

# LM118/218/318

## High-Speed Operational Amplifier

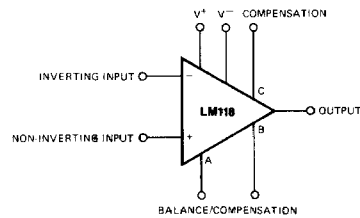
### Distinctive Characteristics

- The LM118/218/318 are functionally, electrically, and pin-for-pin equivalent to the National LM118/218/318
- Slew rate:  $70V/\mu s$
- Small signal bandwidth: 15MHz
- Internal frequency compensation
- Supply voltage range:  $\pm 5V$  to  $\pm 20V$
- Electrically tested and optically inspected dice for hybrid manufacturers.
- Available in metal can, hermetic dual-in-line, hermetic flat package or plastic minidip.

### FUNCTIONAL DESCRIPTION

The LM118/218/318 are internally compensated high-speed operational amplifiers featuring minimum slew rate of  $50V/\mu s$ , low input bias currents, large input voltage range and excellent performance over a wide range of supply voltages and temperature. They have provision for increased speeds when operating in the inverting mode.

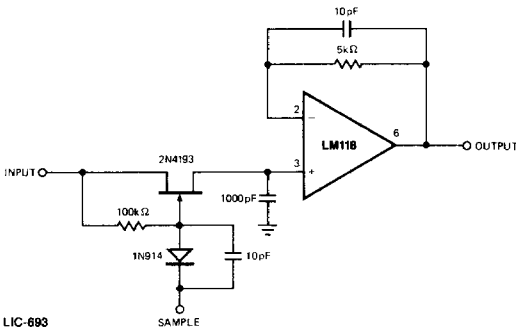
### FUNCTIONAL DIAGRAM



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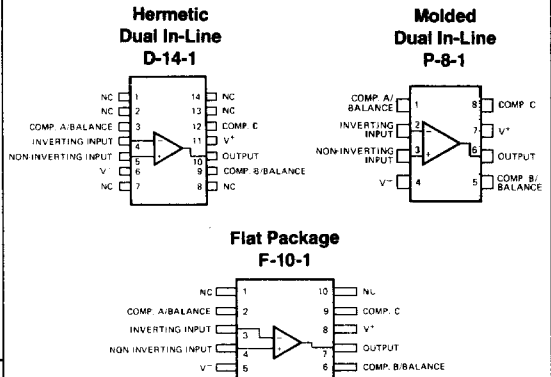
### TYPICAL APPLICATIONS

#### Fast Sample and Hold



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### CONNECTION DIAGRAMS – Top Views

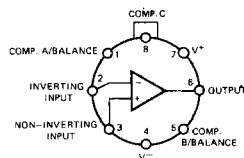


### ORDERING INFORMATION\*

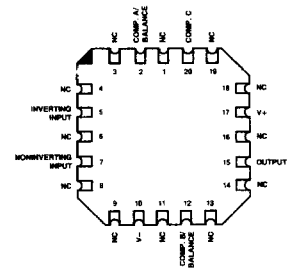
| Part Number | Package Type | Temperature Range | Order Number |
|-------------|--------------|-------------------|--------------|
| LM318       | Metal Can    | 0 to +70°C        | LM318H       |
|             | Hermetic DIP | 0 to +70°C        | LM318D       |
|             | Flat Package | 0 to +70°C        | LM318F       |
|             | Molded DIP   | 0 to +70°C        | LM318N       |
|             | Dice         | 0 to +70°C        | LD318        |
|             | Leadless     | 0 to +70°C        | LM318L       |
| LM218       | Metal Can    | -25 to +85°C      | LM218H       |
|             | Hermetic DIP | -25 to +85°C      | LM218D       |
|             | Flat Pak     | -25 to +85°C      | LM218F       |
|             | Molded DIP   | -25 to +85°C      | LM218N       |
|             | Leadless     | -25 to +85°C      | LM218L       |
| LM118       | Metal Can    | -55 to +125°C     | LM118H       |
|             | Hermetic DIP | -55 to +125°C     | LM118D       |
|             | Flat Package | -55 to +125°C     | LM118F       |
|             | Dice         | -55 to +125°C     | LD118        |
|             | Leadless     | -55 to +125°C     | LM118L       |

\*Also available with burn-in processing. To order add suffix B to part number.

