

## RC4580 Dual Audio Operational Amplifier

### 1 Features

- $\pm 2\text{-V}$  to  $\pm 18\text{-V}$  Operating Voltage
- $0.8\text{-}\mu\text{V}_{\text{rms}}$  Low Noise Voltage
- 12-MHz Gain Bandwidth Product
- 0.0005% Total Harmonic Distortion
- $5\text{-V}/\mu\text{s}$  Slew Rate
- Drop-In Replacement for NJM4580
- Pin and Function Compatible with LM833, NE5532, NJM4558/9, and NJM4560/2/5 devices

### 2 Applications

- Audio Preamplifiers
- Active Filters
- Headphone Amplifiers
- Industrial Measurement Equipment

### 3 Description

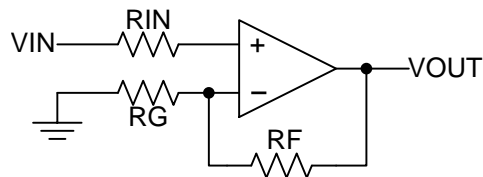
The RC4580 device is a dual operational amplifier that has been designed optimally for audio applications, such as improving tone control. It offers low noise, high gain bandwidth, low harmonic distortion, and high output current, all of which make the device ideally suited for audio electronics, such as preamplifiers, active filters, and industrial measurement equipment. When high output current is required, the RC4580 device can be used as a headphone amplifier. Due to its wide operating supply voltage, the RC4580 device can also be used in low-voltage applications.

#### Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RC4580	SOIC (8)	4.90 mm x 3.91 mm
	TSSOP (8)	3.00 mm x 4.40 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

#### Noninverting Amplifier Schematic



## Table of Contents

<b>1 Features</b> .....	<b>1</b>	7.2 Functional Block Diagram .....	<b>8</b>
<b>2 Applications</b> .....	<b>1</b>	7.3 Feature Description .....	<b>8</b>
<b>3 Description</b> .....	<b>1</b>	7.4 Device Functional Mode .....	<b>8</b>
<b>4 Revision History</b> .....	<b>2</b>	<b>8 Application and Implementation</b> .....	<b>9</b>
<b>5 Pin Configuration and Functions</b> .....	<b>3</b>	8.1 Typical Application .....	<b>9</b>
<b>6 Specifications</b> .....	<b>4</b>	<b>9 Power Supply Recommendations</b> .....	<b>12</b>
6.1 Absolute Maximum Ratings .....	4	<b>10 Layout</b> .....	<b>13</b>
6.2 Handling Ratings .....	4	10.1 Layout Guidelines .....	13
6.3 Recommended Operating Conditions .....	4	10.2 Layout Example .....	13
6.4 Thermal Information .....	4	<b>11 Device and Documentation Support</b> .....	<b>14</b>
6.5 Electrical Characteristics .....	5	11.1 Trademarks .....	14
6.6 Operating Characteristics .....	5	11.2 Electrostatic Discharge Caution .....	14
6.7 Typical Characteristics .....	5	11.3 Glossary .....	14
<b>7 Detailed Description</b> .....	<b>8</b>	<b>12 Mechanical, Packaging, and Orderable Information</b> .....	<b>14</b>
7.1 Overview .....	8		

## 4 Revision History

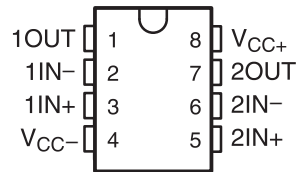
### Changes from Revision C (March 2004) to Revision D

Page

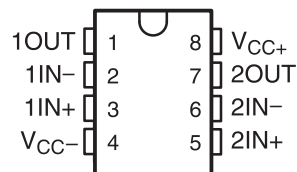
• Added <i>Applications</i> , <i>Device Information</i> table, <i>Pin Functions</i> table, <i>Handling Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section. ....	<b>1</b>
• Removed <i>Ordering Information</i> table. ....	<b>1</b>
• Changed $T_A = 25^\circ\text{C}$ to $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$ in condition statement for <i>Electrical Characteristics</i> table and <i>Operational Characteristics</i> table. ....	<b>5</b>

## 5 Pin Configuration and Functions

**D PACKAGE  
SOIC – 8  
(TOP VIEW)**



**PW PACKAGE  
TSSOP – 8  
(TOP VIEW)**



### Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
1IN+	3	I	Noninverting input
1IN-	2	I	Inverting Input
1OUT	1	O	Output
2IN+	5	I	Noninverting input
2IN-	6	I	Inverting Input
2OUT	7	O	Output
V <sub>CC+</sub>	8	—	Positive Supply
V <sub>CC-</sub>	4	—	Negative Supply

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage		±18	V
$V_I$	Input voltage (any input)		±15	V
$V_{ID}$	Differential input voltage		±30	V
$I_O$	Output current		±50	mA
$T_A$	Ambient temperature range	–40	125	°C
$T_{stg}$	Storage temperature range	–60	125	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### 6.2 Handling Ratings

		MIN	MAX	UNIT	
$T_{stg}$	Storage temperature range	–60	125	°C	
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>	0	1000	V
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup>	0	1000	

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.  
 (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 6.3 Recommended Operating Conditions

