

LM741QML Operational Amplifier

 Check for Samples: [LM741QML](#)

FEATURES

- The amplifier offers many features which make their application nearly foolproof: overload

protection on the input and output, no latch-up when the common mode range is exceeded, as well as freedom from oscillations.

DESCRIPTION

The LM741 is a general purpose operational amplifier which features improved performance over industry standards such as the LM709. They are direct, plug-in replacements for the 709C, LM201, MC1439 and 748 in most applications.

Connection Diagram

Metal Can Package

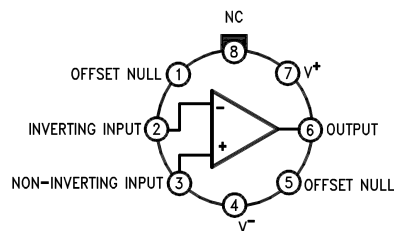


Figure 1. See NS Package Number H08C

Dual-In-Line Package

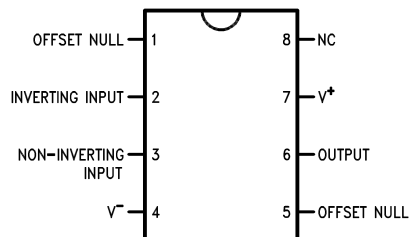


Figure 2. See NS Package Number J08A

Ceramic Flatpak and SOIC Package

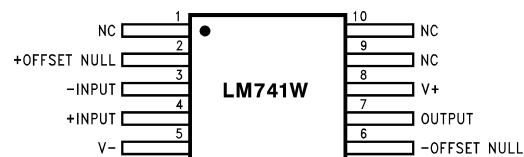


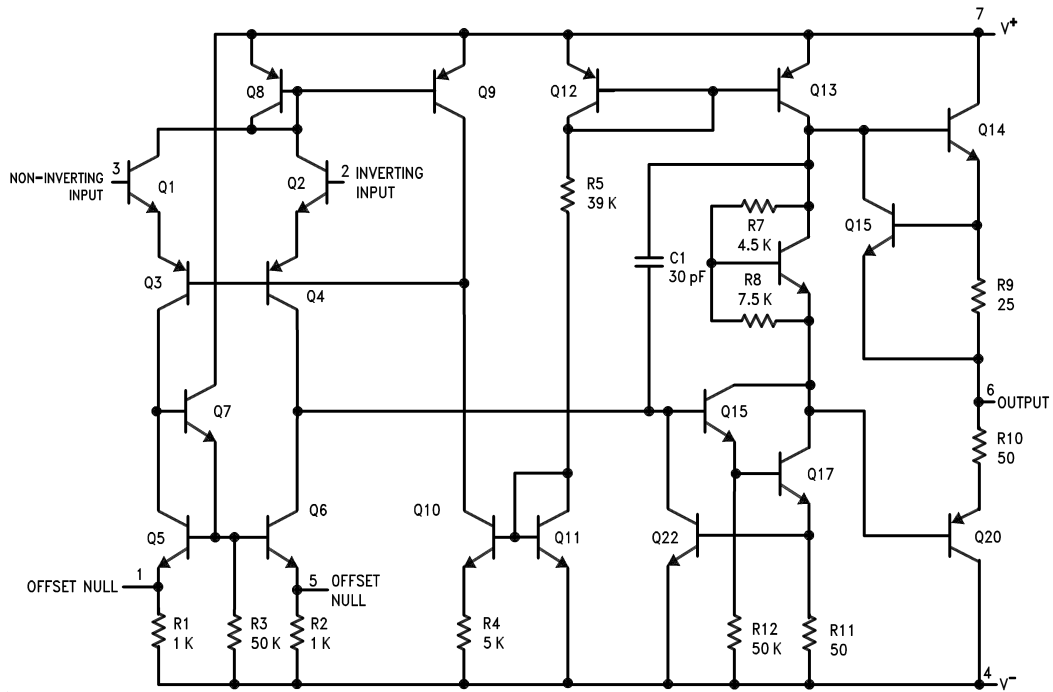
Figure 3. See NS Package Number W10A & WG10A



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.

