

# TPS62A01x-Q1, 2.5-V to 5.5-V, 1-A Automotive Step-Down Converter in SOT563 Package

## 1 Features

- 2.5-V to 5.5-V input voltage range
- AEC-Q100 qualified for automotive applications
  - Device temperature grade 1:  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$   $T_A$
- 0.6-V to  $V_{IN}$  adjustable output voltage range
- 100-m $\Omega$  and 67-m $\Omega$  low  $R_{DS(ON)}$  switches
- < 25- $\mu\text{A}$  quiescent current
- 1.5% feedback accuracy ( $-40^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ )
- 100% mode operation
- 2.4-MHz switching frequency
- Power save mode or PWM option available
- Power-good output pin
- Short-circuit protection (HICCUP)
- Internal soft start-up
- Active output discharge
- Thermal shutdown protection
- Available in a 1.60-mm  $\times$  1.60-mm SOT563 package

## 2 Applications

- [Front camera](#)
- [Surround view system ECU](#)
- [Automotive cluster display](#)

## 3 Description

The TPS62A01x-Q1 family of devices are synchronous step-down buck DC-DC converters optimized for high efficiency and compact design size. The devices integrate switches capable of delivering an output current up to 1 A. At medium to heavy loads, the devices operate in pulse width modulation (PWM) mode with 2.4-MHz switching frequency. At light load, the devices automatically enter power save mode (PSM) to maintain high efficiency over the entire load current range. In shutdown, the current consumption is minimal as well. The TPS62A01A-Q1 variants of this device family operate in forced PWM across the whole load current range.

The TPS62A01x-Q1 devices provide an adjustable output voltage through an external resistor divider. An internal soft-start circuit limits the inrush current during start-up. Other features like overcurrent protection, thermal shutdown protection, and power good are built-in. The devices are available in a SOT-563 package.

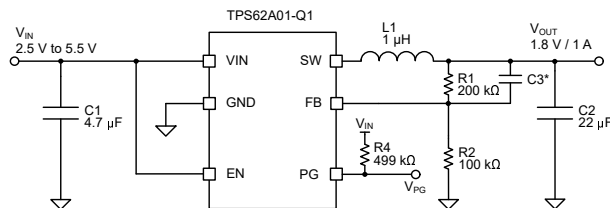
### Device Information

| PART NUMBER <sup>(2)</sup> | OPERATION MODE | PACKAGE <sup>(1)</sup> | PACKAGE SIZE <sup>(3)</sup> |
|----------------------------|----------------|------------------------|-----------------------------|
| TPS62A01-Q1                | PSM, PWM       | DRL (SOT-563, 6)       | 1.60 mm $\times$ 1.60 mm    |
| TPS62A01A-Q1               | FPWM           |                        |                             |

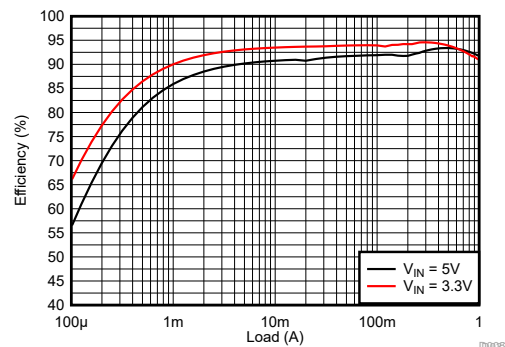
(1) For more information, see [Section 11](#).

(2) See the [Device Comparison Table](#).

(3) The package size (length  $\times$  width) is a nominal value and includes pins, where applicable.



Typical Application



Efficiency vs Output Current at 1.8 V<sub>OUT</sub>



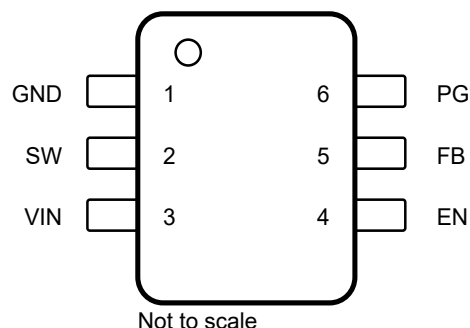
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## 4 Device Comparison Table

| Device Number | Output Current | Operation Mode |
|---------------|----------------|----------------|
| TPS62A01-Q1   | 1 A            | PSM, PWM       |
| TPS62A01A-Q1  | 1 A            | FPWM           |

## 5 Pin Configuration and Functions



**Figure 5-1. 6-Pin DRL SOT-563 Package (Top View)**

**Table 5-1. Pin Functions**

| PIN  |     | TYPE <sup>(1)</sup> | DESCRIPTION                                                                                                                                                  |
|------|-----|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME | NO. |                     |                                                                                                                                                              |
| EN   | 4   | I                   | Device enable logic input. Logic high enables the device. Logic low disables the device and turns the device into shutdown. Do not leave the pin floating.   |
| FB   | 5   | I                   | Feedback pin for the internal control loop. Connect this pin to an external feedback divider.                                                                |
| GND  | 1   | G                   | Ground pin                                                                                                                                                   |
| PG   | 6   | O                   | Power-good open-drain output pin. The pullup resistor cannot be connected to any voltage higher than 5.5 V. If unused, leave the pin open or connect to GND. |
| SW   | 2   | O                   | Switch pin connected to the internal FET switches and inductor terminal. Connect the inductor of the output filter to this pin.                              |
| VIN  | 3   | I                   | Power supply voltage pin                                                                                                                                     |

(1) I = Input, O = Output, G = Ground

## 6 Specifications

### 6.1 Absolute Maximum Ratings

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

|                            |                                | MIN  | MAX       | UNIT |
|----------------------------|--------------------------------|------|-----------|------|
| Pin voltage <sup>(2)</sup> | VIN, EN, PG                    | −0.3 | 6         | V    |
|                            | SW, DC                         | −0.3 | VIN + 0.3 | V    |
|                            | SW, transient < 10 ns          | −3.0 | 10        | V    |
|                            | FB                             | −0.3 | 3         | V    |
| TJ                         | Operating junction temperature | −40  | 150       | °C   |
| Tstg                       | Storage temperature            | −55  | 150       | °C   |

- (1) Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.
- (2) All voltage values are with respect to the network ground terminal.

