

# LM741QML

## Operational Amplifier

### General 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.

### Features

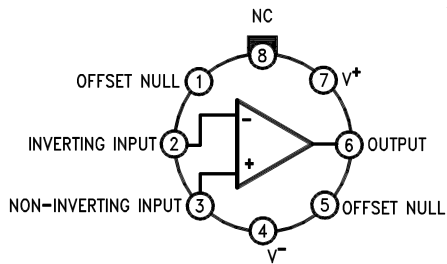
The amplifier offers many features which make their application nearly foolproof: overload protection on the input and output, no latch-up when the common mode range is exceeded, as well as freedom from oscillations.

### Ordering Information

NS Part Number	JAN Part Number	NS Package Number	Package Description
LM741H/883		H08C	8 LD Metal Can
LM741J/883		J08A	8LD CERDIP
LM741W/883		W10A	10LD CERPACK
LM741WG/883		WG10A	10LD Ceramic SOIC

### Connection Diagrams

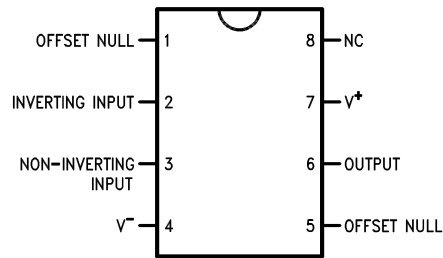
**Metal Can Package**



20143902

See NS Package Number H08C

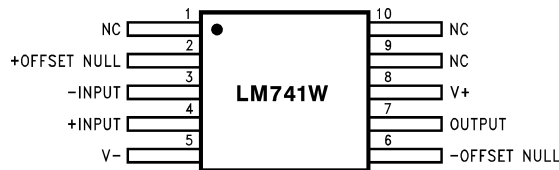
**Dual-In-Line Package**



20143903

See NS Package Number J08A

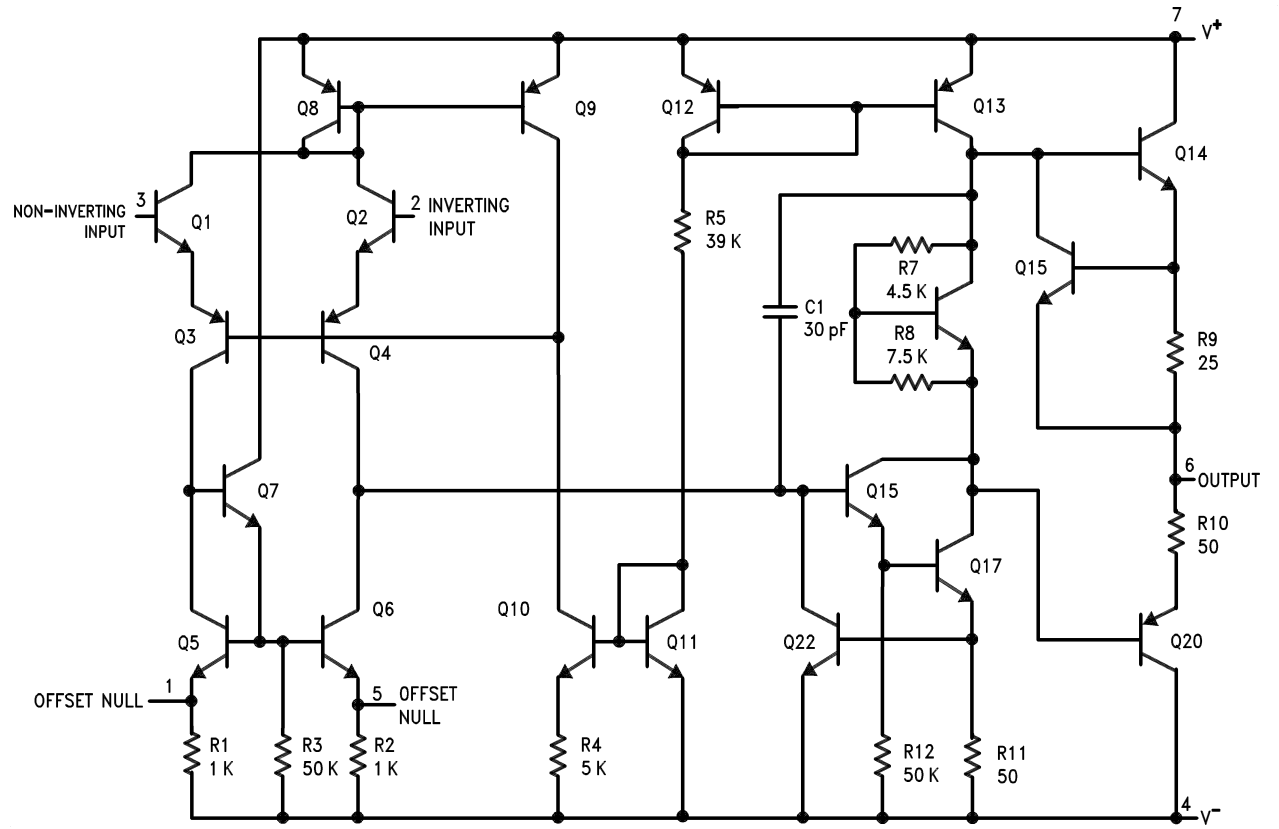
**Ceramic Flatpak and SOIC Package**



20143906

See NS Package Number W10A & WG10A

## Schematic Diagram



20143901

## Absolute Maximum Ratings (Note 1)

Supply Voltage	±22V
Power Dissipation (Note 2)	500 mW
Differential Input Voltage	±30V
Input Voltage (Note 3)	±15V
Output Short Circuit Duration	Continuous
Operating Temperature Range	-55°C ≤ T <sub>A</sub> ≤ +125°C
Storage Temperature Range	-65°C ≤ T <sub>A</sub> ≤ +150°C
Junction Temperature (T <sub>J</sub> )	150°C
Lead Temperature (Soldering, 10 Seconds)	300°C
Thermal Resistance	
θ <sub>JA</sub>	
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 <sub>JC</sub>	
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 (Note 4)	400V

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

