

# 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**

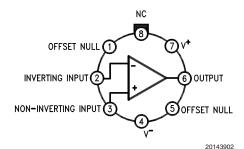
The amplifier offers many features which make their application nearly foolproof: overload protection on the input and output, no latch-up when the common mode range is exceeded, as well as freedom from oscillations.

### **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

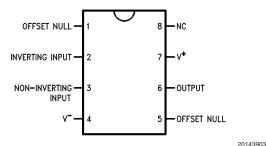
## **Connection Diagrams**

#### Metal Can Package



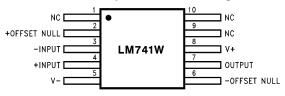
See NS Package Number H08C

#### **Dual-In-LinePackage**



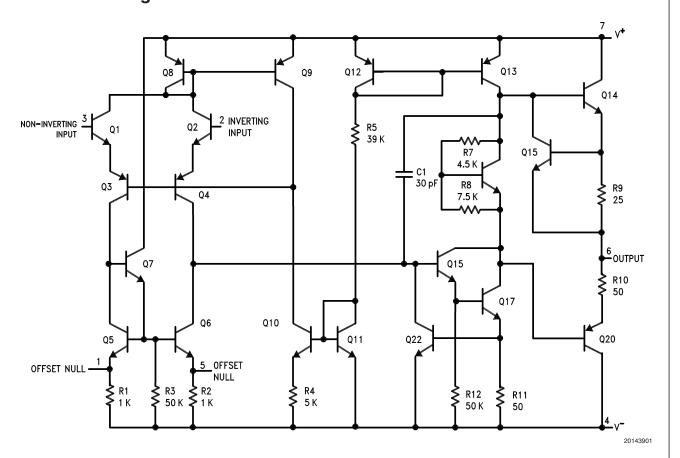
See NS Package Number J08A

#### Ceramic Flatpak and SOIC Package



See NS Package Number W10A & WG10A

## **Schematic Diagram**



## **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  $-55^{\circ}C \leq T_{A} \leq +125^{\circ}C$ Operating Temperature Range Storage Temperature Range  $-65^{\circ}C \le T_A \le +150^{\circ}C$ Junction Temperature (T<sub>J</sub>) 150°C Lead Temperature (Soldering, 10 Seconds) 300°C Thermal Resistance  $\theta_{\mathsf{JA}}$ 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  $\theta_{\text{JC}}$ 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

## **Quality Conformance Inspection**

Mil-Std-883, Method 5005 - Group A

Ceramic SOIC

ESD Tolerance (Note 4)

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

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225mg

400V

## **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 <sub>IO</sub>	Input Offset Voltage	V <sub>CM</sub> = -12V		-5.0	5.0	mV	1
				-6.0	6.0	mV	2, 3
		V <sub>CM</sub> = 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
		$+V_{CC} = \pm 5V$		-5.0	5.0	mV	1
				-6.0	6.0	mV	2, 3
-V <sub>IO</sub> Adj	Offset Null				-6.0	mV	1, 2, 3
+V <sub>IO</sub> Adj	Offset Null			6.0		mV	1, 2, 3
I <sub>IO</sub>	Input Offset Current	V <sub>CM</sub> = -12V		-200	200	nA	1
				-500	500	nA	2, 3
		V <sub>CM</sub> = 12V		-200	200	nA	1
				-500	500	nA	2, 3
				-200	200	nA	1
				-500	500	nA	2, 3
		$V_{CC} = \pm 5V$		-200	200	nA	1
				-500	500	nA	2, 3
±I <sub>IB</sub>	Input Bias Current	V <sub>CM</sub> = -12V		0.0	500	nA	1
				0.0	1500	nA	2, 3
		V <sub>CM</sub> = 12V		0.0	500	nA	1
				0.0	1500	nA	2, 3
				0.0	500	nA	1
				0.0	1500	nA	2, 3
		$V_{CC} = \pm 5V$		0.0	500	mA	1
				0.0	1500	nA	2, 3
I <sub>CC</sub>	Power Supply Current				2.8	mA	1
					2.5	mA	2
					3.5	mA	3
+A <sub>VS</sub>	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 <sub>VS</sub>	Open Loop Voltage Gain	$R_L = 2K\Omega, V_O = 0 \text{ to } -10V$	(Note 7)	50		V/mV	1
			(Note 7)	25		V/mV	2, 3
+PSRR	Power Supply Rejection Ratio	$+V_{CC} = 15V \text{ to } 5V, -V_{CC} = -15V$		77		dB	1, 2, 3
-PSRR	Power Supply Rejection Ratio	$-V_{CC} = -15V \text{ to } -5V,$		77		dB	1, 2, 3
CMRR	Common Mode Rejection Ratio	$+V_{CC} = +15V$ $-12V \le V_{CM} \le 12V$		70		dB	1, 2, 3
+l <sub>os</sub>	Output Short Circuit Current	-16 v > vCM > 16 v		-45	-5.0	mA	1, 2, 3
TIOS	Sulput Short Circuit Current			-45	-5.0 -5.0	mA	3
-l	Output Short Circuit Current			5.0	45	mA	1,2
-l <sub>os</sub>	Catput Offort Offort Ouriefft			5.0	50	mA	3
+V <sub>Opp</sub>	Output Voltage Swing	$R_L = 10K\Omega$		12	50	V	1, 2, 3
т • Орр	Output voltage Swilly	$R_L = 10K\Omega$		10		V	-
						V	1, 2, 3
		$V_{CC} = \pm 20V, R_L = 10K\Omega$		16			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 <sub>Opp</sub>	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 <sub>I</sub>	Input Resistance		(Note 6)	0.3		MΩ	1
V <sub>I</sub>	Input Voltage Range	V <sub>CC</sub> = ± 15V	(Note 5)	±12		V	1, 2, 3
Vo	Output Voltage Swing	$V_{CC} = \pm 5V$	(Note 6)	±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/µS	7
-SR	Slew Rate	$V_I = 5V$ to -5V, $A_V = 1$ , $R_L = 2K\Omega$		0.2		V/µS	7
t <sub>R</sub>	Rise Time	$R_L = 2K\Omega, A_V = 1, C_L = 100pF$			1.0	μS	7
OS	Overshoot	$R_L = 2K\Omega, A_V = 1, C_L = 100pF$			30	%	7
GBW	Gain Bandwidth	$V_I = 50 \text{mV}_{\text{RMS}}, f = 20 \text{KHz}, R_L$ = $2 \text{K}\Omega$		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 ±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.

