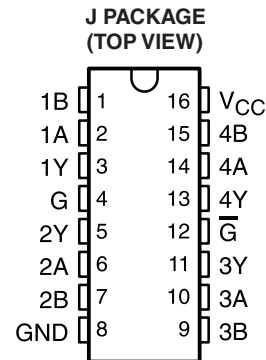


QML CLASS V RS-422 QUADRUPLE DIFFERENTIAL LINE RECEIVER

Check for Samples: [AM26LS33A-SP](#)

FEATURES

- **AM26LS33A Devices Meet or Exceed the Requirements of ANSI TIA/EIA-422-B, TIA/EIA-423-B, and ITU Recommendations V.10 and V.11**
- **±15-V Common-Mode Range With ±500-mV Sensitivity**
- **Input Hysteresis . . . 50 mV Typical**
- **Operate From a Single 5-V Supply**
- **Low-Power Schottky Circuitry**
- **3-State Outputs**
- **Complementary Output-Enable Inputs**
- **Input Impedance . . . 12 kΩ Minimum**
- **Designed to Be Interchangeable With Advanced Micro Device AM26LS33™**
- **QML-V Qualified, SMD 5962-78020**
- **Military Temperature Range (-55°C to 125°C)**
- **Rad-Tolerant: 25 kRad (Si) TID ⁽¹⁾**



- (1) Radiation tolerance is a typical value based upon initial device qualification with dose rate = 10 mrad/sec. Radiation Lot Acceptance Testing is available - contact factory for details.

DESCRIPTION

The AM26LS33A is a quadruple differential line receiver for balanced and unbalanced digital data transmission. The enable function is common to all four receivers and offers a choice of active-high or active-low input. The 3-state outputs permit connection directly to a bus-organized system. Fail-safe design ensures that, if the inputs are open, the outputs always are high.

Compared to the AM26LS33, the AM26LS33A incorporates an additional stage of amplification to improve sensitivity. The input impedance has been increased, resulting in less loading of the bus line. The additional stage has increased propagation delay; however, this does not affect interchangeability in most applications.

The AM26LS33A is characterized for operation over the temperature range of -55°C to 125°C.

ORDERING INFORMATION⁽¹⁾

| T _A | PACKAGE ⁽²⁾ | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------------------|-----------------------|------------------|
| -55°C to 125°C | CDIP - J | 5962-7802007VEA | 5962-7802007VEA |

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
- (2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

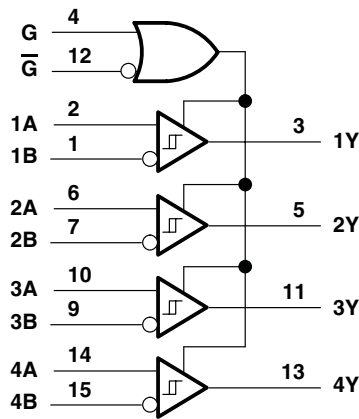


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

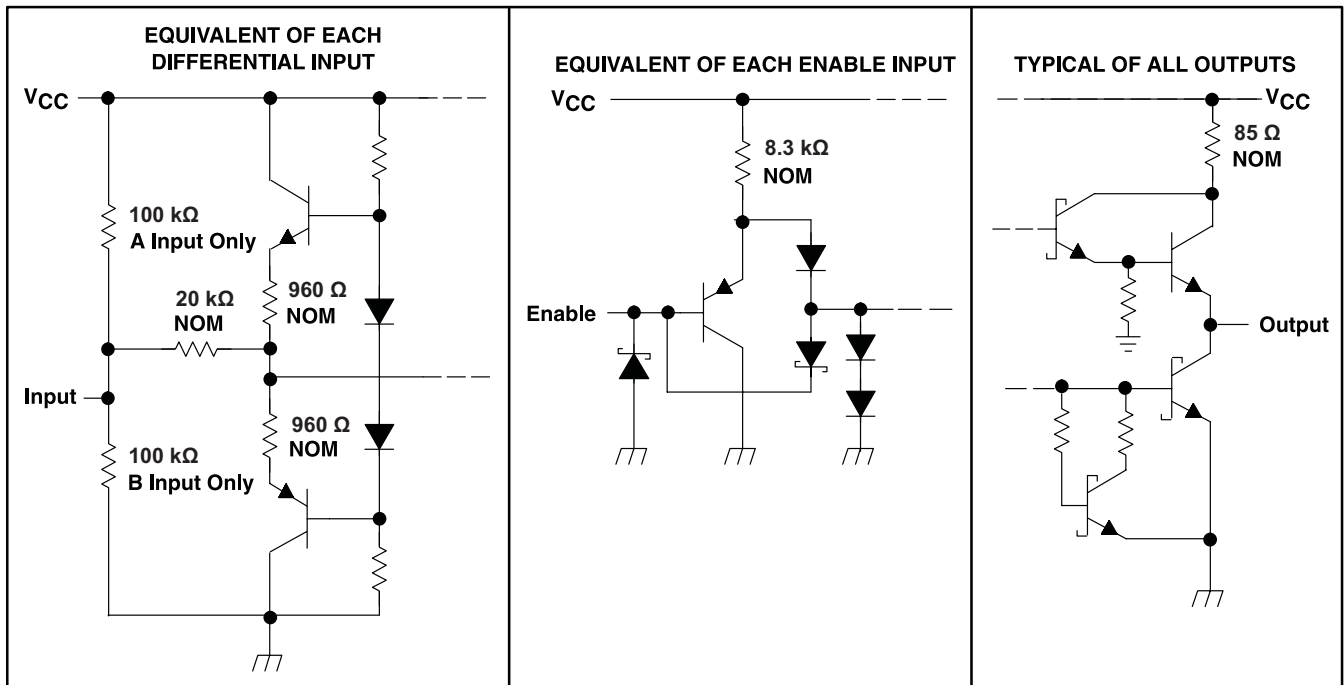
**Table 1. FUNCTION TABLE
Each Receiver**