### 6.2 ESD Ratings

|        |                         |                                                         | VALUE | UNIT |
|--------|-------------------------|---------------------------------------------------------|-------|------|
| V(ESD) | Electrostatic discharge | Human body model (HBM), per AEC Q100-002 <sup>(1)</sup> | ±2000 | V    |
|        |                         | Charged device model (CDM), per AEC Q100-011            | ±750  |      |

- (1) AEC Q100-002 indicates that HBM stressing must be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

### 6.3 Recommended Operating Conditions

Over operating junction temperature range (unless otherwise noted)

|     |                                     |          | MIN | NOM | MAX | UNIT |
|-----|-------------------------------------|----------|-----|-----|-----|------|
| VIN | Input supply voltage range          |          | 2.5 |     | 5.5 | V    |
| VOU | Output voltage range                |          | 0.6 |     | VIN | V    |
| IOU | Output current range                | TPS62A01 |     |     | 1   | A    |
| L   | Effective inductance                |          |     | 1.0 |     | μH   |
| IPG | Power-Good input current capability |          | 0   |     | 1   | mA   |
| TJ  | Operating junction temperature      |          | −40 |     | 150 | °C   |

### 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                              | TPS62A01(A)-Q1 |                    | UNIT |
|-------------------------------|----------------------------------------------|----------------|--------------------|------|
|                               |                                              | JEDEC          | EVM                |      |
|                               |                                              | 6 PINS         |                    |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 154.2          | 122.7              | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 85.3           | n/a <sup>(2)</sup> | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 42.9           | n/a <sup>(2)</sup> | °C/W |
| Ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 2.6            | 2.7                | °C/W |
| Ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 42.4           | 42.1               | °C/W |

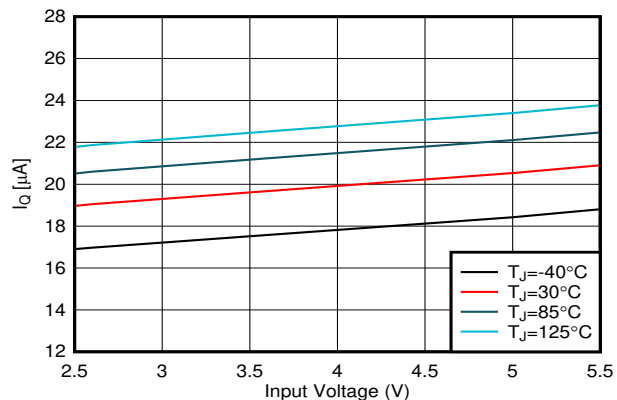
- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) report.
- (2) Not applicable to an EVM.

## 6.5 Electrical Characteristics

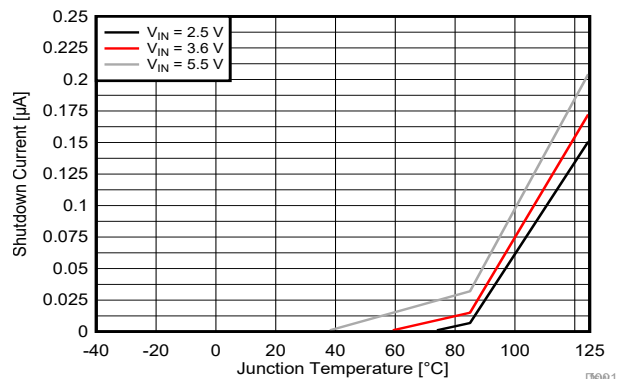
$T_J = -40^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$ ,  $V_{IN} = 2.5\text{ V}$  to  $5.5\text{ V}$ . Typical values are at  $T_J = 25^{\circ}\text{C}$  and  $V_{IN} = 5\text{ V}$  (unless otherwise noted)

| PARAMETER                     |                                                       | TEST CONDITIONS                                                  | MIN | TYP  | MAX | UNIT               |
|-------------------------------|-------------------------------------------------------|------------------------------------------------------------------|-----|------|-----|--------------------|
| <b>SUPPLY</b>                 |                                                       |                                                                  |     |      |     |                    |
| $I_{Q(VIN)}$                  | VIN quiescent current                                 | Non-switching, $V_{EN} = \text{High}$ , $V_{FB} = 610\text{ mV}$ |     | 23   |     | $\mu\text{A}$      |
| $I_{SD(VIN)}$                 | VIN shutdown supply current                           | $V_{EN} = \text{Low}$                                            |     | 0.01 | 4   | $\mu\text{A}$      |
| <b>UVLO</b>                   |                                                       |                                                                  |     |      |     |                    |
| $V_{UVLO(R)}$                 | VIN UVLO rising threshold                             | $V_{IN}$ rising                                                  | 2.3 | 2.4  | 2.5 | V                  |
| $V_{UVLO(F)}$                 | VIN UVLO falling threshold                            | $V_{IN}$ falling                                                 | 2.2 | 2.3  | 2.4 | V                  |
| <b>ENABLE</b>                 |                                                       |                                                                  |     |      |     |                    |
| $V_{EN(R)}$                   | High-level input voltage (EN)                         | EN rising, enable switching                                      | 1.2 |      |     | V                  |
| $V_{EN(F)}$                   | Low-level input voltage (EN)                          | EN falling, disable switching                                    |     |      | 0.4 | V                  |
| $V_{EN(LKG)}$                 | EN Input leakage current                              | $V_{EN} = 5\text{ V}$                                            |     |      | 250 | nA                 |
| <b>REFERENCE VOLTAGE</b>      |                                                       |                                                                  |     |      |     |                    |
| $V_{FB}$                      | FB voltage                                            | PWM mode                                                         | 591 | 600  | 609 | mV                 |
| $I_{FB(LKG)}$                 | FB input leakage current                              | $V_{FB} = 0.6\text{ V}$                                          |     |      | 100 | nA                 |
| <b>SWITCHING FREQUENCY</b>    |                                                       |                                                                  |     |      |     |                    |
| $f_{SW(FCCM)}$                | Switching frequency, FPWM operation                   | $V_{IN} = 5\text{ V}$ ; $V_{OUT} = 1.8\text{ V}$                 |     | 2400 |     | kHz                |
| <b>STARTUP</b>                |                                                       |                                                                  |     |      |     |                    |
|                               | Internal fixed soft-start time                        | From EN = High to $V_{FB} = 0.56\text{ V}$                       |     |      | 1   | ms                 |
| <b>POWER STAGE</b>            |                                                       |                                                                  |     |      |     |                    |
| $R_{DS(ON)(HS)}$              | High-side MOSFET on-resistance                        | $V_{IN} = 5\text{ V}$                                            |     | 100  |     | m $\Omega$         |
| $R_{DS(ON)(LS)}$              | Low-side MOSFET on-resistance                         | $V_{IN} = 5\text{ V}$                                            |     | 67   |     | m $\Omega$         |
| <b>OVERCURRENT PROTECTION</b> |                                                       |                                                                  |     |      |     |                    |
| $I_{HS(OC)}$                  | High-side peak current limit                          |                                                                  | 1.5 | 1.8  |     | A                  |
| $I_{LS(OC)}$                  | Low-side valley current limit                         |                                                                  |     | 1.8  |     | A                  |
| <b>POWER GOOD</b>             |                                                       |                                                                  |     |      |     |                    |
| $V_{PGTH}$                    | Power Good threshold                                  | PG low, FB falling                                               |     | 93.5 |     | %                  |
| $V_{PGTH}$                    | Power Good threshold                                  | PG high, FB rising                                               |     | 96   |     | %                  |
|                               | PG delay falling                                      |                                                                  |     | 35   |     | $\mu\text{s}$      |
|                               | PG delay rising                                       |                                                                  |     | 10   |     | $\mu\text{s}$      |
| $I_{PG(LKG)}$                 | PG pin Leakage current when open drain output is high | $V_{PG} = 5\text{ V}$                                            |     |      | 100 | nA                 |
|                               | PG pin output low-level voltage                       | $I_{PG} = 1\text{ mA}$                                           |     |      | 400 | mV                 |
| <b>OUTPUT DISCHARGE</b>       |                                                       |                                                                  |     |      |     |                    |
|                               | Output discharge current on SW pin                    | $V_{IN} = 3\text{ V}$ , $V_{OUT} = 2.0\text{ V}$                 |     | 76   |     | mA                 |
| <b>THERMAL SHUTDOWN</b>       |                                                       |                                                                  |     |      |     |                    |
| $T_{J(SD)}$                   | Thermal shutdown threshold                            | Temperature rising                                               |     | 170  |     | $^{\circ}\text{C}$ |
| $T_{J(HYS)}$                  | Thermal shutdown hysteresis                           |                                                                  |     | 20   |     | $^{\circ}\text{C}$ |

