

- 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

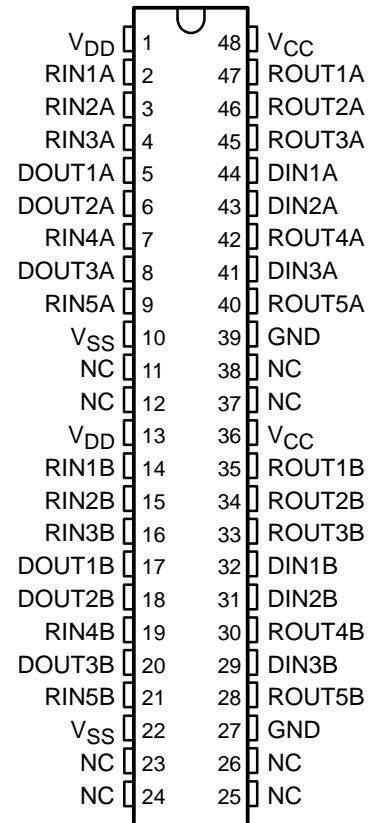
**description**

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.

DGG OR DL PACKAGE  
(TOP VIEW)



AVAILABLE OPTIONS

T <sub>A</sub>	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.



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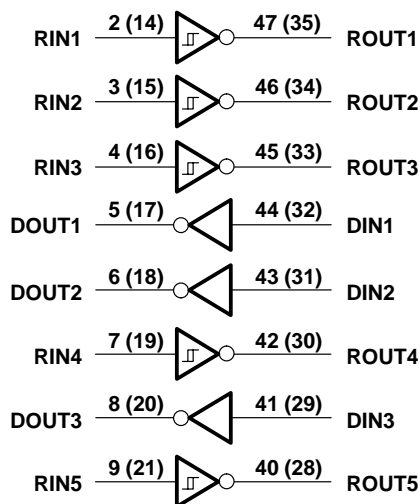
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# SN752232 DUAL RS-232 PORT

