

TL081, TL081A, TL081B, TL082, TL082A, TL082B TL084, TL084A, TL084B JFET-INPUT OPERATIONAL AMPLIFIERS

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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
- Latch-Up-Free Operation
- High Slew Rate . . . 13 V/ μ s Typ
- Common-Mode Input Voltage Range Includes V_{CC+}

description/ordering information

The TL08x JFET-input operational amplifier family is designed to offer a wider selection than any previously developed operational amplifier family. Each of these JFET-input operational amplifiers incorporates well-matched, high-voltage JFET and bipolar transistors in a monolithic integrated circuit. The devices feature high slew rates, low input bias and offset currents, and low offset-voltage temperature coefficient. Offset adjustment and external compensation options are available within the TL08x family.

The C-suffix devices are characterized for operation from 0°C to 70°C. The I-suffix devices are characterized for operation from –40°C to 85°C. The Q-suffix devices are characterized for operation from –40°C to 125°C. The M-suffix devices are characterized for operation over the full military temperature range of –55°C to 125°C.

ORDERING INFORMATION

| T_J | V_{IOmax} AT 25°C | PACKAGE† | ORDERABLE PART NUMBER | TOP-SIDE MARKING | |
|-------------|------------------------|------------|--------------------------|---------------------|---------|
| 0°C to 70°C | 15 mV | PDIP (P) | Tube of 50 | TL081CP | TL081CP |
| | | | Tube of 50 | TL082CP | TL082CP |
| | | PDIP (N) | Tube of 25 | TL084CN | TL084CN |
| | | SOIC (D) | Tube of 75 | TL081CD | TL081C |
| | | | Reel of 2500 | TL081CDR | |
| | | | Tube of 75 | TL082CD | TL082C |
| | | | Reel of 2500 | TL082CDR | |
| | | | Tube of 50 | TL084CD | TL084C |
| | | | Reel of 2500 | TL084CDR | |
| | | SOP (PS) | Reel of 2000 | TL081CPSR | T081 |
| | | | Reel of 2000 | TL082CPSR | T082 |
| | | SOP (NS) | Reel of 2000 | TL084CNSR | TL084 |
| | | TSSOP (PW) | Tube of 150 | TL082CPW | T082 |
| | | | Reel of 2000 | TL082CPWR | |
| | | | Tube of 90 | TL084CPW | T084 |
| | | | Reel of 2000 | TL084CPWR | |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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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.

 **TEXAS
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

**TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL084, TL084A, TL084B
JFET-INPUT OPERATIONAL AMPLIFIERS**

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description/ordering information (continued)

ORDERING INFORMATION

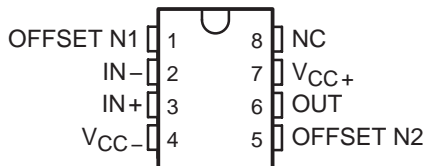
| T _J | V _{IO} max AT 25°C | PACKAGE† | ORDERABLE PART NUMBER | TOP-SIDE MARKING | |
|----------------|--------------------------------|--------------|--------------------------|---------------------|----------|
| 0°C to 70°C | 6 mV | PDIP (P) | Tube of 50 | TL081ACP | TL081ACP |
| | | | Tube of 50 | TL082ACP | TL082ACP |
| | | PDIP (N) | Tube of 25 | TL084ACN | TL084ACN |
| | | SOIC (D) | Tube of 75 | TL081ACD | 081AC |
| | | | Reel of 2500 | TL081ACDR | |
| | | | Tube of 75 | TL082ACD | 082AC |
| | | | Reel of 2500 | TL082ACDR | |
| | | SOIC (D) | Tube of 50 | TL084ACD | TL084AC |
| | Reel of 2500 | | TL084ACDR | | |
| | SOP (PS) | Reel of 2000 | TL082ACPSR | T082A | |
| | SOP (NS) | Reel of 2000 | TL084ACNSR | TL084A | |
| | 3 mV | PDIP (P) | Tube of 50 | TL081BCP | TL081BCP |
| | | | Tube of 50 | TL082BCP | TL082BCP |
| | | PDIP (N) | Tube of 25 | TL084BCN | TL084BCN |
| SOIC (D) | | Tube of 75 | TL081BCD | 081BC | |
| | | Reel of 2500 | TL081BCDR | | |
| | | Tube of 75 | TL082BCD | 082BC | |
| | | Reel of 2500 | TL082BCDR | | |
| SOIC (D) | | Tube of 50 | TL084BCD | TL084BC | |
| | Reel of 2500 | TL084BCDR | | | |
| -40°C to 85°C | 6 mV | PDIP (P) | Tube of 50 | TL081IP | TL081IP |
| | | | Tube of 50 | TL082IP | TL082IP |
| | | PDIP (N) | Tube of 25 | TL084IN | TL081IN |
| | | SOIC (D) | Tube of 75 | TL081ID | TL081I |
| | | | Reel of 2500 | TL081IDR | |
| | | | Tube of 75 | TL082ID | TL082I |
| | | | Reel of 2500 | TL082IDR | |
| | | SOIC (D) | Tube of 50 | TL084ID | TL084I |
| | Reel of 2500 | | TL084IDR | | |
| | TSSOP (PW) | Reel of 2000 | TL082IPWR | Z082 | |
| -40°C to 125°C | 9 mV | SOIC (D) | Tube of 50 | TL084QD | TL084QD |
| | | | Reel of 2500 | TL084QDR | |
| -55°C to 125°C | 9 mV | CDIP (J) | Tube of 25 | TL084MJ | TL084MJ |
| | | LCCC (FK) | Reel of 55 | TL084FK | TL084FK |
| | 6 mV | CDIP (JG) | Tube of 50 | TL082MJG | TL082MJG |
| | | LCCC (FK) | Tube of 55 | TL082MFK | TL082MFK |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

TL081, TL081A, TL081B, TL082, TL082A, TL082B TL084, TL084A, TL084B JFET-INPUT OPERATIONAL AMPLIFIERS

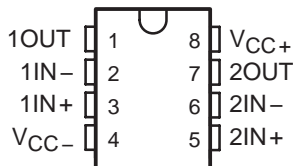
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TL081, TL081A, TL081B
D, P, OR PS PACKAGE
(TOP VIEW)

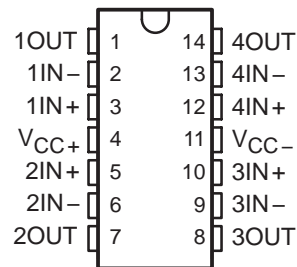


NC – No internal connection

TL082, TL082A, TL082B
D, JG, P, PS, OR PW PACKAGE
(TOP VIEW)



TL084, TL084A, TL084B
D, J, N, NS, OR PW PACKAGE
(TOP VIEW)

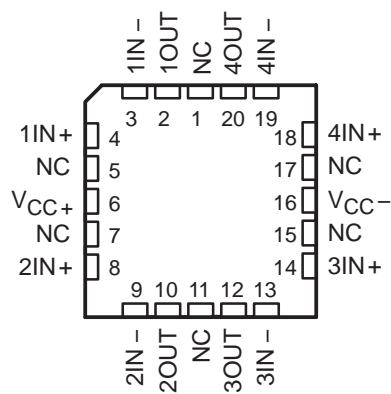


TL082M . . . FK PACKAGE
(TOP VIEW)



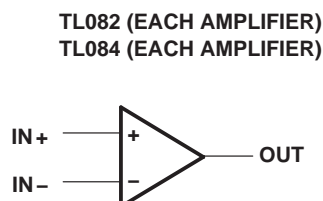
NC – No internal connection

TL084M . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

symbols



**TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL084, TL084A, TL084B
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schematic (each amplifier)



Component values shown are nominal.



