BURR - BROWN®

OPA511

High Current—High Power OPERATIONAL AMPLIFIER

FEATURES

- WIDE SUPPLY RANGE: ±10V to ±30V
- HIGH OUTPUT CURRENT: 5A Peak
- CLASS A/B OUTPUT STAGE: Low Distortion
- SMALL TO-3 PACKAGE

APPLICATIONS

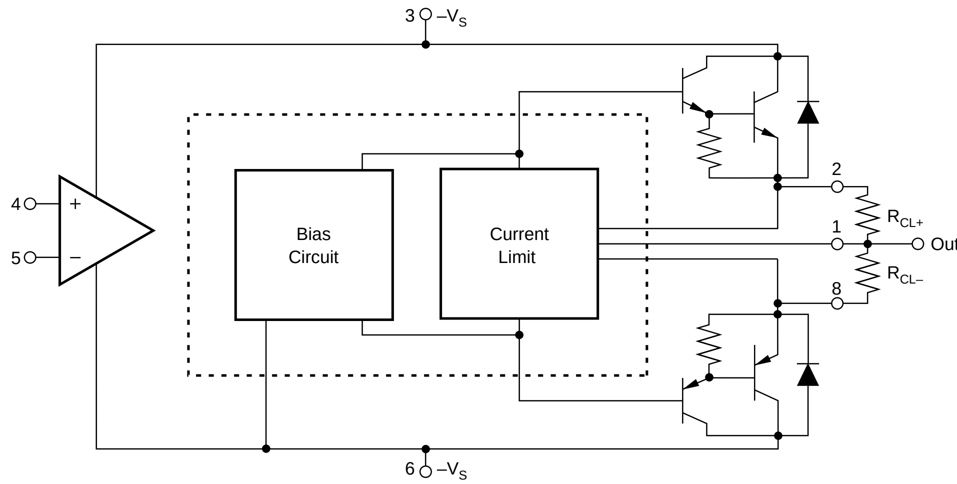
- SERVO AMPLIFIER
- MOTOR DRIVER
- SYNCRO EXCITATION
- AUDIO AMPLIFIER
- TEST PIN DRIVER

DESCRIPTION

The OPA511 is a high voltage, high current operational amplifier designed to drive a wide variety of resistive and reactive loads. Its complementary class A/B output stage provides superior performance in applications requiring freedom from cross-over distortion. User-set current limit circuitry provides protection to the amplifier and load in fault conditions.

The OPA511 employs a laser-trimmed monolithic integrated circuit to bias the output transistors, providing excellent low-level signal fidelity and high output voltage swing. The reduced internal parts count made possible with this bias IC improves performance and reliability.

This hybrid integrated circuit is housed in a hermetically sealed TO-3 package and all circuitry is electrically isolated from the case. This allows direct mounting to a chassis or heat sink without cumbersome insulating hardware and provides optimum heat transfer.



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SPECIFICATIONS

ELECTRICAL

At T_C = +25°C and V_S = ±28VDC unless otherwise noted.

PARAMETER	CONDITIONS	OPA511AM MIN	OPA511AM TYP	OPA511AM MAX	UNITS
INPUT					
OFFSET VOLTAGE					
Initial Offset			±5	±10	mV
vs Temperature	Full Temperature Range		±10	±65	µV/°C
vs Supply Voltage			±35	±200	µV/V
vs Power			±20		µV/W
BIAS CURRENT					
Initial			±15	±40	nA
vs Temperature	Full Temperature Range		±0.05	±0.4	nA/°C
vs Supply voltage			±0.02		nA/V
OFFSET CURRENT					
Initial			±5	±10	nA
vs Temperature	Full Temperature Range		±0.01		nA/°C
INPUT IMPEDANCE					
Common Mode			200		MΩ
Differential			10		MΩ
VOLTAGE RANGE (1)					
Common-Mode Voltage	Full Temperature Range	±(|V_S| – 6)	±(|V_S| – 3)		V
Common-Mode Rejection	V_{CM} = V_S – 6V	70	110		dB
GAIN					
Open-Loop Gain at 10Hz	Full Temperature Range, full load	91	113		dB
Gain-Bandwidth Product at 1MHz	T_C = +25°C, full load		1		MHz
Power Bandwidth	T_C = +25°C, I_O = 4A, V_O = 40Vp-p	15	23		kHz
Phase Margin	Full Temperature Range		45		Degrees
OUTPUT					
Voltage Swing	I_O = 5A	± (|V_S| – 8)	±(|V_S| – 5)		V
Full Temperature Range, I_O = 2A	±(|V_S| – 6)	±(|V_S| – 5)		V	
Full Temperature Range, I_O = 56mA	±(|V_S| – 5)			V	
Current, Peak		±5			A
Settling Time to 0.1%	2V step		2		µs
Slew Rate	R_L = 2.5Ω	±1.0	1.8		V/µs
Capacitive Load: Unity Gain	Full Temperature Range			3.3	nF
Gain>4	Full Temperature Range			SOA(2)	
POWER SUPPLY					
Voltage	Full Temperature Range	±10	±28	±30	V
Current, Quiescent			20	30	mA
THERMAL RESISTANCE					
AC Junction to Case (3)	f > 60Hz		1.9	2.1	°C/W
DC Junction to Case	f > 60Hz		2.4	2.6	°C/W
Junction to Air			30		°C/W
TEMPERATURE RANGE					
Case		–25		+85	°C

