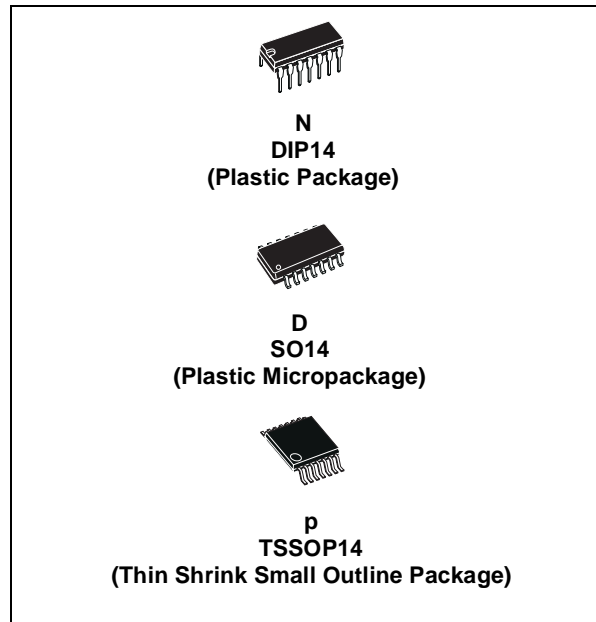




**GENERAL PURPOSE J-FET
QUAD OPERATIONAL AMPLIFIERS**

- WIDE COMMON-MODE (UP TO V_{CC}^+) AND DIFFERENTIAL VOLTAGE RANGE
- LOW INPUT BIAS AND OFFSET CURRENT
- OUTPUT SHORT-CIRCUIT PROTECTION
- HIGH INPUT IMPEDANCE J-FET INPUT STAGE
- INTERNAL FREQUENCY COMPENSATION
- LATCH UP FREE OPERATION
- HIGH SLEW RATE : $16V/\mu s$ (typ)



DESCRIPTION

The TL084, TL084A and TL084B are high speed J-FET input quad operational amplifiers incorporating well matched, high voltage J-FET 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.

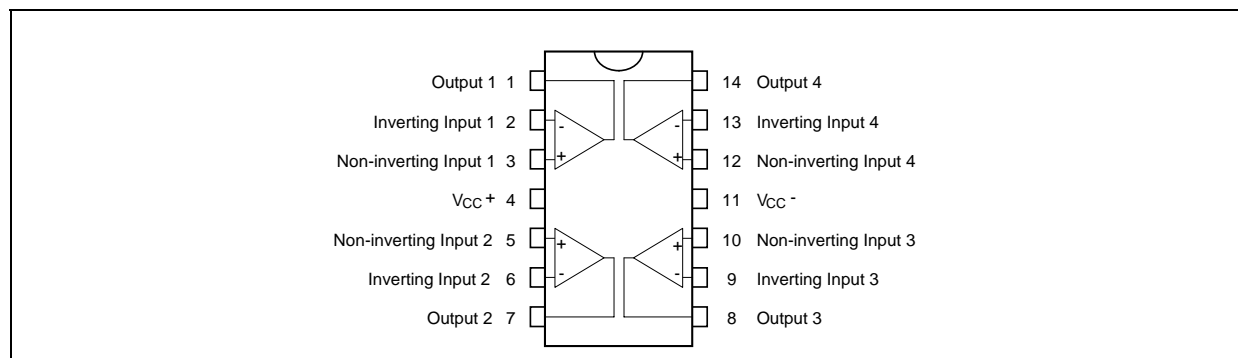
ORDER CODE

| Part Number | Temperature Range | Package | | |
|--------------|-------------------|---------|---|---|
| | | N | D | P |
| TL084M/AM/BM | -55°C, +125°C | • | • | • |
| TL084I/AI/BI | -40°C, +105°C | • | • | • |
| TL084C/AC/BC | 0°C, +70°C | • | • | • |