| DIFFERENTIAL A-B | ENABLES | | OUTPUT Y |
|------------------------------------|---------|-----------|-------------|
| | G | \bar{G} | |
| $V_{ID} \geq V_{IT+}$ | H | X | H |
| | X | L | H |
| $V_{IT-} \leq V_{ID} \leq V_{IT+}$ | H | X | ? |
| | X | L | ? |
| $V_{ID} \leq V_{IT-}$ | H | X | L |
| | X | L | L |
| X | L | H | Z |
| Open | H | X | H |
| | X | L | H |

LOGIC DIAGRAM (POSITIVE LOGIC)



SCHEMATICS OF INPUTS AND OUTPUTS

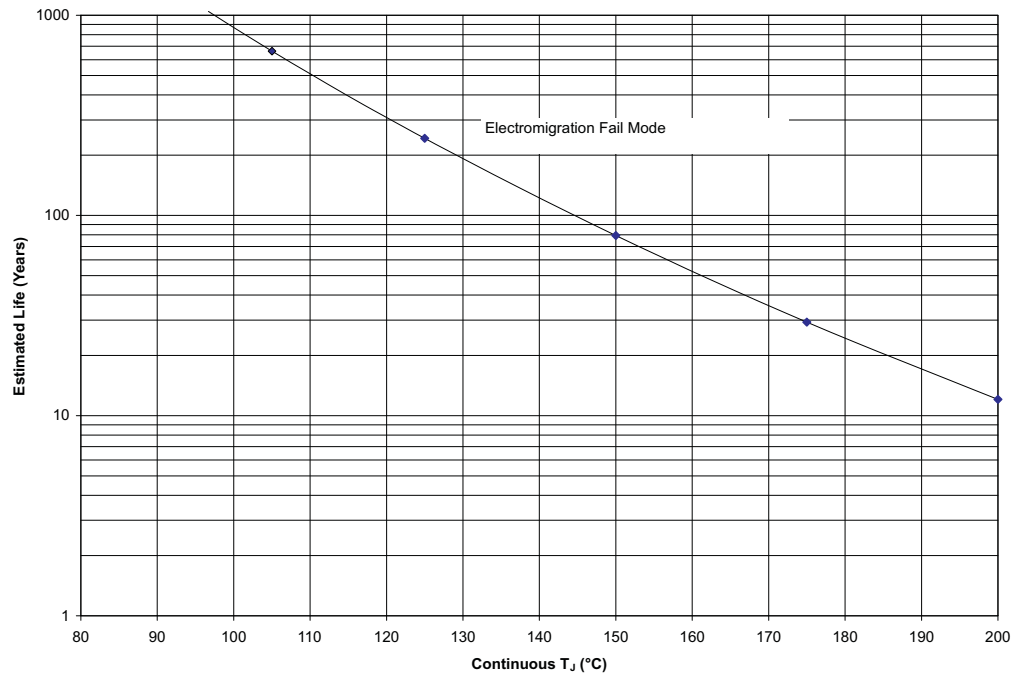


ABSOLUTE MAXIMUM RATINGS⁽¹⁾

over operating free-air temperature range (unless otherwise noted)

| | | MIN | MAX | UNIT |
|--|---|-------------------------------|----------|------|
| V_{CC} | Supply voltage ⁽²⁾ | | 7 | V |
| V_I | Input voltage | Any differential input | ± 25 | V |
| | | Other inputs | 7 | |
| V_{ID} | Differential input voltage ⁽³⁾ | | ± 25 | V |
| Continuous total power dissipation | | See Dissipation Ratings Table | | |
| Lead temperature 1.6 mm (1/16 inch) from case for 60 seconds | | | 300 | °C |
| T_{stg} | Storage temperature range | -65 | 150 | °C |

- (1) 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.
- (2) All voltage values, except differential voltages, are with respect to the network ground terminal.
- (3) Differential voltage values are at the noninverting (A) input terminals with respect to the inverting (B) input terminals.



