA6V8XV5	6.46	6.8	7.14	1.0	0.1	4.3	70	–	8.0	12.5	100
				CASE 766AB 5 PIN FLIP−CHIP CSP							
NUP4103FC	6.0	7.0	8.0	1.0	0.1	3.3	47	–	–	–	–

18. Surge waveform 8 x 20 µsec.

TVS/ESD Protection − Five Line

Table 27. Five Line TVS/ESD Protection; Meets IEC61000−4−2, Level 4

Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 μsec) (Note 19)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(μA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
					**CASE 318F STYLE 1 SC−74 PLASTIC**						
SMS05C	6.2	–	7.2	1.0	5.0	5.0	260	–	24	14.5	350
SMS12C	13.3	–	15	1.0	1.0	12	120	–	15	23	350
SMS15C	17	–	19	1.0	1.0	15	95	–	12	29	350
SMS24C	26.7	–	32	1.0	1.0	24	60	–	8.0	44	350
					**CASE 419B SC−88 (SOT−363)**						
SMF05C	6.2	–	7.2	1.0	5.0	5.0	80	–	8.0	12.5	100
SMF12C	13.3	–	15	1.0	1.0	12	40	–	6.0	23	100
SMF15C	17	–	19	1.0	1.0	15	33	–	5.0	29	100
SMF24C	26.7	–	32	1.0	1.0	24	21	–	2.5	44	100
					**CASE 463A SOT−563**						
NUP5120X6	6.2	6.8	7.2	1.0	0.5	3.0	54	–	–	–	90

19. Surge waveform 8 x 20 μsec.

Low Capacitance TVS/ESD Protection − One Line

SL05 Series

Table 28. Single Line Low Cap TVS/ESD in SOT−23; 300 Watts Peak Power (8 x 20 µs); Meets IEC61000−4−2, Level 4

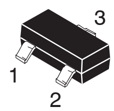
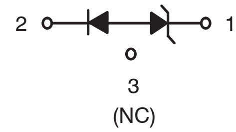
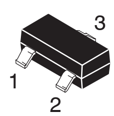
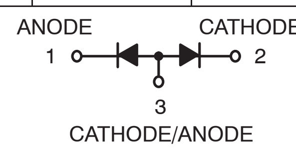
Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
			**CASE 318 STYLE 26 SOT−23**								
SL05	6.0	–	8.0	1.0	20	5.0	3.5	5.0	17	11	300
SL15	16.7	–	18.5	1.0	1.0	15	3.5	5.0	10	30	300
SL24	26.7	–	29	1.0	1.0	24	3.5	5.0	5.0	55	300

Table 29. Meets IEC61000−4−2, Level 4

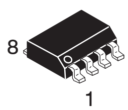
Device	Breakdown Voltage		Forward Voltage		Capacitance* (pF) @ 0 V, 1.0 MHz	
	V_{BR} (V)	@ I_{br}	V_f (V)	I_f		
	Min	µA	Max	mA	Typ	Max
		**CASE 318 SOT−23**				
USB 2.0						
NUP1301ML3	70	100	0.855	10	–	0.9

*C_j = Between I/O pin and ground.

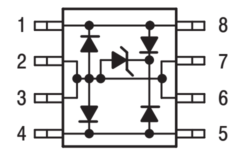
Low Capacitance TVS/ESD Protection − Two Line

Table 30. Two Line Low Cap TVS/ESD Protection; Meets IEC61000−4−2, Level 4

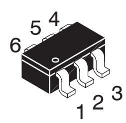
Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance* (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
Device	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts



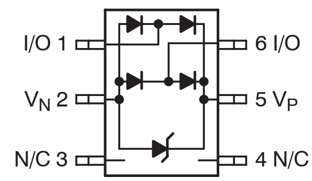
CASE 751
SO−8



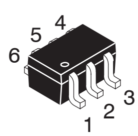
USB 1.1											
LC03−6	6.8	–	–	1.0	20	5.0	16	25	50	15	2000



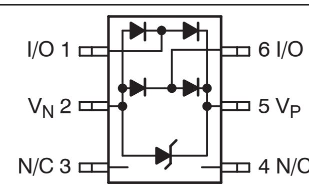
CASE 318G
TSOP−6



USB 2.0											
NUP2201MR6	6.0	–	–	1.0	5.0	5.0	3.0	5.0	25	20	500



CASE 419B
SC−88
(SOT−363)

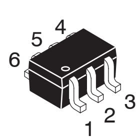


USB 2.0											
NUP2202W1	6.0	–	–	1.0	5.0	5.0	3.0	5.0	28	20	500

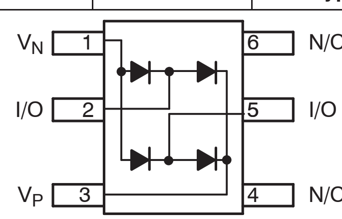
*C_j = Between I/O pin and ground.

Table 31. Meets IEC61000−4−2, Level 4

Device	Breakdown Voltage		Forward Voltage		Capacitance* (pF) @ 0 V, 1.0 MHz	
	V_{BR} (V)	@ I_{br}	V_f (V)	I_f		
Device	Min	µA	Max	mA	Typ	Max



CASE 419B
SC−88

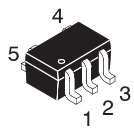
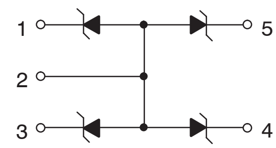
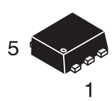
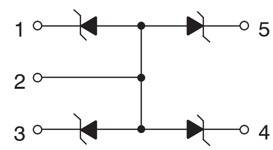


USB 2.0						
NUP2301MW6	70	100	0.855	10	1.6	3.0

*C_j = Between I/O pin and ground.

Low Capacitance TVS/ESD Protection − Four Line

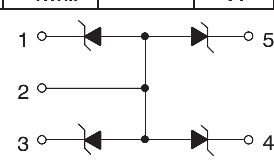
Table 32. Four Line Low Cap TVS/ESD Protection; Meets IEC61000−4−2, Level 4

Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance* (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec) (Note 20)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
 CASE 419A SC−88A (SOT−353) 											
NSQA6V8AW5	6.4	6.8	7.1	1.0	1.0	5.0	12	15	1.6	13	20
NSQA12VAW5	11.4	12	12.7	5.0	0.05	9.0	7.0	15	0.9	23	20
 CASE 463B SOT−553 											
NZQA5V6AXV5	5.3	5.6	5.9	1.0	1.0	3.0	13	17	1.6	13	20
NZQA6V8AXV5	6.1	6.8	7.2	1.0	1.0	4.3	12	15	1.6	13	20

*C_j = Between I/O pin and ground.

20. Surge waveform 8 x 20 µsec.

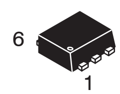
Table 33. Four Line Low Cap TVS/ESD Protection in SOT−953; Meets IEC61000−4−2, Level 4

Device	Breakdown Voltage V_{BR} @ 1.0 mA (Volts)			Leakage Current I_{RM} @ V_{RM}		Typ Capacitance @ 0 V Bias (pF)		Typ Capacitance @ 3.0 V Bias (pF)	
	Min	Nom	Max	V_{RWM}	I_{RWM} (µA)	Typ	Max	Typ	Max
 CASE 527AB SOT−953 									
NUP45V6P5	5.3	5.6	5.9	3.0	1.0	13	17	7.0	11.5
NUP46V8P5	6.47	6.8	7.14	4.3	1.0	12	15	6.7	9.5
NUP412VP5	11.4	12	12.7	9.0	1.0	6.5	10	3.5	5.0

Low Capacitance TVS/ESD Protection − Four Line (continued)

Table 34. Four Line Low Cap TVS/ESD Protection in SOT−563; Meets IEC61000−4−2, Level 4

	Breakdown Voltage (D_1, D_2, and D_3)				Breakdown Voltage (V_{CC})				Working Peak Reverse Voltage (D_1, D_2, and D_3)	Max Reverse Leakage Current (D_1, D_2, and D_3)		Max Reverse Leakage Current (V_{CC})		Capacitance (pF) @ 3.0 V, 1.0 MHz		Peak Power Rating (8x20 µsec) (D_1, D_2, and D_3)	Peak Power Rating (8x20 µsec) (V_{CC})
		V_{BR} (V)		@ I_T		V_{BR} (V)		@ I_T	V_{RWM}	I_R	V_{RWM}	I_R	V_R				
Device	Min	Nom	Max	(mA)	Min	Nom	Max	(mA)	(V)	(µA)	(V)	(µA)	(V)	Typ	Max	Watts	(mW)
NUP4060AXV6	6.2	6.8	7.2	1.0	15.3	16	17.1	5.0	5.0	0.5	3.0	0.05	11	7.0	10	20	200



CASE 463A
SOT−563

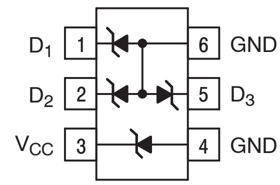
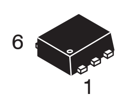
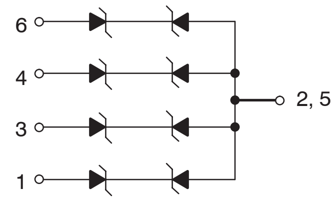


Table 35. Four Line Low Cap Bidirectional TVS/ESD Protection in SOT−563; Meets IEC61000−4−2, Level 4

	Breakdown Voltage				Max Reverse Leakage Current		Capacitance* (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec)
		V_{BR} (V)		@ I_T	nA	V_{RWM}					
Device	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
NUP4102XV6	13.6	–	17.8	1.0	100	12	13	15	3.0	25	75



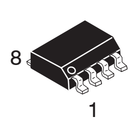
CASE 463A
SOT−563



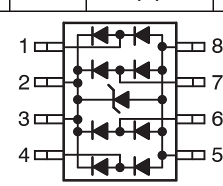
*C_j = Between I/O pin and ground.

Table 36. Four Line Low Cap TVS/ESD Protection; Meets IEC61000−4−2, Level 4

	Breakdown Voltage				Max Reverse Leakage Current		Capacitance* (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
Device	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
USB 2.0											
NUP4201DR2	6.0	–	–	1.0	10	5.0	5.0	10	10	12	500
SRDA05−4R2	6.0	–	–	1.0	10	5.0	10	15	10	12	500



CASE 751
SO−8

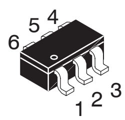


*C_j = Between I/O pin and ground.

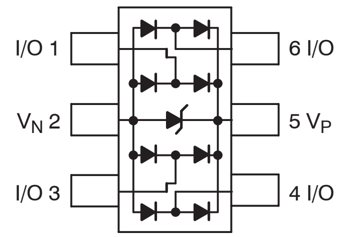
Low Capacitance TVS/ESD Protection − Four Line (continued)

Table 36. Four Line Low Cap TVS/ESD Protection; Meets IEC61000−4−2, Level 4 (continued)

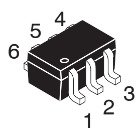
Device	Breakdown Voltage				Max Reverse Leakage Current		Capacitance* (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 μsec)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}			I_{PP} (A)	V_C (V)	
	Min	Nom	Max	(mA)	(μA)	(V)	Typ	Max			Watts



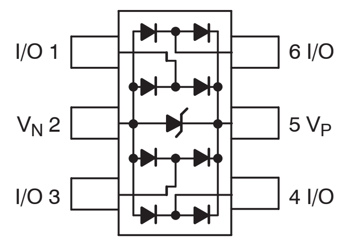
CASE 318G
TSOP−6



Device	Min	Nom	Max	(mA)	(μA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
USB 2.0											
NUP4201MR6	6.0	–	–	1.0	5.0	5.0	3.0	5.0	25	20	500



CASE 419B
SC−88 (SOT−363)

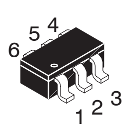


Device	Min	Nom	Max	(mA)	(μA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
USB 2.0											
NUP4202W1	6.0	–	–	1.0	5.0	5.0	3.0	5.0	28	20	500

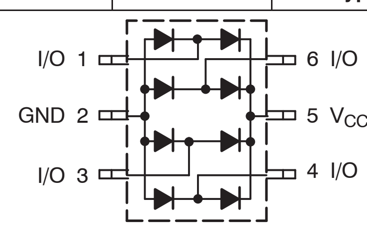
*C_j = Between I/O pin and ground.

Table 37. Four Line Low Cap TVS/ESD Protection; Meets IEC61000−4−2, Level 4

Device	Breakdown Voltage		Forward Voltage		Capacitance* (pF) @ 0 V, 1.0 MHz	
	V_{BR} (V)	@ I_{br}	V_f (V)	I_f		
	Min	μA	Max	mA	Typ	Max



CASE 318G
TSOP−6

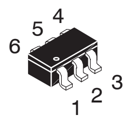
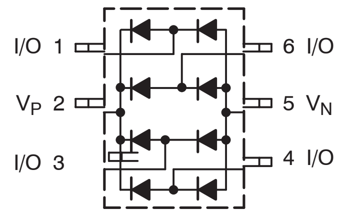


Device	Min	μA	Max	mA	Typ	Max
USB 2.0						
NUP4301MR6	70	100	0.855	10	1.6	3.0

*C_j = Between I/O pin and ground.

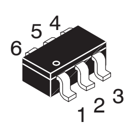
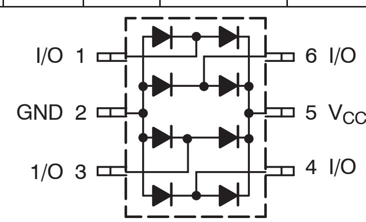
Low Capacitance TVS/ESD Protection − Four Line (continued)

Table 37. Four Line Low Cap TVS/ESD Protection; Meets IEC61000−4−2, Level 4 (continued)

	Breakdown Voltage		Forward Voltage		Capacitance* (pF) @ 0 V, 1.0 MHz	
	V_{BR} (V)	@ I_{br}	V_f (V)	I_f		
Device	**Min**	**µA**	**Max**	**mA**	**Typ**	**Max**
	**CASE 318F TSOP−6**					
USB 2.0						
NUP4304MR6	70	100	0.855	10	1.6	3.0

*C_j = Between I/O pin and ground.

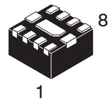
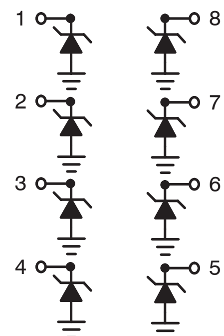
Table 38. Four Line Low Cap TVS/ESD Protection; Meets IEC61000−4−2, Level 4

	Breakdown Voltage				Max Reverse Leakage Current		Capacitance* (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
Device	**Min**	**Nom**	**Max**	**(mA)**	**(µA)**	**(V)**	**Typ**	**Max**	**I_{PP} (A)**	**V_C (V)**	**Watts**
	**CASE 318G TSOP−6**										
USB 2.0											
NUP4302MR6	30	–	–	0.1	30	–	–	28	–	–	–

*C_j = Between I/O pin and ground.

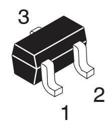
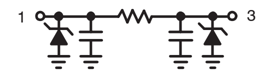
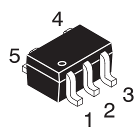
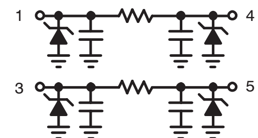
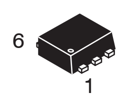
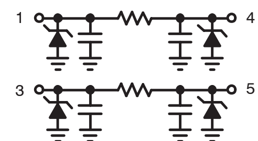
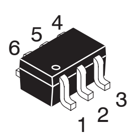
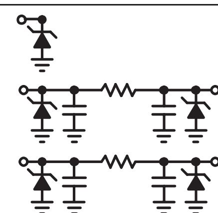
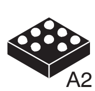
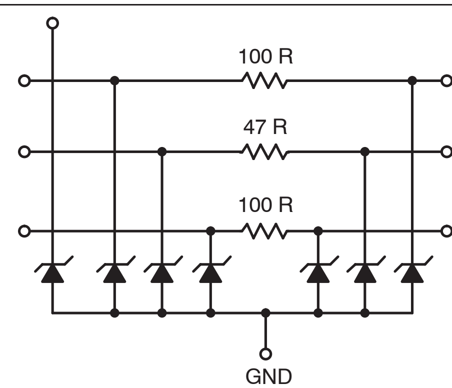
Low Capacitance TVS/ESD Protection − Eight Line

Table 39. . Eight Line Low Cap TVS/ESD Protection; Meets IEC61000−4−2, Level 4

	Breakdown Voltage				Max Reverse Leakage Current		Capacitance* (pF) @ 0 V, 1.0 MHz		Max Reverse Surge Current	Max Reverse Voltage @ I_{PP} (Clamping Voltage)	Peak Power Rating (8x20 µsec)
		V_{BR} (V)		@ I_T	I_R	V_{RWM}					
Device	Min	Nom	Max	(mA)	(µA)	(V)	Typ	Max	I_{PP} (A)	V_C (V)	Watts
	CASE 506AK DFN8										
NUP8010MN	5.3	5.6	5.9	1.0	1.0	3.3	13	17	1.6	13	20

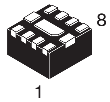
*C_j = Between I/O pin and ground.

