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 Diagrams

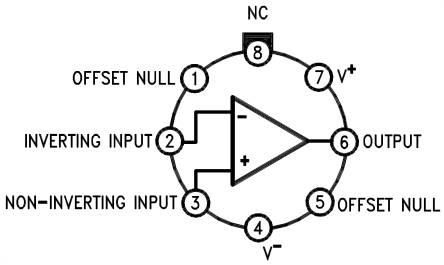


Figure 1. Metal Can Package
See Package Number LMC0008C

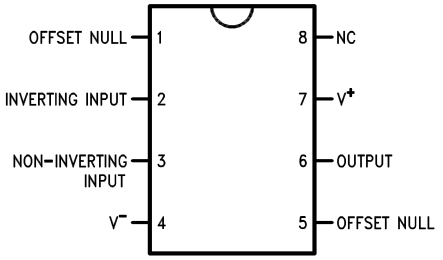


Figure 2. Dual-In-Line Package
See Package Number NAB0008A

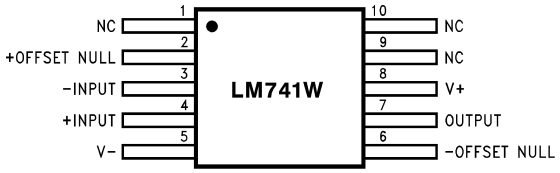
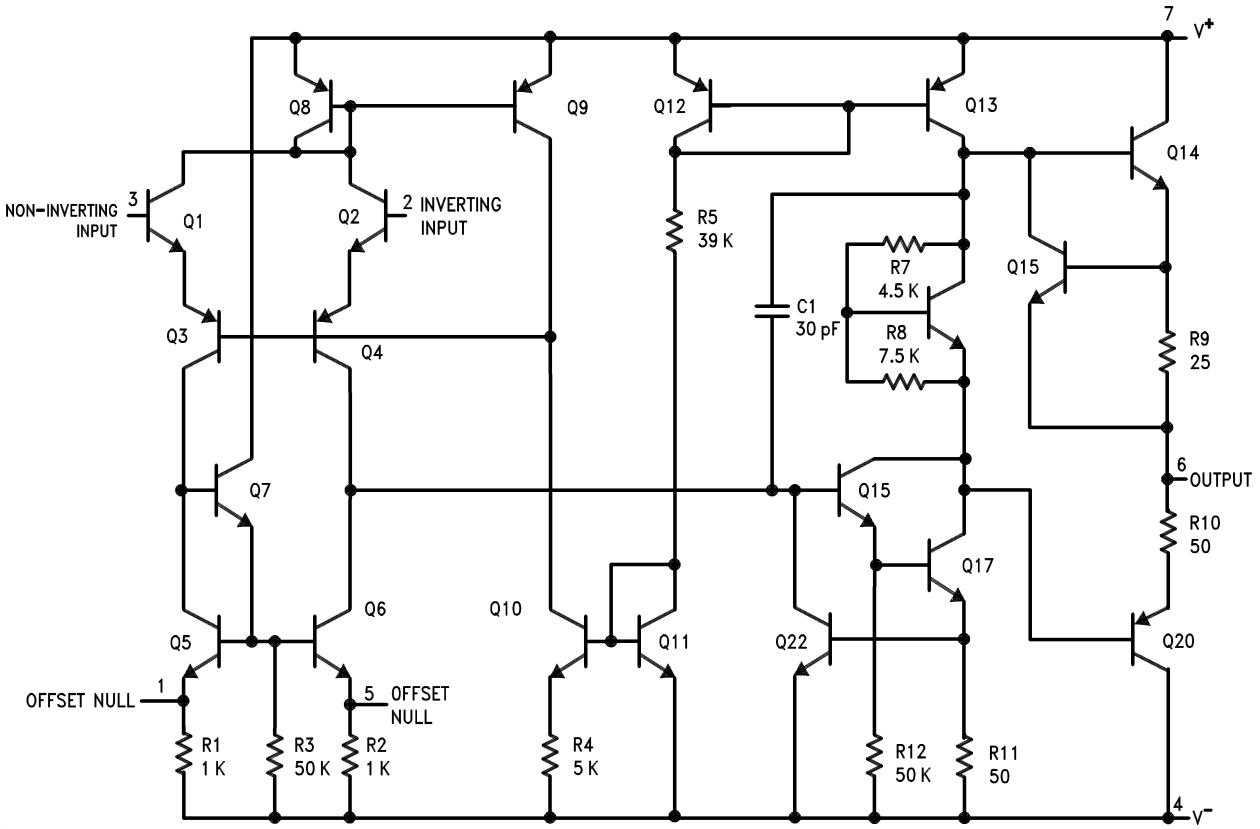


