CIRCUIT TYPES SN52741, SN72741
HIGH-PERFORMANCE OPERATIONAL AMPLIFIERS

- Short-Circuit Protection
- Offset-Voltage Null Capability
- Large Common-Mode and Differential Voltage Ranges
- No Frequency Compensation Required
- Low Power Consumption
- No Latch-up
- Same Pin Assignments as SN52709/SN72709

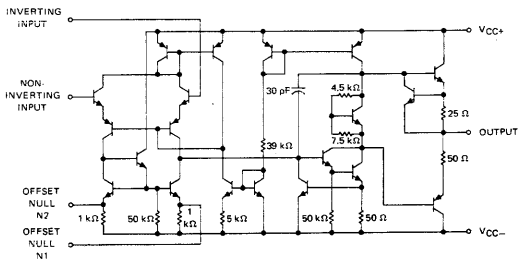
description

The SN52741 and SN72741 are high-performance operational amplifiers, featuring offset-voltage null capability.

The high common-mode input voltage range and the absence of latch-up make the amplifier ideal for voltage-follower applications. The devices are short-circuit protected and the internal frequency compensation ensures stability without external components. A low-value potentiometer may be connected between the offset null inputs to null out the offset voltage as shown in Figure 11.

The SN52741 is characterized for operation over the full military temperature range of −55°C to 125°C; the SN72741 is characterized for operation from 0°C to 70°C.

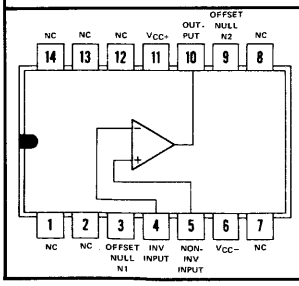
schematic



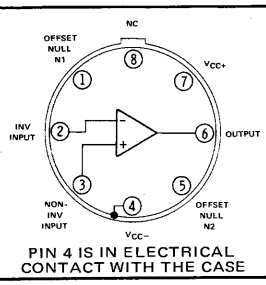
COMPONENT VALUES SHOWN ARE NOMINAL

terminal assignments

J OR N DUAL-IN-LINE PACKAGE (TOP VIEW)

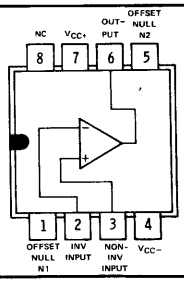


L PLUG-IN PACKAGE (TOP VIEW)

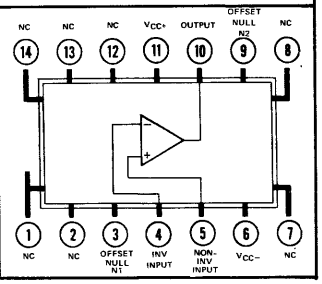


PIN 4 IS IN ELECTRICAL CONTACT WITH THE CASE

P DUAL-IN-LINE PACKAGE (TOP VIEW)



Z FLAT PACKAGE (TOP VIEW)



NC—No internal connection

1170

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

		SN52741	SN72741	UNIT
Supply voltage V_{CC+} (see Note 1)		22	18	V
Supply voltage V_{CC-} (see Note 1)		−22	−18	V
Differential input voltage (see Note 2)		±30	±30	V
Input voltage (either input, see Notes 1 and 3)		±15	±15	V
Voltage between either offset null terminal (N1/N2) and V_{CC-}		±0.5	±0.5	V
Duration of output short-circuit (see Note 4)		unlimited	unlimited	
Continuous total power dissipation at (or below) 55°C free-air temperature (see Note 5)		500	500	mW
Operating free-air temperature range		−55 to 125	0 to 70	°C
Storage temperature range		−65 to 150	−65 to 150	°C
Lead temperature 1/16 inch from case for 60 seconds	J, L, or Z Package	300	300	°C
Lead temperature 1/16 inch from case for 10 seconds	N or P Package	260	260	°C

NOTES: 1. All voltage values, unless otherwise noted, 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 noninverting 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 either power supply. For the SN52741 only, the unlimited duration of the short-circuit applies at (or below) 125°C case temperature or 75°C free-air temperature.
5. For operation above 55°C free-air temperature, refer to Dissipation Derating Curve, Figure 12.

