Operational Amplifiers

LM709 operational amplifier

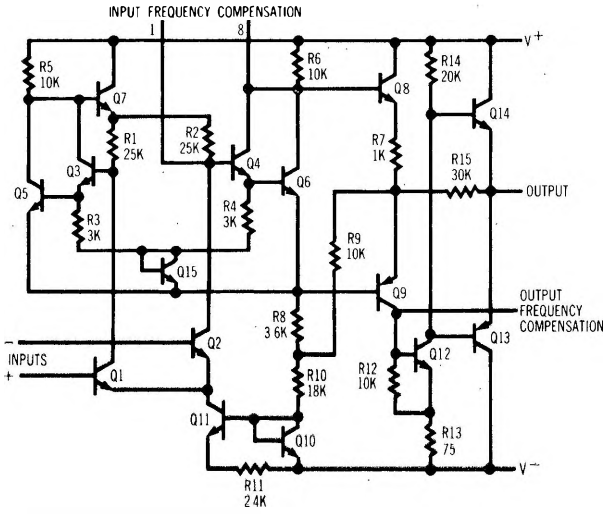
general description

The LM709 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.

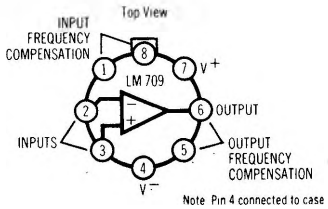
External components are used to frequency compensate the amplifier. Although the unity-gain compensation network specified will make the amplifier unconditionally stable in all feedback configurations, compensation can be tailored to optimize high-frequency performance for any gain setting.

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

schematic and connection diagrams

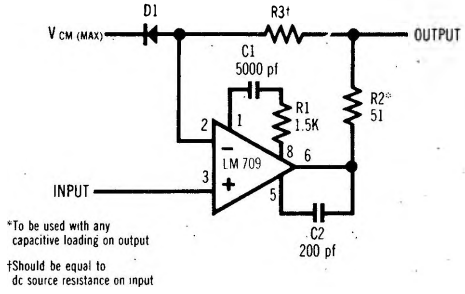


Metal Can

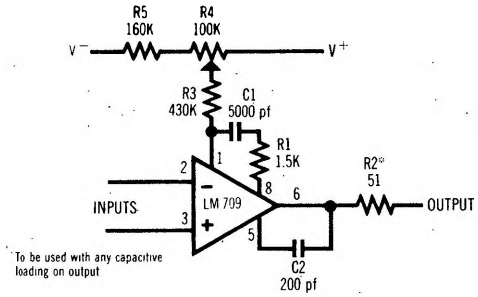


typical applications*

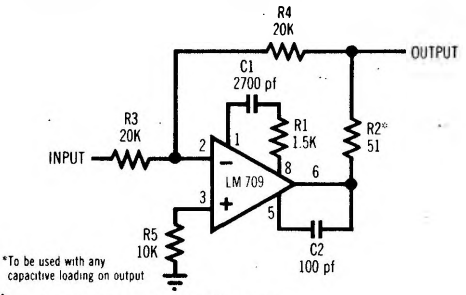
Voltage Follower



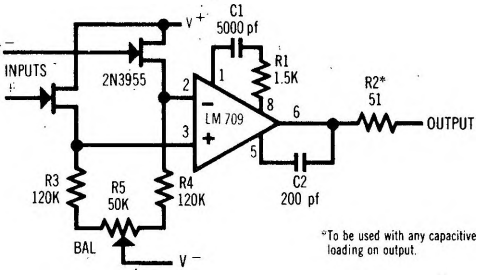
Offset Balancing Circuit



Unity Gain Inverting Amplifier



FET Operational Amplifier



* Pin connections shown are for Metal Can package.

absolute maximum ratings

Supply Voltage	±18V
Power Dissipation (Note 1)	300 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	−55°C to +125°C
Lead Temperature (Soldering, 60 sec)	300°C

electrical characteristics

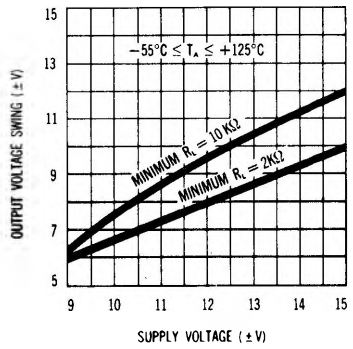
PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNITS
Input Offset Voltage	T_A = 25°C, $R_S \leq$ 10 kΩ		1.0	5.0	mV
Input Bias Current	T_A = 25°C		200	500	nA
Input Offset Current	T_A = 25°C		50	200	nA
Input Resistance	T_A = 25°C	150	400		kΩ
Output Resistance	T_A = 25°C		150		Ω
Supply Current	T_A = 25°C, V_S = ±15V		2.6	5.5	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			6.0	mV
Average Temperature					
Coefficient of Input	R_S = 50 Ω		3.0		μV/°C
Offset Voltage	R_S = 10 kΩ		6.0		μV/°C
Large-Signal	V_S = ±15V, $R_L \geq$ 2 kΩ				
Voltage Gain	V_{OUT} = ±10V	25,000	45,000	70,000	
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	70	90		db
Supply Voltage Rejection Ratio	$R_S \leq$ 10 kΩ		25	150	μV/V
Input Offset Current	T_A = +125°C		20	200	nA
	T_A = −55°C		100	500	nA
Input Bias Current	T_A = −55°C		0.5	1.5	μA
Input Resistance	T_A = −55°C	40	100		kΩ

Note 1: For operating at elevated temperatures, the device must be derated based on a 150°C maximum junction temperature and a thermal resistance of 150°C/W junction to ambient or 45°C/W junction to case 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 (see curve).

