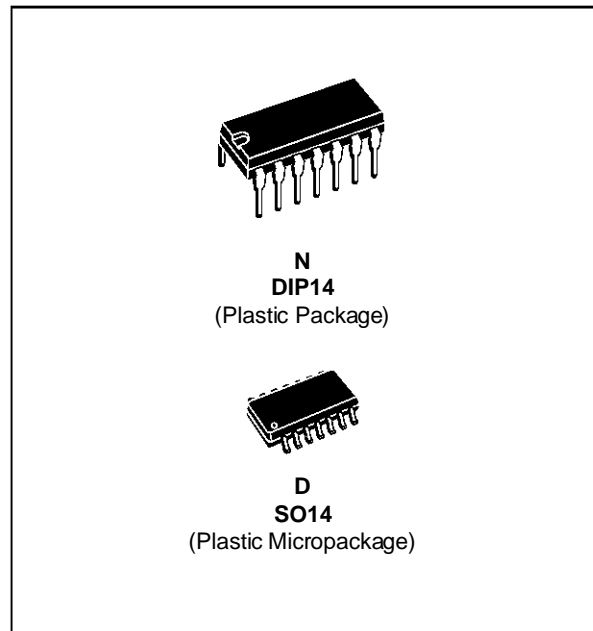


**GENERAL PURPOSE
QUAD J-FET OPERATIONAL AMPLIFIERS**

- LOW POWER CONSUMPTION
- 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

These circuits are high speed J-FET input quad operational amplifiers incorporating well matched, high voltage J-FET and bipolar transistors in a monolithic integrated circuit.

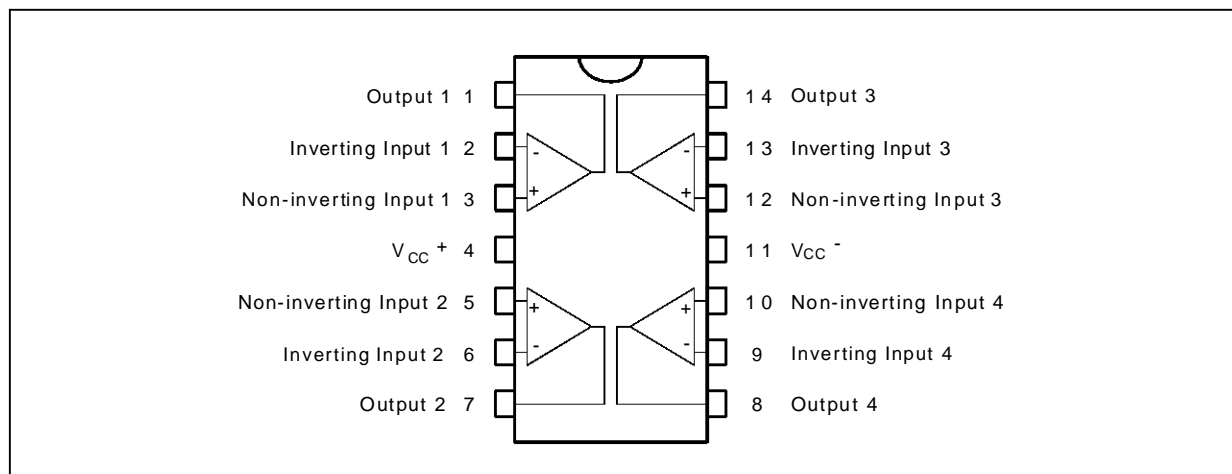
The devices feature high slew rates, low input bias and offset current, and low offset voltage temperature coefficient.

ORDER CODES

| Part Number | Temperature | Package | |
|-------------|---------------|---------|---|
| | | N | D |
| MC34004/A/B | 0°C, +70°C | • | • |
| MC33004/A/B | -40°C, +105°C | • | • |
| MC35004/A/B | -55°C, +125°C | • | • |

