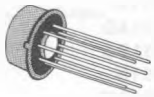
SGS-THOMSON MICROELECTRONICS

LF151/A/B
LF251/A/B
LF351/A/B

J–FET INPUT SINGLE OP–AMPs

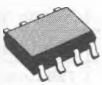
- LOW POWER CONSUMPTION
- WIDE COMMON-MODE AND DIFFERENTIAL VOLTAGE RANGE
- LOW INPUT BIAS AND OFFSET CURRENT
- OUTPUT SHORT-CIRCUIT PROTECTION
- HIGH INPUT IMPEDANCE J–FET INPUT STAGE
- INTERNAL FREQUENCY COMPENSATION
- LATCH UP FREE OPERATION
- HIGH SLEW RATE : 13 V/µs (typ)

N
DIP8
(Plastic package)



H
TO99
(Metal can)

GC
LCC20
(Tricecop LCC)



D
SO8
(Plastic micropackage)

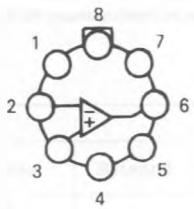
DESCRIPTION

These circuits are high speed J–FET input single 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.

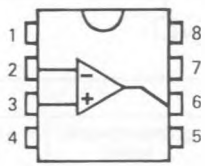
PIN CONNECTIONS (Top views)

TO99



1 - Balance
2 - Inverting input
3 - Non-inverting input
4 - V_{CC}^-
5 - Balance
6 - Output
7 - V_{CC}^+
8 - NC

DIP8
SO8



LCC20

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

ORDER CODES

Part Number	Temperature	Package
LF151GC	– 55 °C to + 125 °C	LCC
LF151AGC	– 55 °C to + 125 °C	LCC
LF151BGC	– 55 °C to + 125 °C	LCC
LF151H	– 55 °C to + 125 °C	METAL CAN
LF151AH	– 55 °C to + 125 °C	METAL CAN
LF151BH	– 55 °C to + 125 °C	METAL CAN
LF251N	– 40 °C to + 105 °C	DIP8
LF251AN	– 40 °C to + 105 °C	DIP8
LF251BN	– 40 °C to + 105 °C	DIP8
LF251D	– 40 °C to + 105 °C	SO8
LF251AD	– 40 °C to + 105 °C	SO8
LF251BD	– 40 °C to + 105 °C	SO8
LF351N	0 °C to + 70 °C	DIP8
LF351AN	0 °C to + 70 °C	DIP8
LF351BN	0 °C to + 70 °C	DIP8
LF351D	0 °C to + 70 °C	SO8
LF351AD	0 °C to + 70 °C	SO8
LF351BD	0 °C to + 70 °C	SO8

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		°C
	LF351, A, B	0 to 70	
	LF251, A, B	– 40 to 105	
	LF151, A, B	– 55 to 125	
T_{stg}	Storage Temperature Range	– 65 to 150	°C

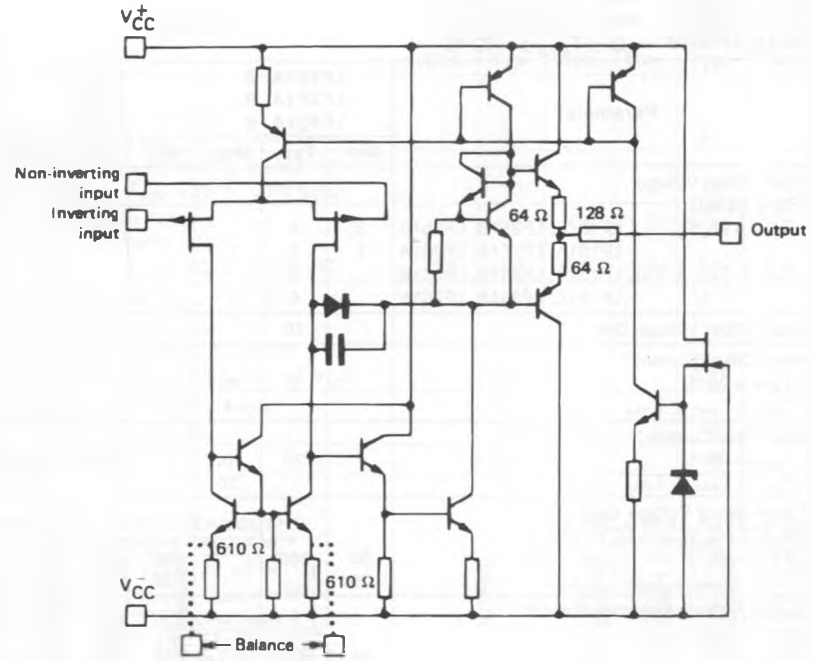
Notes : 1. All voltage values, except differential voltage, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between V_{CC}^- and V_{CC}^+.

