

High Speed Operational Amplifier

FEATURES

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

APPLICATIONS

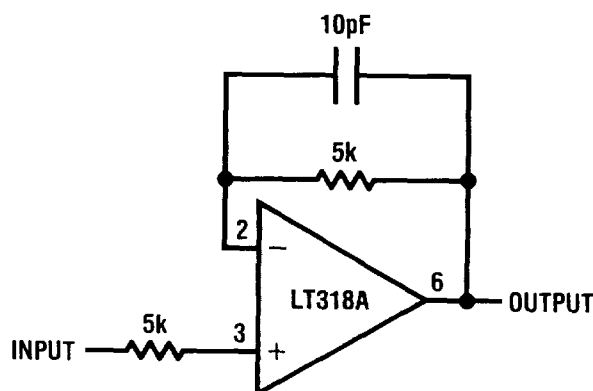
- Wideband Amplifiers
- High Frequency Absolute Value Circuits
- D/A Converter Amplifiers
- Fast Integrators

DESCRIPTION

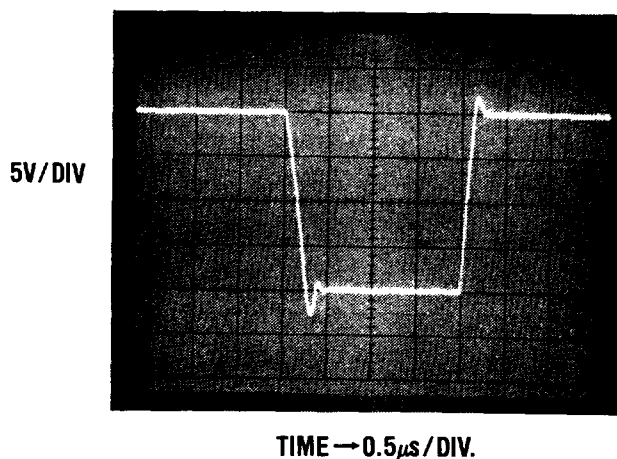
The LT118A is an improved version of the industry standard LM118. The LT118A features lower input offset voltage, lower input offset currents, higher gain and higher common mode and power supply rejection. Because of these enhancements, the LT118A will improve the accuracy of most applications. Unlike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

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Voltage Follower



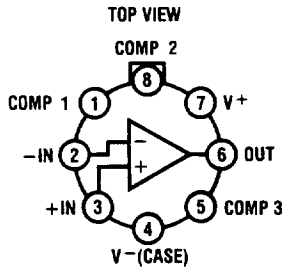
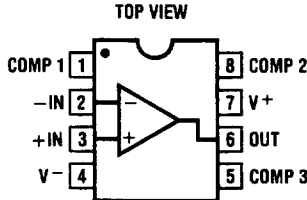
Voltage Follower Pulse Response



ABSOLUTE MAXIMUM RATINGS

Supply Voltage	$\pm 20\text{V}$
Differential Input Current (Note 1)	$\pm 10\text{mA}$
Input Voltage (Note 2)	$\pm 20\text{V}$
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

TOP VIEW	ORDER PART NUMBER	
 METAL CAN H PACKAGE	LT118AH LM118H LT318AH LM318H	
 HERMETIC DIP J8 PACKAGE PLASTIC DIP N8 PACKAGE	LT118AJ8 LM118J8 LT318AJ8 LM318J8 LT318AN8 LM318N8	

ELECTRICAL CHARACTERISTICS (Note 3)