## 6.6 Typical Characteristics



**Figure 6-1. Quiescent Current vs Input Voltage (TPS62A01-Q1)**



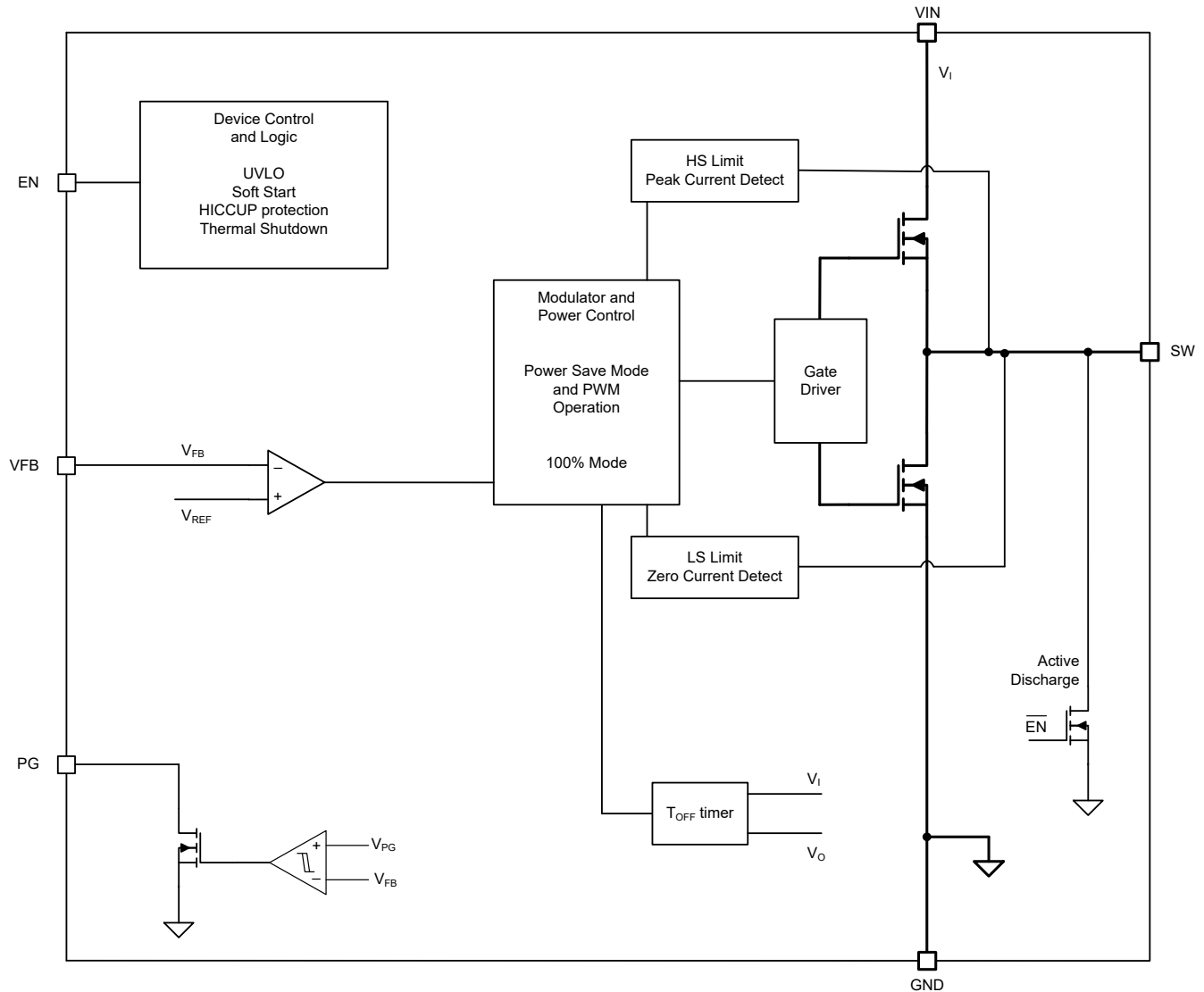
**Figure 6-2. Shutdown Current vs Junction Temperature**

## 7 Detailed Description

### 7.1 Overview

The TPS62A01x-Q1 is a high-efficiency synchronous step-down converter. The device operates with an adaptive off time with a peak current control scheme. The device operates typically at 2.4-MHz frequency pulse width modulation (PWM) at moderate to heavy load currents. Based on the  $V_{IN}/V_{OUT}$  ratio, a simple circuit sets the required off time for the low-side MOSFET, making the switching frequency relatively constant regardless of the variation of the input voltage, output voltage, and load current.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

#### 7.3.1 Power Save Mode

The device automatically enters power save mode to improve efficiency at light load when the inductor current becomes discontinuous. In power save mode, the converter reduces the switching frequency and minimizes current consumption. In power save mode, the output voltage rises slightly above the nominal output voltage. This effect is minimized by increasing the output capacitor or adding a feedforward capacitor.

### 7.3.2 100% Duty Cycle Low Dropout Operation

The device offers low input-to-output voltage difference by entering 100% duty cycle mode. In this mode, the high-side MOSFET switch is constantly turned on and the low-side MOSFET is switched off. The minimum input voltage to maintain output regulation, depending on the load current and output voltage, is calculated as:

$$V_{IN(MIN)} = V_{OUT} + I_{OUT} \times (R_{DS(ON)} + R_L) \quad (1)$$

where

- $R_{DS(ON)}$  = High-side FET on-resistance
- $R_L$  = Inductor ohmic resistance (DCR)

### 7.3.3 Soft Start

After enabling the device, internal soft-start circuitry ramps up the output voltage, which reaches the nominal output voltage during start-up time, avoiding excessive inrush current and creating a smooth voltage rise slope. It also prevents excessive voltage drops of primary cells and rechargeable batteries with high internal impedance.

The TPS62A01x-Q1 is able to start into a prebiased output capacitor. The converter starts with the applied bias voltage and ramps the output voltage to the nominal value.

### 7.3.4 Switch Current Limit and Short-Circuit Protection (HICCUP)

The switch current limit prevents the device from high inductor current and drawing excessive current from the battery or input rail. Due to internal propagation delay, the AC peak current can exceed the static current limit during that time. Excessive current can occur with a shorted or saturated inductor, an overload or shorted output circuit condition. If the inductor current reaches the threshold  $I_{LIM}$ , the high-side MOSFET is turned off and the low-side MOSFET is turned on to ramp down the inductor current with an adaptive off time.

When this switch current limit is triggered 32 times, the device stops switching to protect the output. The device then automatically starts a new start-up after a typical delay time of 100  $\mu$ s has passed. This action is named HICCUP short-circuit protection. The device repeats this mode until the high load condition disappears. HICCUP protection is also enabled during the start-up.

### 7.3.5 Undervoltage Lockout

To avoid misoperation of the device at low input voltages, an undervoltage lockout (UVLO) is implemented, which shuts down the device at voltages lower than  $V_{UVLO}$ .

