# 800-mA, Low-Dropout Linear Regulator

## Features

- Input Voltage: 2.7 V to 16 V
- Output Voltage:
  - Fixed 5 V and 3.3 V
- ±1% Output Accuracy at Room Temperature, ±2% Output Accuracy Over Line Regulation, Load Regulation, and Operating Temperature Range
- 800-mA Maximum Output Current
- Low Dropout Voltage: 800 mV typical at 800 mA Load Current
- Stable with 2.2-µF to 1000-µF Output Capacitor with ESR Range from 0.001 Ω to 5 Ω
- Junction Temperature Range: –40°C to +125°C
- Package Options:
  - SOT223-3

## Applications

- AC Drive Power Stage Modules
- Merchant Network and Server PSU
- Industrial AC/DC
- Ultrasound Scanners
- Servo Drive Control Modules

## Description

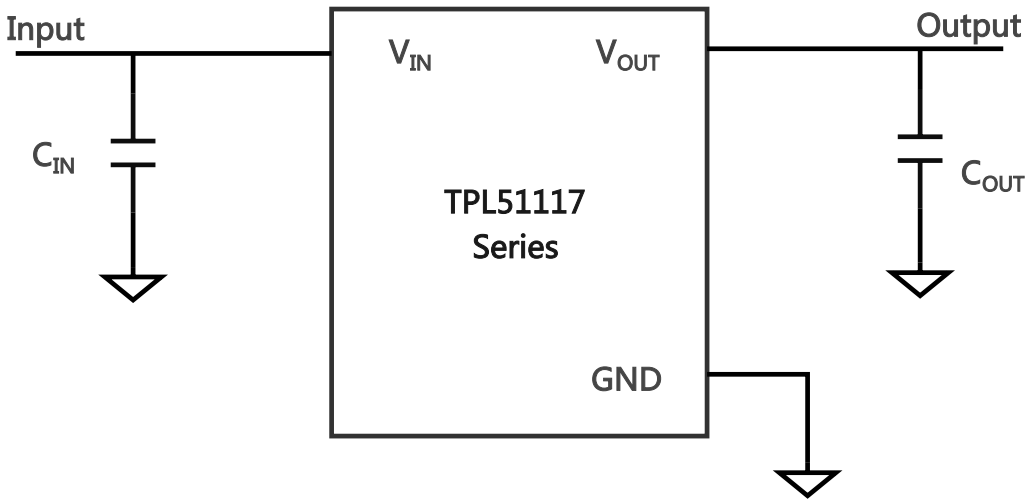
The TPL51117x series is a low dropout voltage regulator with a typical dropout voltage of 800mV at 800 mA load current.

The TPL51117x series is available in two fixed voltages, 3.3 V and 5 V. The TPL51117x series offers current limiting and thermal shutdown.

The TPL51117x series supports a wide range of output capacitors from 2.2 µF to 1000 µF with an ESR range from 0.001 Ω to 5 Ω. Also, the TPL51117x series integrates over-current protection and over-temperature protection.

The TPL51117x series provides the SOT223-3 package with a guaranteed operating junction temperature range ($T_J$) from –40°C to +125°C.

## Typical Application Circuit



# Table of Contents

## Product Family Table

| Order Number | Output Voltage (V) | Package |
|---|---|---|
| TPL5111733-ST4R | 3.3 V | SOT223-3 |
| TPL5111750-ST4R | 5.0 V | SOT223-3 |

## Revision History

| Date | Revision | Notes |
|---|---|---|
| 2025-11-13 | Rev.A.0 | Initial release |
| 2025-12-29 | Rev.A.1 | The following updates are all about the new datasheet formats or typos, and the actual product remains unchanged<br>• Corrected the maximum value of the Dropout Voltage |

## Pin Configuration and Functions

SOT223-3 Package
Top View

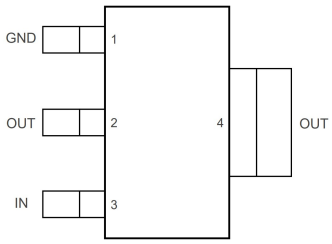



**Table 1. Pin Functions: TPL51117x**

| Pin Number | Pin Name | I/O | Description |
|---|---|---|---|
| 1 | GND | - | Ground reference pin |
| 3 | IN | I | Input voltage pin. |
| 2,4 | OUT | O | Regulated output voltage pin. |

# Specifications

## Absolute Maximum Ratings

| Parameter | | Min | Max | Unit |
|---|---|---|---|---|
| IN | | −0.3 | 20 | V |
| OUT | | −0.3 | 16 | V |
| $T_J$ | Junction Temperature Range | −40 | 150 | °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) All voltage values are with respect to GND.

