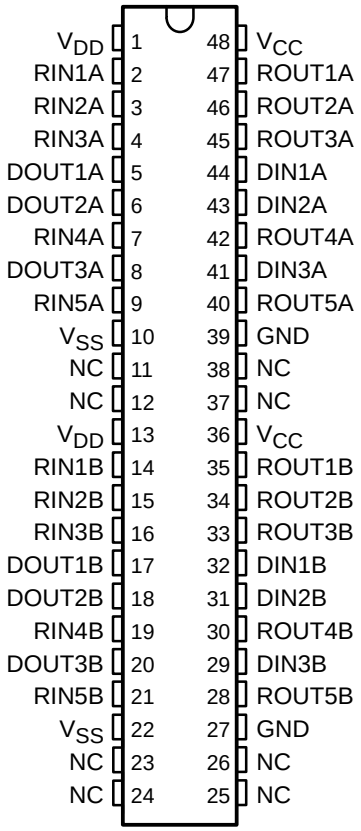
- **Single Chip With Easy Interface Between UART and Two Serial-Port Connectors of IBM™ PC/AT™ and Compatibles**
- **Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU Recommendation V.28**
- **Supports Data Rates up to 120 kbit/s**
- **Package Options Include Plastic Thin Shrink Small-Outline (DGG) and Shrink Small-Outline (DL) Packages**

DGG OR DL PACKAGE
(TOP VIEW)



description

The SN752232 consists of dual ports, each containing three drivers and five receivers, which reduce board space and allow easy interconnection of the UART and two serial-port connectors of an IBM™ PC/AT™ and compatibles. The bipolar circuits and processing of this ‘‘dual GD75232” provide, a rugged, low-cost solution for this function.

The SN752232 complies with the requirements of the TIA/EIA-232-F and ITU V.28 standards. These standards are for data interchange between a host computer and a peripheral at signaling rates up to 20 kbit/s. The device supports data rates up to 120 kbit/s with lower capacitive loads (shorter cables). Interoperability at the higher signaling rates cannot be expected unless the designer has design control of the cable and the interface circuits at both ends. For interoperability at signaling rates up to 120 kbit/s, use of TIA/EIA-423-B (ITU V.10) and TIA/EIA-422-B (ITU V.11) standards is recommended.

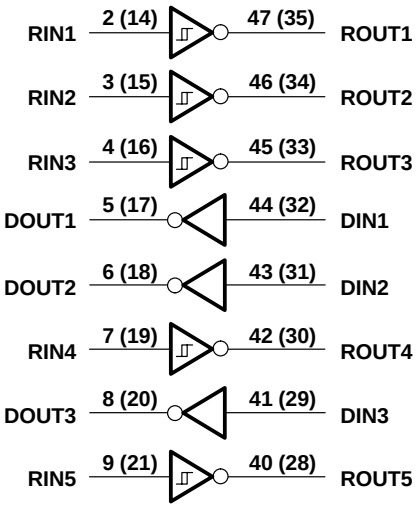
The SN752232 is characterized for operation over the temperature range of 0°C to 70°C.

AVAILABLE OPTIONS

T_A	PACKAGED DEVICES	
	PLASTIC SHRINK SMALL OUTLINE (DL)	PLASTIC THIN SHRINK SMALL OUTLINE (DGG)
0°C to 70°C	SN752232DL	SN752232DGG

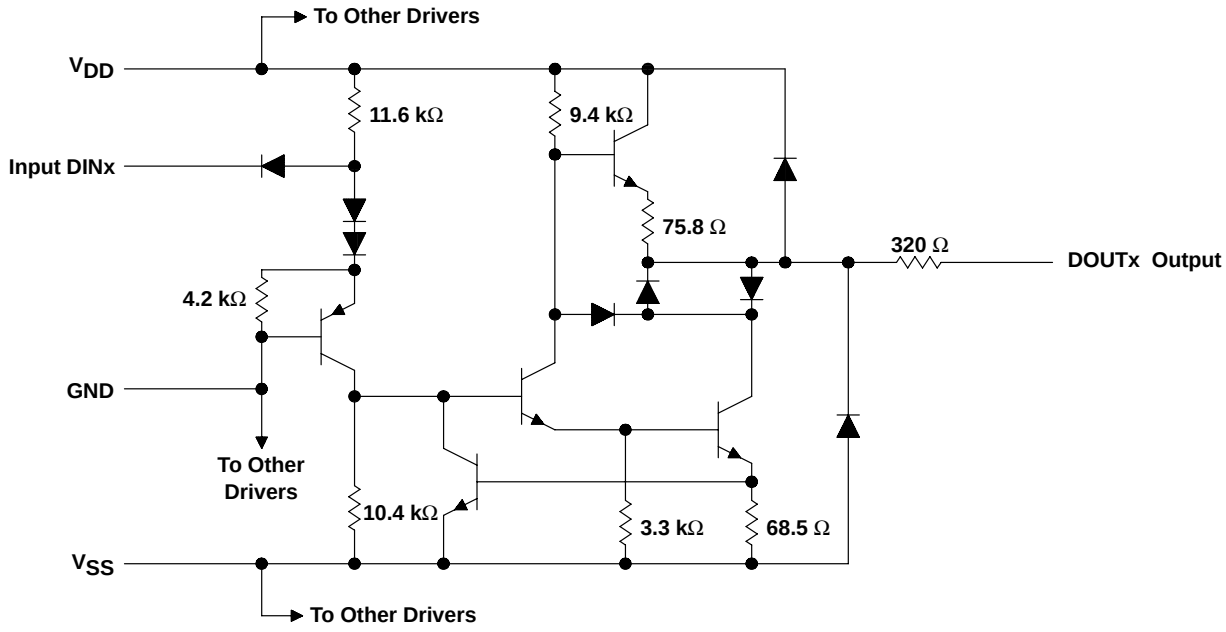
The DL package also is available taped and reeled. Add the suffix R to the device type (e.g., SN752232DLR). The DGG package is only available taped and reeled.

