

DS26LS32AC/DS26LS32C/DS26LS32M/DS26LS33M Quad Differential Line Receivers

 Check for Samples: [DS26LS32AC](#), [DS26LS32C](#), [DS26LS32M](#), [DS26LS33M](#)

FEATURES

- **High Differential or Common-Mode Input Voltage Ranges of $\pm 7V$ on the DS26LS32 and DS26LS32A and $\pm 15V$ on the DS26LS33**
- **$\pm 0.2V$ Sensitivity Over the Input Voltage Range on the DS26LS32 and DS26LS32A, $\pm 0.5V$ Sensitivity on the DS26LS33**
- **DS26LS32 and DS26LS32A Meet All Requirements of RS-422 and RS-423**
- **6k Minimum Input Impedance**
- **100 mV Input Hysteresis on the DS26LS32 and DS26LS32A, 200 mV on the DS26LS33**
- **Operation From a Single 5V Supply**
- **TRI-STATE Outputs, with Choice of Complementary Output Enables for Receiving Directly onto a Data Bus**

DESCRIPTION

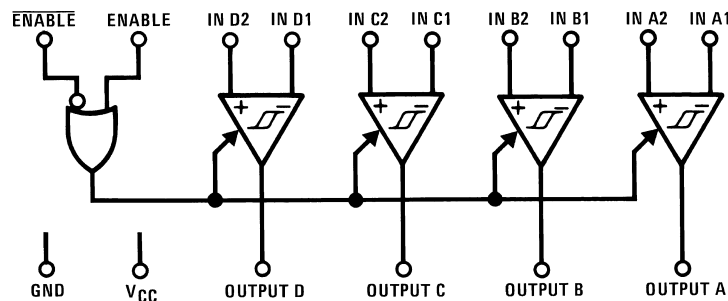
The DS26LS32 and DS26LS32A are quad differential line receivers designed to meet the RS-422, RS-423 and Federal Standards 1020 and 1030 for balanced and unbalanced digital data transmission.

The DS26LS32 and DS26LS32A have an input sensitivity of 200 mV over the input voltage range of $\pm 7V$ and the DS26LS33 has an input sensitivity of 500 mV over the input voltage range of $\pm 15V$.

The DS26LS32A differs in function from the popular DS26LS32 and DS26LS33 in that input pull-up and pull-down resistors are included which prevent output oscillation on unused channels.

Each version provides an enable and disable function common to all four receivers and features TRI-STATE outputs with 8 mA sink capability. Constructed using low power Schottky processing, these devices are available over the full military and commercial operating temperature ranges.

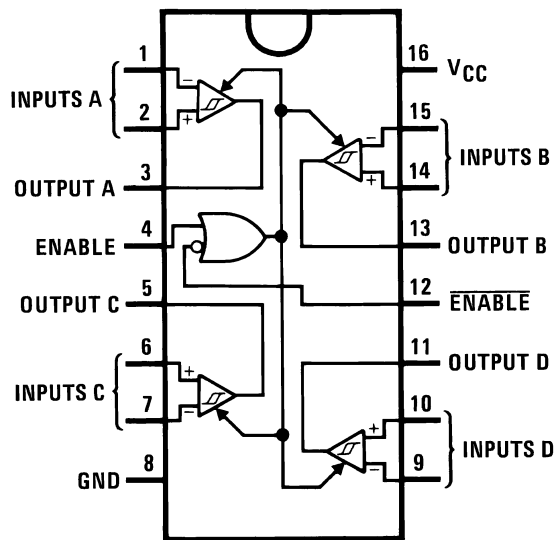
Logic Diagram



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.

All trademarks are the property of their respective owners.

Connection Diagram



For Complete Military Product Specifications, refer to the appropriate SMD or MDS.

