



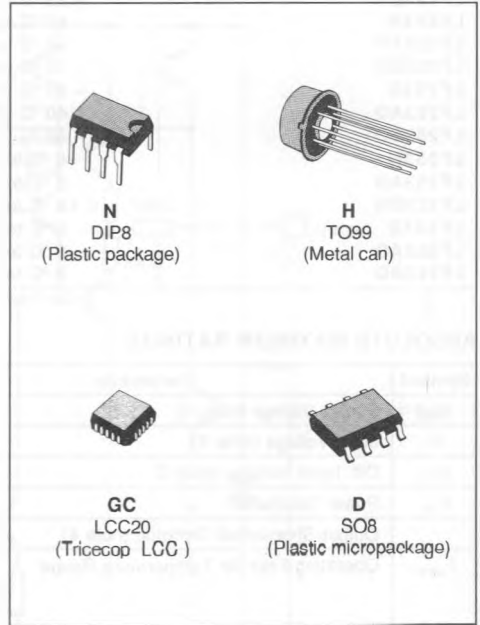
J-FET INPUT DUAL OP-AMPS

- 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

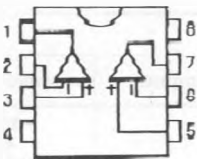
The LF353 - 353A - 353B are high speed J-FET input dual operational amplifiers incorporating well matched, high voltage J-FET and bipolar transistors in a monolithic integrated circuit.

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



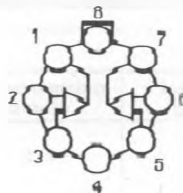
PIN CONNECTIONS (Top views)

**DIP8
SO8**



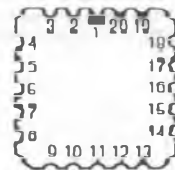
- 1 - Output 1
- 2 - Inverting input 1
- 3 - Non-inverting input 1
- 4 - V_{CC}
- 5 - Non-inverting input 2
- 6 - Inverting input 2
- 7 - Output 2
- 8 - V_{CC}

TO99



- 1 - NG
- 2 - Output 1
- 3 - NG
- 4 - NC
- 5 - Inverting input 1
- 6 - NC
- 7 - Non-Inverting input 1
- 8 - NC
- 9 - NC
- 10 - V_{CC}

LCC20



- 11 - NC
- 12 - Non inverting input 2
- 13 - NC
- 14 - NC
- 15 - Inverting input 2
- 16 - NC
- 17 - Output 2
- 18 - NC
- 19 - NC
- 20 - V_{CC}

ORDER CODES

Part Number	Temperature	Package
LF153GC	- 55 °C to + 125 °C	LCC
LF153AGC	- 55 °C to + 125 °C	LCC
LF153BGC	- 55 °C to + 125 °C	LCC
LF153H	- 55 °C to + 125 °C	METAL CAN
LF153AH	- 55 °C to + 125 °C	METAL CAN
LF153BH	- 55 °C to + 125 °C	METAL CAN
LF253N	- 40 °C to + 105 °C	DIP8
LF253AN	- 40 °C to + 105 °C	DIP8
LF253BN	- 40 °C to + 105 °C	DIP8
LF253D	- 40 °C to + 105 °C	SO8
LF253AD	- 40 °C to + 105 °C	SO8
LF253BD	- 40 °C to + 105 °C	SO8
LF353N	0 °C to + 70 °C	DIP8
LF353AN	0 °C to + 70 °C	DIP8
LF353BN	0 °C to + 70 °C	DIP8
LF353D	0 °C to + 70 °C	SO8
LF353AD	0 °C to + 70 °C	SO8
LF353BD	0 °C to + 70 °C	SO8