logic diagram (positive logic)



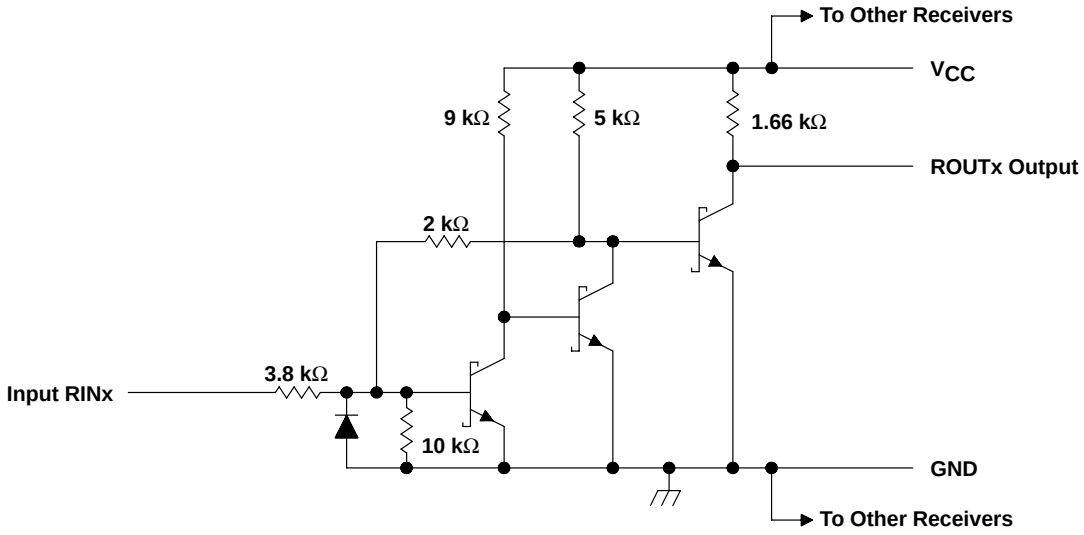
NOTE A: Numbers in parentheses are for B section.

schematic (each driver)



NOTE A: Resistor values shown are nominal.

schematic (each receiver)



NOTE A: Resistor values shown are nominal.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage (see Note 1): V_{CC}	10 V
V_{DD}	15 V
V_{SS}	–15 V
Input voltage range, V_I: Driver	–15 V to 7 V
Receiver	–30 V to 30 V
Driver output voltage range, V_O	–15 V to 15 V
Receiver low-level output current, I_{OL}	20 mA
Package thermal impedance, θ_{JA} (see Note 2): DGG package	70°C/W
DL package	63°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, T_{stg}	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. All voltages are with respect to network GND.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

			MIN	NOM	MAX	UNIT
V_{DD}	Supply voltage		7.5	9	15	V
V_{SS}	Supply voltage		–7.5	–9	–15	V
V_{CC}	Supply voltage		4.5	5	5.5	V
V_{IH}	High-level input voltage (driver only)		1.9			V
V_{IL}	Low-level input voltage (driver only)				0.8	V
I_{OH}	High-level output current	Driver			–6	mA
		Receiver			–0.5	
I_{OL}	Low-level output current	Driver			6	mA
		Receiver			16	
T_A	Operating free-air temperature		0		70	°C

supply currents over recommended operating free-air temperature range

PARAMETER		TEST CONDITIONS			MIN	MAX	UNIT
I_{DD}	Supply current from V_{DD}	All inputs at 1.9 V,	No load	V_{DD} = 9 V, V_{SS} = –9 V		30	mA
				V_{DD} = 12 V, V_{SS} = –12 V		38	
				V_{DD} = 15 V, V_{SS} = –15 V		50	
		All inputs at 0.8 V,	No load	V_{DD} = 9 V, V_{SS} = –9 V		9	
				V_{DD} = 12 V, V_{SS} = –12 V		11	
				V_{DD} = 15 V, V_{SS} = –15 V		18	
I_{SS}	Supply current from V_{SS}	All inputs at 1.9 V,	No load	V_{DD} = 9 V, V_{SS} = –9 V		–30	mA
				V_{DD} = 12 V, V_{SS} = –12 V		–38	
				V_{DD} = 15 V, V_{SS} = –15 V		–50	
		All inputs at 0.8 V,	No load	V_{DD} = 9 V, V_{SS} = –9 V		–6.4	
				V_{DD} = 12 V, V_{SS} = –12 V		–6.4	
				V_{DD} = 15 V, V_{SS} = –15 V		–6.4	
I_{CC}	Supply current from V_{CC}	V_{CC} = 5 V,	All inputs at 5 V,	No load		60	mA

DRIVER SECTION

electrical characteristics over recommended operating free-air temperature range, V_{DD} = 9 V, V_{SS} = –9 V, V_{CC} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage	V_{IL} = 0.8 V,	R_L = 3 kΩ,	See Figure 1	6	7.5		V
V_{OL}	Low-level output voltage (see Note 3)	V_{IH} = 1.9 V,	R_L = 3 kΩ,	See Figure 1		–7.5	–6	V
I_{IH}	High-level input current	V_I = 5 V,	See Figure 2				10	μA
I_{IL}	Low-level input current	V_I = 0,	See Figure 2				–1.6	mA
$I_{OS(H)}$	High-level short-circuit output current (see Note 4)	V_{IL} = 0.8 V,	V_O = 0,	See Figure 1	–4.5	–12	–19.5	mA
$I_{OS(L)}$	Low-level short-circuit output current	V_{IH} = 2 V,	V_O = 0,	See Figure 1	4.5	12	19.5	mA
r_O	Output resistance (see Note 5)	V_{CC} = V_{DD} = V_{SS} = 0,		V_O = –2 V to 2 V	300			Ω

NOTES: 3. The algebraic convention, where the more positive (less negative) limit is designated as maximum, is used in this data sheet for logic levels only (e.g., if –10 V is maximum, the typical value is a more negative voltage).
4. Output short-circuit conditions must maintain the total power dissipation below absolute maximum ratings.
5. Test conditions are those specified by TIA/EIA-232-F and as listed above.

