

PART NUMBER

LM709HB-ROCS

Rochester Electronics

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Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-38535
 - Class Q Military
 - Class V Space Level

Qualified Suppliers List of Distributors (QSLD)

- Rochester is a critical supplier to DLA and meets all industry and DLA standards.

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The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OCM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

LM709

LM709 Operational Amplifier



Literature Number: SNOS659A

LM709 Operational Amplifier

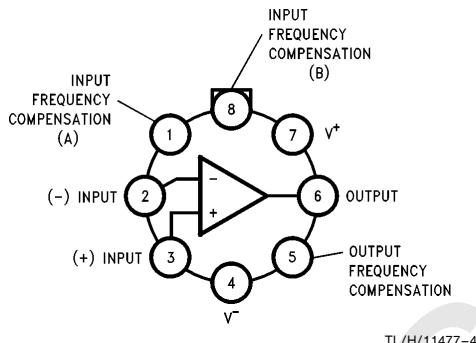
General Description

The LM709 series is a monolithic operational amplifier intended for general-purpose applications. Operation is completely specified over the range of voltages commonly used for these devices. The design, in addition to providing high gain, minimizes both offset voltage and bias currents. Further, the class-B output stage gives a large output capability with minimum power drain.

External components are used to frequency compensate the amplifier. Although the unity-gain compensation network specified will make the amplifier unconditionally stable in all feedback configurations, compensation can be tailored to optimize high-frequency performance for any gain setting. The LM709C is the commercial-industrial version of the LM709. It is identical to the LM709 except that it is specified for operation from 0°C to +70°C.

Connection Diagrams

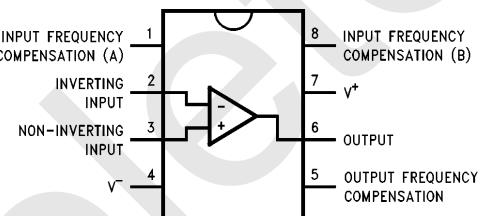
Metal Can Package



TL/H/11477-4

Order Number LM709AH, LM709H or LM709CH
See NS Package Number H08C

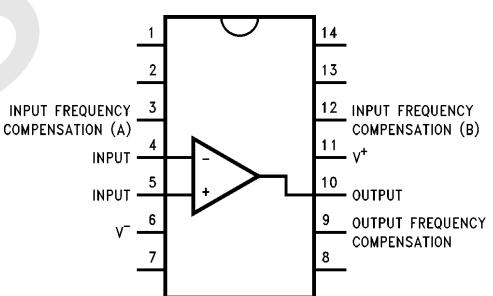
Dual-In-Line Package



TL/H/11477-6

Order Number LM709CN-8
See NS Package Number N08E

Dual-In-Line Package



TL/H/11477-5

Order Number LM709CN
See NS Package Number N14A

Absolute Maximum Ratings (Note 3)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	LM709/LM709A/LM709C	$\pm 18V$
Power Dissipation (Note 1)	LM709/LM709A	300 mW
	LM709C	250 mW
Differential Input Voltage	LM709/LM709A/LM709C	$\pm 5V$
Input Voltage	LM709/LM709A/LM709C	$\pm 10V$
Output Short-Circuit Duration (T _A = +25°C)	LM709/LM709A/LM709C	5 seconds

Storage Temperature Range
LM709/LM709A/LM709C $-65^{\circ}C$ to $+150^{\circ}C$

Lead Temperature (Soldering, 10 sec.)
LM709/LM709A/LM709C $300^{\circ}C$

Operating Ratings (Note 3)

Junction Temperature Range (Note 1)

LM709/LM709A $-55^{\circ}C$ to $+150^{\circ}C$
LM709C $0^{\circ}C$ to $+100^{\circ}C$

Thermal Resistance (θ_{JA})
H Package $150^{\circ}C/W$, (θ_{JC}) $45^{\circ}C/W$
8-Pin N Package $134^{\circ}C/W$
14-Pin N Package $109^{\circ}C/W$

Electrical Characteristics (Note 2)

