

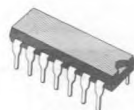
J-FET INPUT QUAD OP-AMPS

- LOW POWER CONSUMPTION
- WIDE COMMON-MODE 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 : 13 V/ μ 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.

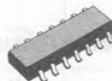
The devices feature high slew rates, low input bias and offset current, and low offset voltage temperature coefficient.



N SUFFIX
DIP14
(Plastic package)



J SUFFIX
CERDIP14
(Cerdip package)



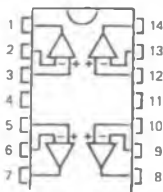
D SUFFIX
SO14
(Plastic micropackage)



GC SUFFIX
LCC20
(Tricop LCC)

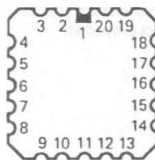
PIN CONNECTIONS (Top views)

**DIP14
CERDIP14
SO14**



- | | |
|---------------------------|----------------------------|
| 1 - Output 1 | 8 - Output 3 |
| 2 - Inverting input 1 | 9 - Inverting input 3 |
| 3 - Non-inverting input 1 | 10 - Non-inverting input 3 |
| 4 - V_{CC} | 11 - V_{CC} |
| 5 - Non-inverting input 2 | 12 - Non-inverting input 4 |
| 6 - Inverting input 2 | 13 - Inverting input 4 |
| 7 - Output 2 | 14 - Output 4 |

LCC20



- | | |
|---------------------------|----------------------------|
| 1 - NC | 11 - NC |
| 2 - Output 1 | 12 - Output 3 |
| 3 - Inverting input 1 | 13 - Inverting input 3 |
| 4 - Non-inverting input 1 | 14 - Non-inverting input 3 |
| 5 - NC | 15 - NC |
| 6 - V_{CC} | 16 - V_{CC} |
| 7 - NC | 17 - NC |
| 8 - Non-inverting input 2 | 18 - Non-inverting input 4 |
| 9 - Inverting input 2 | 19 - Inverting input 4 |
| 10 - Output 2 | 20 - Output 4 |

ORDER CODES

Part Number	Temperature	Package
MC35004GC	- 55 °C to + 125 °C	LCC
MC35004AGC	- 55 °C to + 125 °C	LCC
MC35004BGC	- 55 °C to + 125 °C	LCC
MC35004J	- 55 °C to + 125 °C	CERDIP
MC35004AJ	- 55 °C to + 125 °C	CERDIP
MC35004BJ	- 55 °C to + 125 °C	CERDIP
MC33004N	- 40 °C to + 105 °C	DIP 14
MC33004AN	- 40 °C to + 105 °C	DIP 14
MC33004BN	- 40 °C to + 105 °C	DIP 14
MC33004D	- 40 °C to + 105 °C	SO 14
MC33004AD	- 40 °C to + 105 °C	SO 14
MC33004BD	- 40 °C to + 105 °C	SO 14
MC34004N	0 °C to + 70 °C	DIP 14
MC34004AN	0 °C to + 70 °C	DIP 14
MC34004BN	0 °C to + 70 °C	DIP 14
MC34004D	0 °C to + 70 °C	SO 14
MC34004AD	0 °C to + 70 °C	SO 14
MC34004BD	0 °C to + 70 °C	SO 14

