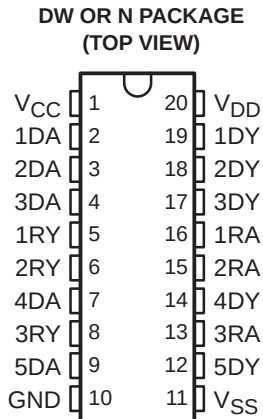


- **Single Chip With Easy Interface Between UART and Serial-Port Connector of an External Modem or Other Computer Peripheral**
- **Five Drivers and Three Receivers Meet or Exceed the Requirements of ANSI Standard TIA/EIA-232-F and ITU Recommendation V.28 Standards**
- **Supports Data Rates up to 120 kbit/s**
- **Complement to the GD75232**
- **Provides Pin-to-Pin Replacement for the Goldstar GD75323**
- **Pin-Out Compatible With SN75196**
- **Functional Replacement for the MC145405**



### description

The GD75323 combines five drivers and three receivers from the trade-standard SN75188 and SN75189 bipolar quadruple drivers and receivers, respectively. The flow-through design of the GD75323 decreases the part count, reduces the board space required, and allows easy interconnection of the UART and serial-port connector. The all-bipolar circuits and processing of the GD75323 provide a rugged, low-cost solution for this function.

The GD75323 complies with the requirements of the ANSI 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 signal rates up to 20 kbit/s. The switching speeds of the GD75323 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 assured 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 Standard TIA/EIA-423-B and TIA/EIA-422-B and ITU Recommendations V.10 and V.11 are recommended.

The GD75323 is characterized for operation over a temperature range of 0°C to 70°C.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

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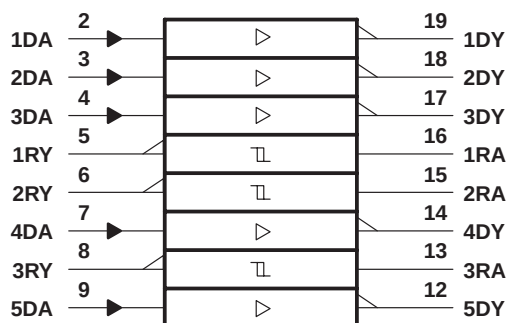
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# GD75323

## MULTIPLE RS-232 DRIVERS AND RECEIVERS

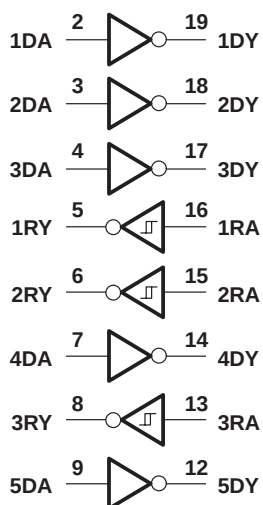
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### logic symbol†

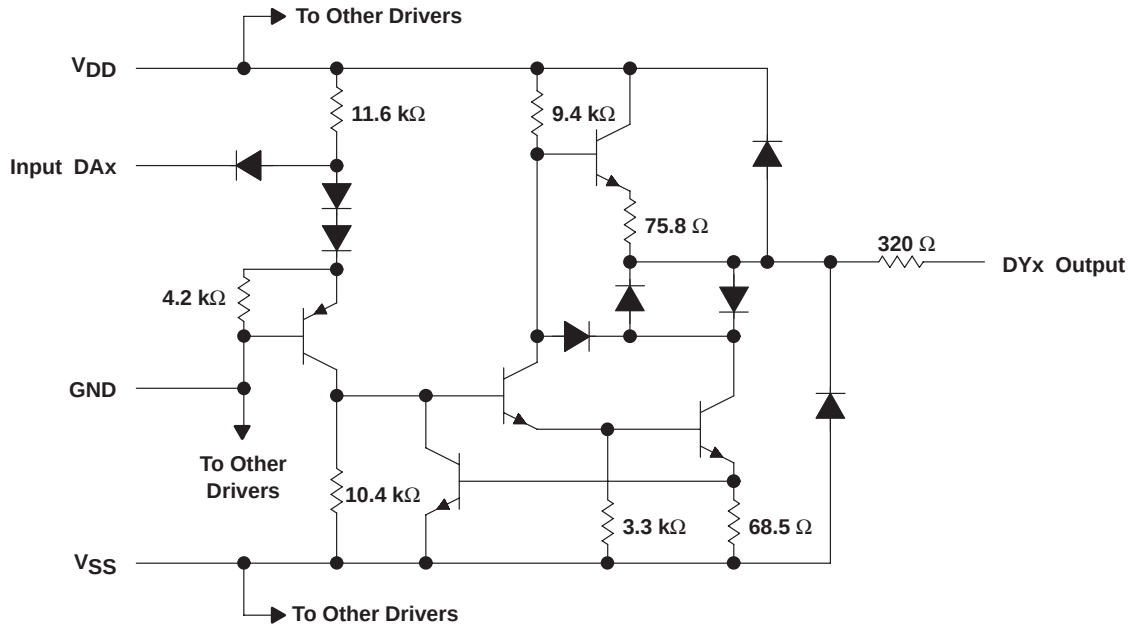


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

### logic diagram (positive logic)

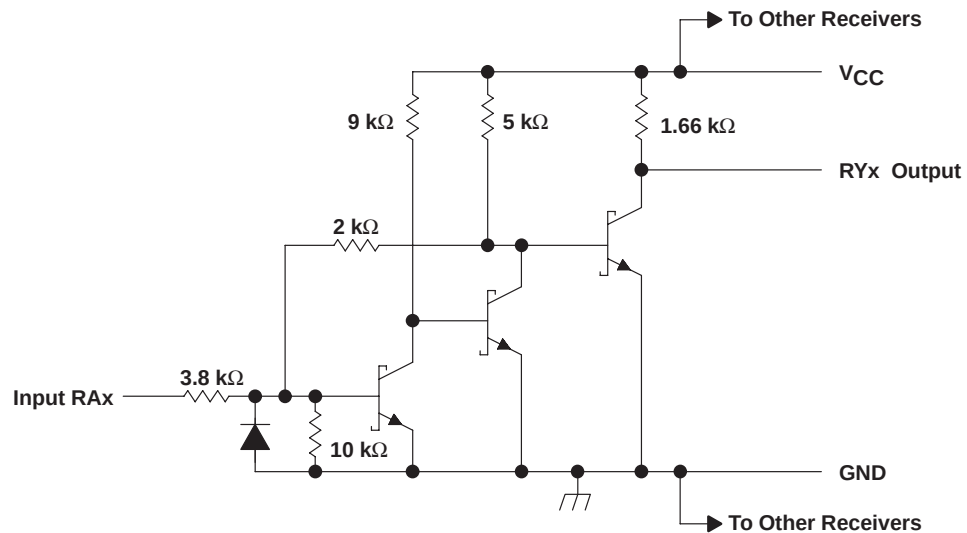


**schematic (each driver)**



Resistor values shown are nominal.

