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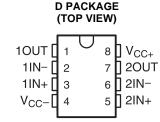
# **DUAL AUDIO OPERATIONAL AMPLIFIER**

Check for Samples: RC4580-Q1

# **FEATURES**

- Qualified for Automotive Applications
- Operating Voltage . . . ±2 V to ±18 V
- Low Noise Voltage . . . 0.8 μVrms (TYP)
- Wide GBW . . . 12 MHz (TYP)
- Low THD . . . 0.0005% (TYP)
- Slew Rate . . . 5 V/μs (TYP)
- Suitable for Applications Such As Audio Preamplifier, Active Filter, Headphone Amplifier, Industrial Measurement Equipment
- Drop-In Replacement for NJM4580

 Pin and Function Compatible With LM833, NE5532, NJM4558/9, and NJM4560/2/5



# **DESCRIPTION/ORDERING INFORMATION**

The RC4580-Q1 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 audio preamplifiers and active filters, as well as industrial measurement equipment. When high output current is required, the RC4580-Q1 also can be used as a headphone amplifier. Due to its wide operating supply voltage, the RC4580 also can be used in low-voltage applications.

# ORDERING INFORMATION(1)

T <sub>A</sub> PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING	
-40°C to 125°C	SOIC - D	Reel of 2000	RC4580QDRQ1	R4580Q

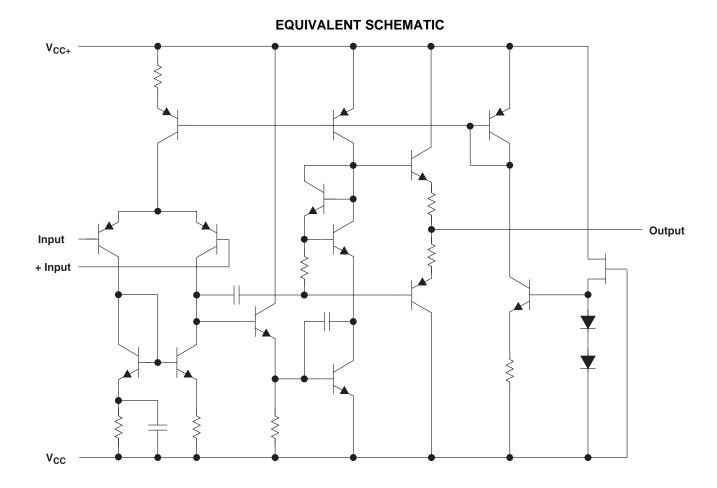
For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI
web site at www.ti.com.

(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.



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# **ABSOLUTE MAXIMUM RATINGS**(1)

over operating free-air temperature range (unless otherwise noted)

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage		±18	V	
	Input voltage (any input)			±15	V
V <sub>ID</sub>	Differential input voltage		±30	V	
	Output current			±50	mA
$\theta_{JA}$	Package thermal impedance, junction to free air (2) (3)	D package		97	°C/W
$T_{J}$	Operating virtual junction temperature	•		150	°C
T <sub>stg</sub>	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, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- Maximum power dissipation is a function of  $T_J(max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(max) T_A)/\theta_{JA}$ . Selecting the maximum of 150°C can affect reliability. The package thermal impedance is calculated in accordance with JESD 51-7.

# RECOMMENDED OPERATING CONDITIONS

		MIN	MAX	UNIT
V <sub>CC+</sub>	Complexedtage	2	16	\ <i>/</i>
V <sub>CC</sub> -	Supply voltage		-16	V
$V_{ICR}$	Input common-mode voltage range	-13.5	13.5	V
T <sub>A</sub>	Operating free-air temperature	-40	125	°C

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# **ELECTRICAL CHARACTERISTICS**

 $V_{CC+} = \pm 15 \text{ V}, T_A = 25^{\circ}\text{C}$  (unless otherwise noted)

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

<sup>(1)</sup> Measured with  $V_{CC\pm}$  varied simultaneously

# **OPERATING CHARACTERISTICS**

 $V_{CC\pm} = \pm 15 \text{ V}, T_A = 25^{\circ}\text{C}$  (unless otherwise noted)

- CO±	PARAMETER	TEST CONDITIONS	TYP	UNIT
SR	Slew rate at unity gain	$R_L \ge 2 k\Omega$	5	V/μs
GBW	Gain-bandwidth product	f = 10 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 <sub>n</sub>	Equivalent input noise voltage	RIAA, $R_S \le 2.2 \text{ k}\Omega$ , 30-kHz LPF	0.8	μVrms

Product Folder Link(s): RC4580-Q1



# **TYPICAL CHARACTERISTICS**

# **MAXIMUM OUTPUT VOLTAGE SWING**

# **LOAD RESISTANCE**

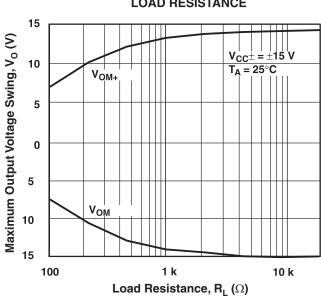


Figure 1.

# **MAXIMUM OUTPUT VOLTAGE SWING**

# **FREQUENCY**

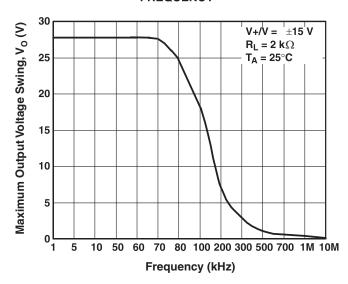
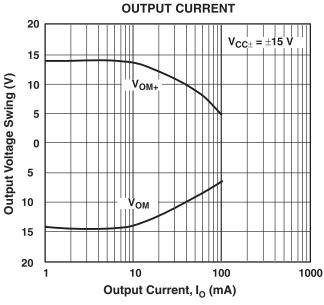


Figure 2.

