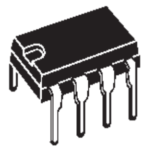
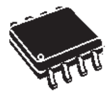
# LF153
# LF253 - LF353

## WIDE BANDWIDTH DUAL 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/µs (typ)



**N**
**DIP8**
(Plastic Package)



**D**
**SO8**
(Plastic Micropackage)

### DESCRIPTION

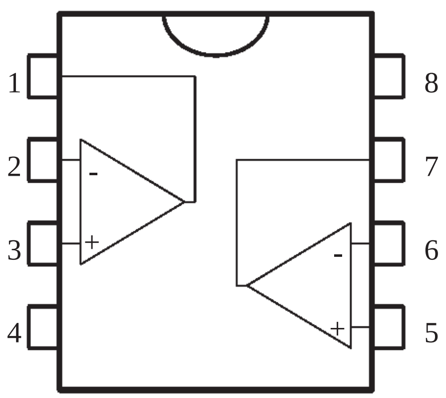
The LF353 are high speed J–FET input dual operational amplifiers incorporating well matched, high voltage J–FET and bipolar transistors in a monolithic integrated circuit.

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

### ORDER CODES

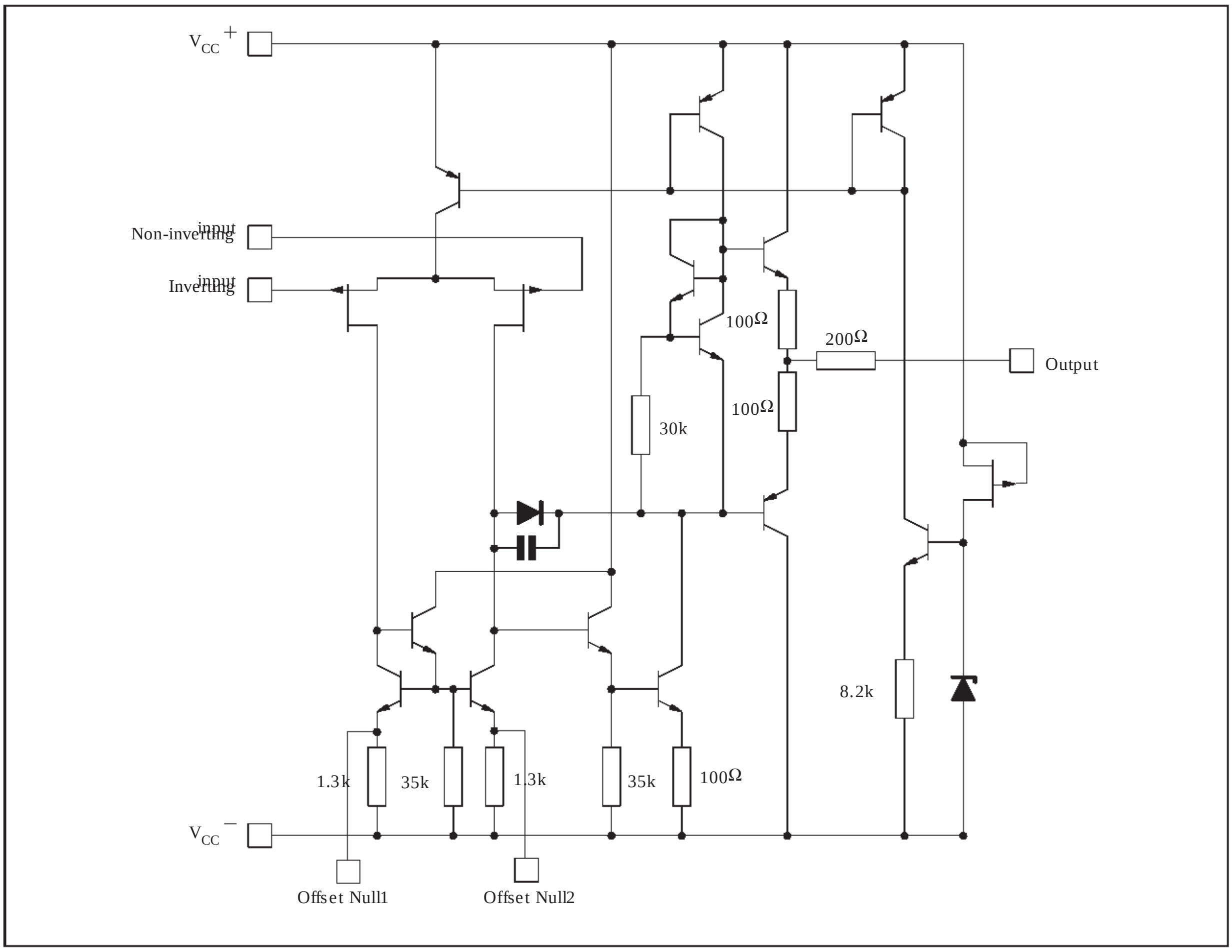
| Part Number | Temperature | Package | |
|---|---|---|---|
| | | N | D |
| LF353 | 0°C, +70°C | • | • |
| LF253 | –40°C, +105°C | • | • |
| LF153 | –55°C, +125°C | • | • |

