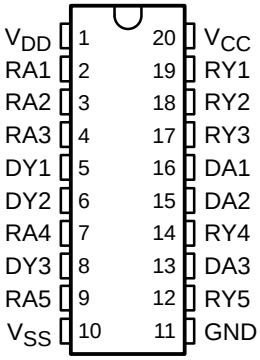
- **Single Chip With Easy Interface Between UART and Serial-Port Connector of IBM™ PC/AT and Compatibles**
- **Meet or Exceed the Requirements of ANSI Standard TIA/EIA-232-F and ITU Recommendation V.28**
- **Designed to Support Data Rates up to 120 kbit/s**
- **Pinout Compatible With SN75C185 and SN75185**

GD65232, GD75232 . . . DB, DW, N, OR PW PACKAGE
(TOP VIEW)



description

The GD65232 and GD75232 combine three drivers and five receivers from the Texas Instruments trade-standard SN75188 and SN75189 bipolar quadruple drivers and receivers, respectively. The pinout matches the flow-through design of the SN75C185 to decrease the part count, reduce the board space required, and allow easy interconnection of the UART and serial-port connector of an IBM™ PC/AT and compatibles. The bipolar circuits and processing of the GD65232 and GD75232 provide a rugged, low-cost solution for this function at the expense of quiescent power and external passive components relative to the SN75C185.

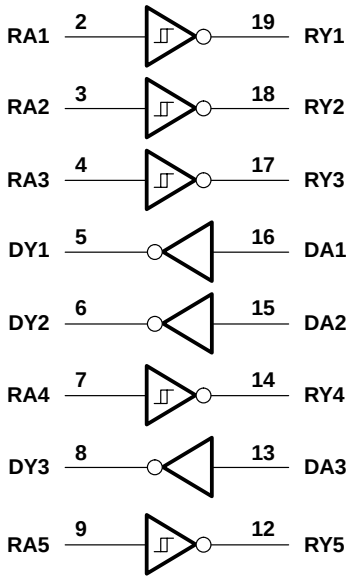
The GD65232 and GD75232 comply with the requirements of the TIA/EIA-232-F and ITU (formerly CCITT) V.28 standards. These standards are for data interchange between a host computer and a peripheral at signaling rates up to 20 kbit/s. The switching speeds of these devices are fast enough to support rates 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 ANSI TIA/EIA-423-B (ITU V.10) and TIA/EIA-422-B (ITU V.11) standards is recommended.

ORDERING INFORMATION

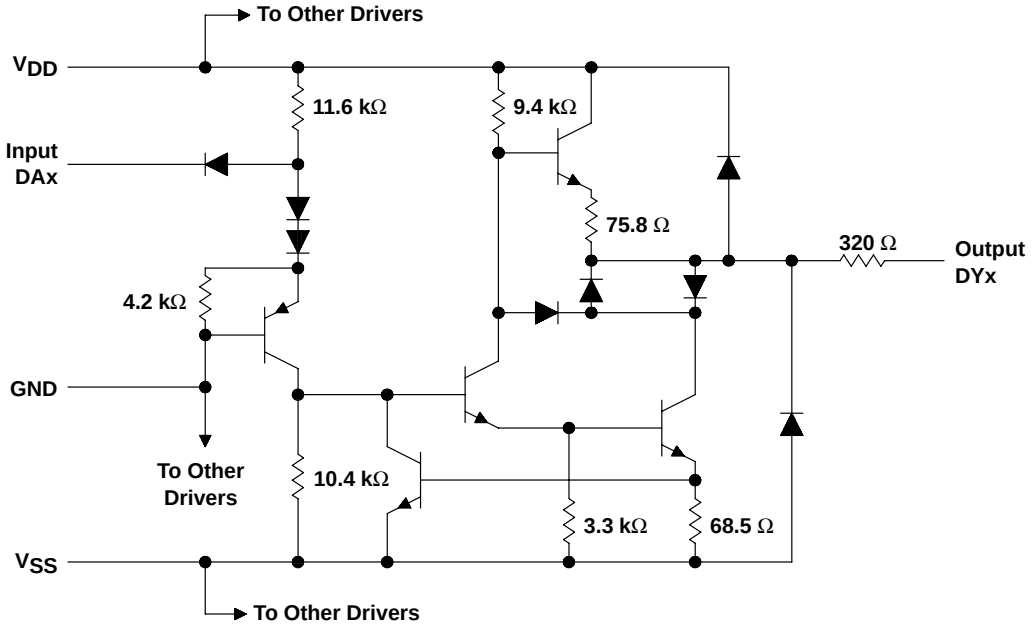
T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP – N	Tube	GD65232N	GD65232N
	SOIC – DW	Tube	GD65232DW	GD65232
		Tape and reel	GD65232DWR	
	SSOP – DB	Tape and reel	GD65232DBR	GD65232
	TSSOP – PW	Tape and reel	GD65232PWR	GD65232
0°C to 70°C	PDIP – N	Tube	GD75232N	GD75232N
	SOIC – DW	Tube	GD75232DW	GD75232
		Tape and reel	GD75232DWR	
	SSOP – DB	Tape and reel	GD75232DBR	GD75232
	TSSOP – PW	Tape and reel	GD75232PWR	GD75232