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TL081, TL081A, TL081B, TL082, TL082A, TL082B TL084, TL084A, TL084B JFET-INPUT OPERATIONAL AMPLIFIERS

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

| | TL08_C TL08_AC TL08_BC | TL08_I | TL084Q | TL08_M | UNIT |
|---|------------------------------|------------|------------|------------|-----------------------------|
| Supply voltage, V_{CC+} (see Note 1) | 18 | 18 | 18 | 18 | V |
| Supply voltage V_{CC-} (see Note 1) | -18 | -18 | -18 | -18 | V |
| Differential input voltage, V_{ID} (see Note 2) | ± 30 | ± 30 | ± 30 | ± 30 | V |
| Input voltage, V_I (see Notes 1 and 3) | ± 15 | ± 15 | ± 15 | ± 15 | V |
| Duration of output short circuit (see Note 4) | Unlimited | Unlimited | Unlimited | Unlimited | |
| Continuous total power dissipation | See Dissipation Rating Table | | | | |
| Operating free-air temperature range, T_A | 0 to 70 | -40 to 85 | -40 to 125 | -55 to 125 | $^{\circ}\text{C}$ |
| Package thermal impedance, θ_{JA} (see Notes 5 and 6) | D package (8-pin) | 97 | 97 | | $^{\circ}\text{C}/\text{W}$ |
| | D package (14-pin) | 86 | 86 | | |
| | N package (14-pin) | 76 | 76 | | |
| | NS package (14-pin) | 80 | | | |
| | P package (8-pin) | 85 | 85 | | |
| | PS package (8-pin) | 95 | 95 | | |
| | PW package (8-pin) | 149 | | | |
| | PW package (14-pin) | 113 | 113 | | |
| Operating virtual junction temperature | 150 | 150 | 150 | 150 | $^{\circ}\text{C}$ |
| Case temperature for 60 seconds, T_C | FK package | | | 260 | $^{\circ}\text{C}$ |
| Lead temperature 1.6 mm (1/16 inch) from case for 60 seconds | J or JG package | | | 300 | $^{\circ}\text{C}$ |
| Storage temperature range, T_{stg} | -65 to 150 | -65 to 150 | -65 to 150 | -65 to 150 | $^{\circ}\text{C}$ |

† 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:
- All voltage values, except differential voltages, are with respect to the midpoint between V_{CC+} and V_{CC-} .
 - Differential voltages are at $IN+$ with respect to $IN-$.
 - The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
 - The output may 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.
 - 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 $^{\circ}\text{C}$ can affect reliability.
 - The package thermal impedance is calculated in accordance with JESD 51-7.

DISSIPATION RATING TABLE

| PACKAGE | $T_A \leq 25^{\circ}\text{C}$ POWER RATING | DERATING FACTOR | DERATE ABOVE T_A | $T_A = 70^{\circ}\text{C}$ POWER RATING | $T_A = 85^{\circ}\text{C}$ POWER RATING | $T_A = 125^{\circ}\text{C}$ POWER RATING |
|------------|---|-----------------------------|-----------------------|--|--|---|
| D (14 pin) | 680 mW | 7.6 mW/ $^{\circ}\text{C}$ | 60 $^{\circ}\text{C}$ | 604 mW | 490 mW | 186 mW |
| FK | 680 mW | 11.0 mW/ $^{\circ}\text{C}$ | 88 $^{\circ}\text{C}$ | 680 mW | 680 mW | 273 mW |
| J | 680 mW | 11.0 mW/ $^{\circ}\text{C}$ | 88 $^{\circ}\text{C}$ | 680 mW | 680 mW | 273 mW |
| JG | 680 mW | 8.4 mW/ $^{\circ}\text{C}$ | 69 $^{\circ}\text{C}$ | 672 mW | 546 mW | 210 mW |



**TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL084, TL084A, TL084B
JFET-INPUT OPERATIONAL AMPLIFIERS**

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

| PARAMETER | TEST CONDITIONS | T _A † | TL081C TL082C TL084C | | | TL081AC TL082AC TL084AC | | | TL081BC TL082BC TL084BC | | | TL081I TL082I TL084I | | | UNIT |
|----------------------------------|---|--------------------|----------------------------|-----------------|------------------|-------------------------------|------------------|-----------------|-------------------------------|-----------------|------------------|----------------------------|------------------|-------|------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| V _{IO} | V _O = 0 R _S = 50 Ω | 25°C Full range | 3 | 15 | 6 | 3 | 6 | 2 | 3 | 3 | 6 | 3 | 6 | mV | |
| α _{VIO} | V _O = 0 R _S = 50 Ω | Full range | | 20 | 7.5 | | | | 5 | | | | 9 | | |
| I _{IO} | V _O = 0 | Full range | 18 | | | 18 | | | 18 | | | 18 | | μV/°C | |
| I _{IB} | V _O = 0 | 25°C Full range | 5 | 200 | 100 | 5 | 100 | 5 | 100 | 5 | 100 | 5 | 100 | pA | |
| V _{ICR} | V _O = 0 | 25°C Full range | 2 | | 2 | 2 | | 2 | | 2 | | 10 | | nA | |
| V _{OM} | V _O = 0 | 25°C Full range | 30 | 400 | 200 | 30 | 200 | 30 | 200 | 30 | 200 | 30 | 200 | pA | |
| V _{ICR} | V _O = 0 | 25°C Full range | 10 | | 7 | 10 | | 7 | | 7 | | 20 | | nA | |
| V _{ICR} | Common-mode input voltage range | 25°C | ±11 | -12 to 15 | ±11 | -12 to 15 | ±11 | -12 to 15 | ±11 | -12 to 15 | ±11 | -12 to 15 | ±11 | V | |
| V _{OM} | Maximum peak output voltage swing | 25°C | ±12 | ±13.5 | ±12 | ±13.5 | ±12 | ±13.5 | ±12 | ±13.5 | ±12 | ±13.5 | ±12 | V | |
| V _{OM} | Maximum peak output voltage swing | Full range | ±12 | | ±12 | | ±12 | | ±12 | | ±12 | | ±12 | V | |
| A _{V/D} | Large-signal differential voltage amplification | 25°C | 25 | 200 | 50 | 200 | 50 | 200 | 50 | 200 | 50 | 200 | 50 | V/mV | |
| A _{V/D} | Large-signal differential voltage amplification | Full range | 15 | | 25 | | 25 | | 25 | | 25 | | 25 | V/mV | |
| B ₁ | Unity-gain bandwidth | 25°C | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | MHz | |
| r _i | Input resistance | 25°C | 10 ¹² | | 10 ¹² | | 10 ¹² | | 10 ¹² | | 10 ¹² | | 10 ¹² | Ω | |
| CMRR | Common-mode rejection ratio | 25°C | 70 | 86 | 75 | 86 | 75 | 86 | 75 | 86 | 75 | 86 | 75 | dB | |
| k _{SVR} | Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO}) | 25°C | 70 | 86 | 80 | 86 | 80 | 86 | 80 | 86 | 80 | 86 | 80 | dB | |
| I _{CC} | Supply current (per amplifier) | 25°C | 1.4 | 2.8 | 1.4 | 2.8 | 1.4 | 2.8 | 1.4 | 2.8 | 1.4 | 2.8 | 1.4 | mA | |
| V _{O1} /V _{O2} | Crosstalk attenuation | 25°C | 120 | | 120 | | 120 | | 120 | | 120 | | 120 | dB | |

† All characteristics are measured under open-loop conditions with zero common-mode voltage, unless otherwise specified. Full range for T_A is 0°C to 70°C for TL08_C, TL08_AC, TL08_BC and -40°C to 85°C for TL08_I.