### PIN CONNECTIONS (top view)




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 - $V_{CC}^{+}$

## SCHEMATIC DIAGRAM (each amplifier)




## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage - (note 1) | | ±18 | V |
| $V_i$ | Input Voltage - (note 3) | | ±15 | V |
| $V_{id}$ | Differential 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<br>LF253<br>LF153 | 0 to 70<br>–40 to 105<br>–55 to 125 | $^oC$ |
| $T_{stg}$ | Storage Temperature Range | | –65 to 150 | $^oC$ |

**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.

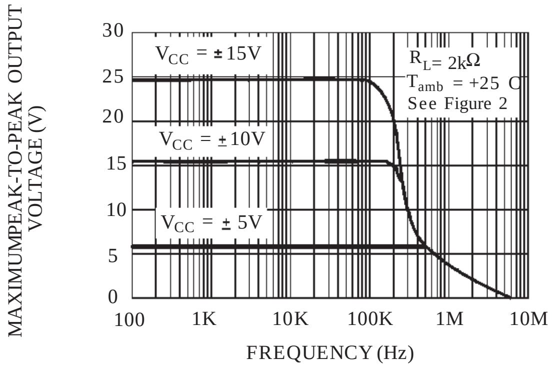
## ELECTRICAL CHARACTERISTICS

$V_{CC}$ = ±15V, $T_{amb}$ = 25°C (unless otherwise specified)

