

## Features

- Supply Voltage: 2.7 V to 5.5 V
- Offset Voltage:  $\pm 20 \mu\text{V}$  Maximum within Temperature Range from  $-40^\circ\text{C}$  to  $125^\circ\text{C}$
- Offset Voltage Drift:  $0.01 \mu\text{V}/^\circ\text{C}$
- Rail-to-Rail Input and Output
- Bandwidth: 3.5 MHz
- Slew Rate:  $4.7 \text{ V}/\mu\text{s}$
- Low Noise:  $12 \text{ nV}/\sqrt{\text{Hz}}$  at 1 kHz

## Applications

- On-Board Charger
- Motor Control
- Current Measurement

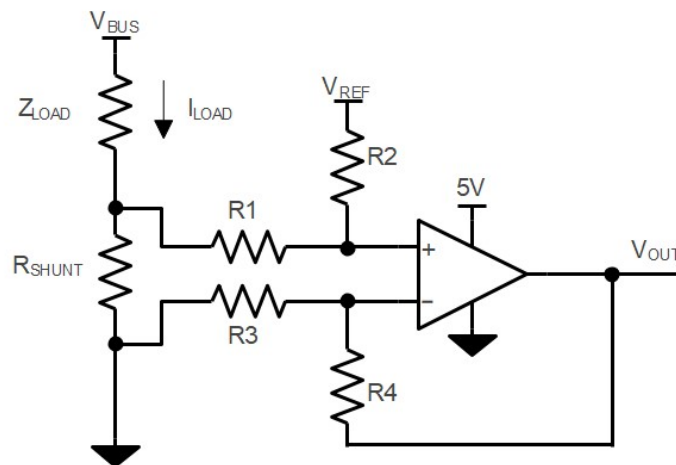
## Description

The TPA5561 and TPA5562 devices are single and dual operational amplifiers. The devices have very low offset voltage within the operating temperature range by the zero-drift technology. The offset voltage of the device is  $\pm 20 \mu\text{V}$  maximum within the temperature range from  $-40^\circ\text{C}$  to  $125^\circ\text{C}$ .

The TPA5561 and TPA5562 devices provide rail-to-rail input and output. The devices have excellent AC performance with 3.5-MHz bandwidth,  $4.7 \text{ V}/\mu\text{s}$  slew rate while drawing 0.5-mA quiescent current per amplifier.

The devices can be used in high-accuracy and high-speed signal conditions.

## Typical Application Circuit



$$V_{\text{OUT}} = (I_{\text{LOAD}} \times R_{\text{SHUNT}}) \times (R_2 / R_1) + V_{\text{REF}}$$

$$\text{When } R_3 = R_1, R_2 = R_4, R_{\text{SHUNT}} \ll R_1$$

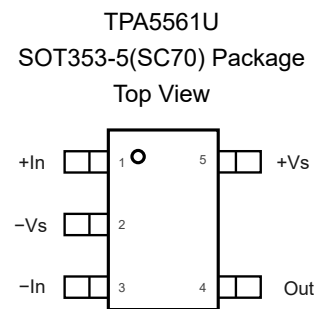
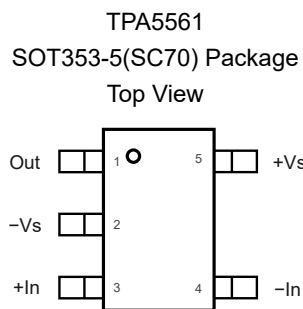
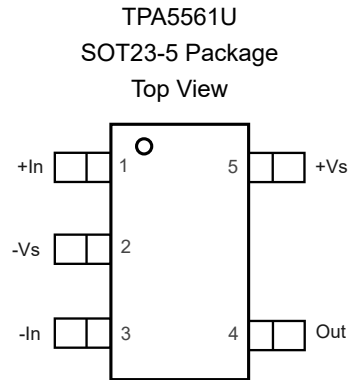
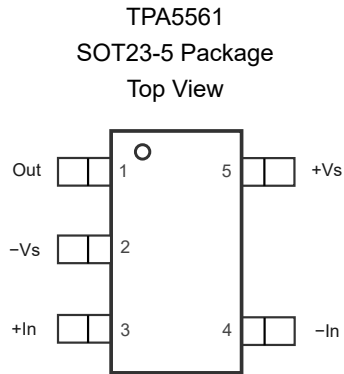
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## Revision History

| Date       | Revision | Notes            |
|------------|----------|------------------|
| 2023-01-03 | Rev.A.0  | Initial version. |

## Pin Configuration and Functions

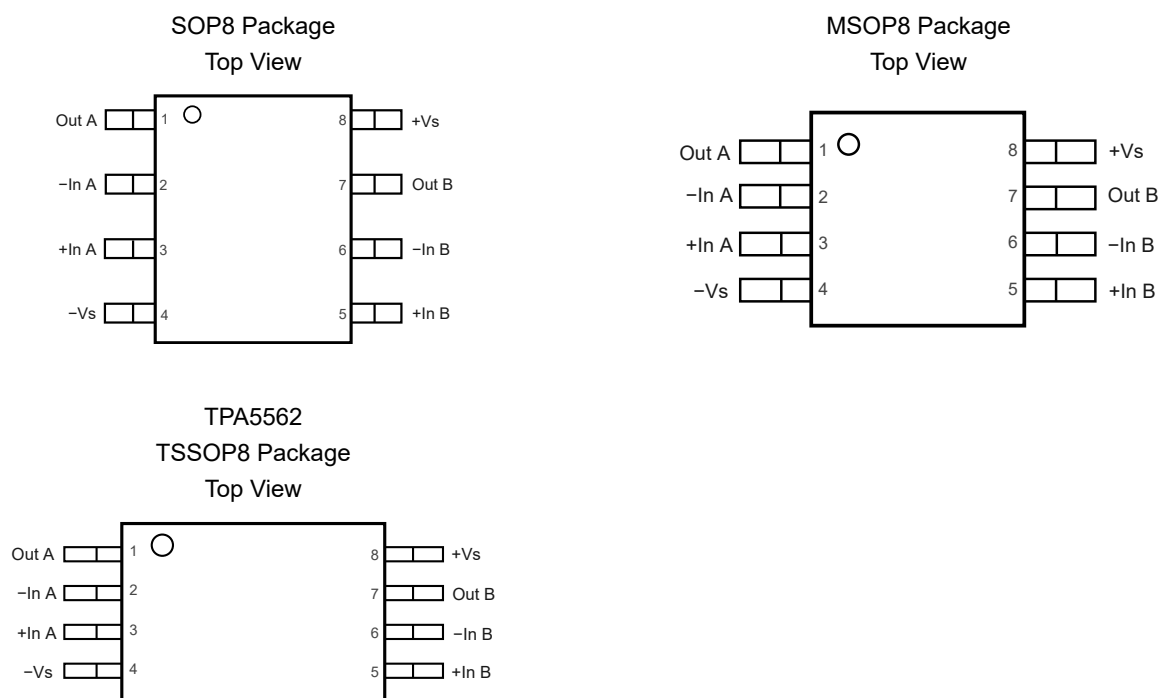


**Table 1. Pin Functions: TPA5561, TPA5561U**

| Pin No. |          | Name | I/O | Description           |
|---------|----------|------|-----|-----------------------|
| TPA5561 | TPA5561U |      |     |                       |
| 1       | 4        | Out  | O   | Output                |
| 2       | 2        | -Vs  | -   | Negative power supply |
| 3       | 1        | +In  | I   | Noninverting input    |
| 4       | 3        | -In  | I   | Inverting input       |
| 5       | 5        | +Vs  | -   | Positive power supply |

TPA5562

TPA5562

**5-V, Zero-Drift Operational Amplifiers**

**Table 2. Pin Functions: TPA5562**

| Pin No. | Name  | I/O | Description           |
|---------|-------|-----|-----------------------|
| 1       | Out A | O   | Output                |
| 2       | -In A | I   | Inverting input       |
| 3       | +In A | I   | Noninverting input    |
| 4       | -Vs   | -   | Negative power supply |
| 5       | +In B | I   | Noninverting input    |
| 6       | -In B | I   | Inverting input       |
| 7       | Out B | O   | Output                |
| 8       | +Vs   |     | Positive power supply |