- A. See datasheet for absolute maximum and minimum recommended operating conditions.
- B. Silicon operating life design goal is 10 years at 105°C junction temperature (does not include package interconnect life).

Figure 1. AM26LS33A 16/J Package Operating Life Derating Chart

RECOMMENDED OPERATING CONDITIONS

| | | MIN | NOM | MAX | UNIT |
|----------|--------------------------------|-----|-----|----------|-------------|
| V_{CC} | Supply voltage | 4.5 | 5 | 5.5 | V |
| V_{IH} | High-level input voltage | 2 | | | V |
| V_{IL} | Low-level input voltage | | | 0.8 | V |
| V_{IC} | Common-mode input voltage | | | ± 15 | V |
| I_{OH} | High-level output current | | | -440 | μA |
| I_{OL} | Low-level output current | | | 8 | mA |
| T_A | Operating free-air temperature | -55 | | 125 | $^{\circ}C$ |

ELECTRICAL CHARACTERISTICS

over recommended ranges of V_{CC} , V_{IC} , and operating free-air temperature (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | MIN | TYP ⁽¹⁾ | MAX | UNIT |
|-------------|--|---------------------|--|-------|------------|
| V_{IT+} | Positive-going input threshold voltage $V_O = V_{OHmin}$, $I_{OH} = -440 \mu A$ $-15 V \leq V_{IC} \leq 15 V$ | | | 0.5 | V |
| V_{IT-} | Negative-going input threshold voltage $V_O = 0.45 V$, $I_{OL} = 8 mA$ $-15 V \leq V_{IC} \leq 15 V$ | -0.5 ⁽²⁾ | | | V |
| V_{hys} | Hysteresis voltage ($V_{IT+} - V_{IT-}$) | | 50 | | mV |
| V_{IK} | Enable-input clamp voltage $V_{CC} = 4.5 V$, $I_I = -18 mA$ | | | -1.5 | V |
| V_{OH} | High-level output voltage $V_{CC} = 4.5 V$, $V_{ID} = 1 V$, $V_{I(G)} = 0.8 V$, $I_{OH} = -440 \mu A$ | 2.5 | | | V |
| V_{OL} | Low-level output voltage $V_{CC} = 4.5 V$, $V_{ID} = -1 V$, $V_{I(G)} = 0.8 V$ | | | 0.4 | V |
| | | | | 0.45 | |
| I_{OZ} | Off-state (high-impedance state) output current $V_{CC} = 5.5 V$ | | | 20 | μA |
| | | | | -20 | |
| I_I | Line input current $V_I = 15 V$, $V_I = -15 V$, | | | 1.2 | mA |
| | | | Other input at -10 V to 15 V Other input at -15 V to 10 V | -1.7 | |
| $I_{I(EN)}$ | Enable input current $V_I = 5.5 V$, $V_{CC} = 5.5 V$ | | | 100 | μA |
| I_H | High-level enable current $V_I = 2.7 V$, $V_{CC} = 5.5 V$ | | | 20 | μA |
| I_L | Low-level enable current $V_I = 0.4 V$, $V_{CC} = 5.5 V$ | | | -0.36 | mA |
| r_i | Input resistance $V_{IC} = -15 V$ to $15 V$, One input to ac ground | 12 | 15 | | k Ω |
| I_{OS} | Short-circuit output current ⁽³⁾ $V_{CC} = MAX$, $V_{ID} = 1 V$, $V_O = 0 V$ | -15 | | -85 | mA |
| I_{CC} | Supply current $V_{CC} = MAX$, data inputs = GND, All outputs disabled | | 52 | 70 | mA |

(1) All typical values are at $V_{CC} = 5 V$, $T_A = 25^{\circ}C$, and $V_{IC} = 0$.

(2) The algebraic convention, in which the less positive (more negative) limit is designated as minimum, is used in this data sheet for threshold levels only.

(3) Not more than one output should be shorted to ground at a time, and duration of the short circuit should not exceed one second.

