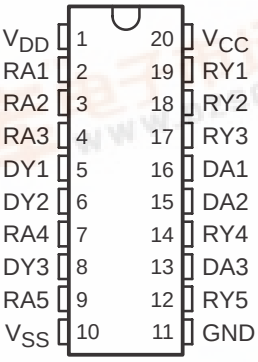
GD65232, GD75232
MULTIPLE RS-232 DRIVERS AND RECEIVERS

SLLS206J − MAY 1995 − REVISED NOVEMBER 2004

- **Single Chip With Easy Interface Between UART and Serial-Port Connector of IBM™ PC/AT and Compatibles**
- **Meet or Exceed the Requirements of TIA/EIA-232-F and ITU v.28 Standards**
- **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/ordering information

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.

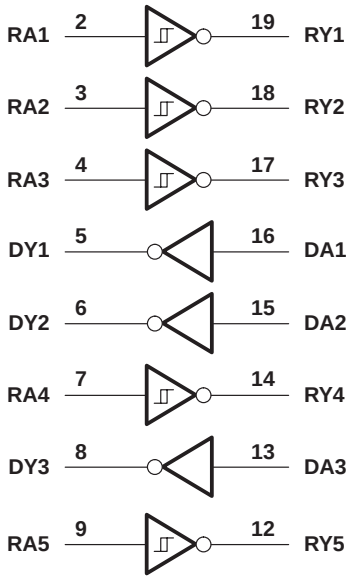
The GD65232 and GD75232 comply with the requirements of the TIA/EIA-232-F and ITU (formerly CCITT) V.28 standards. These standards are for data interchange between a host computer and a peripheral at signaling rates up to 20 kbit/s. The switching speeds of these devices are fast enough to support rates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

ORDERING INFORMATION

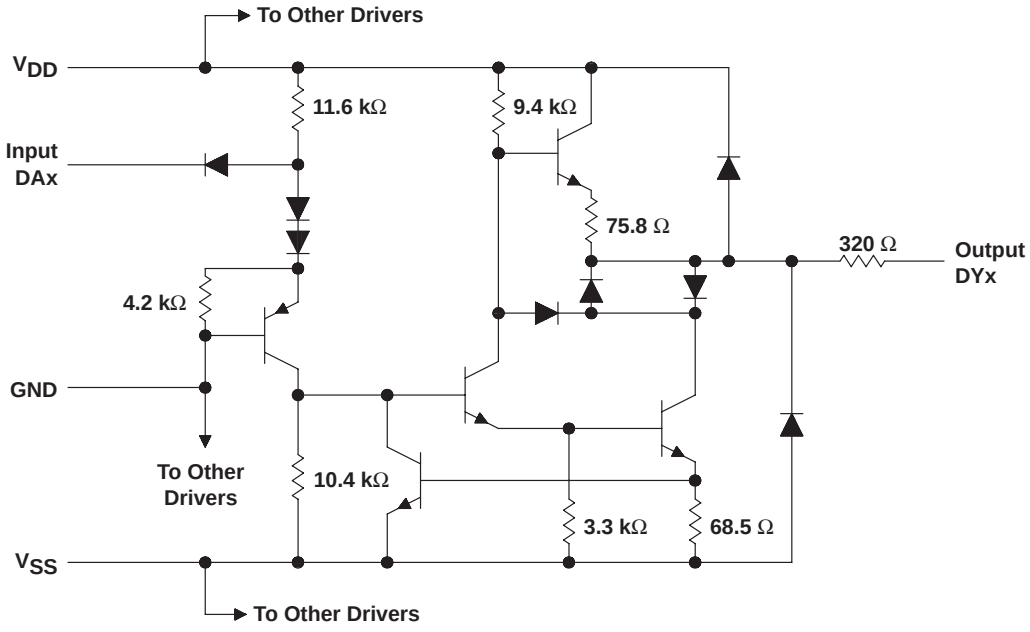
T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	PDIP (N)	Tube of 20	GD65232N	GD65232N
	SOIC (DW)	Tube of 25	GD65232DW	GD65232
		Reel of 2000	GD65232DWR	
	SSOP (DB)	Reel of 2000	GD65232DBR	GD65232
	TSSOP (PW)	Tube of 70	GD65232PW	GD65232
		Reel of 2000	GD65232PWR	
0°C to 70°C	PDIP (N)	Tube of 20	GD75232N	GD75232N
	SOIC (DW)	Tube of 25	GD75232DW	GD75232
		Reel of 2000	GD75232DWR	
	SSOP (DB)	Reel of 2000	GD75232DBR	GD75232
	TSSOP (PW)	Tube of 70	GD75232PW	GD75232
		Reel of 2000	GD75232PWR	

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

logic diagram (positive logic)

