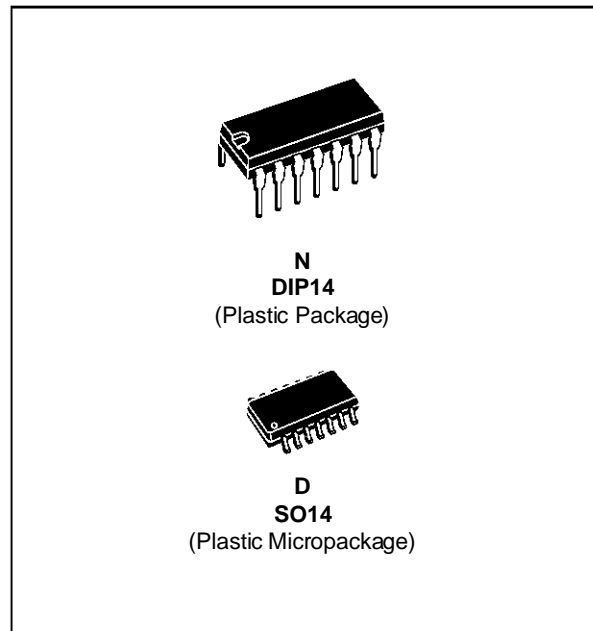


**GENERAL PURPOSE
QUAD J-FET OPERATIONAL AMPLIFIERS**

- 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.

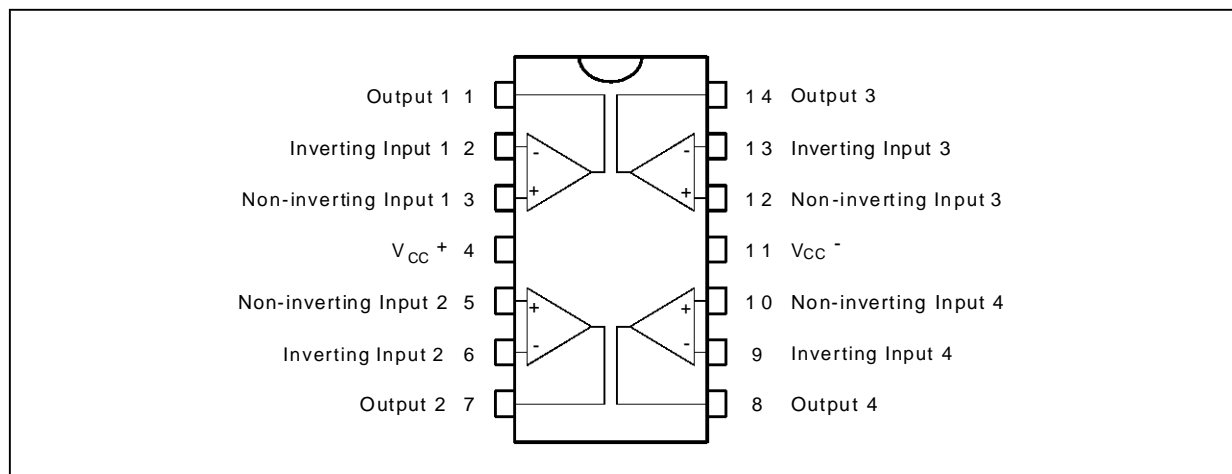
The devices feature high slew rates, low input bias and offset current, and low offset voltage temperature coefficient.

