



**3583**

## High Voltage, High Current OPERATIONAL AMPLIFIER

### FEATURES

- WIDE POWER SUPPLY VOLTAGE:  
 $\pm 70V$  to  $\pm 150V$
- OUTPUT CURRENT TO 75mA
- SLEW RATE:  $30V/\mu s$
- FET INPUT:  $I_B = 20pA$  max
- THERMAL SHUT-DOWN PROTECTION
- HERMETIC TO-3 PACKAGE, ISOLATED CASE

### APPLICATIONS

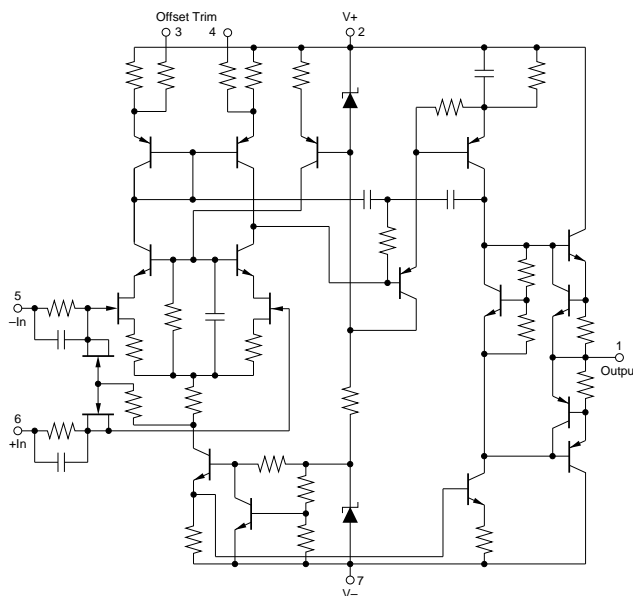
- PROGRAMMABLE POWER SUPPLY
- PIEZO-ELECTRIC TRANSDUCER DRIVER
- HIGH VOLTAGE CURRENT SOURCE

### DESCRIPTION

The 3583 is a high voltage, high speed hybrid operational amplifier designed for a wide variety of programmable power supply and transducer driver applications.

The 3583 operates over a wide power supply range ( $\pm 50V$  to  $\pm 150V$ ) and provides outputs up to 75mA. Laser-trimmed FET input circuitry provides low offset voltage (3mV max) and low input bias current (20pA max). Thermal shut-down circuitry protects internal circuitry from excessive power dissipation.

Commercial and industrial temperature range models are available. The 3583's hermetic 8-pin TO-3 package is electrically isolated from all internal circuitry.



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# SPECIFICATIONS

## ELECTRICAL

$T_{CASE} = +25^{\circ}\text{C}$ ,  $V_S = \pm 150\text{V}$ , unless otherwise noted.

