# TLV62585 3-A High Efficiency Synchronous Buck Converter in QFN or SOT563 Package

## 1 Features

- Up to 95% efficiency
- Low $R_{DS(ON)}$ power switches 56 mΩ / 32 mΩ
- 2.5-V to 5.5-V input voltage range
- Adjustable output voltage from 0.6-V to $V_{IN}$
- Power save mode for light load efficiency
- 100% duty cycle for lowest dropout
- 35-μA operating quiescent current
- 1.5-MHz typical switching frequency
- Short circuit protection (HICCUP)
- Output discharge
- Power good output
- Thermal shutdown protection
- Available in 2-mm × 2-mm QFN or 1.6-mm x 1.6-mm SOT563 package
- Create a custom design using the TLV62585 with the WEBENCH® Power Designer

## 2 Applications

- General purpose point-of-load supply
- Battery-powered application
- Wireless router, solid state drive
- Set-top box, multi functional printer
- Motor control

## 3 Description

The TLV62585 device is a high-frequency synchronous step-down converter optimized for compact solution size and high efficiency. The device integrates switches capable of delivering an output current up to 3 A. At medium to heavy loads, the converter operates in pulse width modulation (PWM) mode with typical 1.5-MHz switching frequency. At light load, the device automatically enters Power Save Mode (PSM) to maintain high efficiency over the entire load current range. In shutdown, the current consumption is reduced to less than 2 μA.

The internal compensation circuit allows a compact solution and small external components. An internal soft start circuit limits the inrush current during startup. Other features like short circuit protection, thermal shutdown protection, output discharge and power good are built-in.
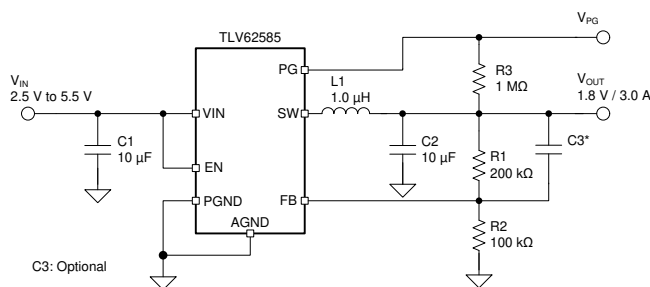
The device is available in a 2-mm × 2-mm QFN or 1.6-mm x 1-6-mm SOT563 package.
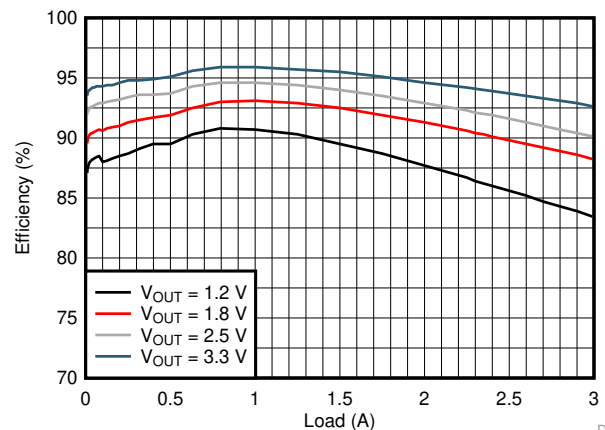
### Device Information[1]

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|---|---|---|
| TLV62585RWT | QFN (12) | 2.00 mm × 2.00 mm |
| TLV62585DRL | SOT563 (6) | 1.60 mm x 1.60 mm |
| TLV62585PDRL | | |

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

### Typical Application Schematic



### 5-V Input Voltage Efficiency

## Table of Contents

## 4 Revision History

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

**Changes from Revision E (June 2018) to Revision F**                                                                     **Page**

• Changed Temperature Range for 1% Accuracy from 25°C to 0°C-85°C ........................................................................ 6

**Changes from Revision D (April 2018) to Revision E**                                                                    **Page**

• Changed TLV62585DRL and TLV62585PDRL From: *Product Preview* To: *Production* data .................................................. 1
• Added PCB layout recommendation for TLV62585PDRL ......................................................................................... 15

**Changes from Revision C (November 2017) to Revision D**                                                                  **Page**

• Added TLV62585DRL and TLV62585PDRL to the *Device Information* table ......................................................... 1
• Added DRL and PDRL devices to the *Pin Configurations and Functions* ............................................................ 4
• Added the DRL Thermal Information ................................................................................................................. 5
• Added Figure 22 ............................................................................................................................................. 14
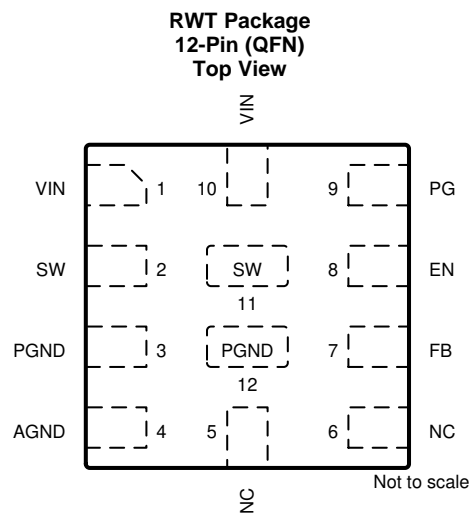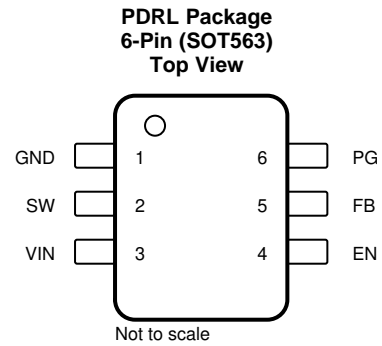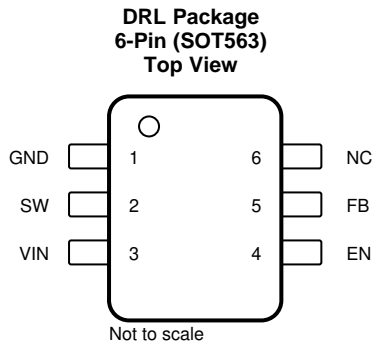
**Changes from Revision B (September 2017) to Revision C**                                                                 **Page**

• Changed HBM From: ±1000 To: ±2000 in the *ESD Ratings* table ....................................................................... 5

**Changes from Revision A (August 2017) to Revision B**                                                                    **Page**

• Changed the device status From: Advanced Information To: Production Data ...................................................... 1
• Changed HBM From: TBD To: ±1000 in the *ESD Ratings* table ......................................................................... 5

**Changes from Original (July 2017) to Revision A**            **Page**

# 5 Pin Configuration and Functions

**DRL Package**
**6-Pin (SOT563)**
**Top View**

| | | |
|---|---|---|
| GND | 1 | 6 NC |
| SW | 2 | 5 FB |
| VIN | 3 | 4 EN |

Not to scale

**PDRL Package**
**6-Pin (SOT563)**
**Top View**

| | | |
|---|---|---|
| GND | 1 | 6 PG |
| SW | 2 | 5 FB |
| VIN | 3 | 4 EN |

Not to scale

**RWT Package**
**12-Pin (QFN)**
**Top View**

VIN

| VIN | 1 | 10 | | 9 | PG |
| SW | 2 | SW | | 8 | EN |
| | | 11 | | | |
| PGND | 3 | PGND | | 7 | FB |
| | | 12 | | | |
| AGND | 4 | 5 | | 6 | NC |

NC

Not to scale

## Pin Functions

| | PIN | | | | |
|---|---|---|---|---|---|
| **NAME** | **RWT (QFN)** | **DRL (SOT563)** | **PDRL (SOT563)** | **I/O** | **DESCRIPTION** |
| VIN | 1, 10 | 3 | 3 | PWR | Power supply voltage pin. |
| SW | 2, 11 | 2 | 2 | PWR | Switch pin connected to the internal FET switches and inductor terminal. Connect the inductor of the output filter to this pin. |
| GND | - | 1 | 1 | PWR | Ground pin. |
| PGND | 3, 12 | - | - | PWR | Power ground pin. |
| AGND | 4 | - | - | - | Ground pin. |
| NC | 5, 6 | 6 | - | - | No connection pin. Leave these pins open, or connect those pins to the output or to AGND. |
| FB | 7 | 5 | 5 | I | Feedback pin for the internal control loop. Connect this pin to an external feedback divider. |
| EN | 8 | 4 | 4 | I | Device enable logic input. Logic high enables the device, logic low disables the device and turns it into shutdown. Do not leave floating. |
| PG | 9 | - | 6 | O | Power good open drain output pin. The pull-up resistor can not be connected to any voltage higher than 5.5 V. If unused, leave it floating or connect to AGND. |