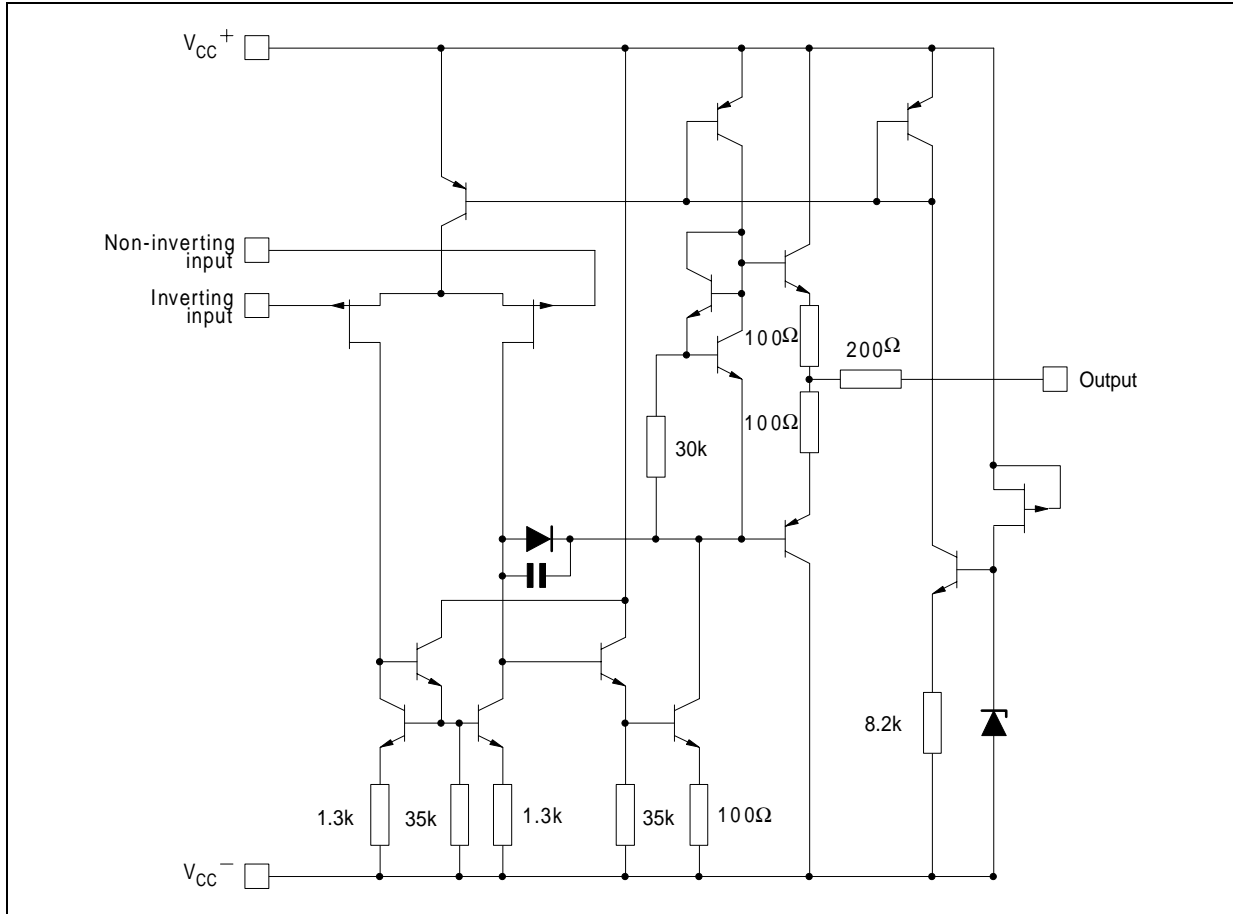
Example : TL084CN, TL084CD

N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)
P = Thin Shrink Small Outline Package (TSSOP) - only available in Tape & Reel (PT)

PIN CONNECTIONS (top view)



SCHEMATIC DIAGRAM (each amplifier)



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | TL084M, AM, BM | TL084I, AI, BI | TL084C, AC, BC | Unit |
|------------|---|----------------|----------------|----------------|------|
| V_{CC} | Supply voltage - note 1) | ±18 | | | V |
| V_i | Input Voltage - note 2) | ±15 | | | V |
| V_{id} | Differential Input Voltage - note 3) | ±30 | | | V |
| P_{tot} | Power Dissipation | 680 | | | mW |
| | Output Short-circuit Duration - note 4) | Infinite | | | |
| T_{oper} | Operating Free-air Temperature Range | -55 to +125 | -40 to +105 | 0 to +70 | °C |
| T_{stg} | Storage Temperature Range | -65 to +150 | | | °C |

1. All voltage values, except differential voltage, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between V_{CC}^+ and V_{CC}^- .
2. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
3. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
4. 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.

ELECTRICAL CHARACTERISTICS

$V_{CC} = \pm 15V$, $T_{amb} = +25^{\circ}C$ (unless otherwise specified)

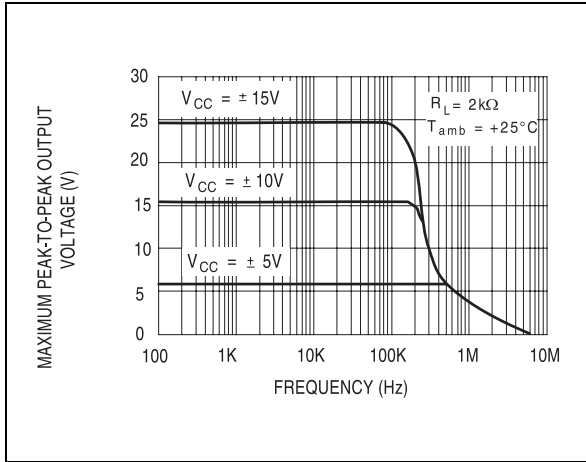
| Symbol | Parameter | TL084I,M,AC,AI,AM, BC,BI,BM | | | TL084C | | | Unit |
|---------------|---|--------------------------------|----------------------|------------------------------|----------|----------------------|------|-------------------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| V_{io} | Input Offset Voltage ($R_S = 50\Omega$) $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 3 3 1 | 10 6 3 13 7 5 | | 3 10 | | mV |
| DV_{io} | Input Offset Voltage Drift | | 10 | | | 10 | | $\mu V/^{\circ}C$ |
| I_{io} | Input Offset Current - note 1) $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 5 | 100 4 | | 5 100 4 | | pA nA |
| I_{ib} | Input Bias Current -note 1 $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 20 | 200 20 | | 20 400 20 | | pA nA |
| A_{vd} | Large Signal Voltage Gain ($R_L = 2k\Omega$, $V_o = \pm 10V$) $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 50 25 | 200 | | 25 15 | 200 | | V/mV |
| SVR | Supply Voltage Rejection Ratio ($R_S = 50\Omega$) $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 80 80 | 86 | | 70 70 | 86 | | dB |
| I_{CC} | Supply Current, no load, per amplifier $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 1.4 | 2.5 2.5 | | 1.4 2.5 2.5 | | mA |
| V_{icm} | Input Common Mode Voltage Range | ± 11 | +15 -12 | | ± 11 | +15 -12 | | V |
| CMR | Common Mode Rejection Ratio ($R_S = 50\Omega$) $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 80 80 | 86 | | 70 70 | 86 | | dB |
| I_{os} | Output Short-circuit Current $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 10 10 | 40 | 60 60 | 10 10 | 40 60 60 | | mA |
| $\pm V_{opp}$ | Output Voltage Swing $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 10 12 10 12 | 12 13.5 | | 10 12 10 12 | | V |
| SR | Slew Rate ($T_{amb} = +25^{\circ}C$) $V_{in} = 10V$, $R_L = 2k\Omega$, $C_L = 100pF$, unity gain | | 8 | 16 | | 8 16 | | V/ μs |
| t_r | Rise Time ($T_{amb} = +25^{\circ}C$) $V_{in} = 20mV$, $R_L = 2k\Omega$, $C_L = 100pF$, unity gain | | | 0.1 | | 0.1 | | μs |
| K_{ov} | Overshoot ($T_{amb} = +25^{\circ}C$) $V_{in} = 20mV$, $R_L = 2k\Omega$, $C_L = 100pF$, unity gain | | | 10 | | 10 | | % |
| GBP | Gain Bandwidth Product ($T_{amb} = +25^{\circ}C$) $V_{in} = 10mV$, $R_L = 2k\Omega$, $C_L = 100pF$, $f = 100kHz$ | | 2.5 | 4 | | 2.5 4 | | MHz |
| R_i | Input Resistance | | | 10^{12} | | 10^{12} | | Ω |