## Specifications

### Absolute Maximum Ratings <sup>(1)</sup>

| Parameter |                                                     | Min               | Max               | Unit |
|-----------|-----------------------------------------------------|-------------------|-------------------|------|
|           | Supply Voltage, $(+V_S) - (-V_S)$                   |                   | 6.5               | V    |
|           | Input Voltage                                       | $(-V_S) - 0.3$    | $(+V_S) + 0.3$    | V    |
|           | Differential Input Voltage                          | $(-V_S) - (+V_S)$ | $(+V_S) - (-V_S)$ | V    |
|           | Input Current: $+I_{IN}$ , $-I_{IN}$ <sup>(2)</sup> | -10               | +10               | mA   |
|           | Output Short-Circuit Duration <sup>(3)</sup>        |                   | Infinite          |      |
| $T_J$     | Maximum Junction Temperature                        |                   | 150               | °C   |
| $T_A$     | Operating Temperature Range                         | -40               | 125               | °C   |
| $T_{STG}$ | Storage Temperature Range                           | -65               | 150               | °C   |
| $T_L$     | Lead Temperature (Soldering 10 sec)                 |                   | 260               | °C   |

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

(2) The inputs are protected by ESD protection diodes to power supply. If the input extends more than 300 mV beyond the power supply, the input current should be limited to less than 10 mA.

(3) A heat sink may be required to keep the junction temperature below the absolute maximum rating. This depends on the power dissipation of the application. Thermal resistance varies with the amount of PC board metal connected to the package.

### ESD, Electrostatic Discharge Protection

| Parameter |                          | Condition                             | Minimum Level | Unit |
|-----------|--------------------------|---------------------------------------|---------------|------|
| HBM       | Human Body Model ESD     | ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup> | 3             | kV   |
| CDM       | Charged Device Model ESD | ANSI/ESDA/JEDEC JS-002 <sup>(2)</sup> | 1.5           | kV   |

(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.

### Recommended Operating Conditions

| Parameter |                                   | Min                   | Typ | Max                   | Unit |
|-----------|-----------------------------------|-----------------------|-----|-----------------------|------|
| $V_S$     | Supply Voltage, $(+V_S) - (-V_S)$ | 2.7<br>( $\pm 1.35$ ) |     | 5.5<br>( $\pm 2.75$ ) | V    |
| $T_A$     | Operating Temperature Range       | -40                   |     | 125                   | °C   |

### Thermal Information

| Package Type    | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|-----------------|---------------|---------------|------|
| SOT353 (SC70-5) | 400           | 150           | °C/W |
| SOT23-5         | 250           | 81            | °C/W |

**5-V, Zero-Drift Operational Amplifiers**

| Package Type | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|--------------|---------------|---------------|------|
| SOP8         | 158           | 43            | °C/W |
| MSOP8        | 210           | 45            | °C/W |

## Electrical Characteristics

All test conditions:  $V_S = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ ,  $R_L = 10\text{ k}\Omega$ , unless otherwise noted.

| Parameter             |                                 | Conditions                                                                                    | Min        | Typ  | Max        | Unit  |
|-----------------------|---------------------------------|-----------------------------------------------------------------------------------------------|------------|------|------------|-------|
| Power Supply          |                                 |                                                                                               |            |      |            |       |
| V <sub>S</sub>        | Supply Voltage Range            |                                                                                               | 2.7        |      | 5.5        | V     |
| I <sub>Q</sub>        | Quiescent Current per Amplifier | V <sub>S</sub> = 5 V                                                                          |            | 0.5  | 1          | mA    |
|                       |                                 | V <sub>S</sub> = 5 V, T <sub>A</sub> = −40°C to 125°C                                         |            |      | 1.2        | mA    |
| PSRR                  | Power Supply Rejection Ratio    | V <sub>S</sub> = 2.7 V to 5.5 V, V <sub>CM</sub> = 0 V                                        | 114        | 124  |            | dB    |
|                       |                                 | V <sub>S</sub> = 2.7 V to 5.5 V, V <sub>CM</sub> = 0 V, T <sub>A</sub> = −40°C to 125°C       | 110        |      |            | dB    |
| Input Characteristics |                                 |                                                                                               |            |      |            |       |
| V <sub>OS</sub>       | Input Offset Voltage            | V <sub>S</sub> = 3.3 V, V <sub>CM</sub> = 0 to 3.3 V                                          | −10        |      | 10         | μV    |
|                       |                                 | V <sub>S</sub> = 3.3 V, V <sub>CM</sub> = 0 to 3.3 V, T <sub>A</sub> = −40°C to 125°C         | −20        |      | 20         | μV    |
|                       |                                 | V <sub>S</sub> = 5 V, V <sub>CM</sub> = 0 to 5 V                                              | −10        |      | 10         | μV    |
|                       |                                 | V <sub>S</sub> = 5 V, V <sub>CM</sub> = 0 to 5 V, T <sub>A</sub> = −40°C to 125°C             | −20        |      | 20         | μV    |
| V <sub>OS</sub> TC    | Input Offset Voltage Drift      | T <sub>A</sub> = −40°C to 125°C                                                               |            | 0.01 |            | μV/°C |
| I <sub>B</sub>        | Input Bias Current              | V <sub>S</sub> = 5 V, V <sub>CM</sub> = 2.5 V                                                 |            | 200  | 1000       | pA    |
|                       |                                 | V <sub>S</sub> = 5 V, V <sub>CM</sub> = 2.5 V, T <sub>A</sub> = −40°C to 125°C                |            | 300  | 1300       | pA    |
| I <sub>OS</sub>       | Input Offset Current            | V <sub>S</sub> = 5 V, V <sub>CM</sub> = 2.5 V                                                 |            | 100  | 600        | pA    |
|                       |                                 | V <sub>S</sub> = 5 V, V <sub>CM</sub> = 2.5 V, T <sub>A</sub> = −40°C to 125°C                |            |      | 850        | pA    |
| C <sub>IN</sub>       | Input Capacitance               | Differential Mode                                                                             |            | 5    |            | pF    |
|                       |                                 | Common Mode                                                                                   |            | 2.5  |            | pF    |
| A <sub>v</sub>        | Open-Loop Voltage Gain          | R <sub>LOAD</sub> = 10 kΩ, V <sub>OUT</sub> = 0.5 V to 4.5 V                                  | 120        | 150  |            | dB    |
|                       |                                 | R <sub>LOAD</sub> = 10 kΩ, V <sub>OUT</sub> = 0.5 V to 4.5 V, T <sub>A</sub> = −40°C to 125°C | 115        |      |            | dB    |
| V <sub>CMR</sub>      | Common-Mode Input Voltage Range |                                                                                               | (V−) − 0.1 |      | (V+) + 0.1 | V     |
| CMRR                  | Common Mode Rejection Ratio     | V <sub>CM</sub> = 0 V to 5V                                                                   | 115        | 140  |            | dB    |
|                       |                                 | V <sub>CM</sub> = 0 V to 5V, T <sub>A</sub> = −40°C to 125°C                                  | 110        |      |            | dB    |

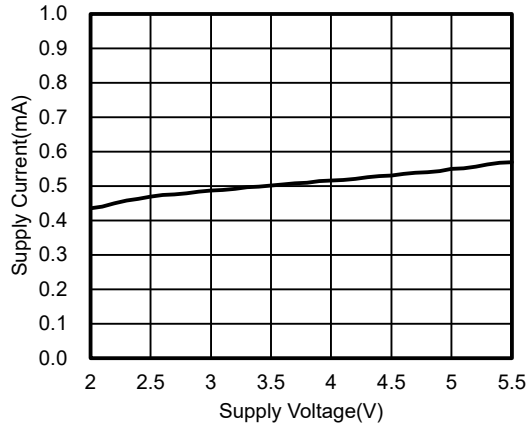
**5-V, Zero-Drift Operational Amplifiers**

All test conditions:  $V_S = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ ,  $R_L = 10\text{ k}\Omega$ , unless otherwise noted.

