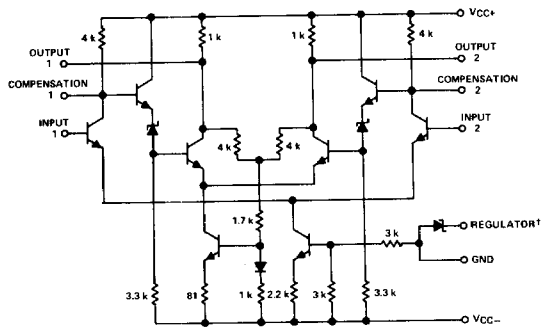
TYPES SN5511, SN7511
DIFFERENTIAL VIDEO AMPLIFIERS

BULLETIN NO. DL-S 7311433, JANUARY 1971—REVISED SEPTEMBER 1973

- Low Common-Mode Offset Voltage
- High Common-Mode Rejection Ratio
- High Gain-Bandwidth Product

schematic



Resistor values are nominal in ohms.

†Regulator terminal is used only with single supply. See description.

description

The SN5511 and SN7511 are wide-band amplifiers with differential inputs and outputs. High gain and low offset voltage permit use in applications requiring feedback. Frequency characteristics are such that a stable closed-loop configuration with 30-dB gain results in a 30-MHz bandwidth.

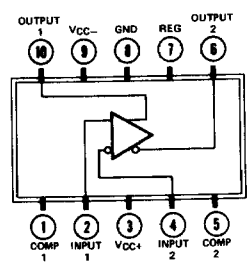
Accessibility to first-stage collectors makes offset balancing and frequency compensation possible with minimal effect on input and frequency characteristics.

The base of the first-stage current-source transistor is made available to permit operation from either a single 12-volt power supply or two 6-volt power supplies. For the latter, leave the regulator terminal open and connect the positive terminal of one supply to V_{CC+}, the negative terminal of the other supply to V_{CC-}, and the remaining terminals of the two supplies to the device ground terminal. For operation from a single 12-volt supply, connect the positive terminal of the supply to both the V_{CC+} and regulator terminals and connect the negative terminal to V_{CC-}. In either case, the device ground terminal is the reference for single-ended input and output voltages.

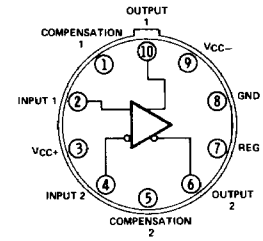
The wide bandwidth and high gain allow this amplifier to be used in a variety of applications where a stable differential video amplifier is required. Low common-mode offset voltage extends possible uses to comparators and direct-coupled amplifiers. The SN5511 is characterized for operation over the full military temperature range of −55°C to 125°C; the SN7511 is characterized for operation from 0°C to 70°C.

terminal assignments

FA
FLAT PACKAGE (TOP VIEW)

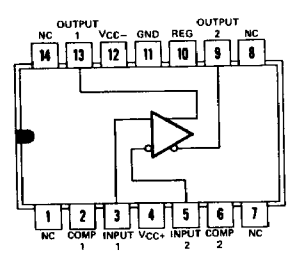


L
PLUG-IN PACKAGE (TOP VIEW)



ALL LEADS ARE ELECTRICALLY INSULATED FROM THE CASE

N
DUAL-IN-LINE PACKAGE (TOP VIEW)



NC — No internal connection

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 5012 • DALLAS, TEXAS 75222

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

Supply voltage V_{CC+} (see Note 1)	8 V
Supply voltage V_{CC-} (see Note 1)	−8 V
Input voltage, either input to ground	±6 V
Differential input voltage	±6 V
Continuous total power dissipation at (or below) 25°C free-air temperature (see Note 2)	500 mW
Operating free-air temperature range: SN5511 Circuits	−55°C to 125°C
SN7511 Circuits	0°C to 70°C
Storage temperature range	−65°C to 150°C
Lead temperature 1/16 inch from case for 60 seconds, FA or L package	300°C
Lead temperature 1/16 inch from case for 10 seconds, N package	260°C

NOTES: 1. All voltage values, unless otherwise specified, are with respect to the network ground terminal.
2. For operation above 25°C free-air temperature, refer to Dissipation Derating Curve, Figure 1.

electrical characteristics, V_{CC+} = 6 V, V_{CC-} = −6 V, T_A = 25°C (unless otherwise noted)

