Application Brief

Future-Proofing Your Level Shifter Design with TI's Dual Footprint Packages

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Introduction

Reducing or eliminating supply shortages within a production flow is essential for many customers. When supply issues arise, customers typically must redesign their boards to accommodate a new package for a given device, forcing customers to push production dates and miss crucial deadlines. However, with TI's expanded small package selections and dual footprint configurations, supply constraints can be reduced. Dual footprint board layout techniques can help mitigate the impact of component shortages by enabling a design to use different package options for a given component.

This application brief covers multiple common package families and provide guidance on how to select a dual footprint.

Dual Footprint Solution using TI's Various Packages

A *dual footprint* is a footprint which can be used with two or more device packages, with minimal to no routing adjustments, eliminating the need for last minute board redesigns or spins. TI offers a variety of packages for both leaded and non-leaded types. Table 1 shows a few examples of popular packages from TI, while a full list can be found in Find TI Packages. TI's level shifter portfolio contains many of the packages listed below and includes devices under Auto Directional, Direction Controlled and Fixed Direction categories for Industrial, Automotive, and High Reliability applications.

Table 1. Package Family and Designator of Leaded and Non-Leaded Packages

Leaded		Non-Leaded	
Package Family	**Package Designator**	**Package Family**	**Package Designator**
TSSOP	PW	UQFN	RJW, RSV
VSSOP	DGS, DCU	VQFN	RGY
SSOP	DCT	WQFN	BQA, BQB
SOT-23	DBV	X2SON	DEA, DTQ, DQE
SOT-SC70	DCK	USON	DRY

With TI's packages being among the industry's smallest, implementing dual footprint layouts for leaded and non-leaded packages is simple given that many of these packages have the same orientation and pinout.

Leaded to Non-Leaded Packages

To create a dual footprint design, the board designer must place the smaller non-leaded package in the center of the larger leaded package, and connect the corresponding pins. This allows either package to be placed on the footprint. Figure 1 shows some examples using TSSOP and QFN packages, while Figure 2 shows some examples using smaller packages like SOT-23 and SOT-SC70 with X2SON and USON. Many level translators use the packages shown in the following examples, and Table 2, Table 3, and Table 4 give the full list of TI devices and the corresponding footprint configurations the devices can support.

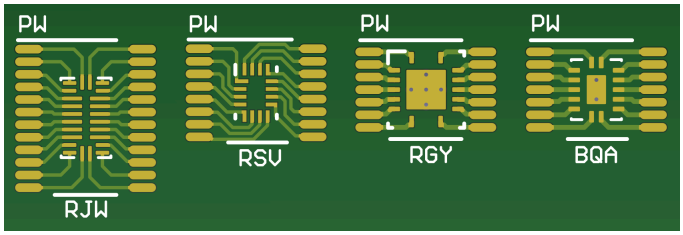

Figure 1. TSSOP Package Layout With QFNs

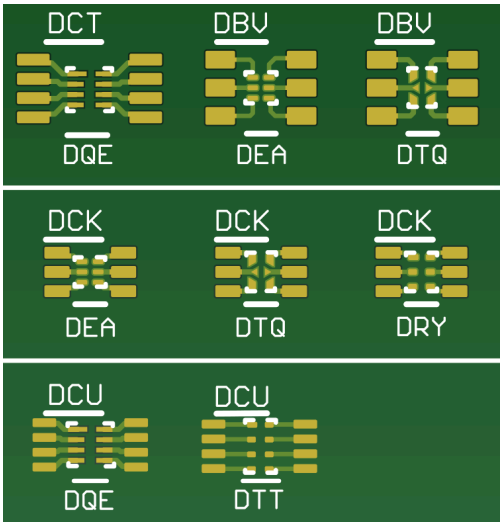

Figure 2. SOT-23, SOT-SC70 Package Layout With X2SON, USON

Table 2. Device Compatibility [Auto Direction]