		MIN	MAX	UNIT
$V_{CC+}$	Supply voltage	2	16	V
$V_{CC-}$		–2	–16	
$V_{ICR}$	Input common-mode voltage range	–13.5	13.5	V
$T_A$	Operating free-air temperature	–40	125	°C

### 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>	RC4580		UNIT	
	D	PW		
	8 PINS	8 PINS		
$R_{\theta JA}$	Junction-to-ambient thermal resistance	109	163	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	55.7	38	
$R_{\theta JB}$	Junction-to-board thermal resistance	49	90.6	
$\Psi_{JT}$	Junction-to-top characterization parameter	10.6	1.3	
$\Psi_{JB}$	Junction-to-board characterization parameter	48.6	88.9	
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	—	—	

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

### 6.5 Electrical Characteristics

$V_{CC\pm} = \pm 15\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{IO}$ Input offset voltage	$R_S = < 10\text{ k}\Omega$		0.5	3	mV
$I_{IO}$ Input offset current			5	200	nA
$I_{IB}$ Input bias current			100	500	nA
$A_{VD}$ Large-signal differential voltage amplification	$R_L \geq 2\text{ k}\Omega$ , $V_O = \pm 10\text{ V}$	90	110		dB
$V_{CM}$ Output voltage swing	$R_L \geq 2\text{ k}\Omega$	$\pm 12$	$\pm 13.5$		V
$V_{ICR}$ Common-mode input voltage		$\pm 12$	$\pm 13.5$		V
CMRR Common-mode rejection ratio	$R_S \leq 10\text{ k}\Omega$	80	110		dB
$k_{SVR}$ Supply-voltage rejection ratio <sup>(1)</sup>	$R_S \leq 10\text{ k}\Omega$	80	110		dB
$I_{CC}$ Total supply current (all amplifiers)			6	9	mA

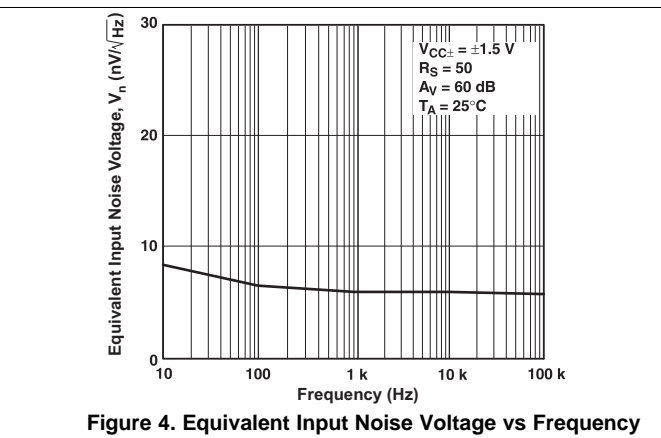
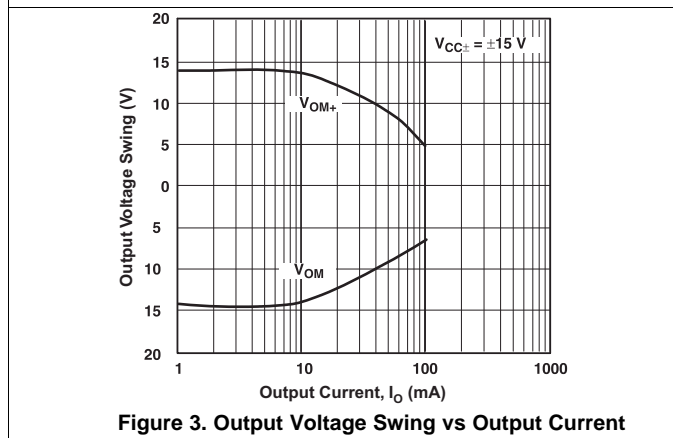
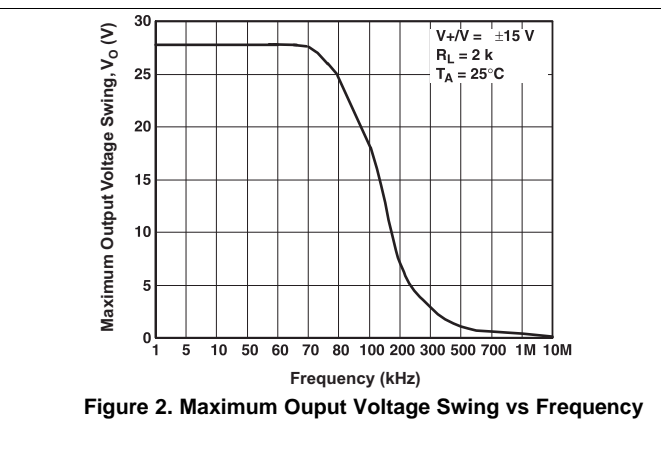
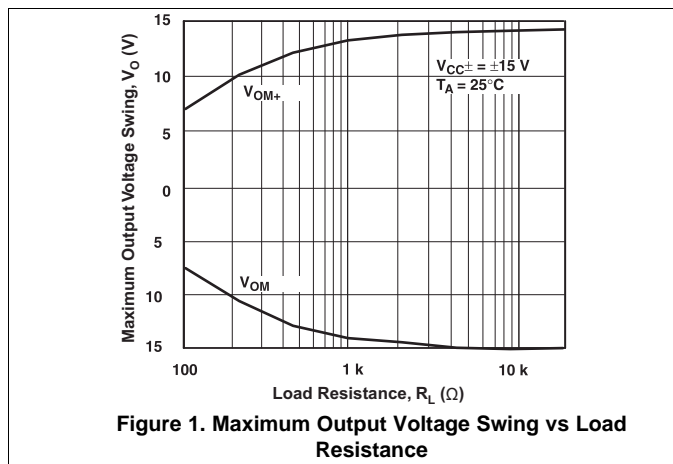
(1) Measured with  $V_{CC\pm}$  varied simultaneously