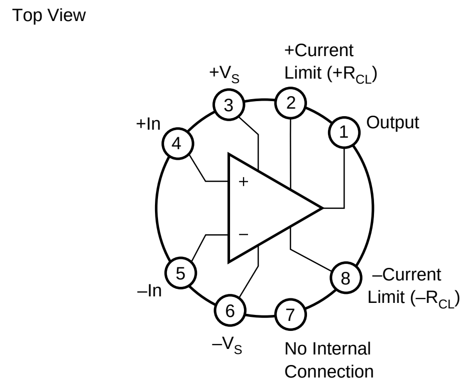
NOTES: (1) $+V_S$ and $–V_S$ denote the positive and negative supply voltage respectively. Total V_S is measured from $+V_S$ to $–V_S$. (2) SOA = Safe Operating Area. (3) Rating applies if the output current alternates between both output transistors at a rate faster than 60Hz.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, $+V_S$ to $-V_S$ 68V
Output Current: Source 5A
Sink .... see SOA
Power Dissipation, internal[1] 67W
Input Voltage: Differential .... $\pm(|V_S| - 3V)$
Common-mode .... $\pm V_S$
Temperature: Junction[1] .... +200°C
Pin solder(10s) .... +300°C
Temperature Range: Storage .... –65°C to +150°C
Operating (case) .... –25°C to +85°C

NOTE: (1) Long term operation at the maximum junction temperature will result in reduced product life. Derate internal power dissipation to achieve high MTTF.