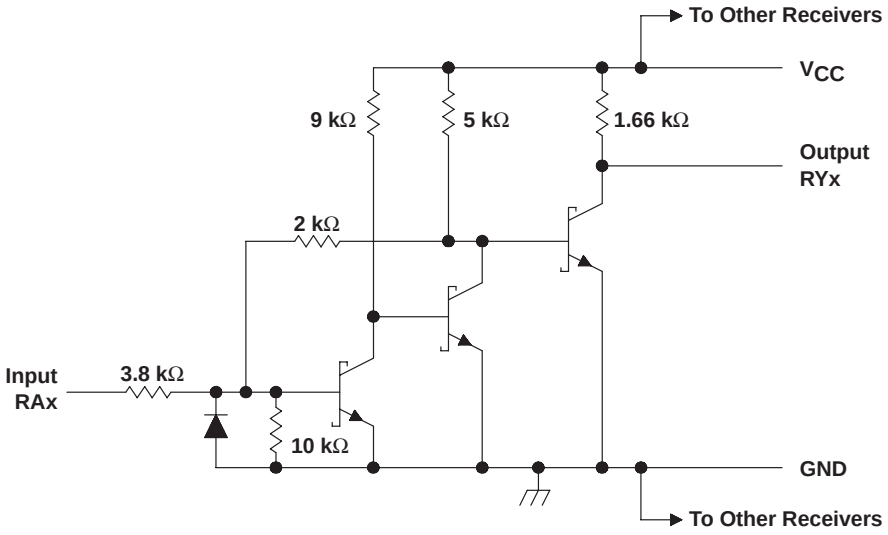


schematic (each driver)



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 Notes 2 and 3):	DB package	70°C/W
	DW package	58°C/W
	N package	69°C/W
	PW package	83°C/W
Operating virtual junction temperature, T_J		150°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. Maximum power dissipation is a function of $T_J(max)$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
3. 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 4)		7.5	9	15	V
V_{SS}	Supply voltage (see Note 4)		−7.5	−9	−15	V
V_{CC}	Supply voltage (see Note 4)		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 4: When powering up the GD65232 and GD75232, the following sequence should be used:
1. V_{SS}
2. V_{DD}
3. V_{CC}
4. I/Os

Applying V_{CC} 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 5)	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 6)	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 7)	V_{CC} = V_{DD} = V_{SS} = 0,	V_O = −2 V to 2 V		300			Ω

NOTES: 5. 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).
6. Output short-circuit conditions must maintain the total power dissipation below absolute maximum ratings.
7. 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 8		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 8		1.5	2.5	µs

NOTE 8: 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 output 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 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_{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

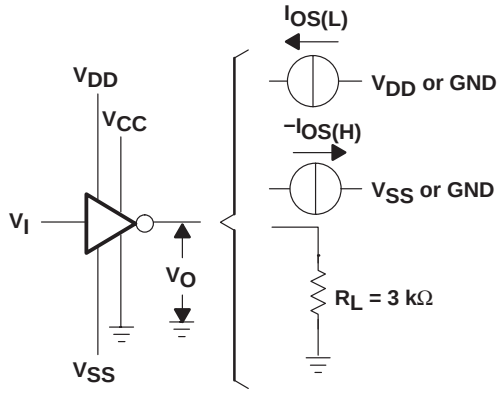


Figure 1. Driver Test Circuit for V_{OH}, V_{OL}, $I_{OS(H)}$, and $I_{OS(L)}$

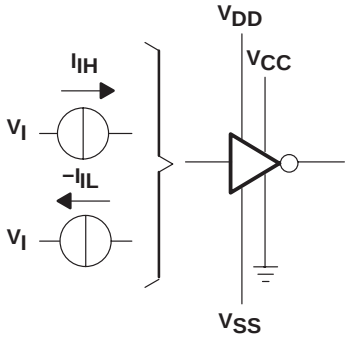
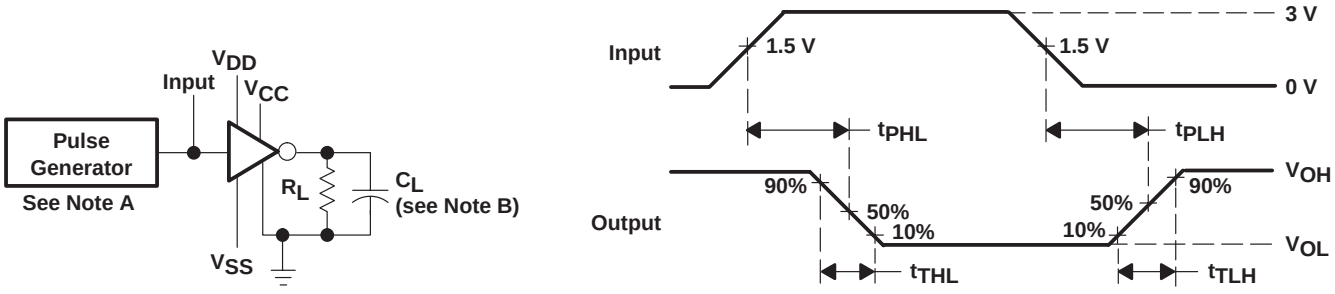