‡ Input bias currents of an FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive, as shown in Figure 17. Pulse techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.



**TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL084, TL084A, TL084B
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electrical characteristics, $V_{CC\pm} = \pm 15\text{ V}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS† | T_A | TL081M, TL082M | | | TL084Q, TL084M | | | UNIT |
|---|--|------------|----------------|------------|----------|----------------|------------|------|------------------------------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V_{IO} Input offset voltage | $V_O = 0, R_S = 50\ \Omega$ | 25°C | 3 | 6 | | 3 | 9 | mV | |
| | | Full range | | | 9 | | 15 | | |
| α_{VIO} Temperature coefficient of input offset voltage | $V_O = 0, R_S = 50\ \Omega$ | Full range | 18 | | | 18 | | | $\mu\text{V}/^\circ\text{C}$ |
| I_{IO} Input offset current‡ | $V_O = 0$ | 25°C | 5 | 100 | | 5 | 100 | pA | |
| | | 125°C | 20 | | | 20 | | | nA |
| I_{IB} Input bias current‡ | $V_O = 0$ | 25°C | 30 | 200 | | 30 | 200 | pA | |
| | | 125°C | 50 | | | 50 | | | nA |
| V_{ICR} Common-mode input voltage range | | 25°C | ± 11 | -12 to 15 | | ± 11 | -12 to 15 | V | |
| V_{OM} Maximum peak output voltage swing | $R_L = 10\ \text{k}\Omega$ | 25°C | ± 12 | ± 13.5 | | ± 12 | ± 13.5 | V | |
| | $R_L \geq 10\ \text{k}\Omega$ | Full range | ± 12 | | ± 12 | | | | |
| | $R_L \geq 2\ \text{k}\Omega$ | | ± 10 | ± 12 | ± 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 | | 25 | 200 | V/mV | |
| | $V_O = \pm 10\ \text{V}, R_L \geq 2\ \text{k}\Omega$ | Full range | 15 | | 15 | | | | |
| B_1 Unity-gain bandwidth | | 25°C | 3 | | | 3 | | | MHz |
| r_i Input resistance | | 25°C | 10^{12} | | | 10^{12} | | | Ω |
| CMRR Common-mode rejection ratio | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50\ \Omega$ | 25°C | 80 | 86 | | 80 | 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 | 80 | 86 | | 80 | 86 | dB | |
| I_{CC} Supply current (per amplifier) | $V_O = 0, \text{ No load}$ | 25°C | 1.4 | 2.8 | | 1.4 | 2.8 | mA | |
| V_{O1}/V_{O2} Crosstalk attenuation | $A_{VD} = 100$ | 25°C | 120 | | | 120 | | | dB |

† All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified.

‡ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive, as shown in Figure 17. Pulse techniques must be used that maintain the junction temperatures as close to the ambient temperature as possible.

operating characteristics, $V_{CC\pm} = \pm 15\ \text{V}, T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT | |
|--------------------------------------|--|---|-------|-----|------------------------------|---|
| SR Slew rate at unity gain | $V_I = 10\ \text{V}, R_L = 2\ \text{k}\Omega, C_L = 100\ \text{pF}, \text{ See Figure 1}$ | 8* | 13 | | V/ μs | |
| | $V_I = 10\ \text{V}, R_L = 2\ \text{k}\Omega, C_L = 100\ \text{pF}, T_A = -55^\circ\text{C to } 125^\circ\text{C}, \text{ See Figure 1}$ | 5* | | | | |
| t_r Rise time | $V_I = 20\ \text{mV}, R_L = 2\ \text{k}\Omega, C_L = 100\ \text{pF}, \text{ See Figure 1}$ | 0.05 | | | μs | |
| Overshoot factor | | 20 | | | % | |
| V_n Equivalent input noise voltage | $R_S = 20\ \Omega$ | f = 1 kHz | | | $\text{nV}/\sqrt{\text{Hz}}$ | |
| | | f = 10 Hz to 10 kHz | | | μV | |
| I_n Equivalent input noise current | $R_S = 20\ \Omega, f = 1\ \text{kHz}$ | 0.01 | | | $\text{pA}/\sqrt{\text{Hz}}$ | |
| THD Total harmonic distortion | $V_{rms} = 6\ \text{V}, f = 1\ \text{kHz}$ | $A_{VD} = 1, R_S \leq 1\ \text{k}\Omega, R_L \geq 2\ \text{k}\Omega,$ | 0.003 | | | % |

*On products compliant to MIL-PRF-38535, this parameter is not production tested.



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TL084, TL084A, TL084B
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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 | $V_I = 20\text{ mV}$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$, See Figure 1 | | 0.05 | | μs |
| Overshoot factor | | | 20 | | % |
| V_n Equivalent input noise voltage | $R_S = 20\ \Omega$ | $f = 1\text{ kHz}$ | 18 | | $\text{nV}/\sqrt{\text{Hz}}$ |
| | | $f = 10\text{ Hz to } 10\text{ kHz}$ | 4 | | μV |
| I_n Equivalent input noise current | $R_S = 20\ \Omega$, $f = 1\text{ kHz}$ | | 0.01 | | $\text{pA}/\sqrt{\text{Hz}}$ |
| THD Total harmonic distortion | $V_{I\text{rms}} = 6\text{ V}$, $f = 1\text{ kHz}$, $A_{VD} = 1$, $R_S \leq 1\text{ k}\Omega$, $R_L \geq 2\text{ k}\Omega$, | | 0.003 | | % |

