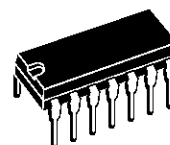
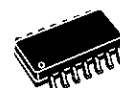


GENERAL PURPOSE QUAD J-FET OPERATIONAL AMPLIFIERS

- 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)



N
DIP14
(Plastic Package)



D
SO14
(Plastic Micropackage)

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.

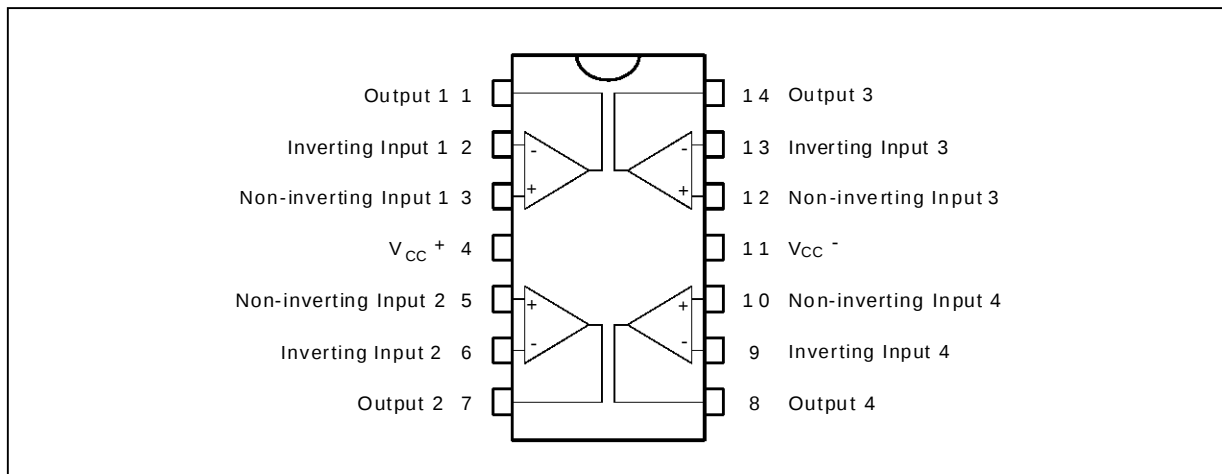
The devices feature high slew rates, low input bias and offset current, and low offset voltage temperature coefficient.