### 6.6 Operating Characteristics

$V_{CC\pm} = \pm 15\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TYP	UNIT
SR Slew rate at unity gain	$R_L \geq 2\text{ k}\Omega$	5	V/ $\mu\text{s}$
GBW Gain-bandwidth product	$f = 10\text{ kHz}$	12	MHz
THD Total harmonic distortion	$V_O = 5\text{ V}$ , $R_L = 2\text{ k}\Omega$ , $f = 1\text{ kHz}$ , $A_{VD} = 20\text{ dB}$	0.0005%	
$V_n$ Equivalent input noise voltage	RIAA, $R_S \leq 2.2\text{ k}\Omega$ , 30-kHz LPF	0.8	$\mu\text{Vrms}$

### 6.7 Typical Characteristics



Typical Characteristics (continued)

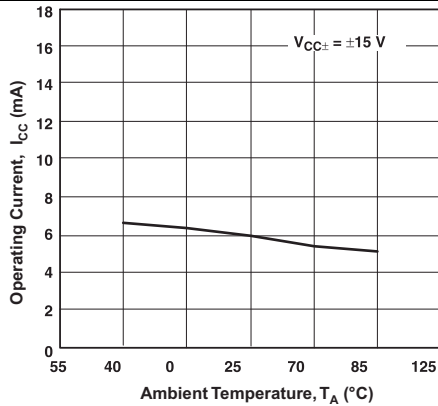


Figure 5. Operating Current vs Temperature

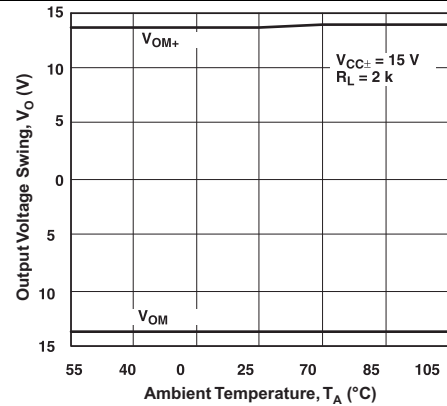


Figure 6. Output Voltage Swing vs Temperature

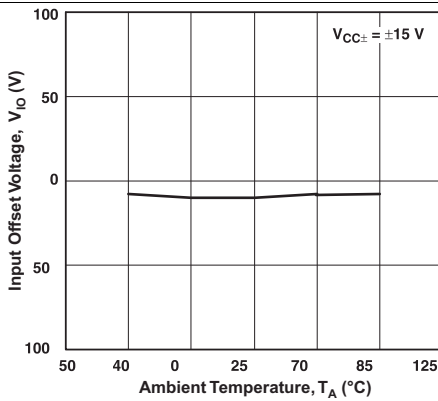


Figure 7. Input Offset Voltage vs Temperature

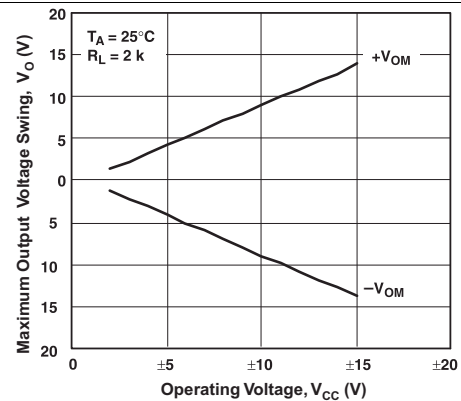


Figure 8. Input Bias Current vs Temperature

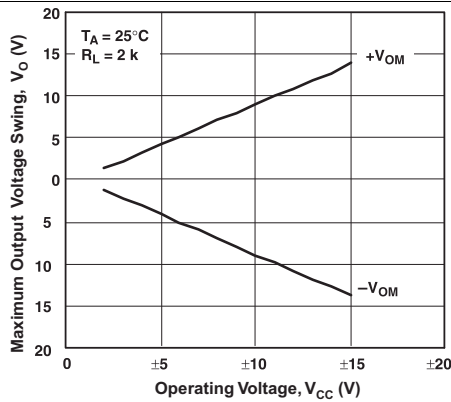


Figure 9. Maximum Output Voltage Swing vs Operating Voltage

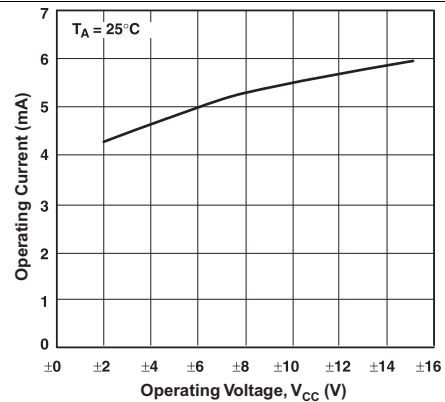


Figure 10. Operating Current vs Operating Voltage

Typical Characteristics (continued)