Figure 1. Dual-In-Line Package (Top View) D Package or NFG0016E Package

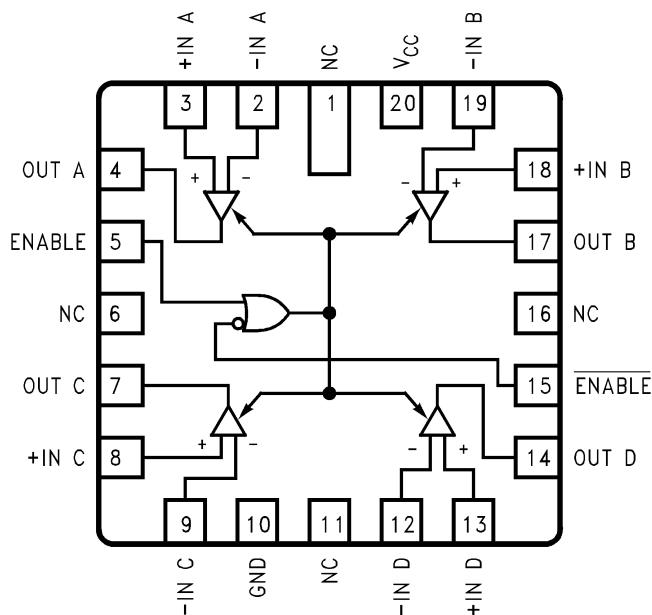


Figure 2. 20-Lead Ceramic Leadless Chip Carrier

Truth Table ⁽¹⁾

ENABLE	ENABLER	Input	Output
0	1	X	Hi-Z
See note below. ⁽²⁾		$V_{ID} \geq V_{TH} \text{ (Max)}$	1
		$V_{ID} \leq V_{TH} \text{ (Min)}$	0

(1) Hi-Z = TRI-STATE

(2) Note: Input conditions may be any combination not defined for ENABLE and ENABLER.



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings⁽¹⁾⁽²⁾

Supply Voltage	7V
Common-Mode Range	±25V
Differential Input Voltage	±25V
Enable Voltage	7V
Output Sink Current	50 mA
Maximum Power Dissipation ⁽³⁾ at 25°C	
Cavity Package	1433 mW
Molded DIP Package	1362 mW
SOIC Package ⁽⁴⁾ DS26LS32	1002 mW
DS26LS32A	1051 mW
Storage Temperature Range	-65°C to +165°C
Lead Temperature (Soldering, 4 seconds)	260°C

- (1) "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.
- (2) If Military/Aerospace specified devices are required, please contact the TI Sales Office/Distributors for availability and specifications.
- (3) Derate cavity package 9.6 mW/°C above 25°C; derate molded DIP package 10.9 mW/°C above 25°C.
- (4) Derate SOIC Package 8.01 mW/°C for DS26LS32 8.41 mW/°C for DS26LS32A

Operating Conditions

	Min	Max	Units
Supply Voltage, (V _{CC})			
DS26LS32M, DS26LS33M (MIL)	4.5	5.5	V
DS26LS32C, DS26LS32AC (COML)	4.75	5.25	V
Temperature, (T _A)			
DS26LS32M, DS26LS33M (MIL)	-55	+125	°C
DS26LS32C, DS26LS32AC (COML)	0	+70	°C

Electrical Characteristics^{(1) (2) (3)}

over the operating temperature range unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V _{TH}	Differential Input Voltage	V _{OUT} = V _{OH} or V _{OL} DS26LS32, DS26LS32A, -7V ≤ V _{CM} ≤ +7V DS26LS33, DS26LS33A, -15V ≤ V _{CM} +15V	-0.2 -0.5	±0.07 ±0.14	0.2 0.5	V
R _{IN}	Input Resistance	-15V ≤ V _{CM} ≤ +15V (One Input AC GND)	6.0	8.5		kΩ
I _{IN}	Input Current (Under Test)	V _{IN} = 15V, Other Input -15V ≤ V _{IN} ≤ +15V V _{IN} = -15V, Other Input -15V ≤ V _{IN} ≤ +15V			2.3 -2.8	mA
V _{OH}	Output High Voltage	V _{CC} = MIN, ΔV _{IN} = 1V, V _{ENABLE} = 0.8V, I _{OH} = -440 μA	2.7 2.5	4.2 4.2		V
V _{OL}	Output Low Voltage	V _{CC} = Min, ΔV _{IN} = -1V, V _{ENABLE} = 0.8V			0.4 0.45	V
V _{IL}	Enable Low Voltage				0.8	V
V _{IH}	Enable High Voltage		2.0			V
V _I	Enable Clamp Voltage	V _{CC} = Min, I _{IN} = -18 mA			-1.5	V