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	•	•

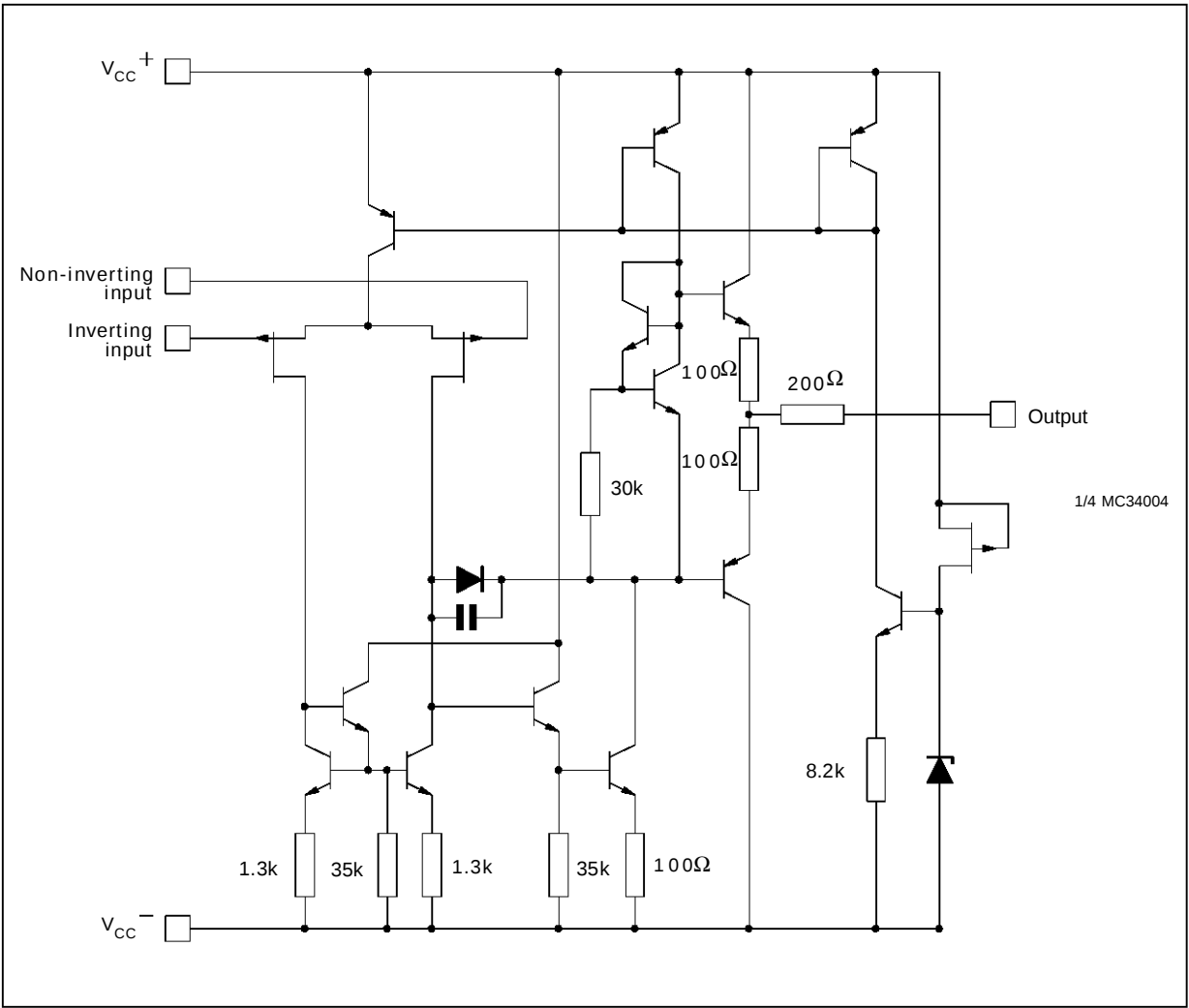
33004-01 TEL

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	$^{\circ}\text{C}$
T_{stg}	Storage Temperature Range	-65 to 150	$^{\circ}\text{C}$

- 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.

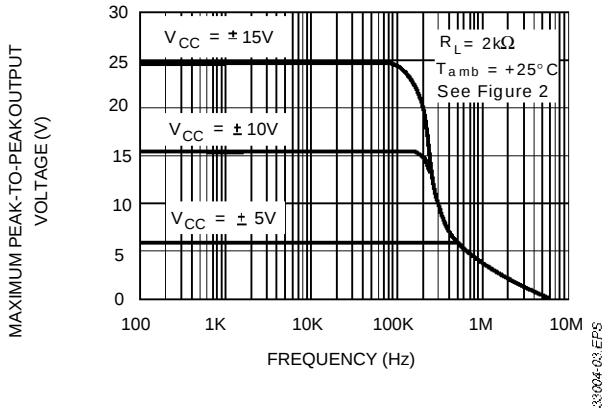
ELECTRICAL CHARACTERISTICS

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

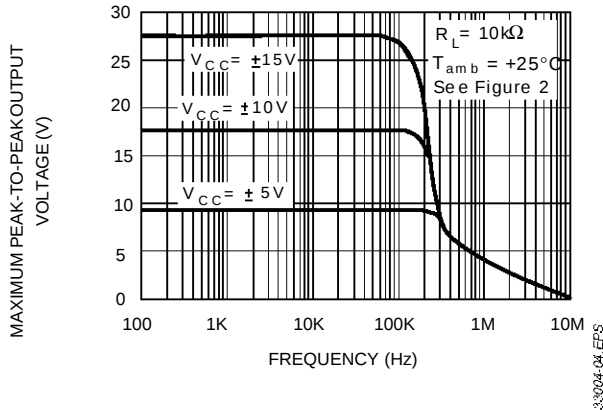
Symbol	Parameter	MC35004A,B MC33004A,B MC34004A,B			MC35004 MC33004 MC34004			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($R_S \leq 10k\Omega$) $T_{amb} = 25^{\circ}C$ MC35004B, MC34004B, MC33004B MC35004A, MC34004A, MC33004A $T_{min.} \leq T_{amb} \leq T_{max.}$ MC35004B, MC34004B, MC33004B MC35004A, MC34004A, MC33004A		3 1	5 2		3 13	10	mV
DV_{io}	Input Offset Voltage Drift		10			10		$\mu V/^{\circ}C$
I_{io}	Input Offset Current * $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		5	50 4		5 100 4		pA nA
I_{ib}	Input Bias Current * $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		20	200 20		20 200 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 ($R_S \leq 10k\Omega$) $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	80 80	86		70 70	86		dB
I_{CC}	Supply Current, per Amp, no Load $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		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 ($R_S \leq 10k\Omega$) $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$	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 $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ $R_L = 2k\Omega$ $R_L = 10k\Omega$ $R_L = 2k\Omega$ $R_L = 10k\Omega$	10 12 10 12	12 13.5		10 12 10 12	12 13.5		V
SR	Slew Rate ($V_{in} = 10V$, $R_L = 2k\Omega$, $C_L = 100pF$, $T_{amb} = 25^{\circ}C$, unity gain)	12	16		12	16		V/ μs
t_r	Rise Time ($V_{in} = 20mV$, $R_L = 2k\Omega$, $C_L = 100pF$, $T_{amb} = 25^{\circ}C$, unity gain)		0.1			0.1		μs
K_{OV}	Overshoot ($V_{in} = 20mV$, $R_L = 2k\Omega$, $C_L = 100pF$, $T_{amb} = 25^{\circ}C$, unity gain)		10			10		%
GBP	Gain Bandwidth Product ($f = 100kHz$, $T_{amb} = 25^{\circ}C$, $V_{in} = 10mV$, $R_L = 2k\Omega$, $C_L = 100pF$)	2.5	4		2.5	4		MHz
R_i	Input Resistance		10^{12}			10^{12}		Ω
THD	Total Harmonic Distortion ($f = 1kHz$, $A_V = 20dB$, $R_L = 2k\Omega$, $C_L = 100pF$, $T_{amb} = 25^{\circ}C$, $V_O = 2V_{PP}$)		0.01			0.01		%
e_n	Equivalent Input Noise Voltage ($f = 1kHz$, $R_S = 100\Omega$)		15			15		$\frac{nV}{\sqrt{Hz}}$
ϕ_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 $10^{\circ}C$ increase in the junction temperature.