SYMBOL	PARAMETER	CONDITIONS		LT118A			LM118			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{OS}	Input Offset Voltage		•		0.5 1	1 2		2 4	4 6	mV mV
I_{OS}	Input Offset Current		•		6 10	20 30		6 50	50 100	nA nA
I_B	Input Bias Current		•		120	250 500		120 250	250 500	nA nA
R_{IN}	Input Resistance			1	3		1	3		M Ω
A_V	Large Signal Voltage Gain	$V_S = \pm 15\text{V}$, $V_{OUT} = \pm 10\text{V}$, $R_L \geq 2\text{k}\Omega$	•	100 100	500		50 25	200		V/mV V/mV
SR	Slew Rate	$V_S = \pm 15\text{V}$, $A_V = 1$		50	70		50	70		V/ μs
GBW	Gain Bandwidth Product	$V_S = \pm 15\text{V}$			15			15		MHz
	Output Voltage Swing	$V_S = \pm 15\text{V}$, $R_L = 2\text{k}\Omega$	•	± 12	± 13		± 12	± 13		V
	Input Voltage Range	$V_S = \pm 15\text{V}$	•	± 11.5			± 11.5			V
I_S	Supply Current	$T_A = 125^{\circ}\text{C}$			5 4.5	8 7		5 4.5	8 7	mA 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	MIN	LT318A TYP	MAX	MIN	LM318 TYP	MAX	UNITS
V_{OS}	Input Offset Voltage		●	0.5	1 2		4	10 15	mV mV
I_{OS}	Input Offset Current		●	10	20 30		30	200 750	nA nA
I_B	Input Bias Current		●	150	250 500		150	500 750	nA 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 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.

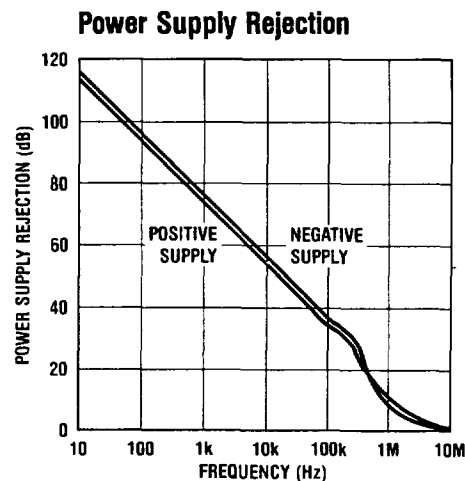
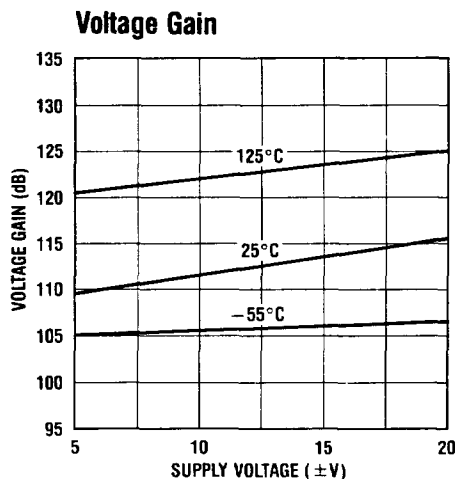
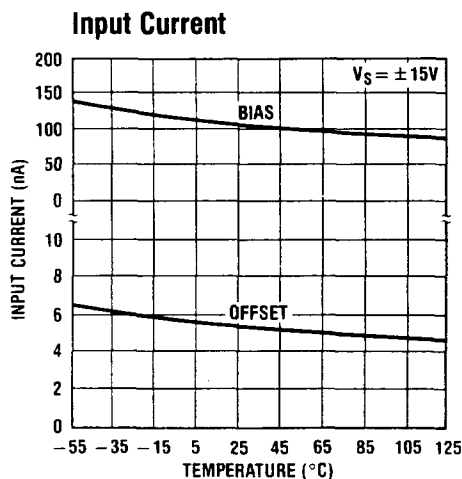
The shaded electrical specifications indicate those parameters which have been improved or guaranteed test limits provided for the first time.

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 $\pm 15V$, the maximum input voltage is equal to the supply voltage.

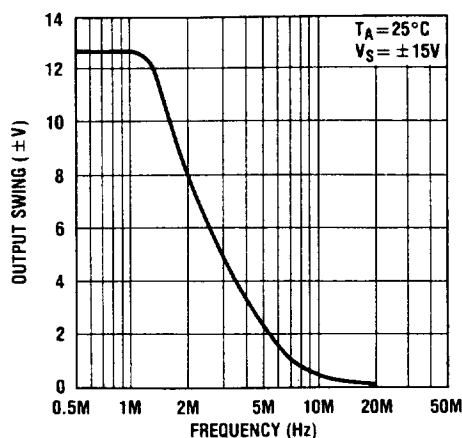
Note 3: These specifications apply for $\pm 5V \leq V_S \leq \pm 20V$. The power supplies must be bypassed with a $0.1\mu F$ or greater disc capacitor within 4 inches of the device.