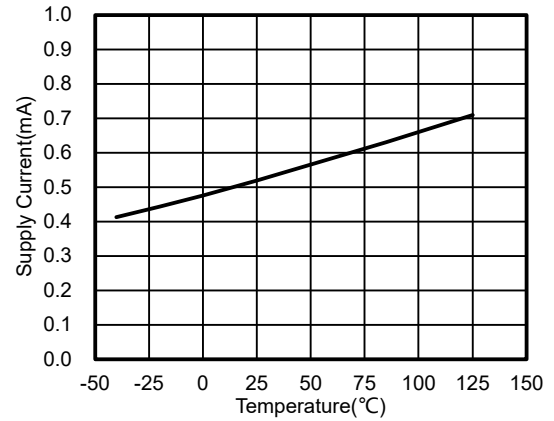
| Symbol                 | Parameter                           | Conditions                                                                      | Min | Typ   | Max | Unit             |
|------------------------|-------------------------------------|---------------------------------------------------------------------------------|-----|-------|-----|------------------|
| Output Characteristics |                                     |                                                                                 |     |       |     |                  |
|                        | Output Swing from Positive Rail     | R <sub>LOAD</sub> = 10 kΩ to V <sub>S</sub> /2                                  |     | 10    | 20  | mV               |
|                        |                                     | R <sub>LOAD</sub> = 10 kΩ to V <sub>S</sub> /2, T <sub>A</sub> = −40°C to 125°C |     |       | 25  | mV               |
|                        |                                     | R <sub>LOAD</sub> = 2 kΩ to V <sub>S</sub> /2                                   |     | 45    | 100 | mV               |
|                        |                                     | R <sub>LOAD</sub> = 2 kΩ to V <sub>S</sub> /2, T <sub>A</sub> = −40°C to 125°C  |     |       | 120 | mV               |
|                        | Output Swing from Negative Rail     | R <sub>LOAD</sub> = 10 kΩ to V <sub>S</sub> /2                                  |     | 10    | 20  | mV               |
|                        |                                     | R <sub>LOAD</sub> = 10 kΩ to V <sub>S</sub> /2, T <sub>A</sub> = −40°C to 125°C |     |       | 25  | mV               |
|                        |                                     | R <sub>LOAD</sub> = 2 kΩ to V <sub>S</sub> /2                                   |     | 25    | 50  | mV               |
|                        |                                     | R <sub>LOAD</sub> = 2 kΩ to V <sub>S</sub> /2, T <sub>A</sub> = −40°C to 125°C  |     |       | 80  | mV               |
| I <sub>SC</sub>        | Output Short-Circuit Current        | Sink or Source                                                                  | 40  | 60    |     | mA               |
|                        |                                     | Sink or Source, T <sub>A</sub> = −40°C to 125°C                                 | 30  |       |     | mA               |
| AC Specifications      |                                     |                                                                                 |     |       |     |                  |
| GBW                    | Gain-Bandwidth Product              |                                                                                 |     | 3.5   |     | MHz              |
| SR                     | Slew Rate                           | G = 1                                                                           |     | 4.7   |     | V/μs             |
| t <sub>OR</sub>        | Overload Recovery                   |                                                                                 |     | 0.8   |     | μs               |
| t <sub>S</sub>         | Settling Time, 0.1%                 | G = 1, 2V Step                                                                  |     | 8     |     | μs               |
| PM                     | Phase Margin                        | R <sub>L</sub> = 10 kΩ, C <sub>L</sub> = 100 pF                                 |     | 70    |     | °                |
| GM                     | Gain Margin                         | R <sub>L</sub> = 10 kΩ, C <sub>L</sub> = 100 pF                                 |     | 15    |     | dB               |
| Noise Performance      |                                     |                                                                                 |     |       |     |                  |
| E <sub>N</sub>         | Input Voltage Noise                 | f = 0.1 Hz to 10 Hz                                                             |     | 0.25  |     | μV <sub>PP</sub> |
| e <sub>N</sub>         | Input Voltage Noise Density         | f = 1 kHz                                                                       |     | 12    |     | nV/√Hz           |
| i <sub>N</sub>         | Input Current Noise Density         | f = 1 kHz                                                                       |     | 100   |     | fA/√Hz           |
| THD+N                  | Total Harmonic Distortion and Noise | f = 1 kHz, G = 1, R <sub>L</sub> = 2 kΩ, V <sub>OUT</sub> = 1 V <sub>RMS</sub>  |     | 0.005 |     | %                |

## Typical Performance Characteristics

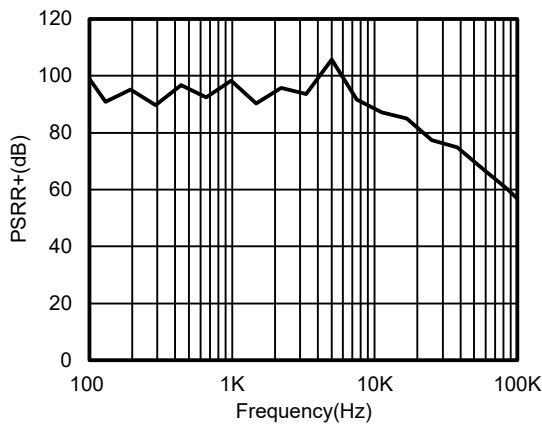
All test conditions:  $V_S = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.



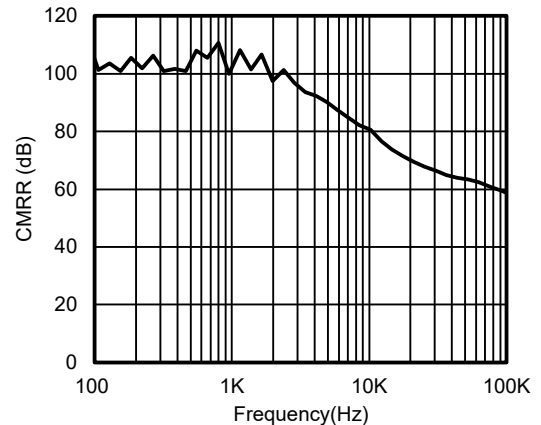
**Figure 1. Supply Current vs Supply Voltage, 1ch**



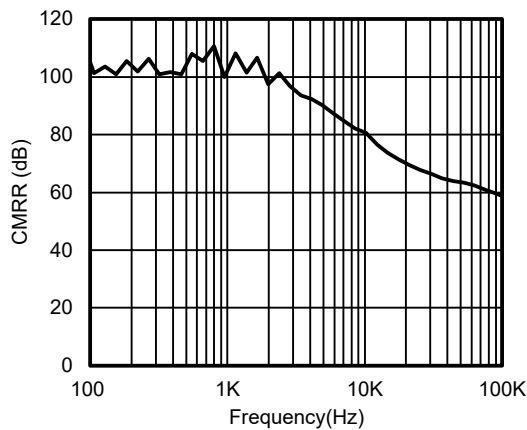
**Figure 2. Supply Current vs Temperature, 1ch**