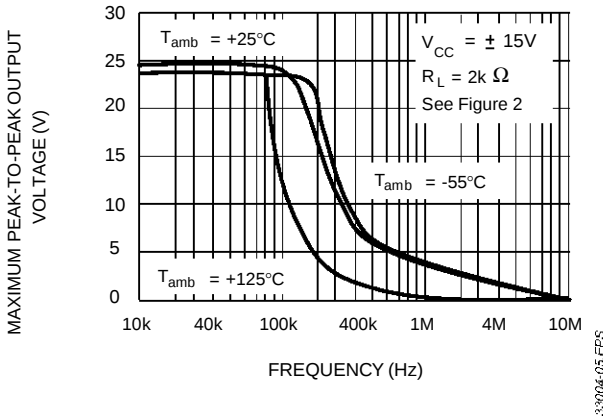
MAXIMUM PEAK-TO-PEAK OUTPUT
VOLTAGE VERSUS FREQUENCY



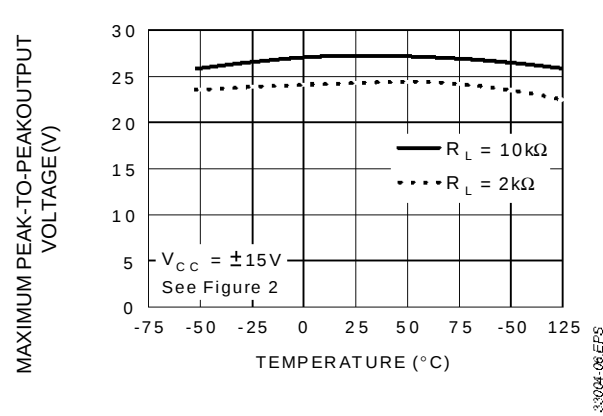
MAXIMUM PEAK-TO-PEAK OUTPUT
VOLTAGE VERSUS FREQUENCY



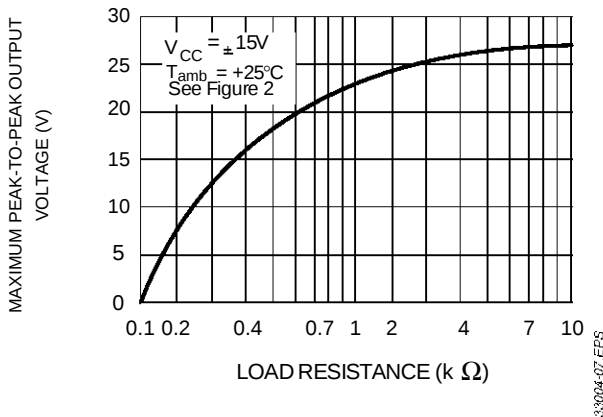
MAXIMUM PEAK-TO-PEAK OUTPUT
VOLTAGE VERSUS FREQUENCY



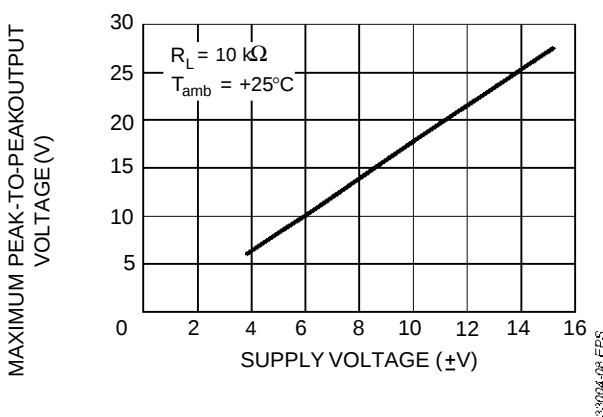
MAXIMUM PEAK-TO-PEAK OUTPUT
VOLTAGE VERSUS FREE AIR TEMP.