3

electrical characteristics at specified free-air temperature, V_{CC+} = 15 V, V_{CC-} = −15 V

PARAMETER		TEST CONDITIONS†		SN52741			SN72741			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	$R_S \leq 10$ kΩ	25°C		1	5		1	6	mV
			Full range			6			7.5	
$\Delta V_{IO(adj)}$	Offset voltage adjust range		25°C		±15			±15		mV
I_{IO}	Input offset current		25°C		20	200		20	200	nA
			Full range			500			300	
I_{IB}	Input bias current		25°C		80	500		80	500	nA
			Full range			1500			800	
V_I	Input voltage range		25°C	±12	±13		±12	±13		V
			Full range	±12			±12			
V_{OPP}	Maximum peak-to-peak output voltage swing	R_L = 10 kΩ	25°C	24	28		24	28		V
		$R_L \geq$ 10 kΩ	Full range	24			24			
		R_L = 2 kΩ	25°C	20	26		20	26		
		$R_L \geq$ 2 kΩ	Full range	20			20			
A_{VD}	Large-signal differential voltage amplification	$R_L \geq$ 2 kΩ, V_O = ±10 V	25°C	50,000	200,000		20,000	200,000		
			Full range	25,000			15,000			
r_i	Input resistance		25°C	0.3	2		0.3	2		MΩ
r_o	Output resistance	V_O = 0 V, See Note 5	25°C		75			75		Ω
C_i	Input capacitance		25°C		1.4			1.4		pF
CMRR	Common-mode rejection ratio	$R_S \leq 10$ kΩ	25°C	70	90		70	90		dB
			Full range	70			70			
$\Delta V_{IO}/\Delta V_{CC}$	Power supply sensitivity	$R_S \leq 10$ kΩ	25°C		30	150		30	150	μV/V
			Full range			150			150	
I_{OS}	Short-circuit output current		25°C		±25	±40		±25	±40	mA
I_{CC}	Supply current	No load, No signal	25°C		1.7	2.8		1.7	2.8	mA
			Full range			3.3			3.3	
P_D	Total power dissipation	No load, No signal	25°C		50	85		50	85	mW
			Full range			100			100	

†All characteristics are specified under open-loop operation. Full range for SN52741 is −55°C to 125°C and for SN72741 is 0°C to 70°C.
NOTE 5: This typical value applies only at frequencies above a few hundred hertz because of the effects of drift and thermal feedback.

operating characteristics, V_{CC+} = 15 V, V_{CC-} = −15 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	SN52741			SN72741			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
t_r	Rise time	V_I = 20 mV, R_L = 2 kΩ,		0.3			0.3		μs
	Overshoot	C_L = 100 pF, See Figure 1		5%			5%		
SR	Slew rate at unity gain	V_I = 10 V, R_L = 2 kΩ, C_L = 100 pF, See Figure 1		0.5			0.5		V/μs

DEFINITION OF TERMS

Input Offset Voltage (V_{IO}) The d-c voltage which must be applied between the input terminals to force the quiescent d-c output voltage to zero. The input offset voltage may also be defined for the case where two equal resistances (R_S) are inserted in series with the input leads.

Input Offset Current (I_{IO}) The difference between the currents into the two input terminals with the output at zero volts.

3

Input Bias Current (I_{IB}) The average of the currents into the two input terminals with the output at zero volts.

Input Voltage Range (V_I) The range of voltage which, if exceeded at either input terminal, will cause the amplifier to cease functioning properly.

Maximum Peak-to-Peak Output Voltage Swing (V_{OPP}) The maximum peak-to-peak output voltage which can be obtained without waveform clipping when the quiescent d-c output voltage is zero.

Large-Signal Differential Voltage Amplification (A_{VD}) The ratio of the peak-to-peak output voltage swing to the change in differential input voltage required to drive the output.