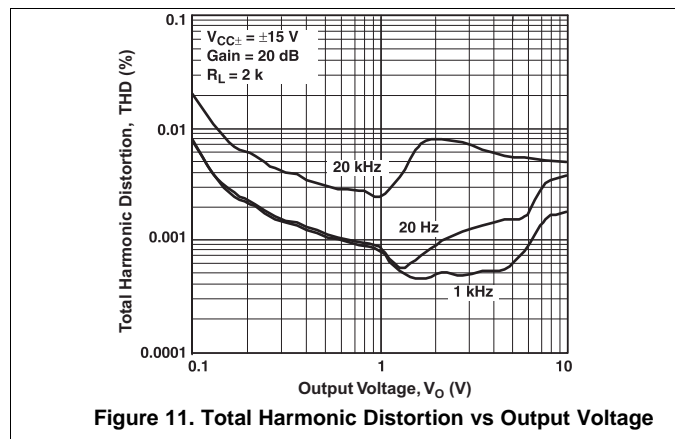


Figure 11. Total Harmonic Distortion vs Output Voltage

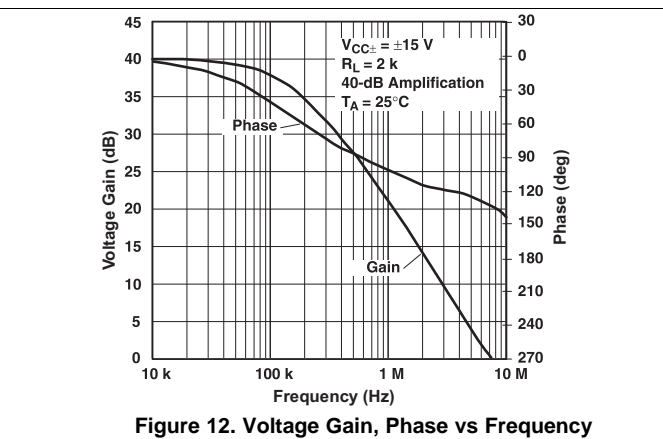


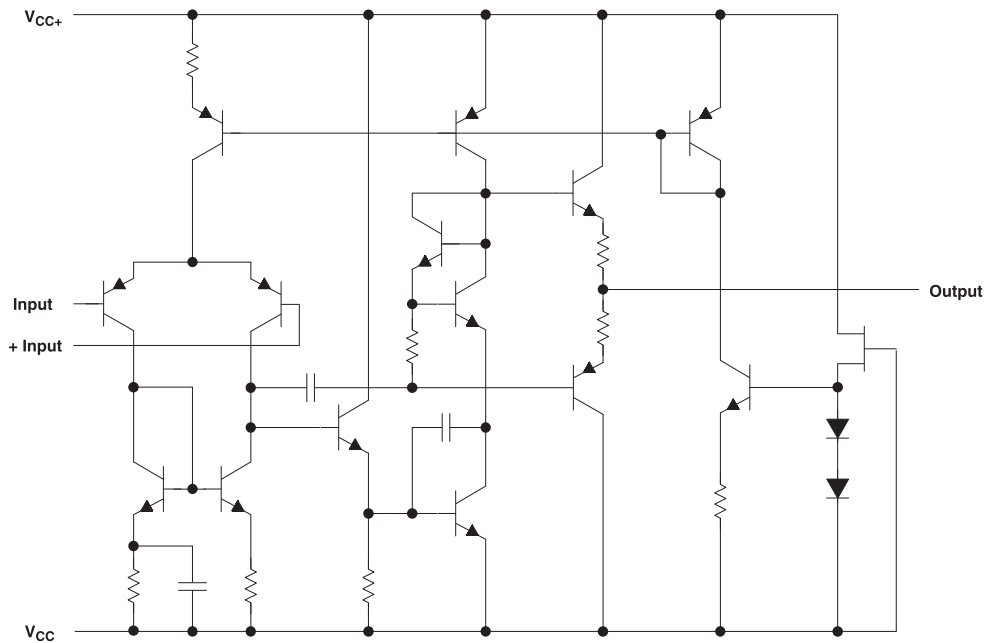
Figure 12. Voltage Gain, Phase vs Frequency

## 7 Detailed Description

### 7.1 Overview

The RC4580 device is a dual operational amplifier that has been designed optimally for audio applications, such as improving tone control. It offers low noise, high gain bandwidth, low harmonic distortion, and high output current, all of which make the device ideally suited for audio electronics, such as preamplifiers, active filters, and industrial measurement equipment. When high output current is required, the RC4580 device can be used as a headphone amplifier. Due to its wide operating supply voltage, the RC4580 device can also be used in low-voltage applications.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

#### 7.3.1 Unity-Gain Bandwidth

The unity-gain bandwidth is the frequency up to which an amplifier with a unity gain may be operated without greatly distorting the signal. The RC4580 device has a 12-MHz unity-gain bandwidth.