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	•	•

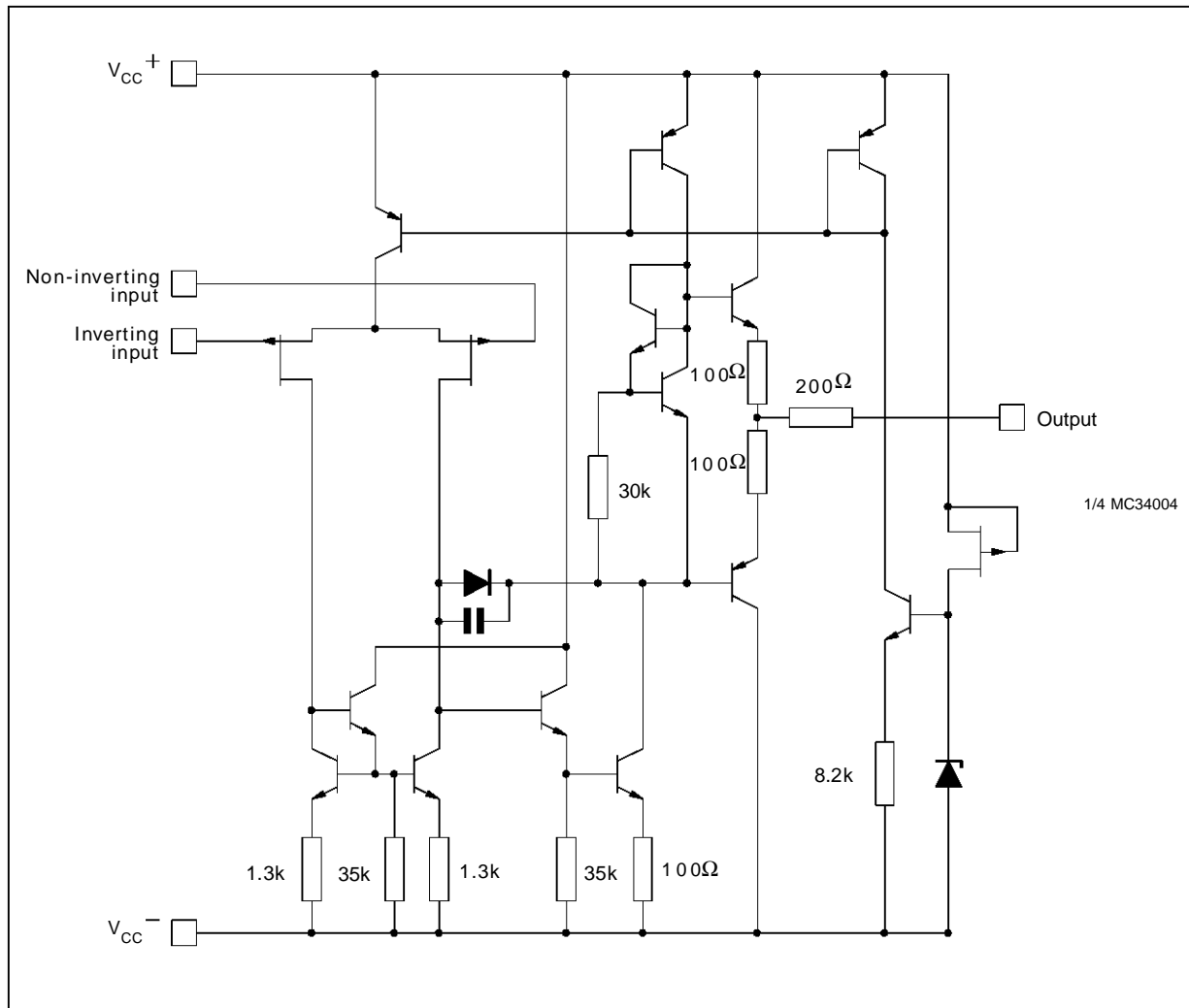
33004-01 TEL

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.

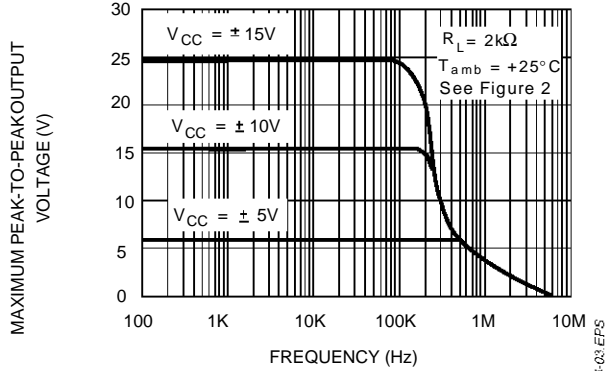
ELECTRICAL CHARACTERISTICS

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

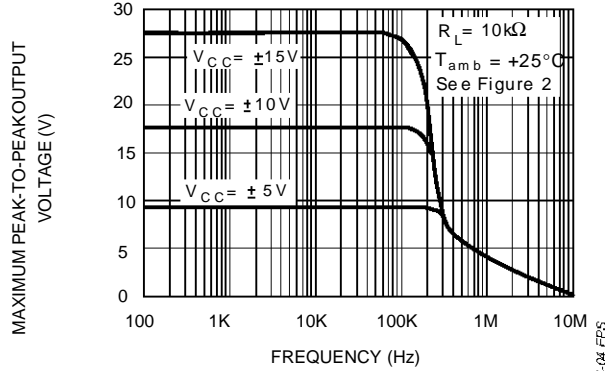
* The input bias currents are junction leakage currents which approximately double for every 10°C increase in the junction temperature.

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



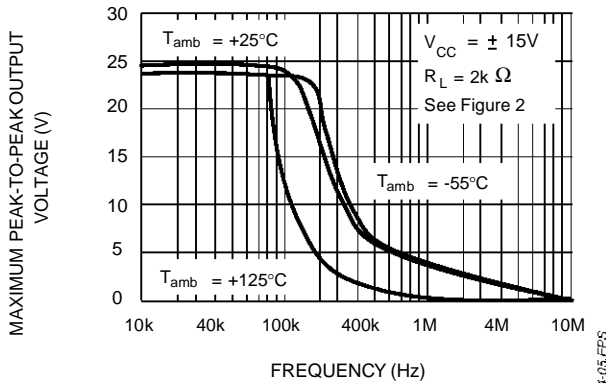
33004-03.EPS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