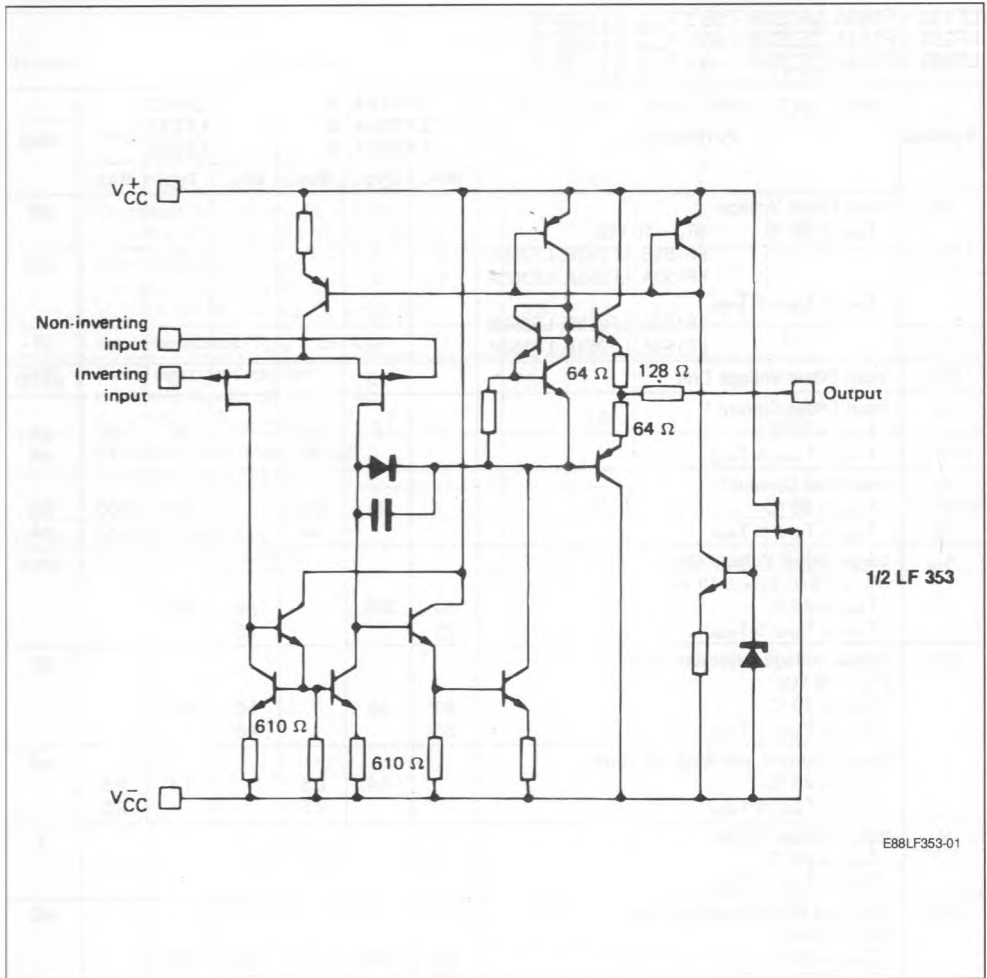
ABSOLUTE MAXIMUM RATINGS

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 LF353, A, B LF253, A, B LF153, 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_{OC} 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 DIAGRAM



Case	Outputs	Non-inverting Inputs	Inverting Inputs	V _{CC}	V _{CC}	N.C.
DIP8 SO8 TO99	1, 7	3, 5	2, 6	4	8	
LCC20	2, 17	7, 12	5, 15	10	20	*

* LCC20 : Other pins are not connected.

