



## WIDE BANDWIDTH 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 currents, and low offset voltage temperature coefficient.

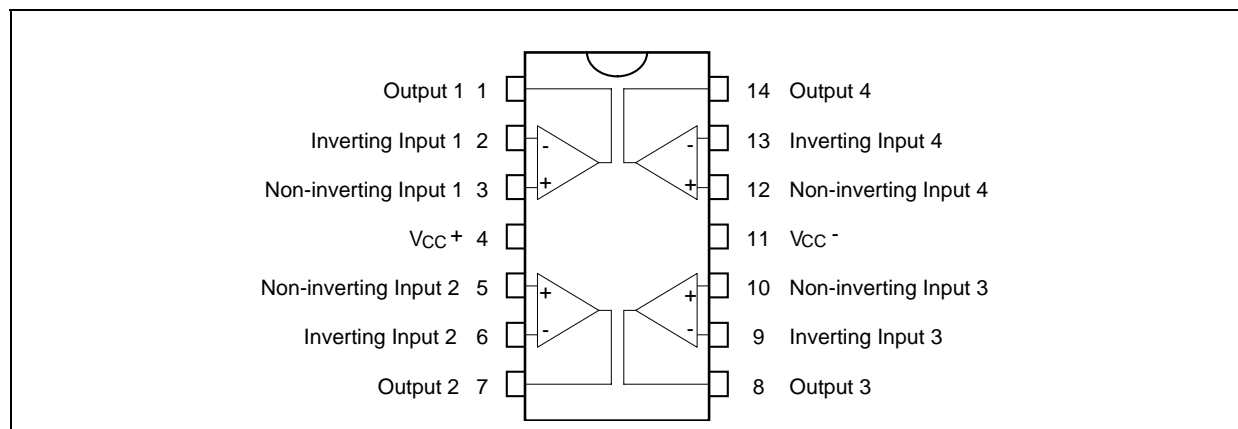
### ORDER CODE

Part Number	Temperature Range	Package	
		N	D
LF147	-55°C, +125°C	•	•
LF247	-40°C, +105°C	•	•
LF347	0°C, +70°C	•	•

