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

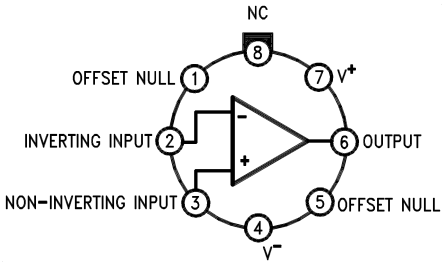


Figure 1. Metal Can Package
See Package Number LMC0008C

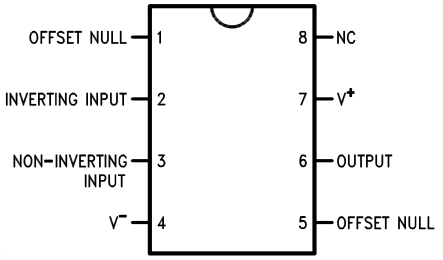


Figure 2. Dual-In-Line Package
See Package Number NAB0008A

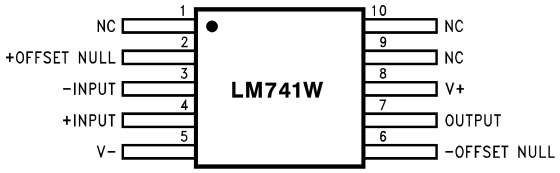
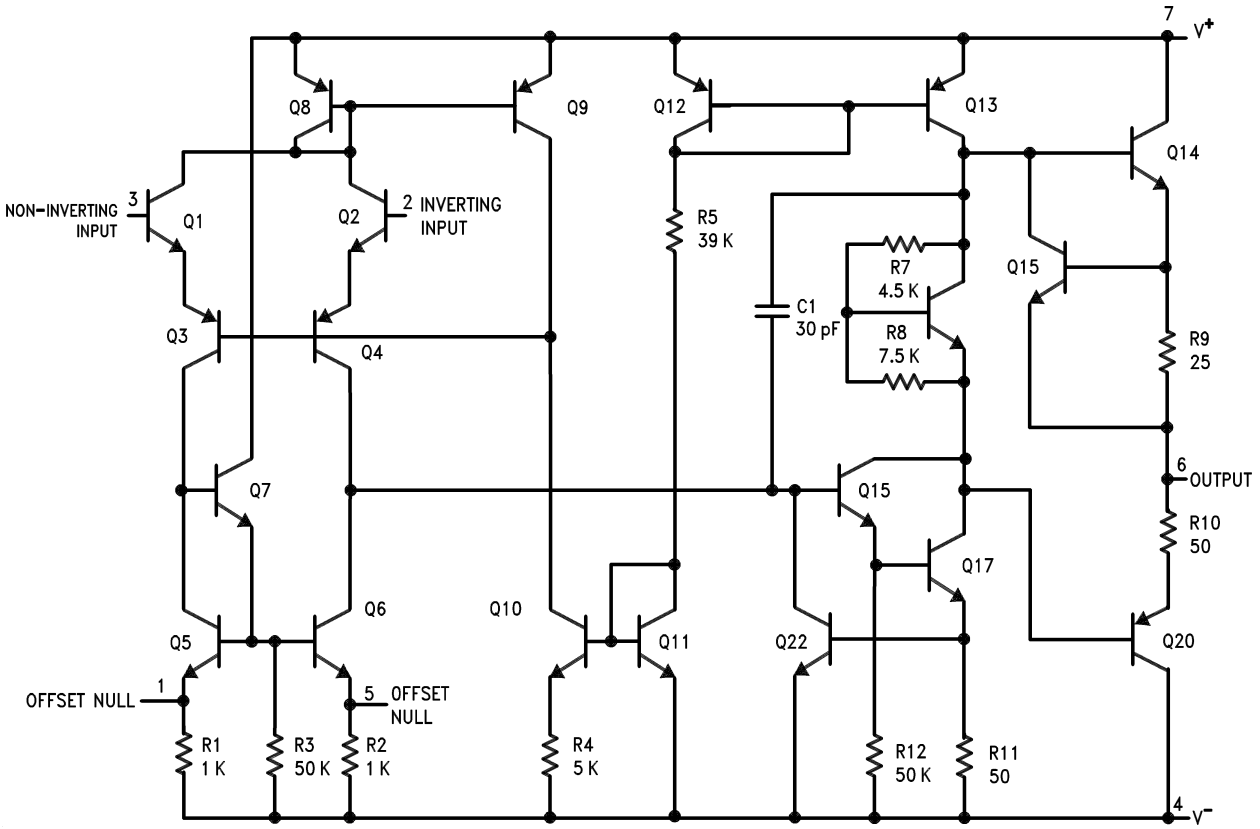