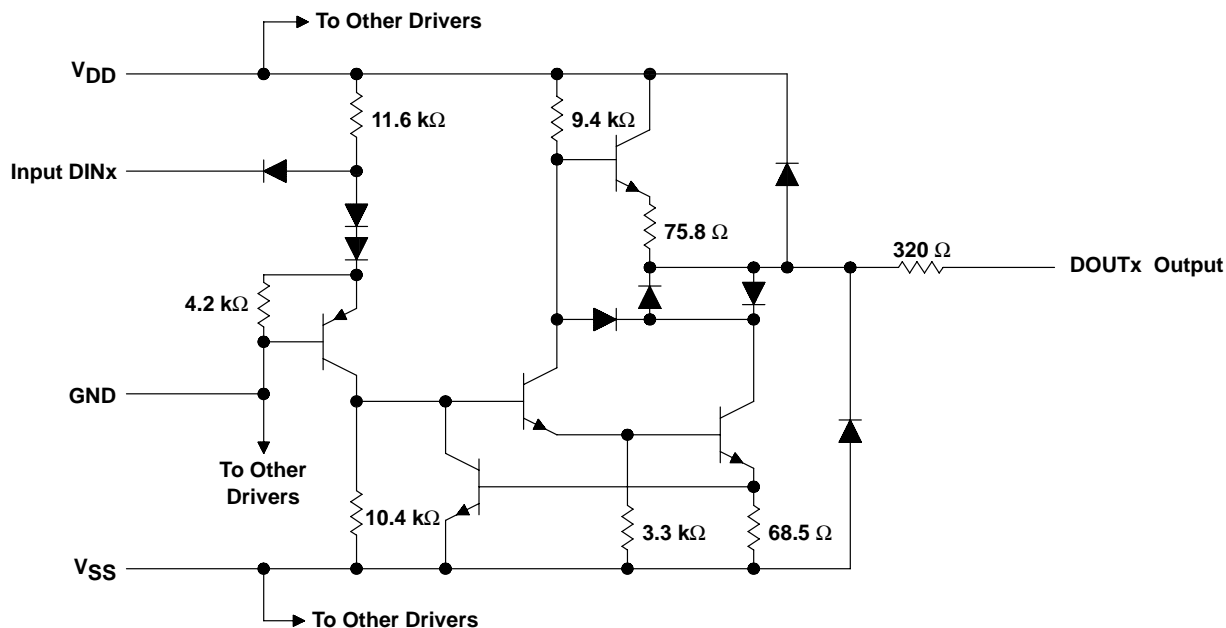
SLLS507 – JUNE 2001

## logic diagram (positive logic)



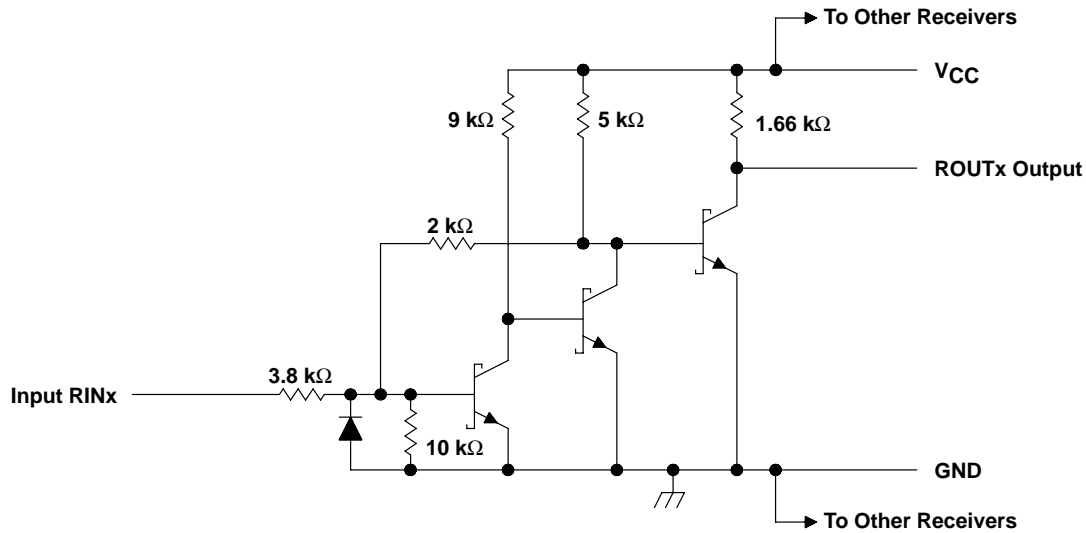
NOTE A: Numbers in parentheses are for B section.

## 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, $\theta_{JA}$ (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.

# SN752232 DUAL RS-232 PORT

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## recommended operating conditions

		MIN	NOM	MAX	UNIT
V <sub>DD</sub>	Supply voltage	7.5	9	15	V
V <sub>SS</sub>	Supply voltage	-7.5	-9	-15	V
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	V
V <sub>IH</sub>	High-level input voltage (driver only)	1.9			V
V <sub>IL</sub>	Low-level input voltage (driver only)			0.8	V
I <sub>OH</sub>	High-level output current	Driver		-6	mA
		Receiver		-0.5	
I <sub>OL</sub>	Low-level output current	Driver		6	mA
		Receiver		16	
T <sub>A</sub>	Operating free-air temperature	0		70	°C

## supply currents over recommended operating free-air temperature range

PARAMETER	TEST CONDITIONS		MIN	MAX	UNIT