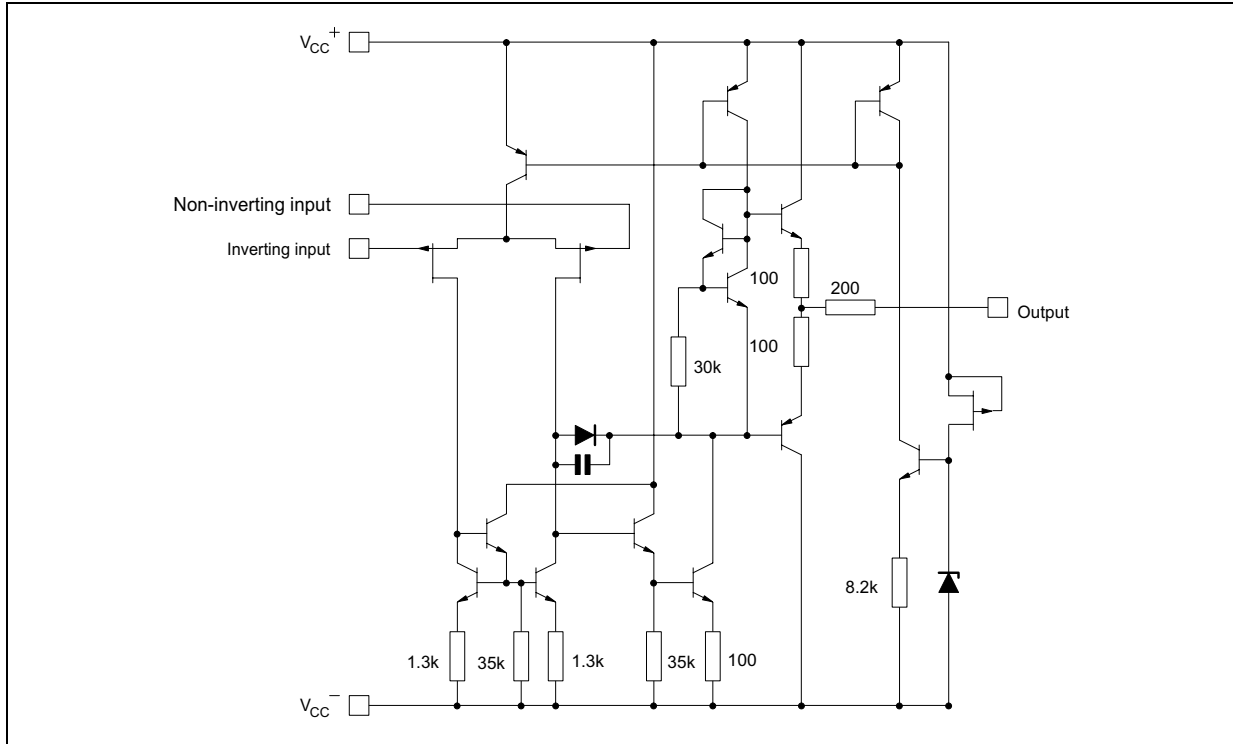
**Example : LF347IN**

**N** = Dual in Line Package (DIP)  
**D** = Small Outline Package (SO) - also available in Tape & Reel (DT)

### PIN CONNECTIONS (top view)



**SCHEMATIC DIAGRAM** (each amplifier)



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	LF147	LF247	LF347	Unit
$V_{CC}$	Supply voltage - note <sup>1)</sup>	±18			V
$V_i$	Input Voltage - note <sup>2)</sup>	±15			V
$V_{id}$	Differential Input Voltage - note <sup>3)</sup>	±30			V
$P_{tot}$	Power Dissipation	680			mW
	Output Short-circuit Duration - note <sup>4)</sup>	Infinite			
$T_{oper}$	Operating Free-air Temperature Range	-55 to +125	-40 to +105	0 to +70	°C
$T_{stg}$	Storage Temperature Range	-65 to +150			°C