PARAMETER MEASUREMENT INFORMATION



Figure 1

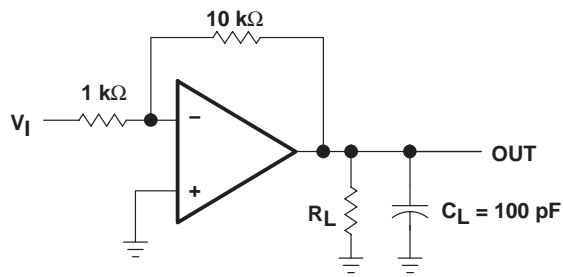


Figure 2

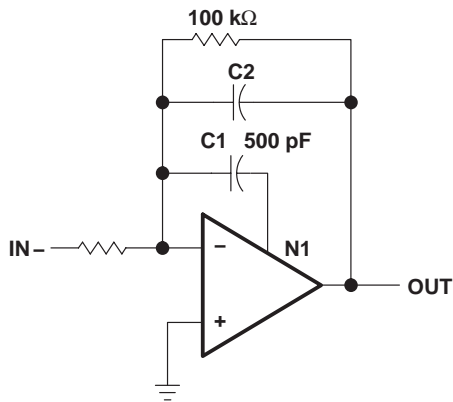


Figure 3

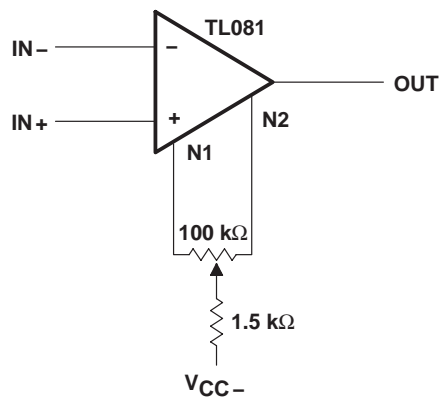


Figure 4

TYPICAL CHARACTERISTICS

Table of Graphs

| | | FIGURE |
|-----------------|---|---|
| V _{OM} | Maximum peak output voltage | vs Frequency |
| | | vs Free-air temperature |
| | | vs Load resistance |
| | | vs Supply voltage |
| AVD | Large-signal differential voltage amplification | 5, 6, 7 |
| | Differential voltage amplification | 8 |
| PD | Total power dissipation | 9 |
| | | vs Free-air temperature |
| I _{CC} | Supply current | 10 |
| | | vs Supply voltage |
| I _{IB} | Input bias current | 11 |
| V _O | Output voltage | 12 |
| | | vs Frequency |
| CMRR | Common-mode rejection ratio | 13 |
| | | vs Frequency with feed-forward compensation |
| P _D | Total power dissipation | 14 |
| I _{CC} | Supply current | 15 |
| I _{IB} | Input bias current | 16 |
| V _O | Large-signal pulse response | 17 |
| | | vs Time |
| V _O | Output voltage | 18 |
| CMRR | Common-mode rejection ratio | 19 |
| V _n | Equivalent input noise voltage | 20 |
| THD | Total harmonic distortion | 21 |
| | | 22 |