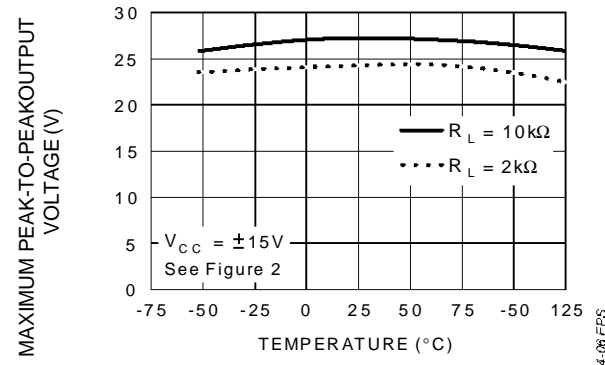
33004-04.EPS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



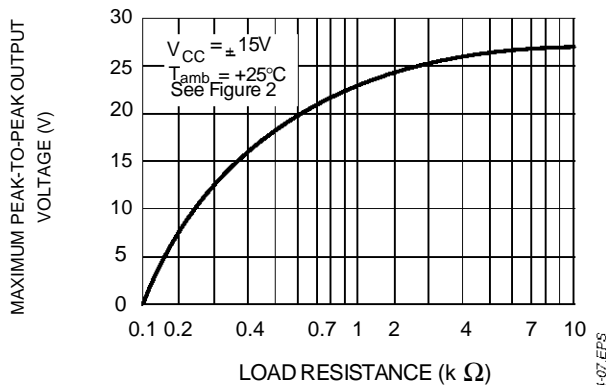
33004-05.EPS

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



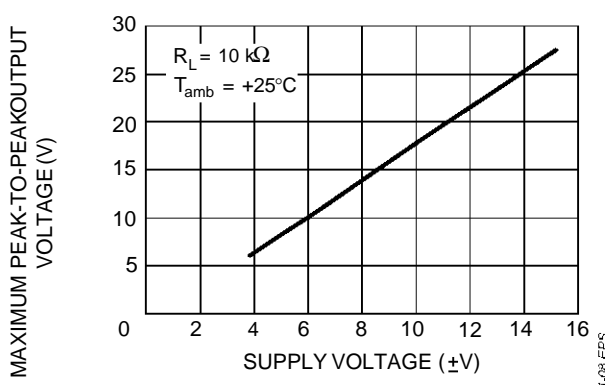
33004-06.EPS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS LOAD RESISTANCE



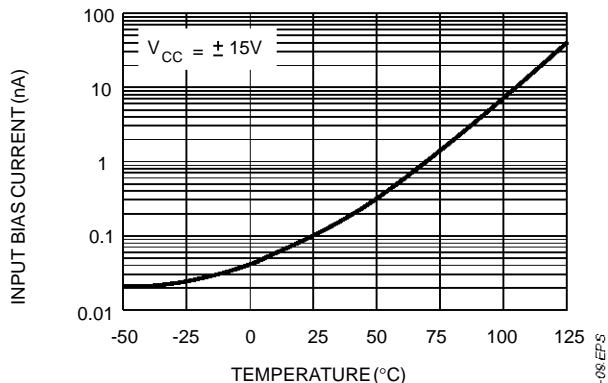
33004-07.EPS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS SUPPLY VOLTAGE



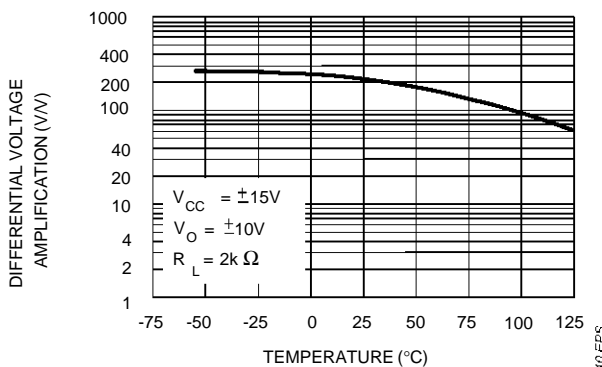
33004-08.EPS

INPUT BIAS CURRENT VERSUS FREE AIR TEMPERATURE



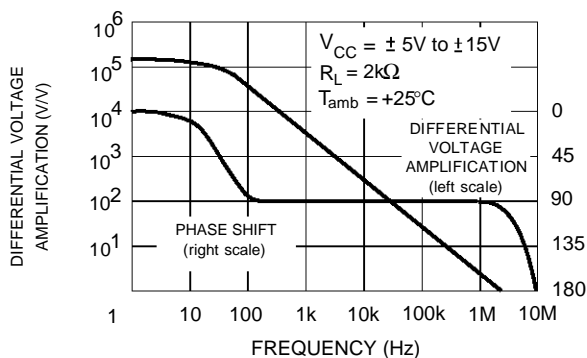
33004-09.EPS

LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION VERSUS FREE AIR TEMPERATURE



