High Speed Operational Amplifier

FEATURES

- *Guaranteed* 1.0mV Max. Input Offset Voltage
- *Guaranteed* 100,000 Min. Gain
- *Guaranteed* 50V/μs Slew Rate
- *Guaranteed* 20nA Max. Input Offset Current
- 15MHz Bandwidth
- Unity Gain Stable

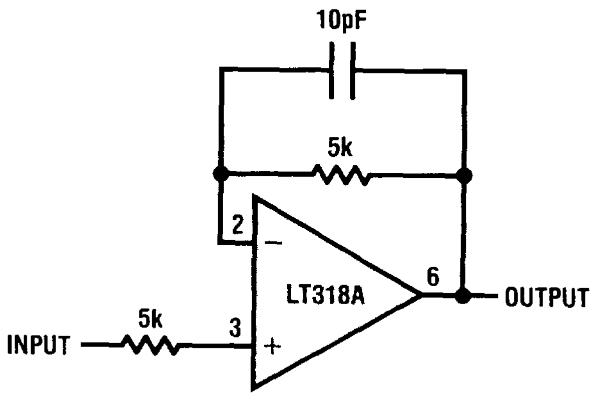
APPLICATIONS

- Wideband Amplifiers
- High Frequency Absolute Value Circuits
- D/A Converter Amplifiers
- Fast Integrators

DESCRIPTION

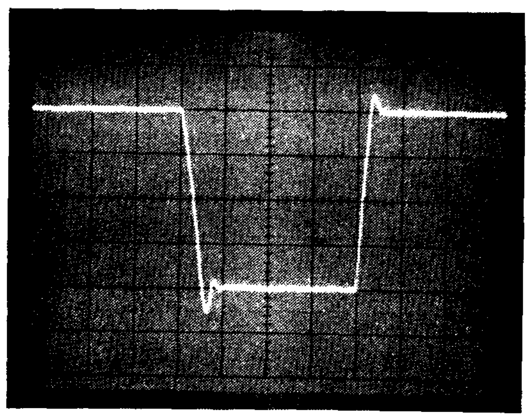
The LT118A is an improved version of the industry standard LM118. The LT118A features lower input offset voltage, lower input offset currents, higher gain and higher common mode and power supply rejection. Because of these enhancements, the LT118A will improve the accuracy of most applications. Unlike many wideband amplifiers, the LT118A is unity gain stable and has a slew rate of 50V/μs. When used in inverting amplifier applications, feedforward compensation can be used to achieve slew rates in excess of 150V/μs. Linear Technology Corporation's advanced processing techniques make the LT118A an ideal choice for high speed applications.

Voltage Follower



Voltage Follower Pulse Response

5V/DIV

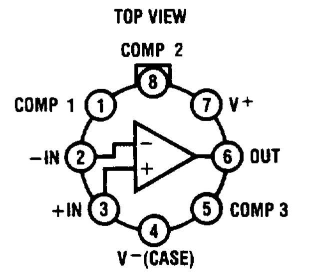


TIME→0.5μs/DIV.

ABSOLUTE MAXIMUM RATINGS

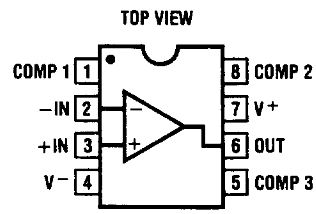
Supply Voltage .... ±20V
Differential Input Current (Note 1) .... ±10mA
Input Voltage (Note 2) .... ±20V
Output Short Circuit Duration .... Indefinite
Operating Temperature Range
  LT118A/LM118 .... −55°C to 125°C
  LT318A/LM318 .... 0°C to 70°C
Storage Temperature Range
  All Devices .... −65°C to 150°C
Lead Temperature (Soldering, 10 sec.) .... 300°C

PACKAGE/ORDER INFORMATION



METAL CAN H PACKAGE

ORDER PART NUMBER: LT118AH, LM118H, LT318AH, LM318H



HERMETIC DIP J8 PACKAGE
PLASTIC DIP N8 PACKAGE

ORDER PART NUMBER: LT118AJ8, LM118J8, LT318AJ8, LM318J8, LT318AN8, LM318N8

ELECTRICAL CHARACTERISTICS (Note 3)