TL084 - TL084A - TL084B

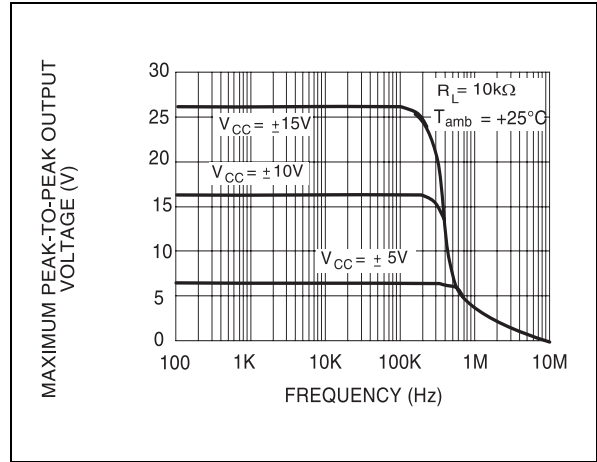
| Symbol | Parameter | TL084I,M,AC,AI,AM, BC,BI,BM | | | TL084C | | | Unit |
|-----------------|---|--------------------------------|------|------|--------|------|------|--------------------------------------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| THD | Total Harmonic Distortion ($T_{amb} = +25^{\circ}\text{C}$), $f = 1\text{kHz}$, $R_L = 2\text{k}\Omega$, $C_L = 100\text{pF}$, $A_V = 20\text{dB}$, $V_o = 2V_{pp}$ | | 0.01 | | | 0.01 | | % |
| e_n | Equivalent Input Noise Voltage $R_S = 100\Omega$, $f = 1\text{KHz}$ | | 15 | | | 15 | | $\frac{\text{nV}}{\sqrt{\text{Hz}}}$ |
| ϕ_m | Phase Margin | | 45 | | | 45 | | degrees |
| V_{o1}/V_{o2} | Channel Separation $A_V = 100$ | | 120 | | | 120 | | dB |

- The input bias currents are junction leakage currents which approximately double for every 10°C increase in the junction temperature.

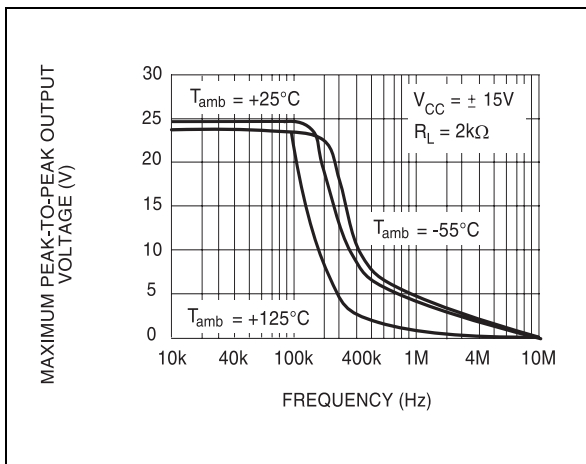
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus FREQUENCY



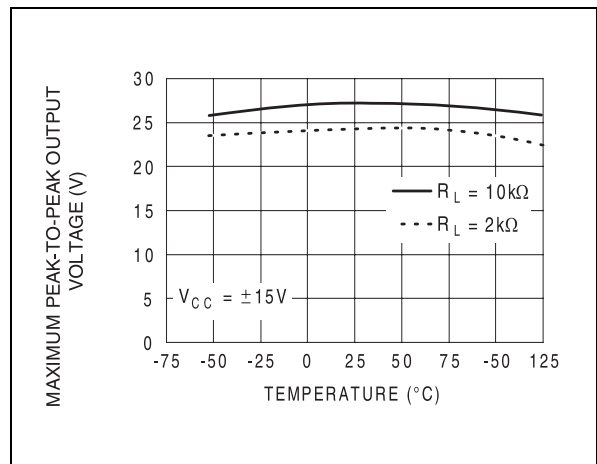
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus FREQUENCY



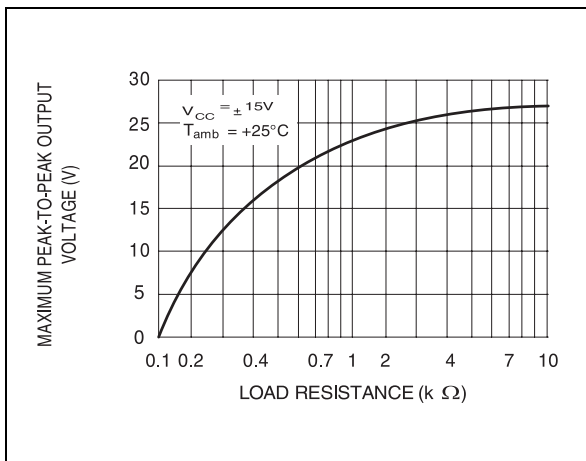
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus FREQUENCY



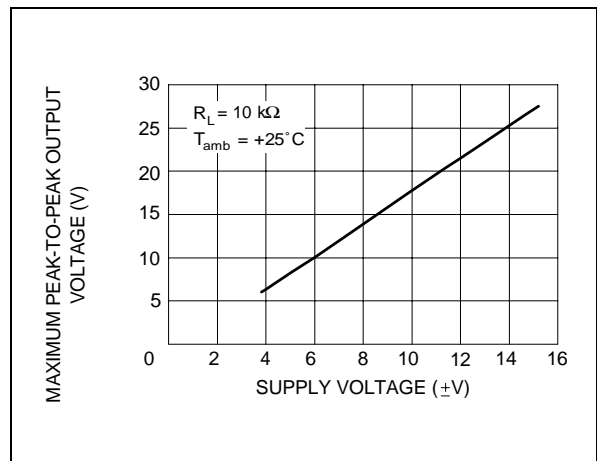
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus FREE AIR TEMP.



