Low Power 5V RS232 Dual Driver/Receiver with 0.1µF Capacitors

FEATURES

- **ESD Protection over ±10kV**
- **Uses Small Capacitors: 0.1µF**
- **120kBaud Operation for R_L = 3k, C_L = 2500pF**
- **250kBaud Operation for R_L = 3k, C_L = 1000pF**
- Outputs Withstand ±30V Without Damage
- CMOS Comparable Low Power: 40mW
- Operates from a Single 5V Supply
- Rugged Bipolar Design
- Outputs Assume a High Impedance State When Off or Powered Down
- Meets All RS232 Specifications
- Available With or Without Shutdown
- Absolutely No Latch-up
- Available in SO Package

APPLICATIONS

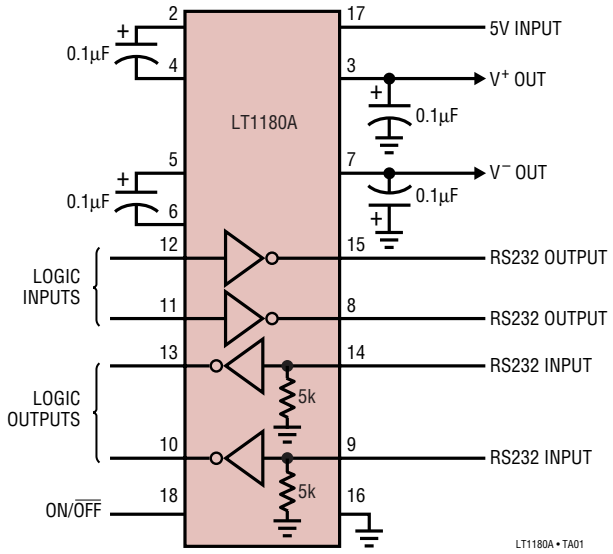
- Portable Computers
- Battery-Powered Systems
- Power Supply Generator
- Terminals
- Modems

DESCRIPTION

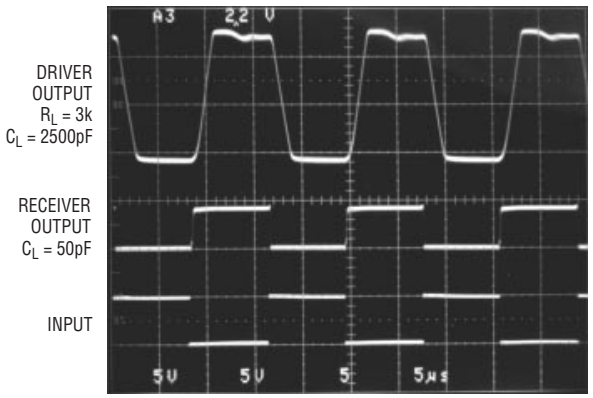
The LT®1180A/LT1181A are dual RS232 driver/receiver pairs with integral charge pump to generate RS232 voltage levels from a single 5V supply. These circuits feature rugged bipolar design to provide operating fault tolerance and ESD protection unmatched by competing CMOS designs. Using only 0.1µF external capacitors, these circuits consume only 40mW of power, and can operate to 120k baud even while driving heavy capacitive loads. New ESD structures on the chip allow the LT1180A/LT1181A to survive multiple ±10kV strikes, eliminating the need for costly TransZorbs® on the RS232 line pins. The LT1180A/LT1181A are fully compliant with EIA RS232 standards. Driver outputs are protected from overload, and can be shorted to ground or up to ±30V without damage. During shutdown or power-off conditions, driver and receiver outputs are in a high impedance state, allowing line sharing.

The LT1181A is available in 16-pin DIP and SO packages. The LT1180A is supplied in 18-pin DIP and SO packages for applications which require shutdown.

TYPICAL APPLICATION



Output Waveforms



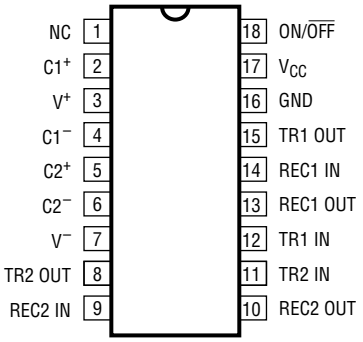
ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage (V_{CC}) 6V
V^+ 13.2V
V^- ..... –13.2V
Input Voltage
Driver ..... V^- to V^+
Receiver ..... –30V to 30V
ON/$\overline{OFF}$ ..... –0.3V to 12V
Output Voltage
Driver ..... V^+ – 30V to V^- + 30V
Receiver ..... –0.3V to V_{CC} + 0.3V

Short-Circuit Duration
V^+ ..... 30 sec
V^- ..... 30 sec
Driver Output ..... Indefinite
Receiver Output ..... Indefinite
Operating Temperature Range
LT1180AI/LT1181AI ..... –40°C to 85°C
LT1180AC/LT1181AC ..... 0°C to 70°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PACKAGE/ORDER INFORMATION

TOP VIEW



N PACKAGE 18-LEAD PDIP
SW PACKAGE 18-LEAD PLASTIC SO (WIDE)
T_{JMAX} = 125°C, θ_{JA} = 80°C/W, θ_{JC} = 36°C/W (N)
T_{JMAX} = 125°C, θ_{JA} = 90°C/W, θ_{JC} = 26°C/W (SW)

ORDER PART NUMBER

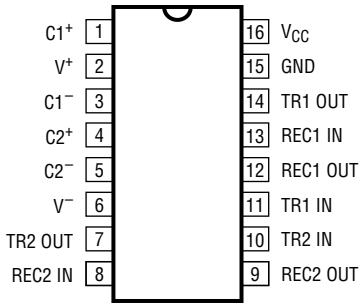
LT1180ACN
LT1180ACSW
LT1180AIN
LT1180AISW