Data Line Filters

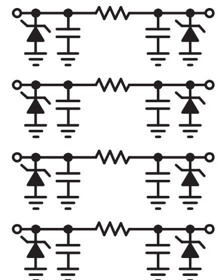
Device	V_{BR} (V)		I_R(μA)	V_{RWM}	C_{diode} (pF) @ 2.5 V (Note 21)	Resistor	
	Typ	Max	Max		Typ	Typ	Max
	CASE 463 SC−75 PLASTIC						
NZF220T	7.0	8.0	1.0	3.0	10	100	110
	CASE 419A SC−88A						
NZF220DF	7.0	8.0	1.0	3.0	7.5	100	110
	CASE 463A SOT−563						
NUF2220XV6	7.0	–	1.0	5.0	7.0	100	115
NUF2230XV6	7.0	–	1.0	5.0	16	100	110
	CASE 419B SC−88						
NUF2240W1	7.0	–	1.0	5.0	17	100	115
	CASE 499AG−01 FLIP−CHIP						
NUF3101FC	7.0	8.0	0.1	3.0	15	100	120

21. Line capacitance is 2x the diode capacitance (C_{diode}).

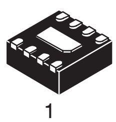
Data Line Filters (continued)



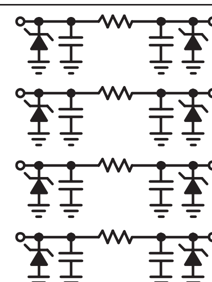
CASE 517AK
DFN8
(1.6 x 1.6 x 0.85 mm)



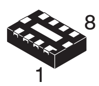
Device	V_{BR} (V) Typ	V_{BR} (V) Max	I_R(μA) Max	@V_{RWM} (V)	C_{diode} (pF) @ 2.5 V (Note 22) Typ	Resistor Typ	Resistor Max
NUF4402MN	7.0	8.0	0.1	5.0	12	100	115
NUF4403MN	7.0	8.0	0.1	5.0	17	100	115
NUF4210MN	7.0	8.0	0.1	5.0	8.5	100	115



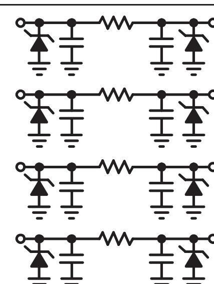
CASE 506AA
DFN8
(2.0 x 2.0 x 0.85 mm)



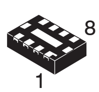
NUF4401MN	7.0	8.0	0.1	5.0	15	200	230



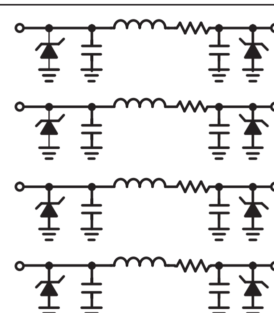
CASE 517AD
UDFN8
(1.2 x 1.8 0.5 mm)



NUF4001MU	7.0	8.0	0.1	5.0	12	100	115



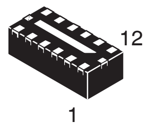
CASE 517AD
UDFN8
(1.2 x 1.8 0.5 mm)



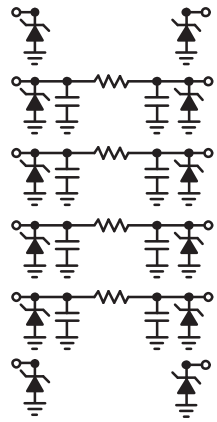
NUF4152MU	7.0	8.0	0.1	5.0	20	25	30

22. Line capacitance is 2x the diode capacitance (C_{diode}).

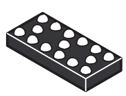
Data Line Filters (continued)



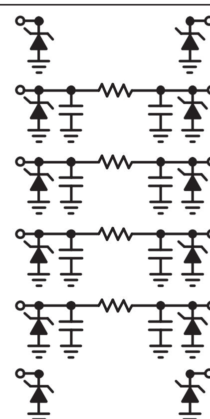
CASE 506AD
DFN12
(1.35 x 3.0 x 0.85 mm)



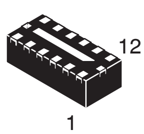
Device	V_{BR} (V) Typ	V_{BR} (V) Max	I_R (μA) Max	@V_{RWM} (V)	C_{diode} (pF) @ 2.5 V (Note 23) Typ	Resistor Typ	Resistor Max
NUF6402MN	7.0	8.0	1.0	5.0	17	100	115



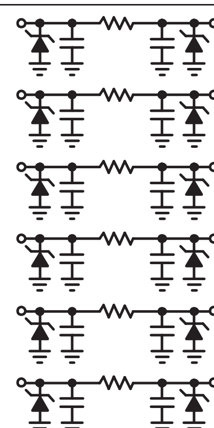
CASE 499D
FLIP–CHIP
300 μm Bumps
(1.35 x 3.0 x 0.65 mm)



Device	V_{BR} (V) Typ	V_{BR} (V) Max	I_R (μA) Max	@V_{RWM} (V)	C_{diode} (pF) @ 2.5 V (Note 23) Typ	Resistor Typ	Resistor Max
NUF4105FC	7.0	8.0	0.1	3.3	23	100	120



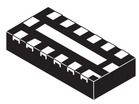
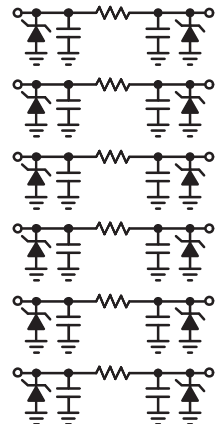
CASE 506AD
DFN12
(1.35 x 3.0 x 0.85 mm)

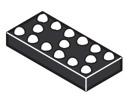
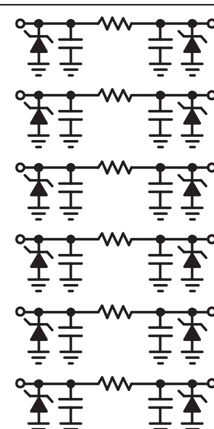


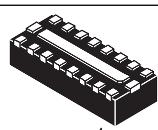
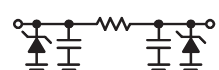
Device	V_{BR} (V) Typ	V_{BR} (V) Max	I_R (μA) Max	@V_{RWM} (V)	C_{diode} (pF) @ 2.5 V (Note 23) Typ	Resistor Typ	Resistor Max
NUF6401MN	7.0	–	1.0	5.0	17	100	115
NUF6406MN	7.0	–	1.0	5.0	12	100	115

23. Line capacitance is 2x the diode capacitance (C_{diode}).

Data Line Filters (continued)

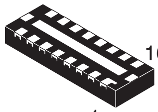
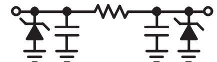
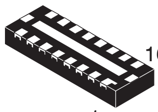
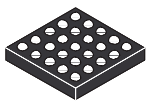
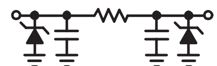
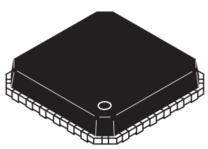
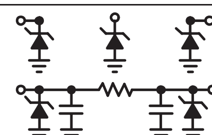
Device	V_{BR} (V)		I_R(μA)	@V_{RWM} (V)	C_{diode} (pF) @ 2.5 V (Note 24)	Resistor	
	Typ	Max	Max		Typ	Typ	Max
 12 1	CASE 517AE UDFN12 (1.2 x 2.5 x 0.5 mm)						
NUF6001MU	7.0	–	1.0	5.0	17	100	115

	CASE 499D FLIP−CHIP 300 μm Bumps (1.35 x 3.0 x 0.65 mm)						
NUF6106FC	7.0	8.0	0.1	3.3	10	100	120
NUF6105FC	7.0	8.0	0.1	3.3	23	100	120

 16 1	CASE 507AC DFN16 (1.6 x 4.0 x 0.85 mm)				 1 of 8 Filter Lines		
NUF8401MN	7.0	8.0	0.1	5.0	12	100	115
NUF8402MN	7.0	8.0	0.1	3.3	17	100	115
NUF8410MN	7.0	8.0	0.1	5.0	8.5	100	115

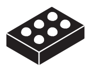
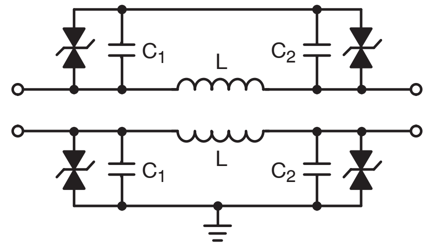
24. Line capacitance is 2x the diode capacitance (C_{diode}).

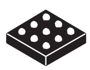
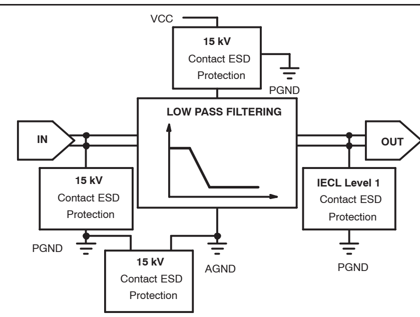
Data Line Filters (continued)

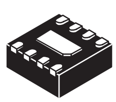
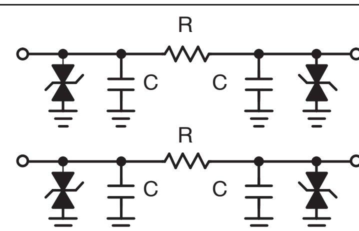
Device	V_{BR} (V)		I_R(μA)	@V_{RWM} (V)	C_{diode} (pF) @ 2.5 V (Note 25)	Resistor	
	Typ	Max	Max		Typ	Typ	Max
 16 1	CASE 517AF UDFN16 (1.2 x 3.5 x 0.5 mm)				 1 of 8 Filter Lines		
NUF8001MU	7.0	8.0	0.1	5.0	12	100	115
 16 1	CASE 517AF UDFN16 (1.2 x 3.5 x 0.5 mm)				 1 of 8 Filter Lines		
NUF8152MU	7.0	8.0	0.1	5.0	20	25	30
 A1	CASE 499G FLIP−CHIP CSP (2.64 x 2.64 x 0.65 mm)				 1 of 10 Filter Lines		
NUF9001FC	7.0	8.0	0.1	5.0	15	200	230
NUF9002FC	7.0	8.0	0.1	5.0	10	100	115
	CASE 485F 24 PIN MLF				 1 of 9 Filter Lines		
NZMM7V0T4	7.0	8.0	0.1	3.0	10	100	110

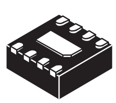
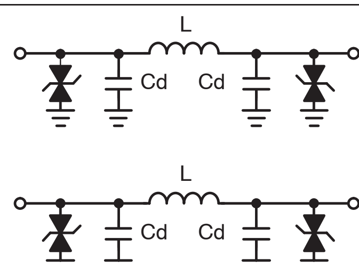
25. Line capacitance is 2x the diode capacitance (C_{diode}).

Audio Filters

Device	V_{BR} (V)		I_R(μA)	@V_{RWM} (V)	C_{diode} (pF) @ 2.5 V (Note 26)	Resistor	
	Typ	Max	Max		Typ	Typ	Max
 A1	CASE 499J FLIP–CHIP			 Typical L = 2.9 nH			
NUF2441FC	14.5	17.7	0.1	12	100	0.28	0.35

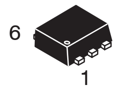
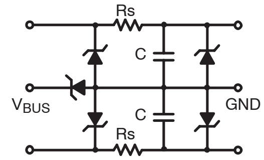
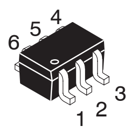
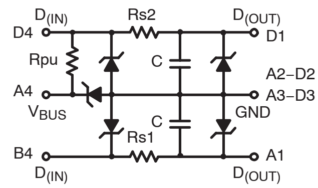
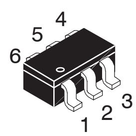
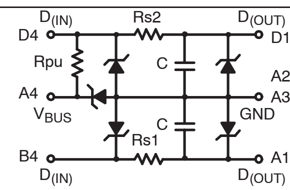
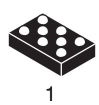
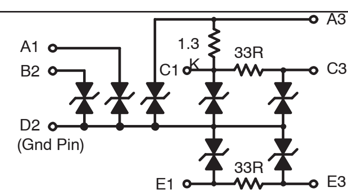
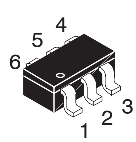
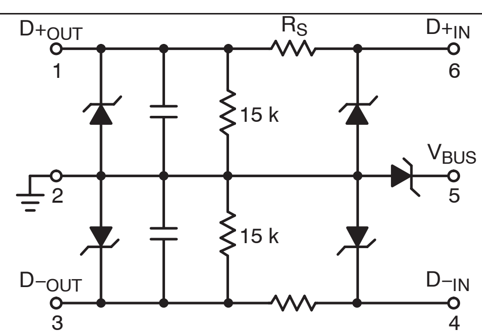
Device	V_{BR} Typ (V)	V_{BR} Max (V)	I_R Max (μA)	@V_{RWM} (V)	C_{diode} Typ (pF)	Resistor Typ	Resistor Max
 A1	CASE 499AE FLIP–CHIP						
NMF3000FC	12	–	0.5	10	500	950	1100

Device	V_{BR} Typ (V)	V_{BR} Max (V)	I_R Max (μA)	@V_{RWM} (V)	C_{diode} Typ (pF)	Resistor Typ	Resistor Max
 1	CASE 506AA DFN8						
NUF2114MN	15.7	17.7	0.1	12	60	8.4	10
NUF2116MN	15.7	17.7	0.01	12	50	64	75

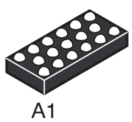
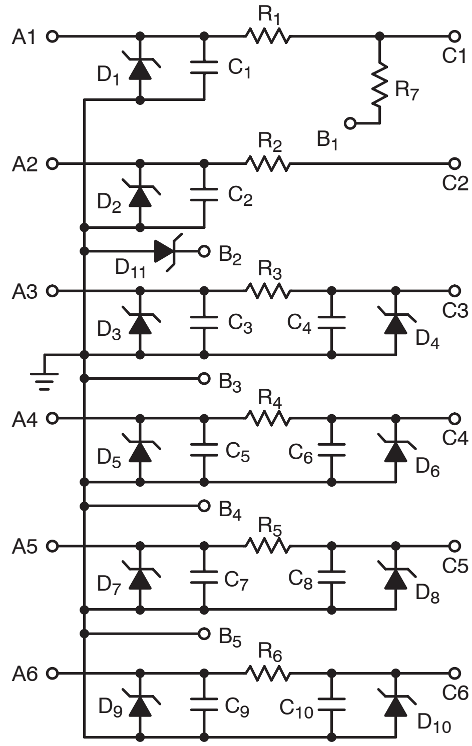
Device	V_{BR} Typ (V)	V_{BR} Max (V)	I_R Max (μA)	@V_{RWM} (V)	C_{diode} Typ (pF)	Resistor Typ	Resistor Max
 1	CASE 506AA DFN8			 Typical L = 10 nH			
NUF2070MN	15.7	17.7	0.1	12	64	2.4	3.5

26. Line capacitance is 2x the diode capacitance.

Data Line Filters

Device	V_{BR} (V)		I_R(μA)	V_{RWM}	C_{line} (pF) @ 2.5 V	Resistor	
	Typ	Max	Max		Typ	Typ	Max
		CASE 463A SOT−563					
NUF2030XV6	6.8	8.0	0.1	5.25	30	22	26.4
NUF2042XV6	6.8	8.0	0.1	5.25	42	22	26.4
		CASE 419B SC−88 (SOT−363)					
NUF2015W1	6.8	8.0	0.1	5.25	42	15	18
NUF2221W1	6.8	8.0	0.1	5.25	42	22	26.4
		CASE 318G TSOP−6					
STF202−22	7.0	8.0	5.0	5.25	57	22	24
		CASE 499AM FLIP−CHIP					
NUF2222FC	7.8	8.8	0.1	5.0	34	33	38
		CASE 318G STYLE 10 TSOP−6					
NUF2101M	7.0	8.0	1.0	5.25	46	30	33.7

Data Line Filters (continued)

Device	V_{BR} (V)		I_R(μA)	@V_{RWM} (V)	C_{line} (pF) @ 2.5 V	Resistor	
	Typ	Max	Max		Typ	Typ	Max
	**CASE 499AD FLIP−CHIP CSP**						
NUF4107FC (Pin A1 to C1, Pin A2 to C2)	7.0	8.0	0.1	5.25	36	22	26
NUF4107FC (Pin A3 to C3, Pin A4 to C4, Pin A5 to C5, Pin A6 to C6)	7.0	8.0	0.1	5.25	60	100	120

Clock and Data Management

Clock and Data Management

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In Brief...

Advanced clock management devices from ON Semiconductor deliver superior performance by providing the lowest skew and lowest jitter with the highest operating frequencies.

ON Semiconductor offers a complete family of Phase Lock Loop (PLL) based products for applications ranging from low cost portable MP3 players, to massive, mission critical servers. Our oscillator replacement ICs offer performance rivaling crystal oscillator solutions at a fraction of the cost, and our new Zero Delay Buffer family is one of the most complete in the industry. Lastly, ON Semiconductor has a series of EMI Suppression Clocks that utilize spread spectrum to minimize the peak electromagnetic interference emissions in consumer products.

This portfolio of products makes designing any low skew, high frequency clock tree an easy task with a large range of clock **distribution, generation** and **skew management** devices. We address the needs of today's systems whether operating at 2.5 V, 3.3 V or legacy systems at 5.0 V or −5.2 V.

ON Semiconductor's High Performance Data Management products are designed into state−of−the−art systems such as communication and networking switches, high−end servers, engineering workstations, high−density memory modules, storage networks and precision test and measurement systems.

While our ECLinPS™ families serve the market well at frequencies up to 6.0 GHz, GigaComm™ family of silicon germanium products enables safe and reliable design up to 12 GHz. GigaComm delivers the performance necessary for high frequency applications, while maintaining the manufacturability and price point required for cost−effective volume production.