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

logic diagram (positive logic)

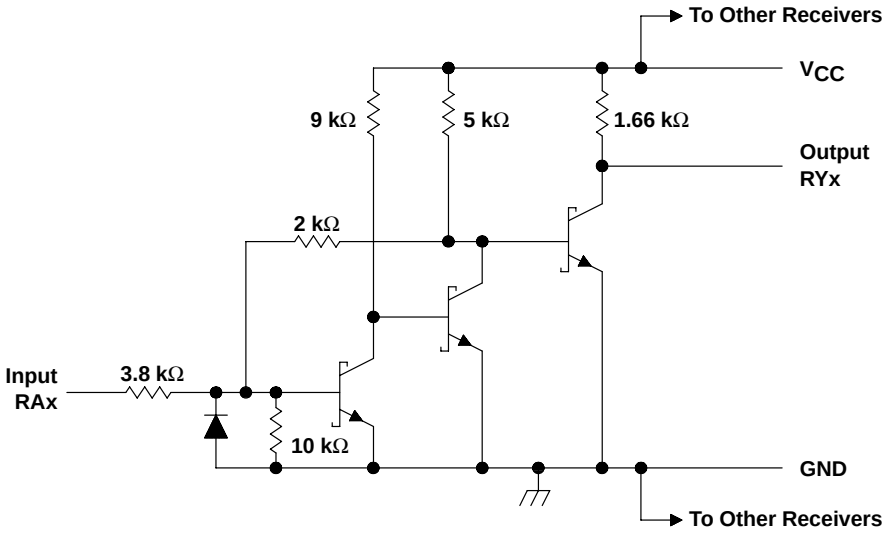


schematic (each driver)



Resistor values shown are nominal.

schematic (each receiver)



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): DB package . . . . . 70°C/W
DW package . . . . . 58°C/W
N package . . . . . 69°C/W
PW package . . . . . 83°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 the network ground terminal.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

			MIN	NOM	MAX	UNIT
V_{DD}	Supply voltage (see Note 3)		7.5	9	15	V
V_{SS}	Supply voltage (see Note 3)		–7.5	–9	–15	V
V_{CC}	Supply voltage (see Note 3)		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	GD65232	–40		85	°C
		GD75232	0		70	

NOTE 3: When powering up the GD65232 and GD75232, the following sequence should be used:
1. V_{SS}
2. GND
3. V_{DD}
4. V_{CC}
5. I/Os

Applying V_{CC} to the device before V_{DD} may allow large currents to flow, causing damage to the device. When powering down the GD65232 and GD75232, the reverse sequence should be used.

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		15	mA
				V_{DD} = 12 V,	V_{SS} = –12 V		19	
				V_{DD} = 15 V,	V_{SS} = –15 V		25	
		All inputs at 0.8 V,	No load	V_{DD} = 9 V,	V_{SS} = –9 V		4.5	
				V_{DD} = 12 V,	V_{SS} = –12 V		5.5	
				V_{DD} = 15 V,	V_{SS} = –15 V		9	
I_{SS}	Supply current from V_{SS}	All inputs at 1.9 V,	No load	V_{DD} = 9 V,	V_{SS} = –9 V		–15	mA
				V_{DD} = 12 V,	V_{SS} = –12 V		–19	
				V_{DD} = 15 V,	V_{SS} = –15 V		–25	
		All inputs at 0.8 V,	No load	V_{DD} = 9 V,	V_{SS} = –9 V		–3.2	
				V_{DD} = 12 V,	V_{SS} = –12 V		–3.2	
				V_{DD} = 15 V,	V_{SS} = –15 V		–3.2	
I_{CC}	Supply current from V_{CC}	All inputs at 5 V,	No load,	V_{CC} = 5 V	GD65232		38	mA
					GD75232		30	