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⁾

Supply Voltage	±22V
Power Dissipation ⁽²⁾	500 mW
Differential Input Voltage	±30V
Input Voltage ⁽³⁾	±15V
Output Short Circuit Duration	Continuous
Operating Temperature Range	-55°C ≤ T _A ≤ +125°C
Storage Temperature Range	-65°C ≤ T _A ≤ +150°C
Junction Temperature (T _J)	150°C
Lead Temperature (Soldering, 10 Seconds)	300°C
Thermal Resistance	
θ _{JA}	
Metal Can (Still Air)	167°C/W
Metal Can (500LF / Min Air Flow)	100°C/W
CERDIP (Still Air)	TBD
CERDIP (500LF / Min Air Flow)	TBD
CERPACK (Still Air)	228°C/W
CERPACK (500LF / Min Air Flow)	154°C/W
Ceramic SOIC (Still Air)	228°C/W
Ceramic SOIC (500LF / Min Air Flow)	154°C/W
θ _{JC}	
Metal Can	44°C/W
CERDIP	TBD
CERPACK	27°C/W
Ceramic SOIC	27°C/W
Package Weight (typical)	
Metal Can	1000mg
CERDIP	1100mg
CERPACK	260mg
Ceramic SOIC	225mg
ESD Tolerance ⁽⁴⁾	400V

- (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 guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed 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) The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{Jmax} (maximum junction temperature), θ_{JA} (package junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is P_{Dmax} = (T_{Jmax} - T_A)/θ_{JA} or the number given in the Absolute Maximum Ratings, whichever is lower.
- (3) For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.
- (4) Human body model, 1.5 kΩ in series with 100 pF.

Table 1. Quality Conformance Inspection

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

Table 1. Quality Conformance Inspection (continued)

Subgroup	Description	Temp °C
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

Electrical Characteristics DC Parameters

The following conditions apply to all the following parameters, unless otherwise specified.

DC: $V_{CC} = \pm 15V$, $V_{CM} = 0V$

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-group
V_{IO}	Input Offset Voltage	$V_{CM} = -12V$		-5.0	5.0	mV	1
				-6.0	6.0	mV	2, 3
		$V_{CM} = 12V$		-5.0	5.0	mV	1
				-6.0	6.0	mV	2, 3
		$+V_{CC} = \pm 5V$		-5.0	5.0	mV	1
				-6.0	6.0	mV	2, 3
$-V_{IO}$ Adj	Offset Null			-6.0	mV	1, 2, 3	
$+V_{IO}$ Adj	Offset Null		6.0		mV	1, 2, 3	
I_{IO}	Input Offset Current	$V_{CM} = -12V$		-200	200	nA	1
				-500	500	nA	2, 3
		$V_{CM} = 12V$		-200	200	nA	1
				-500	500	nA	2, 3
		$V_{CC} = \pm 5V$		-200	200	nA	1
				-500	500	nA	2, 3
$\pm I_B$	Input Bias Current	$V_{CM} = -12V$		0.0	500	nA	1
				0.0	1500	nA	2, 3
		$V_{CM} = 12V$		0.0	500	nA	1
				0.0	1500	nA	2, 3
		$V_{CC} = \pm 5V$		0.0	500	nA	1
				0.0	1500	nA	2, 3
I_{CC}	Power Supply Current				2.8	mA	1
					2.5	mA	2
					3.5	mA	3
$+A_{VS}$	Open Loop Voltage Gain	$R_L = 2K\Omega$, $V_O = 0$ to $10V$	(1)	50		V/mV	1
			(1)	25		V/mV	2, 3
$-A_{VS}$	Open Loop Voltage Gain	$R_L = 2K\Omega$, $V_O = 0$ to $-10V$	(1)	50		V/mV	1
			(1)	25		V/mV	2, 3
$+PSRR$	Power Supply Rejection Ratio	$+V_{CC} = 15V$ to $5V$, $-V_{CC} = -15V$		77		dB	1, 2, 3
$-PSRR$	Power Supply Rejection Ratio	$-V_{CC} = -15V$ to $-5V$, $+V_{CC} = +15V$		77		dB	1, 2, 3
$CMRR$	Common Mode Rejection Ratio	$-12V \leq V_{CM} \leq 12V$		70		dB	1, 2, 3
$+I_{OS}$	Output Short Circuit Current			-45	-5.0	mA	1,2
				-50	-5.0	mA	3
$-I_{OS}$	Output Short Circuit Current			5.0	45	mA	1,2
				5.0	50	mA	3

(1) Datalog reading in $K = V/mV$

Electrical Characteristics DC Parameters (continued)

The following conditions apply to all the following parameters, unless otherwise specified.