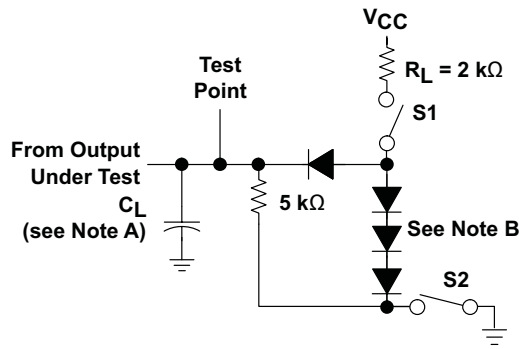
SWITCHING CHARACTERISTICS

$V_{CC} = 5\text{ V}$, over operating free-air temperature (unless otherwise noted)

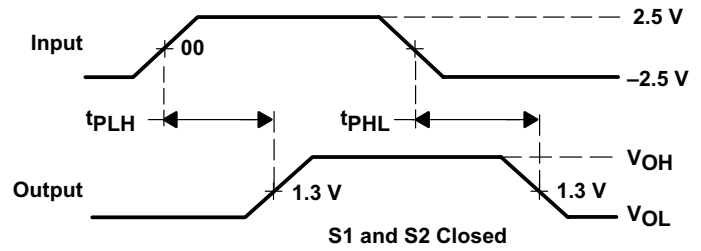
| PARAMETER | | TEST CONDITIONS | | MIN | TYP ⁽¹⁾ | MAX | UNIT |
|-----------|--|------------------------|--|-----|--------------------|-----|------|
| t_{PLH} | Propagation delay time, low-to-high-level output | $C_L = 15\text{ pF}$, | See Figure 2 | 20 | 35 | ns | |
| | | | $T_A = -55^\circ\text{C}$ to 125°C | | 53 | | |
| t_{PHL} | Propagation delay time, high-to-low-level output | $C_L = 15\text{ pF}$, | See Figure 2 | 22 | 35 | ns | |
| | | | $T_A = -55^\circ\text{C}$ to 125°C | | 53 | | |
| t_{PZH} | Output enable time to high level | $C_L = 15\text{ pF}$, | See Figure 2 | 17 | 25 | ns | |
| | | | $T_A = -55^\circ\text{C}$ to 125°C | | 38 | | |
| t_{PZL} | Output enable time to low level | $C_L = 15\text{ pF}$, | See Figure 2 | 20 | 25 | ns | |
| | | | $T_A = -55^\circ\text{C}$ to 125°C | | 38 | | |
| t_{PHZ} | Output disable time from high level | $C_L = 15\text{ pF}$, | See Figure 2 | 21 | 30 | ns | |
| | | | $T_A = -55^\circ\text{C}$ to 125°C | | 45 | | |
| t_{PLZ} | Output disable time from low level | $C_L = 15\text{ pF}$, | See Figure 2 | 30 | 40 | ns | |
| | | | $T_A = -55^\circ\text{C}$ to 125°C | | 60 | | |

(1) All typical values are at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, and $V_{IC} = 0$.

