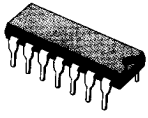
J–FET INPUT QUAD OP–AMPs

- 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/µs (typ)



N
DIP14
(Plastic package)

D
SO14
(Plastic micropackage)

J SUFFIX
(Cerdip package)

GC
LCC20
(Tricecop LCC)

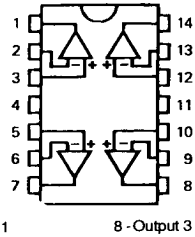
DESCRIPTION

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 currents, and low offset voltage temperature coefficient.

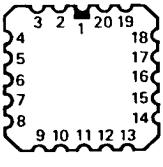
PIN CONNECTIONS (Top views)

DIP14/CERDIP14
SO14



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

LCC20



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

ORDER CODES

Part Number	Temperature	Package
LF147GC	– 55 °C to + 125 °C	LCC
LF147AGC	– 55 °C to + 125 °C	LCC
LF147BGC	– 55 °C to + 125 °C	LCC
LF147J	– 55 °C to + 125 °C	CERDIP
LF147AJ	– 55 °C to + 125 °C	CERDIP
LF147BJ	– 55 °C to + 125 °C	CERDIP
LF247N	– 40 °C to + 105 °C	DIP14
LF247AN	– 40 °C to + 105 °C	DIP14
LF247BN	– 40 °C to + 105 °C	DIP14
LF247D	– 40 °C to + 105 °C	SO14
LF247AD	– 40 °C to + 105 °C	SO14
LF247BD	– 40 °C to + 105 °C	SO14
LF347N	0 °C to + 70 °C	DIP14
LF347AN	0 °C to + 70 °C	DIP14
LF347BN	0 °C to + 70 °C	DIP14
LF347D	0 °C to + 70 °C	SO14
LF347AD	0 °C to + 70 °C	SO14
LF347BD	0 °C to + 70 °C	SO14

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 LF347, A, B LF247, A, B LF147, A, B	 0 to 70 – 40 to 105 – 55 to 125	°C
T_{stg}	Storage Temperature Range	– 65 to 150	°C

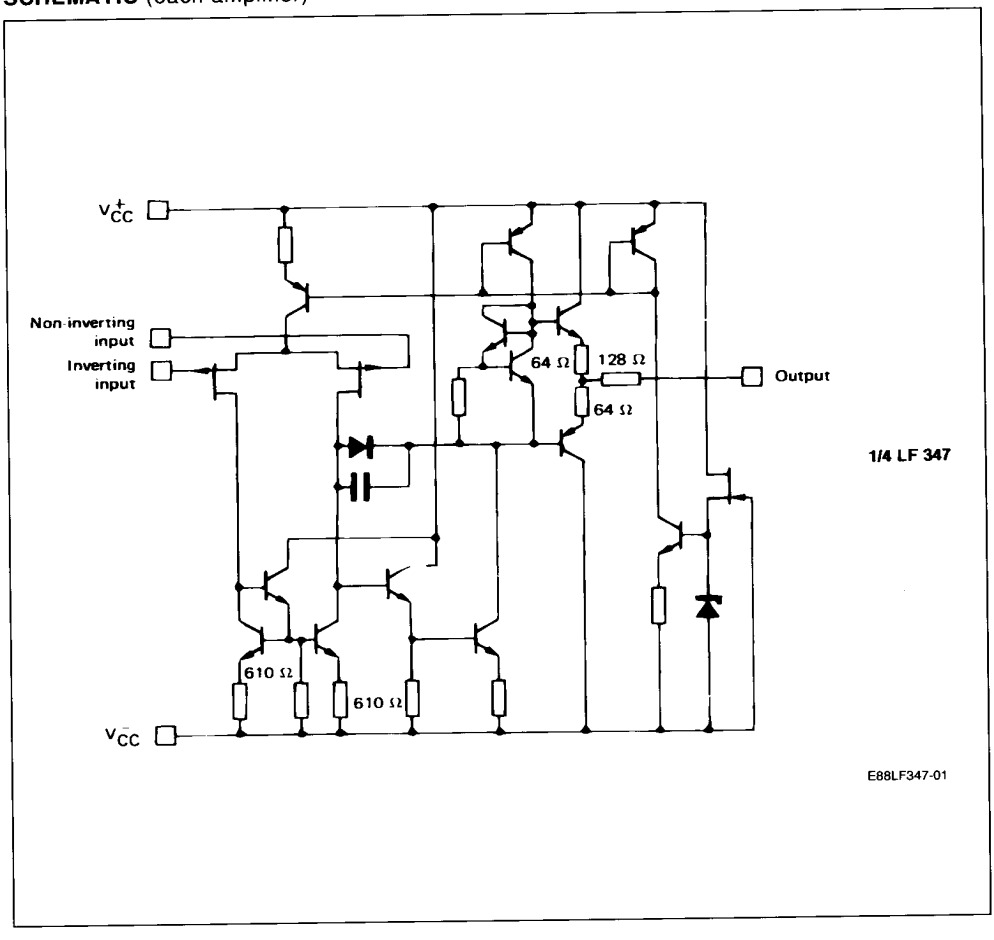
Notes : 1. All voltage values, except differential voltage, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between V_{CC}^{+} and V_{CC}^{-}.

