Application Note

Second Sourcing Options for Multiplexers and Signal Switches

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ABSTRACT

When developing a new PCB, designers are increasingly required to choose signal switches and multiplexers that offer second sourcing options from multiple semiconductor manufacturers. This restriction can limit the ability of the designer to select parts that utilize the latest, smallest, and most cost-effective packages on the market. A solution to this roadblock is to place a secondary footprint of the smaller package inside of the footprint of the larger package. Several of the benefits gained by this design are discussed in this application note.

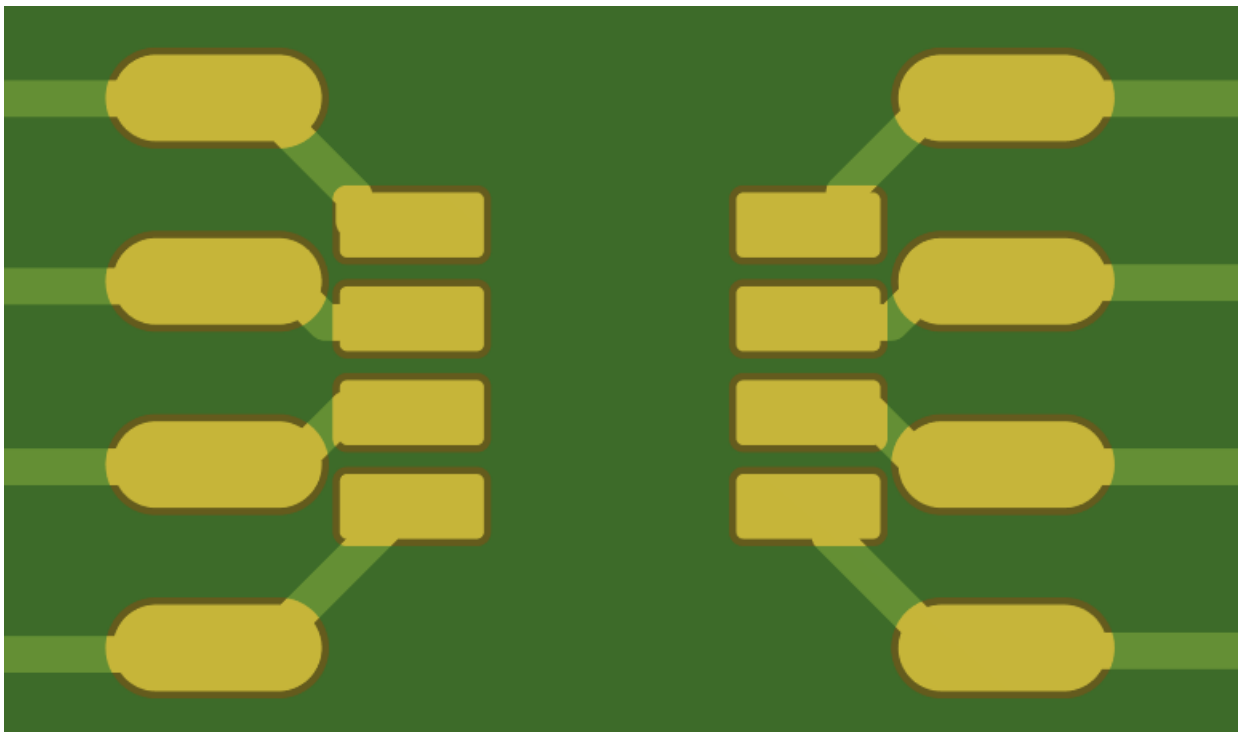

Figure 1-1. Example of a SOT-23 (DCN) Footprint Within a SOIC (D) Footprint

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1 Simplifying the Sourcing Strategy

As sourcing strategies have become an increasingly large concern, this dual footprint design method provides an remarkable way to fulfill customer's multi-source requirement. The design allows for a single vendor, for example, TI, to satisfy the sourcing demands. The design increases the number of orderable parts that can be used for a socket without sacrificing board space. This reduces the out of stock, inventory management issues that can pop up since there is a greater chance that at least one package option is available for purchase. Most TI signal switches and multiplexers are offered in more than one package. Another added benefit is the security of staying ahead of package obsolescence. The semiconductor industry is moving towards smaller footprints which brings the risk of a package being discontinued at some point in the future by a manufacturer. By placing the newest package offering's footprint in your design, this risk is mitigated.

1.1 Cost Savings and Increased Flexibility

Larger packages are typically more expensive than smaller ones due to the greater amount of materials needed to produce them. This is especially true of older, legacy packages. Being able to choose the smaller, more cost-effective option of a given device lowers the BOM costs. Another advantage is avoiding increased costs and lost revenue due to semiconductor manufacturers not being able to meet supply demand.

