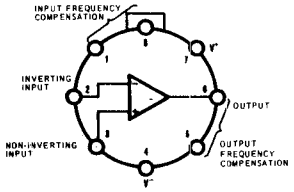
µA709A

high performance operational amplifier

EXTENDED TEMPERATURE RANGE, - 55°C + 125°C

The µA709A is a High-Gain Operational amplifier constructed on a single silicon chip using the Planar epitaxial process. It features low offset, high input impedance, large input common mode range, high output swing under load and low power consumption. The device displays exceptional temperature stability and will operate over a wide range of supply voltages with little degradation of performance. The amplifier is intended for use in DC servo systems, high impedance analog computers, in low-level instrumentation applications and for the generation of special linear and nonlinear transfer functions.

CONNECTION DIAGRAM
(Top view)



Note : Pin 4 connected to case.

ORDERING NUMBER

U5B 7709311

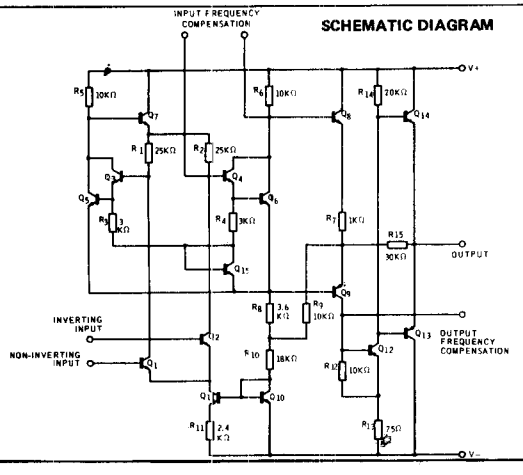
ABSOLUTE MAXIMUM RATINGS
(above which the useful life may be impaired)

Supply Voltage	± 18V
Internal Power Dissipation (Note 1)	300 mW
Differential Input Voltage	± 5 V
Input Voltage	± 10 V
Output Short - Circuit Duration (T_A = 25°C)	5 sec
Storage Temperature Range	- 65°C to 150°C
Operating Ambient Temperature Range	- 55°C to 125°C
Lead Temperature (Soldering, 60 sec)	300°C

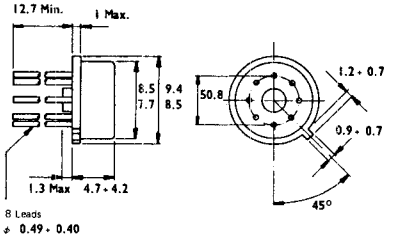
NOTE 1:

Rating applies for case temperatures to 125°C; derate linearly at 5.6 mW/°C for ambient temperatures above 95°C.

SCHEMATIC DIAGRAM



PHYSICAL DIMENSIONS
similar to
Jedec TO 99 outline



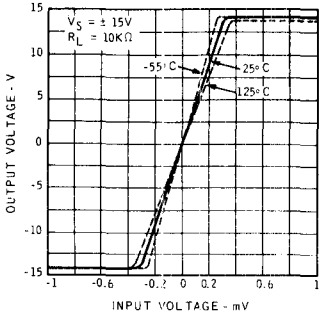
Notes : All dimensions in mm.
Leads are gold-plated Kovar.

ELECTRICAL CHARACTERISTICS ($T_A = 25°C$, $\pm 9\ V \leq V_S \leq \pm 15V$ unless otherwise specified)