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

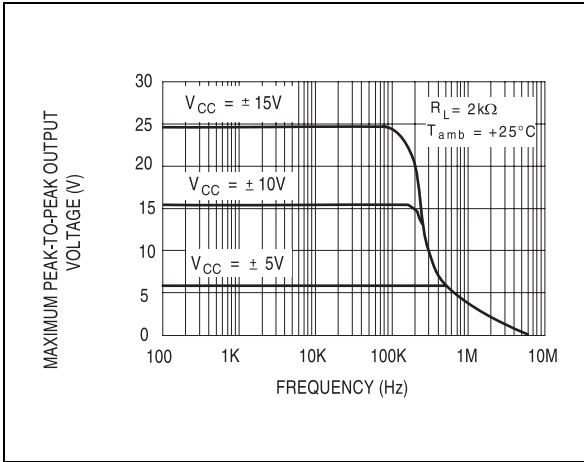
**ELECTRICAL CHARACTERISTICS**

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

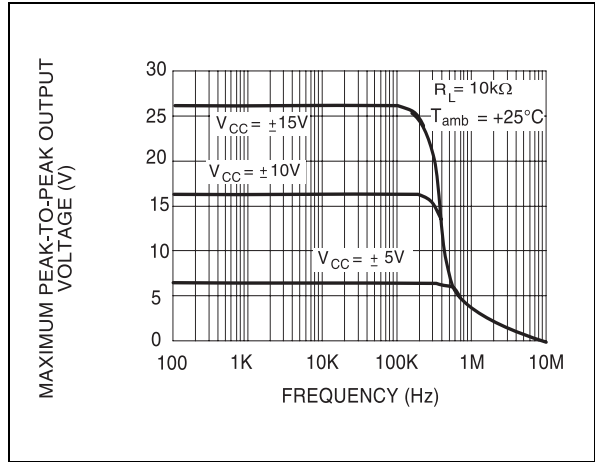
Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{io}$	Input Offset Voltage ( $R_S = 10k\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		3	10 13	mV
$DV_{io}$	Input Offset Voltage Drift		10		$\mu V/^{\circ}C$
$I_{io}$	Input Offset Current - note 1) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		5	100 4	pA nA
$I_{ib}$	Input Bias Current - note 1 $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		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		V/mV
SVR	Supply Voltage Rejection Ratio ( $R_S = 10k\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	80 80	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	2.7 2.7	mA
$V_{icm}$	Input Common Mode Voltage Range	$\pm 11$	+15 -12		V
CMR	Common Mode Rejection Ratio ( $R_S = 10k\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	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	mA
$\pm V_{opp}$	Output Voltage Swing $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	$R_L = 2k\Omega$ 10 $R_L = 10k\Omega$ 12 $R_L = 2k\Omega$ 10 $R_L = 10k\Omega$ 12	12 13.5		V
SR	Slew Rate $V_i = 10V$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $T_{amb} = 25^{\circ}C$ , unity gain	12	16		V/ $\mu s$
$t_r$	Rise Time $V_i = 20mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $T_{amb} = 25^{\circ}C$ , unity gain		0.1		$\mu s$
$K_{ov}$	Overshoot $V_i = 20mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $T_{amb} = 25^{\circ}C$ , unity gain		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		MHz
$R_i$	Input Resistance		$10^{12}$		$\Omega$
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		%
$e_n$	Equivalent Input Noise Voltage ( $R_S = 100\Omega$ , $f = 1kHz$ )		15		$\frac{nV}{\sqrt{Hz}}$
$\phi_m$	Phase Margin		45		Degrees
$V_{O1}/V_{O2}$	Channel Separation ( $A_v = 100$ )		120		dB

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

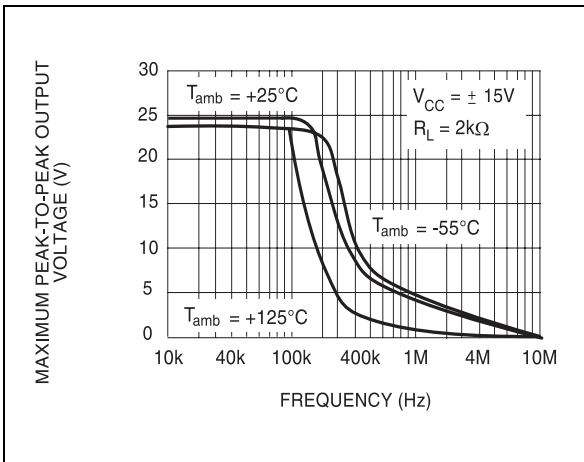
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus FREQUENCY**