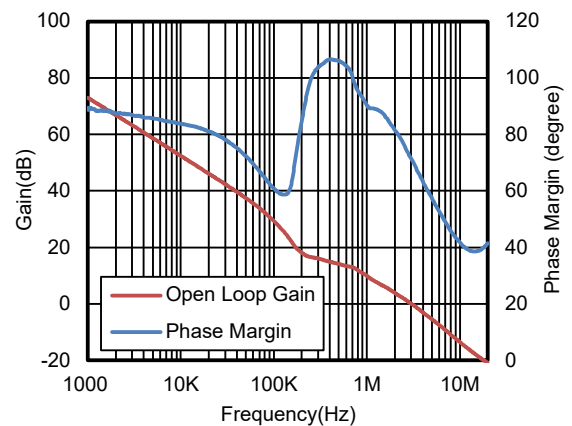
**Figure 3. PSRR+ vs Frequency**



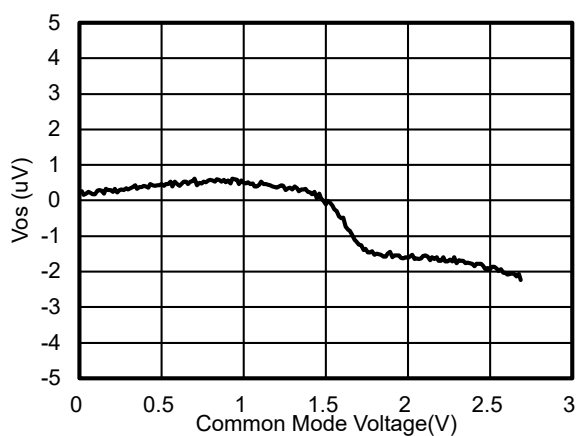
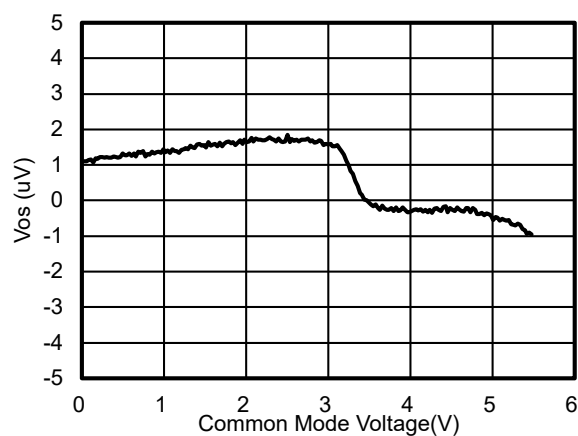
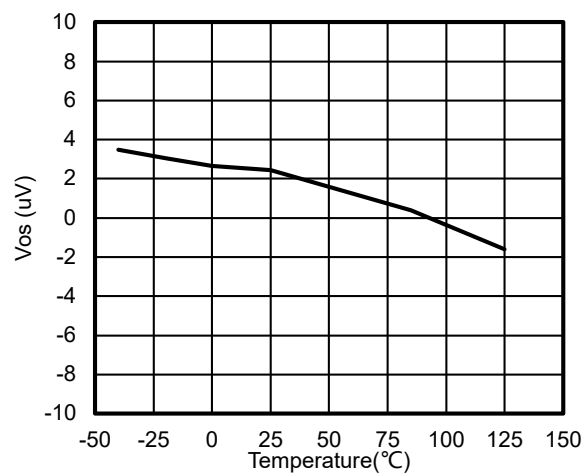
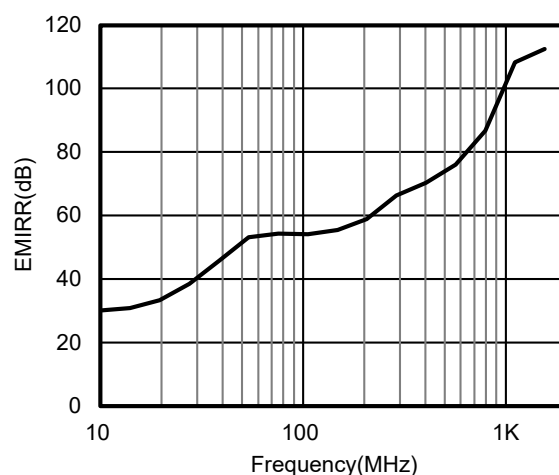
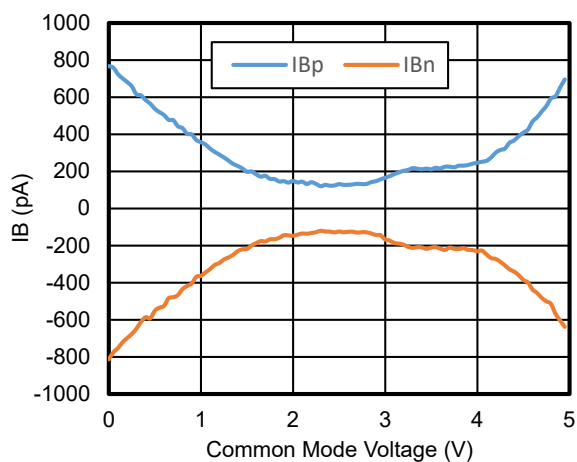
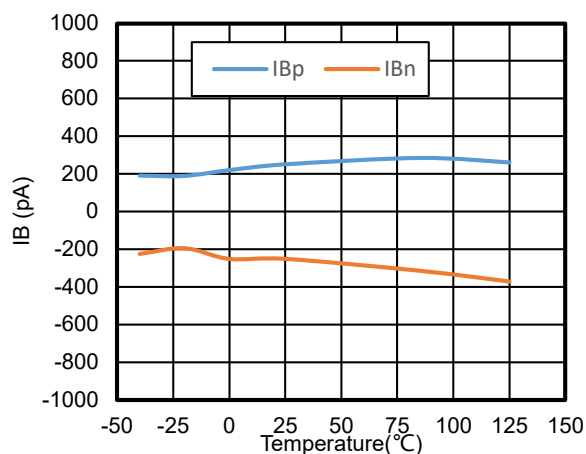
**Figure 4. PSRR- vs Frequency**

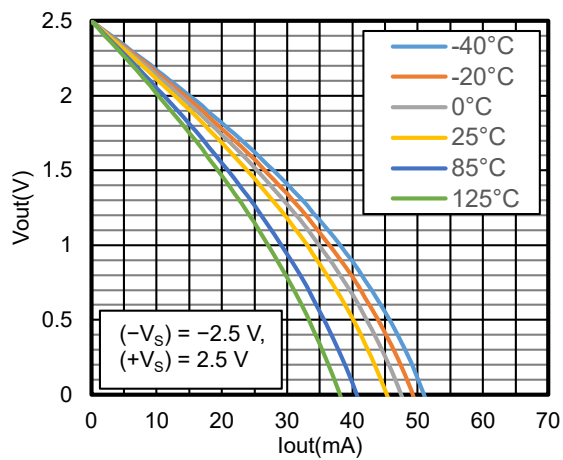
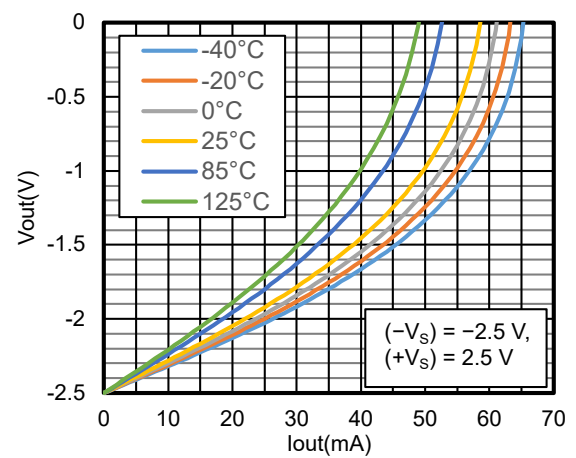
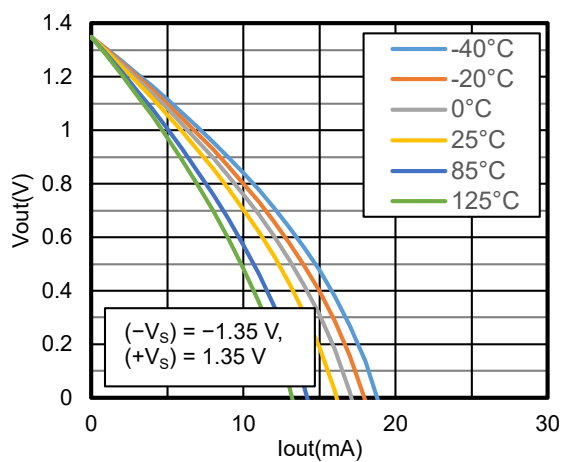
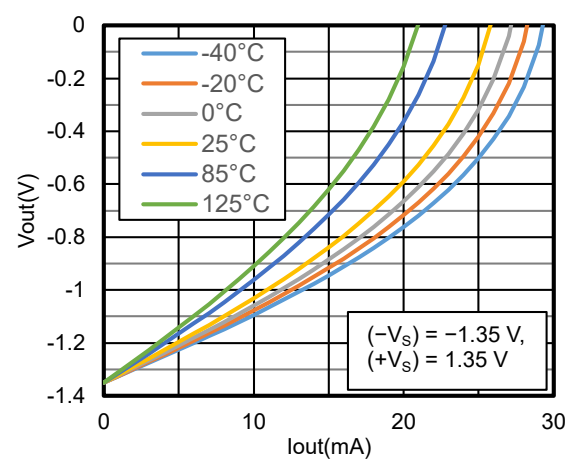
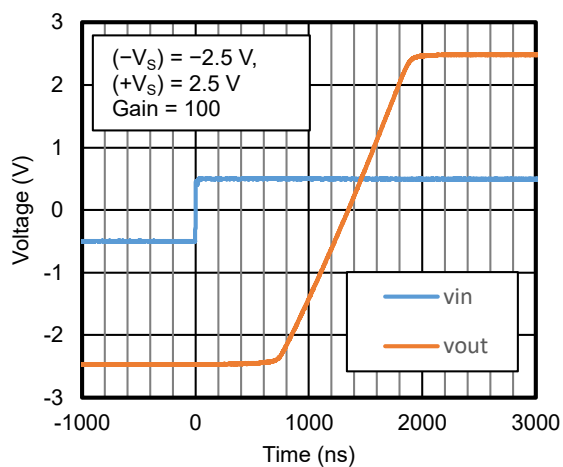
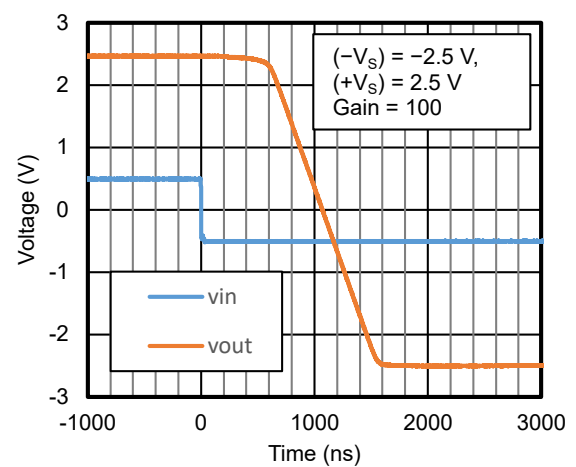


