

LM102/LM302 Voltage Followers

General Description

The LM102 series are high-gain operational amplifiers designed specifically for unity-gain voltage follower applications. Built on a single silicon chip, the devices incorporate advanced processing techniques to obtain very low input current and high input impedance. Further, the input transistors are operated at zero collector-base voltage to virtually eliminate high temperature leakage currents. It can therefore be operated in a temperature stabilized component oven to get extremely low input currents and low offset voltage drift.

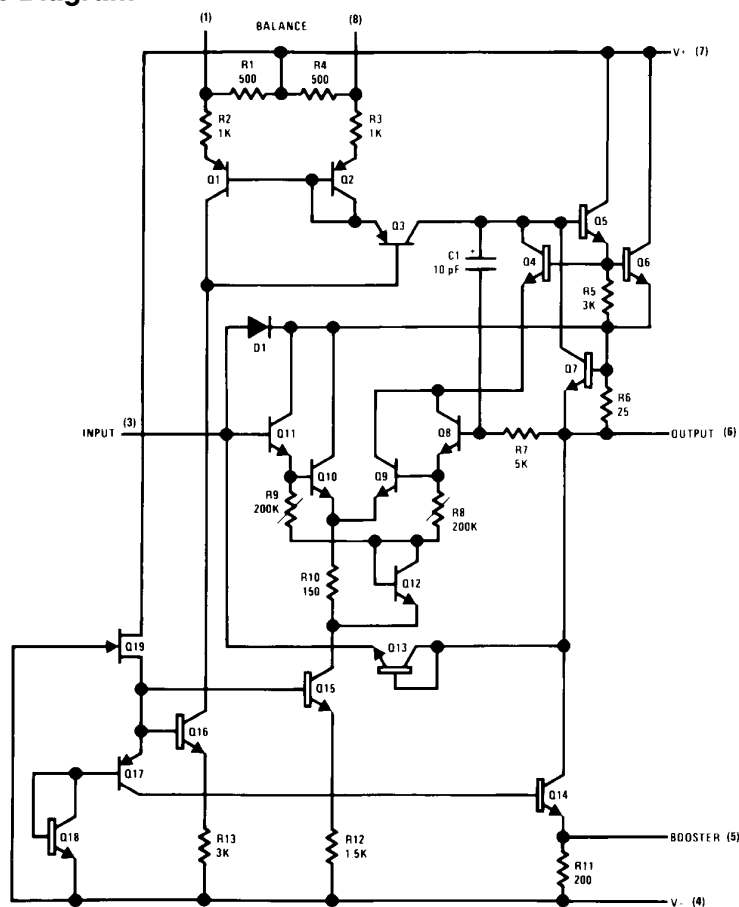
The LM102, which is designed to operate with supply voltages between $\pm 12\text{V}$ and $\pm 15\text{V}$, also features low input capacitance as well as excellent small signal and large signal frequency response—all of which minimize high fre-

quency gain error. Because of the low wiring capacitances inherent in monolithic construction, this fast operation can be realized without increasing power consumption.

Features

- Fast slewing — $10\text{V}/\mu\text{s}$
- Low input current — 10 nA (max)
- High input resistance — $10,000\text{ M}\Omega$
- No external frequency compensation required
- Simple offset balancing with optional $1\text{ k}\Omega$ potentiometer
- Plug-in replacement for both the LM101 and LM709 in voltage follower applications

Schematic Diagram



Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications. (Note 6)

Supply Voltage	$\pm 18V$
Power Dissipation (Note 1)	500 mW
Input Voltage (Note 2)	$\pm 15V$
Output Short Circuit Duration (Note 3)	Indefinite

Operating Free Air Temperature Range

LM102 -55°C to $+125^{\circ}\text{C}$

LM302 0°C to $+70^{\circ}\text{C}$

Storage Temperature Range -65°C to $+150^{\circ}\text{C}$

Lead Temperature (Soldering, 10 sec.) 300°C

ESD rating to be determined.

Electrical Characteristics (Note 4)