ELECTRICAL CHARACTERISTICS
 $V_{CC} = \pm 15\text{ V}$ (unless otherwise specified)

 LF153, LF153A, LF153B $-55 \leq T_{amb} \leq +125\text{ }^{\circ}\text{C}$

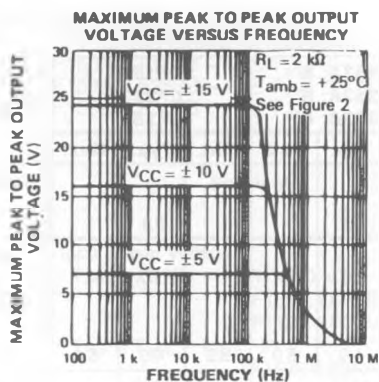
 LF253, LF153A, LF253B $-40 \leq T_{amb} \leq +105\text{ }^{\circ}\text{C}$

 LF353, LF153A, LF353B $0 \leq T_{amb} \leq +70\text{ }^{\circ}\text{C}$

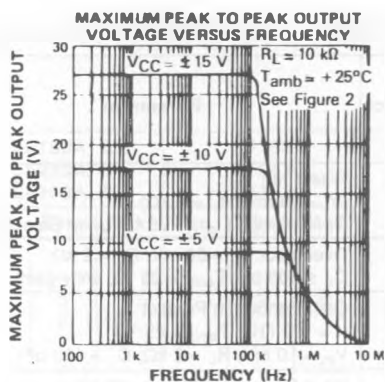
Symbol	Parameter	LF153A, B LF253A, B LF353A, B			LF153 LF253 LF353			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage $T_{amb} = 25\text{ }^{\circ}\text{C}$ ($R_s < 10\text{ k}\Omega$) LF153B, LF253B, LF353B LF153A, LF253A, LF353A $T_{min} \leq T_{amb} \leq T_{max}$ LF153B, LF253B, LF353B LF153A, LF253A, LF353A	3 1	5 2			3	8	mV
DV_{io}	Input Offset Voltage Drift		10			10		$\mu\text{V}/^{\circ}\text{C}$
I_{io}	Input Offset Current * $T_{amb} = 25\text{ }^{\circ}\text{C}$ $T_{min} \leq T_{amb} \leq T_{max}$		5	50 4		5	50 4	pA nA
I_{ib}	Input Bias Current * $T_{amb} = 25\text{ }^{\circ}\text{C}$ $T_{min} \leq T_{amb} \leq T_{max}$		20	200 20		20	200 20	pA nA
A_{vd}	Large Signal Voltage Gain ($R_L > 2\text{ k}\Omega$, $V_o = \pm 10\text{ V}$) $T_{amb} = 25\text{ }^{\circ}\text{C}$ $T_{min} \leq T_{amb} \leq T_{max}$	50 25	200		50 25	200		V/mV
SVR	Supply voltage Rejection Ratio ($R_s < 10\text{ k}\Omega$) $T_{amb} = 25\text{ }^{\circ}\text{C}$ $T_{min} \leq T_{amb} \leq T_{max}$	80 80	86		80 80	86		dB
I_{cc}	Supply Current, per Amp, no Load $T_{amb} = 25\text{ }^{\circ}\text{C}$ $T_{min} \leq T_{amb} \leq T_{max}$		1.4	2.5 2.5		1.4	2.5 2.5	mA
V_i	Input Voltage Range $T_{amb} = 25\text{ }^{\circ}\text{C}$ $T_{min} \leq T_{amb} \leq T_{max}$	- 11		+ 11	- 11		+ 11	V
CMR	Common Mode Rejection Ratio ($R_s < 10\text{ k}\Omega$) $T_{amb} = 25\text{ }^{\circ}\text{C}$ $T_{min} \leq T_{amb} \leq T_{max}$	80 80	86		70 70	86		dB
I_{os}	Output Short-circuit Current $T_{amb} = 25\text{ }^{\circ}\text{C}$ $T_{min} \leq T_{amb} \leq T_{max}$	10 10	40	60 60	10 10	40	60 60	mA
$\pm V_{opp}$	Output Voltage Swing $T_{amb} = 25\text{ }^{\circ}\text{C}$ $T_{min} \leq T_{amb} \leq T_{max}$ $R_L \geq 2\text{ k}\Omega$ $R_L \geq 10\text{ k}\Omega$ $R_L \geq 2\text{ k}\Omega$ $R_L \geq 10\text{ k}\Omega$	11 12 11 12	12 13.5		11 12 11 12	12 13.5		V
S_{vo}	Slew-rate ($V_i = 10\text{ V}$, $R_L = 2\text{ k}\Omega$) $C_L \leq 100\text{ pF}$, $T_{amb} = 25\text{ }^{\circ}\text{C}$, unity gain)	12	16		12	16		V/ μs