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 4)	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 5)	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 6)	V_{CC} = V_{DD} = V_{SS} = 0,		V_O = –2 V to 2 V	300			Ω

NOTES: 4. 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).
5. Output short-circuit conditions must maintain the total power dissipation below absolute maximum ratings.
6. 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

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,	See Figure 3		315	500	ns
t_{PHL}	Propagation delay time, high- to low-level output	R_L = 3 kΩ to 7 kΩ,	C_L = 15 pF,	See Figure 3		75	175	ns
t_{TLH}	Transition time, low- to high-level output	R_L = 3 kΩ to 7 kΩ	C_L = 15 pF,	See Figure 3		60	100	ns
			C_L = 2500 pF,	See Figure 3 and Note 7		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,	See Figure 3		40	75	ns
			C_L = 2500 pF,	See Figure 3 and Note 7		1.5	2.5	μs

NOTE 7: 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,	See Figure 5		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	GD65232	3.6		11	mA
				GD75232	3.6		8.3	
		V_I = 3 V,	See Figure 5		0.43			
I_{IL}	Low-level output current	V_I = –25 V,	See Figure 5	GD65232	–3.6		–11	mA
				GD75232	–3.6		–8.3	
		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

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,	See Figure 6		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,	See Figure 6		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

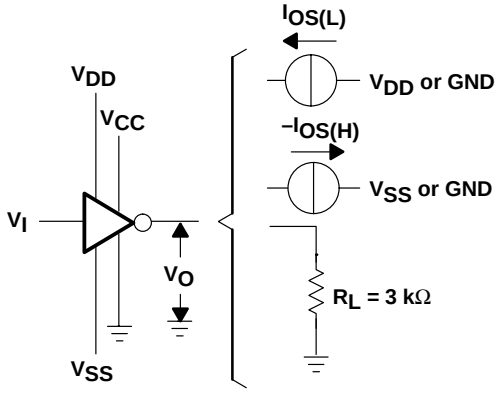


Figure 1. Driver Test Circuit for V_{OH}, V_{OL}, $I_{OS(H)}$, and $I_{OS(L)}$

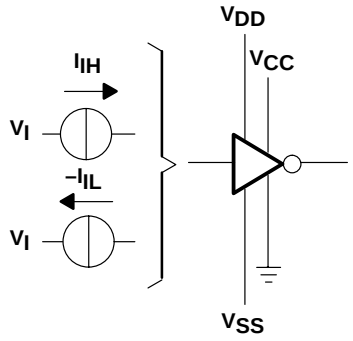
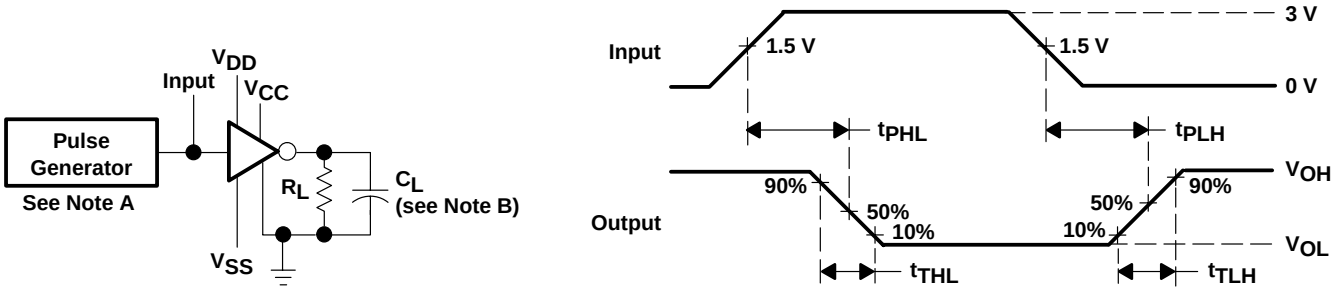


