



# 1.8V, 2.9 $\mu$ A, 90kHz, Rail-to-Rail I/O OPERATIONAL AMPLIFIERS

## FEATURES

- **LOW NOISE:** 2.8 $\mu$ V<sub>PP</sub> (0.1Hz - 10Hz)
- **microPower:** 5.5 $\mu$ A (max)
- **LOW OFFSET VOLTAGE:** 1.5mV (max)
- **DC PRECISION:**
  - **CMRR:** 100dB
  - **PSRR:** 2 $\mu$ V/V
  - **A<sub>OL</sub>:** 120dB
- **WIDE SUPPLY VOLTAGE RANGE:** 1.8V to 5.5V
- **microSize PACKAGES:**
  - SC70-5, SOT23-5, SOT23-8, SO-8, TSSOP-14

## APPLICATIONS

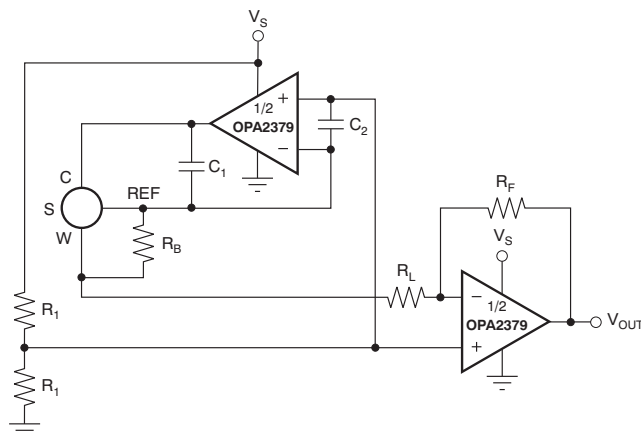
- **BATTERY-POWERED INSTRUMENTS**
- **PORTABLE DEVICES**
- **MEDICAL INSTRUMENTS**
- **HANDHELD TEST EQUIPMENT**

## DESCRIPTION

The OPA379 family of micropower, low-voltage operational amplifiers is designed for battery-powered applications. These amplifiers operate on a supply voltage as low as 1.8V ( $\pm 0.9$ V). High-performance, single-supply operation with rail-to-rail capability (10 $\mu$ V max) makes the OPA379 family useful for a wide range of applications.

In addition to *microSize* packages, the OPA379 family of op amps features impressive bandwidth (90kHz), low bias current (5pA), and low noise (80nV/ $\sqrt{\text{Hz}}$ ) relative to the very low quiescent current (5.5 $\mu$ A max).

The OPA379 (single) is available in SC70-5, SOT23-5, and SO-8 packages. The OPA2379 (dual) comes in SOT23-8 and SO-8 packages. The OPA4379 (quad) is offered in a TSSOP-14 package. All versions are specified from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .



**Figure 1. OPA2379 in Portable Gas Meter Application**

**Table 1. OPAX379 RELATED PRODUCTS**

| FEATURES                                                              | PRODUCT                 |
|-----------------------------------------------------------------------|-------------------------|
| 1 $\mu$ A, 70kHz, 2mV V <sub>OS</sub> , 1.8V to 5.5V Supply           | <a href="#">OPAx349</a> |
| 1 $\mu$ A, 5.5kHz, 390 $\mu$ V V <sub>OS</sub> , 2.5V to 16V Supply   | <a href="#">TLV240x</a> |
| 1 $\mu$ A, 5.5kHz, 0.6mV V <sub>OS</sub> , 2.5V to 12V Supply         | <a href="#">TLV224x</a> |
| 7 $\mu$ A, 160kHz, 0.5mV V <sub>OS</sub> , 2.7V to 16V Supply         | <a href="#">TLV27Lx</a> |
| 7 $\mu$ A, 160kHz, 0.5mV V <sub>OS</sub> , 2.7V to 16V Supply         | <a href="#">TLV238x</a> |
| 20 $\mu$ A, 350kHz, 2mV V <sub>OS</sub> , 2.3V to 5.5V Supply         | <a href="#">OPAx347</a> |
| 20 $\mu$ A, 500kHz, 550 $\mu$ V V <sub>OS</sub> , 1.8V to 3.6V Supply | <a href="#">TLV276x</a> |
| 45 $\mu$ A, 1MHz, 1mV V <sub>OS</sub> , 2.1V to 5.5V Supply           | <a href="#">OPAx348</a> |



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This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Over operating free-air temperature range (unless otherwise noted).

|                                                |                            | OPA379, OPA2379, OPA4379     | UNIT |
|------------------------------------------------|----------------------------|------------------------------|------|
| Supply Voltage                                 | $V_S = (V+) - (V-)$        | +7                           | V    |
| Signal Input Terminals, Voltage <sup>(2)</sup> |                            | $(V-) - 0.5$ to $(V+) + 0.5$ | V    |
| Signal Input Terminals, Current <sup>(2)</sup> |                            | ±10                          | mA   |
| Output Short-Circuit <sup>(3)</sup>            |                            | Continuous                   |      |
| Operating Temperature                          | $T_A$                      | –40 to +125                  | °C   |
| Storage Temperature                            | $T_A$                      | –65 to +150                  | °C   |
| Junction Temperature                           | $T_J$                      | +150                         | °C   |
| ESD Rating                                     | Human Body Model (HBM)     | 2000                         | V    |
|                                                | Charged Device Model (CDM) | 1000                         | V    |

- (1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not supported.
- (2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.5V beyond the supply rails should be current-limited to 10mA or less.
- (3) Short-circuit to ground, one amplifier per package.

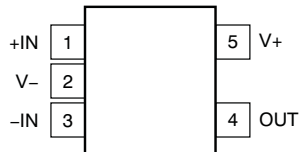
## PACKAGE/ORDERING INFORMATION<sup>(1)</sup>

| PRODUCT | PACKAGE-LEAD | PACKAGE DESIGNATOR | PACKAGE MARKING |
|---------|--------------|--------------------|-----------------|
| OPA379  | SC70–5       | DCK                | AYR             |
|         | SOT23–5      | DBV                | B53             |
|         | SO–8         | D                  | OPA379A         |
| OPA2379 | SOT23–8      | DCN                | B61             |
|         | SO–8         | D                  | OPA2379A        |
| OPA4379 | TSSOP–14     | PW                 | OPA4379A        |

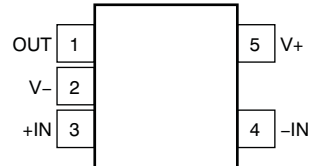
- (1) For the most current package and ordering information see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

## PIN CONFIGURATIONS

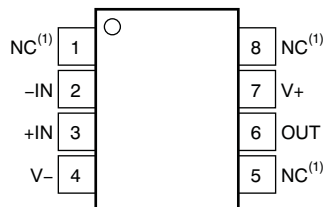
**OPA379  
SC70-5  
(TOP VIEW)**



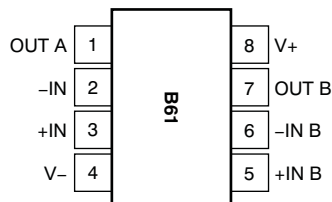
**OPA379  
SOT23-5  
(TOP VIEW)**



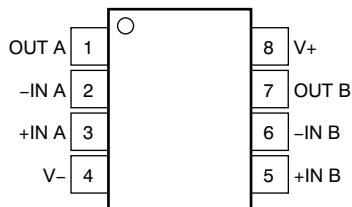
**OPA379  
SO-8  
(TOP VIEW)**



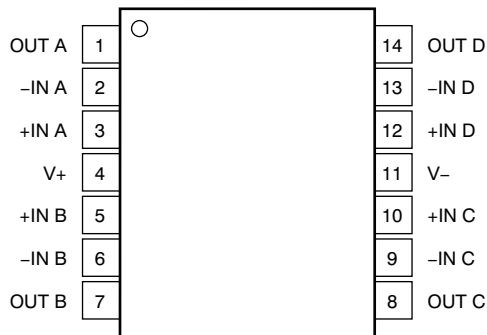
**OPA2379<sup>(2)</sup>  
SOT23-8  
(TOP VIEW)**



**OPA2379  
SO-8  
(TOP VIEW)**



**OPA4379  
TSSOP-14  
(TOP VIEW)**



(1) NC denotes no internal connection.

(2) Pin 1 of the SOT23-8 package is determined by orienting the package marking as shown.

## ELECTRICAL CHARACTERISTICS: $V_S = +1.8V$ to $+5.5V$

**Boldface** limits apply over the specified temperature range indicated.

At  $T_A = +25^\circ\text{C}$ ,  $R_L = 25\text{k}\Omega$  connected to  $V_S/2$ , and  $V_{CM} < (V+) - 1V$ , unless otherwise noted.