2. Differential voltages are at the non-inverting input terminal with respect to the inverting input terminal.

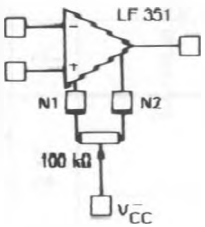
3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.

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 DIAGRAM



INPUT OFFSET VOLTAGE NULL CIRCUITS



E99LF151-01

Case	Balance	Inverting Input	Non-inverting Input	Output	V_{CC}^+	V_{CC}^-	N.C.
DIP8 SO8 TO99	1, 5	2	3	6	7	4	8
LCC20	2, 12	5	7	15	17	10	*

* LCC20 : Other pins are not connected

ELECTRICAL CHARACTERISTICS

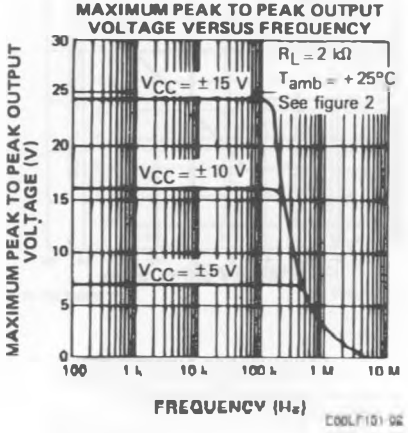
$V_{CC} = \pm 15$ V (unless otherwise specified)
LF151, LF151A, LF151B $-55 \leq T_{amb} \leq +125$ °C
LF251, LF251A, LF251B $-40 \leq T_{amb} \leq +105$ °C
LF351, LF351A, LF351B $0 \leq T_{amb} \leq +70$ °C

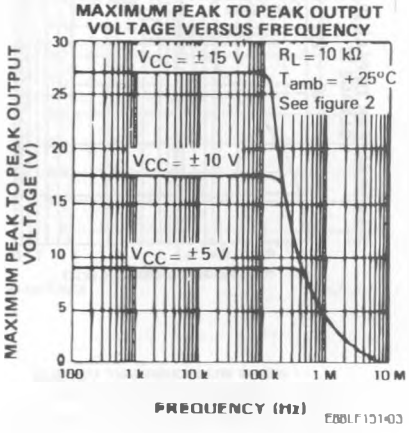
Symbol	Parameter	LF151A, B LF251A, B LF351A, B			LF151 LF251 LF351			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($R_S < 10$ kΩ)							mV
	T_{amb} = 25 °C LF151B, LF251B, LF351B	3	5			3	8	
	LF151A, LF251A, LF351A	1	2					
	$T_{min} \leq T_{amb} \leq T_{max}$ LF151B, LF251B, LF351B		9				13	
	LF151A, LF251A, LF351A		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		20	200		20	200	pA
	$T_{min} \leq T_{amb} \leq T_{max}$			20			20	nA
A_{vd}	Large Signal Voltage Gain ($R_L > 2$ kΩ, $V_o = \pm 10$ 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			
Icc	Supply Current, 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	
$\pm V_{opp}$	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)							V/µs
	$C_L \leq 100$ pF, T_{amb} = 25 °C, unity gain)	12	16		12	16		