PARAMETER			TEST FIGURE	TEST CONDITIONS†	SN5511			SN7511			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
A_{VD}	Large-signal differential voltage amplification		1	f ≤ 1 kHz, No load		3000					
				f ≤ 1 kHz, R_L = 5 kΩ		1200			600		
A_{VS}	Large-signal single-ended voltage amplification		2	f ≤ 1 kHz, R_L = 5 kΩ	400	600		250	300		
BW	Bandwidth	−3 dB		R_S = 500 Ω, No load		3			3		MHz
		Unity gain				100			100		
V_{IO}	Input offset voltage					1	5		1	5	mV
α_{VIO}	Average temperature coefficient of input offset voltage			T_A = −55°C to 25°C		4					μV/°C
				T_A = 25°C to 125°C		2					
				T_A = 0°C to 25°C					4		
				T_A = 25°C to 70°C					2		
I_{IO}	Input offset current					0.6	7		0.6	10	μA
I_{IB}	Input bias current					10	15		15	20	μA
V_I	Input voltage range		3		+2.5 −2			±1			V
V_{OO}	Output offset voltage			No load		0.35			0.35		V
				R_L = 500 Ω		0.17			0.17		
V_{OPP}	Maximum peak-to-peak output voltage swing		2	f ≤ 1 kHz, R_L = 5 kΩ	2.5	5		1.5	3		V
				f ≤ 1 kHz, R_L = 500 Ω		3			2		
z_{id}	Differential input impedance			f = 1 kHz		5			5		kΩ
z_{os}	Single-ended output impedance			f = 1 kHz		800			800		Ω
CMRR	Common-mode rejection ratio		3	f ≤ 100 kHz, No load, See Note 3	59	95		52	90		dB
P_D	Total power dissipation			No load, No signal		180			180		mW

NOTE 3: For SN5511, V_{IC} = +2.5 V to −2 V; for SN7511, V_{IC} = + 1 V to −1 V.

†Unless otherwise specified, V_{IO} is applied and the regulator terminal is open.

7

DEFINITION OF TERMS

Large-Signal Differential Voltage Amplification (A_{VD}) The ratio of the change in voltage between the output terminals to the change in voltage between the input terminals producing it.

Large-Signal Single-Ended Voltage Amplification (A_{VS}) The ratio of the change in single-ended output voltage to the change in single-ended input voltage.

Input Offset Voltage (V_{IO}) The d-c voltage which must be applied between the input terminals to force the quiescent d-c differential output voltage to zero.

Average Temperature Coefficient of Input Offset Voltage (α_{VIO}) The ratio of the change in input offset voltage to the change in free-air temperature. This is an average value for the specified temperature range.

$$\alpha_{VIO} = \left| \frac{(V_{IO} @ T_{A(1)}) - (V_{IO} @ T_{A(2)})}{T_{A(1)} - T_{A(2)}} \right|$$ where $T_{A(1)}$ and $T_{A(2)}$ are the specified temperature extremes.

Input Offset Current (I_{IO}) The difference between the currents into the two input terminals with the inputs grounded.

Input Bias Current (I_{IB}) The average of the currents into the two input terminals with the inputs grounded.

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

Output Offset Voltage (V_{OO}) The difference between the d-c voltages at the two output terminals when the input terminals are grounded.

Maximum Peak-to-Peak Output Voltage Swing (V_{OPP}) The maximum peak-to-peak output voltage swing that can be obtained without clipping. This includes the unbalance caused by output offset voltage.

Differential Input Impedance (z_{id}) The small-signal impedance between the two input terminals.

Single-Ended Output Impedance (z_{os}) The small-signal impedance between one output terminal and ground.

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.

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; $P_D = V_{CC+} \cdot I_{CC+} + V_{CC-} \cdot I_{CC-}$.