SIGNAL TRANSLATORS (Specifications are at 25°C unless otherwise stated)

Device(s)	From	To	Voltage	# of Channels	Freq. (Typ) MHz	Prop. Delay (Typ) ps	Tr & Tf (Max) ps	Package
MC100EL90	LVNECL/NECL	PECL	3.3/5	3	650	500	500	SO–20
MC100EL91	LVPECL/PECL	NECL	3.3/5	3	700	670	400	SO–20
MC100ELT20	TTL	PECL	5	1	100 MHz (min)*	1200	1500	SO–8/TSSOP–8
MC100ELT21	PECL	TTL	5	1	TBD	5500	750 (10%–90%)	SO–8/TSSOP–8
MC100ELT22	TTL	PECL	5	2	100 MHz (min)*	1200	1600	SO–8/TSSOP–8
MC100ELT23	PECL	TTL	5	2	100	3500	1600 (10%–90%)	SO–8/TSSOP–8
MC100ELT24	TTL	NECL	5	1	400	950	1250	SO–8/TSSOP–8
MC100ELT25	NECL	TTL	5/–5.2	1	100	3300*	2300 (10%–90%)	SO–8/TSSOP–8
MC100ELT28	PECL to TTL & TTL to PECL (Dual)	PECL to TTL & TTL to PECL (Dual)	5	2	100	3500 PECL–to–TTL/ 1200 TTL–to–PECL	1500	SO–8/TSSOP–8
MC100EP90	LVNECL/NECL	LVPECL/PECL	0.66	3	>3000	260	180	SO–20
MC100EPT20	LVTTL/LVCMOS	LVPECL	3.3	1	>1000	370	180	SO–8/TSSOP–8
MC100EPT21	LVPECL	LVTTL	3.3	1	350	1400	600/900 (0.8–2.0 V)	SO–8/TSSOP–8
MC100EPT22	LVTTL/LVCMOS	LVPECL	3.3	2	1100	420	220	SO–8/TSSOP–8
MC100EPT23	LVPECL	LVTTL	3.3	2	350	1500	600/900 (0.8–2.0 V)	SO–8/TSSOP–8
MC100EPT24	LVTTL/LVCMOS	LVPECL	3.3	1	>1000	530	180	SO–8/TSSOP–8
MC100EPT25	LVNECL/NECL	LVTTL	3.3/–3.3 to –5.2	1	275	1100	1100/1400 (0.8–2.0 V)	SO–8/TSSOP–8
MC100EPT26	LVPECL	LVTTL	3.3	1	275	1500	900	SO–8/TSSOP–8
MC100EPT622	LVTTL/LVCMOS	PECL (10–Bit)	3.3	1	1500	450	250	LQFP–32
MC100LVEL90	LVNECL/NECL	LVPECL	0.66	3	650	500	500	SO–20
MC100LVEL91	LVPECL/PECL	LVNECL	3.3/5	3	600	620	580	
MC100LVEL92	PECL	LVPECL	3.3/5	3	600	610	580	SO–20
MC100LVELT22	LVTTL/LVCMOS	LVPECL	3.3	2	100 MHz (min)*	350	500	SO–8/TSSOP–8
MC100LVELT23	LVPECL	LVTTL	3.3	2	>180	1700	600/900 (0.8–2.0 V)	SO–8/TSSOP–8
MC10ELT20	TTL	PECL	5	1	100 MHz (min)*	1200	1500	SO–8/TSSOP–8
MC10ELT21	PECL	TTL	5	1	TBD	5500	750 (10%–90%)	SO–8/TSSOP–8
MC100LVELT20	LVTTL/LVCMOS	LVPECL	3.3	1	800	390	225	SO–8

SIGNAL TRANSLATORS **(continued)** (Specifications are at 25°C unless otherwise stated)

Device(s)	From	To	Voltage	# of Channels	Freq. (Typ) MHz	Prop. Delay (Typ) ps	Tr & Tf (Max) ps	Package
MC10ELT22	TTL	PECL	5	2	100MHz (min)*	1200	1600	SO−8/TSSOP−8
MC10ELT24	TTL	NECL	5	1	400	950	1250	SO−8/TSSOP−8
MC10ELT25	NECL	TTL	5/−5.2	1	100	3300*	2300 (10%−90%)	SO−8/TSSOP−8
MC10ELT28	PECL to TTL & TTL to PECL (Dual)	PECL to TTL & TTL to PECL (Dual)	5	2	100	3500 PECL−to−TTL/ 1200 TTL−to−PECL	1500	SO−8/TSSOP−8
MC10EP90	LVNECL/NECL	LVPECL/PECL	0.66	3	>3000	260	180	SO−20
MC10EPT20	LVTTL/LVCMOS	LVPECL	3.3	1	>1000	370	180	SO−8/TSSOP−8
NB100ELT23L	LVPECL	LVTTL	3.3	2	275	2.1	1300	SO−8/TSSOP−8
NB100LVEP91	LVPECL/LVTTL/ LVCMOS/HSTL/ CML/LVDS	LVNECL/NECL	2.5/3.3	3	2500	430	85 (typ)	SO−20, QFN−24
*NB4N5275	LVPECL/LVTTL/ LVCMOS/HSTL/ CML/LVDS	LVDS	3.3	2	1250	500	300	QFN−16
*NB4N8555	LVPECL/LVTTL/ LVCMOS/HSTL/ CML/LVDS	LVDS	3.3	2	1000	490	180	Micro10

*Duplicate in Receiver/Driver category.

CROSSPOINT SWITCHES

Device(s)	From	To	Voltage	# of Inputs	# of Outputs	Freq. (Typ) MHz	Prop. Delay (Typ) ps	Tr & Tf (Max) ps	Package
NB4L858M	LVPECL/CML	CML	2.5/3.3	2+2	2+2	3000	350	80	LQFP−32
NB4N840M	LVPECL/CML	CML	3.3	2+2	2+2	2700	225	80	QFN−32
NBSG72A	Any Level	LVPECL (w/o LS)	2.5/3.3	2	2	7000	200	55	QFN−16

CLOCK FAN−OUT (Specifications are at 25°C unless otherwise stated)

Device(s)	Input Clock	Output Clock	Voltage	# of Input Channels	# of Outputs per Channel	Frequency (Typ) GHz	Output−to−Output Skew (Max) ps	Cycle−to−Cycle Jitter (Typ/Max) ps	Tr & Tf (Max) ps	Package
MC100E111	ECL/PECL	ECL/PECL	5	1	9	>1.5	50	0.2	600	PLCC−28
MC100E210	ECL/PECL	ECL/PECL	5	2	4/5	0.7	75	0.2	600	PLCC−28
MC100E211	ECL/PECL	ECL/PECL	5	1	6	>1.5	75	0.2	400	PLCC−28
MC100E310	ECL/PECL	ECL/PECL	5	1	8	1	50	0.2	600	PLCC−28
MC100EL11	ECL/PECL	ECL/PECL	5	1	2	2	5	0.2	350	SO−8, TSSOP−8
MC100EL13	ECL/PECL	ECL/PECL	5	2	3	1	50	0.2	500	SO−20
MC100EL14	ECL/PECL	ECL/PECL	5	1	5	1	50	0.2	500	SO−8, TSSOP−8
MC100EL15	ECL/PECL	ECL/PECL	5	1	4	1	50	0.2	575	SO−16
MC100EP11	ECL/PECL	ECL/PECL	3.3/5	1	2	>3	20	0.2	180	SO−8, TSSOP−8
MC100EP14	ECL/PECL/HSTL	ECL/PECL	3.3/5	1	5	>2	45	0.2	270	TSSOP−20
MC100EP210S	LVDS/PECL	LVDS	3.3	2	5	>1	20	0.2	225	LQFP−32
MC100EP809	ECL/PECL/HSTL	HSTL	3.3	1	9	>0.75	15	1.4	600	LQFP−32
MC100LVE111	ECL/PECL	ECL/PECL	3.3	1	9	>1.5	20	0.2	600	PLCC−28
MC100LVE210	ECL/PECL	ECL/PECL	3.3	2	4/5	0.7	75	0.2	600	PLCC−28
MC100LVE310	ECL/PECL	ECL/PECL	3.3	1	8	1.5	50	0.2	600	PLCC−28
MC100LVEL11	ECL/PECL	ECL/PECL	3.3	1	2	>3	20	0.2	180	SO−8, TSSOP−8
MC100LVEL13	ECL/PECL	ECL/PECL	3.3	2	3	1	50	0.2	500	SO−20
MC100LVEL14	ECL/PECL	ECL/PECL	3.3	1	5	>1	50	0.2	500	SOIC−20
MC100LVEP11	ECL/PECL	ECL/PECL	2.5/3.3	1	2	>3	20	0.2	180	SO−8, TSSOP−8
MC100LVEP111	ECL/PECL	ECL/PECL	2.5/3.3	1	10	>3	25	0.2	150	LQFP−32, QFN−32
MC100LVEP14	ECL/PECL/HSTL	ECL/PECL	2.5/3.3	1	5	>2	25	0.2	250	TSSOP−20
MC100LVEP210	ECL/PECL/HSTL	ECL/PECL	2.5/3.3	2	5	>3	20	0.2	270	LQFP−32
MC10E111	ECL/PECL	ECL/PECL	5	1	9	>1.5	50	0.2	600	PLCC−28
MC10E211	ECL/PECL	ECL/PECL	5	1	6	>1.5	75	0.2	400	PLCC−28

CLOCK FAN−OUT (continued) (Specifications are at 25°C unless otherwise stated)

Device(s)	Input Clock	Output Clock	Voltage	# of Input Channels	# of Outputs per Channel	Frequency (Typ) GHz	Output−to−Output Skew (Max) ps	Cycle−to−Cycle Jitter (Typ/Max) ps	Tr & Tf (Max) ps	Package
MC10E411	ECL/PECL	ECL/PECL	5	1	9	1	50	0.2	600	PLCC−28
MC10EL11	ECL/PECL	ECL/PECL	5	1	2	2	5	0.2	350	SO−8, TSSOP−8
MC10EL15	ECL/PECL	ECL/PECL	5	1	4	1	50	0.2	575	SO−16
MC10EP11	ECL/PECL	ECL/PECL	3.3/5	1	2	>3	20	0.2	180	SO−8, TSSOP−8
MC10LVEP11	ECL/PECL	ECL/PECL	2.5/3.3	1	2	>3	20	0.2	180	SO−8, TSSOP−8
NB100EP223	ECL/PECL/HSTL	HSTL	3.3	1	22	>0.5	25	0.2	700	LQFP−64
NB100LVEP221	ECL/PECL/HSTL	ECL/PECL	2.5/3.3	1	20	>1	20	0.2	200 (typ)	LQFP−52
NB100LVEP224	ECL/PECL	ECL/PECL	2.5/3.3	1	24	>1	15	0.2	160 (min)	LQFP−64
NBSG11	ECL/TTL/CMOS/ CML/LVDS	RSPECL/RSECL	2.5/3.3	1	2	>12	15	0.5	30	FCBGA−16
NBSG111	ECL/PECL/TTL/ CMOS/CML/LVDS	RSPECL/RSECL	2.5/3.3	1	10	>6	15 (typ)	0.2	40 (typ)	FCBGA−14
NBSG14	ECL/PECL/TTL/ CMOS/CML/LVDS	RSPECL/RSECL	2.5/3.3	1	5	12	15	0.5	55	FCBGA−16
NB6L11	LVPECL, LVDS, CML, LVCMOS or LVTTL	LVECL/LVPECL	2.5, 3.3	1	2	>6	15	0.2	120	SO−8, TSSOP−8
NB7L11M	ECL/TTL/ CMOS/CML/LVDS	CML	2.5/3.3	1	2	>8	15	0.2	60	QFN−16
NB7L14M	ECL/TTL/ CMOS/CML/LVDS	CML	2.5/3.3	1	5	>8	15	0.2	60	QFN−16
NB7L111M	ECL/TTL/ CMOS/CML/LVDS	CML	2.5/3.3	1	10	>5.5	20	0.2	75	QFN−52
NB4N11S	ECL/TTL/ CMOS/CML/LVDS	LVDS	3.3	1	2	2.0	25	0.5	170	QFN−16
NB4N11M	ECL/TTL/ CMOS/CML/LVDS	CML	3.3	1	2	2.5	25	1	300	TSSOP−8

CLOCK DIVIDERS (Specifications are at 25°C unless otherwise stated)

Device(s)	Output	Frequency Division	# of Channels	Outputs per Bank	Voltage	Frequency (Typ) GHz	Propagation Delay (Typ) ps	Cycle–to–Cycle Jitter (Typ/Max) ps	Tr & Tf (Max) ps	Package
MC100EL32	ECL/PECL	Div2	1	1	5	>3	510	0.2 / 1.0	350	SO–8, TSSOP–8
MC100EL33	ECL/PECL	Div4	1	1	5	>4	650	1.0 (typ)	350	SO–8, TSSOP–8
MC100EL34	ECL/PECL	Div2, Div4, Div8	1	1+1+1	5	1.1	1000	<1 (typ)	525	SO–16
MC100EL38	ECL/PECL	Div2, Div4/6	1	2+2	5	1	900	0.2 / 1.0	550	SO–20
MC100EL39	ECL/PECL	Div2/4, Div4/6	1	2+2	5	1	900	0.2 / 1.0	550	SO–20
MC100EP139	ECL/PECL	Div2/4, Div4/5/6	1	2+2	3.3/5	>1	750	0.2 / 1.0	275	SO–20, TSSOP–20
MC100EP32	ECL/PECL	Div2	1	1	3.3/5	>4	350	0.2 / 1.0	170	SO–8, TSSOP–8, DFN–8
MC100EP33	ECL/PECL	Div4	1	1	3.3/5	>4	320	0.2 / 1.0	180	SO–8, TSSOP–8
MC100LVE222	ECL/PECL	1:15 Diff. Div1, Div2	2	15	3.3	1.5	1180	0.2 / 1.0	600	TQFP–52
MC100LVEL32	ECL/PECL	Div2	1	1	3.3	>2.6	510	0.2 / 1.0	320	SO–8, TSSOP–8
MC100LVEL33	ECL/PECL	Div4	1	1	3.3	>4	630	0.2 / 1.0	320	SO–8, TSSOP–8
MC100LVEL34	ECL/PECL	Div2, Div4, Div8	1	1+1+1	3.3	1.5	700	<1 (typ)	250	SO–16, TSSOP–16
MC100LVEL37	ECL/PECL	Div1 Div2	2	2+2	3.3	1	700	0.2 / 1.0	550	SO–20
MC100LVEL38	ECL/PECL	Div2 Div4/6	1	2+2	3.3	1	900	0.2 / 1.0	550	SO–20
MC100LVEL39	ECL/PECL	Div2/4, Div4/6	1	2+2	3.3	1	900	0.2 / 1.0	550	SO–20
MC100LVEP34	ECL/PECL	Div2, Div4, Div8	1	1+1+1	3.3	2.8	700	<1 (typ)	250	SO–16
MC10EL32	ECL/PECL	Div2	1	1	5	>3	510	0.2 / 1.0	350	SO–8, TSSOP–8
MC10EL33	ECL/PECL	Div4	1	1	5	>4	650	1.0 (typ)	350	SO–8, TSSOP–8
MC10EL34	ECL/PECL	Div2, Div4, Div8	1	1+1+1	5	1.1	1000	<1 (typ)	525	SO–16
MC10EP139	ECL/PECL	Div2/4, Div4/5/6	1	2+2	3.3/5	>1	750	0.2 / 1.0	275	SO–20, TSSOP–20
MC10EP32	ECL/PECL	Div2	1	1	3.3/5	>4	350	0.2 / 1.0	170	SO–8, TSSOP–8

CLOCK DIVIDERS (continued) (Specifications are at 25°C unless otherwise stated)

Device(s)	Output	Frequency Division	# of Channels	Outputs per Bank	Voltage	Frequency (Typ) GHz	Propagation Delay (Typ) ps	Cycle–to–Cycle Jitter (Typ/Max) ps	Tr & Tf (Max) ps	Package
MC10EP33	ECL/PECL	Div4	1	1	3.3/5	>4	320	0.2 / 1.0	180	SO–8, TSSOP–8
NB100LVEP222	ECL/PECL	1:15 Diff. Div1, Div2	2	15	2.5/3.3	1	875	0.2 / 1.0	160 (typ)	LQFP–52
NBSG53A	RSECL	Div1, Div2	2	1	2.5/3.3	>8	210	0.5 / 1.0	60	FCBGA–16
NB6L239	PECL	1/2/4/8, 2/4/8/16	2	1	2.5, 3.3	3	470	0.2 / 1.0	120	QFN–16
NB6N239S	LVDS	1/2/4/8, 2/4/8/16	2	1	3.3	3	470	0.2 / 1.0	120	QFN–16
NB7N017M	CML	Dual 8–Bit Modulus	1	1	3.3	3.5	500	3.0	65	QFN–52
NB7L32M	CML	Div2	1	1	2.5/3.3	14	200	<0.5	30	QFN–16

SKEW MANAGEMENT (Specifications are at 25°C unless otherwise stated)

Device(s)	Voltage	Frequency (Typ) GHz	Min Programmable Delay (Typ) ns	Max Programmable Delay (Typ) ns	Step Delay Resolution (Typ) ps	Cycle–to–Cycle Jitter (Max) ps	Tr & Tf (Max) ps	Package
MC100E195	5	>1	2.05	2.6	20	<5	325	PLCC–28
MC100E196[1]	5	>1	2.05	2.6	20	<5	325	PLCC–28
MC100EP195	3.3/5	>2.5	2.2	12.2	10	0.2 / 1.0	300	LQFP–32
MC100EP196[2]	3.3/5	>1.8	2.2	12.2	10	0.2 / 1.0	210	LQFP32
MC10E195	5	>1	2.05	2.6	20	<5	325	PLCC–28
MC10E196[1]	5	>1	2.05	2.6	20	<5	325	PLCC–28
MC10EP195	3.3/5	>2.5	2.2	12.2	10	0.2 / 1.0	300	LQFP–32
MC10EP196[2]	3.3/5	>1.8	2.2	12.2	10	0.2 / 1.0	210	LQFP32

SPECIAL NOTES/FEATURES:
1 FTUNE input provides <20 pS resolution control.
2 FTUNE input provides 0 to 60 pS programmable resolution control.

