

LM160QML High Speed Differential Comparator

Check for Samples: [LM160QML](#)

FEATURES

- Ensured High Speed: 20nS max
- Tight Delay Matching on Both Outputs
- Complementary TTL Outputs
- High Input Impedance
- Low Speed Variation with Overdrive Variation
- Fan-Out of 4
- Low Input Offset Voltage
- Series 74 TTL Compatible

DESCRIPTION

The LM160 is a very high speed differential input, complementary TTL output voltage comparator with improved characteristics over the μ A760/ μ A760C, for which it is a pin-for-pin replacement. The device has been optimized for greater speed, input impedance and fan-out, and lower input offset voltage. Typically delay varies only 3nS for overdrive variations of 5mV to 400mV.

Complementary outputs having minimum skew are provided. Applications involve high speed analog to digital convertors and zero-crossing detectors in disk file systems.

Connection Diagrams

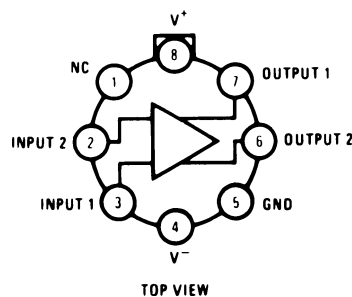


Figure 1. Metal Can Package
See Package Number LMC0008C



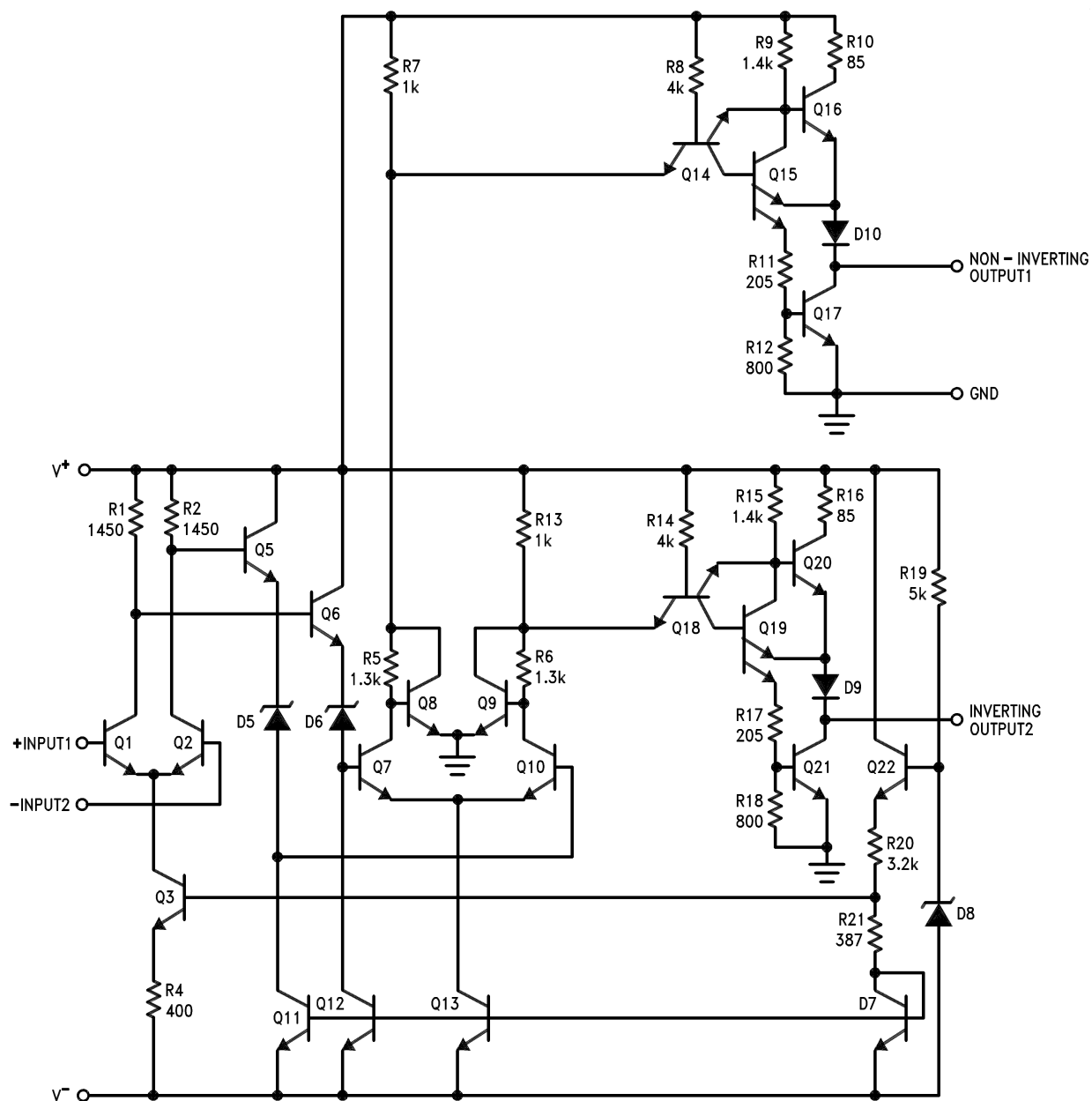
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

All trademarks are the property of their respective owners.