## ESD, Electrostatic Discharge Protection

| Symbol | Parameter | Condition | Minimum Level | Unit |
|---|---|---|---|---|
| HBM | Human Body Model ESD | ANSI/ESDA/JEDEC JS-001 (1) | ±3 | kV |
| CDM | Charged Device Model ESD | ANSI/ESDA/JEDEC JS-002 (2) | ±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 | Max | Unit |
|---|---|---|---|---|
| IN | | 2.7 | 16 | V |
| OUT | | 0 | 5 | V |
| $C_{OUT}$ (1)(2) | Output Capacitor Requirements | 2.2 | 1000 | μF |
| ESR (2) | Output Capacitor ESR Requirements | 0.001 | 5 | Ω |
| $T_J$ | Junction Temperature Range | −40 | 125 | °C |

(1) The minimum output capacitance requirement is applicable for a worst-case capacitance tolerance of 30%.
(2) Not subject to production test, specified by design.

## Thermal Information

| Package Type | $\theta_{JA}$ | $\theta_{JB}$ | $\theta_{JC}$ | Unit |
|---|---|---|---|---|
| SOT223-3 | 59.1 | 10.6 | 46.6 | °C/W |

## Electrical Characteristics

All test conditions: $V_{IN}$ = $V_{OUT\ (NOM)}$ + 2 V, $C_{IN}$ = $C_{OUT}$ = 10 µF, $I_{OUT}$ = 10 mA. $T_J$ = –40°C to 125°C, unless otherwise noted.

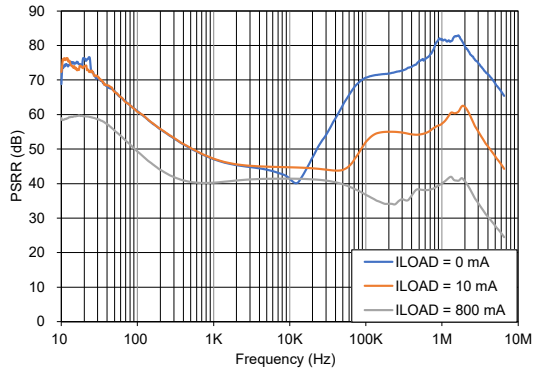
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Supply Input Voltage and Current** | | | | | | |
| $V_{IN}$ | Input Supply Voltage Range | | 2.7 | | 16 | V |
| $I_Q$ | Quiescent Current | $I_{OUT}$ = 0 mA | | 1 | 5 | mA |
| **Regulated Output Voltage and Current** | | | | | | |
| $V_{OUT}$ | Output Accuracy | $T_J$ = 25°C | −1% | | 1% | |
| | | –40°C ≤ $T_J$ ≤ +125°C | −2% | | 2% | |
| $\Delta V_{OUT}$ | Line Regulation | $V_{IN}$ = $V_{OUT\ (NOM)}$ + 1.4 V to 10 V | | 1 | 10 | mV |
| | Load Regulation | $I_{OUT}$ = 0 mA to 800 mA | | 1 | 15 | mV |
| $V_{DO}$ | Dropout Voltage (1) | $I_{OUT}$ = 800 mA | | 800 | 1000 | mV |
| $I_{OUT}$ | Output Current Range | $V_{OUT}$ in regulation | 0 | | 800 | mA |
| $I_{CL}$ | Output Current Limit | $V_{OUT}$ is forced to 0.9*$V_{OUT\ (NOM)}$ | 800 | 1000 | 1600 | mA |
| $I_{SC}$ | Short-circuit Current Limit | $V_{OUT}$ = 0, $T_J$ = 25°C | | 1000 | | mA |
| PSRR | Power Supply Rejection Ratio (2) | $I_{OUT}$ = 10 mA, f = 120 Hz | | 60 | | dB |
| | | $I_{OUT}$ = 10 mA, f = 1 kHz | | 50 | | dB |
| | | $I_{OUT}$ = 10 mA, f = 10 kHz | | 50 | | dB |
| **Temperature Range** | | | | | | |
| $T_{SD}$ | Thermal Shutdown Threshold (2) | | | 165 | | °C |
| | Thermal Shutdown Hysteresis (2) | | | 15 | | °C |