- (1) All currents into device pins are shown as positive, all currents out of device pins are shown as negative, all voltages are referenced to ground, unless otherwise specified. All values shown as max or min are so classified on absolute value basis.
- (2) All typical values are V_{CC} = 5V, T_A = 25°C.
- (3) Only one output at a time should be shorted.

Electrical Characteristics ⁽¹⁾ ⁽²⁾ ⁽³⁾ (continued)

over the operating temperature range unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I _O	OFF-State (High Impedance) Output Current	V _{CC} = Max	V _O = 2.4V		20	μA
			V _O = 0.4V		-20	μA
I _{IL}	Enable Low Current	V _{IN} = 0.4V			-0.36	mA
I _{IH}	Enable High Current	V _{IN} = 2.7V			20	μA
I _{SC}	Output Short-Circuit Current	V _O = 0V, V _{CC} = Max, ΔV _{IN} = 1V	-15		-85	mA
I _{CC}	Power Supply Current	V _{CC} = Max, All V _{IN} = GND, Outputs Disabled		52	70	mA
			DS26LS32, DS26LS32A		57	80
I _I	Input High Current	V _{IN} = 5.5V			100	μA
V _{HYST}	Input Hysteresis	T _A = 25°C, V _{CC} = 5V, V _{CM} = 0V		100		mV
			DS26LS32, DS26S32A		200	
						mV
						mV

Switching Characteristics

V_{CC} = 5V, T_A = 25°C

Symbol	Parameter	Conditions	DS26LS32/DS26LS33			DS26LS32A/DS26LS33A			Units
			Min	Typ	Max	Min	Typ	Max	
t _{PLH}	Input to Output	C _L = 15 pF		17	25		23	35	ns
t _{PHL}				17	25		23	35	ns
t _{LZ}	ENABLE to Output	C _L = 5 pF		20	30		15	30	ns
t _{HZ}				15	22		20	25	ns
t _{ZL}	ENABLE to Output	C _L = 15 pF		15	22		14	22	ns
t _{ZH}				15	22		15	22	ns

AC TEST CIRCUIT AND SWITCHING TIME WAVEFORMS

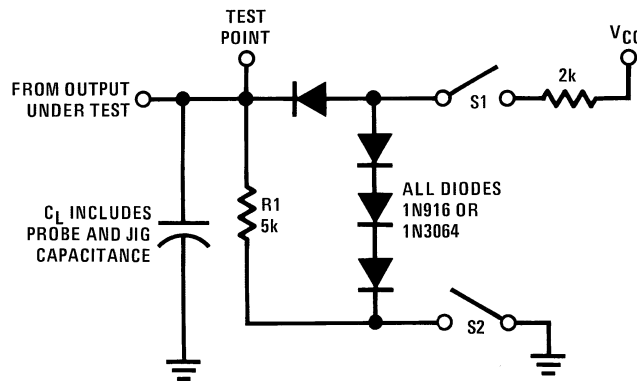


Figure 3. Load Test Circuit for TRI-STATE Outputs

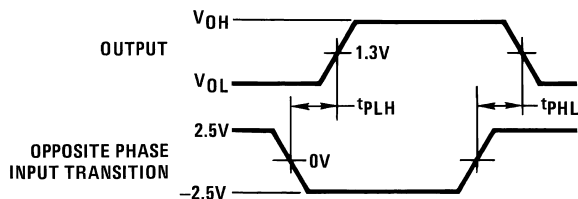
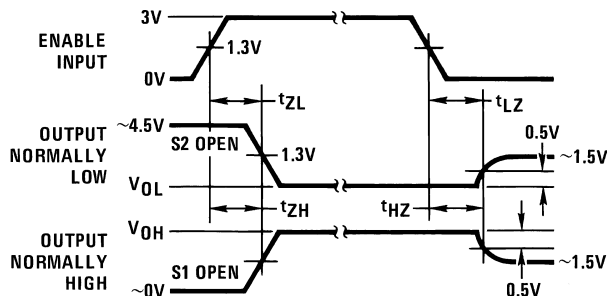


