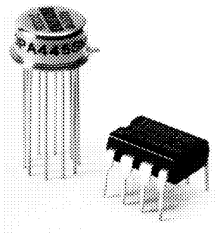
BURR - BROWN®



OPA445

High Voltage FET-Input OPERATIONAL AMPLIFIER

FEATURES

- WIDE POWER SUPPLY RANGE: ±10V to ±45V
- HIGH SLEW RATE: 10V/μs
- LOW INPUT BIAS CURRENT: 50pA max
- STANDARD-PINOUT TO-99 AND DIP PACKAGES

APPLICATIONS

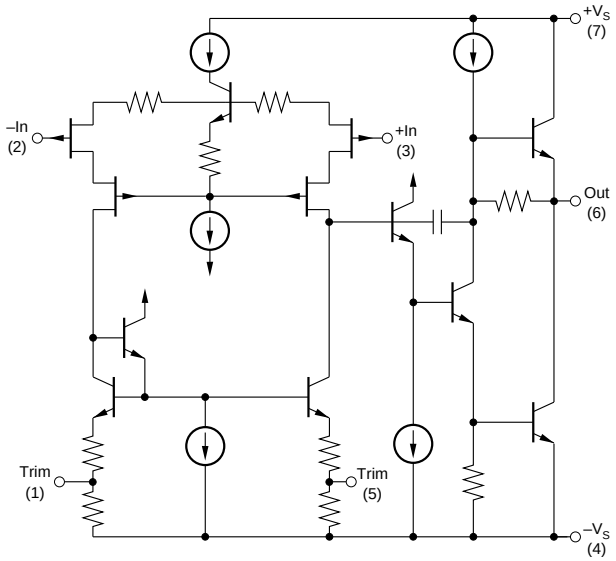
- TEST EQUIPMENT
- HIGH VOLTAGE REGULATORS
- POWER AMPLIFIERS
- DATA ACQUISITION
- SIGNAL CONDITIONING

DESCRIPTION

The OPA445 is a monolithic operational amplifier capable of operation from power supplies up to ±45V and output currents of 15mA. It is useful in a wide variety of applications requiring high output voltage or large common-mode voltage swings.

The OPA445's high slew rate provides wide power-bandwidth response, which is often required for high voltage applications. FET input circuitry allows the use of high impedance feedback networks, thus minimizing their output loading effects. Laser trimming of the input circuitry yields low input offset voltage and drift.

The OPA445 is unity-gain stable and requires no external compensation components. It is available in both industrial (–25°C to +85°C) and military (–55°C to +125°C) temperature ranges.



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SPECIFICATIONS

ELECTRICAL

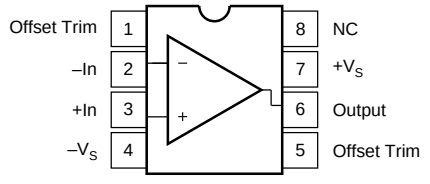
At V_S = ±40°C and T_A = +25°C, unless otherwise specified.