Figure 2. Driver Test Circuit for I_{IH} and I_{IL}



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

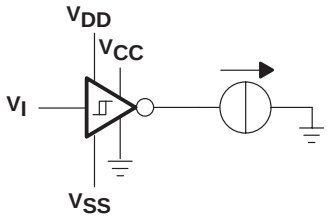


Figure 4. Receiver Test Circuit for I_{OS}

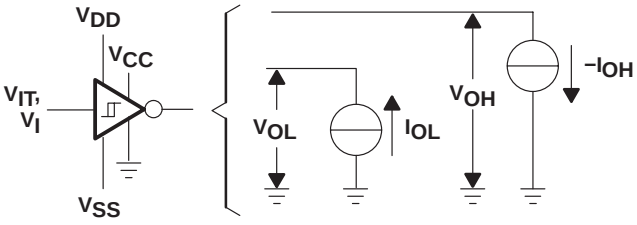
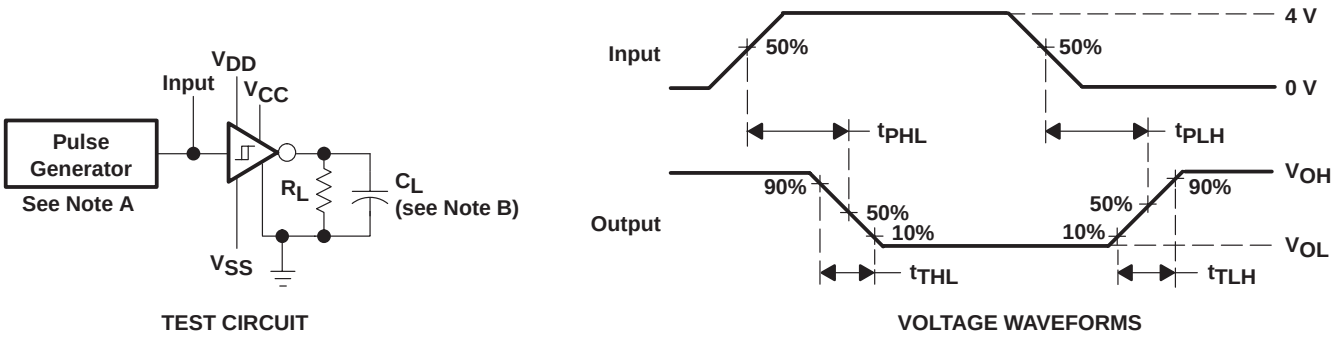