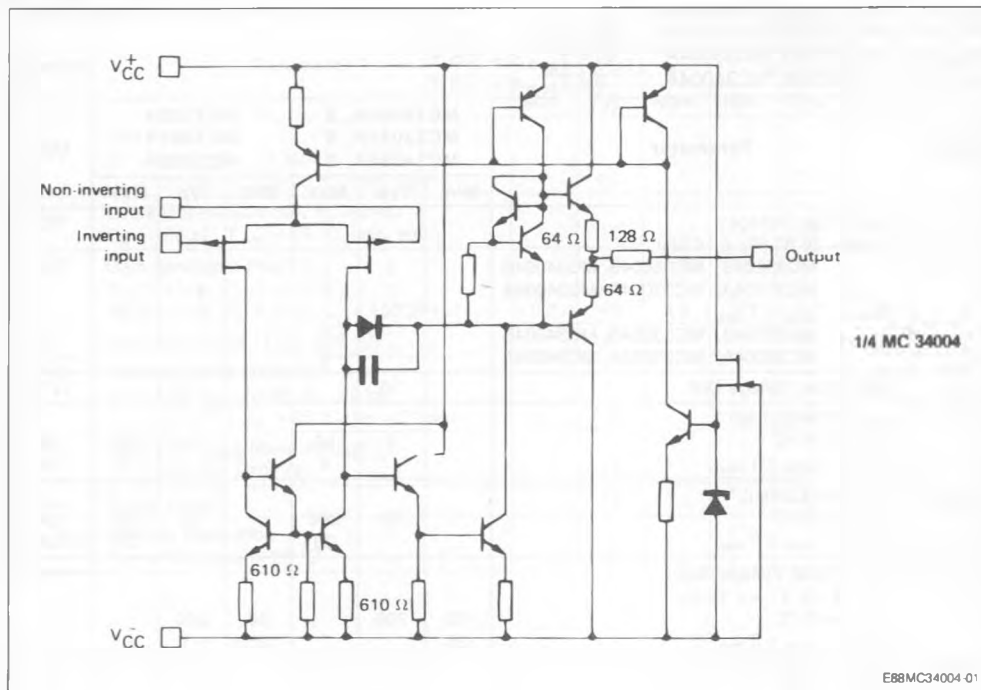
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage (note 1)	± 18	V
V_I	Input Voltage (note 3)	± 15	V
V_{CC}	Diff. 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_{sig}	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} .

- Differential voltages are at the non-inverting input terminal with respect to the inverting input terminal
- The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, 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.

SCHEMATIC (each amplifier)



Case	Outputs	Inverting Inputs	Non-inverting Inputs	V _{CC} ⁺	V _{CC} ⁻	N.C.
DIP14 CERDIP14 SO14	1, 7, 14, 8	2, 6, 13, 9	3, 5, 12, 10	4	11	
LCC20	2, 10, 12, 20	3, 9, 13, 19		4, 8, 14, 18	6	16

* LCC20 : Other pins are not connected.

ELECTRICAL CHARACTERISTICS

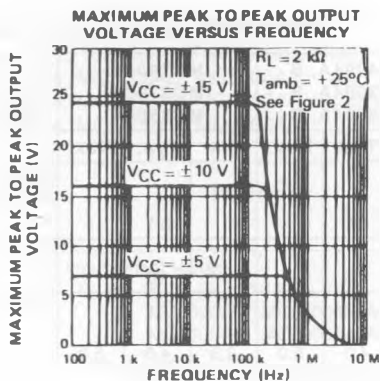
 $V_{CC} = \pm 15$ V (unless otherwise specified)MC35004, MC35004B, MC35004A $-55 \leq T_{amb} \leq +125$ °CMC33004, MC33004B, MC33004A $-40 \leq T_{amb} \leq +105$ °CMC34004, MC34004B, MC34004A $0 \leq T_{amb} \leq +70$ °C

Symbol	Parameter	MC35004A, B MC33004A, B MC34004A, B			MC35004 MC33004 MC34004			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage $T_{amb} = 25$ °C ($R_s \leq 10$ k Ω) MC35004B, MC33004B, MC34004B MC35004A, MC33004A, MC34004A $T_{min} \leq T_{amb} \leq T_{max}$ MC35004B, MC33004B, MC34004B MC35004A, MC33004A, MC34004A		3 1	5 2		3 8	13	mV
DV_{IO}	Input Offset Voltage Drift		10			10		μ V/°C
I_{IO}	Input Offset Current * $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$		5	50 4		5 50 4		pA nA
I_{IB}	Input Bias Current * $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$		30	200 20		30 200 20		pA nA
A_{VD}	Large Signal Voltage Gain ($R_L > 2$ k Ω , $V_o = \pm 10$ V) $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$	50 25	200		50 25	200		V/mV
SVR	Supply Voltage Rejection Ratio ($R_s < 10$ k Ω) $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$	80 80	86		80 80	86		dB
I_{CC}	Supply Current, per Amp, no Load $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$		1.4	2.5 2.5		1.4 2.5 2.5		mA
V_i	Input Voltage Range $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$	- 11		+ 11	- 11		+ 11	V
CMR	Common Mode Rejection Ratio ($R_s < 10$ k Ω) $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$	80 80	86		70 70	86		dB
I_{OS}	Output Short-circuit Current $T_{amb} = 25$ °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 $T_{amb} = 25$ °C $T_{min} \leq T_{amb} \leq T_{max}$ $R_L \geq 2$ k Ω $R_L \geq 10$ k Ω $R_L \geq 2$ k Ω $R_L \geq 10$ k Ω	11 12 11 12	12 13.5		11 12 11 12	12 13.5		V
S_{VO}	Slew-rate ($V_i = 10$ V, $R_L = 2$ k Ω) $C_L \leq 100$ pF, $T_{amb} = 25$ °C, unity gain	12	16		12	16		V/ μ s