PARAMETER	CONDITIONS	OPA445SM			OPA445BM			OPA445AP			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
INPUT											
OFFSET VOLTAGE											
Input Offset Voltage	V_{CM} = 0V		0.5	1.0		1.0	3.0		2.0	5.0	mV
Average Drift	$T_A = T_{MIN}$ to T_{MAX}		*			10			15		µV/°C
Supply Rejection	V_S = ±10V to ±50V	*	*		80	110		*	*		dB
BIAS CURRENT											
Input Bias Current	V_{CM} = 0V		*	*		20	50		50	100	pA
Over Temperature				100			10			20	nA
OFFSET CURRENT											
Input Offset Current	V_{CM} = 0V		*	*		4	10		20	40	pA
Over Temperature				50			5			10	nA
IMPEDANCE											
Differential			*			10^{13} || 1			*		Ω || pF
Common-Mode			*			10^{14} || 3			*		Ω || pF
VOLTAGE RANGE											
Common-Mode Input Range		*			±35			*			V
Common-Mode Rejection	V_{IN} = ±30V,										
	Over Temp.	*	*		80	95		*	*		dB
OPEN-LOOP GAIN, DC											
Open-Loop Voltage Gain	R_L =5kΩ	*	*		100	105		*	*		dB
Over Temperature		*			97			*			dB
FREQUENCY RESPONSE											
Gain Bandwidth	Small Signal		*			2			*		MHz
Full Power Response	35Vp-p, R_L = 5kΩ	*	*		45	55		*	*		kHz
DYNAMIC RESPONSE											
Slew Rate	V_O = ±35V,										
	R_L = 5kΩ	*	*		5	10		*	*		V/µs
Rise Time	V_O = ±200mV		*			100			*		ns
Overshoot	A_V = +1										
	Z_L = 5kΩ || 50pF		*			30			*		%
OUTPUT											
Voltage Output, Over Temp.	R_L = 5kΩ	*			±35			*			V
Current Output	V_O = ±28V	*			±15			*			mA
Output Resistance	DC, Open Loop		*			220			*		Ω
Short Circuit Current			*			±26			*		mA
POWER SUPPLY											
Rated Voltage, ±V_S			*			±40			*		V
Voltage Range, ±V_S											
Derated Performance	Over Temperature	*		*	±10		±45	*		*	V
Current, Quiescent	I_O = 0mA		*	*		3.8	4.5		*	*	mA
TEMPERATURE RANGE											
Specification		–55		+125	–25		+85	*		*	°C
Operating	Ambient Temperature	*		*	–55		+125	–25		+85	°C
θ Junction-Ambient			*			200			100		°C/W

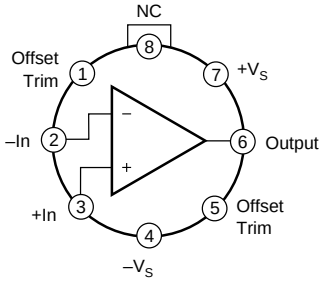
*Specifications same as OPA445BM.

CONNECTION DIAGRAMS

Top View **DIP**

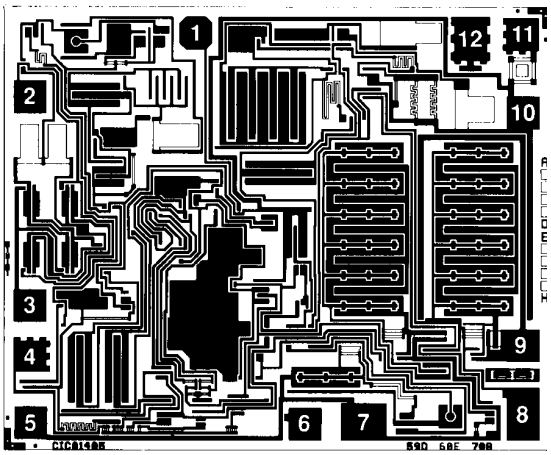


Top View **TO-99**



Case is connected to –V_S

DICE INFORMATION



OPA445 DIE TOPOGRAPHY

PAD	FUNCTION	PAD	FUNCTION
1	Offset Trim	7	$-V_S$
2	–In	8	(Compensation)
3	+In	9	Output
4	NC	10	$+V_S$
5	$-V_S$	11	NC
6	Offset Trim	12	NC

Substrate Bias: Electrically connected to $-V_S$ supply.
NC: No Connection.

MECHANICAL INFORMATION

	MILS (0.001")	MILLIMETERS
Die Size	88 x 72 ±5	2.24 x 1.83 ±0.13
Die Thickness	20 ±3	0.51 ±0.08
Min. Pad Size	4 x 4	0.1 x 0.1
Backing		Chromium-Silver

ABSOLUTE MAXIMUM RATINGS

Power Supply	±50V
Internal Power Dissipation	680mW
Differential Input Voltage	±80V
Input Voltage Range	$\|\pm V_S\|$ –3V
Storage Temperature Range: M	–65°C to +150°C
P	–40°C to +85°C
Operating Temperature Range: M	–55°C to +125°C
P	–40°C to +85°C
Lead Temperature (soldering, 10s)	+300°C
Output Short-Circuit to Ground (T_A = +25°C)	Continuous
Junction Temperature	+175°C