Figure 5. Receiver Test Circuit for V_{IT}, V_{OH}, and V_{OL}



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

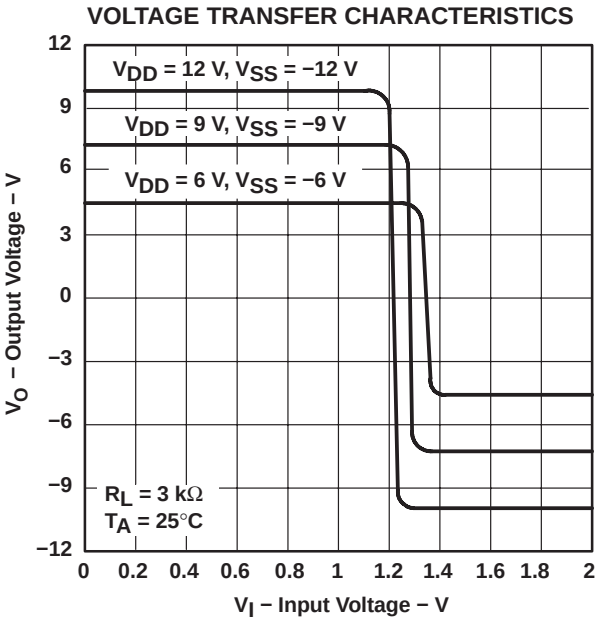


Figure 7

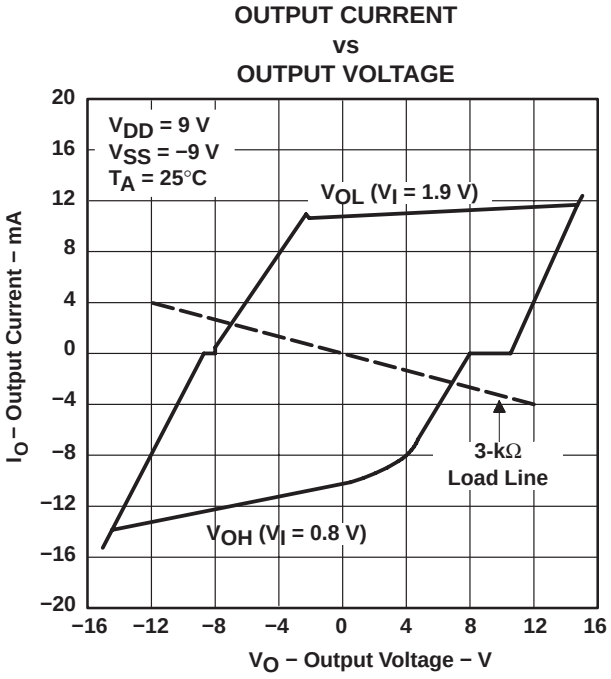


Figure 8

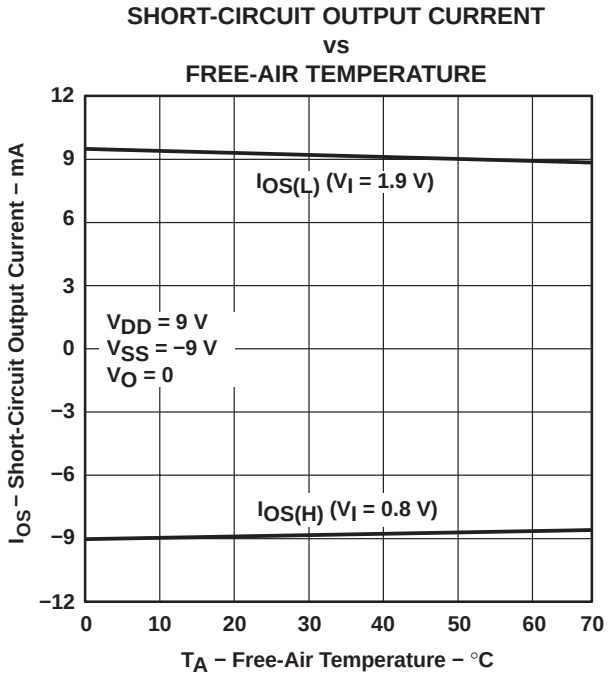


Figure 9

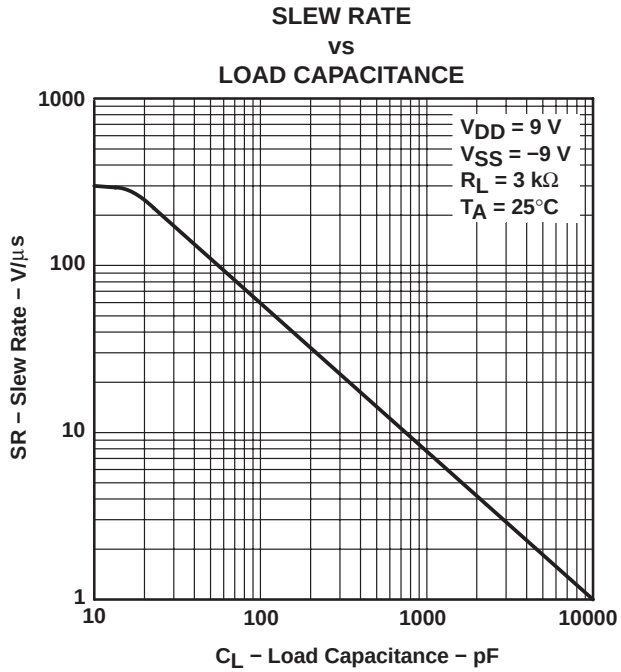


Figure 10

TYPICAL CHARACTERISTICS

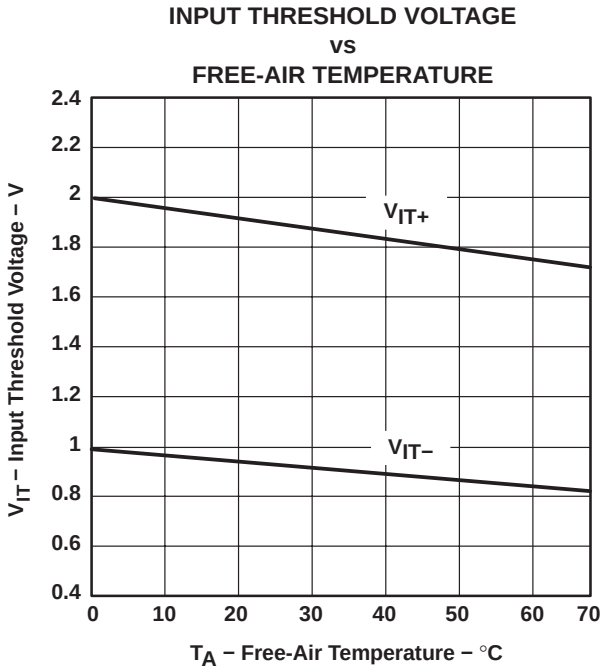