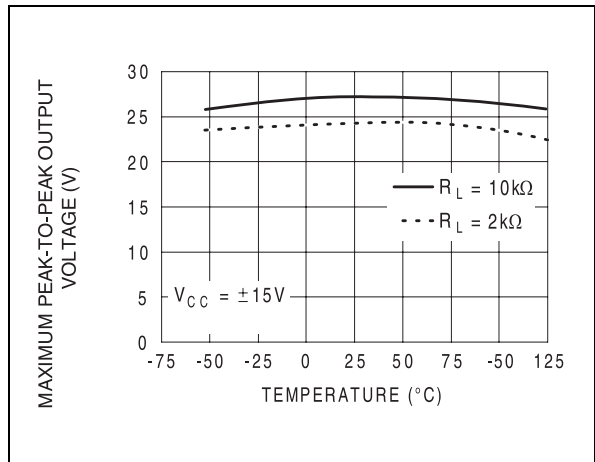
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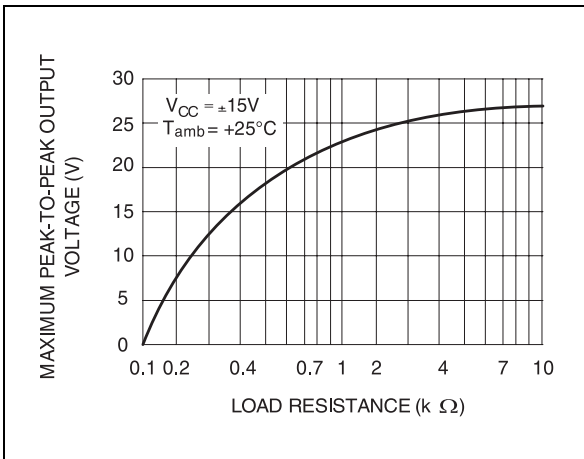
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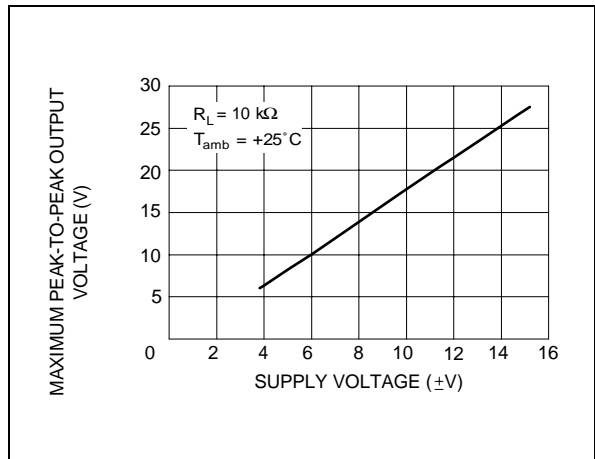
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus FREE AIR TEMP.**



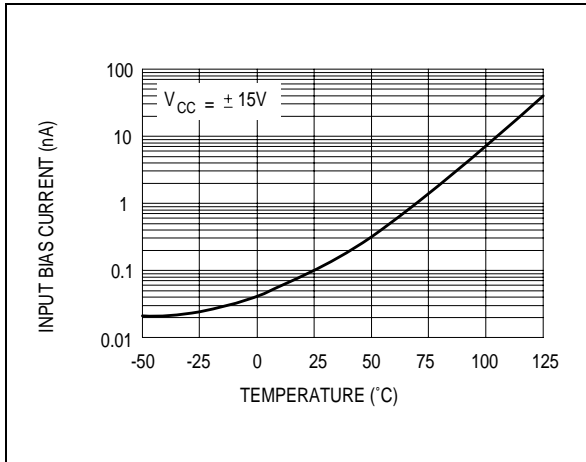
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus LOAD RESISTANCE**



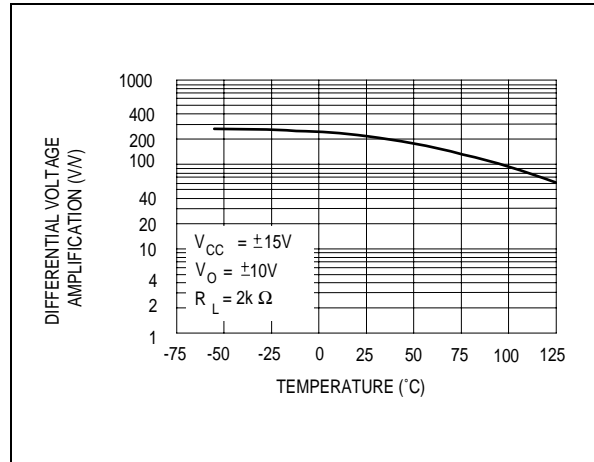
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus SUPPLY VOLTAGE**