J PACKAGE 18-LEAD CERDIP
T_{JMAX} = 150°C, θ_{JA} = 100°C/W, θ_{JC} = 40°C/W (J)

LT1180AMJ

OBSOLETE PACKAGE
Consider N Package for Alternate Source

TOP VIEW



N PACKAGE 16-LEAD PDIP
SW PACKAGE 16-LEAD PLASTIC SO (WIDE)
T_{JMAX} = 125°C, θ_{JA} = 90°C/W, θ_{JC} = 46°C/W (N)
T_{JMAX} = 125°C, θ_{JA} = 95°C/W, θ_{JC} = 27°C/W (SW)

ORDER PART NUMBER

LT1181ACN
LT1181ACSW
LT1181AIN
LT1181AISW

J PACKAGE 16-LEAD CERDIP
T_{JMAX} = 150°C, θ_{JA} = 100°C/W, θ_{JC} = 40°C/W (J)

LT1181AMJ

OBSOLETE PACKAGE
Consider N Package for Alternate Source

Consult LTC Marketing for parts specified with wider operating temperature ranges.

ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the operating temperature range (0°C ≤ T_A ≤ 70°C for commercial grade, and –40°C ≤ T_A ≤ 85°C for industrial grade. (Note 2)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Power Supply Generator						
V^+ Output				7.9		V
V^- Output				–7.0		V
Supply Current (V_{CC})	(Note 3), T_A = 25°C			9	13	mA
		●			16	mA
Supply Current When OFF (V_{CC})	Shutdown (Note 4) LT1180A Only	●		1	10	µA
Supply Rise Time	C1 = C2 = C3 = C4 = 0.1µF			0.2		ms
Shutdown to Turn-On	LT1180A Only			0.2		ms
ON/$\overline{OFF}$ Pin Thresholds	Input Low Level (Device Shutdown)	●	0.8	1.2		V
	Input High Level (Device Enabled)	●		1.6	2.4	V

ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the operating temperature range ($0°C \le T_A \le 70°C$ for commercial grade, and $-40°C \le T_A \le 85°C$ for industrial grade. (Note 2)

PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
ON/$\overline{OFF}$ Pin Current	$0V \le V_{ON/\overline{OFF}} \le 5V$		●	–15		80	µA
Oscillator Frequency					130		kHz
Driver							
Output Voltage Swing	Load = 3k to GND	Positive		5.0	7.5		V
		Negative	●		–6.3	–5.0	V
Logic Input Voltage Level	Input Low Level (V_{OUT} = High)		●		1.4	0.8	V
Input High Level (V_{OUT} = Low)			●	2.0	1.4		V
Logic Input Current	$0.8V \le V_{IN} \le 2.0V$		●		5	20	µA
Output Short-Circuit Current	V_{OUT} = 0V			±9	17		mA
Output Leakage Current	Shutdown V_{OUT} = ±30V (Note 4)		●		10	100	µA
Date Rate (Note 7)	R_L = 3k, C_L = 2500pF			120			kBaud
	R_L = 3k, C_L = 1000pF			250			kBaud
Slew Rate	R_L = 3k, C_L = 51pF				15	30	V/µs
R_L = 3k, C_L = 2500pF				4	7		V/µs
Propagation Delay	Output Transition t_{HL} High-to-Low (Note 5)				0.6	1.3	µs
	Output Transition t_{LH} Low-to-High				0.5	1.3	µs
Receiver							
Input Voltage Thresholds	Input Low Threshold (V_{OUT} = High)	C Grade	●	0.8	1.3		V
	Input High Threshold (V_{OUT} = Low)	C Grade	●		1.7	2.4	V
	Input LowI,	M Grade	●	0.2	1.3		V
	Input HighI,	M Grade	●		1.7	3.0	V
Hysteresis			●	0.1	0.4	1.0	V
Input Resistance	V_{IN} = ±10V			3	5	7	kΩ
Output Leakage Current	Shutdown (Note 4) $0 \le V_{OUT} \le V_{CC}$		●		1	10	µA
Output Voltage	Output Low, I_{OUT} = –1.6mA		●		0.2	0.4	V
	Output High, I_{OUT} = 160µA (V_{CC} = 5V)		●	3.5	4.2		V
Output Short-Circuit Current	Sinking Current, $V_{OUT} = V_{CC}$				–20	–10	mA
	Sourcing Current, V_{OUT} = 0V			10	20	mA	
Propagation Delay	Output Transition t_{HL} High-to-Low (Note 6)				250	600	ns
	Output Transition t_{LH} Low-to-High				350	600	ns

Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

Note 2: Testing done at V_{CC} = 5V and $V_{ON/\overline{OFF}}$ = 3V, unless otherwise specified.

Note 3: Supply current is measured as the average over several charge pump cycles. $C^+ = C^- = C1 = C2 = 0.1\mu F$. All outputs are open, with all driver inputs tied high.

Note 4: Supply current measurements in SHUTDOWN are performed with $V_{ON/\overline{OFF}} \le 0.1V$.

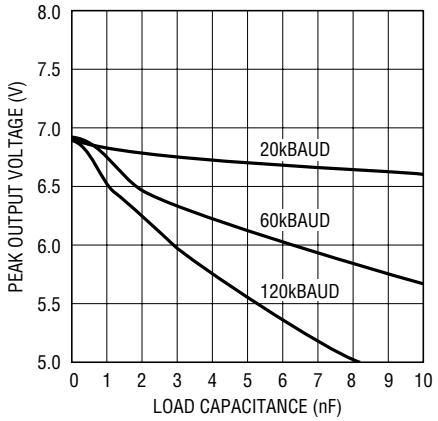
Note 5: For driver delay measurements, R_L = 3k and C_L = 51pF. Trigger points are set between the driver's input logic threshold and the output transition to the zero crossing (t_{HL} = 1.4V to 0V and t_{LH} = 1.4V to 0V).