Figure 11

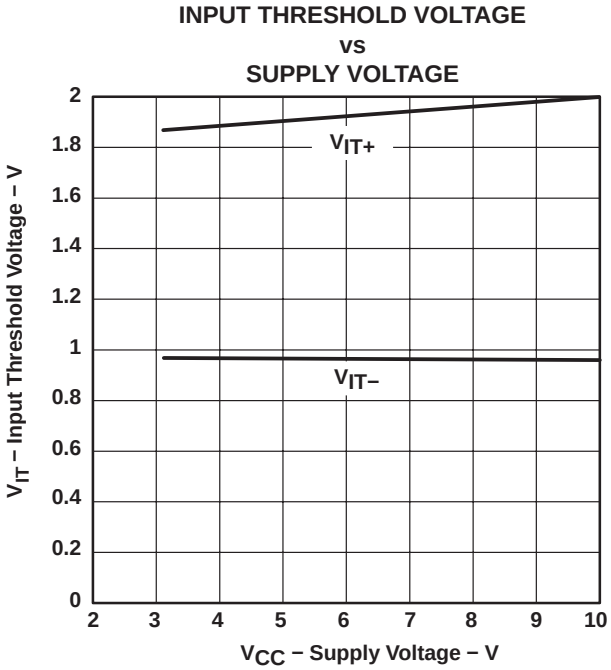
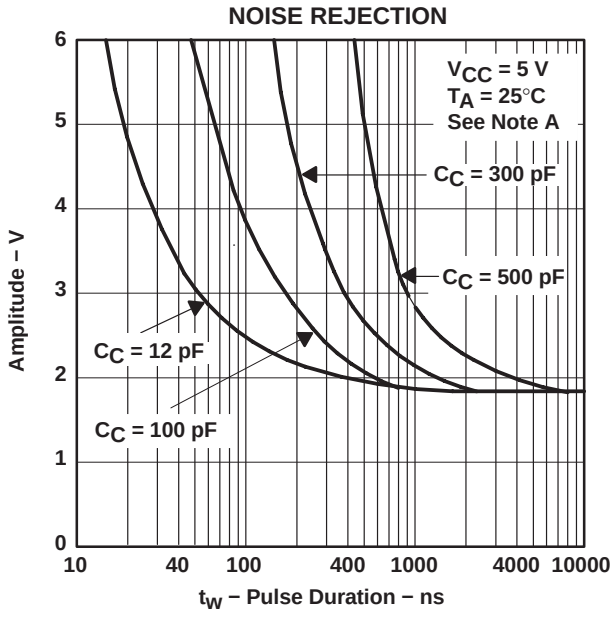


Figure 12



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

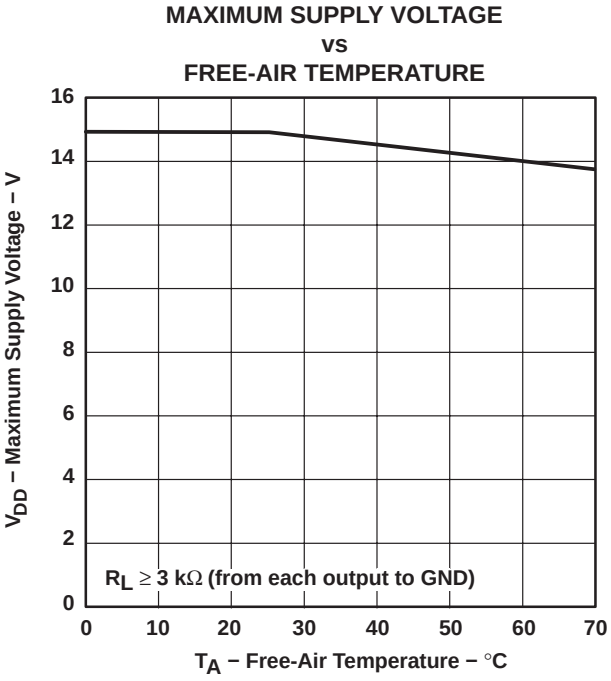


Figure 14

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).

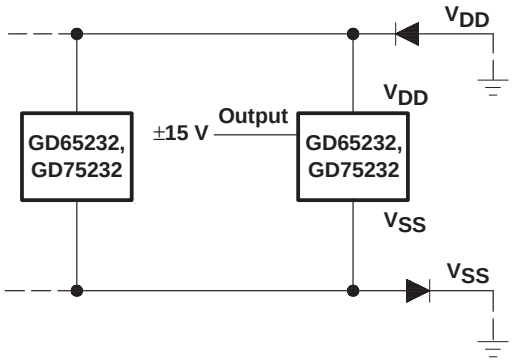


Figure 15. Power-Supply Protection to Meet Power-Off Fault Conditions of TIA/EIA-232-F

