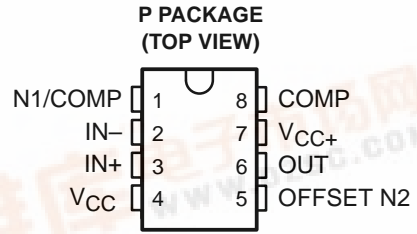


JFET-INPUT OPERATIONAL AMPLIFIER

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- Low Power Consumption
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Total Harmonic Distortion . . . 0.003% Typ
- High Input Impedance . . . JFET Input Stage
- External Frequency Compensation
- Common-Mode Input Voltage Range Includes V_{CC+}
- Latch-Up-Free Operation
- High Slew Rate . . . 13 V/ μ s Typ



description

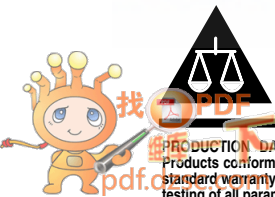
The TL080 JFET-input operational amplifier incorporates well-matched, high-voltage JFET and bipolar transistors in an integrated circuit. This device features high slew rates, low input bias and offset currents, and a low offset-voltage temperature coefficient. Offset adjustment and external-compensation options are available.

The TL080C is characterized for operation from 0°C to 70°C.

AVAILABLE OPTIONS

T _A	V _{IO} max AT 25°C	PACKAGE
		PLASTIC DIP (P)
0°C to 70°C	10 mV	TL080CP

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



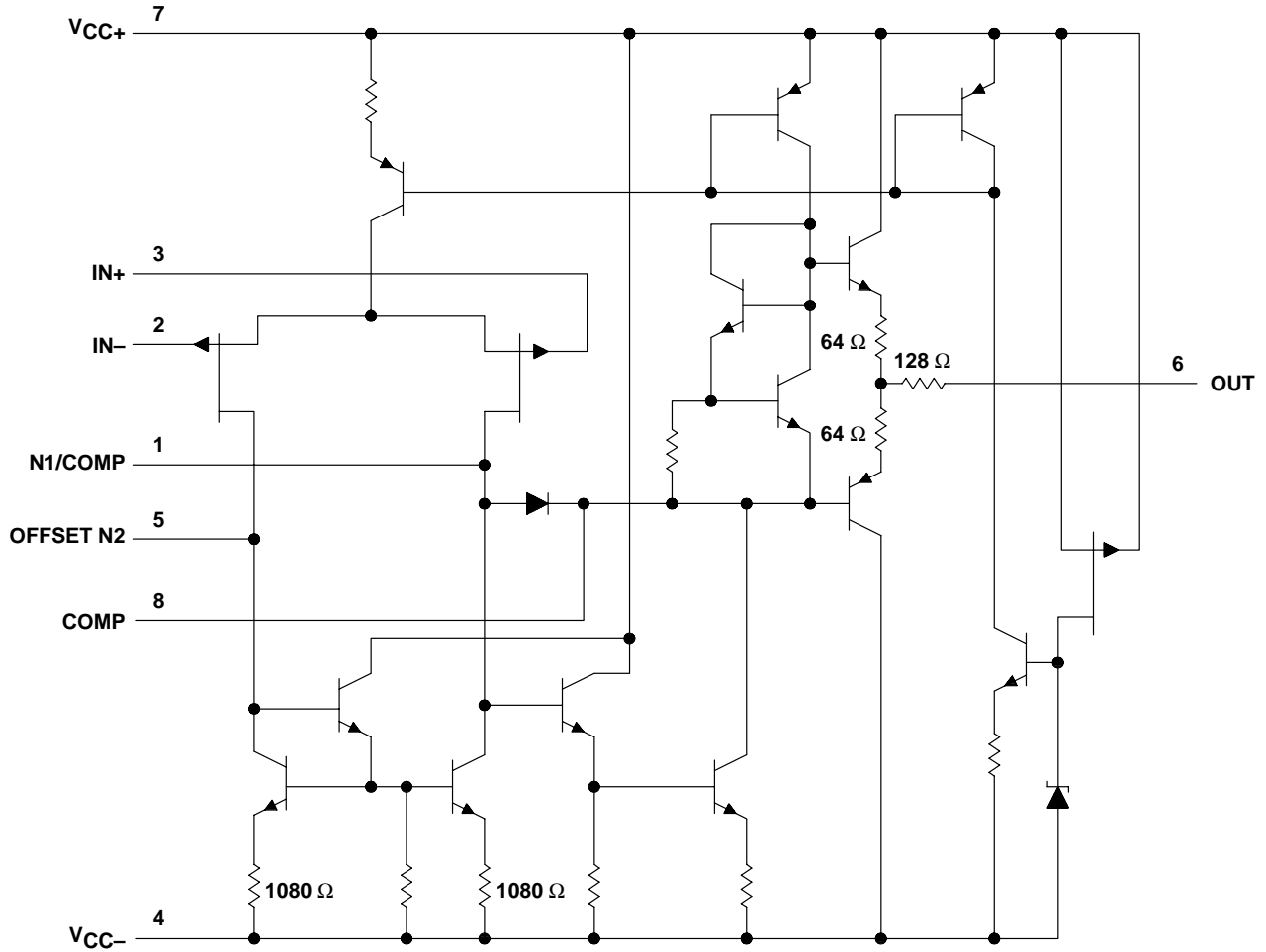
PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



TL080 JFET-INPUT OPERATIONAL AMPLIFIER

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schematic



All component values shown are nominal.