PRESCALERS (Specifications are at 25°C unless otherwise stated)

Device(s)	Frequency Division	Voltage	Supply Current (Icc–Max) mA	Frequency (Max) GHz	Supply Current Un-loaded (Typ) mA	Input Voltage Sensitivity Min/Max (mV p–p)	Package
MC12026A	Div8/9 or Div16/17	5	5.3	1.1	4	100 / 1000	SO–8
MC12080	Div10, Div20, Div40, Div80	5	5	1.1	3.7	100 / 1000	SO–8
MC12093	Div2, Div4, Div8	3.3/5	4.5	1.1	3	100 / 1000	SO–8
MC12095	Div2, Div4, Div8	3.3/5	14	2.5	3	200 / 1000	SO–8

CLOCK SYNTHESIZERS (Specifications are at 25°C unless otherwise stated)

Device(s)	V_{CC} (Typ) V	Min Output Freq. (MHz)	Max Output Freq. (MHz)	Max Input Freq. XTAL (MHz)	t_jitter (+–ps)	Min Output Rise/Fall (ps)	Temperature Rating	Package
NBC12429	3.3, 5	25	400	20	20	300	0 to 70°C	28–PLCC, 32–LQFP
NBC12430	3.3, 5	50	800	20	20	175	0 to 70°C	28–PLCC, 32–LQFP
NBC12439	3.3, 5	50	800	20	25	300	0 to 70°C	28–PLCC, 32–LQFP
NBC12429A	3.3, 5	25	400	20	20	300	–40 to 85°C	28–PLCC, 32–LQFP, QFN–32
NBC12430A	3.3, 5	50	800	20	20	175	–40 to 85°C	28–PLCC, 32–LQFP, QFN–32
NBC12439A	3.3, 5	50	800	20	25	300	–40 to 85°C	28–PLCC, 32–LQFP, QFN–32
NB4N507A	3.3, 5	50	200	27	10	50	–40 to 85°C	SOIC–16

ZERO DELAY BUFFERS (Specifications are at 25°C unless otherwise stated)

Device(s)	Outputs Per Device	V_{DD} Typ (V)	tskew (O–O) Max (ps)	F Max (MHz)	t_Jitter Max (ps)	Package
NB2304AC1D	4	3.3	200	133.3	100	SOIC–8
NB2304AI1D	4	3.3	200	133.3	100	SOIC–8
NB2304AC1HD	4	3.3	200	133.3	100	SOIC–8
NB2304AI1HD	4	3.3	200	133.3	100	SOIC–8
NB2304AC2D	4	3.3	200	133.3	100	SOIC–8
NB2304AI2D	4	3.3	200	133.3	100	SOIC–8
NB2305AC1D	5	3.3	250	133.3	200	SOIC–8
NB2305AI1D	5	3.3	250	133.3	200	SOIC–8
NB2305AC1DT	5	3.3	250	133.3	200	TSSOP–8
NB2305AI1DT	5	3.3	250	133.3	200	TSSOP–8
NB2305AC1HD	5	3.3	250	133.3	200	SOIC–8
NB2305AI1HD	5	3.3	250	133.3	200	SOIC–8
NB2305AC1HDT	5	3.3	250	133.3	200	TSSOP–8
NB2305AI1HDT	5	3.3	250	133.3	200	TSSOP–8
NB2308AC1D	8	3.3	200	133.3	100	SOIC–16
NB2308AI1D	8	3.3	200	133.3	100	SOIC–16
NB2308AC1DT	8	3.3	200	133.3	100	TSSOP–16
NB2308AI1DT	8	3.3	200	133.3	100	TSSOP–16
NB2308AC1HD	8	3.3	200	133.3	100	SOIC–16
NB2308AI1HD	8	3.3	200	133.3	100	SOIC–16
NB2308AC1HDT	8	3.3	200	133.3	100	TSSOP–16
NB2308AI1HDT	8	3.3	200	133.3	100	TSSOP–16
NB2308AC2D	8	3.3	200	133.3	100	SOIC–16
NB2308AI2D	8	3.3	200	133.3	100	SOIC–16
NB2308AC2DT	8	3.3	200	133.3	100	TSSOP–16
NB2308AI2DT	8	3.3	200	133.3	100	TSSOP–16
NB2308AC3D	8	3.3	200	133.3	100	SOIC–16

ZERO DELAY BUFFERS (continued) (Specifications are at 25°C unless otherwise stated)

Device(s)	Outputs Per Device	V_{DD} Typ (V)	tskew (O–O) Max (ps)	F Max (MHz)	t_Jitter Max (ps)	Package
NB2308AI3D	8	3.3	200	133.3	100	SOIC–16
NB2308AC3DT	8	3.3	200	133.3	100	TSSOP–16
NB2308AI3DT	8	3.3	200	133.3	100	TSSOP–16
NB2308AC4D	8	3.3	200	133.3	100	SOIC–16
NB2308AI4D	8	3.3	200	133.3	100	SOIC–16
NB2308AC4DT	8	3.3	200	133.3	100	TSSOP–16
NB2308AI4DT	8	3.3	200	133.3	100	TSSOP–16
NB2308AC5HD	8	3.3	200	133.3	100	SOIC–16
NB2308AI5HD	8	3.3	200	133.3	100	SOIC–16
NB2308AC5HDT	8	3.3	200	133.3	100	TSSOP–16
NB2308AI5HDT	8	3.3	200	133.3	100	TSSOP–16
NB2309AC1D	9	3.3	250	133.3	200	SOIC–16
NB2309AI1D	9	3.3	250	133.3	200	SOIC–16
NB2309AC1DT	9	3.3	250	133.3	200	SOIC–16
NB2309AI1DT	9	3.3	250	133.3	200	TSSOP–16
NB2309AC1HD	9	3.3	250	133.3	200	SOIC–16
NB2309AI1HD	9	3.3	250	133.3	200	SOIC–16
NB2309AC1HDT	9	3.3	250	133.3	200	TSSOP–16
NB2309AI1HDT	9	3.3	250	133.3	200	TSSOP–16

EMI SUPPRESSION CLOCKS (Specifications are at 25°C unless otherwise stated)133.3

Device(s)	V_{DD} Typ (V)	Modulation	F Max (MHz)	Duty Cycle	tR & tF Max (ps)	Package
NB2579A	3.3	±1%	40	50	1100	TSSOP−6
NB2669A	3.3	±1%	12	50	1100	TSSOP−6
NB2760A	3.3	±0.75%	12	50	1100	TSSOP−6
NB2762A	3.3	−1.25%	12	50	1100	TSSOP−6
NB2769A	3.3	±1%	12	50	1100	TSSOP−6
NB2779A	3.3	±1%	30	50	1100	TSSOP−6
NB2780A	3.3	±0.75%	50	50	1100	TSSOP−6
NB2869A	3.3	±1%	12	50	1100	TSSOP−6
NB2870A	3.3	±0.75%	30	50	1100	TSSOP−6
NB2872A	3.3	−1.25%	30	50	1100	TSSOP−6
NB2879A	3.3	±1%	30	50	1100	TSSOP−6
NB2969A	3.3	±1%	12	50	1100	TSSOP−6

VCO (PLL) (Specifications are at 25°C unless otherwise stated)

Device(s)	Frequency (Max) GHz	Voltage	Duty Cycle (Typ) %	SNR from Carrier (dB)	Package
MC100EL1648	1.1	5	50	40	SOIC−8, TSSOP−8, SOIC EIAJ−14

PHASE/FREQUENCY DETECTORS (Specifications are at 25°C unless otherwise stated)

Device(s)	Voltage	Transfer Gain mV/Degree	Vref & FB Inputs (S.E./Diff.)	Frequency (Typ) GHz	Propagation Delay (Typ) ps	Cycle−to−Cycle Jitter (Typ) ps	Tr & Tf (Max) ps	Package
MC100LVEL40	3.3/5	2	Diff	0.25	1350	0.2 / 1.0	475	SO−20
MC100EP40	3.3/5	0.93	Diff	>2	550	0.2 / 1.0	150	TSSOP−20
MC100EP140	3.3	1.2073	S.E.	>2	475	0.2 / 1.0	200	SO−8
MCH12140	3.3, 5	N/A	S.E.	800	0.44	N/A	350	SOIC 8
MCK12140	3.3, 5	N/A	S.E.	800	0.44	N/A	350	SOIC 8

FLIP–FLOPS (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Voltage	Freq. (Typ) GHz	Prop. Delay (Typ) ps	Setup Time (Min) ps	Hold Time (Min) ps	Set/ Reset Recovery (Min) ps	Jitter (Typ) ps RMS	Tr & Tf (Max) ps	Package
MC100E131	3.3/5 V ECL Quad D Flip–Flop with Set, Reset and Differential Clock	5	1.1	500	150	175	290	1	480	LQFP–32
MC100E431	5 V ECL Triple Differential Data and Clock D Flip–Flop with Edge Triggered Set and Reset	5	1.1	600	200	200	400	<1	650	PLCC–28
MC100EL29	5 V ECL Dual Differential Data and Clock D Flip–Flop with Set and Reset	5	1.1	580	0	100	100	<1	550	SO–20
MC100EL30	5 V ECL Triple D Flip Flop with Set and Reset	5	1.2	450	150	200	400	<1	550	SO–20
MC100EL31	5 V ECL D Flip–Flop with Set and Reset	5	2.8	475	150	250	400	<1	350	SO–8, TSSOP–8
MC100EL35	5 V ECL JK Flip Flop	5	2.2	525	150	250	400	<1	350	SO–8, TSSOP–8
MC100EL51	5 V ECL Differential D Flip–Flop	3.3/5	2.8	475	150	250	400	<1	350	SO–8, TSSOP–8
MC100EL52	5 V Differential Data and Clock D Flip–Flop	5	2.8	365	125	150	N/A	<1	350	SO–8, TSSOP–8
MC100EP131	3.3/5 V ECL Quad D Flip–Flop with Set, Reset and Differential Clock	3.3/5	>3	460	120	120	290	0.2	290	LQFP–32
MC100EP29	3.3/5 V ECL Dual Differential Data and Clock D Flip–Flop with Set and Reset	3.3/5	3	420	100	100	150	0.2	300	TSSOP–20
MC100EP31	3.3/5 V ECL D Flip–Flop with Set and Reset	3.3/5	>3	340	100	150	225	0.2	200	SO–8, TSSOP–8
MC100EP35	3.3/5 V ECL JK Flip Flop	3.3/5	>3	410	150	150	150	0.2	180	SO–8, TSSOP–8
MC100EP51	3.3/5 V ECL Differential Data and Clock D Flip–Flop	3.3	>3	375	100	100	150	0.2	180	SO–8, TSSOP–8
MC100EP52	3.3/5 V Differential Data and Clock D Flip–Flop	3.3/5	>4	330	50	0	N/A	0.2	180	SO–8, TSSOP–8
MC100LVEL29	3.3 V ECL Dual Differential Data and Clock D Flip–Flop with Set and Reset	3.3	1.1	580	0	100	100	<1	550	SO–20
MC100LVEL30	3.3 V ECL Triple D Flip Flop with Set and Reset	5	1.2	450	150	200	400	<1	550	SO–20
MC100LVEL31	3.3 V ECL D Flip–Flop with Set & Reset	3.3	2.9 (min)	475	150	250	400	<1	320	SO–8, TSSOP–8

FLIP–FLOPS (continued) (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Voltage	Freq. (Typ) GHz	Prop. Delay (Typ) ps	Setup Time (Min) ps	Hold Time (Min) ps	Set/ Reset Recovery (Min) ps	Jitter (Typ) ps RMS	Tr & Tf (Max) ps	Package
MC100LVEL51	3.3 V ECL Differential D Flip–Flop	3.3	2.8	475	150	250	350	<1	320	SO–8, TSSOP–8
MC10E131	5 V ECL Quad Differential Data and S.E. Clock D Flip–Flop with Edge Triggered Set and Reset	5	1.1	500	150	175	400	<1	480 (typ)	PLCC–28
MC10E431	5 V ECL Triple Differential Data and Clock D Flip–Flop with Edge Triggered Set and Reset	5	1.1	600	200	200	400	<1	650	PLCC–28
MC10EL30	5 V ECL Triple D Flip Flop with Set and Reset	5	1.2	450	150	200	400	<1	550	SO–20
MC10EL31	5 V ECL D Flip–Flop with Set and Reset	5	2.8	475	150	250	400	<1	350	SO–8, TSSOP–8
MC10EL35	5 V ECL JK Flip Flop	5	2.2	525	150	250	400	<1	350	SO–8, TSSOP–8
MC10EL51	5 V ECL Differential D Flip–Flop	3.3/5	2.8	475	150	250	400	<1	350	SO–8, TSSOP–8
MC10EL52	5 V Differential Data and Clock D Flip–Flop	5	2.8	365	125	150	N/A	<1	350	SO–8, TSSOP–8
MC10EP29	3.3/5 V ECL Dual Differential Data and Clock D Flip–Flop with Set and Reset	3.3/5	3	420	100	100	150	0.2	300	TSSOP–20
MC10EP131	3.3/5 V ECL Quad D Flip–Flop with Set, Reset and Differential Clock	3.3/5	>3	460	120	120	290	0.2	290	LQFP–32
MC10EP31	3.3/5 V ECL D Flip–Flop with Set and Reset	3.3/5	>3	340	100	150	225	0.2	200	SO–8, TSSOP–8
MC10EP35	3.3/5 V ECL JK Flip Flop	3.3/5	>3	410	150	150	150	0.2	180	SO–8, TSSOP–8
MC10EP51	3.3/5 V ECL Differential Data and Clock D Flip–Flop	3.3	>3	375	100	100	150	0.2	180	SO–8, TSSOP–8
MC10EP52	3.3/5 V Differential Data and Clock D Flip–Flop	3.3/5	>4	330	50	0	N/A	<1	180	SO–8, TSSOP–8
NB4L52	2.5 to 5.5 V ECL D–Flip–Flop with Differential Reset and Input Termination	2.5/3.3/5	>4	330	145	50	100	<1	190	QFN–16

LATCHES (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Voltage	Freq. (Typ) GHz	Prop. Delay (Typ) ps	Setup Time (Min) ps	Hold Time (Min) ps	Set/Reset Recovery (Min) ps	Tr & Tf (Max) ps	Package
MC10E150	5 V ECL 6–Bit D Latch	5	>1	800	200	200	750	450	PLCC–28
MC10E151	5 V ECL 6–Bit Register	5	1.1	650	150	350	750	450	PLCC–28
MC100E150	5 V ECL 6–Bit D Latch	5	>1	800	200	200	750	450	PLCC–28
MC100E151	5 V ECL 6–Bit Register	5	1.1	650	150	350	750	450	PLCC–28
MC10E175	5 V ECL 9–Bit Latch With Parity	5	>1	600	275	175	850	800	PLCC–28
MC100E175	5 V ECL 9–Bit Latch With Parity	5	>1	600	275	175	850	800	PLCC–28
MC10E154	5 V ECL 5–Bit 2:1 Mux–Latch	5	>1	500	300	300	800	800	PLCC–28
MC10E155	5 V ECL 6–Bit 2:1 Mux–Latch	5	>1	500	300	300	800	800	PLCC–28
MC10E156	5 V ECL 3–Bit 4:1 Mux–Latch	5	>1	600	400	300	800	700	PLCC–28
MC100E154	5 V ECL 5–Bit 2:1 Mux–Latch	5	>1	500	300	300	800	800	PLCC–28
MC100E155	5 V ECL 6–Bit 2:1 Mux–Latch	5	>1	500	300	300	800	800	PLCC–28
MC100E156	5 V ECL 3–Bit 4:1 Mux–Latch	5	>1	600	400	300	800	700	PLCC–28

SHIFT REGISTERS (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Voltage	# of Bits	Clock Source	Freq. (Typ) GHz	Prop. Delay (Typ) ps	Setup Time (Min) ps	Hold Time (Min) ps	Set/ Reset Recovery (Min) ps	Jitter (Typ) ps RMS	Tr & Tf (Max) ps	Package
MC100E141	5 V ECL 8−Bit Shift Register	5	8	S.E.	0.9	750	175	200	900	<1	800	PLCC−28
MC100E142	5 V ECL 9−Bit Shift Register	5	9	Dual S.E. (OR'ed)	0.9	800	50	300	900	<1	800	PLCC−28
MC100E143	5 V ECL 9−Bit Hold Register	5	S.E.	Dual (OR'ed)	>1	800	50	300	900	<1	800	PLCC−28
MC100E151	5 V ECL 6−Bit Register	5	S.E.	Dual (OR'ed)	1.1	650	150	350	750	<1	450	PLCC−28
MC100E212	5 V ECL 3−Bit Scannable Registered Address Driver	5	3	S.E.	0.9	800	175	250	600	<1	600	PLCC−28
MC100E241	5 V ECL 8−Bit Scannable Register	5	8	S.E.	0.9	750	175	200	900	<1	800	PLCC−28
MC100E451	5 V ECL 6−Bit D Register with Differential Data and Clock Inputs	5	Diff.	Diff.	1.1	650	150	350	750	<1	800	PLCC−28
MC100E452	5 V ECL 5−Bit Differential Register	5	Diff.	Diff.	1.1	600	175	225	750	<1	650	PLCC−28
MC100EP131	3.3/5 V ECL Quad D Flip−Flop with Set, Reset and Differential Clock	3.3/5	S.E.	Diff.	>3	460	120	120	290	0.2	290	LQFP−32
MC100EP142	5 V ECL 9−Bit Shift Register	3.3/5	9	Dual Diff. (OR'ed)	3.4	675	50	100	800	1	275	LQFP−32
MC100EP451	3.3/5 V ECL 6−Bit D Register with Differential Data and Clock Inputs	3.3/5	Diff.	Diff.	>3	450	80	80	250	0.2	260	LQFP−32
MC10E141	5 V ECL 8−Bit Shift Register	5	8	S.E.	0.9	750	175	200	900	<1	800	PLCC−28
MC10E142	5 V ECL 9−Bit Shift Register	5	9	Dual S.E. (OR'ed)	0.9	800	50	300	900	<1	800	PLCC−28
MC10E143	5 V ECL 9−Bit Hold Register	5	S.E.	Dual (OR'ed)	>1	800	50	300	900	<1	800	PLCC−28
MC10E151	5 V ECL 6−Bit Register	5	S.E.	Dual (OR'ed)	1.1	650	150	350	750	<1	450	PLCC−28
MC10E451	5 V ECL 6−Bit D Register with Differential Data and Clock Inputs	5	Diff.	Diff.	1.1	650	150	350	750	<1	800	PLCC−28
MC10E452	5 V ECL 5−Bit Differential Register	5	Diff.	Diff.	1.1	600	175	225	750	<1	650	PLCC−28
MC10EP142	5 V ECL 9−Bit Shift Register	3.3/5	9	Dual Diff. (OR'ed)	3.4	675	50	100	800	1	275	LQFP−32
MC10EP451	3.3/5 V ECL 6−Bit D Register with Differential Data and Clock Inputs	3.3/5	Diff.	Diff.	>3	450	80	80	250	0.2	260	LQFP−32
MC10H141	4−Bit Universal Shift Register	5	4	S.E.	0.25	1500	1500	1000	N/A	N/A	2400	PLCC−20, PDIP−16

MULTIPLEXERS (Specifications are at 25°C unless otherwise stated)

Device(s)	Voltage	Mux Radio	# of Muxes	Data Path	Freq. (Typ) GHz	Prop. Delay (Typ) ps	Within Device Skew (Max) ps	Jitter (Typ) ps RMS	Tr/Tf (Max) ps	Package
MC100E157	5	2:1	4	S.E.	>1	380	70	<1	650	PLCC–28
MC100E158	5	2:1	5	S.E.	>1	385	60	<1	650	PLCC–28
MC100E163	5	8:1	2	S.E.	>1	550	40	<1	575	PLCC–28
MC100E164	5	16:1	1	S.E.	>1	600	50 (typ)	<1	550	PLCC–28
MC100E167	5	2:1	6	S.E.	1	650	75	<1	800	PLCC–28
MC100E171	5	4:1	3	S.E.	>1	480	60 (typ)	<1	650	PLCC–28
MC100E256	5	4:1	3	S.E.	>1	600	50	<1	700	PLCC–28
MC100E457	5	2:1	3	Diff.	>1	475	40	<1	500	PLCC–28
MC100EL56	3.3	2:1	2	Diff.	>1	440	80	<1	540	SO–20
MC100EL57	5	4:1	1	Diff.	>1	560	100	<1	375	SO–16
MC100EL58	5	2:1	1	S.E.	1.5	230	N/A	<1	350	SO–8
MC100EL59	5	2:1	3	S.E.	>1	500	100	<1	540	SO–20
MC100EP56	3.3/5	2:1	2	Diff.	>3	360	100	0.2	180	SO–20
MC100EP57	3.3/5	4:1	1	Diff.	>3	475	200	0.2	200	TSSOP–20
MC100EP58	3.3/5	2:1	1	S.E.	>3	310	N/A	0.2	180	SO–8
MC100LVE164	3.3	16:1	1	S.E.	>1	600	50	<1	550	TQFP–32
MC100LVEL56	3.3	2:1	2	Diff.	>1	440	80	<3 (typ)	540	SO–20
MC100LVEL58	3.3	2:1	1	S.E.	1.5	440	N/A	<1	320	SO–8
MC100LVEL59	3.3	2:1	3	S.E.	>1	500	100	<1	540	SO–20
MC10E154	5	2:1	5	S.E.	>1	500	50	<1	800	PLCC–28
MC10E155	5	2:1	6	S.E.	>1	500	75	<1	800	PLCC–28
MC10E156	5	4:1	3	S.E.	>1	600	50	<1	700	PLCC–28
MC10E157	5	2:1	4	S.E.	>1	380	70	<1	650	PLCC–28
MC10E158	5	2:1	5	S.E.	>1	385	60	<1	650	PLCC–28