I <sub>DD</sub>	Supply current from V <sub>DD</sub>	All inputs at 1.9 V, No load	V <sub>DD</sub> = 9 V, V <sub>SS</sub> = -9 V	30	mA
			V <sub>DD</sub> = 12 V, V <sub>SS</sub> = -12 V	38	
			V <sub>DD</sub> = 15 V, V <sub>SS</sub> = -15 V	50	
	All inputs at 0.8 V, No load	V <sub>DD</sub> = 9 V, V <sub>SS</sub> = -9 V	9		
		V <sub>DD</sub> = 12 V, V <sub>SS</sub> = -12 V	11		
		V <sub>DD</sub> = 15 V, V <sub>SS</sub> = -15 V	18		
I <sub>SS</sub>	Supply current from V <sub>SS</sub>	All inputs at 1.9 V, No load	V <sub>DD</sub> = 9 V, V <sub>SS</sub> = -9 V	-30	mA
			V <sub>DD</sub> = 12 V, V <sub>SS</sub> = -12 V	-38	
			V <sub>DD</sub> = 15 V, V <sub>SS</sub> = -15 V	-50	
	All inputs at 0.8 V, No load	V <sub>DD</sub> = 9 V, V <sub>SS</sub> = -9 V	-6.4		
		V <sub>DD</sub> = 12 V, V <sub>SS</sub> = -12 V	-6.4		
		V <sub>DD</sub> = 15 V, V <sub>SS</sub> = -15 V	-6.4		
I <sub>CC</sub>	Supply current from V <sub>CC</sub>	V <sub>CC</sub> = 5 V, All inputs at 5 V, No load		60	mA