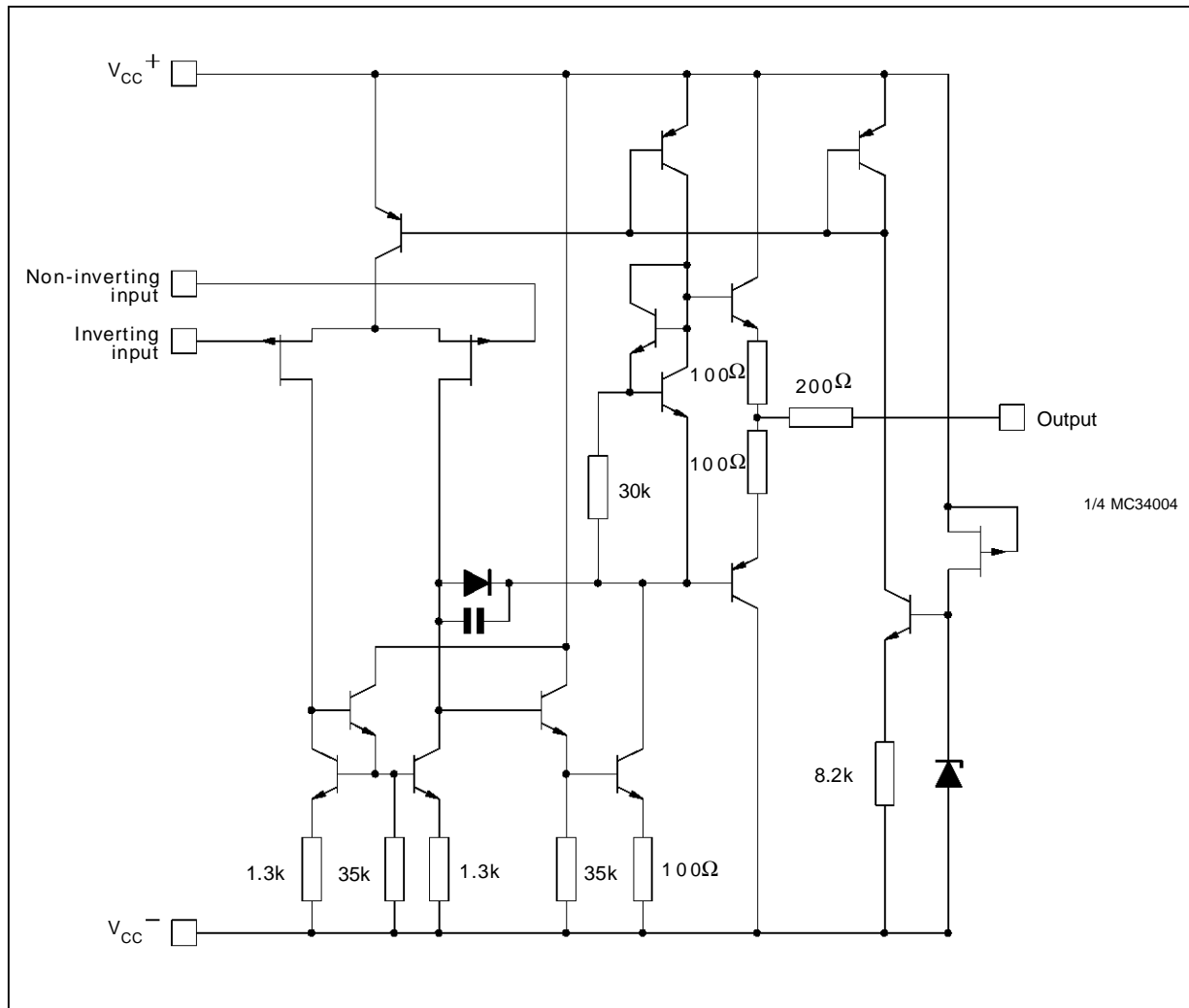
33004-01 TEL

PIN CONNECTIONS (top view)



33004-01 EPS

SCHEMATIC DIAGRAM (each amplifier)



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit | |
|-------------------|--|---|-------------------------------------|----|
| V _{CC} | Supply Voltage - (note 1) | ±18 | V | |
| V _I | Input Voltage - (note 3) | ±15 | V | |
| V _{id} | Differential Input Voltage - (note 2) | ±30 | V | |
| P _{tot} | Power Dissipation | 680 | mW | |
| | Output Short-circuit Duration (note 4) | Infinite | | |
| T _{oper} | Operating Free Air Temperature Range | MC34004, A, B MC33004, A, B MC35004, A, B | 0 to 70 -40 to 105 -55 to 125 | °C |
| T _{stg} | Storage Temperature Range | | -65 to 150 | °C |

- Notes :**
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. Differential voltages are at the non-inverting input terminal with respect to the inverting input terminal.
 3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
 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

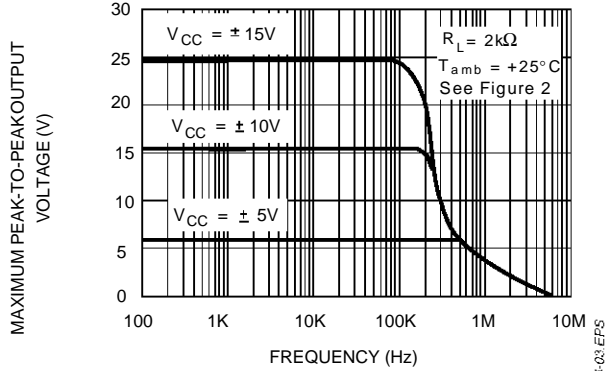
V_{CC} = ±15V, T_{amb} = 25°C (unless otherwise specified)