TL080 JFET-INPUT OPERATIONAL AMPLIFIER

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage (see Note 1): V_{CC+}	18 V
V_{CC-}	–18 V
Differential input voltage, V_{ID} (see Note 2)	±30 V
Input voltage, V_I (see Notes 1 and 3)	±15 V
Duration of short-circuit current (see Note 4)	Unlimited
Package thermal impedance, θ_{JA} (see Notes 5 and 6)	85°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, T_{stg}	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values, except differential voltages, are with respect to the midpoint between V_{CC+} and V_{CC-} .
 2. Differential voltages are at $IN+$ with respect to $IN-$.
 3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
 4. The output can be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.
 5. Maximum power dissipation is a function of $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can impact reliability.
 6. The package thermal impedance is calculated in accordance with JESD 51-7.

electrical characteristics, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A †	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	$V_O = 0, R_S = 50 \Omega$	25°C		3	15	mV
			Full range			20	
$\alpha_{V_{IO}}$	Temperature coefficient of input offset voltage	$V_O = 0, R_S = 50 \Omega$	Full range		18		$\mu\text{V}/^\circ\text{C}$
I_{IO}	Input offset current‡	$V_O = 0$	25°C		5	200	pA
			Full range			2	nA
I_{IB}	Input bias current‡	$V_O = 0$	25°C		30	400	pA
			Full range			10	nA
V_{ICR}	Common-mode input voltage range		25°C	±11	–12 to 15		V
V_{OM}	Maximum peak output voltage swing	$R_L = 10 \text{ k}\Omega$	25°C	±12	±13.5		V
		$R_L \geq 10 \text{ k}\Omega$	Full range	±12			
		$R_L \geq 2 \text{ k}\Omega$		±10	±12		
A_{VD}	Large-signal differential voltage amplification	$V_O = \pm 10 \text{ V}, R_L \geq 2 \text{ k}\Omega$	25°C	25	200		V/mV
			Full range	15			
B_1	Unity-gain bandwidth		25°C		3		MHz
r_i	Input resistance		25°C		10^{12}		Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR\text{min}}, V_O = 0, R_S = 50 \Omega$	25°C	70	86		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC} = \pm 15 \text{ V to } \pm 9 \text{ V}, V_O = 0, R_S = 50 \Omega$	25°C	70	86		dB
I_{CC}	Supply current	$V_O = 0, \text{ No load}$	25°C		1.4	2.8	mA
V_{O1}/V_{O2}	Crosstalk attenuation	$A_{VD} = 100$	25°C		120		dB

† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified. Full range for T_A is –40°C to 85°C.

‡ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive, as shown in Figure 5. Pulse techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

TL080 JFET-INPUT OPERATIONAL AMPLIFIER

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operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
SR Slew rate at unity gain	$V_I = 10\text{ V}$,	$R_L = 2\text{ k}\Omega$,	$C_L = 100\text{ pF}$, See Figure 1	8	13		$\text{V}/\mu\text{s}$
t_r Rise-time overshoot factor	$V_I = 20\text{ mV}$,	$R_L = 2\text{ k}\Omega$,	$C_L = 100\text{ pF}$, See Figure 1		0.05		μs
V_n Equivalent input noise voltage	$R_S = 100\ \Omega$	$f = 1\text{ kHz}$			18		$\text{nV}/\sqrt{\text{Hz}}$
		$f = 10\text{ Hz to } 10\text{ kHz}$			4		μV
I_n Equivalent input noise current	$R_S = 100\ \Omega$,	$f = 1\text{ kHz}$			0.01		$\text{pA}/\sqrt{\text{Hz}}$
THD Total harmonic distortion	$V_{O(\text{rms})} = 10\text{ V}$,	$R_S \leq 1\text{ k}\Omega$,	$R_L \geq 2\text{ k}\Omega$, $f = 1\text{ kHz}$		0.003%		