Note 6: For receiver delay measurements, C_L = 51pF. Trigger points are set between the receiver's input logic threshold and the output transition to standard TTL/CMOS logic threshold (t_{HL} = 1.3V to 2.4V and t_{LH} = 1.7V to 0.8V).

Note 7: Data rate operation guaranteed by slew rate, short-circuit current and propagation delay tests.

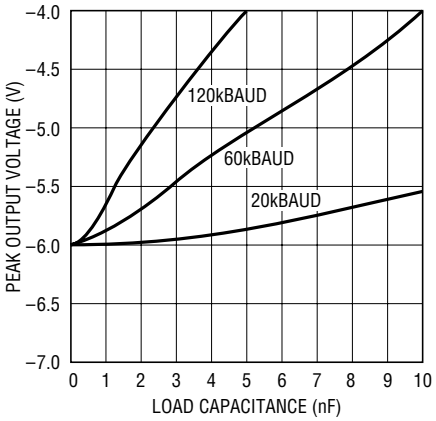
TYPICAL PERFORMANCE CHARACTERISTICS

Driver Maximum Output Voltage vs Load Capacitance



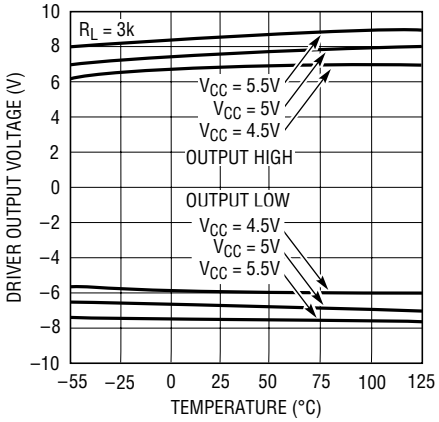
LT1180A • TPC01

Driver Minimum Output Voltage vs Load Capacitance



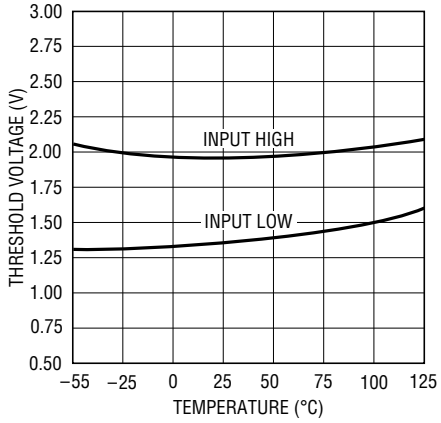
LT1180A • TPC02

Driver Output Voltage



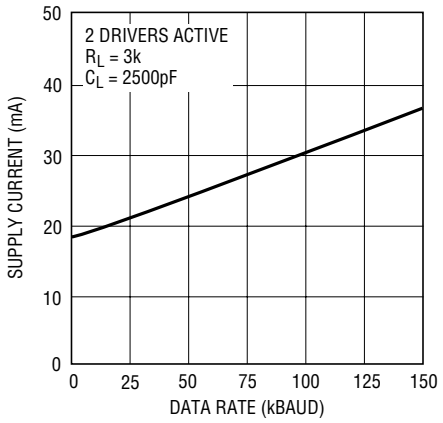
LT1180A • TPC03

Receiver Input Thresholds



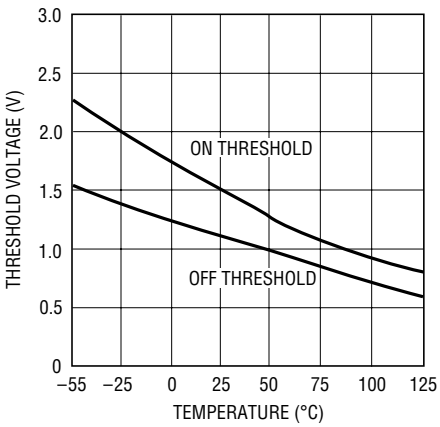
LT1180A • TPC04

Supply Current vs Data Rate



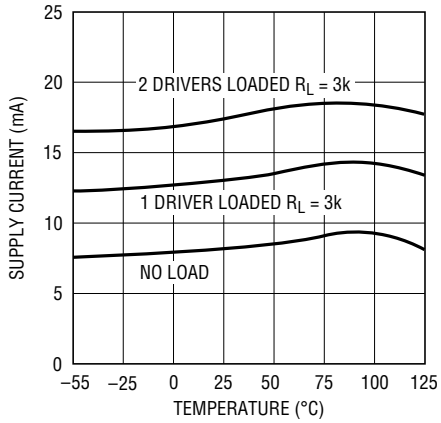
LT1180A • TPC05

ON/$\overline{\text{OFF}}$ Thresholds



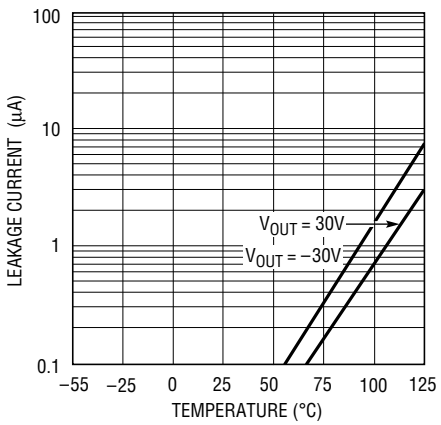
LT1180A • TPC06

Supply Current



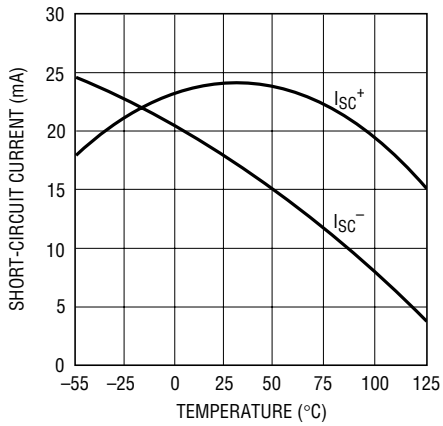
LT1180A • TPC07

Driver Leakage in Shutdown



LT1180A • TPC08

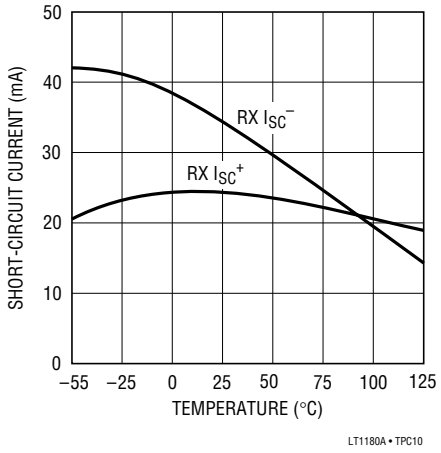
Driver Short-Circuit Current



LT1180A • TPC09

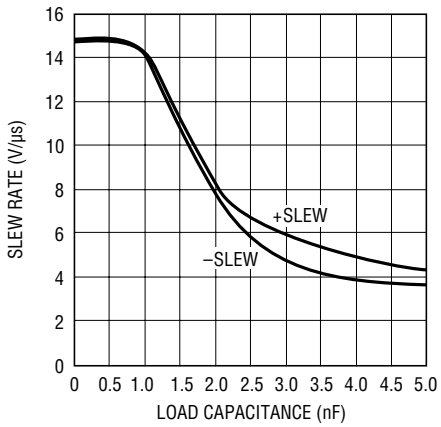
TYPICAL PERFORMANCE CHARACTERISTICS

Receiver Short-Circuit Current



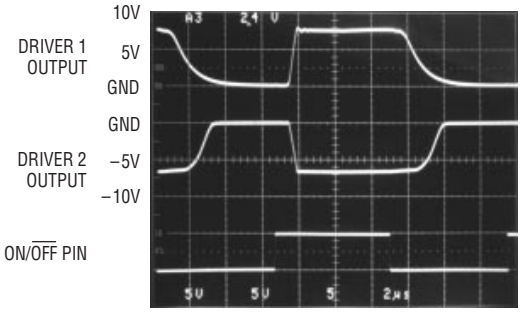
LT1180A • TPC10

Slew Rate vs Load Capacitance



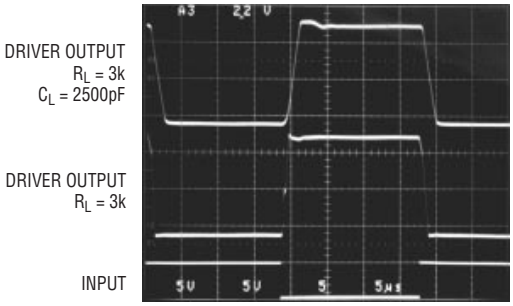
LT1180A • TPC11

Shutdown to Driver Outputs



LT1180A • TPC12

Driver Output Waveforms



LT1180A • TPC13

PIN FUNCTIONS

V_{CC}: 5V Input Supply Pin. This pin should be decoupled with a 0.1µF ceramic capacitor close to the package pin. Insufficient supply bypassing can result in low output drive levels and erratic charge pump operation.

GND: Ground Pin.

ON/$\overline{OFF}$: A TTL/CMOS Compatible Operating Mode Control. A logic low puts the LT1180A in shutdown mode. Supply current drops to zero and both driver and receiver outputs assume a high impedance state. A logic high fully enables the device.