## DRIVER SECTION

### electrical characteristics over recommended operating free-air temperature range, V<sub>DD</sub> = 9 V, V<sub>SS</sub> = -9 V, V<sub>CC</sub> = 5 V (unless otherwise noted)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V <sub>OH</sub>	High-level output voltage	V <sub>IL</sub> = 0.8 V, R <sub>L</sub> = 3 kΩ, See Figure 1	6	7.5		V
V <sub>OL</sub>	Low-level output voltage (see Note 3)	V <sub>IH</sub> = 1.9 V, R <sub>L</sub> = 3 kΩ, See Figure 1		-7.5	-6	V
I <sub>IH</sub>	High-level input current	V <sub>I</sub> = 5 V, See Figure 2			10	μA
I <sub>IL</sub>	Low-level input current	V <sub>I</sub> = 0, See Figure 2			-1.6	mA
I <sub>OS(H)</sub>	High-level short-circuit output current (see Note 4)	V <sub>IL</sub> = 0.8 V, V <sub>O</sub> = 0, See Figure 1	-4.5	-12	-19.5	mA
I <sub>OS(L)</sub>	Low-level short-circuit output current	V <sub>IH</sub> = 2 V, V <sub>O</sub> = 0, See Figure 1	4.5	12	19.5	mA
r <sub>O</sub>	Output resistance (see Note 5)	V <sub>CC</sub> = V <sub>DD</sub> = V <sub>SS</sub> = 0, V <sub>O</sub> = -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,  $V_{CC} = 5\text{ V}$ ,  $V_{DD} = 12\text{ V}$ ,  $V_{SS} = -12\text{ V}$ ,  $T_A = 25^\circ\text{C}$  (see Figure 3)**

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

NOTE 6: Measured between  $\pm 3\text{-V}$  and  $\pm 3\text{-V}$  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	$T_A = 25^\circ\text{C}$	See Figure 5	1.75	1.9	2.3	V
		$T_A = 0^\circ\text{C}$ to $70^\circ\text{C}$		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	$I_{OH} = -0.5\text{ mA}$	$V_{IH} = 0.75\text{ V}$	2.6	4	5	V
			Inputs open	2.6			
$V_{OL}$	Low-level input voltage	$I_{OL} = 10\text{ mA}$ ,	$V_I = 3\text{ V}$		0.2	0.45	V
$I_{IH}$	High-level input current	$V_I = 25\text{ V}$ ,	See Figure 5	3.6		8.8	mA
		$V_I = 3\text{ V}$ ,	See Figure 5	0.43			
$I_{IL}$	Low-level output current	$V_I = -25\text{ V}$ ,	See Figure 5	-3.6		-8.8	mA
		$V_I = -3\text{ V}$ ,	See Figure 5	-0.43			
$I_{OS}$	Short-circuit output current	See Figure 4		-3.4		-12	mA

† All typical values are at  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5\text{ V}$ ,  $V_{DD} = 9\text{ V}$ , and  $V_{SS} = -9\text{ V}$ .

**switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $V_{DD} = 12\text{ V}$ ,  $V_{SS} = -12\text{ V}$ ,  $T_A = 25^\circ\text{C}$  (see Figure 6)**

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$t_{PLH}$	Propagation delay time, low- to high-level output	$C_L = 50\text{ pF}$ ,	$R_L = 5\text{ k}\Omega$		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	$C_L = 15\text{ pF}$ ,	$R_L = 1.5\text{ k}\Omega$		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

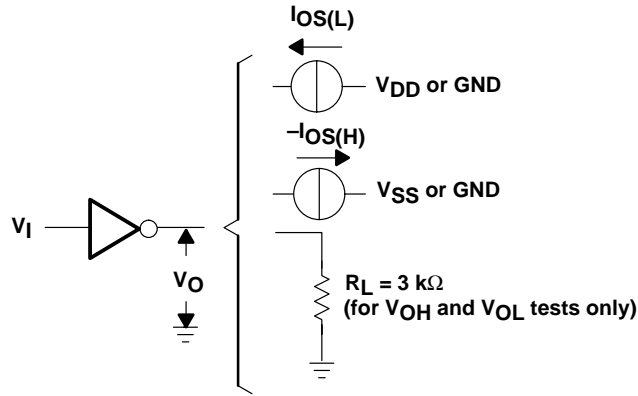


Figure 1. Driver Test Circuit for  $V_{OH}$ ,  $V_{OL}$ ,  $I_{OS(H)}$ , and  $I_{OS(L)}$