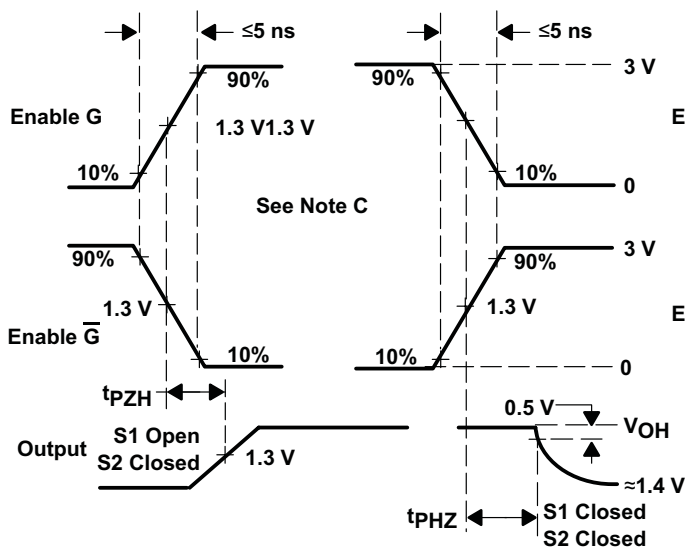
PARAMETER MEASUREMENT INFORMATION



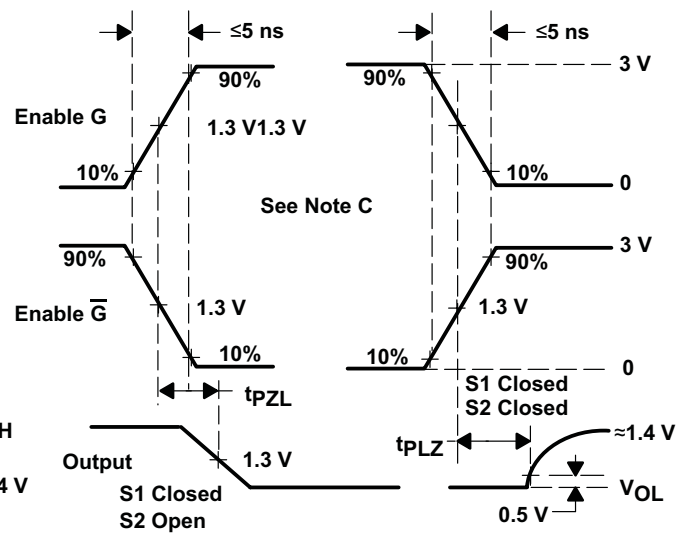
TEST CIRCUIT



VOLTAGE WAVEFORMS FOR t_{PLH} , t_{PHL}



VOLTAGE WAVEFORMS FOR t_{PHZ} , t_{PZH}

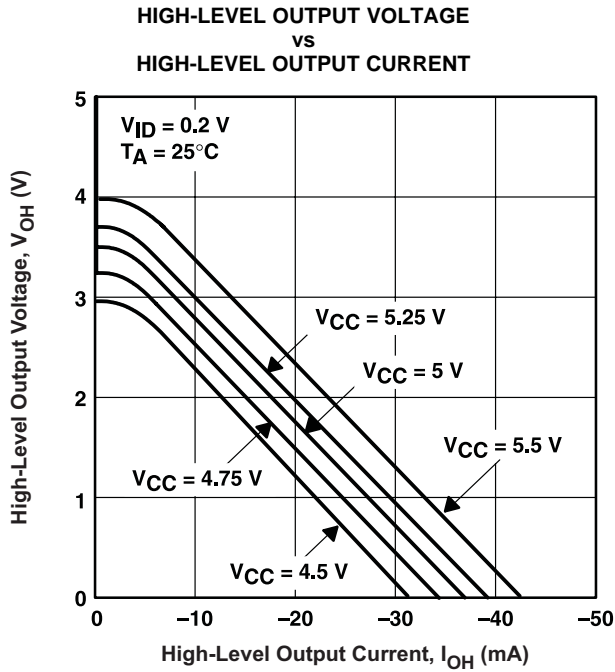


VOLTAGE WAVEFORMS FOR t_{PLZ} , t_{PZL}

- NOTES: A. C_L includes probe and jig capacitance.
 B. All diodes are 1N3064 or equivalent.
 C. Enable G is tested with \bar{G} high; \bar{G} is tested with G low.

Figure 2. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS



† $V_{CC} = 5.5\text{ V}$ and $V_{CC} = 4.5\text{ V}$ applies to M-suffix devices only.

Figure 3.

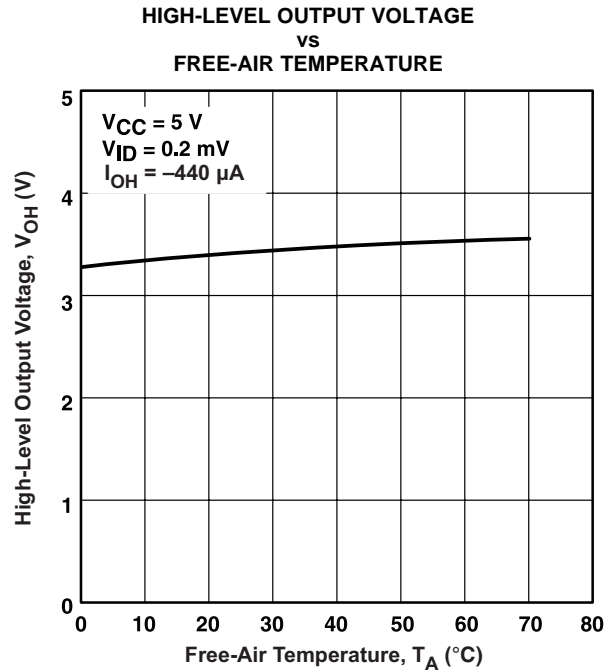


Figure 4.