DC: $V_{CC} = \pm 15V$, $V_{CM} = 0V$

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-group
+V _{Opp}	Output Voltage Swing	R _L = 10K Ω		12		V	1, 2, 3
		R _L = 2K Ω		10		V	1, 2, 3
		V _{CC} = $\pm 20V$, R _L = 10K Ω		16		V	1, 2, 3
		V _{CC} = $\pm 20V$, R _L = 2K Ω		15		V	1, 2, 3
-V _{Opp}	Output Voltage Swing	R _L = 10K Ω			-12	V	1, 2, 3
		R _L = 2K Ω			-10	V	1, 2, 3
		V _{CC} = $\pm 20V$, R _L = 10K Ω			-16	V	1, 2, 3
		V _{CC} = $\pm 20V$, R _L = 2K Ω			-15	V	1, 2, 3
R _I	Input Resistance		(2)	0.3		M Ω	1
V _I	Input Voltage Range	V _{CC} = $\pm 15V$	(3)	± 12		V	1, 2, 3
V _O	Output Voltage Swing	V _{CC} = $\pm 5V$	(2)	± 2.0		V	1, 2, 3

(2) Guaranteed parameter, not tested.

(3) Guaranteed by CMRR, I_B, I_O, V_{IO}

Electrical Characteristics AC Parameters

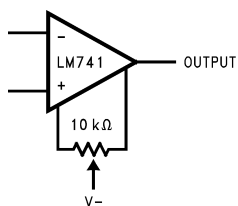
The following conditions apply to all the following parameters, unless otherwise specified.

AC: $V_{CC} = \pm 15V$, $V_{CM} = 0V$

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-group
+SR	Slew Rate	$V_I = -5V$ to $5V$, $A_V = 1$, $R_L = 2K\Omega$		0.2		V/ μ S	7
-SR	Slew Rate	$V_I = 5V$ to $-5V$, $A_V = 1$, $R_L = 2K\Omega$		0.2		V/ μ S	7
t_R	Rise Time	$R_L = 2K\Omega$, $A_V = 1$, $C_L = 100pF$			1.0	μ S	7
OS	Overshoot	$R_L = 2K\Omega$, $A_V = 1$, $C_L = 100pF$			30	%	7
GBW	Gain Bandwidth	$V_I = 50mV_{RMS}$, $f = 20KHz$, $R_L = 2K\Omega$		250		KHz	-

Typical Application

Figure 4. Offset Nulling Circuit



REVISION HISTORY

Date Released	Revision	Section	Originator	Changes
08/22/05	A	New Release to the corporate format	L. Lytle	1 MDS datasheet converted into one corporate datasheet format. Since drift is not performed on 883 product, the table was removed. MNLM741-X Rev 1A0 will be archived.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
LM741H/883	ACTIVE	TO-99	LMC	8	20	TBD	POST-PLATE	Level-1-NA-UNLIM	
LM741J/883	ACTIVE	CDIP	NAB	8	40	TBD	A42 SNPB	Level-1-NA-UNLIM	

(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.

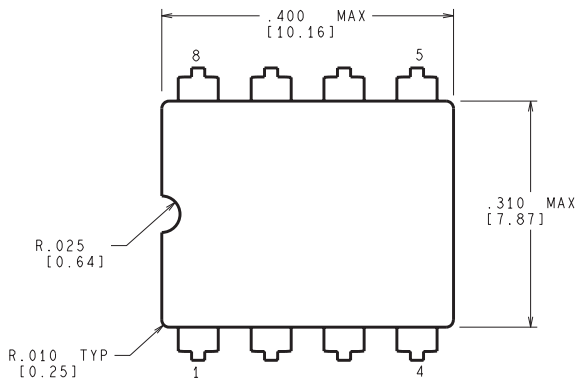
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

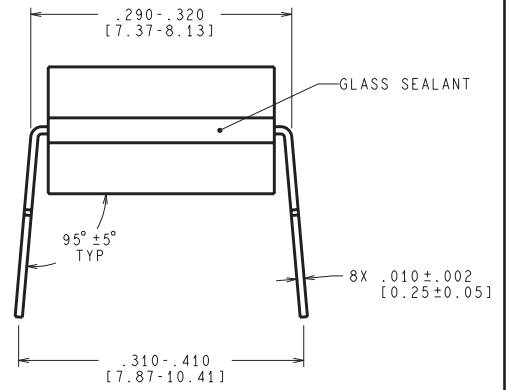
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. 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.