**schematic (each receiver)**



Resistor values shown are nominal.

# GD75323

## MULTIPLE RS-232 DRIVERS AND RECEIVERS

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### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|                                                                   |                |
|-------------------------------------------------------------------|----------------|
| Supply voltage, $V_{CC}$ (see Note 1)                             | 10 V           |
| Supply voltage, $V_{DD}$ (see Note 1)                             | 15 V           |
| Supply voltage, $V_{SS}$ (see Note 1)                             | –15 V          |
| Input voltage range, $V_I$ : Driver                               | –15 V to 7 V   |
| Receiver                                                          | –30 V to 30 V  |
| Output voltage range, $V_O$ (Driver)                              | –15 V to 15 V  |
| Low-level output current, $I_{OL}$ (Receiver)                     | 20 mA          |
| Package thermal impedance, $\theta_{JA}$ (see Note 2): DW package | 97°C/W         |
| N package                                                         | 67°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 |

<sup>†</sup> 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, except for through-hole packages, which use a trace length of zero.

### recommended operating conditions

|                                       |          | MIN  | NOM | MAX   | UNIT |
|---------------------------------------|----------|------|-----|-------|------|
| Supply voltage                        | $V_{DD}$ | 7.5  | 9   | 13.5  | V    |
|                                       | $V_{SS}$ | –7.5 | –9  | –13.5 |      |
|                                       | $V_{CC}$ | 4.5  | 5   | 5.5   |      |
| High-level input voltage, $V_{IH}$    | Driver   | 1.9  |     |       | V    |
| Low-level input voltage, $V_{IL}$     | Driver   |      |     | 0.8   | V    |
| High-level output current, $I_{OH}$   | Driver   |      |     | –6    | mA   |
|                                       | Receiver |      |     | –0.5  |      |
| High-level output current, $I_{OL}$   | Driver   |      |     | 6     | mA   |
|                                       | Receiver |      |     | 16    |      |
| Operating free-air temperature, $T_A$ |          | 0    |     | 70    | °C   |

### supply currents over 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 | $V_{DD} = 9\text{ V}, V_{SS} = -9\text{ V}$   |     | 25   | mA   |
|                                       |                              | $V_{DD} = 12\text{ V}, V_{SS} = -12\text{ V}$ |     | 32   |      |
|                                       | All inputs at 0.8 V, No load | $V_{DD} = 9\text{ V}, V_{SS} = -9\text{ V}$   |     | 7.5  | mA   |
|                                       |                              | $V_{DD} = 12\text{ V}, V_{SS} = -12\text{ V}$ |     | 9.5  |      |
| $I_{SS}$ Supply current from $V_{SS}$ | All inputs at 1.9 V, No load | $V_{DD} = 9\text{ V}, V_{SS} = -9\text{ V}$   |     | –25  | mA   |
|                                       |                              | $V_{DD} = 12\text{ V}, V_{SS} = -12\text{ V}$ |     | –32  |      |
|                                       | All inputs at 0.8 V, No load | $V_{DD} = 9\text{ V}, V_{SS} = -9\text{ V}$   |     | –5.3 | mA   |
|                                       |                              | $V_{DD} = 12\text{ V}, V_{SS} = -12\text{ V}$ |     | –5.3 |      |
| $I_{CC}$ Supply current from $V_{CC}$ | $V_{CC} = 5\text{ V},$       | All inputs at 5 V, No load                    |     | 20   | mA   |



## DRIVER SECTION

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

| PARAMETER                                                        | TEST CONDITIONS                                                     | MIN  | TYP  | MAX   | UNIT          |
|------------------------------------------------------------------|---------------------------------------------------------------------|------|------|-------|---------------|
| $V_{OH}$ High-level output voltage                               | $V_{IL} = 0.8\text{ V}$ , $R_L = 3\text{ k}\Omega$ , See Figure 1   | 6    | 7.5  |       | V             |
| $V_{OL}$ Low-level output voltage (see Note 3)                   | $V_{IH} = 1.9\text{ V}$ , $R_L = 3\text{ k}\Omega$ , See Figure 1   |      | -7.5 | -6    | V             |
| $I_{IH}$ High-level input current                                | $V_I = 5\text{ V}$ , See Figure 2                                   |      |      | 10    | $\mu\text{A}$ |
| $I_{IL}$ 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) | $V_{IL} = 0.8\text{ V}$ , $V_O = 0$ , See Figure 1                  | -4.5 | -9   | -19.5 | mA            |
| $I_{OS(L)}$ Low-level short-circuit output current               | $V_{IH} = 2\text{ V}$ , $V_O = 0$ , See Figure 1                    | 4.5  | 9    | 19    | mA            |
| $r_o$ Output resistance (see Note 5)                             | $V_{CC} = V_{DD} = V_{SS} = 0$ , $V_O = -2\text{ V to } 2\text{ V}$ | 300  |      |       | $\Omega$      |

- 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  $-10\text{ V}$  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,  $V_{DD} = 12\text{ V}$ ,  $V_{SS} = -12\text{ V}$ ,  $V_{CC} = 5\text{ V} \pm 10\%$ ,  $T_A = 25^\circ\text{C}$**

| PARAMETER                                                         | TEST CONDITIONS                                                                                      | MIN | TYP | MAX | UNIT          |
|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| $t_{PLH}$ Propagation delay time, low- to high-level output       | $R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$ , $C_L = 15\text{ pF}$ ,<br>See Figure 3              |     | 315 | 500 | ns            |
| $t_{PHL}$ Propagation delay time, high- to low-level output       |                                                                                                      |     | 75  | 175 | ns            |
| $t_{TLH}$ Transition time, low- to high-level output              | $R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$ , $C_L = 15\text{ pF}$ ,<br>See Figure 3              |     | 60  | 100 | ns            |
|                                                                   | $R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$ , $C_L = 2500\text{ pF}$ ,<br>See Figure 3 and Note 6 |     | 1.7 | 2.5 | $\mu\text{s}$ |
| $t_{THL}$ Transition time, high- to low-level output (see Note 5) | $R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$ , $C_L = 15\text{ pF}$ ,<br>See Figure 3              |     | 40  | 75  | ns            |
|                                                                   | $R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$ , $C_L = 2500\text{ pF}$ ,<br>See Figure 3 and Note 7 |     | 1.5 | 2.5 | $\mu\text{s}$ |

- NOTES: 6. Measured between  $-3\text{ V}$  and  $3\text{ V}$  points of the output waveform (TIA/EIA-232-F conditions), all unused inputs are tied either high or low.  
 7. Measured between  $3\text{ V}$  and  $-3\text{ V}$  points of the output waveform (TIA/EIA-232-F conditions), all unused inputs are tied either high or low.

