BURR-BROWN®

3583

High Voltage - High Current OPERATIONAL AMPLIFIER

FEATURES

- HIGH OUTPUT SWINGS. Up to ±140V
- LARGE LOAD CURRENTS. ±75mA
- PROTECTED OUTPUT STAGE. Automatic Thermal Shutoff
- REDUCES SOURCE LOADING. $10^{11}\Omega$ Input Z
- PRESERVES SYSTEM ACCURACY. 110dB CMR 20pA Bias Current

APPLICATIONS

- PROGRAMMABLE POWER SUPPLY OUTPUT AMPLIFIER
- HIGH VOLTAGE CURRENT SOURCE
- POWER BOOSTER
- HIGH VOLTAGE INTEGRATOR
- DIFFERENTIAL AMPLIFIER FOR HIGH COMMON-MODE VOLTAGE CIRCUITS

DESCRIPTION

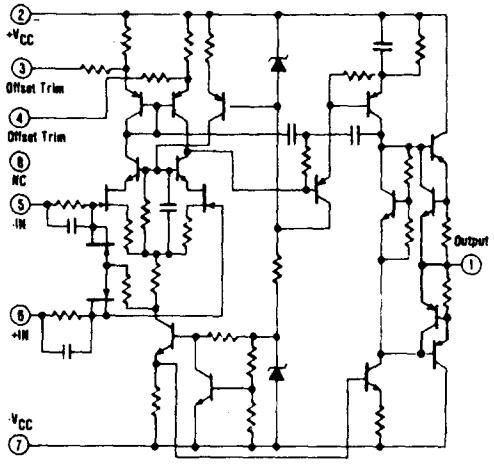
The 3583 is the first integrated circuit operational amplifier to provide output voltage swings of ±140V with currents as high as ±75mA.

The amplifier operates over a wide supply range (±50VDC to ±150VDC) and has excellent input characteristics (110dB CMR, 3mV V_{OS}, 25μV/°C $\Delta V_{OS}/\Delta T$).

The monolithic FET input stage has low bias current (20pA) which minimizes the offset voltages caused by the bias current and the large resistances normally associated with high voltage circuits.

The input stage is protected against overvoltages and the output stage is protected against short-circuits to ground for supply voltages below ±100VDC. A special thermal sensing circuit prevents damage to the amplifier by automatically shutting the amplifier down when too much power is being dissipated.

Two temperature ranges are available: 0°C to +70°C (3583JM) and -25°C to +85°C (3583AM).



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PDS-343D

SPECIFICATIONS

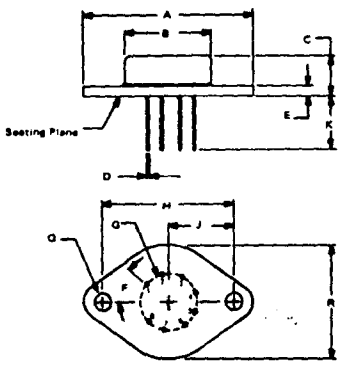
ELECTRICAL

Specifications typical at T_{CASE} = +25°C and ±V_{CC} = 150VDC unless otherwise noted.