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
$\pm I_{IB}$	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
		$V_{CC} = \pm 5V$		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 $10V$	(Note 7)	50		V/mV	1
			(Note 7)	25		V/mV	2, 3
$-A_{VS}$	Open Loop Voltage Gain	$R_L = 2K\Omega$ , $V_O = 0$ to $-10V$	(Note 7)	50		V/mV	1
			(Note 7)	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
$+V_{Opp}$	Output Voltage Swing	$R_L = 10K\Omega$		12		V	1, 2, 3
		$R_L = 2K\Omega$		10		V	1, 2, 3
		$V_{CC} = \pm 20V$ , $R_L = 10K\Omega$		16		V	1, 2, 3
		$V_{CC} = \pm 20V$ , $R_L = 2K\Omega$		15		V	1, 2, 3

## Electrical Characteristics (Continued)

### 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	$R_L = 10K\Omega$			-12	V	1, 2, 3
		$R_L = 2K\Omega$			-10	V	1, 2, 3
		$V_{CC} = \pm 20V$ , $R_L = 10K\Omega$			-16	V	1, 2, 3
		$V_{CC} = \pm 20V$ , $R_L = 2K\Omega$			-15	V	1, 2, 3
$R_i$	Input Resistance		(Note 6)	0.3		M $\Omega$	1
$V_i$	Input Voltage Range	$V_{CC} = \pm 15V$	(Note 5)	$\pm 12$		V	1, 2, 3
$V_o$	Output Voltage Swing	$V_{CC} = \pm 5V$	(Note 6)	$\pm 2.0$		V	1, 2, 3

### 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/ $\mu$ S	7
-SR	Slew Rate	$V_i = 5V$ to $-5V$ , $A_v = 1$ , $R_L = 2K\Omega$		0.2		V/ $\mu$ S	7
$t_R$	Rise Time	$R_L = 2K\Omega$ , $A_v = 1$ , $C_L = 100pF$			1.0	$\mu$ 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	-

**Note 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.

**Note 2:** The maximum power dissipation must be derated at elevated temperatures and is dictated by  $T_{Jmax}$  (maximum junction temperature),  $\theta_{JA}$  (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.