# **OUTPUT VOLTAGE SWING**



# Figure 3.

# **EQUIVALENT INPUT NOISE VOLTAGE**

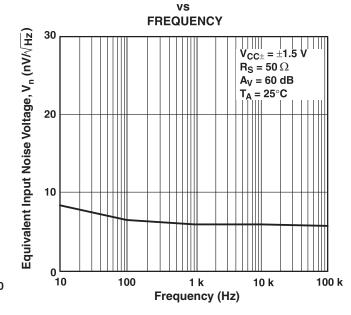


Figure 4.



# **TYPICAL CHARACTERISTICS (continued)**

15

15 L 55

# **OPERATING CURRENT TEMPERATURE** 18 $V_{CC\pm} = \pm 15 \text{ V}$ 16 14 Operating Current, I<sub>CC</sub> (mA) 12 10 8 6 2 40 0 25 70 125 55 Ambient Temperature, T<sub>A</sub> (°C)

V<sub>OM+</sub>

**OUTPUT VOLTAGE SWING** 

**TEMPERATURE** 

Figure 6.

Ambient Temperature, T<sub>A</sub> (°C)

25

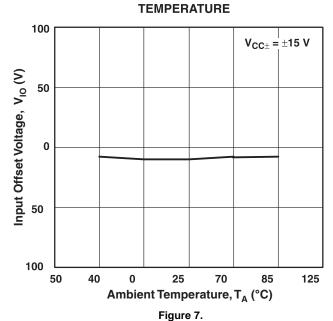
70

85

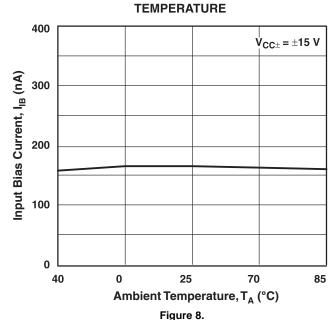
105

# INPUT OFFSET VOLTAGE vs

Figure 5.



# INPUT BIAS CURRENT vs



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# TYPICAL CHARACTERISTICS (continued)

# MAXIMUM OUTPUT VOLTAGE SWING

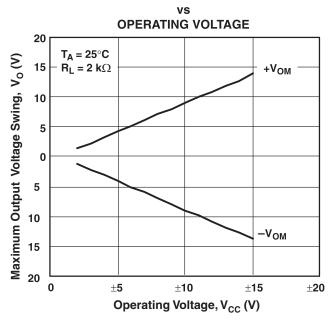


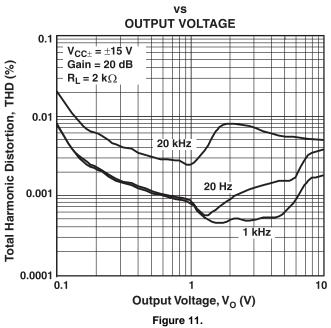
Figure 9.

# OPERATING VOLTAGE 7 TA = 25°C 6 6 7 Ta = 25°C 1 1 0 ±0 ±0 ±2 ±4 ±6 E8 ±10 ±12 ±14 ±16 Operating Voltage, V<sub>CC</sub> (V)

**OPERATING CURRENT** 

Figure 10.

# **TOTAL HARMONIC DISTORTION**



VOLTAGE GAIN, PHASE vs

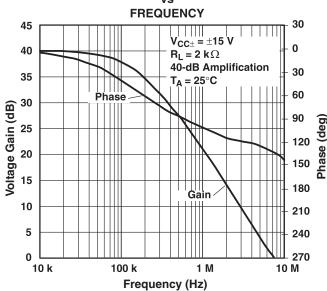


Figure 12.

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### **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>	Samples (Requires Login)
RC4580QDRQ1	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples

(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.

**OBSOLETE:** 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.

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### OTHER QUALIFIED VERSIONS OF RC4580-Q1:

Catalog: RC4580

NOTE: Qualified Version Definitions:

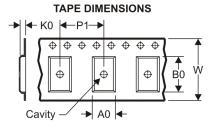
Catalog - TI's standard catalog product

# PACKAGE MATERIALS INFORMATION

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# TAPE AND REEL INFORMATION





A0	Dimension designed to accommodate the component width
	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	e recent tricker of the control tape
P1	Pitch between successive cavity centers

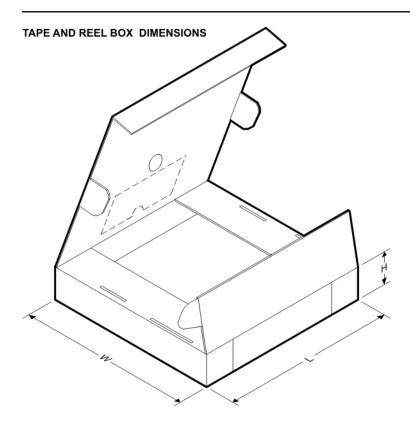
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



# \*All dimensions are nominal

Device	Package Type	Package Drawing			Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
RC4580QDRQ1	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

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## \*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
RC4580QDRQ1	SOIC	D	8	2500	340.5	338.1	20.6

# 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.
- 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.
- 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.



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