TYPICAL PERFORMANCE CHARACTERISTICS

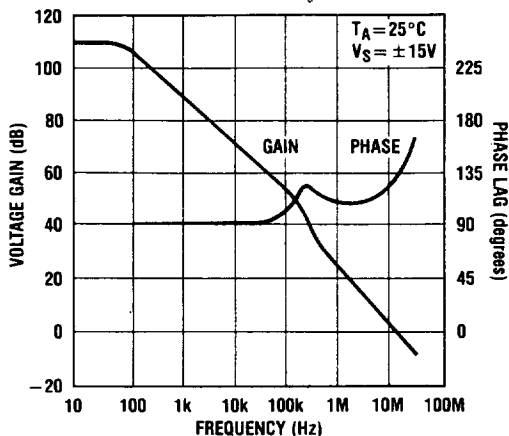


TYPICAL PERFORMANCE CHARACTERISTICS

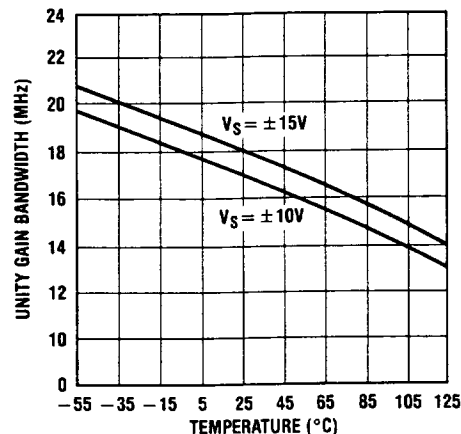
Large Signal Frequency Response



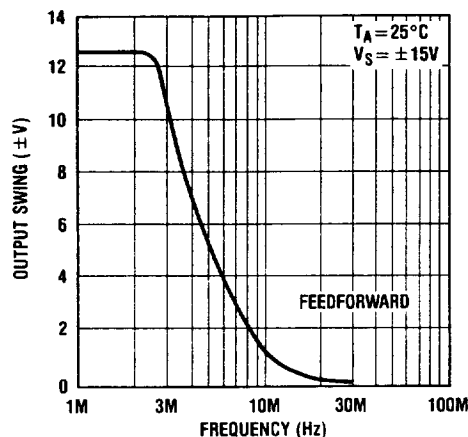
Open Loop Frequency Response



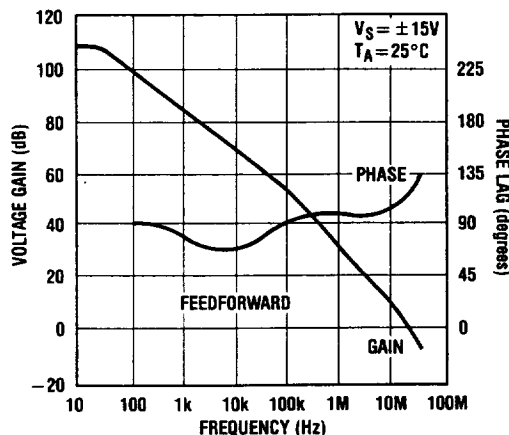
Unity Gain Bandwidth



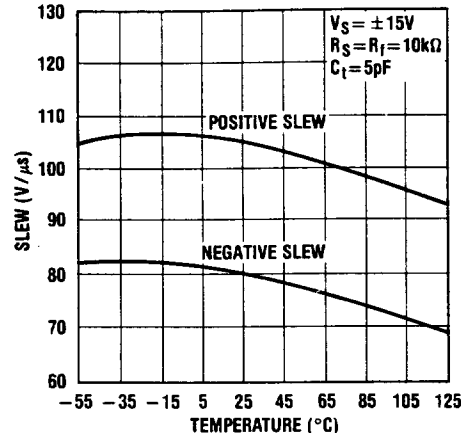
Large Signal Frequency Response



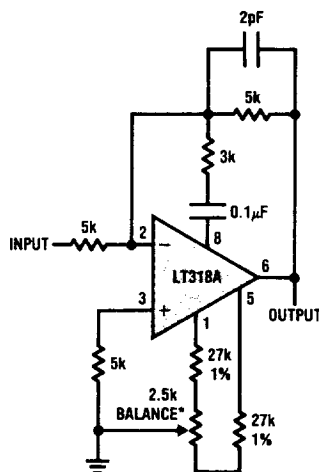