(1) Dropout voltage is the minimum input-to-output voltage differential needed to maintain regulation at a specified output current. Dropout voltage is measured when the output voltage has dropped 100 mV from the nominal value. In dropout, the output voltage will be equal to ($V_{IN}$ – $V_{DO}$).

(2) Not tested during production.

## Typical Performance Characteristics

All test conditions: $V_{IN}$ = $V_{OUT\ (NOM)}$ + 1 V, $C_{IN}$ = $C_{OUT}$ = 10 µF, $I_{OUT}$ = 10 mA. $T_A$ = 25°C, unless otherwise noted.




$V_{OUT}$ = 5 V

**Figure 1. PSRR**

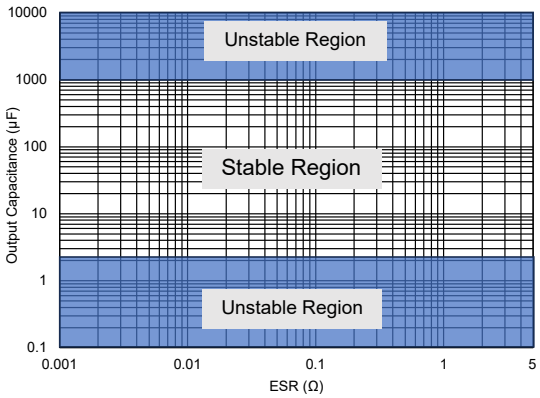
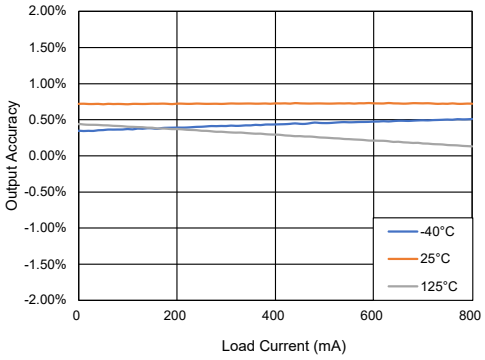
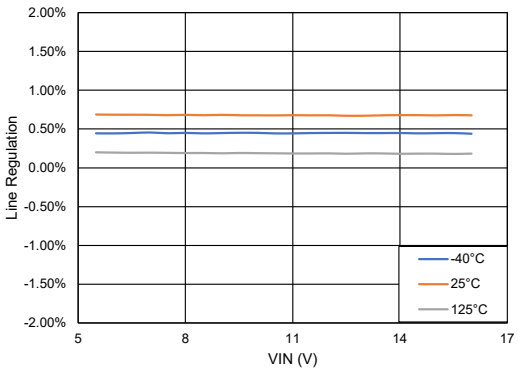