**MAXIMUM PEAK OUTPUT VOLTAGE
 vs
 FREQUENCY**



Figure 5

**MAXIMUM PEAK OUTPUT VOLTAGE
 vs
 FREQUENCY**



Figure 6

**TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL084, TL084A, TL084B
JFET-INPUT OPERATIONAL AMPLIFIERS**

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TYPICAL CHARACTERISTICS†

**MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREQUENCY**

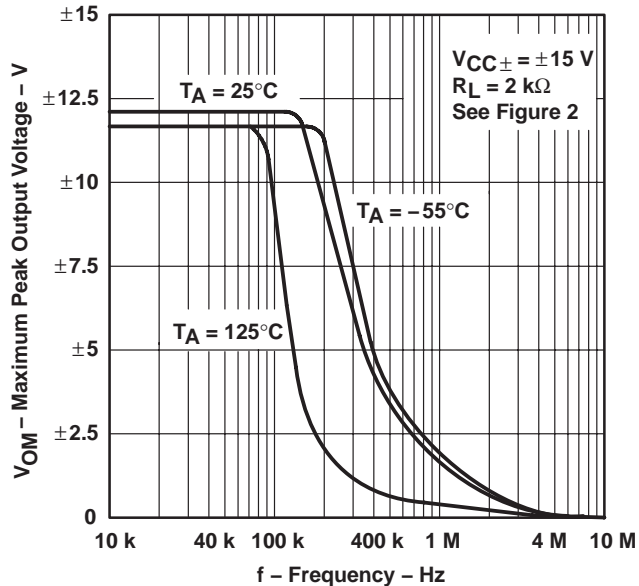


Figure 7

**MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE**

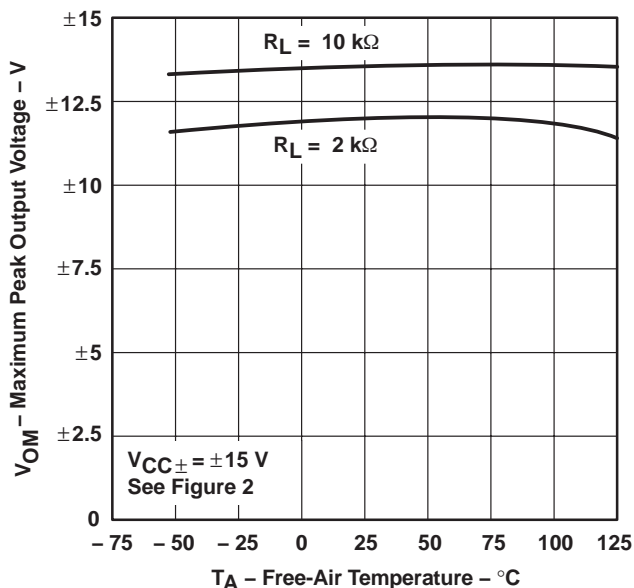


Figure 8

**MAXIMUM PEAK OUTPUT VOLTAGE
vs
LOAD RESISTANCE**

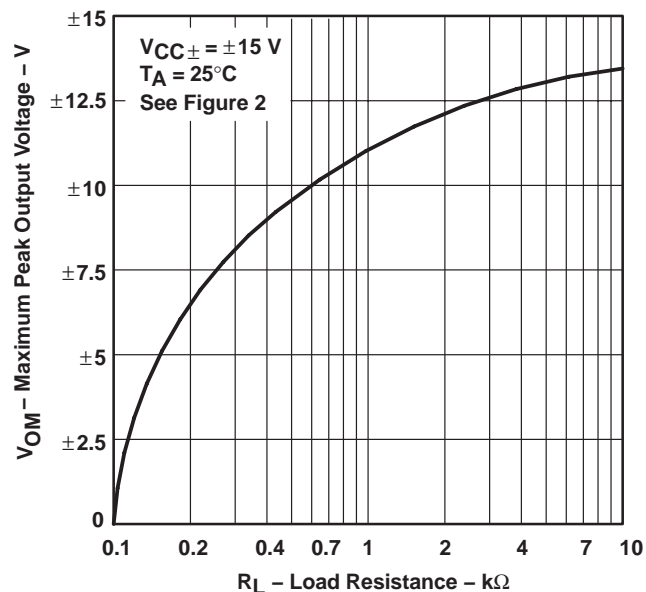


Figure 9

**MAXIMUM PEAK OUTPUT VOLTAGE
vs
SUPPLY VOLTAGE**

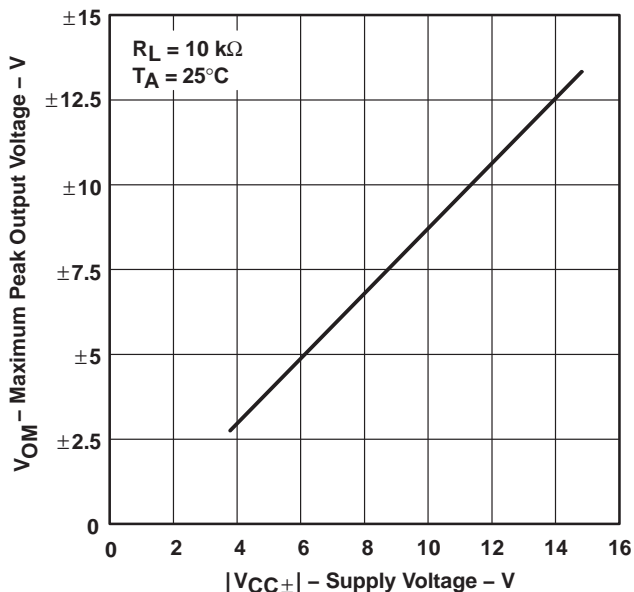


Figure 10

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



TYPICAL CHARACTERISTICS†

**LARGE-SIGNAL
 DIFFERENTIAL VOLTAGE AMPLIFICATION
 vs
 FREE-AIR TEMPERATURE**



Figure 11

**LARGE-SIGNAL
 DIFFERENTIAL VOLTAGE AMPLIFICATION
 vs
 FREQUENCY**

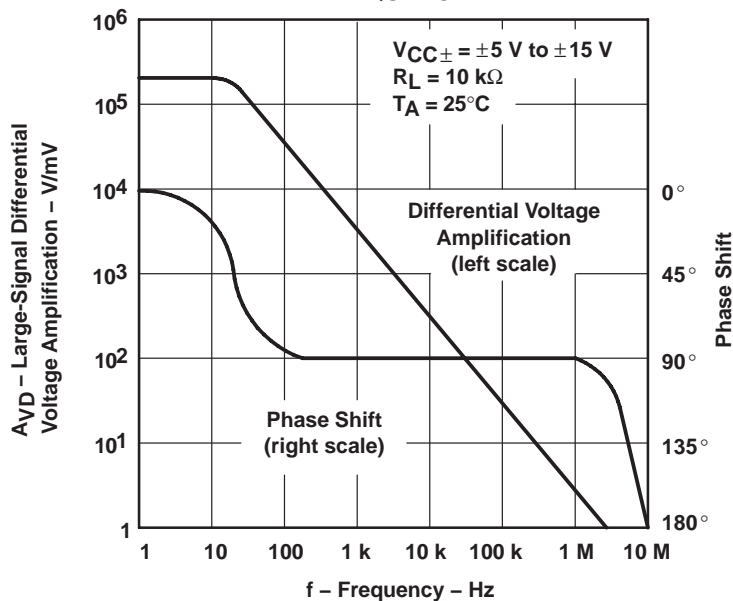


Figure 12

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

**TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL084, TL084A, TL084B
JFET-INPUT OPERATIONAL AMPLIFIERS**

SLOS081G – FEBRUARY 1977 – REVISED SEPTEMBER 2004

TYPICAL CHARACTERISTICS†

**DIFFERENTIAL VOLTAGE AMPLIFICATION
vs
FREQUENCY WITH FEED-FORWARD COMPENSATION**



Figure 13

**TOTAL POWER DISSIPATION
vs
FREE-AIR TEMPERATURE**



Figure 14

**SUPPLY CURRENT PER AMPLIFIER
vs
FREE-AIR TEMPERATURE**



Figure 15

**SUPPLY CURRENT
vs
SUPPLY VOLTAGE**

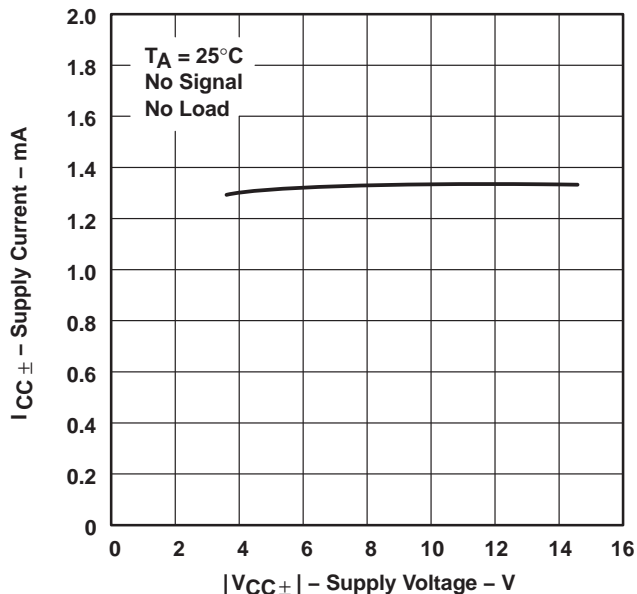
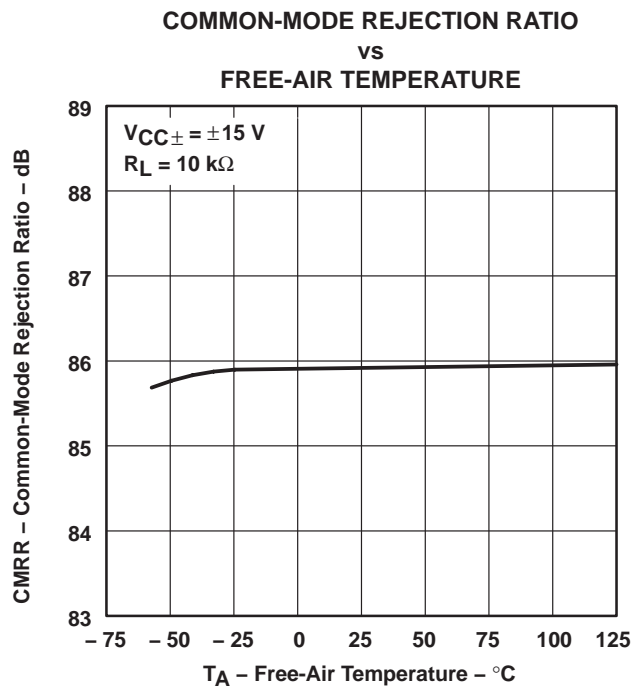
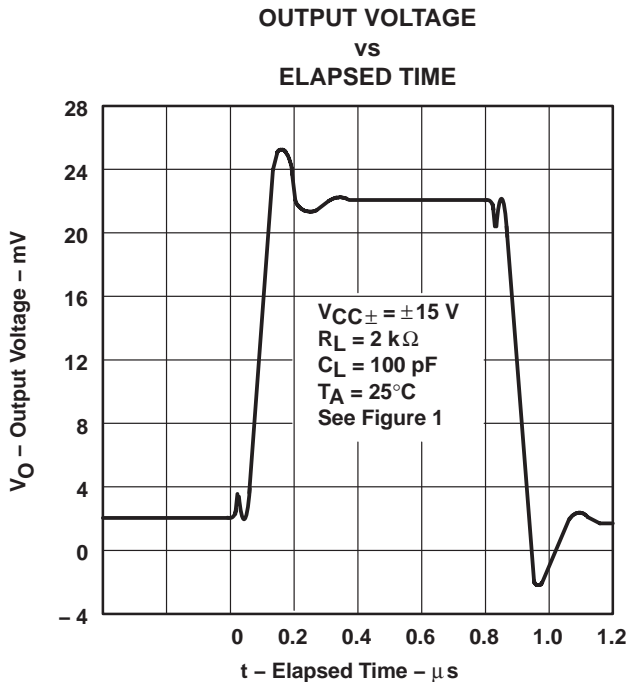
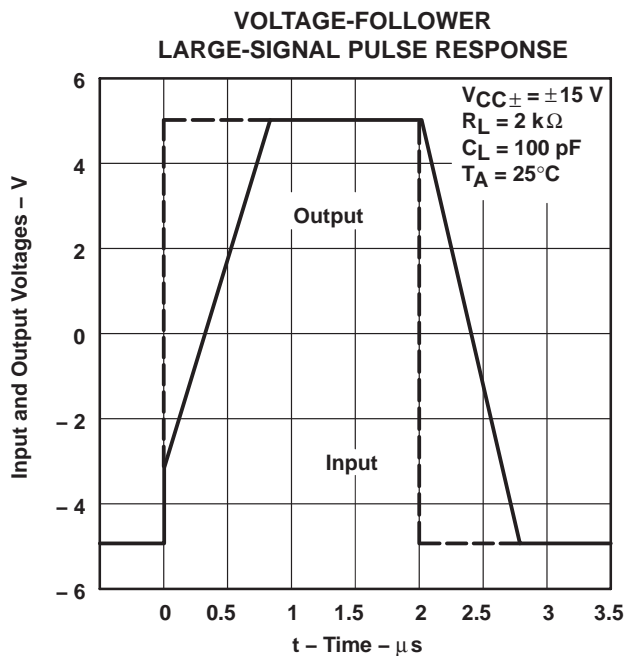