| PARAMETER                                              |              | TEST CONDITIONS                                                                                      | OPA379, OPA2379, OPA4379     |                       |           | UNIT                           |
|--------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------------|------------------------------|-----------------------|-----------|--------------------------------|
|                                                        |              |                                                                                                      | MIN                          | TYP                   | MAX       |                                |
| OFFSET VOLTAGE                                         |              |                                                                                                      |                              |                       |           |                                |
| Initial Offset Voltage                                 | $V_{OS}$     | $V_S = 5V$                                                                                           |                              | 0.4                   | 1.5       | mV                             |
| Over $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$   |              |                                                                                                      |                              |                       | 2         | mV                             |
| Drift, $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$  | $dV_{OS}/dT$ |                                                                                                      |                              | 1.5                   |           | $\mu\text{V}/^{\circ}\text{C}$ |
| Drift, $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ |              |                                                                                                      |                              | 2.7                   |           | $\mu\text{V}/^{\circ}\text{C}$ |
| vs Power Supply                                        | PSRR         |                                                                                                      |                              | 2                     | 10        | $\mu\text{V}/V$                |
| Over $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$   |              |                                                                                                      |                              |                       | 20        | $\mu\text{V}/V$                |
| INPUT VOLTAGE RANGE                                    |              |                                                                                                      |                              |                       |           |                                |
| Common-Mode Voltage Range                              | $V_{CM}$     |                                                                                                      | $(V-) - 0.1$ to $(V+) + 0.1$ |                       |           | V                              |
| Common-Mode Rejection Ratio <sup>(1)</sup>             | CMRR         | $(V-) < V_{CM} < (V+) - 1V$                                                                          | 90                           | 100                   |           | dB                             |
| Over $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$    |              | $(V-) < V_{CM} < (V+) - 1V$                                                                          | 80                           |                       |           | dB                             |
| Over $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$   |              | $(V-) < V_{CM} < (V+) - 1V$                                                                          | 62                           |                       |           | dB                             |
| INPUT BIAS CURRENT                                     |              |                                                                                                      |                              |                       |           |                                |
| Input Bias Current                                     | $I_B$        | $V_S = 5V, V_{CM} \leq V_S/2$                                                                        |                              | $\pm 5$               | $\pm 50$  | pA                             |
| Input Offset Current                                   | $I_{OS}$     | $V_S = 5V$                                                                                           |                              | $\pm 5$               | $\pm 50$  | pA                             |
| INPUT IMPEDANCE                                        |              |                                                                                                      |                              |                       |           |                                |
| Differential                                           |              |                                                                                                      |                              | $10^{13} \parallel 3$ |           | $\Omega \parallel \text{pF}$   |
| Common-Mode                                            |              |                                                                                                      |                              | $10^{13} \parallel 6$ |           | $\Omega \parallel \text{pF}$   |
| NOISE                                                  |              |                                                                                                      |                              |                       |           |                                |
| Input Voltage Noise                                    |              | $f = 0.1\text{Hz}$ to $10\text{Hz}$                                                                  |                              | 2.8                   |           | $\mu\text{V}_{PP}$             |
| Input Voltage Noise Density                            | $e_n$        | $f = 1\text{kHz}$                                                                                    |                              | 80                    |           | $\text{nV}/\sqrt{\text{Hz}}$   |
| Input Current Noise Density                            | $i_n$        | $f = 1\text{kHz}$                                                                                    |                              | 1                     |           | $\text{fA}/\sqrt{\text{Hz}}$   |
| OPEN-LOOP GAIN                                         |              |                                                                                                      |                              |                       |           |                                |
| Open-Loop Voltage Gain                                 | $A_{OL}$     | $V_S = 5V, R_L = 25\text{k}\Omega, 100\text{mV} < V_O < (V+) - 100\text{mV}$                         | 100                          | 120                   |           | dB                             |
| Over $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$   |              | <b><math>V_S = 5V, R_L = 25\text{k}\Omega, 100\text{mV} &lt; V_O &lt; (V+) - 100\text{mV}</math></b> | <b>80</b>                    |                       |           | <b>dB</b>                      |
|                                                        |              | $V_S = 5V, R_L = 5\text{k}\Omega, 500\text{mV} < V_O < (V+) - 500\text{mV}$                          | 100                          | 120                   |           | dB                             |
| Over $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$   |              | <b><math>V_S = 5V, R_L = 5\text{k}\Omega, 500\text{mV} &lt; V_O &lt; (V+) - 500\text{mV}</math></b>  | <b>80</b>                    |                       |           | <b>dB</b>                      |
| OUTPUT                                                 |              |                                                                                                      |                              |                       |           |                                |
| Voltage Output Swing from Rail                         |              | $R_L = 25\text{k}\Omega$                                                                             |                              | 5                     | 10        | mV                             |
| Over $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$   |              | <b><math>R_L = 25\text{k}\Omega</math></b>                                                           |                              |                       | <b>15</b> | <b>mV</b>                      |
|                                                        |              | $R_L = 5\text{k}\Omega$                                                                              |                              | 25                    | 50        | mV                             |
| Over $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$   |              | <b><math>R_L = 5\text{k}\Omega</math></b>                                                            |                              |                       | <b>75</b> | <b>mV</b>                      |
| Short-Circuit Current                                  | $I_{SC}$     |                                                                                                      |                              | $\pm 5$               |           | mA                             |
| Capacitive Load Drive                                  | $C_{LOAD}$   |                                                                                                      | See Typical Characteristics  |                       |           |                                |
| Closed-Loop Output Impedance                           | $R_{OUT}$    | $G = 1, f = 1\text{kHz}, I_O = 0$                                                                    |                              | 10                    |           | $\Omega$                       |
| Open-Loop Output Impedance                             | $R_O$        | $f = 100\text{kHz}, I_O = 0$                                                                         |                              | 28                    |           | k $\Omega$                     |
| FREQUENCY RESPONSE                                     |              | $C_{LOAD} = 30\text{pF}$                                                                             |                              |                       |           |                                |
| Gain Bandwidth Product                                 | GBW          |                                                                                                      |                              | 90                    |           | kHz                            |
| Slew Rate                                              | SR           | $G = +1$                                                                                             |                              | 0.03                  |           | V/ $\mu\text{s}$               |
| Overload Recovery Time                                 |              | $V_{IN} \times \text{GAIN} > V_S$                                                                    |                              | 25                    |           | $\mu\text{s}$                  |
| Turn-On Time                                           | $t_{ON}$     |                                                                                                      |                              | 1                     |           | ms                             |

(1) See Typical Characteristic graph, *Common-Mode Rejection Ratio vs Frequency* (Figure 3).

**ELECTRICAL CHARACTERISTICS:  $V_S = +1.8V$  to  $+5.5V$  (continued)**

**Boldface** limits apply over the specified temperature range indicated.

At  $T_A = +25^\circ C$ ,  $R_L = 25k\Omega$  connected to  $V_S/2$ , and  $V_{CM} < (V+) - 1V$ , unless otherwise noted.

| PARAMETER                         | TEST CONDITIONS | OPA379, OPA2379, OPA4379 |     |      | UNIT |
|-----------------------------------|-----------------|--------------------------|-----|------|------|
|                                   |                 | MIN                      | TYP | MAX  |      |
| POWER SUPPLY                      |                 |                          |     |      |      |
| Specified/Operating Voltage Range | V <sub>S</sub>  | 1.8                      |     | 5.5  | V    |
| Quiescent Current per Amplifier   | I <sub>Q</sub>  |                          | 2.9 | 5.5  | μA   |
| Over –40°C to +125°C              |                 |                          |     | 10   | μA   |
| TEMPERATURE                       |                 |                          |     |      |      |
| Specified/Operating Range         | T <sub>A</sub>  | –40                      |     | +125 | °C   |
| Storage Range                     | T <sub>J</sub>  | –65                      |     | +150 | °C   |
| Thermal Resistance                | θ <sub>JA</sub> |                          |     |      |      |
| SC70–5                            |                 |                          | 250 |      | °C/W |
| SOT23–5                           |                 |                          | 200 |      | °C/W |
| SOT23–8, TSSOP–14, SO–8           |                 |                          | 150 |      | °C/W |

## TYPICAL CHARACTERISTICS

At  $T_A = +25^\circ\text{C}$ ,  $V_S = 5\text{V}$ , and  $R_L = 25\text{k}\Omega$  connected to  $V_S/2$ , unless otherwise noted.

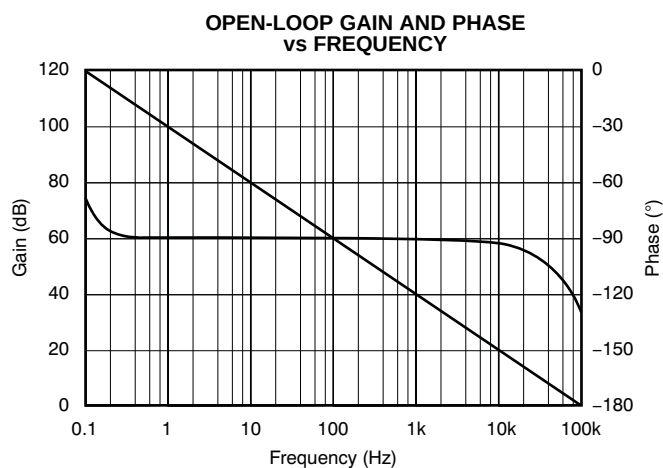


Figure 2.

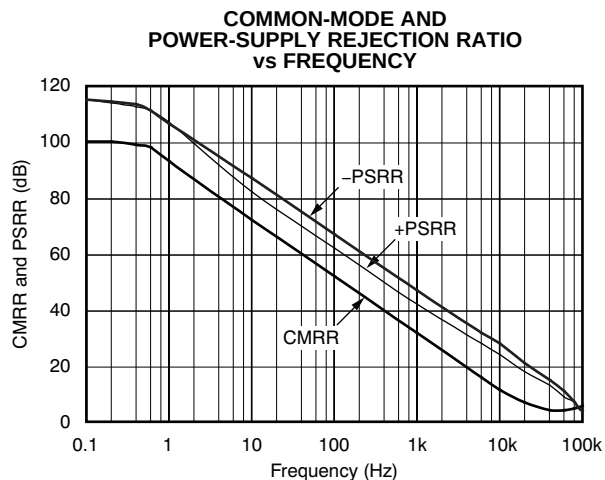


Figure 3.

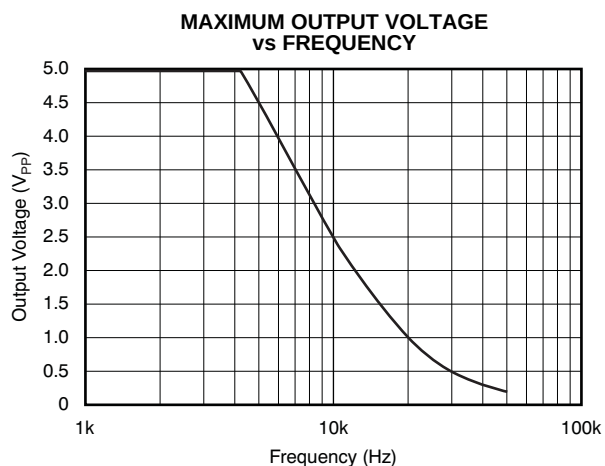


Figure 4.

