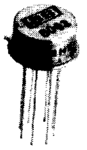
BURR-BROWN®

OPA11HT



Wide Temperature-Range General Purpose OPERATIONAL AMPLIFIER

FEATURES

- –55°C TO +175°C SPECIFICATIONS
- 30nA MAX. INPUT BIAS CURRENT AT +175°C
- ±6mV, MAX. INPUT OFFSET VOLTAGE AT +175°C
- ±5μV/°C TYP. INPUT OFFSET VOLTAGE COEFFICIENT
- 12MHz BANDWIDTH, TYPICAL
- HERMETIC PACKAGE WITH STANDARD PINOUT (741-TYPE)

DESCRIPTION

These specifications give you a versatile operational amplifier that will work in circuits that are subjected to extremely wide temperature ranges. Typical applications for OPA11HT include general purpose gain blocks, high-speed pulse amplifiers, audio amplifiers, high-frequency active filters, high-speed integrators, and photodiode amplifiers.

You're assured of this product's performance over the -55°C to +175°C range because we conduct 100% screening procedures in accordance with MIL-STD-883, method 5004, class B. Burn-in is performed at 200°C. Our sample and inspection procedures include both destructive and nondestructive bonding wire pull tests in accordance with Method 2011 of MIL-STD-883. The product is assembled in a clean-room environment.

Model OPA11HT is internally compensated for stability at all gains. Pins are available for special tailoring of the bandwidth compensation. Significant advantages in high gain, wide bandwidth, low-bias current, high output current and high common-mode rejection are provided by OPA11HT. Inputs are protected against common-mode voltages up to the value of the power supplies while the output is current limited to offer short circuited protection. TO-99 hermetic package has standard 741-type pinout arrangement.

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PDS-476

SPECIFICATIONS

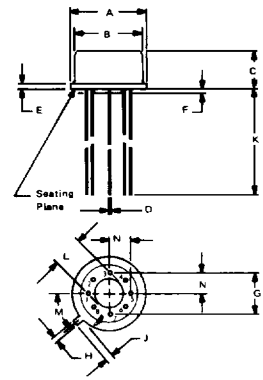
ELECTRICAL

Specifications at ±15VDC and T_A = +175°C unless otherwise noted.

MODEL	OPA11HT				
CHARACTERISTIC	**SYMBOL**	**MIN**	**TYP**	**MAX**	**UNIT**
OPEN LOOP GAIN, DC, single-ended	Av				
No load			103		dB
R_L = 2kΩ		94	100		dB
RATED OUTPUT					
Voltage, R_L = 2kΩ	V_{om}	±10	±12		V
Current (T_A = 25°C)	I_{om}	±15	±23		mA
DYNAMIC RESPONSE (T_A = 25°C)					
Small-Signal Bandwidth (0dB)			12		MHz
Full-Power Bandwidth } V_{OUT} = ±10V	BW_{fp}	50	75		kHz
Slew Rate } R_L = 2kΩ	SR	4	7		V/μsec
Settling Time (0.1%)			1.5		μsec
Rise Time (10% to 90%, small-signal)			30		nsec
INPUT OFFSET VOLTAGE	V_{io}				
Initial (without adj. at 25°C)			±1	±5	mV
Over Temperature					
T_A = +175°C				±6	mV
T_A = −55°C				±7	mV
Average V_{io} coefficient			±5		μV/°C
Average V_{io} coefficient vs supply voltage (T_A = 25°C)			±10	±200	μV/V
INPUT BIAS CURRENT	I_{ib}				
Initial at +25°C			±10	±25	nA
Over Temperature					
T_A = +175°C				±30	nA
T_A = −55°C				±40	nA
Average I_{ib} coefficient			±0.1		nA/°C
INPUT DIFFERENCE CURRENT	I_{io}				
Initial at +25°C			±10	±25	nA
Over Temperature					
T_A = +175°C				±30	nA
T_A = −55°C				±40	nA
Average I_{io} coefficient			±0.1		nA/°C
INPUT IMPEDANCE (T_A = 25°C)					
Differential	r_i	100	300		MΩ
	c_i		3		pF
Common Mode	r_i(CM)		1000		MΩ
	c_i(CM)		3		pF
INPUT VOLTAGE RANGE					
Common Mode				±11	V
Differential Mode				±12	V
Common-Mode Rejection	CMR	80	100		dB
Over Temperature (−55°C ≤ T_A ≤ +175°C)			100		dB
POWER SUPPLY (T_A = 25°C)					
Rated Voltage	V_{CC}			±15	V
Voltage Range, derated			±8 to ±22		V
Current, quiescent	I_q		±3	±3.7	mA
Over Temperature (−55°C ≤ T_A ≤ +175°C)			±3		mA
Power Supply Rejection Ratio (T_A = +175°C)	PS_{rr}	80	100		dB
TEMPERATURE RANGE					
Specification	−55°C ≤ T_A ≤ +175°C				
Operating	−55°C ≤ T_A ≤ +200°C				
Storage	−65°C ≤ T_A ≤ +250°C				

MECHANICAL

TO-99 PACKAGE

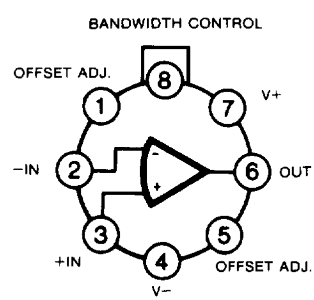


NOTE:
Leads in true position within .010" (.25mm) R @ MMC at seating plane.