| Symbol | Parameter | LF153 - LF253 - LF353 | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| $V_{io}$ | Input Offset Voltage ($R_S$ = 10kΩ)<br>$T_{amb}$ = 25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | | <br>3 | <br>10<br>13 | mV |
| $DV_{io}$ | Input Offset Voltage Drift | | 10 | | μV/°C |
| $I_{io}$ | Input Offset Current *<br>$T_{amb}$ = 25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | | <br>5 | <br>100<br>4 | <br>pA<br>nA |
| $I_{ib}$ | Input Bias Current *<br>$T_{amb}$ = 25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | | <br>20 | <br>200<br>20 | <br>pA<br>nA |
| $A_{vd}$ | Large Signal Voltage Gain ($R_L$ = 2kΩ, $V_O$ = ±10V)<br>$T_{amb}$ = 25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | <br>50<br>25 | <br>200 | | V/mV |
| SVR | Supply Voltage Rejection Ratio ($R_S$ = 10kΩ)<br>$T_{amb}$ = 25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | <br>80<br>80 | <br>86 | | dB |
| $I_{CC}$ | Supply Current (no load)<br>$T_{amb}$ = 25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | | <br>1.4 | <br>3.2<br>3.2 | mA |
| $V_{icm}$ | Input Common Mode Voltage Range | ±11 | +15<br>-12 | | V |
| CMR | Common Mode Rejection Ratio ($R_S$ = 10kΩ)<br>$T_{amb}$ = 25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | <br>70<br>70 | <br>86 | | dB |
| Ios | Output Short-circuit Current<br>$T_{amb}$ = 25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | <br>10<br>10 | <br>40 | <br>60<br>60 | mA |
| $\pm V_{OPP}$ | Output Voltage Swing<br>$T_{amb}$ = 25°C $R_L$ = 2kΩ<br>$R_L$ = 10kΩ<br>$T_{min.} \le T_{amb} \le T_{max.}$ $R_L$ = 2kΩ<br>$R_L$ = 10kΩ | <br>10<br>12<br>10<br>12 | <br>12<br>13.5 | | V |
| SR | Slew Rate<br>($V_i$ = 10V, $R_L$ = 2kΩ, $C_L$ = 100pF, $T_{amb}$ = 25°C, unity gain) | <br>12 | <br>16 | | V/μs |
| $t_r$ | Rise Time<br>($V_i$ = 20mV, $R_L$ = 2kΩ, $C_L$ = 100pF, $T_{amb}$ = 25°C, unity gain) | | <br>0.1 | | μs |
| $K_{OV}$ | Overshoot<br>($V_i$ = 20mV, $R_L$ = 2kΩ, $C_L$ = 100pF, $T_{amb}$ = 25°C, unity gain) | | <br>10 | | % |
| GBP | Gain Bandwidth Product<br>(f = 100kHz, $T_{amb}$ = 25°C, $V_{in}$ = 10mV, $R_L$ = 2kΩ, $C_L$ = 100pF) | <br>2.5 | <br>4 | | MHz |
| $R_i$ | Input Resistance | | $10^{12}$ | | Ω |
| THD | Total Harmonic Distortion (f = 1kHz, $A_V$ = 20dB, $R_L$ = 2kΩ,<br>$C_L$ = 100pF, $T_{amb}$ = 25°C, $V_O$ = 2$V_{PP}$) | | <br>0.01 | | % |
| $e_n$ | Equivalent Input Noise Voltage (f = 1kHz, $R_s$ = 100Ω) | | 15 | | $\frac{nV}{\sqrt{Hz}}$ |
| ∅m | Phase Margin | | 45 | | Degrees |
| $V_{O1}/V_{O2}$ | Channel Separation ($A_V$ = 100, $T_{amb}$ = 25°C) | | 120 | | dB |

* 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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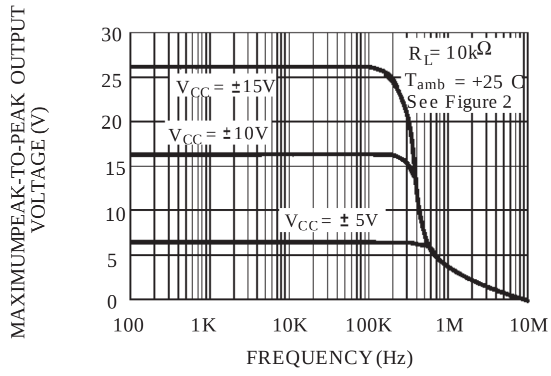


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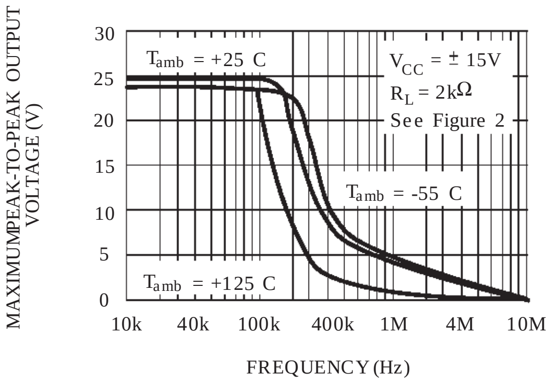
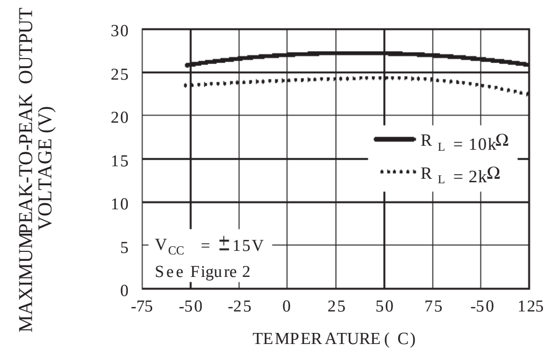
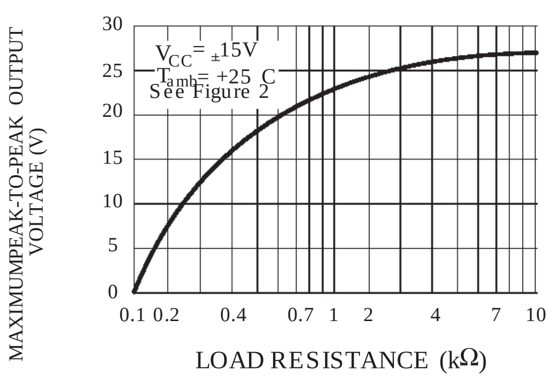