ORDERING INFORMATION

MODEL	PACKAGE	TEMPERATURE RANGE
OPA445AP	8-pin plastic DIP	–25°C to +85°C
OPA445BM	8-pin TO-99	–25°C to +85°C
OPA445SM	8-pin TO-99	–55°C to +125°C

PACKAGE INFORMATION

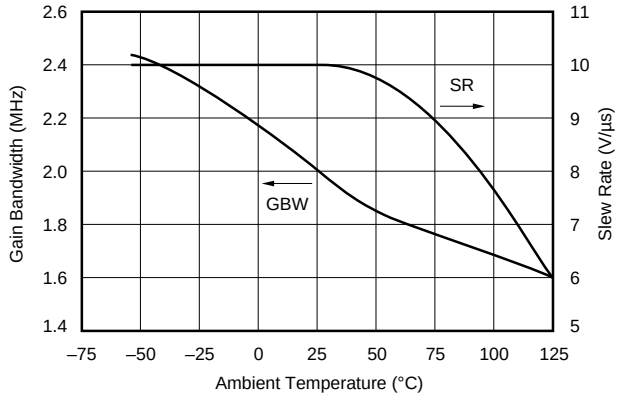
MODEL	PACKAGE	PACKAGE DRAWING NUMBER[1]
OPA445AP	8-pin plastic DIP	006
OPA445BM	8-pin TO-99	001
OPA445SM	8-pin TO-99	001

NOTE: (1) For detailed drawing and dimension table, please see end of data sheet, or Appendix D of Burr-Brown IC Data Book.

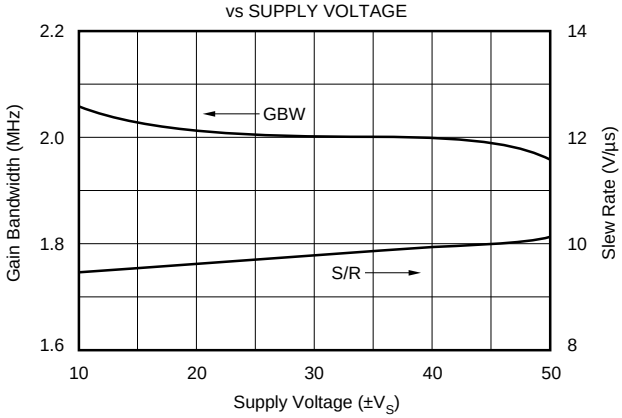
TYPICAL PERFORMANCE CURVES

T_A = +25°C, V_S = ±40VDC, unless otherwise noted.

GAIN BANDWIDTH AND SLEW RATE vs TEMPERATURE



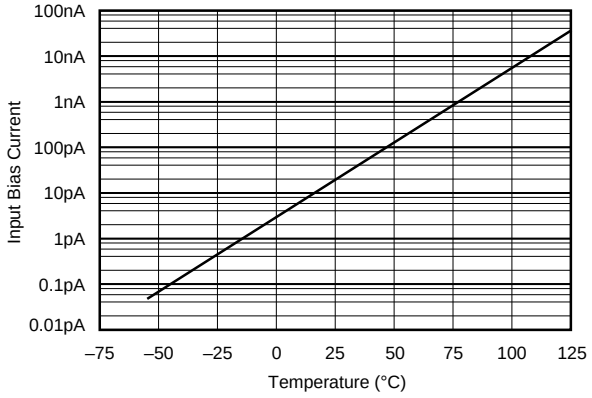
GAIN BANDWIDTH AND SLEW RATE vs SUPPLY VOLTAGE



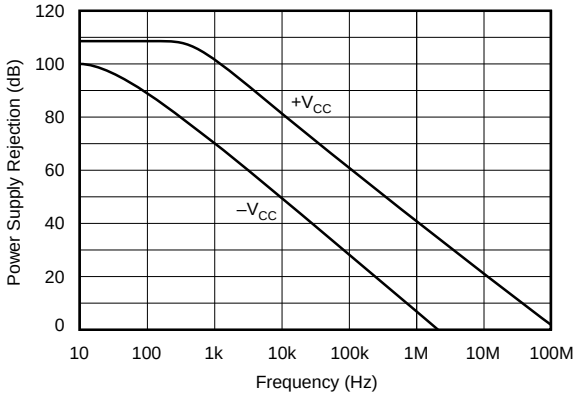
TYPICAL PERFORMANCE CURVES (CONT)

T_A = +25°C, V_S = ±40VDC, unless otherwise noted.