APPLICATION INFORMATION

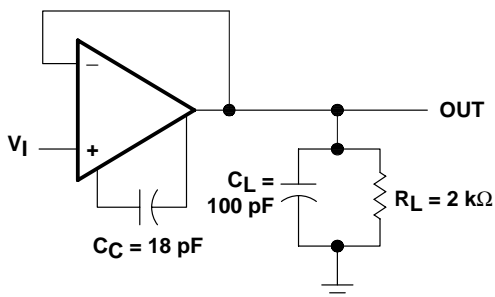


Figure 1. Unity-Gain Amplifier

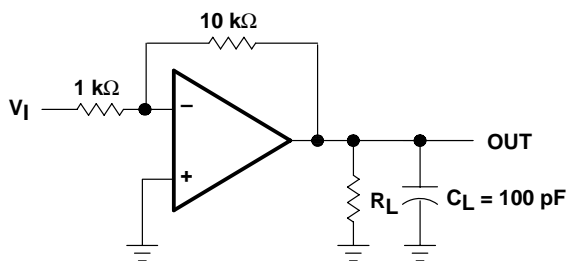


Figure 2. Gain-of-10 Inverting Amplifier

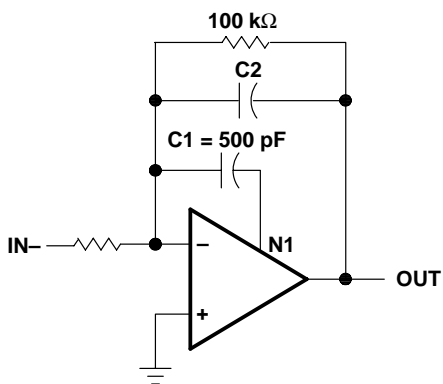


Figure 3. Feed-Forward Compensation

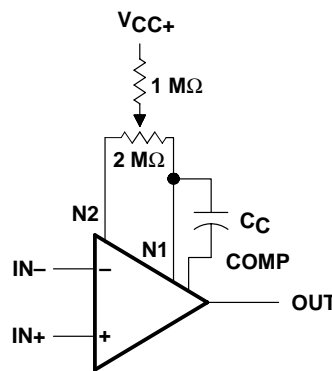


Figure 4. Input Offset Voltage Null Circuit

TYPICAL CHARACTERISTICS

Table of Graphs

		FIGURE	
V _{OM}	Maximum peak output voltage	vs Frequency	5, 6, 7
		vs Free-air temperature	8
		vs Load resistance	9
		vs Supply voltage	10
A _{VD}	Large-signal differential voltage amplification	vs Free-air temperature	11
	Differential voltage amplification	vs Frequency	12
P _D	Total power dissipation	vs Free-air temperature	14
I _{CC}	Supply current	vs Free-air temperature	14
		vs Supply voltage	15
I _{IB}	Input bias current	vs Free-air temperature	16
	Large-signal pulse response	vs Time	17
V _O	Output voltage	vs Elapsed time	18
CMRR	Common-mode rejection ratio	vs Free-air temperature	19
V _n	Equivalent input noise voltage	vs Frequency	20
THD	Total harmonic distortion	vs Frequency	21

MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREQUENCY

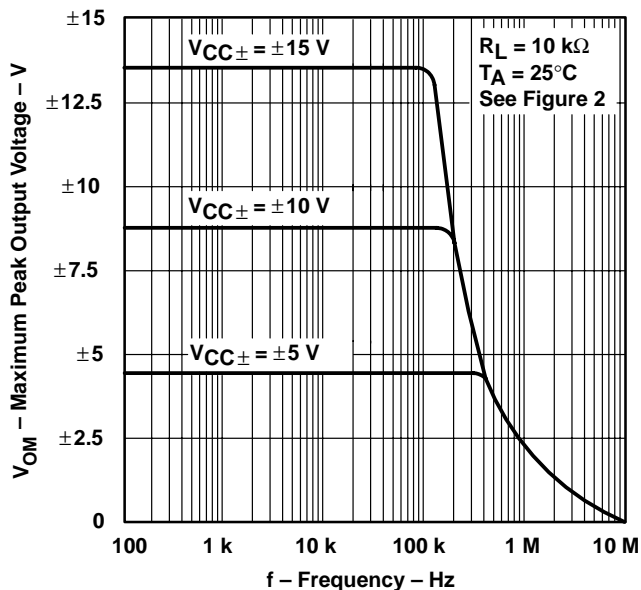


Figure 5

MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREQUENCY

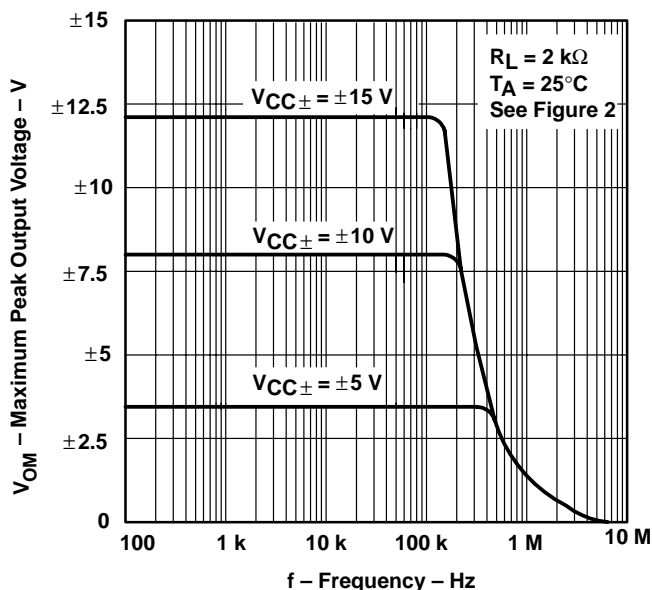


Figure 6

TL080 JFET-INPUT OPERATIONAL AMPLIFIER

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TYPICAL CHARACTERISTICS

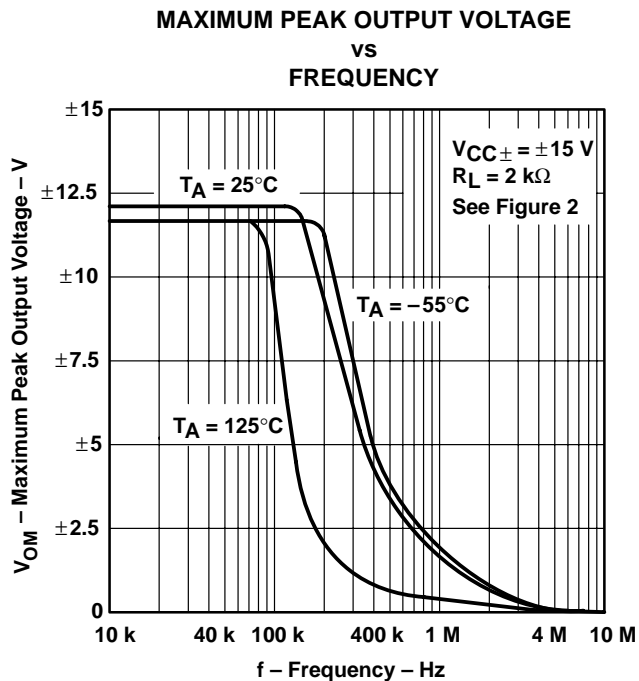


Figure 7

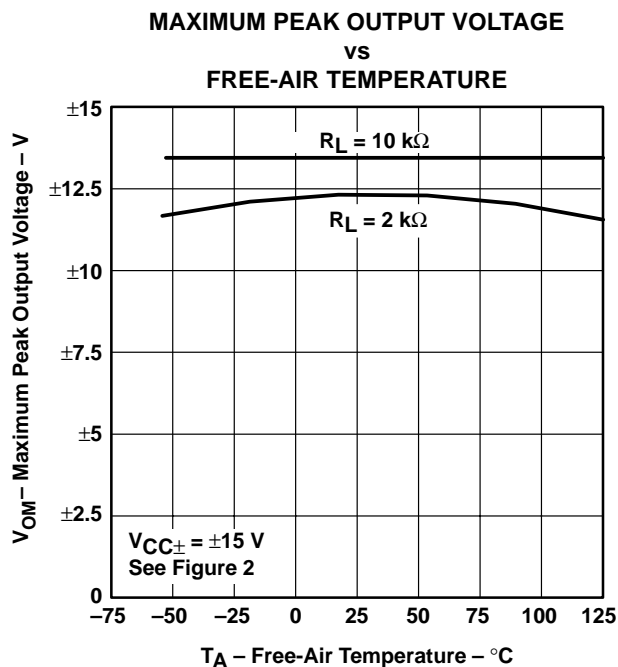


