Operational Amplifiers

LM709C operational amplifier

general description

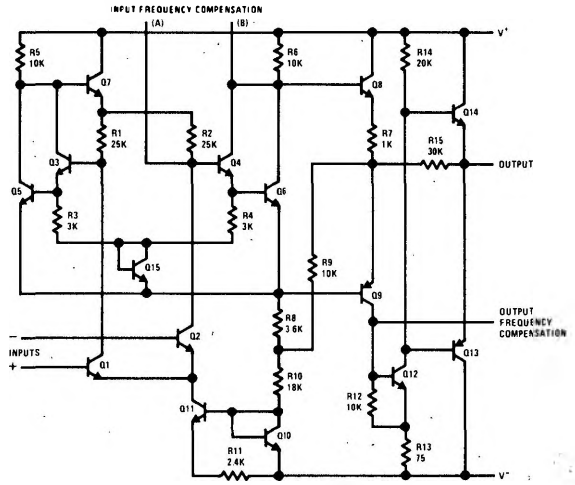
The LM709C is a monolithic operational amplifier intended for general-purpose applications. Operation is completely specified over the range of voltages commonly used for these devices. The design, in addition to providing high gain, minimizes both offset voltage and bias currents. Further, the class-B 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.

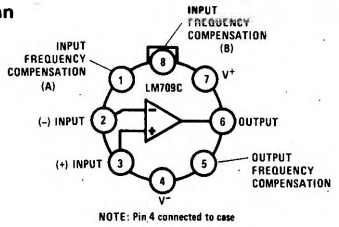
The fact that the amplifier is built on a single silicon ship provides low offset and temperature drift at minimum cost. It also ensures negligible drift due to temperature gradients in the vicinity of the amplifier.

The LM709C is 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.

schematic and connection diagrams

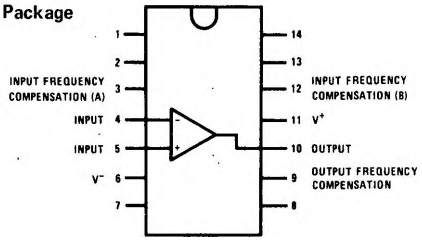


Metal Can



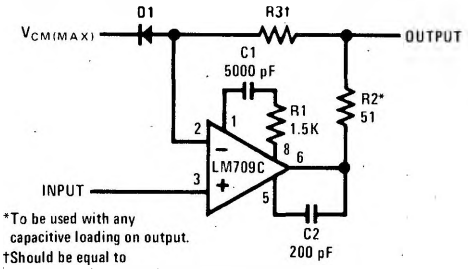
NOTE: Pin 4 connected to case

Dip Package



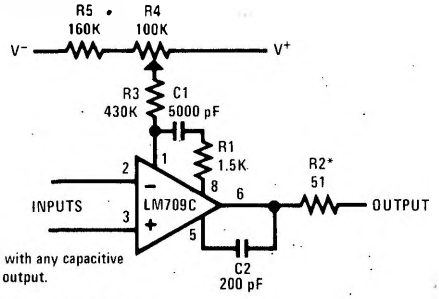
typical applications**

Voltage Follower



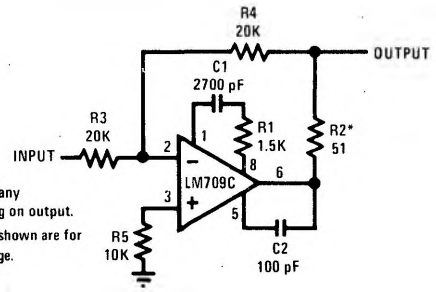
*To be used with any capacitive loading on output.
†Should be equal to dc source resistance on input.

Offset Balancing Circuit



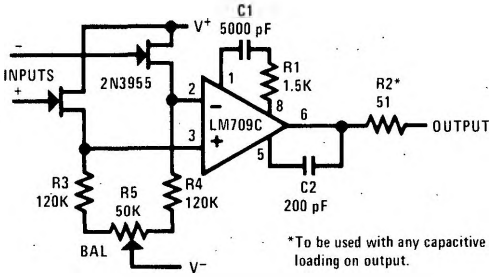
*To be used with any capacitive loading on output.

Unity Gain Inverting Amplifier



*To be used with any capacitive loading on output.
**Pin connections shown are for metal can package.

FET Operational Amplifier



*To be used with any capacitive loading on output.

absolute maximum ratings

Supply Voltage	±18V
Power Dissipation (Note 1)	250 mW
Differential Input Voltage	±5V
Input Voltage	±10V
Output Short-Circuit Duration (T_A = 25°C)	5 sec
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	0°C to +70°C
Lead Temperature (soldering, 60 sec)	300°C

electrical characteristics (Note 2)