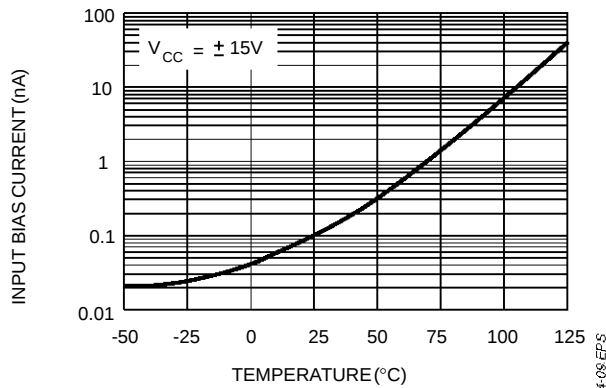
MAXIMUM PEAK-TO-PEAK OUTPUT
VOLTAGE VERSUS LOAD RESISTANCE



MAXIMUM PEAK-TO-PEAK OUTPUT
VOLTAGE VERSUS SUPPLY VOLTAGE

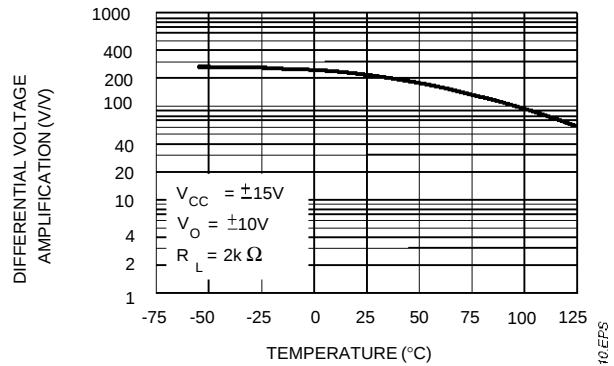


**INPUT BIAS CURRENT VERSUS
FREE AIR TEMPERATURE**



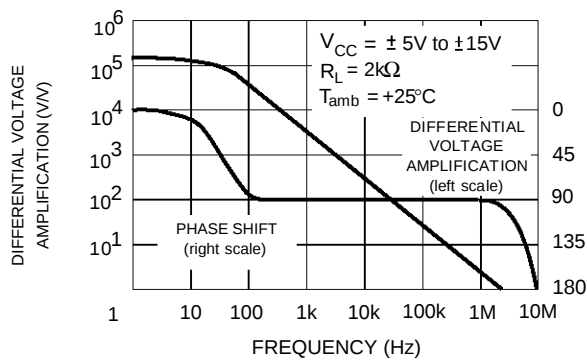
33004-08.EPS

**LARGE SIGNAL DIFFERENTIAL
VOLTAGE AMPLIFICATION VERSUS
FREE AIR TEMPERATURE**



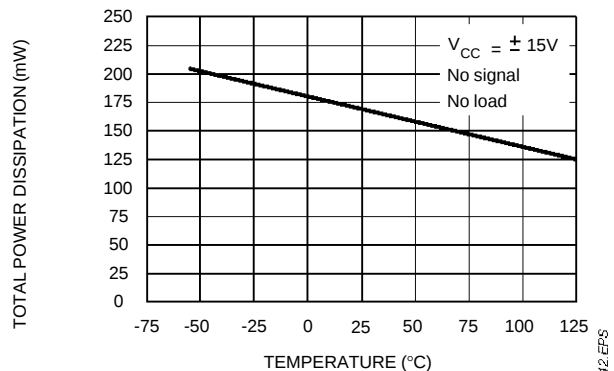
33004-10.EPS

**LARGE SIGNAL DIFFERENTIAL
VOLTAGE AMPLIFICATION AND PHASE
SHIFT VERSUS FREQUENCY**



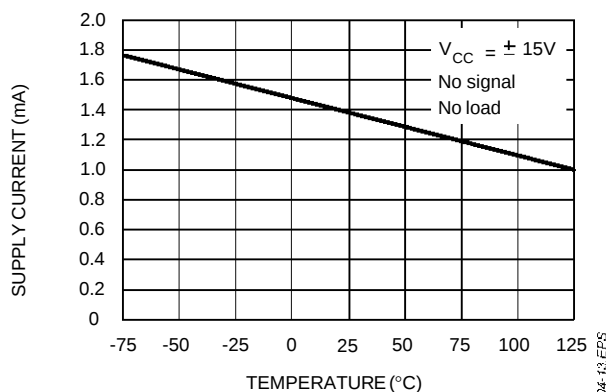