#### 7.3.2 Common-Mode Rejection Ratio

The common-mode rejection ratio (CMRR) of an amplifier is a measure of how well the device rejects unwanted input signals common to both input leads. It is found by taking the ratio of the change in input offset voltage to the change in the input voltage, then converting to decibels. Ideally the CMRR is infinite, but in practice, amplifiers are designed to have it as high as possible. The CMRR of the RC4580 device is 110 dB.

#### 7.3.3 Slew Rate

The slew rate is the rate at which an operational amplifier can change its output when there is a change on the input. The RC4580 device has a 5-V/ms slew rate.

### 7.4 Device Functional Mode

The RC4580 device is powered on when the supply is connected. Each device can be operated as a single-supply operational amplifier or dual-supply amplifier depending on the application.



## 8 Application and Implementation

### NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 8.1 Typical Application

Some applications require differential signals. Figure 13 shows a simple circuit to convert a single-ended input of 2 V to 10 V into differential output of  $\pm 8$  V on a single 15-V supply. The output range is intentionally limited to maximize linearity. The circuit is composed of two amplifiers. One amplifier acts as a buffer and creates a voltage,  $V_{OUT+}$ . The second amplifier inverts the input and adds a reference voltage to generate  $V_{OUT-}$ . Both  $V_{OUT+}$  and  $V_{OUT-}$  range from 2 V to 10 V. The difference,  $V_{DIFF}$ , is the difference between  $V_{OUT+}$  and  $V_{OUT-}$ .

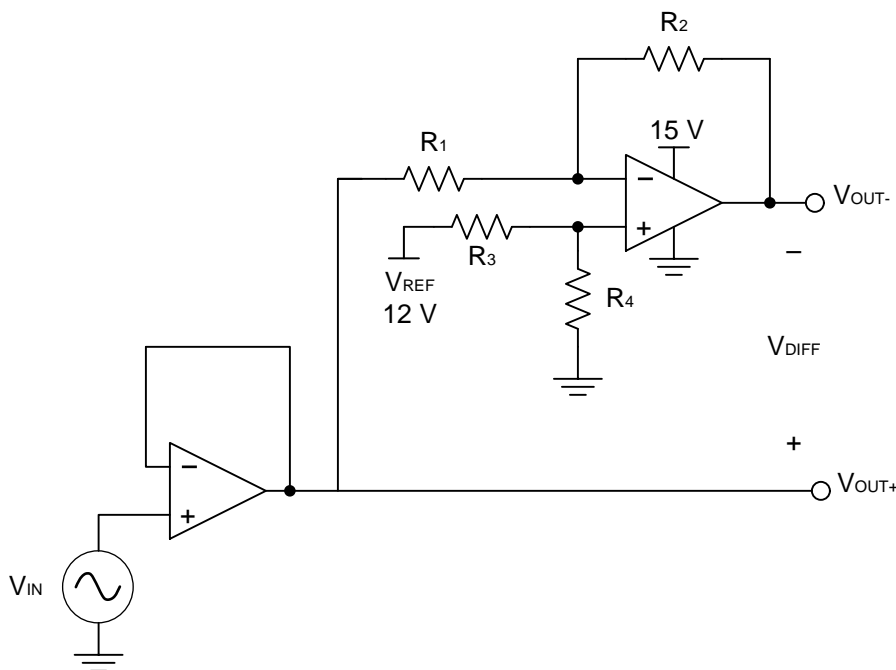


Figure 13. Schematic for Single-Ended Input to Differential Output Conversion

## Typical Application (continued)

### 8.1.1 Design Requirements

The design requirements are as follows:

- Supply voltage: 15 V
- Reference voltage: 12V
- Input: 2 V to 10 V
- Output differential:  $\pm 8$  V

### 8.1.2 Detailed Design Procedure

The circuit in [Figure 13](#) takes a single-ended input signal,  $V_{IN}$ , and generates two output signals,  $V_{OUT+}$  and  $V_{OUT-}$  using two amplifiers and a reference voltage,  $V_{REF}$ .  $V_{OUT+}$  is the output of the first amplifier and is a buffered version of the input signal,  $V_{IN}$  (see [Equation 1](#)).  $V_{OUT-}$  is the output of the second amplifier which uses  $V_{REF}$  to add an offset voltage to  $V_{IN}$  and feedback to add inverting gain. The transfer function for  $V_{OUT-}$  is [Equation 2](#).

$$V_{OUT+} = V_{IN} \quad (1)$$

$$V_{OUT-} = V_{REF} \times \left( \frac{R_4}{R_3 + R_4} \right) \times \left( 1 + \frac{R_2}{R_1} \right) - V_{IN} \times \frac{R_2}{R_1} \quad (2)$$

The differential output signal,  $V_{DIFF}$ , is the difference between the two single-ended output signals,  $V_{OUT+}$  and  $V_{OUT-}$ . [Equation 3](#) shows the transfer function for  $V_{DIFF}$ . By applying the conditions that  $R_1 = R_2$  and  $R_3 = R_4$ , the transfer function is simplified into [Equation 6](#). Using this configuration, the maximum input signal is equal to the reference voltage and the maximum output of each amplifier is equal to the  $V_{REF}$ . The differential output range is  $2 \times V_{REF}$ . Furthermore, the common mode voltage will be one half of  $V_{REF}$  (see [Equation 7](#)).