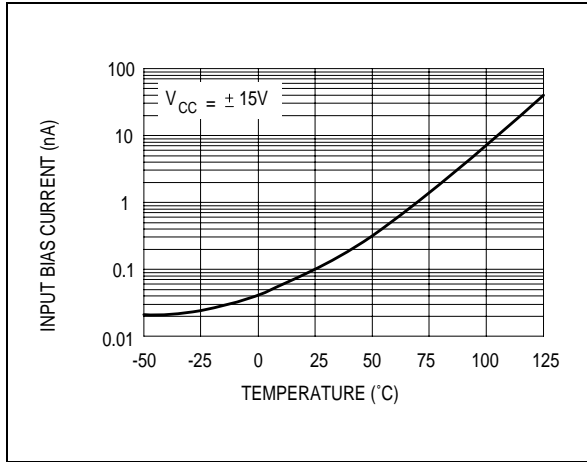
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus LOAD RESISTANCE



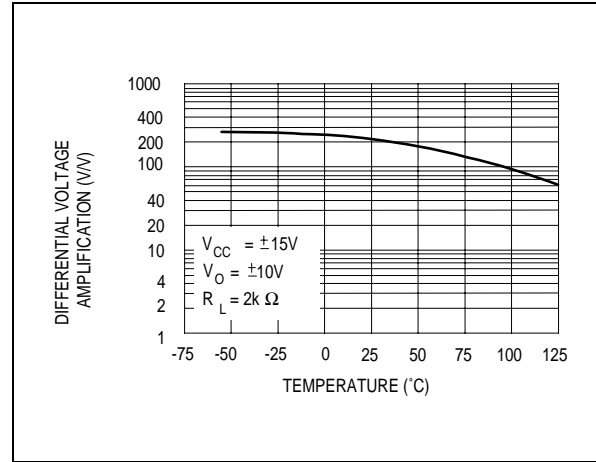
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus SUPPLY VOLTAGE



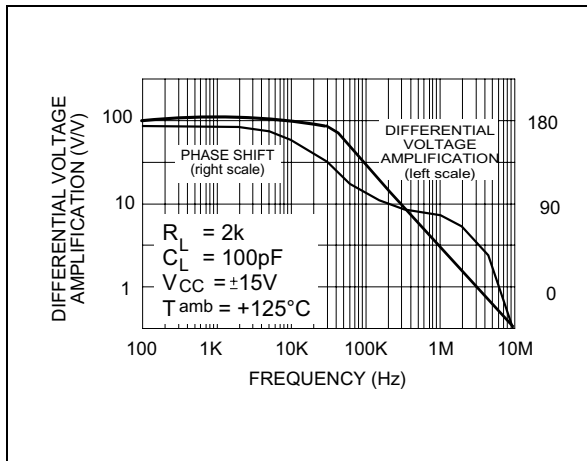
INPUT BIAS CURRENT versus FREE AIR TEMPERATURE



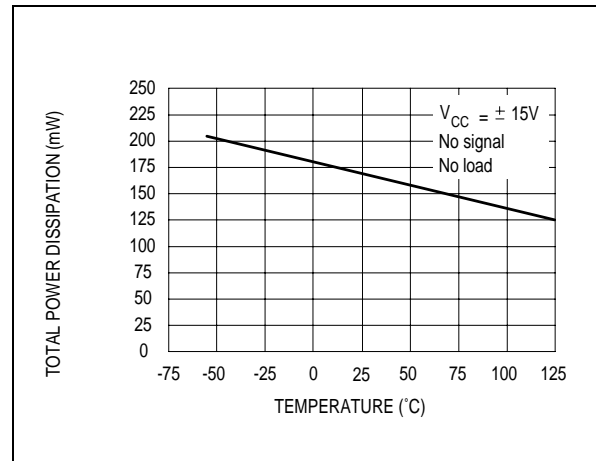
LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION versus FREE AIR TEMP.



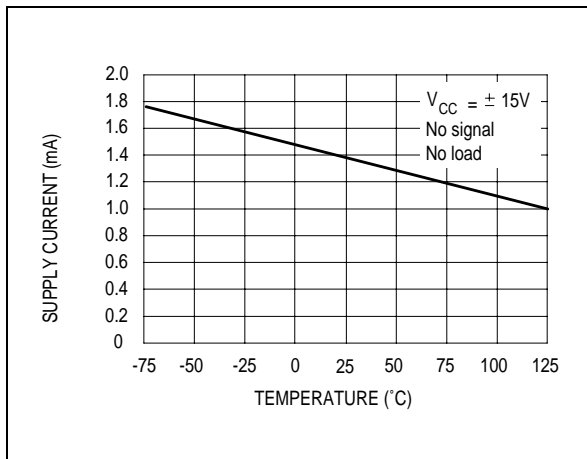
LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT versus FREQUENCY



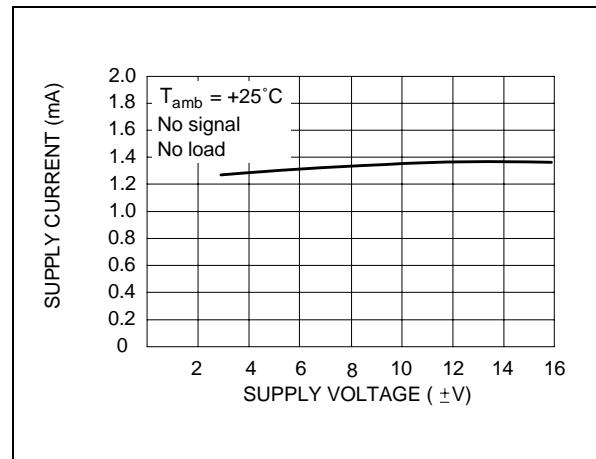
TOTAL POWER DISSIPATION versus FREE AIR TEMPERATURE