Pin numbers shown for reference only. Numbers may not be marked on package.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	.335	.370	8.51	9.40
B	.305	.335	7.75	8.51
C	.165	.185	4.19	4.70
D	.016	.021	0.41	0.53
E	.010	.040	0.25	1.02
F	.010	.040	0.25	1.02
G	.200 BASIC		5.08 BASIC	
H	.028	.034	0.71	0.86
J	.029	.045	0.74	1.14
K	.500	—	12.7	—
L	.110	.160	2.79	4.06
M	45° BASIC		45° BASIC	
N	.095	.105	2.41	2.67

CONNECTION DIAGRAM



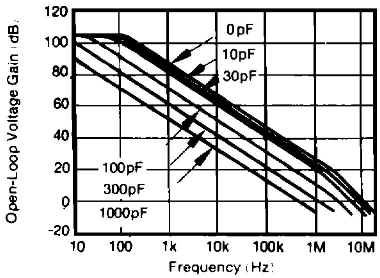
(TOP VIEW)

PIN 4 IS CONNECTED TO CASE

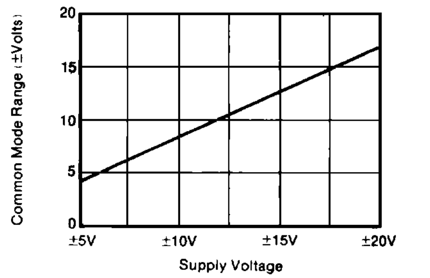
TYPICAL PERFORMANCE CURVES

(at ±15VDC and T_A = +25°C unless otherwise specified)

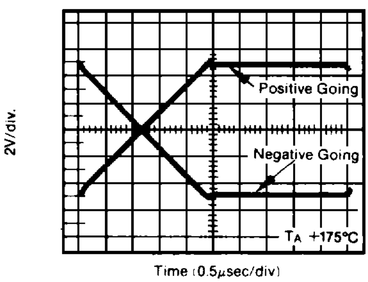
OPEN LOOP FREQUENCY RESPONSE[1]



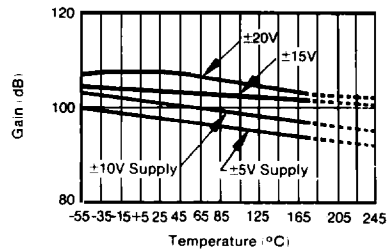
COMMON MODE VOLTAGE RANGE vs. SUPPLY VOLTAGE



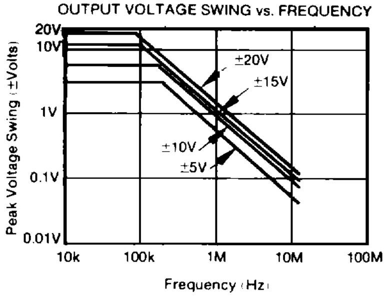
STEP RESPONSE IN FOLLOWER CONFIGURATION[2]



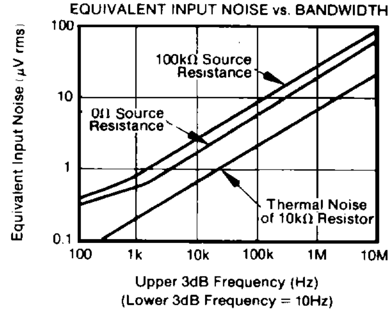
OPEN LOOP VOLTAGE GAIN vs. TEMPERATURE



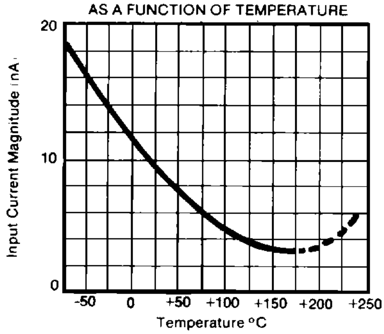
OUTPUT VOLTAGE SWING vs. FREQUENCY



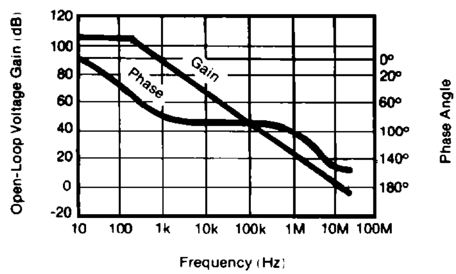
EQUIVALENT INPUT NOISE vs. BANDWIDTH



INPUT BIAS CURRENT AND DIFFERENCE CURRENT AS A FUNCTION OF TEMPERATURE



OPEN-LOOP FREQUENCY AND PHASE RESPONSE



1. Capacitance values shown are compensation from pin 8 to common. Not required for stability. See Figure 1. 2. See Figure 3.