PARAMETER	CONDITIONS	3583AM			3583JM			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
<b>OFFSET VOLTAGE</b> Input Offset Voltage vs Temperature vs Power Supply vs Time	Specified Temp. Range		20 50	$\pm 3$ $\pm 23$		* *	* *	mV $\mu\text{V}/^{\circ}\text{C}$ $\mu\text{V}/\text{V}$ $\mu\text{V}/\text{month}$
<b>INPUT BIAS CURRENT<sup>(1)</sup></b> Input Bias Current vs Temperature vs Power Supply Input Offset Current vs Temperature vs Power Supply	$V_{CM} = 0\text{V}$  $V_{CM} = 0\text{V}$		Doubles Every $10^{\circ}\text{C}$ 0.2  Doubles Every $10^{\circ}\text{C}$ 0.2	-20  $\pm 20$		* * * *	*  *	pA  pA/V pA pA/V
<b>NOISE</b> Voltage, 0.01Hz to 10Hz 10Hz to 1kHz Current, 0.01Hz to 10Hz			5 1.7 0.3			* * *		$\mu\text{Vp-p}$ $\mu\text{Vrms}$ pA-p-p
<b>INPUT VOLTAGE RANGE</b> Max Safe Differential Input Max Safe Common-Mode Input Common-Mode Input Range Common-Mode Rejection	Linear Operation		$(V+) +  V- $ $V- \text{ to } V+$ $V_S - 10$ 110			* * * *		V dB
<b>INPUT IMPEDANCE</b> Differential Common-Mode			$10^{11} \parallel 10$ $10^{11}$			* *		$\Omega \parallel \text{pF}$ $\Omega \parallel \text{pF}$
<b>OPEN-LOOP GAIN</b> Open-Loop Voltage Gain Open-Loop Voltage Gain	No Load, DC Rated Load, DC		118 105			* *		dB dB
<b>FREQUENCY RESPONSE</b> Unity-Gain Bandwidth Full-Power Bandwidth Slew Rate Settling Time: 0.1%	Small-Signal $R_L = 10\text{k}\Omega$		5 60 30 12			* * * *		MHz kHz V/ $\mu\text{s}$ $\mu\text{s}$
<b>OUTPUT</b> Voltage Output Current Output Short Circuit Current Load Capacitance		$V_S - 10$ $\pm 75$	$\pm 100$	10	* *	* *	* *	V mA mA nF
<b>POWER SUPPLY</b> Operating Voltage Range Quiescent Current	$I_O = 0$	$\pm 50$		$\pm 150$ $\pm 8.5$	* *		* *	V mA
<b>TEMPERATURE RANGE (CASE)</b> Specification Operating Storage $\theta_{JC} = 4^{\circ}\text{C}/\text{W}$		-25 -55 -55		+85 +125 +125	0 * *		+70 * *	$^{\circ}\text{C}$ $^{\circ}\text{C}$ $^{\circ}\text{C}$

\* Specification same as 3583AM.

NOTE: (1) Inputs may be damaged by input slew rates exceeding  $1000\text{V}/\mu\text{s}$ . Inputs can be protected from signals exceeding  $1000\text{V}/\mu\text{s}$  by limiting input current to  $150\text{mA}$  with external series resistors (pins 5 and 6).

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**Top View** **TO-3**

Optional Offset Adjust

Offset Trim

100k $\Omega$

to V+ Supply

+V<sub>CC</sub>

Output

NC<sup>(1)</sup>

-V<sub>CC</sub>

+In

-In

Offset Trim

NOTE: (1) No internal connection.

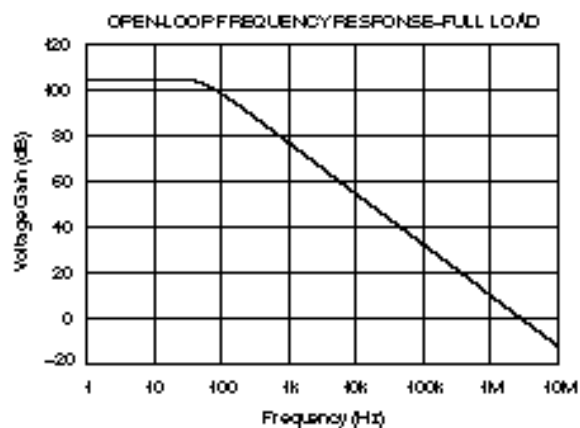
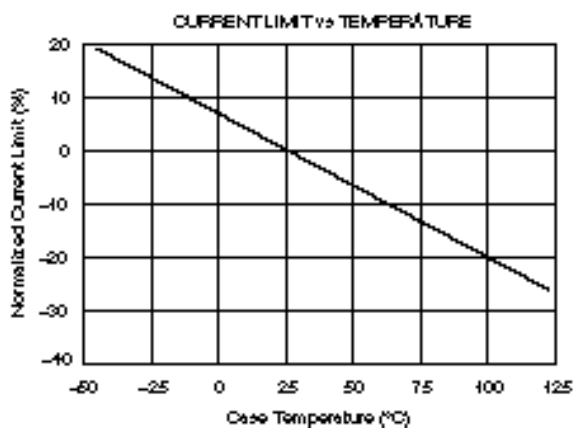
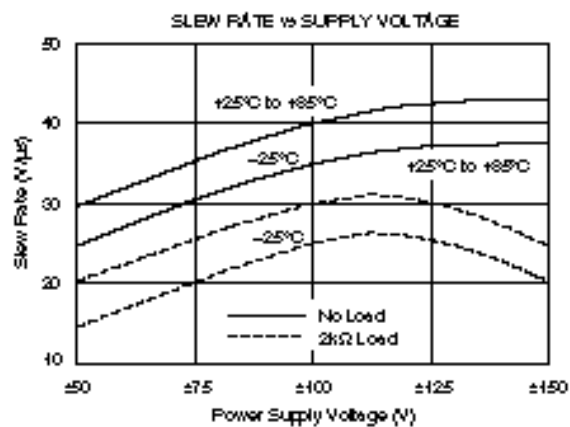
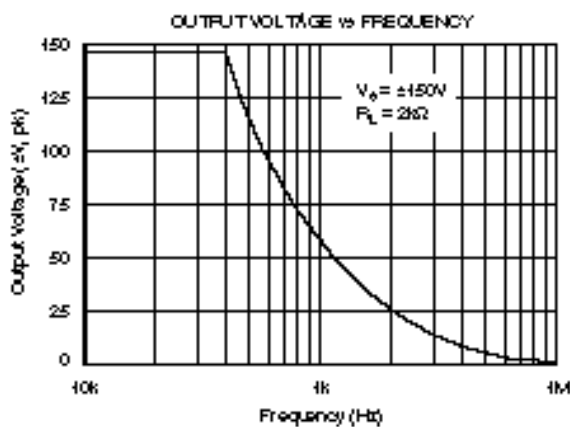
Optional socket available: 804MC