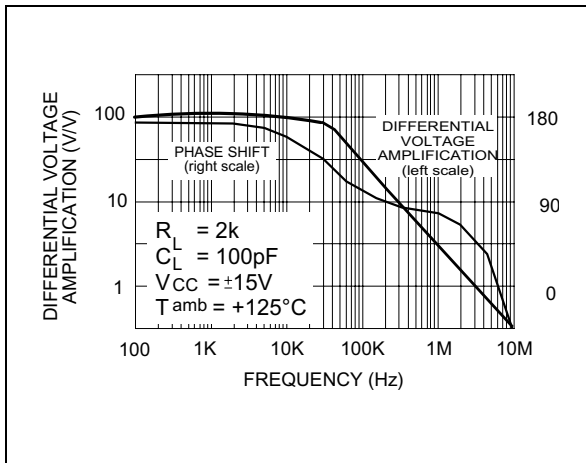
**INPUT BIAS CURRENT versus FREE AIR TEMPERATURE**



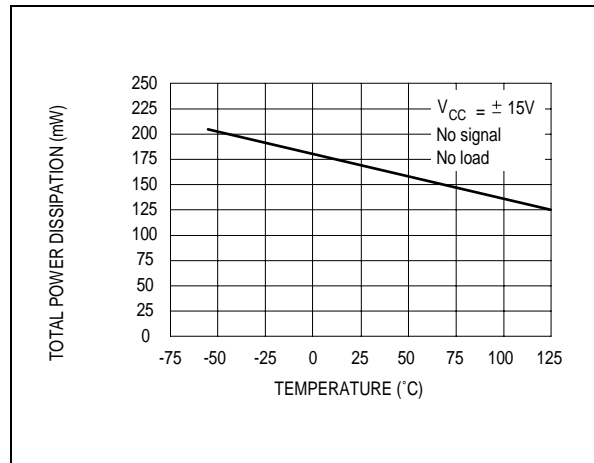
**LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT versus FREQUENCY**



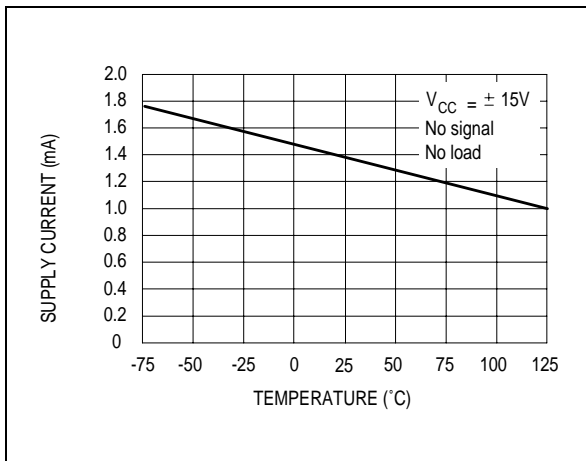
**LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT versus FREQUENCY**



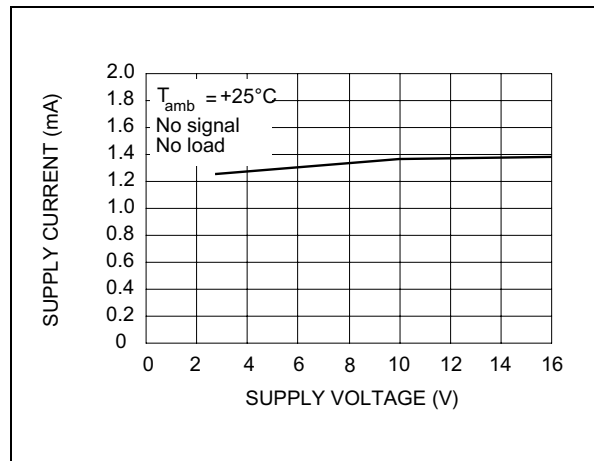
**TOTAL POWER DISSIPATION versus FREE AIR TEMPERATURE**