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.

SCHEMATIC (each amplifier)



Case	Outputs	Inverting Inputs	Non-inverting Inputs	V_{CC}^{+}	V_{CC}^{-}	N.C.
DIP14 SO14 CERDIP14	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} = ± 15 V (unless otherwise specified)
LF147, LF147B, LF147A $-55 \leq T_{amb} \leq +125$ °C
LF247, LF247B, LF247A $-40 \leq T_{amb} \leq +105$ °C
LF247, LF247B, LF247A $0 \leq T_{amb} \leq +70$ °C

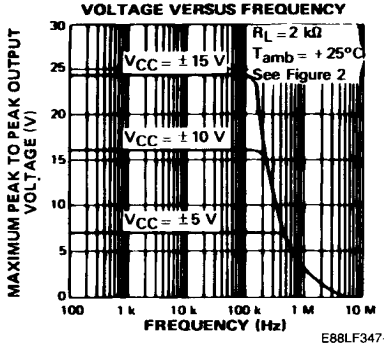
Symbol	Parameter	LF147A, B LF247A, B LF347A, B			LF147 LF247 LF347			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage							mV
	T_{amb} = 25 °C (R_S < 10 kΩ)					3	8	
	LF147B, LF247B, LF347B		3	5				
	LF147A, LF247A, LF347A		1	2				
	$T_{min} \leq T_{amb} \leq T_{max}$						13	
	LF147B, LF247B, LF347B			9				
	LF147A, LF247A, LF347A			5				
DV_{io}	Input Offset Voltage Drift		10			10		µV/°C
I_{io}	Input Offset Current *							
	T_{amb} = 25 °C		5	50		5	50	pA
	$T_{min} \leq T_{amb} \leq T_{max}$			4			4	nA
I_{ib}	Input Bias Current *							
	T_{amb} = 25 °C		30	200		30	200	pA
	$T_{min} \leq T_{amb} \leq T_{max}$			20			20	nA
A_{vd}	Large Signal Voltage Gain (R_L > 2 kΩ, V_o = ± 10 V)							V/mV
	T_{amb} = 25 °C	50	200		50	200		
	$T_{min} \leq T_{amb} \leq T_{max}$	25			25			
SVR	Supply Voltage Rejection Ratio (R_s < 10 kΩ)							dB
	T_{amb} = 25 °C	80	86		80	86		
	$T_{min} \leq T_{amb} \leq T_{max}$	80			80			
I_{cc}	Supply Current, per Amp, no Load							mA
	T_{amb} = 25 °C		1.4	2.5		1.4	2.5	
	$T_{min} \leq T_{amb} \leq T_{max}$			2.5			2.5	
V_i	Input Voltage Range							V
	T_{amb} = 25 °C	−11		+11	−11		+11	
	$T_{min} \leq T_{amb} \leq T_{max}$							
CMR	Common Mode Rejection Ratio (R_s < 10 kΩ)							dB
	T_{amb} = 25 °C	80	86		70	86		
	$T_{min} \leq T_{amb} \leq T_{max}$	80			70			
I_{os}	Output Short-circuit Current							mA
	T_{amb} = 25 °C	10	40	60	10	40	60	
	$T_{min} \leq T_{amb} \leq T_{max}$	10		60	10		60	
± V_{opp}	Output Voltage Swing							V
	T_{amb} = 25 °C $R_L \geq$ 2 kΩ	11	12		11	12		
	$R_L \geq$ 10 kΩ	12	13.5		12	13.5		
	$T_{min} \leq T_{amb} \leq T_{max}$ $R_L \geq$ 2 kΩ	11			11			
	$R_L \geq$ 10 kΩ	12			12			
S_{vo}	Slew-rate (V_i = 10 V, R_L = 2 kΩ) $C_L \leq$ 100 pF, T_{amb} = 25 °C, unity gain	12	16		12	16		V/µs