MODEL	PACKAGE	PACKAGE DRAWING NUMBER <sup>(1)</sup>
3583AM	8-Pin TO 3	030
3583JM	8-Pin TO 3	030

## ORDERING INFORMATION

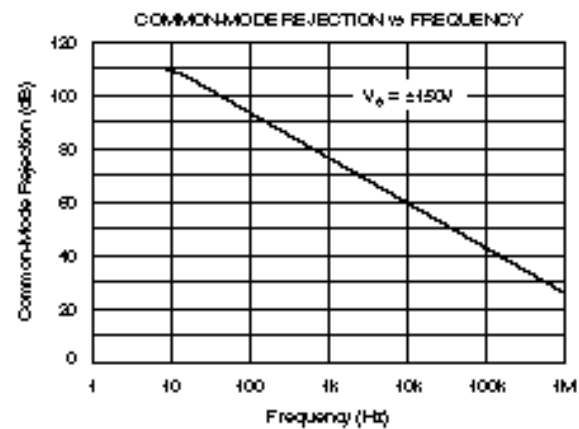
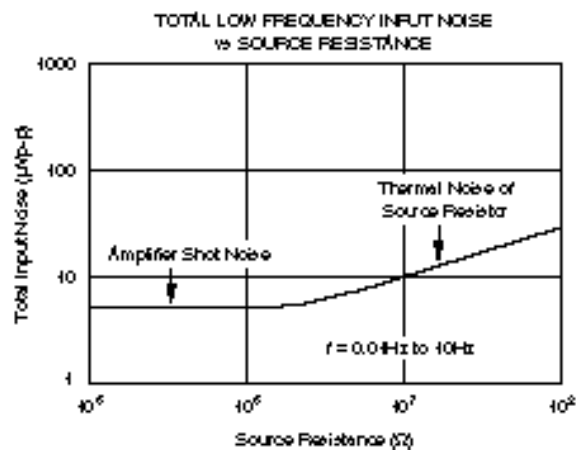
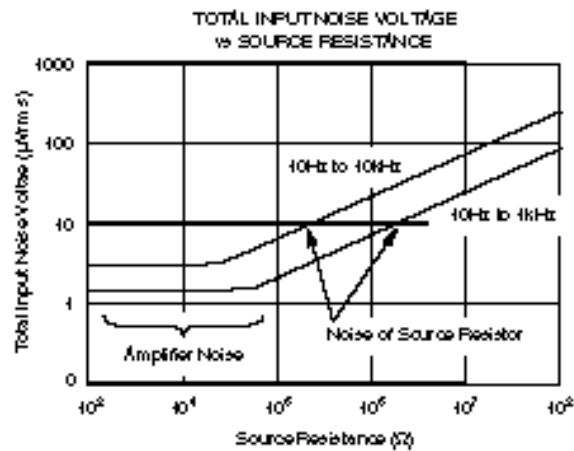
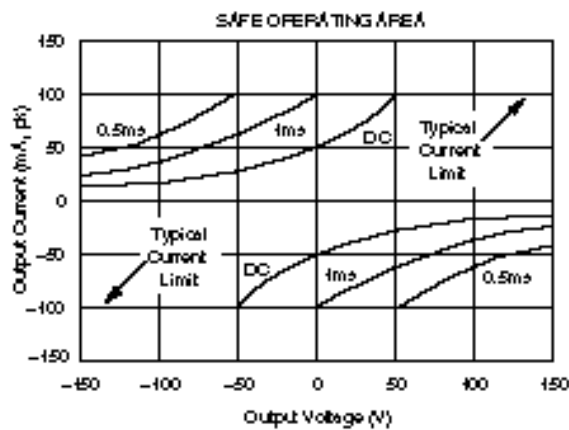
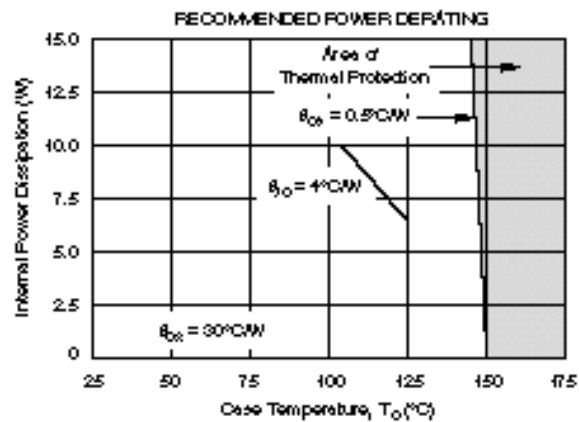