APPLICATIONS

BANDWIDTH COMPENSATION

The frequency response of the OPA11HT can be adjusted by use of an external compensation capacitor from pin 8 to common as shown in Figure 1. The open-loop frequency response curves illustrate the effect of various values of capacitance. The OPA11HT is stable at any gain level without the use of compensation, provided that stray wiring capacitance and/or load capacitance are not excessive, and that moderate values of feedback resistance are used ($R_{FB} \leq 10k\Omega$). A load capacitance of ≈50pF is desirable in all feedback configurations.

STABILITY

Because the OPA11HT is an extremely-fast amplifier with high gain, stray wiring capacitance and inductance in power supply leads can cause circuit oscillation. This can be prevented by proper circuit layout (all leads or patterns as short as possible) and by properly by passing the power supply lines to common at points close to the amplifier. In addition, it is recommended that the load be bypassed by a 50pF capacitor, see Figure 1.

OFFSET VOLTAGE AND ADJUSTMENT

Although the offset voltage of these amplifiers is only a few millivolts, it may in some cases be desirable to null this offset. This is done by use of a 100kΩ potentiometer as shown in Figure 2.

TEST CIRCUIT - DYNAMIC RESPONSE

The test circuit of Figure 3 is used for measurement of slew rate, settling time, rise time and overshoot. Both rise time and overshoot are measured for a small output signal (V_{OUT} = ±100mV). Slew rate and settling time are measured for a 10V, p-p, square wave.

VOLTAGE REGULATOR AT 200°C

In many applications, a regulated source of ±15V is needed. A voltage regulator that typically will operate up to +175°C is shown in Figure 4. This regulator accepts +16V to +30V at its input and provides +15V at 20mA at its output. A complementary version may be constructed to provide -15V by using the OPA11HT with a 2N1711 transistor. Short-circuit protection should be added if required.

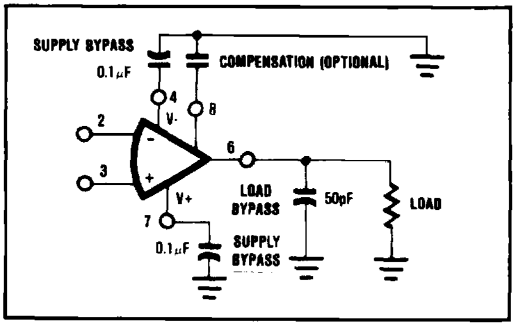


FIGURE 1. Compensated Amplifier with Supply Load Bypassing.

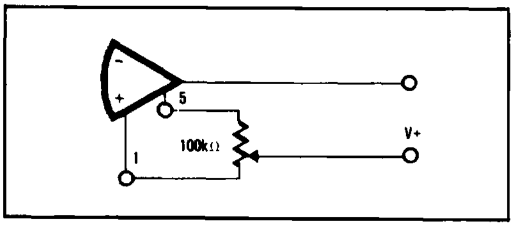


FIGURE 2. External Adjustment of Offset Voltage.

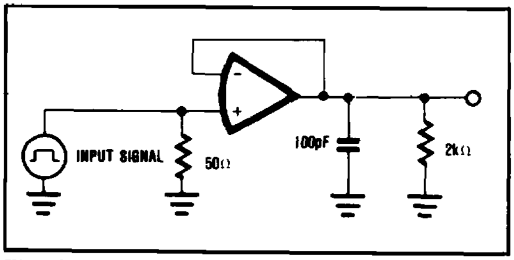


FIGURE 3. Dynamic Response Test Circuit.

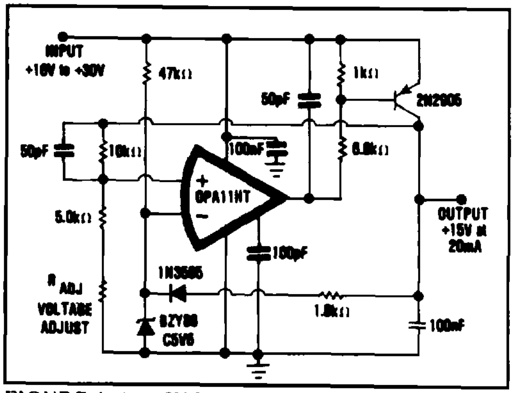


FIGURE 4. A +15V Voltage Regulator that will Operate at +175°C.