33004-11.EPS

**TOTAL POWER DISSIPATION VERSUS
FREE AIR TEMPERATURE**



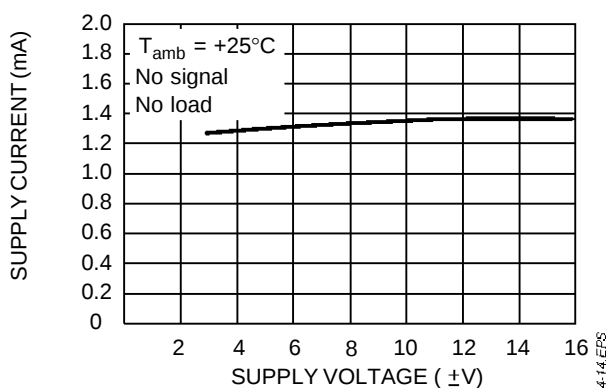
33004-12.EPS

**SUPPLY CURRENT PER AMPLIFIER
VERSUS FREE AIR TEMPERATURE**



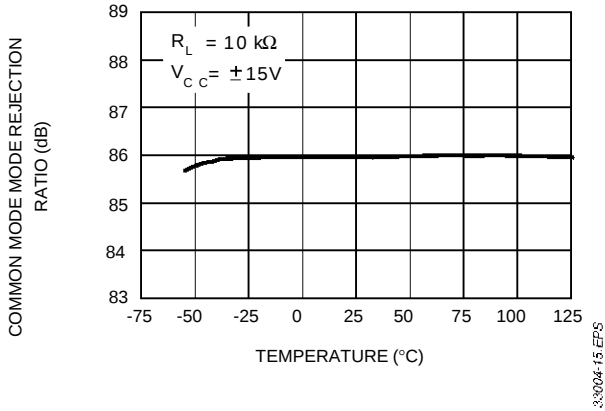
33004-13.EPS

**SUPPLY CURRENT PER AMPLIFIER
VERSUS SUPPLY VOLTAGE**

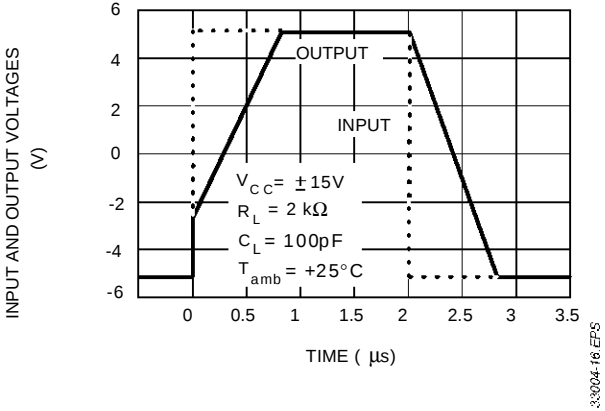


33004-14.EPS

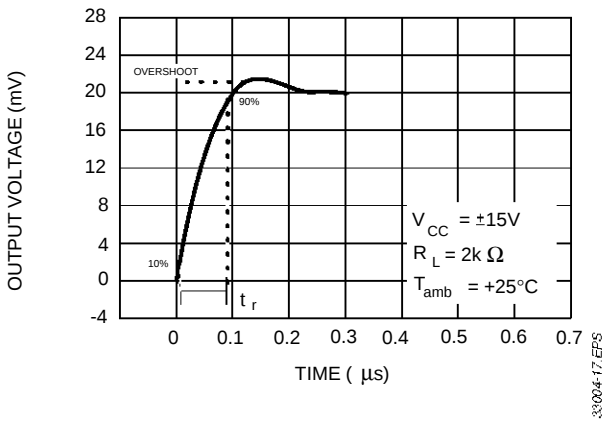
COMMON MODE REJECTION RATIO
VERSUS FREE AIR TEMPERATURE



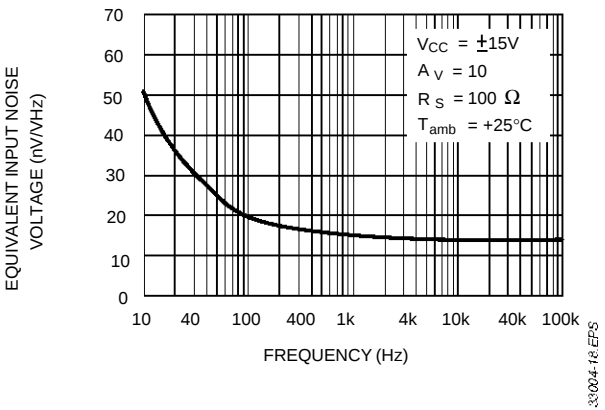
VOLTAGE FOLLOWER LARGE SIGNAL
PULSE RESPONSE