Product Folder Links: *TLV62585*

# 6 Specifications

## 6.1 Absolute Maximum Ratings

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Voltage at Pins[1] | VIN, EN, PG | −0.3 | 6 | V |
| | FB | −0.3 | 3 | |
| | SW (DC) | −0.3 | $V_{IN}$ + 0.3 | |
| | SW (AC, less than 10ns)[2] | −3.0 | 9 | |
| Temperature | Operating Junction, $T_J$ | −40 | 150 | °C |
| | Storage, $T_{stg}$ | −65 | 150 | °C |

(1) All voltage values are with respect to network ground terminal.
(2) While switching

## 6.2 ESD Ratings

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001[1] | ±2000 | V |
| | | Charged device model (CDM), per JEDEC specification JESD22-C101[2] | ±500 | |

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

## 6.3 Recommended Operating Conditions

| | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{IN}$ | Input voltage range | 2.5 | | 5.5 | V |
| $V_{OUT}$ | Output voltage range | 0.6 | | $V_{IN}$ | V |
| $I_{SINK\_PG}$ | Sink current at PG pin | | | 1 | mA |
| $I_{OUT}$ | Output current | 0 | | 3 | A |
| $T_J$ | Operating junction temperature | −40 | | 125 | °C |

## 6.4 Thermal Information

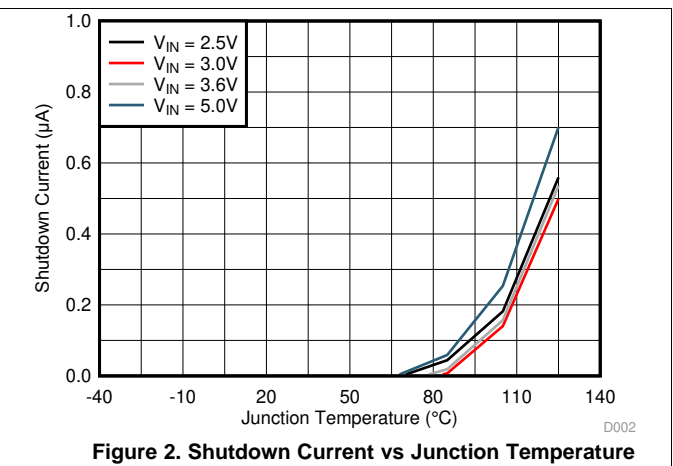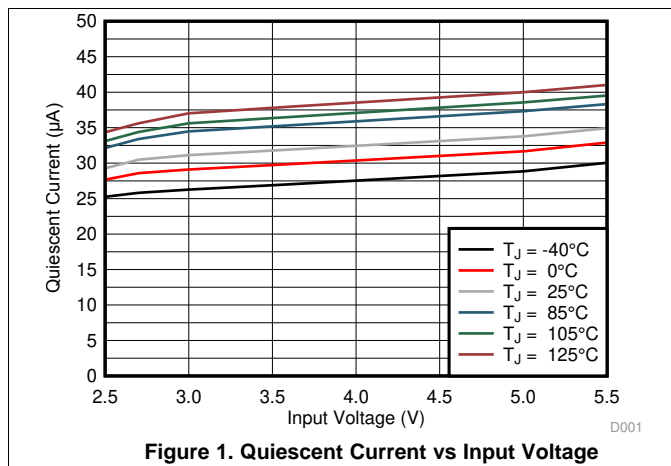| THERMAL METRIC[1] | | TLV62585 | | UNIT |
|---|---|---|---|---|
| | | RWT [QFN] | DRL [SOT] | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 95.7 | 132.7 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 74.1 | 43.8 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 29.4 | 27.3 | °C/W |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 5.8 | 1.2 | °C/W |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 29.7 | 26.6 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | N/A | N/A | °C/W |

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report.

Product Folder Links: *TLV62585*

## 6.5 Electrical Characteristics

$T_J$ = 25 °C, and $V_{IN}$ = 5 V, unless otherwise noted.

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **SUPPLY** | | | | | | |
| $I_Q$ | Quiescent current into VIN | No load, device not switching | | 35 | | µA |
| $I_{SD}$ | Shutdown current into VIN | EN = Low | | 0.7 | 2 | µA |
| $V_{UVLO}$ | Under voltage lock out threshold | $V_{IN}$ falling | | 2.3 | 2.45 | V |
| | Under voltage lock out hysteresis | | | 150 | | mV |
| $T_{JSD}$ | Thermal shutdown threshold | $T_J$ rising | | 150 | | °C |
| | Thermal shutdown hysteresis | | | 20 | | °C |
| **LOGIC INTERFACE EN** | | | | | | |
| $V_{IH}$ | High-level input voltage | $V_{IN}$ = 2.5 V to 5.5 V | 1.2 | | | V |
| $V_{IL}$ | Low-level input voltage | $V_{IN}$ = 2.5 V to 5.5 V | | | 0.4 | V |
| **SOFT START, POWER GOOD** | | | | | | |
| $t_{SS}$ | Soft start time | Time from EN high to 95% of $V_{OUT}$ nominal | | 900 | | µs |
| $V_{PG}$ | Power good threshold | $V_{OUT}$ rising, referenced to $V_{OUT}$ nominal | | 95% | | |
| | | $V_{OUT}$ falling, referenced to $V_{OUT}$ nominal | | 90% | | |
| $V_{PG,OL}$ | Low-level output voltage | $I_{sink}$ = 1 mA | | | 0.4 | V |
| $I_{PG,LKG}$ | Input leakage current into PG pin | $V_{PG}$ = 5.0 V | | 0.01 | | µA |
| $t_{PG,DLY}$ | Power good delay | $V_{FB}$ falling | | 40 | | µs |
| **OUTPUT** | | | | | | |
| $V_{FB}$ | Feedback regulation voltage | PWM mode, 2.5 V ≤ VIN ≤ 5.5 V, 0°C to 85°C | 594 | 600 | 606 | mV |
| | | PWM mode, 2.5 V ≤ VIN ≤ 5.5 V, -40°C to 125°C | 588 | 600 | 612 | |
| $I_{FB,LKG}$ | Feedback input leakage current | $V_{FB}$ = 0.6 V | | 0.01 | | µA |
| $R_{DIS}$ | Output discharge FET on-resistance | EN = Low, $V_{OUT}$ = 1.8 V | | 10 | | Ω |
| **POWER SWITCH** | | | | | | |
| $R_{DS(on)}$ | High-side FET on-resistance | | | 56 | | mΩ |
| | Low-side FET on-resistance | | | 32 | | mΩ |
| $I_{LIM}$ | High-side FET switch current limit | | 4 | 4.6 | | A |
| $f_{SW}$ | PWM switching frequency | $V_{OUT}$ = 1.8V, $I_{OUT}$ = 1 A | | 1.5 | | MHz |

## 6.6 Typical Characteristics



**Figure 1. Quiescent Current vs Input Voltage**



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

Product Folder Links: *TLV62585*

# 7 Detailed Description

## 7.1 Overview

The TLV62585 is a high-efficiency synchronous step-down converter. The device operates with an adaptive off-time with peak current control scheme. The device operates at typically 1.5-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. It makes the switching frequency relatively constant regardless of the variation of input voltage, output voltage, and load current.

## 7.2 Functional Block Diagram
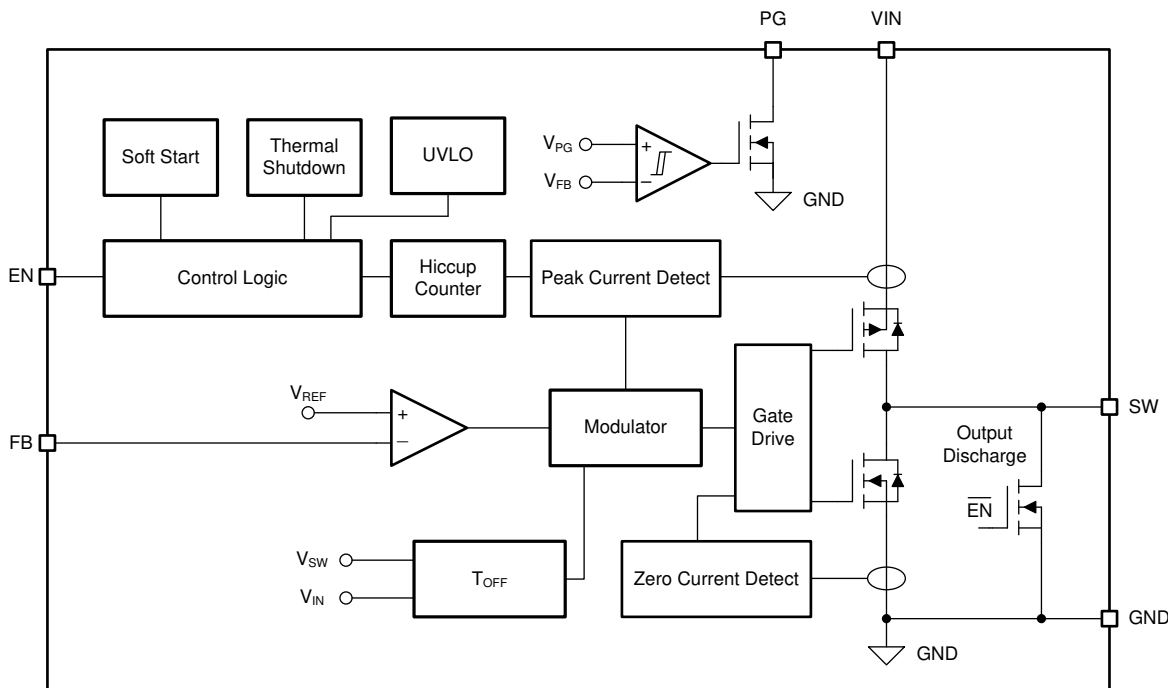


**Figure 3. Functional Block Diagram**

## 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 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 feed forward capacitor, as shown in Figure 14.