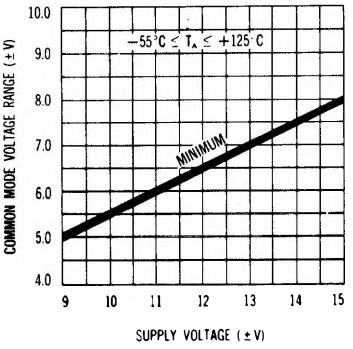
Note 2: These specifications apply for −55°C $\leq T_A \leq$ +125°C, ±9V $\leq V_S \leq$ +15V, C_1 = 5000 pF, R_1 = 1.5K, C_2 = 200 pF and R_2 = 51Ω unless otherwise specified.

guaranteed performance characteristics

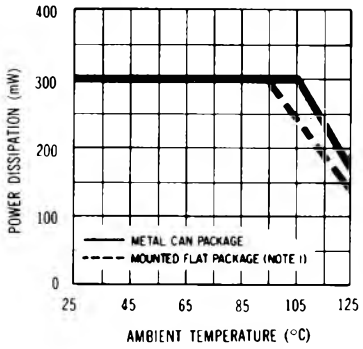
Output Voltage Swing



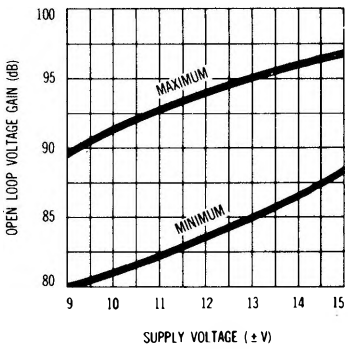
Input Common Mode Voltage Range



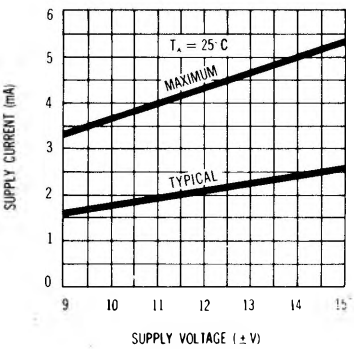
Maximum Power Dissipation



Voltage Gain

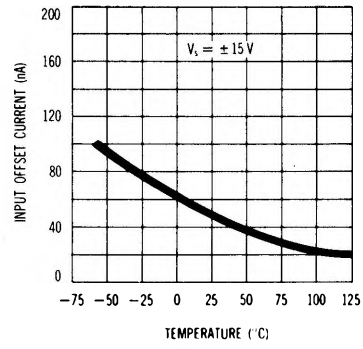


Supply Current

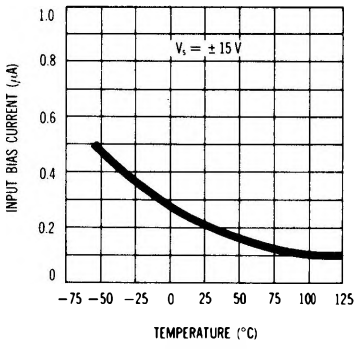


typical performance characteristics

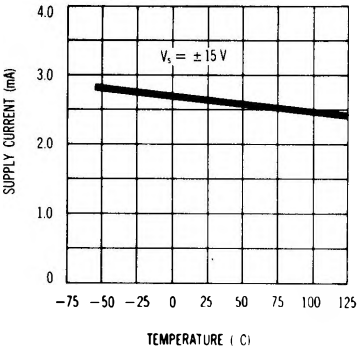
Input Offset Current



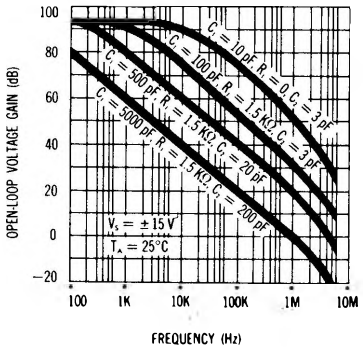
Input Bias Current



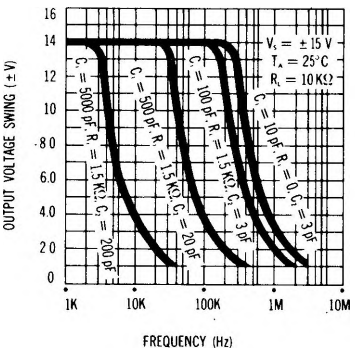
Supply Current



Open-Loop Frequency Response



Output Voltage Swing as a Function of Frequency



Output Voltage Swing