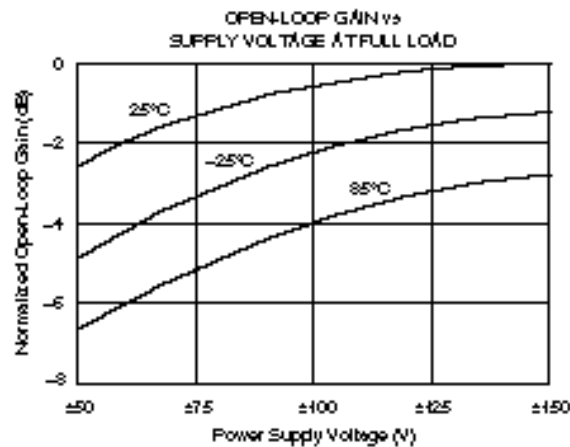
MODEL	PACKAGE	TEMPERATURE RANGE
3583AM	8-Pin TO-3	-25°C to +85°C
3583JM	8-Pin TO-3	0°C to +70°C

$T_{CASE} = +25^{\circ}C$ ,  $\pm V_{CC} = 150VDC$ , unless otherwise noted.



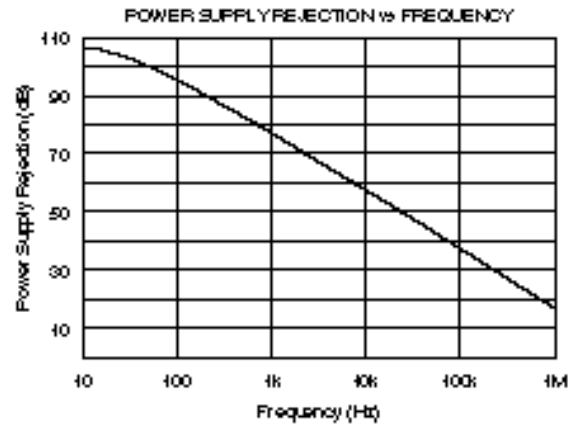
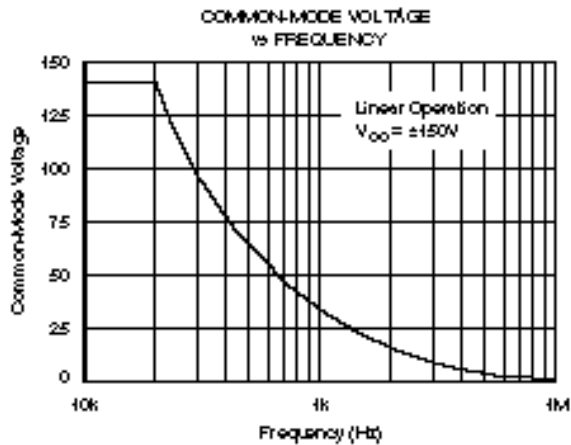
# TYPICAL PERFORMANCE CURVES