Figure 3. Ceramic Flatpak and SOIC Package
See Package Number NAD0010A & NAC0010A

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			$-55°C \le T_A \le +125°C$
Storage Temperature Range			$-65°C \le T_A \le +150°C$
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 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) 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 $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$ 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.

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

Electrical Characteristics DC Parameters

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

DC: V_{CC} = ±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
				-5.0	5.0	mV	1
				-6.0	6.0	mV	2, 3
		$+V_{CC}$ = ± 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
				-200	200	nA	1
				-500	500	nA	2, 3
		V_{CC} = ± 5V		-200	200	nA	1
				-500	500	nA	2, 3
$±I_{IB}$	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
				0.0	500	nA	1
				0.0	1500	nA	2, 3
		V_{CC} = ± 5V		0.0	500	mA	1
				0.0	1500	nA	2, 3

Electrical Characteristics DC Parameters (continued)

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

DC: V_{CC} = ±15V, V_{CM} = 0V

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-group
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 = 2KΩ, V_O = 0 to 10V	See (1)	50		V/mV	1
			See (1)	25		V/mV	2, 3
$-A_{VS}$	Open Loop Voltage Gain	R_L = 2KΩ, V_O = 0 to −10V	See (1)	50		V/mV	1
			See (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 ≤ V_{CM} ≤ 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
$+V_{Opp}$	Output Voltage Swing	R_L = 10KΩ		12		V	1, 2, 3
		R_L = 2KΩ		10		V	1, 2, 3
		V_{CC} = ± 20V, R_L = 10KΩ		16		V	1, 2, 3
		V_{CC} = ± 20V, R_L = 2KΩ		15		V	1, 2, 3
$-V_{Opp}$	Output Voltage Swing	R_L = 10KΩ			-12	V	1, 2, 3
		R_L = 2KΩ			-10	V	1, 2, 3
		V_{CC} = ± 20V, R_L = 10KΩ			-16	V	1, 2, 3
		V_{CC} = ± 20V, R_L = 2KΩ			-15	V	1, 2, 3
R_I	Input Resistance		See (2)	0.3		MΩ	1
V_I	Input Voltage Range	V_{CC} = ± 15V	See (3)	±12		V	1, 2, 3
V_O	Output Voltage Swing	V_{CC} = ± 5V	See (2)	±2.0		V	1, 2, 3

(1) Datalog reading in K = V/mV
(2) Specified parameter, not tested.
(3) Ensured by CMRR, I_{IB}, I_{IO}, V_{IO}

Electrical Characteristics AC Parameters

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

AC: V_{CC} = ±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 = 2KΩ		0.2		V/µS	7
-SR	Slew Rate	V_I = 5V to -5V, A_V =1, R_L = 2KΩ		0.2		V/µS	7
t_R	Rise Time	R_L = 2KΩ, A_V = 1, C_L = 100pF			1.0	µS	7
OS	Overshoot	R_L = 2KΩ, A_V = 1, C_L = 100pF			30	%	7
GBW	Gain Bandwidth	V_I = 50mV_{RMS}, f = 20KHz, R_L = 2KΩ		250		KHz	-