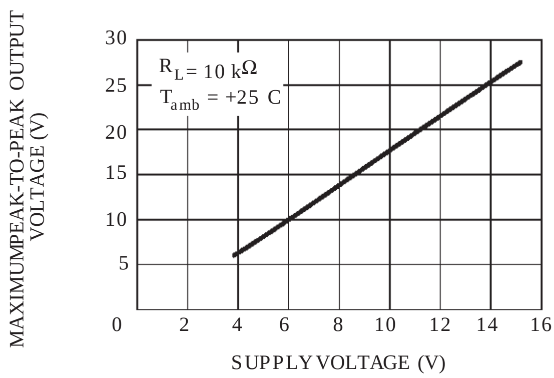

## MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREE AIR TEMP.



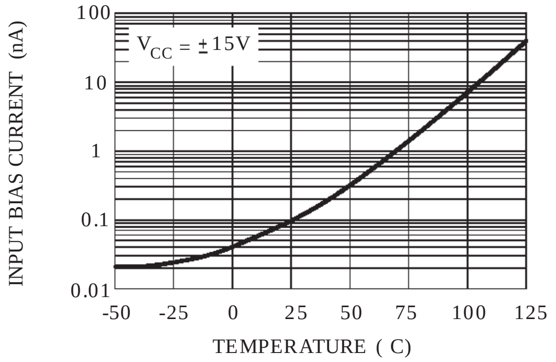

## MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS LOAD RESISTANCE



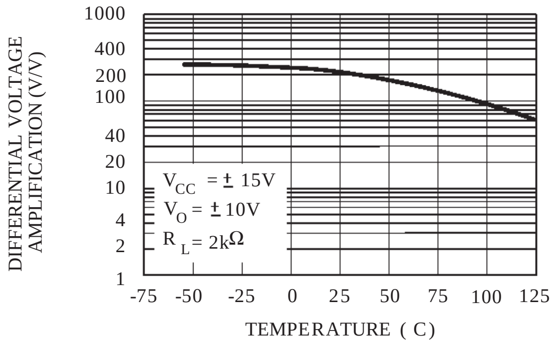

## MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS SUPPLY VOLTAGE



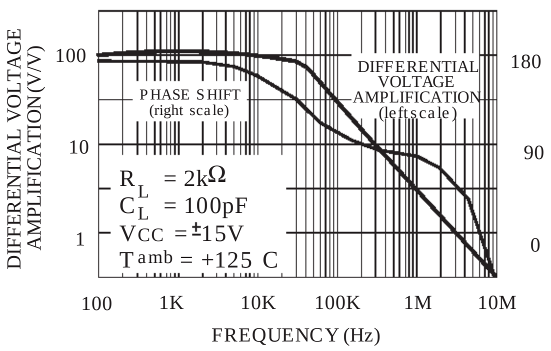
## INPUT BIAS CURRENT VERSUS FREE AIR TEMPERATURE



