## Description

The LM358 contains two independent high gain operational amplifiers with internal compensation.

The two op-amps operate over a wide voltage range from a single power supply.Also use a split power supply.

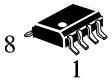
The device has low power supply voltage.The low power drain also makes the LM358 a good choice for battery operation.

When your project calls for a traditional op-amp function,now you can streanline your design with a simple any digital system or personal computer application,without requiring an extra 15V power supply just to have the interface electronics you need.

The LM358 is a versatile,rugged workhorse with a thousand-and-one use,from amplifying signals from a variety of transducers to dcgain blocks,,or any op-amp function.The attached pages offer some recipes rhat will have your project cooking in no time.

## Features

- Internally frequency compensated for unity gain
- Large DC voltage gain:100dB Wide power supply range: 3V ~ 32V (or ±1.5V ~ ±16V)
- Input common-mode voltage range includes ground
- Large output voltage swing:0V DC to Vcc-1,5V DC
- Power drain suitable for battery operation
- Differential inpit voltage range equal to the power supply
- Low input offset voltage and offset current

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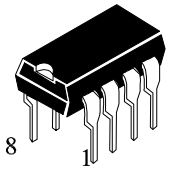


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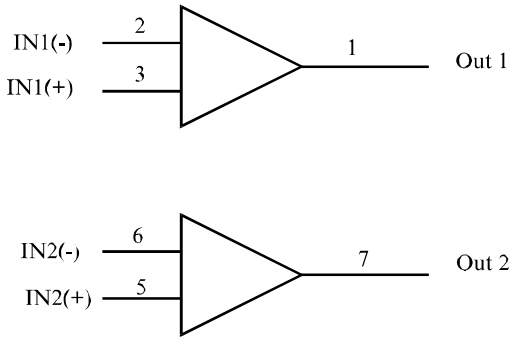
**Package**

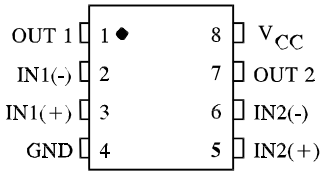
## Internal Block Digram

### Logic Diagram




PIN 4 = GND
PIN 8=V cc

### Pin Assinment




Aug. 2010

# Electrical Characteristics

at specified free-air temperature, Vcc = 5 V (unless otherwise noted)

| Symbol | Parameter | Test conditions* | | LM358 | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| $V_{IO}$ | Input offset voltage | Vcc = 5 V to MAX, $V_{IC} = V_{ICR}$ min, Vo=1.4 V | 25 °C | | 3 | 7 | mV |
| | | | Full range | | | 9 | |
| $\alpha V_{IO}$ | Average temperature coefficient of input offset voltage | | Full range | | 7 | | µV/°C |
| $I_{IO}$ | Input offset current | Vo=1.4 V | 25 °C | | 2 | 50 | nA |
| | | | Full range | | | 150 | |
| αIIO | Average temperature coefficient of input offset current | | Full range | | 10 | | pA/°C |
| $I_{IB}$ | Input bias current | Vo=1.4 V | 25 °C | | -20 | -250 | nA |
| | | | Full range | | | -500 | |
| $V_{ICR}$ | Common-mode input voltage range | Vcc = 5 V to MAX | 25° C | 0 to Vcc-1.5 | | | V |
| | | | Full range | 0 to Vcc - 2 | | | |
| $V_{OH}$ | High-level output voltage | $R_L$ ≥2 kΩ | 25 °C | Vcc-1.5 | | | V |
| | | Vcc = MAX, $R_L$=2 kΩ | Full range | 26 | | | |
| | | Vcc = MAX, $R_L$ ≥ 10 kΩ | Full range | 27 | 28 | | |
| | $V_{OL}$ Low-level output voltage | $R_L$ ≥ 10 kΩ | Full range | | 5 | 20 | mV |
| $A_{VD}$ | Large-signal differential voltage amplification | Vcc = 15 V, Vo=1V to 11 V, $R_L$ ≥ 2 kΩ | 25 °C | 25 | 100 | | V/mV |
| | | | Full range | 15 | | | |
| CMRR | Common-mode rejection ratio | Vcc = 5 V to MAX, $V_{IC} = V_{ICR}$ min | 25 °C | 65 | 80 | | dB |
| $k_{SVR}$ | Supply voltage rejection ratio ($\Delta Vcc/\Delta V_{IO}$) | Vcc = 5 V to MAX | 25 °C | 65 | 100 | | dB |
| Vo1 /Vo2 | Crosstalk attenuation | f=1 kHz to 20 kHz | 25 °C | | 120 | | dB |
| Io | Output current | Vcc = 15 V, $V_{ID}$=1 V, $V_O$= 0 | 25 °C | -20 | -30 | | mA |
| | | | Full range | -10 | | | |
| | | Vcc = 15 V, $V_{ID}$ = - 1 V, Vo = 15 V | 25 °C | 10 | 20 | | |
| | | | Full range | 5 | | | |
| | | $V_{ID}$ = - 1 V, Vo =200 mV | 25 °C | 12 | 30 | | µA |
| $I_{OS}$ | Short-circuit output current | Vcc at 5 V, GND at -5 V,Vo=0 | 25 °C | | ±40 | ±60 | mA |
| $I_{CC}$ | Supply current (two amplifiers) | Vo - 2.5 V, No load | Full range | | 0.7 | 1.2 | mA |
| | | Vcc = MAX, Vo = 0.5Vcc, No load | Full range | | 1 | 2 | |