### 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:

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

Where

- $R_{DS(ON)}$ = High side FET on-resistance
- $R_L$ = Inductor ohmic resistance (DCR)                                                      (1)

## Feature Description (continued)

### 7.3.3 Soft Start

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

The TLV62585 is able to start into a pre-biased output capacitor. The converter starts with the applied bias voltage and ramps the output voltage to its 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 from drawing excessive current from the battery or input voltage rail. Excessive current might occur with a shorted or saturated inductor or a over load 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 limits is triggered 32 times, the device reduces the current limit for further 32 cycles and then stops switching to protect the output. The device then automatically start a new startup after a typical delay time of 500 $\mu$s has passed. This is named HICCUP short circuit protection. The devices repeat this mode until the high load condition disappears. HICCUP protection is also enabled during the startup.

### 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 $V_{UVLO}$ with a hysteresis of 150 mV.

### 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 pin to a logic HIGH. Accordingly, shutdown mode is forced if the EN pin is pulled LOW with a shutdown current of typically 0.7 $\mu$A.

In shutdown mode, the internal power switches as well as the entire control circuitry are turned off. An internal output discharge FET discharges the output through the SW pin smoothly.

### 7.4.2 Power Good

The TLV62585 has a power good output. The power good goes high impedance once the output is above 95% of the nominal voltage, and is driven low once the output voltage falls below typically 90% of the nominal voltage. The PG pin is an open-drain output and is specified to sink up to 1 mA. The power good output requires a pull-up resistor connecting to any voltage rail less than 5.5 V. The PG signal can be used for sequencing of multiple rails by connecting it to the EN pin of other converters. Leave the PG pin unconnected when not used.

**Table 1. PG Pin Logic**

| DEVICE CONDITIONS | | LOGIC STATUS | |
|---|---|---|---|
| | | **HIGH Z** | **LOW** |
| Enable | EN = High, $V_{FB} \geq V_{PG}$ | √ | |
| | EN = High, $V_{FB} \leq V_{PG}$ | | √ |
| Shutdown | EN = Low | | √ |
| Thermal Shutdown | | | √ |
| UVLO | 1.4 V < $V_{IN}$ < 2.3 V | | √ |
| Power Supply Removal | $V_{IN} \leq 1.4$ V | √ | |

Product Folder Links: *TLV62585*

# 8 Application and Implementation

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

## 8.1 Application Information

The TLV62585 is a synchronous step-down converter in which output voltage is adjusted by component selection. 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
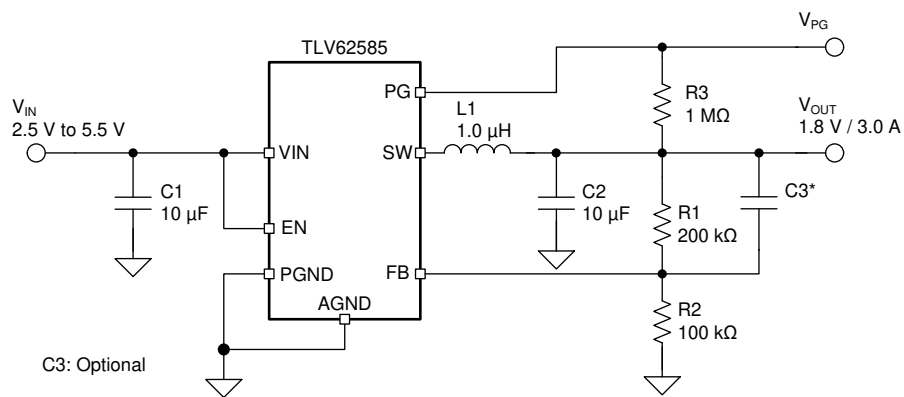


**Figure 4. 1.8-V Output Voltage Application**

### 8.2.1 Design Requirements

For this design example, use the parameters listed in Table 2 as the input parameters.

**Table 2. Design Parameters**

| DESIGN PARAMETER | EXAMPLE VALUE |
|---|---|
| Input voltage | 2.5 V to 5.5 V |
| Output voltage | 1.8 V |
| Maximum output current | 3 A |

Table 3 lists the components used for the example.

**Table 3. List of Components[1]**

| REFERENCE | DESCRIPTION | MANUFACTURER |
|---|---|---|
| C1 | 10 µF, Ceramic capacitor, 10 V, X7R, size 0805, GRM21BR71A106ME51 | Murata |
| C2 | 22 µF, Ceramic capacitor, 6.3 V, X7T, size 0805, GRM21BD70J226ME44 | Murata |
| C3 | Optional | Std |
| L1 | 1 µH, Power Inductor, size 4 mm x 4 mm x 1.5 mm, XFL4020-102ME | Coilcraft |
| R1 | Depending on the output voltage, 1%, size 0603; | Std |
| R2 | 100 kΩ, Chip resistor, 1/16 W, 1%, size 0603; | Std |
| R3 | 1 MΩ, Chip resistor, 1/16 W, 1%, size 0603 | Std |

(1)  See *Third-Party Products* disclaimer.

### 8.2.2 Detailed Design Procedure

#### 8.2.2.1 Custom Design With WEBENCH® Tools

Click here to create a custom design using the TLV62585 device with the WEBENCH® Power Designer.

1. Start by entering the input voltage ($V_{IN}$), output voltage ($V_{OUT}$), and output current ($I_{OUT}$) requirements.
2. Optimize the design for key parameters such as efficiency, footprint, and cost using the optimizer dial.
3. Compare the generated design with other possible solutions from Texas Instruments.

The WEBENCH Power Designer provides a customized schematic along with a list of materials with real-time pricing and component availability.

In most cases, these actions are available:

- Run electrical simulations to see important waveforms and circuit performance
- Run thermal simulations to understand board thermal performance
- Export customized schematic and layout into popular CAD formats
- Print PDF reports for the design, and share the design with colleagues

Get more information about WEBENCH tools at www.ti.com/WEBENCH.

#### 8.2.2.2 Setting The Output Voltage

The output voltage is set by an external resistor divider according to Equation 2:

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

(2)

R2 must not be higher than 100 kΩ to achieve high efficiency at light load while providing acceptable noise sensitivity.

#### 8.2.2.3 Output Filter Design

The inductor and the output capacitor together provide a low-pass filter. To simplify the selection process, Table 4 outlines possible inductor and capacitor value combinations for most applications.

**Table 4. Matrix of Output Capacitor and Inductor Combinations**

| NOMINAL L [µH][1] | NOMINAL C$_{OUT}$ [µF][2][3] | | | |
|:---:|:---:|:---:|:---:|:---:|
| | 10 | 22 | 47 | 100 |
| 0.47 | | | | |
| 1 | + | +[4] | + | |
| 2.2 | | | | |

(1) Inductor tolerance and current derating is anticipated. The effective inductance can vary by 20% and −30%.
(2) For low output voltage applications (< 1.8 V), more output capacitance is recommended (usually ≥ 22 µF) for smaller ripple. For output capacitance higher than 47 µF, a feed forward capacitor is needed.
(3) Capacitance tolerance and bias voltage derating is anticipated. The effective capacitance can vary by 20% and −50%.
(4) Typical application configuration. Other '+' mark indicates recommended filter combinations.

### 8.2.2.4  Inductor Selection

The main parameter for the inductor selection is the inductor value and then the saturation current of the inductor. To calculate the maximum inductor current under static load conditions, Equation 3 is given.

$$I_{L,MAX} = I_{OUT,MAX} + \frac{\Delta I_L}{2}$$

$$\Delta I_L = V_{OUT} \times \frac{1 - \dfrac{V_{OUT}}{V_{IN}}}{L \times f_{SW}}$$

where

- $I_{OUT,MAX}$ = Maximum output current
- $\Delta I_L$ = Inductor current ripple
- $f_{SW}$ = Switching frequency
- L = Inductor value                                                                                    (3)

TI recommends choosing the saturation current for the inductor 20% to 30% higher than the $I_{L,MAX}$, out of Equation 3. A higher inductor value is also useful to lower ripple current but increases the transient response time as well.