V^+: Positive Supply Output (RS232 Drivers). $V^+ \approx 2V_{CC} - 1.5V$. This pin requires an external charge storage capacitor $C \geq 0.1\mu F$, tied to ground or V_{CC}. Larger value capacitors may be used to reduce supply ripple. With multiple transceivers, the V^+ and V^- pins may be paralleled into common capacitors.

V^-: Negative Supply Output (RS232 Drivers). $V^- \approx -(2V_{CC} - 2.5V)$. This pin requires an external charge storage capacitor $C \geq 0.1\mu F$. Larger value capacitors may be used to reduce supply ripple. With multiple transceivers, the V^+ and V^- pins may be paralleled into common capacitors.

PIN FUNCTIONS

TR1 IN, TR2 IN: RS232 Driver Input Pins. These inputs are TTL/CMOS compatible. Inputs should not be allowed to float. Tie unused inputs to V_{CC}.

TR1 OUT, TR2 OUT: Driver Outputs at RS232 Voltage Levels. Driver output swing meets RS232 levels for loads up to 3k. Slew rates are controlled for lightly loaded lines. Output current capability is sufficient for load conditions up to 2500pF. Outputs are in a high impedance state when in shutdown mode, V_{CC} = 0V, or when the driver disable pin is active. Outputs are fully short-circuit protected from V^- + 30V to V^+ – 30V. Applying higher voltages will not damage the device if the overdrive is moderately current limited. Short circuits on one output can load the power supply generator and may disrupt the signal levels of the other outputs. The driver outputs are protected against ESD to ±10kV for human body model discharges.

REC1 IN, REC2 IN: Receiver Inputs. These pins accept RS232 level signals (±30V) into a protected 5k terminating resistor. The receiver inputs are protected against ESD to ±10kV for human body model discharges. Each receiver provides 0.4V of hysteresis for noise immunity. Open receiver inputs assume a logic low state.