ELECTRICAL CHARACTERISTICS (continued)

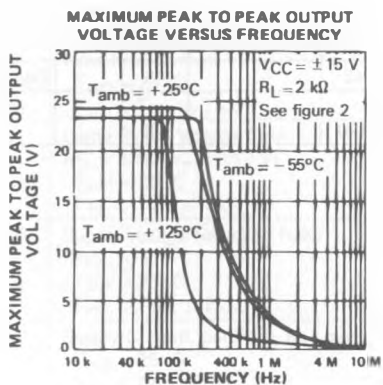
Symbol	Parameter	LF153A, B LF253A, B LF353A, B			LF153 LF253 LF353			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
t_r	Rise Time ($V_i = 20$ mV, $R_L = 2$ k Ω) $C_L = 100$ pF, $T_{amb} = 25$ °C, unity Gain		0.1			0.1		μ s
K_{ov}	Overshoot ($V_i = 20$ mV, $R_L = 2$ k Ω) $C_L \leq 100$ pF, $T_{amb} = 25$ °C, unity 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) $C_L < 100$ 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		dB



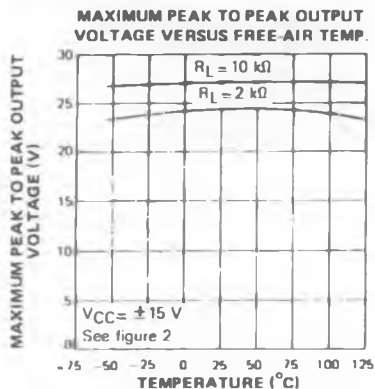
E88LF353-02



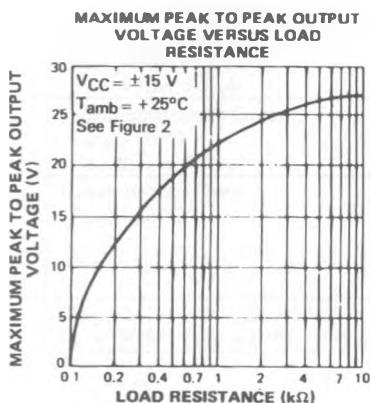
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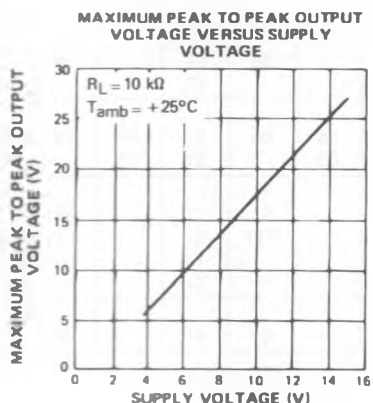
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E88LF353-05

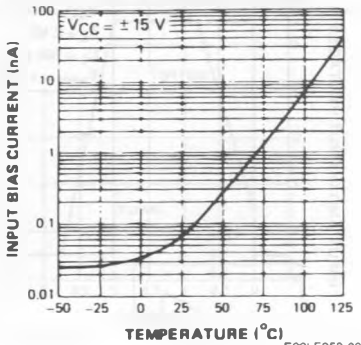


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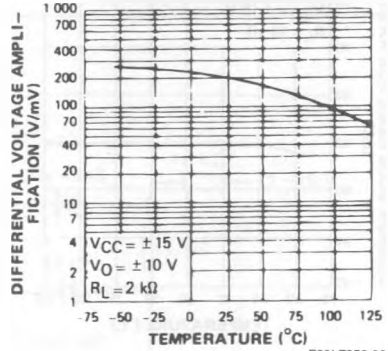
E88LF353-07