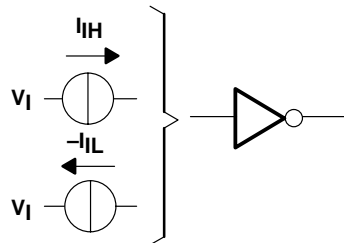
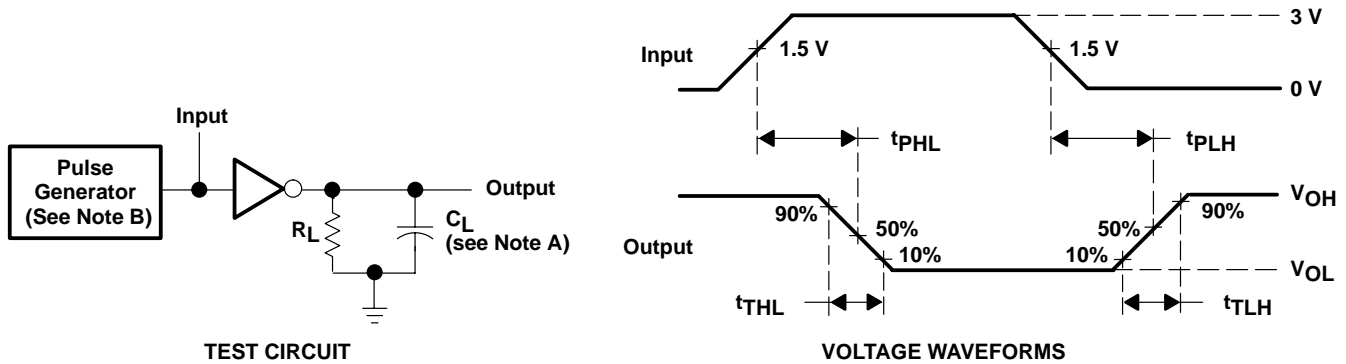


Figure 2. Driver Test Circuit for  $I_{IH}$  and  $I_{IL}$



NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. The pulse generator has the following characteristics:  $t_W = 25\ \mu\text{s}$ ,  $\text{PRR} = 20\ \text{kHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r = t_f < 50\ \text{ns}$ .

Figure 3. Driver Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION

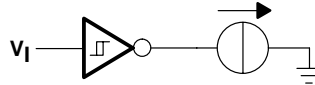


Figure 4. Receiver Test Circuit for  $I_{0S}$

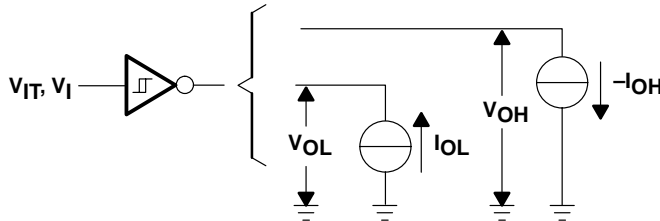
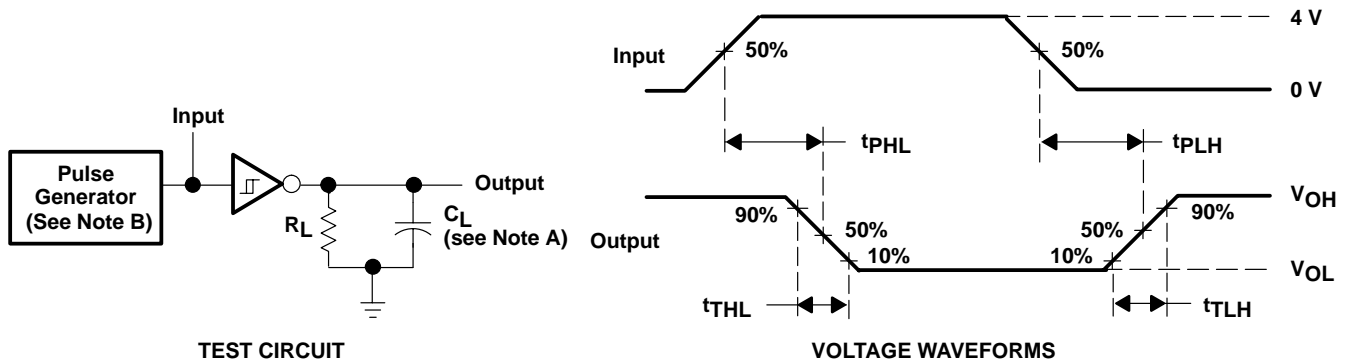