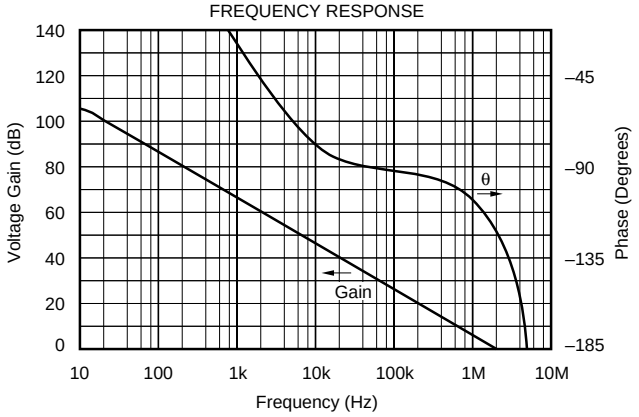
INPUT BIAS CURRENT vs TEMPERATURE



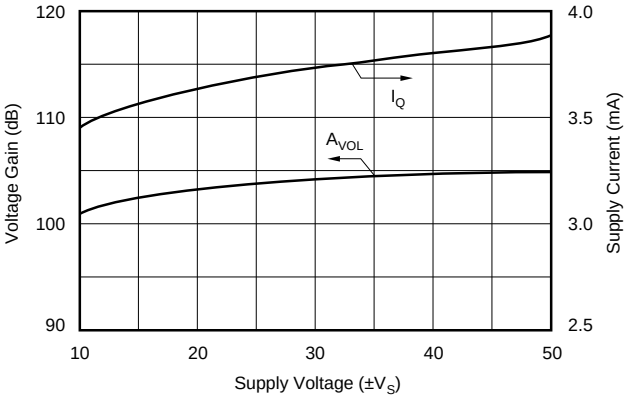
POWER SUPPLY REJECTION vs FREQUENCY



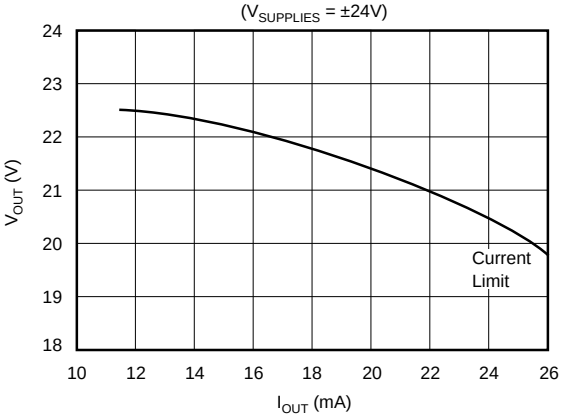
OPEN-LOOP FREQUENCY RESPONSE



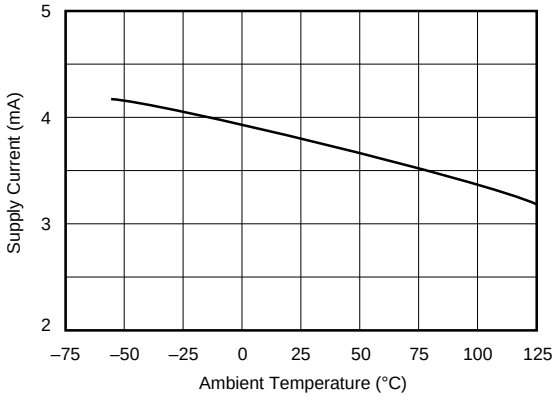
OPEN-LOOP GAIN AND SUPPLY CURRENT vs SUPPLY VOLTAGE



OUTPUT VOLTAGE vs OUTPUT CURRENT ($V_{SUPPLIES}$ = ±24V)