### 7.3.6 Thermal Shutdown

The device goes into thermal shutdown and stops switching when the junction temperature exceeds  $T_{JSD}$ . When the device temperature falls below the threshold by 20°C, the device returns to normal operation automatically.

## 7.4 Device Functional Modes

### 7.4.1 Enable and Disable

The device is enabled by setting the EN input to a logic High. Accordingly, a logic Low disables the device. If the device is enabled, the internal power stage starts switching and regulates the output voltage to the set point voltage. The EN input must be terminated and should not be left floating.

### 7.4.2 Power Good

The TPS62A01x-Q1 has a built-in power-good (PG) feature to indicate whether the output voltage has reached the target and the device is ready. The PG signal can be used for start-up sequencing of multiple rails. The PG pin is an open-drain output that requires a pullup resistor to any voltage up to the recommended input voltage level. PG is low when the device is turned off due to EN, UVLO (undervoltage lockout), or thermal shutdown. VIN must remain present for the PG pin to stay low. If not used, the power good can be tie to GND or left open. The PG indicator has a de-glitch to avoid the signal indicating glitches or transient responses from the loop.

**Table 7-1. Power-Good indicator Functional Table**

| Logic Signals        |                             |                  |                       | PG Status      |
|----------------------|-----------------------------|------------------|-----------------------|----------------|
| $V_I$                | EN Pin                      | Thermal Shutdown | $V_O$                 |                |
| $V_I > UVLO$         | HIGH                        | NO               | $V_O$ on target       | High Impedance |
|                      |                             |                  | $V_O < \text{target}$ | LOW            |
|                      |                             |                  | YES                   | LOW            |
|                      |                             | YES              | x                     | LOW            |
|                      | $UVLO < V_I < 1.8\text{ V}$ | x                | x                     | LOW            |
| $V_I < 1.8\text{ V}$ | x                           | x                | x                     | Undefined      |

## 8 Application and Implementation

### Note

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

### 8.1 Application Information

The following section discusses the design of the external components to complete the power supply design for several input and output voltage options by using typical applications as a reference.

### 8.2 Typical Application

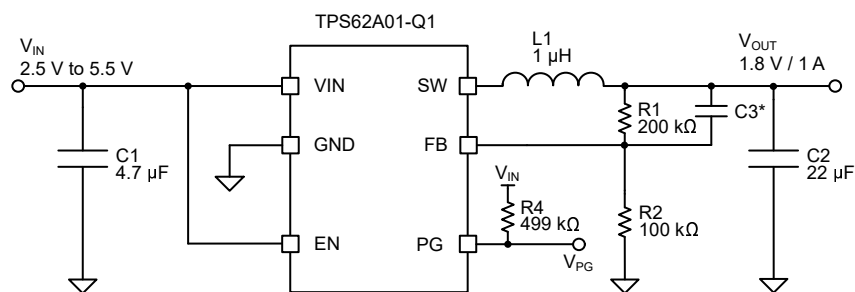


Figure 8-1. TPS62A01x-Q1 Typical Application Circuit

\*C3 is optional

#### 8.2.1 Design Requirements

For this design example, use the parameters listed in Table 8-1 as the input parameters

Table 8-1. Design Parameters

| Design Parameter       | Example Value  |
|------------------------|----------------|
| Input voltage          | 2.5 V to 5.5 V |
| Output voltage         | 1.8 V          |
| Maximum output current | 1.0 A          |

Table 8-2 lists the components used for the example.

Table 8-2. List of Components

| Reference | Description                                                         | Manufacturer <sup>(1)</sup> |
|-----------|---------------------------------------------------------------------|-----------------------------|
| C1        | 4.7 μF, Ceramic Capacitor, 10 V, X7R, size 0805, GRM21BR71A475KA73L | Murata                      |
| C2        | 22 μF, Ceramic Capacitor, 10 V, X7R, size 0805, GRM21BZ71A226KE15L  | Murata                      |
| L1        | 1 μH, Power Inductor, XGL3520-102MEC                                | Coilcraft                   |
| R1, R2    | Chip resistor, 1%, size 0603                                        | Std.                        |
| C3        | Optional, 27 pF or 33 pF if needed <sup>(2)</sup>                   | Std.                        |

(1) See the [Third-Party Products Disclaimer](#).

(2) TI recommends 33 pF for ≤1.8-V output voltage and 27 pF for 3.3-V output voltage.

## 8.2.2 Detailed Design Procedure

### 8.2.2.1 Setting the Output Voltage

The output voltage is set by an external resistor divider according to [Equation 2](#).

$$R1 = R2 \times \left( \frac{V_{OUT}}{V_{FB}} - 1 \right) = R2 \times \left( \frac{V_{OUT}}{0.6V} - 1 \right) \quad (2)$$

R2 must not be higher than 100 kΩ to provide acceptable noise sensitivity.

### 8.2.2.2 Output Filter Design

The inductor and output capacitor together provide a low-pass filter. To simplify this process, [Table 8-3](#) outlines possible inductor and capacitor value combinations. Please note that stability may vary based on board layout and parasitic elements and it is essential to evaluate and confirm the appropriate values for each specific application. Checked cells represent combinations that are proven for stability by simulation and lab test. Further combinations should be checked for each individual application.

In case a lower output ripple is desired, higher output capacitance may help reduce the ripple.

**Table 8-3. Matrix of Output Capacitor and Inductor Combinations for TPS62A01x-Q1**

| V <sub>OUT</sub> [V]         | L [μH] <sup>(1)</sup> | C <sub>OUT</sub> [μF] <sup>(2)</sup> |                   |                   |
|------------------------------|-----------------------|--------------------------------------|-------------------|-------------------|
|                              |                       | 10                                   | 22                | 2 × 22            |
| 0.6 ≤ V <sub>OUT</sub> < 1.2 | 1                     |                                      | +                 | ++ <sup>(3)</sup> |
| 1.2 ≤ V <sub>OUT</sub> < 1.8 | 1                     | + <sup>(4)</sup>                     | ++ <sup>(3)</sup> | +                 |
| 1.8 ≤ V <sub>OUT</sub>       | 1                     | + <sup>(4)</sup>                     | ++ <sup>(3)</sup> | +                 |

- (1) Inductor tolerance and current de-rating is anticipated. The effective inductance can vary by +20% and –30%.
- (2) Capacitance tolerance and bias voltage de-rating is anticipated. The effective capacitance can vary by +20% and –50%.
- (3) This LC combination is the standard value and recommended for most applications.
- (4) The minimum C<sub>OUT</sub> of 10 μF does not support an additional feedforward capacitor.

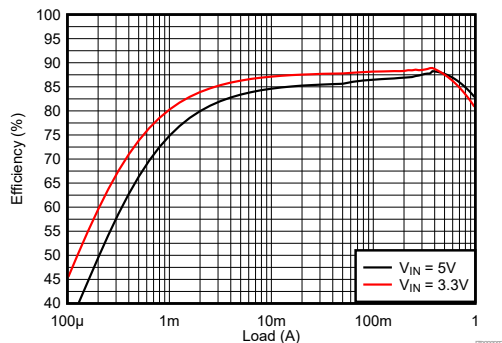
### 8.2.2.3 Input and Output Capacitor Selection

The architecture of the TPS62A01x-Q1 allows use of tiny ceramic-type output capacitors with low equivalent series resistance (ESR). These capacitors provide low output voltage ripple and are thus recommended. To keep the resistance up to high frequencies and to achieve narrow capacitance variation with temperature, TI recommends to use X7R dielectric.