Dual Footprint Candidate	Package Options
TXS0108E, TXB0108, LSF0108	20 Pin: PW and RGY
TXS0104E, TXS0104E-Q1	14 Pin: PW and BQA, PW and RGY
TXB0104, TXB0104-Q1	14 Pin: PW and RGY
LSF0102	8 Pin: DCT and DQE, DCU and DQE

Table 3. Device Compatibility [Direction Controlled]

Dual Footprint Candidate	Package Options
SN74AXC8T245	24 Pin: PW and RJW
SN74AXC4T245, SN74AXC4T774	16 Pin: PW and BQB, PW and RSV
SN74AXC1T45	6 Pin: DBV and DTQ, DBV, and DEA, 6 Pin: DCK and DTQ, DCK, and DEA
SN74AXC1T45-Q1	6 Pin: DCK and DRY

Table 4. Device Compatibility [Fixed Direction]

Dual Footprint Candidate	Package Options
TXU0304, TXU0304-Q1	14 Pin: PW and BQA
TXU0204, TXU0204-Q1	14 Pin: PW and BQA
TXU0104, TXU0104-Q1	14 Pin: PW and BQA
TXU0202, TXU0202-Q1	8 Pin: DCU and DTT
TXU0102, TXU0102-Q1	8 Pin: DCU and DTT

Leaded to Leaded Packages

Creating a dual footprint design depends on the packages used. If using a smaller package like SOT-23-THN, then the package can fit underneath a bigger package like TSSOPs (See PW and DYY example below). If a package cannot fit underneath because of PCB design violations, then the package needs to be moved to the side (See PW and DGS example below). Figure 3 shows an example on how to implement these configurations.

Table 5 and Table 6 gives the full list of devices and the corresponding footprint configurations the devices can support.

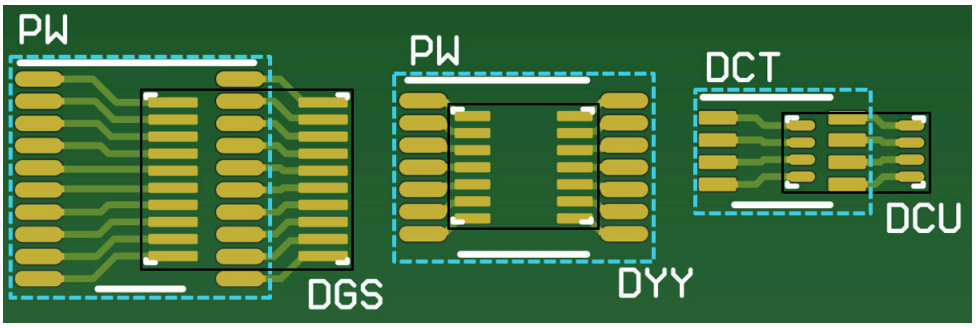

Figure 3. Package Layout of TSSOP, SSOP With VSSOP and SOT-23-THN

Table 5. Device Compatibility [Auto Direction]

Dual Footprint Candidate	Package Options
LSF0108	20 Pin: PW and DGS
LSF0102	8 Pin: DCT and DCU
TXS0102	8 Pin: DCT and DCU

Table 6. Device Compatibility [Direction Controlled]

Dual Footprint Candidate	Package Options
SN74AXC2T45	8 Pin: DCT and DCU
SN74AVC2T45	8 Pin: DCT and DCU

Design Consideration

Make sure proper spacing is used when designing a dual footprint layout. Most manufactures follow a 0.1 mm (approximately 4 mil) design rule for spacing between each pad. If such a rule is not followed, there will be insufficient or no space for solder mask to fill between pads of the layout. A lack of solder mask can cause the device to shift, resulting in shorted or floating pins.

Conclusion

Using TI's numerous package options, customers can easily design dual footprint layouts for multiple components which can dramatically reduce the chances of missing delivery deadlines that can result from component supply shortages. Dual footprint layout considerations can be a vital tool for design engineers as they select and design in components that are resilient to supply chain disruptions. Customers can use the previous examples to provide an effective second source and future-proof their design.

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