Figure 8

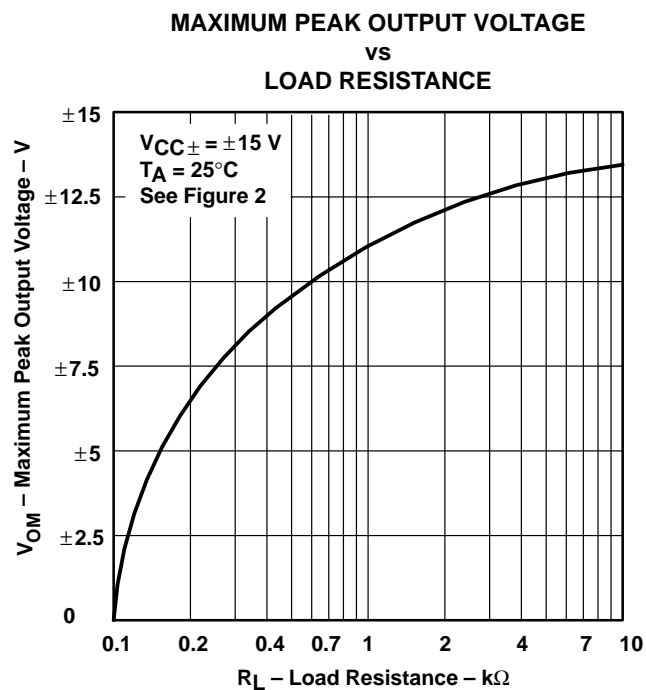


Figure 9

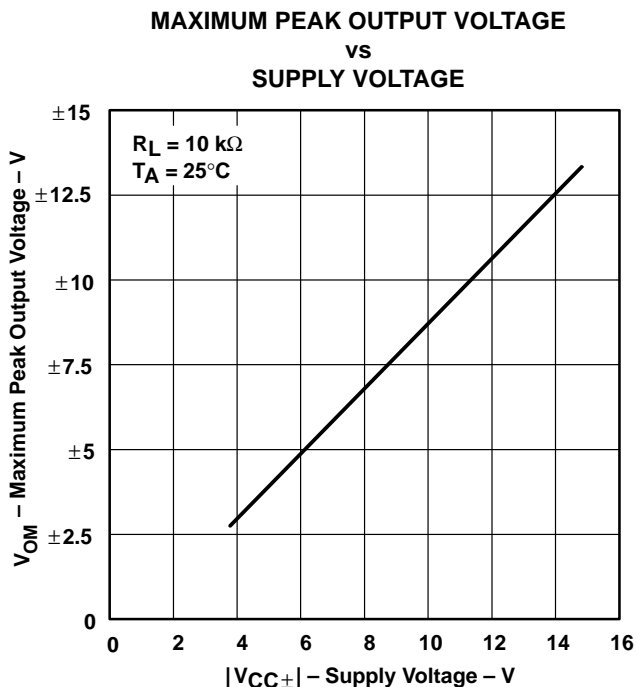


Figure 10

TYPICAL CHARACTERISTICS

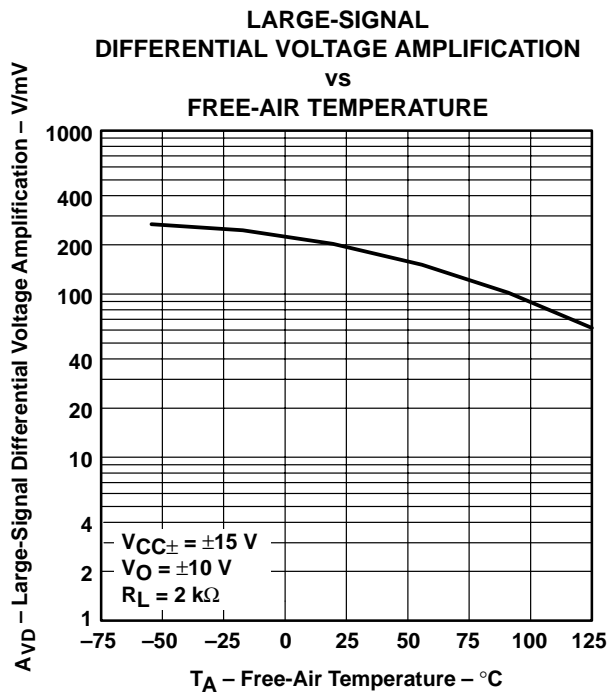


Figure 11

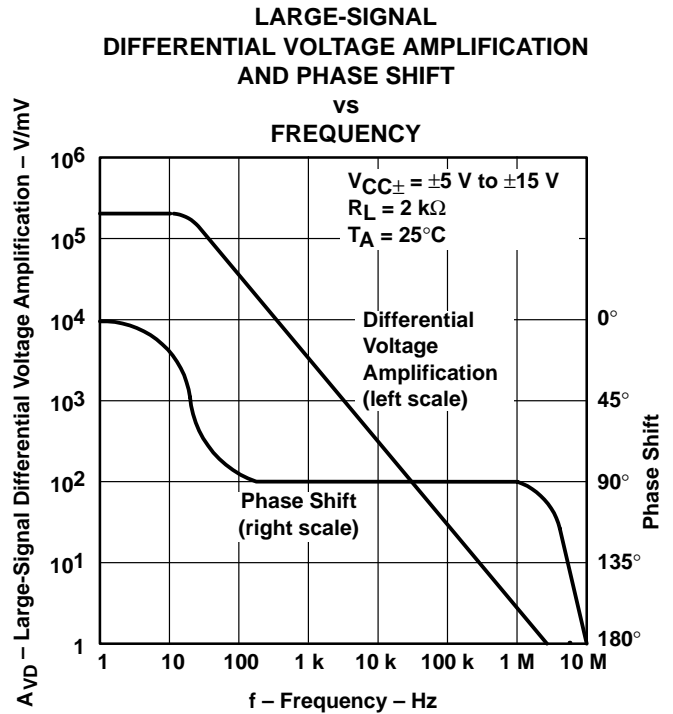


Figure 12

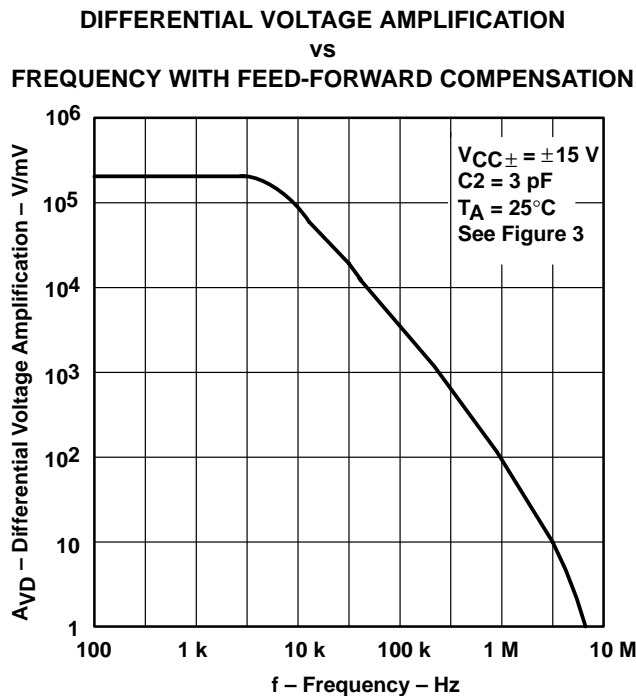


Figure 13

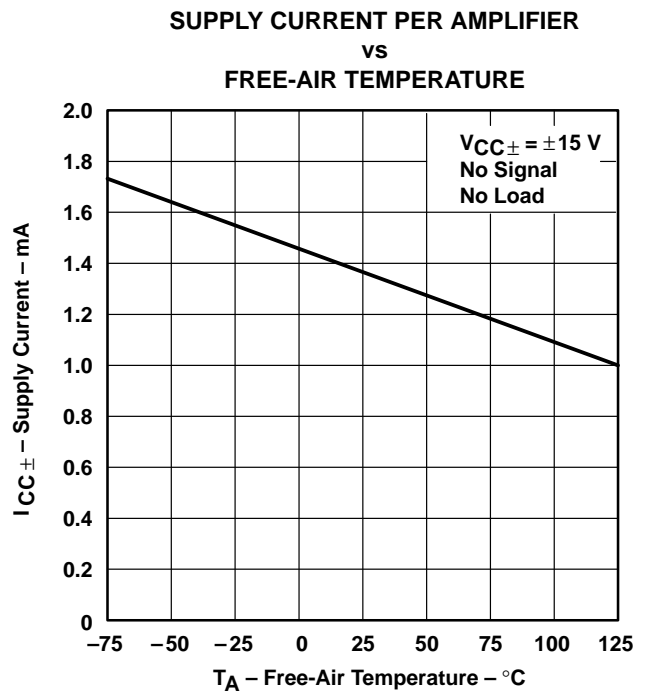


Figure 14

TL080 JFET-INPUT OPERATIONAL AMPLIFIER

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TYPICAL CHARACTERISTICS