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

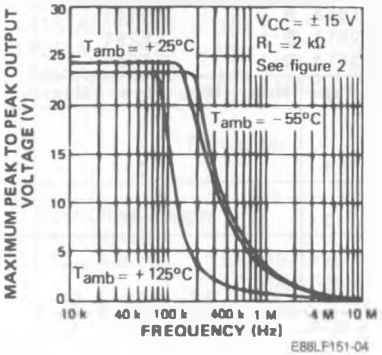
ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	LF151A, B LF251A, B LF351A, B			LF151 LF251 LF351			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 $C_L \leq$ 100 pF, T_{amb} = 25 °C, unity gain)		10			10		%
GBP	Gain Bandwidth Product (f = 100 kHz, Tamb = 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 $C_L \leq$ 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/√Hz
Øm	Phase Margin		45			45		Degrees



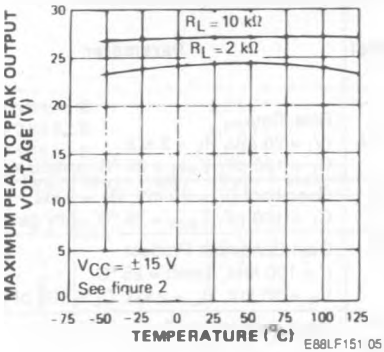


MAXIMUM PEAK TO PEAK OUPUT VOLTAGE VERSUS FREE-AIR TEMP



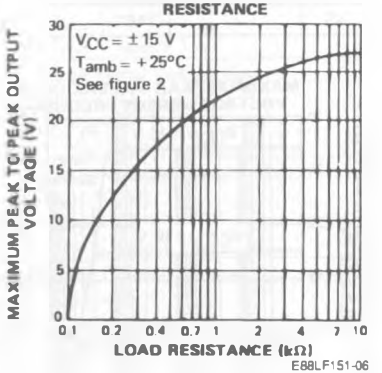
E88LF151-04

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



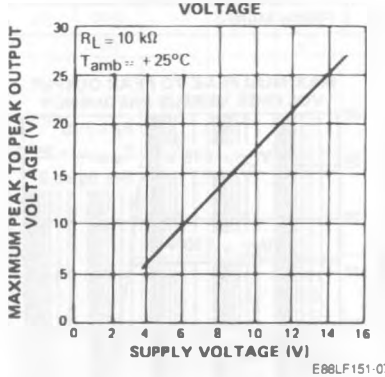
E88LF151-05

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE VERSUS LOAD RESISTANCE



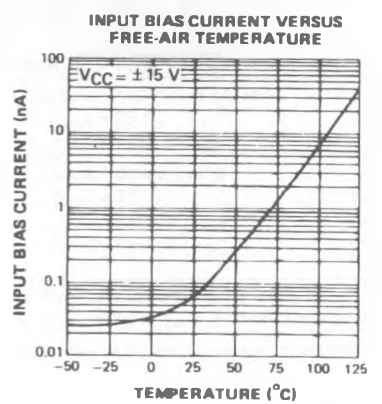
E88LF151-06

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE VERSUS SUPPLY VOLTAGE



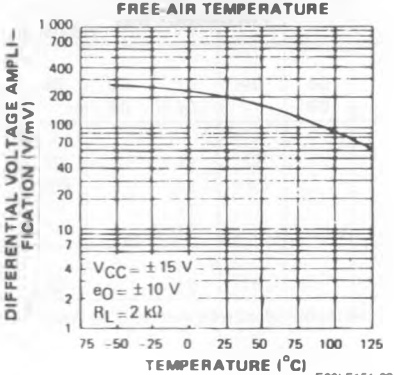
E88LF151-07

INPUT BIAS CURRENT VERSUS FREE-AIR TEMPERATURE



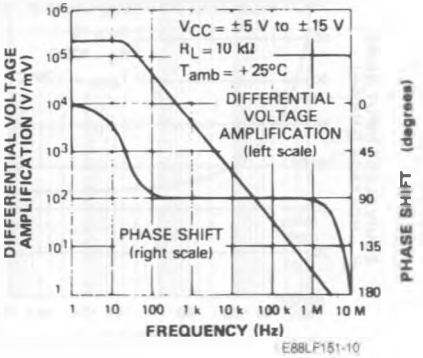
E88LF151-08

LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION VERSUS FREE-AIR TEMPERATURE



