

SN75ALS172A QUADRUPLE DIFFERENTIAL LINE DRIVER

SLLS121D – AUGUST 1990 – REVISED APRIL 1998

- Meets or Exceeds ANSI Standards EIA/TIA-422-B and RS-485 and ITU Recommendation V.11
- High-Speed Advanced Low-Power Schottky Circuitry
- Designed for 20-MBaud Operation in Both Serial and Parallel Applications
- Designed for Multipoint Transmission on Long Bus Lines in Noisy Environments
- Low Supply-Current Requirements: 55 mA Max
- Wide Positive and Negative Input/Output Bus-Voltage Ranges
- Driver Output Capacity . . . ± 60 mA
- Thermal Shutdown Protection
- Driver Positive and Negative Current Limiting
- Logically Interchangeable With SN75172

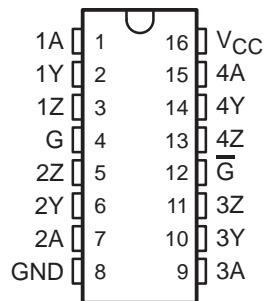
description

The SN75ALS172A comprises four line drivers with 3-state differential outputs. They are designed to meet the requirements of ANSI Standards EIA/TIA-422-B and RS-485 and ITU Recommendation V.11. This device is optimized for balanced multipoint bus transmission at rates of up to 20 Mbaud. Each driver features wide positive and negative common-mode output voltage ranges, making it suitable for party-line applications in noisy environments.

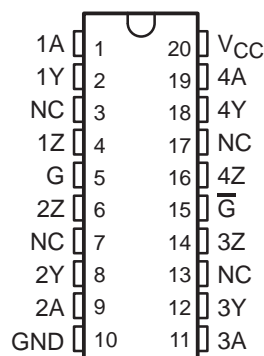
The SN75ALS172A provides positive- and negative-current limiting and thermal shutdown for protection from line-fault conditions on the transmission bus line. Shutdown occurs at a junction temperature of approximately 150°C.

The SN75ALS172A is characterized for operation from 0°C to 70°C.

**N PACKAGE
(TOP VIEW)**



**DW PACKAGE
(TOP VIEW)**



NC – No internal connection



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**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1998, Texas Instruments Incorporated

SN75ALS172A QUADRUPLE DIFFERENTIAL LINE DRIVER

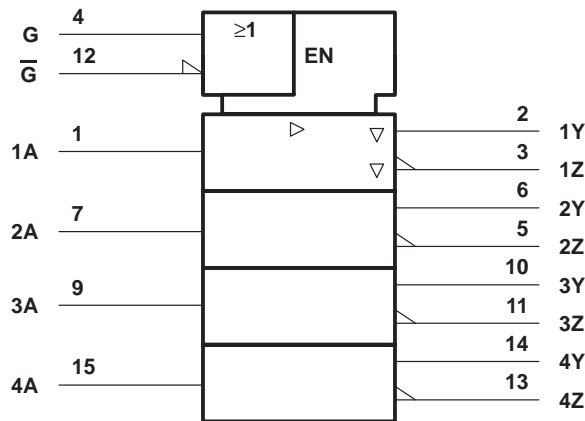
SLLS121D – AUGUST 1990 – REVISED APRIL 1998

FUNCTION TABLE
(each driver)

| INPUT A | ENABLES | | OUTPUTS | |
|------------|---------|-----------|---------|---|
| | G | \bar{G} | Y | Z |
| H | H | X | H | L |
| L | H | X | L | H |
| H | X | L | H | L |
| L | X | L | L | H |
| X | L | H | Z | Z |

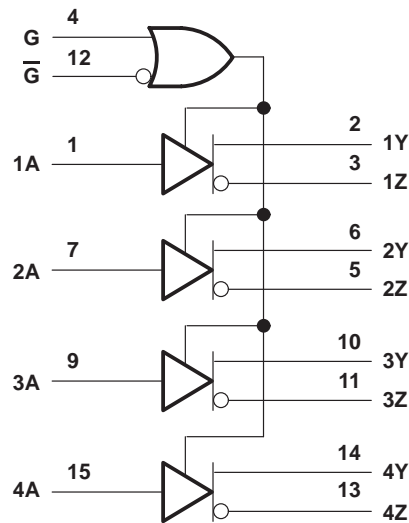
H = high level, L = low level, X = irrelevant,
Z = high impedance (off)