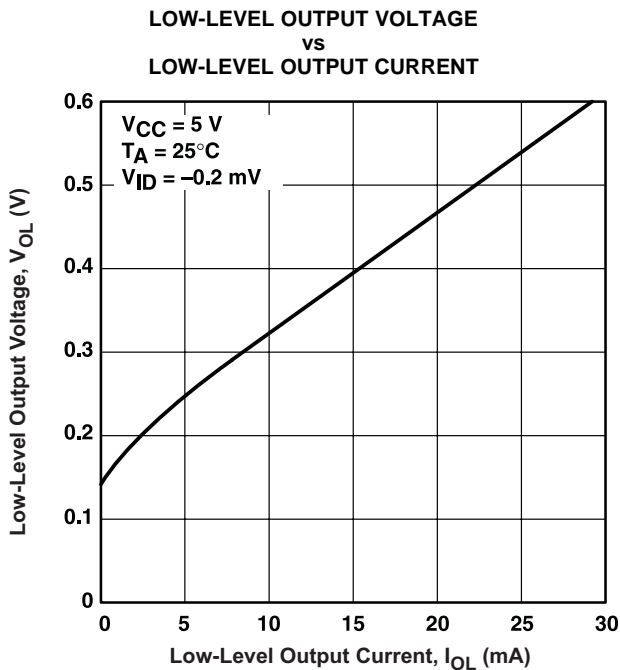


Figure 5.

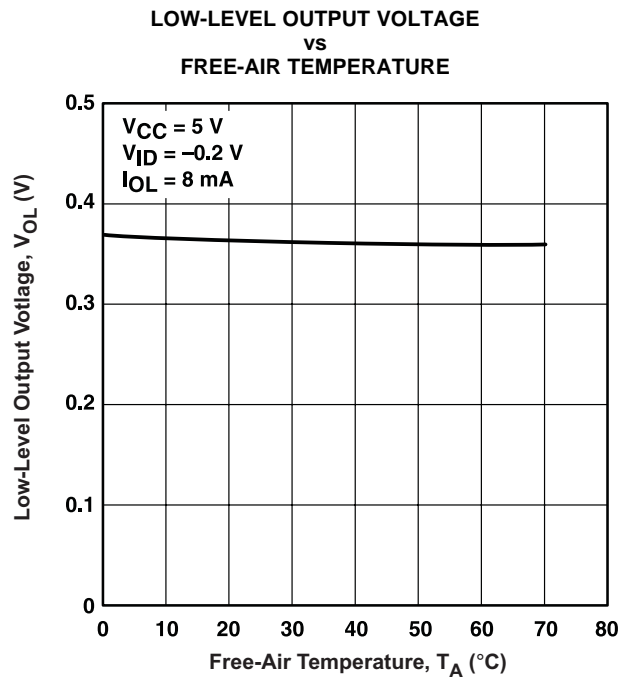


Figure 6.

TYPICAL CHARACTERISTICS (continued)

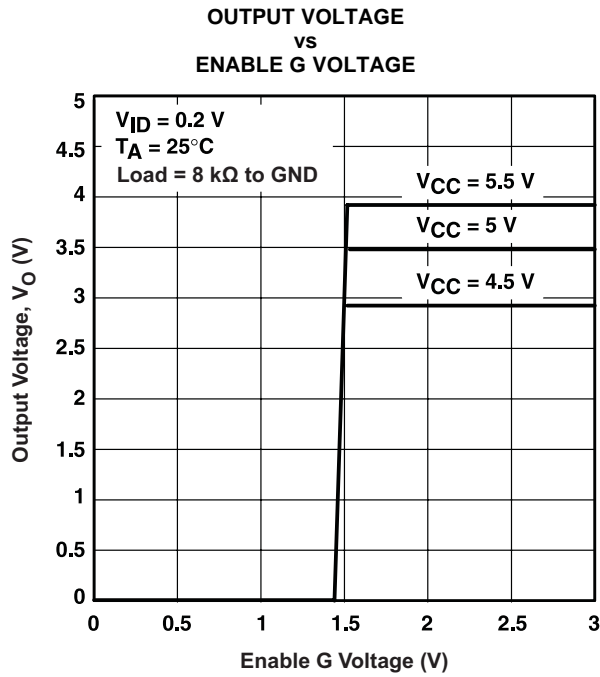


Figure 7.

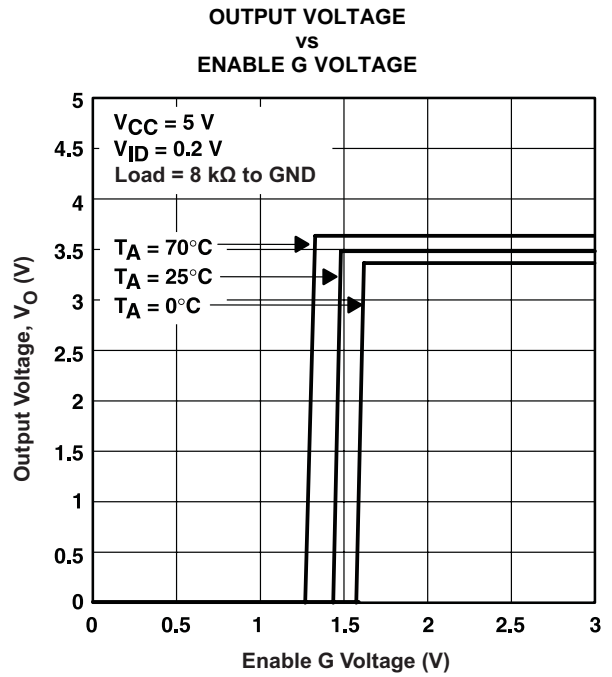


Figure 8.