MODELS	3583AM	3583JM
POWER SUPPLY		
Voltage, ±Vcc	±50VDC to ±150VDC	
Quiescent Current, max	8.5mA	
RATED OUTPUT		
Voltage, ±(|Vcc| -10)VDC, min	±40VDC to ±140VDC	
Current, min	±75mA	
Current, Short Circuit	±100mA	
Load Capacitance, max	10nF	
OPEN-LOOP GAIN		
No Load, DC	118dB	
Rated Load, DC	94dB, min; 105dB, typ	
FREQUENCY RESPONSE		
Unity Gain Bandwidth, Small Signal	5MHz	
Full Power Bandwidth, R_L = 10kΩ	60kHz	
Slew Rate	30V/µsec	
Settling Time, 0.1%	12µsec	
INPUT OFFSET VOLTAGE T_A = +25°C		
Initial at 25°C, max	±3mV	
Drift vs Temp, max	±23µ/°C	
Drift vs Supply Voltage	±20µV/V	
Drift vs Time	±50µV/mo	
INPUT BIAS CURRENT		
Initial at 25°C, max	-20pA	
Drift vs Temp	doubles every 10°C	
Drift vs Supply Voltage	0.2pA/V	
INPUT OFFSET CURRENT		
Initial at 25°C	±20pA	
Drift vs Temp	doubles every 10°C	
Drift vs Supply Voltage	0.2pA/V	
INPUT IMPEDANCE		
Differential	10^{11}Ω||10pF	
Common-mode	10^{11}Ω	
INPUT NOISE		
Voltage 0.01Hz to 10Hz, p-p	5µV	
10Hz to 1kHz, rms	1.7µV	
Current 0.01Hz to 10Hz, p-p	0.3pA	
INPUT VOLTAGE RANGE		
Max Safe Differential Voltage(1)	(+Vcc +|-Vcc|)	
Max Safe Common-mode Voltage	+Vcc to -Vcc	
Common-mode Voltage, Linear Operation	±(|Vcc| -10)V	
Common-mode Rejection	110dB	
TEMPERATURE RANGE (Case)		
Specification	-25°C to +85°C	0°C to 70°C
Operating	-55°C to +125°C	
Storage	-55°C to +125°C	

NOTES:
1. The inputs may be damaged by pulses at pins 5 or 8 with dV/dt ≥ 1V/nsec. Any possible damage can be eliminated by limiting the input current to 150mA with external resistors in series with those pins. No external protection is needed for slower voltage changes.

MECHANICAL



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.

ORDER NUMBER:
3583AM 3583JM

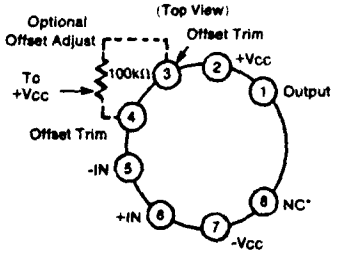
WEIGHT:
15.1 Grams

MATING CONNECTOR:
0803MC

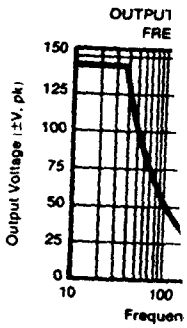
DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	1.510	1.550	38.35	39.37
B	.745	.770	18.92	19.56
C	.260	.300	6.60	7.62
D	.038	.042	0.97	1.07
E	.080	.105	2.03	2.67
F	40° BASIC		40° BASIC	
G	.500 BASIC		12.7 BASIC	
H	1.186 BASIC		30.12 BASIC	
J	.593 BASIC		15.06 BASIC	
K	.400	.500	10.16	12.70
Q	.151	.161	3.84	4.09
R	.980	1.020	24.89	25.91

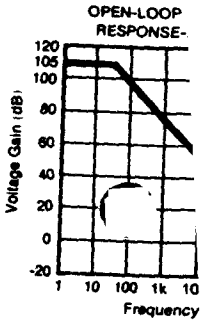
CONNECTION DIAGRAM

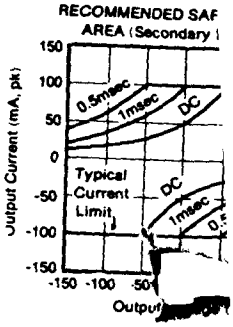
(Top View)

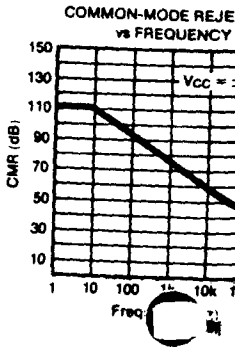


* No internal connection.
The metal case is electrically isolated. It is recommended that the case be grounded during use.