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

Copyright © 2010–2013, Texas Instruments Incorporated

Schematic Diagram



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⁾

Positive Supply Voltage			+8V
Negative Supply Voltage			–8V
Peak Output Current			20 mA
Differential Input Voltage			±5V
Input Voltage			$V^+ \geq V_I \geq V^-$
Operating Temperature Range			–55°C ≤ T _A ≤ +125°C
Storage Temperature Range			–65°C ≤ T _A ≤ +150°C
Thermal Resistance	θ _{JA}	Still Air	165°C/W
		400 LF/min	67°C/W
	θ _{JC}		25°C/W
Lead Temperature (Soldering, 10 sec.)			260°C
ESD Tolerance ⁽²⁾			1,600V

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

- (2) Human body model, 1.5 kΩ in series with 100 pF.

Quality Conformance Inspection

Mil-Std-883, Method 5005 - Group A

Subgroup	Description	Temp (°C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	–55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	–55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	–55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	–55
12	Settling time at	+25
13	Settling time at	+125
14	Settling time at	–55

LM160H/883 Electrical Characteristics DC Parameters

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
$V_{OH\ B}$	Logical "1" Output Voltage	$V_{CC} \pm 4.5V$, $I_O = -320\mu A$		2.4		V	1, 2, 3
$V_{OH\ A}$	Logical "1" Output Voltage	$V_{CC} \pm 4.5V$, $I_O = -320\mu A$		2.4		V	1, 2, 3
$V_{OL\ A}$	Logical "0" Output Voltage	$V_{CC} \pm 4.5V$, $I_O = 6.4mA$			0.4	V	1, 2, 3
$V_{OL\ B}$	Logical "0" Output Voltage	$V_{CC} = 4.5V$, $I_O = 6.4mA$			0.4	V	1, 2, 3
I_{IB}	Input Bias Current	$V_{CC} = \pm 5V$, $V_{IN} = 5V$			20	μA	1, 2, 3
I_{CC+}	Positive Supply Current	$V_{CC} = \pm 6.5V$			32	mA	1, 2, 3
I_{CC-}	Negative Supply Current	$V_{CC} = \pm 6.5V$			-16	mA	1, 2, 3
$I_{OS\ B}$	Short Circuit Current	$V_{CC} = \pm 4.5V$		-15	-52	mA	1, 2, 3
$I_{OS\ A}$	Short Circuit Current	$V_{CC} = \pm 4.5V$		-15	-52	mA	1, 2, 3
V_{IO}	Input Offset Voltage	$V_{CC} = \pm 5V$		-5.0	5.0	mV	1, 2, 3
I_{IO}	Input Offset Current	$V_{CC} = \pm 5V$		-3.0	3.0	μA	1, 2, 3
$I_I\ (1)$	Unbalanced Input Current	$V_{CC} = \pm 5V$, $V_{IN(1)} = 0$, $V_{IN(2)} = 5V$	See ⁽¹⁾		-1.0	mA	1, 2, 3
$I_I\ (2)$	Unbalanced Input Current	$V_{CC} = \pm 5V$, $V_{IN(1)} = 5V$, $V_{IN(2)} = 0V$	See ⁽¹⁾		-1.0	mA	1, 2, 3
V_{CC}	Supply Voltage		See ⁽¹⁾	± 4.5	± 6.5	V	1, 2, 3
BV_{CC}	Supply Breakdown Voltage		See ⁽¹⁾	± 8.0		V	1, 2, 3
V_{CM}	Common Mode Input Voltage Range	$V_{CC} = \pm 6.5V$	See ⁽¹⁾	± 4.0		V	1, 2, 3
V_{Diff}	Differential Input Voltage Range		See ⁽¹⁾	± 5.0		V	1, 2, 3

(1) Parameter tested go-no-go, only.

LM160H/883 Electrical Characteristics AC ParametersThe following conditions apply, unless otherwise specified. $V_{CC} = \pm 5V$, $f = 10MHz$ (sinusoidal)

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
t_{Resp}	Response Time	$V_{IN} = 30mV_{P-P}$	See ⁽¹⁾		25	nS	9
t_{Resp}	Response Time	$V_{IN} = 2\ V_{P-P}$	See ⁽¹⁾		20	nS	9

(1) Bench test, use 70256644.