Open Loop Frequency Response



Voltage Follower Slew Rate

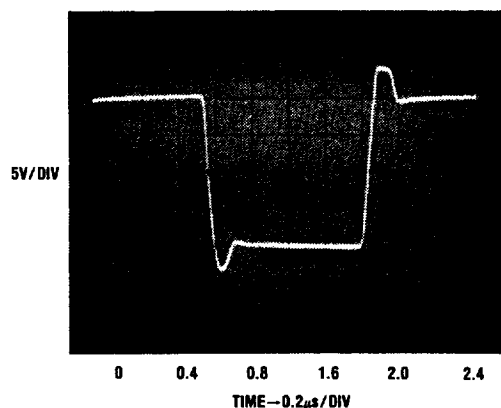


Feedforward Compensation for Slew Rates of $150V/\mu s$

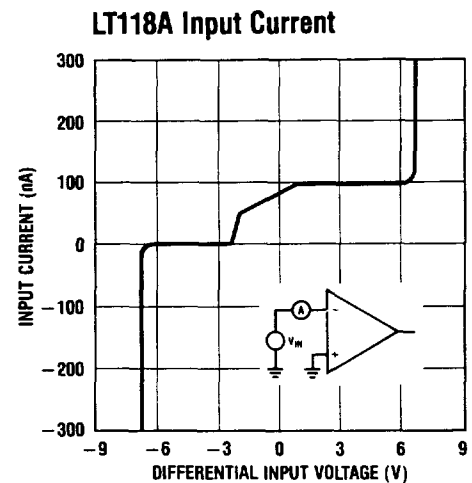
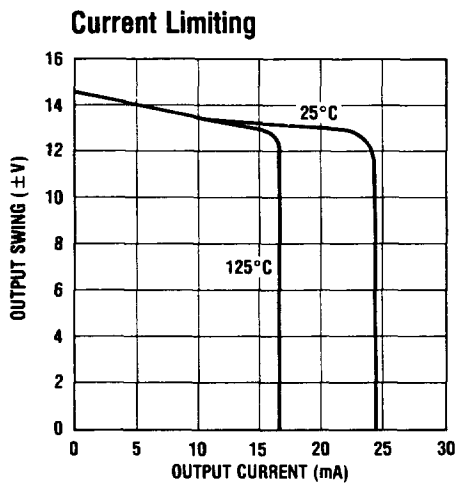
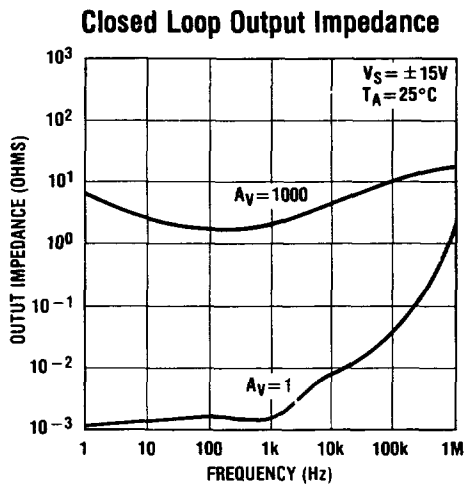
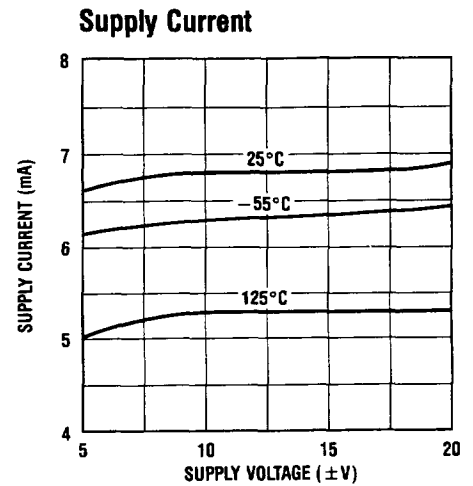
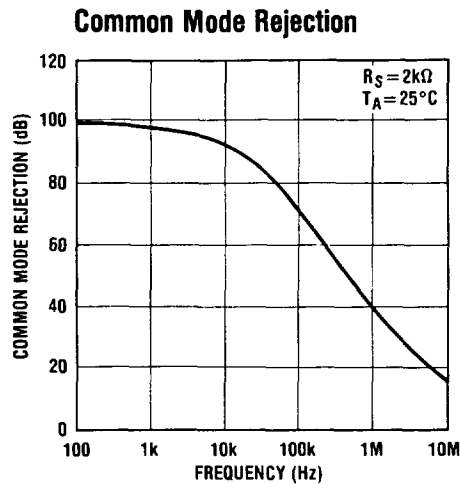
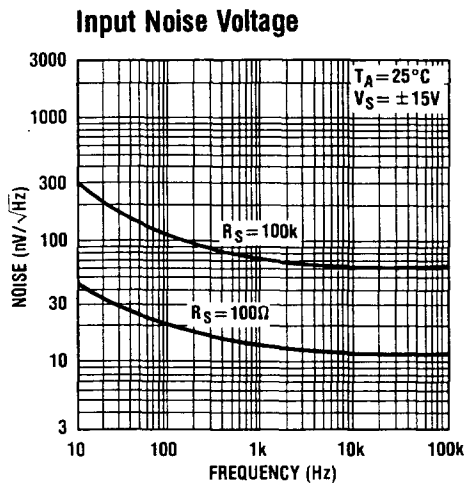