Input Resistance (r_i) The resistance between the input terminals with either input grounded.

Output Resistance (r_o) The resistance between the output terminal and ground.

Input Capacitance (C_i) The capacitance between the input terminals with either input grounded.

Common-Mode Rejection Ratio (CMRR) The ratio of differential voltage amplification to common-mode voltage amplification. This is measured by determining the ratio of a change in input common-mode voltage to the resulting change in input offset voltage.

Power Supply Sensitivity ($\Delta V_{IO}/\Delta V_{CC}$) The ratio of the change in input offset voltage to the change in supply voltages producing it. For these devices, both supply voltages are varied symmetrically.

Short-Circuit Output Current (I_{OS}) The maximum output current available from the amplifier with the output shorted to ground or to either supply.

Total Power Dissipation (P_D) The total d-c power supplied to the device less any power delivered from the device to a load. At no load: $P_D = V_{CC+} \cdot I_{CC+} + V_{CC-} \cdot I_{CC-}$.

Rise Time (t_r) The time required for an output voltage step to change from 10% to 90% of its final value.

Overshoot The quotient of: (1) the largest deviation of the output signal value from its steady-state value after a step-function change of the input signal, and (2) the difference between the output signal values in the steady state before and after the step-function change of the input signal.

Slew Rate (SR) The average time rate of change of the closed-loop amplifier output voltage for a step-signal input. Slew rate is measured between specified output levels (0 and 10 volts for this device) with feedback adjusted for unity gain.

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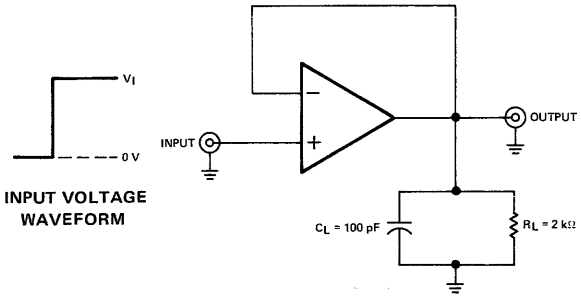
PARAMETER MEASUREMENT INFORMATION