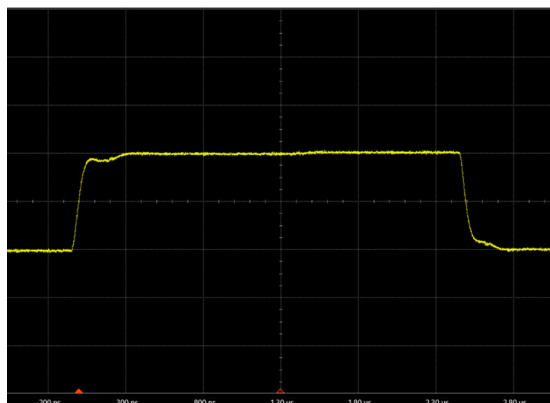
**Figure 5. CMRR vs Frequency**



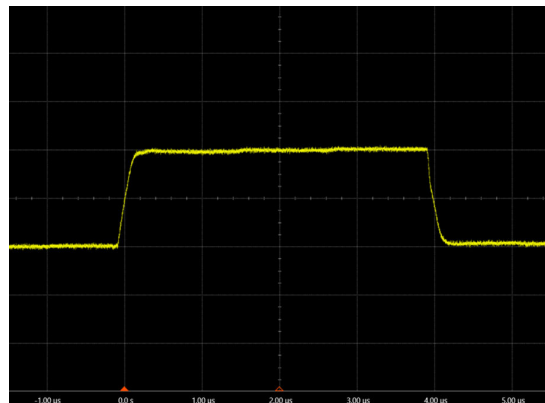
**Figure 6. Open Loop Gain and Phase Margin vs Frequency,  $R_L = 10\text{ k}\Omega$ ,  $C_L = 100\text{ pF}$**

**5-V, Zero-Drift Operational Amplifiers**

**Figure 7.  $V_{OS}$  vs  $V_{CM}$ ,  $V_S = 2.7\text{ V}$** 

**Figure 8.  $V_{OS}$  vs  $V_{CM}$ ,  $V_S = 5.5\text{ V}$** 

**Figure 9.  $V_{OS}$  vs Temperature**

**Figure 10. EMIRR vs Frequency**

**Figure 11.  $I_B$  vs Common-Mode Voltage**

**Figure 12.  $I_B$  vs Temperature**

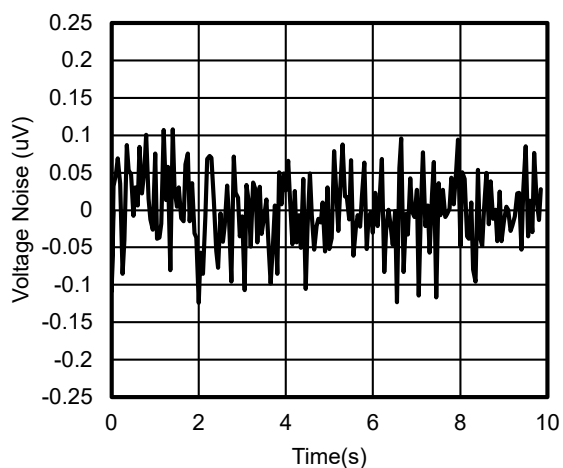
**5-V, Zero-Drift Operational Amplifiers**

**Figure 13. Output Voltage vs Output Current**

**Figure 14. Output Voltage vs Output Current**

**Figure 15. Output Voltage vs Output Current**

**Figure 16. Output Voltage vs Output Current**

**Figure 17. Overload Recovery at Negative Rail**

**Figure 18. Overload Recovery at Positive Rail**

**5-V, Zero-Drift Operational Amplifiers**


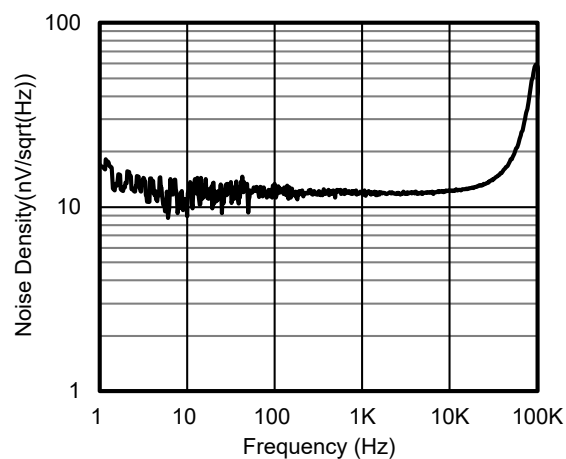
**Figure 19. 100-mV Small Signal Step Response Voltage:**  
50 mV/div, Time: 500 ns/div



**Figure 20. 1-V Large Signal Step Response Voltage: 500**  
mV/div, Time: 1 μs/div



**Figure 21. 0.1 to 10 Hz Voltage Noise**



**Figure 22. Voltage Noise Spectral Density vs Frequency**

## Detailed Description

### Overview

The TPA556x series of op amps can operate on a single-supply voltage (2.7 V to 5.5 V), or a split-supply voltage ( $\pm 1.35$  V to  $\pm 2.75$  V), making them highly versatile and easy to use. The power-supply pins have local bypass ceramic capacitors (typically 0.01  $\mu$ F to 0.1  $\mu$ F). These amplifiers are fully specified from 2.7 V to 5.5 V and over the extended temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

### Functional Block Diagram

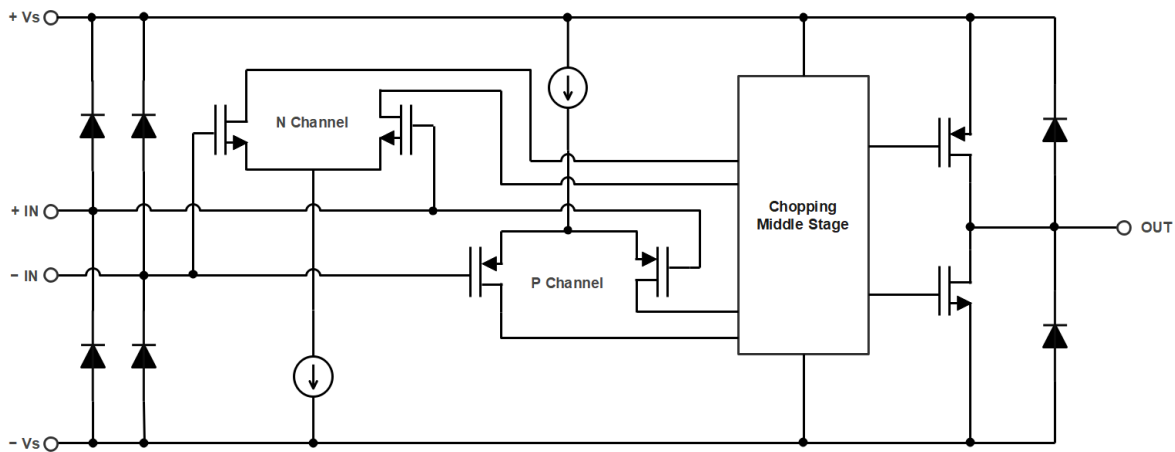


Figure 23. Functional Block Diagram

## Feature Description

### Operating Voltage

The devices are designed for single supply operation from 2.7 V to 5.5 V or dual supply operation from  $\pm 1.35$  V to  $\pm 2.75$  V.