- All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. “MAX” $V_{CC}$ for testing purposes is 30 V. Full range is 0 °C to 70 °C.

## Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CC}$ | Power Supply Voltages<br>Single Supply<br>Split Supplies | <br>32<br>±16 | V |
| $V_{IDR}$ | Input Differential Voltage Range (1) | ±32 | V |
| $V_{ICR}$ | Input Common Mode Voltage Range | -0.3 to 32 | V |
| $t_S$ | Short-Circuit duration of Output | 100 | ms |
| $I_{IN}$ | Input Current, per pin (2) | 50 | mA |
| $T_J$ | Junction Temperature<br>Plastic Packages | 150 | °C |
| Tstg | Storage Temperature ($T_A$= +25ºC)<br>Plastic Packages | -55 to +125 | °C |
| $T_L$ | Lead Temperature, 1mm from Case for 10 Seconds | 260 | °C |

Maximum Ratings are those values beyond which damage to the device may occur.
Functional operation should be restricted to the Recommended Operating Conditions.
Notes:

1. Split Power Supplies.
2. $V_{IN}$ <-0.3V. This input current will only exist when voltage at any of the input leads is driven negative.

# Typcal Peformance Characteristics

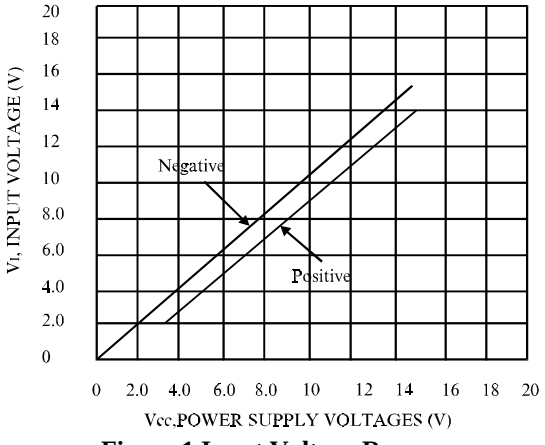



**Figure 1.Input Voltage Range**

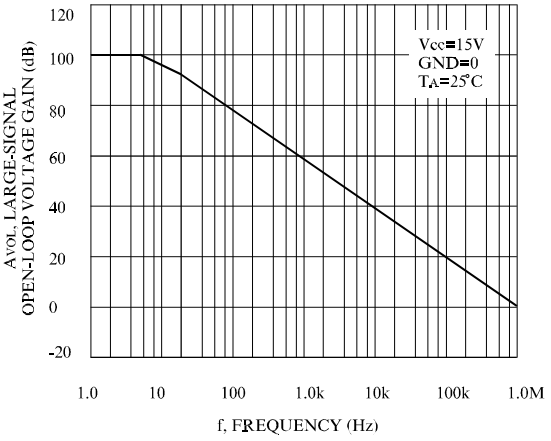



**Figure 2. Open-Loop Frequency**

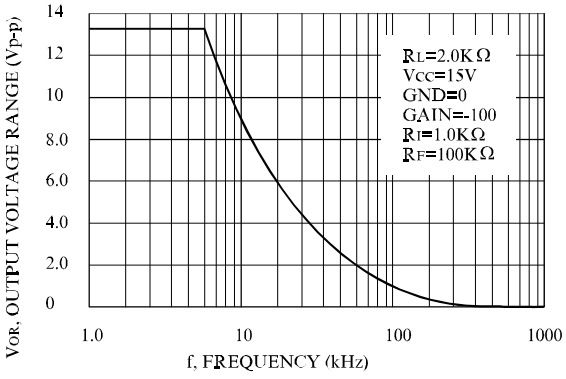



**Figure 3. Large-Signal Frequency Response**

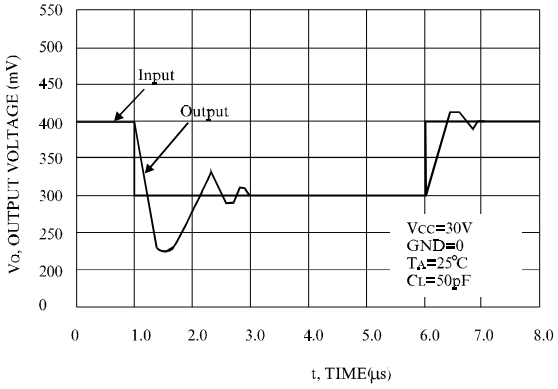



**Figure 4. Small-Signal Voltage Follower Pulse Response (Noninverting)**

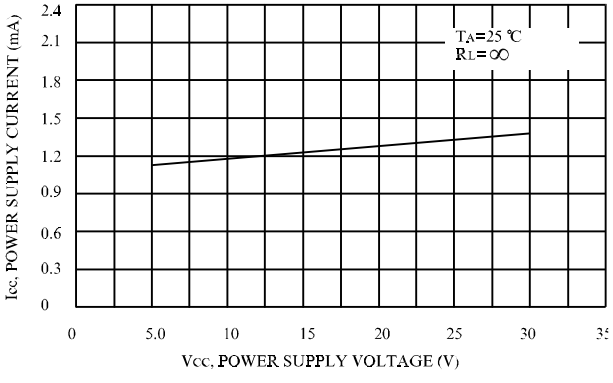



**Figure 5. Power Supply Current versus Powe r**

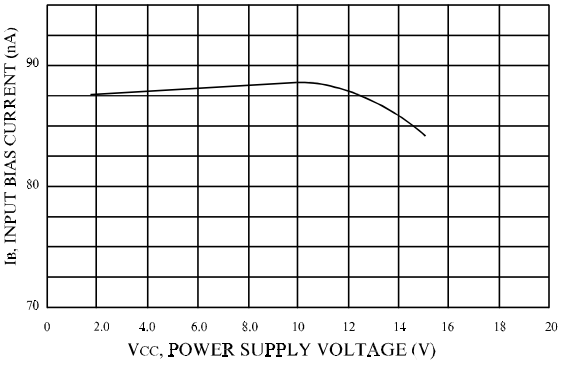



**Figure 6. Input Bias Current versus Power Supply Voltage**

## Ordering Information

| ORDERING NUMB | PACKAGE | MARKING |
|---|---|---|
| LM358 | DIP - 8 / SOP - 8 | LM358 |