Figure 3. Ceramic Flatpak and SOIC Package
See Package Number NAD0010A & NAC0010A

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

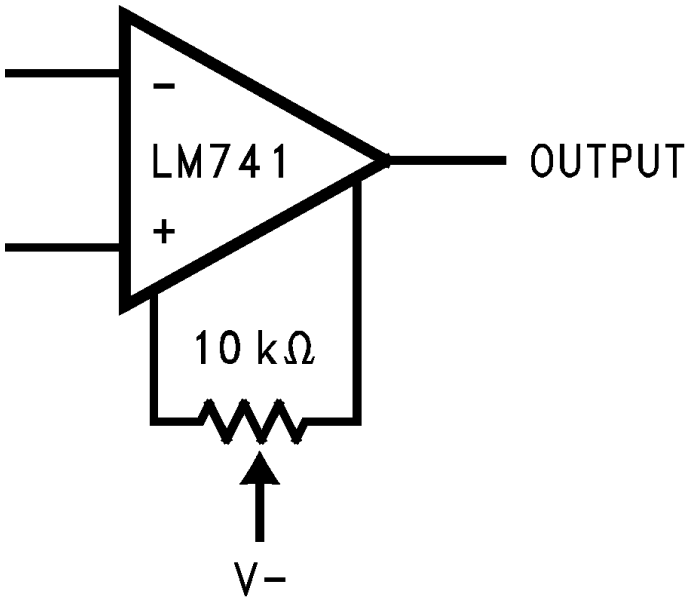


Figure 4. Offset Nulling Circuit

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 part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LM741 MD8	Active	Production	DIESALE (Y) | 0	400 | JEDEC TRAY (5+1)	Yes	Call TI	Level-1-NA-UNLIM	-55 to 125	
LM741H/883	Active	Production	TO-99 (LMC) | 8	20 | JEDEC TRAY (5+1)	Yes	Call TI	Level-1-NA-UNLIM	-55 to 125	LM741H/883 Q ACO LM741H/883 Q >T
LM741J/883	Active	Production	CDIP (NAB) | 8	40 | TUBE	No	SNPB	Level-1-NA-UNLIM	-55 to 125	LM741J /883 Q ACO /883 Q >T

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

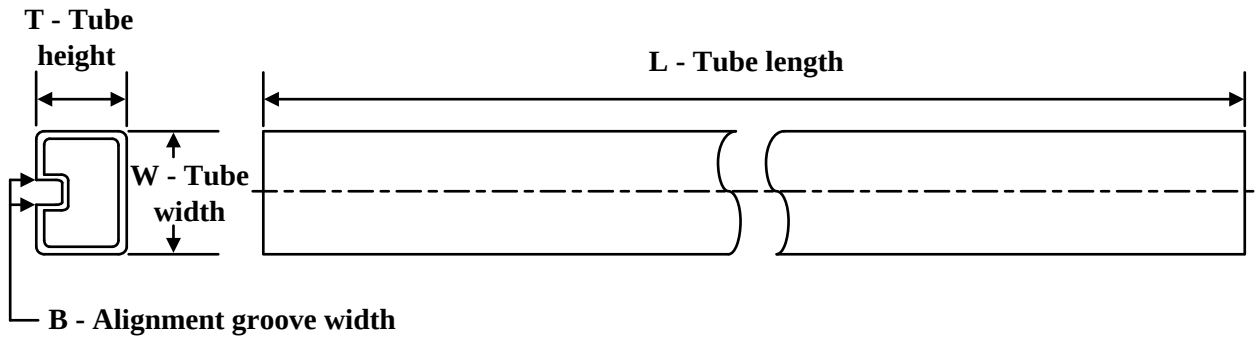
(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