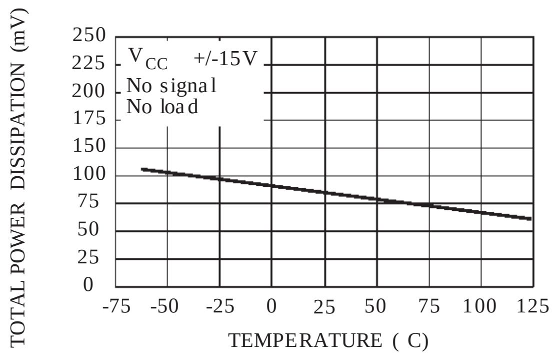

## LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION VERSUS FREE AIR TEMPERATURE



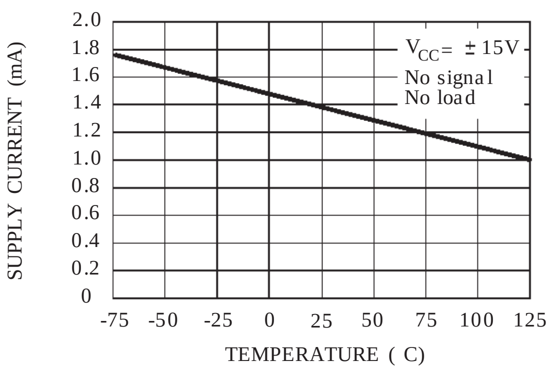

## LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VERSUS FREQUENCY



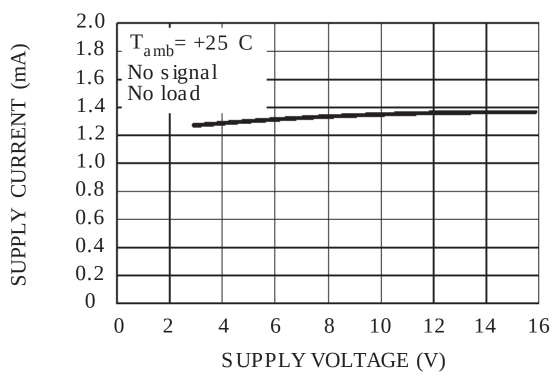

## TOTAL POWER DISSIPATION VERSUS FREE AIR TEMPERATURE



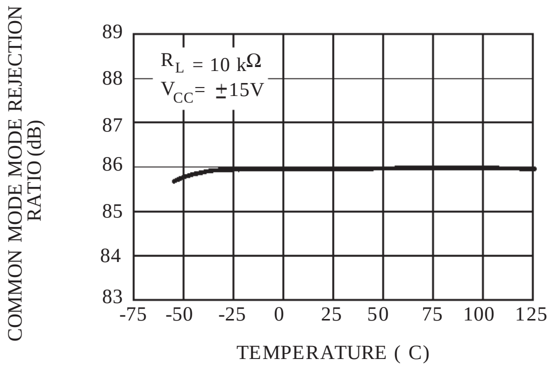