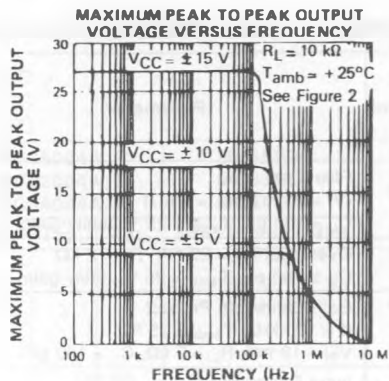
* The input bias currents are junction leakage currents which are approximately double for every 10 °C increase in the junction temperature.

ELECTRICAL CHARACTERISTICS (continued)

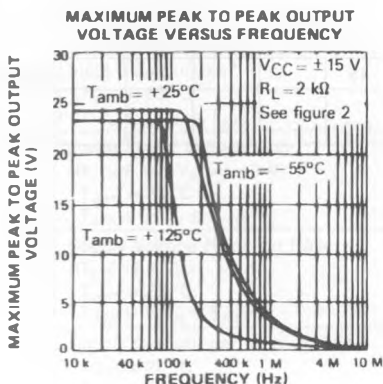
Symbol	Parameter	MC34004A, B MC33004A, B MC35004A, B			MC34004 MC33004 MC35004			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
t_r	Rise Time ($V_I = 20$ mV, $R_L = 2$ k Ω) $C_L = 100$ pF, $T_{amb} = 25$ °C, unity Gain		0.1			0.1		μ s
K_{OV}	Overshoot ($V_I = 20$ mV, $R_L = 2$ k Ω) $C_L \leq 100$ pF, $T_{amb} = 25$ °C, unity gain)		10			10		%
GBP	Gain Bandwidth Product ($f = 100$ kHz, $T_{amb} = 25$ °C $V_{IN} = 10$ mV, $R_L = 2$ k Ω , $C_L = 100$ pF)	3.3	4.0	5.0	3.3	4.0	5.0	MHz
R_I	Input Resistance ($T_{amb} = 25$ °C)		10^{12}			10^{12}		Ω
THD	Total Harmonic Distortion ($f = 1$ kHz, $A_V = 20$ dB, $R_L = 2$ k Ω) $C_L \leq 100$ pF, $T_{amb} = 25$ °C, $V_O = 2$ V _{PP})		0.01			0.01		%
V_n	Equivalent Input Noise Voltage ($f = 1$ kHz, $R_g = 100$ Ω)		15			15		nV/ $\sqrt{Hz}$
ϕ_m	Phase Margin		45			45		Degrees
V_{O1}/V_{O2}	Channel Separation $A_{VD} = 100$, $T_{amb} = 25$ °C		120					120