*BALANCE CIRCUIT NECESSARY FOR INCREASED SLEW RATE

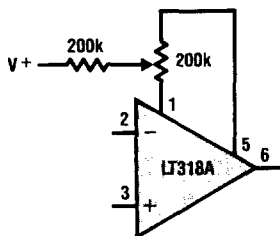
Pulse Response of Feedforward Inverter



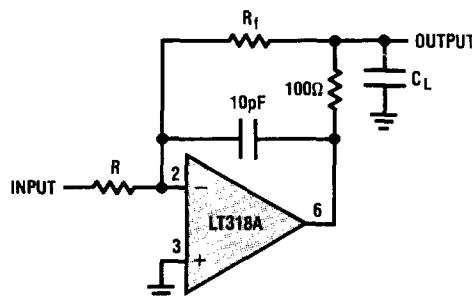
TYPICAL PERFORMANCE CHARACTERISTICS



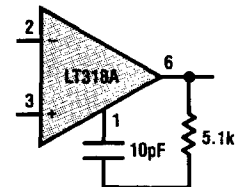
Offset Balancing



Isolating Large Capacitive Loads

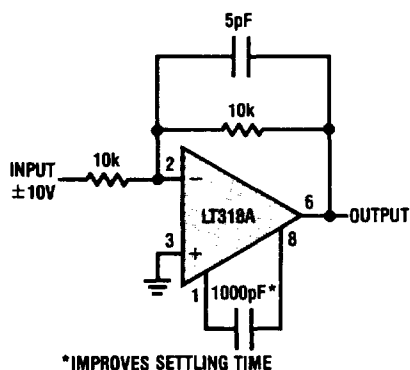


Overcompensation for Increased Stability

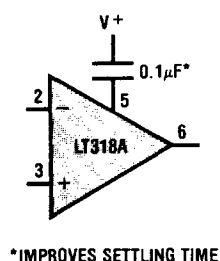


SETTLING TIME CIRCUITS

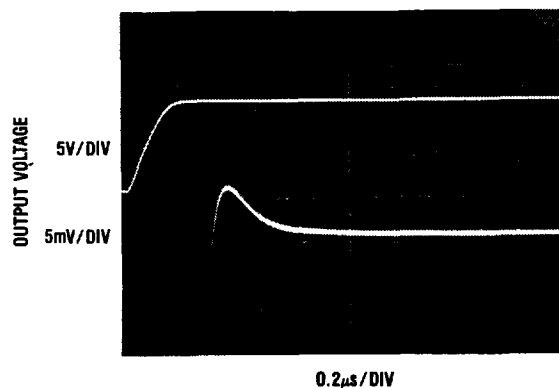
Settling Time Test Circuit



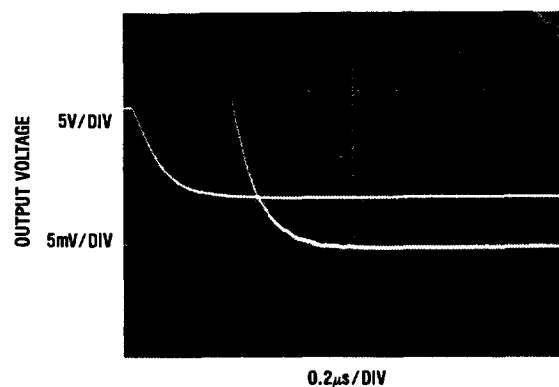
Alternate Compensation for Improved Settling Time