### Metal Can H-8-1



### Leadless Chip-Pak L-20-1



Note: 1. On Metal Can, pin 4 is connected to case.

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**LM118/218/318**  
**MAXIMUM RATINGS**

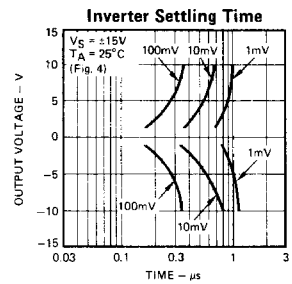
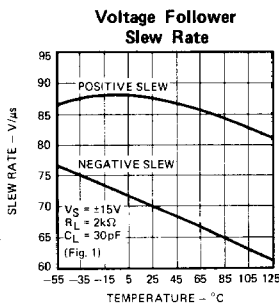
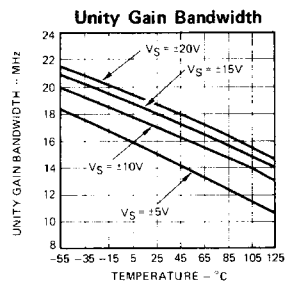
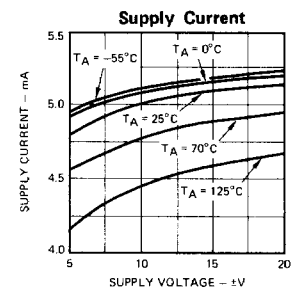
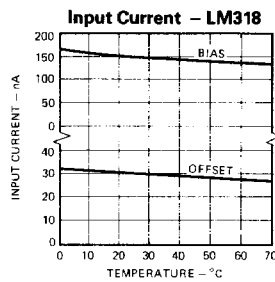
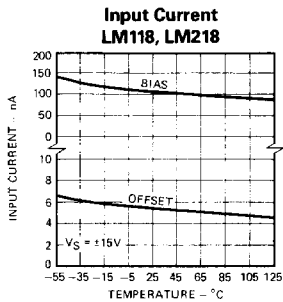
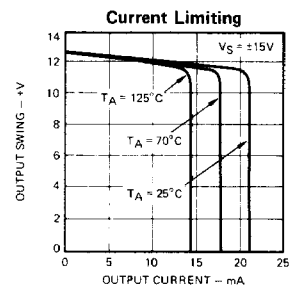
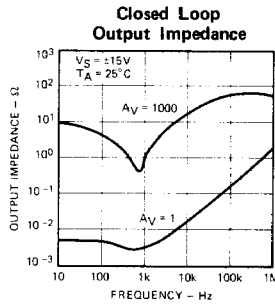
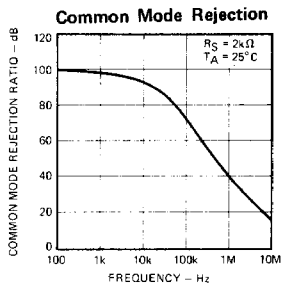
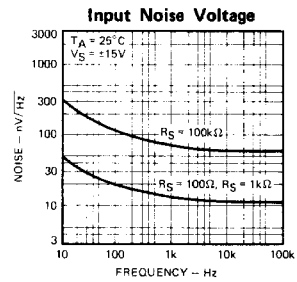
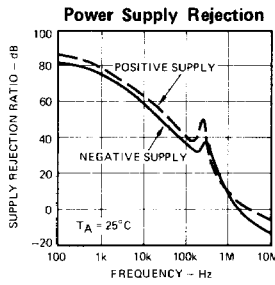
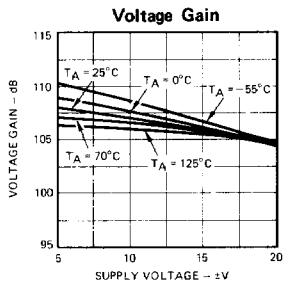
|                                       |                 |
|---------------------------------------|-----------------|
| Supply Voltage                        | ±20V            |
| Internal Power Dissipation (Note 1)   | 500mW           |
| Differential Input Voltage (Note 2)   | ±5V             |
| Input Voltage (Note 3)                | ±15V            |
| Output Short-Circuit Duration         | Indefinite      |
| Operating Temperature Range           |                 |
| LM118                                 | -55°C to +125°C |
| LM218                                 | -25°C to +85°C  |
| LM318                                 | 0°C to +70°C    |
| Storage Temperature Range             | -65°C to +150°C |
| Lead Temperature (Soldering, 60 sec.) | 300°C           |