$$V_{DIFF} = V_{OUT+} - V_{OUT-} = V_{IN} \times \left( 1 + \frac{R_2}{R_1} \right) - V_{REF} \times \left( \frac{R_4}{R_3 + R_4} \right) \left( 1 + \frac{R_2}{R_1} \right) \quad (3)$$

$$V_{OUT+} = V_{IN} \quad (4)$$

$$V_{OUT-} = V_{REF} - V_{IN} \quad (5)$$

$$V_{DIFF} = 2 \times V_{IN} - V_{REF} \quad (6)$$

$$V_{cm} = \left( \frac{V_{OUT+} + V_{OUT-}}{2} \right) = \frac{1}{2} V_{REF} \quad (7)$$

#### 8.1.2.1 Amplifier Selection

Linearity over the input range is key for good dc accuracy. The common mode input range and the output swing limitations determine the linearity. In general, an amplifier with rail-to-rail input and output swing is required. Bandwidth is a key concern for this design. Because the RC4580 device has a bandwidth of 12 MHz, this circuit will only be able to process signals with frequencies of less than 12 MHz.

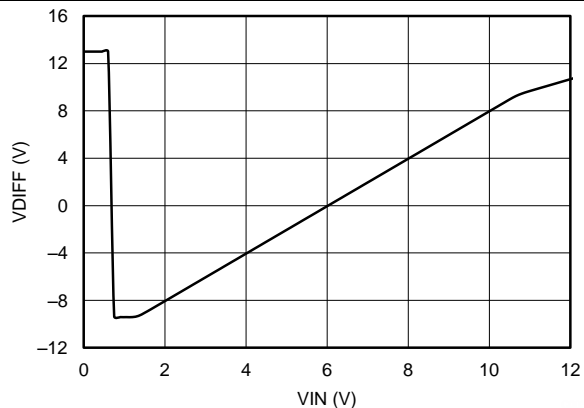
#### 8.1.2.2 Passive Component Selection

Because the transfer function of  $V_{OUT-}$  is heavily reliant on resistors ( $R_1$ ,  $R_2$ ,  $R_3$ , and  $R_4$ ), use resistors with low tolerances to maximize performance and minimize error. This design used resistors with resistance values of 36 k $\Omega$  with tolerances measured to be within 2%. But, if the noise of the system is a key parameter, the user can select smaller resistance values (6 k $\Omega$  or lower) to keep the overall system noise low. This ensures that the noise from the resistors is lower than the amplifier noise.

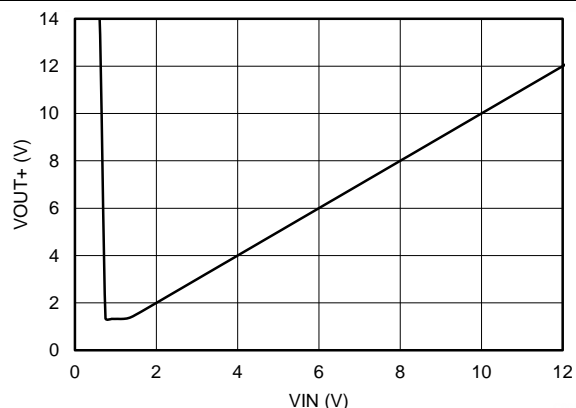
## Typical Application (continued)

### 8.1.3 Application Curves

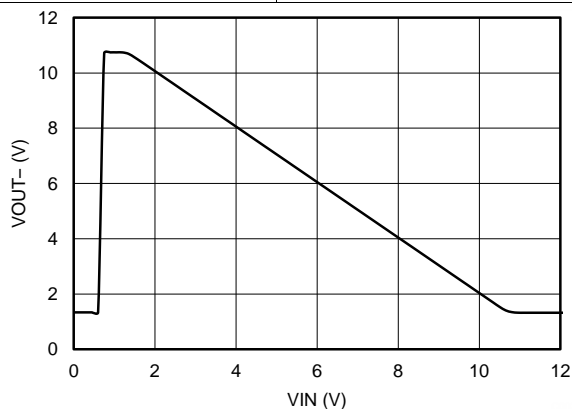
The measured transfer functions in [Figure 14](#), [Figure 15](#), and [Figure 16](#) were generated by sweeping the input voltage from 0 V to 12 V. However, this design should only be used between 2 V and 10 V for optimum linearity.



**Figure 14. Differential Output Voltage vs Input Voltage**



**Figure 15. Positive Output Voltage vs Input Voltage**



**Figure 16. Positive Output Voltage vs Input Voltage**

## 9 Power Supply Recommendations

The RC4580 device is specified for operation over the range of  $\pm 2$  to  $\pm 16$  V; many specifications apply from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The [Typical Characteristics](#) section presents parameters that can exhibit significant variance with regard to operating voltage or temperature.

### CAUTION

Supply voltages outside of the  $\pm 18$  V range can permanently damage the device (see the [Absolute Maximum Ratings](#)).

Place 0.1- $\mu\text{F}$  bypass capacitors close to the power-supply pins to reduce errors coupling in from noisy or high impedance power supplies. For more detailed information on bypass capacitor placement, refer to the [Layout Guidelines](#).