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

ELECTRICAL CHARACTERISTICS (continued)

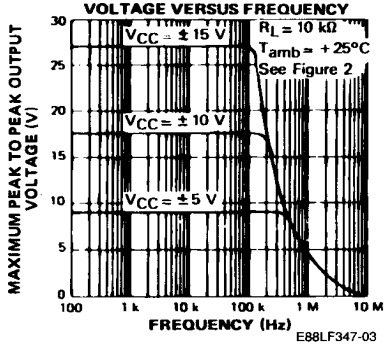
Symbol	Parameter	LF147A, B LF247A, B LF347A, B			LF147 LF247 LF347			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
t_r	Rise Time (V_i = 20 mV, R_L = 2 kΩ) C_L = 100 pF, T_{amb} = 25 °C, unity gain		0.1			0.1		µs
K_{ov}	Overshoot (V_i = 20 mV, R_L = 2 kΩ C_L ≤ 100 pF, T_{amb} = 25 °C, unity gain)		10			10		%
GBP	Gain Bandwidth Product (f = 100 kHz, T_{amb} = 25 °C V_{in} = 10 mV, R_L = 2 kΩ, 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 kΩ C_L ≤ 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/√Hz
Øm	Phase Margin		45			45		Degrees
V_{o1}/V_{o2}	Channel Separation A_{vd} = 100, T_{amb} = 25 °C		120			120		dB