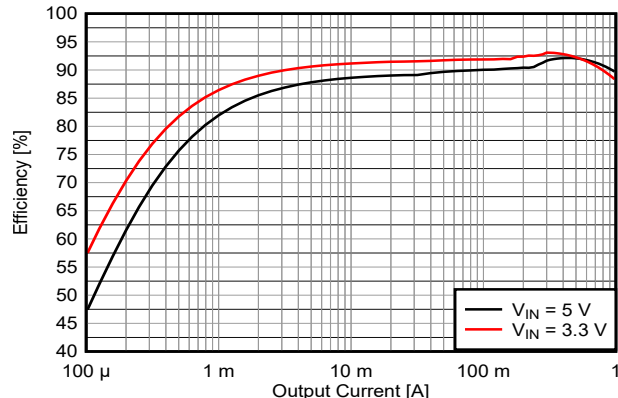
The input capacitor is the low impedance energy source for the converter that helps provide stable operation. TI recommends a low-ESR multilayer ceramic capacitor for best filtering. For most applications, a 4.7-μF input capacitor is sufficient; a larger value reduces input voltage ripple.

A feedforward capacitor reduces the output ripple in PSM and improves the load transient response. A 33-pF capacitor is good for the 1.8-V output typical application. For the 3.3-V output typical application a 27-pF capacitor is recommended.

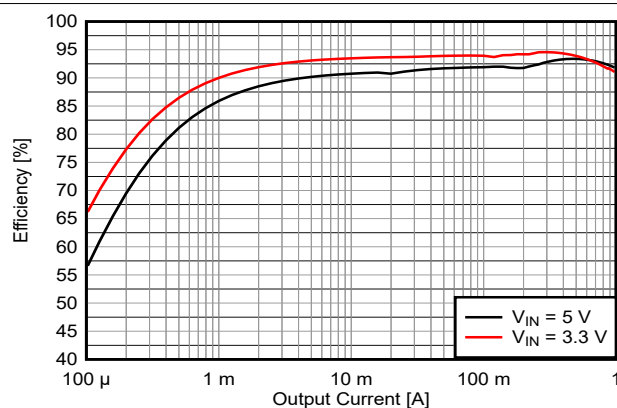
## 8.2.3 Application Curves



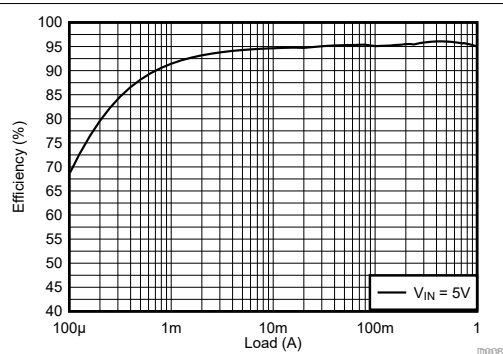
**Figure 8-2. 0.6-V Output Efficiency (TPS62A01-Q1)**



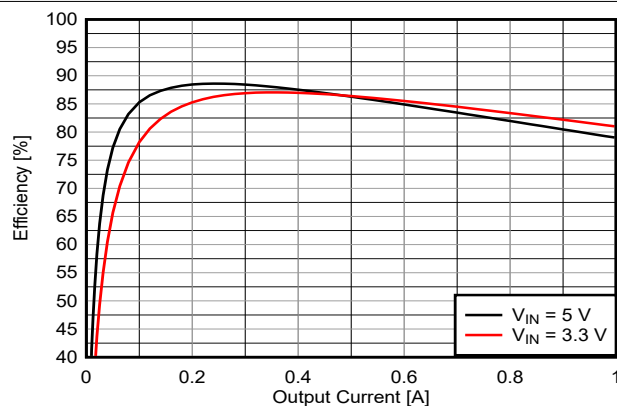
**Figure 8-3. 1.2-V Output Efficiency (TPS62A01-Q1)**



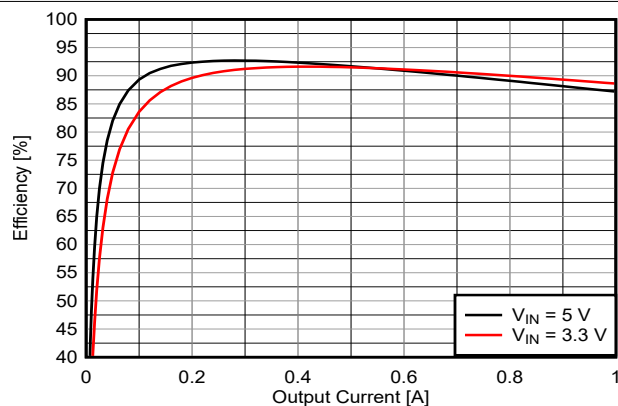
**Figure 8-4. 1.8-V Output Efficiency (TPS62A01-Q1)**



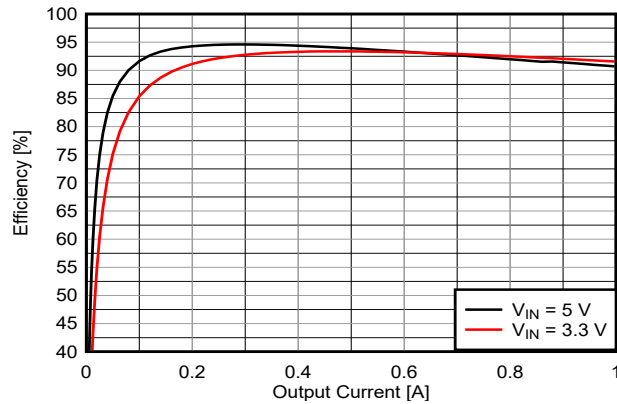
**Figure 8-5. 3.3-V Output Efficiency (TPS62A01-Q1)**



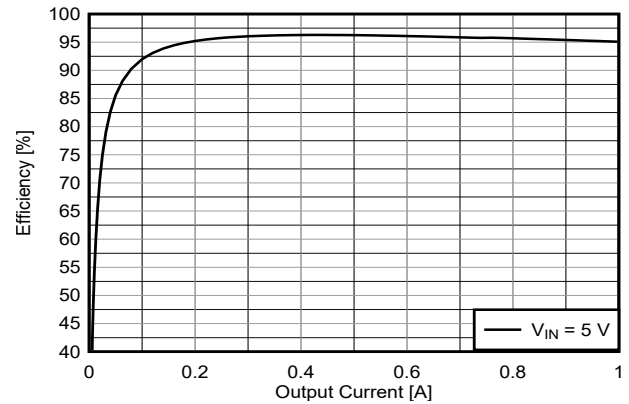
**Figure 8-6. 0.6-V Output Efficiency (TPS62A01A-Q1)**