Typical Performance Characteristics

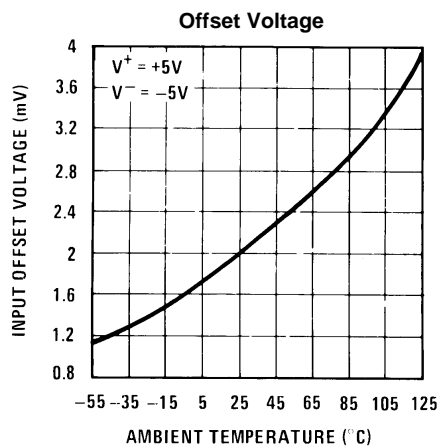


Figure 2.

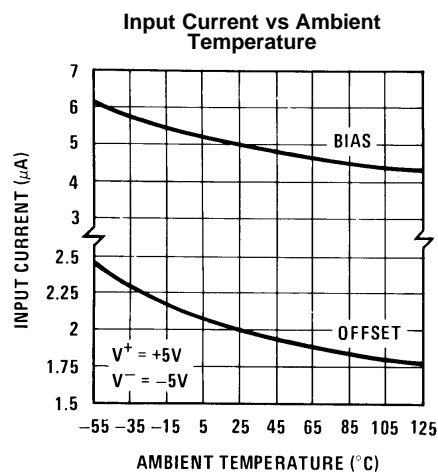


Figure 3.

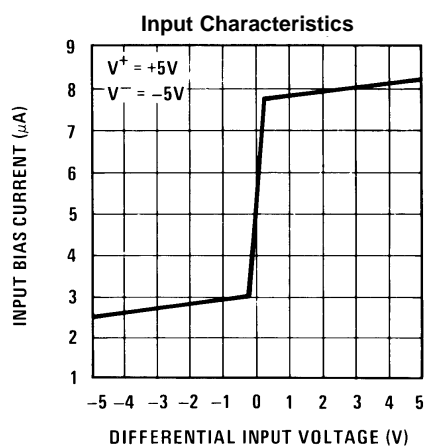


Figure 4.

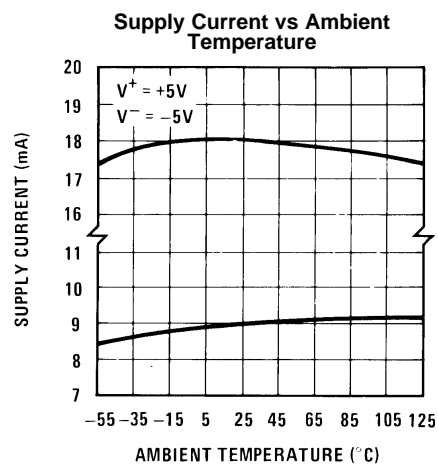


Figure 5.

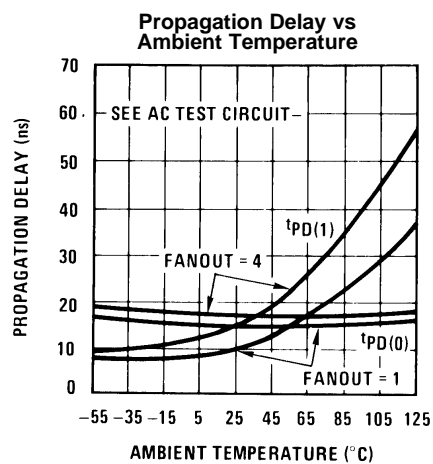


Figure 6.

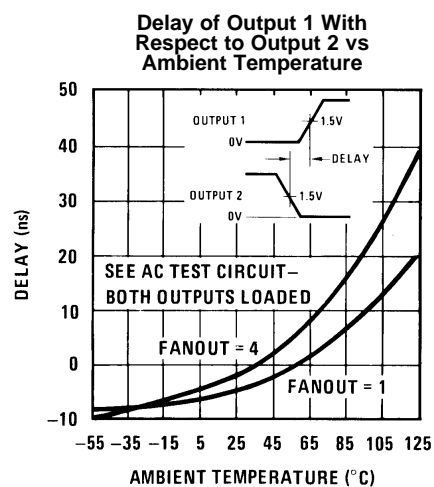
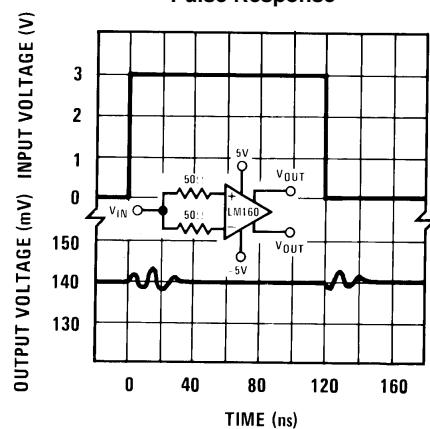
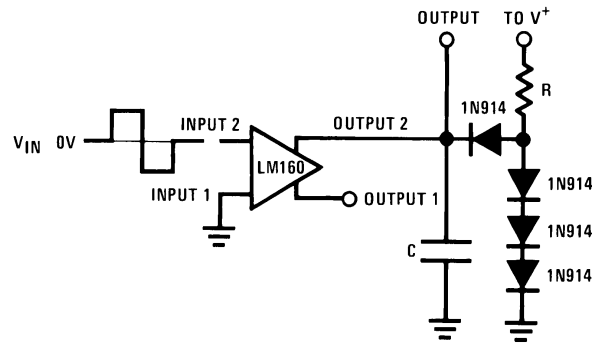