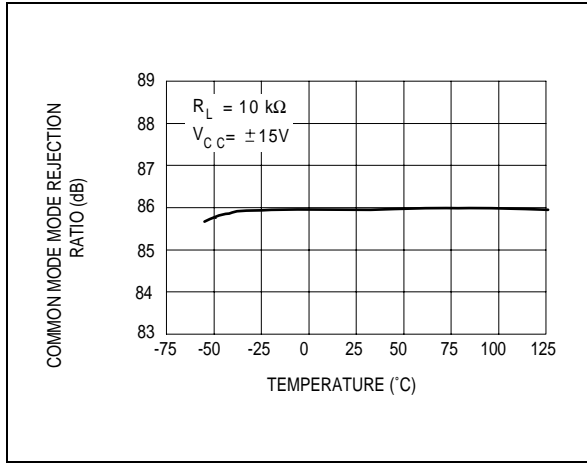
**SUPPLY CURRENT PER AMPLIFIER versus FREE AIR TEMPERATURE**



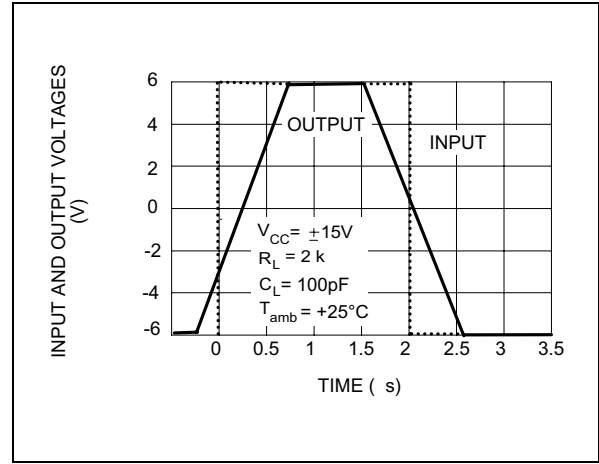
**COMMON MODE REJECTION RATIO versus FREE AIR TEMPERATURE**