### 8.2.2.5  Input and Output Capacitor Selection

The architecture of the TLV62585 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 its resistance up to high frequencies and to achieve narrow capacitance variation with temperature, it is recommended to use X7R or X5R dielectric.

The input capacitor is the low impedance energy source for the converter that helps provide stable operation. A low ESR multilayer ceramic capacitor is recommended for best filtering. For most applications, 10-μF input capacitor is sufficient; a larger value reduces input voltage ripple.

The TLV62585 is designed to operate with an output capacitor of 10 μF to 47 μF, as outlined in Table 4.

A feed forward capacitor reduces the output ripple in PSM and improves the load transient response. A 22-pF capacitor is good for the 1.8-V output typical application.

Product Folder Links: *TLV62585*

### 8.2.3 Application Curves

$V_{IN}$ = 5 V, $V_{OUT}$ = 1.8 V, $T_A$ = 25 ⁰C, unless otherwise noted.



$V_{OUT}$ = 1.2 V
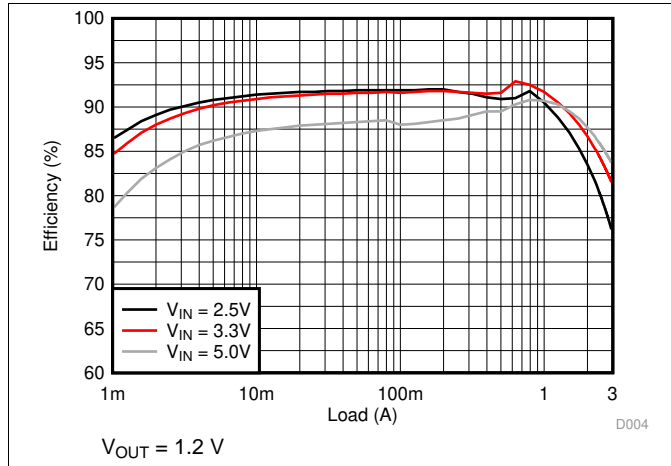
**Figure 5. Efficiency**



$V_{OUT}$ = 1.8 V
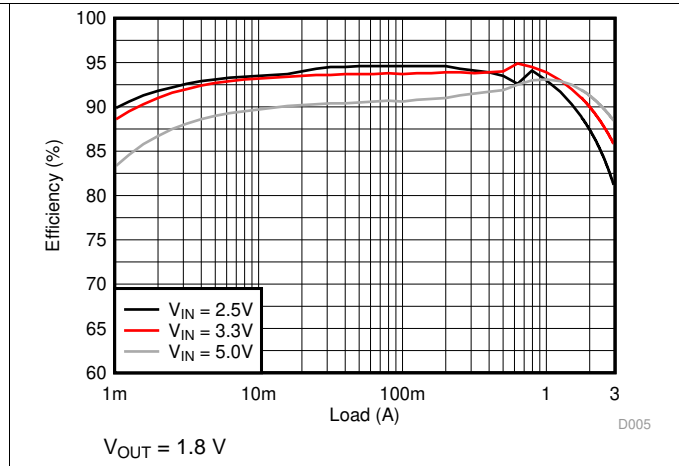
**Figure 6. Efficiency**



$V_{OUT}$ = 2.5 V
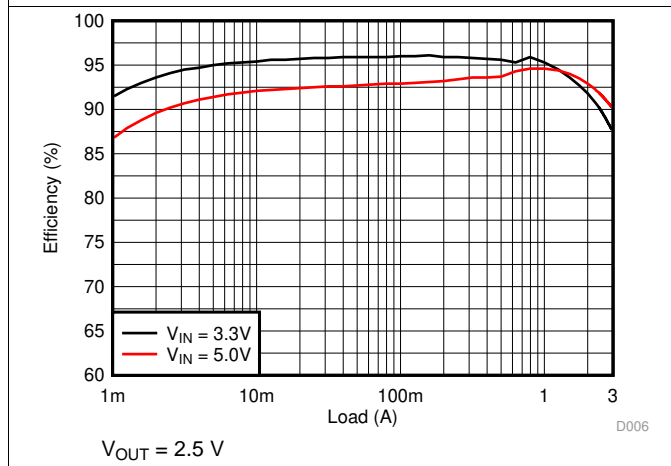
**Figure 7. Efficiency**



$V_{OUT}$ = 3.3 V
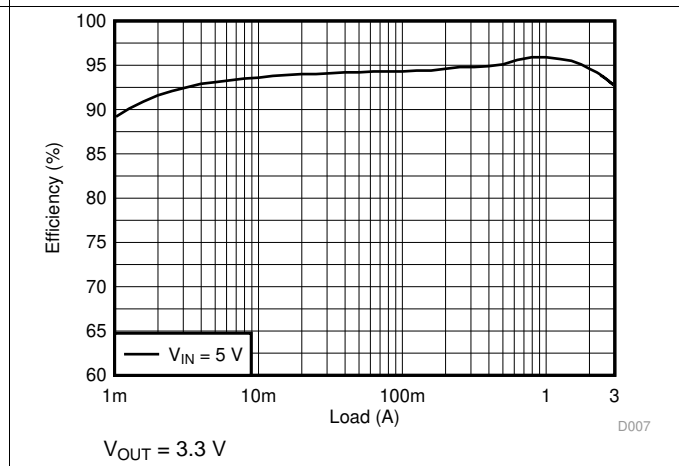
**Figure 8. Efficiency**



$V_{IN}$ = 5 V
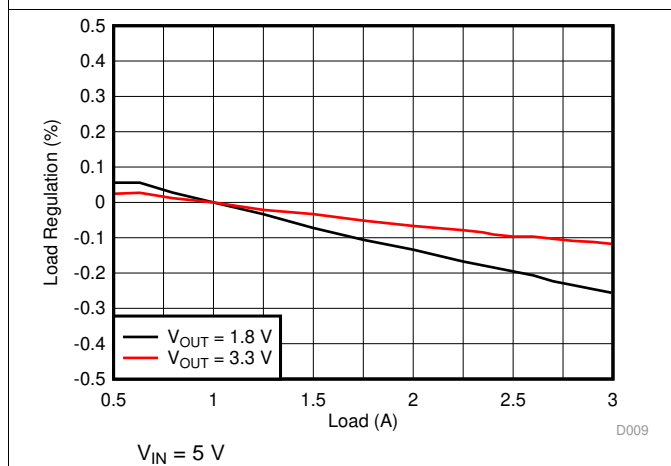
**Figure 9. Load Regulation**



$V_{OUT}$ = 1.8 V
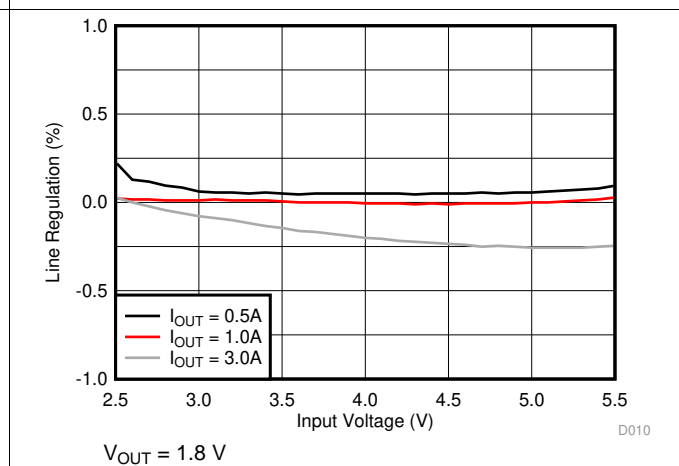
**Figure 10. Line Regulation**

Product Folder Links: *TLV62585*

$V_{IN}$ = 5 V
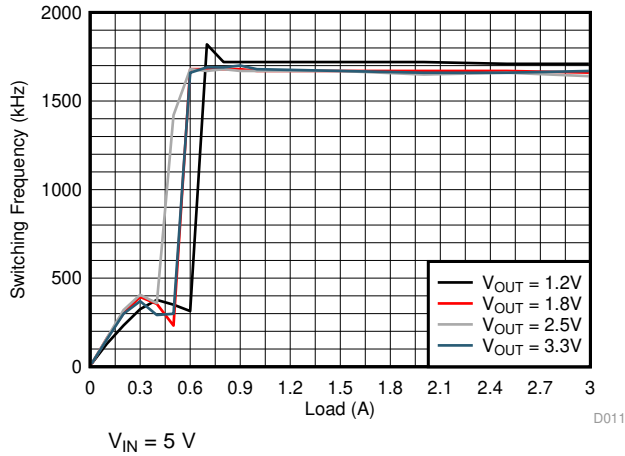
**Figure 11. Switching Frequency**