### Ultra Low Offset Voltage and Offset Voltage Drift in Operating Temperature Range

The devices provide 45- $\mu$ V offset voltage within the temperature range from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , which is achieved through the chopper stabilized technology. This unique topology allows the devices to maintain their low-offset voltage over a wide temperature range and over their operating lifetime.

### Low 1/f Noise

Flicker noise, as known as 1/f noise, is inherent in semiconductor devices and increases as frequency decreases. The flicker noise provides higher degrees of error for low-frequency applications. The devices use the chopper stabilized technology to reduce flicker noise. This reduction in 1/f noise allows the devices to have lower noise at dc and low-frequency range compared to standard amplifier.

### Residual Voltage Ripple

The chopping technique can be used in amplifier design due to the internal notch filter. Although the chopping related voltage ripple is suppressed, higher noise spectrum exists at the chopping frequency and its harmonics due to residual ripple.

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**5-V, Zero-Drift Operational Amplifiers**

The devices set the chopping frequency to 450 kHz. If the frequency of input signal is close to the chopping frequency, the signal may be interfered by the residue ripple. To suppress the noise at the chopping frequency, it is recommended that a post filter to be placed at the output of the amplifier.

**Rail-to-Rail Input**

The input common-mode voltage range of the devices extends 100 mV beyond the supply rails. This performance is achieved with a complementary input stage: a PMOS input differential pair in parallel with an NMOS input differential pair.

**Rail-to-Rail Output**

The devices deliver rail-to-rail output swing capability with a class-AB output stage. Different load conditions change the ability of the amplifier to swing close to the rails.

## Application and Implementation

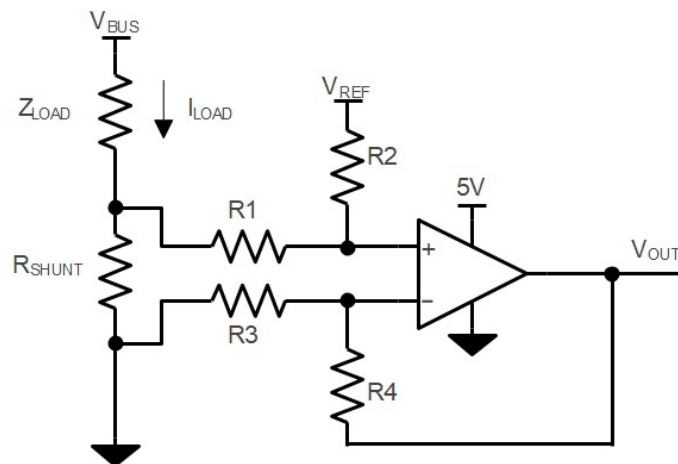
### Note

Information in the following application sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

## Application Information

### Low-Side Current Sensing Application

Figure 24 shows the device configured in a low-side current sensing application. The low-side current sensing method consists of placing a sense resistor between the load and the circuit ground. The voltage dropping across the resistor is amplified by different amplifier circuits with the device. The  $V_{REF}$  can be used to add bias voltage to the output voltage. Particular attention must be paid to the matching and precision of R1, R2, R3, and R4, to maximize the accuracy of the measurement.



$$V_{OUT} = (I_{LOAD} \times R_{SHUNT}) \times (R2 / R1) + V_{REF}$$

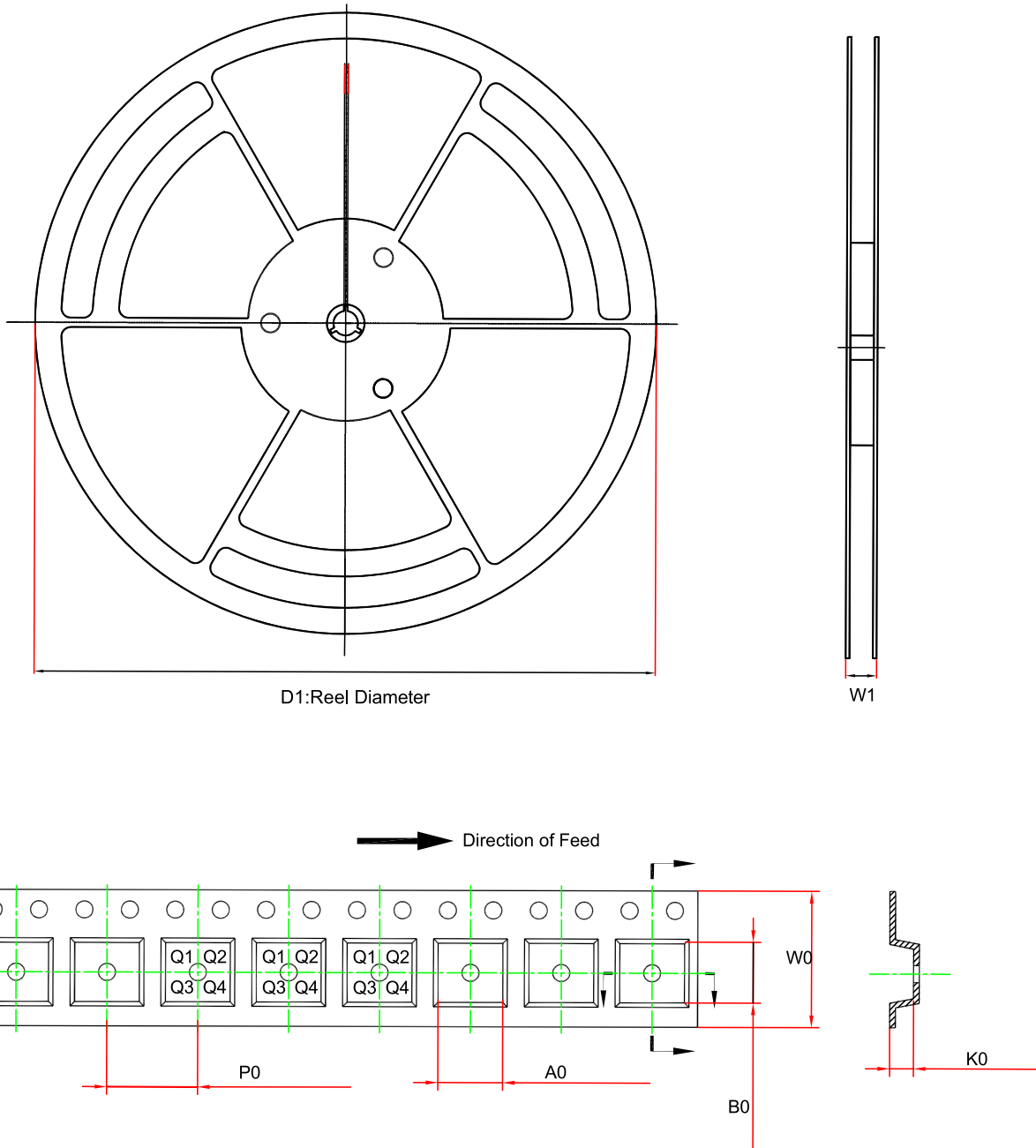
$$\text{When } R3 = R1, R2 = R4, R_{SHUNT} \ll R1$$

Figure 24. Low-Side Current Sensing Application

### Power Supply Recommendations

Place 0.1-μF bypass capacitors close to the power supply pins for reducing coupling errors from the noisy or high-impedance power supplies.