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



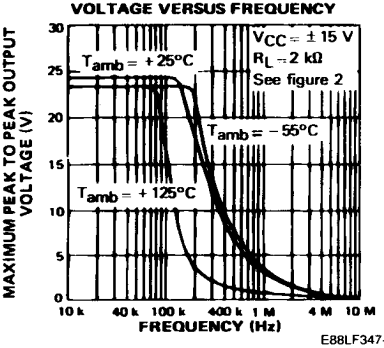
E88LF347-02

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



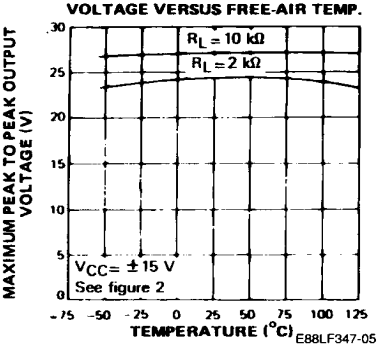
E88LF347-03

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



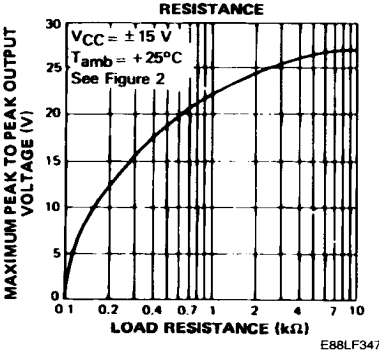
E88LF347-04

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



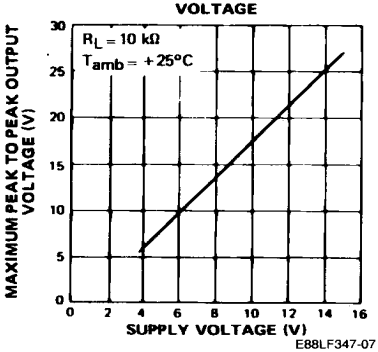
E88LF347-05

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE VERSUS LOAD RESISTANCE



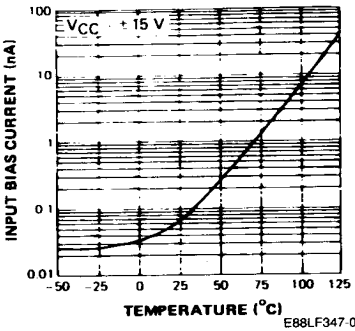
E88LF347-06

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE VERSUS SUPPLY VOLTAGE



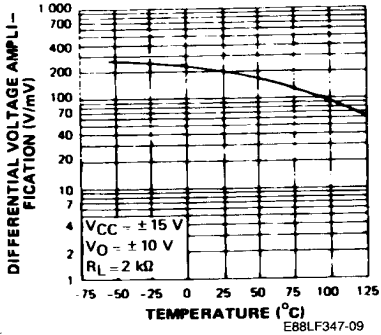
E88LF347-07

INPUT BIAS CURRENT VERSUS FREE-AIR TEMPERATURE



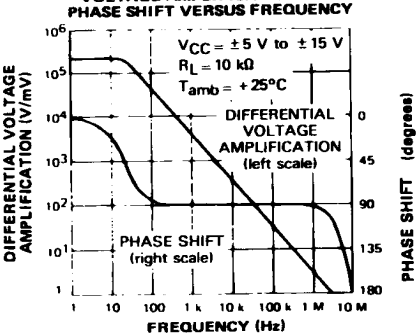
E88LF347-08

LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION VERSUS FREE-AIR TEMPERATURE