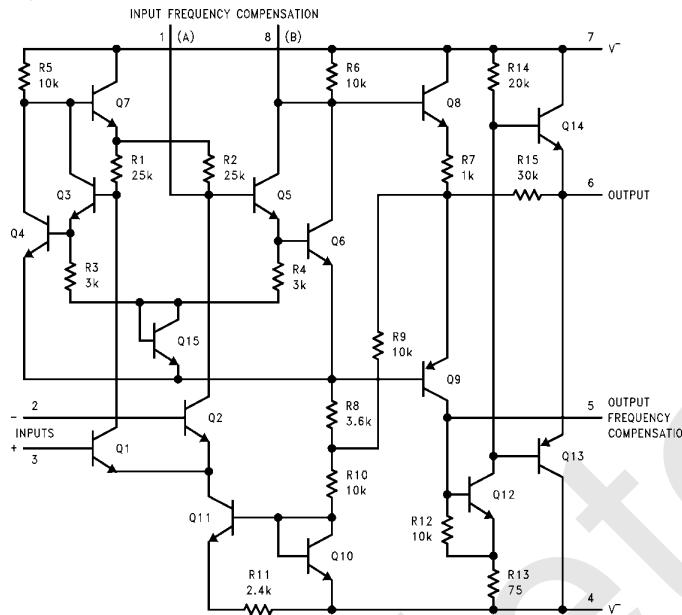
Parameter	Conditions	LM709A			LM709			LM709C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	T _A = 25°C, R _S $\leq 10\text{k}\Omega$	0.6	2.0		1.0	5.0		2.0	7.5		mV
Input Bias Current	T _A = 25°C	100	200		200	500		300	1500		nA
Input Offset Current	T _A = 25°C	10	50		50	200		100	500		nA
Input Resistance	T _A = 25°C	350	700		150	400		50	250		k Ω
Output Resistance	T _A = 25°C	150			150			150			Ω
Supply Current	T _A = 25°C, V _S = $\pm 15V$	2.5	3.6		2.6	5.5		2.6	6.6		mA
Transient Response	V _{IN} = 20 mV, C _L $\leq 100\text{ pF}$										
Risetime	T _A = 25°C	1.5			0.3	1.0		0.3	1.0		μs
Overshoot		30			10	30		10	30		%
Slew Rate	T _A = 25°C	0.25			0.25			0.25			V/ μs
Input Offset Voltage	R _S $\leq 10\text{k}\Omega$		3.0			6.0			10		mV
Average Temperature Coefficient of Input Offset Voltage	R _S = 50 Ω T _A = 25°C to T _{MAX}	1.8	10		3.0			6.0			
	T _A = 25°C to T _{MIN}	1.8	10		6.0			12			
	R _S = 10 k Ω T _A = 25°C to T _{MAX}	2.0	15								$\mu\text{V/}^{\circ}\text{C}$
	T _A = 25°C to T _{MIN}	4.8	25								
Large Signal Voltage Gain	V _S = $\pm 15V$, R _L $\geq 2\text{k}\Omega$ V _{OUT} = $\pm 10V$	25	70	25	45	70	15	45			V/mV
Output Voltage Swing	V _S = $\pm 15V$, R _L = 10 k Ω V _S = $\pm 15V$, R _L = 2 k Ω	± 12	± 14	± 12	± 14		± 12	± 14			V
		± 10	± 13	± 10	± 13		± 10	± 13			
Input Voltage Range	V _S = $\pm 15V$	± 8		± 8	± 10		± 8	± 10			V
Common-Mode Rejection Ratio	R _S $\leq 10\text{k}\Omega$	80	110	70	90		65	90			dB
Supply Voltage Rejection Ratio	R _S $\leq 10\text{k}\Omega$		40	100	25	150		25	200		$\mu\text{V/V}$
Input Offset Current	T _A = T _{MAX}	3.5	50	20	200		75	400			nA
	T _A = T _{MIN}	40	250	100	500		125	750			
Input Bias Current	T _A = T _{MIN}	0.3	0.6	0.5	1.5		0.36	2.0			μA
Input Resistance	T _A = T _{MIN}	85	170	40	100		50	250			k Ω

Note 1: For operating at elevated temperatures, the device must be derated based on a $150^{\circ}C$ maximum junction temperature for LM709/LM709A and $100^{\circ}C$ maximum for L709C. For operating at elevated temperatures, the device must be derated based on thermal resistance θ_{JA} , T_{J(MAX)} and T_A.