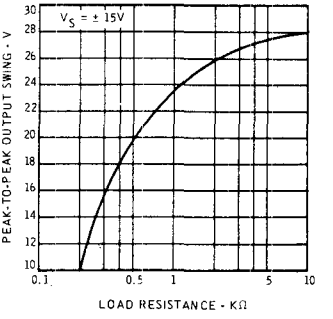
PARAMETER (see definitions)	CONDITIONS	Min.	Typ.	Max.	UNIT
Input Offset Voltage	$R_S \leq 10\ k\Omega$		0.6	2	mV
Input Offset Current			10	50	nA
Input Bias Current			100	200	nA
Input Resistance		350	700		kΩ
Output Resistance			150		Ω
Supply Current	$V_S = \pm 15\ V$		2.5	3.6	mA
Power Consumption	$V_S = \pm 15\ V$		75	108	mW
Transient Response	$V_S = \pm 15\ V$, $V_{IN} = 20\ mV$, $R_L = 2\ k\Omega$, $C_1 = 5\ nF$, $R_1 = 1.5\ k\Omega$, $C_2 = 200\ pF$, $R_2 = 50\ \Omega$				
Risetime				1.5	μsec
Overshoot	$C_L \leq 100\ pF$			30	%
The following specifications apply for $-55°C \leq T_A \leq 125°C$:					
Input Offset Voltage	$R_S \leq 10\ k\Omega$			3	mV
Average Temperature Coefficient of Input Offset Voltage	$R_S = 50\ \Omega$, $T_A = 25°C$ to $T_A = 125°C$		1.8	10	μV/°C
	$R_S = 50\ \Omega$, $T_A = 25°C$ to $T_A = -55°C$		1.8	10	μV/°C
	$R_S = 10\ k\Omega$, $T_A = 25°C$ to $T_A = 125°C$		2	15	μV/°C
	$R_S = 10\ k\Omega$, $T_A = 25°C$ to $T_A = -55°C$		4.8	25	μV/°C
Input Offset Current	$T_A = 125°C$		3.5	50	nA
	$T_A = -55°C$		40	250	nA
Average Temperature Coefficient of Input Offset Current	$T_A = 25°C$ to $T_A = 125°C$		0.08	0.5	nA/°C
	$T_A = 25°C$ to $T_A = -55°C$		0.45	2.8	nA/°C
Input Bias Current	$T_A = -55°C$		300	600	nA
Input Resistance	$T_A = -55°C$	85	170		kΩ
Input Voltage Range	$V_S = \pm 15\ V$	±8			V
Common Mode Rejection Ratio	$R_S \leq 10\ k\Omega$	80	110		dB
Supply Voltage Rejection Ratio	$R_S \leq 10\ k\Omega$		40	100	μV/V
Large-Signal Voltage Gain	$V_S = \pm 15\ V$, $R_L \geq 2\ k\Omega$, $V_{OUT} = \pm 10V$	25,000		70,000	
Output Voltage Swing	$V_S = \pm 15V$, $R_L \geq 10\ k\Omega$	±12	±14		V
	$V_S = \pm 15\ V$, $R_L \geq 2\ k\Omega$	±10	±13		V
Supply Current	$T_A = 125°C$, $V_S = \pm 15\ V$		2.1	3	mA
	$T_A = -55°C$, $V_S = \pm 15\ V$		2.7	4.5	mA
Power Consumption	$T_A = 125°C$, $V_S = \pm 15\ V$		63	90	mW
	$T_A = -55°C$, $V_S = \pm 15\ V$		81	135	mW

TYPICAL ELECTRICAL CHARACTERISTICS (25°C free air temperature unless otherwise noted)

VOLTAGE TRANSFER CHARACTERISTIC

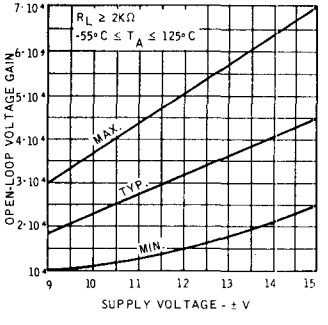


OUTPUT VOLTAGE SWING VERSUS LOAD RESISTANCE

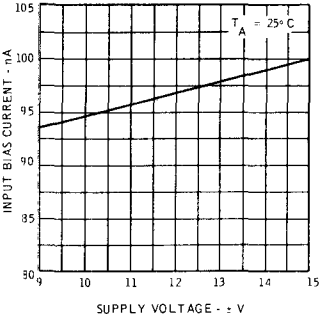


DC CHARACTERISTICS AS A FUNCTION OF SUPPLY VOLTAGE

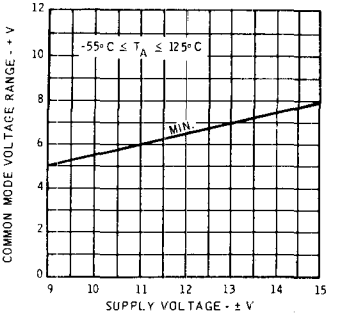
VOLTAGE GAIN



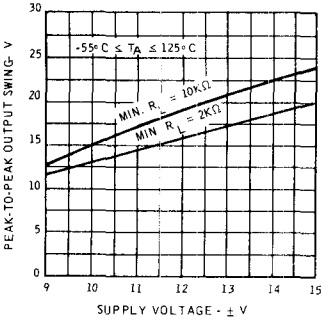
INPUT BIAS CURRENT VERSUS SUPPLY VOLTAGE