INPUT VOLTAGE WAVEFORM

TEST CIRCUIT

FIGURE 1–RISE TIME, OVERSHOOT, AND SLEW RATE

TYPICAL CHARACTERISTICS

INPUT OFFSET CURRENT
vs
FREE-AIR TEMPERATURE

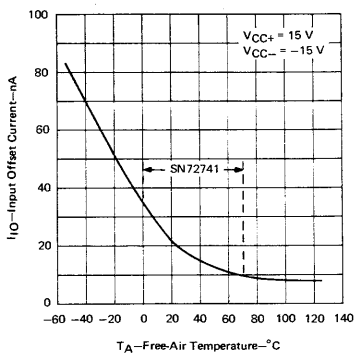


FIGURE 2

INPUT BIAS CURRENT
vs
FREE-AIR TEMPERATURE

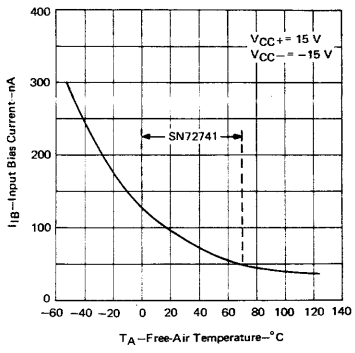


FIGURE 3

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE
vs
LOAD RESISTANCE

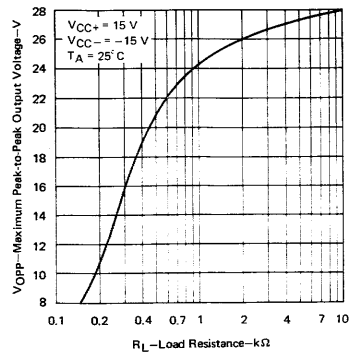


FIGURE 4

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE
vs
FREQUENCY

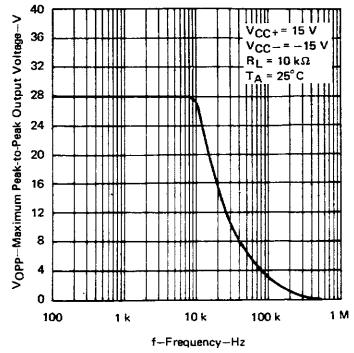


FIGURE 5

TYPICAL CHARACTERISTICS

OPEN-LOOP LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs SUPPLY VOLTAGE

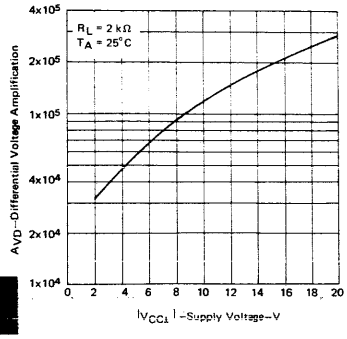


FIGURE 6

COMMON-MODE REJECTION RATIO vs FREQUENCY

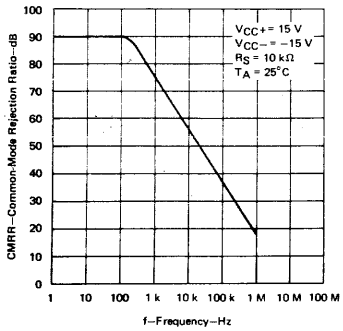


FIGURE 8

OPEN-LOOP LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREQUENCY

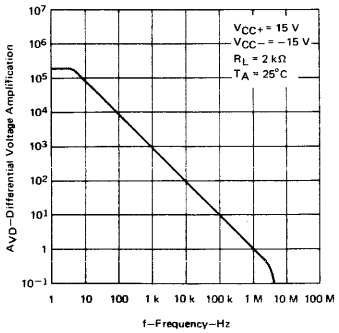


FIGURE 7

OUTPUT VOLTAGE vs ELAPSED TIME

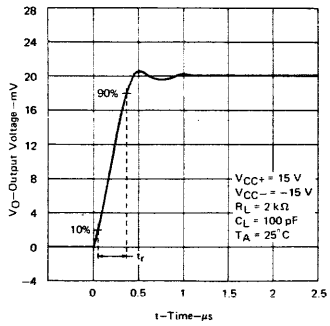


FIGURE 9

VOLTAGE-FOLLOWER LARGE-SIGNAL PULSE RESPONSE

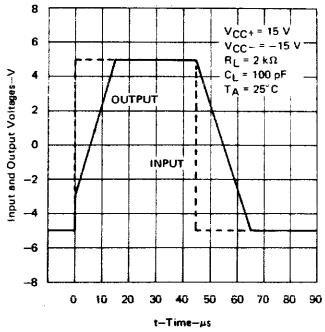


FIGURE 10

TYPICAL APPLICATION DATA

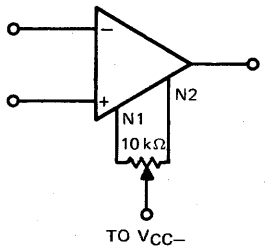
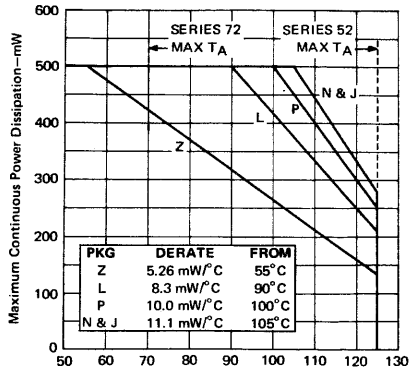


FIGURE 11–INPUT OFFSET VOLTAGE NULL CIRCUIT

THERMAL INFORMATION

DISSIPATION DERATING CURVE



PKG	DERATE	FROM
Z	5.26 mW/°C	55°C
L	8.3 mW/°C	90°C
P	10.0 mW/°C	100°C
N & J	11.1 mW/°C	105°C

FIGURE 12

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