INPUT BIAS CURRENT VERSUS
FREE AIR TEMPERATURE



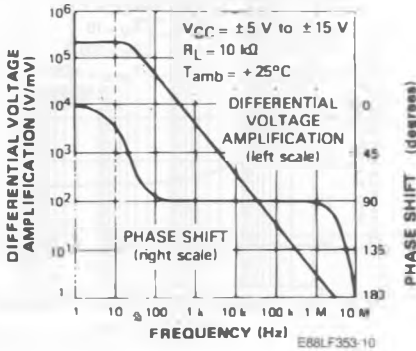
E88LF353-08

LARGE SIGNAL DIFFERENTIAL
VOLTAGE AMPLIFICATION VERSUS
FREE-AIR TEMPERATURE



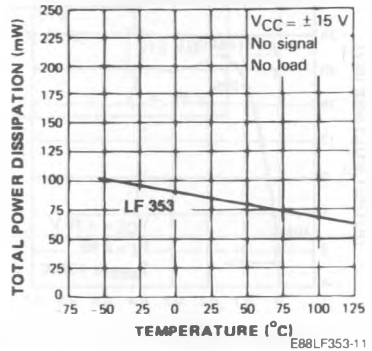
E88LF353-09

LARGE SIGNAL DIFFERENTIAL
VOLTAGE AMPLIFICATION AND
PHASE SHIFT VERSUS FREQUENCY



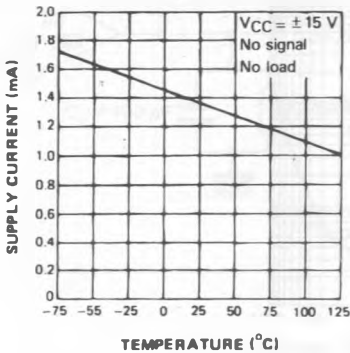
E88LF353-10

TOTAL POWER DISSIPATION VERSUS
FREE AIR TEMPERATURE



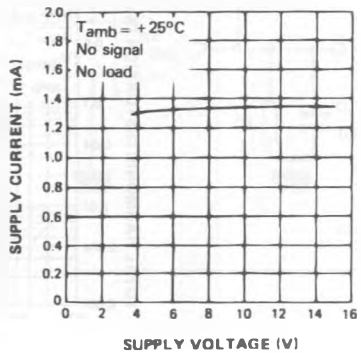
E88LF353-11

SUPPLY CURRENT PER AMPLIFIER
VERSUS FREE AIR TEMPERATURE



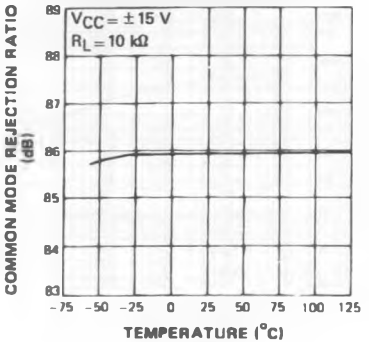
E88LF353-12

SUPPLY CURRENT PER AMPLIFIER
VERSUS SUPPLY VOLTAGE