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise specified) (Note 4)

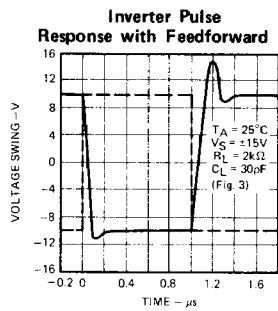
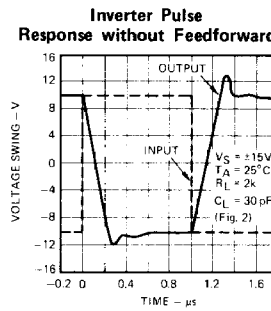
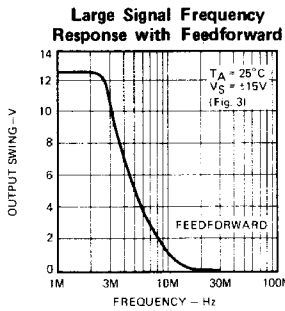
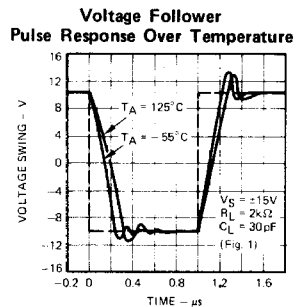
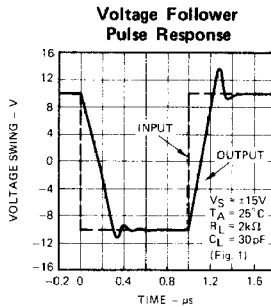
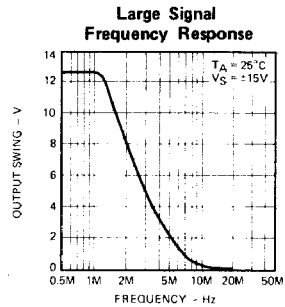
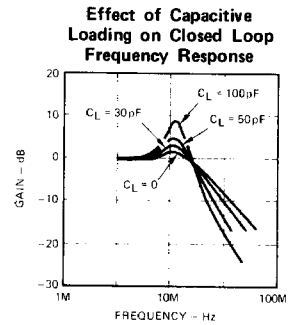
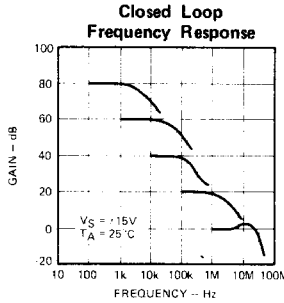
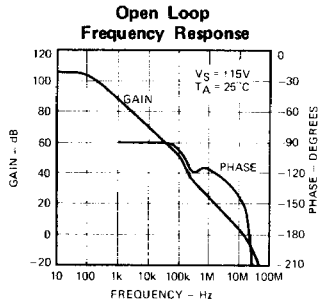
| Parameter<br>(see definitions)  | Conditions  | LM318 |      |      | LM218 |      |      | Units      |
|---|---|-------|------|------|-------|------|------|------------|
|   |   | Min.  | Typ. | Max. | Min.  | Typ. | Max. |            |
| Input Offset Voltage  | $R_S \leq 5k\Omega$   |       | 4    | 10   |       | 2    | 4    | mV         |
| Input Offset Current  |   |       | 30   | 200  |       | 6    | 50   | nA         |
| Input Bias Current  |   |       | 150  | 500  |       | 120  | 250  | nA         |
| Input Resistance  |   | 0.5   | 3    |      | 1.0   | 3    |      | M $\Omega$ |
| Supply Current  | $V_S = \pm 20V$   |       | 5    | 10   |       | 5    | 8    | mA         |
| Large Signal Voltage Gain   | $V_S = \pm 15V, V_{OUT} = \pm 10V$<br>$R_L \geq 2k\Omega$         | 25    | 200  |      | 50    | 200  |      | V/mV       |
| Slew Rate   | $A_V = +1, V_S = \pm 15V$ (Fig.1)<br>$R_L = 2k\Omega, C_L = 30pF$ | 50    | 70   |      | 50    | 70   |      | V/ $\mu$ s |
| Small Signal Bandwidth  | $V_S = \pm 15V$   |       | 15   |      |       | 15   |      | MHz        |
| <b>The Following Specifications Apply Over The Operating Temperature Ranges</b> |   |       |      |      |       |      |      |            |
| Input Offset Voltage  | $R_S \leq 5k\Omega$   |       |      | 15   |       |      | 6    | mV         |
| Input Offset Current  |   |       |      | 300  |       |      | 100  | nA         |
| Input Bias Current  |   |       |      | 750  |       |      | 500  | nA         |
| Large Signal Voltage Gain   | $V_S = \pm 15V, V_{OUT} = \pm 10V$<br>$R_L \geq 2k\Omega$         | 20    |      |      | 25    |      |      | V/mV       |
| Input Voltage Range   | $V_S = \pm 15V$   | ±11.5 |      |      | ±11.5 |      |      | V          |
| Common Mode Rejection Ratio   | $R_S \leq 5k\Omega$   | 70    |      |      | 80    |      |      | dB         |
| Supply Voltage Rejection Ratio  | $R_S \leq 5k\Omega$   | 65    |      |      | 70    |      |      | dB         |
| Output Voltage Swing  | $V_S = \pm 15V, R_L = 2k\Omega$                                   | ±12   | ±13  |      | ±12   | ±13  |      | V          |
| Supply Current  | $V_S = \pm 20V, T_A = 125^\circ\text{C}$                          |       |      |      |       |      | 7    | mA         |