logic symbol†



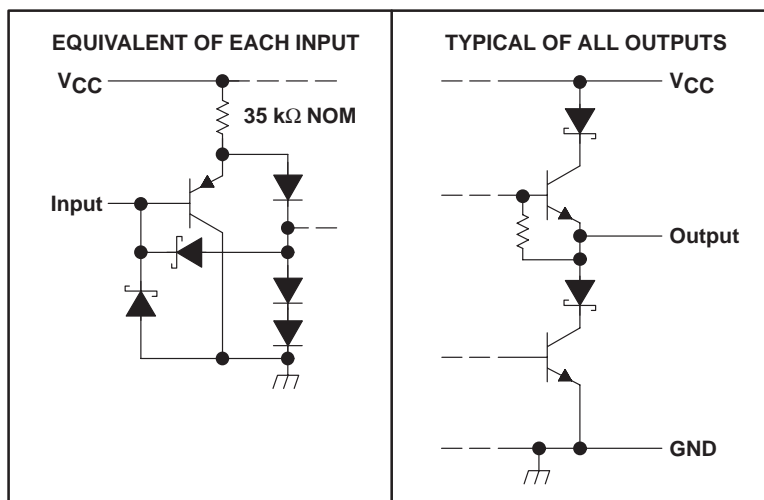
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the N package.

logic diagram (positive logic)



Pin numbers shown are for the N package.

schematics of inputs and outputs



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

| | |
|--|------------------------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage, V_I | 7 V |
| Output voltage range, V_O | -9 V to 14 V |
| Continuous total dissipation | See Dissipation Rating Table |
| Storage temperature range, T_{stg} | -65°C to 150°C |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | 260°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.

NOTE 1: All voltage values are with respect to network ground terminal.

DISSIPATION RATING TABLE

| PACKAGE | $T_A \leq 25^\circ\text{C}$ POWER RATING | DERATING FACTOR | $T_A = 70^\circ\text{C}$ POWER RATING | $T_A = 85^\circ\text{C}$ POWER RATING |
|---------|---|--------------------|--|--|
| DW | 1125 mW | 9 mW/°C | 720 mW | 585 mW |
| N | 1150 mW | 9.2 mW/°C | 736 mW | 598 mW |

recommended operating conditions

| | MIN | NOM | MAX | UNIT |
|---------------------------------------|------|-----|----------|------|
| Supply voltage, V_{CC} | 4.75 | 5 | 5.25 | V |
| High-level input voltage, V_{IH} | 2 | | | V |
| Low-level input voltage, V_{IL} | | | 0.8 | V |
| Common-mode output voltage, V_{OC} | | | 12 -7 | V |
| High-level output current, I_{OH} | | | -60 | mA |
| Low-level output current, I_{OL} | | | 60 | mA |
| Operating free-air temperature, T_A | 0 | | 70 | °C |

SN75ALS172A

QUADRUPLE DIFFERENTIAL LINE DRIVER

SLLS121D – AUGUST 1990 – REVISED APRIL 1998

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | MIN | TYP† | MAX | UNIT | |
|-------------------|---|---|----------------------------|------|---------|------|----|
| V _{IK} | Input clamp voltage | I _I = -18 mA | | | -1.5 | V | |
| V _O | Output voltage | I _O = 0 | 0 | | 6 | V | |
| V _{OD1} | Differential output voltage | I _O = 0 | 1.5 | | 6 | V | |
| V _{OD2} | Differential output voltage | V _{CC} = 5 V, R _L = 100 Ω, See Figure 1 | 1/2 V _{OD1} or 2‡ | | | V | |
| | | R _L = 54 Ω, See Figure 1 | 1.5 | 2.5 | 5 | | |
| V _{OD3} | Differential output voltage | See Note 2 | 1.5 | | 5 | V | |
| Δ V _{OD} | Change in magnitude of differential output voltage§ | R _L = 54 Ω or 100 Ω, See Figure 1 | | | ±0.2 | V | |
| V _{OC} | Common-mode output voltage¶ | R _L = 54 Ω or 100 Ω, See Figure 1 | | | 3 -1 | V | |
| Δ V _{OC} | Change in magnitude of common-mode output voltage§ | R _L = 54 Ω or 100 Ω, See Figure 1 | | | ±0.2 | V | |
| I _O | Output current with power off | V _{CC} = 0, V _O = -7 V to 12 V | | | ±100 | μA | |
| I _{OZ} | High-impedance-state output current | V _O = -7 V to 12 V | | | ±100 | μA | |
| I _{IH} | High-level input current | V _I = 2.7 V | | | 20 | μA | |
| I _{IL} | Low-level input current | V _I = 0.4 V | | | -100 | μA | |
| I _{OS} | Short-circuit output current | V _O = -7 V to 12 V | | | ±250 | mA | |
| I _{CC} | Supply current (all drivers) | No load | Outputs enabled | | 36 | 55 | mA |
| | | | Outputs disabled | | 15 | 30 | |

† All typical values are at V_{CC} = 5 V and T_A = 25°C.