Parameter	Conditions	LM102			LM302			Units
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	$T_A = 25^{\circ}\text{C}$		2	5		5	15	mV
Input Bias Current	$T_A = 25^{\circ}\text{C}$		3	10		10	30	nA
Input Resistance	$T_A = 25^{\circ}\text{C}$	10^{10}	10^{12}		10^9	10^{12}		Ω
Input Capacitance				3.0		3.0		pF
Large Signal Voltage Gain	$T_A = 25^{\circ}\text{C}$, $V_S = \pm 15V$, $V_{OUT} = \pm 10V$, $R_L = 8\text{ k}\Omega$	0.999	0.9996		0.9985	0.9995	1.0	V/V
Output Resistance	$T_A = 25^{\circ}\text{C}$		0.8	2.5		0.8	2.5	Ω
Supply Current	$T_A = 25^{\circ}\text{C}$		3.5	5.5		3.5	5.5	mA
Input Offset Voltage				7.5			20	mV
Offset Voltage Temperature Drift			6			20		$\mu\text{V}/^{\circ}\text{C}$
Input Bias Current	$T_A = T_{A\text{MAX}}$ $T_A = T_{A\text{MIN}}$		3 30	10 100		3.0 20	15 50	nA nA
Large Signal Voltage Gain	$V_S = \pm 15V$, $V_{OUT} = \pm 10V$, $R_L = 10\text{ k}\Omega$	0.999						
Output Voltage Swing	$V_S = \pm 15V$, $R_L = 10\text{ k}\Omega$ (Note 5)	± 10			± 10			V
Supply Current	$T_A = 125^{\circ}\text{C}$		2.6	4.0				mA
Supply Voltage Rejection Ratio	$\pm 12V \leq V_S \leq \pm 15V$	60			60			dB

Note 1: The maximum junction temperature of the LM102 is 150°C , while that of the LM302 is 85°C . For operating at elevated temperatures, devices in the H08 package must be derated based on a thermal resistance of $150^{\circ}\text{C}/\text{W}$, junction to ambient, or $20^{\circ}\text{C}/\text{W}$, junction to case.

Note 2: For supply voltages less than $\pm 15V$, the absolute maximum input voltage is equal to the supply voltage.

Note 3: It is necessary to insert a resistor (at least $5\text{ k}\Omega$ and preferably $10\text{ k}\Omega$) in series with the input pin when the amplifier is driven from low impedance sources to prevent damage when the output is shorted and to ensure stability.

Note 4: These specifications apply for $\pm 12V \leq V_S \leq \pm 15V$ and $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$ for the LM102 and $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$ for the LM302 unless otherwise specified.

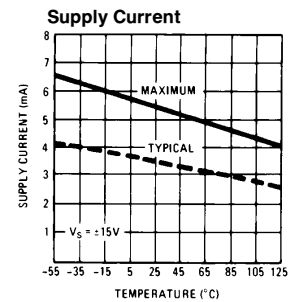
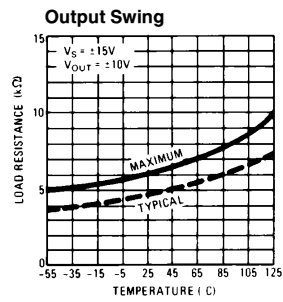
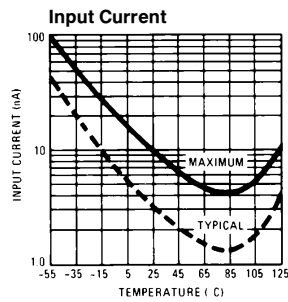
Note 5: Increased output swing under load can be obtained by connecting an external resistor between the booster and V^- terminals. See curve.

Note 6: Refer to RETS102X for the LM102H military specifications.

APPLICATION HINT

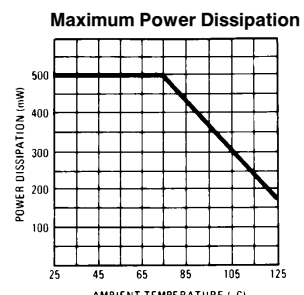
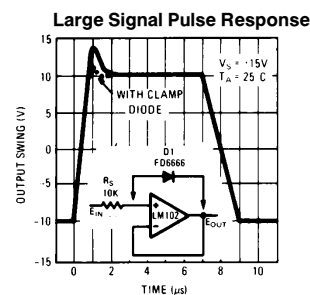
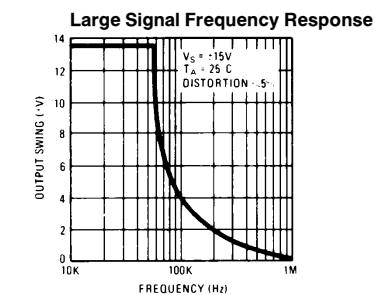
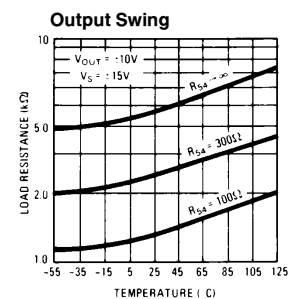
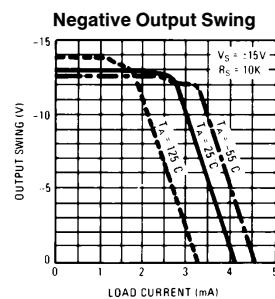
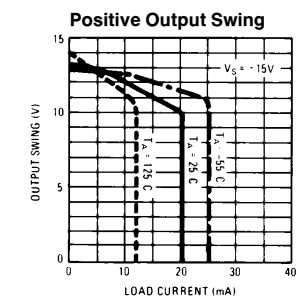
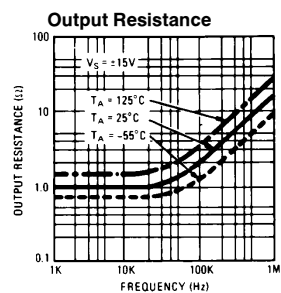
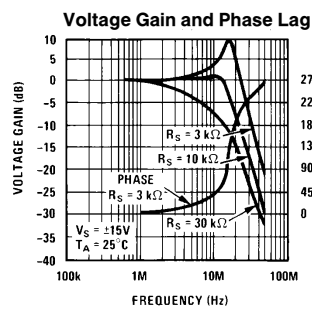
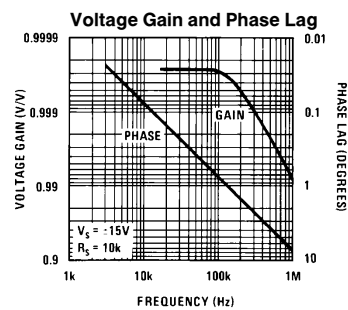
The input must be driven from a source impedance of typically $10\text{ k}\Omega$ ($5\text{ k}\Omega$ Min) to maintain stability. The total source impedance will be reduced at high frequencies if there is stray capacitance at the input pin. In these cases, a $10\text{ k}\Omega$ resistor should be inserted in series with the input, physically close to the input pin to minimize the stray capacitance and prevent oscillation.