Figure 2. Driver Test Circuit for I_{IH} and I_{IL}



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

Figure 3. Driver Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION

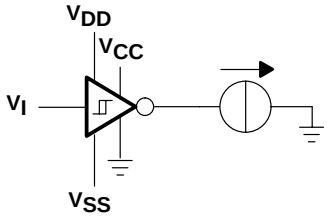


Figure 4. Receiver Test Circuit for I_{OS}

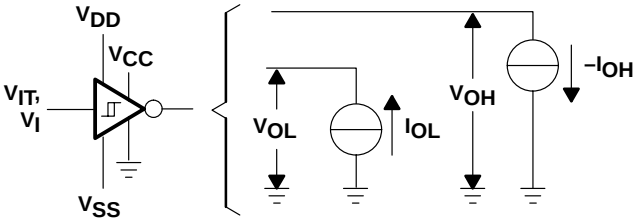
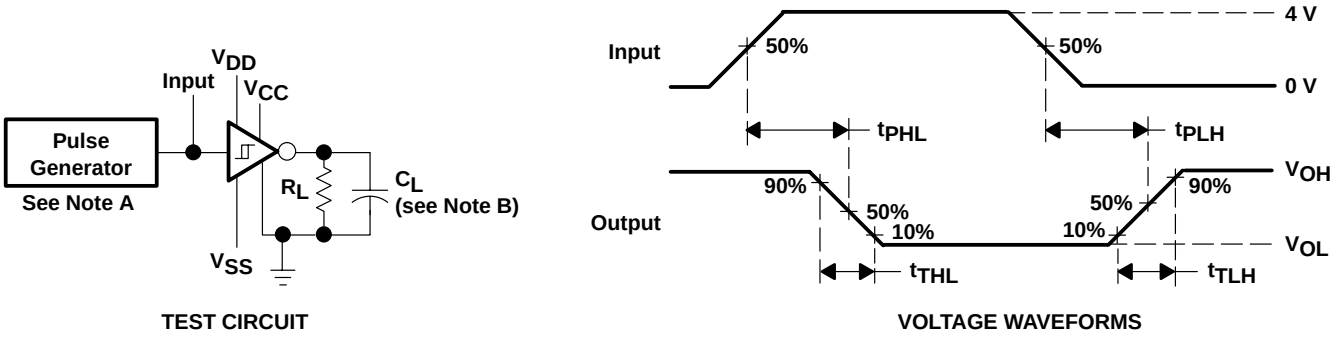