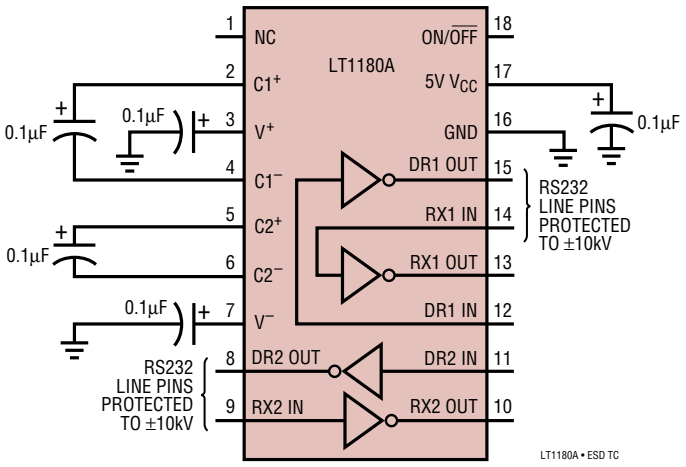
REC1 OUT, REC2 OUT: Receiver outputs with TTL/CMOS Voltage Levels. Outputs are in a high impedance state when in shutdown mode to allow data line sharing. Outputs are fully short-circuit protected to ground or V_{CC} with the power on, off or in the shutdown mode.

$C1^+$, $C1^-$, $C2^+$, $C2^-$: Commutating Capacitor Inputs. These pins require two external capacitors C ≥ 0.1µF: one from $C1^+$ to $C1^-$ and another from $C2^+$ to $C2^-$. C1 should be deleted if a separate 12V supply is available and connected to pin $C1^+$. Similarly, C2 should be deleted if a separate –12V supply is connected to pin V^-.

ESD PROTECTION

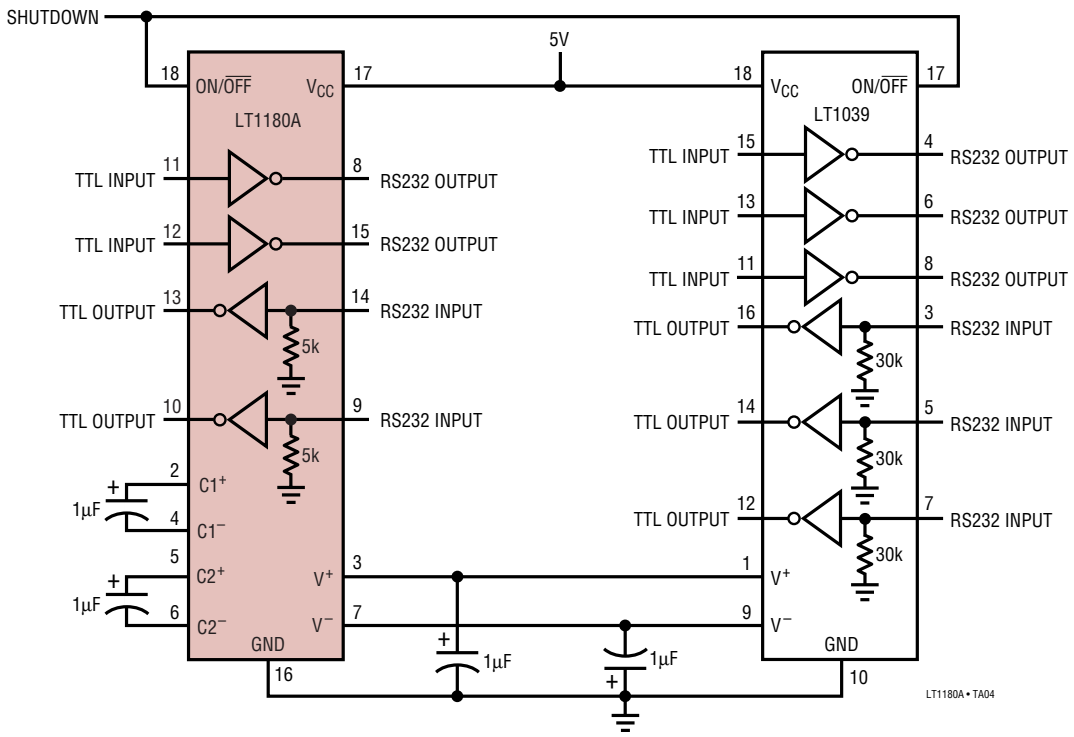
The RS232 line inputs of the LT1180A/LT1181A have on-chip protection from ESD transients up to ±10kV. The protection structures act to divert the static discharge safely to system ground. In order for the ESD protection to function effectively, the power supply and ground pins of the circuit must be connected to ground through low impedances. The power supply decoupling capacitors and charge pump storage capacitors provide this low impedance in normal application of the circuit. The only constraint is that low ESR capacitors must be used for bypassing and charge storage. ESD testing must be done with pins V_{CC}, V_L, V^+, V^-, and GND shorted to ground or connected with low ESR capacitors.