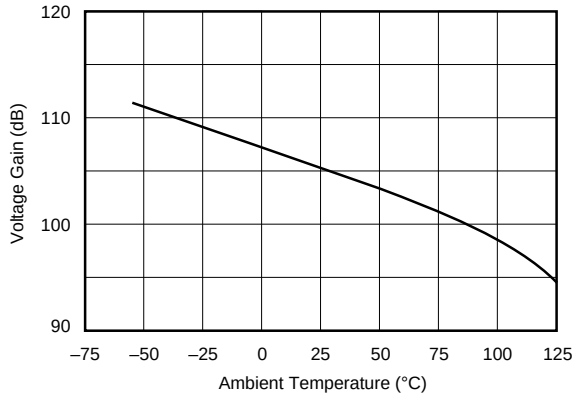
SUPPLY CURRENT vs TEMPERATURE



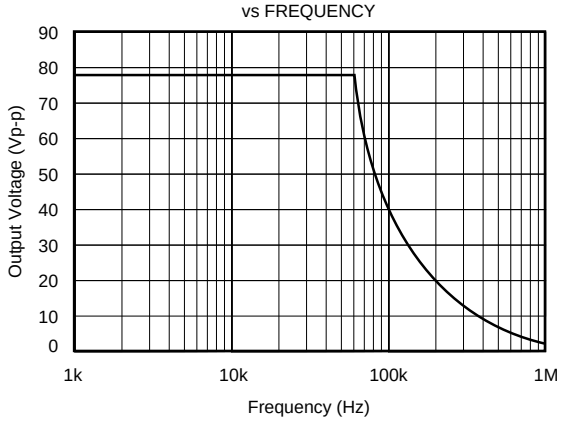
TYPICAL PERFORMANCE CURVES (CONT)

T_A = +25°C, V_S = ±15VDC unless otherwise noted.

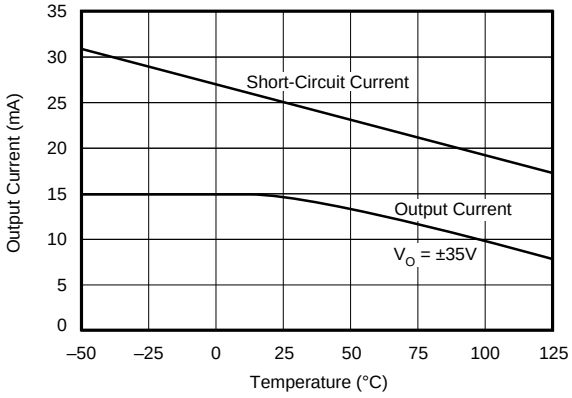
OPEN-LOOP GAIN vs TEMPERATURE



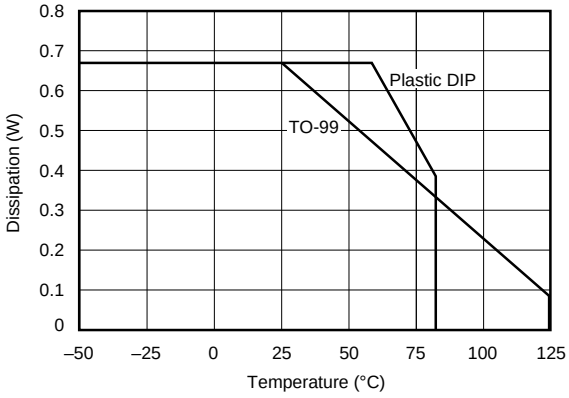
MAXIMUM OUTPUT VOLTAGE SWING vs FREQUENCY



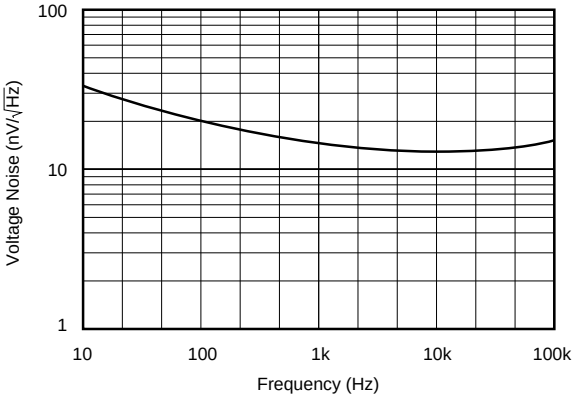
OUTPUT CURRENT vs TEMPERATURE



MAXIMUM POWER DISSIPATION vs TEMPERATURE



INPUT VOLTAGE NOISE SPECTRAL DENSITY



INSTALLATION AND OPERATING INSTRUCTIONS

The OPA445 may be operated from power supplies up to ±45V or a total of 90V. Power supplies should be bypassed with 0.022µF capacitors, or greater, near the power supply pins. Be sure that the capacitors are appropriately rated for the supply voltage used.