MULTIPLEXERS **(continued)** (Specifications are at 25°C unless otherwise stated)

Device(s)	Voltage	Mux Radio	# of Muxes	Data Path	Freq. (Typ) GHz	Prop. Delay (Typ) ps	Within Device Skew (Max) ps	Jitter (Typ) ps RMS	Tr/Tf (Max) ps	Package
MC10E163	5	8:1	2	S.E.	>1	550	40	<1	575	PLCC–28
MC10E164	5	16:1	1	S.E.	>1	600	50 (typ)	<1	550	PLCC–28
MC10E167	5	2:1	6	S.E.	1	650	75	<1	800	PLCC–28
MC10E171	5	4:1	3	S.E.	>1	480	60 (typ)	<1	650	PLCC–28
MC10E457	5	2:1	3	Diff.	>1	475	40	<1	500	PLCC–28
MC10EL56	3.3	2:1	2	Diff.	>1	440	80	<1	540	SO–20
MC10EL57	5	4:1	1	Diff.	>1	560	100	<1	375	SO–16
MC10EL58	5	2:1	1	S.E.	1.5	230	N/A	<1	350	SO–8
MC10EP56	3.3/5	2:1	2	Diff.	>3	360	100	0.2	180	SO–20
MC10EP57	3.3/5	4:1	1	Diff.	>3	475	200	0.2	200	TSSOP–20
MC10EP58	3.3/5	2:1	1	S.E.	>3	310	N/A	0.2	180	SO–8
MC10LVEL58	3.3	2:1	1	S.E.	1.5	440	N/A	<1	320	SO–8
NB100LVEP56	2.5/3.3/5	2:1	2	Diff.	>2.5	700	650	0.2	170	TSSOP–20, QFN–24
NBSG86A	2.5	2:1	1	Diff.	>8	165	15	0.5	65	FCBGA–16, QFN–16
NB7L86M	2.5/3.3	2:1	1	Diff.	>8	90	10	0.2	60	QFN–16

SERIAL/PARALLEL CONVERTER AND PARALLEL/SERIAL CONVERTERS (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Voltage	Data Rate (Typ) Gb/s	Prop. Delay (Typ) ps	Setup Time (Typ) ps	Hold Time (Typ) ps	Reset Recovery (Typ) ps	Jitter (Typ) ps RMS	Tr/Tf (Max) ps	Package
MC100E445	5 V ECL 4–Bit Serial/Parallel Converter	5	2.0 (min)	1800	–250	300	300	<1	350	PLCC–28
MC100E446	5 V ECL 4–Bit Parallel/Serial Converter	5	1.6	1200	–450	650	N/A	<1	350	PLCC–28
MC100EP445	3.3/5 V ECL 8–Bit Serial/Parallel Converter	3.3/5	2.5	1300	–400	600	180	0.2	300	LQFP–32
MC100EP446	3.3/5 V ECL 8–Bit Parallel/Serial Converter	3.3/5	3.4	800	–450	–600	N/A	0.2	170	LQFP–32
MC10E445	5 V ECL 4–Bit Serial/Parallel Converter	5	2.0 (min)	1800	–250	300	300	<1	350	PLCC–28
MC10E446	5 V ECL 4–Bit Parallel/Serial Converter	5	1.6	1200	–450	650	N/A	<1	350	PLCC–28
MC10EP445	3.3/5 V ECL 8–Bit Serial/Parallel Converter	3.3/5	2.5	1300	–400	600	180	0.2	300	LQFP–32
MC10EP446	3.3/5 V ECL 8–Bit Parallel/Serial Converter	3.3/5	3.4	800	–450	–600	N/A	0.2	170	LQFP–32

GATES (Specifications are at 25°C unless otherwise stated)

Device(s)	Output Type	Type	Frequency (Typ) GHz	Propagation Delay (Typ) ps	Jitter (Typ) ps RMS	Tr/Tf (Max) ps	Package
MC100E101	ECL/PECL	OR/NOR	2	350	<1	575	PLCC–28
MC100E104	ECL/PECL	AND/NAND	2	385	<1	700	PLCC–28
MC100E107	ECL/PECL	XOR/XNOR	2	410	<1	700	PLCC–28
MC100E404	ECL/PECL	AND/NAND	2	475	<1	400	PLCC–28
MC100EL01	ECL/PECL	OR/NOR	2	230	<1	235	SO–8, TSSOP–8
MC100EL04	ECL/PECL	AND/NAND	2	240	<1	350	SO–8, TSSOP–8
MC100EL05	ECL/PECL	AND/NAND	2	275	<1	350	SO–8, TSSOP–8
MC100EL07	ECL/PECL	XOR/XNOR	2	260	<1	225	SO–8, TSSOP–8
MC100EP01	ECL/PECL	OR/NOR	>3	270	0.2	180	SO–8, TSSOP–8
MC100EP05	ECL/PECL	AND/NAND	>3	220	0.2	180	SO–8, TSSOP–8
MC100EP08	ECL/PECL	XOR/XNOR	>3	250	0.2	180	SO–8, TSSOP–8
MC100EP101	ECL/PECL	OR/NOR	>3	300	0.2	220	PLCC–28
MC100EP105	ECL/PECL	AND/NAND	>3	220	0.2	180	SO–8, TSSOP–8
MC100LVEL01	ECL/PECL	OR/NOR	2	370	<1	320	SO–8, TSSOP–8
MC100LVEL05	ECL/PECL	AND/NAND	2	340	<1	320	SO–8, TSSOP–8
MC10E101	ECL/PECL	OR/NOR	2	350	<1	575	PLCC–28
MC10E104	ECL/PECL	AND/NAND	2	385	<1	700	PLCC–28
MC10E107	ECL/PECL	XOR/XNOR	2	410	<1	700	PLCC–28
MC10E404	ECL/PECL	AND/NAND	2	475	<1	400	PLCC–28
MC10EL01	ECL/PECL	OR/NOR	2	230	<1	235	SO–8, TSSOP–8
MC10EL04	ECL/PECL	AND/NAND	2	240	<1	350	SO–8, TSSOP–8
MC10EL05	ECL/PECL	AND/NAND	2	275	<1	350	SO–8, TSSOP–8
MC10EL07	ECL/PECL	XOR/XNOR	2	260	<1	225	SO–8, TSSOP–8
MC10EP01	ECL/PECL	OR/NOR	>3	270	0.2	180	SO–8, TSSOP–8
MC10EP05	ECL/PECL	AND/NAND	>3	220	0.2	180	SO–8, TSSOP–8

GATES (continued) (Specifications are at 25°C unless otherwise stated)

Device(s)	Output Type	Type	Frequency (Typ) GHz	Propagation Delay (Typ) ps	Jitter (Typ) ps RMS	Tr/Tf (Max) ps	Package
MC10EP08	ECL/PECL	XOR/XNOR	>3	250	0.2	180	SO−8, TSSOP−8
MC10EP101	ECL/PECL	OR/NOR	>3	300	0.2	220	PLCC−28
MC10EP105	ECL/PECL	AND/NAND	>3	220	0.2	180	SO−8, TSSOP−8
NBSG86A	PECL with Output Level Select	Smart Gate (AND/NAND, OR/NOR, XOR/ XNOR. 2:1 MUX)	>8	165	0.5	65	FCBGA−16, QFN−16
NB7L86M	CML	Smart Gate (AND/NAND, OR/NOR, XOR/ XNOR. 2:1 MUX)	>8	120	0.2	60	QFN−16

COUNTERS (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Voltage	Count Freq. (Typ) GHz	Prop. Delay (Typ) ps	Setup Time (Typ) ps	Hold Time (Typ) ps	Reset Recovery (Typ) ps	Jitter (Typ) ps RMS	Tr/Tf (Max) ps	Package
MC100E016	5 V ECL 8−Bit Synchronous Binary Up Counter	5	0.9	775	−30	100	700	3	800	PLCC−28
MC100E136	5 V ECL 6−Bit Universal Up/Down Counter	5	0.65	1150	650	−200	700	<5	600	PLCC−28
MC100E137	5 V ECL 8−Bit Ripple Counter	5	2.2	2900	−150	150	200	<5	600	PLCC−28
MC100EP016A	3.3 V ECL 8−Bit Synchronous Binary Up Counter	3.3	1.4	570	240	−155	205	2.5	320	LQFP−32
MC10E016	5 V ECL 8−Bit Synchronous Binary Up Counter	5	0.9	775	−30	100	700	3	800	PLCC−28
MC10E136	5 V ECL 6−Bit Universal Up/Down Counter	5	0.65	1150	650	−200	700	<5	600	PLCC−28
MC10E137	5 V ECL 8−Bit Ripple Counter	5	2.2	2900	−150	150	200	<5	600	PLCC−28

COMPARATORS (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Voltage	Frequency (Typ) GHz	Propagation Delay (Typ) ps	Jitter (Typ) ps RMS	Tr/Tf (Max) ps	Package
MC10E166	5 V ECL 9−Bit Magnitude Comparator	5	>1	850	<1	800	PLCC−28
MC100E166	5 V ECL 9−Bit Magnitude Comparator	5	>1	850	<1	800	PLCC−28
MC10E1651	5 V, −5 V ECL Dual ECL Output Comparator with Latch	5 / −5	>1	775	<1	475	CDIP−16, PLCC−20
MC10E1652	5 V ECL Dual ECL Output Comparator with Latch	5	>1	775	<1	475	CDIP−16, PLCC−20

PARITY CHECKERS (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Voltage	Propagation Delay (Typ) ps	Setup Time (Typ) ps	Hold Time (Typ) ps	Tr/Tf (Max) ps	Package
MC10/100E160	5 V ECL 12−Bit Parity Generator/Checker	5	650	900	−900	650	PLCC−28
MC100E193	5 V ECL Error Detection/Correction Circuit	5	775	350	−350	1100	PLCC−28

DRIVERS/RECEIVERS (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Input I/O	Output I/O	Voltage	Freq. (Typ) GHz	Prop. Delay (Typ) ps	Jitter (Typ) ps RMS	Tr/Tf (Max) ps	Package
MC10/100EP16VB	3.3/5 V ECL Differential Receiver/Driver with High and Low Gain	ECL/PECL	ECL/PECL	3.3/5	>3	300	0.2	240	SO−8, TSSOP−8
MC10/100EP16VC	3.3/5 V ECL Differential Receiver/Driver with High Gain and Enable Output	ECL/PECL	ECL/PECL	3.3/5	>3	380	0.2	240	SO−8, TSSOP−8
MC100E116	5 V ECL Quint Differential Line Receiver	ECL/PECL	ECL/PECL	5	>1.2	300	0.2	575	PLCC−28
MC100E416	5 V ECL Quint Differential Line Receiver	ECL/PECL	ECL/PECL	5	>2	350	0.2	350	PLCC−28
MC100EL16	5 V ECL Differential Receiver	ECL/PECL	ECL/PECL	5	>2	250	0.2	350	SO−8, TSSOP−8
MC100EL17	5 V ECL Quad Differential Receiver	ECL/PECL	ECL/PECL	5	>2	425	0.2	550	SO−20
MC100EP116	3.3/5 V ECL Hex Differential Line Receiver/Driver	ECL/PECL	ECL/PECL	3.3/5	>3	260	0.2	240	LQFP−32
MC100EP16	3.3/5 V ECL Differential Receiver/Driver	ECL/PECL	ECL/PECL	3.3/5	>4	220	0.2	180	SO−8, TSSOP−8
MC100EP16F	3.3/5 V ECL Differential Receiver/Driver	ECL/PECL	ECL/PECL	2.5/3.3	>3	300	0.2	100	SO−8, TSSOP−8
MC100EP16T	3.3/5 V ECL Differential Receiver/Driver with Internal Input Termination	ECL/PECL	ECL/PECL	3.3/5	>3	220	0.2	180	SO−8, TSSOP−8
MC100EP16VA	3.3/5 V ECL Differential Receiver/Driver with High Gain	ECL/PECL	ECL/PECL	3.3/5	>3	270	0.2	180	SO−8, TSSOP−8
MC100EP16VB	3.3/5 V ECL Differential Receiver/Driver with High and Low Gain	ECL/PECL	ECL/PECL	3.3/5	>3	300	0.2	240	SO−8, TSSOP−8
MC100EP16VC	3.3/5 V ECL Differential Receiver/Driver with High Gain and Enable Output	ECL/PECL	ECL/PECL	3.3/5	>3	380	0.2	240	SO−8, TSSOP−8
MC100EP16VS	3.3/5 V ECL Differential Receiver/Driver with Variable Output Swing	ECL/PECL	ECL/PECL	3.3/5	>4	220	0.2	180	SO−8, TSSOP−8

DRIVERS/RECEIVERS (continued) (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Input I/O	Output I/O	Voltage	Freq. (Typ) GHz	Prop. Delay (Typ) ps	Jitter (Typ) ps RMS	Tr/Tf (Max) ps	Package
NB4L16M	2.5/3.3 V 5 Gb/s Multi Level Clock/Data Input to CML Driver/ Receiver/Buffer/Translator with Internal Termination	LVPECL, LVTTL, LVCMOS, CML, LVDS	CML	2.5/3.3	3.5	220	0.2	90	QFN−16
MC100EP16VT	3.3/5 V ECL Differential Receiver/Driver with Variable Output Swing and Internal Input Termination	ECL/PECL	ECL/PECL	3.3/5	>4	300	0.2	180	SO−8, TSSOP−8
MC100EP17	3.3 V ECL Quad Differential Receiver	ECL/PECL	ECL/PECL	3.3/5	>3	220	0.2	230	SO−20, TSSOP−20
MC100LVEL16	3.3 V ECL Differential Receiver	ECL/PECL	ECL/PECL	3.3	>2	300	0.2	320	SO−8, TSSOP−8
MC100LVEL17	3.3 V ECL Quad Differential Receiver	ECL/PECL	ECL/PECL	3.3	>2	425	0.2	550	SO−20
MC100LVEP16	2.5/3.3 V ECL Differential Receiver/Driver	ECL/PECL	ECL/PECL	2.5/3.3	>4	240	0.2	180	SO−8, TSSOP−8
MC10E116	5 V ECL Quint Differential Line Receiver	ECL/PECL	ECL/PECL	5	>2	300	0.2	575	PLCC−28
MC10E416	5 V ECL Quint Differential Line Receiver	ECL/PECL	ECL/PECL	5	>2	350	0.2	350	PLCC−28
MC10EL16	5 V ECL Differential Receiver	ECL/PECL	ECL/PECL	5	>2	250	0.2	350	SO−8, TSSOP−8
MC10EP116	3.3/5 V ECL Hex Differential Line Receiver/Driver	ECL/PECL	ECL/PECL	3.3/5	>3	260	0.2	240	LQFP−32
MC10EP16	3.3/5 V ECL Differential Receiver/Driver	ECL/PECL	ECL/PECL	3.3/5	>4	220	0.2	180	SO−8, TSSOP−8
MC10EP16T	3.3/5 V ECL Differential Receiver/Driver with Internal Input Termination	ECL/PECL	ECL/PECL	3.3/5	>3	220	0.2	180	SO−8, TSSOP−8
MC10EP16VA	3.3/5 V ECL Differential Receiver/Driver with High Gain	ECL/PECL	ECL/PECL	3.3/5	>3	270	0.2	180	SO−8, TSSOP−8
MC10EP16VB	3.3/5 V ECL Differential Receiver/Driver with High and Low Gain	ECL/PECL	ECL/PECL	3.3/5	>3	300	0.2	240	SO−8, TSSOP−8
MC10EP16VC	3.3/5 V ECL Differential Receiver/Driver with High Gain and Enable Output	ECL/PECL	ECL/PECL	3.3/5	>3	380	0.2	240	SO−8, TSSOP−8

DRIVERS/RECEIVERS (continued) (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Input I/O	Output I/O	Voltage	Freq. (Typ) GHz	Prop. Delay (Typ) ps	Jitter (Typ) ps RMS	Tr/Tf (Max) ps	Package
MC10EP16VT	3.3/5 V ECL Differential Receiver/Driver with Variable Output Swing and Internal Input Termination	ECL/PECL	ECL/PECL	3.3/5	>4	300	0.2	180	SO−8, TSSOP−8
MC10EP17	3.3 V ECL Quad Differential Receiver	ECL/PECL	ECL/PECL	3.3/5	>3	220	0.2	230	SO−20, TSSOP−20
MC10LVEP16	2.5/3.3 V ECL Differential Receiver/Driver	ECL/PECL	ECL/PECL	2.5/3.3	>4	240	0.2	180	SO−8, TSSOP−8
NB100LVEP17	2.5 V/3.3 V/5 V ECL Quad Differential Driver/Receiver	ECL/PECL	ECL/PECL	2.5/3.3/5	>2.5	250	0.5	240	TSSOP−20, QFN−24
NBSG16	2.5/3.3 V SiGe Differential Receiver/Driver with RSPECL Output	ECL/PECL, HSTL, GTL, TTL, CMOS, CML or LVDS	RSECL	2.5/3.3	>12	120	0.3	65	FCBGA−16, QFN−16
NBSG16VS	2.5/3.3 V SiGe Differential Receiver/Driver with Variable Output Swing	ECL/PECL, TTL, CMOS, LVDS or LVDS	ECL/PECL	2.5/3.3	>12	125	0.8	55	FCBGA−16, QFN−16
NB6L16	2.5/3.3 V Multi−level Input to Differential LVECL Clock or Data Translator/Receiver/Driver Buffer	LVDS, LVPECL, LVNECL, CML, LVCMOS or LVTTL	ECL/PECL	2.5/3.3	>6	130	0.2	120	SO−8, TSSOP−8
NBSG16M	2.5/3.3 V Multi−level Input to CML Clock/Data Receiver/Driver/Translator Buffer	ECL/PECL/LVTTL/ LVCMOS/CML/LV DS	CML	2.5/3.3	>10	120	0.2	53	QFN−16
NB4N527S	3.3 V 2.5 Gb/s Dual Any Level to LVDS Receiver/Driver/Buffer/ Translator with Input Termination	LVNECL, LVPECL, LVTTL, LVCMOS, CML, LVDS, HSTL	LVDS	3.3	>1.25	275	0.5	140	QFN−16
NB4L16M	2.5/3.3 V 5 Gb/s Multi Level Clock/Data Input to CML Driver/ Receiver/Buffer/Translator with Internal Termination	LVPECL, LVDS, CML, LVCMOS, LVTTL	CML	2.5/3.3	>3.5	220	0.2	90	QFN−16
NB7L216	2.5/3.3 V 12 Gb/s Multi Level Clock/Data Input to RSECL High Gain Receiver/Buffer/Translator with Internal Termination	LVNECL, LVPECL, HSTL, LVTTL, LVCMOS, CML or LVDS	RSECL	2.5/3.3	>8.5	120	0.1	45	QFN−16
NB4N316M	3.3 V Any Level Input to Open Collector CML Output Buffer/Translator with Input Hysteresis	LVPECL, CML, LVCMOS, LVTTL, LVDS	CML	3.3	>2	550	1	150	TSSOP−8