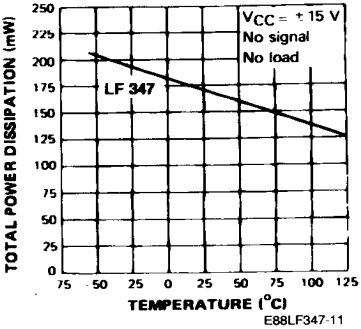
E88LF347-09

LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VERSUS FREQUENCY



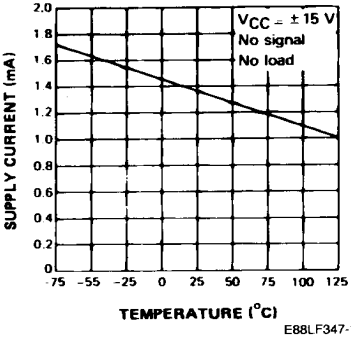
E88LF347-10

TOTAL POWER DISSIPATION VERSUS FREE-AIR TEMPERATURE



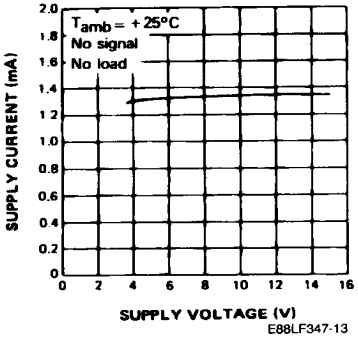
E88LF347-11

SUPPLY CURRENT PER AMPLIFIER VERSUS FREE-AIR TEMPERATURE



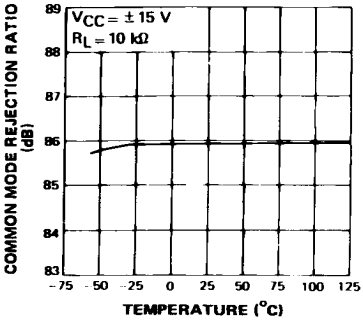
E88LF347-12

SUPPLY CURRENT PER AMPLIFIER VERSUS SUPPLY VOLTAGE



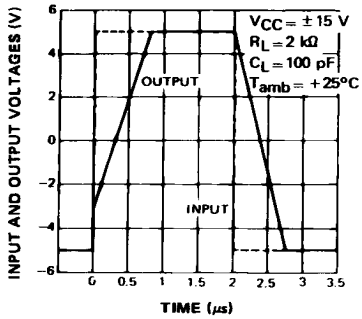
E88LF347-13

COMMON MODE REJECTION RATIO VERSUS FREE-AIR TEMPERATURE



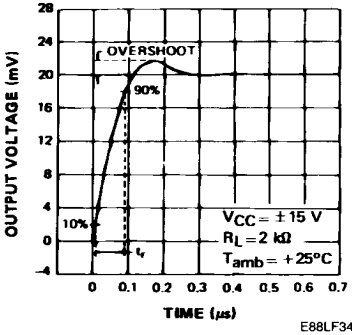
E88LF347-14

VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE



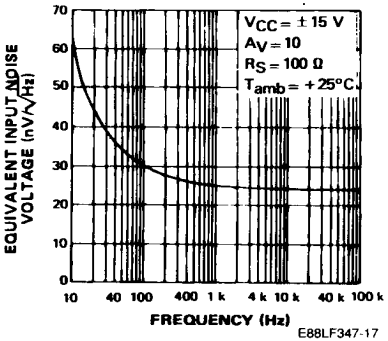
E88LF347-15

OUTPUT VOLTAGE VERSUS TIME



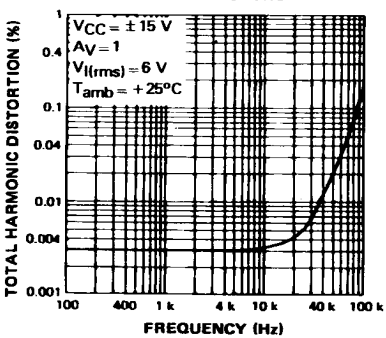
E88LF347-16

EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY



E88LF347-17

TOTAL HARMONIC DISTORTION VERSUS FREQUENCY



E88LF347-18

PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower.

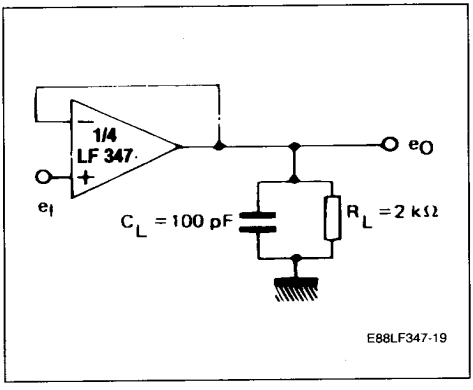
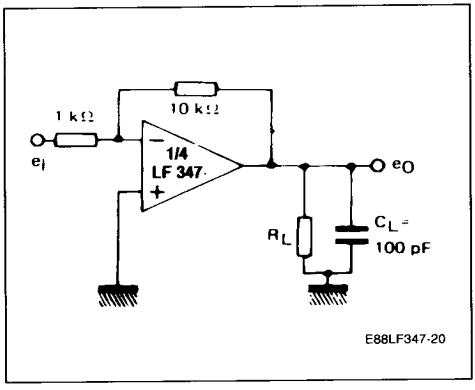
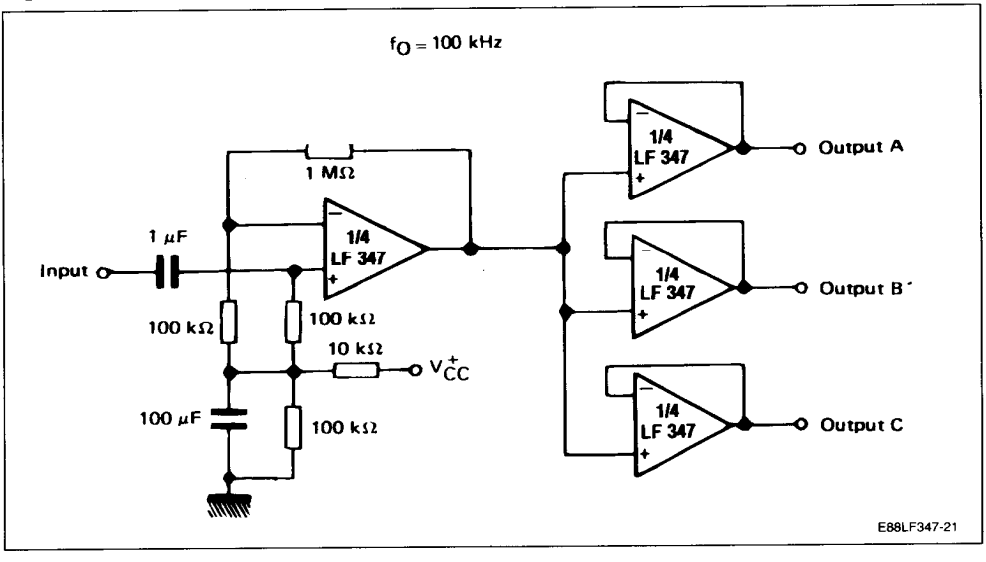