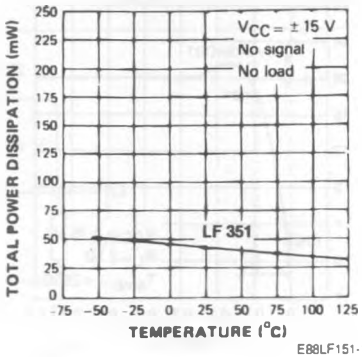
E88LF151-09

LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VERSUS FREQUENCY



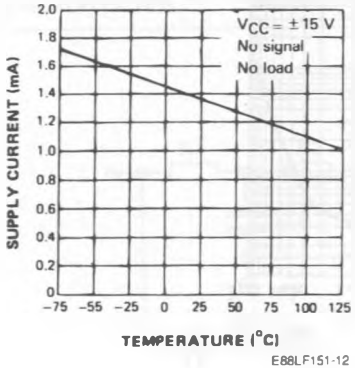
E88LF151-10

TOTAL POWER DISSIPATION VERSUS FREE-AIR TEMPERATURE



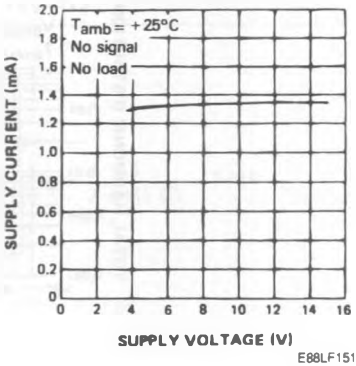
E88LF151-11

SUPPLY CURRENT PER AMPLIFIER VERSUS FREE-AIR TEMPERATURE



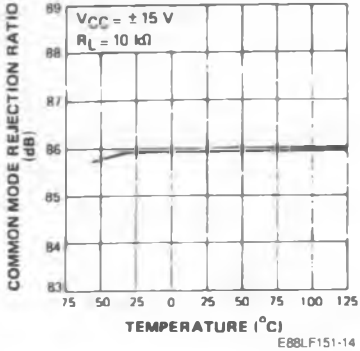
E88LF151-12

SUPPLY CURRENT PER AMPLIFIER VERSUS SUPPLY VOLTAGE



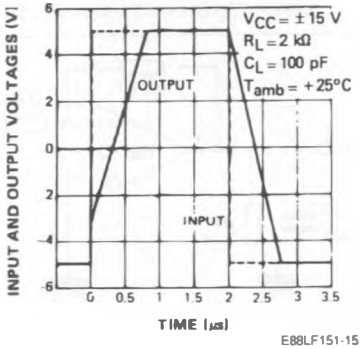
E88LF151-13

COMMON MODE REJECTION RATIO VERSUS FREE-AIR TEMPERATURE