DRIVERS/BUFFERS (Specifications are at 25°C unless otherwise stated)

Device(s)	Description	Voltage	Outputs	Propagation Delay (Typ) ps	Within Gate Skew (Max) ps	Tr/Tf (Max) ps	Package
MC10EL12	5 V ECL Low Impedance 1:2 Driver	5	OR/NOR ECL	290	N/A	550	SO−8, TSSOP−8
MC100EL12	5 V ECL Low Impedance 1:2 Driver	5	OR/NOR ECL	290	N/A	550	SO−8, TSSOP−8
MC100LVEL12	3.3 V ECL Low Impedance 1:2 Driver	3.3	OR/NOR ECL	445	N/A	550	SO−8, TSSOP−8
MC10E112	5 V ECL Quad Driver	5	OR/NOR ECL	400	40	700	PLCC−28
MC10E212	5 V ECL 3−Bit Scannable Registered Address Driver	5	OR/NOR ECL	800	50	650	PLCC−28
MC10E122	5 V ECL 9−Bit Buffer	5	S.E.	350	75	800	PLCC−28
MC100E112	5 V ECL Quad Driver	5	OR/NOR ECL	400	40	700	PLCC−28
MC100E212	5 V ECL 3−Bit Scannable Registered Address Driver	5	OR/NOR ECL	800	50	650	PLCC−28
MC100E122	5 V ECL 9−Bit Buffer	5	S.E.	350	75	800	PLCC−28

Interface

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Data Transmission

LINE RECEIVERS – EIA STANDARD

S = Single Ended D = Differential	Type of Output	t_{prop} Delay Time Max (ns)	Party Line Operation	Strobe or Enable	Power Supplies (V)	Device	Suffix/ Package	Receivers Per Package	Companion Drivers	Comments
S	R (Note 27)	85	–	–	+5.0	MC1489 MC1489A	DIP–16, SO–16	4	MC1488 MC14C88B	EIA–232–D

27. R = Resistor Pull–up, TP = Totem–pole output.

LINE DRIVERS – EIA STANDARD

Output Current Capability (mA)	t_{prop} Delay Time Max (ns)	S = Single Ended D = Differential	Party Line Operation	Strobe or Enable	Power Supplies (V)	Device	Suffix/ Package	Receivers Per Package	Companion Drivers	Comments
85	35	D	√	√	+5.0	MC75174B MC75172B	SO–20L	4	–	EIA–485
10	350	S	–	√	±9.0 to ±12	MC1488	DIP–8, SO–8	4	MC1489 MC1489A	EIA–232–D
60	300	S/D	–	EIA–422 √ EIA–423 –	±5.0	MC26LS30	SO–16	4 (423) 2 (422)	–	EIA–422 or EIA–423 Switchable
18	–	D	–	–	±10.8 to ±13.2	MC3488A	SO–8	1 (423) 1 (232)	–	Dual EIA–423 EIA–232D

PERIPHERAL DRIVERS

Output Current Capability (mA)	Input Capability	Propagation Delay Time Max (μs)	Output Clamp Diode	Off State Voltage Max (V)	Device	Drivers Per Package	Suffix/ Package	Logic Function
500	TTL, 5.0 V CMOS	1.0	√	50	MC1413B	7	DIP–16, SO–16	Invert

MODULATOR/DEMODULATORS

Product	T_A (min) (°C)	T_A (max) (°C)	Z_{is} (typ) (kΩ)	Z_{os} (typ) (kΩ)	V_{CFT} (typ) (μV)	V_{CS} (typ) (mV)	A_{VS} (typ) (V)	B_W (typ) (MHz)	I_{IB} (typ) (μA)	A_{CM} (typ) (dB)	Packages
MC1496BD	−40	125	200	40	20	65	3.5	300	12	85	SOIC−14
MC1496BP	−40	125	200	40	20	65	3.5	300	12	85	PDIP−14
MC1496D	0	70	200	40	20	65	3.5	300	12	85	SOIC−14
MC1496P	0	70	200	40	20	65	3.5	300	12	85	PDIP−14

TIMERS

Product	T_A (min) (°C)	T_A (max) (°C)	V_{CC} (min) (V)	V_{CC} (max) (V)	E_T (max) (%)	Packages
MC1455B	−40	85	4.5	16	1	SOIC−8 Narrow Body
MC1455D	0	70	4.5	16	1	SOIC−8 Narrow Body
MC1455P	0	70	4.5	16	1	PDIP−8
NCV1455B	−40	125	4.5	16	1	SOIC−8 Narrow Body

SMART CARD AND SIM CARD INTERFACE

Product	Description	V_{CC} (min) (V)	V_{CC} (max) (V)	I_T (typ) (mA)	$I_{I(standby)}$ (max) (μA)	f_{Clock} (max) (MHz)	Packages
NCN4555	SIM Card Power Supply/Level Translator	1.8	5.5	0.03	4	5	QFN−16
NCN4557	Dual SIM/Smart Card Interface	1.8	5.5	0.03	3	5	QFN−16
NCN6000	Compact Smart Card Interface	2.7	6	5	15	40	TSSOP−20
NCN6001	Compact Smart Card Interface	2.7	6	0.5	60	40	TSSOP−20
NCN6004A	Dual Asynchronous/Synchronous Smart Card Interface	1.8	5.5		50		QFP−48
NCN6010	Power Management and Level Shifter for SIM Cards	2.7	6	20	2	10	TSSOP−14

Standard Logic

Standard Logic

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In Brief...

This selector guide is a quick reference to ON Semiconductor’s offering of exciting new Analog Switches and MiniGate™ products as well as the traditional standard logic integrated circuits. ON Semiconductor continues to increase the breadth of its portfolio offering in the MiniGate arena, and continues to offer the traditional industry standard IC Logic families that have become the foundation for a multitude of legacy electronic systems. The company’s standard logic portfolio provides designers with a wide selection of voltages and speed/drive combinations to meet their application needs.

The **MiniGate** family of devices takes advantage of ON Semiconductor’s world class discrete micropackaging manufacturing technology to enable best−in−class products. The technologies offered in the MiniGate family are direct “relatives” of the standard IC Logic products, designed and manufactured in the same CMOS based technology. These include Analog Switch, LCX, VHC and HC technologies, with the majority of the popular functions available in these different families in industry standard 5, 6 and 8 pin packages.

The traditional industry standard Logic IC offerings consist of families in the high voltage standard logic arena (5.0 V and greater).

In the low voltage standard logic arena, ON Semiconductor offers the following families:

VCX: This is the fastest, lowest voltage logic family offered by ON Semiconductor. Ten devices in all are offered, with five of the most popular functions, as well as five enhanced devices with a bus hold option. It is specified at 0.9 V to 3.6 V, is offered in the industry standard 48 pin TSSOP package and is specifically well suited for networking/ communication equipment applications, demanding high speed and low power.

LCX: LCX is fast becoming the industry “workhorse” product family in 3.0 V applications. This family features 5.0 V tolerant inputs and outputs and is especially suited for mixed−voltage, high−end, advanced workstation designs, as well as for low−power portable applications.

LVX: LVX is specified from 2.0 V to 3.6 V and is similar tin performance to VHC, but with lower output drive. It too has overvoltage tolerant (OVT) inputs to 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems. This family is available in industry standard JEDEC SOIC, EIAJ SOIC, and the popular TSSOP packages. It is specified at –55 to +125°C.

VHC: This “5.0 V to 3.0 V transitional family” is specified at 2.0 V to 5.5 V. When operating at supply voltages below 5.0 V, this family features 5.0 V tolerant inputs to support 3.0 V to 5.0 V mixed voltage system designs. Low power, low switching noise and fast switching speeds make this family perfect for low power, low cost applications. The VHCT functions offer TTL level compatibility with CMOS low power performance. VHCT accepts TTL level inputs and delivers full swing (4.5 V to 5.5 V) outputs. The supply voltage range for VHCT is VCC = 4.5 V − 5.5 V. The temperature range for this family is also –55 to +125°C and is also available in the same packages as LVX family.

There are three families offered in the more mature 5.0 V and greater operating voltage arena. **FACT** (AC/ACT), **High Speed** (HC/HCT) and **Metal Gate** (14000 series), remain as the legacy logic families. These families, although past the maturity stage in the industry product life cycle, continue to find new applications and will remain industry standards for many more years.

MiniGates

VHC One−Gates

Ordering Suffixes: TSSOP−5 = DTT1, SC−88A = DFT2 (available in T & R only), G = Pb−free

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
MC74VHC1G00	2−Input NAND Gate	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT00	2−Input NAND Gate (TTL Compatible)	TSOP−5, SC−88A	−55 to +125	3.0 to 5.5 V
MC74VHC1G01	2−Input NAND Gate (Open Drain)	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1G02	2−Input NOR Gate	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT02	2−Input NOR Gate (TTL Compatible)	TSOP−5, SC−88A	−55 to +125	3.0 to 5.5 V
MC74VHC1G03	2−Input NOR Gate (Open Drain)	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1G04	Inverter	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT04	Inverter (TTL Compatible)	TSOP−5, SC−88A	−55 to +125	3.0 to 5.5 V
MC74VHC1GU04	Inverter (Unbuffered)	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1G05	Inverter w/Open−Drain Output	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1G07	Buffer w/Open−Drain Output	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1G08	2−Input AND Gate	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT08	2−Input AND Gate (TTL Compatible)	TSOP−5, SC−88A	−55 to +125	3.0 to 5.5 V
MC74VHC1G09	2−Input AND Gate (Open Drain)	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1G14	Schmitt Trigger−Inverter	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT14	Schmitt Trigger Inverter (TTL Compatible)	TSOP−5, SC−88A	−55 to +125	3.0 to 5.5 V
MC74VHC1G32	2−Input OR Gate	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT32	2−Input OR Gate (TTL Compatible)	TSOP−5, SC−88A	−55 to +125	3.0 to 5.5 V
MC74VHC1G50	Buffer	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT50	Buffer (TTL Compatible)	TSOP−5, SC−88A	−55 to +125	3.0 to 5.5 V
MC74VHC1G66	Analog Switch	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT66	Analog Switch	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1G86	2−Input Exclusive−OR Gate	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT86	2−Input Exclusive−OR Gate (TTL Compatible)	TSOP−5, SC−88A	−55 to +125	3.0 to 5.5 V
MC74VHC1G125	Bus Buffer (3−State)	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT125	Non−Inverting Tri−State Buffer, Low Enable	TSOP−5, SC−88A	−55 to +125	3.0 to 5.5 V
MC74VHC1G126	Non−Inverting Tri−State Buffer, High Enable	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1GT126	Bus Buffer Gate (3−State) (TTL Compatible)	TSOP−5, SC−88A	−55 to +125	3.0 to 5.5 V
MC74VHC1G132	Quad 2−Input Schmitt NAND Gate	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V
MC74VHC1G135	2−Input NAND Schmitt−Trigger with Open Drain Output	TSOP−5, SC−88A	−55 to +125	2.0 to 5.5 V

HC One−Gates

Ordering Suffixes: TSSOP−5 = DTT1, SC−88A = DFT2 (available in T & R only), G = Pb−free

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
MC74HC1G00	2−Input NAND Gate	TSOP−5, SC−88A	−55 to +125	2.0 to 6.0 V
MC74HC1G02	2−Input Positive−NOR Gate	TSOP−5, SC−88A	−55 to +125	2.0 to 6.0 V
MC74HC1G04	Inverter	TSOP−5, SC−88A	−55 to +125	2.0 to 6.0 V
MC74HC1G08	2−Input AND Gate	TSOP−5, SC−88A	−55 to +125	2.0 to 6.0 V
MC74HC1G14	Inverter with Schmitt Trigger	TSOP−5, SC−88A	−55 to +125	2.0 to 6.0 V
MC74HC1G32	2−Input OR Gate	TSOP−5, SC−88A	−55 to +125	2.0 to 6.0 V
MC74HC1GU04	Inverter (Unbuffered)	TSOP−5, SC−88A	−55 to +125	2.0 to 6.0 V

LCX One−Gates

Ordering Suffixes: SC−88/A = DFT2, US = US8 (available in T & R only), G = Pb−free, UDFN6 = MUR2

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
NL7SZ18	2:1 Multiplexer, Tri−State	SC−88A, UDFN6	−40 to +85	1.65 to 5.5 V
NL7SZ19	2:1 Multiplexer	SC−88, UDFN6	−40 to +85	1.65 to 5.5 V
NL17SZ00	Single 2−Input NAND Gate	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V
NL17SZ02	Single 2−Input NOR Gate	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V
NL17SZ04	Single Inverter	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V
NL17SZ06	Inverter w/Open Drain Outputs	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V
NL17SZ07	Buffer w/Open−Drain Output	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V
NL17SZ08	Single 2−Input AND Gate	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V
NL17SZ14	Schmitt Trigger Inverter	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V
NL17SZ16	Single Buffer	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V
NL17SZ17	Non−Inverting Schmitt Trigger Buffer	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V
NL17SZ32	Single 2−Input OR Gate	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V
NL17SZ74	D Flip−Flop	US8	−40 to +85	1.65 to 5.5 V
NL17SZ86	Exclusive OR Gate	SC−88A	−40 to +85	1.65 to 5.5 V
NL17SZ125	Non−Inverting Tri−State Buffer, Low Enable	SC−88A	−40 to +85	1.65 to 5.5 V
NL17SZ126	Non−Inverting Tri−State Buffer, High Enable	SC−88A	−40 to +85	1.65 to 5.5 V
NL17SZU04	Single Inverter, Unbuffered	SC−88A, SOT−553	−40 to +85	1.65 to 5.5 V

LCX Two−Gates and Three−GateS

Ordering Suffixes: TSSOP−5/6 = DTT1, SC−88/A = DFT2, US = US8 (available in T & R only), G = Pb−free

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
NL27WZ00	Dual 2−Input NAND Gate	US8	−40 to +85	1.65 to 5.5 V
NL27WZ02	Dual 2−Input NOR Gate	US8	−40 to +85	1.65 to 5.5 V
NL27WZ04	Dual Inverter	TSOP−6, SC−88	−40 to +85	1.65 to 5.5 V
NL27WZ06	Dual Inverter w/Open Drain Outputs	TSOP−6, SC−88	−40 to +85	1.65 to 5.5 V
NL27WZ07	Dual Non−Inverting Bufffer, Open Drain	TSOP−6, SC−88	−40 to +85	1.65 to 5.5 V
NL27WZ08	Dual 2−Input AND Gate	US8	−40 to +85	1.65 to 5.5 V
NL27WZ14	Dual Schmitt Trigger Inverter	TSOP−6, SC−88	−40 to +85	1.65 to 5.5 V
NL27WZ16	Dual Non−Inverting Buffer	TSOP−6, SC−88	−40 to +85	1.65 to 5.5 V
NL27WZ17	Dual Non−Inverting Schmitt Trigger Buffer	TSOP−6, SC−88	−40 to +85	1.65 to 5.5 V
NL27WZ32	Dual 2−Input OR Gate	US8	−40 to +85	1.65 to 5.5 V
NL27WZ86	Dual Exclusive OR Gate	US8	−40 to +85	1.65 to 5.5 V
NL27WZ125	Dual Non−Inverting Tri−State Buffer, Low Enable	US8	−40 to +85	1.65 to 5.5 V
NL27WZ126	Dual Non−Inverting Tri−State Buffer, High Enable	US8	−40 to +85	1.65 to 5.5 V
NL27WZU04	Dual Inverter, Unbuffered	TSOP−6, SC−88	−40 to +85	1.65 to 5.5 V
NL37WZ04	Triple Inverter	US8	−40 to +85	1.65 to 5.5 V
NL37WZ06	Triple Inverter w/Open Drain Outputs	US8	−40 to +85	1.65 to 5.5 V
NL37WZ07	Triple Non−Inverting Buffer, Open Drain	US8	−40 to +85	1.65 to 5.5 V
NL37WZ14	Ttriple Schmitt Trigger Inverter	US8	−40 to +85	1.65 to 5.5 V
NL37WZ16	Triple Buffer	US8	−40 to +85	1.65 to 5.5 V
NL37WZ17	Triple Non−Inverting Schmitt Trigger Buffer	US8	−40 to +85	1.65 to 5.5 V

VCX One Gates

Ordering Suffixes: XV5T2 = SOT−553 (available in T & R only), G = Pb−free				
Part Number	**Description**	**Surface Mount Packages**	**Temperature**	**Operating Voltage**
NL17SV00	Single 2−Input NAND Gate	SOT−553	−40 to +85	0.9 to 3.6 V
NL17SV02	Single 2−Input NOR Gate	SOT−553	−40 to +85	0.9 to 3.6 V
NL17SV04	Single Inverter	SOT−553	−40 to +85	0.9 to 3.6 V
NL17SV08	Single 2−Input AND Gate	SOT−553	−40 to +85	0.9 to 3.6 V
NL17SV16	Single Buffer	SOT−553	−40 to +85	0.9 to 3.6 V
NL17SV32	Single 2−Input OR Gate	SOT−553	−40 to +85	0.9 to 3.6 V