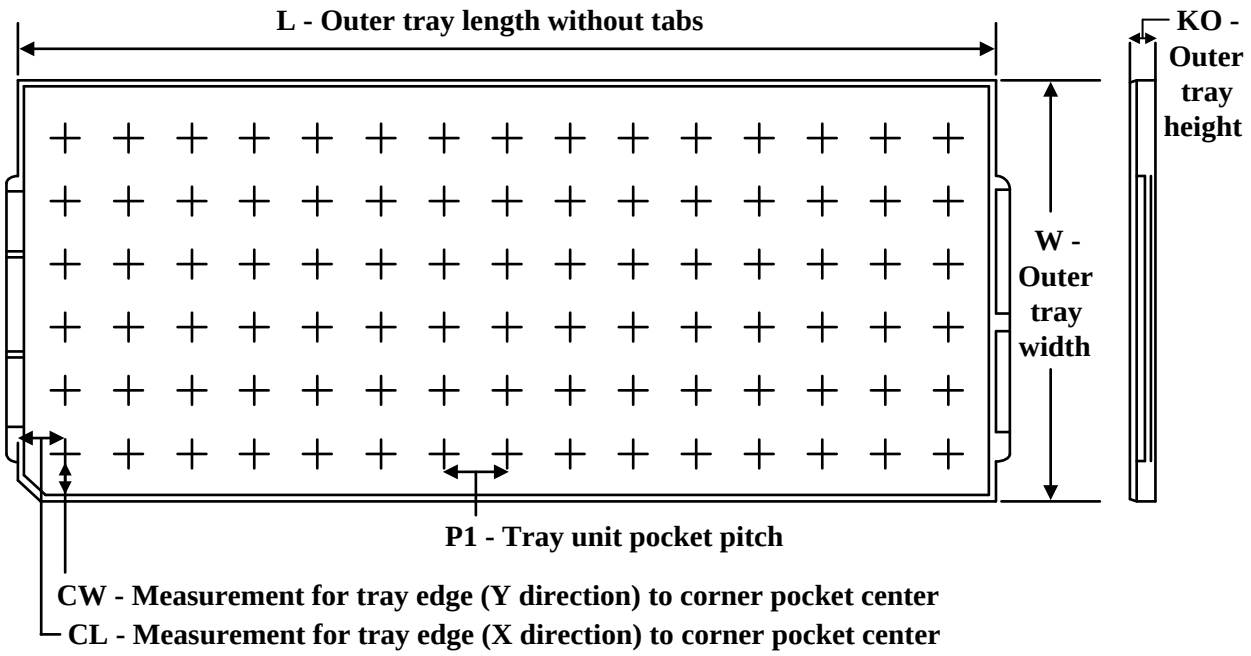
TUBE



*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

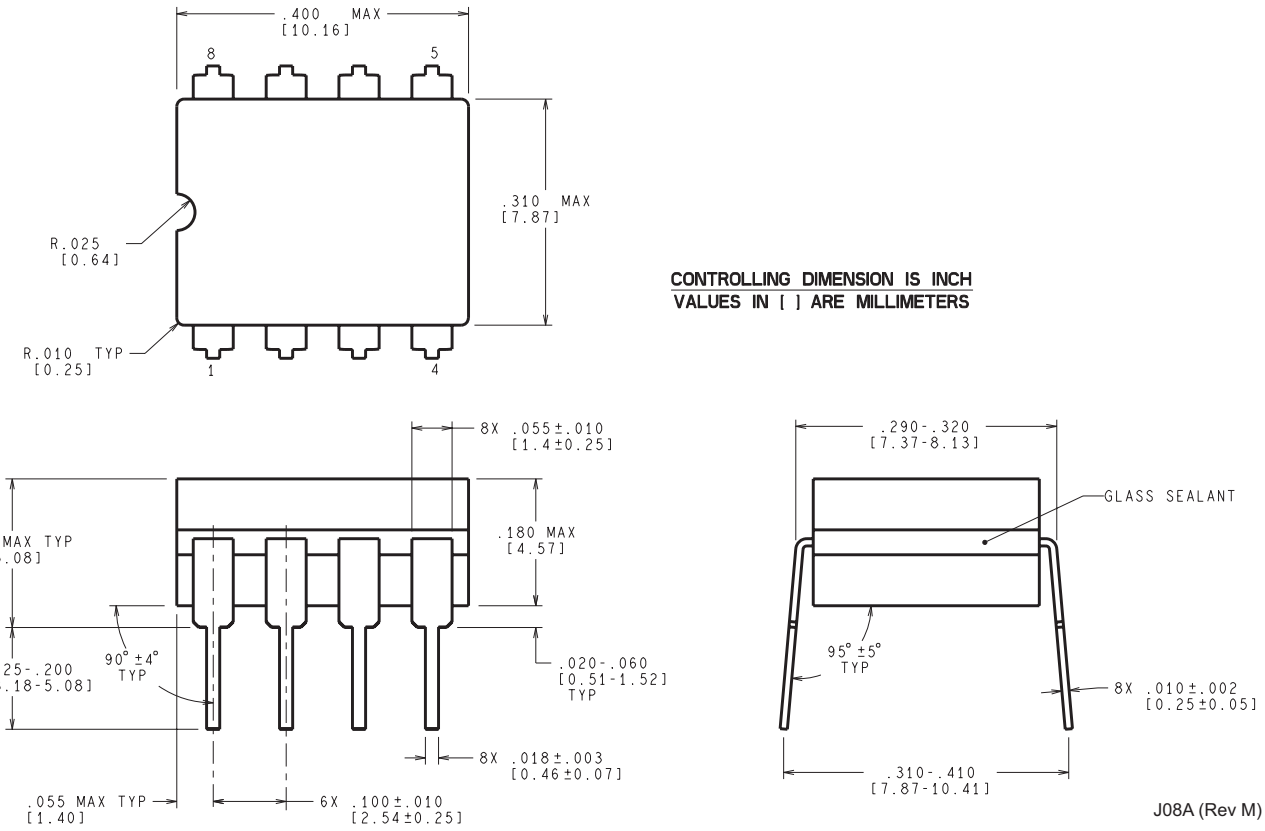


Chamfer on Tray corner indicates Pin 1 orientation of packed units.