SYMBOL	PARAMETER	CONDITIONS		LT118A MIN	LT118A TYP	LT118A MAX	LM118 MIN	LM118 TYP	LM118 MAX	UNITS
V_{OS}	Input Offset Voltage				0.5	1		2	4	mV
			●		1	2			6	mV
I_{OS}	Input Offset Current				6	20		6	50	nA
			●		10	30			100	nA
I_B	Input Bias Current				120	250		120	250	nA
			●			500			500	nA
R_{IN}	Input Resistance			1	3		1	3		MΩ
A_V	Large Signal Voltage Gain	$V_S = \pm 15V$, $V_{OUT} = \pm 10V$, $R_L \geq 2k\Omega$		100	500		50	200		V/mV
			●	100			25			V/mV
SR	Slew Rate	$V_S = \pm 15V$, $A_V = 1$		50	70		50	70		V/µs
GBW	Gain Bandwidth Product	$V_S = \pm 15V$			15			15		MHz
	Output Voltage Swing	$V_S = \pm 15V$, $R_L = 2k\Omega$	●	±12	±13		±12	±13		V
	Input Voltage Range	$V_S = \pm 15V$	●	±11.5			±11.5			V
I_S	Supply Current				5	8		5	8	mA
		$T_A = 125°C$			4.5	7		4.5	7	mA
CMRR	Common Mode Rejection Ratio		●	86	100		80	100		dB
PSRR	Power Supply Rejection Ratio		●	86	100		70	80		dB

ELECTRICAL CHARACTERISTICS (Note 3)

SYMBOL	PARAMETER	CONDITIONS		LT318A MIN	LT318A TYP	LT318A MAX	LM318 MIN	LM318 TYP	LM318 MAX	UNITS
V_{OS}	Input Offset Voltage				0.5	1		4	10	mV
			●			2			15	mV
I_{OS}	Input Offset Current				10	20		30	200	nA
			●			30			750	nA
I_B	Input Bias Current				150	250		150	500	nA
			●			500			750	nA
R_{IN}	Input Resistance			0.5	3		0.5	3		MΩ
A_V	Large Signal Voltage Gain	$V_S = \pm 15V$, $V_{OUT} = \pm 10V$, $R_L \geq 2k\Omega$		100	500		25	200		V/mV
			●	100			20			V/mV
SR	Slew Rate	$V_S = \pm 15V$, $A_V = 1$		50	70		50	70		V/μs
GBW	Gain Bandwidth Product	$V_S = \pm 15V$			15			15		MHz
	Output Voltage Swing	$V_S = \pm 15V$, $R_L = 2k\Omega$	●	±12	±13		±12	±13		V
	Input Voltage Range	$V_S = \pm 15V$	●	±11.5			±11.5			V
I_S	Supply Current				5	10		5	10	mA
CMRR	Common Mode Rejection Ratio		●	86	100		70	100		dB
PSRR	Power Supply Rejection Ratio		●	86	100		65	80		dB

The ● denotes those specifications which apply over the full operating temperature range.

The shaded electrical specifications indicate those parameters which have been improved or guaranteed test limits provided for the first time.

Note 1: The inputs are shunted with back-to-back zeners for overvoltage protection. Excessive current will flow if a differential voltage greater than 5V is applied to the inputs.

Note 2: For supply voltages less than ±15V, the maximum input voltage is equal to the supply voltage.

Note 3: These specifications apply for $\pm 5V \leq V_S \leq \pm 20V$. The power supplies must be bypassed with a 0.1μF or greater disc capacitor within 4 inches of the device.

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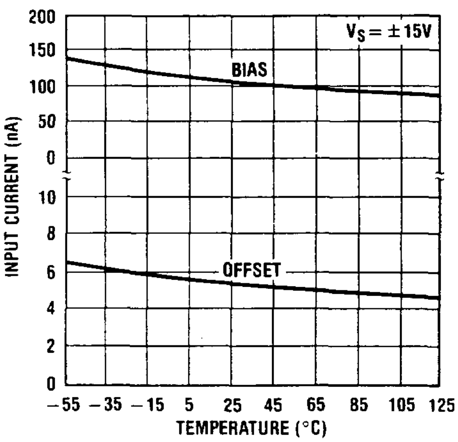
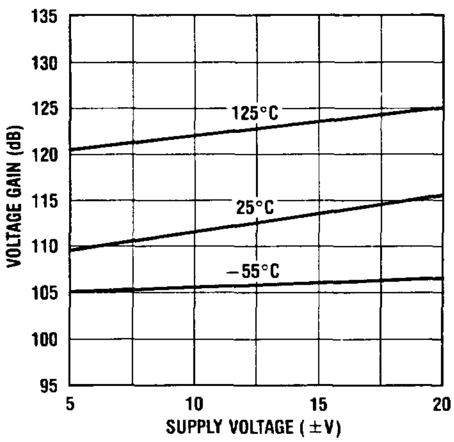
TYPICAL PERFORMANCE CHARACTERISTICS