‡ The minimum V_{OD2} with a 100-Ω load is either 1/2 V_{OD1} or 2 V, whichever is greater.

§ Δ|V_{OD}| and Δ|V_{OC}| are the changes in magnitude of V_{OD} and V_{OC}, respectively, that occur when the input is changed from a high level to a low level.

¶ In ANSI Standard EIA/TIA-422-B, V_{OC}, which is the average of the two output voltages with respect to ground, is called output offset voltage, V_{OS}.

NOTE 2: See EIA Standard RS-485, Figure 3-5, Test Termination Measurement 2.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C_L = 50 pF

| PARAMETER | | TEST CONDITIONS | MIN | TYP† | MAX | UNIT |
|--------------------|-------------------------------------|--------------------------------------|-----|------|-----|------|
| t _{d(OD)} | Differential-output delay time | R _L = 54 Ω, See Figure 2 | 9 | 15 | 22 | ns |
| t _{PZH} | Output enable time to high level | R _L = 110 Ω, See Figure 3 | 30 | 45 | 70 | ns |
| t _{PZL} | Output enable time to low level | R _L = 110 Ω, See Figure 4 | 25 | 40 | 65 | ns |
| t _{PHZ} | Output disable time from high level | R _L = 110 Ω, See Figure 3 | 10 | 20 | 35 | ns |
| t _{PLZ} | Output disable time from low level | R _L = 110 Ω, See Figure 4 | 10 | 30 | 45 | ns |

† All typical values are at V_{CC} = 5 V and T_A = 25°C.



PARAMETER MEASUREMENT INFORMATION

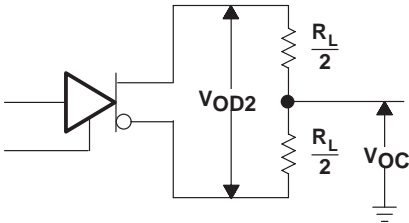
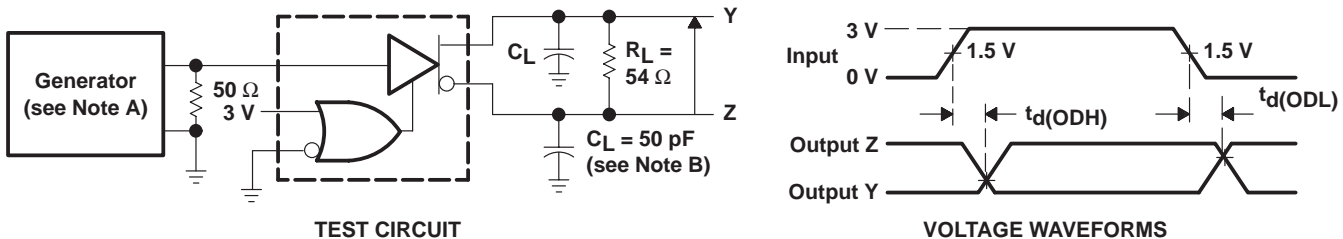
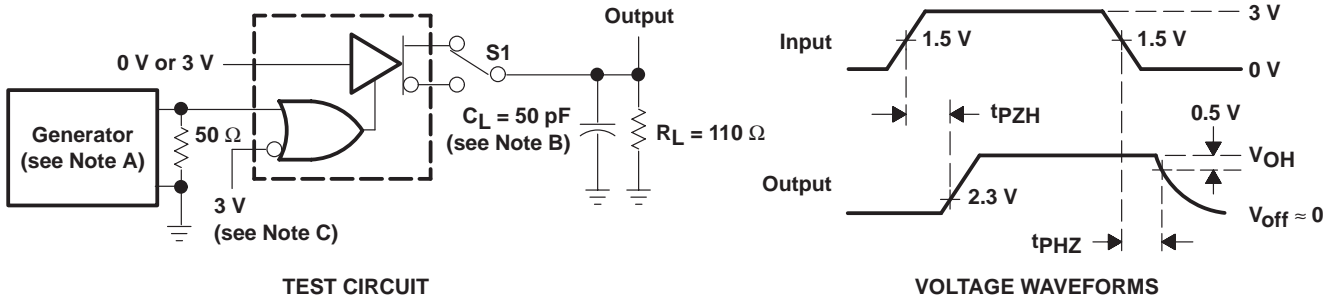


Figure 1. Differential and Common-Mode Output Voltages



NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, $Z_O = 50 \Omega$, duty cycle = 50%, $t_f \leq 5$ ns, $t_r \leq 5$ ns.
 B. C_L includes probe and stray capacitance.