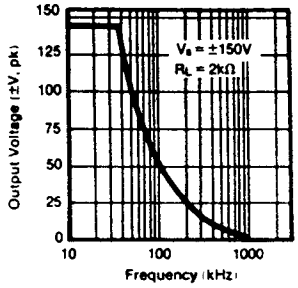




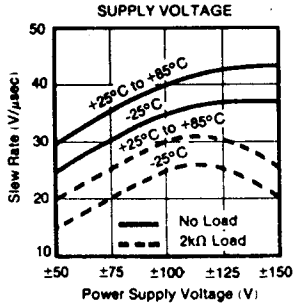
TYPICAL PERFORMANCE CURVES

Typical at T_{CASE} = +25°C and $\pm V_{CC}$ = 150VDC unless otherwise noted.

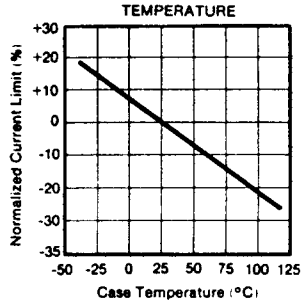
OUTPUT VOLTAGE vs FREQUENCY



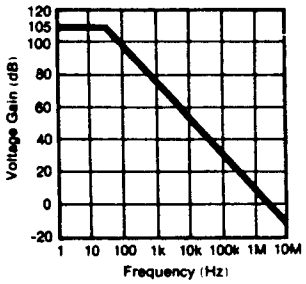
SLEW RATE vs SUPPLY VOLTAGE



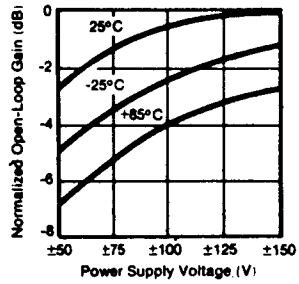
CURRENT LIMIT vs TEMPERATURE



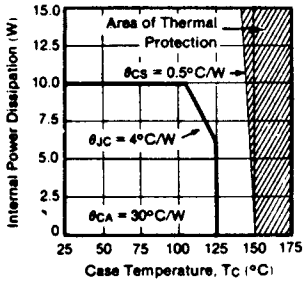
OPEN-LOOP FREQUENCY RESPONSE-FULL LOAD



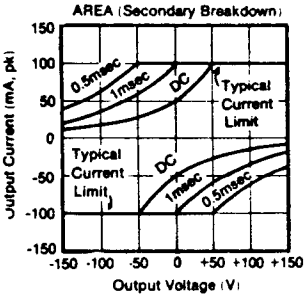
OPEN-LOOP GAIN vs SUPPLY VOLTAGE AT FULL LOAD



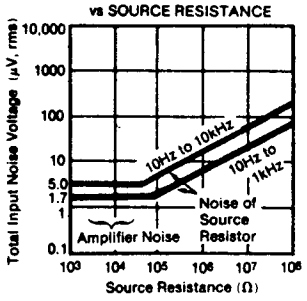
RECOMMENDED POWER DERATING



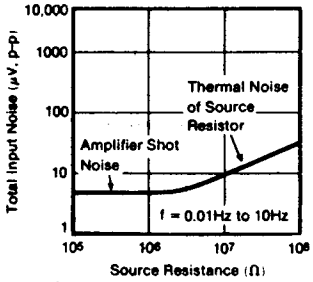
RECOMMENDED SAFE OPERATING AREA (Secondary Breakdown)



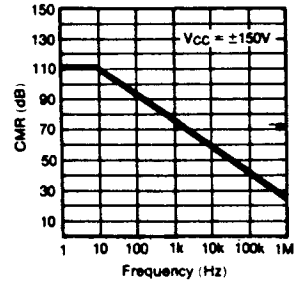
TOTAL INPUT NOISE VOLTAGE vs SOURCE RESISTANCE



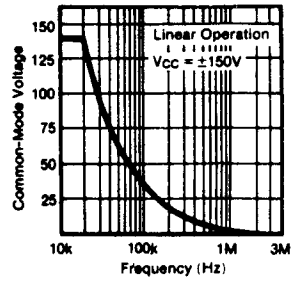
TOTAL LOW FREQUENCY INPUT NOISE vs SOURCE RESISTANCE



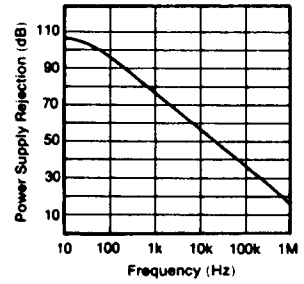
COMMON-MODE REJECTION vs FREQUENCY



COMMON-MODE VOLTAGE vs FREQUENCY



POWER SUPPLY REJECTION vs FREQUENCY



APPLICATIONS INFORMATION

The 3583 is a high voltage, high output current integrated circuit operational amplifier. Its ease of use, compact size, and excellent input and output specifications makes it well suited for a wide variety of high voltage applications.