Figure 16

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



TYPICAL CHARACTERISTICS†



† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

**TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL084, TL084A, TL084B
JFET-INPUT OPERATIONAL AMPLIFIERS**

SLOS081G – FEBRUARY 1977 – REVISED SEPTEMBER 2004

TYPICAL CHARACTERISTICS†

**EQUIVALENT INPUT NOISE VOLTAGE
VS
FREQUENCY**



Figure 21

**TOTAL HARMONIC DISTORTION
VS
FREQUENCY**



Figure 22

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

APPLICATION INFORMATION

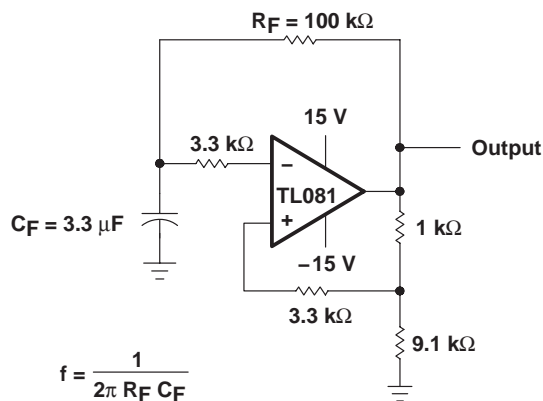


Figure 23

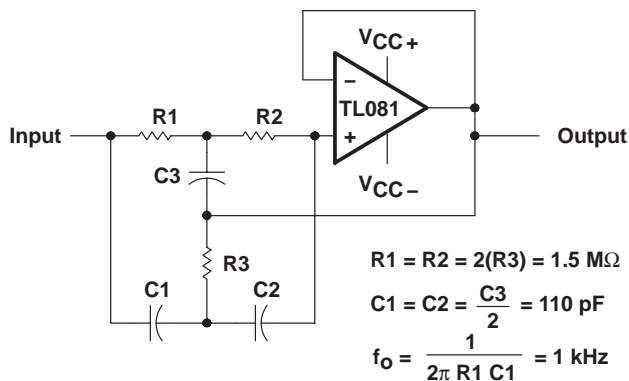


Figure 24

$$R1 = R2 = 2(R3) = 1.5 \text{ M}\Omega$$

$$C1 = C2 = \frac{C3}{2} = 110 \text{ pF}$$

$$f_0 = \frac{1}{2\pi R1 C1} = 1 \text{ kHz}$$

APPLICATION INFORMATION



Figure 25. Audio-Distribution Amplifier



NOTE A: These resistor values may be adjusted for a symmetrical output.