THERMAL INFORMATION

DISSIPATION DERATING CURVE

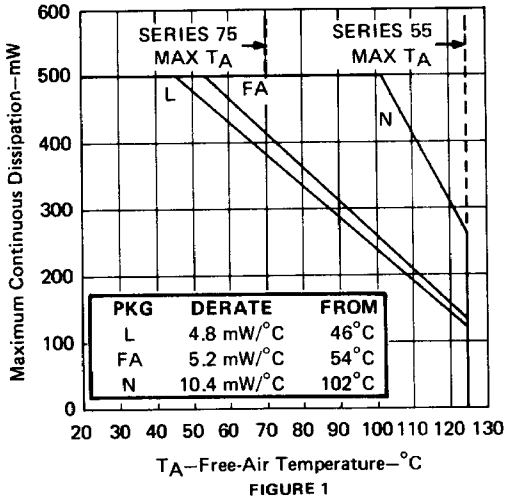


FIGURE 1

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 5012 • DALLAS, TEXAS 75222

PARAMETER MEASUREMENT INFORMATION

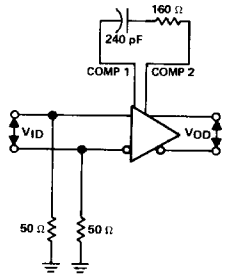


FIGURE 2 – A_{VD}

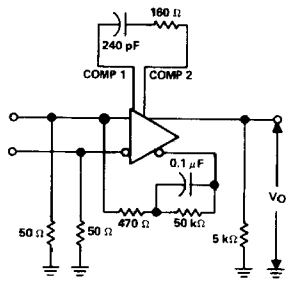


FIGURE 3 – A_{VS}, V_{OPP}

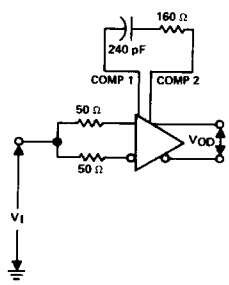


FIGURE 4 – V_I, CMRR

TYPICAL CHARACTERISTICS

SN5511
SINGLE-ENDED OPEN-LOOP VOLTAGE AMPLIFICATION
vs
FREQUENCY

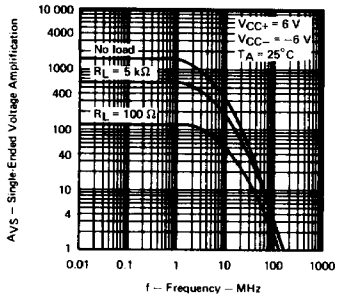


FIGURE 5

SN5511
SINGLE-ENDED OPEN-LOOP VOLTAGE AMPLIFICATION
vs
FREE-AIR TEMPERATURE

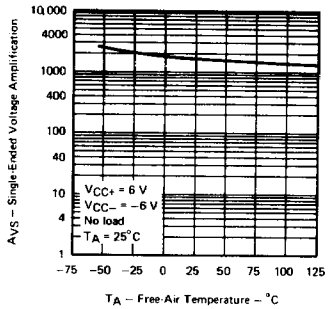


FIGURE 6

SN5511
SINGLE-ENDED OPEN-LOOP VOLTAGE AMPLIFICATION
vs
SUPPLY VOLTAGES

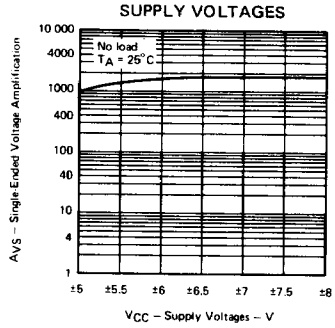


FIGURE 7

SN5511
INPUT BIAS CURRENT
vs
FREE-AIR TEMPERATURE

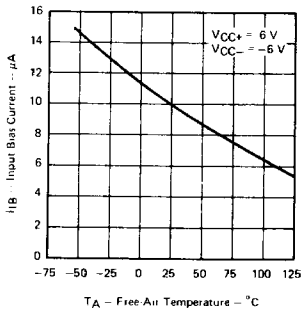


FIGURE 8

SN5511
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE (OPEN-LOOP)
vs
LOAD RESISTANCE

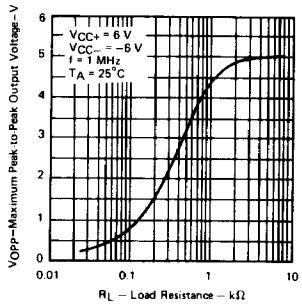


FIGURE 9

SN5511
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE (OPEN-LOOP)
vs
FREQUENCY