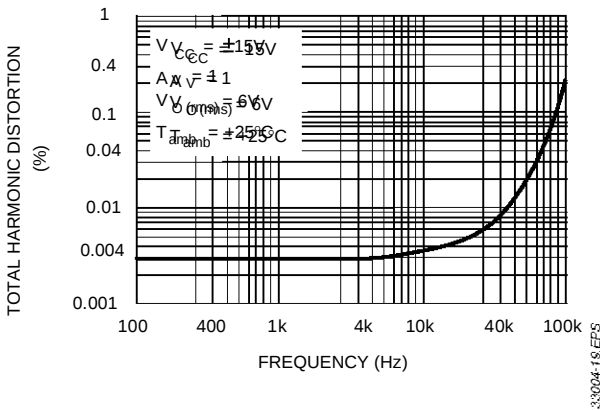
OUTPUT VOLTAGE VERSUS
ELAPSED TIME



EQUIVALENT INPUT NOISE VOLTAGE
VERSUS FREQUENCY



TOTAL HARMONIC DISTORTION VERSUS
FREQUENCY



PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower

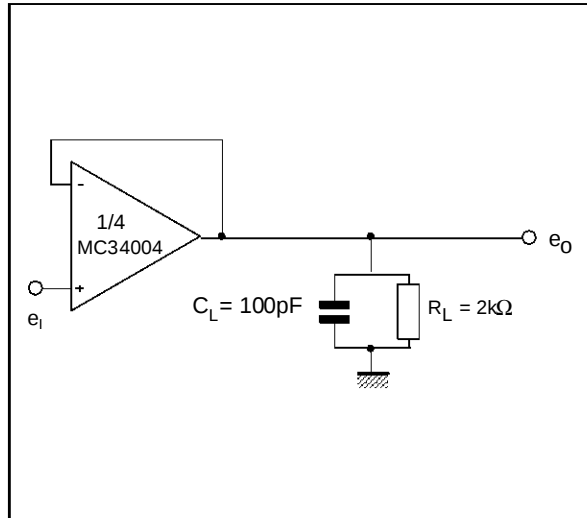
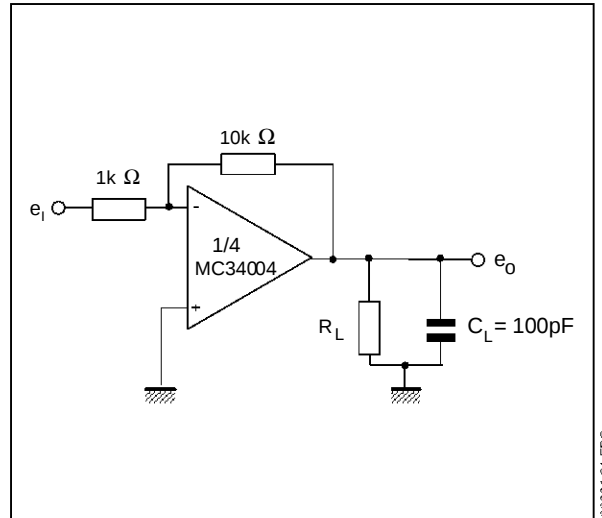
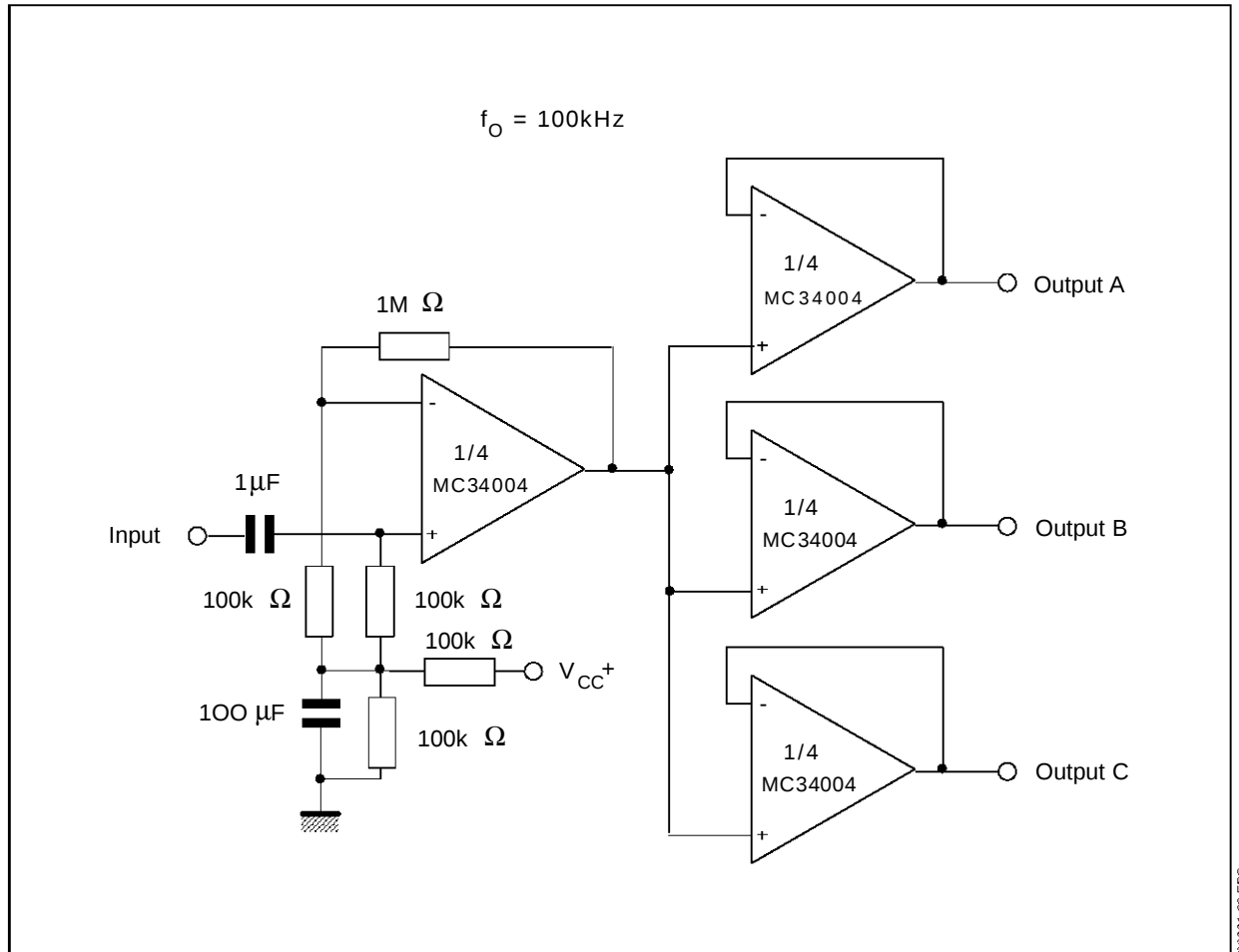