PIN CONFIGURATION

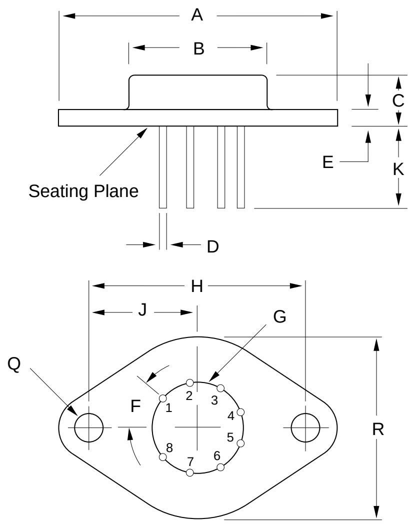


ORDERING INFORMATION

MODEL	PACKAGE	TEMPERATURE RANGE
OPA511AM	TO-3	–25°C to +85°C

MECHANICAL

M Package — 8-Pin Metal TO-3

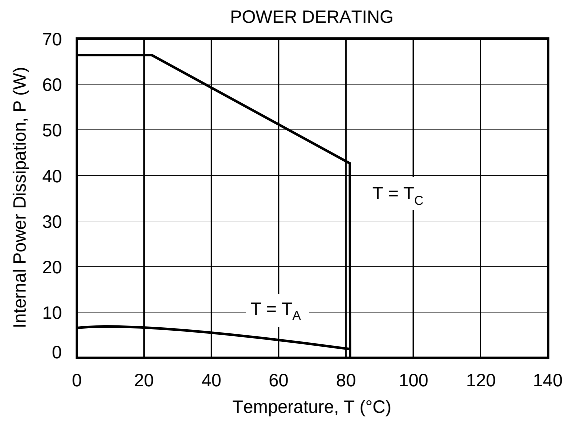


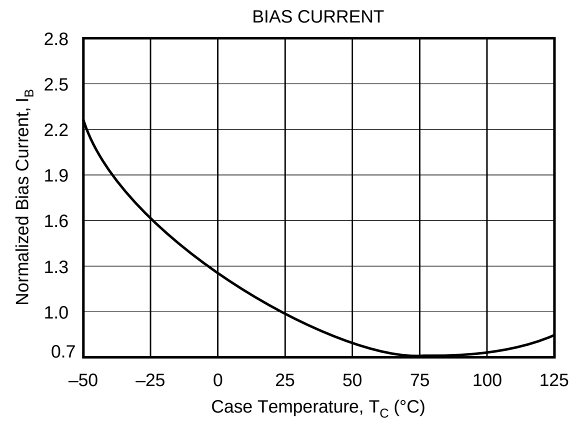
DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	1.510	1.550	38.35	39.37
B	.745	.770	18.92	19.56
C	.260	.300	6.60	7.62
D	.038	.042	0.97	1.07
E	.080	.105	2.03	2.67
F	40° BASIC		40° BASIC	
G	.500 BASIC		12.70 BASIC	
H	1.182	1.192	30.02	30.28
J	.591	.596	15.01	15.14
K	.400	.500	10.16	12.70
Q	.151	.161	3.84	4.09
R	.980	1.020	24.89	25.91

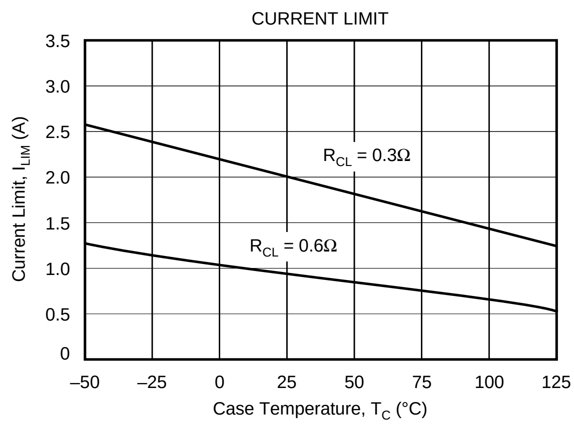
NOTE: Leads in true position within 0.01" (0.25mm) R at MMC at seating plane. Pin numbers shown for reference only. Numbers may not be marked on package.

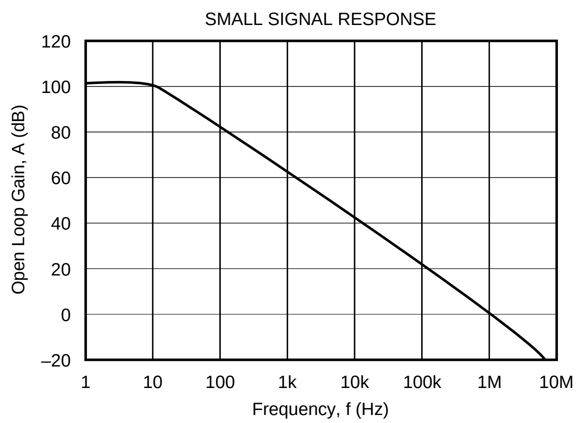
TYPICAL PERFORMANCE CURVES

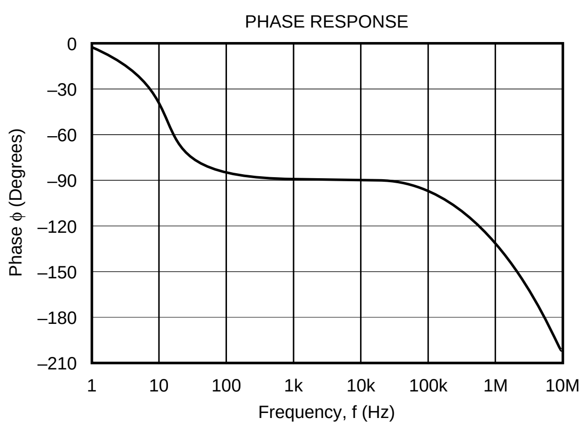
T_A = +25°C, V_S = ±28VDC unless otherwise noted.