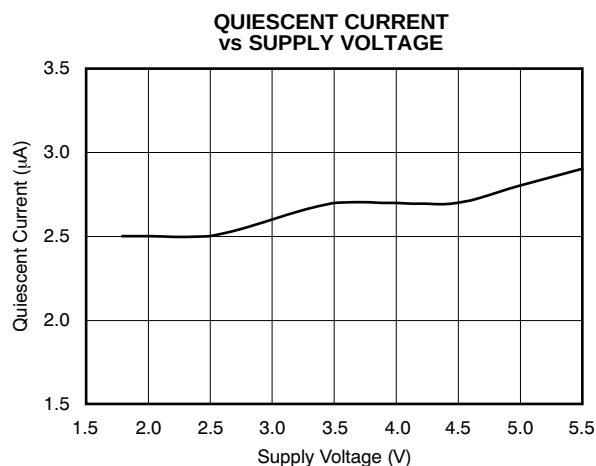


Figure 5.

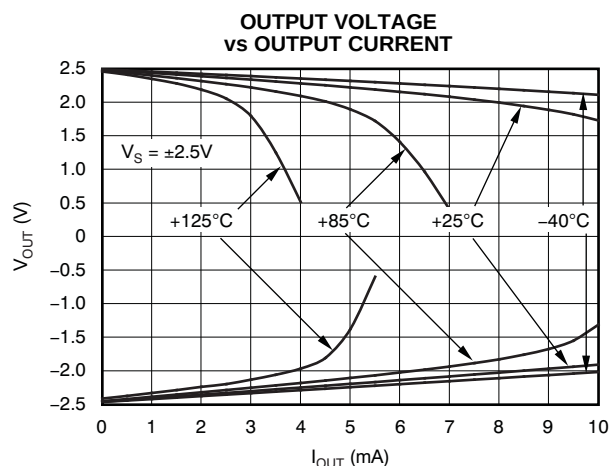


Figure 6.

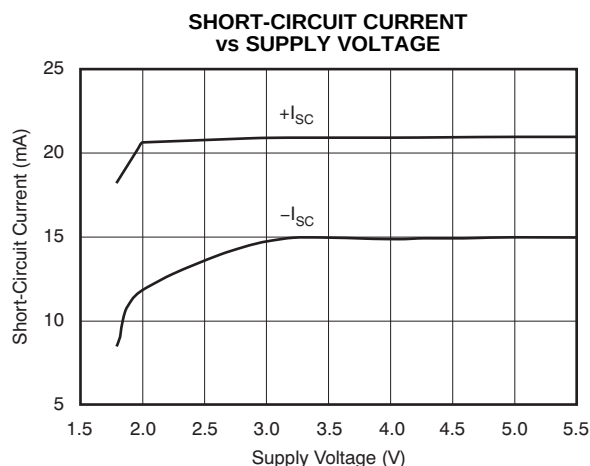


Figure 7.

## TYPICAL CHARACTERISTICS (continued)

At  $T_A = +25^\circ\text{C}$ ,  $V_S = 5\text{V}$ , and  $R_L = 25\text{k}\Omega$  connected to  $V_S/2$ , unless otherwise noted.

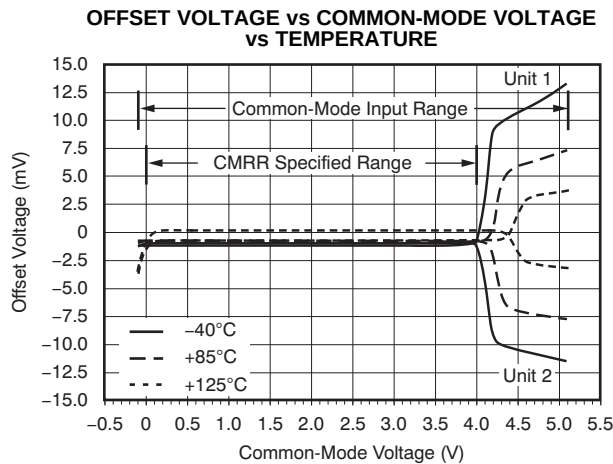


Figure 8.

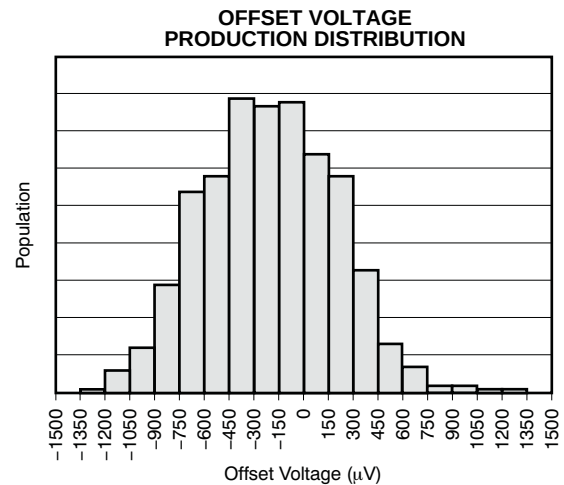


Figure 9.

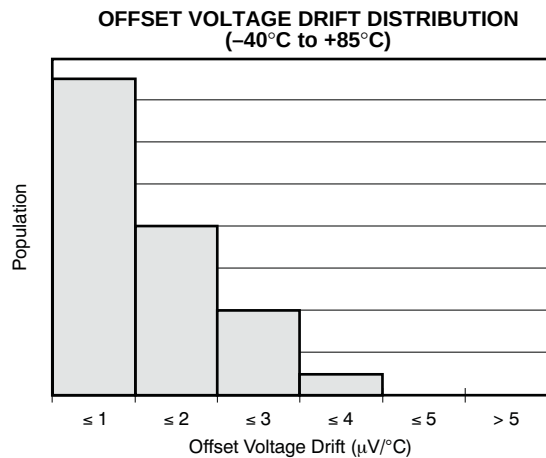


Figure 10.

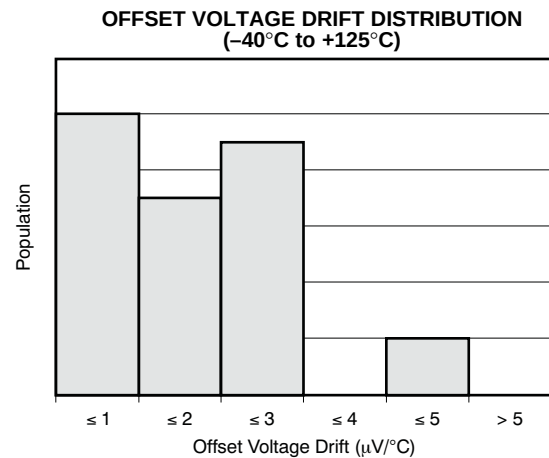


Figure 11.

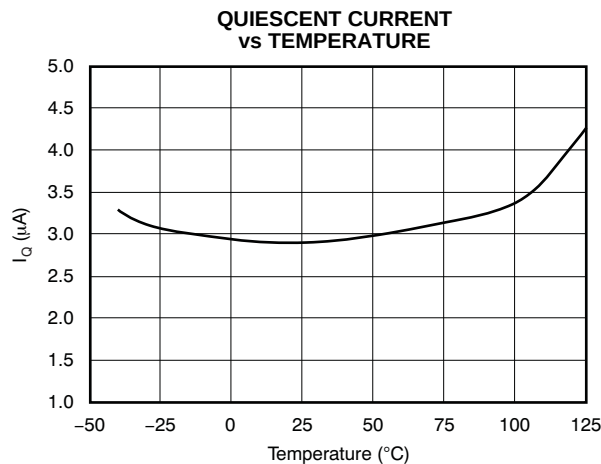


Figure 12.

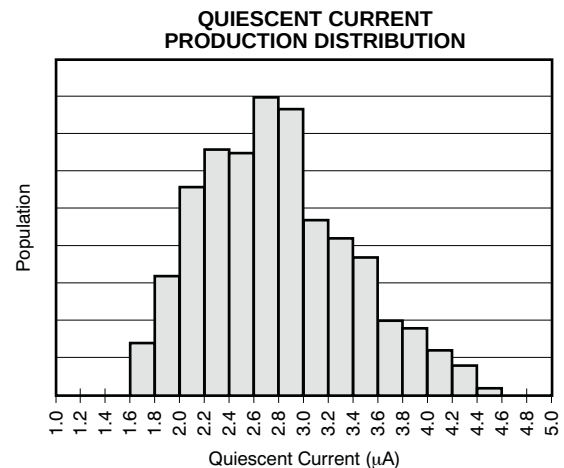


Figure 13.

## TYPICAL CHARACTERISTICS (continued)

At  $T_A = +25^\circ\text{C}$ ,  $V_S = 5\text{V}$ , and  $R_L = 25\text{k}\Omega$  connected to  $V_S/2$ , unless otherwise noted.

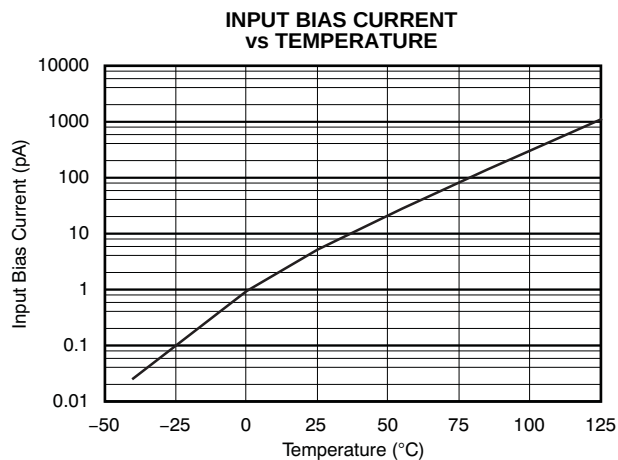


Figure 14.