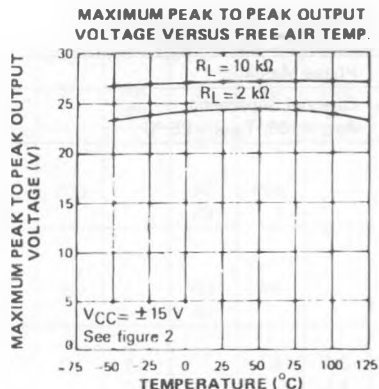
E88MC34004-02



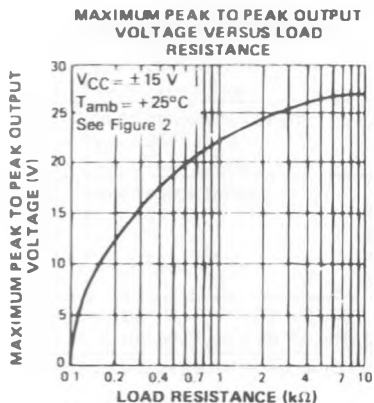
E88MC34004-03



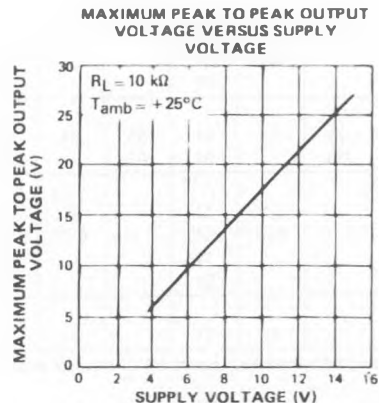
E88MC34004-04



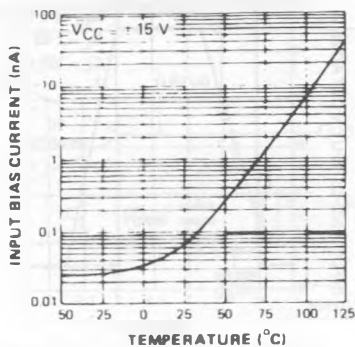
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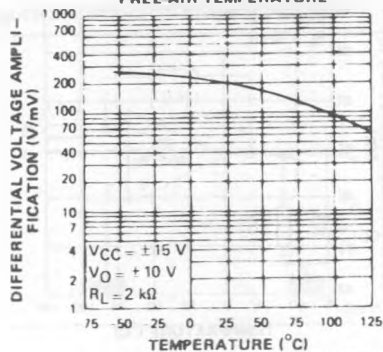
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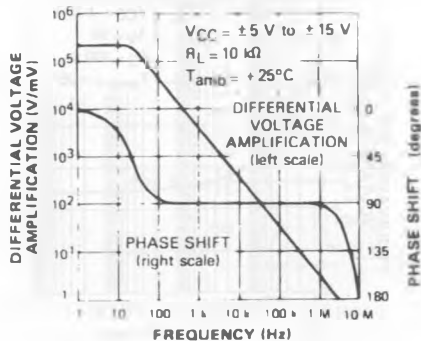
E88MC34004-07