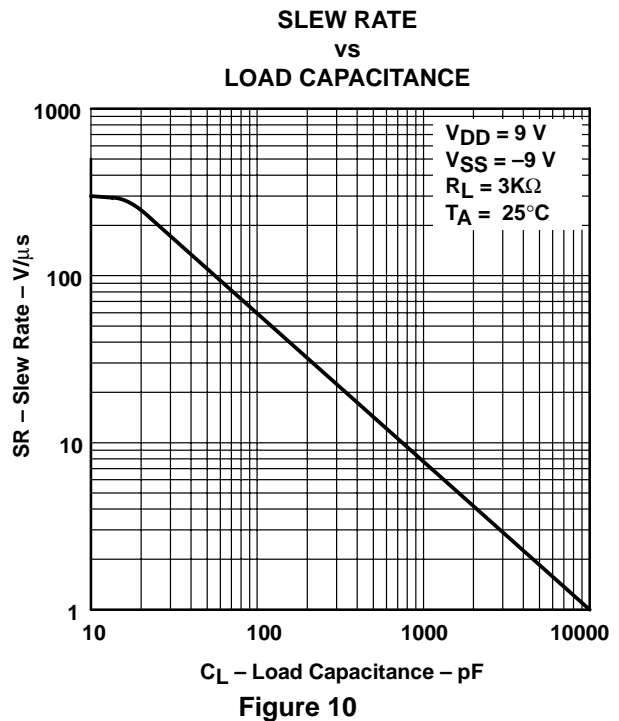
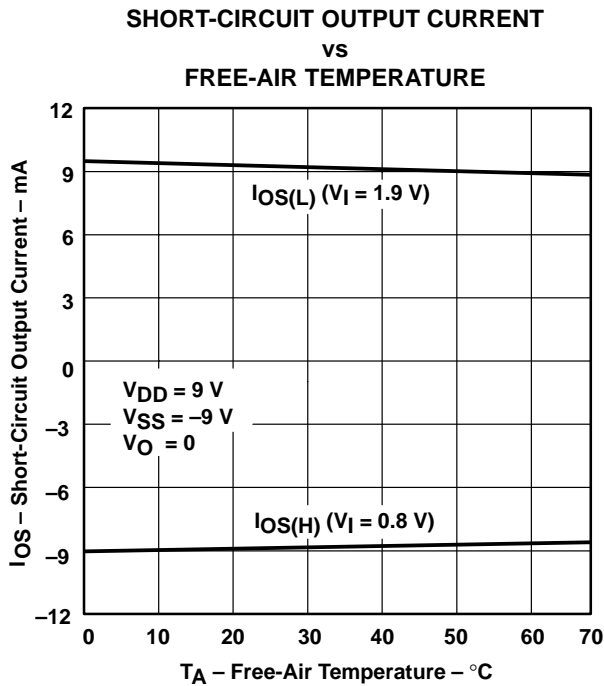
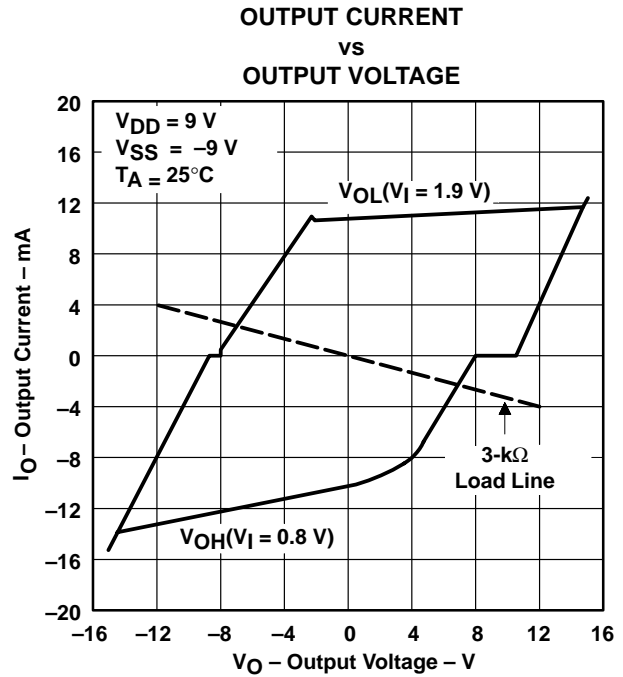
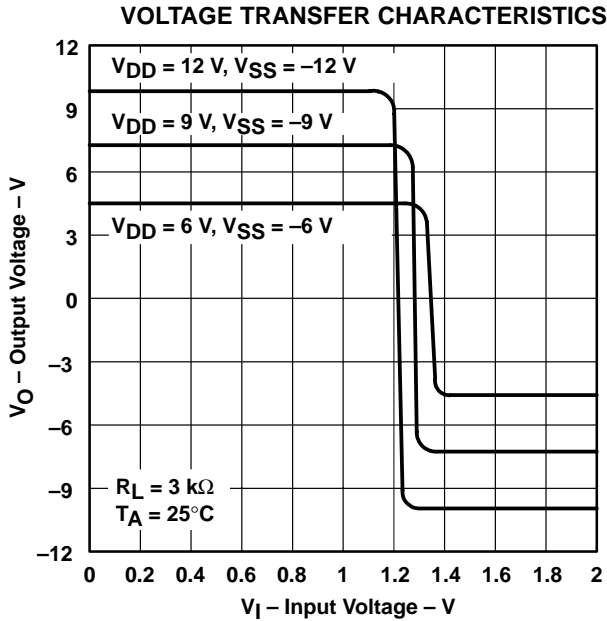
Figure 5. Receiver Test Circuit for  $V_{IT}$ ,  $V_{OH}$ , and  $V_{OL}$