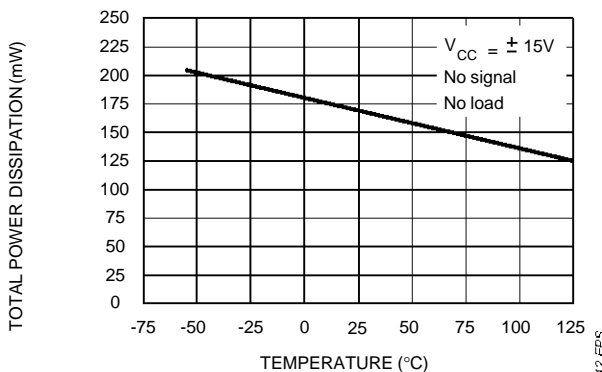
33004-10.EPS

LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VERSUS FREQUENCY



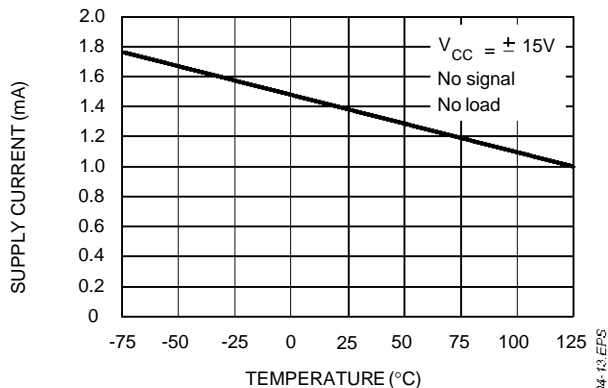
33004-11.EPS

TOTAL POWER DISSIPATION VERSUS FREE AIR TEMPERATURE



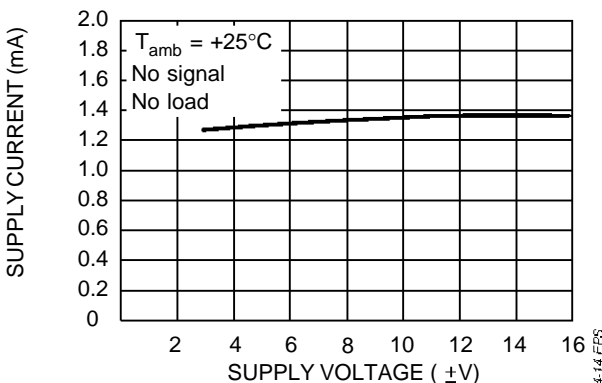
33004-12.EPS

SUPPLY CURRENT PER AMPLIFIER VERSUS FREE AIR TEMPERATURE



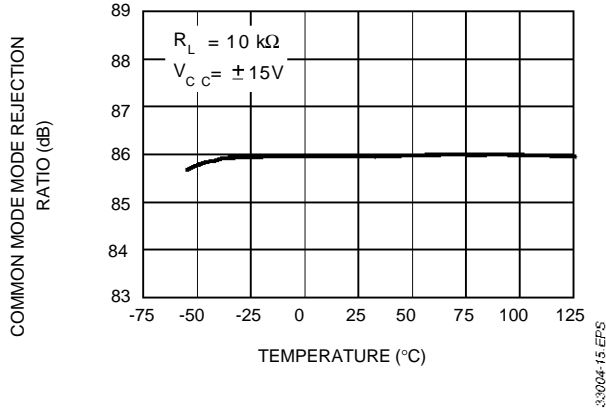
33004-13.EPS

SUPPLY CURRENT PER AMPLIFIER VERSUS SUPPLY VOLTAGE

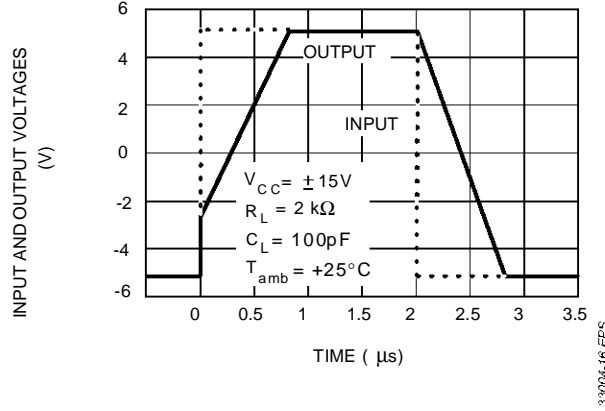


33004-14.EPS

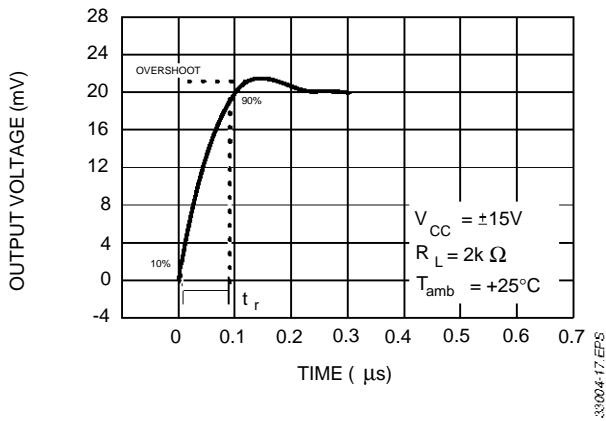
**COMMON MODE REJECTION RATIO
VERSUS FREE AIR TEMPERATURE**



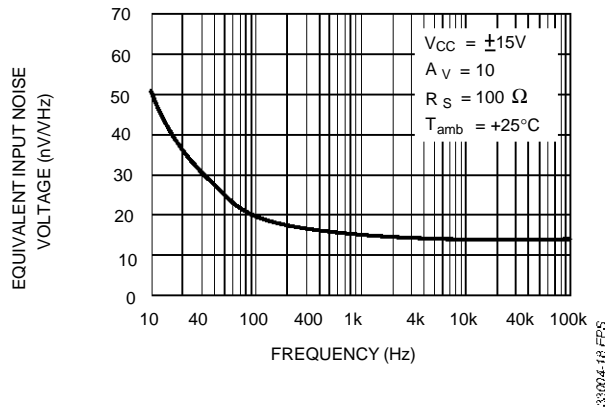
**VOLTAGE FOLLOWER LARGE SIGNAL
PULSE RESPONSE**