## SUPPLY CURRENT PER AMPLIFIER VERSUS FREE AIR TEMPERATURE



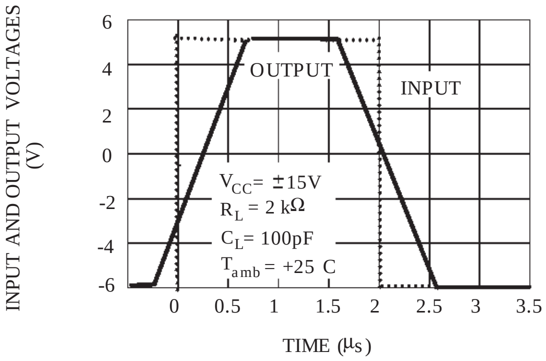

## SUPPLY CURRENT PER AMPLIFIER VERSUS SUPPLY VOLTAGE



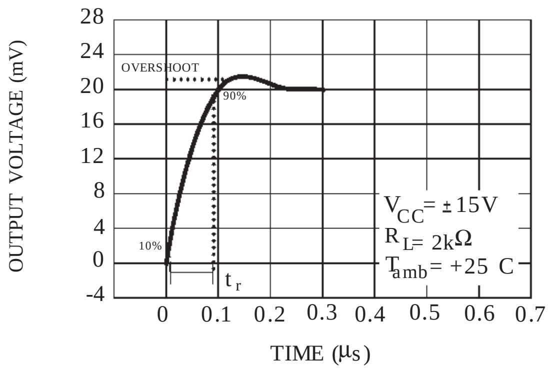
## COMMON MODE REJECTION RATIO VERSUS FREE AIR TEMPERATURE



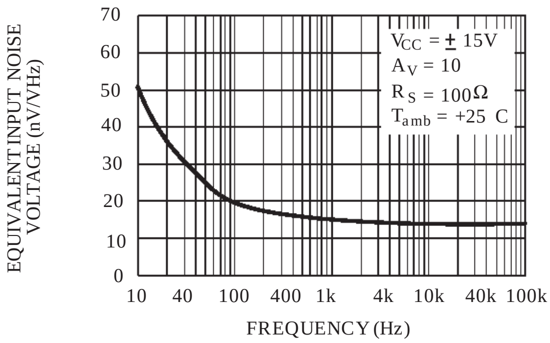

## VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE



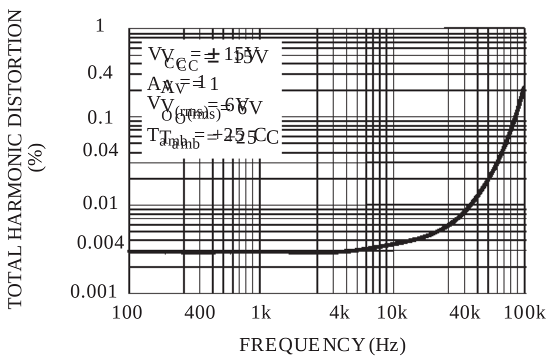