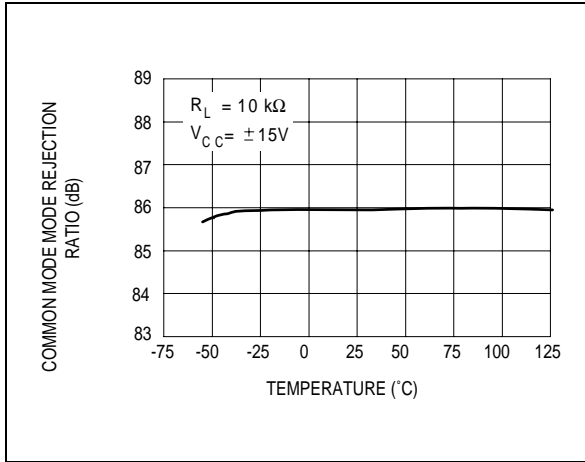
SUPPLY CURRENT PER AMPLIFIER versus FREE AIR TEMPERATURE



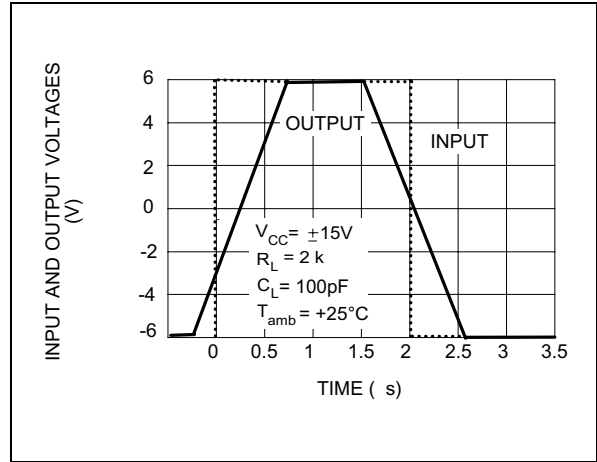
SUPPLY CURRENT PER AMPLIFIER versus SUPPLY VOLTAGE



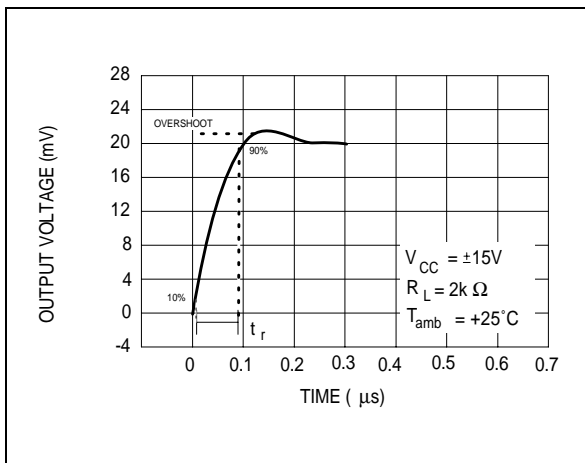
COMMON MODE REJECTION RATIO versus FREE AIR TEMPERATURE



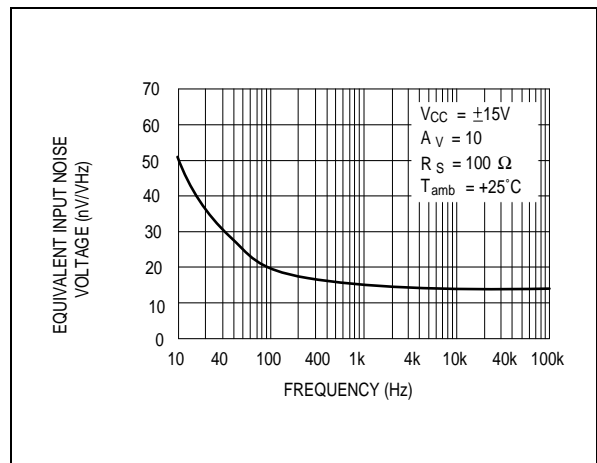
VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE



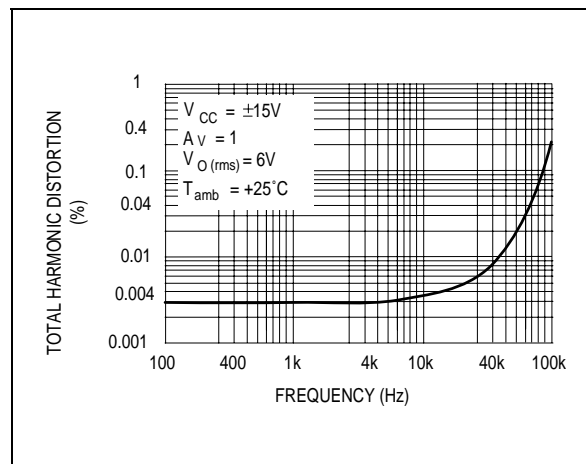
OUTPUT VOLTAGE versus ELAPSED TIME



EQUIVALENT INPUT NOISE VOLTAGE versus FREQUENCY



TOTAL HARMONIC DISTORTION versus FREQUENCY



PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower

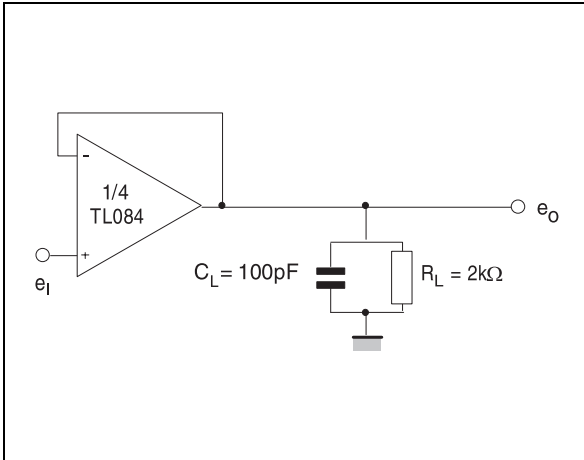
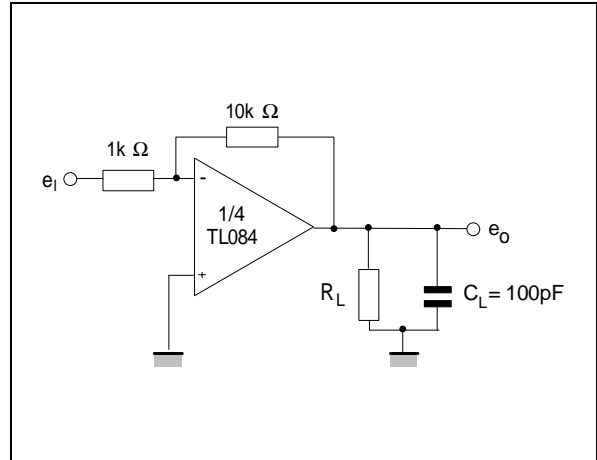
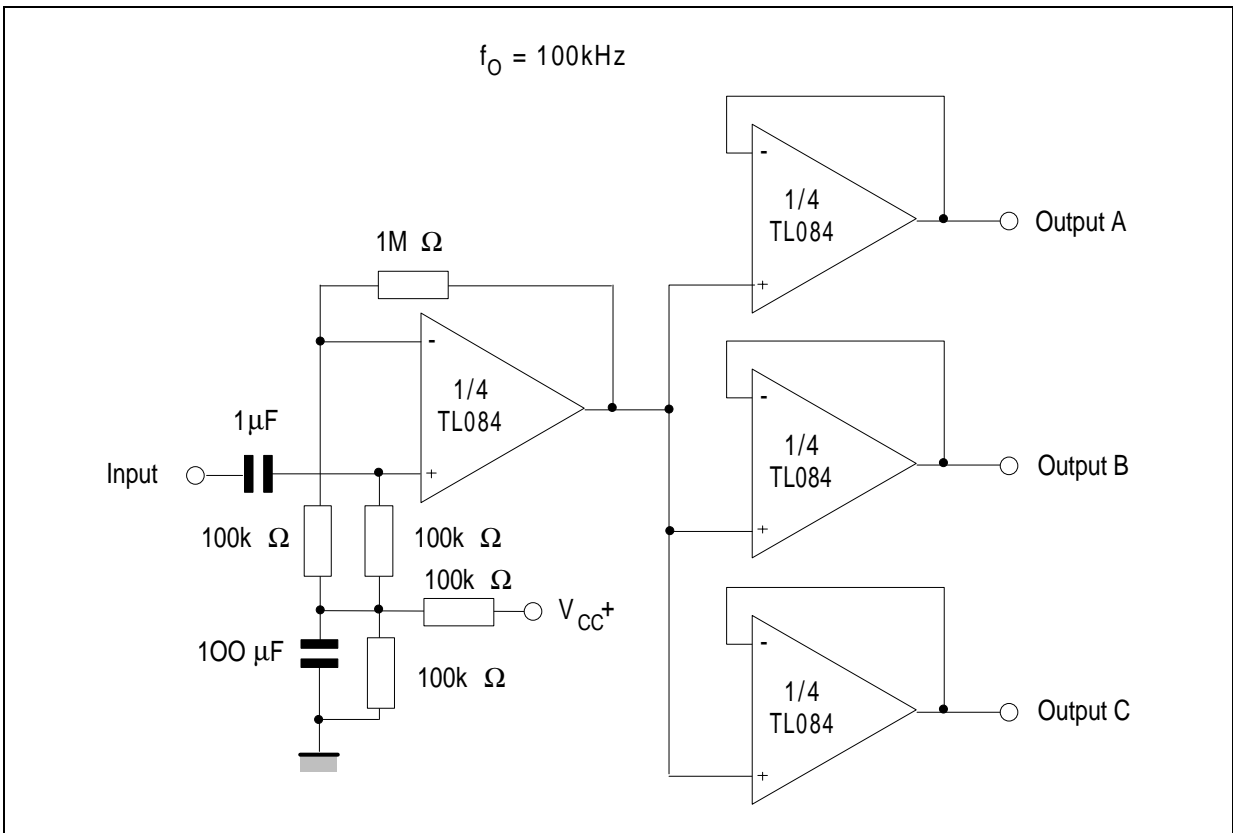