Figure 2 : Gain-of-10 Inverting Amplifier



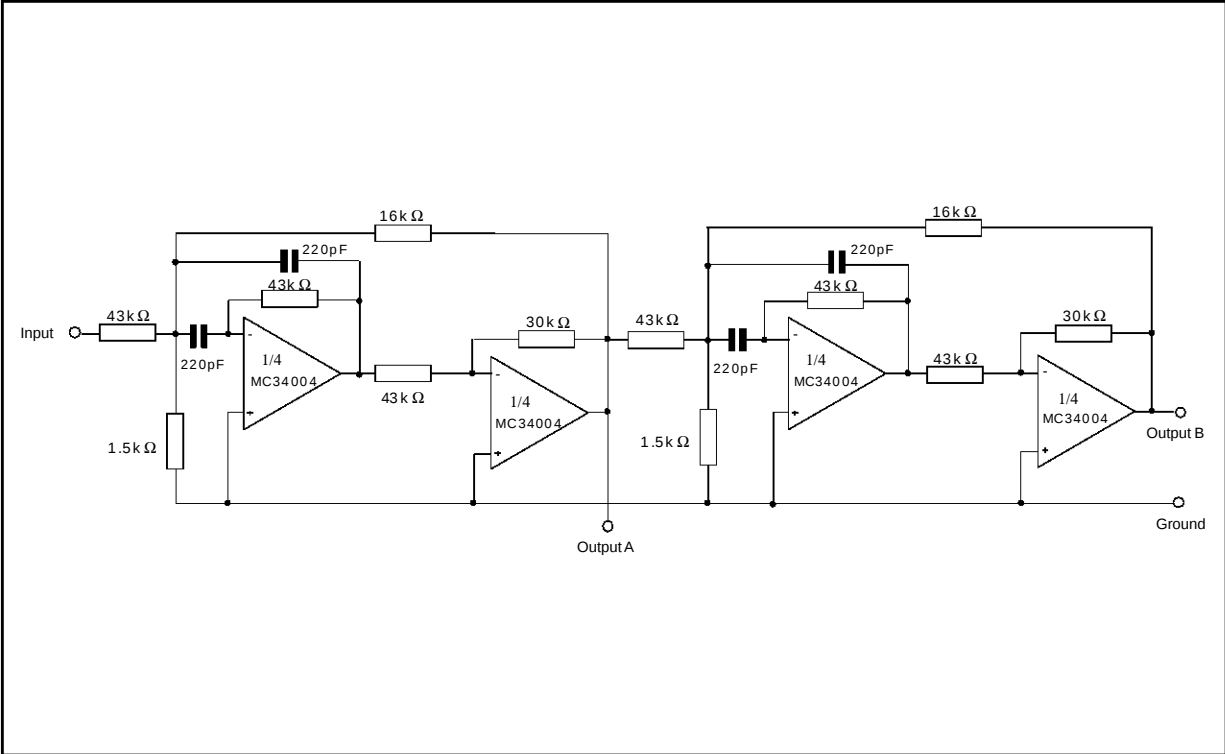
TYPICAL APPLICATIONS

AUDIO DISTRIBUTION AMPLIFIER



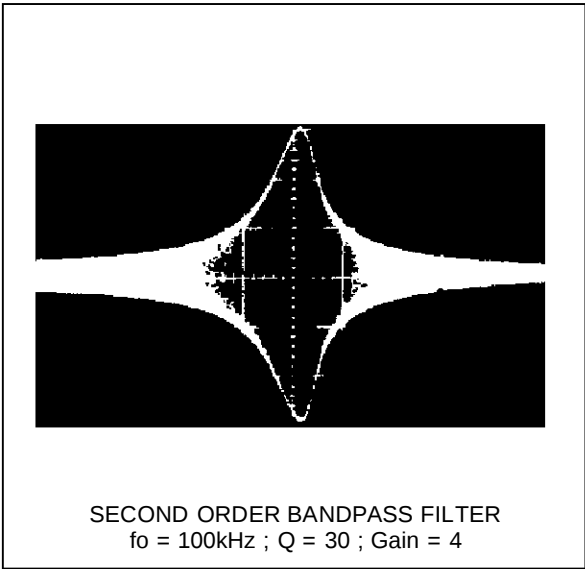
TYPICAL APPLICATIONS (continued)