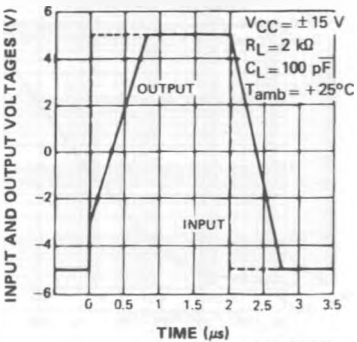
E88LF353-13

COMMON MODE REJECTION RATIO
VERSUS FREE-AIR TEMPERATURE



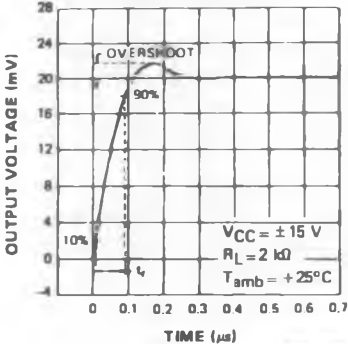
E88LF353-14

VOLTAGE FOLLOWER LARGE
SIGNAL PULSE RESPONSE



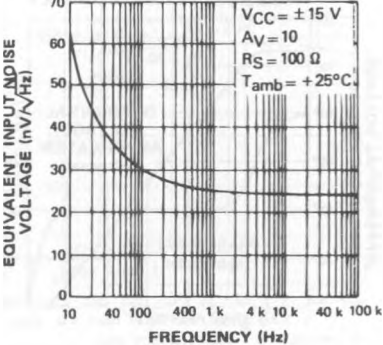
E88LF353-15

OUTPUT VOLTAGE VERSUS TIME



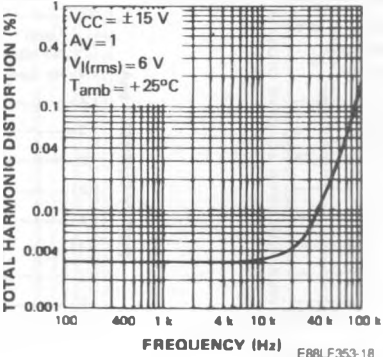
E88LF353-16

EQUIVALENT INPUT NOISE VOL-
TAGE VERSUS FREQUENCY



E88LF353-17

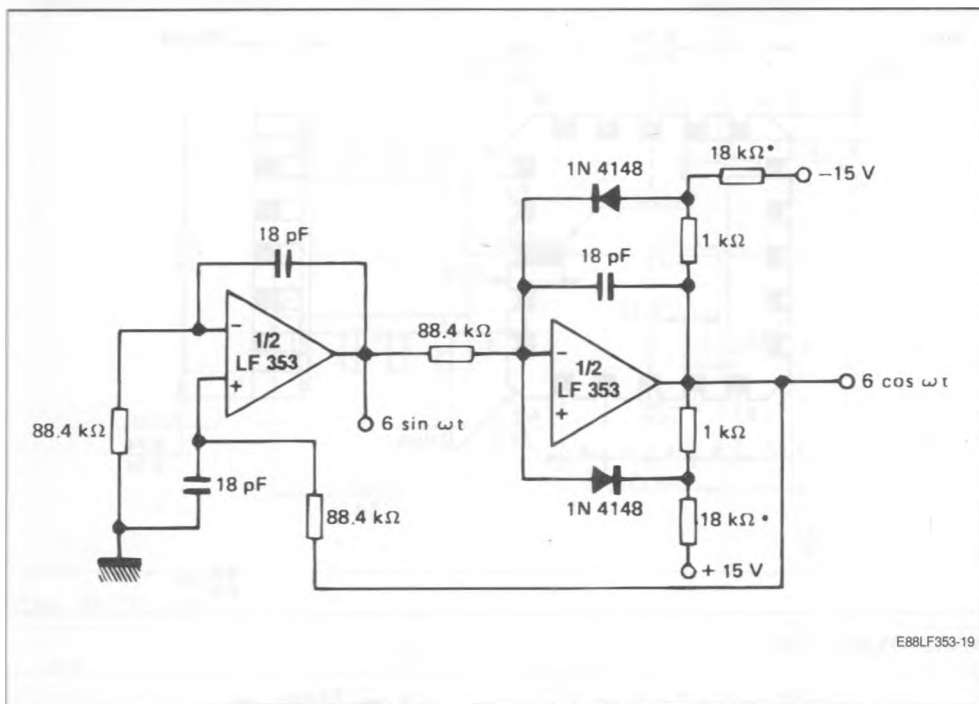
TOTAL HARMONIC DISTORTION
VERSUS FREQUENCY



E88LF353-18

TYPICAL APPLICATION

QUADRATURE OSCILLATOR



* These resistor values may be adjusted for a symmetrical output.

PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower.

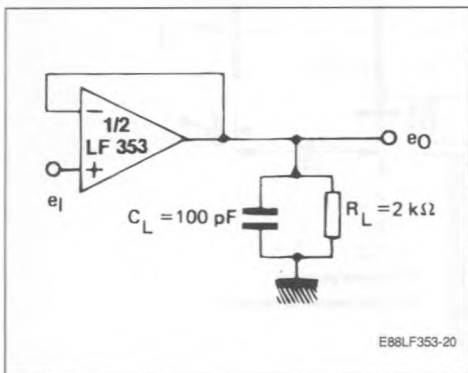
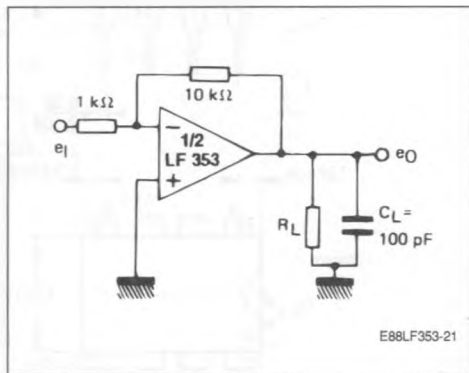
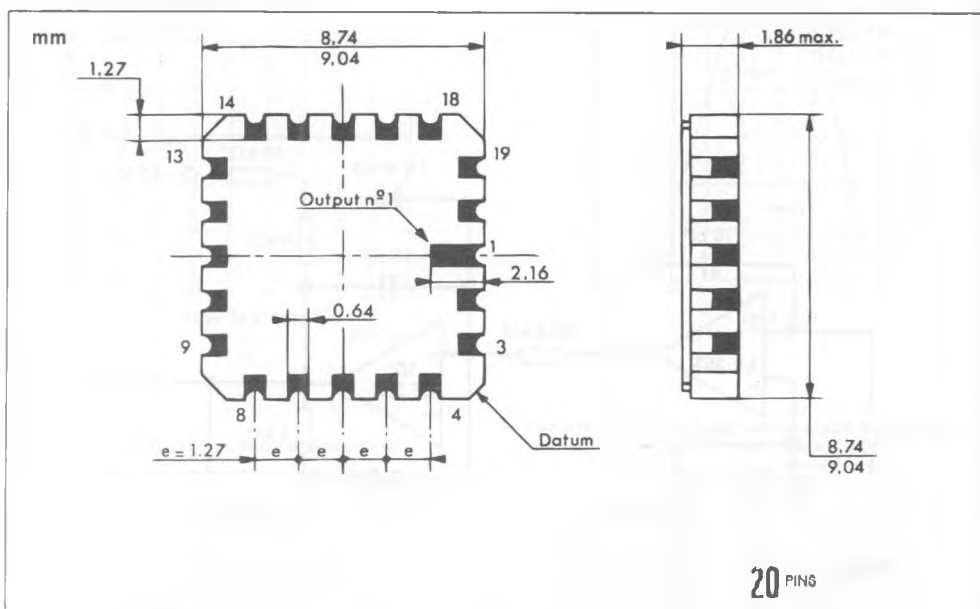


Figure 2 : Gain-of-10 Inverting Amplifier.