NAB0008A



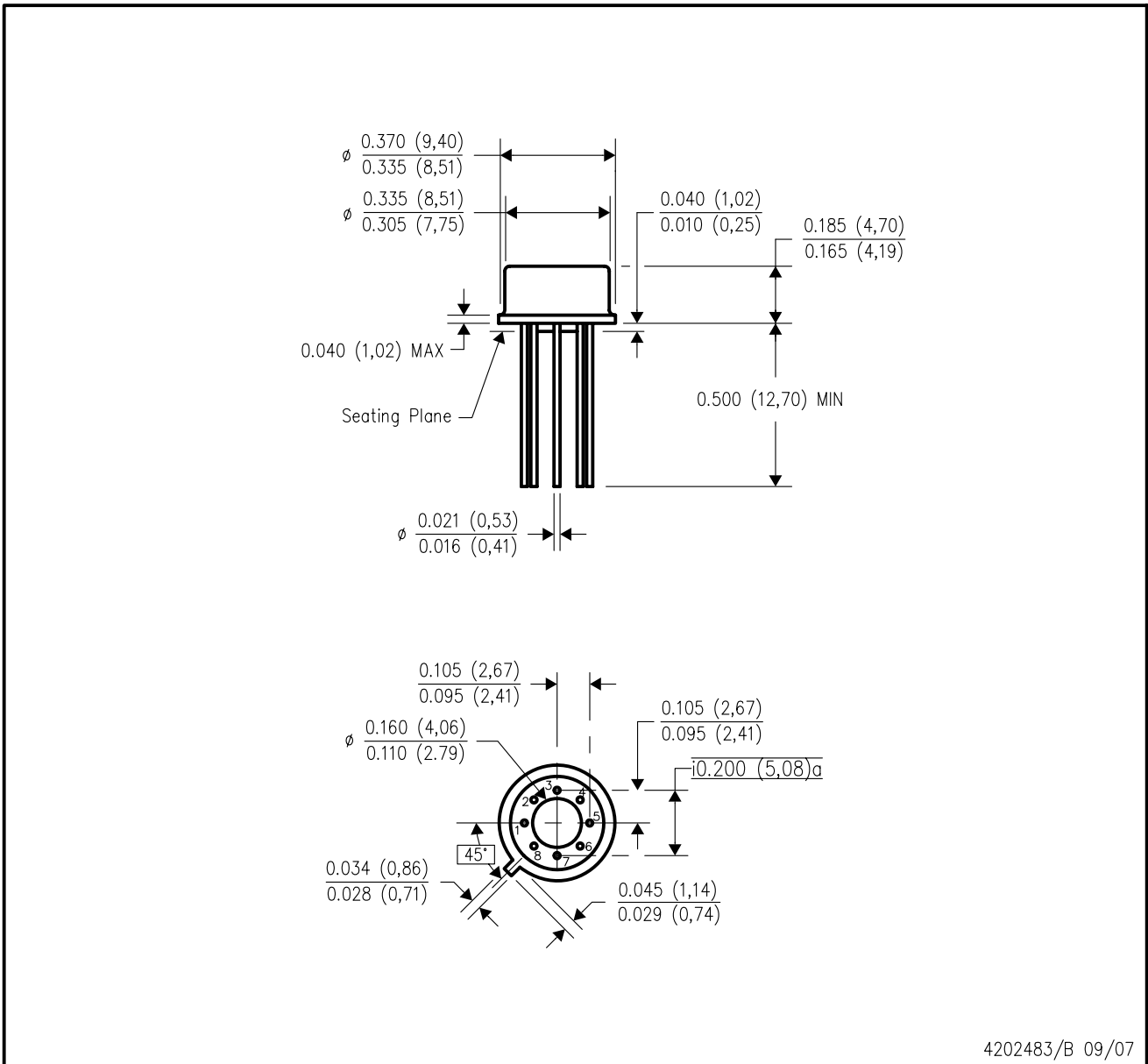
CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE MILLIMETERS



J08A (Rev M)

LMC (O-MBCY-W8)

METAL CYLINDRICAL PACKAGE



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