Figure 5. Receiver Test Circuit for V_{IT}, V_{OH}, and V_{OL}



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

Figure 6. Receiver Propagation and Transition Times

TYPICAL CHARACTERISTICS

DRIVER SECTION

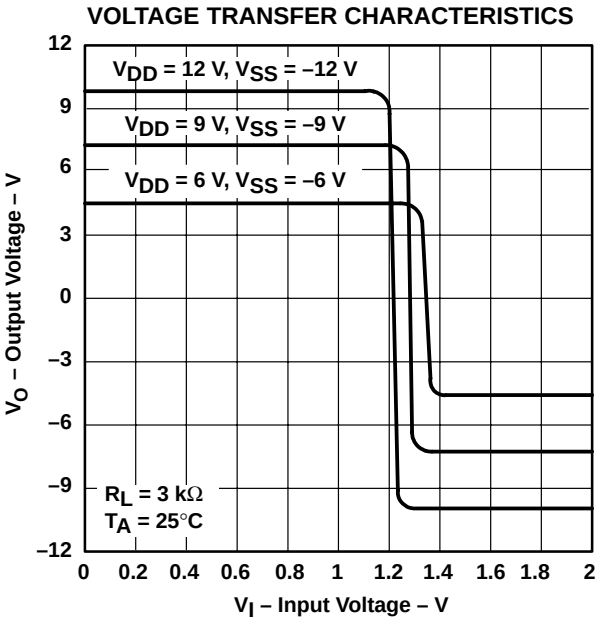


Figure 7

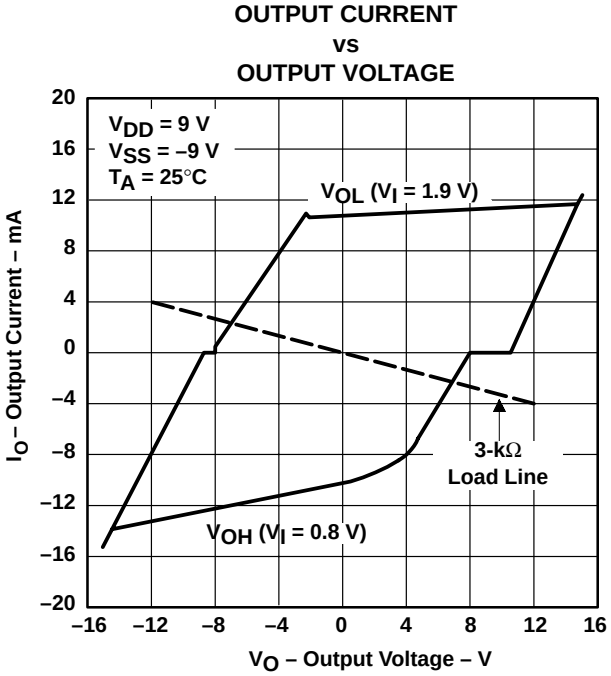