Figure 2 : Gain-of-10 Inverting Amplifier



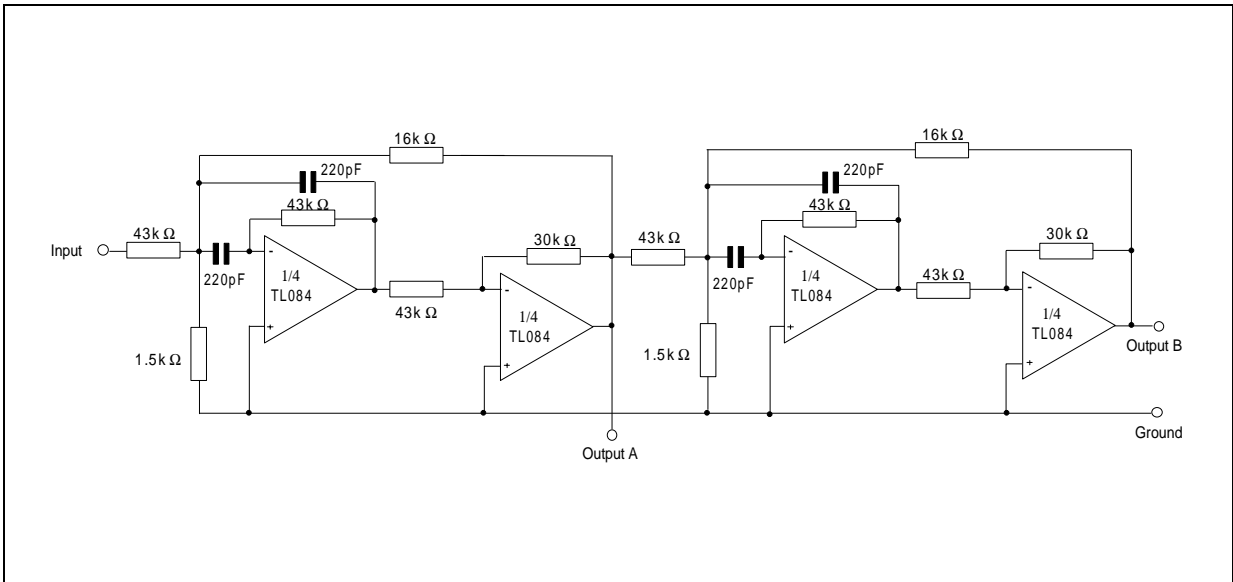
TYPICAL APPLICATIONS

AUDIO DISTRIBUTION AMPLIFIER

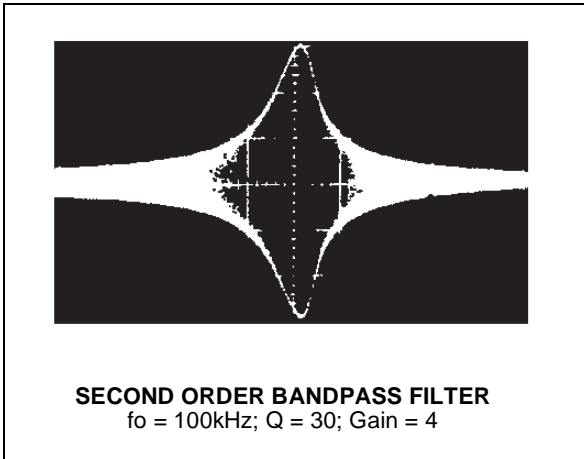


TYPICAL APPLICATIONS (continued)