Diagram shown for $\overline{\text{ENABLE}}$ low.

Pulse generator for all pulses: Rate = 1.0 MHz; $Z_0 = 50\Omega$; $t_r \leq 6 \text{ ns}$; $t_f \leq 6.0 \text{ ns}$.

Figure 4. Propagation Delay



S1 and S2 of load circuit are closed except where shown.

Pulse generator for all pulses: Rate = 1.0 MHz; $Z_0 = 50\Omega$; $t_r \leq 6 \text{ ns}$; $t_f \leq 6.0 \text{ ns}$.

Figure 5. Enable and Disable Times

TYPICAL APPLICATIONS

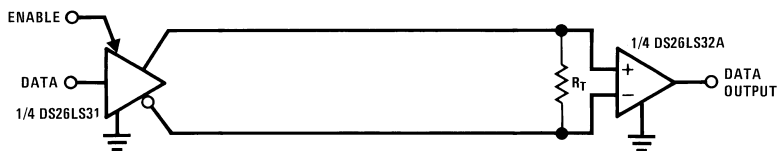


Figure 6. Two-Wire Balanced Interface—RS-422

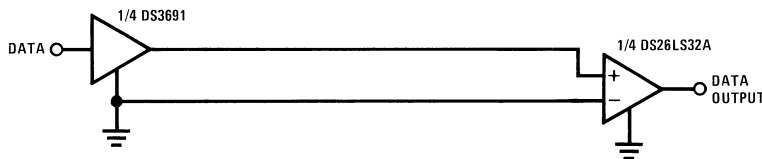


Figure 7. Single Wire with Driver Ground Reference—RS-423

REVISION HISTORY

Changes from Revision B (February 2013) to Revision C	Page
• Changed layout of National Data Sheet to TI format	5

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
AM26LS32CN	NRND	PDIP	NFG	16	25	TBD	Call TI	Call TI	0 to 70	DS26LS32CN	
AM26LS32PC	NRND	PDIP	NFG	16	25	TBD	Call TI	Call TI	0 to 70	DS26LS32CN	
DS26LS32ACM	NRND	SOIC	D	16	48	TBD	Call TI	Call TI	0 to 70	DS26LS32 ACM	
DS26LS32ACM/NOPB	ACTIVE	SOIC	D	16	48	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	DS26LS32 ACM	Samples
DS26LS32ACMX	NRND	SOIC	D	16	2500	TBD	Call TI	Call TI	0 to 70	DS26LS32 ACM	
DS26LS32ACMX/NOPB	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	DS26LS32 ACM	Samples
DS26LS32ACN	NRND	PDIP	NFG	16	25	TBD	Call TI	Call TI	0 to 70	DS26LS32ACN	
DS26LS32ACN/NOPB	ACTIVE	PDIP	NFG	16	25	Pb-Free (RoHS)	CU SN	Level-1-NA-UNLIM	0 to 70	DS26LS32ACN	Samples
DS26LS32CM	NRND	SOIC	D	16	48	TBD	Call TI	Call TI	0 to 70	DS26LS32CM	
DS26LS32CM/NOPB	ACTIVE	SOIC	D	16	48	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	DS26LS32CM	Samples
DS26LS32CMX	NRND	SOIC	D	16	2500	TBD	Call TI	Call TI	0 to 70	DS26LS32CM	
DS26LS32CMX/NOPB	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	DS26LS32CM	Samples
DS26LS32CN	NRND	PDIP	NFG	16	25	TBD	Call TI	Call TI	0 to 70	DS26LS32CN	
DS26LS32CN/NOPB	ACTIVE	PDIP	NFG	16	25	Pb-Free (RoHS)	SN	Level-1-NA-UNLIM	0 to 70	DS26LS32CN	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.