| Symbol | Parameter | MC35004A,B MC33004A,B MC34004A,B | | | MC35004 MC33004 MC34004 | | | Unit |
|----------------------------------|---|--|------------------|------------|-------------------------------|-------------------|------|------------------------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| V _{io} | Input Offset Voltage (R _S ≤ 10kΩ) T _{amb} = 25°C MC35004B, MC34004B, MC33004B MC35004A, MC34004A, MC33004A T _{min.} ≤ T _{amb} ≤ T _{max.} MC35004B, MC34004B, MC33004B MC35004A, MC34004A, MC33004A | | 3 1 | 5 2 | | 3 10 | | mV |
| DV _{io} | Input Offset Voltage Drift | | 10 | | | 10 | | μV/°C |
| I _{io} | Input Offset Current * T _{amb} = 25°C T _{min.} ≤ T _{amb} ≤ T _{max.} | | 5 | 50 4 | | 5 100 4 | | pA nA |
| I _{ib} | Input Bias Current * T _{amb} = 25°C T _{min.} ≤ T _{amb} ≤ T _{max.} | | 20 | 200 20 | | 20 200 20 | | pA nA |
| A _{vd} | Large Signal Voltage Gain (R _L = 2kΩ, V _O = ±10V) T _{amb} = 25°C T _{min.} ≤ T _{amb} ≤ T _{max.} | 50 25 | 200 | | 25 15 | 200 | | V/mV |
| SVR | Supply Voltage Rejection Ratio (R _S ≤ 10kΩ) T _{amb} = 25°C T _{min.} ≤ T _{amb} ≤ T _{max.} | 80 80 | 86 | | 70 70 | 86 | | dB |
| I _{CC} | Supply Current, per Amp, no Load T _{amb} = 25°C T _{min.} ≤ T _{amb} ≤ T _{max.} | | 1.4 | 2.5 2.8 | | 1.4 2.5 2.8 | | mA |
| V _{icm} | Input Common Mode Voltage Range | ±11 | +15 -12 | | ±11 | +15 -12 | | V |
| CMR | Common Mode Rejection Ratio (R _S ≤ 10kΩ) T _{amb} = 25°C T _{min.} ≤ T _{amb} ≤ T _{max.} | 80 80 | 86 | | 70 70 | 86 | | dB |
| I _{os} | Output Short-circuit Current T _{amb} = 25°C T _{min.} ≤ T _{amb} ≤ T _{max.} | 10 10 | 40 | 60 60 | 10 10 | 40 60 60 | | mA |
| ±V _{OPP} | Output Voltage Swing T _{amb} = 25°C R _L = 2kΩ R _L = 10kΩ T _{min.} ≤ T _{amb} ≤ T _{max.} R _L = 2kΩ R _L = 10kΩ | 10 12 10 12 | 12 13.5 | | 10 12 10 12 | 12 13.5 | | V |
| SR | Slew Rate (V _{in} = 10V, R _L = 2kΩ, C _L = 100pF, T _{amb} = 25°C, unity gain) | 12 | 16 | | 12 | 16 | | V/μs |
| t _r | Rise Time (V _{in} = 20mV, R _L = 2kΩ, C _L = 100pF, T _{amb} = 25°C, unity gain) | | 0.1 | | | 0.1 | | μs |
| K _{OV} | Overshoot (V _{in} = 20mV, R _L = 2kΩ, C _L = 100pF, T _{amb} = 25°C, unity gain) | | 10 | | | 10 | | % |
| GBP | Gain Bandwidth Product (f = 100kHz, T _{amb} = 25°C, V _{in} = 10mV, R _L = 2kΩ, C _L = 100pF) | 2.5 | 4 | | 2.5 | 4 | | MHz |
| R _i | Input Resistance | | 10 ¹² | | | 10 ¹² | | Ω |
| THD | Total Harmonic Distortion (f = 1kHz, A _V = 20dB, R _L = 2kΩ, C _L = 100pF, T _{amb} = 25°C, V _O = 2V _{PP}) | | 0.01 | | | 0.01 | | % |
| e _n | Equivalent Input Noise Voltage (f = 1kHz, R _S = 100Ω) | | 15 | | | 15 | | $\frac{nV}{\sqrt{Hz}}$ |
| ∅ _m | Phase Margin | | 45 | | | 45 | | Degrees |
| V _{O1} /V _{O2} | Channel Separation (A _{vd} = 100) | | 120 | | | 120 | | dB |

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

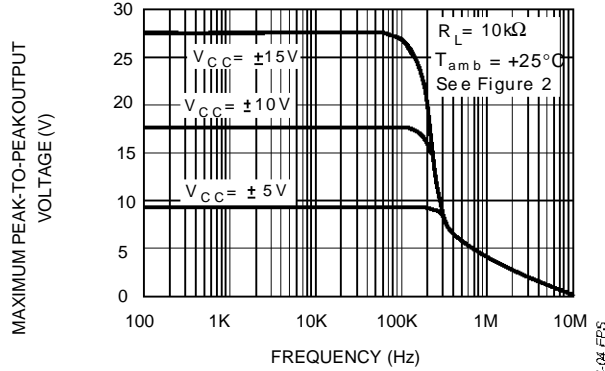
33004-C03 TEL

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



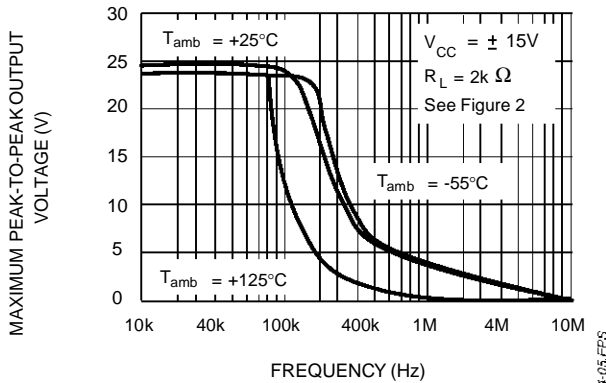
33004-03.EPS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



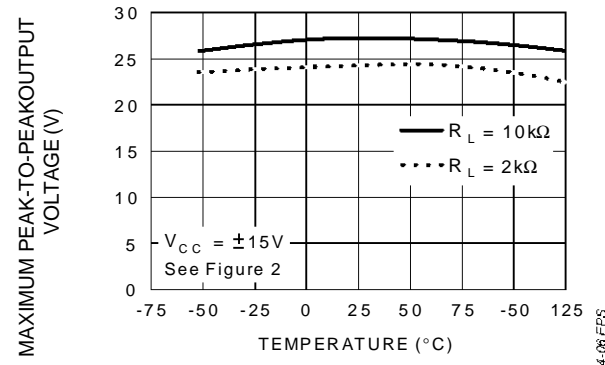
33004-04.EPS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