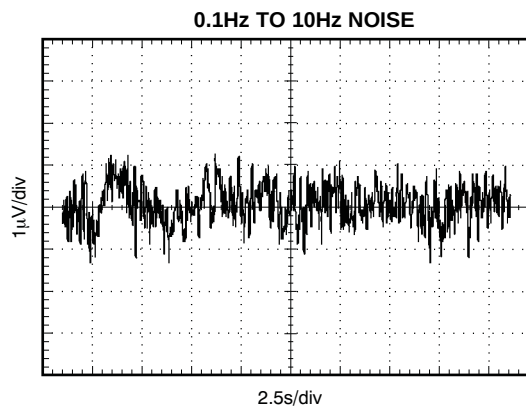


Figure 15.

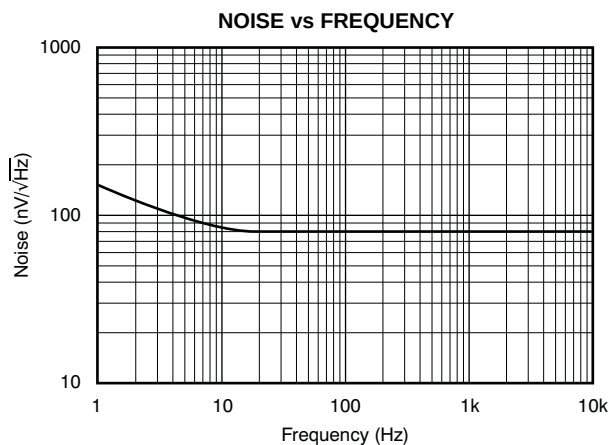


Figure 16.

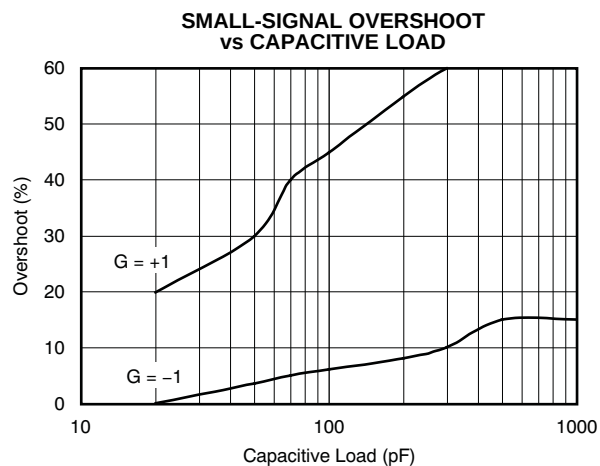


Figure 17.

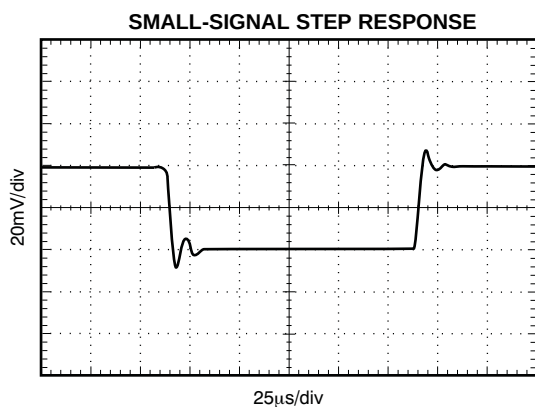


Figure 18.

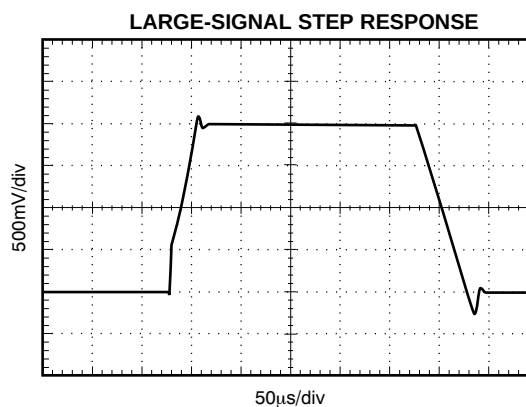


Figure 19.

## APPLICATION INFORMATION

The OPA379 family of operational amplifiers minimizes power consumption without compromising bandwidth or noise. Power-supply rejection ratio (PSRR), common-mode rejection ratio (CMRR), and open-loop gain ( $A_{OL}$ ) typical values are 100dB or better.

When designing for ultra-low power, choose system components carefully. To minimize current consumption, select large-value resistors. Any resistors will react with stray capacitance in the circuit and the input capacitance of the operational amplifier. These parasitic RC combinations can affect the stability of the overall system. A feedback capacitor may be required to assure stability and limit overshoot or gain peaking.

Good layout practice mandates the use of a 0.1μF bypass capacitor placed closely across the supply pins.

### OPERATING VOLTAGE

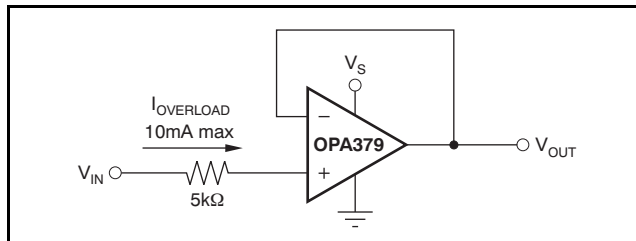
OPA379 series op amps are fully specified and tested from +1.8V to +5.5V ( $\pm 0.9V$  to  $\pm 2.75V$ ). Parameters that will vary with supply voltage are shown in the [Typical Characteristics](#) curves.

### INPUT COMMON-MODE VOLTAGE RANGE

The input common-mode voltage range of the OPA379 family typically extends 100mV beyond each supply rail. This rail-to-rail input is achieved using a complementary input stage. CMRR is specified from the negative rail to 1V below the positive rail. Between  $(V+) - 1V$  and  $(V+) + 0.1V$ , the amplifier operates with higher offset voltage because of the transition region of the input stage. See the typical characteristic, *Offset Voltage vs Common-Mode Voltage vs Temperature* ([Figure 8](#)).

### PROTECTING INPUTS FROM OVER-VOLTAGE

Normally, input currents are 5pA. However, a large voltage input (greater than 500mV beyond the supply rails) can cause excessive current to flow in or out of the input pins. Therefore, as well as keeping the input voltage below the maximum rating, it is also important to limit the input current to less than 10mA. This limiting is easily accomplished with an input voltage resistor, as shown in [Figure 20](#).



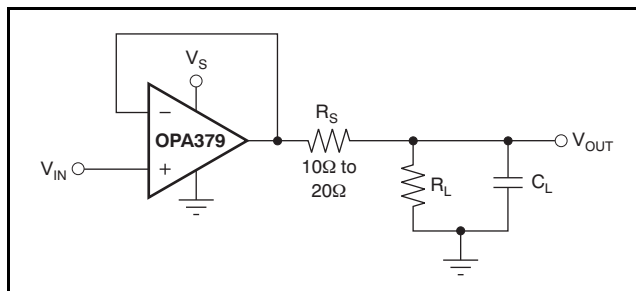
**Figure 20. Input Current Protection for Voltages Exceeding the Supply Voltage**

### NOISE

Although micropower amplifiers frequently have high wideband noise, the OPA379 series offer excellent noise performance. Resistors should be chosen carefully because the OPA379 has only 2.8μV<sub>PP</sub> of 0.1Hz to 10Hz noise, and 80nV/√Hz of wideband noise; otherwise, they can become the dominant source of noise.

### CAPACITIVE LOAD AND STABILITY

Follower configurations with load capacitance in excess of 30pF can produce extra overshoot (see typical characteristic *Small-Signal Overshoot vs Capacitive Load*, [Figure 17](#)) and ringing in the output signal. Increasing the gain enhances the ability of the amplifier to drive greater capacitive loads. In unity-gain configurations, capacitive load drive can be improved by inserting a small (10Ω to 20Ω) resistor,  $R_S$ , in series with the output, as shown in [Figure 21](#). This resistor significantly reduces ringing while maintaining direct current (dc) performance for purely capacitive loads. However, if there is a resistive load in parallel with the capacitive load, a voltage divider is created, introducing a dc error at the output and slightly reducing the output swing. The error introduced is proportional to the ratio  $R_S/R_L$ , and is generally negligible.



**Figure 21. Series Resistor in Unity-Gain Buffer Configuration Improves Capacitive Load Drive**

In unity-gain inverter configuration, phase margin can be reduced by the reaction between the capacitance at the op amp input and the gain setting resistors. Best performance is achieved by using smaller valued resistors. However, when large valued resistors cannot be avoided, a small (4pF to 6pF) capacitor,  $C_{FB}$ , can be inserted in the feedback, as shown in Figure 22. This configuration significantly reduces overshoot by compensating the effect of capacitance,  $C_{IN}$ , which includes the amplifier input capacitance (3pF) and printed circuit board (PC) parasitic capacitance.