Typical Application

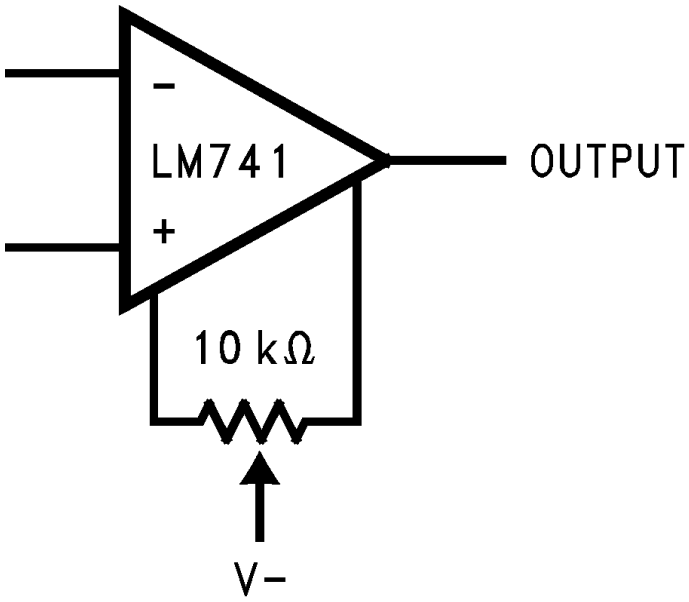


Figure 4. Offset Nulling Circuit

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.
03/26/13	A	All	-	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 finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM741 MD8	ACTIVE	DIESALE	Y	0	400	RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125		Samples
LM741H/883	ACTIVE	TO-99	LMC	8	20	RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	LM741H/883 Q ACO LM741H/883 Q >T	Samples
LM741J/883	ACTIVE	CDIP	NAB	8	40	Non-RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	LM741J /883 Q ACO /883 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) **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 <=1000ppm 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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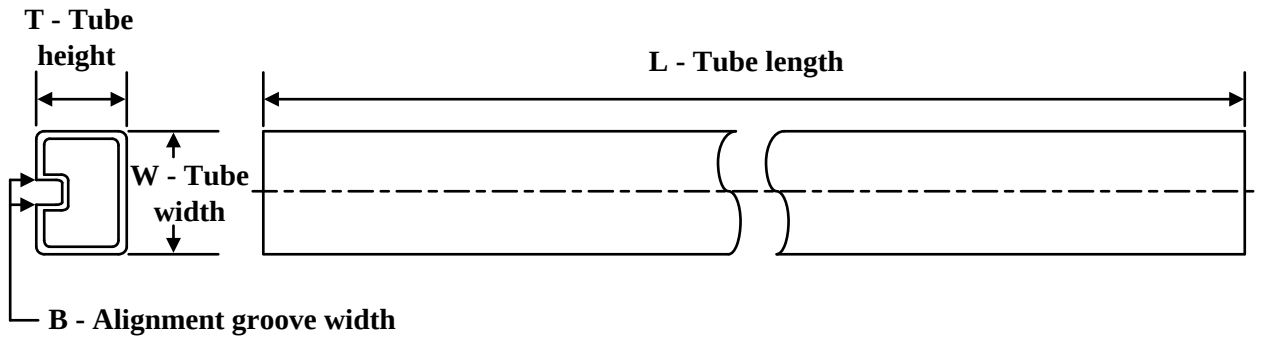
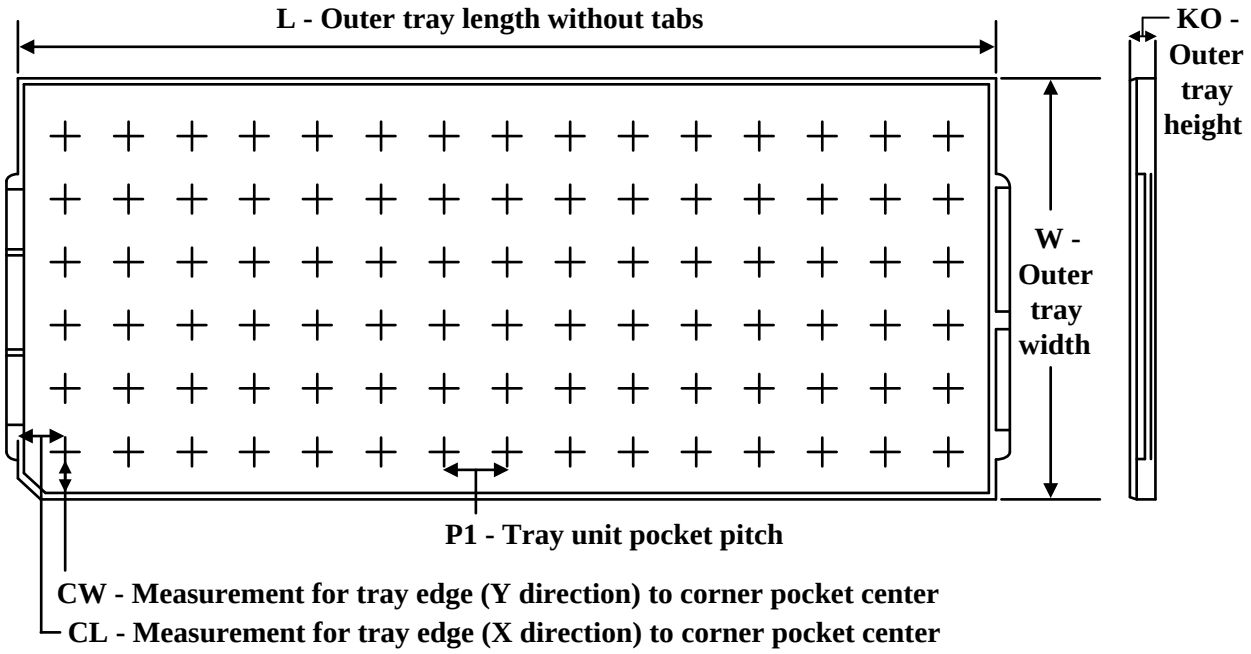
TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
LM741J/883	NAB	CDIP	8	40	506.98	15.24	13440	NA