## Tape and Reel Information



| Order Number  | Package         | D1<br>(mm) | W1<br>(mm) | A0<br>(mm) | B0<br>(mm) | K0<br>(mm) | P0<br>(mm) | W0<br>(mm) | Pin1<br>Quadrant |
|---------------|-----------------|------------|------------|------------|------------|------------|------------|------------|------------------|
| TPA5561-SC5R  | SOT353 (SC70-5) | 178.0      | 12.3       | 2.4        | 2.5        | 1.2        | 4.0        | 8.0        | Q3               |
| TPA5561U-SC5R | SOT353 (SC70-5) | 178.0      | 12.3       | 2.4        | 2.5        | 1.2        | 4.0        | 8.0        | Q3               |
| TPA5561-S5TR  | SOT23-5         | 178.0      | 11.4       | 3.3        | 3.2        | 1.4        | 4.0        | 8.0        | Q3               |
| TPA5561U-S5TR | SOT23-5         | 178.0      | 11.4       | 3.3        | 3.2        | 1.4        | 4.0        | 8.0        | Q3               |
| TPA5562-SO1R  | SOP8            | 330.0      | 16.8       | 6.5        | 5.4        | 2          | 8.0        | 12.0       | Q1               |
| TPA5562-TS1R  | TSSOP8          | 330.0      | 17.6       | 6.8        | 3.3        | 1.2        | 8.0        | 12.0       | Q1               |

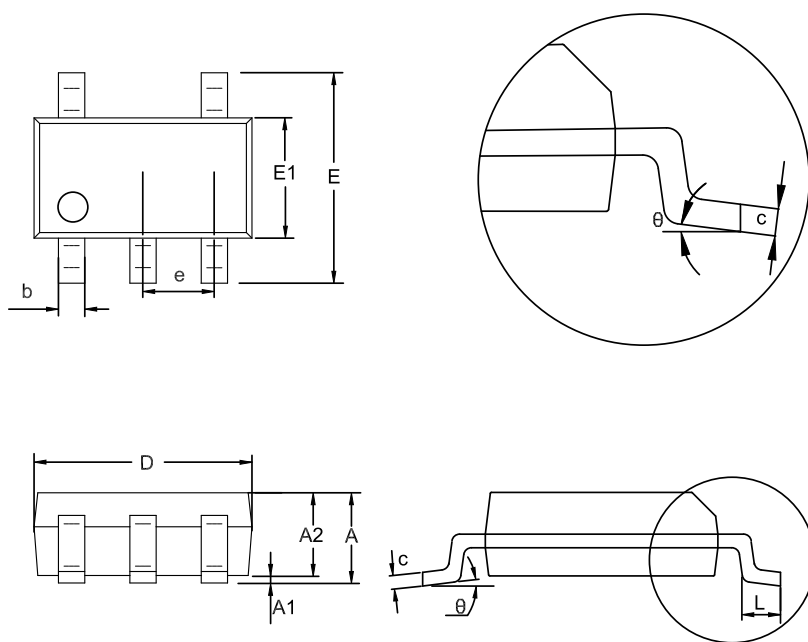
| Order Number | Package | D1<br>(mm) | W1<br>(mm) | A0<br>(mm) | B0<br>(mm) | K0<br>(mm) | P0<br>(mm) | W0<br>(mm) | Pin1<br>Quadrant |
|--------------|---------|------------|------------|------------|------------|------------|------------|------------|------------------|
| TPA5562-VS1R | MSOP8   | 330.0      | 17.6       | 5.2        | 3.3        | 1.5        | 8.0        | 12.0       | Q1               |

## Package Outline Dimensions

### SOT23-5

#### Package Outline Dimensions

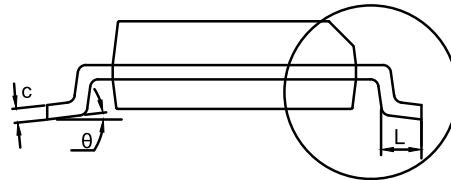
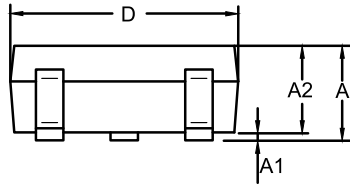
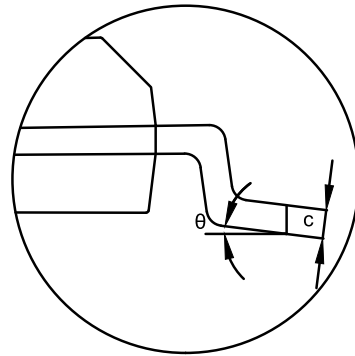
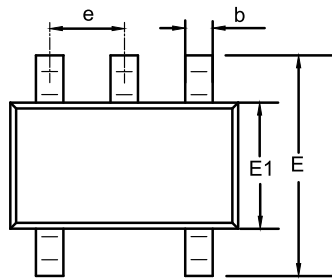
#### S5T(SOT23-5-A)



#### NOTES

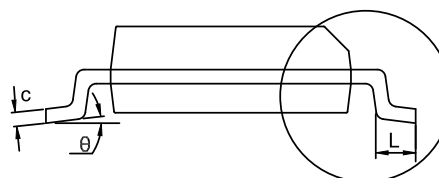
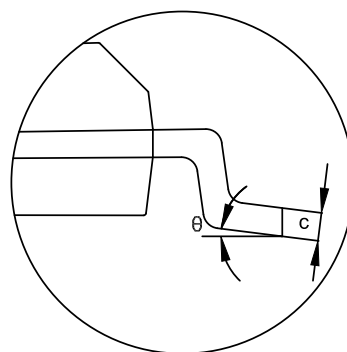
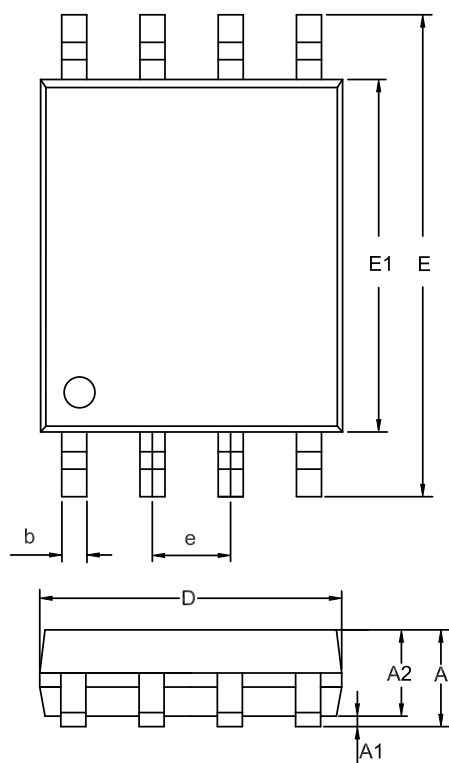
1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 1.050                        | 1.250 | 0.041                   | 0.049 |
| A1     | 0.000                        | 0.150 | 0.000                   | 0.006 |
| A2     | 1.000                        | 1.200 | 0.039                   | 0.047 |
| b      | 0.280                        | 0.500 | 0.011                   | 0.020 |
| c      | 0.100                        | 0.230 | 0.004                   | 0.009 |
| D      | 2.820                        | 3.020 | 0.111                   | 0.119 |
| E      | 2.600                        | 3.000 | 0.102                   | 0.118 |
| E1     | 1.500                        | 1.720 | 0.059                   | 0.068 |
| e      | 0.950 BSC                    |       | 0.037 BSC               |       |
| L      | 0.300                        | 0.600 | 0.012                   | 0.024 |
| θ      | 0                            | 8°    | 0                       | 8°    |