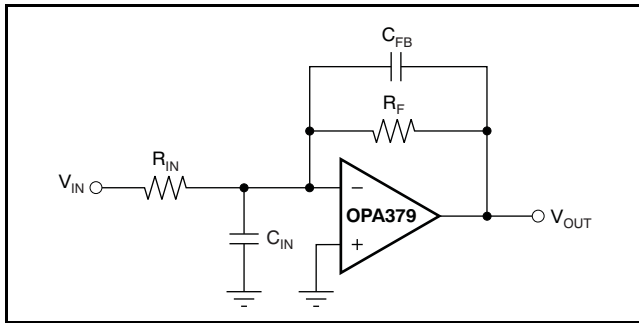


Figure 22. Improving Stability for Large  $R_F$  and  $R_{IN}$

## BATTERY MONITORING

The low operating voltage and quiescent current of the OPA379 series make it an excellent choice for battery monitoring applications, as shown in Figure 23. In this circuit,  $V_{STATUS}$  is high as long as the battery voltage remains above 2V. A low-power reference is used to set the trip point. Resistor values are selected as follows:

1.  $R_F$  Selecting: Select  $R_F$  such that the current through  $R_F$  is approximately 1000x larger than the maximum bias current over temperature:

$$\begin{aligned} R_F &= \frac{V_{REF}}{1000(I_{BMAX})} \\ &= \frac{1.2V}{1000(100pA)} \\ &= 12M\Omega \approx 10M\Omega \end{aligned} \quad (1)$$

2. Choose the hysteresis voltage,  $V_{HYST}$ . For battery monitoring applications, 50mV is adequate.

3. Calculate  $R_1$  as follows:

$$R_1 = R_F \left[ \frac{V_{HYST}}{V_{BATT}} \right] = 10M\Omega \left[ \frac{50mV}{2.4V} \right] = 210k\Omega \quad (2)$$

4. Select a threshold voltage for  $V_{IN}$  rising ( $V_{THRS}$ ) = 2.0V

5. Calculate  $R_2$  as follows:

$$\begin{aligned} R_2 &= \frac{1}{\left( \left[ \frac{V_{THRS}}{V_{REF} \times R_1} \right] - \frac{1}{R_1} - \frac{1}{R_F} \right)} \\ &= \frac{1}{\left( \left[ \frac{2V}{1.2V \times 210k\Omega} \right] - \frac{1}{210k\Omega} - \frac{1}{10M\Omega} \right)} \\ &= 325k\Omega \end{aligned} \quad (3)$$

6. Calculate  $R_{BIAS}$ : The minimum supply voltage for this circuit is 1.8V. The REF1112 has a current requirement of 1.2μA (max). Providing 2μA of supply current assures proper operation. Therefore:

$$R_{BIAS} = \frac{(V_{BATTMIN} - V_{REF})}{I_{BIAS}} = \frac{(1.8V - 1.2V)}{2\mu A} = 0.3M\Omega \quad (4)$$

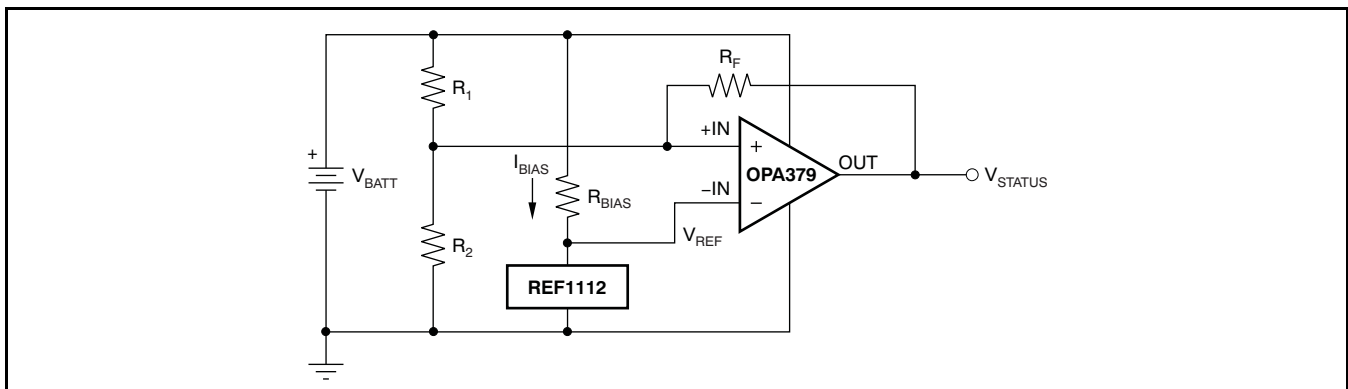


Figure 23. Battery Monitor

## WINDOW COMPARATOR

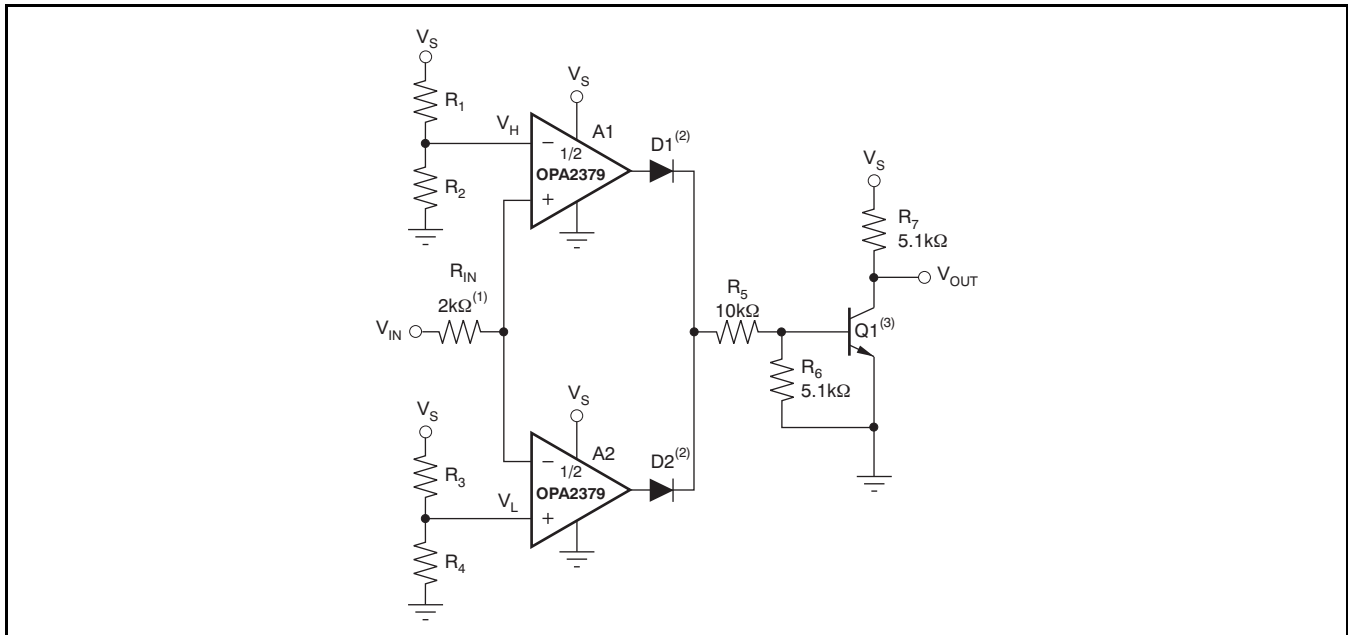
Figure 24 shows the OPA2379 used as a window comparator. The threshold limits are set by  $V_H$  and  $V_L$ , with  $V_H > V_L$ . When  $V_{IN} < V_H$ , the output of A1 is low. When  $V_{IN} > V_L$ , the output of A2 is low. Therefore, both op amp outputs are at 0V as long as  $V_{IN}$  is between  $V_H$  and  $V_L$ . This architecture results in no current flowing through either diode, Q1 in cutoff, with the base voltage at 0V, and  $V_{OUT}$  forced high.

If  $V_{IN}$  falls below  $V_L$ , the output of A2 is high, current flows through D2, and  $V_{OUT}$  is low. Likewise, if  $V_{IN}$  rises above  $V_H$ , the output of A1 is high, current flows through D1, and  $V_{OUT}$  is low.

The window comparator threshold voltages are set as follows:

$$V_H = \frac{R_2}{R_1 + R_2} \times V_S \quad (5)$$

$$V_L = \frac{R_4}{R_3 + R_4} \times V_S \quad (6)$$



- (1)  $R_{IN}$  protects A1 and A2 from possible excess current flow.
- (2) IN4446 or equivalent diodes.
- (3) 2N2222 or equivalent NPN transistor.

**Figure 24. OPA2379 as a Window Comparator**

## ADDITIONAL APPLICATION EXAMPLES

Figure 25 through Figure 29 illustrate additional application examples.