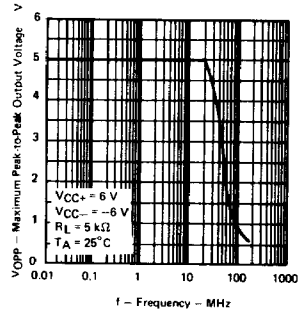


FIGURE 10

7

TYPICAL CHARACTERISTICS

SN5511
SINGLE-ENDED CLOSED-LOOP
VOLTAGE AMPLIFICATION
vs
FREQUENCY

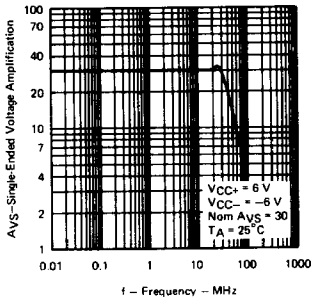
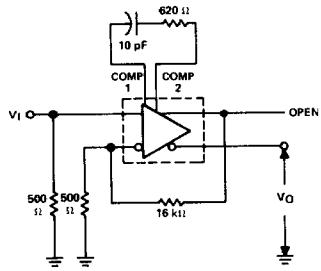


FIGURE 11

NOMINAL AMPLIFICATION OF 30



TEST CIRCUIT
FOR FIGURES 11 AND 12

SN5511
MAXIMUM PEAK-TO-PEAK
OUTPUT VOLTAGE (CLOSED-LOOP)
vs
FREQUENCY

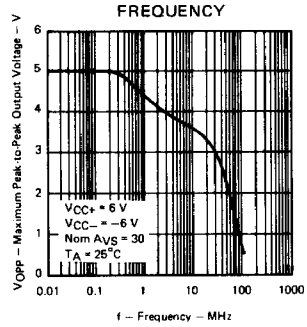


FIGURE 12

SN5511
SINGLE-ENDED CLOSED-LOOP
VOLTAGE AMPLIFICATION
vs
FREQUENCY

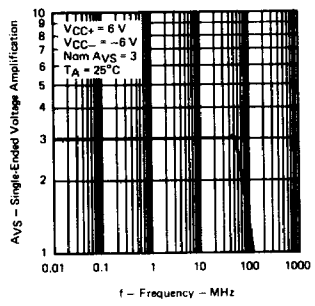
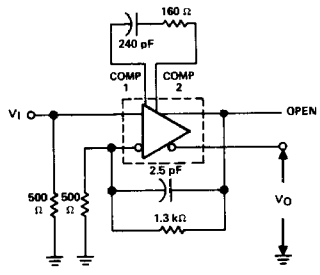


FIGURE 13

NOMINAL AMPLIFICATION OF 3



TEST CIRCUIT
FOR FIGURES 13 AND 14

SN5511
MAXIMUM PEAK-TO-PEAK
OUTPUT VOLTAGE (CLOSED-LOOP)
vs
FREQUENCY

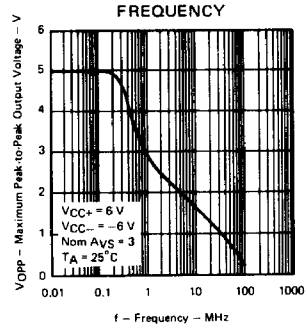


FIGURE 14

SN5511
SINGLE-ENDED CLOSED-LOOP
VOLTAGE AMPLIFICATION
vs
FREQUENCY

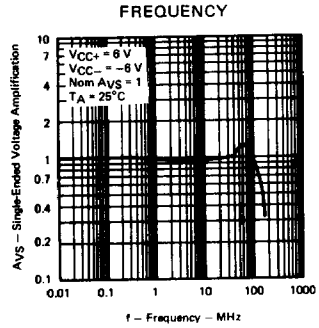
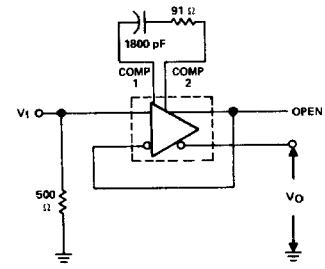