**SUPPLY CURRENT
vs
SUPPLY VOLTAGE**

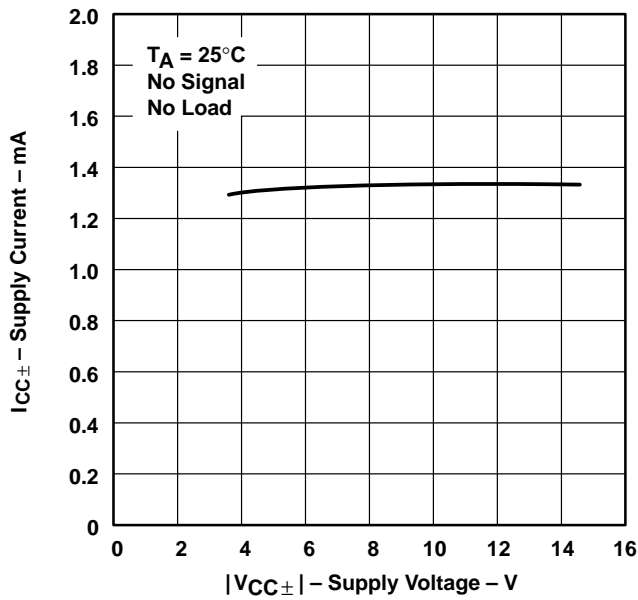


Figure 15

**INPUT BIAS CURRENT
vs
FREE-AIR TEMPERATURE**

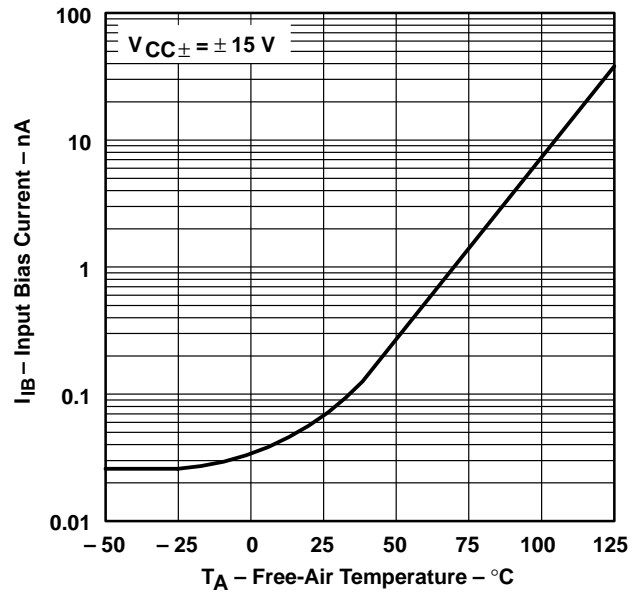


Figure 16

**VOLTAGE-FOLLOWER
LARGE-SIGNAL PULSE RESPONSE**

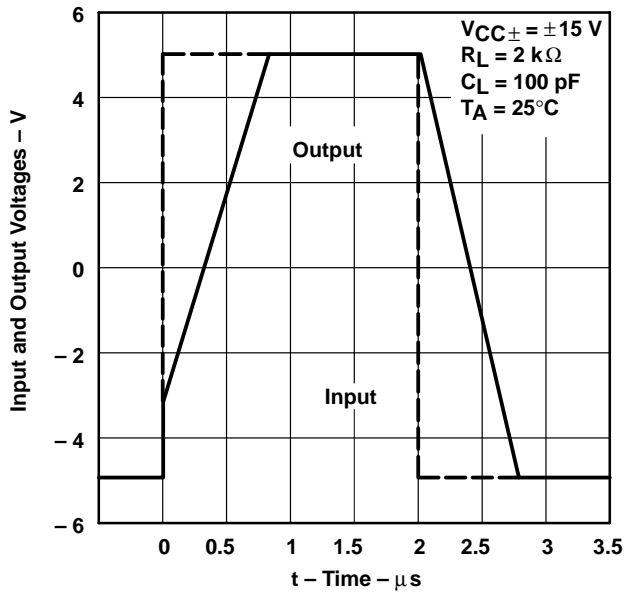


Figure 17

**OUTPUT VOLTAGE
vs
ELAPSED TIME**

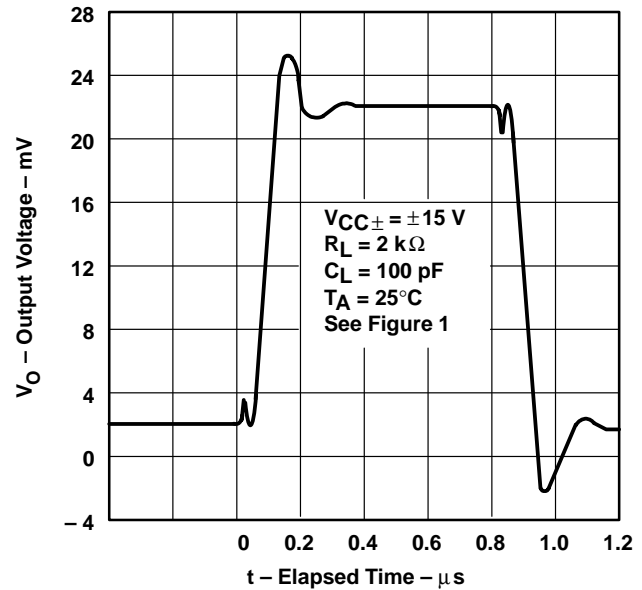


Figure 18

TYPICAL CHARACTERISTICS