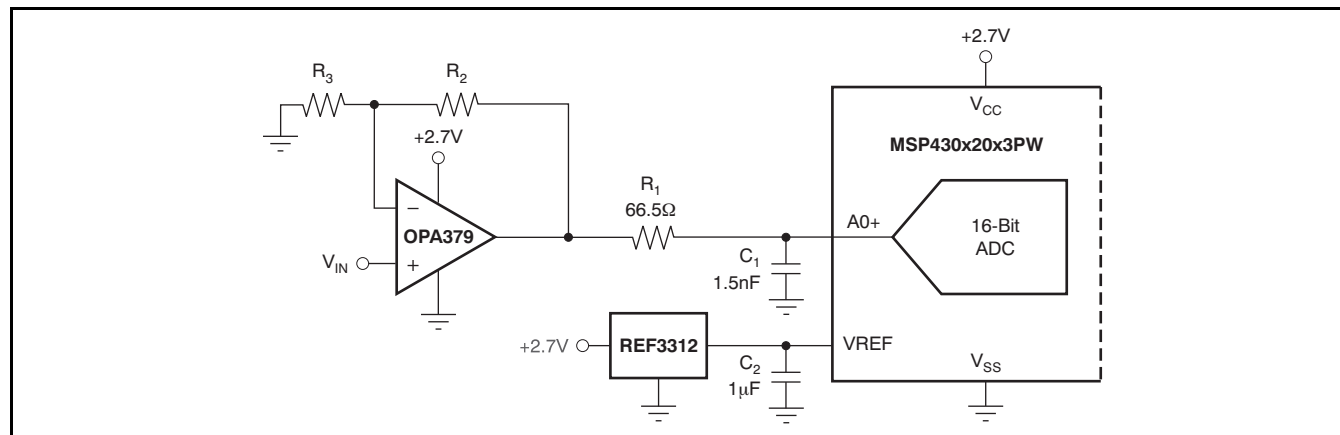


Figure 25. Unipolar Signal Chain Configuration

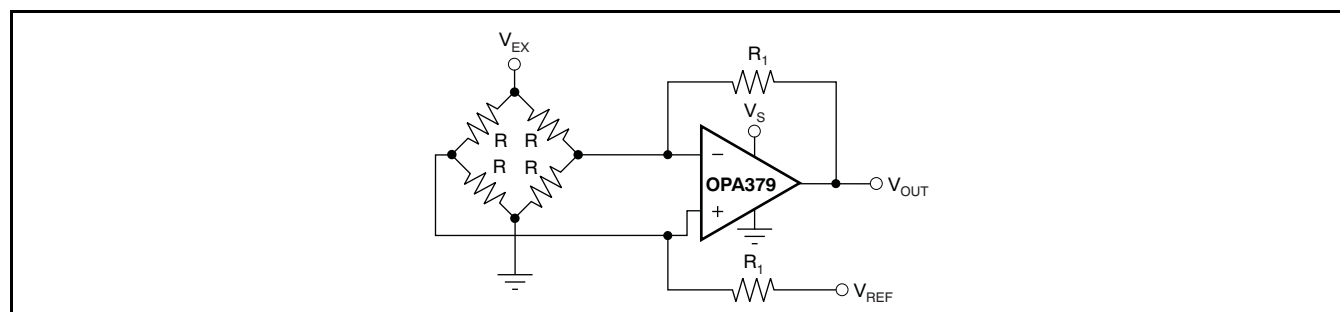
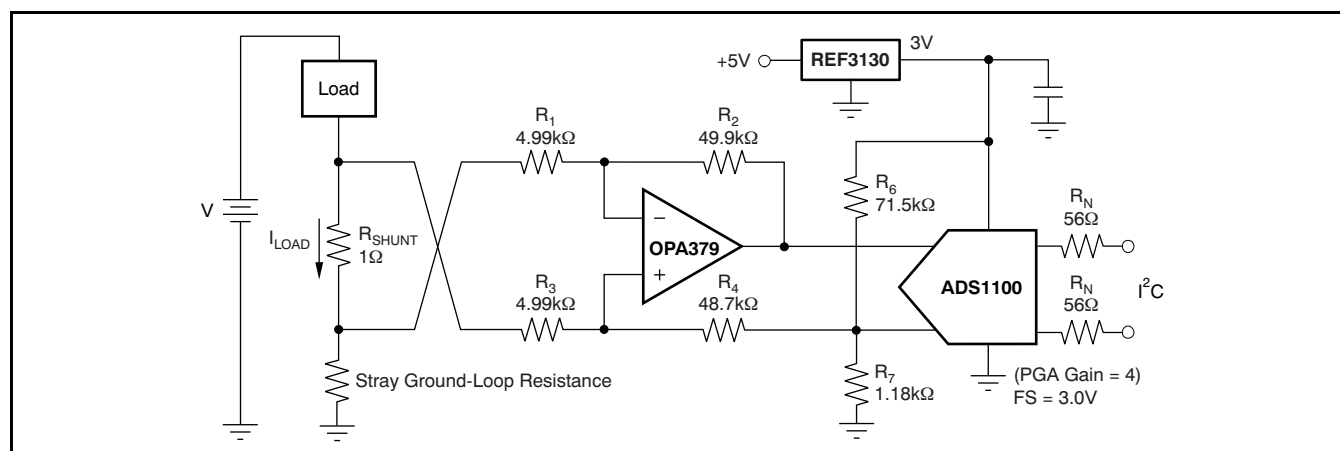
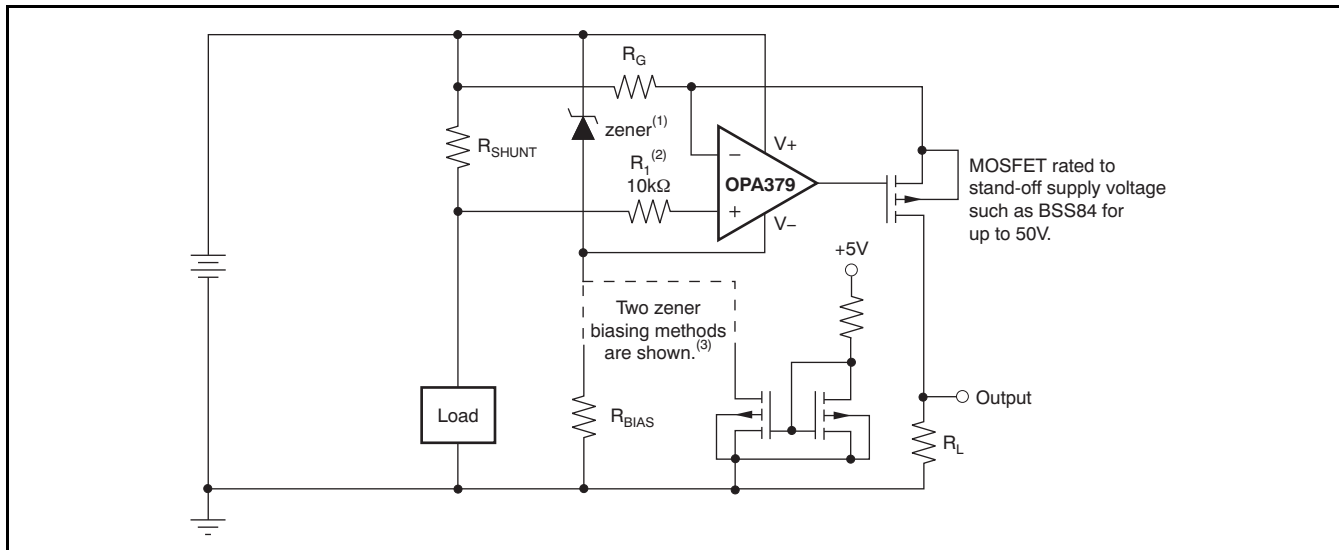


Figure 26. Single Op Amp Bridge Amplifier



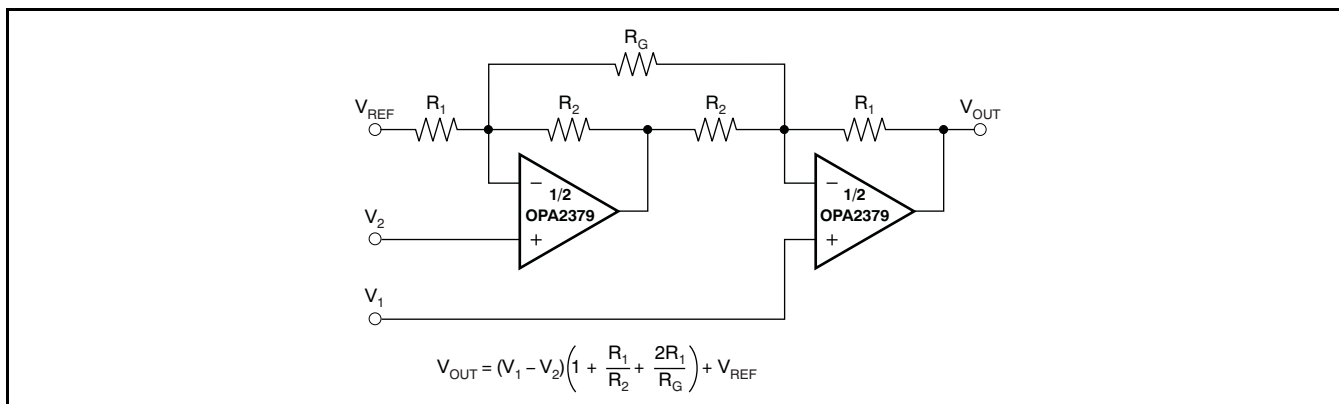
NOTE: 1% resistors provide adequate common-mode rejection at small ground-loop errors.

Figure 27. Low-Side Current Monitor



- (1) Zener rated for op amp supply capability (that is, 5.1V for OPA379).
- (2) Current-limiting resistor.
- (3) Choose zener biasing resistor or dual NMOSMETs (FDG6301N, NTJD4001N, or Si1034).

**Figure 28. High-Side Current Monitor**



**Figure 29. Two Op Amp Instrumentation Amplifier**

**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| OPA2379AID       | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | 2379A                   | <a href="#">Samples</a> |
| OPA2379AIDCNR    | ACTIVE        | SOT-23       | DCN                | 8    | 3000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | BPK                     | <a href="#">Samples</a> |
| OPA2379AIDCNRG4  | ACTIVE        | SOT-23       | DCN                | 8    | 3000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | BPK                     | <a href="#">Samples</a> |
| OPA2379AIDCNT    | ACTIVE        | SOT-23       | DCN                | 8    | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | BPK                     | <a href="#">Samples</a> |
| OPA2379AIDG4     | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | 2379A                   | <a href="#">Samples</a> |
| OPA2379AIDR      | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | 2379A                   | <a href="#">Samples</a> |
| OPA2379AIDRG4    | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | 2379A                   | <a href="#">Samples</a> |
| OPA379AID        | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | OPA<br>379A             | <a href="#">Samples</a> |
| OPA379AIDBVR     | ACTIVE        | SOT-23       | DBV                | 5    | 3000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | B53                     | <a href="#">Samples</a> |
| OPA379AIDBVRG4   | ACTIVE        | SOT-23       | DBV                | 5    | 3000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | B53                     | <a href="#">Samples</a> |
| OPA379AIDBVT     | ACTIVE        | SOT-23       | DBV                | 5    | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | B53                     | <a href="#">Samples</a> |
| OPA379AIDBVTG4   | ACTIVE        | SOT-23       | DBV                | 5    | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | B53                     | <a href="#">Samples</a> |
| OPA379AIDCKR     | ACTIVE        | SC70         | DCK                | 5    | 3000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | B54                     | <a href="#">Samples</a> |
| OPA379AIDCKT     | ACTIVE        | SC70         | DCK                | 5    | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | B54                     | <a href="#">Samples</a> |
| OPA379AIDCKTG4   | ACTIVE        | SC70         | DCK                | 5    | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | B54                     | <a href="#">Samples</a> |
| OPA379AIDG4      | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | OPA<br>379A             | <a href="#">Samples</a> |
| OPA379AIDR       | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | OPA<br>379A             | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)         | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| OPA379AIDRG4     | ACTIVE        | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | OPA 379A                | <a href="#">Samples</a> |
| OPA4379AIPWR     | ACTIVE        | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | 4379A                   | <a href="#">Samples</a> |
| OPA4379AIPWRG4   | ACTIVE        | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | -40 to 125   | 4379A                   | <a href="#">Samples</a> |

<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.