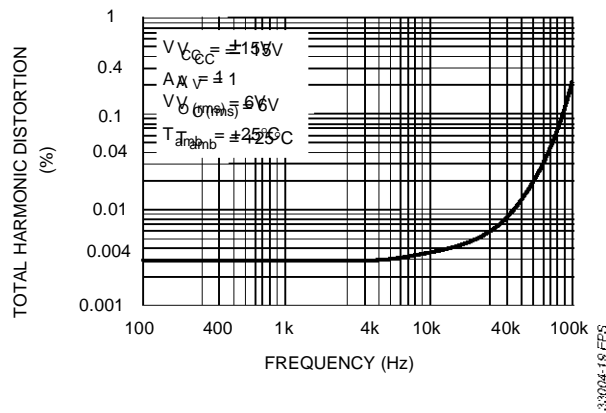
**OUTPUT VOLTAGE VERSUS
ELAPSED TIME**



**EQUIVALENT INPUT NOISE VOLTAGE
VERSUS FREQUENCY**



**TOTAL HARMONIC DISTORTION VERSUS
FREQUENCY**



PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower

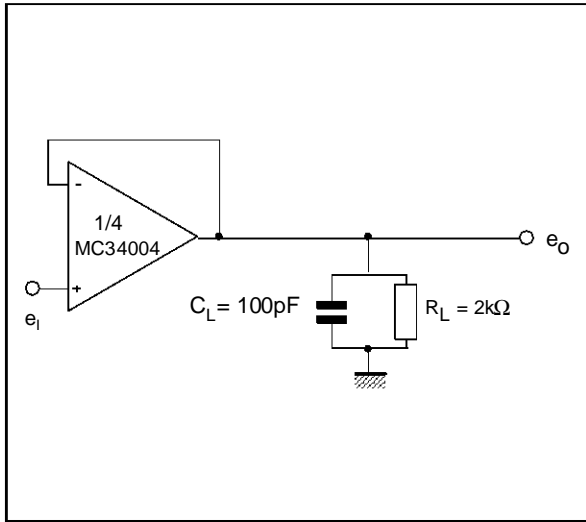
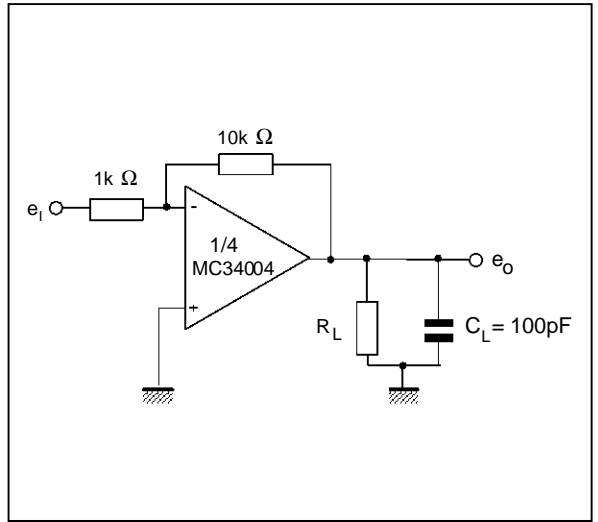
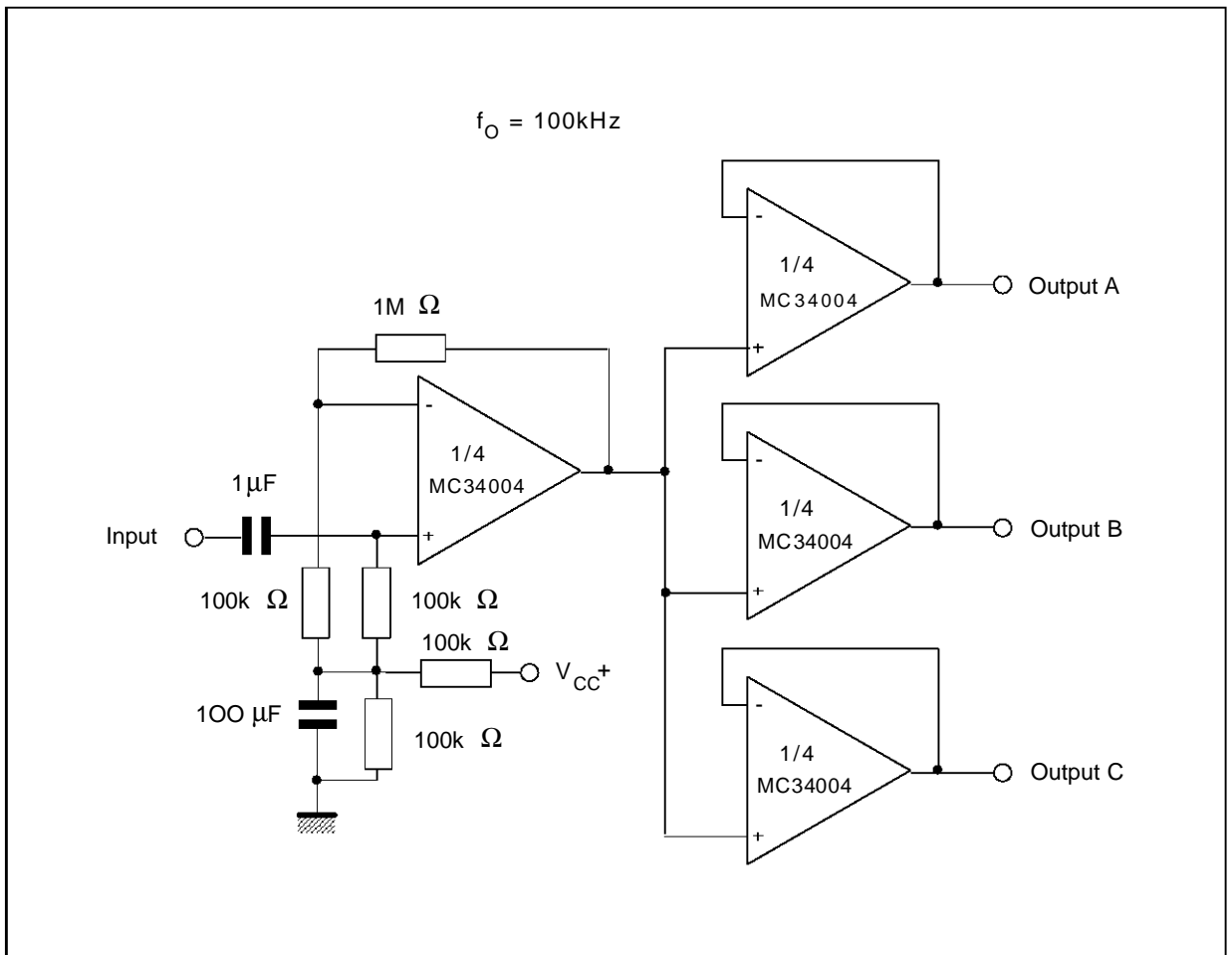