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.

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

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

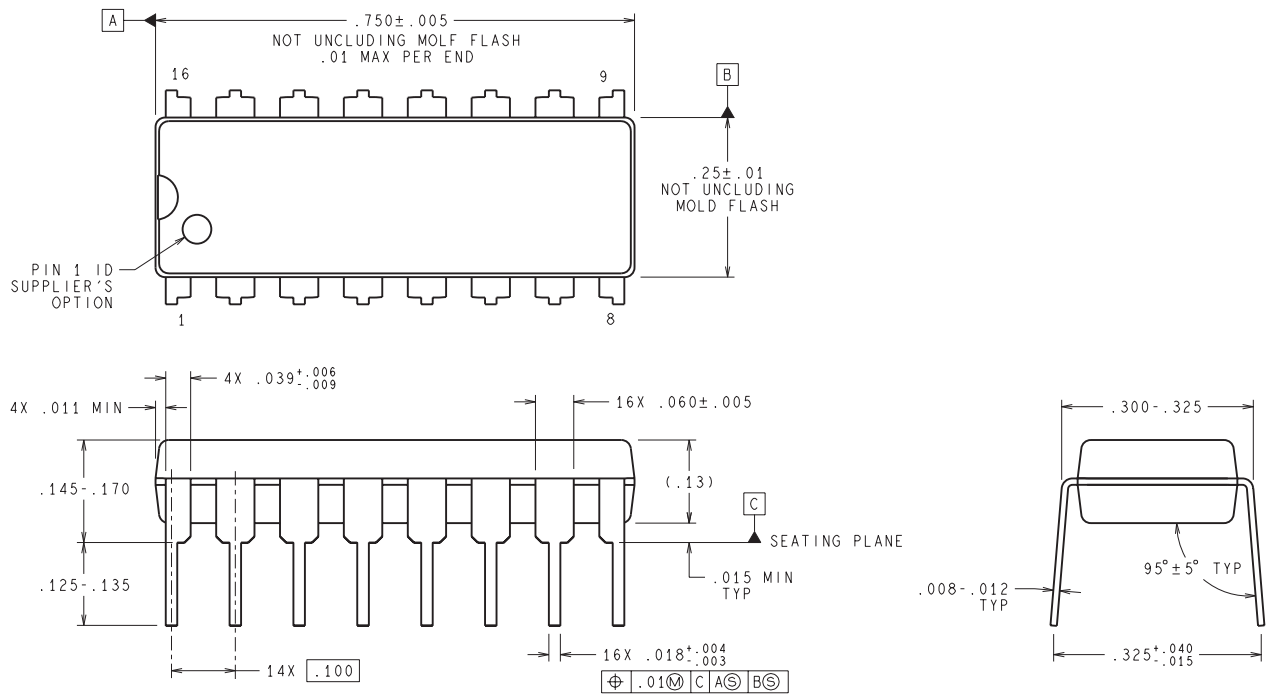
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
DS26LS32ACMX	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.3	8.0	16.0	Q1
DS26LS32ACMX/NOPB	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.3	8.0	16.0	Q1
DS26LS32CMX	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.3	8.0	16.0	Q1
DS26LS32CMX/NOPB	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.3	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DS26LS32ACMX	SOIC	D	16	2500	367.0	367.0	35.0
DS26LS32ACMX/NOPB	SOIC	D	16	2500	367.0	367.0	35.0
DS26LS32CMX	SOIC	D	16	2500	367.0	367.0	35.0
DS26LS32CMX/NOPB	SOIC	D	16	2500	367.0	367.0	35.0

NFG0016E



DIMENSIONS ARE IN INCHES
DIMENSIONS IN () FOR REFERENCE ONLY

N16E (Rev G)

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