NLU Multi−Gates

Part Number	Description	Operating Voltage (V)	Package Type	Size	Production
NLU1G04MUTCG	Single Inverter	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1G14MUTCG	Single Inverter, Schmitt Input	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1GT04MUTCG	Single Inverter, TTL Level	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1GT14MUTCG	Single Inverter, Schmitt Input,TTL Level	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1GT50MUTCG	Single Buffer Non Inverting, TTL Level	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1GU04MUTCG	Single Inverter Unbuffered	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1G07MUTCG	Single Non Inverting Buffer, Open Drain	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1G08MUTCG	Single 2−Input AND Gate	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1G32MUTCG	Single 2−Input OR Gate	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1G86MUTCG	Single 2−Input Exclusive OR Gate	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1GT32MUTCG	Single 2−Input OR Gate, TTL Levels	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1GT86MUTCG	Single 2−Input Exclusive OR Gate, TTL Levels	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1GT125MUTCG	Non−Inverting 3−State Buffer, TTL Levels	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU1GT126MUTCG	Non−Inverting 3−State Buffer, TTL Levels	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU2G04MUTCG	Dual Inverter	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU2G06MUTCG	Dual Inverter, Open Drain	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU2G07MUTCG	Dual Buffer, Open Drain	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU2G14MUTCG	Dual Inverter, Schmitt	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU2G16MUTCG	Dual Buffer	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU2G17MUTCG	Dual Buffer Schmitt	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU2GU04MUTCG	Dual Unbuffered Inverter	1.65 to 5.5	UDFN6	1.2 mm x 1.0mm x 0.5 mm	2Q07
NLU3G14MUTCG	Triple Inverter, Schmitt	1.65 to 5.5	UDFN8	1.8 mm x 1.2 mm x 0.5 mm	2Q07
NLU3G16MUTCG	Triple Buffer	1.65 to 5.5	UDFN8	1.8 mm x 1.2 mm x 0.5 mm	2Q07
NLU3G17MUTCG	Triple Non Inverting Schmitt Trigger Buffer	1.65 to 5.5	UDFN8	1.8 mm x 1.2 mm x 0.5 mm	2Q07

Low Voltage Standard Logic

VCX

Ordering Suffixes: DTR = TSSOP T & R, MNR2 = DFN, G = Pb−free

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
74VCXH245	8−Bit Bus Buffer (3−State, Bus Hold)	QFN−20	−40 to +85	1.65 to 3.6 V
74VCXH16245	16−Bit Bus Transceiver (3−State, Bus Hold)	TSSOP−48	−40 to +85	1.65 to 3.6 V

VHC

Ordering Suffixes: D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, M = SOEIAJ Rail, MEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
MC74VHC00	Quad 2−Input NAND Gate	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT00A	Quad 2−Input NAND Gate (TTL Compatible)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC02	Quad 2−Input Positive−NOR Gate	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT02A	Quad 2−Input Positive−NOR Gate	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC04	Hex Inverter	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT04A	Hex Inverter (TTL Compatible)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHCU04	Hex Inverter (Unbuffered)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHC08	Quad 2−Input AND Gate	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT08A	Quad 2−Input AND Gate, TTL Compatible	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC14	Hex Schmitt Trigger	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT14A	Hex Schmitt Trigger, TTL Compatible	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC32	Quad 2−Input OR Gate	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT32A	Quad 2−Input OR Gate (TTL Compatible)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC50	Hex Buffer	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT50A	Hex Buffer (TTL Compatible)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC74	Dual D Flip−Flop w/Preset and Clear	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT74A	Dual D Flip−Flop w/Preset and Clear (TTL Compatible)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC86	Quad Exclusive−OR Gate	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT86A	Quad 2−Input Exclusive−OR Gate (TTL Compatible)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC125	Quad Bus Buffer (3−State)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT125A	Quad Bus Buffer Gate (3−State) (TTL Compatible)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC126	Quad Bus Buffer (3−State)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT126A	Quad Bus Buffer Gate (3−State) (TTL Compatible)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC132	Quad 2−Input Schmitt NAND Gate	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT132A	Quad 2−Input Schmitt NAND Gate	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC138	3−to−8 Line Decoder/Demultiplexer	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 5.5 V
MC74VHCT138A	3−to−8 Line Decoder (TTL Compatible)	SO−16, TSSOP−16, EIAJ−16	−55 to +125	4.5 to 5.5 V
MC74VHC139	Dual 2−to−4 Line Decoder/Demultiplexer	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 5.5 V
MC74VHCT139A	Dual 2−to−4 Line Decoder/DeMultiplexer (TTL Compatible)	SO−16, TSSOP−16, EIAJ−16	−55 to +125	4.5 to 5.5 V
MC74VHC157	Quad 2−Channel Multiplexer	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 5.5 V
MC74VHCT157A	Quad 2−to−1 Data Selector/Multiplexer (TTL Compatible)	SO−16, TSSOP−16, EIAJ−16	−55 to +125	4.5 to 5.5 V
MC74VHC240	Octal Bus Buffer (3−State/Inverted)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74VHCT240A	Octal Bus Buffer (3−State/Inverted) (TTL Compatible)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V

VHC (continued)

Ordering Suffixes: D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, M = SOEIAJ Rail, MEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
MC74VHC244	Octal Bus Buffer (3−State)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74VHCT244A	Octal Bus Buffer (3−State) (TTL Compatible)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74VHC245	Octal Bus Transceiver (3−State)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74VHCT245A	Octal Bus Transceiver (3−State) (TTL Compatible)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74VHC257	Quad 2−Line to 1−Line Data Selectors/Multiplexer (3−State)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74VHCT257A	Quad 2−to−1 Data Selectors/Mux (3−State) (TTL Compatible)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74VHC259	8−Bit Addressable Latch	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHCT259A	8−Bit Addressable Latch (TTL Compatible)	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74VHC373	Octal D−Type Latch (3−State)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74VHCT373A	Octal D−Type Latch (3−State) (TTL Compatible)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74VHC374	Octal D−Type Flip−Flop (3−State)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74VHCT374A	Octal D−Type Flip−Flop (3−State) (TTL Compatible)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74VHC540	Octal Bus Buffer (3−State/Inverted)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74VHCT540A	Octal Bus Buffer (3−State/Inverted) (TTL Compatible)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74VHC541	Octal Bus Buffer (3−State)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74VHCT541A	Octal Bus Buffer (3−State) (TTL Compatible)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74VHC573	Octal D−Type Latch (3−State)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74VHCT573A	Octal D−Type Latch (3−State) (TTL Compatible)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74VHC574	Octal D−Type Flip−Flop (3−State)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74VHCT574A	Octal D−Type Flip−Flop (3−State)(TTL Compatible)	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74VHC4051	8−to−1 Channel Analog Multiplexer	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 5.5 V
MC74VHC4052	Dual 4 Channel Analog Multiplexer	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 5.5 V
MC74VHC4053	Triple 2 Channel Analog Multiplexer	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 5.5 V
MC74VHC4066	Quad Analog Switch	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC74VHC4316	Quad Analog Switch w/Translator	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 5.5 V

LCX

Ordering Suffixes: D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, M = SOEIAJ Rail, MEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
MC74LCX00	Quad 2−Input NAND Gate	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCX02	Quad 2−Input Positive−NOR Gate	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCX04	Hex Inverter	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCXU04	Hex Inverter (Unbuffered)	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCX06	Hex Inverter w/Open−Drain Output	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCX07	Hex Buffer w/Open−Drain Output	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCX08	Quad 2−Input AND Gate	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCX14	Hex Schmitt Trigger	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCX32	Quad 2−Input OR Gate	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCX74	Dual D Flip−Flop w/Preset and Clear	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V

LCX (continued)

Ordering Suffixes: D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, M = SOEIAJ Rail, MEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
MC74LCX86	Quad Exclusive−OR Gate	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCX125	Quad Bus Buffer (3−State)	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LCX138	3−to−8 Line Decoder/Demultiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LCX139	Dual 2−to−4 Line Decoder/Demultiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LCX157	Quad 2−Channel Multiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LCX158	Quad 2−to−1 Data Selector/Multiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LCX240	Octal Bus Buffer (3−State/Inverted)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX244	Octal Bus Buffer (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX245	Octal Bus Transceiver (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX257	Quad 2−Line To 1−Line Data Selectors/Multiplexer (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX258	Quad 2−Line To 1−Line Data Selectors/Multiplexer (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX373	Octal D−Type Latch (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX374	Octal D−Type Flip−Flop (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX540	Octal Bus Buffer (3−State/Inverted)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX541	Octal Bus Buffer (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX573	Octal D−Type Latch (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX574	Octal D−Type Flip−Flop (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LCX16240	16−Bit Bus Buffer (3−State/Inverted)	TSSOP−48	−40 to +85	2.0 to 3.6 V
MC74LCX16244	16−Bit Bus Buffer (3−State)	TSSOP−48	−40 to +85	2.0 to 3.6 V
MC74LCX16245	16−Bit Bus Transceiver (3−State)	TSSOP−48	−40 to +85	2.0 to 3.6 V
MC74LCX16373	16−Bit D−Type Latch (3−State)	TSSOP−48	−40 to +85	2.0 to 3.6 V
MC74LCX16374	16−Bit D−Type Flip−Flop (3−State)	TSSOP−48	−40 to +85	2.0 to 3.6 V

LVX

Ordering Suffixes: D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, M = SOEIAJ Rail, MEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
MC74LVX00	Quad 2−Input NAND Gate	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX02	Quad 2−Input Positive−NOR Gate	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX04	Hex Inverter	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVXU04	Hex Inverter (Unbuffered)	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX08	Quad 2−Input AND Gate	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX14	Hex Schmitt Trigger	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX32	Quad 2−Input OR Gate	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX50	Hex Buffer	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX74	Dual D Flip−Flop w/Preset and Clear	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX86	Quad Exclusive−OR Gate	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX125	Non−Inverting Tri−State Buffer, Low Enable	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX126	Quad Bus Buffer	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX132	Quad 2−Input NAND Schmitt Trigger	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX138	3−to−8 Line Decoder/Demultiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVX139	Dual 2−to−4 Line Decoder/Demultiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVX157	Quad 2−Channel Multiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVX240	Octal Bus Buffer (3−State/Inverted)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LVX244	Octal Bus Buffer (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LVX245	Octal Bus Transceiver (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V

LVX (continued)

Ordering Suffixes: D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, M = SOEIAJ Rail, MEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Surface Mount Packages	Temperature	Operating Voltage
MC74LVX257	Quad 2−Line to 1−Line Data Selectors/Multiplexer (3−State)	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX259	8−Bit Addressable Latch	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVX373	Octal D−Type Latch (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LVX374	Octal D−Type Flip−Flop (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LVX540	Octal Inverting Bus Buffer	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.6 to 3.6 V
MC74LVX541	Octal Bus Buffer (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LVX573	Octal D−Type Latch (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LVX574	Octal D−Type Flip−Flop (3−State)	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 3.6 V
MC74LVXC3245	Octal Dual Supply Translating Bus Transceiver	SO−24W, TSSOP−24	−40 to +85	2.0 to 3.6 V
MC74LVX4051	8−to−1 Channel Analog Multiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVXT4051	8−to−1 Channel Analog Multiplexer (TTL Compatible Inputs)	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVX4052	Dual 4 Channel Analog Multiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVXT4052	Dual 4 Channel Analog Multiplexer (TTL Compatible Inputs)	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVX4053	Triple 2 Channel Analog Multiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVXT4053	Triple 2 Channel Analog Multiplexer (TTL Compatible Inputs)	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVX4066	Quad Analog Switch	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVXT4066	Quad Analog Switch (TTL Compatible Inputs)	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 3.6 V
MC74LVX4245	Octal Dual Supply Translating Bus Transceiver	SO−24W, TSSOP−24	−40 to +85	2.0 to 3.6 V
MC74LVX8051	8−to−1 Channel Analog Multiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVXT8051	8−to−1 Channel Analog Multiplexer (TTL Compatible Inputs)	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVX8053	Triple 2 Channel Analog Multiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V
MC74LVXT8053	Triple 2 Channel Analog Multiplexer	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 3.6 V

High−Speed CMOS Product Designation Definitions

HC vs. HCT

ON Semiconductor's High−Speed CMOS product family, intended to give the designer an alternative to LSTTL. HSCMOS, with the faster speed advantage over metal−gate CMOS (MC14000 series) and the lower power consumption advantage over LSTTL, is an optimum choice for midrange designs. With the availability of high−speed CMOS microprocessors and memories, the ability to design a 100% CMOS system is possible.

HCT devices offer a short−term solution to the TTL/NMOS−to−CMOS interface problem. To achieve this interface capability, some CMOS advantages had to be compromised. These compromises include power consumption, operating voltage range, and noise immunity.

In most cases HCT devices are drop−in replacements of TTL devices with significant advantages over the TTL devices. However, in some cases, an equivalent HCT device may not replace a TTL device without some form of circuit modification.

Designers can use HCT devices to perform logic level conversions only. In newer designs, the designer wants all the advantages of a true CMOS system and designs using only HC devices.

"A" versus "Non−A"

"A" Versus "Non−A" — ON Semiconductor has a device performance enhancement program for the High−Speed CMOS family. This is indicated by an "A" suffix on the device identification. Some of the characteristics of this "A" enhancement program are improved design, a better quality process, faster performing AC propagation delays and enhancements to various DC characteristics.

5.0 V and Greater Standard Logic

High Speed CMOS: HC A−Family

Ordering Suffixes: N = PDIP Rail, D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, F = SOEIAJ Rail, FEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Dual−In−Line Packages	Surface Mount Packages	Temperature	Operating Voltage
MC74HC00A	Quad 2−Input NAND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC02A	Quad 2−Input Positive−NOR Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC03A	Quad 2−Input NAND Gate (Open Drain)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC04A	Hex Inverter	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HCT04A	Hex Inverter (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74HCU04A	Hex Inverter (Unbuffered)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC08A	Quad 2−Input AND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC14A	Hex Schmitt Trigger	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HCT14A	Hex Schmitt Trigger Inverter (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74HC32A	Quad 2−Input OR Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC74A	Dual D Flip−Flop w/Preset and Clear	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HCT74A	Dual D Flip−Flop w/ Preset and Clear (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	4.5 to 5.5 V
MC74HC86A	Quad Exclusive−OR Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC125A	Quad Bus Buffer (3−State)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC126A	Quad Bus Buffer (3−State)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC132A	Quad 2−Input Schmitt NAND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC138A	3−to−8 Line Decoder/Demultiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HCT138A	Dual 2−to−4 Line Decoder/Demultiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	4.5 to 5.5 V
MC74HC139A	Dual 1−of−4 Decoder/Demultiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC157A	Quad 2−Channel Multiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC161A	Synchronous Binary Counter w/Asynchronous Clear	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC163A	Synchronous Binary Counter w/Asynchronous Clear	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC164A	8−Bit SIPO Shift Register	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC165A	8−Bit PISO Shift Register	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC174A	Hex D Flip−Flop w/Clear	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC175A	Quad D Flip−Flop w/Clear	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC240A	Octal Bus Buffer (3−State/Inverted)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 6.0 V
MC74HC244A	Octal Bus Buffer (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 6.0 V
MC74HCT244A	Octal Bus Buffer (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74HC245A	Octal Bus Transceiver (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 6.0 V

High Speed CMOS: HC A−Family

Ordering Suffixes: N = PDIP Rail, D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, F = SOEIAJ Rail, FEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Dual−In−Line Packages	Surface Mount Packages	Temperature	Operating Voltage
MC74HCT245A	Octal Bus Transceiver (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74HC273A	Octal D−Type Flip−Flop	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 5.5 V
MC74HCT273A	Octal D−Type Flip−Flop w/Clear (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74HC373A	Octal D−Type Latch (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 6.0 V
MC74HCT373A	Octal D−Type Latch (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74HC374A	Octal D−Type Flip−Flop (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 6.0 V
MC74HCT374A	Octal D−Type Flip−Flop (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74HC390A	Dual Binary Counter w/ +2 +5 Sections	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC393A	Dual 4−Stage Binary Ripple Counter	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC540A	Octal Bus Buffer (3−State/Inverted)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 6.0 V
MC74HC541A	Octal Bus Buffer (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 6.0 V
MC74HCT541A	Octal Bus Buffer (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74HC573A	Octal D−Type Latch (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 6.0 V
MC74HCT573A	Octal D−Type Latch (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74HC574A	Octal D−Type Flip−Flop (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	2.0 to 6.0 V
MC74HCT574A	Octal D−Type Flip−Flop (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−55 to +125	4.5 to 5.5 V
MC74HC589A	8−Bit Shift Register	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC595A	8−Bit Shift Register/Latch (3−State)	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC4020A	14−Stage Binary Ripple Counter	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC4040A	12−Stage Binary Ripple Counter	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC4046A	Phase Lock Loop	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC4051A	8−to−1 Channel Analog Multiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC4052A	Dual 4 Channel Analog Multiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC4053A	Triple 2 Channel Analog Multiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC4060A	14−Stage Binary Ripple Counter w/Oscillator	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC4066A	Quad Analog Switch	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 6.0 V
MC74HC4316A	Quad Analog Switch w/Translator	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V

High Speed CMOS: HC A−Family

Ordering Suffixes: N = PDIP Rail, D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, F = SOEIAJ Rail, FEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Dual−In−Line Packages	Surface Mount Packages	Temperature	Operating Voltage
MC74HC4538A	Dual Re−triggerable Precision Monostable Multivibrator	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC4851A	8−to−1 Channel Analog Multiplexer w/Inj Current Control	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V
MC74HC4852A	Dual 4 Channel Analog Multiplexer w/Inj Current Control	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	2.0 to 6.0 V

High Speed CMOS: HC Family

Ordering Suffixes: DR2G = Pb−free SOIC in Tape & Reel, DTR2G = Pb−free TSSOP in Tape & Reel

