Application Report
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Low Voltage SWIFT DC/DC Converters Pin Compatibility

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ABSTRACT

Load requirements often change during the project development phase, affecting time to market, schedules, and budgets. Additionally, higher efficiency may be needed to meet tight power budgets, and higher output current devices typically have lower drain-to-source resistances. Fortunately, many SWIFT™ DC/DC converters are pin compatible, allowing the user to increase or decrease the output current capability without affecting the circuit board layout.

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1 Introduction

The low voltage family of SWIFT DC/DC converters was designed using similar building blocks. The controller portion is the same; however, different MOSFETs were incorporated on the same die to optimize cost and size for the user. Two different package styles with thermal pads were selected: the 28-pin HTSSOP and the 20-pin HTSSOP. The 28HTSSOP package supports 6-A, 8-A, 9-A, and 14-A devices. The 20HTSSOP package supports 1.5-A and 3-A devices. The SWIFT family includes several derivatives for DDR memory (TPS54x72), sequencing (TPS54x80), and prebias loads (TPS54x73), summarized in Table 1. These derivatives share pin compatibility among themselves when the same package size is used.

SWIFT is a trademark of Texas Instruments.

Table 1. Low Input Voltage SWIFT Product Offering

PART NUMBER	INPUT VOLTAGE (V)	CURRENT (A)	PACKAGE
ADJUSTABLE AND FIXED OUTPUT VOLTAGES			
TPS54110	3 to 6	1.5	20HTSSOP
TPS54310	3 to 6	3	20HTSSOP
TPS54311 through TPS65316	3 to 6	3	20HTSSOP
TPS54610	3 to 6	6	28HTSSOP
TPS54611 through TPS54616	3 to 6	6	28HTSSOP
TPS54810	4 to 6	8	28HTSSOP
TPS54910	3 to 4	9	28HTSSOP
TPS54010	2.2 to 4	14	28HTSSOP
DDR MEMORY (ACTIVE BUS TERMINATION)			
TPS54372	3 to 6	3	20HTSSOP
TPS54672	3 to 6	6	28HTSSOP
TPS54872	4 to 6	8	28HTSSOP
TPS54972	3 to 4	9	28HTSSOP
SEQUENCING			
TPS54380	3 to 6	3	20HTSSOP
TPS54680	3 to 6	6	28HTSSOP
TPS54880	4 to 6	8	28HTSSOP
TPS54980	3 to 4	9	28HTSSOP
PREBIAS			
TPS54373	3 to 6	3	20HTSSOP
TPS54673	3 to 6	6	28HTSSOP
TPS54873	4 to 6	8	28HTSSOP
TPS54973	3 to 6	9	28HTSSOP

2 Pin Compatibility With Adjustable SWIFT Devices

2.1 Pin Compatibility Among TPS54610, TPS54810, TPS54910, and TPS54010

The TPS54610, TPS54810, TPS54910, and the TPS54010 have different input voltage ranges, but they all share a common input capability from 3 V to 4 V, allowing the layouts of these devices to be interchangeable. The drain-to-source resistance of the MOSFETs in each of these four devices differs, along with the current limit trip point. Although the change in MOSFET resistance should not be a major factor affecting the stability of the power supply, it is a good idea to use the SWIFT designer software tool (http://www.ti.com/swift) to check if the values of compensation resistors and capacitors need to be modified. If the cross-over frequency and phase margin of the original design were conservative, most probably no changes are needed to meet the application's stability criterion. Because the MOSFET resistance affects the thermal considerations of board layout, it is a good idea to check the package dissipation and the thermal performance of the new device with respect to the circuit board. Application report SLVA201 provides thermal comparisons of the 6-A, 8-A, 9-A, and 14-A SWIFT devices in the 28HTSSOP package. Note that in Figure 1 the TPS54010 provides a VIN pin (pin 24) in addition to the PVIN pins, which allows the integrated circuit (IC) to be biased at 3.3 V for gate drive and logic functions. Therefore, a lower input voltage, such as 2.5 V, may be applied to the PVIN pins. The PVIN and VIN pins can be tied together allowing the TPS54010 to operate from 3 V to 4 V and share pin compatibility with the other devices.