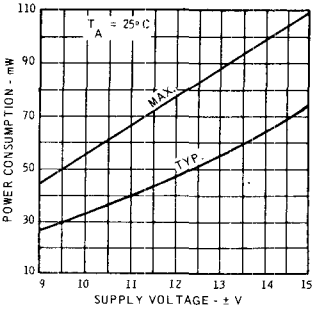
INPUT COMMON MODE VOLTAGE RANGE



OUTPUT VOLTAGE SWING

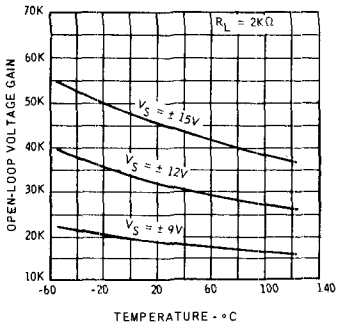


POWER CONSUMPTION VERSUS SUPPLY VOLTAGE

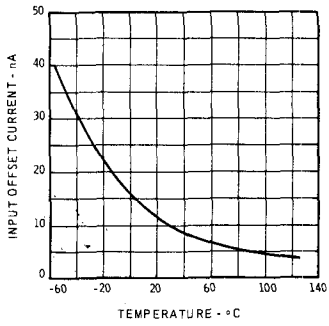


DC CHARACTERISTICS AS A FUNCTION OF AMBIENT TEMPERATURE

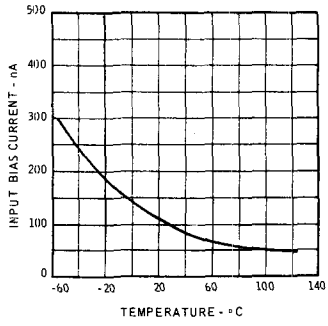
VOLTAGE GAIN VERSUS AMBIENT TEMPERATURE



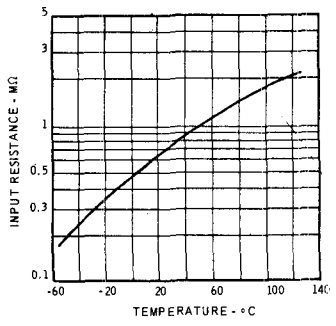
INPUT OFFSET CURRENT VERSUS AMBIENT TEMPERATURE



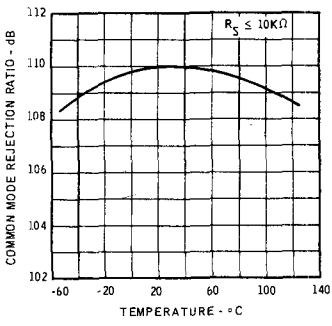
INPUT BIAS CURRENT VERSUS AMBIENT TEMPERATURE



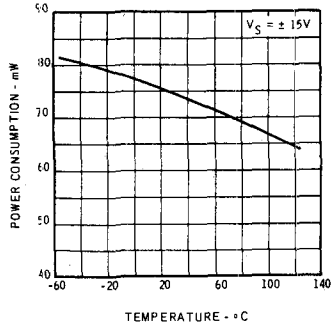
INPUT RESISTANCE VERSUS AMBIENT TEMPERATURE