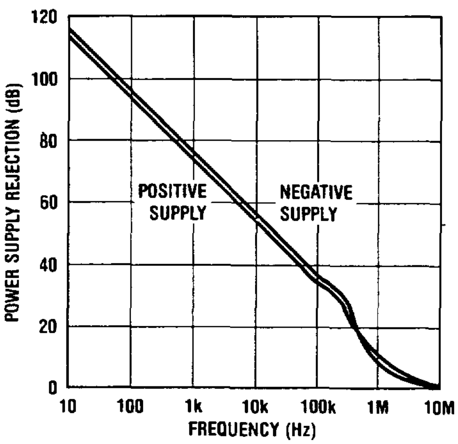
Input Current



Voltage Gain

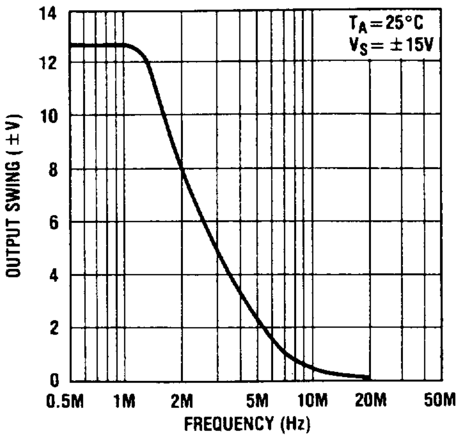


Power Supply Rejection

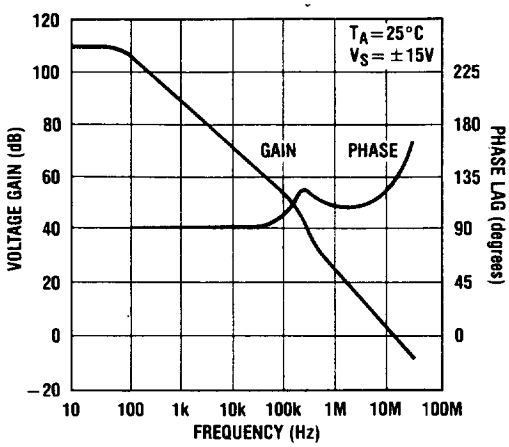


TYPICAL PERFORMANCE CHARACTERISTICS

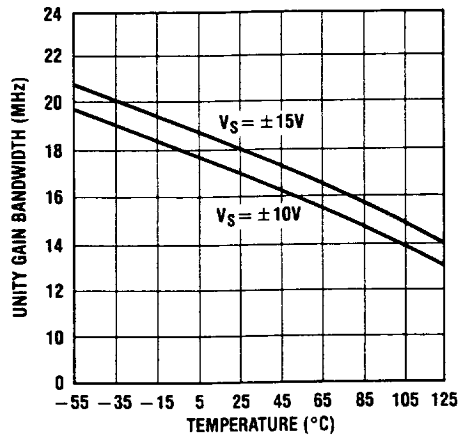
Large Signal Frequency Response



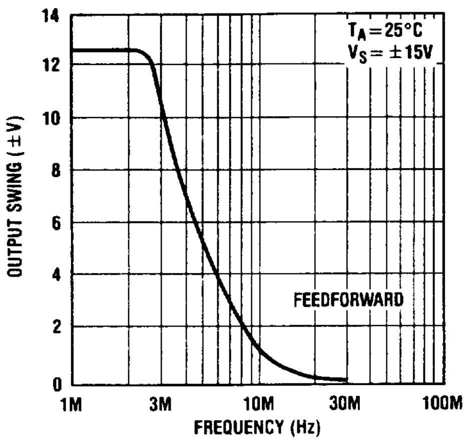
Open Loop Frequency Response



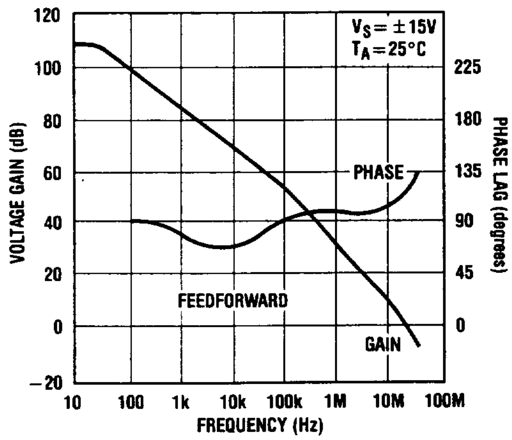