$I_{OUT}$ = 1 A
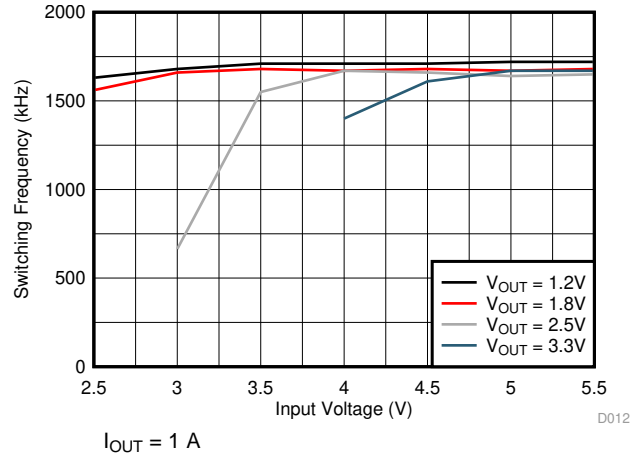
**Figure 12. Switching Frequency**
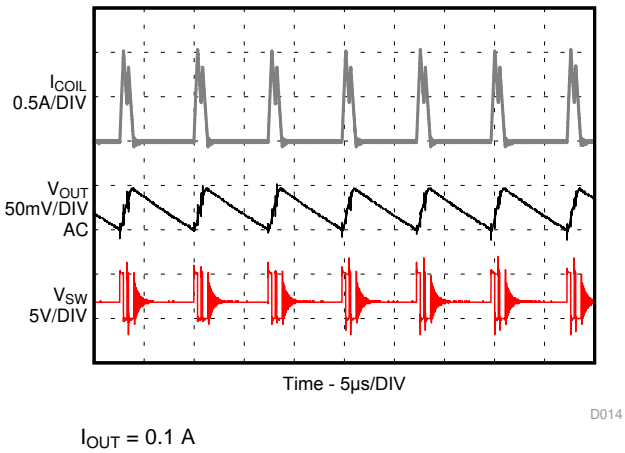


$I_{OUT}$ = 0.1 A

**Figure 13. PSM Operation**
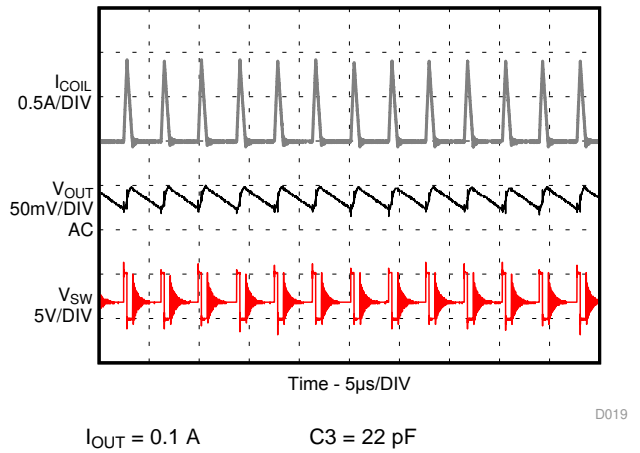


$I_{OUT}$ = 0.1 A          C3 = 22 pF

**Figure 14. PSM Operation with A Feedforward Capacitor**
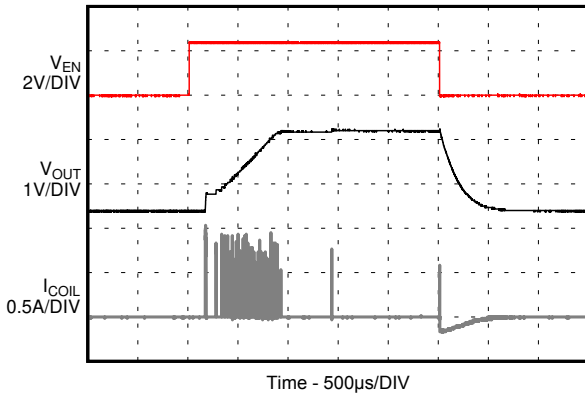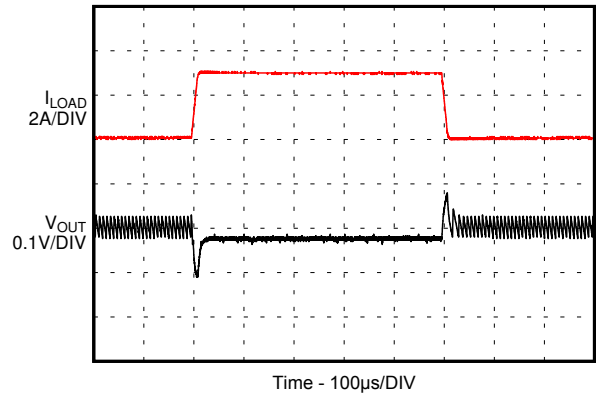


$I_{OUT}$ = 3 A
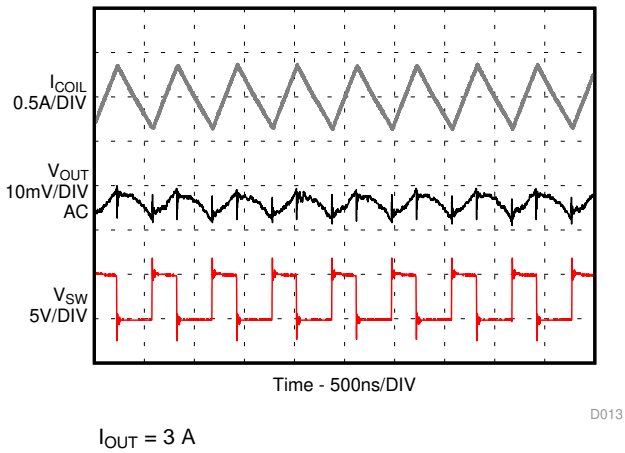
**Figure 15. PWM Operation**



$R_{OUT}$ = 0.6 Ω
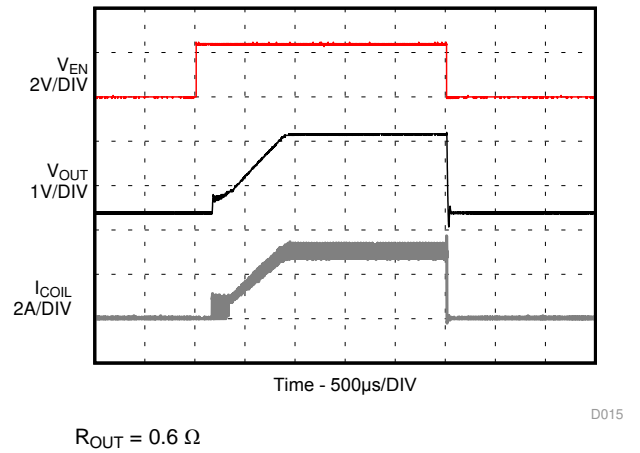
**Figure 16. Start-Up and Shut-Down with Load**

No Load

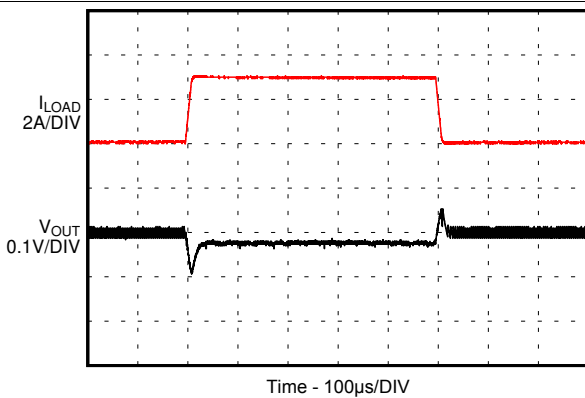**Figure 17. Start-Up and Shut-Down without Load**
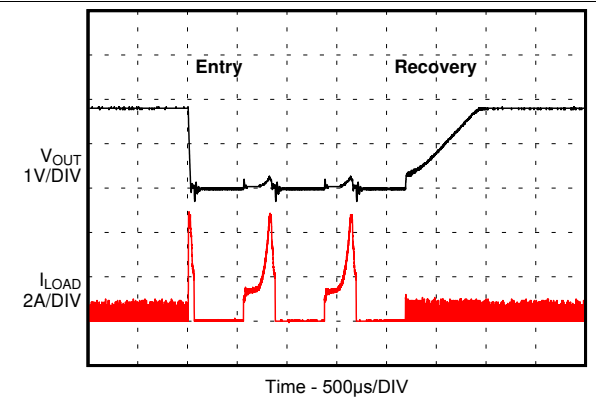