Figure 2 : Gain-of-10 Inverting Amplifier



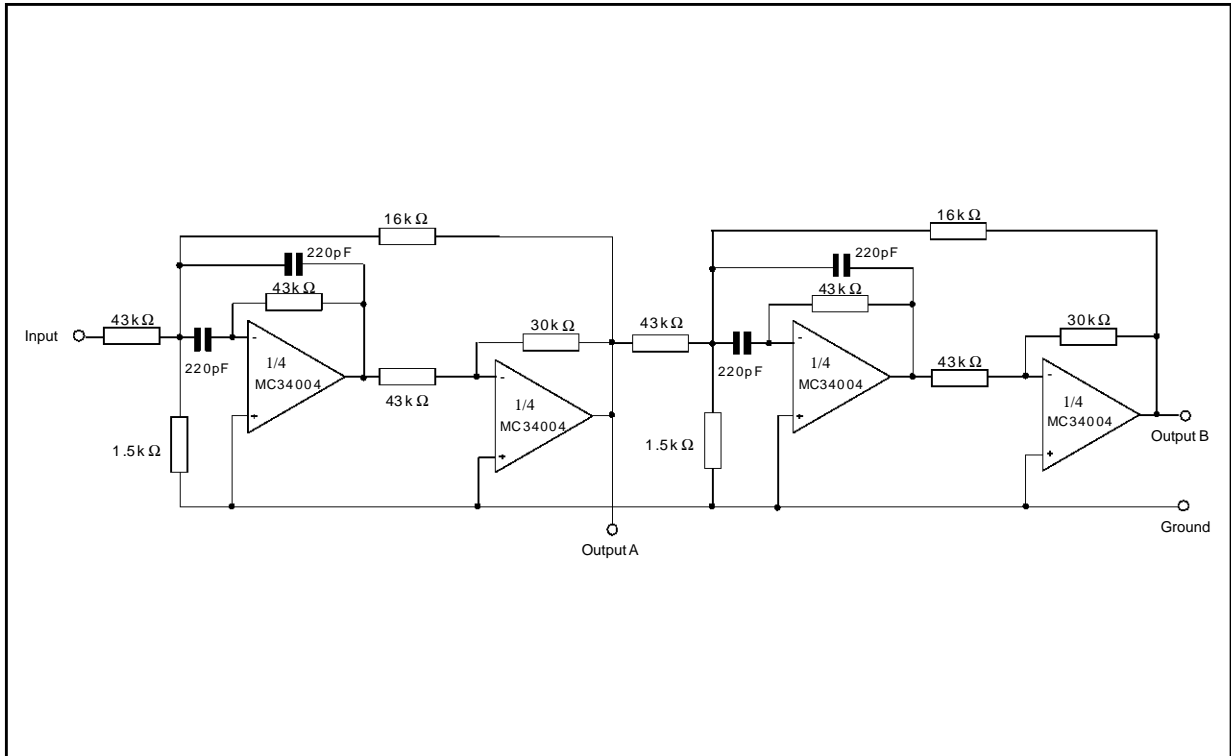
TYPICAL APPLICATIONS

AUDIO DISTRIBUTION AMPLIFIER



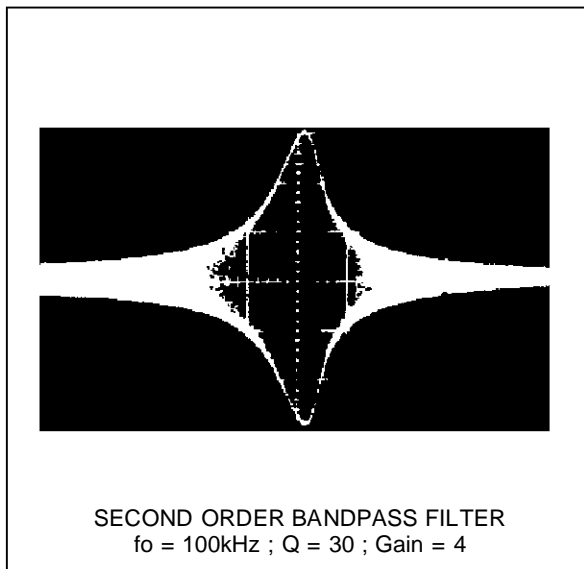
TYPICAL APPLICATIONS (continued)