Unity Gain Bandwidth



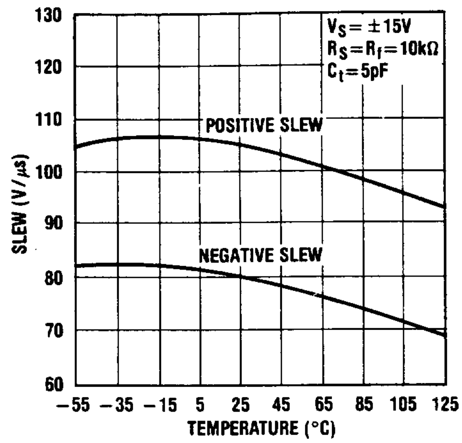
Large Signal Frequency Response



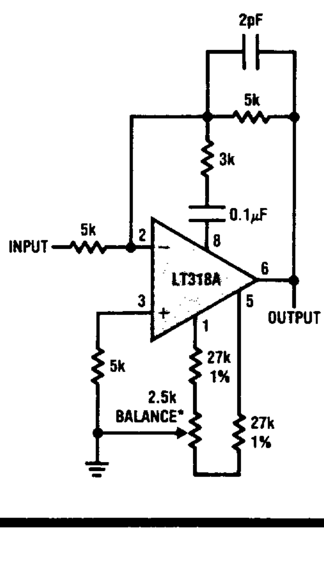
Open Loop Frequency Response



Voltage Follower Slew Rate

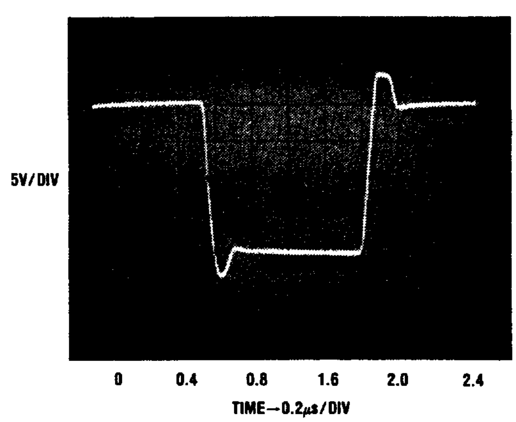


Feedforward Compensation for Slew Rates of 150V/µs



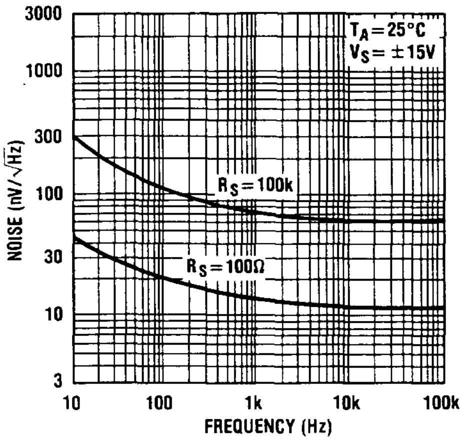
*BALANCE CIRCUIT NECESSARY FOR INCREASED SLEW RATE