**Figure 2. Output Capacitance vs. ESR Stability**



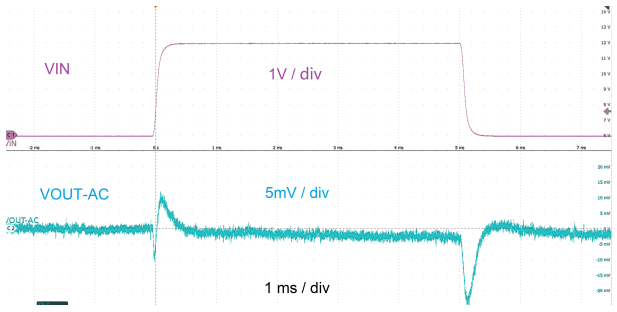

$V_{OUT}$ = 5 V

**Figure 3. Load Regulation**



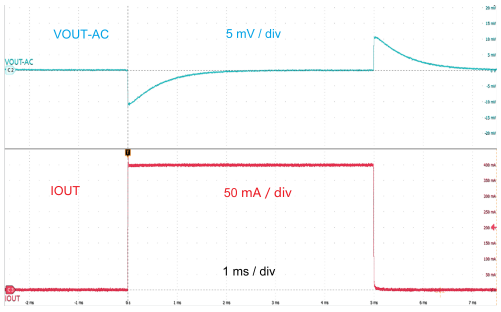

$V_{OUT}$ = 5 V

**Figure 4. Line Regulation**




$V_{OUT}$ = 5 V, $V_{IN}$ = 6 V to 12 V

**Figure 5. Line Transient**




$V_{OUT}$ = 5 V, $I_{OUT}$ = 1 mA to 800 mA

**Figure 6. Load Transient**

# Detailed Description

## Overview

The TPL51117x series is a low dropout voltage regulator with a typical dropout voltage of 800 mV at 800 mA load current.

The TPL51117x series is available in two fixed voltages, 3.3 V and 5 V. The TPL51117x series offers current limiting and thermal shutdown features.

The TPL51117x series supports a wide range of output capacitors from 2.2 µF to 1000 µF with an ESR range from 0.001 Ω to 5 Ω. Also, the TPL51117x series integrates over-current protection and over-temperature protection.

The TPL51117x series provides the SOT223-3 package with a guaranteed operating junction temperature range ($T_J$) from –40°C to +125°C.

## Functional Block Diagram

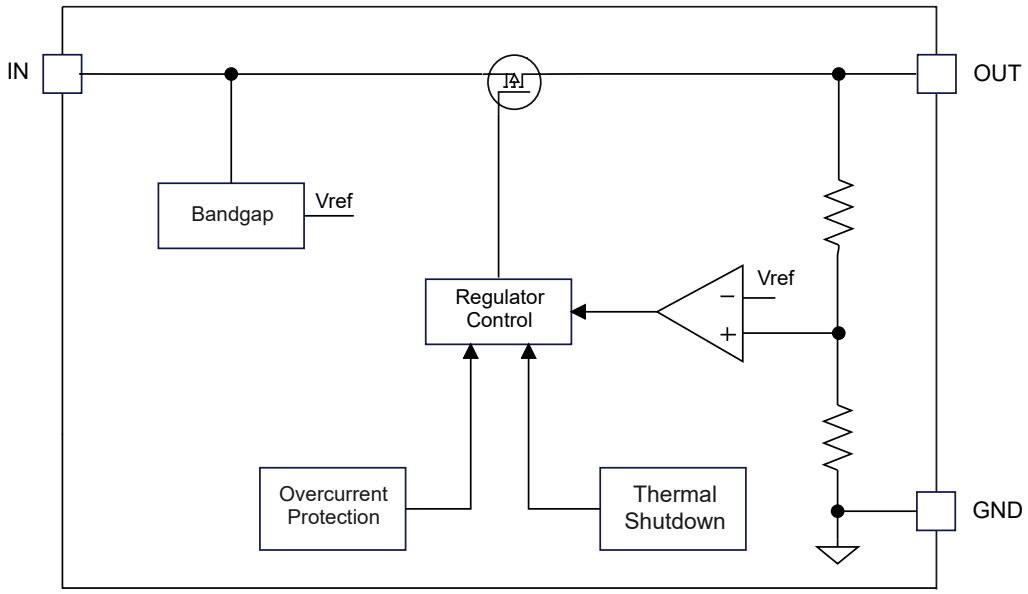



**Figure 7. Functional Block Diagram**

## Feature Description

### Operating Voltage Range ($V_{IN}$)

The TPL51117x series does not include any dedicated UVLO circuitry. The output voltage of the TPL51117x series is not well regulated until VIN exceeds ($V_{OUT}$ + $V_{DO}$).

### Regulated Output Voltage (OUT)

The TPL51117x series is available in fixed voltage versions of 3.3 V and 5 V. When the input voltage is higher than $V_{OUT\ (NOM)}$ + $V_{DO}$, the output pin is the regulated output based on the selected voltage version. When the input voltage falls below $V_{OUT\ (NOM)}$ + $V_{DO}$, the output pin tracks the input voltage minus the dropout voltage.