**SOT353**
**Package Outline Dimensions**
**SC5(SOT353-5-A)**

**NOTES**

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

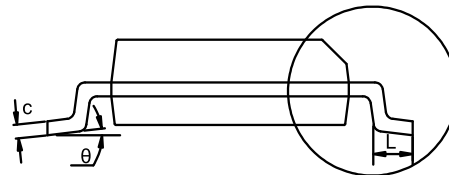
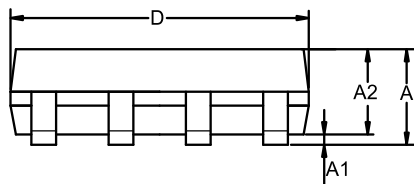
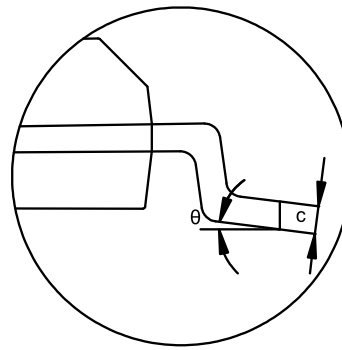
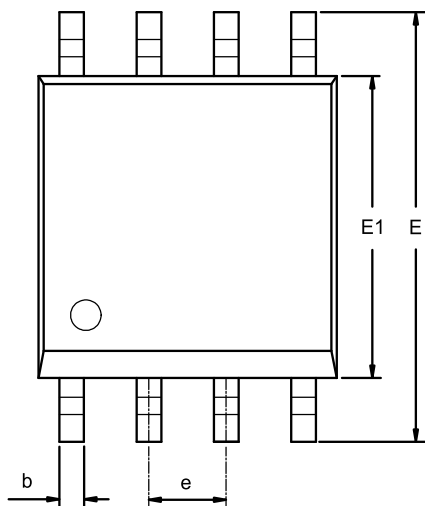
| Symbol   | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|----------|------------------------------|-------|-------------------------|-------|
|          | MIN                          | MAX   | MIN                     | MAX   |
| A        | 0.850                        | 1.100 | 0.033                   | 0.043 |
| A1       | 0.000                        | 0.100 | 0.000                   | 0.004 |
| A2       | 0.800                        | 1.000 | 0.031                   | 0.039 |
| b        | 0.150                        | 0.350 | 0.006                   | 0.014 |
| c        | 0.110                        | 0.230 | 0.004                   | 0.009 |
| D        | 2.000                        | 2.200 | 0.079                   | 0.087 |
| E        | 2.150                        | 2.450 | 0.085                   | 0.096 |
| E1       | 1.150                        | 1.350 | 0.045                   | 0.053 |
| e        | 0.650 BSC                    |       | 0.026 BSC               |       |
| L        | 0.260                        | 0.460 | 0.010                   | 0.018 |
| $\theta$ | 0                            | 8°    | 0                       | 8°    |

**TSSOP8**
**Package Outline Dimensions**
**TS1(TSSOP-8-A)**


| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 0.900                        | 1.200 | 0.035                   | 0.047 |
| A1     | 0.050                        | 0.150 | 0.002                   | 0.006 |
| A2     | 0.800                        | 1.050 | 0.031                   | 0.041 |
| b      | 0.190                        | 0.300 | 0.007                   | 0.012 |
| c      | 0.090                        | 0.200 | 0.004                   | 0.008 |
| D      | 2.900                        | 3.100 | 0.114                   | 0.122 |
| E      | 6.200                        | 6.600 | 0.244                   | 0.260 |
| E1     | 4.300                        | 4.500 | 0.169                   | 0.177 |
| e      | 0.650 BSC                    |       | 0.026 BSC               |       |
| L      | 0.450                        | 0.750 | 0.018                   | 0.030 |
| θ      | 0                            | 8°    | 0                       | 8°    |

**NOTES**

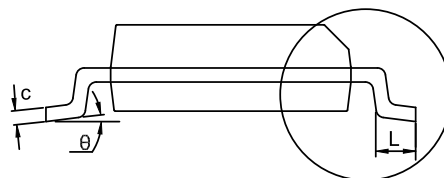
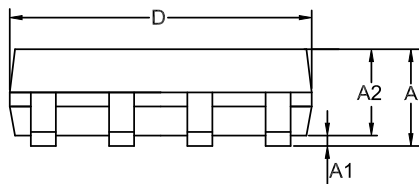
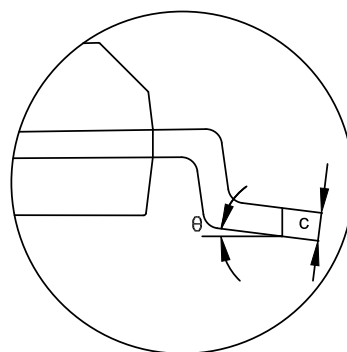
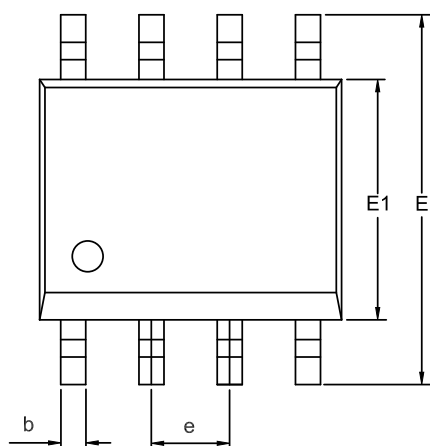
1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

**MSOP8**
**Package Outline Dimensions**
**VS1(MSOP-8-A)**


| Symbol   | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|----------|------------------------------|-------|-------------------------|-------|
|          | MIN                          | MAX   | MIN                     | MAX   |
| A        | 0.800                        | 1.100 | 0.031                   | 0.043 |
| A1       | 0.020                        | 0.150 | 0.001                   | 0.006 |
| A2       | 0.750                        | 0.950 | 0.030                   | 0.037 |
| b        | 0.250                        | 0.380 | 0.010                   | 0.015 |
| c        | 0.090                        | 0.230 | 0.004                   | 0.009 |
| D        | 2.900                        | 3.100 | 0.114                   | 0.122 |
| E        | 4.700                        | 5.100 | 0.185                   | 0.201 |
| E1       | 2.900                        | 3.100 | 0.114                   | 0.122 |
| e        | 0.650 BSC                    |       | 0.026 BSC               |       |
| L        | 0.400                        | 0.800 | 0.016                   | 0.031 |
| $\theta$ | 0                            | 8°    | 0                       | 8°    |

**NOTES**

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

**SOP8**
**Package Outline Dimensions**
**SO1(SOP-8-A)**


| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 1.350                        | 1.750 | 0.053                   | 0.069 |
| A1     | 0.050                        | 0.250 | 0.002                   | 0.010 |
| A2     | 1.250                        | 1.550 | 0.049                   | 0.061 |
| b      | 0.330                        | 0.510 | 0.013                   | 0.020 |
| c      | 0.170                        | 0.250 | 0.007                   | 0.010 |
| D      | 4.700                        | 5.100 | 0.185                   | 0.201 |
| E      | 5.800                        | 6.200 | 0.228                   | 0.244 |
| E1     | 3.800                        | 4.000 | 0.150                   | 0.157 |
| e      | 1.270 BSC                    |       | 0.050 BSC               |       |
| L      | 0.400                        | 1.000 | 0.016                   | 0.039 |
| θ      | 0                            | 8°    | 0                       | 8°    |

**NOTES**

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

## Order Information

| Order Number  | Operating Temperature Range | Package         | Marking Information | MSL | Transport Media, Quantity | Eco Plan |
|---------------|-----------------------------|-----------------|---------------------|-----|---------------------------|----------|
| TPA5561-SC5R  | -40 to 125°C                | SOT353 (SC70-5) | 561                 | 3   | Tape and Reel, 3000       | Green    |
| TPA5561U-SC5R | -40 to 125°C                | SOT353 (SC70-5) | 56U                 | 3   | Tape and Reel, 3000       | Green    |
| TPA5561-S5TR  | -40 to 125°C                | SOT23-5         | 561                 | 3   | Tape and Reel, 3000       | Green    |
| TPA5561U-S5TR | -40 to 125°C                | SOT23-5         | 56U                 | 3   | Tape and Reel, 3000       | Green    |
| TPA5562-SO1R  | -40 to 125°C                | SOP8            | A5562               | 3   | Tape and Reel, 4000       | Green    |
| TPA5562-TS1R  | -40 to 125°C                | TSSOP8          | A5562               | 3   | Tape and Reel, 3000       | Green    |
| TPA5562-VS1R  | -40 to 125°C                | MSOP8           | A5562               | 3   | Tape and Reel, 3000       | Green    |

**Green:** 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

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