*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

NAB0008A

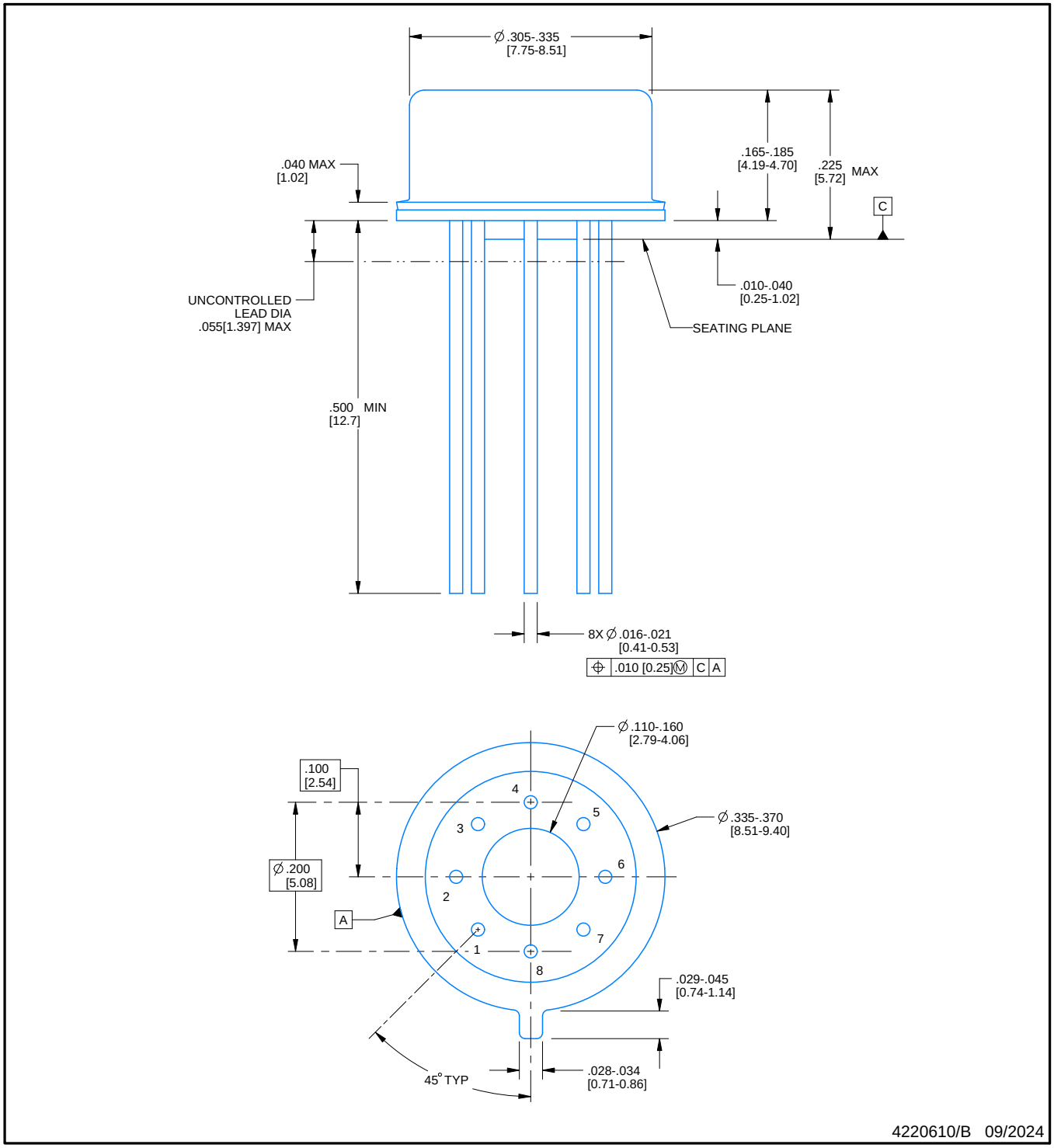

.400 MAX
[10.16]
8
5
.310 MAX
[7.87]
R.025
[0.64]
R.010 TYP
[0.25]
1
4
CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS
8X .055±.010
[1.4±0.25]
.200 MAX TYP
[5.08]
.180 MAX
[4.57]
8X .125-.200
[3.18-5.08]
90° ±4°
TYP
.020-.060
[0.51-1.52]
TYP
8X .018±.003
[0.46±0.07]
.055 MAX TYP
[1.40]
6X .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)

PACKAGE OUTLINE