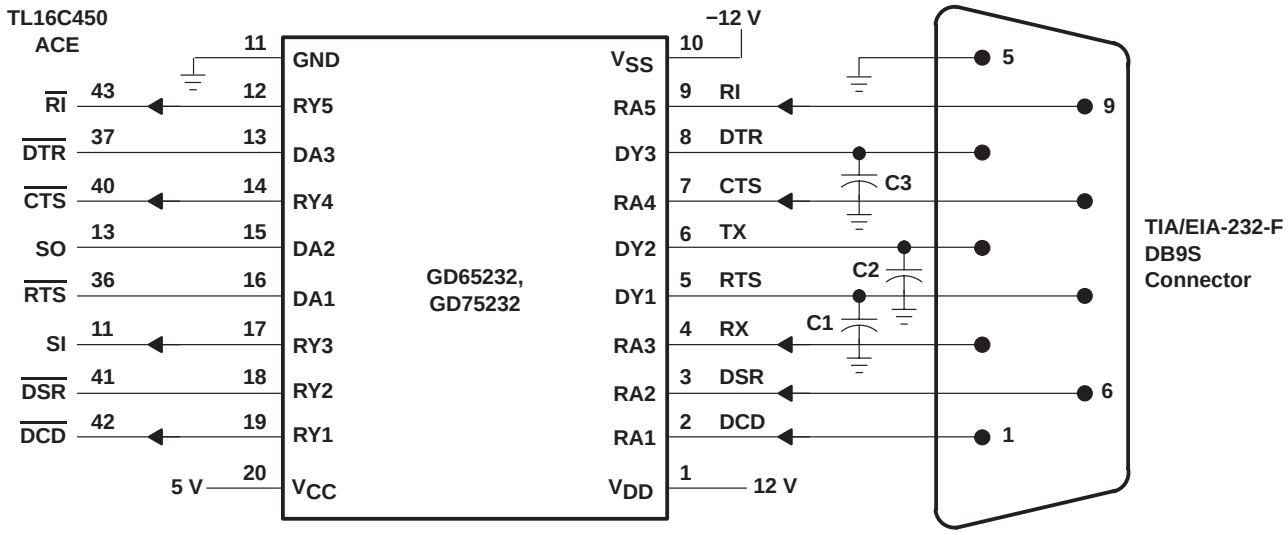


Figure 16. Typical Connection

PACKAGE OPTION ADDENDUM

4-Mar-2005

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
GD65232DBR	ACTIVE	SSOP	DB	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
GD65232DW	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
GD65232DWR	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
GD65232N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
GD65232PW	ACTIVE	TSSOP	PW	20	70	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
GD65232PWR	ACTIVE	TSSOP	PW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
GD75232DB	OBSOLETE	SSOP	DB	20		Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
GD75232DBR	ACTIVE	SSOP	DB	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
GD75232DW	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
GD75232DWR	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
GD75232N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
GD75232PW	ACTIVE	TSSOP	PW	20	70	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
GD75232PWR	ACTIVE	TSSOP	PW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-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 - May not be currently available - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
None: Not yet available Lead (Pb-Free).
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.
Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

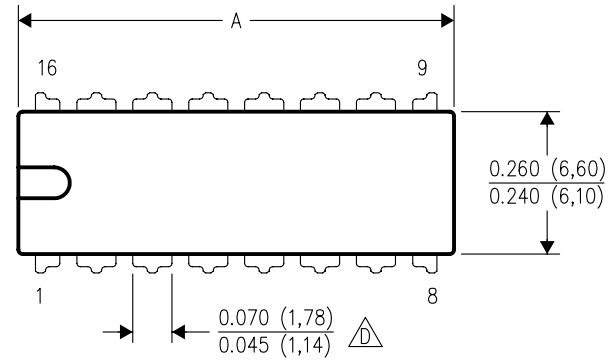
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDECindustry standard classifications, and peak solder temperature.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

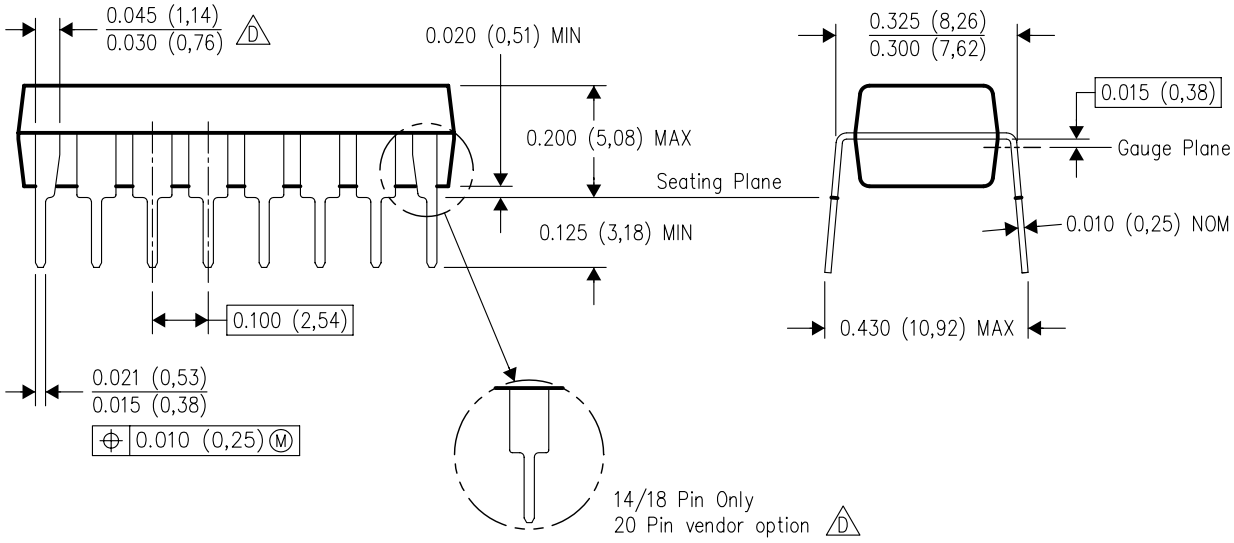
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