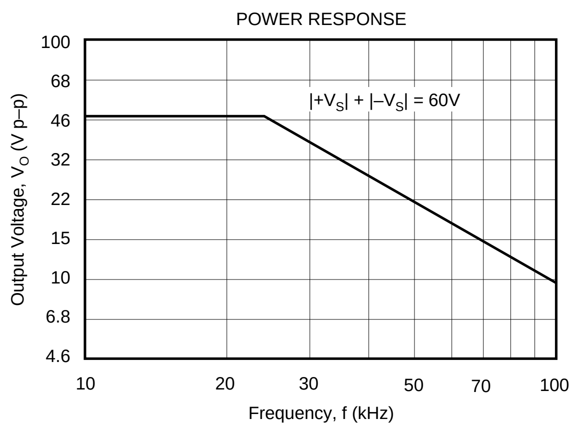












TYPICAL PERFORMANCE CURVES (CONT)

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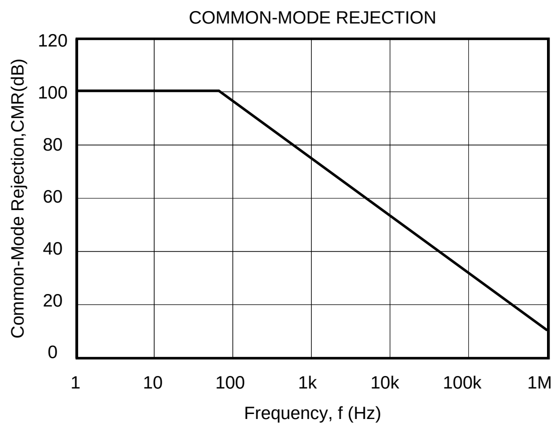