Guaranteed Performance Characteristics LM102



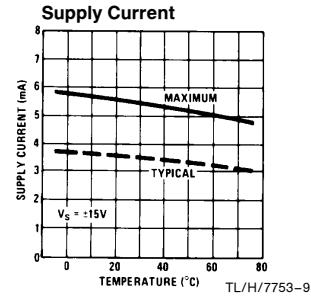
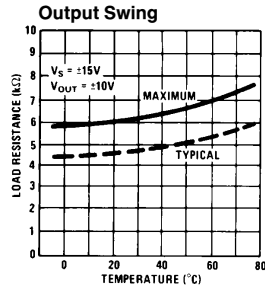
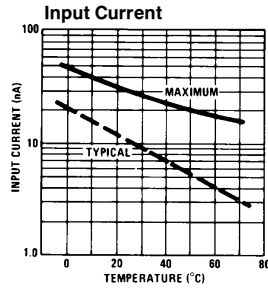
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Typical Performance Characteristics LM102

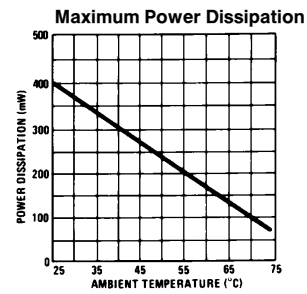
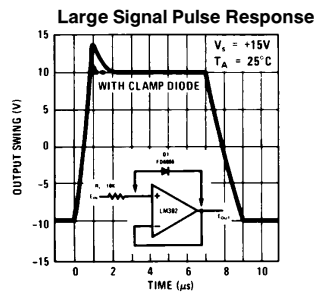
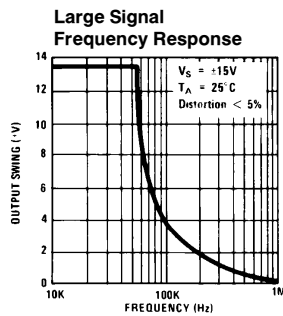
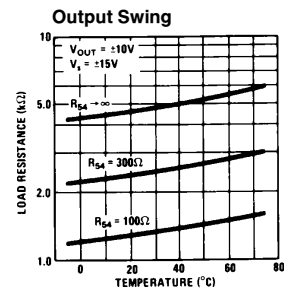
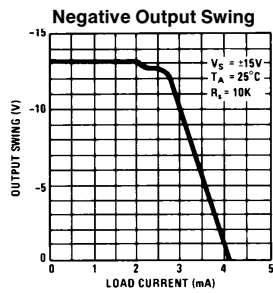
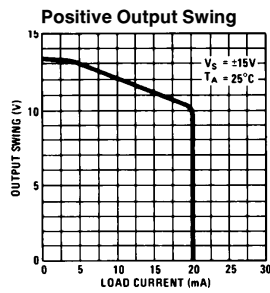
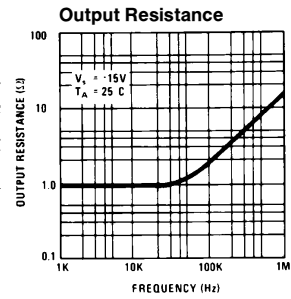
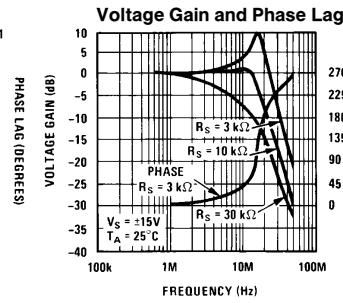
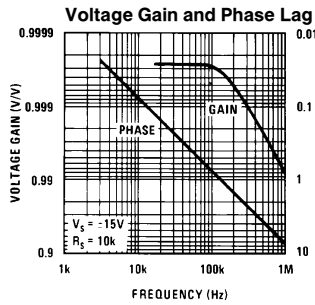