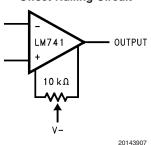
Note 5: Guaranteed by CMRR,  $I_{IB}$ ,  $I_{IO}$ ,  $V_{IO}$ 

Note 6: Guaranteed parameter, not tested.

Note 7: Datalog reading in K = V/mV

## **Typical Application**

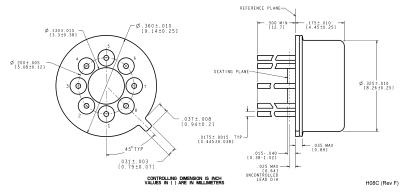
#### Offset Nulling Circuit



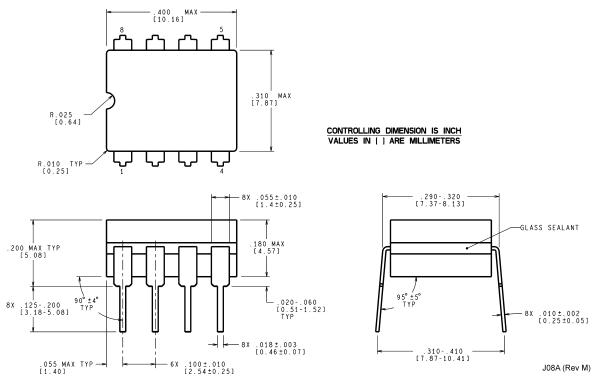
## **Revision History**

Date	Revision	Section	Originator	Changes
Released				
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

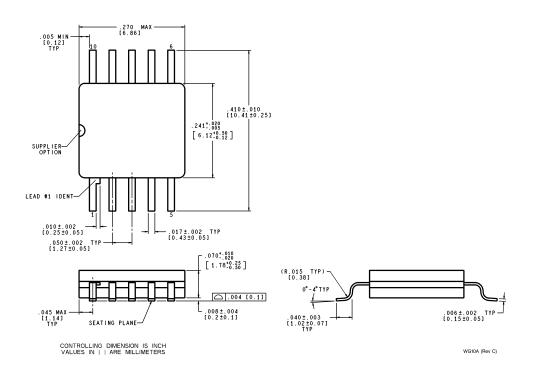


Metal Can Package (H) NS Package Number H08C

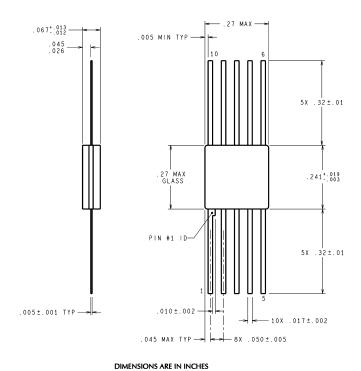


Ceramic Dual-In-Line Package (J) NS Package Number J08A

## 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

W10A (Rev H)

#### **Notes**

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