ESD Test Circuit



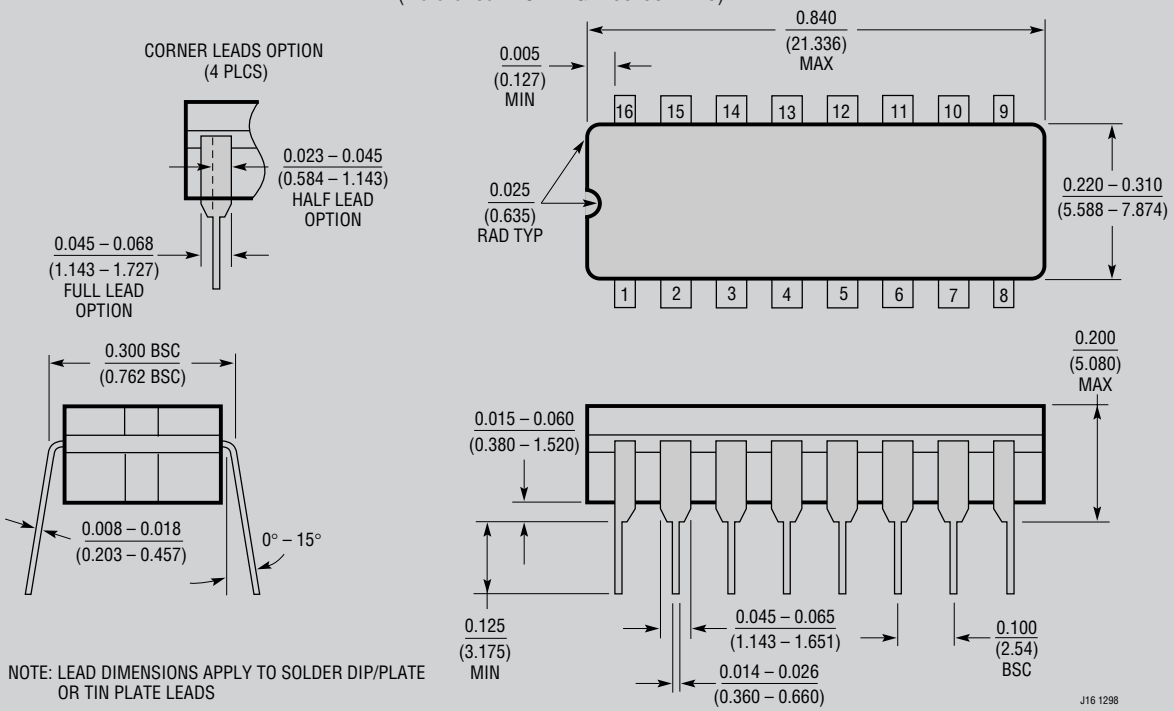
TYPICAL APPLICATION

Supporting an LT1039 (Triple Driver/Receiver)



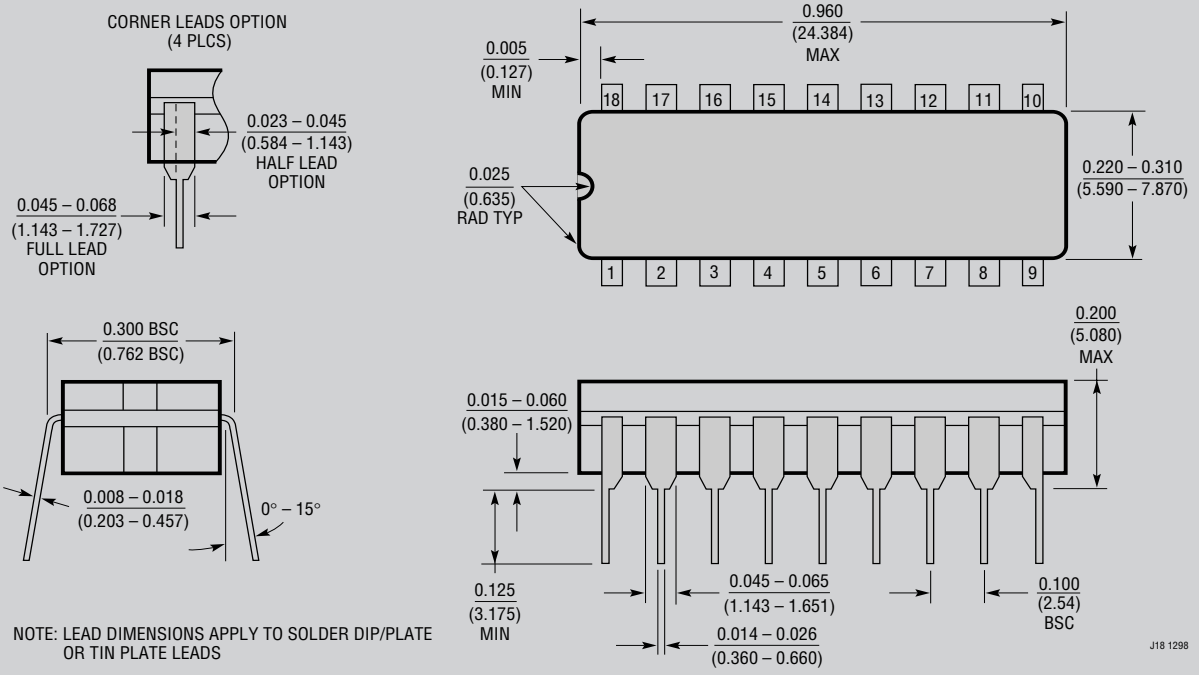
PACKAGE DESCRIPTION

J Package
16-Lead CERDIP (Narrow .300 Inch, Hermetic)
(Reference LTC DWG # 05-08-1110)



NOTE: LEAD DIMENSIONS APPLY TO SOLDER DIP/PLATE OR TIN PLATE LEADS

J Package
18-Lead CERDIP (Narrow .300 Inch, Hermetic)
(Reference LTC DWG # 05-08-1110)