Figure 26. 100-KHz Quadrature Oscillator

APPLICATION INFORMATION

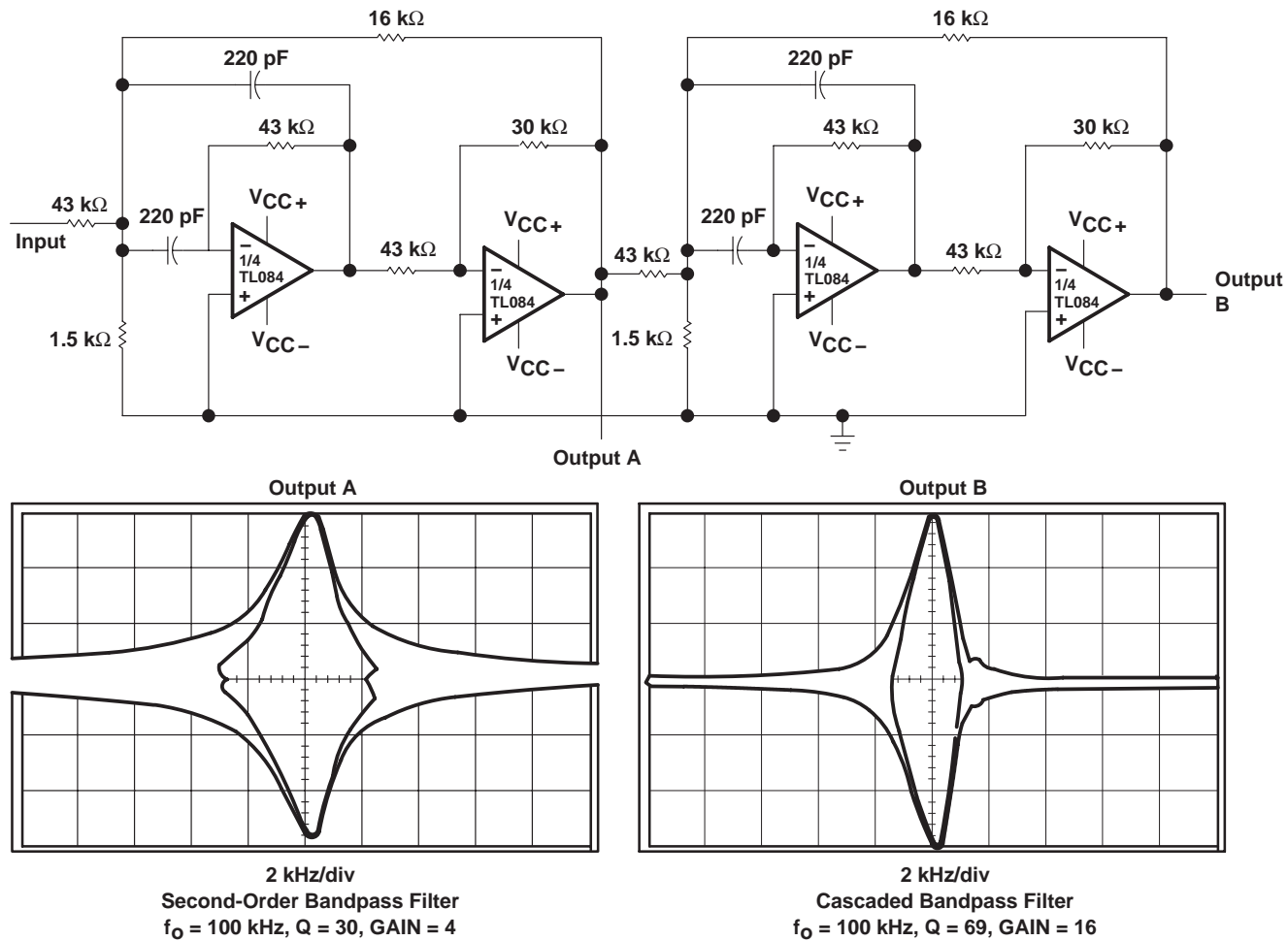


Figure 27. Positive-Feedback Bandpass Filter

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TL081ACD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081ACDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081ACDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081ACDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081ACDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081ACDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081ACJG | OBSOLETE | CDIP | JG | 8 | | TBD | Call TI | Call TI |
| TL081ACP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL081ACPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL081BCD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081BCDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081BCDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081BCDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081BCDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081BCDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081BCP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL081BCPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL081CD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081CDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081CDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081CDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081CDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081CDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081CP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL081CPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TL081CPSR | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081CPSRE4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081CPSRG4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081CPWLE | OBSOLETE | TSSOP | PW | 8 | | TBD | Call TI | Call TI |
| TL081ID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081IDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081IDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081IDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081IDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081IDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL081IP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL081IPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL081MFKB | OBSOLETE | LCCC | FK | 20 | | TBD | Call TI | Call TI |
| TL081MJG | OBSOLETE | CDIP | JG | 8 | | TBD | Call TI | Call TI |
| TL081MJGB | OBSOLETE | CDIP | JG | 8 | | TBD | Call TI | Call TI |
| TL082ACD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082ACDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082ACDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082ACDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082ACDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082ACDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082ACP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL082ACPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL082ACPSR | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082ACPSRE4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082ACPSRG4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082BCD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082BCDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| | | | | | | no Sb/Br) | | |
| TL082BCDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082BCDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082BCDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082BCDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082BCP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL082BCPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL082CD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CJG | OBSOLETE | CDIP | JG | 8 | | TBD | Call TI | Call TI |
| TL082CP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL082CPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL082CPSR | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CPSRG4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CPW | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CPWE4 | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CPWG4 | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CPWLE | OBSOLETE | TSSOP | PW | 8 | | TBD | Call TI | Call TI |
| TL082CPWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CPWRE4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082CPWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082ID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082IDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TL082IDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082IDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082IDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082IDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082IJG | OBSOLETE | CDIP | JG | 8 | | TBD | Call TI | Call TI |
| TL082IP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL082IPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL082IPWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082IPWRE4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082IPWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL082MFK | OBSOLETE | LCCC | FK | 20 | | TBD | Call TI | Call TI |
| TL084ACD | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084ACDE4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084ACDG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084ACDR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084ACDRE4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084ACDRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084ACN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL084ACNE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL084ACNSR | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084ACNSRE4 | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084ACNSRG4 | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084BCD | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084BCDE4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084BCDG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084BCDR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084BCDRE4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| | | | | | | no Sb/Br) | | |
| TL084BCDRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084BCN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL084BCNE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL084CD | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CDE4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CDG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CDR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CDRE4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CDRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CJ | OBSOLETE | CDIP | J | 14 | | TBD | Call TI | Call TI |
| TL084CN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL084CNE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL084CNSLE | OBSOLETE | SO | NS | 14 | | TBD | Call TI | Call TI |
| TL084CNSR | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CNSRG4 | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CPW | ACTIVE | TSSOP | PW | 14 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CPWE4 | ACTIVE | TSSOP | PW | 14 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CPWG4 | ACTIVE | TSSOP | PW | 14 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CPWLE | OBSOLETE | TSSOP | PW | 14 | | TBD | Call TI | Call TI |
| TL084CPWR | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CPWRE4 | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084CPWRG4 | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084ID | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084IDE4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084IDG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084IDR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084IDRE4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| | | | | | | no Sb/Br) | | |
| TL084IDRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084IJ | OBSOLETE | CDIP | J | 14 | | TBD | Call TI | Call TI |
| TL084IN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL084INE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TL084QD | ACTIVE | SOIC | D | 14 | 50 | TBD | CU NIPDAU | Level-1-220C-UNLIM |
| TL084QDG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TL084QDR | ACTIVE | SOIC | D | 14 | 2500 | TBD | CU NIPDAU | Level-1-220C-UNLIM |
| TL084QDRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

⁽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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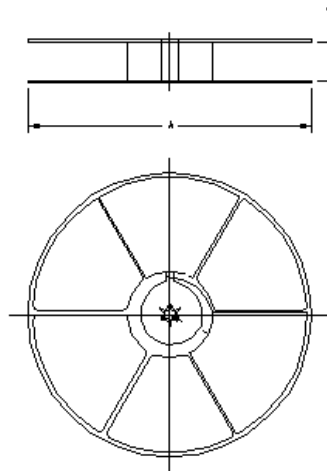
Carrier tape design is defined largely by the component length, width, and thickness.

| |
|--|
| A_o = Dimension designed to accommodate the component width. |
| B_o = Dimension designed to accommodate the component length. |
| K_o = Dimension designed to accommodate the component thickness. |
| W = Overall width of the carrier tape. |
| P = Pitch between successive cavity centers. |



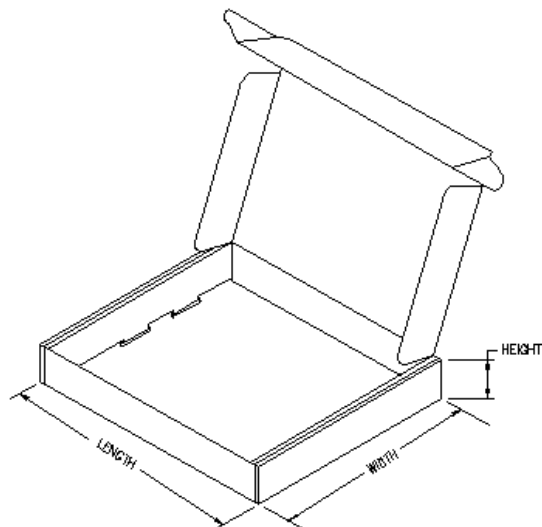
TAPE AND REEL INFORMATION

| Device | Package | Pins | Site | Reel Diameter (mm) | Reel Width (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------|---------|------|------|--------------------|-----------------|---------|---------|---------|---------|--------|---------------|
| TL081ACDR | D | 8 | FMX | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL081BCDR | D | 8 | FMX | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL081CDR | D | 8 | FMX | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL081CPSR | PS | 8 | MLA | 330 | 16 | 8.2 | 6.6 | 2.5 | 12 | 16 | Q1 |
| TL081IDR | D | 8 | FMX | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL082ACDR | D | 8 | FMX | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL082ACDR | D | 8 | MLA | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL082ACPSR | PS | 8 | MLA | 330 | 16 | 8.2 | 6.6 | 2.5 | 12 | 16 | Q1 |
| TL082BCDR | D | 8 | FMX | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL082CDR | D | 8 | FMX | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL082CDR | D | 8 | MLA | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL082CPSR | PS | 8 | MLA | 330 | 16 | 8.2 | 6.6 | 2.5 | 12 | 16 | Q1 |
| TL082CPWR | PW | 8 | MLA | 330 | 12 | 7.0 | 3.6 | 1.6 | 8 | 12 | Q1 |
| TL082IDR | D | 8 | FMX | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL082IDR | D | 8 | MLA | 330 | 12 | 6.4 | 5.2 | 2.1 | 8 | 12 | Q1 |
| TL082IPWR | PW | 8 | MLA | 330 | 12 | 7.0 | 3.6 | 1.6 | 8 | 12 | Q1 |
| TL084ACDR | D | 14 | FMX | 330 | 16 | 6.5 | 9.0 | 2.1 | 8 | 16 | Q1 |
| TL084ACDR | D | 14 | MLA | 330 | 16 | 6.5 | 9.0 | 2.1 | 8 | 16 | Q1 |
| TL084ACNSR | NS | 14 | MLA | 330 | 16 | 8.2 | 10.5 | 2.5 | 12 | 16 | Q1 |
| TL084BCDR | D | 14 | FMX | 330 | 16 | 6.5 | 9.0 | 2.1 | 8 | 16 | Q1 |
| TL084CDR | D | 14 | FMX | 330 | 16 | 6.5 | 9.0 | 2.1 | 8 | 16 | Q1 |
| TL084CNSR | NS | 14 | MLA | 330 | 16 | 8.2 | 10.5 | 2.5 | 12 | 16 | Q1 |
| TL084CPWR | PW | 14 | MLA | 330 | 12 | 7.0 | 5.6 | 1.6 | 8 | 12 | Q1 |
| TL084IDR | D | 14 | FMX | 330 | 16 | 6.5 | 9.0 | 2.1 | 8 | 16 | Q1 |