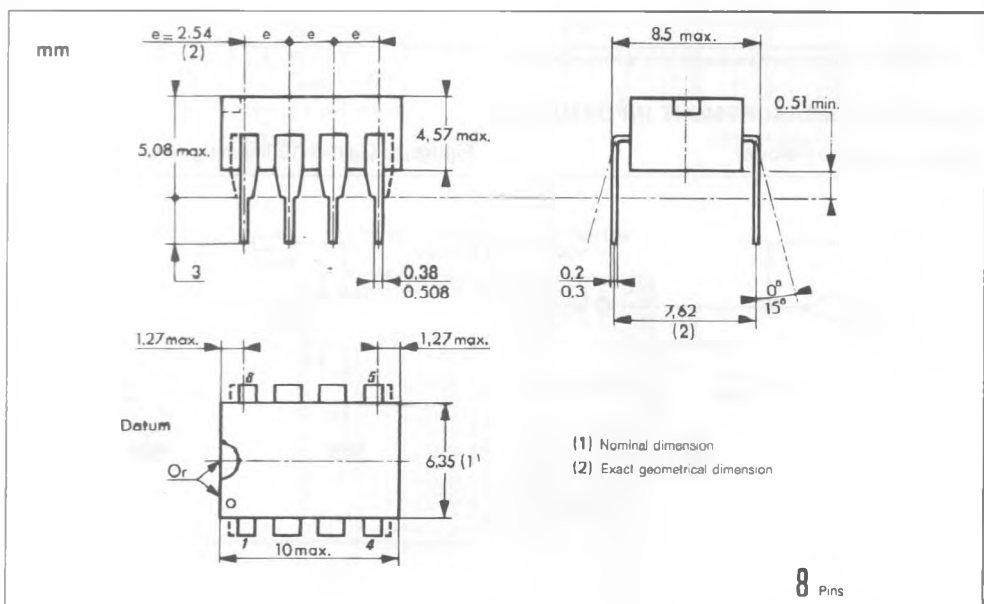


PACKAGE MECHANICAL DATA

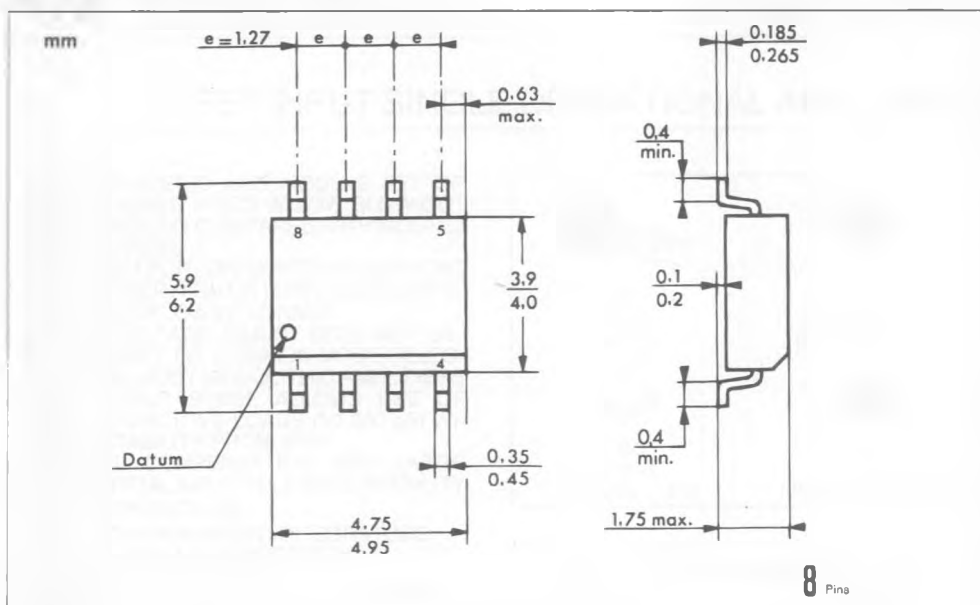
20 PINS – TRICECOP (LCC)



8 PINS – PLASTIC DIP



8 PINS – PLASTIC MICROPACKAGE (SO)



TO99 - METAL CAN