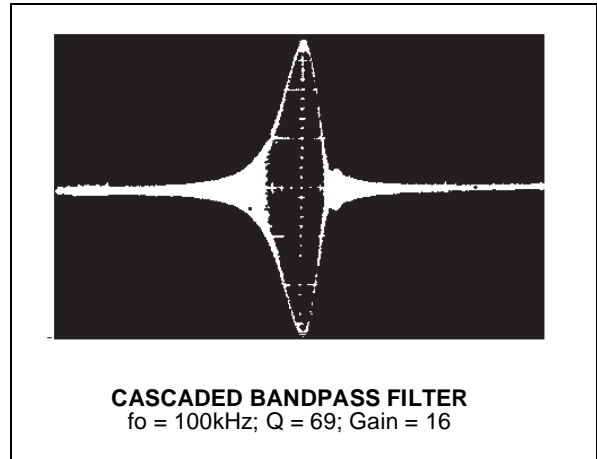
POSITIVE FEEDBACK BANDPASS FILTER



OUTPUT A

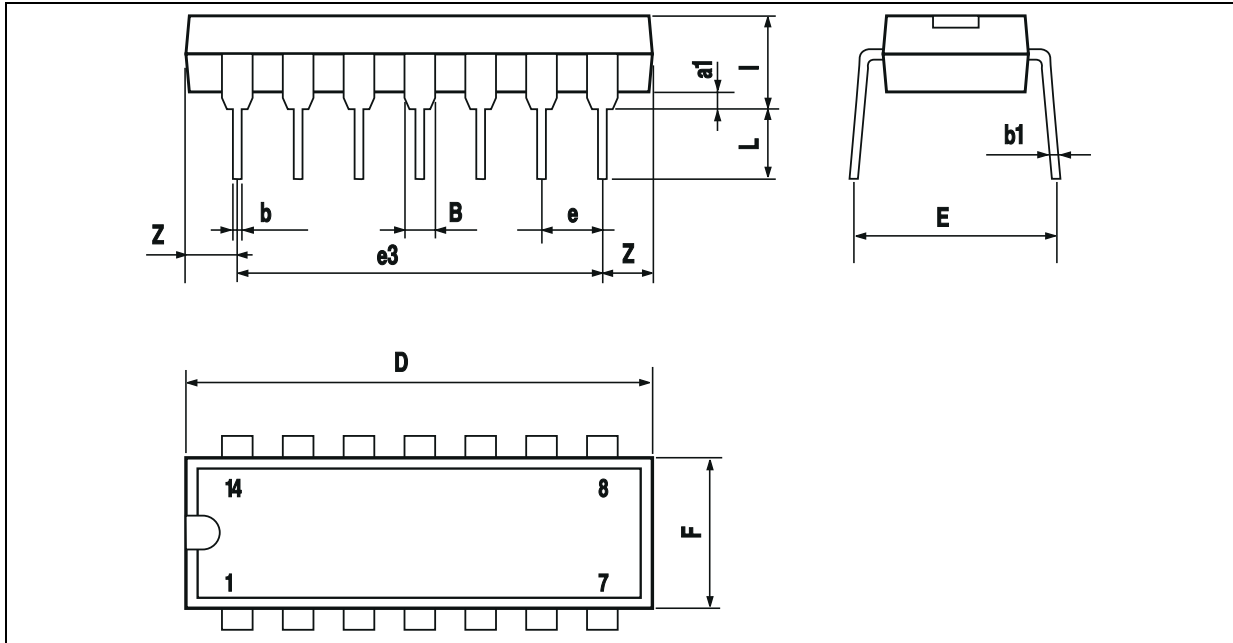


OUTPUT B



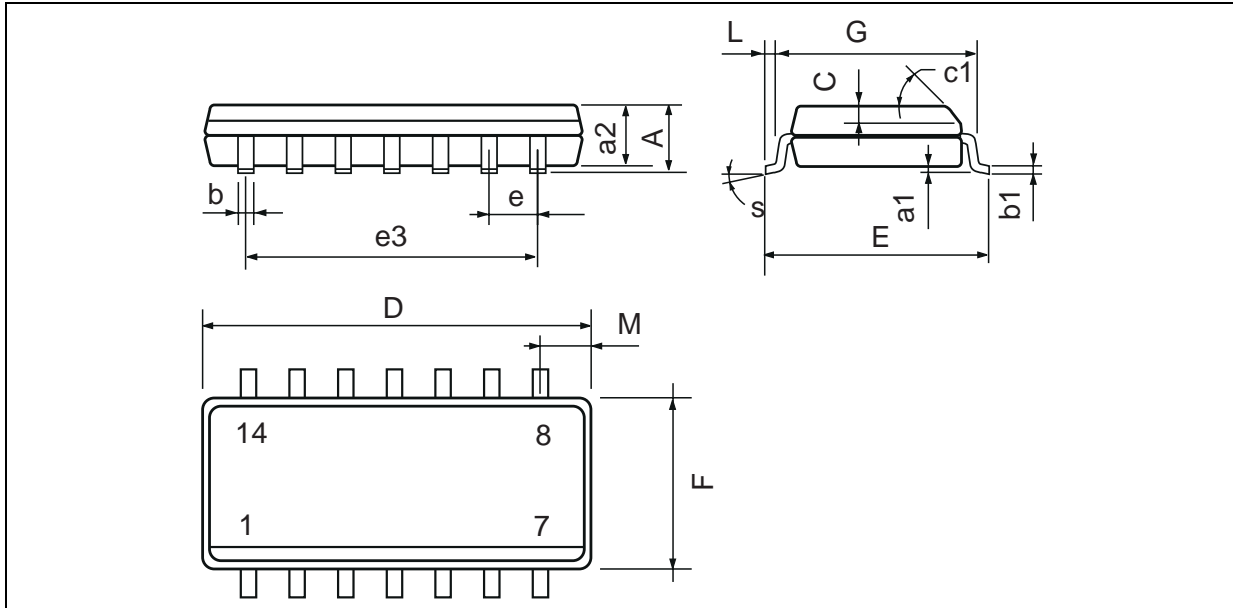
TL084 - TL084A - TL084B

PACKAGE MECHANICAL DATA
14 PINS - PLASTIC DIP



| Dim. | Millimeters | | | Inches | | |
|-------|-------------|-------|------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| a_1 | 0.51 | | | 0.020 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b_1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e_3 | | 15.24 | | | 0.600 | |
| F | | | 7.1 | | | 0.280 |
| i | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | 1.27 | | 2.54 | 0.050 | | 0.100 |

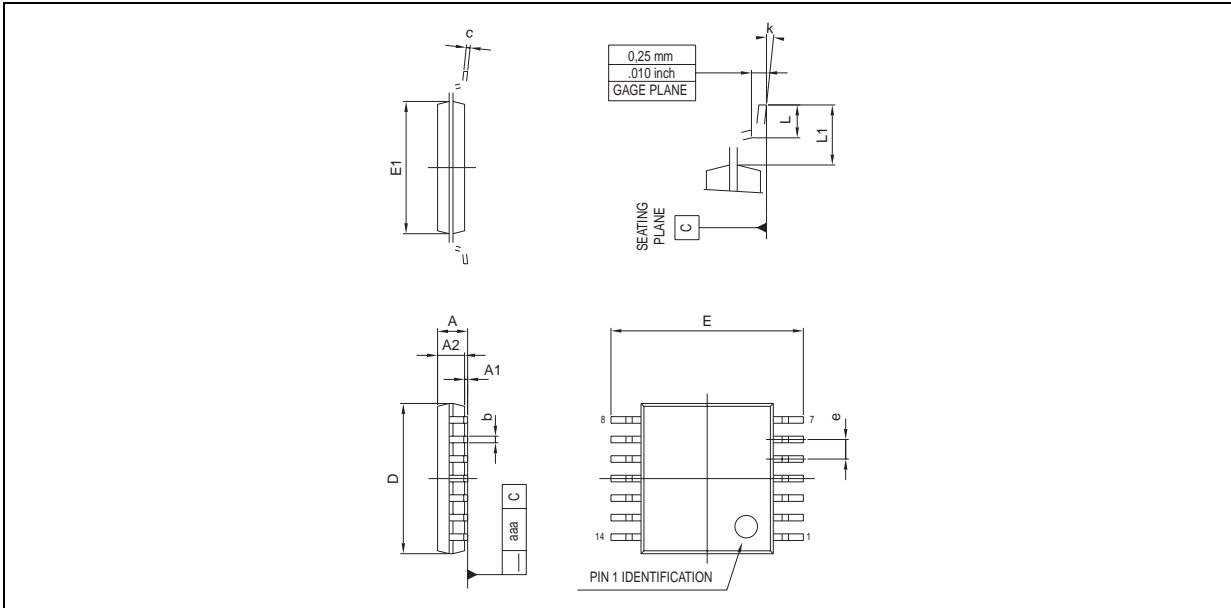
PACKAGE MECHANICAL DATA
 14 PINS - PLASTIC MICROPACKAGE (SO)



| Dim. | Millimeters | | | Inches | | |
|-------|-------------|------|------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.008 |
| a2 | | | 1.6 | | | 0.063 |
| b | 0.35 | | 0.46 | 0.014 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.020 | |
| c1 | 45° (typ.) | | | | | |
| D (1) | 8.55 | | 8.75 | 0.336 | | 0.344 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 7.62 | | | 0.300 | |
| F (1) | 3.8 | | 4.0 | 0.150 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.020 | | 0.050 |
| M | | | 0.68 | | | 0.027 |
| S | 8° (max.) | | | | | |

Note : (1) D and F do not include mold flash or protrusions - Mold flash or protrusions shall not exceed 0.15mm (.066 inc) ONLY FOR DATA BOOK.

PACKAGE MECHANICAL DATA
 14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE



| Dim. | Millimeters | | | Inches | | |
|------|-------------|------|------|--------|--------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.20 | | | 0.05 |
| A1 | 0.05 | | 0.15 | 0.01 | | 0.006 |
| A2 | 0.80 | 1.00 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | | 0.30 | 0.007 | | 0.15 |
| c | 0.09 | | 0.20 | 0.003 | | 0.012 |
| D | 4.90 | 5.00 | 5.10 | 0.192 | 0.196 | 0.20 |
| E | | 6.40 | | | 0.252 | |
| E1 | 4.30 | 4.40 | 4.50 | 0.169 | 0.173 | 0.177 |
| e | | 0.65 | | | 0.025 | |
| k | 0° | | 8° | 0° | | 8° |
| l | 0.50 | 0.60 | 0.75 | 0.09 | 0.0236 | 0.030 |

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