### Over-Current Protection

The TPL51117x series integrates an internal current limit that helps to protect the regulator during fault conditions. The output voltage is not regulated when the device is in current limit and $V_{OUT} = I_{CL} \times R_{LOAD}$.

### Over-Temperature Protection

The over-temperature protection starts to work when the junction temperature exceeds the thermal shutdown ($T_{SD}$) threshold, which turns off the regulator immediately. When the device cools down and the junction temperature falls below the thermal shutdown threshold minus thermal shutdown hysteresis, the regulator turns on again. The junction temperature range should be limited according to the Recommended Operating Conditions table, continuously operating above the junction temperature range will reduce the device lifetime.

# 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

The TPL51117x is a series of 800-mA, low-dropout linear regulators. The following application schematic shows the typical usage of the TPL51117x series.

## Typical Application

Figure 8 shows the typical application schematic of the TPL51117x series.

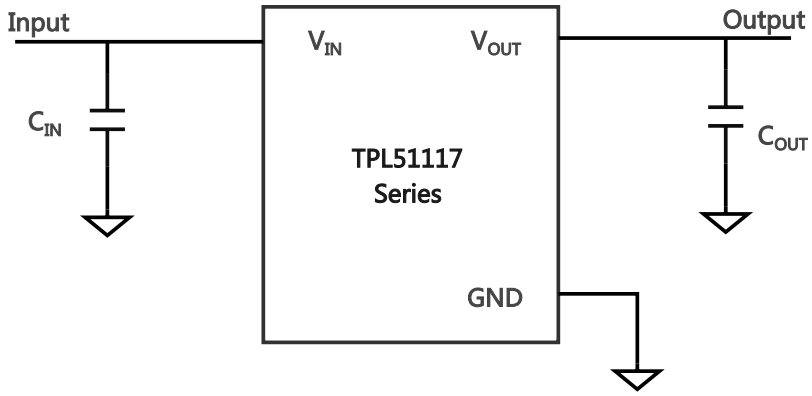



**Figure 8. Typical Application Circuit**

### Input Capacitor and Output Capacitor

3PEAK recommends adding a 10-µF or greater capacitor with a 0.1-µF bypass capacitor in parallel at the IN pin to keep the input voltage stable. The voltage rating of the capacitors must be greater than the maximum input voltage.

To ensure loop stability, the TPL51117x series supports a wide range of output capacitors from 2.2 µF to 1000 µF with an ESR range from 0.001 Ω to 5 Ω. 3PEAK recommends selecting a 10-µF output capacitor.

Both input and output capacitors must be placed as close to the device pins as possible.

### Power Dissipation and Thermal Consideration

During normal operation, the LDO junction temperature should not exceed 125°C. Use the equations below to calculate the power dissipation and estimate the junction temperature.

The power dissipation can be calculated using Equation 1.

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_{GND} \quad (1)$$

The junction temperature can be estimated using Equation 2. $\theta_{JA}$ is the junction-to-ambient thermal resistance.

$$T_J = T_A + P_D \times \theta_{JA} \quad (2)$$

# Layout

## Layout Guideline

- Both input and output capacitors must be placed to the device pins as close as possible, and the vias between capacitors and device power pins must be avoided.
- It is recommended to bypass the input pin to ground with a 0.1-μF bypass capacitor. The loop area formed by the bypass capacitor connection, the IN pin, and the GND pin of the system must be as small as possible.
- It is recommended to use wide and thick copper to minimize I×R drop and heat dissipation.

## Layout Example

The following figure shows a layout example of TPL51117x.