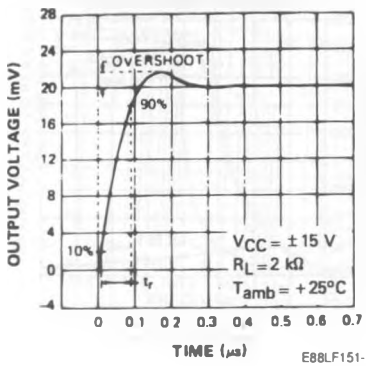
E88LF151-14

VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE



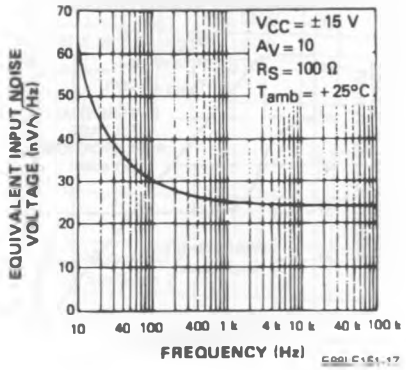
E88LF151-15

OUTPUT VOLTAGE VERSUS TIME



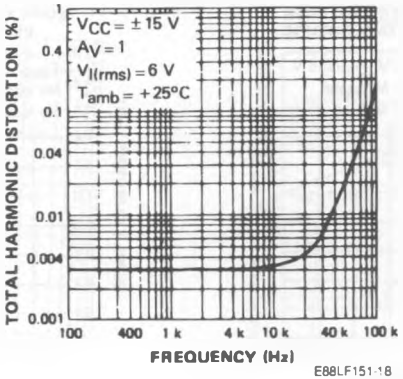
E88LF151-16

EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY



E88LF151-17

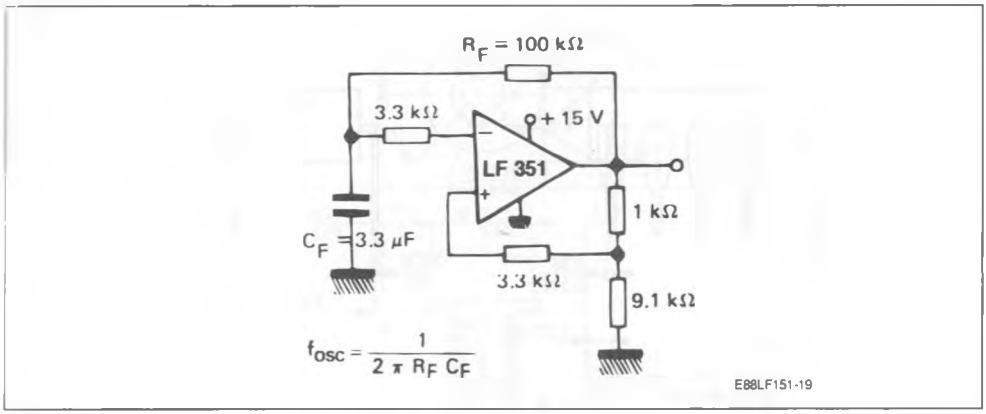
TOTAL HARMONIC DISTORTION VERSUS FREQUENCY



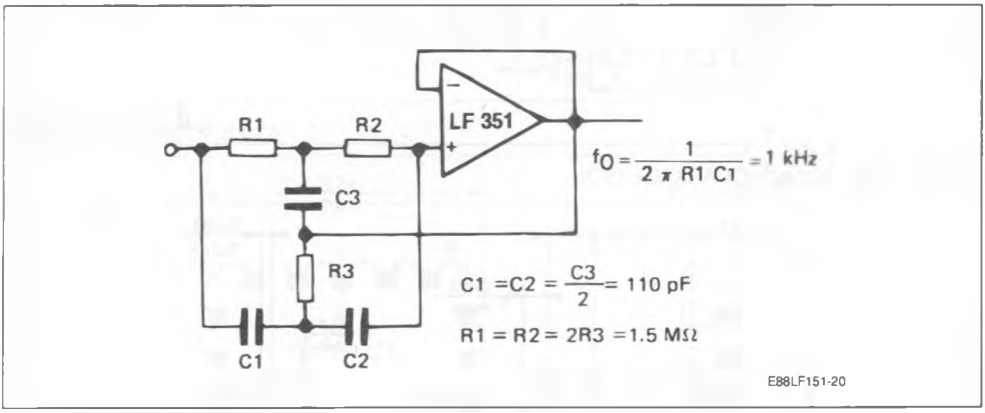
E88LF151-18

TYPICAL APPLICATIONS

(0.5 Hz) SQUARE WAVE OSCILLATOR



HIGH Q NOTCH FILTER



PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower.