GD75323

MULTIPLE RS-232 DRIVERS AND RECEIVERS

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RECEIVER SECTION

electrical characteristics over recommended operating conditions (unless otherwise noted)

| PARAMETER        |                                                                 | TEST CONDITIONS                               |                               | MIN   | TYP† | MAX  | UNIT |
|------------------|-----------------------------------------------------------------|-----------------------------------------------|-------------------------------|-------|------|------|------|
| V <sub>IT+</sub> | Positive-going input threshold voltage                          | See Figure 5                                  | T <sub>A</sub> = 25°C         | 1.75  | 1.9  | 2.3  | V    |
|                  |                                                                 |                                               | T <sub>A</sub> = 0°C to 70 °C | 1.55  |      | 2.3  |      |
| V <sub>IT–</sub> | Negative-going input threshold voltage                          | See Figure 5                                  |                               | 0.75  | 0.97 | 1.25 |      |
| V <sub>hys</sub> | Input hysteresis voltage (V <sub>IT+</sub> – V <sub>IT–</sub> ) |                                               |                               | 0.5   |      |      |      |
| V <sub>OH</sub>  | High-level output voltage                                       | I <sub>OH</sub> = –0.5 mA                     | V <sub>IH</sub> = 0.75 V      | 2.6   | 4    | 5    | V    |
|                  |                                                                 |                                               | Inputs open                   | 2.6   |      |      |      |
| V <sub>OL</sub>  | Low-level output voltage                                        | I <sub>OL</sub> = 10 mA, V <sub>I</sub> = 3 V |                               |       | 0.2  | 0.45 | V    |
| I <sub>IH</sub>  | High-level input current                                        | V <sub>I</sub> = 25 V, See Figure 5           |                               | 3.6   |      | 8.3  | mA   |
|                  |                                                                 | V <sub>I</sub> = 3 V, See Figure 5            |                               | 0.43  |      |      |      |
| I <sub>IL</sub>  | Low-level input current                                         | V <sub>I</sub> = –25 V, See Figure 5          |                               | –3.6  |      | –8.3 | mA   |
|                  |                                                                 | V <sub>I</sub> = –3 V, See Figure 5           |                               | –0.43 |      |      |      |
| I <sub>OS</sub>  | Short-circuit output current                                    | See Figure 4                                  |                               |       | –3.4 | –12  | mA   |

† All typical values are at T<sub>A</sub> = 25°C, V<sub>CC</sub> = 5 V, V<sub>DD</sub> = 9 V, and V<sub>SS</sub> = –9 V.

switching characteristics, V<sub>CC</sub> = 5 V, V<sub>DD</sub> = 12 V, V<sub>SS</sub> = –12 V, T<sub>A</sub> = 25°C

| PARAMETER        |                                                   | TEST CONDITIONS                                             |  | MIN | TYP | MAX | UNIT |
|------------------|---------------------------------------------------|-------------------------------------------------------------|--|-----|-----|-----|------|
| t <sub>PLH</sub> | Propagation delay time, low- to high-level output | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 5 kΩ, See Figure 6 |  |     | 107 | 500 | ns   |
| t <sub>PHL</sub> | Propagation delay time, high- to low-level output |                                                             |  |     | 42  | 150 | ns   |
| t <sub>TLH</sub> | Transition time, low- to high-level output        |                                                             |  |     | 175 | 525 | ns   |
| t <sub>THL</sub> | Transition time, high- to low-level output        |                                                             |  |     | 16  | 60  | ns   |

PARAMETER MEASUREMENT INFORMATION

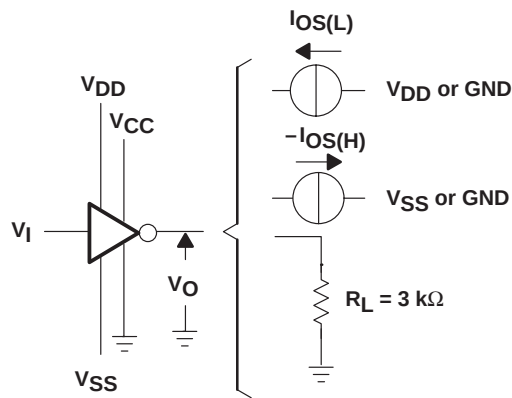


Figure 1. Driver Test Circuit for V<sub>OH</sub>, V<sub>OL</sub>, I<sub>OS(H)</sub>, and I<sub>OS(L)</sub>

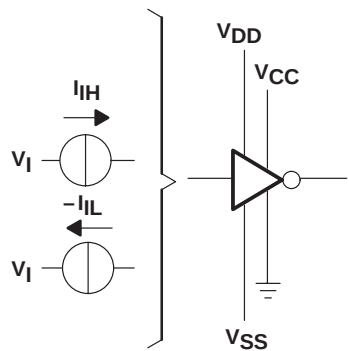
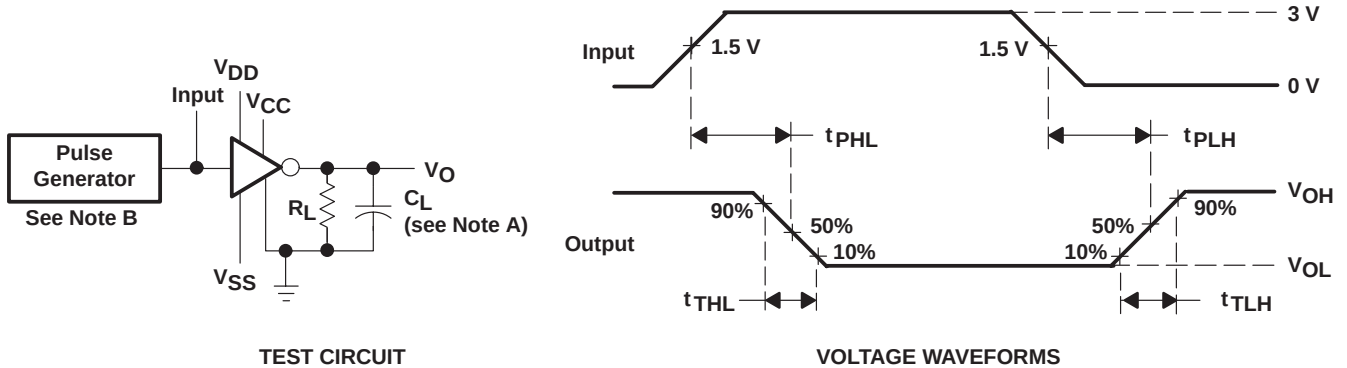