Settling Time



Settling Time



APPLICATIONS INFORMATION

Because of their wider bandwidth, the LT118A and LM118 operational amplifiers 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 0.1 μ F (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 (22 μ F) solid tantalum capacitors are preferred to minimize supply aberrations.

[illegible]

IC DIAGRAM

IC60000

10-BIT 100NS CMOS DAC

Pin 1: 5V

Pin 2: 0V

Pin 3: Output

Pin 4: 0V

Pin 5: 0V

Pin 6: 0V

Pin 7: 0V

Pin 8: 0V

Pin 9: 0V

Pin 10: 0V

Pin 11: 0V

Pin 12: 0V

Pin 13: 0V

Pin 14: 0V

Pin 15: 0V

Pin 16: 0V

Pin 17: 0V

Pin 18: 0V

Pin 19: 0V

Pin 20: 0V

Pin 21: 0V

Pin 22: 0V

Pin 23: 0V

Pin 24: 0V

Pin 25: 0V

Pin 26: 0V

Pin 27: 0V

Pin 28: 0V

Pin 29: 0V

Pin 30: 0V

Pin 31: 0V

Pin 32: 0V

Pin 33: 0V

Pin 34: 0V

Pin 35: 0V

Pin 36: 0V

Pin 37: 0V

Pin 38: 0V

Pin 39: 0V

Pin 40: 0V

Pin 41: 0V

Pin 42: 0V

Pin 43: 0V

Pin 44: 0V

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Pin 46: 0V

Pin 47: 0V

Pin 48: 0V

Pin 49: 0V

Pin 50: 0V

Pin 51: 0V

Pin 52: 0V

Pin 53: 0V

Pin 54: 0V

Pin 55: 0V

Pin 56: 0V

Pin 57: 0V

Pin 58: 0V

Pin 59: 0V

Pin 60: 0V

Pin 61: 0V

Pin 62: 0V

Pin 63: 0V

Pin 64: 0V

Pin 65: 0V

Pin 66: 0V

Pin 67: 0V

Pin 68: 0V

Pin 69: 0V

Pin 70: 0V

Pin 71: 0V

Pin 72: 0V

Pin 73: 0V

Pin 74: 0V

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Pin 86: 0V

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Pin 90: 0V

Pin 91: 0V

Pin 92: 0V

Pin 93: 0V

Pin 94: 0V

Pin 95: 0V

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Pin 98: 0V

Pin 99: 0V

Pin 100: 0V

Pin 101: 0V

Pin 102: 0V

Pin 103: 0V

Pin 104: 0V

Pin 105: 0V

Pin 106: 0V

Pin 107: 0V

Pin 108: 0V

Pin 109: 0V

Pin 110: 0V

Pin 111: 0V

Pin 112: 0V

Pin 113: 0V

Pin 114: 0V

Pin 115: 0V

Pin 116: 0V

Pin 117: 0V

Pin 118: 0V

Pin 119: 0V

Pin 120: 0V

Pin 121: 0V

Pin 122: 0V

Pin 123: 0V

Pin 124: 0V

Pin 125: 0V

Pin 126: 0V

Pin 127: 0V

Pin 128: 0V

Pin 129: 0V

Pin 130: 0V

Pin 131: 0V

Pin 132: 0V

Pin 133: 0V

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Pin 136: 0V

Pin 137: 0V

Pin 138: 0V

Pin 139: 0V

Pin 140: 0V

Pin 141: 0V

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Pin 150: 0V

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Pin 153: 0V

Pin 154: 0V

Pin 155: 0V

Pin 156: 0V

Pin 157: 0V

Pin 158: 0V

Pin 159: 0V

Pin 160: 0V

Pin 161: 0V

Pin 162: 0V

Pin 163: 0V

Pin 164: 0V

Pin 165: 0V

Pin 166: 0V

Pin 167: 0V

Pin 168: 0V

Pin 169: 0V

Pin 170: 0V

Pin 171: 0V

Pin 172: 0V

Pin 173: 0V

Pin 174: 0V

Pin 175: 0V

Pin 176: 0V