**Note 3:** For supply voltages less than  $\pm 15V$ , the absolute maximum input voltage is equal to the supply voltage.

**Note 4:** Human body model, 1.5 k $\Omega$  in series with 100 pF.

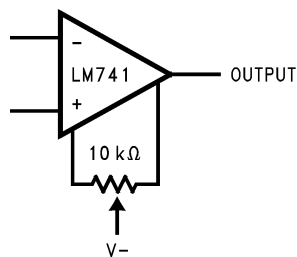
**Note 5:** Guaranteed by CMRR,  $I_{IB}$ ,  $I_{IO}$ ,  $V_{IO}$

**Note 6:** Guaranteed parameter, not tested.

**Note 7:** Datalog reading in K = V/mV

## Typical Application

Offset Nulling Circuit

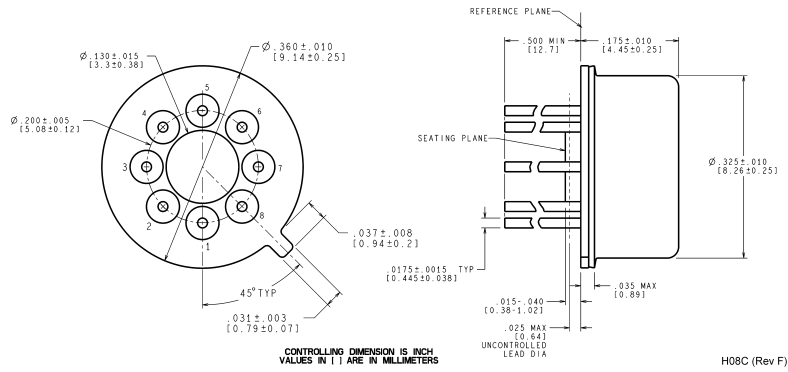


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## Revision History

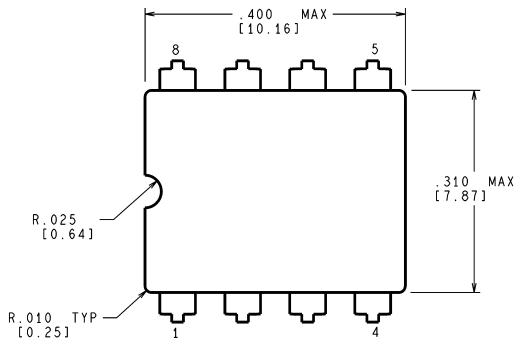
Date Released	Revision	Section	Originator	Changes
08/22/05	A	New Release to the corporate format	L. Lytle	1 MDS datasheet converted into one corporate datasheet format. Since drift is not performed on 883 product, the table was removed. MNLM741-X Rev 1A0 will be archived.

**Physical Dimensions** inches (millimeters) unless otherwise noted

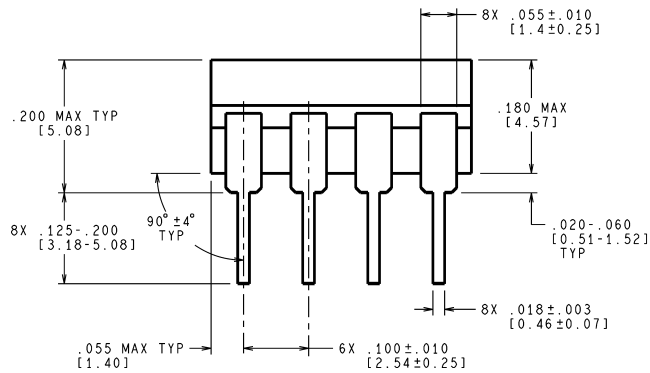


**Metal Can Package (H)**  
NS Package Number H08C

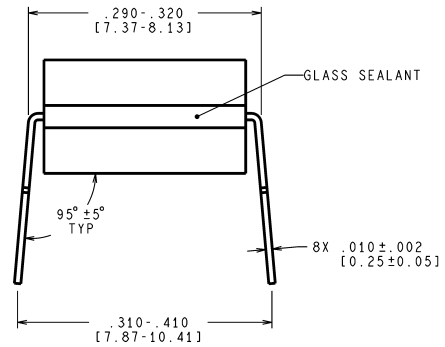
H08C (Rev F)