switching characteristics, V_{CC} = 5 V, V_{DD} = 12 V, V_{SS} = –12 V, T_A = 25°C (see Figure 3)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	R_L = 3 kΩ to 7 kΩ,	C_L = 15 pF		315	500	ns
t_{PHL}	Propagation delay time, high- to low-level output	R_L = 3 kΩ to 7 kΩ,	C_L = 15 pF		75	175	ns
t_{TLH}	Transition time, low- to high-level output	R_L = 3 kΩ to 7 kΩ	C_L = 15 pF		60	100	ns
			C_L = 2500 pF, See Note 6		1.7	2.5	µs
t_{THL}	Transition time, high- to low-level output	R_L = 3 kΩ to 7 kΩ	C_L = 15 pF		40	75	ns
			C_L = 2500 pF, See Note 6		1.5	2.5	µs

NOTE 6: Measured between ±3-V and ±3-V points of the output waveform (TIA/EIA-232-F conditions), all unused inputs are tied either high or low.

RECEIVER SECTION

electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage	T_A = 25°C	See Figure 5	1.75	1.9	2.3	V
		T_A = 0°C to 70 °C		1.55		2.3	
$V_{IT–}$	Negative-going input threshold voltage			0.75	0.97	1.25	V
V_{hys}	Input hysteresis voltage ($V_{IT+} – V_{IT–}$)			0.5			V
V_{OH}	High-level output voltage	I_{OH} = –0.5 mA	V_{IH} = 0.75 V	2.6	4	5	V
			Inputs open	2.6			
V_{OL}	Low-level input voltage	I_{OL} = 10 mA,	V_I = 3 V		0.2	0.45	V
I_{IH}	High-level input current	V_I = 25 V,	See Figure 5	3.6		8.8	mA
		V_I = 3 V,	See Figure 5	0.43			
I_{IL}	Low-level output current	V_I = –25 V,	See Figure 5	–3.6		–8.8	mA
		V_I = –3 V,	See Figure 5	–0.43			
I_{OS}	Short-circuit output current	See Figure 4			–3.4	–12	mA

† All typical values are at T_A = 25°C, V_{CC} = 5 V, V_{DD} = 9 V, and V_{SS} = –9 V.

switching characteristics, V_{CC} = 5 V, V_{DD} = 12 V, V_{SS} = –12 V, T_A = 25°C (see Figure 6)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	C_L = 50 pF,	R_L = 5 kΩ		107	250	ns
t_{PHL}	Propagation delay time, high- to low-level output				42	150	ns
t_{TLH}	Transition time, low- to high-level output				175	350	ns
t_{THL}	Transition time, high- to low-level output				16	60	ns
t_{PLH}	Propagation delay time, low- to high-level output	C_L = 15 pF,	R_L = 1.5 kΩ		100	160	ns
t_{PHL}	Propagation delay time, high- to low-level output				60	100	ns
t_{TLH}	Transition time, low- to high-level output				90	175	ns
t_{THL}	Transition time, high- to low-level output				15	50	ns

PARAMETER MEASUREMENT INFORMATION

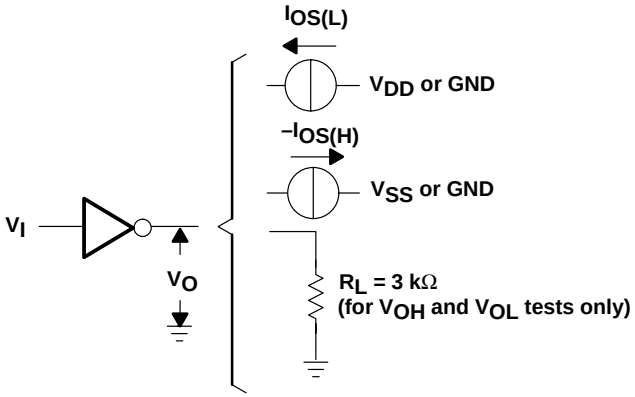


Figure 1. Driver Test Circuit for V_{OH}, V_{OL}, $I_{OS(H)}$, and $I_{OS(L)}$

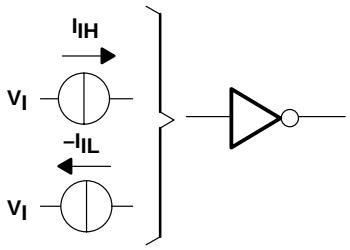
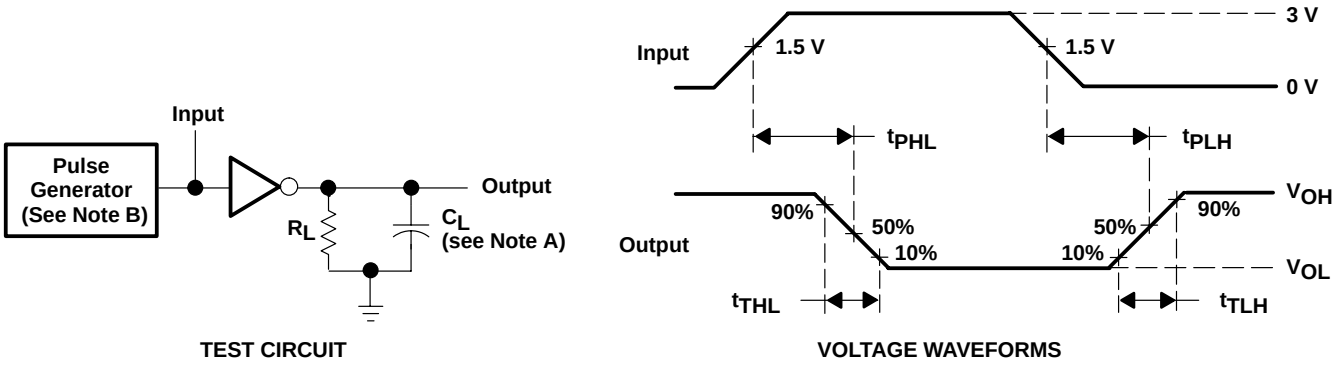


Figure 2. Driver Test Circuit for I_{IH} and I_{IL}



NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: t_W = 25 µs, PRR = 20 kHz, Z_O = 50 Ω, $t_r = t_f$ < 50 ns.