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

<sup>(5)</sup> 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.

<sup>(6)</sup> 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.

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**TAPE AND REEL INFORMATION**


\*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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| OPA2379AIDCNR | SOT-23       | DCN             | 8    | 3000 | 179.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| OPA2379AIDCNT | SOT-23       | DCN             | 8    | 250  | 179.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| OPA2379AIDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| OPA379AIDBVR  | SOT-23       | DBV             | 5    | 3000 | 178.0              | 9.0                | 3.3     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| OPA379AIDBVT  | SOT-23       | DBV             | 5    | 250  | 178.0              | 9.0                | 3.3     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| OPA379AIDCKR  | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| OPA379AIDCKR  | SC70         | DCK             | 5    | 3000 | 178.0              | 9.0                | 2.4     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| OPA379AIDCKT  | SC70         | DCK             | 5    | 250  | 178.0              | 9.0                | 2.4     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| OPA379AIDCKT  | SC70         | DCK             | 5    | 250  | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| OPA379AIDR    | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| OPA4379AIPWR  | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

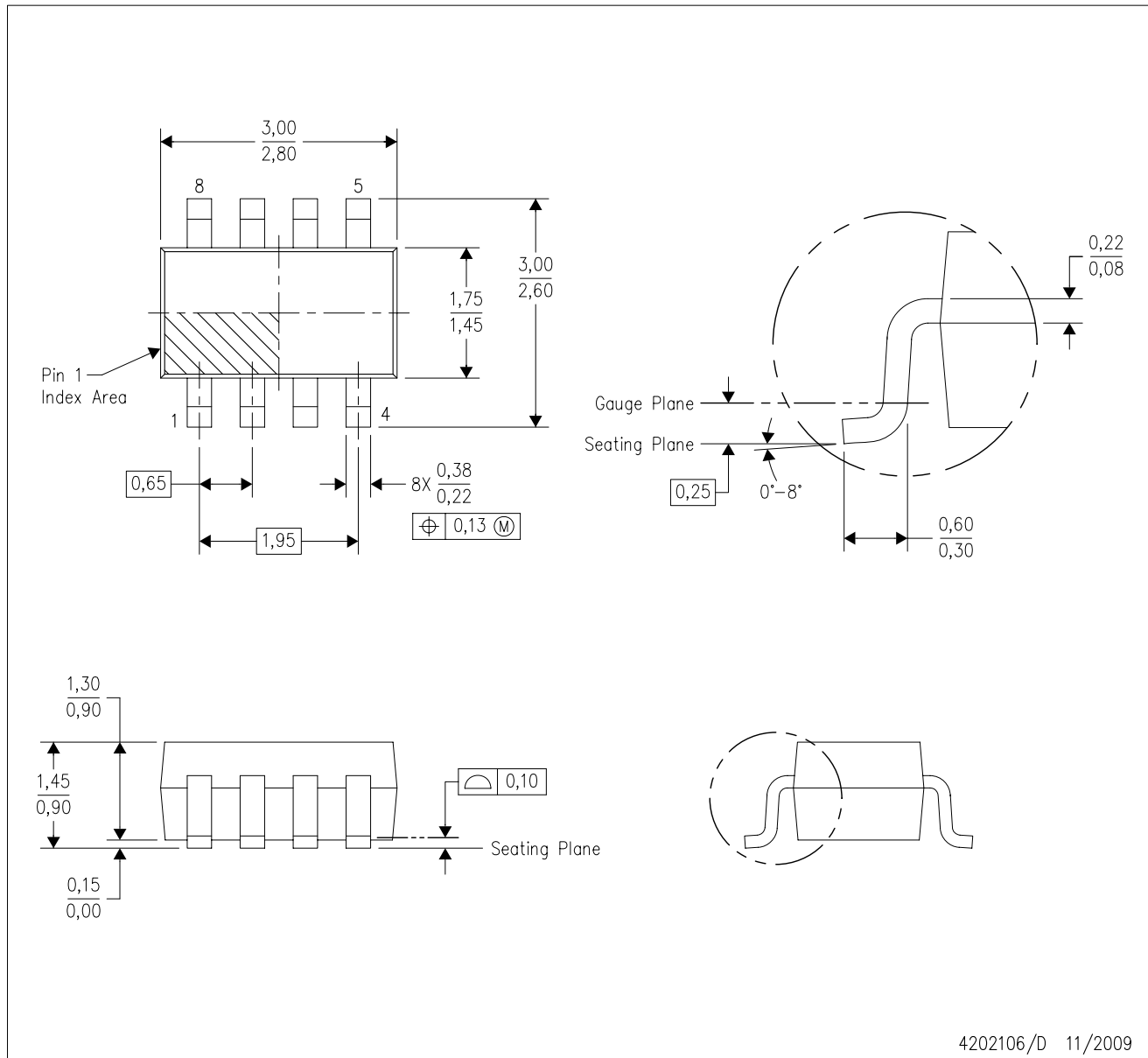


\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| OPA2379AIDCNR | SOT-23       | DCN             | 8    | 3000 | 195.0       | 200.0      | 45.0        |
| OPA2379AIDCNT | SOT-23       | DCN             | 8    | 250  | 195.0       | 200.0      | 45.0        |
| OPA2379AIDR   | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| OPA379AIDBVR  | SOT-23       | DBV             | 5    | 3000 | 180.0       | 180.0      | 18.0        |
| OPA379AIDBVT  | SOT-23       | DBV             | 5    | 250  | 180.0       | 180.0      | 18.0        |
| OPA379AIDCKR  | SC70         | DCK             | 5    | 3000 | 195.0       | 200.0      | 45.0        |
| OPA379AIDCKR  | SC70         | DCK             | 5    | 3000 | 190.0       | 190.0      | 30.0        |
| OPA379AIDCKT  | SC70         | DCK             | 5    | 250  | 190.0       | 190.0      | 30.0        |
| OPA379AIDCKT  | SC70         | DCK             | 5    | 250  | 195.0       | 200.0      | 45.0        |
| OPA379AIDR    | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| OPA4379AIPWR  | TSSOP        | PW              | 14   | 2000 | 367.0       | 367.0      | 35.0        |

DCN (R-PDSO-G8)

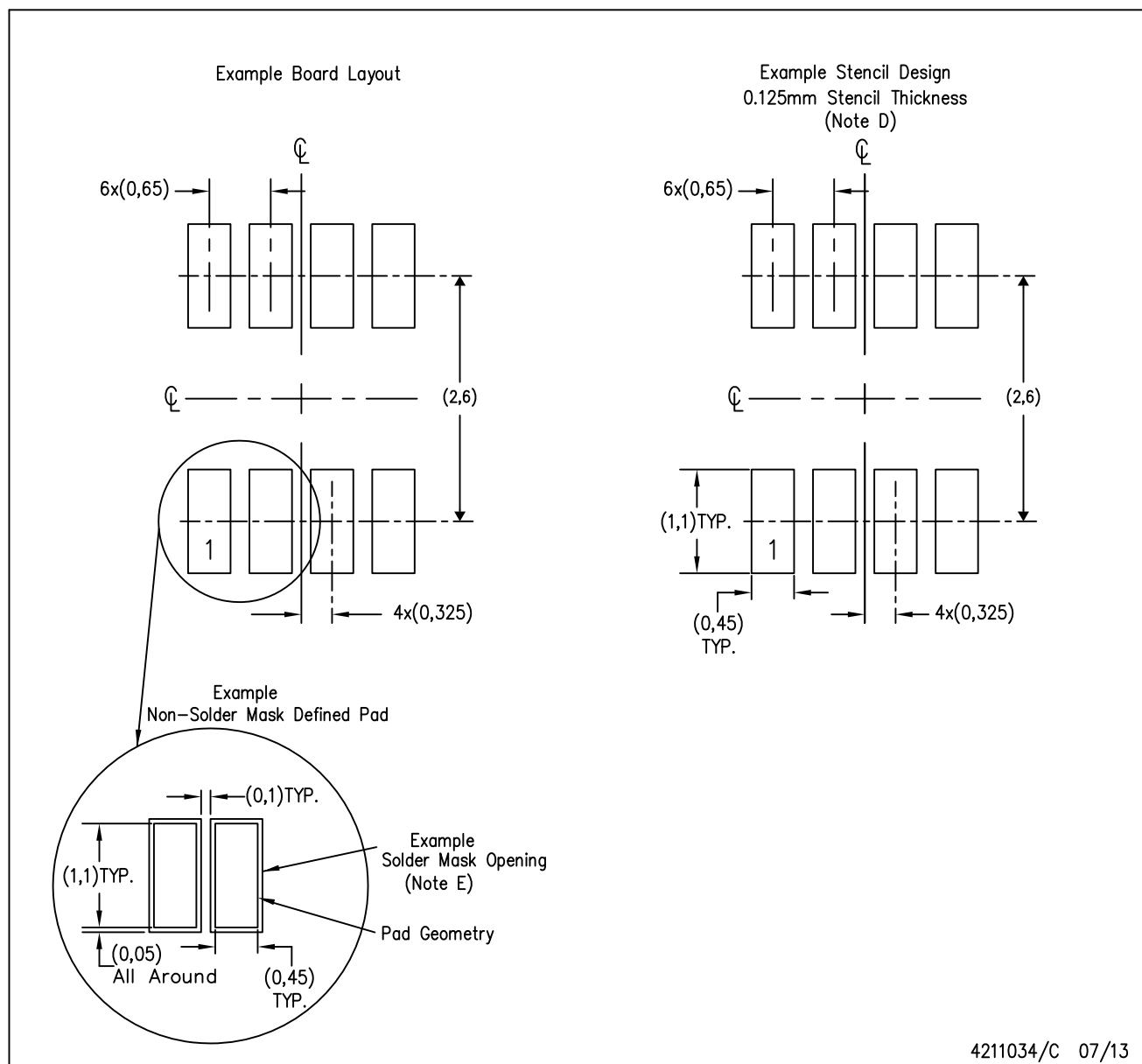
PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Package outline exclusive of metal burr & dambar protrusion/intrusion.
  - D. Package outline inclusive of solder plating.
  - E. A visual index feature must be located within the Pin 1 index area.
  - F. Falls within JEDEC MO-178 Variation BA.
  - G. Body dimensions do not include flash or protrusion. Mold flash and protrusion shall not exceed 0.25 per side.