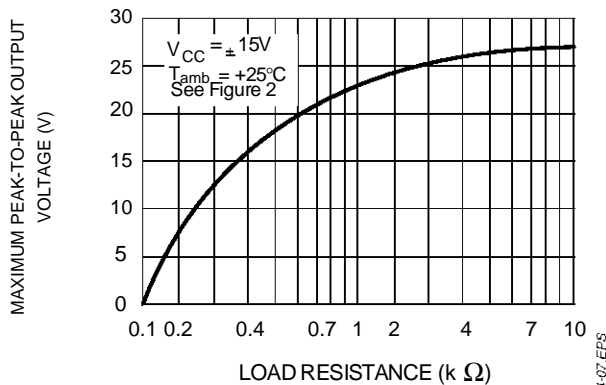
33004-05.EPS

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



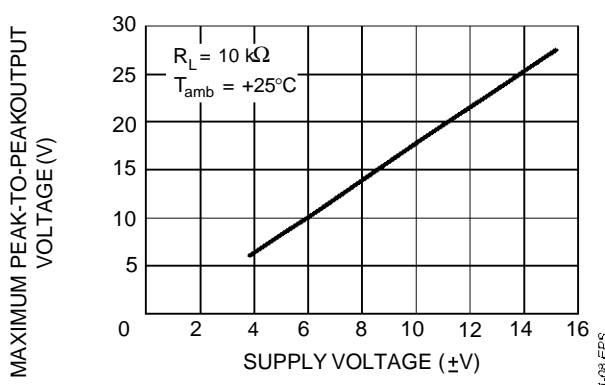
33004-06.EPS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS LOAD RESISTANCE



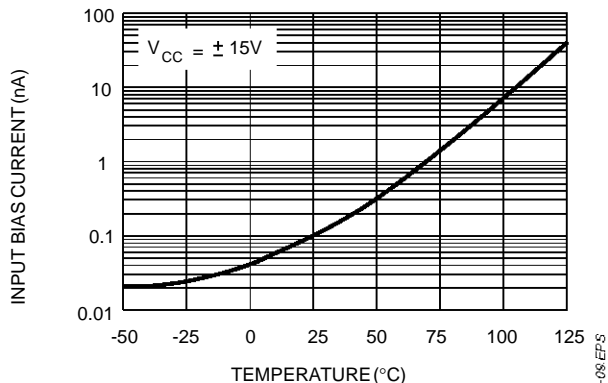
33004-07.EPS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS SUPPLY VOLTAGE



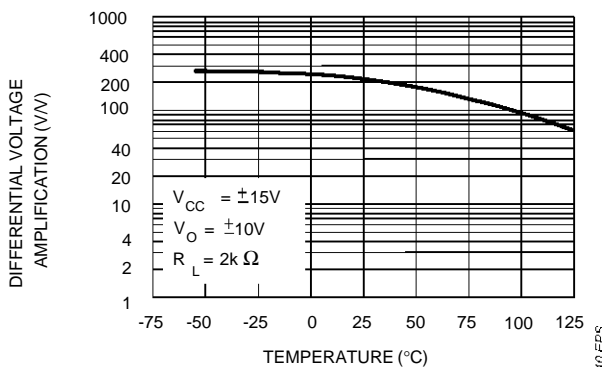
33004-08.EPS

INPUT BIAS CURRENT VERSUS FREE AIR TEMPERATURE



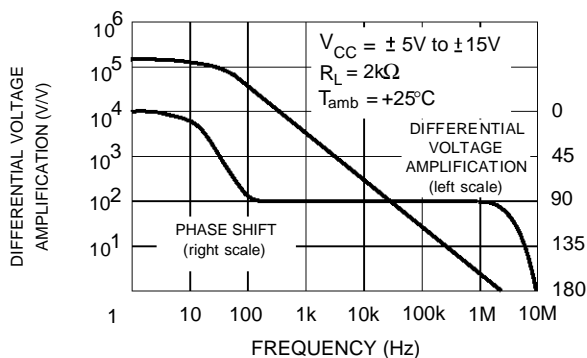
33004-09.EPS

LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION VERSUS FREE AIR TEMPERATURE