Pulse Response of Feedforward Inverter

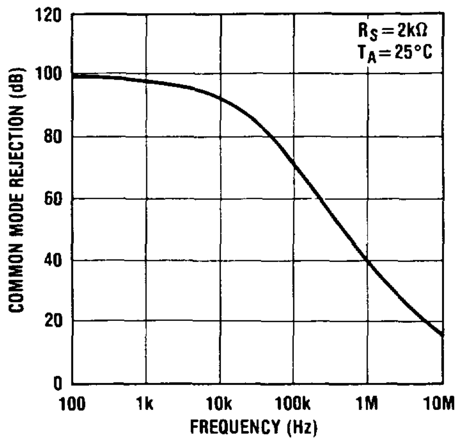


TYPICAL PERFORMANCE CHARACTERISTICS

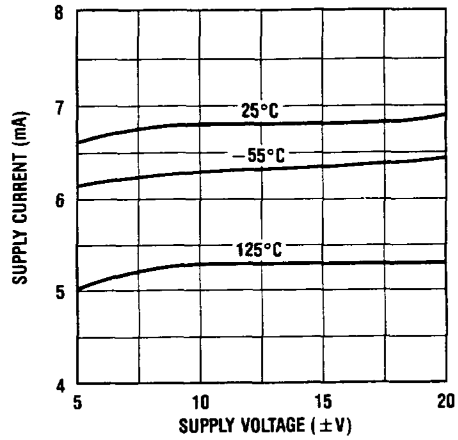
Input Noise Voltage



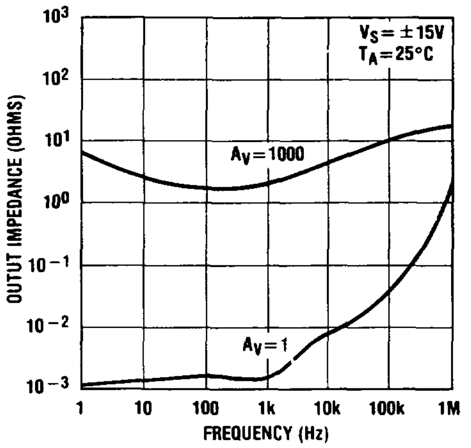
Common Mode Rejection



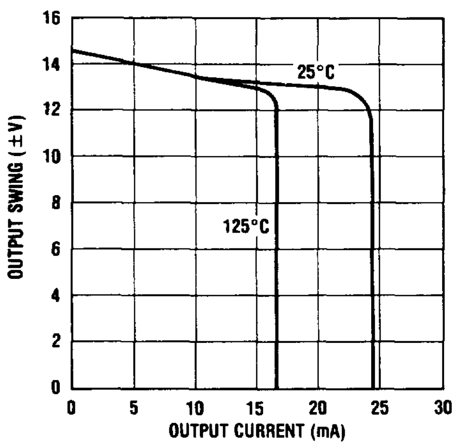
Supply Current



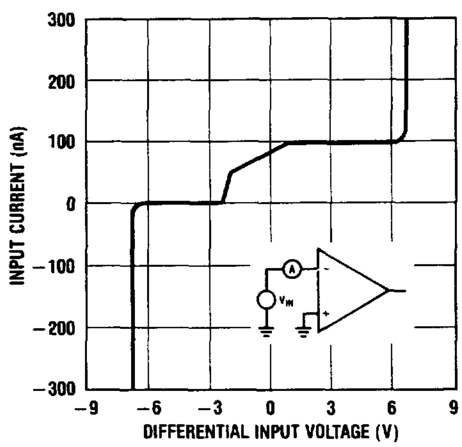
Closed Loop Output Impedance



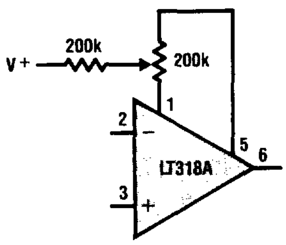
Current Limiting



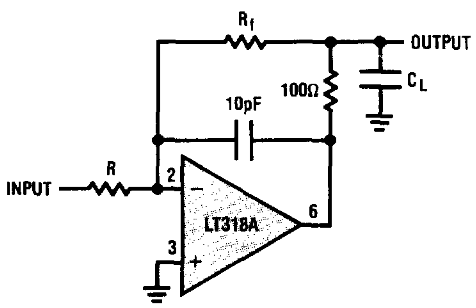
LT118A Input Current



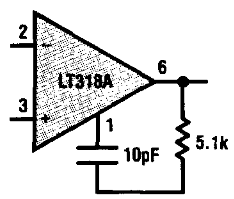
Offset Balancing



Isolating Large Capacitive Loads

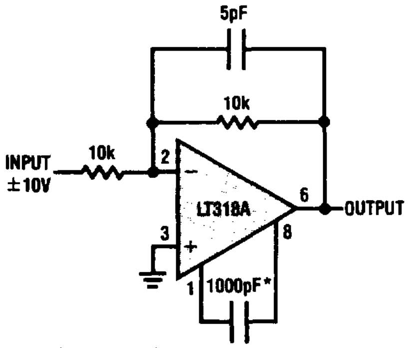


Overcompensation for Increased Stability



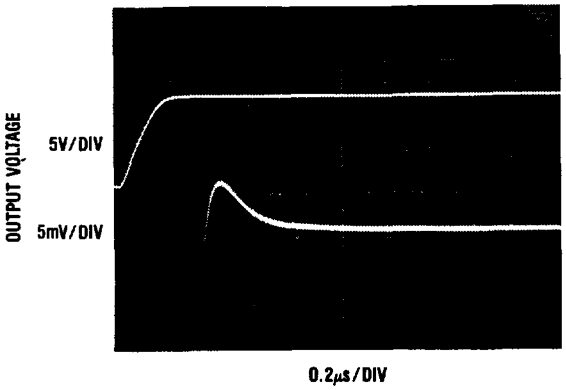
SETTLING TIME CIRCUITS

Settling Time Test Circuit

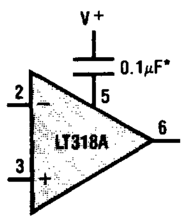


*IMPROVES SETTLING TIME

Settling Time

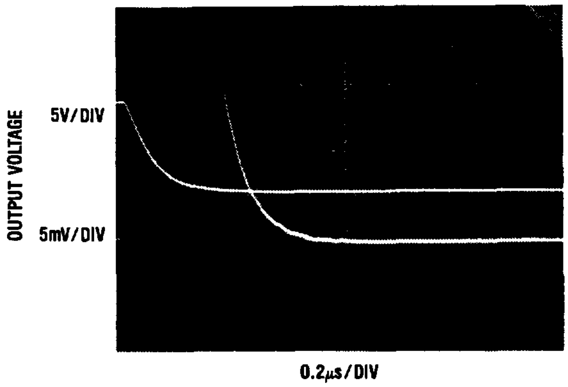


Alternate Compensation for Improved Settling Time



*IMPROVES SETTLING TIME

Settling Time



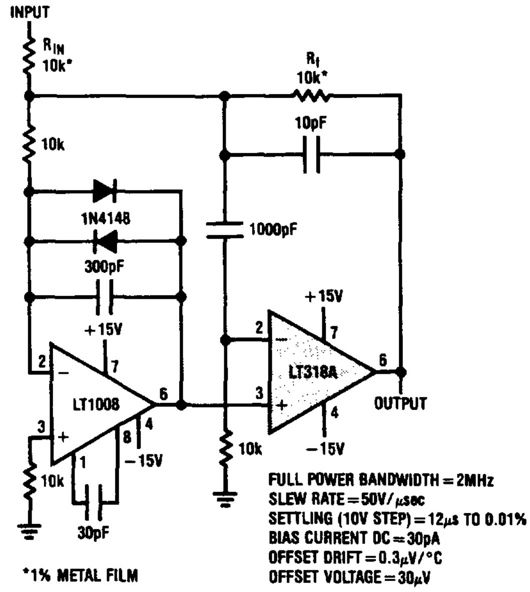
APPLICATIONS INFORMATION

Because of their wider bandwidth, the LT118A and LM118 operational amplfiers require more application care than most general purpose low frequency amplifiers. One of the most critical requirements is that power supplies should be bypassed with a 0.1µF (or larger) disc ceramic capacitor within an inch of the device. Also, stray capacitance at either the input or output can cause oscillation. While input capacitance can be compensated by placing a capacitor across the feedback resistor, load capacitance must be minimized or isolated as shown. Even the 50pF input capacitance of a 1X scope probe can alter the response of the device.

Settling time, an important parameter in many high speed amplifier applications, is difficult to measure and optimize. Settling time is very "application dependent" and is influenced by external components, layout and the amplifier. In general, the settling time to 0.01% can be minimized by using a circuit similar to that shown. In addition to the compensation network shown, a capacitor is needed across the feedback resistor to minimize ringing.

Power supply bypassing can also affect settling time. The amplifier has low power supply rejection ratio at high frequencies, so transients and ringing on the supply leads can appear at the output. Large (22µF) solid tantalum capacitors are preferred to minimize supply aberrations.