Note 2: These specifications apply for $-55^{\circ}C \leq T_A \leq +125^{\circ}C$ for the LM709/LM709A and $0^{\circ}C \leq T_A \leq +70^{\circ}C$ for the LM709C with the following conditions:
 $\pm 9V \leq V_S \leq \pm 15V$, C₁ = 5000 pF, R₁ = 1.5 k Ω , C₂ = 200 pF and R₂ = 51 Ω .

Note 3: Absolute Maximum Ratings indicate limits which if exceeded may result in damage. Operating Ratings are conditions where the device is expected to be functional but not necessarily within the guaranteed performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics.

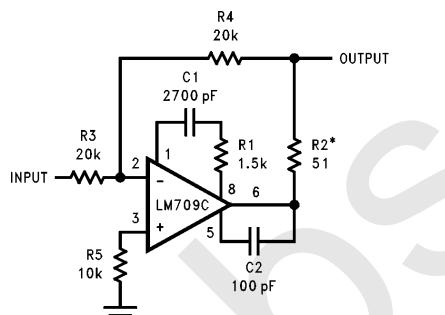
Schematic Diagram**



TL/H/11477-1

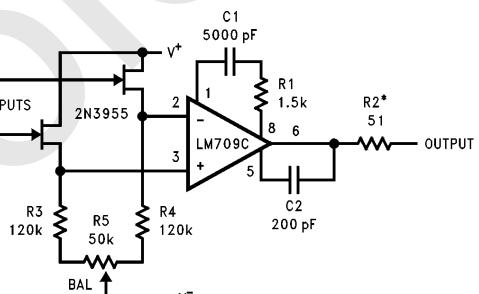
Typical Applications**

Unity Gain Inverting Amplifier



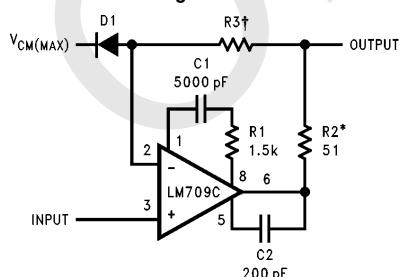
TL/H/11477-2

FET Operational Amplifier



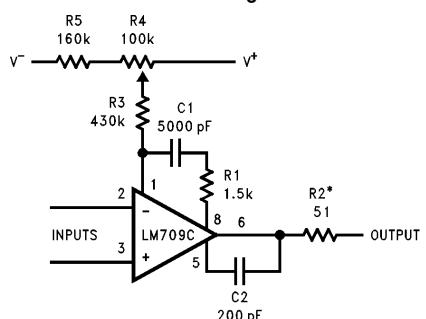
TL/H/11477-3

Voltage Follower



TL/H/11477-7

Offset Balancing Circuit



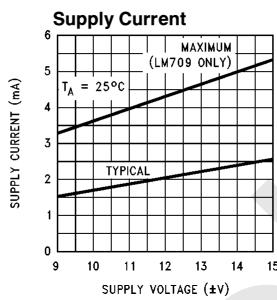
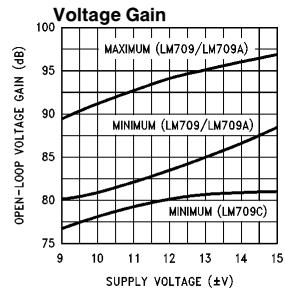
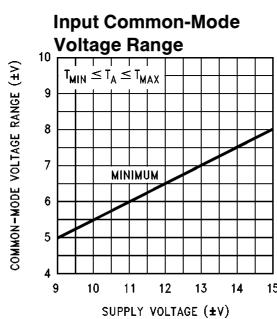
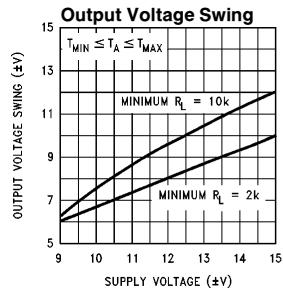
TL/H/11477-8

*To be used with any capacitive loading on output.