Figure 3. Driver Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION

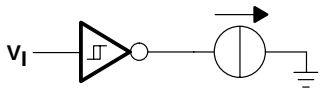


Figure 4. Receiver Test Circuit for I_{OS}

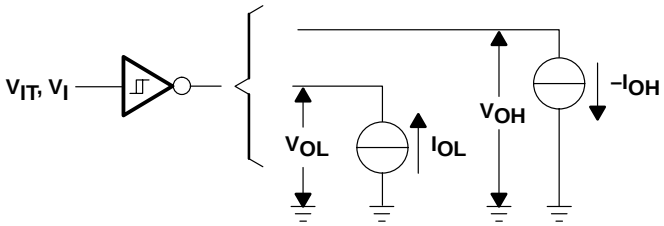
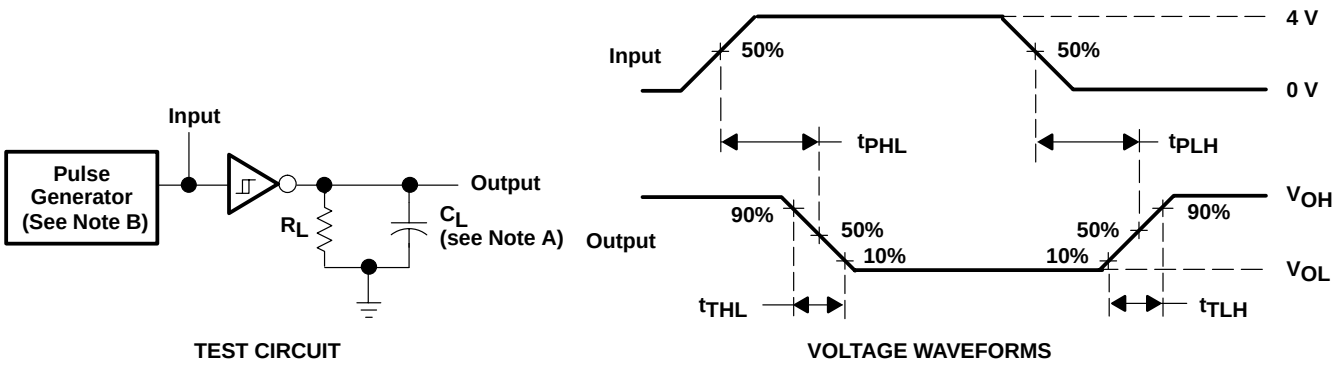


Figure 5. Receiver Test Circuit for V_{IT}, V_{OH}, and V_{OL}



NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: t_W = 25 µs, PRR = 20 kHz, Z_O = 50 Ω, $t_r = t_f$ < 50 ns.