The equivalent circuit for the 3583 is shown in Figure 1. The design uses a monolithic FET input stage for high input impedance, low bias current, and low voltage drift versus temperature. The offset voltage at 25°C and the drift versus temperature are compensated by state-of-the-art laser-trimming techniques. They are low enough so that user-trimming will not be required in most applications. The high input impedance provides negligible source impedance loading errors when the noninverting circuit configuration is used. The low bias currents minimize offset errors when large values of source and feedback resistors are used.

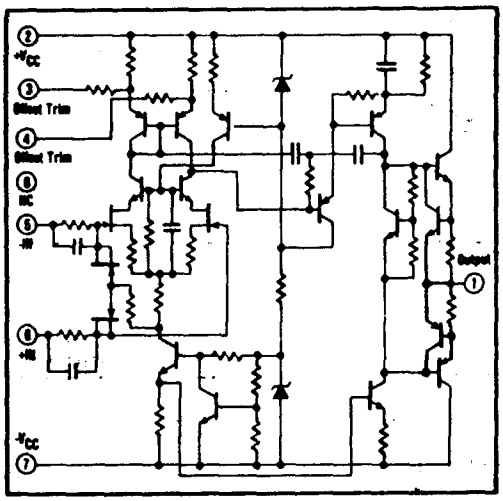


FIGURE 1. 3583 Equivalent Circuit.

A true cascade input stage is used together with considerable protection circuitry. There are voltage limiting transistors to prevent damage due to reverse bias breakdown of the input pair and current limiting resistors to limit the input current to 1mA with the inputs at ±150 volts. The units are conservatively rated (and 100% tested) at full rated differential voltage (+150V and -150V) but typically will withstand a 50% overvoltage without damage.

The unit operates over a wide supply range (±50V to ±150V) with outstanding common-mode rejection (110dB). It also has another feature which is important in many high voltage applications. The input bias current is virtually independent of applied common-mode voltage. The output circuit has a unique protection feature which is only practical in integrated-circuit amplifiers - self-contained automatic thermal sensing and shutoff circuitry which automatically turns the amplifier off when the internal temperature reaches approximately 150°C. This is accomplished by sensing the substrate temperature and deactivating the amplifier's biasing network when the temperature reaches 150°C. As this happens, the output load current limits at a safe value and the amplifier's quiescent current decreases. The output current will remain at a low value or oscillate between two values depending on the amount of power being dissipated and the heat sink conditions seen by the amplifier. In either case, the amplifier will not sustain internal damage and will return to normal operation within a few seconds after the abnormal load condition is removed.

The internal thermal protection removes some of the constraints of power derating for abnormal operating conditions. The amplifier will protect itself for many conditions of excess power dissipation (see the Power Derating Curve). This allows the use of a smaller heat sink to protect against abnormal output conditions since the amplifier has its own internal protection for many conditions of excess power dissipation. The output constraints of the Recommended Safe Operating Area curves must still be observed.

The 3583 has several other features that improve its utility. For instance, the metal case of the unit is completely electrically isolated. (This can be contrasted to most power semiconductors where the case is connected to the collector of the device.) This simplifies mounting and reduces cost since the need for insulating spacers and bushings is eliminated. The hermetically sealed package improves reliability and will more easily withstand severe environments than do discrete component amplifiers. The small package size reduces weight and makes mounting more convenient.

Burr-Brown offers three heat sinks as accessories; 0803HS with a thermal resistance of 12°C/watt, 0804HS at 4.2°C/watt, and 0805HS at 3°C/watt. A convenient mating connector, 0803MC is also available.