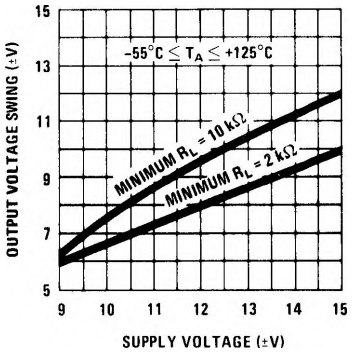
PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
Input Offset Voltage	T_A = 25°C, $R_S \leq$ 10 kΩ		2.0	7.5	mV
Input Offset Current	T_A = 25°C		100	500	nA
Input Bias Current	T_A = 25°C		0.3	1.5	μA
Input Resistance	T_A = 25°C	50	250		kΩ
Output Resistance	T_A = 25°C		150		Ω
Supply Current	T_A = 25°C, V_S = ±15V		2.6	6.6	mA
Transient Response	V_{IN} = 20 mV, $C_L \leq$ 100 pF				
Risetime	T_A = 25°C		0.3	1.0	μs
Overshoot			10	30	%
Slewing Rate	T_A = 25°C		0.25		V/μs
Input Offset Voltage	$R_S \leq$ 10 kΩ			10	mV
Average Temperature Coefficient of Input Offset Voltage	R_S = 50Ω		6.0		μV/°C
	R_S = 10 kΩ		12		μV/°C
Large-Signal Voltage Gain	V_S = ±15V, $R_L \geq$ 2 kΩ V_{OUT} = ±10V	15,000	45,000		
Output Voltage Swing	V_S = ±15V, R_L = 10 kΩ	±12	±14		V
	V_S = ±15V, R_L = 2 kΩ	±10	±13		V
Input Voltage Range	V_S = ±15V	±8.0	±10		V
Common Mode Rejection Ratio	$R_S \leq$ 10 kΩ	65	90		dB
Supply Voltage Rejection Ratio	$R_S \leq$ 10 kΩ		25	200	μV/V
Input Offset Current	T_A = +70°C		75	400	nA
	T_A = 0°C		125	750	nA
Input Bias Current	T_A = 0°C		0.36	2.0	μA

Note 1: For operating at elevated temperatures, the device must be derated based on a 100°C maximum junction temperature and a thermal resistance of 45°C/W junction to case or 150°C/W junction to ambient for the metal can package. For the flat package, the derating is based on a thermal resistance of 185°C/W when mounted on a 1/16-inch-thick, epoxy-glass board with ten, 0.03-inch-wide, 2-ounce copper conductors.

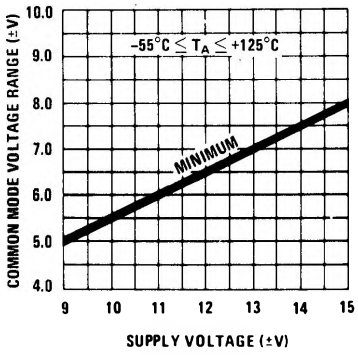
Note 2: These specifications apply for 0°C $\leq T_A \leq$ +70°C, ±9V $\leq V_S \leq$ ±15V, C_1 = 5000 pF, R_1 = 1.5K, C_2 = 200 pF and R_2 = 51Ω unless otherwise specified.

guaranteed performance characteristics

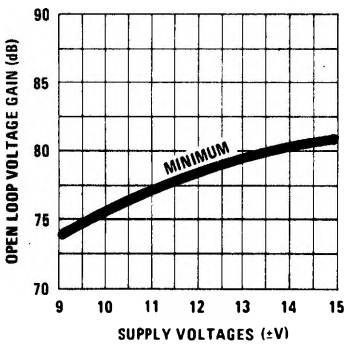
Output Voltage Swing



Input Common Mode Voltage Range

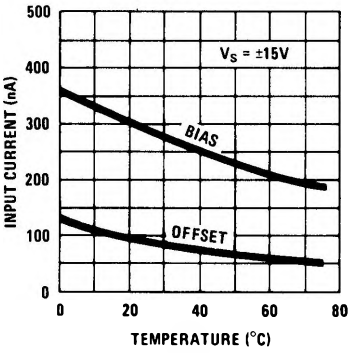


Voltage Gain

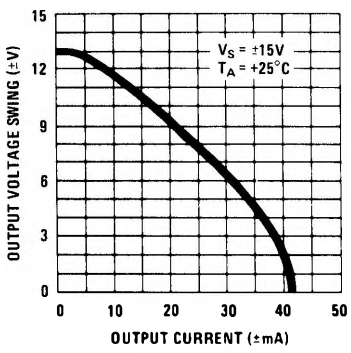


typical performance characteristics

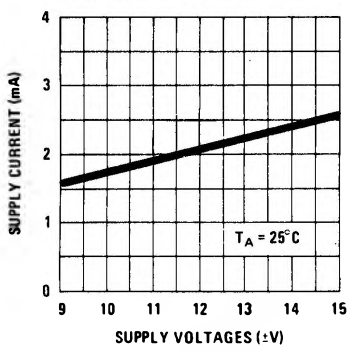
Input Current



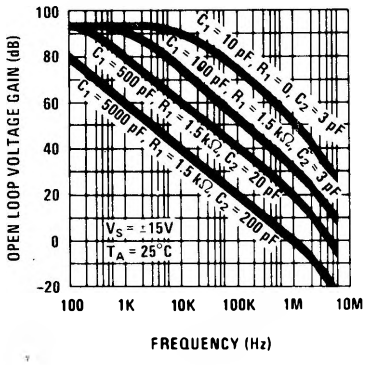
Output Voltage Swing



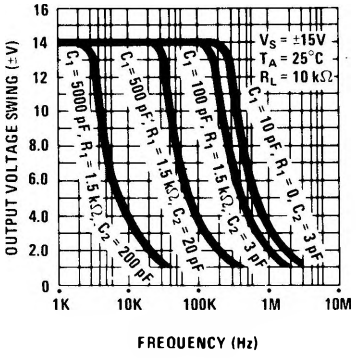
Supply Current



Open Loop Frequency Response



Output Voltage Swing as a Function of Frequency



Voltage Follower Pulse Response