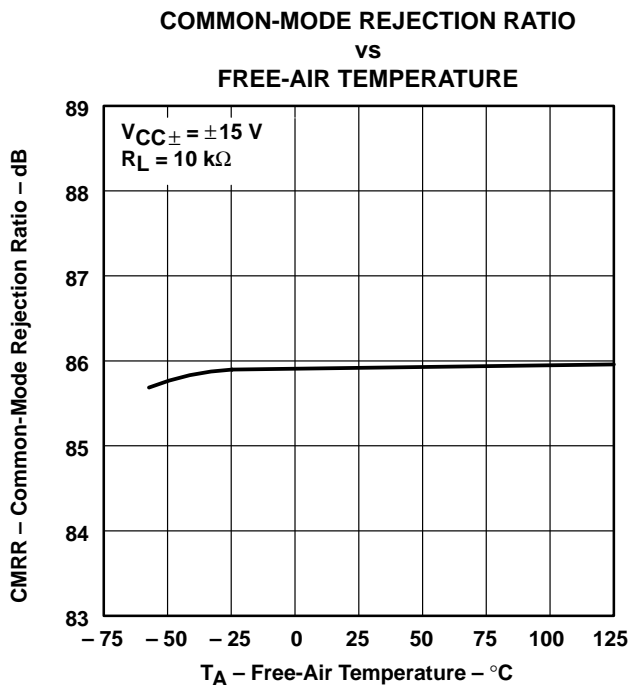


Figure 19

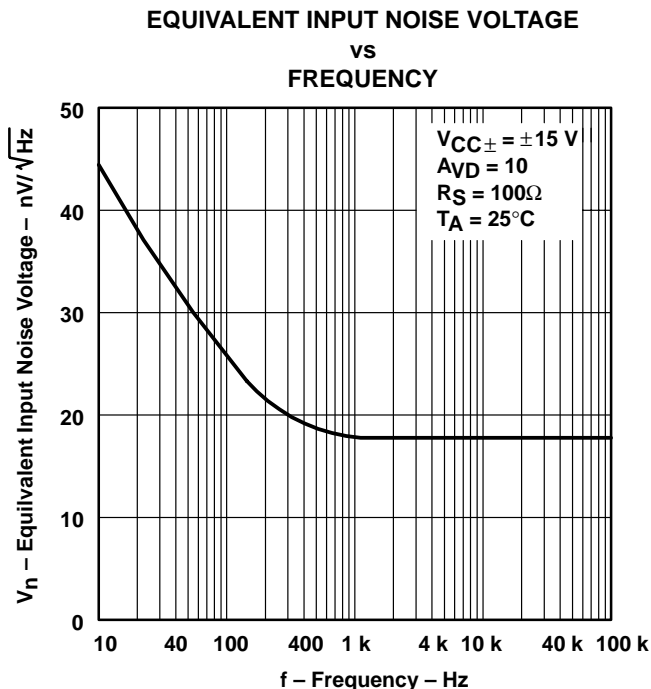


Figure 20

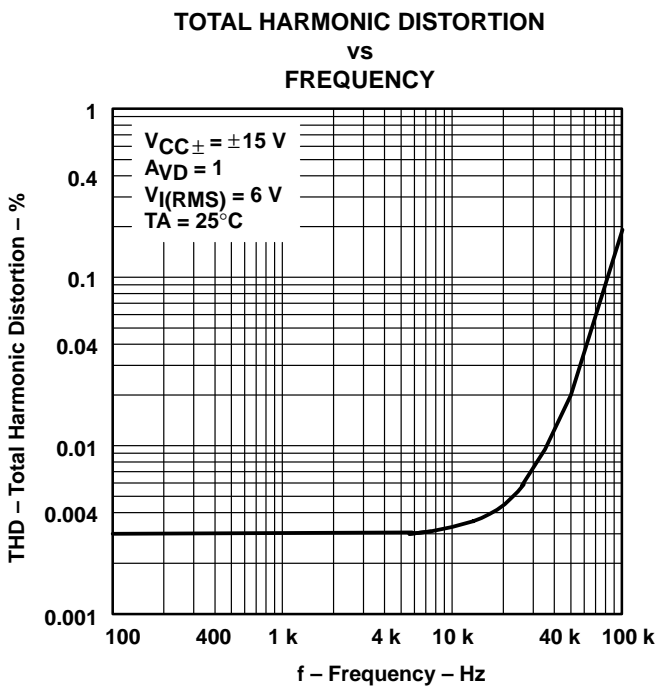


Figure 21

TL080 JFET-INPUT OPERATIONAL AMPLIFIER

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APPLICATION INFORMATION

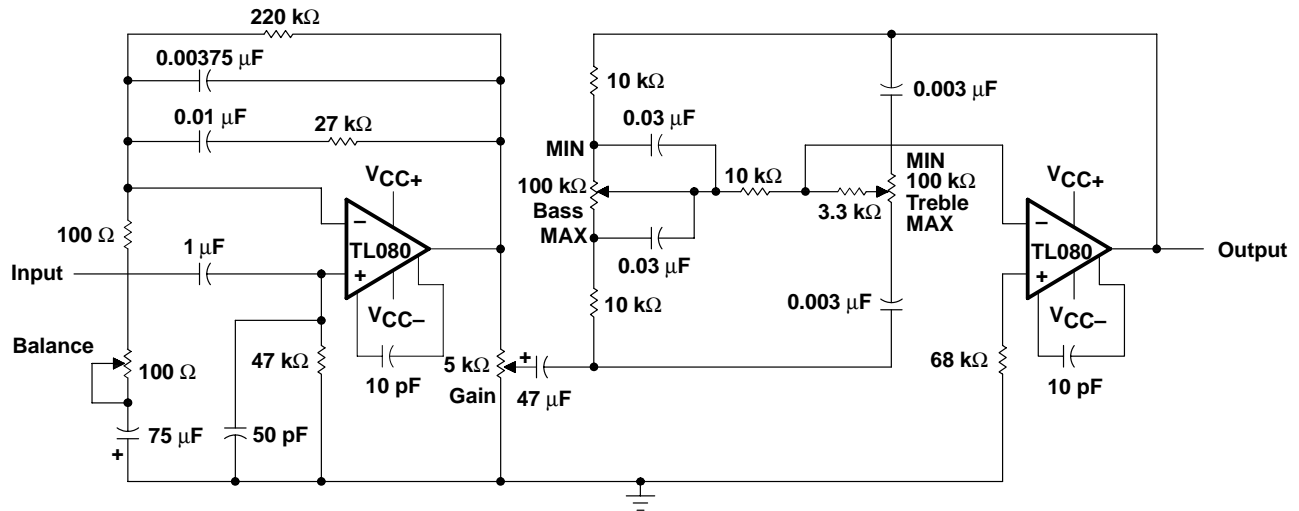


Figure 22. IC Preampifier

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TL080CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL080CPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL080IP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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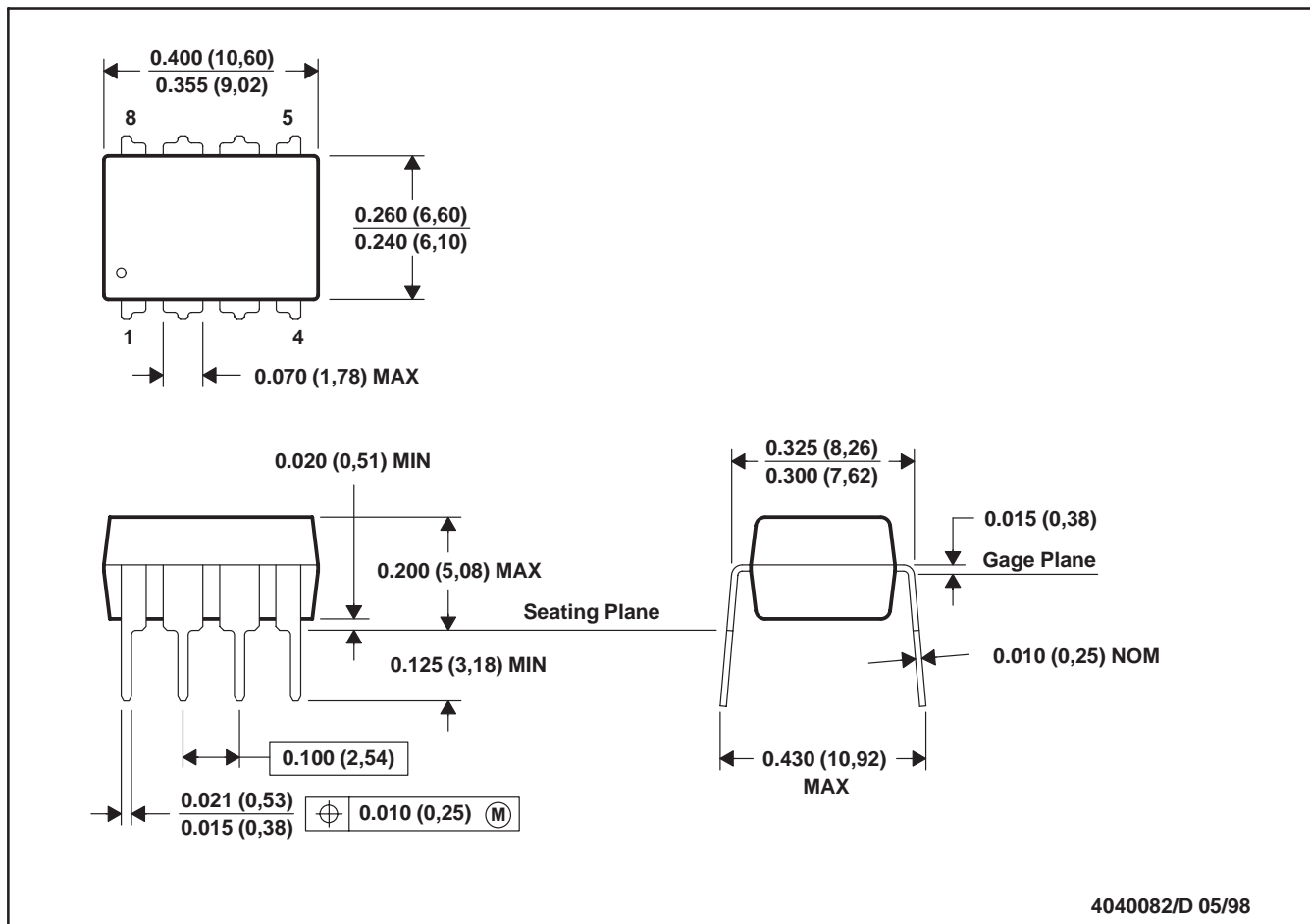
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MECHANICAL DATA

MPDI001A – JANUARY 1995 – REVISED JUNE 1999

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Falls within JEDEC MS-001

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