NOTES: A.  $C_L$  includes probe and jig capacitance.  
B. The pulse generator has the following characteristics:  $t_w = 25 \mu s$ ,  $PRR = 20 \text{ kHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r = t_f < 50 \text{ ns}$ .

Figure 6. Receiver Propagation and Transition Times

TYPICAL CHARACTERISTICS  
DRIVER SECTION



TYPICAL CHARACTERISTICS

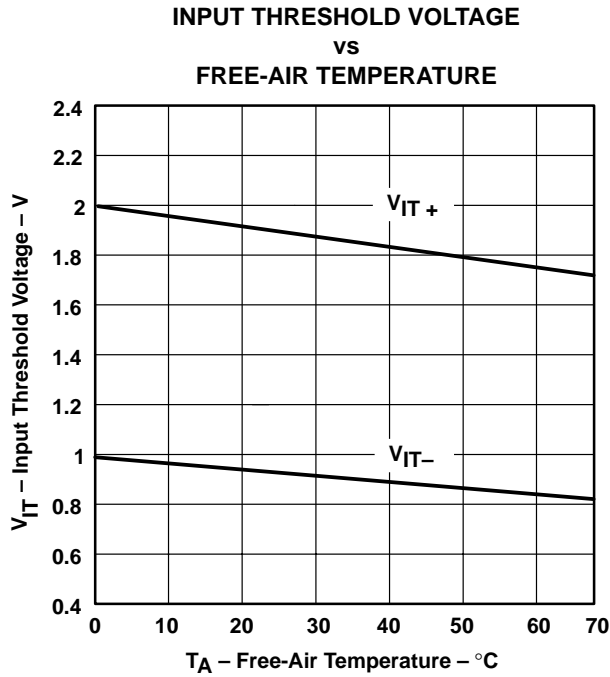


Figure 11

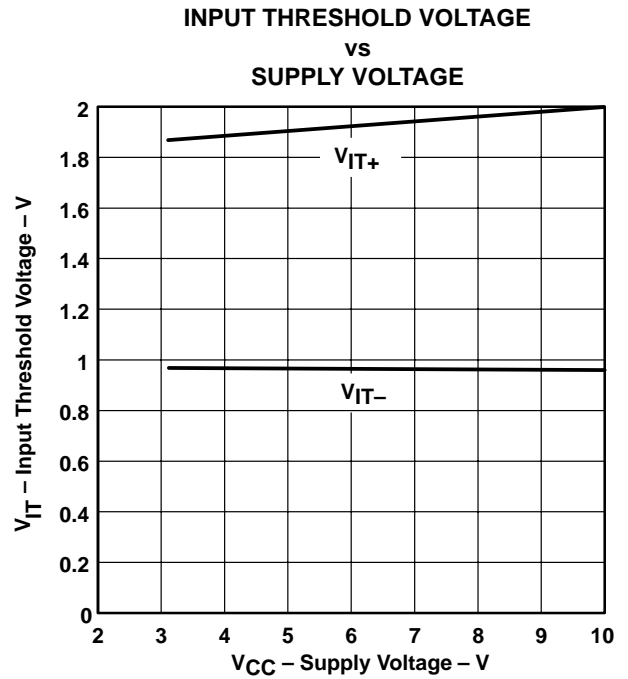
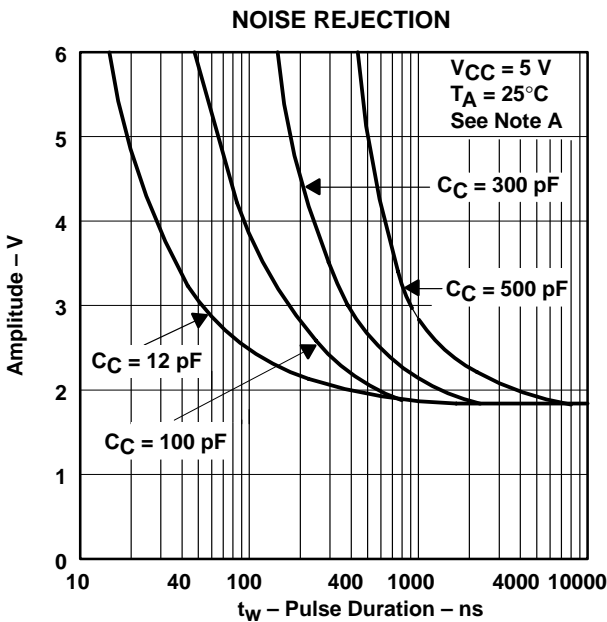


Figure 12



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

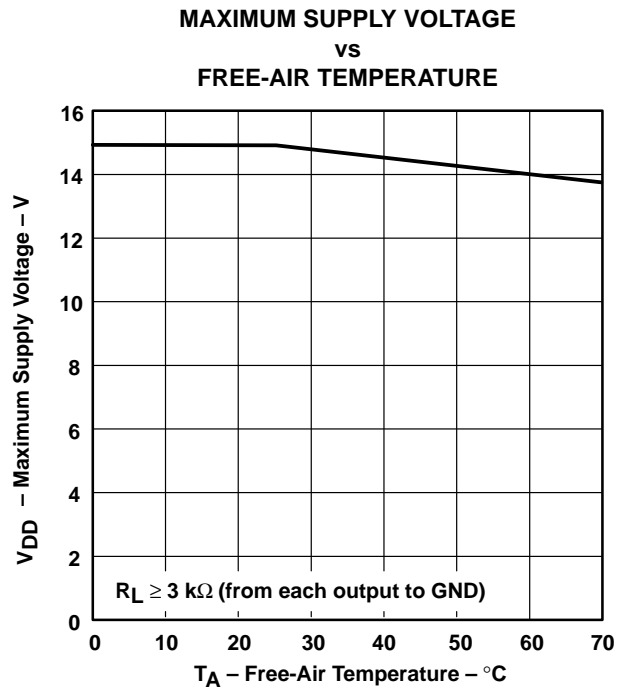


Figure 14

# SN752232 DUAL RS-232 PORT

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## 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  $\pm 15$  V, and the power supplies are at low and provide low-impedance paths to ground (see Figure 15).