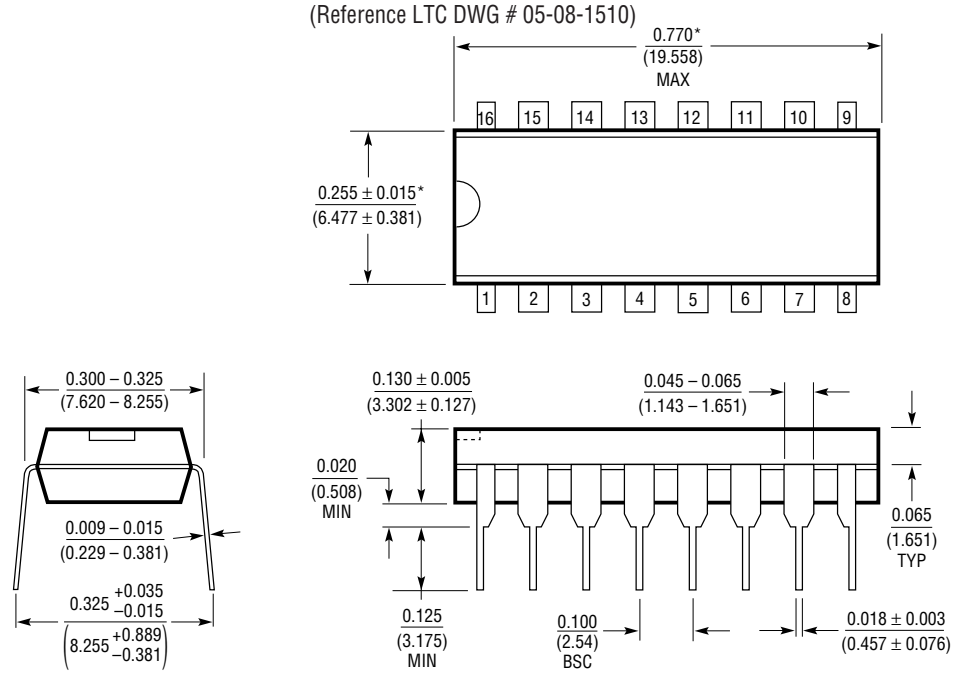


NOTE: LEAD DIMENSIONS APPLY TO SOLDER DIP/PLATE OR TIN PLATE LEADS

OBSOLETE PACKAGES

PACKAGE DESCRIPTION

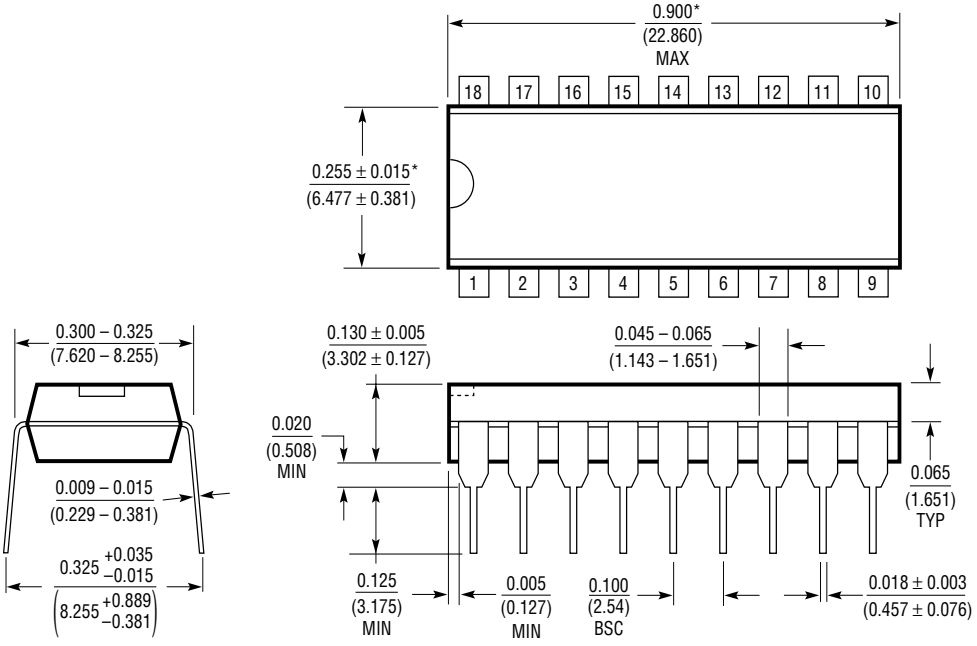
N Package
16-Lead PDIP (Narrow .300 Inch)
(Reference LTC DWG # 05-08-1510)



*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH (0.254mm)

N16 1098

N Package
18-Lead PDIP (Narrow .300 Inch)
(Reference LTC DWG # 05-08-1510)

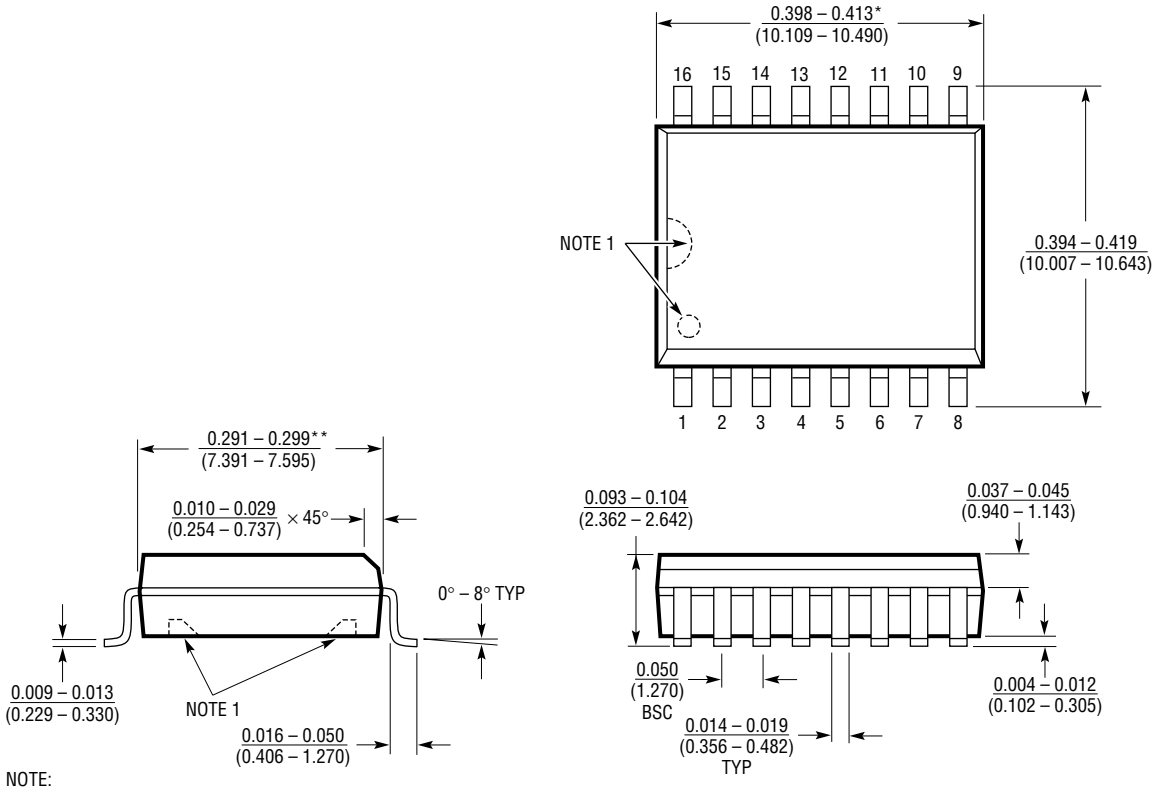


*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH (0.254mm)