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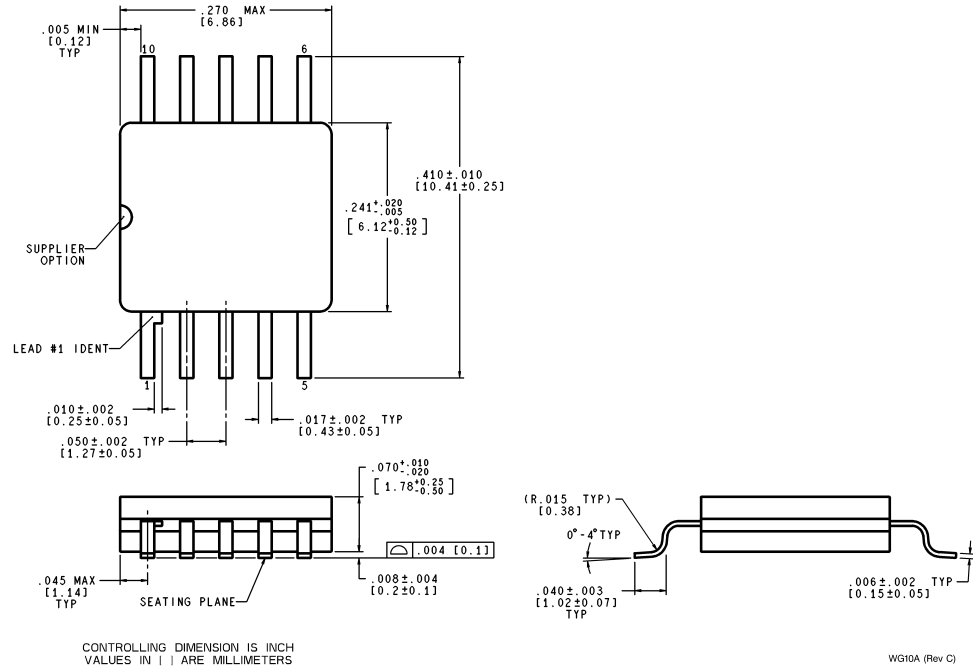


**Ceramic Dual-In-Line Package (J)**  
NS Package Number J08A

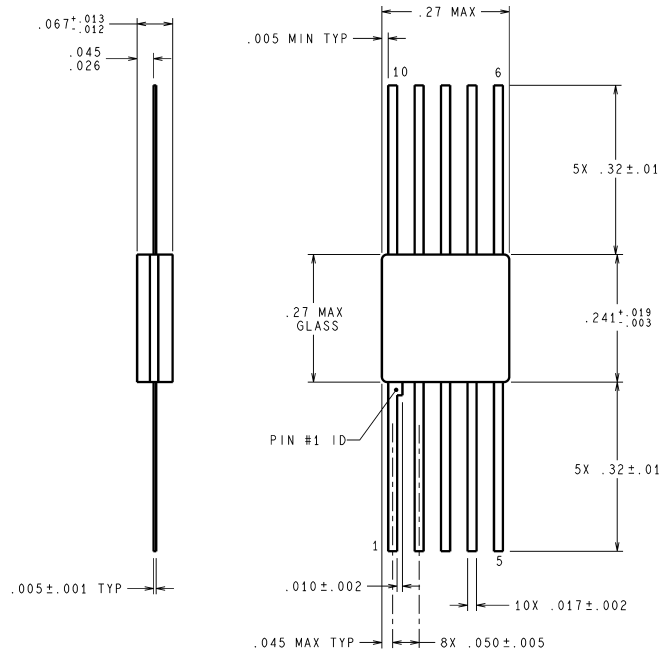


J08A (Rev M)

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**10-Lead Ceramic SOIC (WG)**  
NS Package Number WG10A



**10-Lead Ceramic Flatpak (W)**  
NS Package Number W10A



## Notes

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