Figure 2. Differential Output Test Circuit and Voltage Waveforms



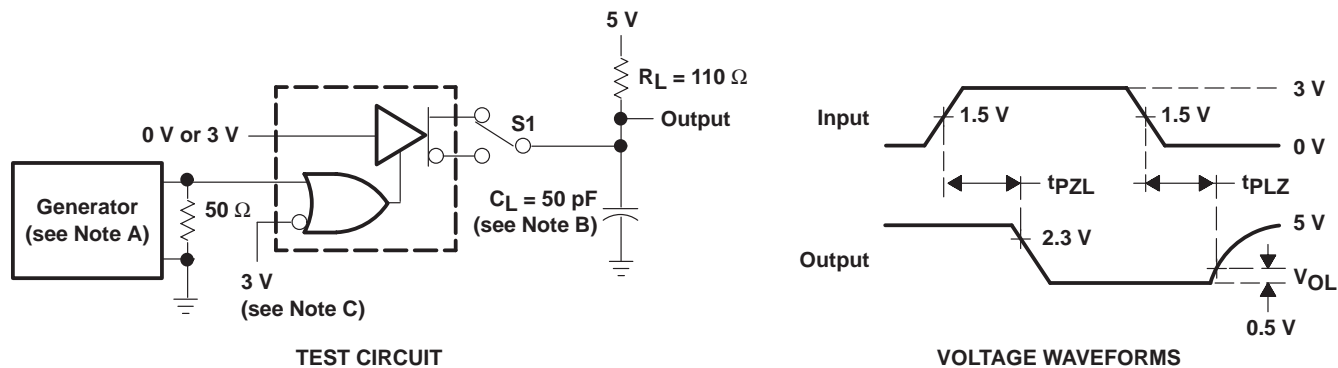
NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, $Z_O = 50 \Omega$, duty cycle = 50%, $t_f \leq 5$ ns, $t_r \leq 5$ ns.
 B. C_L includes probe and stray capacitance.
 C. To test the active-low enable \bar{G} , ground \bar{G} and apply an inverted input waveform to \bar{G} .

Figure 3. Test Circuit and Voltage Waveforms, t_{pZH} and t_{pHZ}

SN75ALS172A QUADRUPLE DIFFERENTIAL LINE DRIVER

SLLS121D – AUGUST 1990 – REVISED APRIL 1998

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, $Z_O = 50 \Omega$, duty cycle = 50%, $t_f \leq 5$ ns, $t_r \leq 5$ ns.
- B. C_L includes probe and stray capacitance.
- C. To test the active-low enable \overline{G} , ground G and apply an inverted input waveform to \overline{G} .

Figure 4. Test Circuit and Voltage Waveforms, t_{PZL} and t_{PLZ}

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN75ALS172ADW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS172ADWE4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS172ADWG4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS172ADWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS172ADWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS172ADWRG4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75ALS172AN | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPD | N / A for Pkg Type |
| SN75ALS172ANE4 | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPD | N / A for Pkg Type |

⁽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.

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ 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)

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

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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



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 |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN75ALS172ADWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.3 | 2.7 | 12.0 | 24.0 | Q1 |
| SN75ALS172ADWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.0 | 2.7 | 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) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN75ALS172ADWR | SOIC | DW | 20 | 2000 | 367.0 | 367.0 | 45.0 |
| SN75ALS172ADWR | SOIC | DW | 20 | 2000 | 367.0 | 367.0 | 45.0 |

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



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



- NOTES:
- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
 - 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.

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



4209202-4/E 07/11

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Refer to IPC7351 for alternate board design.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license 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 significant portions of TI 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. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

| | |
|------------------------------|--|
| Audio | www.ti.com/audio |
| Amplifiers | amplifier.ti.com |
| Data Converters | dataconverter.ti.com |
| DLP® Products | www.dlp.com |
| DSP | dsp.ti.com |
| Clocks and Timers | www.ti.com/clocks |
| Interface | interface.ti.com |
| Logic | logic.ti.com |
| Power Mgmt | power.ti.com |
| Microcontrollers | microcontroller.ti.com |
| RFID | www.ti-rfid.com |
| OMAP Applications Processors | www.ti.com/omap |
| Wireless Connectivity | www.ti.com/wirelessconnectivity |

Applications

| | |
|-------------------------------|--|
| Automotive and Transportation | www.ti.com/automotive |
| Communications and Telecom | www.ti.com/communications |
| Computers and Peripherals | www.ti.com/computers |
| Consumer Electronics | www.ti.com/consumer-apps |
| Energy and Lighting | www.ti.com/energy |
| Industrial | www.ti.com/industrial |
| Medical | www.ti.com/medical |
| Security | www.ti.com/security |
| Space, Avionics and Defense | www.ti.com/space-avionics-defense |
| Video and Imaging | www.ti.com/video |

TI E2E Community

e2e.ti.com