**Pin connections shown are for metal can package.

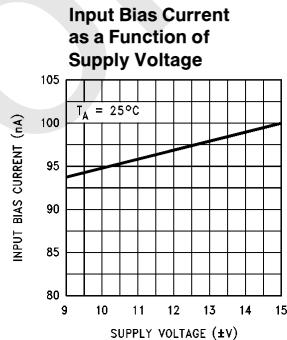
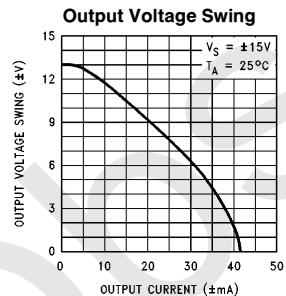
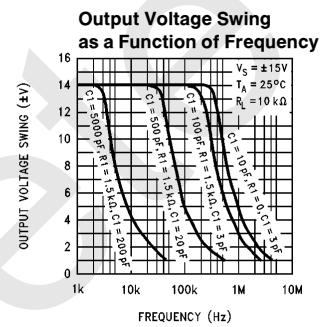
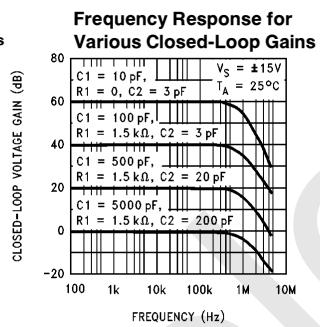
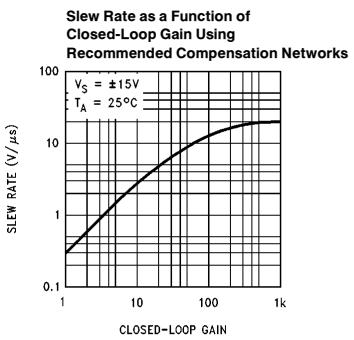
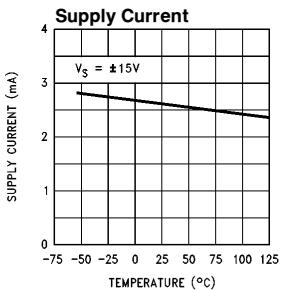
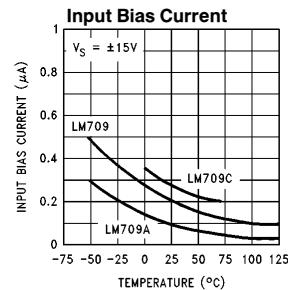
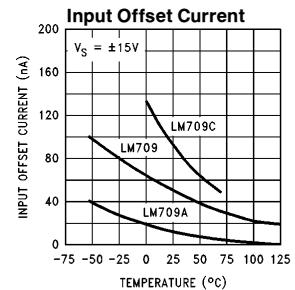
†Should be equal to DC source resistance on input.