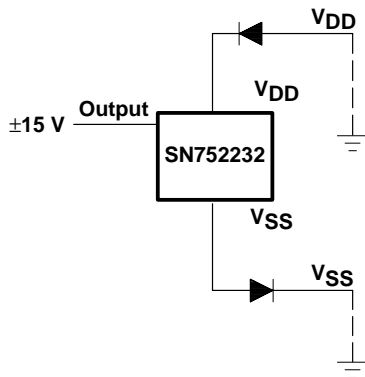
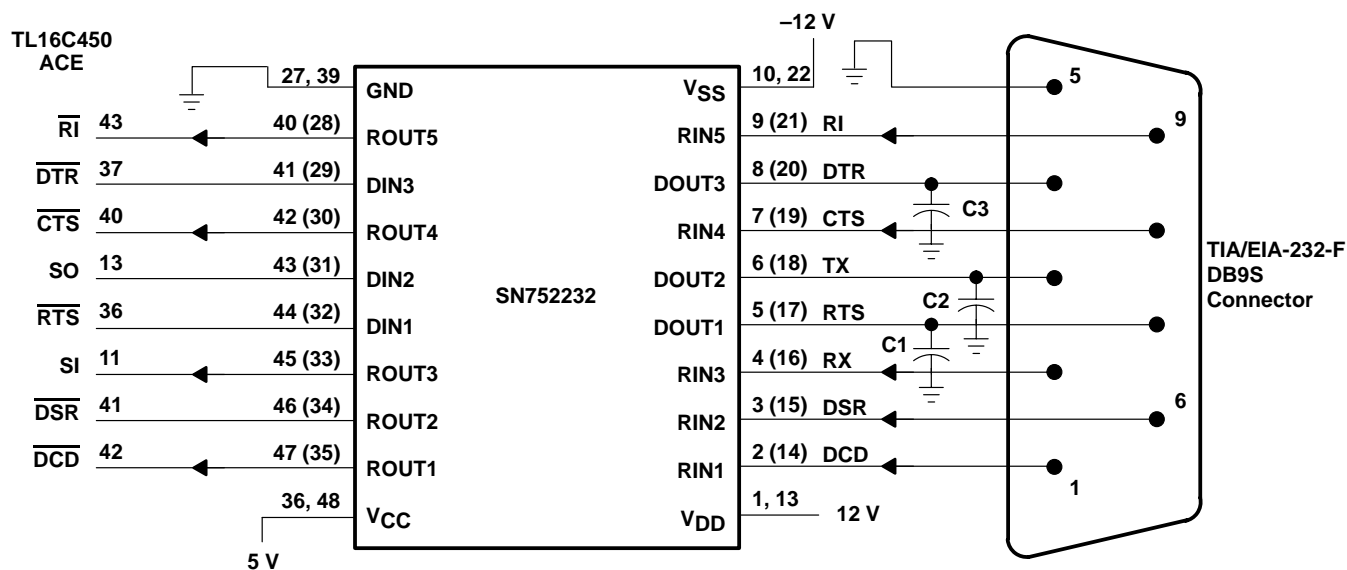


Figure 15. Power-Supply Protection to Meet Power-Off Fault Conditions of TIA/EIA-232-F



NOTE A: Numbers in parentheses are for B section.

Figure 16. Typical Connection Per Port

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
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
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

<sup>(1)</sup> 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.

<sup>(2)</sup> 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.

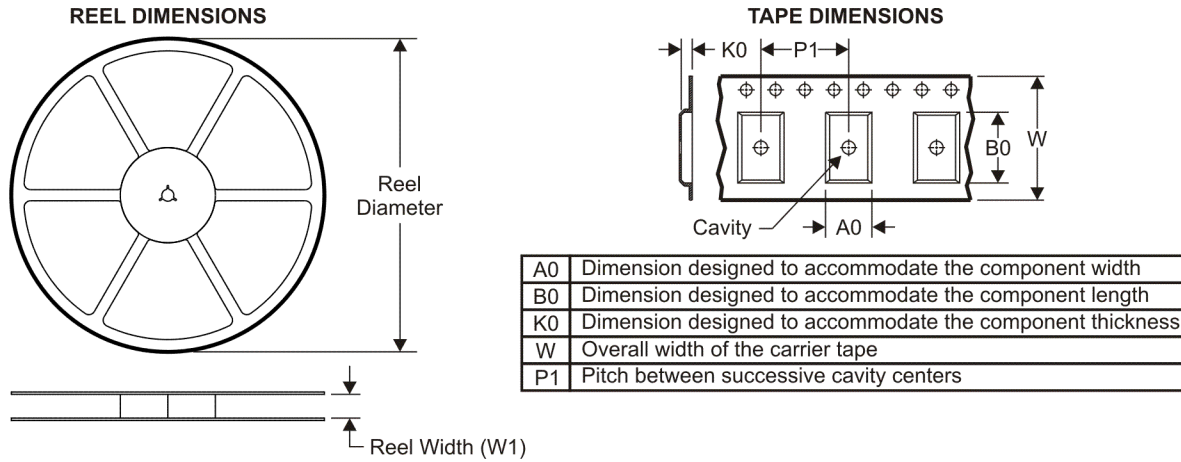
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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**TAPE AND REEL INFORMATION**



**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



- 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



- 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

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