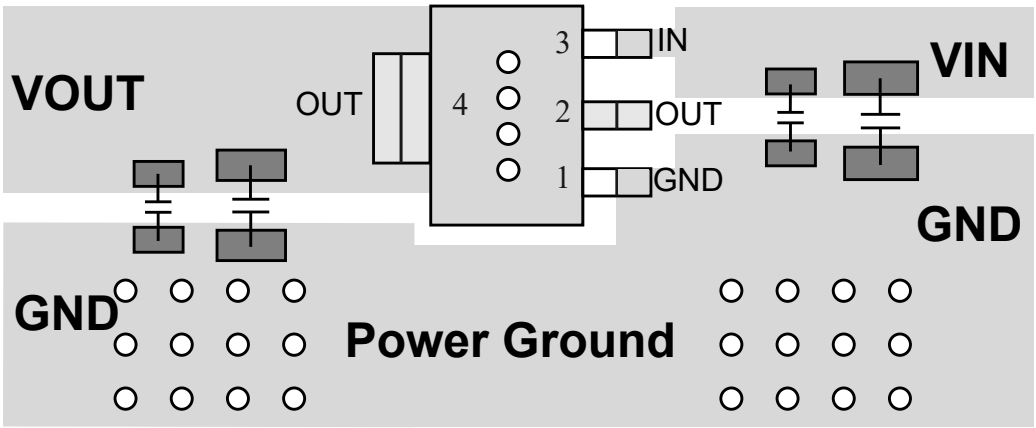
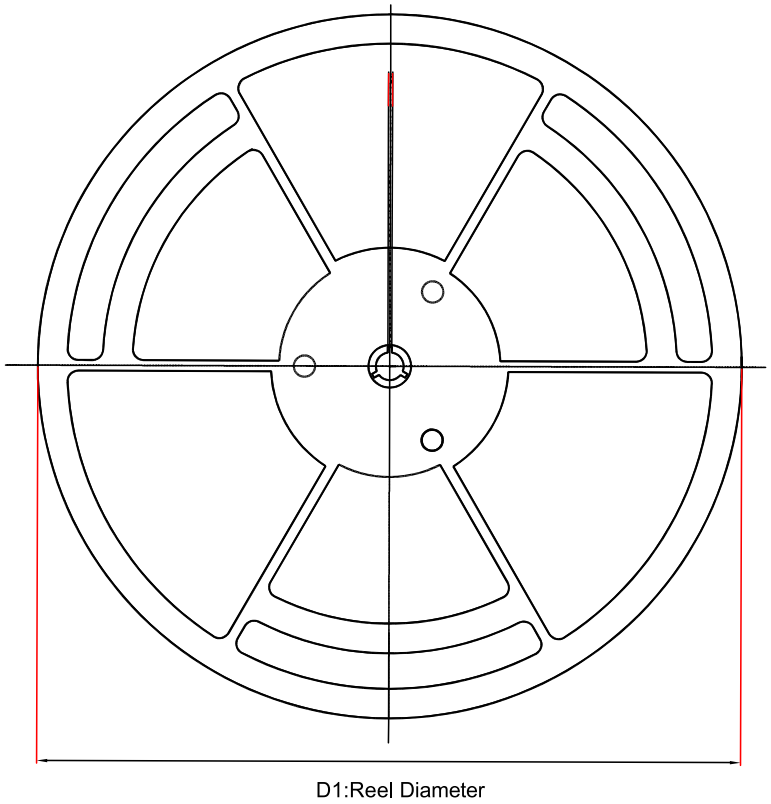
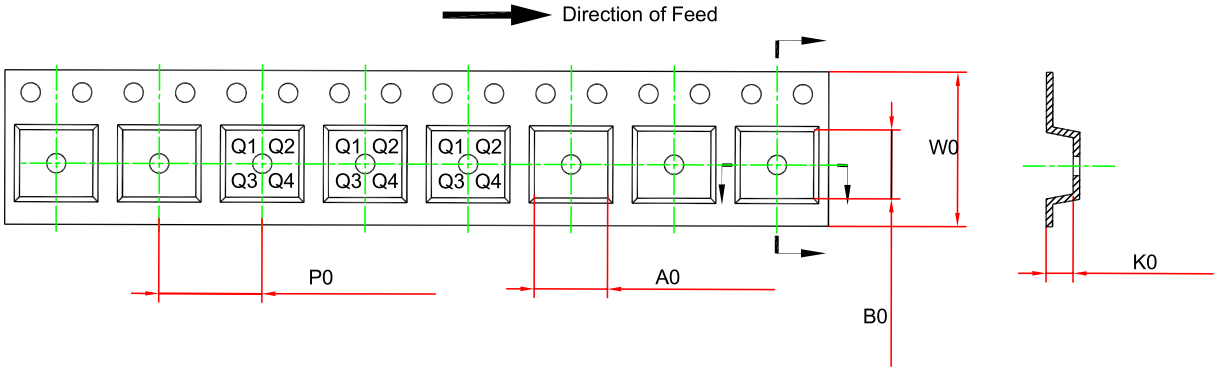