N18 1098

PACKAGE DESCRIPTION

SW Package
16-Lead Plastic Small Outline (Wide .300 Inch)
(Reference LTC DWG # 05-08-1620)



NOTE:
1. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS

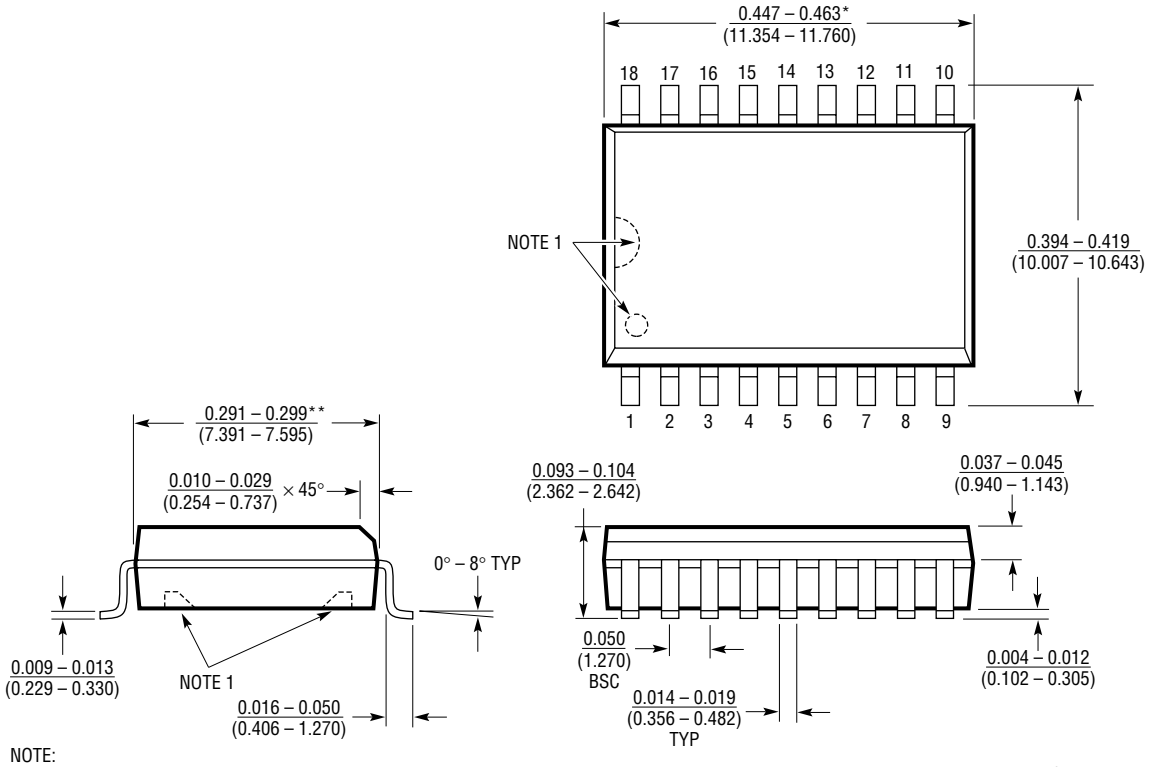
*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

S16 (WIDE) 1098

PACKAGE DESCRIPTION

SW Package
18-Lead Plastic Small Outline (Wide .300 Inch)
(Reference LTC DWG # 05-08-1620)



NOTE:
1. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS

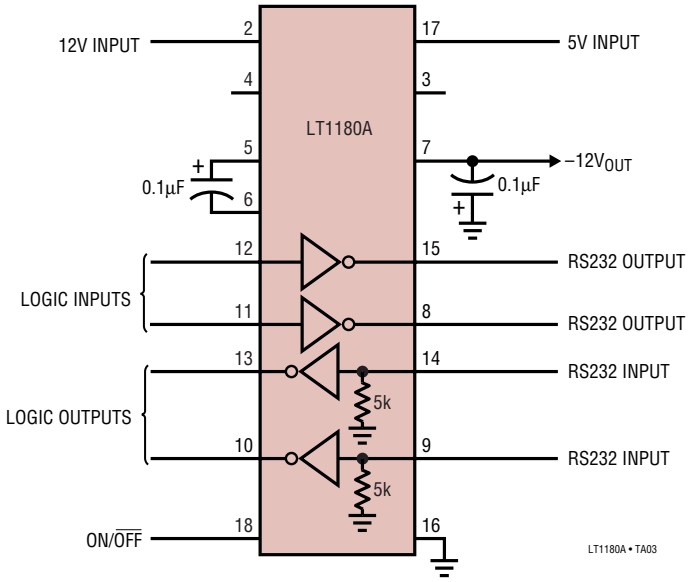
*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

S18 (WIDE) 1098

TYPICAL APPLICATION

Operation Using 5V and 12V Power Supplies



RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1280A/LT1281A	5V 2-Driver/2-Receiver RS232 Transceivers	Pin Compatible with LT1180A/LT1181A, I_{CC} = 10mA Max
LT1381	5V 2-Driver/2-Receiver RS232 Transceiver	Narrow 16-Pin SO Package
LT1780/LT1781	5V 2-Driver/2-Receiver RS232 Transceivers	IEC 1000-4-2 Level 4 Compliance

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