The OPA445 can supply output currents of 15mA and larger. This would present no problem for a standard op amp operating from ±15V supplies. With high supply voltages, however, internal power dissipation of the op amp can be quite large. Operation from a single power supply (or unbalanced power supplies) can produce even larger power dissipation since a larger voltage is impressed across the conducting output transistor.

Dissipation should be limited to 680mW at 25°C. At temperatures above 25°C, the maximum dissipation should be derated according to the thermal resistance of the package type used.

Package thermal resistance, θ_{JC}, is affected by mounting techniques and environments. The figures provided are typical for common mounting configurations with convection air flow. Poor air circulation and use of sockets can significantly increase thermal resistance. Best thermal performance is achieved by soldering the op amp into a circuit board with wide printed circuit traces to allow greater conduction through the op amp leads. Simple clip-on heat sinks can reduce the thermal resistance of the TO-99 metal package by as much as 50°C/W.

A short-circuit to ground will produce a typical output current of 25mA. With ±40V power supplies, this creates an internal power dissipation of 1.0W. This exceeds the maximum rating for the device, and is not recommended. Permanent damage is unlikely, however, since the short-circuit output current will diminish as the junction temperature rises.

TYPICAL APPLICATIONS

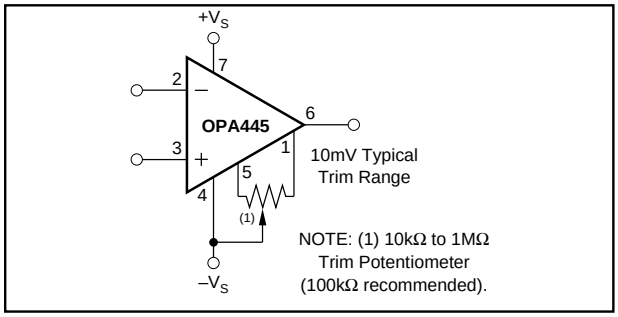


FIGURE 1. Offset Voltage Trim.

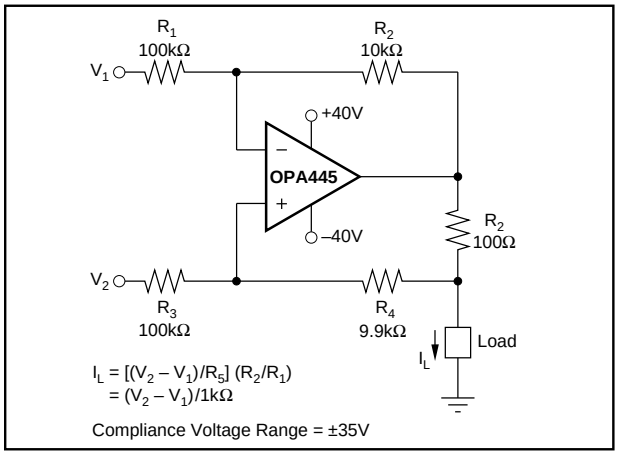


FIGURE 2. Voltage-to-Current Converter.

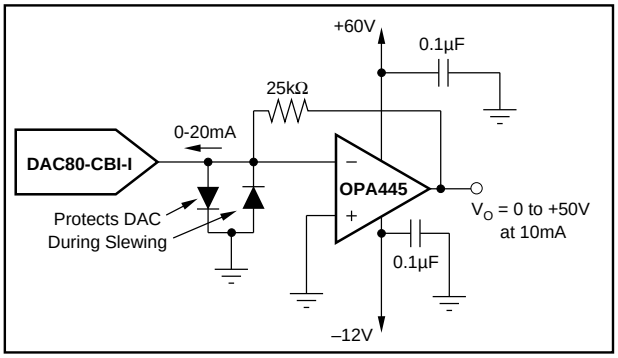


FIGURE 3. Programmable Voltage Source.