POSITIVE FEEDBACK BANDPASS FILTER



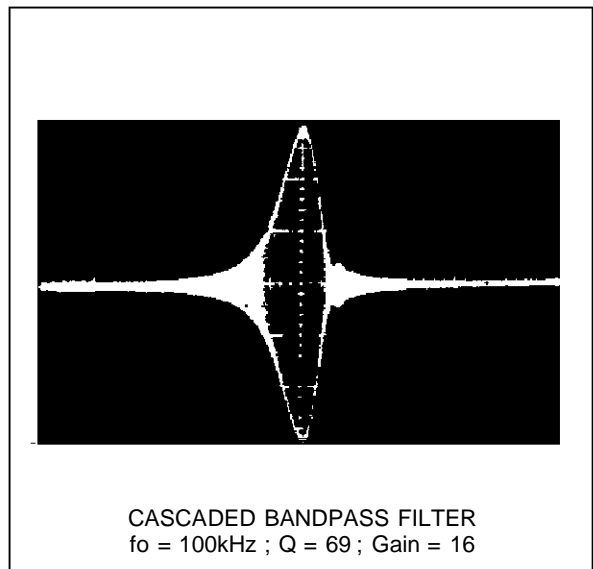
33004-23.EPS

OUTPUT A



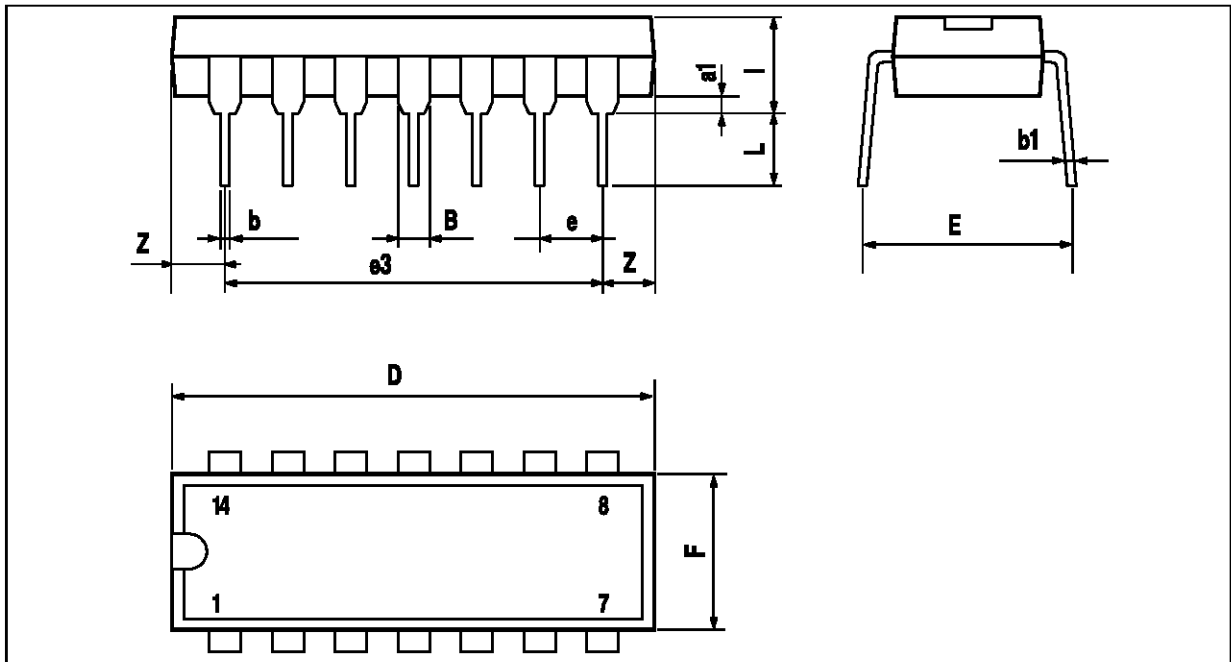
33004-24.MKG

OUTPUT B



33004-25.MKG

PACKAGE MECHANICAL DATA
14 PINS - PLASTIC DIP



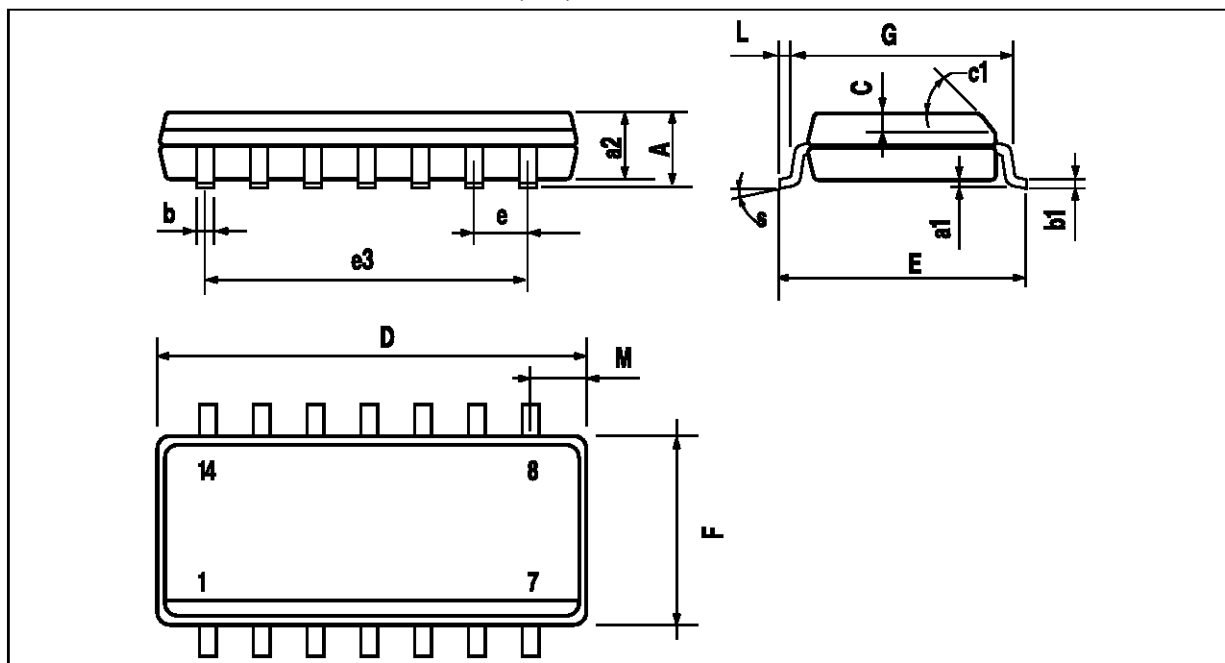
PM-DIP14.EPS

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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