TRAY

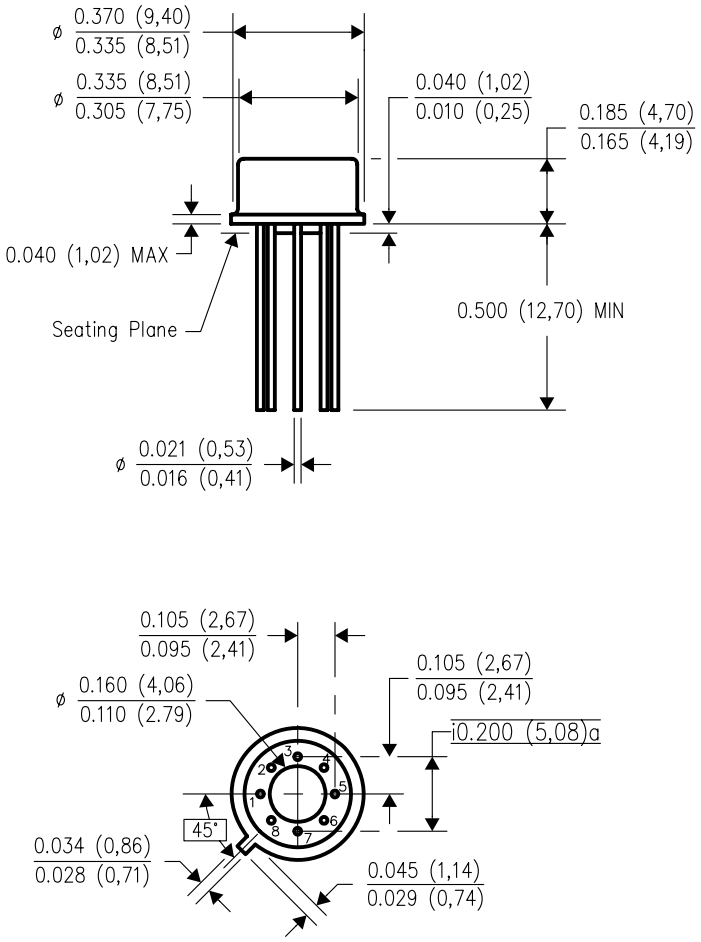


Chamfer on Tray corner indicates Pin 1 orientation of packed units.