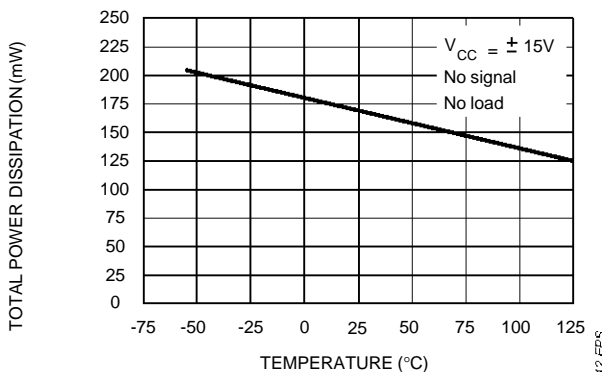
33004-10.EPS

LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VERSUS FREQUENCY



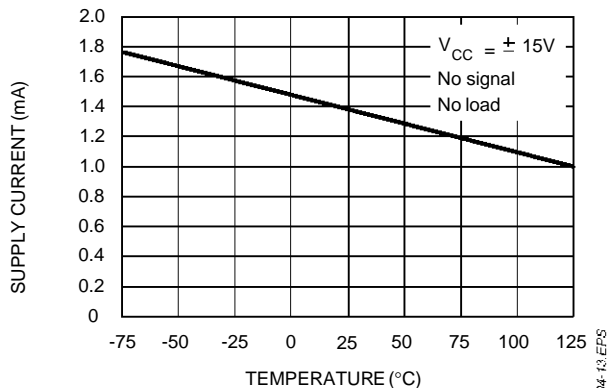
33004-11.EPS

TOTAL POWER DISSIPATION VERSUS FREE AIR TEMPERATURE



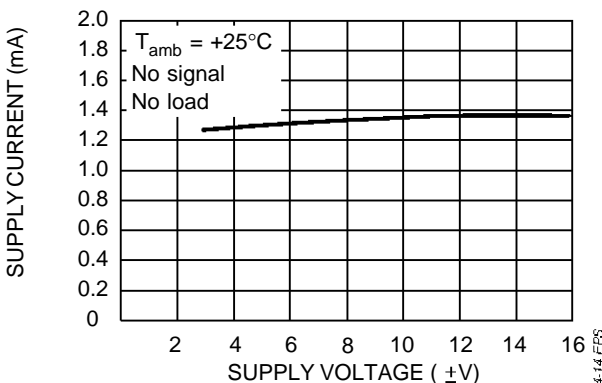
33004-12.EPS

SUPPLY CURRENT PER AMPLIFIER VERSUS FREE AIR TEMPERATURE



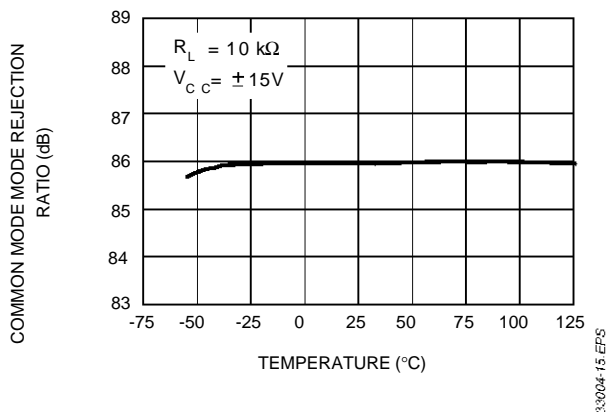
33004-13.EPS

SUPPLY CURRENT PER AMPLIFIER VERSUS SUPPLY VOLTAGE

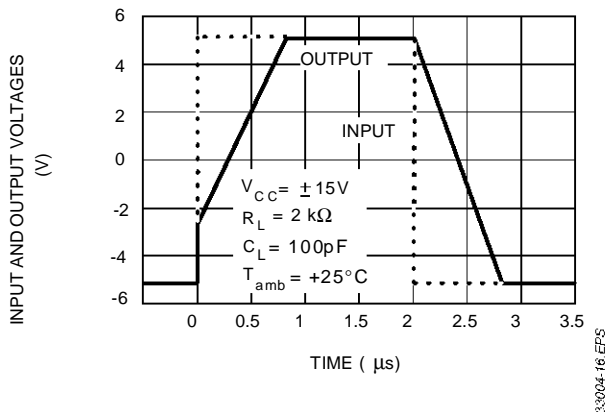


33004-14.EPS

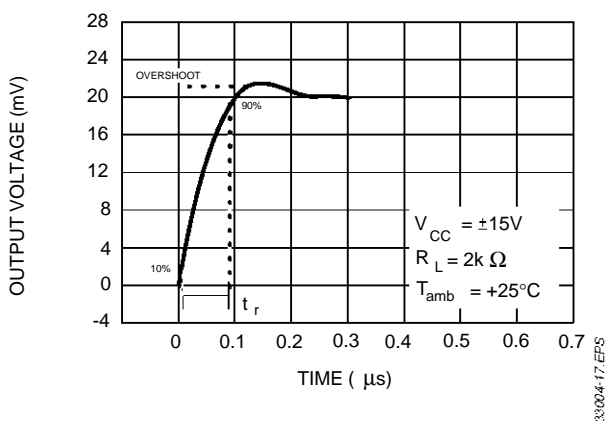
**COMMON MODE REJECTION RATIO
VERSUS FREE AIR TEMPERATURE**



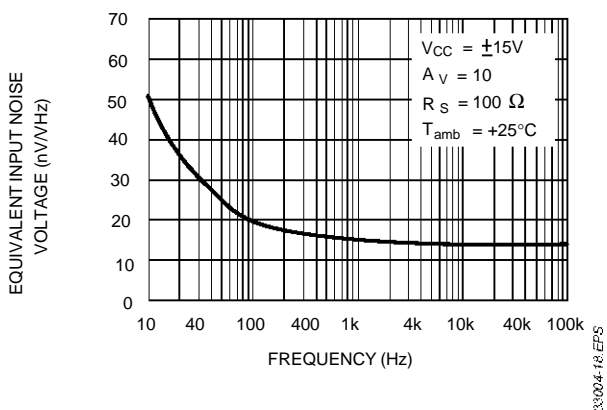
**VOLTAGE FOLLOWER LARGE SIGNAL
PULSE RESPONSE**