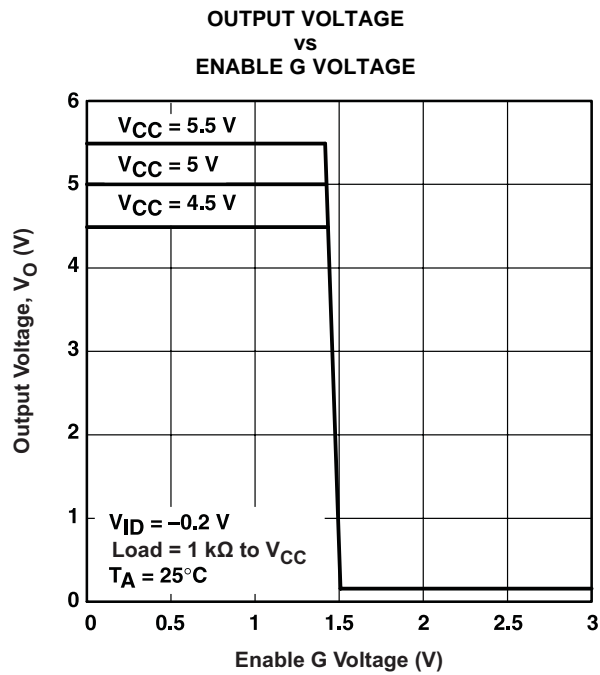


Figure 9.

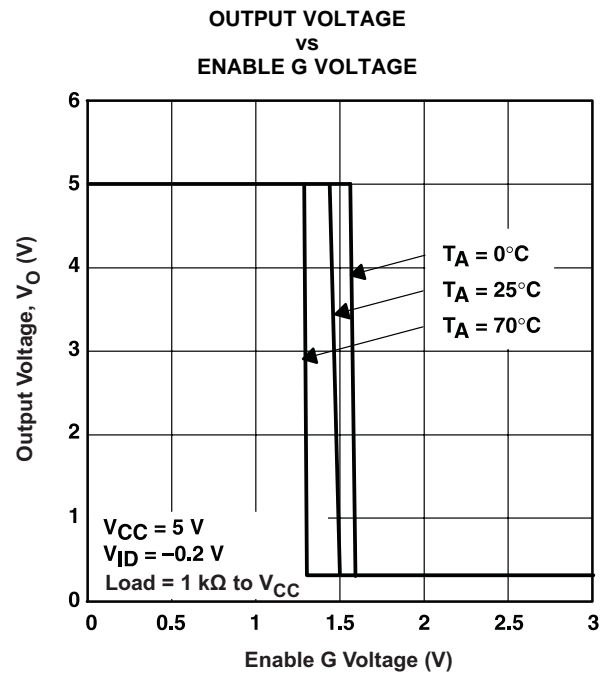


Figure 10.

TYPICAL CHARACTERISTICS (continued)