Figure 8

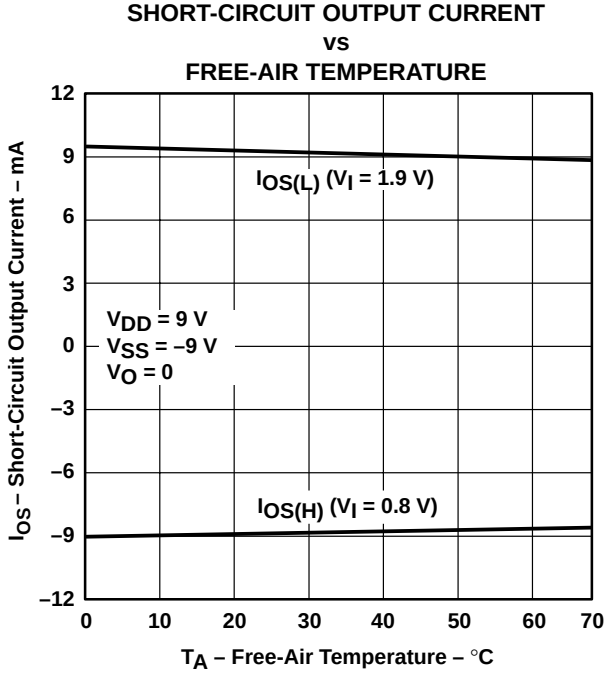


Figure 9

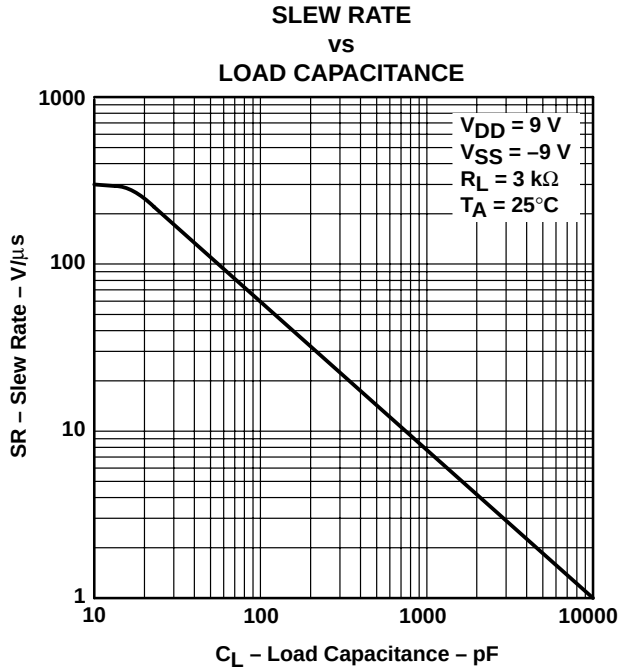


Figure 10

TYPICAL CHARACTERISTICS

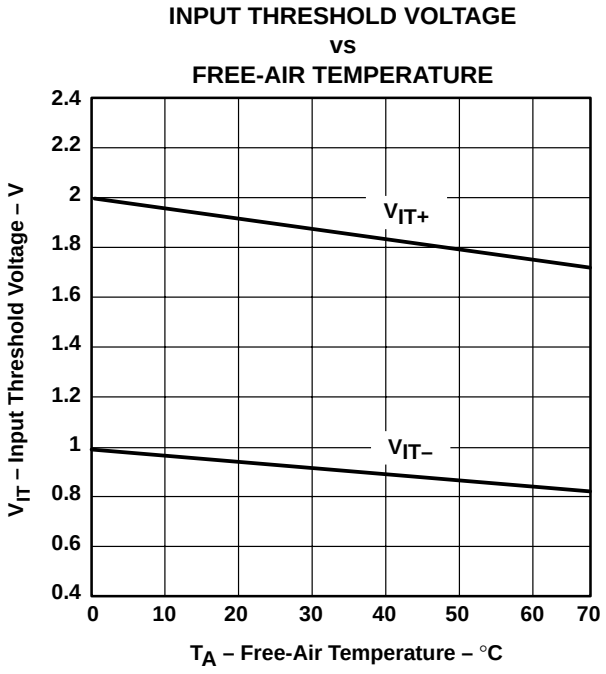


Figure 11

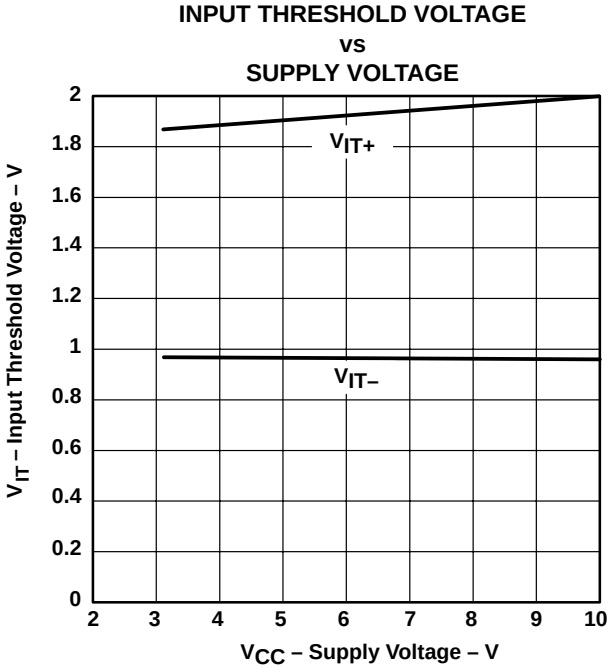
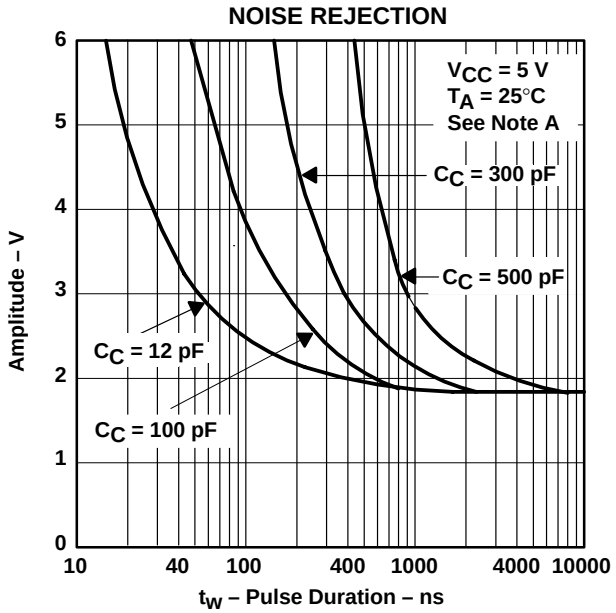