$I_{OUT}$ = 0.1 A to 3 A

**Figure 18. Load Transient**



$I_{OUT}$ = 0.1 A to 3 A          C3 = 22 pF

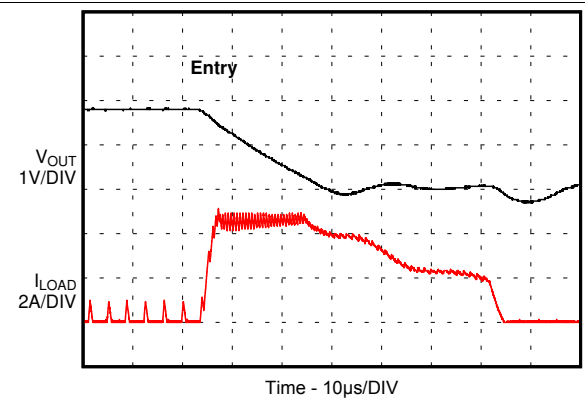**Figure 19. Load Transient with A Feedforward Capacitor**



$I_{OUT}$ = 0.1 A

**Figure 20. Output Short Protection (HICCUP)**



$I_{OUT}$ = 0.1 A
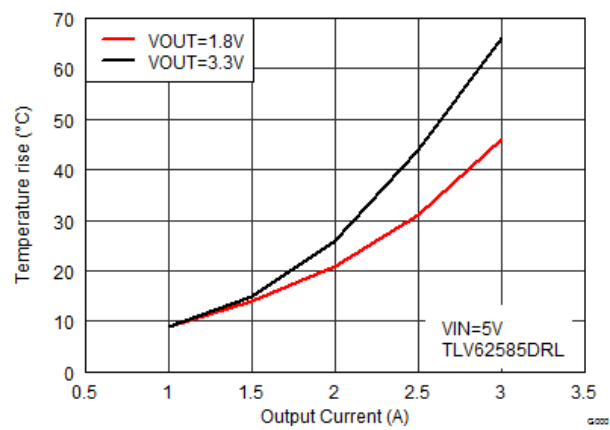
**Figure 21. Output Short Protection (HICCUP) - Zoom In**



**Figure 22. Temperature Rise of DRL Package on EVM**

Product Folder Links: *TLV62585*

# 9 Power Supply Recommendations

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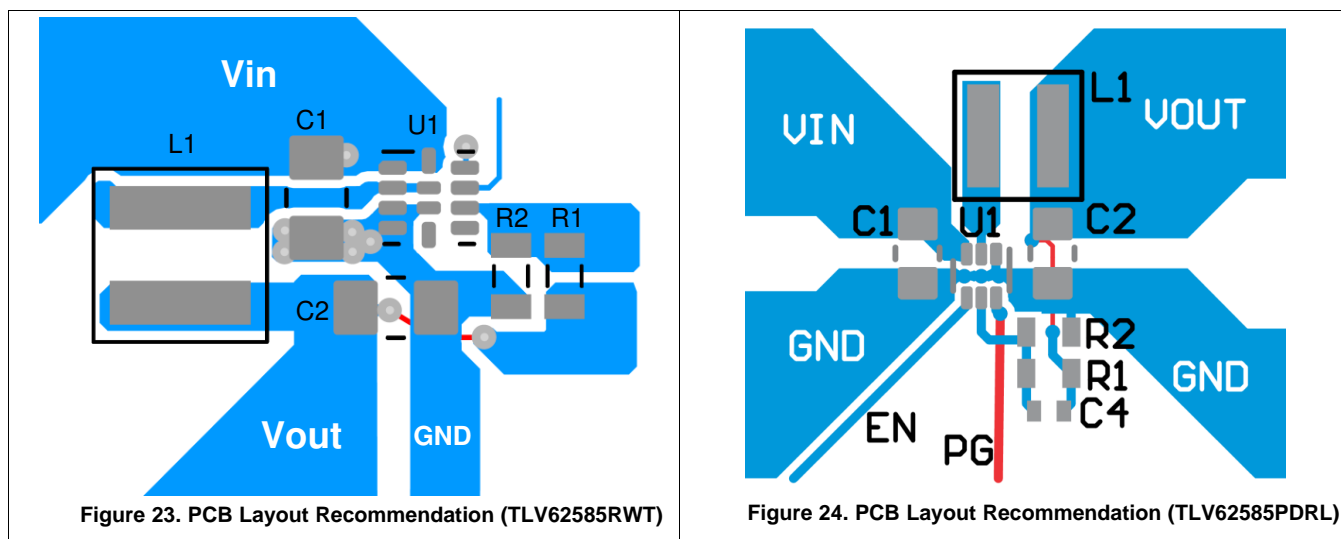
# 10 Layout

## 10.1 Layout Guidelines

The printed-circuit-board (PCB) layout is an important step to maintain the high performance of the TLV62585 device.

* The input/output capacitors and the inductor should be placed as close as possible to the IC. This 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 should be taken to avoid noise being induced. Keep these traces away from SW nodes.
* A common ground should be used. GND layers might be used for shielding.

See Figure 23 and Figure 24 for the recommended PCB layout.

## 10.2 Layout Example



**Figure 23. PCB Layout Recommendation (TLV62585RWT)**



**Figure 24. PCB Layout Recommendation (TLV62585PDRL)**

## 10.3 Thermal Considerations

Implementation of integrated circuits in low-profile and fine-pitch surface-mount packages typically requires special attention to power dissipation. Many system-dependent issues such as thermal coupling, airflow, added heat sinks and convection surfaces, and the presence of other heat-generating components affect the power dissipation limits of a given component.

Two basic approaches for enhancing thermal performance are:
*   Improving the power dissipation capability of the PCB design
*   Introducing airflow in the system

The big copper planes connecting to the pads of the IC on the PCB improve the thermal performance of the device. For more details on how to use the thermal parameters, see: .
*   *Thermal Characteristics Application Notes*, SZZA017 and SPRA953

# 11 Device and Documentation Support

## 11.1 Device Support

### 11.1.1 Third-Party Products Disclaimer

TI'S PUBLICATION OF INFORMATION REGARDING THIRD-PARTY PRODUCTS OR SERVICES DOES NOT CONSTITUTE AN ENDORSEMENT REGARDING THE SUITABILITY OF SUCH PRODUCTS OR SERVICES OR A WARRANTY, REPRESENTATION OR ENDORSEMENT OF SUCH PRODUCTS OR SERVICES, EITHER ALONE OR IN COMBINATION WITH ANY TI PRODUCT OR SERVICE.

### 11.1.2 Custom Design With WEBENCH® Tools

Click here to create a custom design using the TLV62585 device with the WEBENCH® Power Designer.

1. Start by entering the input voltage ($V_{IN}$), output voltage ($V_{OUT}$), and output current ($I_{OUT}$) requirements.
2. Optimize the design for key parameters such as efficiency, footprint, and cost using the optimizer dial.
3. Compare the generated design with other possible solutions from Texas Instruments.

The WEBENCH Power Designer provides a customized schematic along with a list of materials with real-time pricing and component availability.

In most cases, these actions are available:
- Run electrical simulations to see important waveforms and circuit performance
- Run thermal simulations to understand board thermal performance
- Export customized schematic and layout into popular CAD formats
- Print PDF reports for the design, and share the design with colleagues

Get more information about WEBENCH tools at www.ti.com/WEBENCH.

## 11.2 Documentation Support

### 11.2.1 Related Documentation

For related documentation, see the following:
- *Thermal Characteristics Application Note*
- *Thermal Characteristics Application Note*

## 11.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on Alert me 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.

## 11.4 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.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

## 11.5 Trademarks

E2E is a trademark of Texas Instruments.
WEBENCH is a registered trademark of Texas Instruments.

## 11.6 Electrostatic Discharge Caution

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

## 11.7 Glossary

SLYZ022 — *TI Glossary*.

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

## 12 Mechanical, Packaging, and Orderable Information

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

# PACKAGE OPTION ADDENDUM

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TLV62585DRLR | ACTIVE | SOT-5X3 | DRL | 6 | 3000 | RoHS & Green | Call TI \| SN | Level-1-260C-UNLIM | -40 to 125 | 1BQ | Samples |
| TLV62585DRLT | ACTIVE | SOT-5X3 | DRL | 6 | 250 | RoHS & Green | Call TI \| SN | Level-1-260C-UNLIM | -40 to 125 | 1BQ | Samples |
| TLV62585PDRLR | ACTIVE | SOT-5X3 | DRL | 6 | 3000 | RoHS & Green | Call TI \| SN | Level-1-260C-UNLIM | -40 to 125 | 1BP | Samples |
| TLV62585PDRLT | ACTIVE | SOT-5X3 | DRL | 6 | 250 | RoHS & Green | Call TI \| SN | Level-1-260C-UNLIM | -40 to 125 | 1BP | Samples |
| TLV62585RWTR | ACTIVE | VQFN-HR | RWT | 12 | 3000 | RoHS & Green | Call TI | Level-1-260C-UNLIM | -40 to 125 | 17BI | Samples |
| TLV62585RWTT | ACTIVE | VQFN-HR | RWT | 12 | 250 | RoHS & Green | Call TI | Level-1-260C-UNLIM | -40 to 125 | 17BI | Samples |

**(1)** The marketing status values are defined as follows:
**ACTIVE:** Product device recommended for new designs.
**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.
**OBSOLETE:** TI has discontinued the production of the device.