## OUTPUT VOLTAGE VERSUS ELAPSED TIME




## EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY




## TOTAL HARMONIC DISTORTION VERSUS FREQUENCY



## PARAMETER MEASUREMENT INFORMATION

**Figure 1 :** Voltage Follower

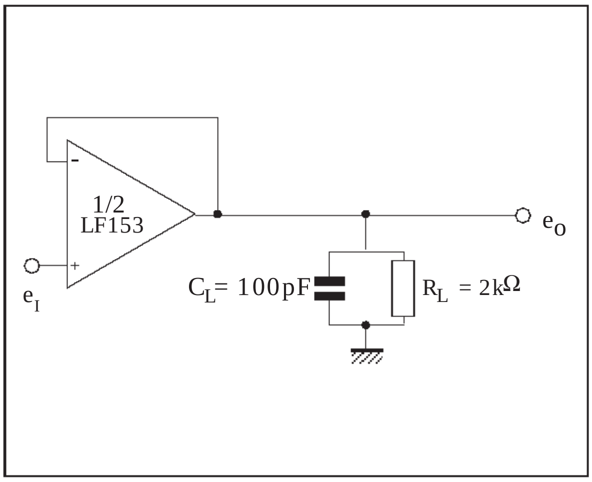
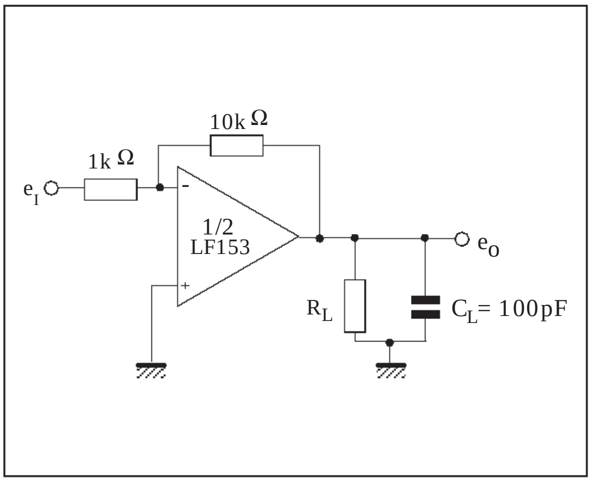
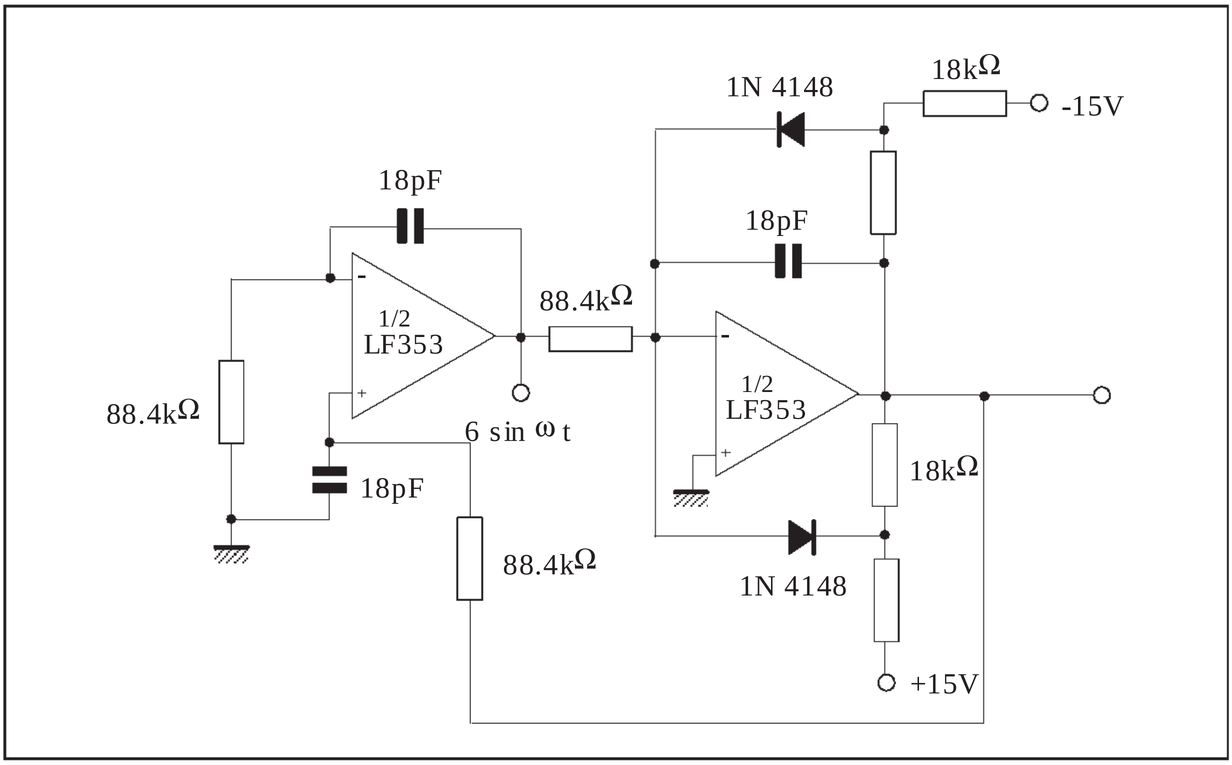