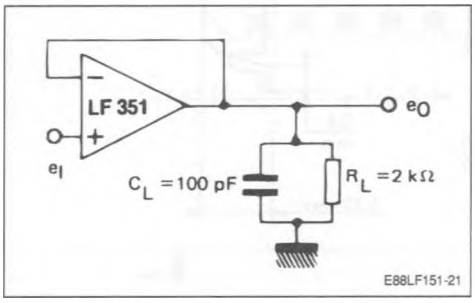
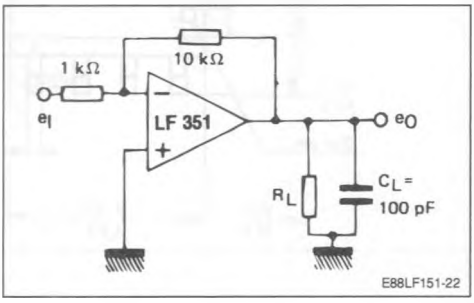
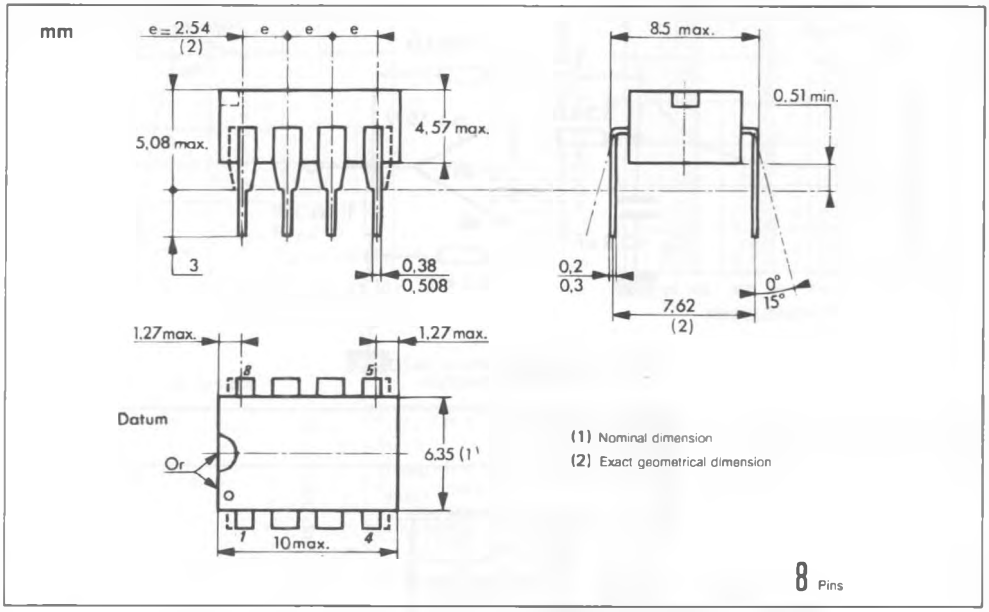


Figure 2 : Gain-of-10 Inverting Amplifier.