Figure 2. Driver Test Circuit for I<sub>IH</sub> and I<sub>IL</sub>

## PARAMETER MEASUREMENT INFORMATION



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 3. Driver Test Circuit and Voltage Waveforms

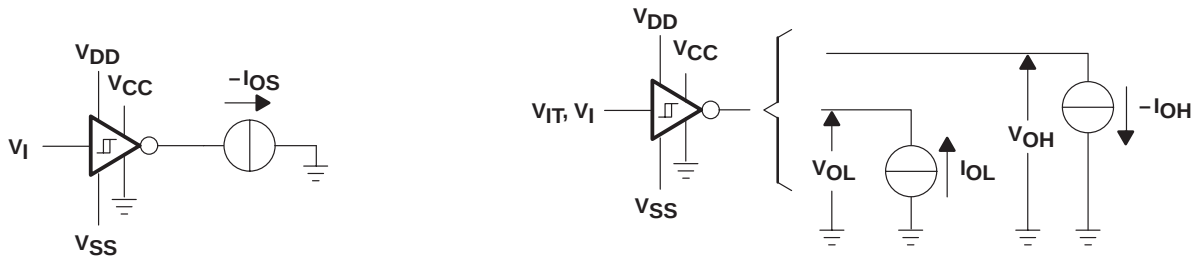
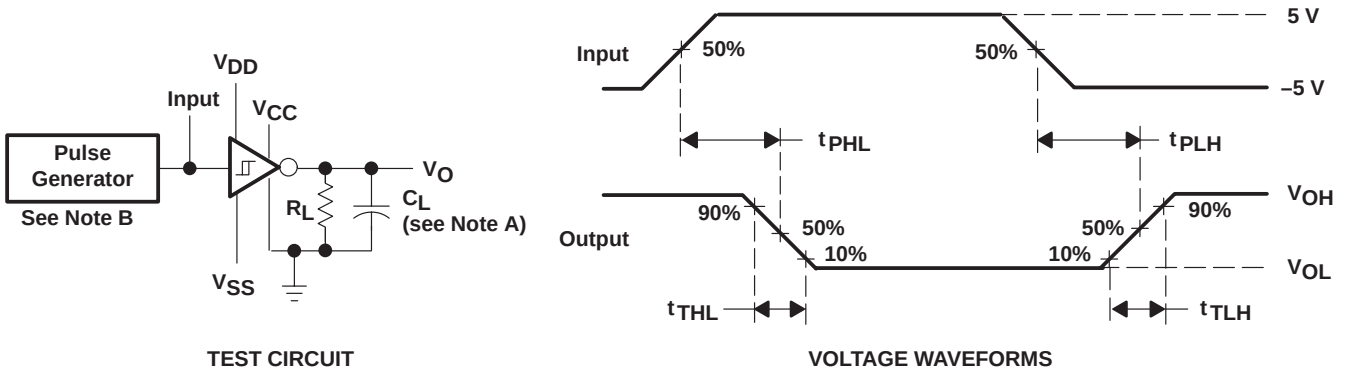


Figure 4. Receiver Test Circuit for  $I_{OS}$

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:  $t_W = 25 \mu s$ ,  $PRR = 20 \text{ kHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r = t_f < 50 \text{ ns}$ .