*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	Unit array matrix	Max temperature (°C)	L (mm)	W (mm)	K0 (µm)	P1 (mm)	CL (mm)	CW (mm)
LM741H/883	LMC	TO-CAN	8	20	2 X 10	150	126.49	61.98	8890	11.18	12.95	18.54

LMC (O–MBCY–W8) METAL CYLINDRICAL PACKAGE



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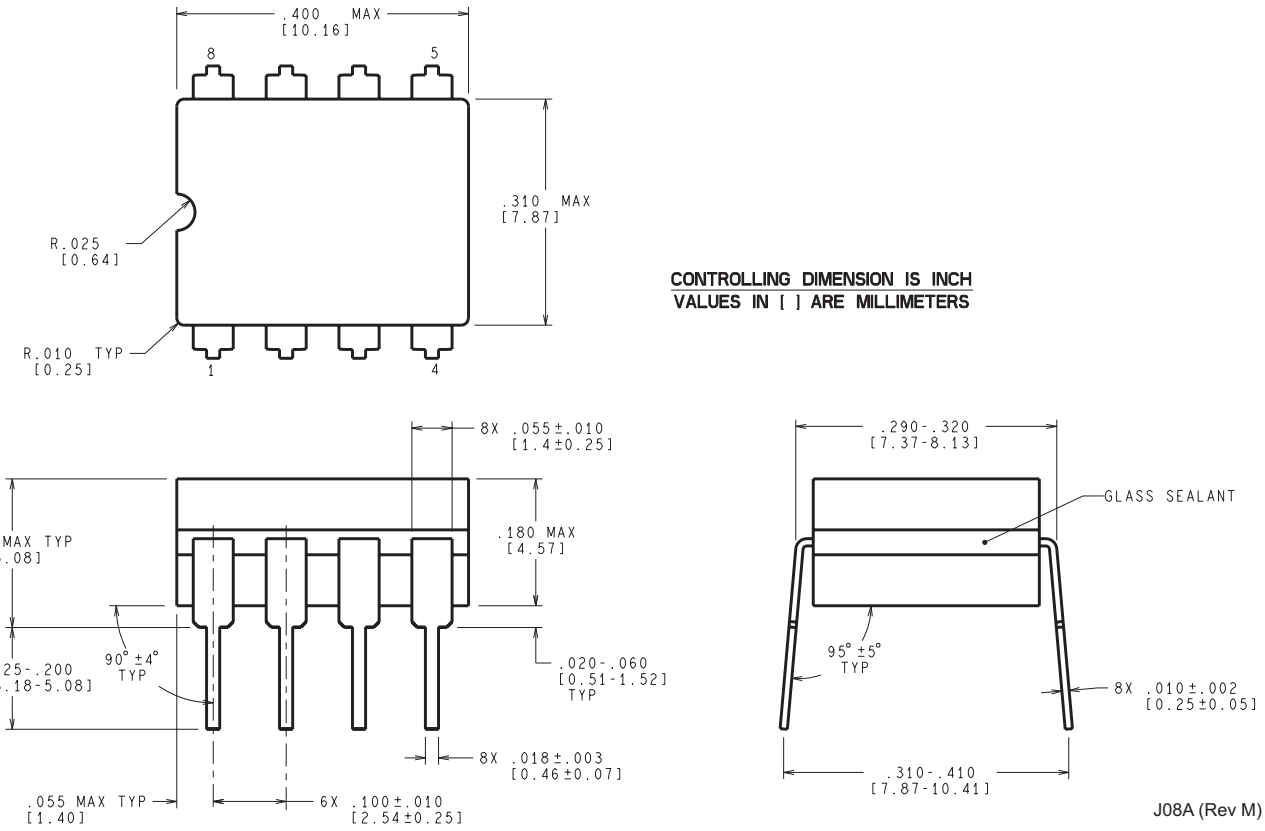
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Leads in true position within 0.010 (0,25) R @ MMC at seating plane.
D. Pin numbers shown for reference only. Numbers may not be marked on package.
E. Falls within JEDEC MO–002/TO–99.

NAB0008A


.400 MAX
[10.16]
8
5
.310 MAX
[7.87]
R.025
[0.64]
R.010 TYP
[0.25]
1
4
CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS
8X .055±.010
[1.4±0.25]
.200 MAX TYP
[5.08]
.180 MAX
[4.57]
8X .125-.200
[3.18-5.08]
90° ±4°
TYP
.020-.060
[0.51-1.52]
TYP
8X .018±.003
[0.46±0.07]
.055 MAX TYP
[1.40]
6X .100±.010
[2.54±0.25]
.290-.320
[7.37-8.13]
GLASS SEALANT
95° ±5°
TYP
8X .010±.002
[0.25±0.05]
.310-.410
[7.87-10.41]
J08A (Rev M)

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