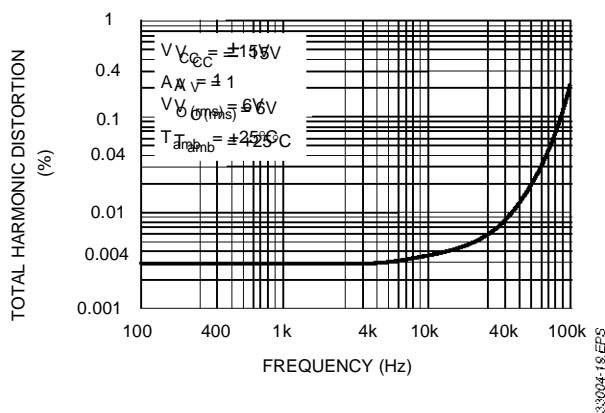
**OUTPUT VOLTAGE VERSUS
ELAPSED TIME**



**EQUIVALENT INPUT NOISE VOLTAGE
VERSUS FREQUENCY**



**TOTAL HARMONIC DISTORTION VERSUS
FREQUENCY**



PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower

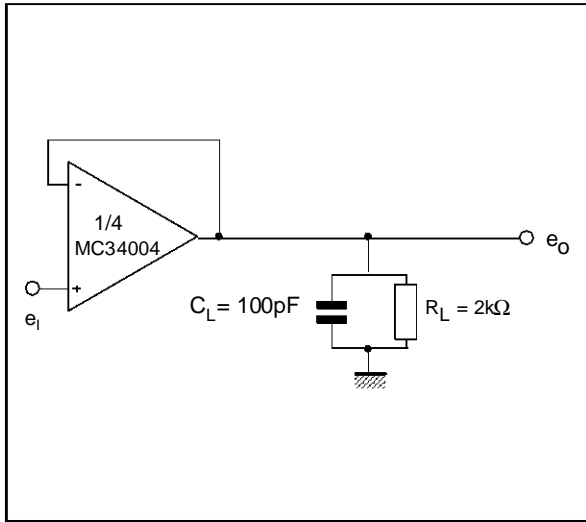
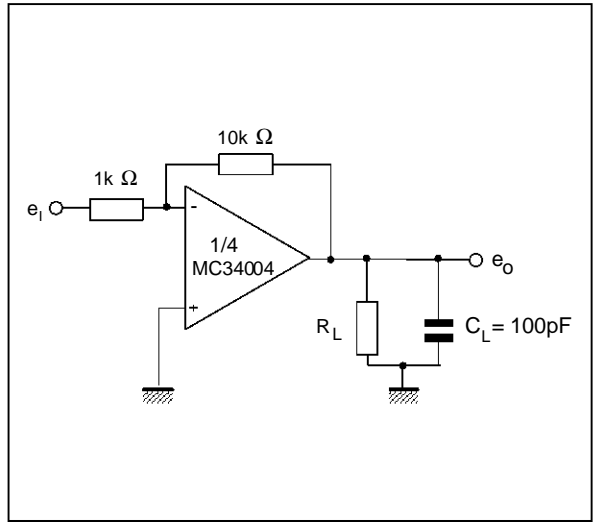
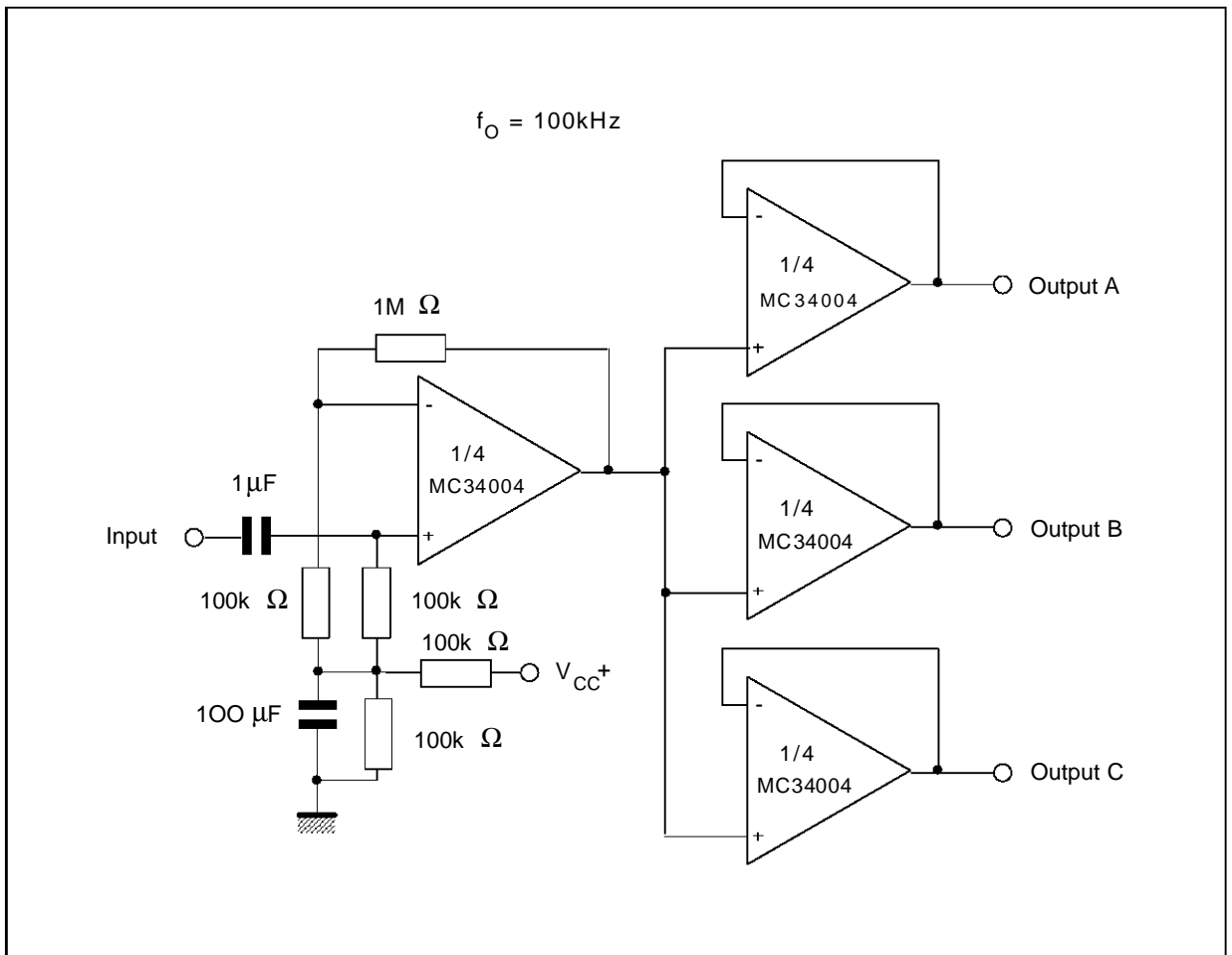