POSITIVE FEEDBACK BANDPASS FILTER



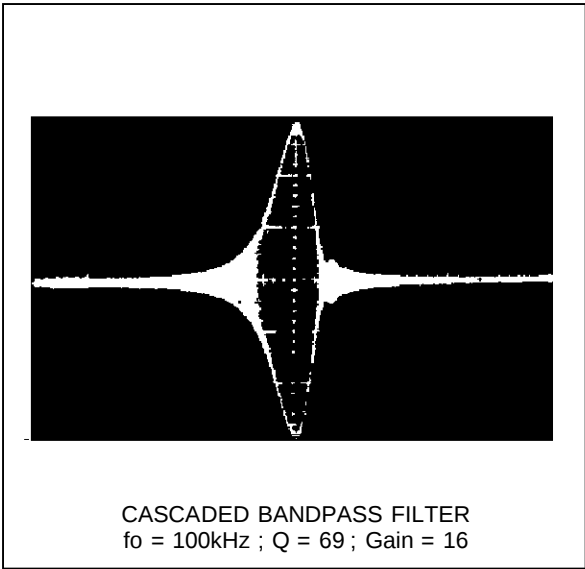
33004-23 #FS

OUTPUT A



33004-24 #FG

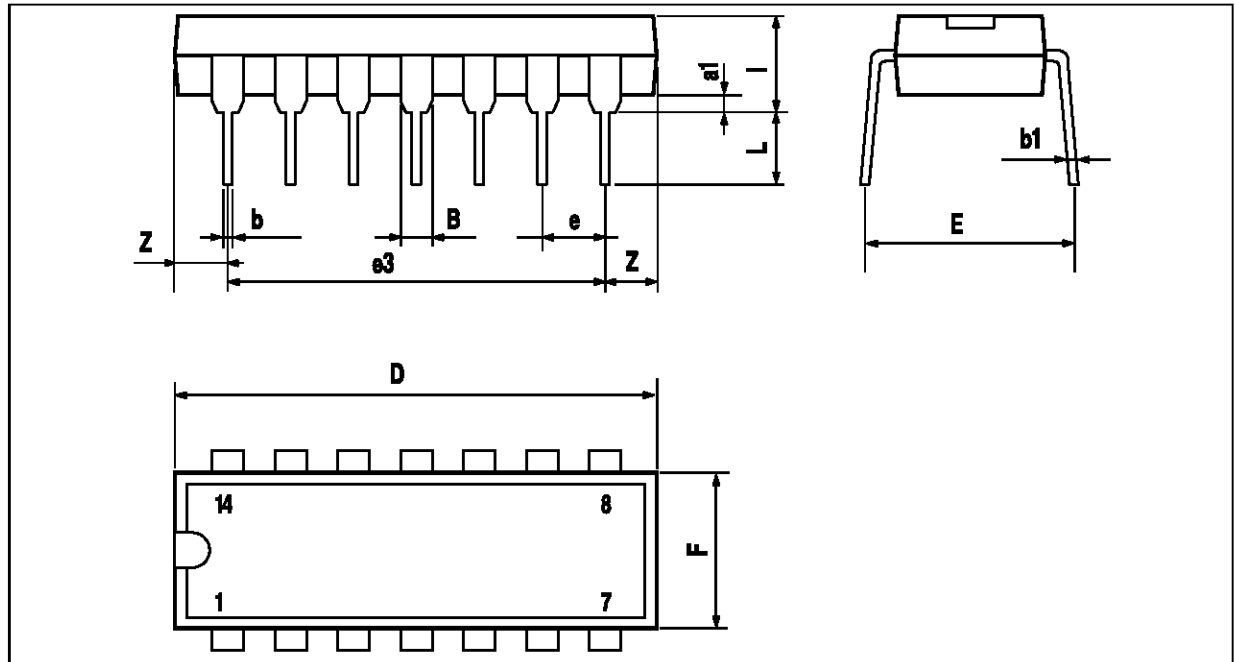
OUTPUT B



33004-25 #FG

PACKAGE MECHANICAL DATA

14 PINS - PLASTIC DIP



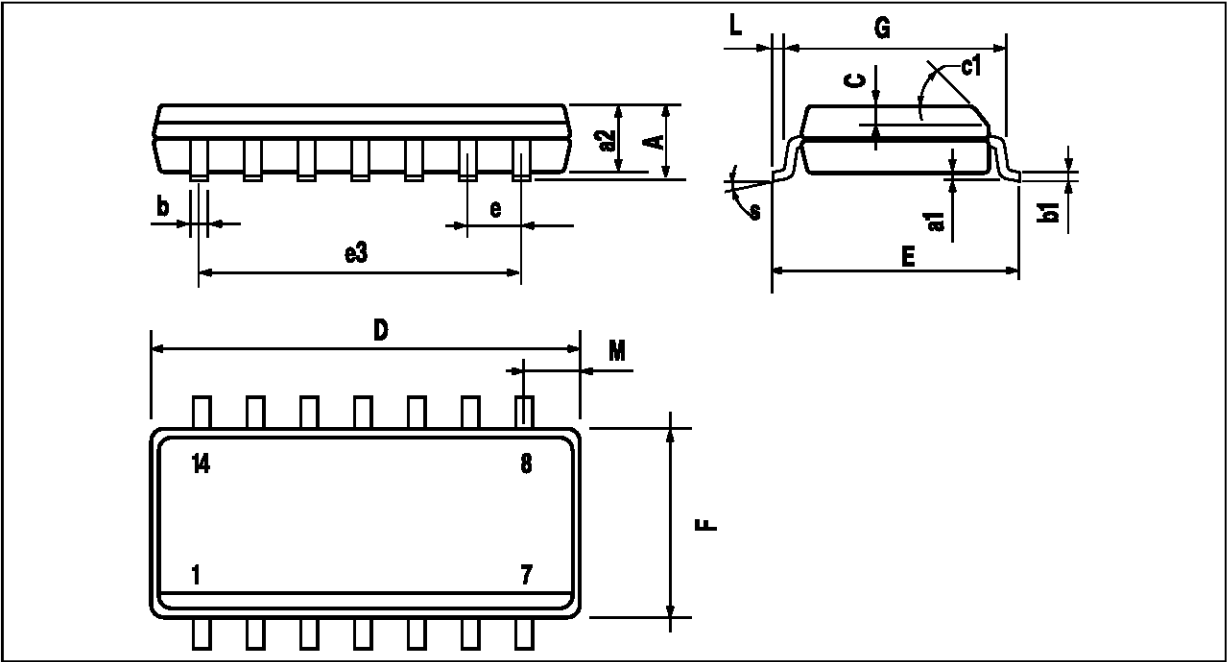
PM-DIP14.EPS

Dimensions	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

DIP14.TEL

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

PACKAGE MECHANICAL DATA
14 PINS - PLASTIC MICROPACKAGE (SO)



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.)					

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