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



**VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE**



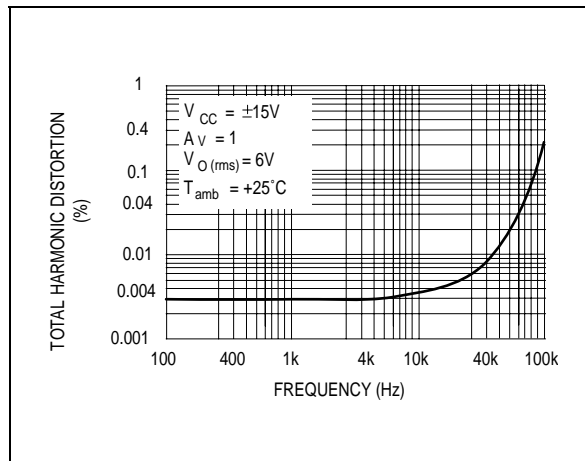
**OUTPUT VOLTAGE versus ELAPSED TIME**



**EQUIVALENT INPUT NOISE VOLTAGE versus FREQUENCY**



**TOTAL HARMONIC DISTORTION versus FREQUENCY**



PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower

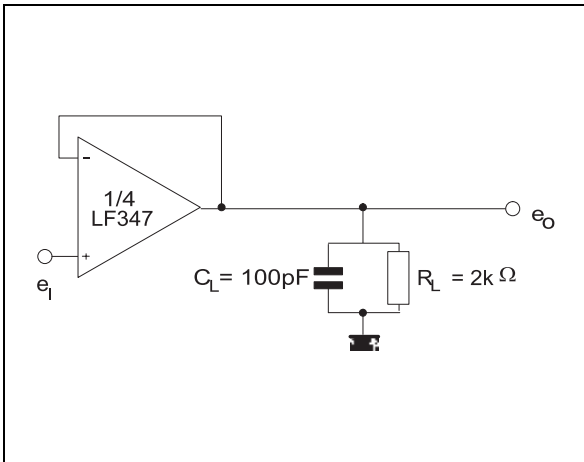
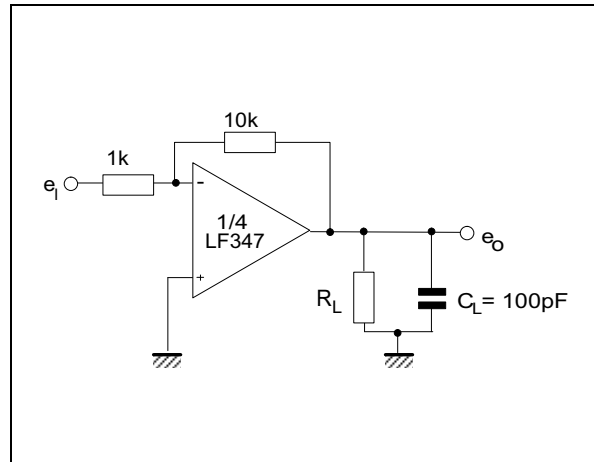
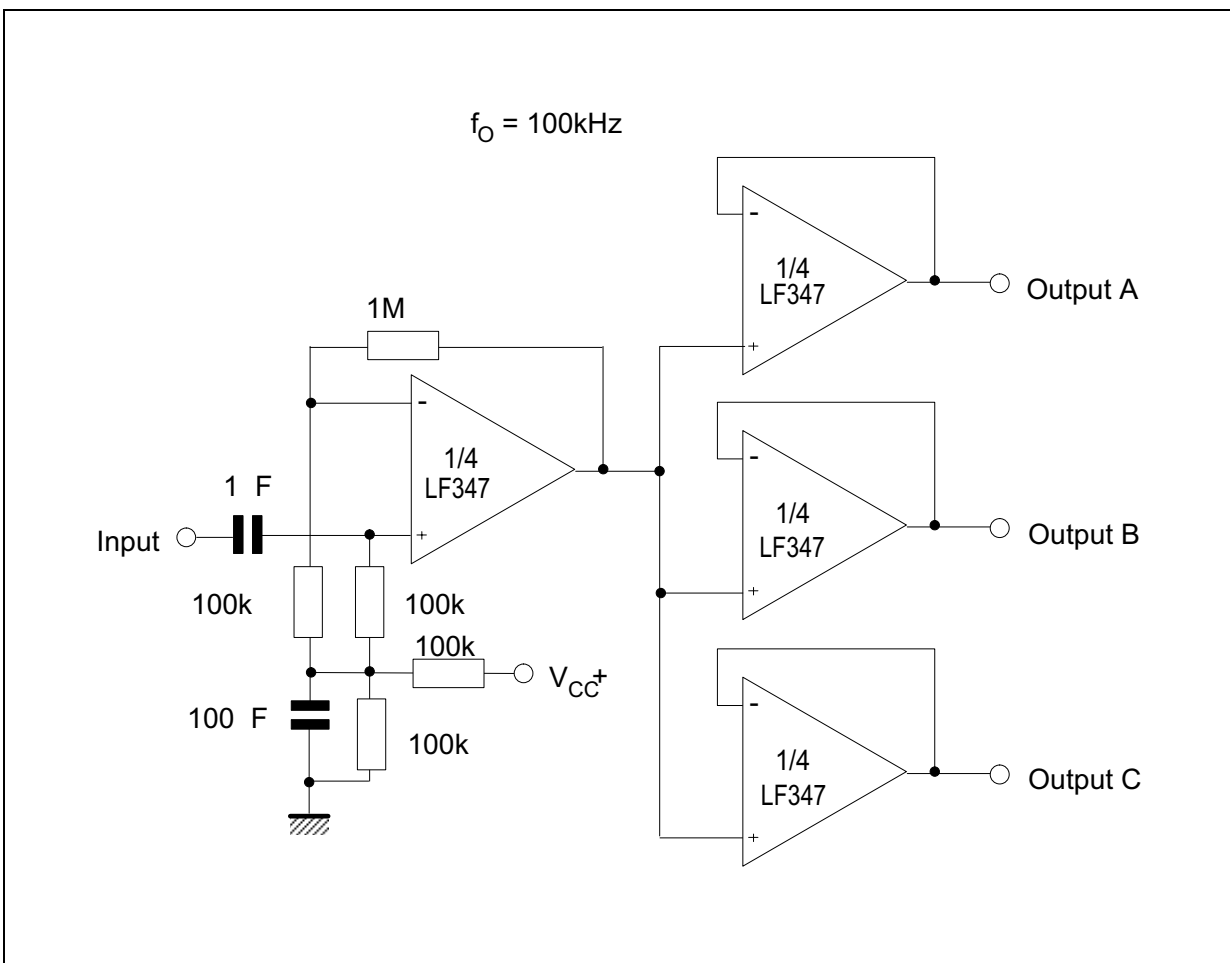