Figure 2 : Gain-of-10 Inverting Amplifier



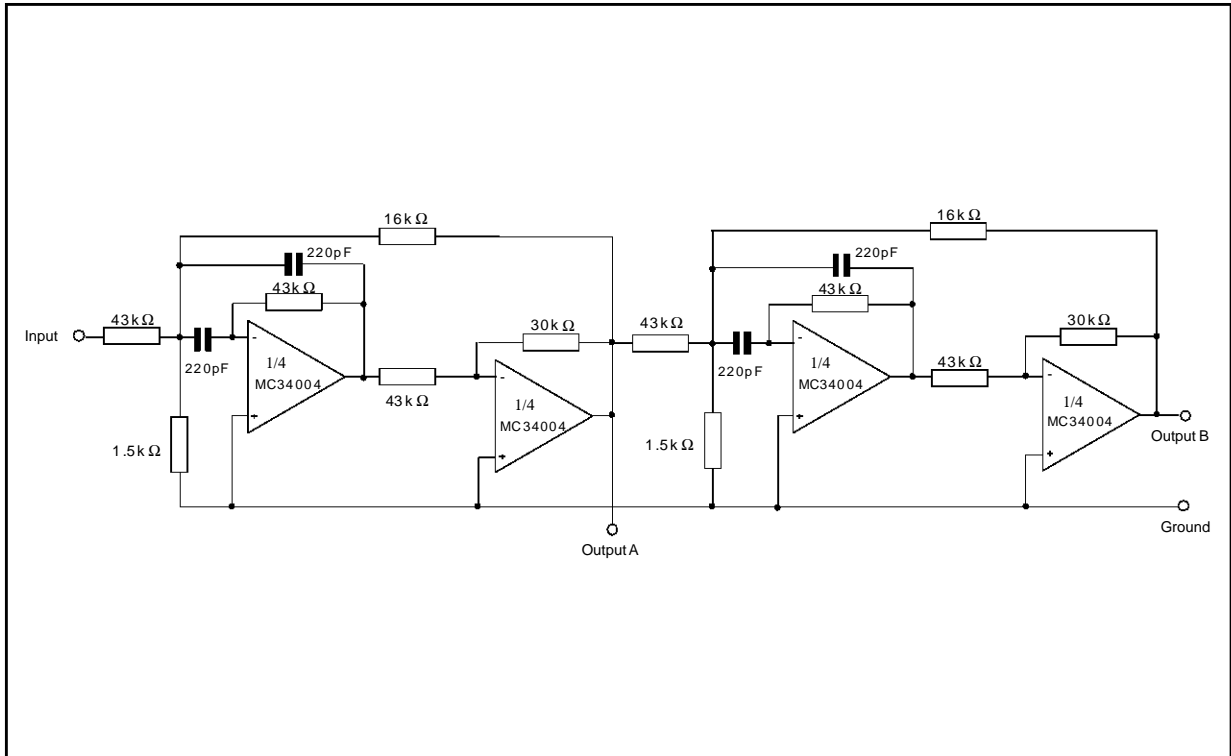
TYPICAL APPLICATIONS

AUDIO DISTRIBUTION AMPLIFIER



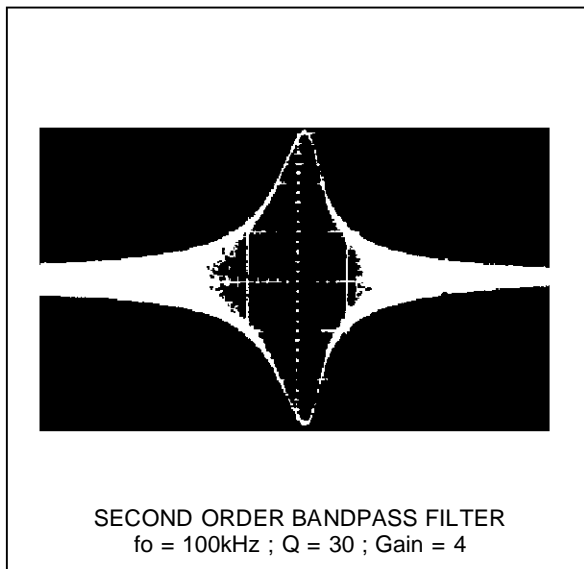
TYPICAL APPLICATIONS (continued)