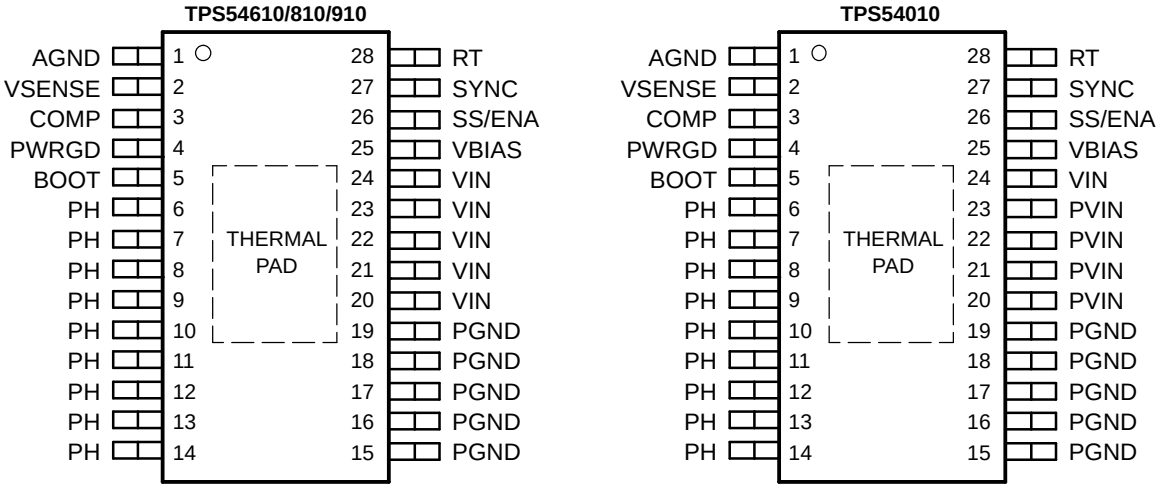

Figure 1. TPS54610/810/910 vs TPS54010 Pinout

Table 2. Comparison of 28HTSSOP Device Differences

	TPS54610	TPS54810	TPS54910	TPS54010
Output current	6 A	8 A	9 A	14 A
Package	28HTSSOP	28HTSSOP	28HTSSOP	28HTSSOP
Input range	3 V – 6 V	4 V – 6 V	3 V – 4 V	2.2 V – 4 V
Typical Rds (on)	30 mΩ	30 mΩ	15 mΩ	8 mΩ

2.2 Pin Compatibility Between TPS54110 and TPS54310

The TPS54310 and TPS54110 share the same 20HTSSOP package, pinout, and input voltage range. The only difference is the drain-to-source resistance of the MOSFETs and the current limit trip point. When interchanging between the TPS54110 and the TPS54310, consider the thermal implications described previously. The drain-to-source resistance of the TPS54310 and TPS54110 is 60 mΩ and 240 mΩ, respectively. The benefit of the TPS54310 is higher efficiency, while the benefit of TPS54110 is lower cost.

2.3 Pin Compatibility Among DDR Memory, Sequencing, and Prebias Derivatives

As shown in Table 1, the SWIFT family is available in derivatives for use in sequencing and active bus termination (DDR memory). The same FET resistance and thermal issues addressed previously pertain to the derivatives when offered in the same package. The following 6-A, 8-A, and 9-A versions are pin compatible. Because the 3-A versions are offered in a 20HTSSOP package, they are not pin compatible with the other three. If switching from a 6-A to a 3-A device, the circuit board will need another layout revision.

Table 3. Comparison of DDR Memory Derivatives in 28HTSSOP

	TPS54672	TPS54872	TPS54972
Output current	6 A	8 A	9 A
Package	28HTSSOP	28HTSSOP	28HTSSOP
Input range	3 V – 6 V	4 V – 6 V	3 V – 4 V
Typical Rds (on)	30 mΩ	30 mΩ	15 mΩ

Table 4. Comparison of Sequencing Derivatives in 28HTSSOP

	TPS54680	TPS54880	TPS54980
Output current	6 A	8 A	9 A
Package	28HTSSOP	28HTSSOP	28HTSSOP
Input range	3 V – 6 V	4 V – 6 V	3 V – 4 V
Typical Rds (on)	30 mΩ	30 mΩ	15 mΩ

Table 5. Comparison of Prebias Derivatives in 28HTSSOP

	TPS54673	TPS54873	TPS54973
Output current	6 A	8 A	9 A
Package	28HTSSOP	28HTSSOP	28HTSSOP
Input range	3 V – 6 V	4 V – 6 V	3 V – 4 V
Typical Rds (on)	30 mΩ	30 mΩ	15 mΩ

2.4 Pin Compatibility Between TPS54x10 and TPS54x73 Devices

The prebias derivatives shown in Table 5 are used when a processor needs voltage applied before the processor is powered up, and is implemented with diodes tied between the processor's core and I/O input voltage pins. See application report SLVA007 for more information about how to use the TPS54x73 family in prebiased sequencing applications. Note that the TPS54x73 devices are pin compatible with the TPS54x10 versions at all output current levels. The difference is that the TPS54x73 devices keep the low side MOSFET off during start-up in order to maintain the bias voltage on the processor's core. However, if the load is not prebiased, TPS54x10 devices are better suited.

Table 6. Comparison of Internally Compensated, Fixed Output Voltage Versions

	Package	0.9 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V
3-A	20HTSSOP	TPS54311	TPS54312	TPS54313	TPS54314	TPS54315	TPS54316
6-A	28HTSSOP	TPS54611	TPS54612	TPS54613	TPS54614	TPS54615	TPS54616

3 Pin Compatibility Between TPS5461x and TPS5431x Fixed Output Voltage Versions

Low voltage SWIFT devices with fixed output voltages are internally compensated, which simplifies the design, reduces the number of components, and increases the circuit board's mean time between failures. As shown in Table 6, all of the 3-A versions are pin compatible with each other and all of the 6-A versions are pin compatible with each other; simply swap ICs. However, make sure that the output capacitors have adequate voltage rating headroom to accommodate the increased output voltage. Note that the adjustable TPS54x10 versions are not compatible with the internally compensated versions; therefore, a circuit board change is needed. The TPS54x10 versions are recommended because they are more flexible with the output voltage and output filter selections.

4 Conclusion

The SWIFT concept provides easy, high-performance power solutions. The pin compatibility of the low voltage DC/DC converters noted in this application report can enhance product development and save cost for the design engineer.

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