Figure 6. Receiver Propagation and Transition Times

TYPICAL CHARACTERISTICS

DRIVER SECTION

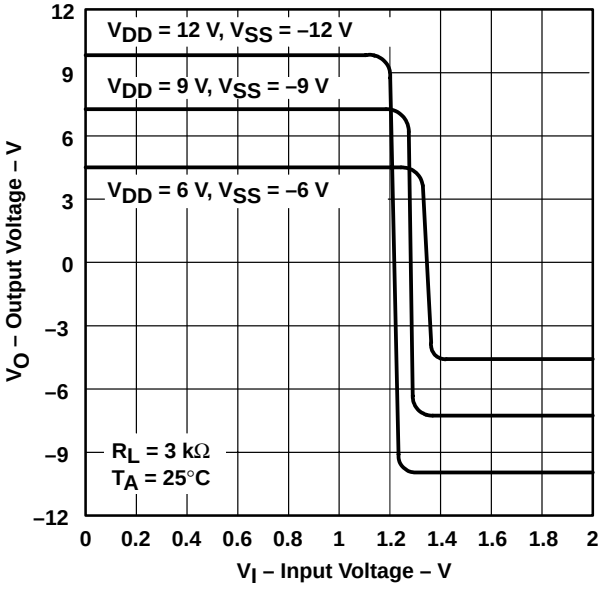


Figure 7

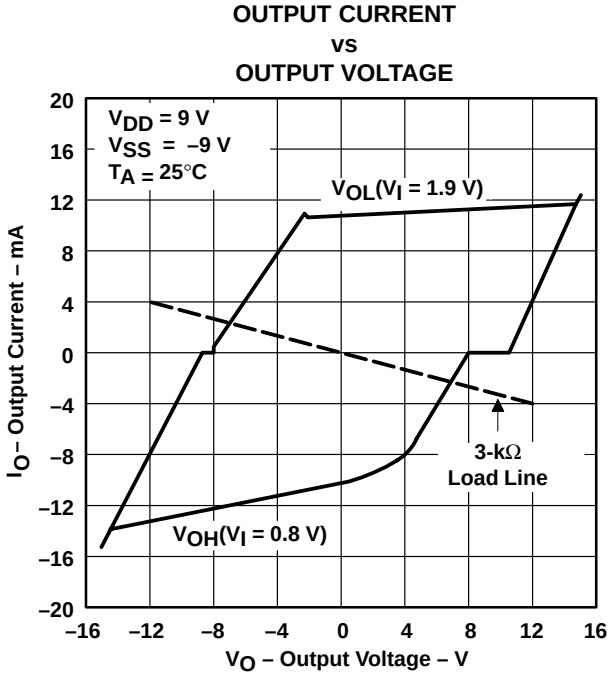


Figure 8

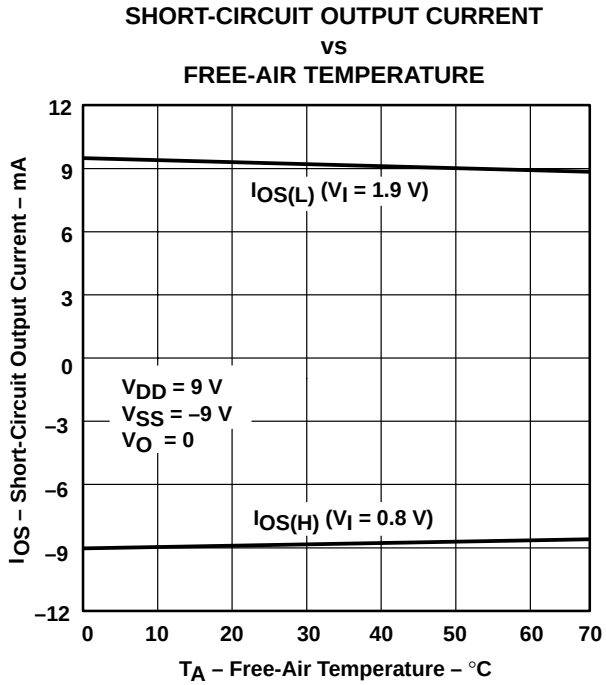


Figure 9

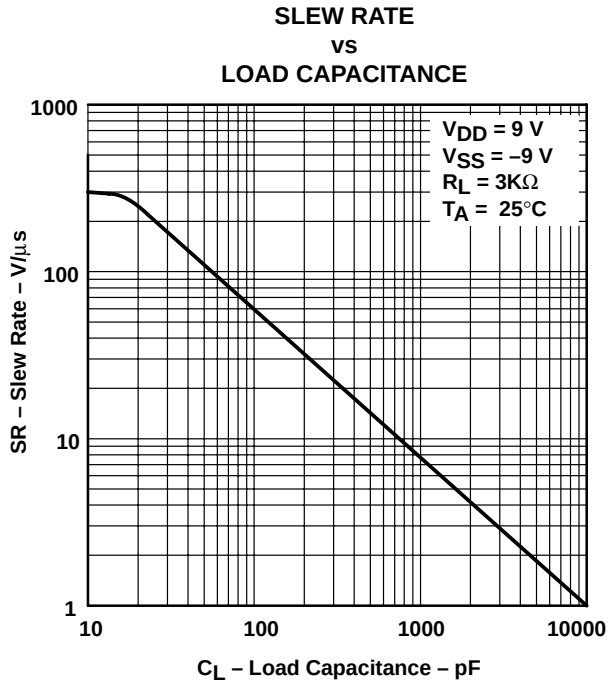


Figure 10

TYPICAL CHARACTERISTICS

INPUT THRESHOLD VOLTAGE vs FREE-AIR TEMPERATURE

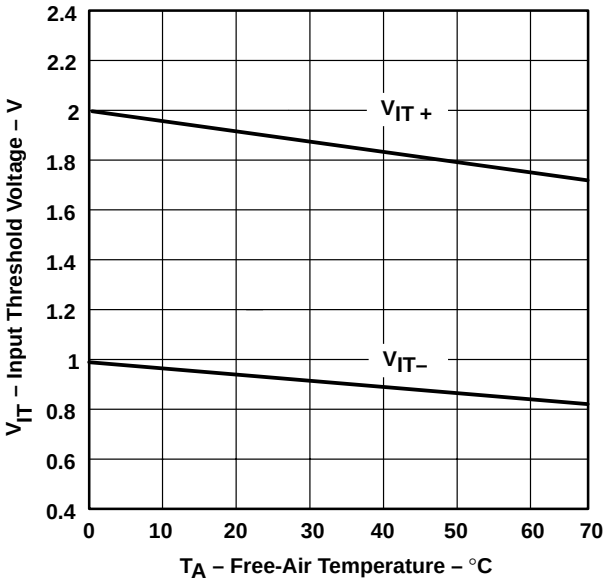


Figure 11

INPUT THRESHOLD VOLTAGE vs SUPPLY VOLTAGE

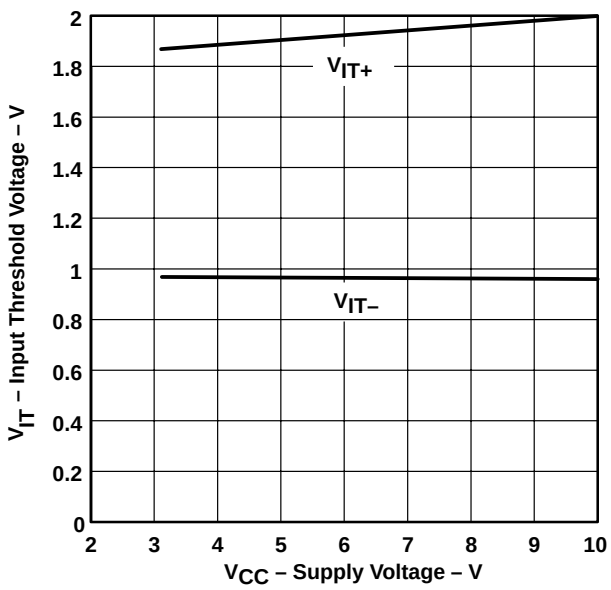
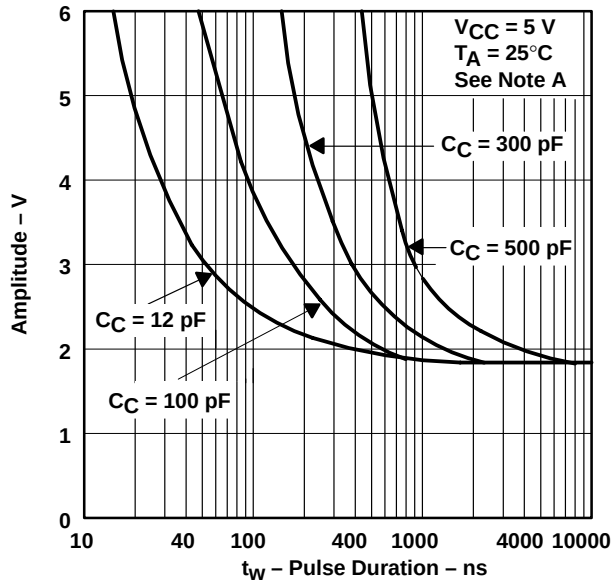


Figure 12

NOISE REJECTION



NOTE A: This figure shows the maximum amplitude of a positive-going pulse that, starting from 0 V, does not cause a change of the output level.