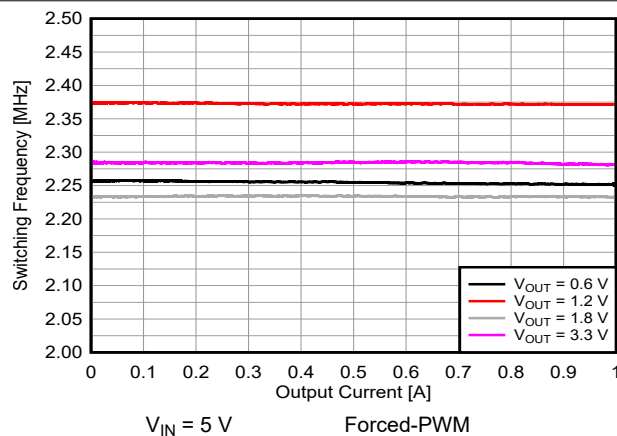
**Figure 8-7. 1.2-V Output Efficiency (TPS62A01A-Q1)**



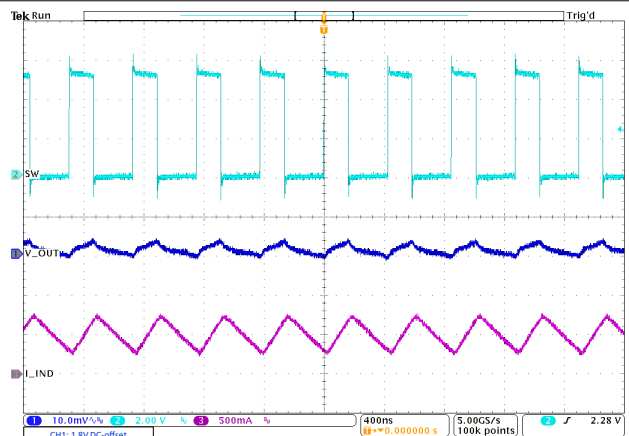
**Figure 8-8. 1.8-V Output Efficiency (TPS62A01A-Q1)**



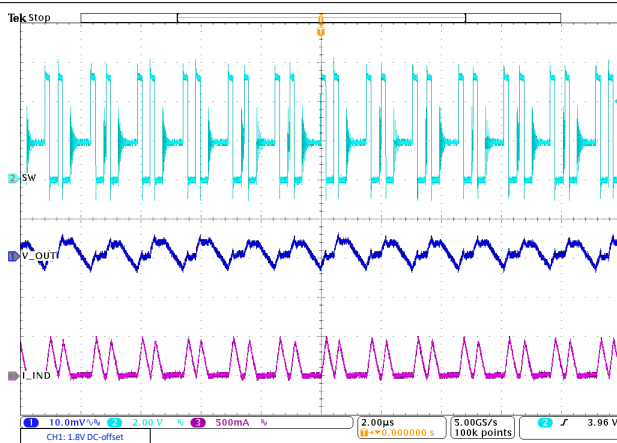
**Figure 8-9. 3.3-V Output Efficiency (TPS62A01A-Q1)**



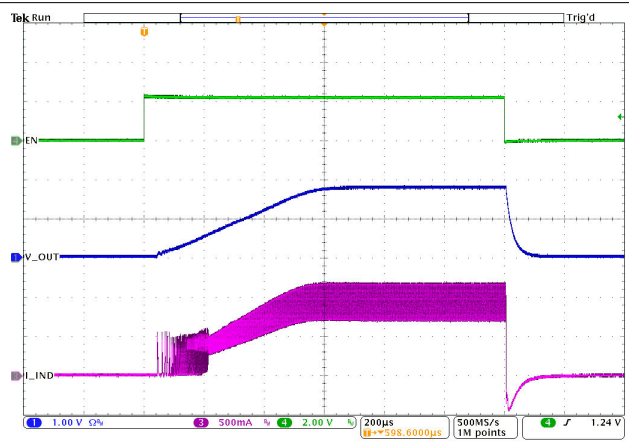
**Figure 8-10. Switching Frequency vs. Output Current**



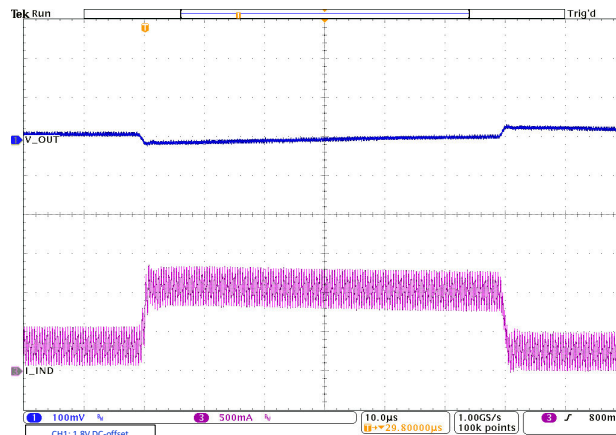
**Figure 8-11. PWM Operation**



**Figure 8-12. Power Save Mode Operation**



**Figure 8-13. Start-Up with Load**



Load step: 0.3 A to 1 A

**Figure 8-14. Load Transient**

### 8.3 Power Supply Recommendations

The device is designed to operate from an input voltage supply range from 2.5 V to 5.5 V. Make sure that the input power supply has a sufficient current rating for the application.

### 8.4 Layout

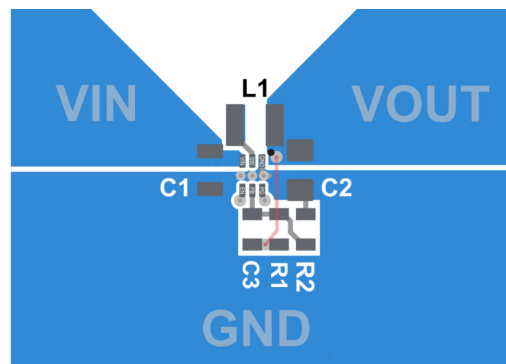
#### 8.4.1 Layout Guidelines

The printed-circuit-board (PCB) layout is an important step to maintain the high performance of the TPS62A01x-Q1 device.

- The input, output capacitors and the inductor must be placed as close as possible to the IC. This action keeps the power traces short. Routing these power traces direct and wide results in low trace resistance and low parasitic inductance.
- The low side of the input and output capacitors must be connected properly to the GND pin to avoid a ground potential shift.
- The sense traces connected to FB is a signal trace. Special care must be taken to avoid noise being induced. Keep these traces away from SW nodes.
- A common ground must be used. GND layers can be used for shielding.

See [Figure 8-15](#) for the recommended PCB layout.

#### 8.4.2 Layout Example

**Figure 8-15. TPS62A01x-Q1 PCB Layout Recommendation**

## 9 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

### 9.1 Device Support

#### 9.1.1 Third-Party Products Disclaimer

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### 9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](https://www.ti.com). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 9.3 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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### 9.4 Trademarks

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### 9.5 Electrostatic Discharge Caution



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.