Precision Inverting Amplifier



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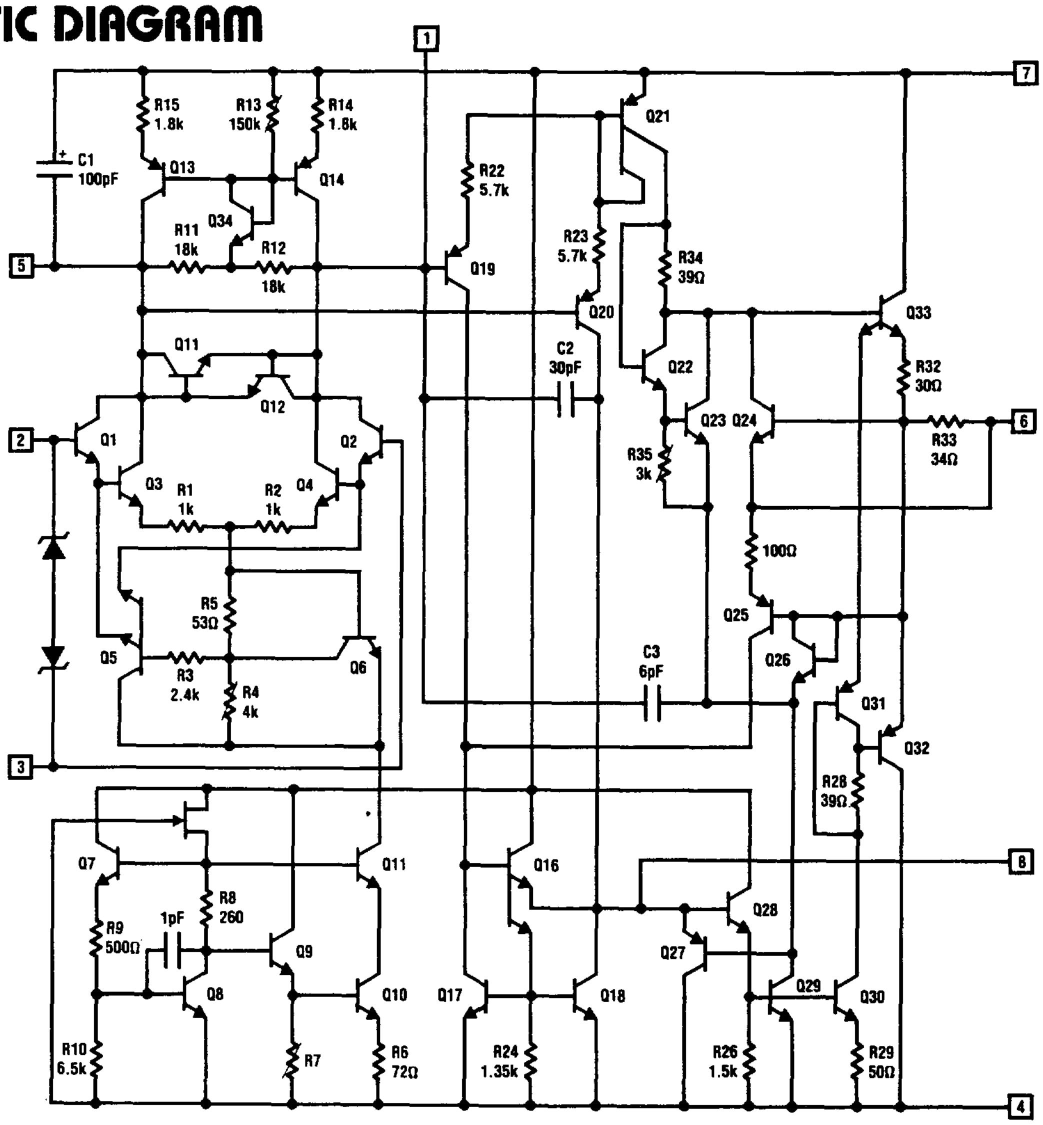
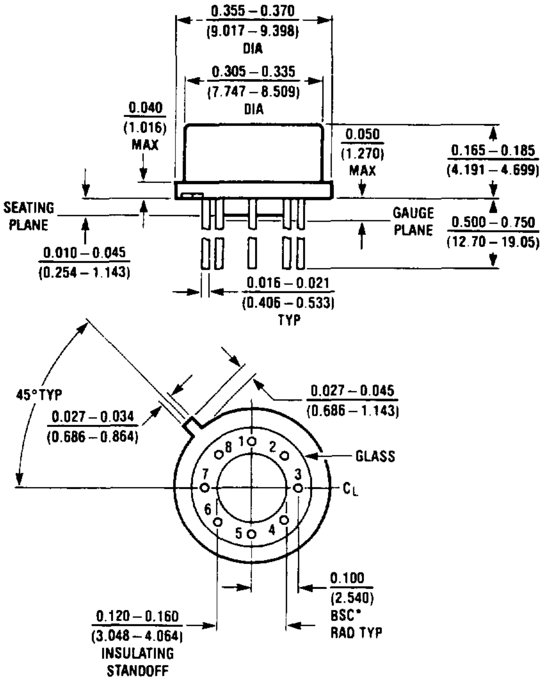
SCHEMATIC DIAGRAM