POSITIVE FEEDBACK BANDPASS FILTER



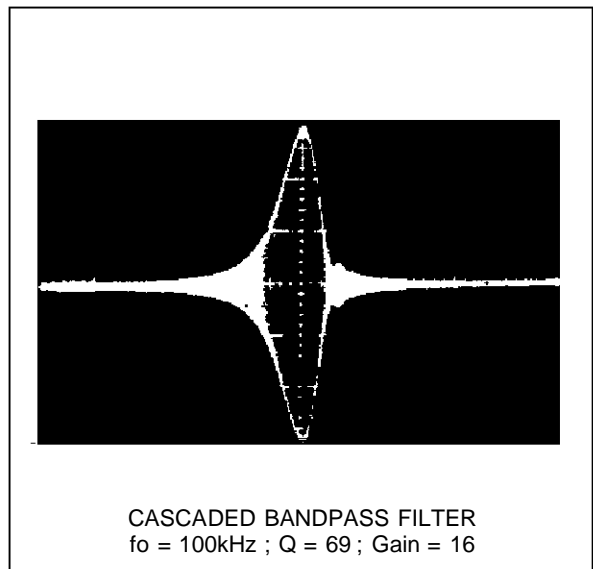
33004-24.EPS

OUTPUT A



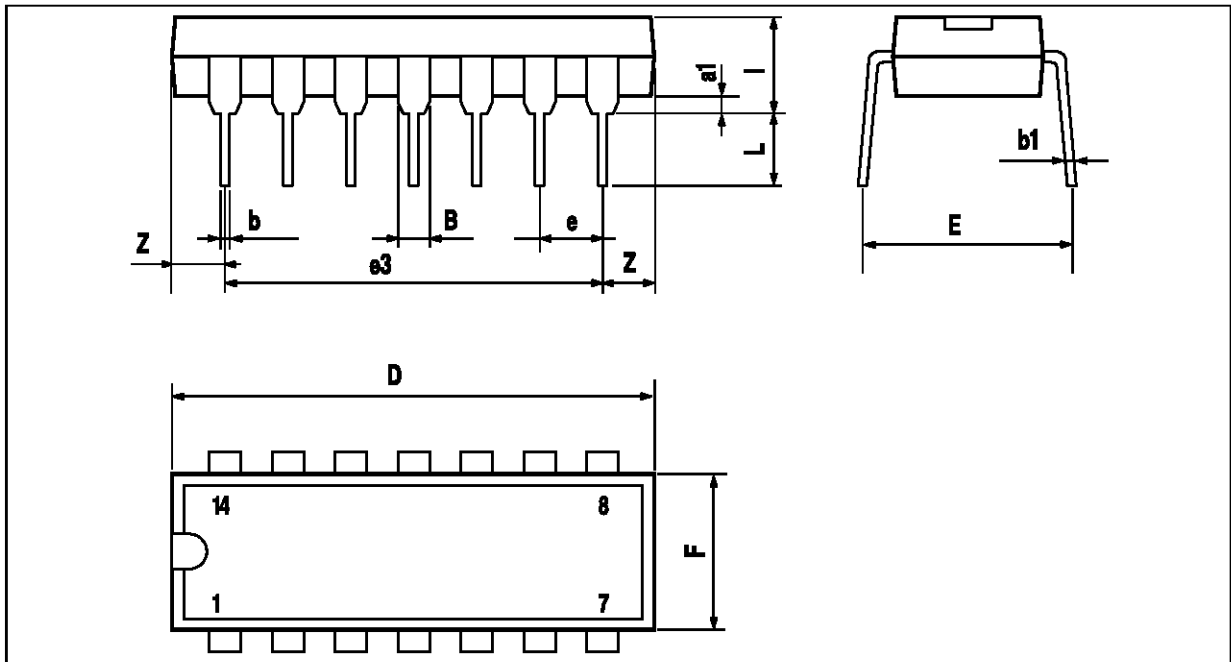
33004-24.MKG

OUTPUT B



33004-25.MKG

PACKAGE MECHANICAL DATA
14 PINS - PLASTIC DIP



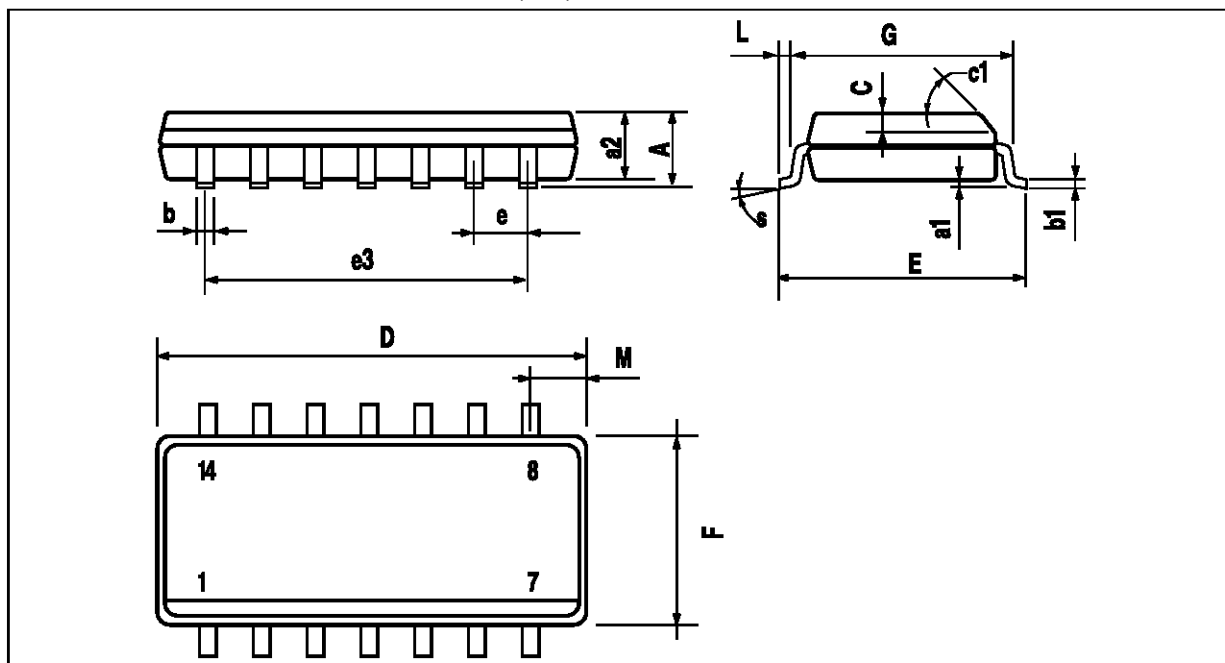
PM-DIP14.EPS

| Dimensions | Millimeters | | | Inches | | |
|------------|-------------|-------|------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 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 |

DIP14.TEL

MC33004/A/B - MC34004/A/B - MC35004/A/B

PACKAGE MECHANICAL DATA
14 PINS - PLASTIC MICROPACKAGE (SO)



PM-SO14/EPS

| Dimensions | 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 | 8.55 | | 8.75 | 0.336 | | 0.334 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 7.62 | | | 0.300 | |
| F | 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.) | | | | | |

SO14 TEL

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