**Figure 9. TPL51117x Layout Example**

## Tape and Reel Information



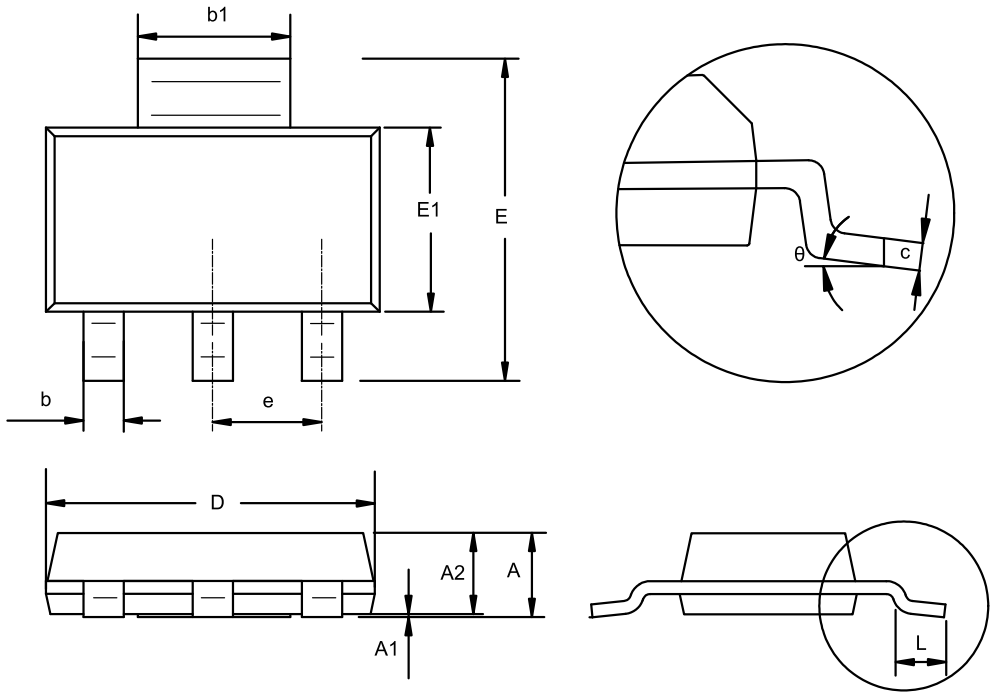




| Order Number | Package | D1 (mm) | W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | W0 (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|
| TPL5111733-ST4R | SOT223-3 | 330 | 17.6 | 6.8 | 7.3 | 1.9 | 8 | 12.2 | Q3 |
| TPL5111750-ST4R | SOT223-3 | 330 | 17.6 | 6.8 | 7.3 | 1.9 | 8 | 12.2 | Q3 |

## Package Outline Dimensions

### SOT223-3

Package Outline Dimensions ST4(SOT223-3-A)




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.500 | 1.800 | 0.059 | 0.071 |
| A1 | 0.020 | 0.100 | 0.001 | 0.004 |
| A2 | 1.500 | 1.700 | 0.059 | 0.067 |
| b | 0.660 | 0.840 | 0.026 | 0.033 |
| b1 | 2.900 | 3.100 | 0.114 | 0.122 |
| c | 0.200 | 0.350 | 0.008 | 0.014 |
| D | 6.300 | 6.700 | 0.248 | 0.264 |
| E | 6.700 | 7.300 | 0.264 | 0.287 |
| E1 | 3.300 | 3.700 | 0.130 | 0.146 |
| e | 2.300 BSC | | 0.091 BSC | |
| L | 0.750 | 1.150 | 0.030 | 0.045 |
| θ | 0 | 10° | 0 | 10° |

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 |
|---|---|---|---|---|---|---|
| TPL5111733-ST4R | −40 to 125°C | SOT223-3 | LEB | MSL3 | 4,000 | Green |
| TPL5111750-ST4R | −40 to 125°C | SOT223-3 | LEC | MSL3 | 4,000 | Green |

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

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