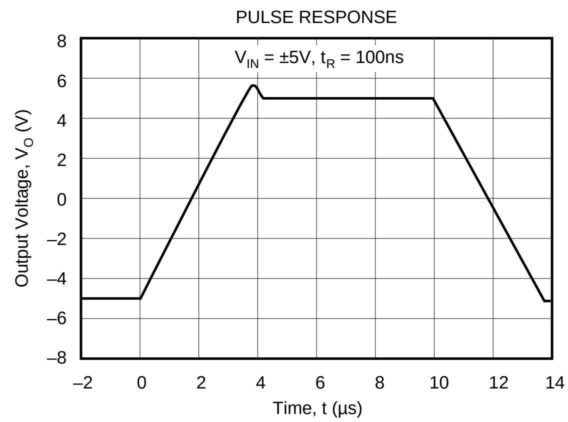

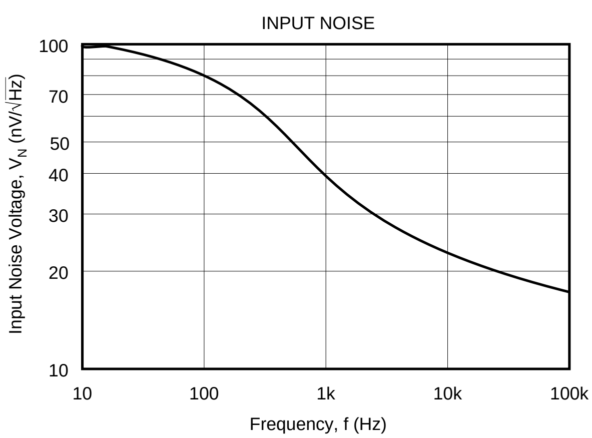

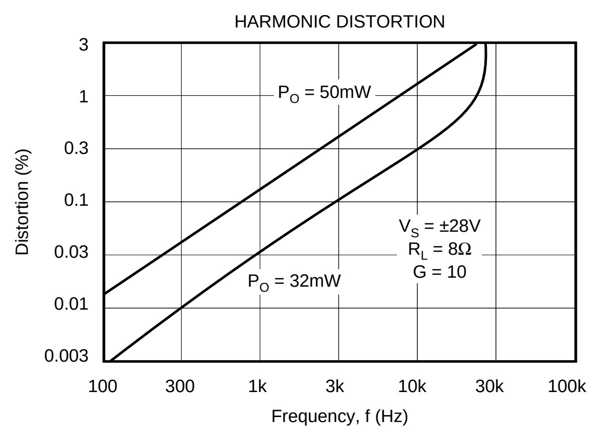

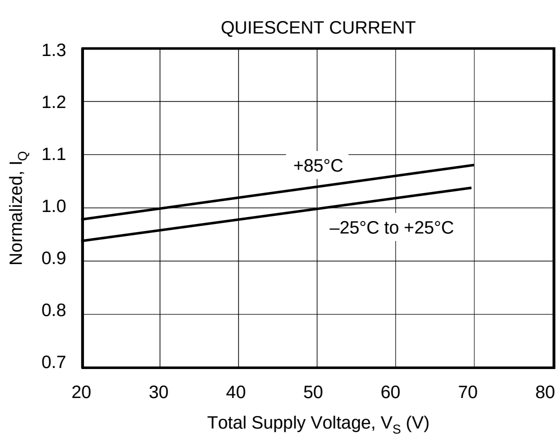

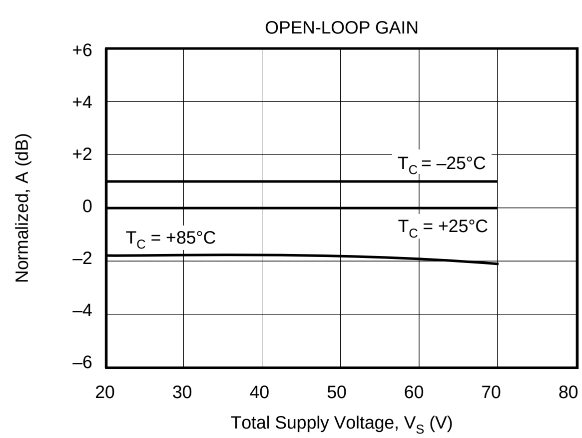

APPLICATIONS INFORMATION

POWER SUPPLIES

Specifications for the OPA511 are based on a nominal operating voltage ±28V. A single power supply or unbalanced supplies may be used so long as the maximum total operating voltage (total of $+V_S$ and $-V_S$) is not greater than 68V.

CURRENT LIMITS

Current limit resistors must be provided for proper operation. Independent positive and negative current limit values may be selected by choice of R_{CL+} and R_{CL-}, respectively. Resistor values are calculated by:

$$R_{CL} = 0.65/I_{LIM} \text{ (amps) } -0.01$$

This is the nominal current limit value at room temperature. The maximum output current decreases at high temperature as shown in the typical performance curve. Most wire-wound resistors are satisfactory, but some highly inductive types may cause loop stability problems. Be sure to evaluate performance with the actual resistors to be used in production.

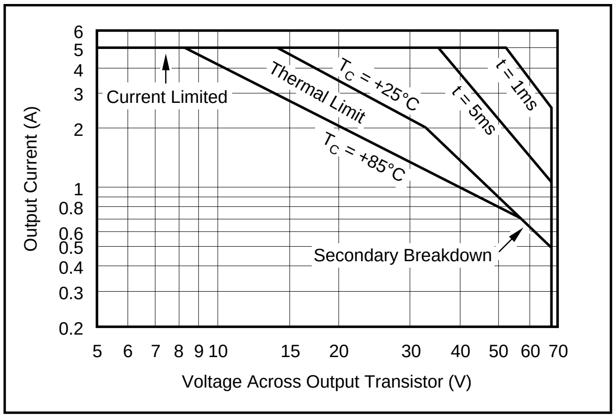

FIGURE 1. Safe Operating Area.

HEAT SINKING

Power amplifiers are rated by case temperature (not ambient temperature). The maximum allowable power dissipation is a function of the case temperature as shown in the power derating curve. Load characteristics, signal conditions, and power supply voltage determine the power dissipated by the amplifier. The case temperature will be determined by the heat sinking conditions. Sufficient heat sinking must be provided to keep the case temperature within safe bounds given the power dissipated and ambient temperature. See Application Note AN-83 for further details.

SAFE OPERATING AREA (SOA)

The safe area plot provides a comprehensive summary of the power handling limitations of a power amplifier, including maximum current, voltage and power as well as the secondary breakdown region (see Figure 1). It shows the allowable output current as a function of the power supply to output voltage differential (voltage across the conducting power device). See Application Note AN-123 for details on SOA.