### 9.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision * (February 2023) to Revision A (November 2023)      | Page |
|----------------------------------------------------------------------------|------|
| • First public release of the full data sheet.....                         | 1    |
| • Changed document status from Advance Information to Production Data..... | 1    |

## 11 Mechanical, Packaging, and Orderable Information

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

## PACKAGING INFORMATION

| Orderable part number            | Status<br>(1) | Material type<br>(2) | Package   Pins    | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|----------------------------------|---------------|----------------------|-------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">TPS62A01AQDRLRQ1</a> | Active        | Production           | SOT-5X3 (DRL)   6 | 4000   LARGE T&R      | Yes         | Call TI   Sn                         | Level-1-260C-UNLIM                | -40 to 125   | 1OH                 |
| TPS62A01AQDRLRQ1.A               | Active        | Production           | SOT-5X3 (DRL)   6 | 4000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 1OH                 |
| <a href="#">TPS62A01QDRLRQ1</a>  | Active        | Production           | SOT-5X3 (DRL)   6 | 4000   LARGE T&R      | Yes         | Call TI   Sn                         | Level-1-260C-UNLIM                | -40 to 125   | 1OG                 |
| TPS62A01QDRLRQ1.A                | Active        | Production           | SOT-5X3 (DRL)   6 | 4000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 1OG                 |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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

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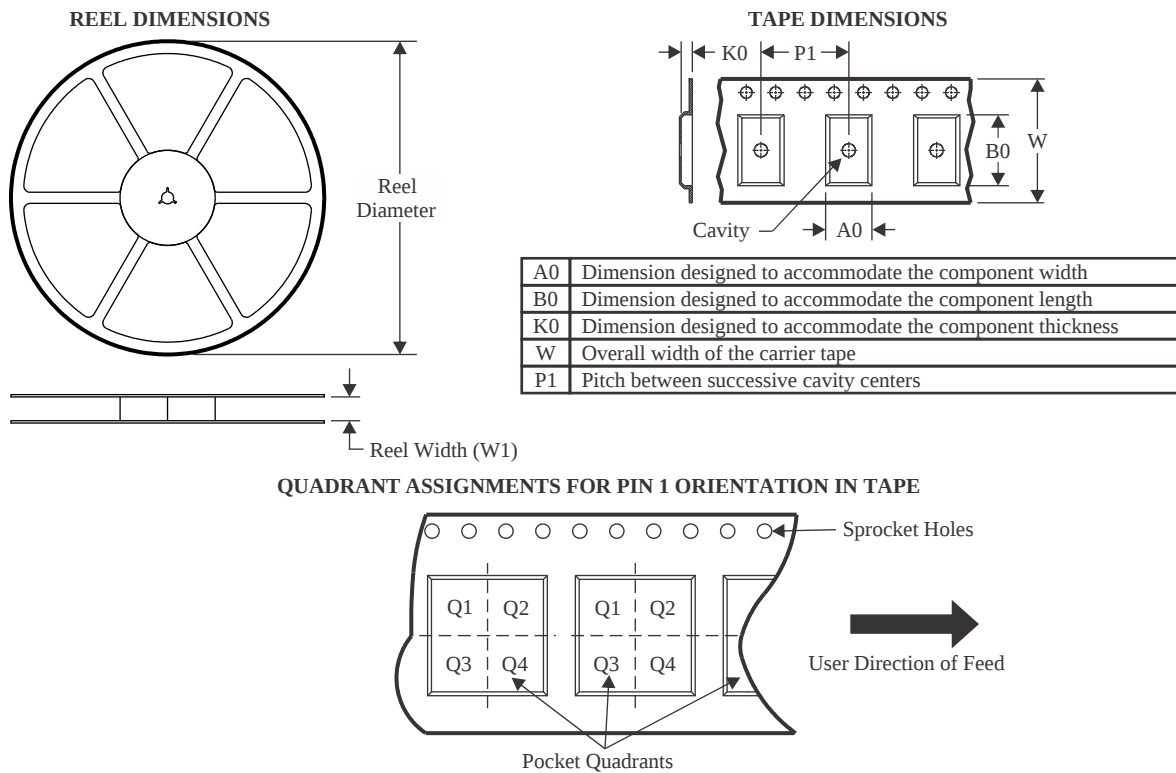
**OTHER QUALIFIED VERSIONS OF TPS62A01-Q1, TPS62A01A-Q1 :**

- Catalog : [TPS62A01](#), [TPS62A01A](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

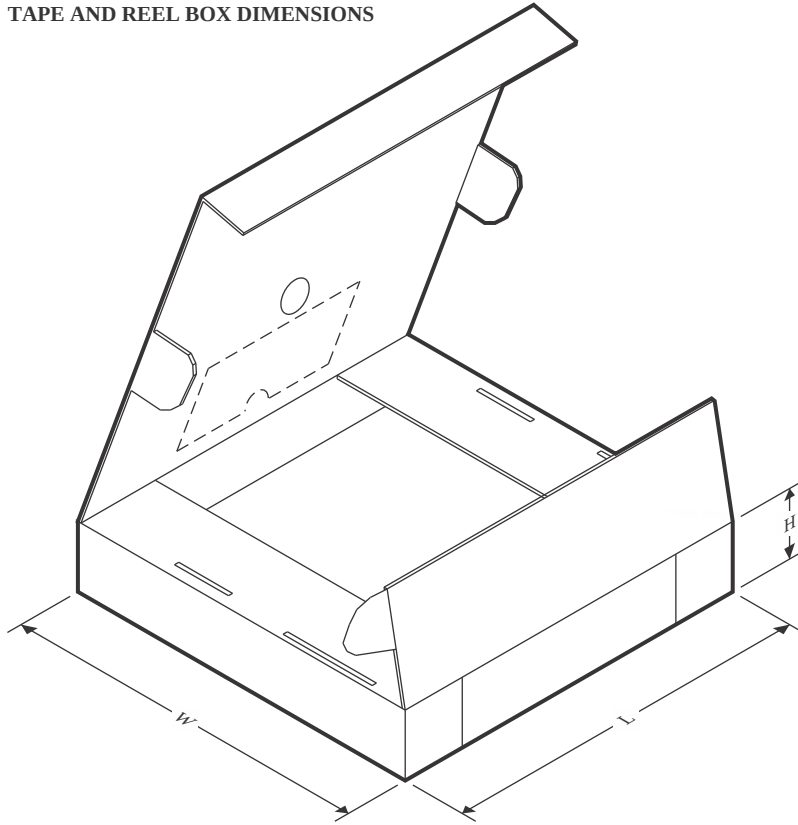
## TAPE AND REEL INFORMATION



\*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 |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TPS62A01AQDRLRQ1 | SOT-5X3      | DRL             | 6    | 4000 | 180.0              | 8.4                | 2.0     | 1.8     | 0.75    | 4.0     | 8.0    | Q3            |
| TPS62A01QDRLRQ1  | SOT-5X3      | DRL             | 6    | 4000 | 180.0              | 8.4                | 2.0     | 1.8     | 0.75    | 4.0     | 8.0    | Q3            |