- Notes: 1. Derate Metal Can package at 6.8 mW/ $^\circ\text{C}$  for operation at ambient temperatures above 75 $^\circ\text{C}$ , the Dual-In-Line package at 9 mW/ $^\circ\text{C}$  for operation at ambient temperatures above 95 $^\circ\text{C}$ , and the Flat Package at 5.4 mW/ $^\circ\text{C}$  for operation at ambient temperatures above 57 $^\circ\text{C}$ .
2. The inputs are shunted with diodes for overvoltage protection. To limit the current in the protection diodes, resistances of 2 k $\Omega$  or greater should be inserted in series with the input leads for differential input voltages greater than ±5 V.
3. For supply voltages less than ±15 V, the maximum input voltage is equal to the supply voltage.
4. Unless otherwise specified, these specifications apply for supply voltages from ±5 V to ±20 V.

PERFORMANCE CURVES



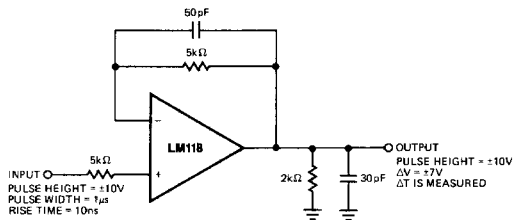
PERFORMANCE CURVES



The high gain and large bandwidth of the LM118 make it mandatory to observe the following precautions in using the device, as is the case with any high-frequency amplifier. Circuit layout should be arranged to keep all lead lengths as short as possible and the output separated from the inputs. The values of the feedback and source impedances should be kept small to reduce the effect of stray capacitance at the inputs. The power supplies must be bypassed to ground at the supply leads of the amplifier with low inductance capacitors. Capacitive loading must be kept to minimum, or the amplifier must be isolated as shown in the applications.

APPLICATIONS

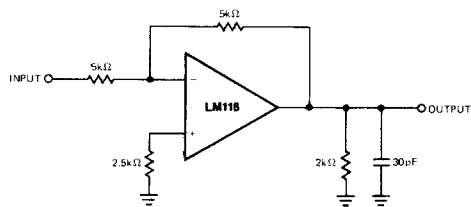
**Voltage Follower  
(Slew Rate Test Circuit)**



LIC-697

Figure 1

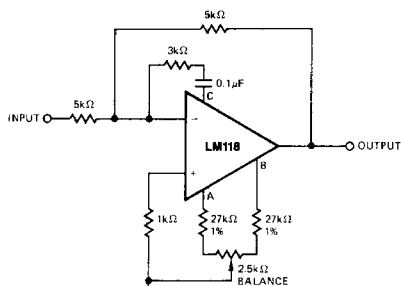
**Inverter**



LIC-698

Figure 2

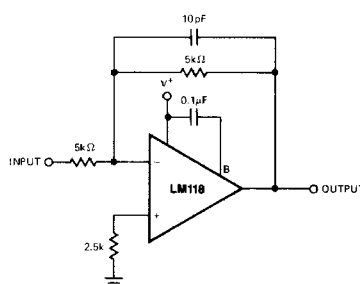
**Inverter with Feedforward  
Compensation for Higher Slew Rate**