Figure 6. Receiver Propagation and Transition Times

# TYPICAL CHARACTERISTICS

## DRIVER SECTION

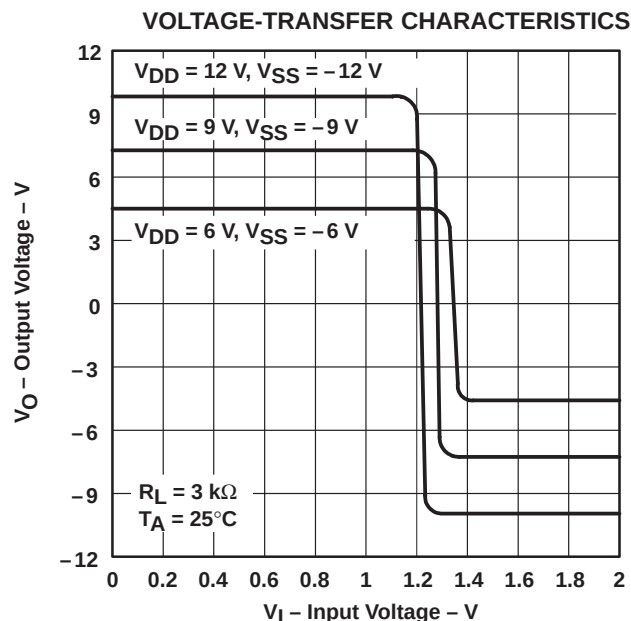


Figure 7

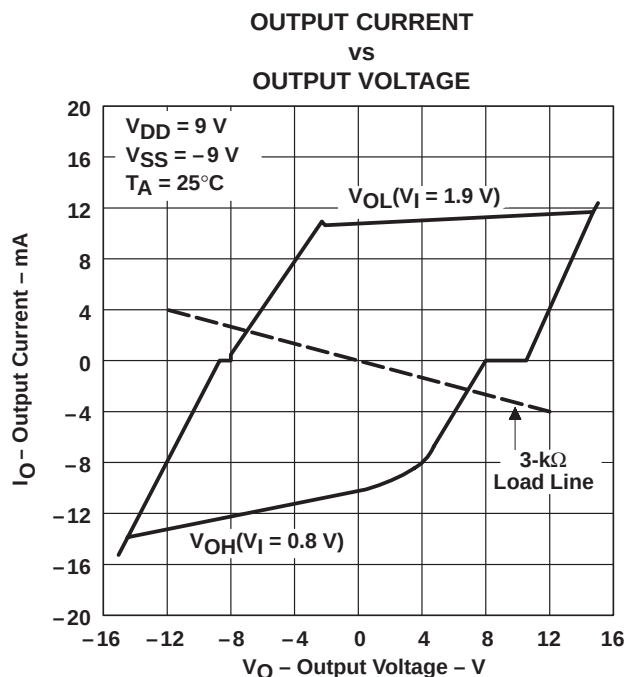


Figure 8

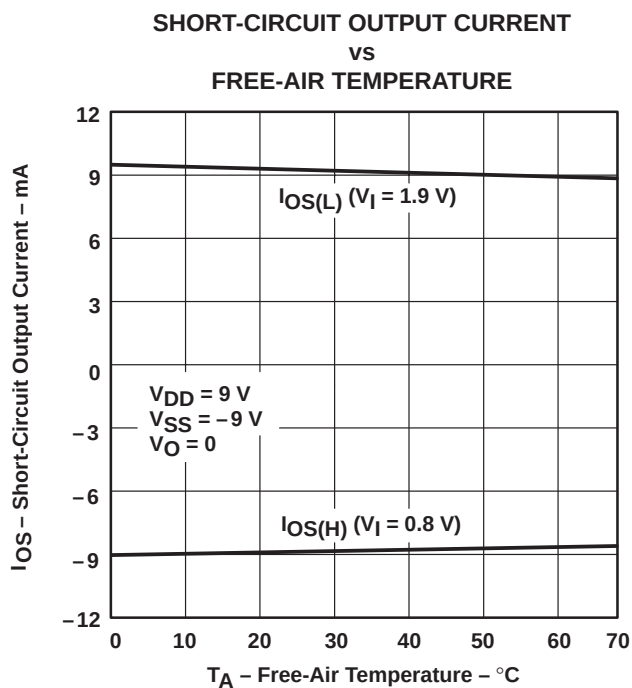


Figure 9

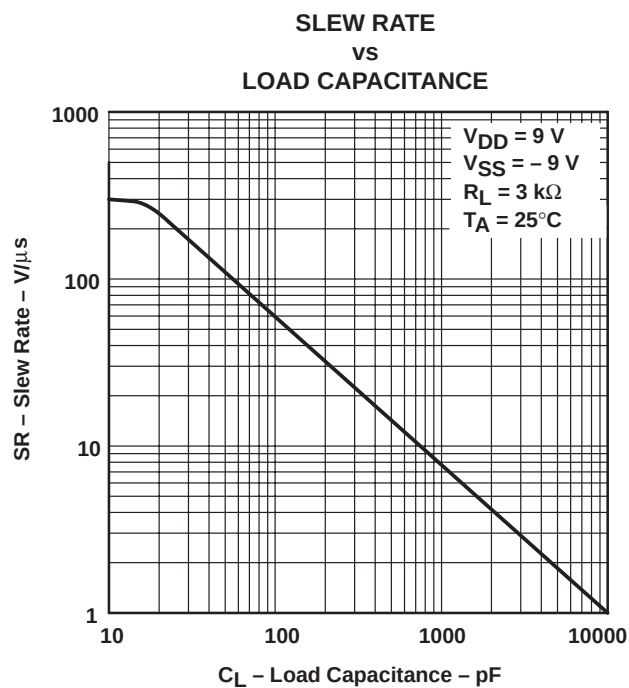


Figure 10



TYPICAL CHARACTERISTICS  
RECEIVER SECTION

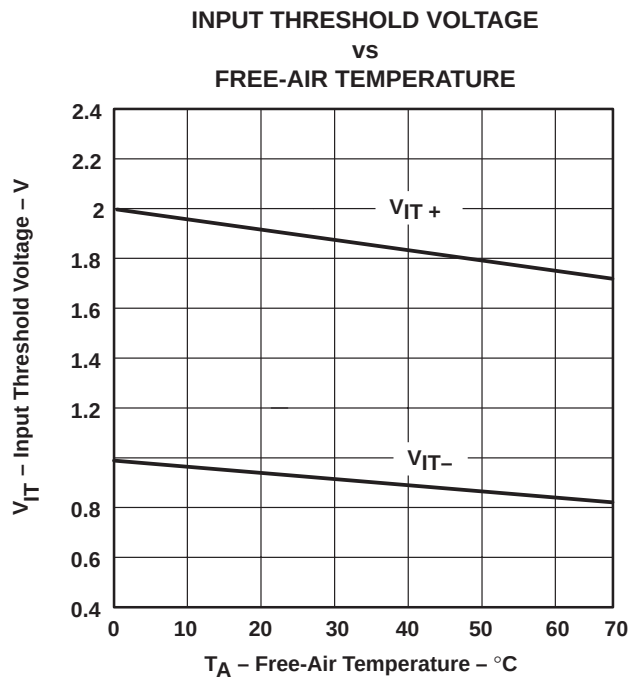


Figure 11

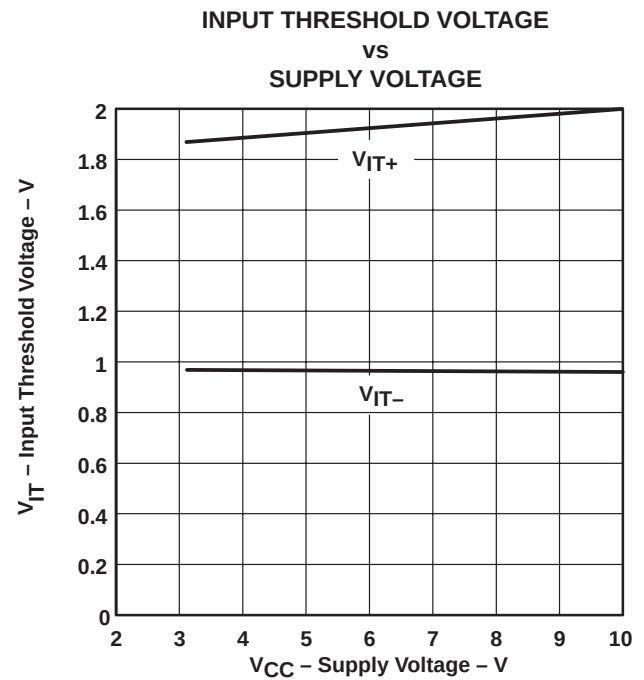
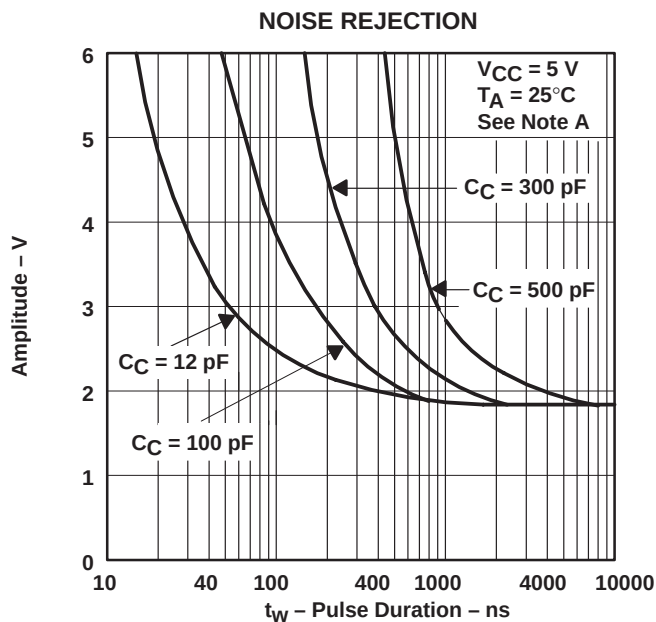