Guaranteed Performance Characteristics



TL/H/11477-9

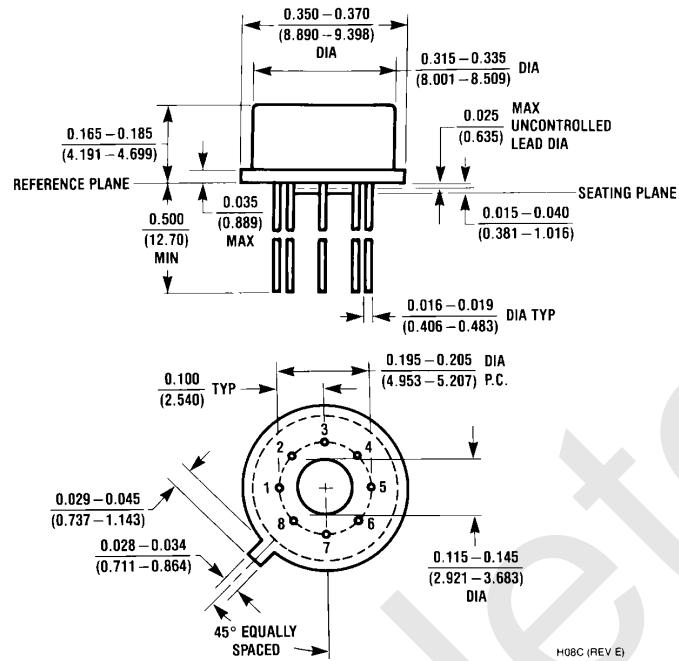
Typical Performance Characteristics



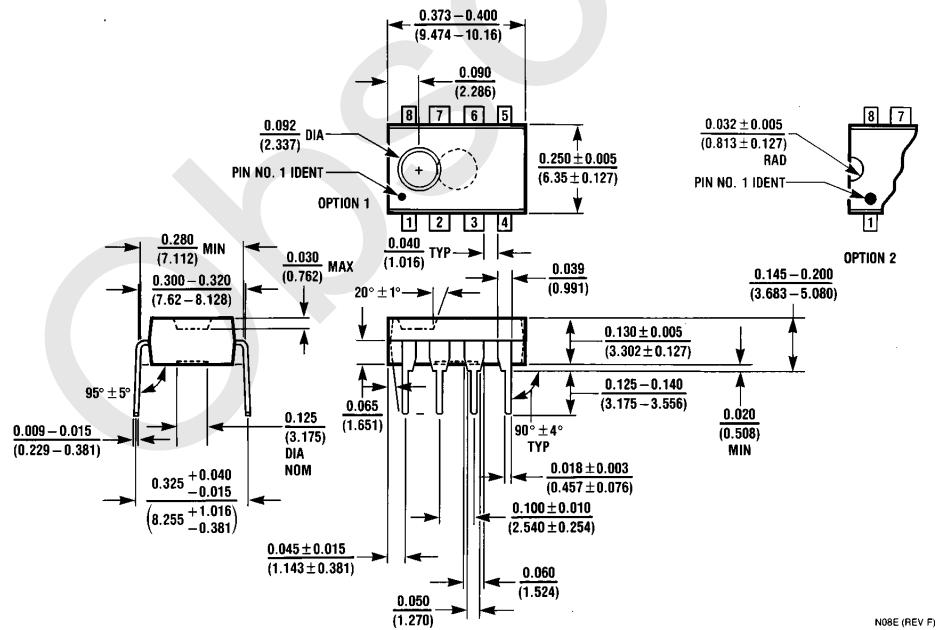
TL/H/11477-10

Obsolete

Physical Dimensions inches (millimeters)

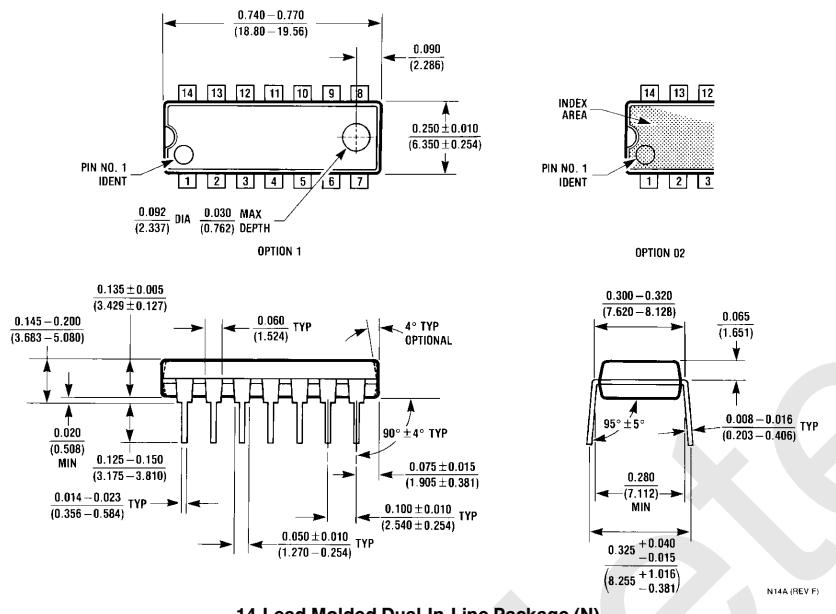


Metal Can Package (H)
Order Number LM709AH, LM709H or LM709CH
NS Package Number H08C



8-Lead Molded Dual-In-Line Package (N)
Order Number LM709CN-8
NS Package Number N08E

Physical Dimensions inches (millimeters) (Continued)



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