**(2) RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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

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

**(6)** Lead finish/Ball material - Orderable Devices 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.

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

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

# PACKAGE MATERIALS INFORMATION

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

**TAPE DIMENSIONS**

| A0 | Dimension designed to accommodate the component width |
|----|----|
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------|--------------|-----------------|------|-----|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TLV62585DRLR | SOT-5X3 | DRL | 6 | 3000 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TLV62585DRLT | SOT-5X3 | DRL | 6 | 250 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TLV62585PDRLR | SOT-5X3 | DRL | 6 | 3000 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TLV62585PDRLT | SOT-5X3 | DRL | 6 | 250 | 180.0 | 8.4 | 2.0 | 1.8 | 0.75 | 4.0 | 8.0 | Q3 |
| TLV62585RWTR | VQFN-HR | RWT | 12 | 3000 | 180.0 | 8.4 | 2.3 | 2.3 | 1.15 | 4.0 | 8.0 | Q2 |
| TLV62585RWTT | VQFN-HR | RWT | 12 | 250 | 180.0 | 8.4 | 2.3 | 2.3 | 1.15 | 4.0 | 8.0 | Q2 |

![Texas Instruments logo]

# PACKAGE MATERIALS INFORMATION

**TAPE AND REEL BOX DIMENSIONS**



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TLV62585DRLR | SOT-5X3 | DRL | 6 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV62585DRLT | SOT-5X3 | DRL | 6 | 250 | 210.0 | 185.0 | 35.0 |
| TLV62585PDRLR | SOT-5X3 | DRL | 6 | 3000 | 210.0 | 185.0 | 35.0 |
| TLV62585PDRLT | SOT-5X3 | DRL | 6 | 250 | 210.0 | 185.0 | 35.0 |
| TLV62585RWTR | VQFN-HR | RWT | 12 | 3000 | 182.0 | 182.0 | 20.0 |
| TLV62585RWTT | VQFN-HR | RWT | 12 | 250 | 182.0 | 182.0 | 20.0 |
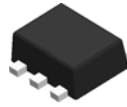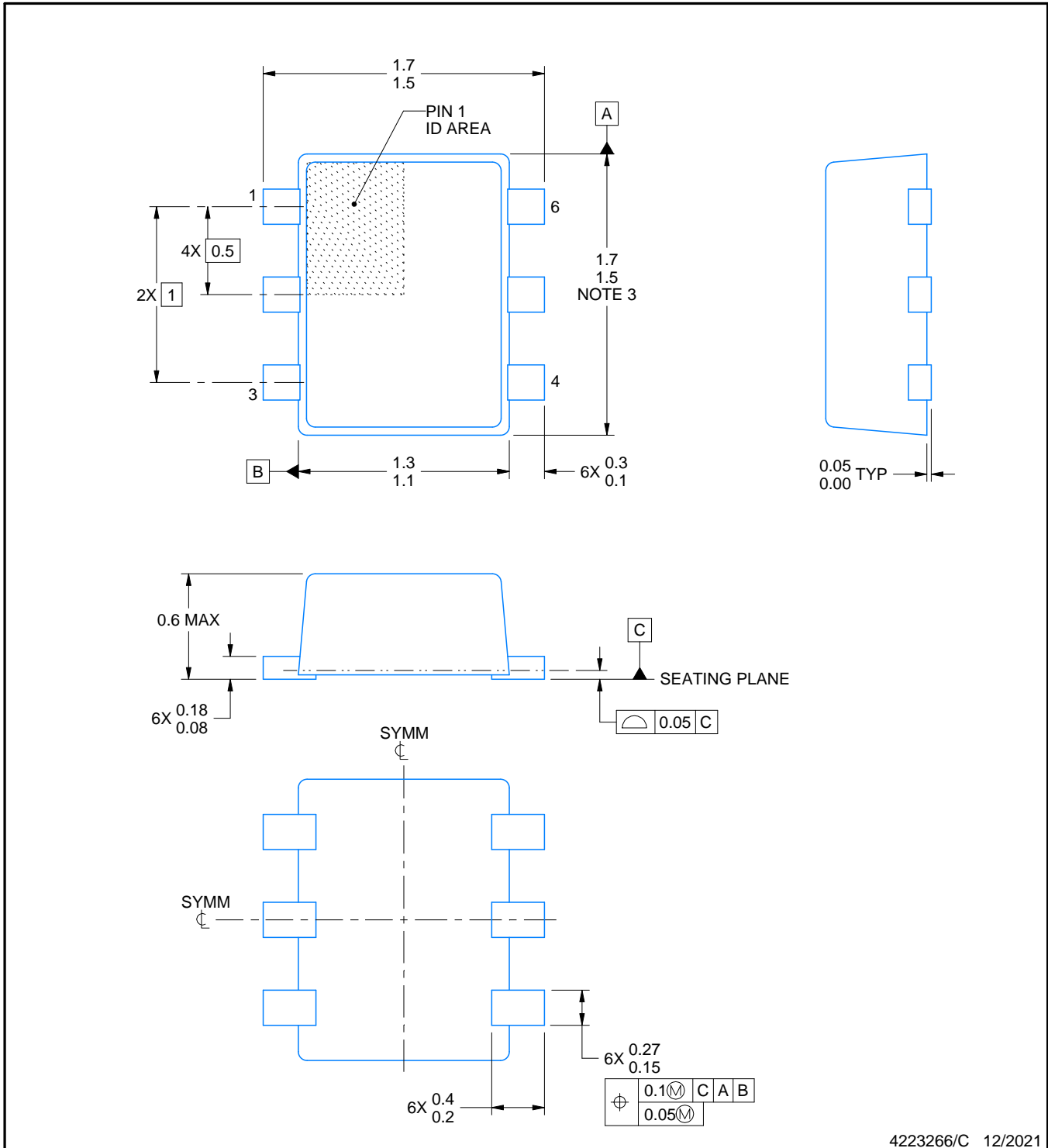
1.7
1.5

PIN 1
ID AREA

A

1
4X 0.5
2X 1
3

6
1.7
1.5
NOTE 3
4

B
1.3
1.1

6X 0.3
0.1

0.05
0.00 TYP

0.6 MAX

6X 0.18
0.08

C

SEATING PLANE

0.05 C

SYMM

SYMM

6X 0.27
0.15

6X 0.4
0.2

⊕ 0.1 Ⓜ C A B
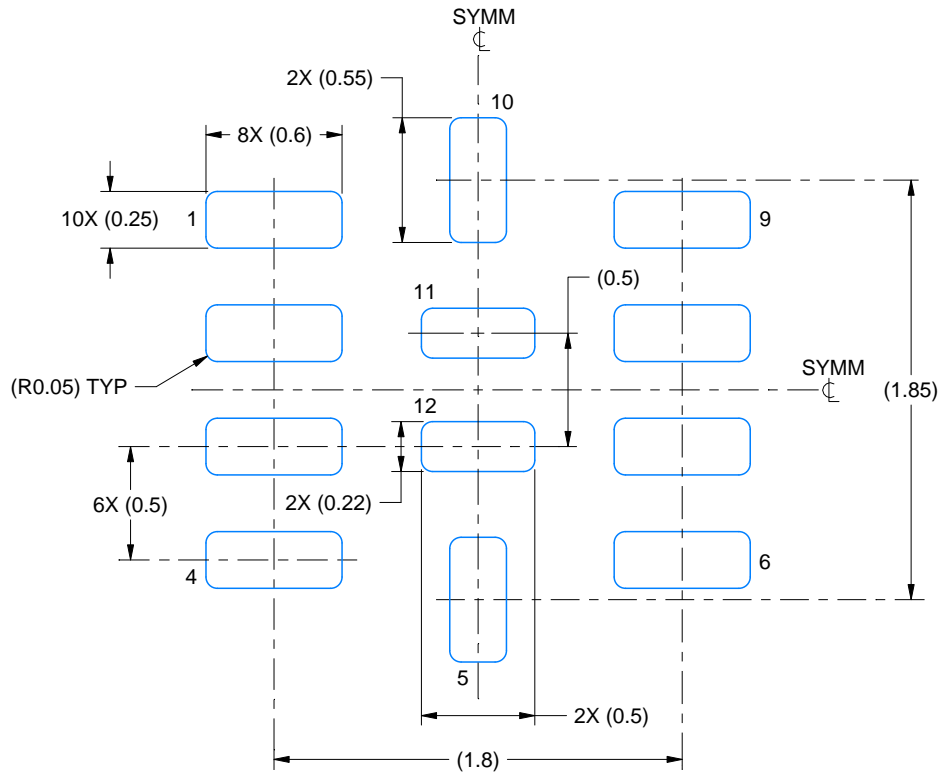0.05 Ⓜ

4223266/C   12/2021

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

6X (0.67)

SYMM
₡

1

6X (0.3)

6

SYMM
₡

4X (0.5)

3

4

(R0.05) TYP

(1.48)

LAND PATTERN EXAMPLE
SCALE:30X

0.05 MAX
AROUND

SOLDER MASK
OPENING

METAL

NON SOLDER MASK
DEFINED
(PREFERRED)

0.05 MIN
AROUND

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

SOLDER MASK
DEFINED

SOLDERMASK DETAILS

4223266/C   12/2021

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.