FIGURE 15

NOMINAL AMPLIFICATION OF 1



TEST CIRCUIT
FOR FIGURES 15 AND 16

SN5511
MAXIMUM PEAK-TO-PEAK
OUTPUT VOLTAGE (CLOSED-LOOP)
vs
FREQUENCY

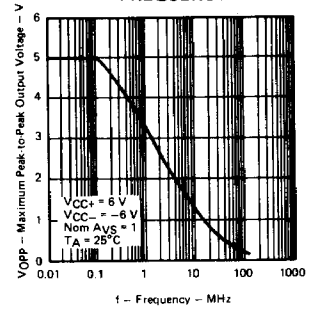


FIGURE 16

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 5012 • DALLAS, TEXAS 75222

TYPICAL CHARACTERISTICS

INPUT IMPEDANCE
vs
FREE-AIR TEMPERATURE

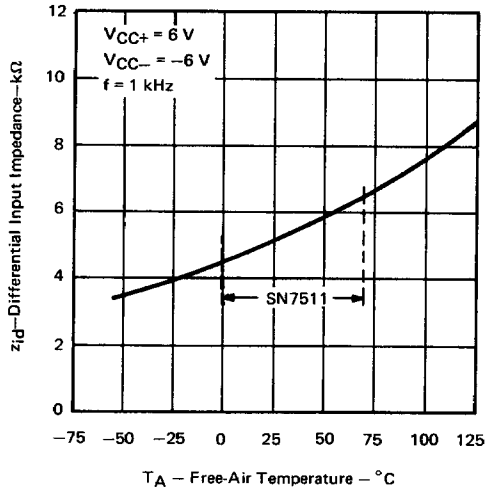


FIGURE 17

SN5511
COMMON-MODE REJECTION RATIO
vs
FREQUENCY

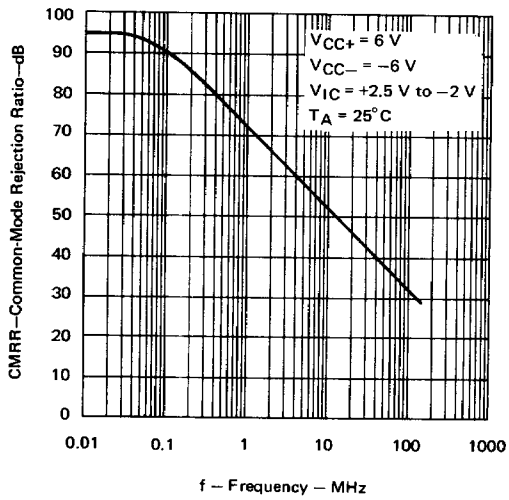


FIGURE 18

7

TOTAL POWER DISSIPATION
vs
FREE-AIR TEMPERATURE

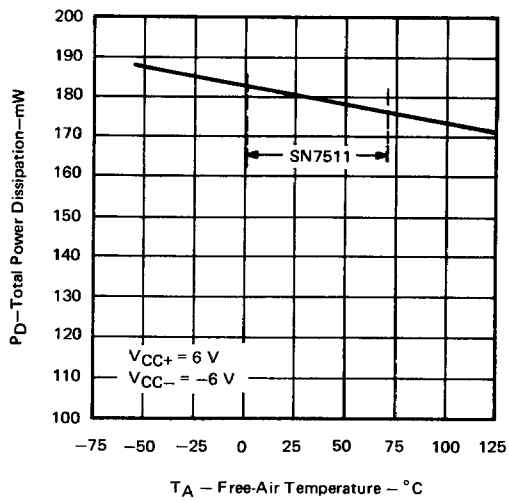


FIGURE 19

SPOT NOISE FIGURE
vs
FREQUENCY

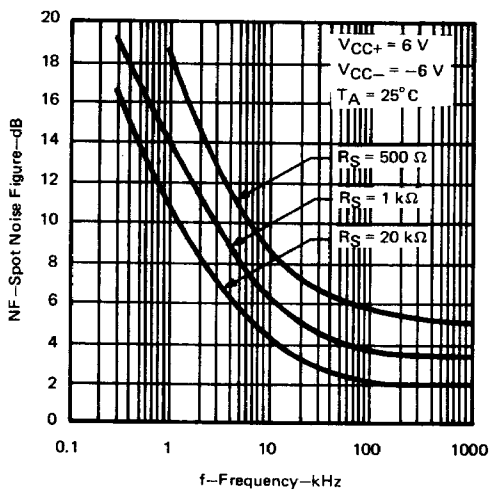


FIGURE 20

PRINTED IN U.S.A.
TI cannot assume any responsibility for any circuits shown or represent that they are free from patent infringement.

TEXAS INSTRUMENTS RESERVES THE RIGHT TO MAKE CHANGES AT ANY TIME IN ORDER TO IMPROVE DESIGN AND TO SUPPLY THE BEST PRODUCT POSSIBLE.

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 5012 • DALLAS, TEXAS 75222