## 10 Layout

### 10.1 Layout Guidelines

For best operational performance of the device, use good PCB layout practices, including:

- Noise can propagate into analog circuitry through the power pins of the circuit as a whole and the operational amplifier. Bypass capacitors are used to reduce the coupled noise by providing low impedance power sources local to the analog circuitry.
  - Connect low-ESR, 0.1- $\mu$ F ceramic bypass capacitors between each supply pin and ground, placed as close to the device as possible. A single bypass capacitor from V+ to ground is applicable for single supply applications.
- Separate grounding for analog and digital portions of circuitry is one of the simplest and most-effective methods of noise suppression. One or more layers on multilayer PCBs are usually devoted to ground planes. A ground plane helps distribute heat and reduces EMI noise pickup. Make sure to physically separate digital and analog grounds, paying attention to the flow of the ground current. For more detailed information, refer to *Circuit Board Layout Techniques*, (SLOA089).
- To reduce parasitic coupling, run the input traces as far away from the supply or output traces as possible. If it is not possible to keep them separate, it is much better to cross the sensitive trace perpendicular as opposed to in parallel with the noisy trace.
- Place the external components as close to the device as possible. Keeping RF and RG close to the inverting input minimizes parasitic capacitance, as shown in *Layout Example*.
- Keep the length of input traces as short as possible. Always remember that the input traces are the most sensitive part of the circuit.
- Consider a driven, low-impedance guard ring around the critical traces. A guard ring can significantly reduce leakage currents from nearby traces that are at different potentials.

### 10.2 Layout Example

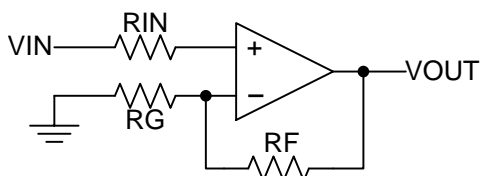


Figure 17. Operational Amplifier Schematic for Noninverting Configuration

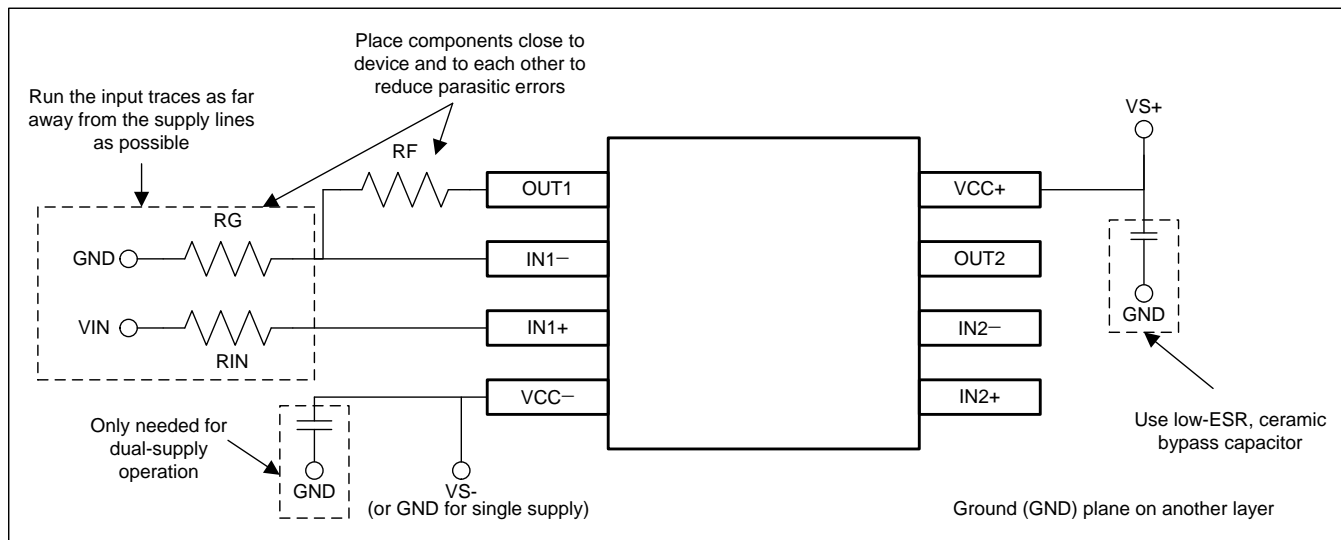


Figure 18. Operational Amplifier Board Layout for Noninverting Configuration

## 11 Device and Documentation Support

### 11.1 Trademarks

All trademarks are the property of their respective owners.