Figure 12



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

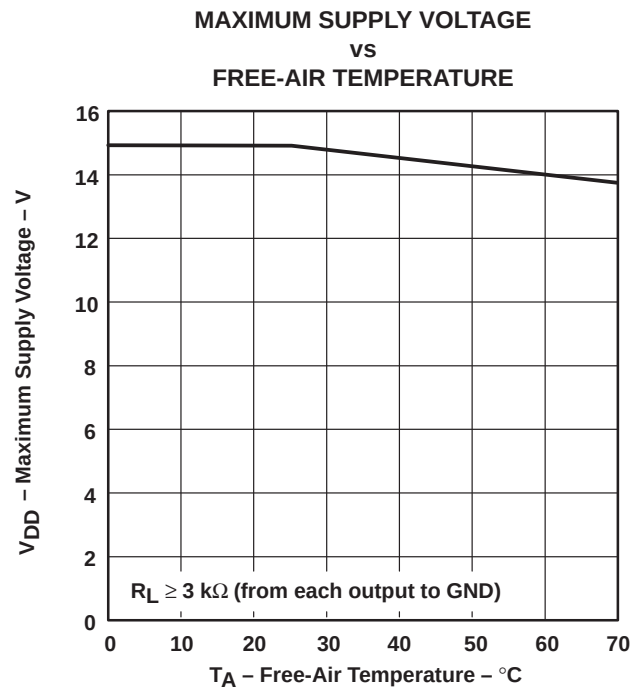


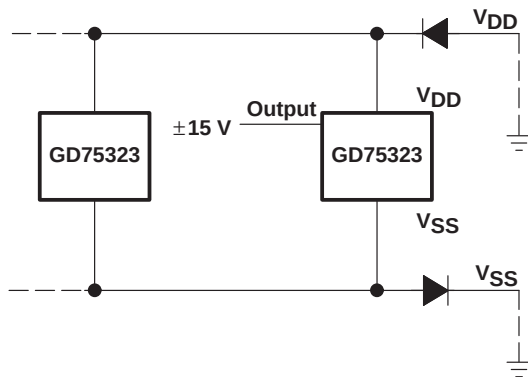
Figure 14

## GD75323

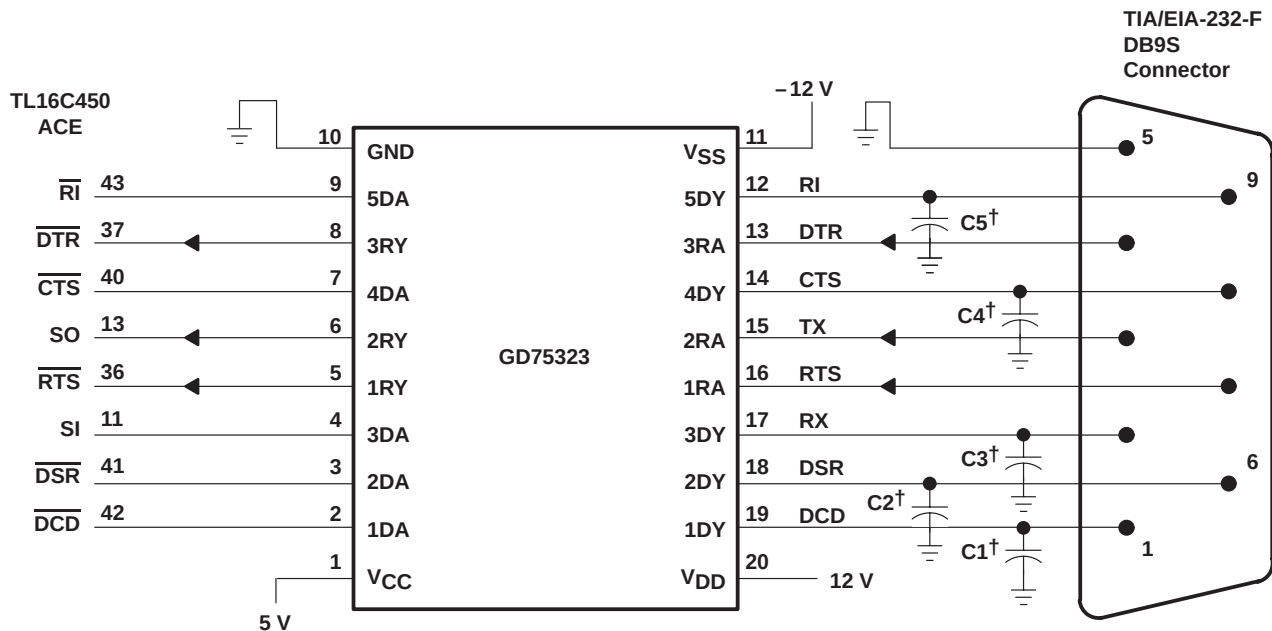
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## APPLICATION INFORMATION

Diodes placed in series with the  $V_{DD}$  and  $V_{SS}$  leads protect the GD75323 in the fault condition in which the device outputs are shorted to  $V_{DD}$  or  $V_{SS}$ , 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**



† See Figure 10 to select the correct values for the loading capacitors (C1, C2, C3, C4, and C5), which may be required to meet the RS-232 maximum slew-rate requirement of 30 V/μs. The value of the loading capacitors required depends upon the line length and desired slew rate, but is typically 330 pF.