Figure 7.

Typical Performance Characteristics (continued)**Common-Mode
Pulse Response****Figure 8.**

AC Test Circuit



$V_I = \pm 50 \text{ mV}$

$V^+ = +5\text{V}$

$V^- = -5\text{V}$

FANOUT=1

$R = 2.4\text{K}\Omega$

$C = 15 \text{ pF}$

FANOUT=4

$R = 630\Omega$

$C = 30 \text{ pF}$

REVISION HISTORY

Released	Revision	Section	Changes
11/30/2010	A	New Release, Corporate format	1 MDS data sheets converted into one Corp. data sheet format. The drift table was eliminated since it did not apply MNL160-X Rev 0BL will be archived.
03/26/2013	A	All Sections	Changed layout of National Data Sheet to TI format

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
5962-8767401GA	ACTIVE	TO-99	LMC	8	20	TBD	Call TI	Call TI	-55 to 125	LM160H/883 5962-8767401GA Q A CO 5962-8767401GA Q > T	Samples
LM160H/883	ACTIVE	TO-99	LMC	8	20	TBD	Call TI	Call TI	-55 to 125	LM160H/883 5962-8767401GA Q A CO 5962-8767401GA Q > T	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) 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.

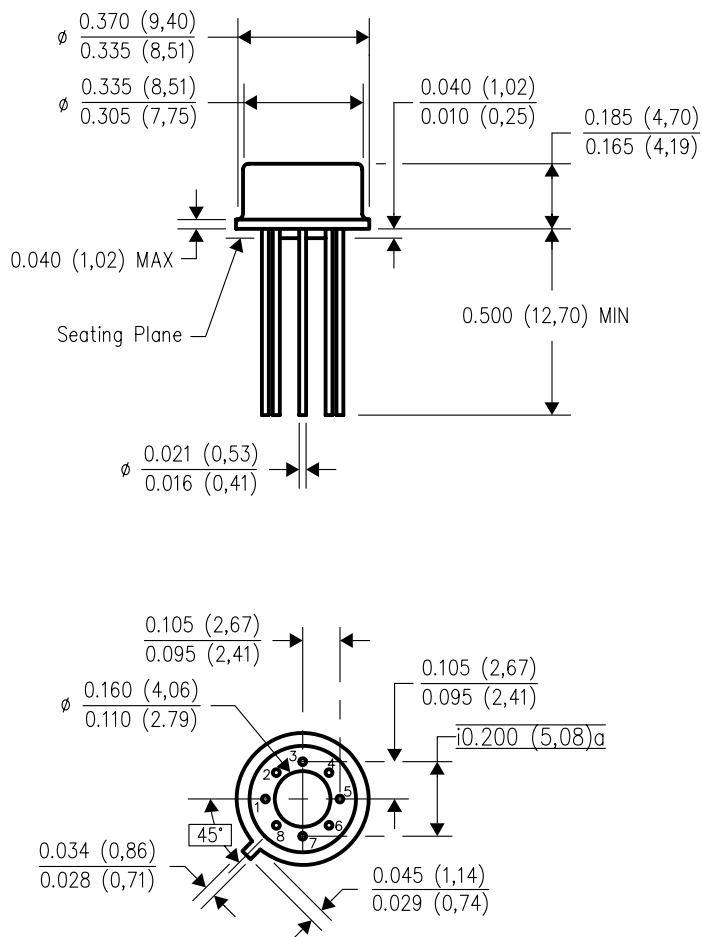
(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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.

LMC (O-MBCY-W8)

METAL CYLINDRICAL PACKAGE



4202483/B 09/07

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Leads in true position within 0.010 (0,25) R @ MMC at seating plane.
 - Pin numbers shown for reference only. Numbers may not be marked on package.
 - Falls within JEDEC MO-002/TO-99.

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