### 11.2 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 11.3 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 12 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
RC4580ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	R4580I	<a href="#">Samples</a>
RC4580IDE4	ACTIVE	SOIC	D	8		TBD	Call TI	Call TI	-40 to 85		<a href="#">Samples</a>
RC4580IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	R4580I	<a href="#">Samples</a>
RC4580IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	R4580I	<a href="#">Samples</a>
RC4580IDRE4	ACTIVE	SOIC	D	8		TBD	Call TI	Call TI	-40 to 85		<a href="#">Samples</a>
RC4580IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	R4580I	<a href="#">Samples</a>
RC4580IP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 85	RC4580IP	<a href="#">Samples</a>
RC4580IPE4	ACTIVE	PDIP	P	8		TBD	Call TI	Call TI	-40 to 85		<a href="#">Samples</a>
RC4580IPW	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	R4580I	<a href="#">Samples</a>
RC4580IPWE4	ACTIVE	TSSOP	PW	8		TBD	Call TI	Call TI	-40 to 85		<a href="#">Samples</a>
RC4580IPWG4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	R4580I	<a href="#">Samples</a>
RC4580IPWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	R4580I	<a href="#">Samples</a>
RC4580IPWRE4	ACTIVE	TSSOP	PW	8		TBD	Call TI	Call TI	-40 to 85		<a href="#">Samples</a>
RC4580IPWRG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	R4580I	<a href="#">Samples</a>

(1) 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.

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

(2) 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)

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

#### **OTHER QUALIFIED VERSIONS OF RC4580 :**

- Automotive: [RC4580-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects



## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
RC4580IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
RC4580IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
RC4580IPWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
RC4580IDR	SOIC	D	8	2500	340.5	338.1	20.6
RC4580IDR	SOIC	D	8	2500	367.0	367.0	35.0
RC4580IPWR	TSSOP	PW	8	2000	367.0	367.0	35.0

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MS-001 variation BA.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

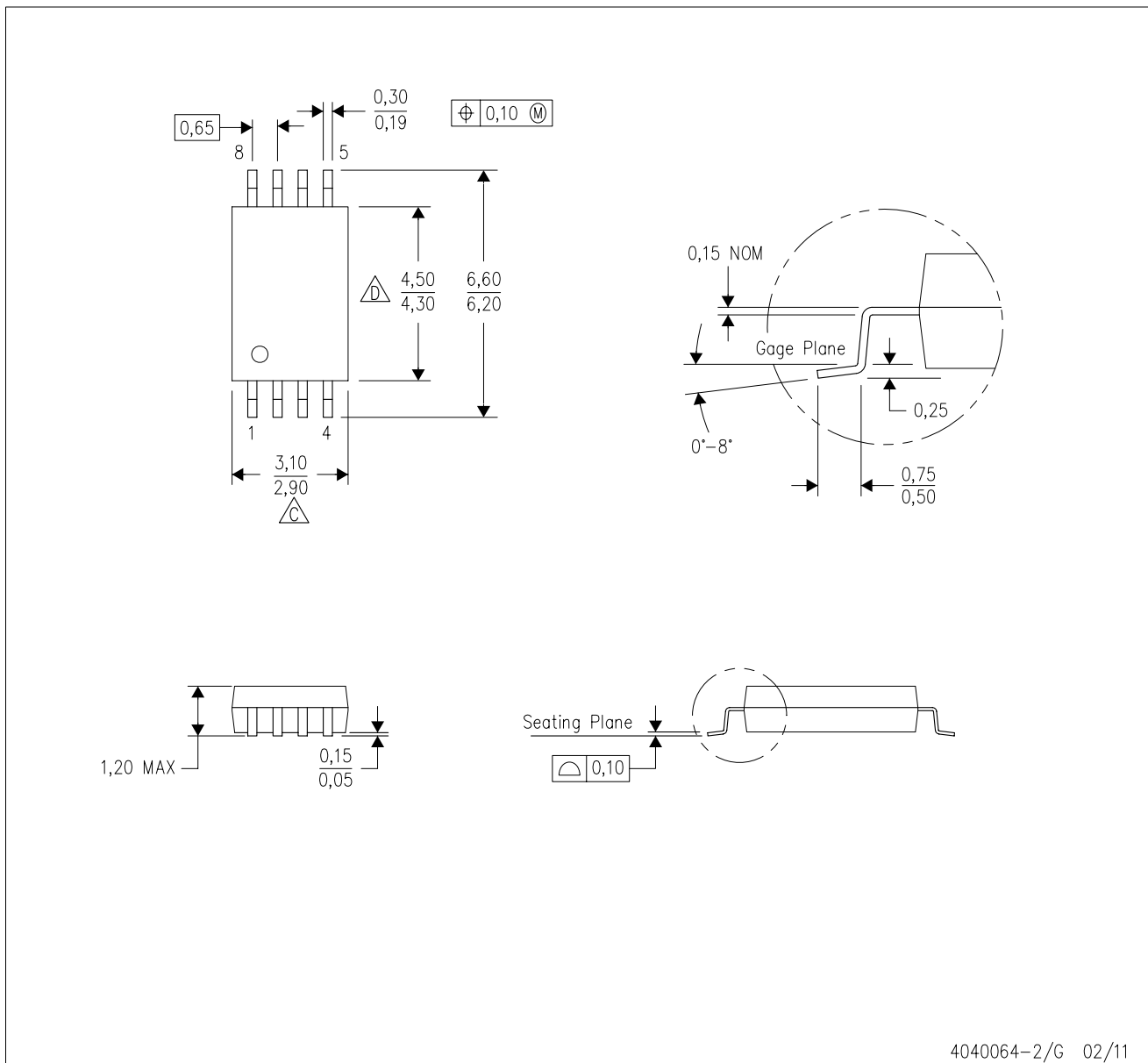
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)