## DRL0006A

PLASTIC SMALL OUTLINE

6X (0.67)

SYMM
₵

1

6X (0.3)

6

SYMM
₵

4X (0.5)

3

4

(R0.05) TYP

(1.48)

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

4223266/C   12/2021

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.

A

2.1
1.9

B

PIN 1 INDEX AREA

2.1
1.9

1.0
0.8

C

0.05
0.00

SEATING PLANE

0.08 | C

2X $\frac{0.4}{0.3}$

2X $\frac{0.55}{0.45}$

6X 0.5

5

4

6

12

2X

1.5

SYMM

0.5

PIN 1 ID

11

1

9

10

2X $\frac{0.24}{0.20}$

SYMM

10X $\frac{0.3}{0.2}$

8X $\frac{0.45}{0.35}$

0.1 (M) | C | A | B

0.05 (M)

(0.1) TYP
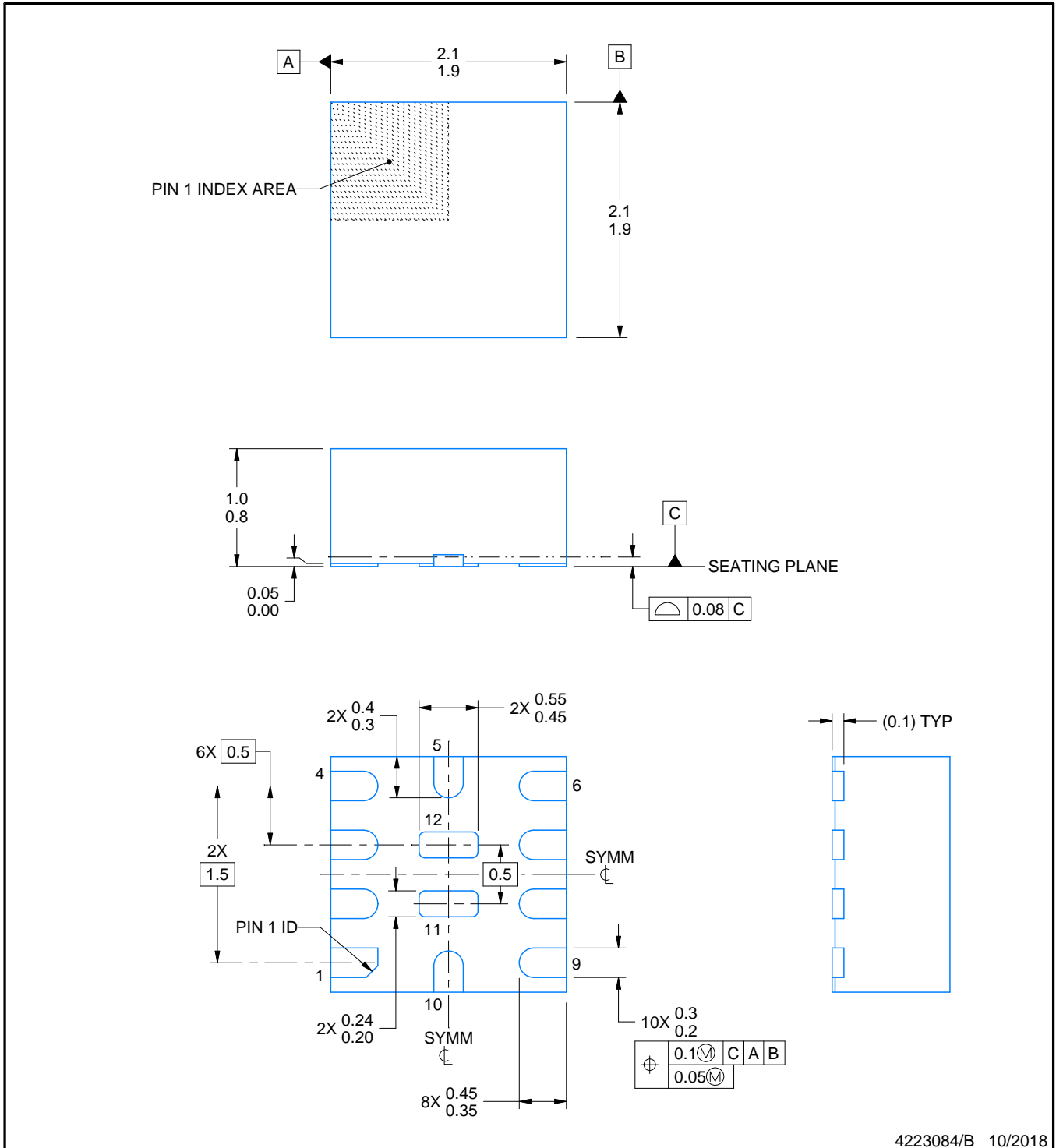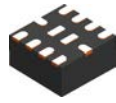
4223084/B   10/2018

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.

SYMM

2X (0.55)

8X (0.6)

10X (0.25)   1

10

(R0.05) TYP

11

(0.5)

9

SYMM

(1.85)

12

6X (0.5)

2X (0.22)

4

5

2X (0.5)

(1.8)

**LAND PATTERN EXAMPLE**
SCALE:30X

0.07 MAX
ALL AROUND

METAL

SOLDER MASK
OPENING

NON SOLDER MASK
DEFINED
(PREFERRED)

0.07 MIN
ALL AROUND

SOLDER MASK
OPENING

METAL UNDER
SOLDER MASK

SOLDER MASK
DEFINED

**SOLDER MASK DETAILS**

4223084/B   10/2018

NOTES: (continued)

3. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
4. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, it is recommended that vias under
   paste be filled, plugged or tented.

TEXAS
INSTRUMENTS
www.ti.com
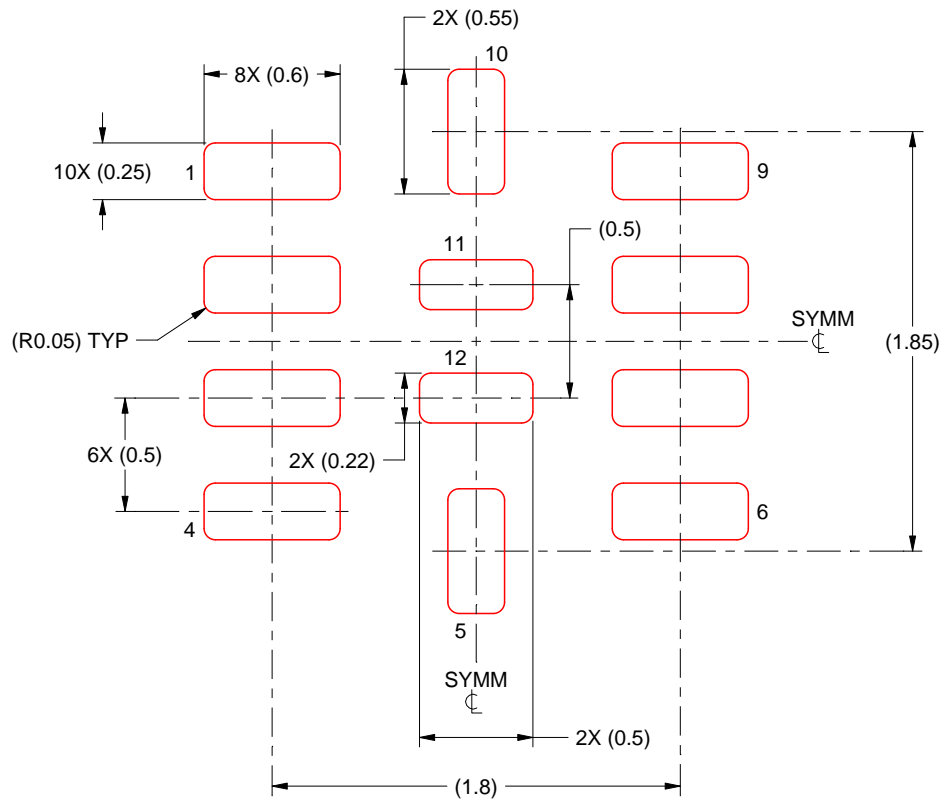
SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:30X

4223084/B   10/2018

NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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