Figure 2 : Gain-of-10 Inverting Amplifier.



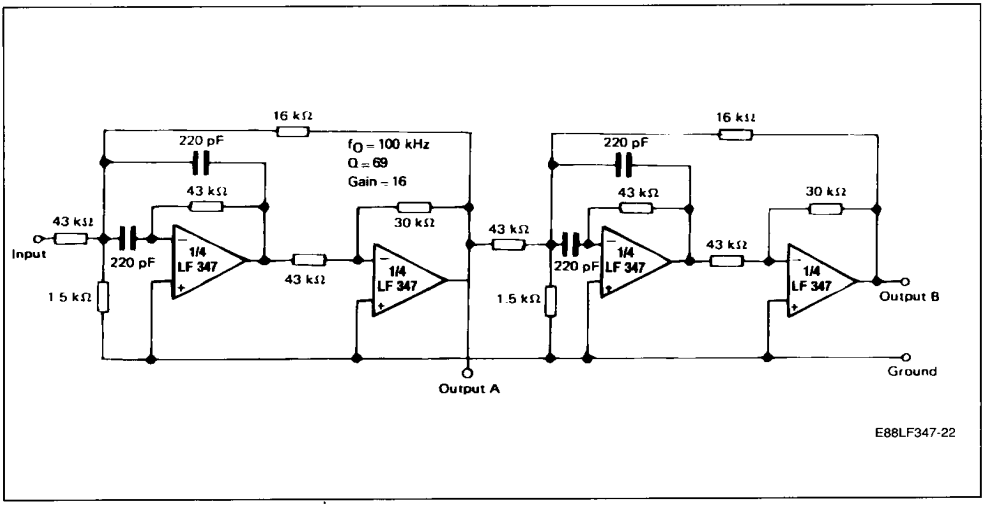
AUDIO DISTRIBUTION AMPLIFIER (f_o = 100 KHz)

Figure 3 : Voltage Follower.