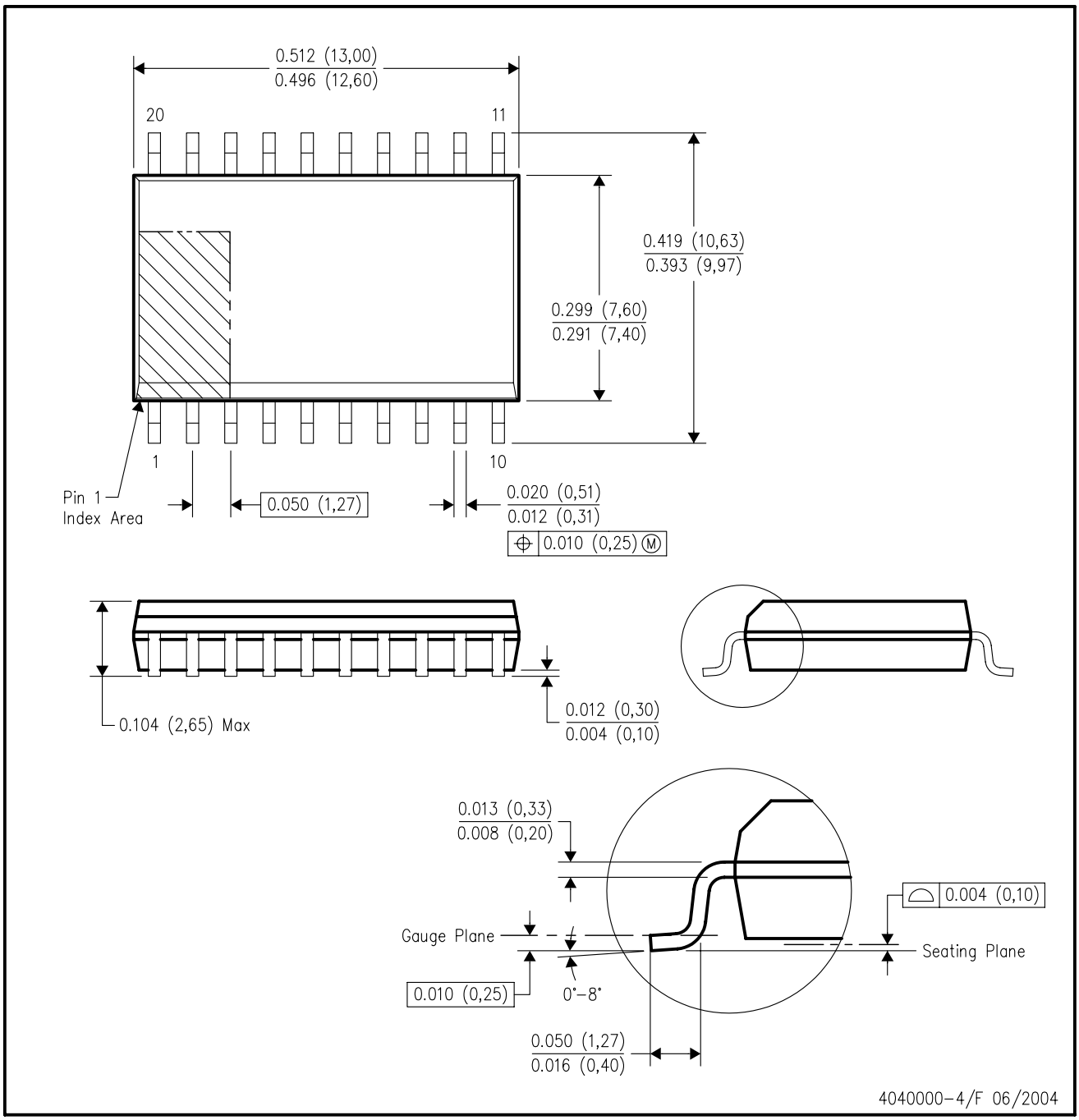
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

DW (R–PDSO–G20) PLASTIC SMALL–OUTLINE PACKAGE



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 MS–013 variation AC.