LIC-699

Figure 3

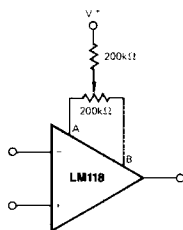
**Compensation for  
Minimum Settling Time**



LIC-700

Figure 4

**Offset Nulling**



LIC-701

Figure 5

**Isolating Large  
Capacitive Loads**

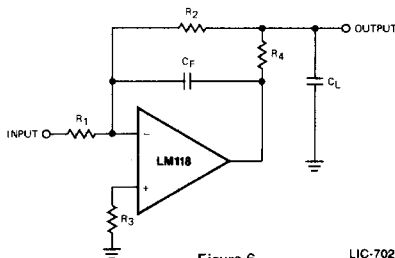
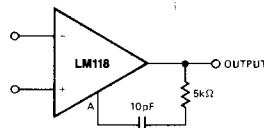


Figure 6

LIC-702

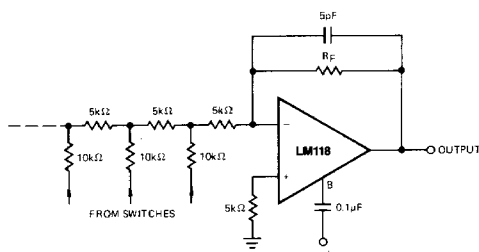
**Over Compensation**



LIC-703

Figure 7

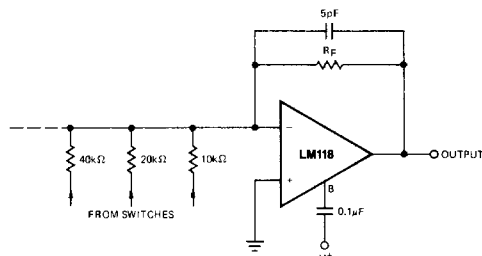
**D/A Converter  
with Ladder Network**



LIC-704

Figure 8

**D/A Converter  
with Binary Network**



LIC-705



ADDITIONAL APPLICATIONS

High Speed Summing Amplifier with Low Input Bias Currents

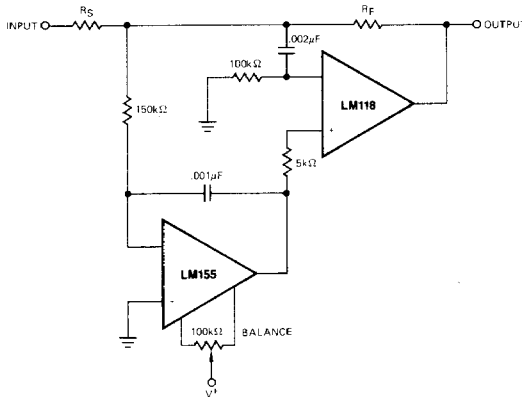


Figure 10

LIC-706

Wien Bridge Oscillator

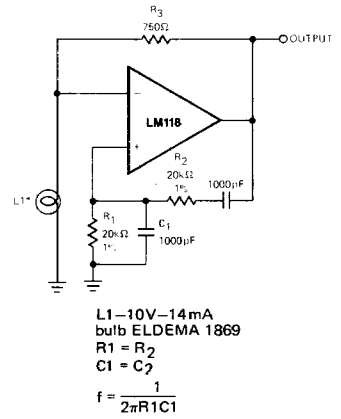
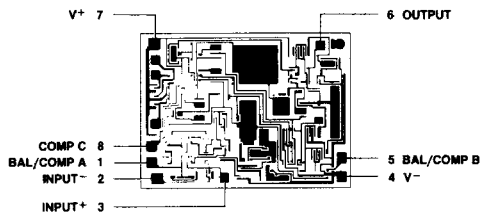


Figure 11

LIC-707

Metalization and Pad Layout



DIE SIZE: 0.065" X 0.087"