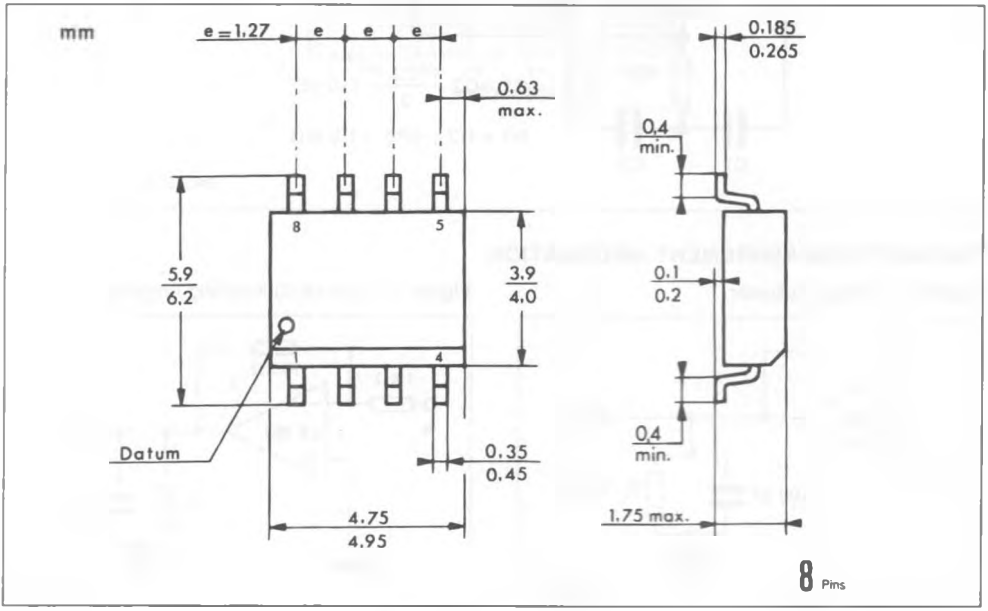


PACKAGE MECHANICAL DATA

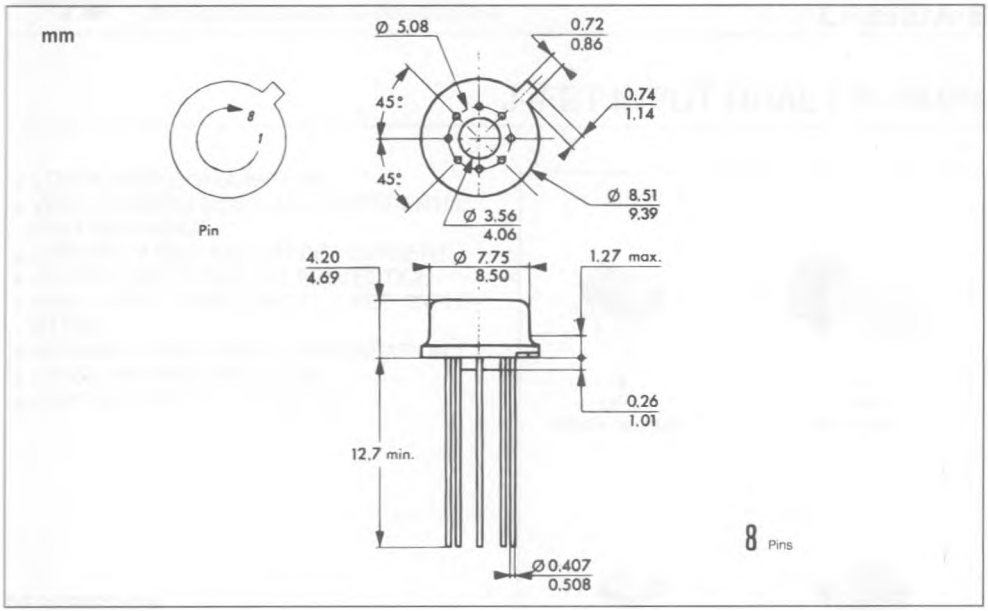
8 PINS – PLASTIC DIP



8 PINS – PLASTIC MICROPACKAGE (SO)



TO99 – METAL CAN



20 PINS – TRICECOP (LCC)