Figure 13

MAXIMUM SUPPLY VOLTAGE vs FREE-AIR TEMPERATURE

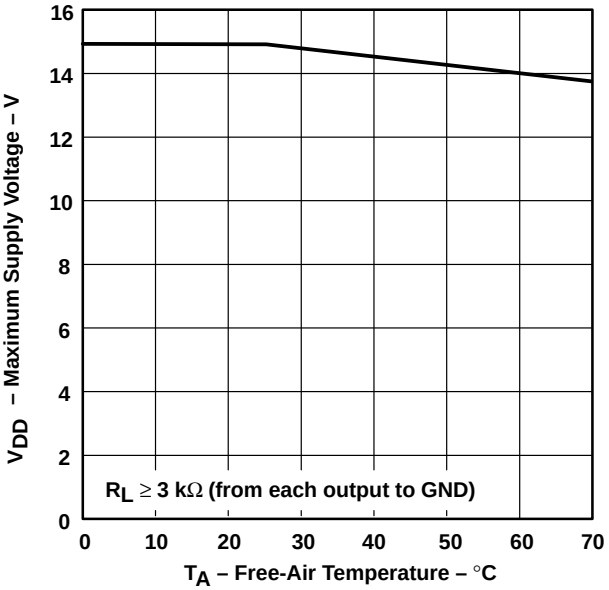


Figure 14

APPLICATION INFORMATION

Diodes placed in series with the V_{DD} and V_{SS} leads protect the SN752232 in the fault condition in which the device outputs are shorted to ±15 V, and the power supplies are at low and provide low-impedance paths to ground (see Figure 15).

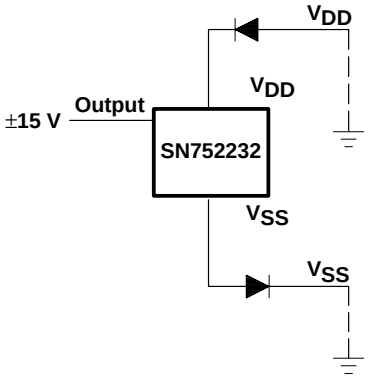
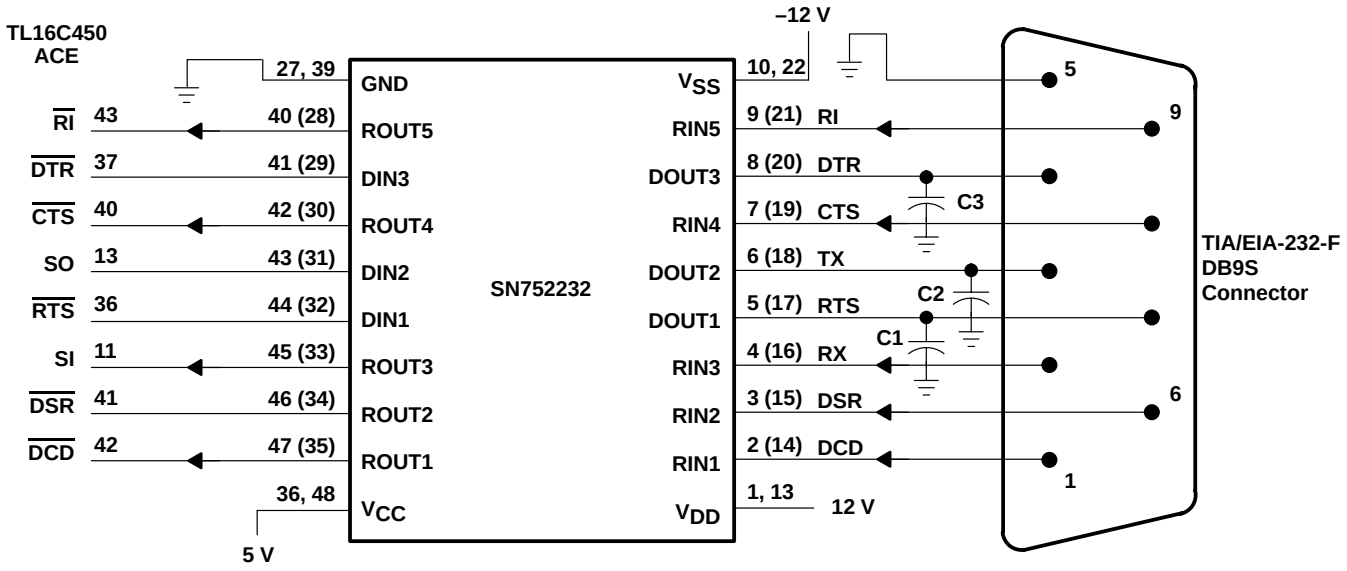


Figure 15. Power-Supply Protection to Meet Power-Off Fault Conditions of TIA/EIA-232-F



NOTE A: Numbers in parentheses are for B section.