LMC0008A

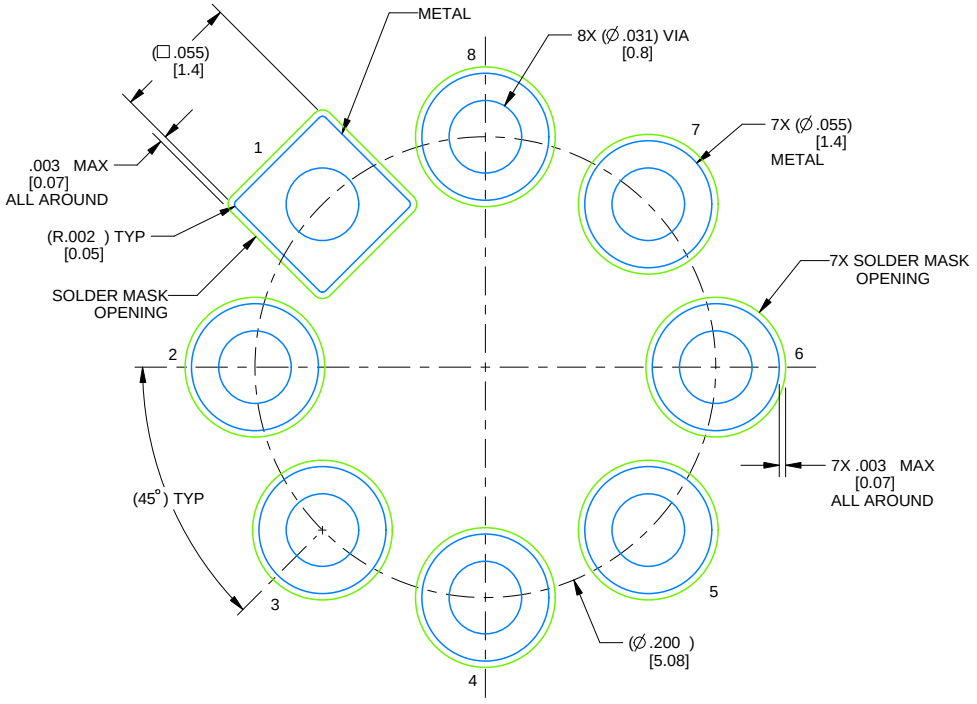
TO-CAN - 5.72 mm max height

TRANSISTOR OUTLINE



NOTES:

1. All linear dimensions are in inches [millimeters]. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Pin numbers shown for reference only. Numbers may not be marked on package.
4. Reference JEDEC registration MO-002/TO-99.



LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE: 12X

4220610/B 09/2024

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