PACKAGE DESCRIPTION

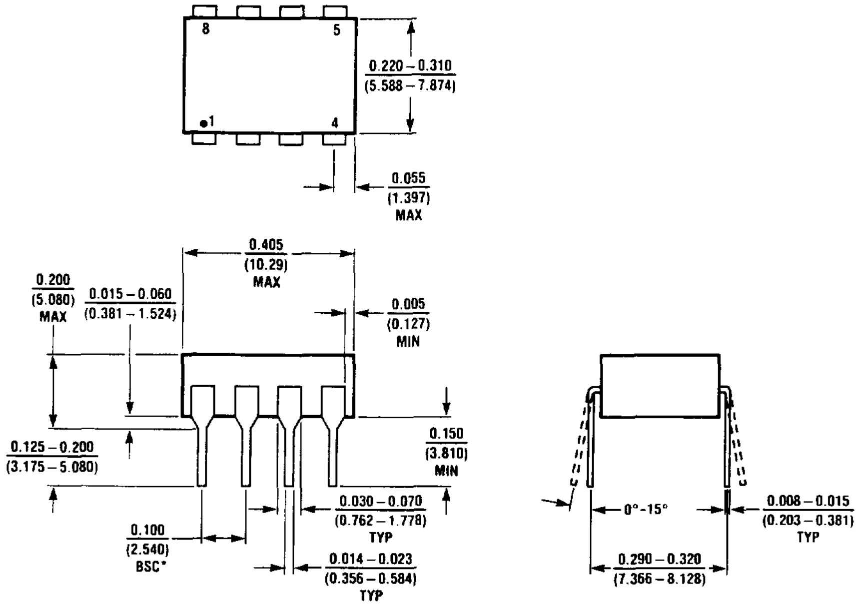
H Package
Metal Can



NOTE: DIMENSIONS IN INCHES

$T_j$max	θ_{ja}	θ_{jc}
150°C	150°C/W	45°C/W

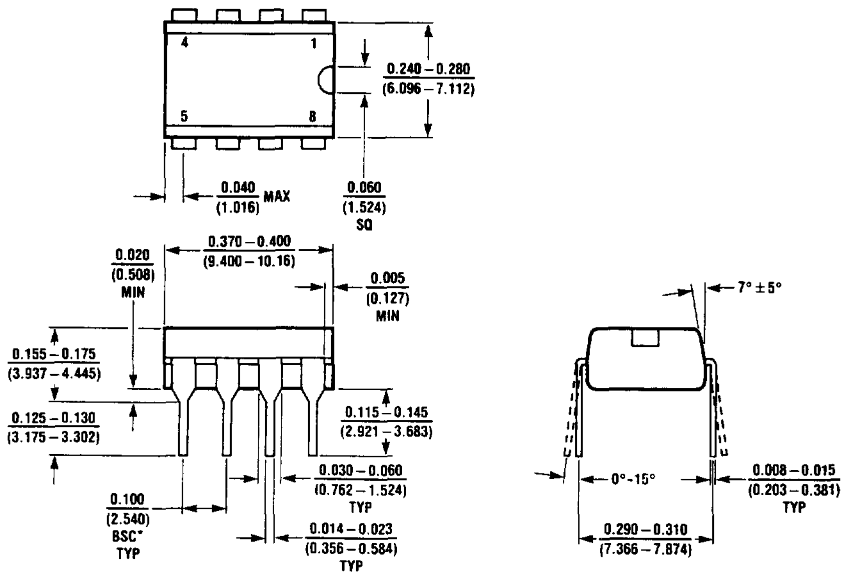
J8 Package
8 Lead Hermetic DIP



NOTE: DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED
*LEADS WITHIN 0.007 OF TRUE POSITION (TP) AT GAUGE PLANE

$T_j$max	θ_{ja}
150°C	100°C/W

N8 Package
8 Lead Plastic



NOTE: DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED
*LEADS WITHIN 0.007 OF TRUE POSITION (TP) AT GAUGE PLANE

$T_j$max	θ_{ja}
100°C	130°C/W