Figure 16. Typical Connection Per Port

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN752232DGGR	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN752232DGGRE4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN752232DGGRG4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN752232DL	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN752232DLG4	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN752232DLR	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN752232DLRG4	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

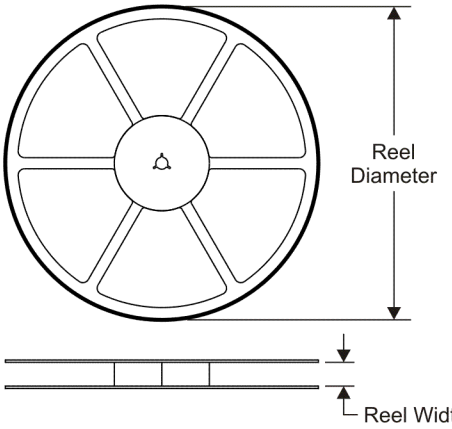
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

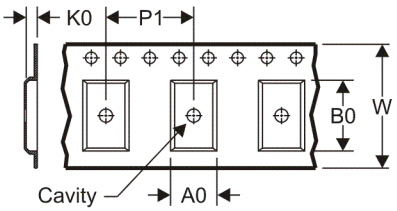
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

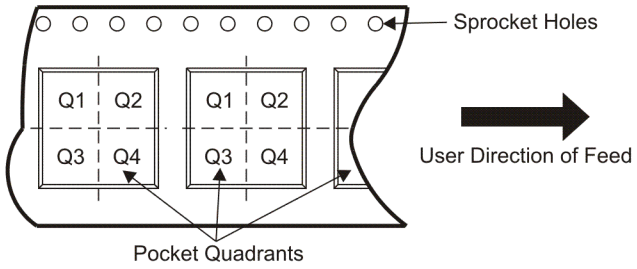


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

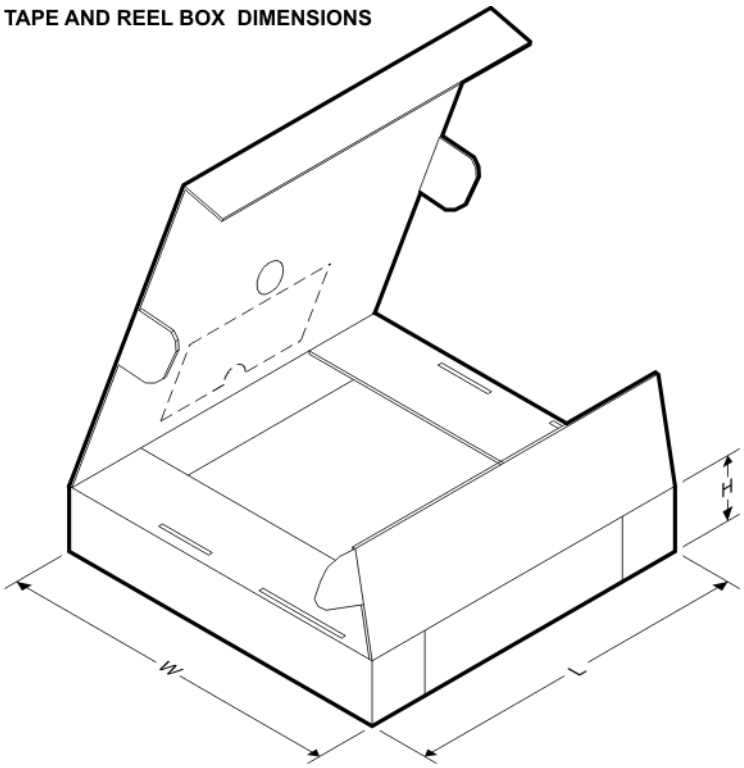
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN752232DGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	15.8	1.8	12.0	24.0	Q1
SN752232DLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1