INPUT BIAS CURRENT VERSUS
FREE AIR TEMPERATURE

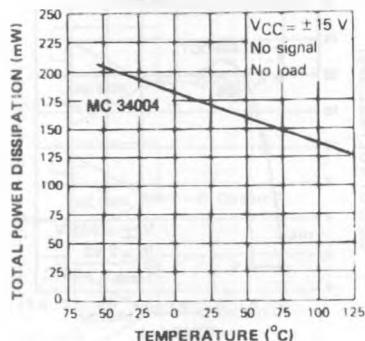
E88MC34004-08

LARGE SIGNAL DIFFERENTIAL
VOLTAGE AMPLIFICATION VERSUS
FREE AIR TEMPERATURE

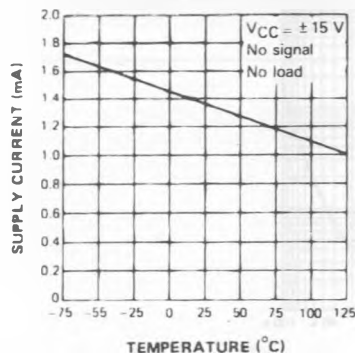
E88MC34004-09

LARGE SIGNAL DIFFERENTIAL
VOLTAGE AMPLIFICATION AND
PHASE SHIFT VERSUS FREQUENCY

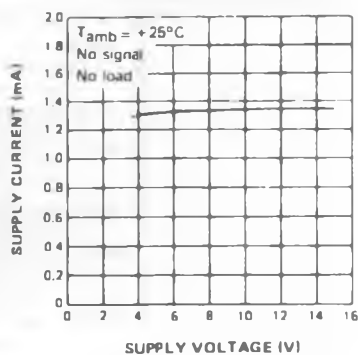
E88MC34004-10

TOTAL POWER DISSIPATION VERSUS
FREE AIR TEMPERATURE

E88MC34004-11

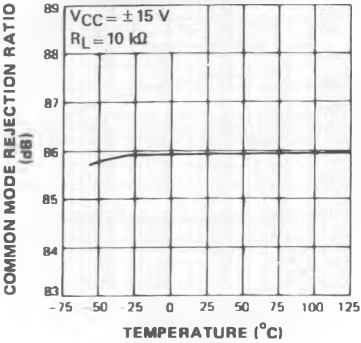
SUPPLY CURRENT PER AMPLIFIER
VERSUS FREE AIR TEMPERATURE

E88MC34004-12

SUPPLY CURRENT PER AMPLIFIER
VERSUS SUPPLY VOLTAGE

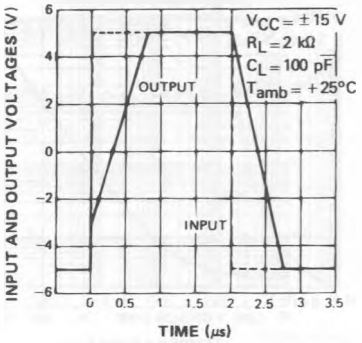
E88MC34004-13

COMMON MODE REJECTION RATIO
VERSUS FREE-AIR TEMPERATURE



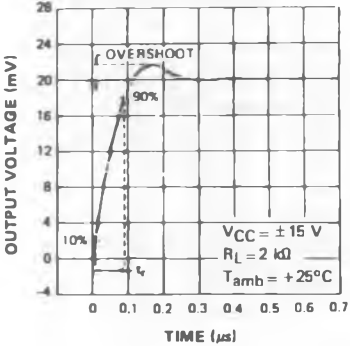
E88MC34004-14

VOLTAGE FOLLOWER LARGE
SIGNAL PULSE RESPONSE



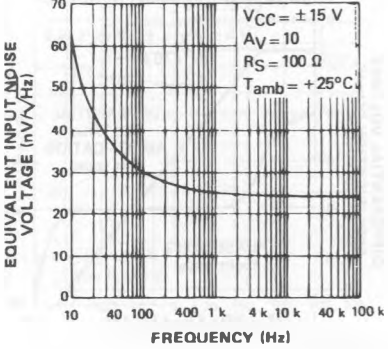
E88MC34004-15

OUTPUT VOLTAGE VERSUS TIME



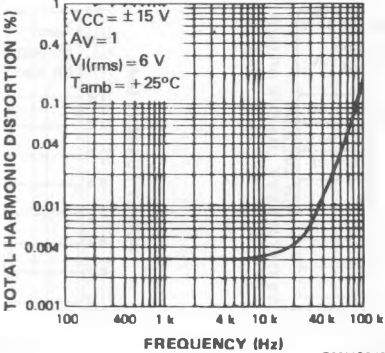
E88MC34004-16

EQUIVALENT INPUT NOISE VOL-
TAGE VERSUS FREQUENCY



E88MC34004-17

TOTAL HARMONIC DISTORTION
VERSUS FREQUENCY



E88MC34004-18

PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower.

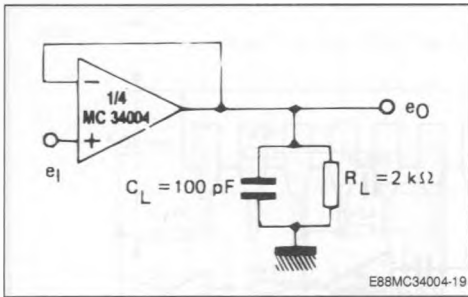
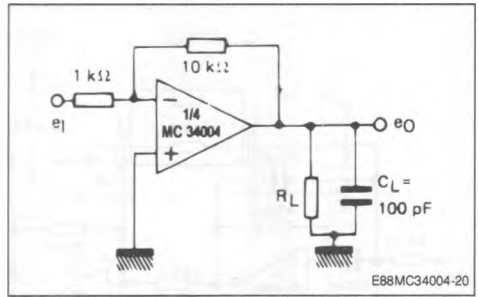
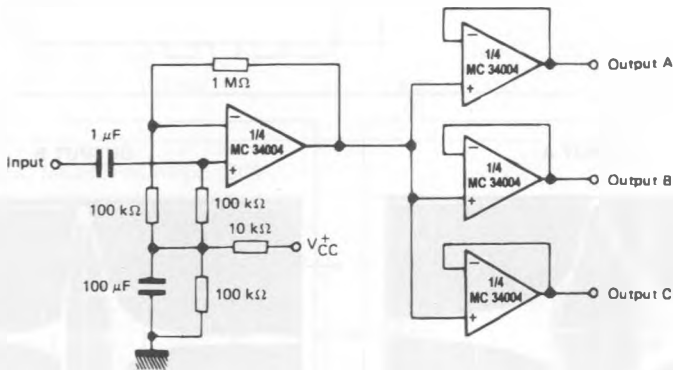