NOTE C: To use the receivers only,  $V_{DD}$  and  $V_{SS}$  both must be powered or tied to ground.

### Figure 16. Typical Connection

## 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| GD75323DW        | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| GD75323DWE4      | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| GD75323DWG4      | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| GD75323DWR       | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| GD75323DWRE4     | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| GD75323DWRG4     | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| GD75323N         | OBSOLETE              | PDIP         | N               | 20   |             | TBD                     | Call TI          | Call TI                      |

<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.

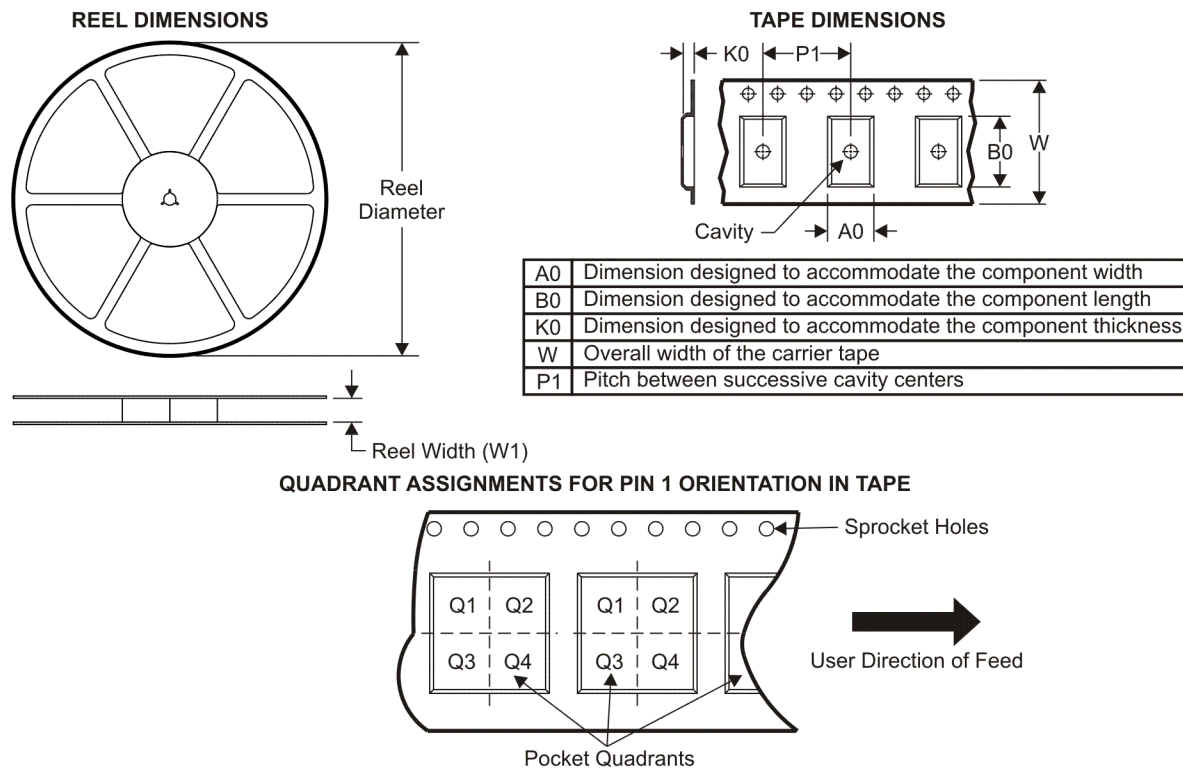
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<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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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.

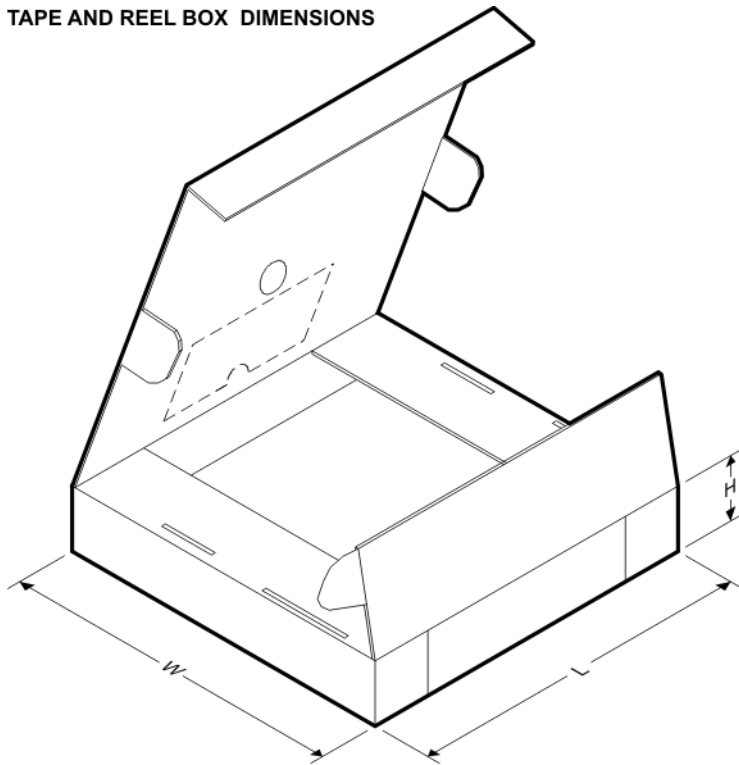
**TAPE AND REEL INFORMATION**



\*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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| GD75323DWR | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.0    | 2.7     | 12.0    | 24.0   | Q1            |
| GD75323DWR | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.1    | 2.65    | 12.0    | 24.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

