

Application Report

TPS50601x-SP Comparison Guide



ABSTRACT

The TPS50601-SP device is a 6-A, point-of-load buck converter. With all devices, improvements can be made to better satisfy the system requirements, as well as make it more robust for harsh environments. The TPS50601A-SP improves upon the existing TPS50601-SP by being more robust to radiation, improving on electrical specification accuracy, and providing for higher voltages to allow more headroom for derating. Minor changes had to be made to allow for this improvement.

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Trademarks

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1 Introduction

The TPS50601A-SP device is an upgraded version of the TPS50601-SP device in the same package. The TPS50601A-SP improved the radiation performance as well as improved the reference voltage accuracy over the TPS50601-SP. The TPS50601A-SP switched the high-side MOSFET to a pFET to allow for a reference capacitor to help improve the reference voltage accuracy. The TPS50601A-SP also had process improvements that allowed the improved radiation performance. There was also the inclusion of more bond wires for PVIN, PGND, and PH pins that allowed the TPS50601A-SP to have higher efficiency than the TPS50601-SP.

2 Overview

Table 2-1 shows the differences between the two devices, as well as describing what the changes mean at a system level.

Table 2-1. Comparison Table

Specification	TPS50601A-SP	TPS50601-SP	Comparison
Voltage reference	±1.5 %	+2.5%, -3.5%	The improved voltage reference allows for tighter regulation for designs where accuracy is critical.
Radiation performance	SEFI free up to 75 MeV	Onset at 48 MeV (SEFI MTBE = 700 k/200 k years SET MTBE = 4.6 M/1.6 M years in LEO/GEO)	For space-grade devices radiation performance is critical, so the improved SEFI performance is important for designs looking to withstand the space environment for longer duration missions.
VIN	VIN = 3 V to 7 V	VIN = 3 V to 6.3 V	Higher voltage specification allows for higher input voltage to support larger headroom for derating.
PVIN	PVIN = 3 V to 7 V	PVIN = 1.6 V to 6.3 V	While the TPS50601-SP has a lower analog input voltage, the TPS50601A-SP has a higher PVIN voltage for when the analog input voltage is taken from the same rail as the higher VIN.
Efficiency	96.6% (PVIN = 3.3 V)	95% (PVIN = 3.3 V)	The change to include more bond wires allowed for higher efficiency for the TPS50601A-SP. This efficiency increase allows for less heat to be generated and dispersed in space designs where heat dispersal is difficult.
Minimum on time	235 ns	175 ns	The TPS50601A-SP has a larger on time than the TPS50601-SP which makes it harder to use at higher frequencies and large input to output differentials.
SYNC input thresholds	900 mV/2.45 V (PVIN = VIN = 3 V), 900 mV/4.25 V (PVIN = VIN = 7 V)	800 mV, 1.85 V	The TPS50601A-SP has a slightly better input threshold for a low, while the trade-off is the TPS50601-SP has a better threshold for a high input.
Error amplifier DC gain	10 kV/V	39 kV/V	The TPS50601-SP has a higher error amplifier DC gain which can come into play if there is a compensation scheme that will saturate the gain of the error amplifier, but this is largely a non-issue because most compensation schemes will never hit that saturation point.
COMP to ISWITCH gm	22 S	18 S	A slight change that should be noted when changing compensation between the two devices.
VIN shutdown supply current	2.5 mA	5.9 mA	The TPS50601A-SP has a lower shutdown current allowing for less power consumption when the device is disabled.

3 Schematic and Layout Changes

Most designs will need very little change to upgrade from the TPS50601-SP. The package pictures of the devices are shown in [Figure 3-1](#) and [Figure 3-2](#). While the devices are mechanically the same, pin 16 is different between the two devices. The TPS50601-SP has pin 16 as a bootstrap pin for the high-side nFET, and the TPS50601A-SP has a pin to place a capacitor to help stabilize the reference voltage. For layout, the TPS50601-SP requires a 0.1- μ F ceramic capacitor to be placed between the pin and the PH node, while the TPS50601A-SP requires a 470- μ F ceramic capacitor from the pin to ground. If all the component value changes have a comparable footprint, this is the only layout change needed between the two devices.

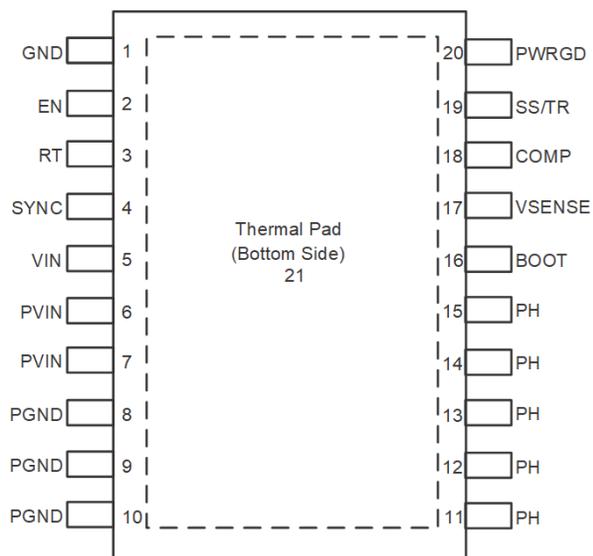


Figure 3-1. TPS50601-SP Pin Out Diagram

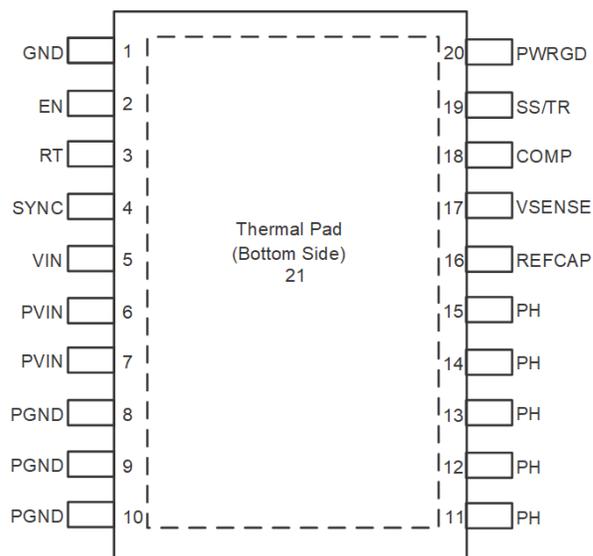


Figure 3-2. TPS50601A-SP Pin Out Diagram

4 References

- Texas Instruments, [TPS50601A-SP Radiation Hardened 3-V to 7-V Input, 6-A Synchronous Buck Converter Data Sheet](#)
- Texas Instruments, [TPS50601-SP Radiation Hardened 1.6- to 6.3-V Input, 6-A Synchronous Buck Converter Data Sheet](#)

5 Revision History

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

Changes from Revision * (April 2020) to Revision A (November 2020)	Page
• Updated the numbering format for tables, figures and cross-references throughout the document.....	1
• Update was made in Section 3	3

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