## TAPE AND REEL BOX DIMENSIONS



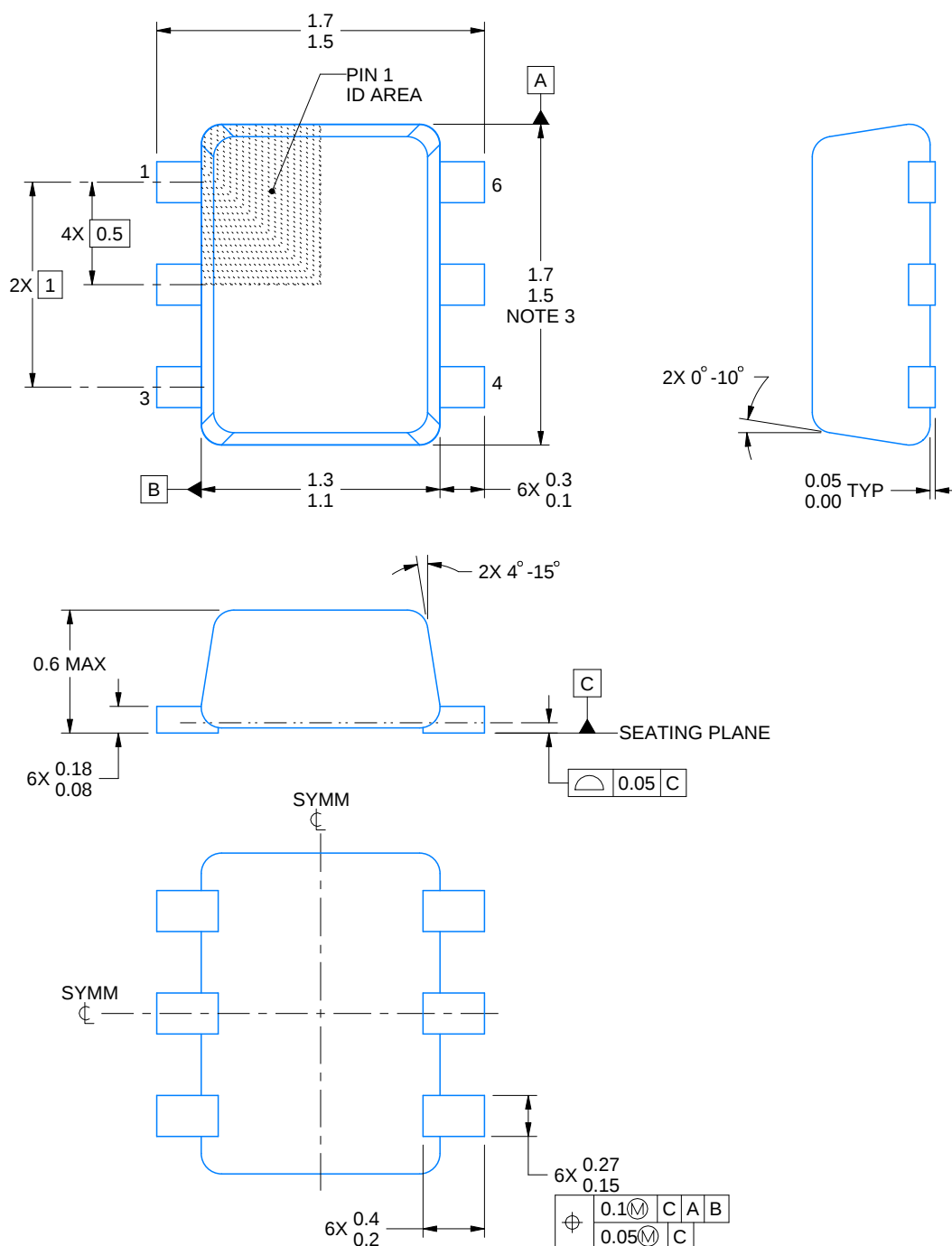
\*All dimensions are nominal

| Device           | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TPS62A01AQDRLRQ1 | SOT-5X3      | DRL             | 6    | 4000 | 210.0       | 185.0      | 35.0        |
| TPS62A01QDRLRQ1  | SOT-5X3      | DRL             | 6    | 4000 | 210.0       | 185.0      | 35.0        |



**SOT - 0.6 mm max height**

## PLASTIC SMALL OUTLINE



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NOTES:

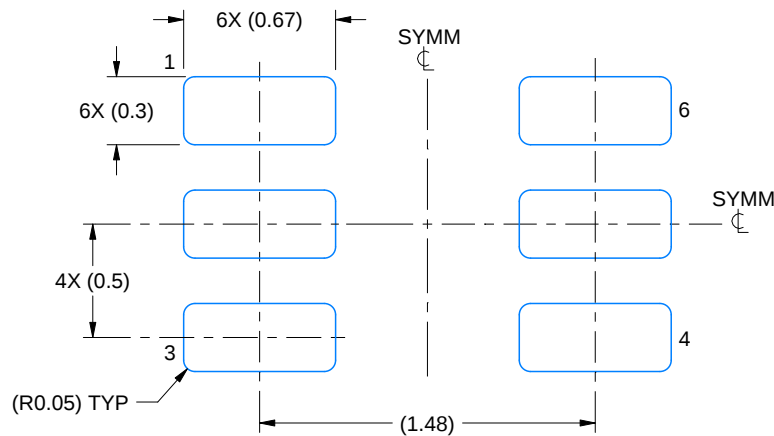
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-293 Variation UAAD

# EXAMPLE BOARD LAYOUT

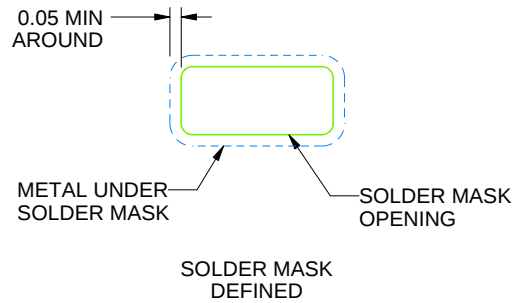
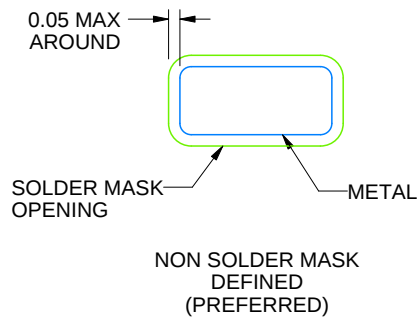
DRL0006A

SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE  
SCALE:30X



SOLDERMASK DETAILS

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NOTES: (continued)

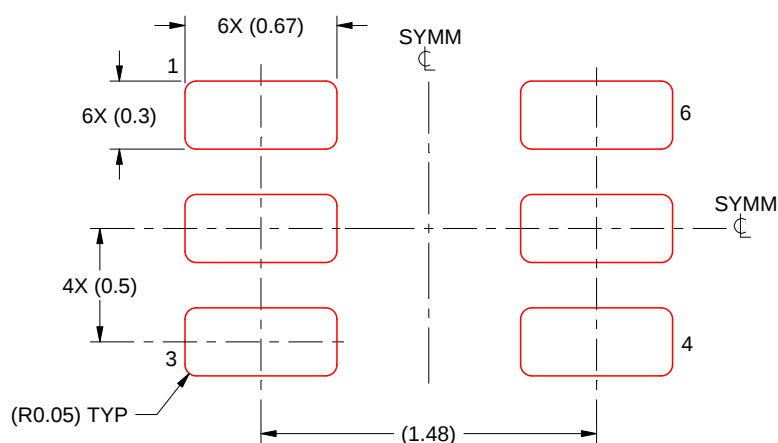
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
7. Land pattern design aligns to IPC-610, Bottom Termination Component (BTC) solder joint inspection criteria.

## EXAMPLE STENCIL DESIGN

DRL0006A

SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE



SOLDER PASTE EXAMPLE  
BASED ON 0.1 mm THICK STENCIL  
SCALE:30X

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NOTES: (continued)

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

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