$T_{CASE} = +25^{\circ}\text{C}$ ,  $\pm V_{CC} = 150\text{VDC}$ , unless otherwise noted.



# TYPICAL PERFORMANCE CURVES (CONT)

$T_{CASE} = +25^{\circ}\text{C}$ ,  $\pm V_{CC} = 150\text{VDC}$ , unless otherwise noted.



## APPLICATION INFORMATION

Figure 1 shows the basic connections required to operate the 3583. Power supply bypass capacitors should be connected close to the device pins. Be sure that these capacitors have an adequate voltage rating.

Input offset voltage and drift of the 3583 are laser-trimmed. Many applications require no external offset trimming. Figure 1 also shows connection of an optional offset trim potentiometer connected to pins 3 and 4.

FET input circuitry reduces the input bias current of the 3583 to less than 20pA at room temperature. Input bias current remains nearly constant throughout the full common-mode range. Input bias current approximately doubles for each  $10^{\circ}\text{C}$  increase in case temperature above  $25^{\circ}\text{C}$ . Heat sinking can help minimize this effect by reducing the case temperature.

Input circuitry of the 3583 is protected with series limiting resistors and input clamp diodes. The inputs can withstand the full rated supply voltage of  $\pm 150\text{V}$  (common-mode or differential).

## THERMAL PROTECTION

The 3583 has internal thermal shut-down circuitry that activates at a case temperature of approximately  $150^{\circ}\text{C}$  or higher. As this circuitry is activated, the output current drive is reduced. As the case temperature returns to less than the activation temperature, operation will return to normal. A heat sink may be required depending on load and signal conditions.

Note that a 75mA output may not be safe for all output voltages—see typical performance curve “Safe Operating Area”. Applications such as current sources where output voltage may be low (or the opposite polarity of the output current) can overstress the output stage.

The thermal shut-down circuit will normally protect the amplifier during a short-circuit to ground. It will not protect against short-circuit to one of the power supplies. The typical performance curve “Safe Operating Area” shows that the large stress occurring during this high voltage condition may cause damage if it exceeds 5ms duration. The thermal protection circuitry will not activate fast enough to protect the device from short-circuits to one of the power supplies.

The package case of the 3583 is electrically isolated from all circuitry. No special insulating hardware is required. Although not absolutely required, it is recommended that the case be connected to ground.

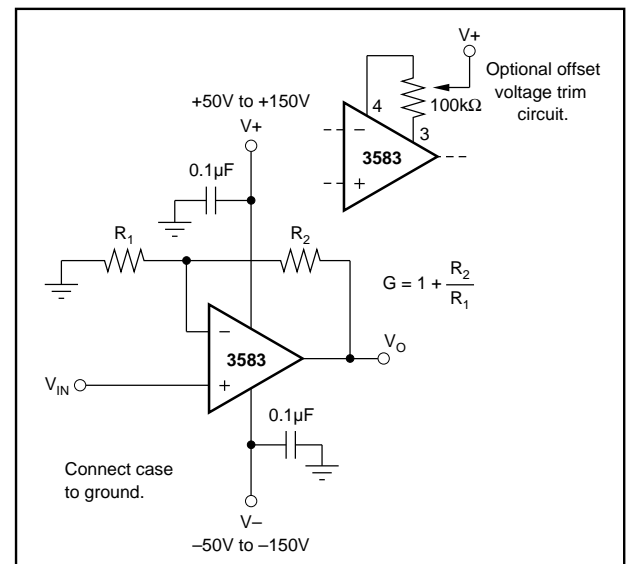


FIGURE 1. Basic Circuit Connections.

## PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
3583JM	NRND	TO-3	LMF	8		TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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