Figure 2 : Gain-of-10 Inverting Amplifier.



AUDIO DISTRIBUTION AMPLIFIER

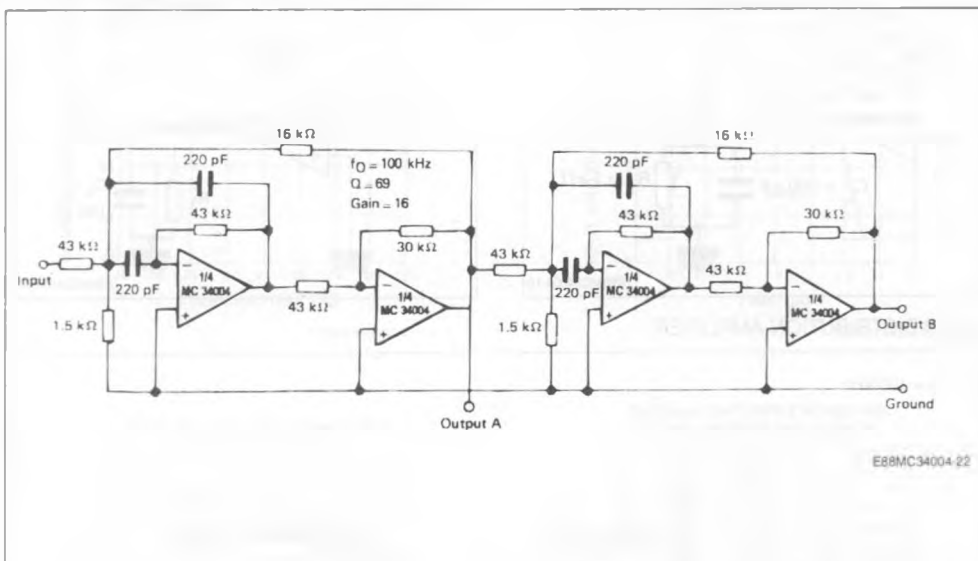
$f_0 = 100\text{ kHz}$



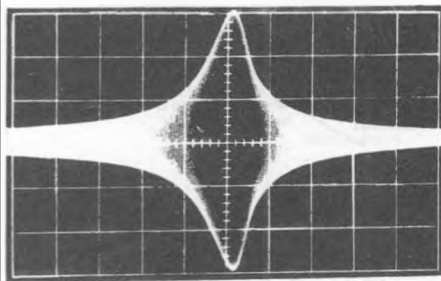
E88MC34004-21

TYPICAL APPLICATION

POSITIVE FEEDBACK BANDPASS FILTER



OUTPUT A



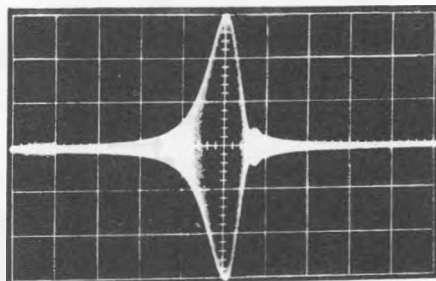
E88MC34004-23

2 kHz /div

SECOND ORDER BANDPASS FILTER