Part Number	Desciption	Packages	Temperature (°C)	Operating Voltage (V)
74HC00	Quad 2−Input NAND Gate	SO−14, TSSOP−14	−55 to +125	2.0 to 6.0
74HC02	Quad 2−Input Positive NOR Gate	SO−14, TSSOP−14	−55 to +125	2.0 to 6.0
74HC04	Hex Inverter	SO−14, TSSOP−14	−55 to +125	2.0 to 6.0
74HCT04	Hex Inverter (TTL Compatible)	SO−14, TSSOP−14	−55 to +125	4.5 to 6.0
74HCU04	Hex Inverter (Unbuffered)	SO−14, TSSOP−14	−55 to +125	4.5 to 6.0
74HC08	Quad 2−Input AND Gate	SO−14, TSSOP−14	−55 to +125	2.0 to 6.0
74HCT08	Quad 2−Input AND Gate (TTL Compatible)	SO−14, TSSOP−14	−55 to +125	4.5 to 6.0
74HC14	Hex Schmitt Trigger	SO−14, TSSOP−14	−55 to +125	2.0 to 6.0
74HCT14	Hex Schmitt Trigger (TTL Compatible)	SO−14, TSSOP−14	−55 to +125	4.5 to 6.0
74HC32	Quad 2−Input OR Gate	SO−14, TSSOP−14	−55 to +125	2.0 to 6.0
74HC74	Dual D Flip−Flop 2/ Preset and Clear	SO−14, TSSOP−14	−55 to +125	2.0 to 6.0
74HC86	Quad Exclusive OR Gate	SO−14, TSSOP−14	−55 to +125	2.0 to 6.0
74HC125	Quad Bus Buffer 3−State	SO−14, TSSOP−14	−55 to +125	2.0 to 6.0
74HC132	Quad 2−Input Schmitt NAND Gate	SO−14, TSSOP−14	−55 to +125	2.0 to 6.0
74HC138	3−to−8 Line Decoder / Demultiplexer	SO−16, TSSOP−16	−55 to +125	2.0 to 6.0
74HCT157	Quad 2−Channel Multiuplexer (TTL Compatible)	SO−16, TSSOP−16	−55 to +125	4.5 to 6.0
74HC244	Octal Bus Buffer (3−State)	TSSOP−20	−55 to +125	2.0 to 6.0
74HC245	Octal Bus Transceiver (3−State)	TSSOP−20	−55 to +125	2.0 to 6.0
74HC373	Octal D−Type Latch (3−State)	TSSOP−20	−55 to +125	2.0 to 6.0
74HC374	Octal D−Type Flip−Flop (3−State)	TSSOP−20	−55 to +125	2.0 to 6.0
74HC574	Octal D−Type Flip Flop (3−State)	TSSOP−20	−55 to +125	2.0 to 6.0
74HC595	8 Bit Shift Register/Latch (3−State)	SO−16, TSSOP−16	−55 to +125	2.0 to 6.0

AC/ACT

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Part Number	Description	Dual−In−Line Packages	Surface Mount Packages	Temperature	Operating Voltage
MC74AC00	Quad 2−Input NAND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT00	Quad 2−Input NAND Gate (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC02	Quad 2−Input NOR Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT02	Quad 2−Input NOR Gate (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC04	Hex Inverter	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT04	Hex Inverter (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC05	Hex Inverter w/Open−Drain Output	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT05	Hex Inverter w/Open−Drain Output (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC08	Quad 2−Input AND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT08	Quad 2−Input AND Gate (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC10	Triple 3−Input NAND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT10	Triple 3−Input NAND Gate (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC11	Triple 3−Input AND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT11	Triple 3−Input AND Gate (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC14	Hex Schmitt Trigger	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT14	Hex Schmitt Trigger Inverter (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC20	Dual 4−Input NAND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT20	Dual 4−Input NAND Gate (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC32	Quad 2−Input OR Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT32	Quad 2−Input OR Gate (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC74	Dual D Flip−Flop w/Preset and Clear	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT74	Dual D Flip−Flop w/Preset and Clear (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC86	Quad Exclusive−OR Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT86	Quad 2−Input Exclusive−OR Gate (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC125	Quad Bus Buffer (3−State)	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 6.0 V
MC74ACT125	Quad Bus Buffer Gate (3−State) (TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC132	Quad 2−Input NAND Gate (Schmitt−Trigger)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	2.0 to 6.0 V
MC74ACT132	Quad 2−Input NAND Gate (Schmitt−Trigger, TTL Compatible)	DIP−14	SO−14, TSSOP−14, EIAJ−14	−40 to +85	4.5 to 5.5 V
MC74AC138	3−to−8 Line Decoder/Demultiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 6.0 V

AC/ACT

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MC74ACT138	3−to−8 Line Decoder (TTL Compatible)	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	4.5 to 5.5 V
MC74AC139	Dual 2−to−4 Line Decoder/Demultiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 6.0 V
MC74ACT139	Dual 2−to−4 Line Decoder/DeMultiplexer (TTL Compatible)	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	4.5 to 5.5 V
MC74ACT153	Dual 4−Input Multiplexer, TTL Compatible Inputs	DIP−16	SO−16, EIAJ−16	−40 to +85	4.5 to 5.5 V
MC74AC157	Quad 2−Channel Multiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 6.0 V
MC74ACT157	Quad 2−to−1 Data Selector/Multiplexer (TTL Compatible)	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	4.5 to 5.5 V
MC74AC161	Synchronous Presettable Binary Counter	DIP−16	SO−16, EIAJ−16	−40 to +85	2.0 to 6.0 V
MC74ACT161	Synchronous Presettable Binary Counter, TTL Compatible Inputs	DIP−16	SO−16, EIAJ−16	−40 to +85	4.5 to 5.5 V
MC74AC163	Synchronous Presettable Binary Counter	DIP−16	SO−16, EIAJ−16	−40 to +85	2.0 to 6.0 V
MC74ACT163	Synchronous Presettable Binary Counter, TTL Compatible Inputs	DIP−16	SO−16, EIAJ−16	−40 to +85	4.5 to 5.5 V
MC74AC240	Octal Bus Buffer (3−State/Inverted)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V
MC74ACT240	Octal Bus Buffer (3−State/Inverted) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74ACT241	Octal Bus Buffer (3−State/Non−Inverted) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC244	Octal Bus Buffer (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V
MC74ACT244	Octal Bus Buffer (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC245	Octal Bus Transceiver (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V
MC74ACT245	Octal Bus Transceiver (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC253	Dual 4−Input Multiplexer w/3−State Outputs	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 6.0 V
MC74ACT253	Dual 4−Input Multiplexer w/3−State Outputs	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	4.5 to 5.5 V
MC74AC257	Quad 2−Line to 1−Line Data Selectors/Multiplexer (3−State)	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 6.0 V
MC74ACT257	Quad 2−to−1 Data Selectors/Mux (3−State) (TTL Compatible)	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	4.5 to 5.5 V
MC74AC259	8−Bit Addressable Latch	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 6.0 V
MC74ACT259	8−Bit Addressable Latch	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	4.5 to 5.5 V
MC74AC273	Octal D−Type Flip−Flop	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V
MC74ACT273	Octal D−Type Flip−Flop w/Clear (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC373	Octal D−Type Latch (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V

AC/ACT

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MC74ACT373	Octal D−Type Latch (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC374	Octal D−Type Flip−Flop (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V
MC74ACT374	Octal D−Type Flip−Flop (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC377	Octal D−Type Flip−Flop w/Data Enable (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V
MC74ACT377	Octal D−Type Flip−Flop w/Data Enable (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC540	Octal Bus Buffer (3−State/Inverted)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V
MC74ACT540	Octal Bus Buffer (3−State/Inverted) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC541	Octal Bus Buffer (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V
MC74ACT541	Octal Bus Buffer (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74ACT564	Octal D−Type Latch w/3−State Outputs (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC573	Octal D−Type Latch (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V
MC74ACT573	Octal D−Type Latch (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC574	Octal D−Type Flip−Flop (3−State)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	2.0 to 6.0 V
MC74ACT574	Octal D−Type Flip−Flop (3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74ACT640	Octal Bus Transceiver (Inverting, 3−State) (TTL Compatible)	DIP−20	SO−20W, TSSOP−20, EIAJ−20	−40 to +85	4.5 to 5.5 V
MC74AC646	Octal Bus Transceiver/Register (3−State)	DIP−24	SO−24W, TSSOP−24, EIAJ−24	−40 to +85	2.0 to 6.0 V
MC74ACT646	Octal Bus Transceiver/Register (3−State) (TTL Compatible)	DIP−24	SO−24W, TSSOP−24, EIAJ−24	−40 to +85	4.5 to 5.5 V
MC74AC652	Octal Bus Transceiver/Register (3−State)	DIP−24	SO−24W, TSSOP−24, EIAJ−24	−40 to +85	2.0 to 6.0 V
MC74ACT652	Octal Bus Transceiver/Register (3−State) (TTL Compatible)	DIP−24	SO−24W, TSSOP−24, EIAJ−24	−40 to +85	4.5 to 5.5 V
MC74AC4040	12−Stage Binary Ripple Counter	DIP−16	SO−16, TSSOP−16, EIAJ−16	−40 to +85	2.0 to 6.0 V

Metal Gate CMOS

Ordering Suffixes:	CP = PDIP, D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, F = SOEIAJ Rail, FEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Dual−In−Line Packages	Surface Mount Packages	Temperature	Operating Voltage
MC14001B	Quad 2−Input NOR Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14001UB	Quad 2−Input NOR Gate Unbuffered	DIP−14	SO−14	−55 to +125	3.0 to 18 V
MC14007UB	Dual Complementary Pair plus Inverter	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14008B	4−Bit Full Adder	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14011B	Quad 2−Input NAND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14011UB	Quad 2−Input NAND Gate Unbuffered	DIP−14	SO−14	−55 to +125	3.0 to 18 V
MC14012B	Dual 4−Input NAND Gate	DIP−14	SO−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14013B	Dual D Flip−Flop	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14014B	8−Bit Static Shift Register	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14015B	Dual 4−Bit Static Shift Register	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14016B	Quad Analog Switch/Multiplexer	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14017B	Decade Counter	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14018B	Presettable Divide−by−N Counter	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14020B	14−Bit Binary Counter	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14021B	8−Bit Static Shift Register	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14022B	Octal Counter	DIP−16	SO−16	−55 to +125	3.0 to 18 V
MC14023B	Triple 3−Input NAND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14024B	7−Stage Ripple Counter	DIP−14	SO−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14025B	Triple 3−Input NOR Gate	DIP−14	SO−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14027B	Dual J−K Flip−Flop	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14028B	BCD−to−Decimal/Binary−to−Octal De-coder	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14029B	Presettable Binary/BCD Up/Down Count-er	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14040B	12−Stage Ripple−Carry Binary Counter/ Divider	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14042B	Quad Clocked D−Latch	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14043B	Quad NOR R−S Latch	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14044B	Quad NAND R−S Latch	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14046B	Phase−Locked Loop	DIP−16	SO−16W,EIAJ−16	−55 to +125	3.0 to 18 V
MC14049B	Hex Inverter	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14049UB	Hex Inverter Unbuffered	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14050B	Hex Buffer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V

Metal Gate CMOS

Ordering Suffixes: CP = PDIP, D = SOIC Rail, DR2 = SOIC T & R, DW = SOICW Rail, DWR2 = SOICW T & R, DT = TSSOP Rail, DTR2 = TSSOP T & R, F = SOEIAJ Rail, FEL = SOEIAJ T & R, G = Pb−free

Part Number	Description	Dual−In−Line Packages	Surface Mount Packages	Temperature	Operating Voltage
MC14051B	8−Channel Analog Multiplexer/Demultiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14052B	Dual 4−Channel Analog Multiplexer/Demultiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14053B	Triple 2−Channel Analog Multiplexer/Demultiplexer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14060B	14−Stage Binary Counter/Oscillator	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14066B	Quad Analog Switch	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14067B	16−Channel Analog Multiplexer/Demultiplexer	DIP−24	SO−24W, TSSOP−24	−55 to +125	3.0 to 18 V
MC14069UB	Hex Inverter	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14070B	Quad 2−Input Exclusive−OR Gate	DIP−14	SO−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14071B	Quad 2−Input OR Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14073B	Triple 3−Input AND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14076B	Quad D−Type Register w/3−State Outputs	DIP−24	SO−24	−55 to +125	3.0 to 18 V
MC14077B	Quad 2−Input Exclusive−NOR Gate	DIP−14	SO−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14081B	Quad 2−Input AND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14082B	Dual 4−Input AND Gate	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14093B	Quad 2−Input Schmitt Trigger NAND	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	3.0 to 18 V
MC14094B	8−Stage Shift/Store Register w/3−State Outputs	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14099B	8−Bit Addressable Latch	DIP−16	SO−16W	−55 to +125	3.0 to 18 V
MC14106B	Hex Schmitt Trigger	DIP−14	SO−14, TSSOP−14	−55 to +125	3.0 to 18 V
MC14174B	Hex D Flip−Flop	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14175B	Quad D Flip−Flop	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14490	Hex Contact Bounce Eliminator	DIP−16	SO−16W, EIAJ−16	−55 to +125	3.0 to 18 V
MC14503B	Hex 3−State Buffer	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14504B	TTL or CMOS to CMOS Hex Level Shifter	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14511B	BCD−to−7 Segment Latch/Decoder/Driver	DIP−16	SO−16, SO−16W, EIAJ−16	−55 to +125	3.0 to 18 V
MC14512B	8−Channel Data Selector	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14513B	BCD−to−7 Segment Latch/Decoder/Driver w/Ripple Blanking	DIP−18	N/A	−55 to +125	3.0 to 18 V
MC14514B	4−Bit Transparent Latch/4−to−16 Line Decoder (High)	DIP−24	SO−24W	−55 to +125	3.0 to 18 V
MC14515B	4−Bit Transparent Latch/4−to−16 Line Decoder (Low)	DIP−24	SO−24W	−55 to +125	3.0 to 18 V
MC14516B	Presettable Binary Up/Down Counter	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V

Metal Gate CMOS

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Part Number	Description	Dual−In−Line Packages	Surface Mount Packages	Temperature	Operating Voltage
MC14517B	Dual 64−Bit Static Shift Register	DIP−16	SO−16W	−55 to +125	3.0 to 18 V
MC14518B	Dual BCD Up Counter	DIP−16	SO−16W, EIAJ−16	−55 to +125	3.0 to 18 V
MC14520B	Dual Binary Up Counter	DIP−16	SO−16W, EIAJ−16	−55 to +125	3.0 to 18 V
MC14521B	24−Stage Frequency Divider	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14526B	Presettable 4−Bit Binary Down Counter	DIP−16	SO−16W, EIAJ−16	−55 to +125	3.0 to 18 V
MC14528B	Dual Monostable Multivibrator	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14532B	8−Bit Priority Encoder	DIP−16	SO−16, EIAJ−16,	−55 to +125	3.0 to 18 V
MC14536B	Programmable Timer	DIP−16	SO−16W, EIAJ−16	−55 to +125	3.0 to 18 V
MC14538B	Dual Precision Monostable Multivibrator	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14541B	Programmable Oscillator/Timer	DIP−16	SO−16, TSSOP−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14543B	BCD−to−7 Segment Latch/Decoder/Driver for LCD	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14549B	Successive Approximation Register	DIP−16	SO−16W	−55 to +125	3.0 to 18 V
MC14551B	Quad 2−Channel Analog Multiplexer/Demultiplexer	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14553B	3−Digit BCD Counter	DIP−16	SO−16W	−55 to +125	3.0 to 18 V
MC14555B	Dual Binary to 1−of−4 Decoder (Active High Outputs)	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14556B	Dual Binary to 1−or−4 Decoder/Demultiplexer	DIP−16	SO−16, EIAJ−16	−55 to +125	3.0 to 18 V
MC14557B	1−to−64 Bit Variable Length Shift Register	DIP−16	SO−16W, EIAJ−16	−55 to +125	3.0 to 18 V
MC14559B	Successive Approximation Register	DIP−16	SO−16W	−55 to +125	3.0 to 18 V
MC14562B	128−Bit Static Shift Register	DIP−14	N/A	−55 to +125	3.0 to 18 V
MC14569B	Programmable Dual 4−Bit Binary/BCD Down Converter	DIP−16	SO−16W, TSSOP−16	−55 to +125	3.0 to 18 V
MC14572UB	Hex Gate Unbuffered	DIP−16	SO−16, EIAJ−16	−55 to +125	2.0 to 5.5 V
MC14584B	Hex Schmitt Trigger	DIP−14	SO−14, TSSOP−14, EIAJ−14	−55 to +125	2.0 to 5.5 V
MC14585B	4−Bit Magnitude Comparator	DIP−16	SO−16, EIAJ−16	−55 to +125	2.0 to 5.5 V
MC14598B	8−Bit Bus−Compatible Addressable Latch	DIP−18	N/A	−55 to +125	2.0 to 5.5 V

Logic Special Functions

Part Number	Description	Dual−In−Line Packages	Surface Mount Packages	Temperature	Operating Voltage
JLC1562	I2C Bus I/O Expander	DIP−16	EIAJ−16	−40 to +85	4.2 to 6.0 V
NL7SZ18	2:1 Digital MUX, 3−State Output		SC−88	−40 to +85	1.65 to 5.5 V
NL7SZ19	2:1 Digital MUX		SC−88	−40 to +85	1.65 to 5.5 V
NLSF1174	Hex D Flip−Flop with Clear		QFN−16, 3x3mm	−55 to +125	2.0 to 6.0 V
NLSF2500	Keypad Multiplexer		QFN−16, 3x3mm	−40 to +85	1.5 to 5.5 V
NLSF3T125	Quad Bus Buffer, TTL Compatible		QFN−16, 3x3mm	−40 to +85	2.5 to 5.5 V
NLSF3T126	Quad Bus Buffer, TTL Compatible		QFN−16, 3x3mm	−40 to +85	2.5 to 5.5 V
NLSF595	Serial (SPI) Tri−Color LED Driver		TSSOP−16, SOIC−16, QFN−16	−55 to +125	2.0 to 5.5 V

Translators

Device	Type	Description	Package	Size	Production
NLSX3014MUTAG	Auto Sense Bi–Directional	4–Bit 100 Mbps Configurable Dual–Supply Level Translator	UQFN12	2.00 mm x 1.70 mm	2Q07
NLSV4T3234FCT1G	Uni–Directional	4–Bit Dual–Supply Bus Buffer Level Translator with 26 Ohm Output Series Resistor	μBump11	2.04 mm x 1.41 mm	NOW
NLSV1T240MUTAG	Uni–Directional	1–Bit Configurable Dual–Supply Bus Buffer Level Translator (Inverter)	UDFN6	1.20 mm x 1.00 mm	2Q07
NLSV1T244MUTAG	Uni–Directional	1–Bit Configurable Dual–Supply Bus Buffer Level Translator	UDFN6	1.20 mm x 1.00 mm	2Q07
NLSV2T240MUTAG	Uni–Directional	2–Bit Configurable Dual–Supply Bus Buffer Level Translator (Inverter)	UDFN8	1.80 mm x 1.20 mm	2Q07
NLSV2T244MUTAG	Uni–Directional	2–Bit Configurable Dual–Supply Bus Buffer Level Translator	UDFN8	1.80 mm x 1.20 mm	2Q07
NLSV4T240MUTAG	Uni–Directional	4–Bit Configurable Dual–Supply Bus Buffer Level Translator (Inverter)	UQFN12	1.70 mm x 2.00 mm	2Q07
NLSV4T244MUTAG	Uni–Directional	4–Bit Configurable Dual–Supply Bus Buffer Level Translator	UQFN12	1.70 mm x 2.00 mm	2Q07

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