TAPE AND REEL BOX INFORMATION

| Device | Package | Pins | Site | Length (mm) | Width (mm) | Height (mm) |
|------------|---------|------|------|-------------|------------|-------------|
| TL081ACDR | D | 8 | FMX | 342.9 | 336.6 | 20.64 |
| TL081BCDR | D | 8 | FMX | 342.9 | 336.6 | 20.64 |
| TL081CDR | D | 8 | FMX | 342.9 | 336.6 | 20.64 |
| TL081CPSR | PS | 8 | MLA | 346.0 | 346.0 | 33.0 |
| TL081IDR | D | 8 | FMX | 342.9 | 336.6 | 20.64 |
| TL082ACDR | D | 8 | FMX | 342.9 | 336.6 | 20.64 |
| TL082ACDR | D | 8 | MLA | 346.0 | 346.0 | 29.0 |
| TL082ACPSR | PS | 8 | MLA | 346.0 | 346.0 | 33.0 |
| TL082BCDR | D | 8 | FMX | 342.9 | 336.6 | 20.64 |
| TL082CDR | D | 8 | FMX | 342.9 | 336.6 | 20.64 |
| TL082CDR | D | 8 | MLA | 346.0 | 346.0 | 29.0 |
| TL082CPSR | PS | 8 | MLA | 346.0 | 346.0 | 33.0 |
| TL082CPWR | PW | 8 | MLA | 346.0 | 346.0 | 29.0 |
| TL082IDR | D | 8 | FMX | 342.9 | 336.6 | 20.64 |
| TL082IDR | D | 8 | MLA | 346.0 | 346.0 | 29.0 |
| TL082IPWR | PW | 8 | MLA | 346.0 | 346.0 | 29.0 |
| TL084ACDR | D | 14 | FMX | 342.9 | 336.6 | 28.58 |
| TL084ACDR | D | 14 | MLA | 346.0 | 346.0 | 33.0 |
| TL084ACNSR | NS | 14 | MLA | 346.0 | 346.0 | 33.0 |
| TL084BCDR | D | 14 | FMX | 342.9 | 336.6 | 28.58 |
| TL084CDR | D | 14 | FMX | 342.9 | 336.6 | 28.58 |
| TL084CNSR | NS | 14 | MLA | 346.0 | 346.0 | 33.0 |
| TL084CPWR | PW | 14 | MLA | 346.0 | 346.0 | 29.0 |
| TL084IDR | D | 14 | FMX | 342.9 | 336.6 | 28.58 |



JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. This package can be hermetically sealed with a ceramic lid using glass frit.
 D. Index point is provided on cap for terminal identification.
 E. Falls within MIL STD 1835 GDIP1-T8

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---------------|------------------------|------------------------|------------------------|------------------------|
| A | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC |
| B MAX | 0.785 (19,94) | .840 (21,34) | 0.960 (24,38) | 1.060 (26,92) |
| B MIN | — | — | — | — |
| C MAX | 0.300 (7,62) | 0.300 (7,62) | 0.310 (7,87) | 0.300 (7,62) |
| C MIN | 0.245 (6,22) | 0.245 (6,22) | 0.220 (5,59) | 0.245 (6,22) |



4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package is hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a metal lid.
 - D. The terminals are gold plated.
 - E. Falls within JEDEC MS-004

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

For the latest package information, go to http://www.ti.com/sc/docs/package/pkg_info.htm



N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - D The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

D (R-PDSO-G14)

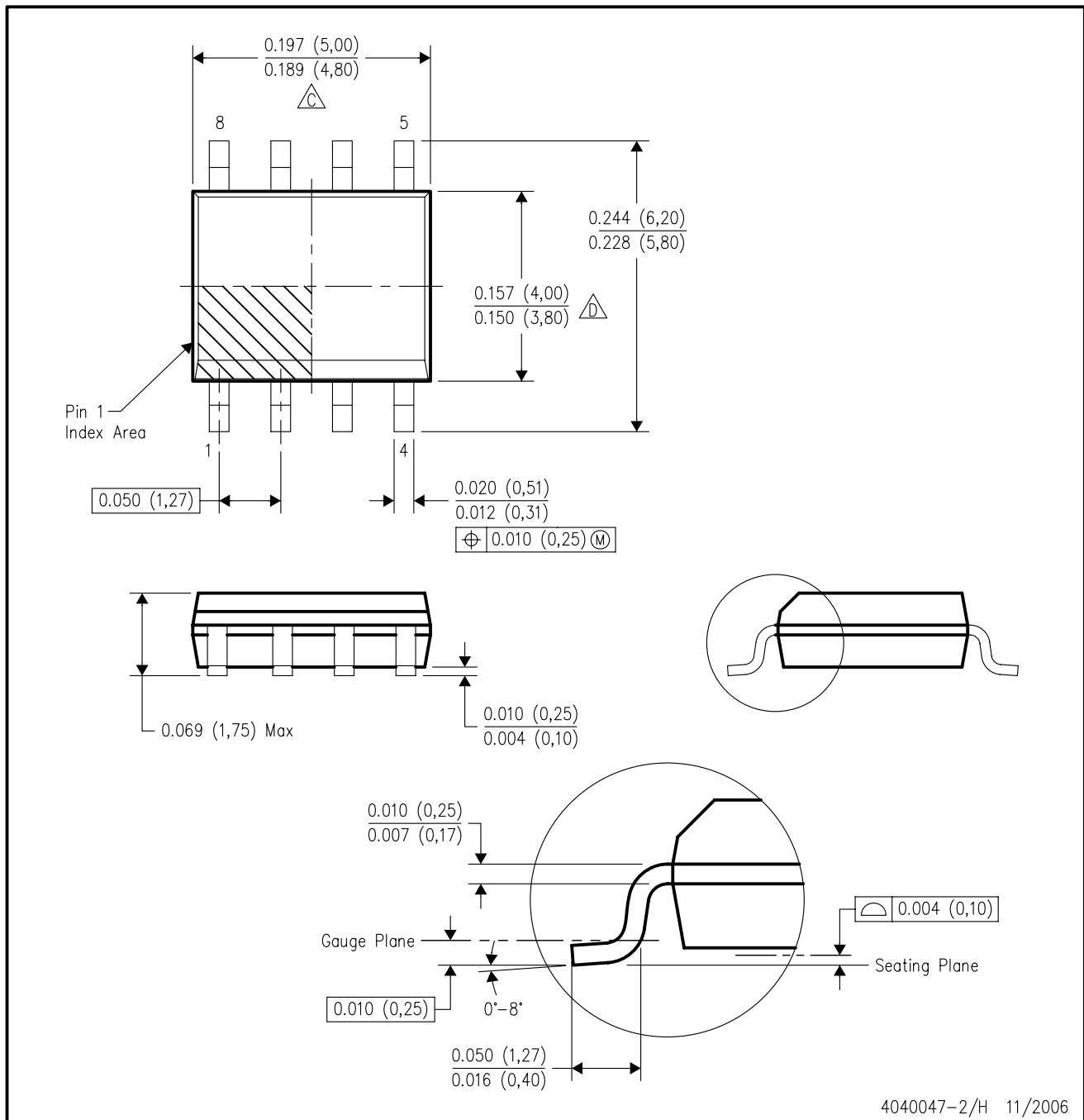
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
 - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - (C) Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
 - (D) Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
 - E. Reference JEDEC MS-012 variation AA.

MECHANICAL DATA

PS (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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