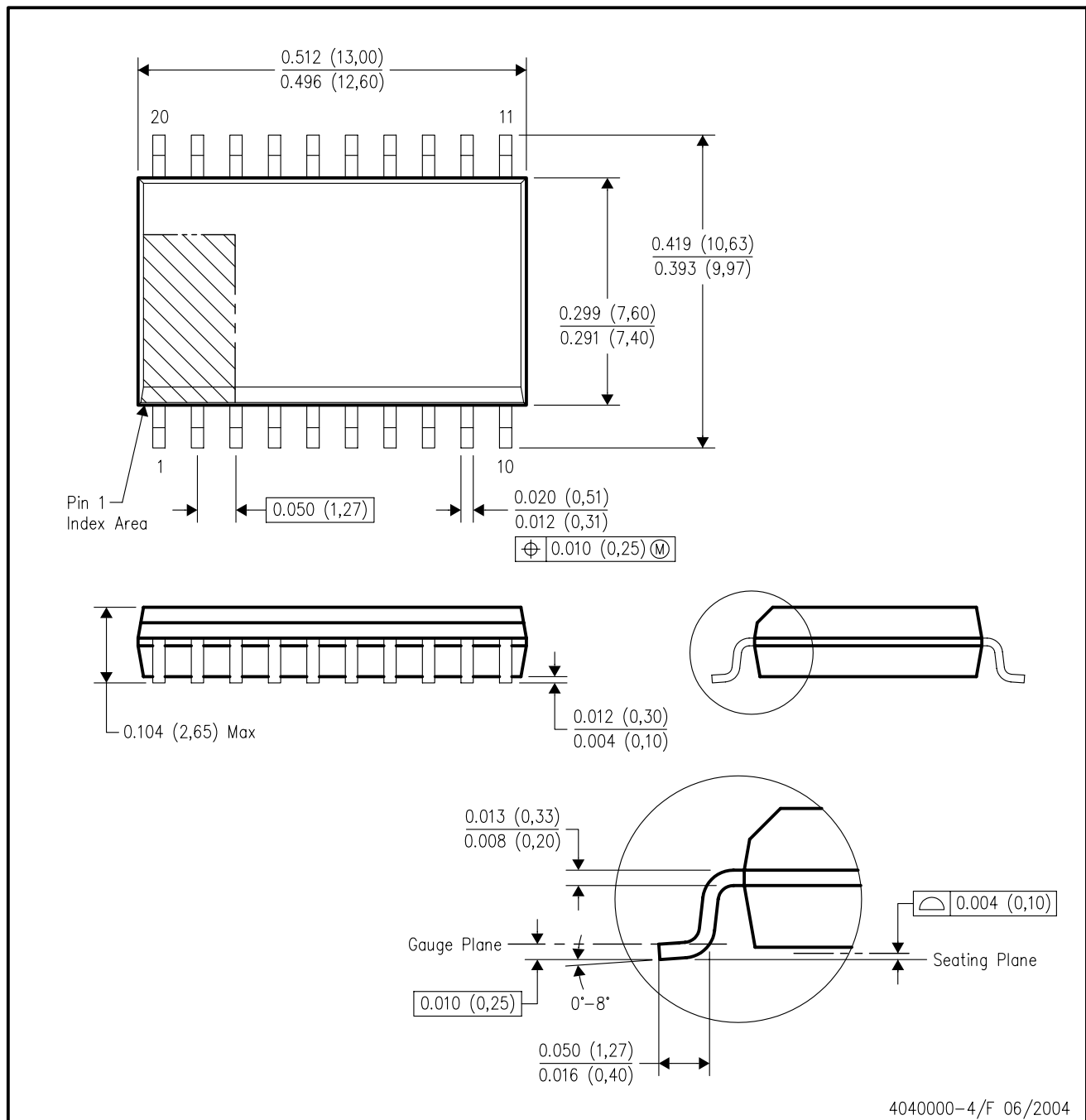


\*All dimensions are nominal

| Device     | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| GD75323DWR | SOIC         | DW              | 20   | 2000 | 346.0       | 346.0      | 41.0        |
| GD75323DWR | SOIC         | DW              | 20   | 2000 | 346.0       | 346.0      | 41.0        |

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE

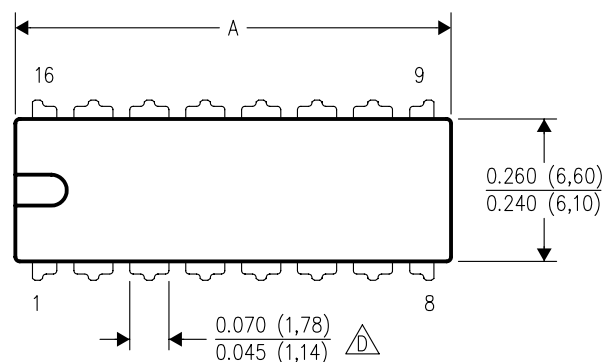


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-013 variation AC.

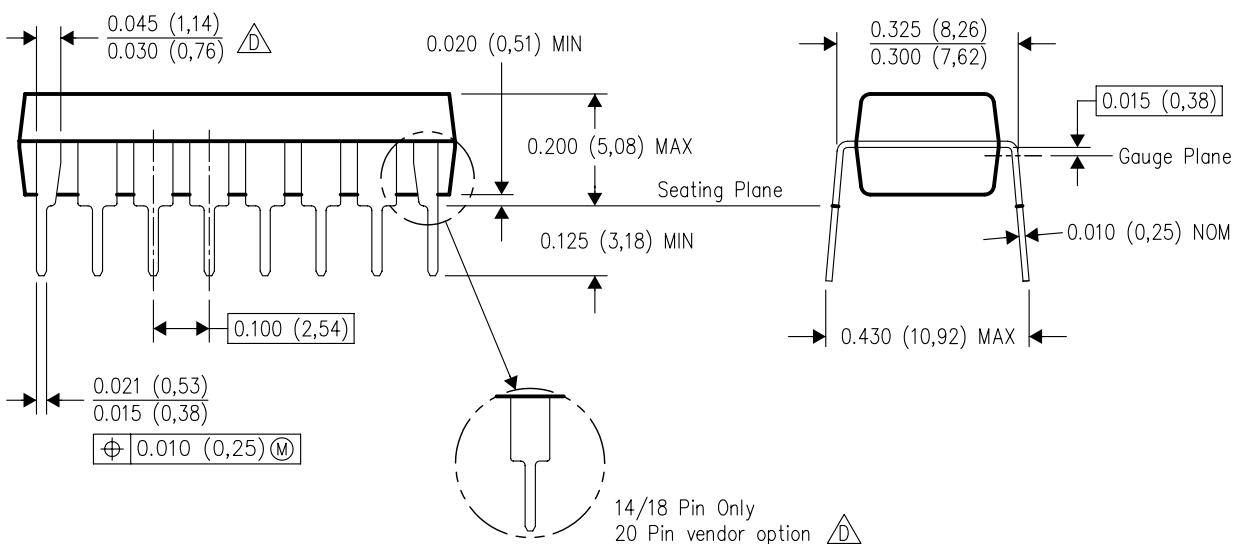
N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **<br>DIM      | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | 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.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

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