Figure 12



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

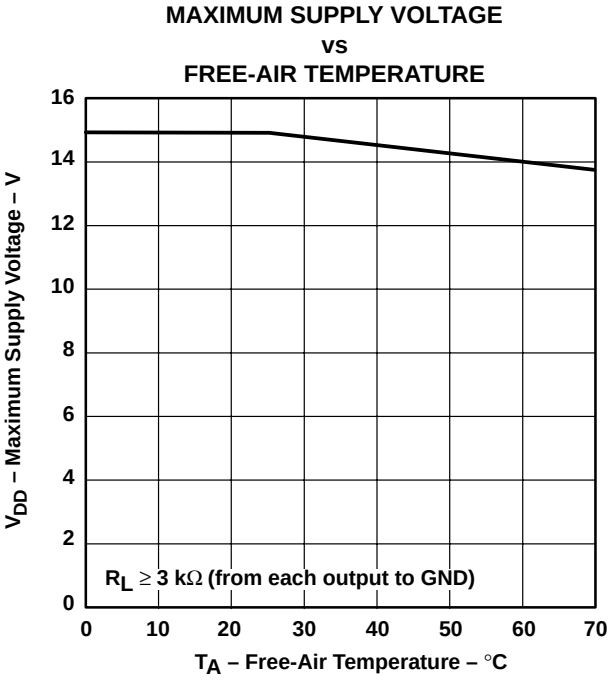


Figure 14

APPLICATION INFORMATION

Diodes placed in series with the V_{DD} and V_{SS} leads protect the GD65232 and GD75232 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).

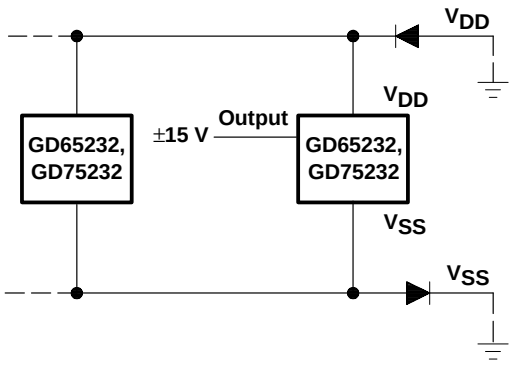


Figure 15. Power-Supply Protection to Meet Power-Off Fault Conditions of TIA/EIA-232-F

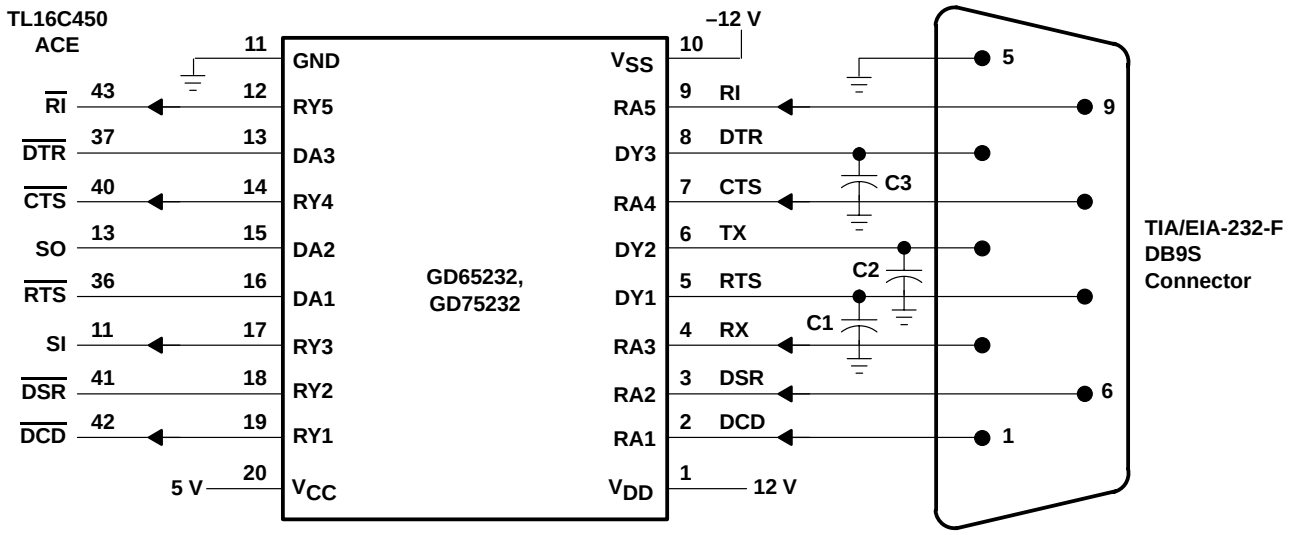


Figure 16. Typical Connection

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 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.

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.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265