Figure 2 : Gain-of-10 Inverting Amplifier



TYPICAL APPLICATIONS

AUDIO DISTRIBUTOR AMPLIFIER



TYPICAL APPLICATIONS (continued)

POSITIVE FEEDBACK BANDPASS FILTER



OUTPUT A



OUTPUT B



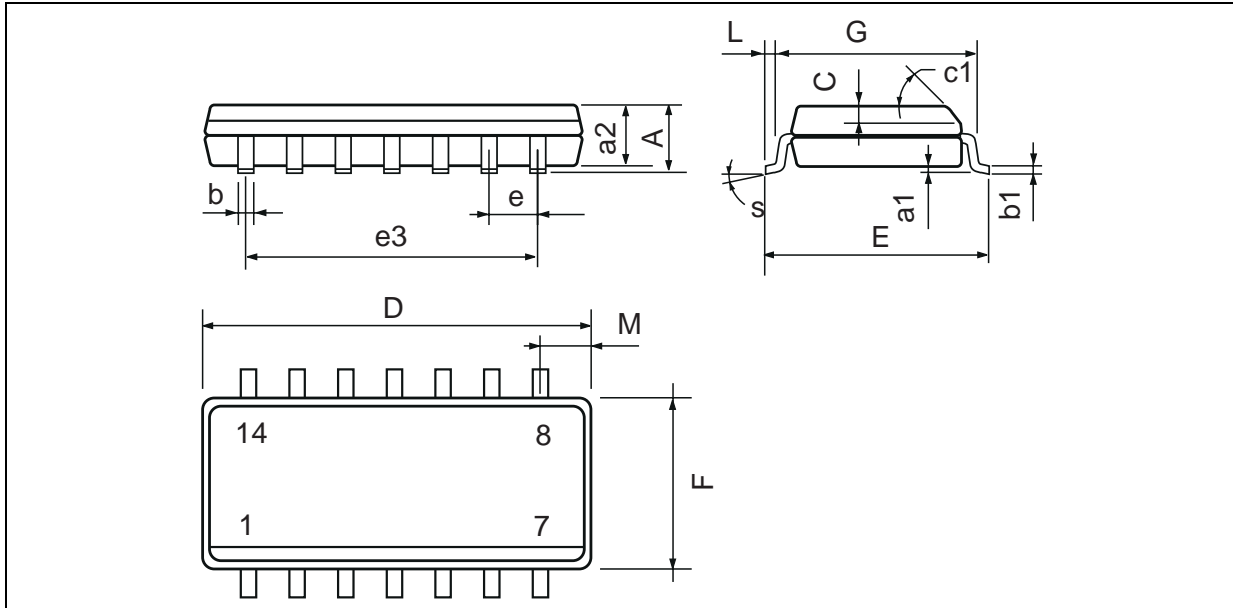


**PACKAGE MECHANICAL DATA**  
14 PINS - PLASTIC DIP



Dim.	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

**PACKAGE MECHANICAL DATA**  
 14 PINS - PLASTIC MICROPACKAGE (SO)



Dim.	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 (1)	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F (1)	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.)					

Note : (1) D and F do not include mold flash or protrusions - Mold flash or protrusions shall not exceed 0.15mm (.066 inc) ONLY FOR DATA BOOK.

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