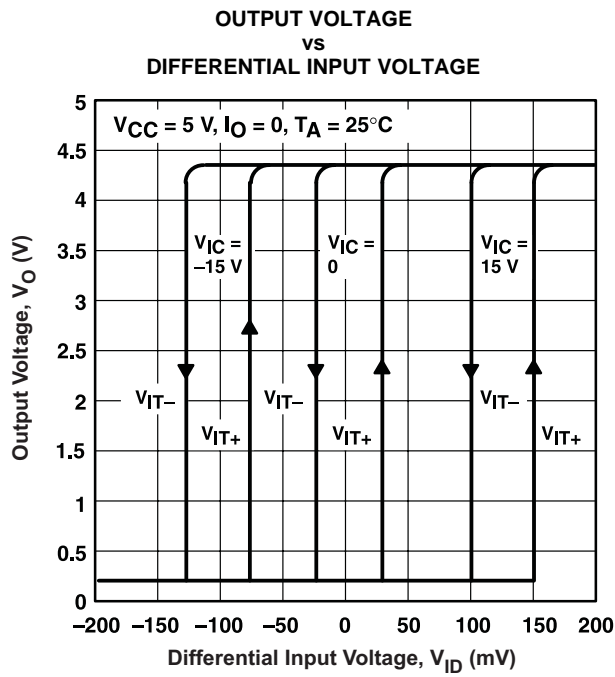
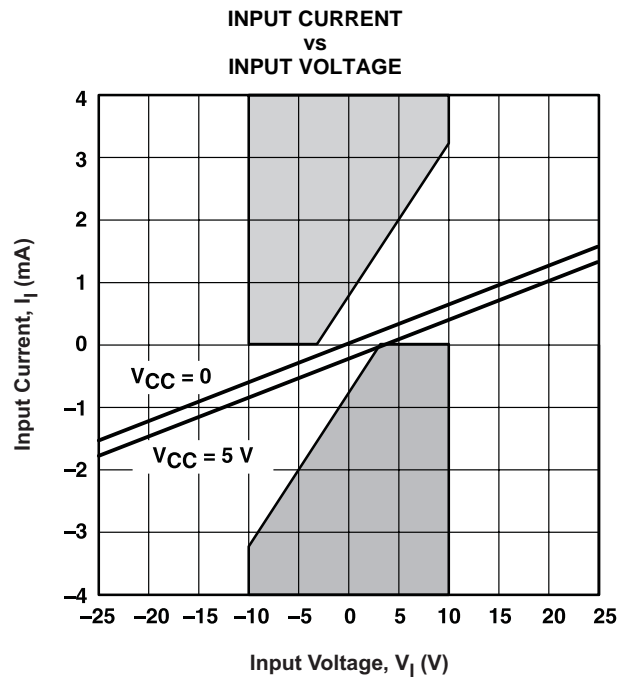


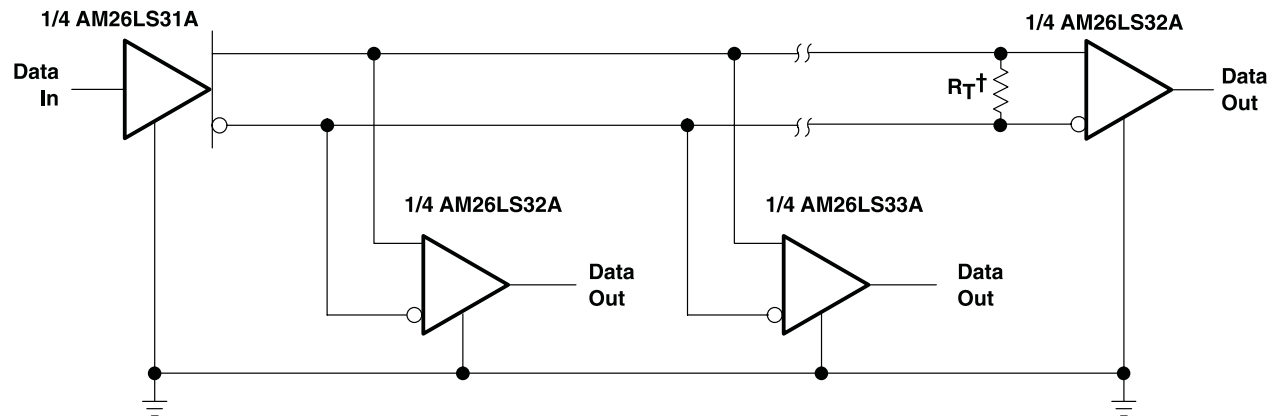
Figure 11.



The unshaded area shows requirements of paragraph 4.2.1 of ANSI Standards EIA/TIA-422-B and EIA/TIA-423-B.

Figure 12.

APPLICATION INFORMATION



$^\dagger R_T$ equals the characteristic impedance of the line.

Figure 13. Circuit with Multiple Receivers

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------|---------|
| 5962-7802007VEA | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-7802007VE A | Samples |

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=100ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF AM26LS33A-SP :

- Catalog : [AM26LS33A](#)
- Military : [AM26LS33AM](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TUBE


*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-----------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-7802007VEA | J | CDIP | 16 | 25 | 506.98 | 15.24 | 13440 | NA |

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---------------|------------------------|------------------------|------------------------|------------------------|
| A | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC |
| B MAX | 0.785 (19,94) | .840 (21,34) | 0.960 (24,38) | 1.060 (26,92) |
| B MIN | — | — | — | — |
| C MAX | 0.300 (7,62) | 0.300 (7,62) | 0.310 (7,87) | 0.300 (7,62) |
| C MIN | 0.245 (6,22) | 0.245 (6,22) | 0.220 (5,59) | 0.245 (6,22) |



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

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