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Guaranteed Performance Characteristics LM302

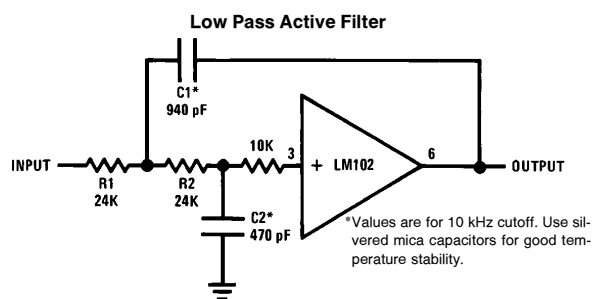


Typical Performance Characteristics LM302

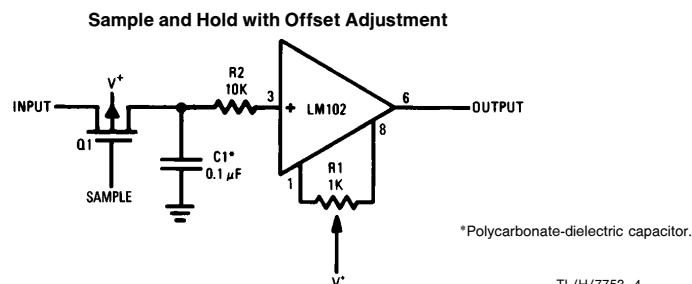


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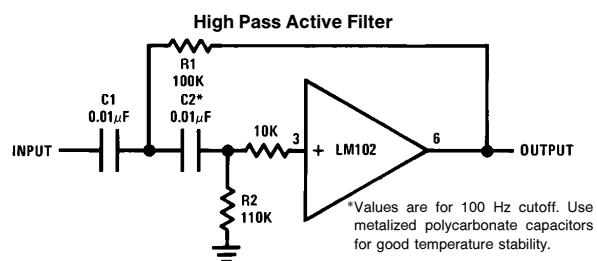
Typical Applications



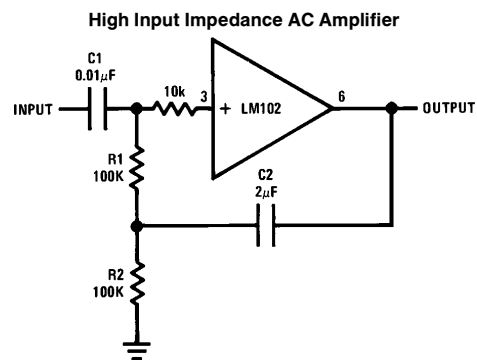
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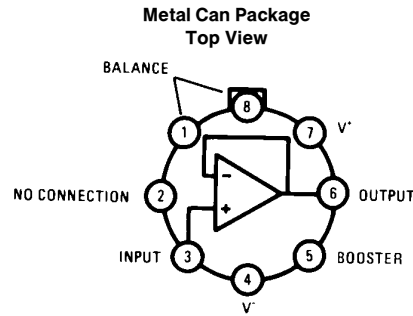


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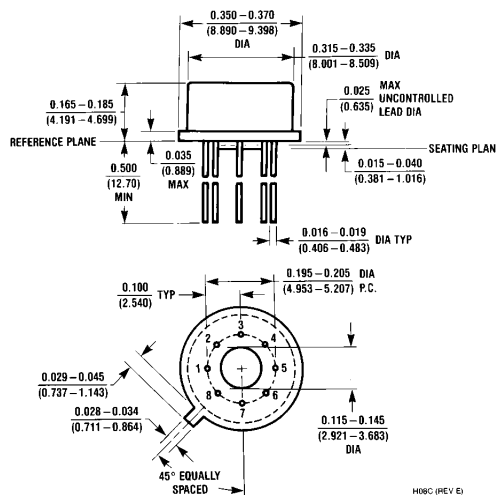
Connection Diagram



TL/H/7753-2

Order Number LM102H/883
See NS Package Number H08C

Physical Dimensions inches (millimeters)



Metal Can Package (H)
Order Number LM102H/883
NS Package Number H08C

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