**Figure 2 :** Gain-of-10 Inverting Amplifier



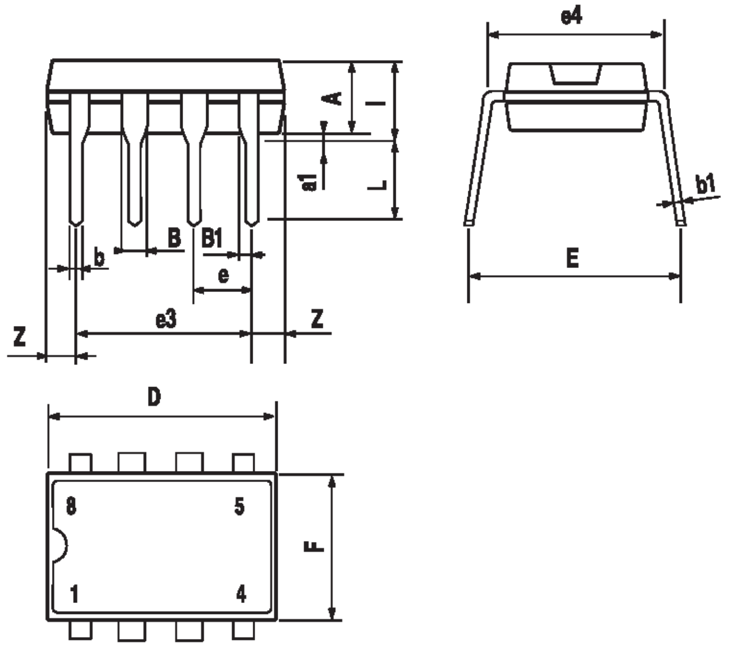

## TYPICAL APPLICATIONS

QUADRUPLE OSCILLATOR



## PACKAGE MECHANICAL DATA

8 PINS - PLASTIC DIP

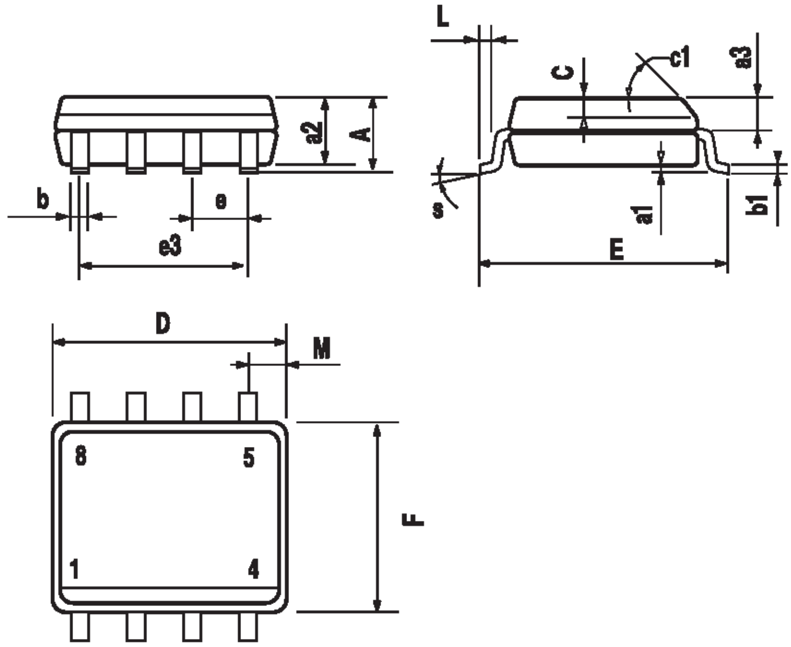



| Dimensions | Millimeters | | | Inches | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | 3.32 | | | 0.131 | |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.15 | | 1.65 | 0.045 | | 0.065 |
| b | 0.356 | | 0.55 | 0.014 | | 0.022 |
| b1 | 0.204 | | 0.304 | 0.008 | | 0.012 |
| D | | | 10.92 | | | 0.430 |
| E | 7.95 | | 9.75 | 0.313 | | 0.384 |
| e | | 2.54 | | | 0.100 | |
| e3 | | 7.62 | | | 0.300 | |
| e4 | | 7.62 | | | 0.300 | |
| F | | | 6.6 | | | 0260 |
| i | | | 5.08 | | | 0.200 |
| L | 3.18 | | 3.81 | 0.125 | | 0.150 |
| Z | | | 1.52 | | | 0.060 |

DIP8.TBL

## PACKAGE MECHANICAL DATA

8 PINS - PLASTIC MICROPACKAGE (SO)




PM-SO8.EPS

| Dimensions | Millimeters | | | Inches | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| a2 | | | 1.65 | | | 0.065 |
| a3 | 0.65 | | 0.85 | 0.026 | | 0.033 |
| b | 0.35 | | 0.48 | 0.014 | | 0.019 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | 0.25 | | 0.5 | 0.010 | | 0.020 |
| c1 | $45^o$ (typ.) | | | | | |
| D | 4.8 | | 5.0 | 0.189 | | 0.197 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 3.81 | | | 0.150 | |
| F | 3.8 | | 4.0 | 0.150 | | 0.157 |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 |
| M | | | 0.6 | | | 0.024 |
| S | $8^o$ (max.) | | | | | |

SO8.TBL



ORDER CODE :