Pin 177: 0V

Pin 178: 0V

Pin 179: 0V

Pin 180: 0V

Pin 181: 0V

Pin 182: 0V

Pin 183: 0V

Pin 184: 0V

Pin 185: 0V

Pin 186: 0V

Pin 187: 0V

Pin 188: 0V

Pin 189: 0V

Pin 190: 0V

Pin 191: 0V

Pin 192: 0V

Pin 193: 0V

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Pin 199: 0V

Pin 200: 0V

Pin 201: 0V

Pin 202: 0V

Pin 203: 0V

Pin 204: 0V

Pin 205: 0V

Pin 206: 0V

Pin 207: 0V

Pin 208: 0V

Pin 209: 0V

Pin 210: 0V

Pin 211: 0V

Pin 212: 0V

Pin 213: 0V

Pin 214: 0V

Pin 215: 0V

Pin 216: 0V

Pin 217: 0V

Pin 218: 0V

Pin 219: 0V

Pin 220: 0V

Pin 221: 0V

Pin 222: 0V

Pin 223: 0V

Pin 224: 0V

Pin 225: 0V

Pin 226: 0V

Pin 227: 0V

Pin 228: 0V

Pin 229: 0V

Pin 230: 0V

Pin 231: 0V

Pin 232: 0V

Pin 233: 0V

Pin 234: 0V

Pin 235: 0V

Pin 236: 0V

Pin 237: 0V

Pin 238: 0V

Pin 239: 0V

Pin 240: 0V

Pin 241: 0V

Pin 242: 0V

Pin 243: 0V

Pin 244: 0V

Pin 245: 0V

Pin 246: 0V

Pin 247: 0V

Pin 248: 0V

Pin 249: 0V

Pin 250: 0V

Pin 251: 0V

Pin 252: 0V

Pin 253: 0V

Pin 254: 0V

Pin 255: 0V

Pin 256: 0V

Pin 257: 0V

Pin 258: 0V

Pin 259: 0V

Pin 260: 0V

Pin 261: 0V

Pin 262: 0V

Pin 263: 0V

Pin 264: 0V

Pin 265: 0V

Pin 266: 0V

Pin 267: 0V

Pin 268: 0V

Pin 269: 0V

Pin 270: 0V

Pin 271: 0V

Pin 272: 0V

Pin 273: 0V

Pin 274: 0V

Pin 275: 0V

J8 Package
8 Lead Hermetic DIP



T_{jmax} 150°C	θ_{ja} 150°C/W	θ_{jc} 45°C/W
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T_{jmax}	θ_{ja}
150°C	100°C/W

Technical drawing of a 16-pin connector. The drawing shows a top view and a side view. The top view is a rectangle with 16 pins (8 on each side) numbered 1 through 8. The side view shows the profile of the connector with dimensions for height, width, and pin spacing. Dimensions are given in inches and millimeters.

Dimensions (inches / millimeters):

- Overall height: $0.240 - 0.280$ (6.096 - 7.112)
- Pin pitch (center-to-center): 0.040 (1.016) MAX
- Pin diameter: 0.060 (1.524) SQ
- Pin length (from top surface): 0.020 (0.508) MIN
- Pin length (from bottom surface): $0.155 - 0.175$ (3.937 - 4.445)
- Pin length (from bottom surface): $0.125 - 0.130$ (3.175 - 3.302)
- Pin length (from bottom surface): $0.115 - 0.145$ (2.921 - 3.683)
- Pin length (from bottom surface): 0.100 (2.540) BSC* TYP
- Pin length (from bottom surface): $0.030 - 0.060$ (0.762 - 1.524) TYP
- Pin length (from bottom surface): $0.014 - 0.023$ (0.356 - 0.584) TYP
- Pin length (from bottom surface): 0.005 (0.127) MIN
- Pin length (from bottom surface): $0.370 - 0.400$ (9.400 - 10.16)

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

T_{jmax}	θ_{ja}
100°C	130°C/W