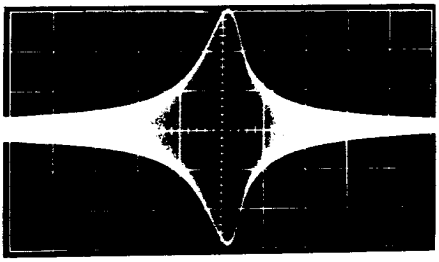


TYPICAL APPLICATION

POSITIVE FEEDBACK BANDPASS FILTER



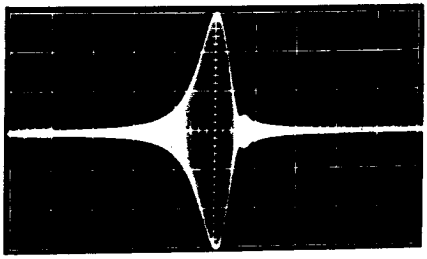
OUTPUT A



E88LF347-23

SECOND ORDER BANDPASS FILTER
f_o = 100 KHz ; Q = 30 ; Gain = 4

OUTPUT B

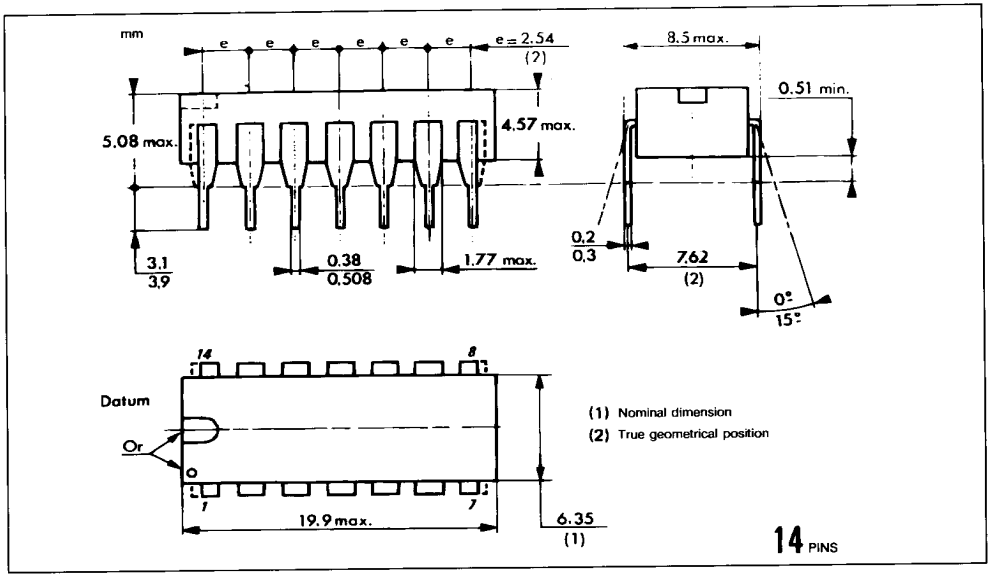


E88LF347-24

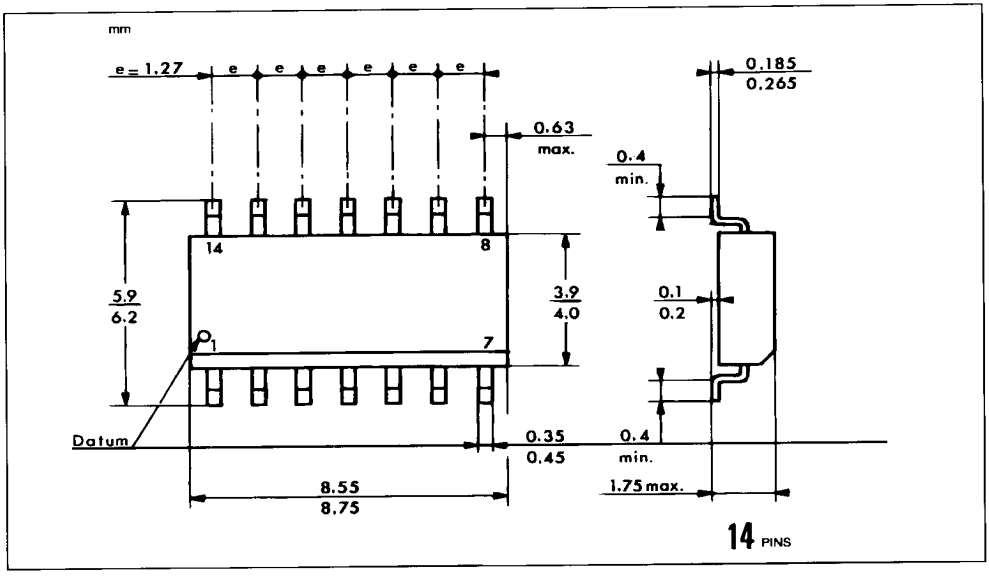
CASCADED BANDPASS FILTER
f_o = 100 KHz ; Q = 69 ; Gain = 16

PACKAGE MECHANICAL DATA

14 PINS – PLASTIC DIP OR CERDIP



14 PINS – PLASTIC MICROPACKAGE SO



20 PINS – TRICECOP (LCC)