COMMON MODE REJECTION RATIO VERSUS AMBIENT TEMPERATURE

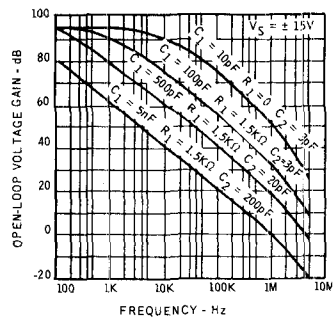


POWER CONSUMPTION VERSUS AMBIENT TEMPERATURE

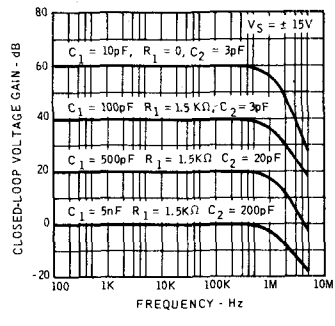


AC CHARACTERISTICS

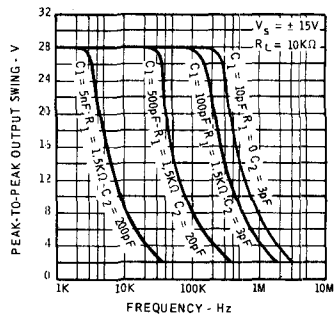
OPEN-LOOP FREQUENCY RESPONSE FOR VARIOUS VALUES OF COMPENSATION



FREQUENCY RESPONSE FOR VARIOUS CLOSED-LOOP GAINS

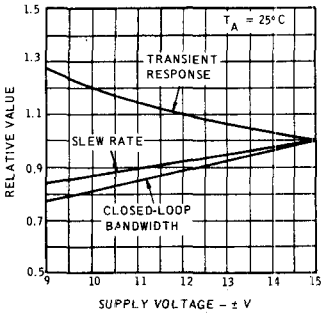


OUTPUT VOLTAGE SWING VERSUS FREQUENCY FOR VARIOUS COMPENSATION NETWORKS

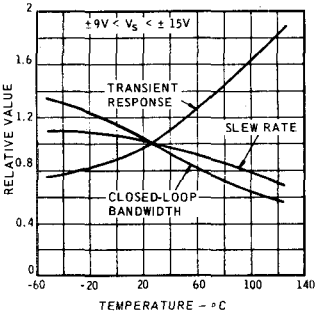


AC CHARACTERISTICS

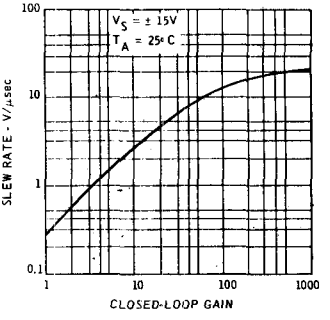
FREQUENCY CHARACTERISTICS VERSUS SUPPLY VOLTAGE



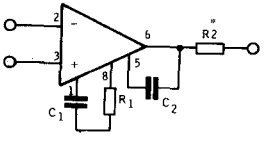
FREQUENCY CHARACTERISTICS VERSUS AMBIENT TEMPERATURE



SLEW RATE VERSUS CLOSED-LOOP GAIN USING RECOMMENDED COMPENSATION NETWORKS

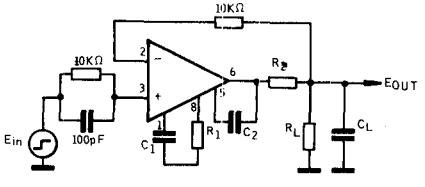


FREQUENCY COMPENSATION CIRCUIT

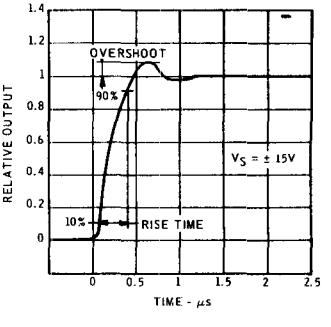


*Use R_2 = 50Ω when the amplifier is operated with capacitive Loading

TRANSIENT RESPONSE TEST CIRCUIT



TRANSIENT RESPONSE



DEFINITION OF TERMS

INPUT OFFSET VOLTAGE - That voltage which must be applied between the input terminals to obtain zero output voltage. The input offset voltage may also be defined for the case where two equal resistances are inserted in series with the input leads.

INPUT OFFSET CURRENT - The difference in the currents into the two input terminals with the output at zero volts.

INPUT RESISTANCE - The resistance looking into either input terminal with the other grounded.

INPUT BIAS CURRENT - The average of the two input currents.

INPUT VOLTAGE RANGE - A range of voltage which, if exceeded on either input terminal, could cause the amplifier to cease functioning properly.

INPUT COMMON MODE REJECTION RATIO - The ratio of the input voltage range to the maximum change in input offset voltage over this range.

LARGE-SIGNAL VOLTAGE GAIN - The ratio of the maximum output voltage swing with load to the change in input voltage required to drive the output from zero to this voltage.

OUTPUT VOLTAGE SWING - The peak output swing, referred to zero, that can be obtained without clipping.

OUTPUT RESISTANCE - The resistance seen looking into the output terminal with the output at null. This parameter is defined only under small signal conditions at frequencies above a few hundred cycles to eliminate the influence of drift and thermal feedback.

POWER CONSUMPTION - The DC power required to operate the amplifier with the output at zero and with no load current.

SUPPLY VOLTAGE REJECTION RATIO - The ratio of the change in input offset voltage to the change in supply voltage producing it.

TRANSIENT RESPONSE - The closed - loop step function response of the amplifier under small - signal conditions.