TAPE AND REEL BOX DIMENSIONS

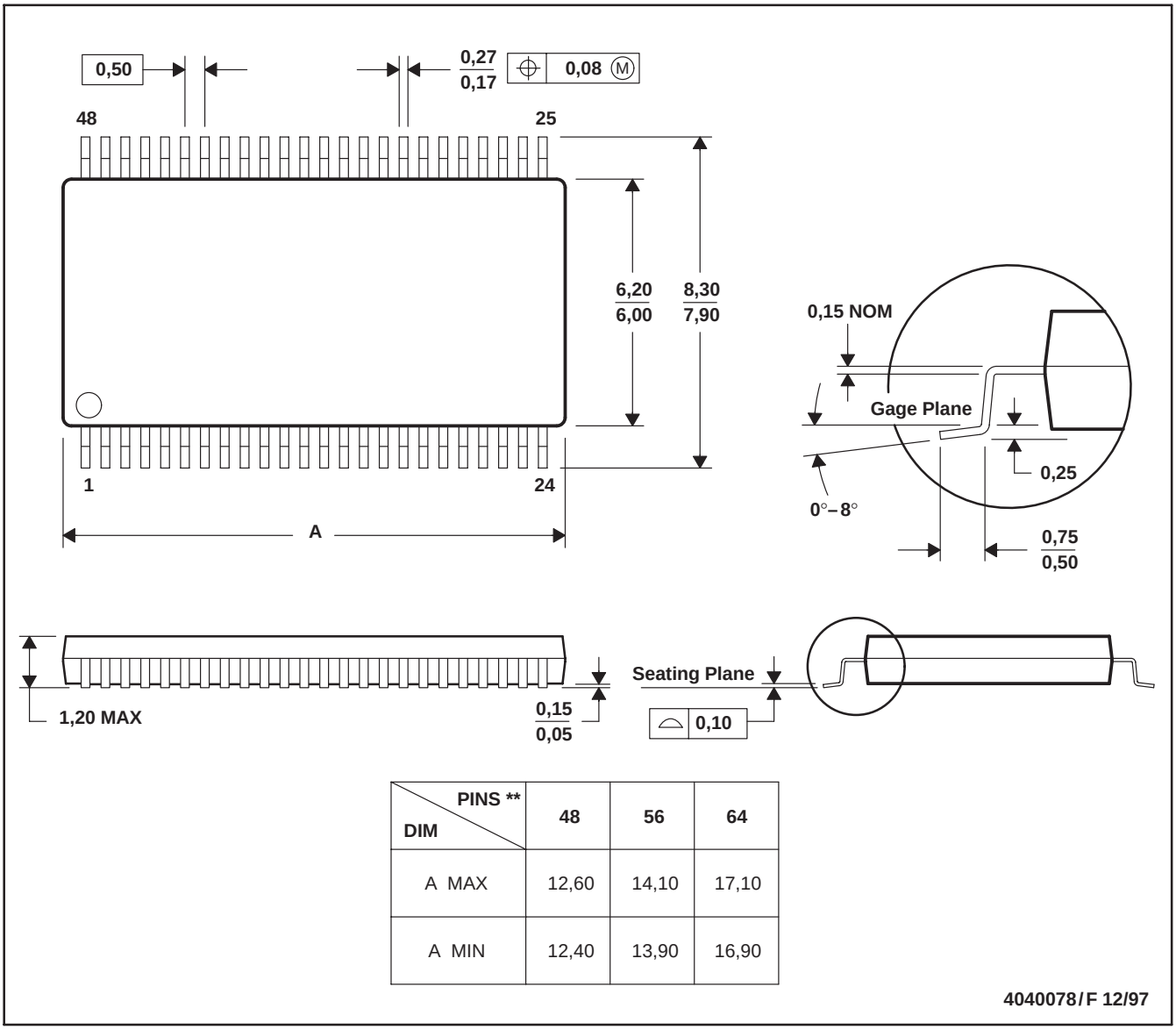


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN752232DGGR	TSSOP	DGG	48	2000	346.0	346.0	41.0
SN752232DLR	SSOP	DL	48	1000	346.0	346.0	49.0

DGG (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

48 PINS SHOWN

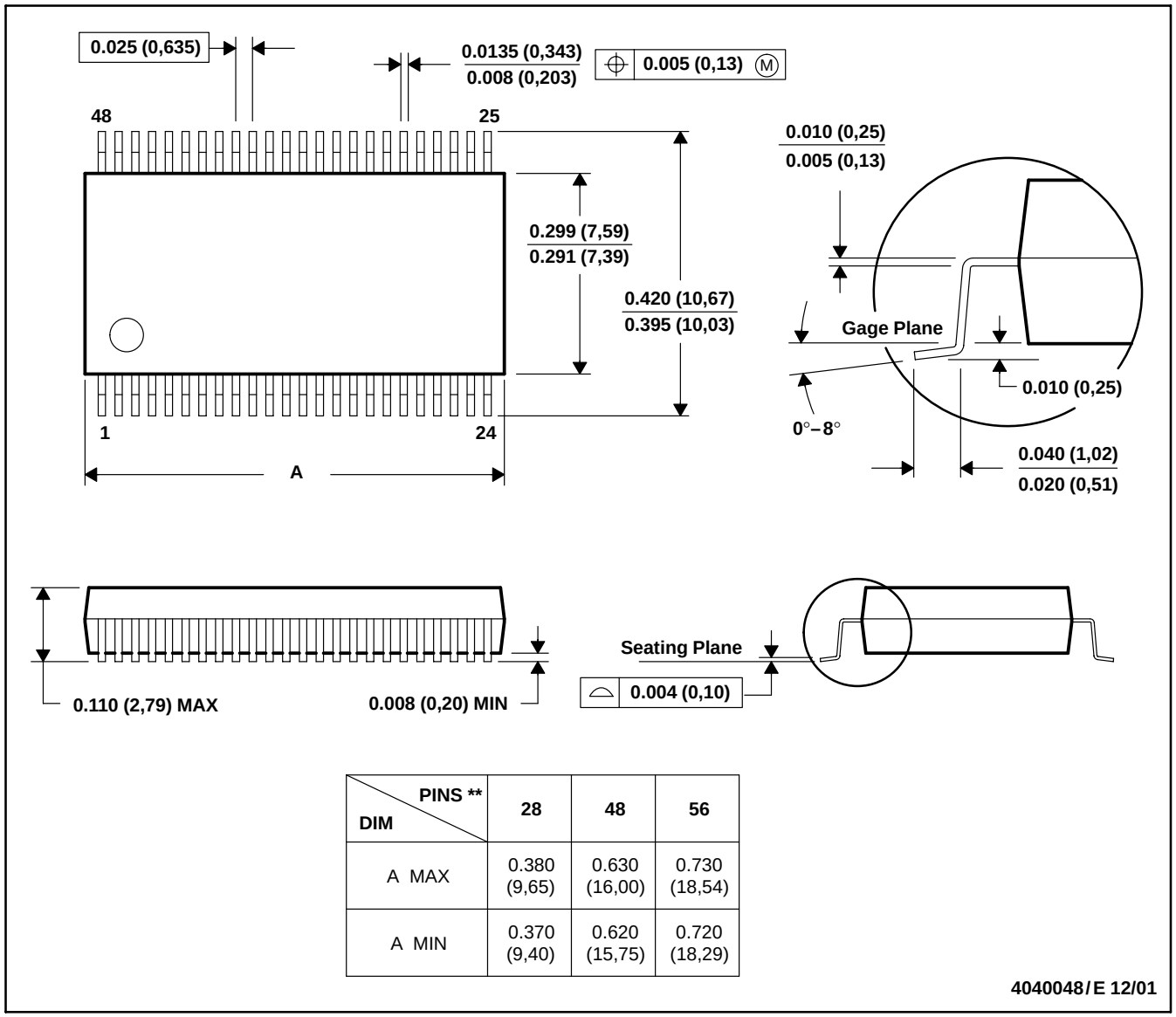


DIM \ PINS **	48	56	64
A MAX	12,60	14,10	17,10
A MIN	12,40	13,90	16,90

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

DL (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

48 PINS SHOWN



DIM \ PINS **	28	48	56
A MAX	0.380 (9,65)	0.630 (16,00)	0.730 (18,54)
A MIN	0.370 (9,40)	0.620 (15,75)	0.720 (18,29)

4040048/E 12/01

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MO-118

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Clocks and Timers	www.ti.com/clocks	Digital Control	www.ti.com/digitalcontrol
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265