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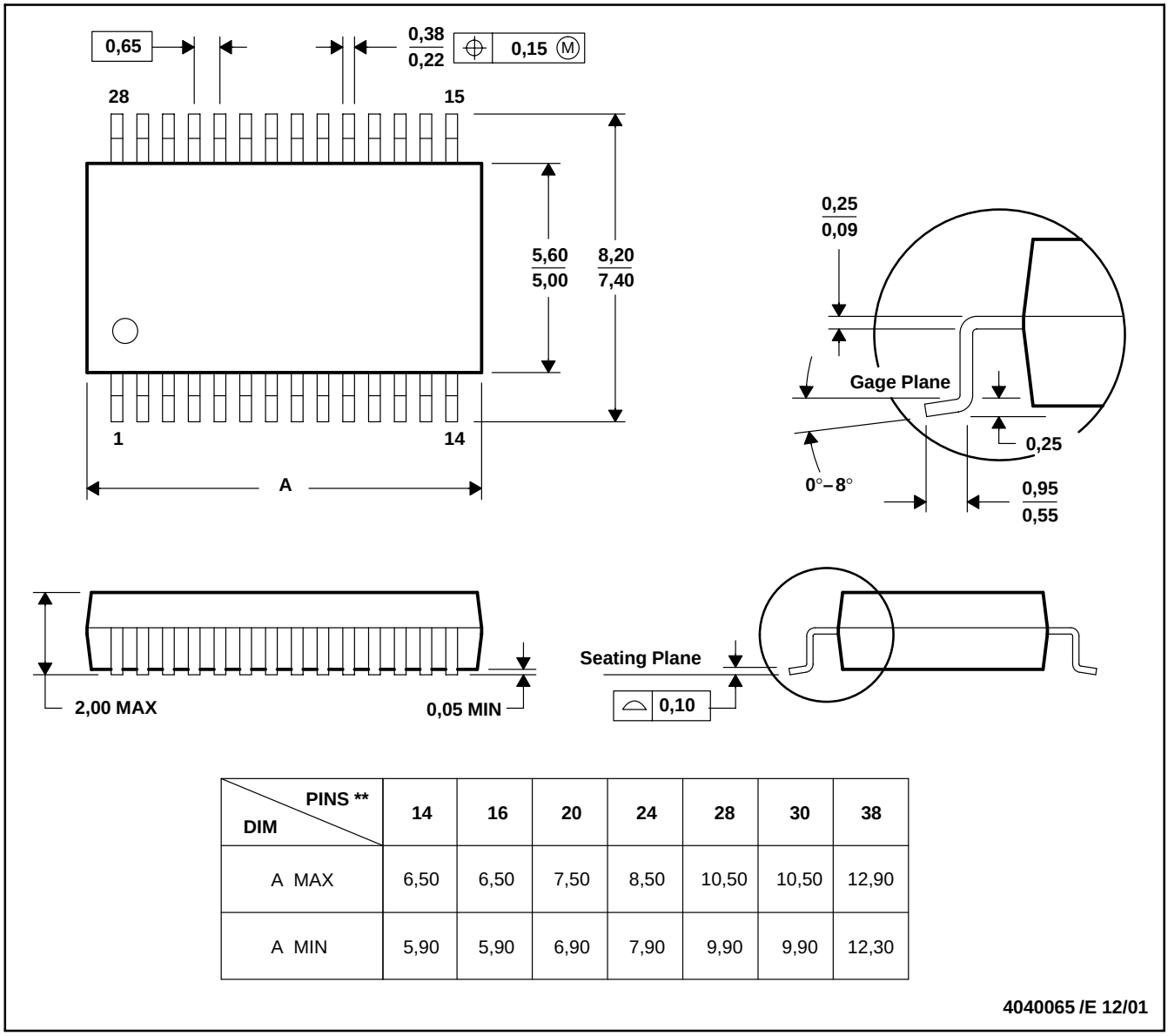
DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN



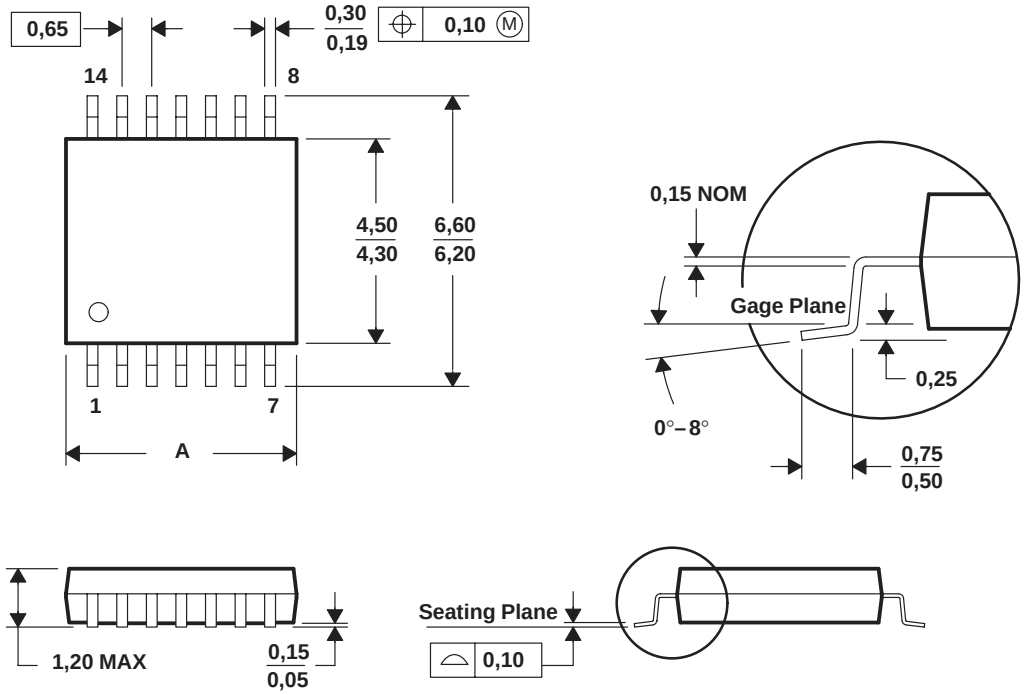
DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-150

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

14 PINS SHOWN



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

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

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