DCN (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



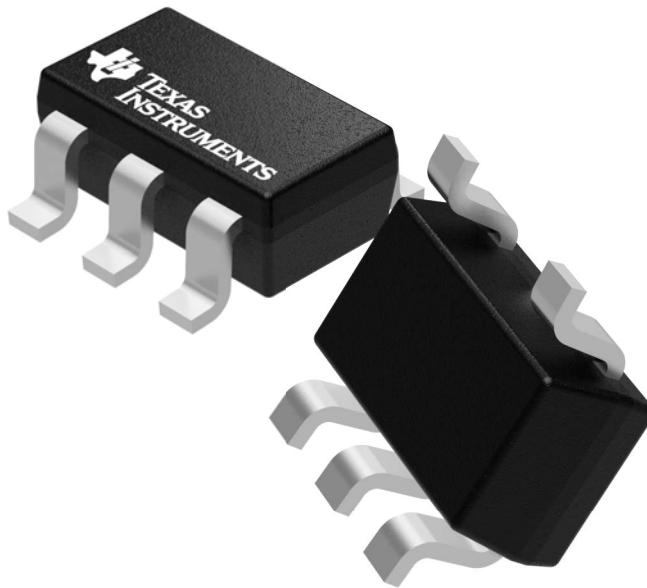
- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact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

## GENERIC PACKAGE VIEW

**DBV 5**

**SOT-23 - 1.45 mm max height**

SMALL OUTLINE TRANSISTOR



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4073253/P

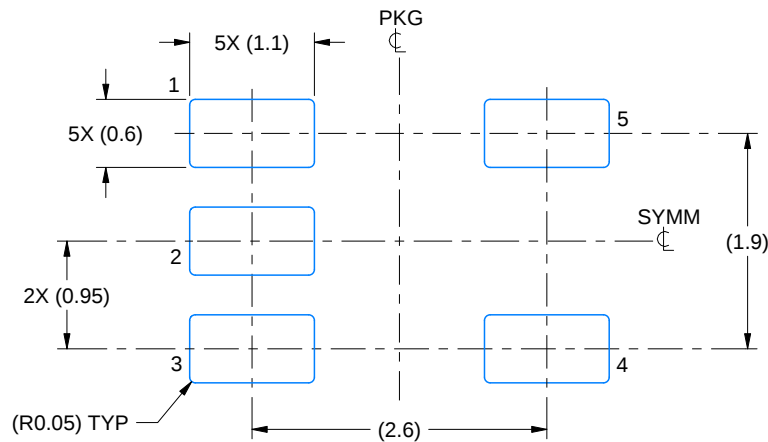


# EXAMPLE BOARD LAYOUT

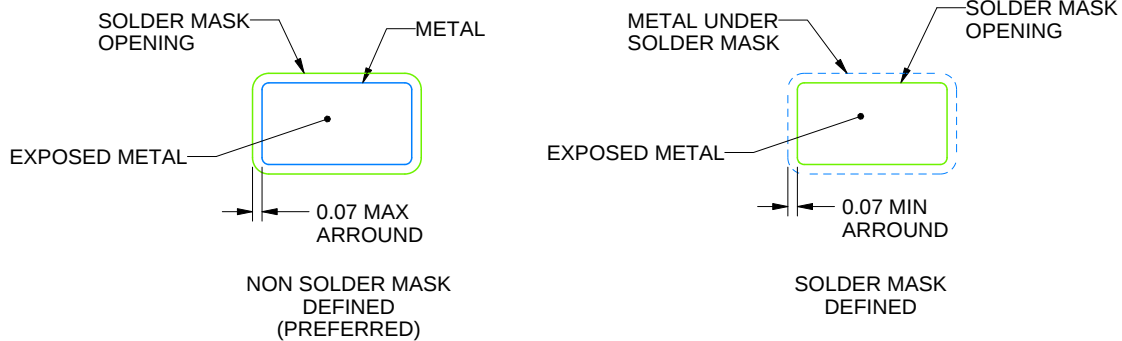
DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4214839/C 04/2017

NOTES: (continued)

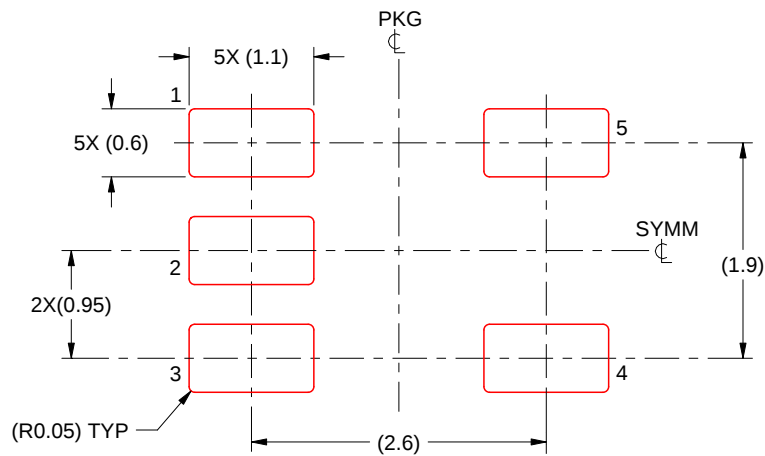
4. Publication IPC-7351 may have alternate designs.
5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:15X

4214839/C 04/2017

NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
7. Board assembly site may have different recommendations for stencil design.

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040064-3/G 02/11

- 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

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - 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.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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.
  - $\triangle C$  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.
  - $\triangle D$  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.

## DCK (R-PDSO-G5)

## PLASTIC SMALL-OUTLINE PACKAGE

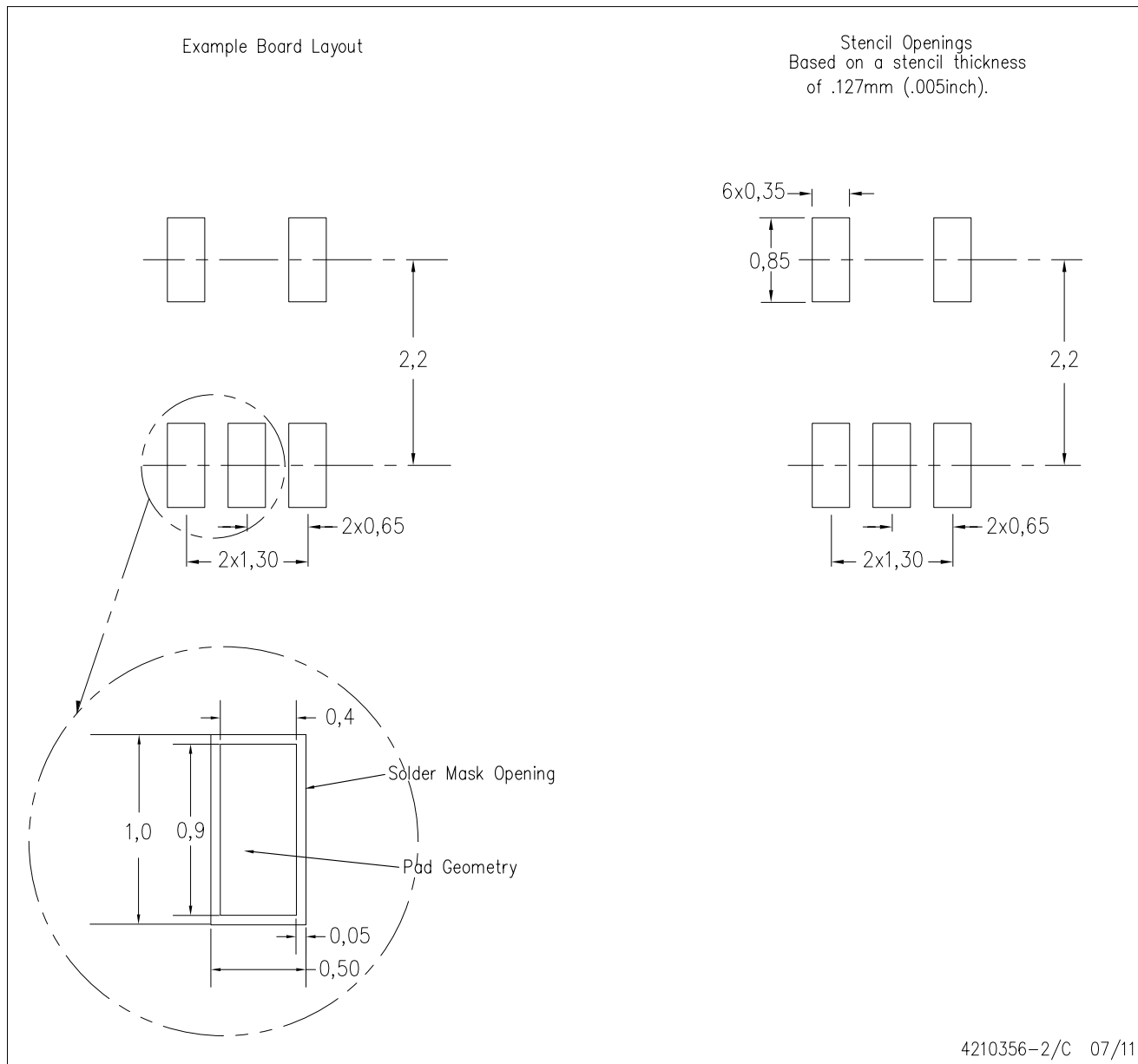


4093553-3/G 01/2007

- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - Falls within JEDEC MO-203 variation AA.

## DCK (R-PDSO-G5)

# PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - D. Publication IPC-7351 is recommended for alternate designs.
  - E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

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