 $f_0 = 100$ kHz, $Q = 30$; Gain = 4

OUTPUT B



E88MC34004-24

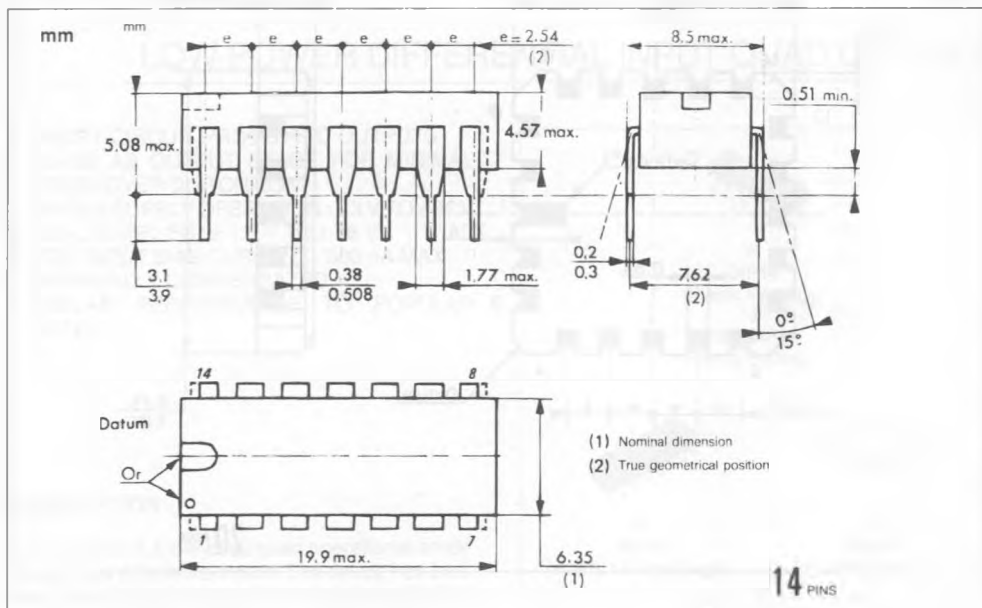
2 kHz /div

CASCADED BANDPASS FILTER

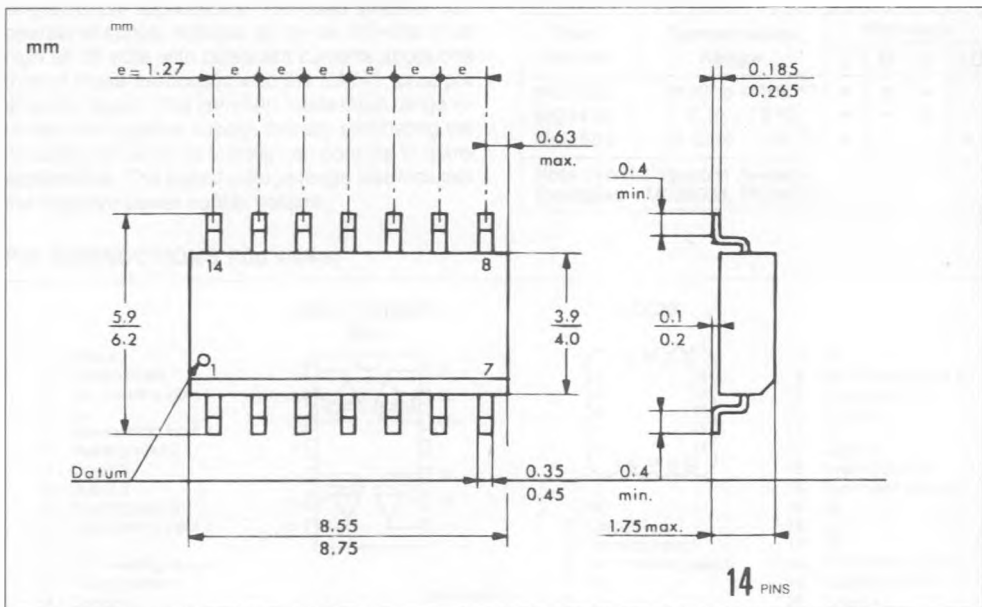
 $f_0 = 100$ kHz, $Q = 69$; Gain = 16

PACKAGE MECHANICAL DATA

14 PINS - PLASTIC DIP OR CerdIP



14 PINS - PLASTIC MICROPACKAGE (SO)



20 PINS – TRICECOP (LCC)