The secondary footprint allows for effortless migration to the next generation signal switches and multiplexers. When newer versions of current multiplexers are released, smaller package sizes are often the first to become available. Having the ability to switch to the latest version without making a new PCB revision saves time and money.

1.2 Placement and Routing Tips

For this strategy to work, care must be taken during routing to connect the correct pins between each device. Many devices have the same pinout across packages, but some do not, especially between leaded and non-leaded versions. The secondary footprint can still be used if they do not match but extra attention must be used to guarantee compatibility. In the example footprint section, both matching pinouts between packages and mis-matched pinouts between packages are shown.

Sufficient spacing is required between the pads of the primary footprint and the pads of the secondary footprint to guarantee adequate solder mask fill and electrical performance. According to the industry standard IPC-2221, a minimum of 4 mills is the recommended spacing up to 30 V and a minimum of 24 mills is recommended for voltages 31 V and above. Designers should also consider that the secondary footprint may add a small amount of trace length. This will also cause passive components such as decoupling capacitors to be further away from the device when the secondary footprint is utilized.

1.3 Example Secondary Footprints

Common industry standard packages that can utilize secondary footprints are SOIC, TSSOPs, and VSSOPs. Examples are shown below.

The much smaller USON package easily fits within the VSSOP footprint. The pinout for each package match in this configuration.

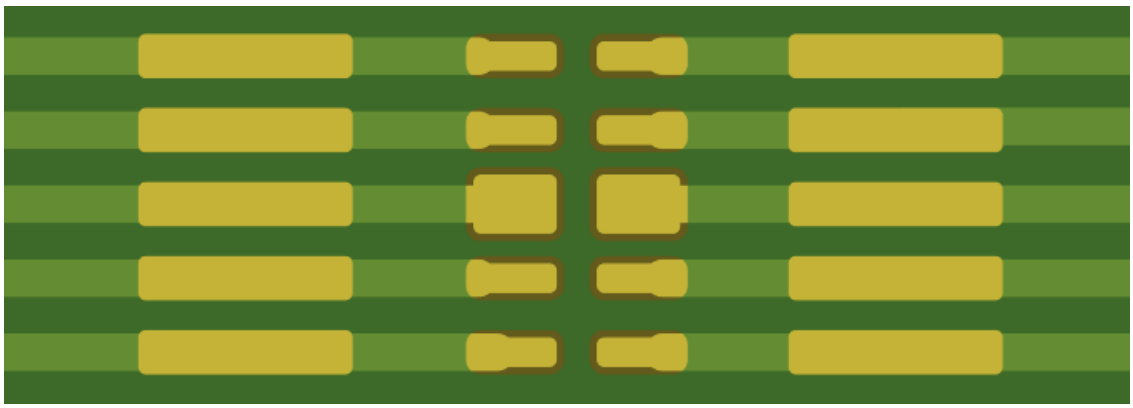

Figure 1-1. VSSOP (DGS) – USON (DQA)

The WSON footprint is a tighter fit within the VSSOP footprint but it still has the required 4 mils of clearance between adjacent pins. The pinout for each package match in this configuration.

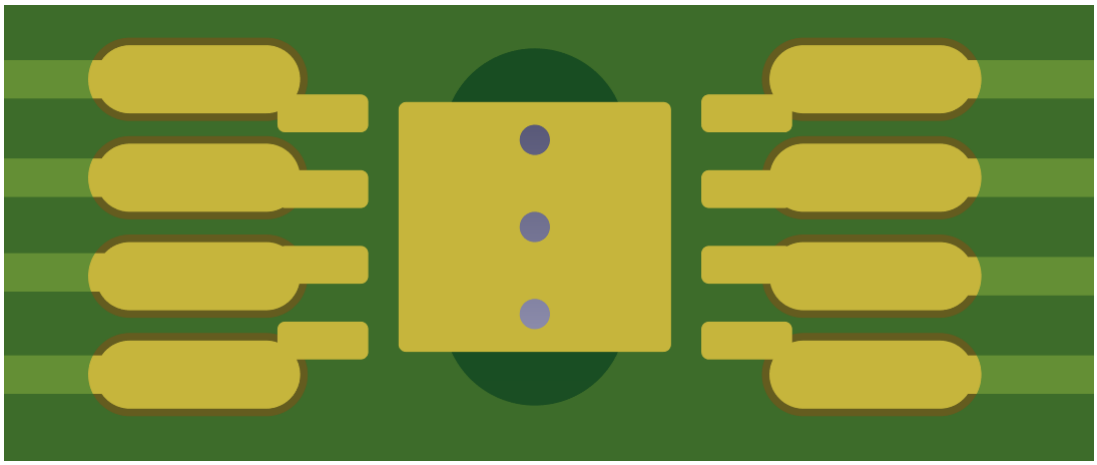

Figure 1-2. VSSOP (DGK) – WSON (RQX)

This example shows that with creativity, three footprints can be layered within the same space. The pinouts are the same for all three packages.

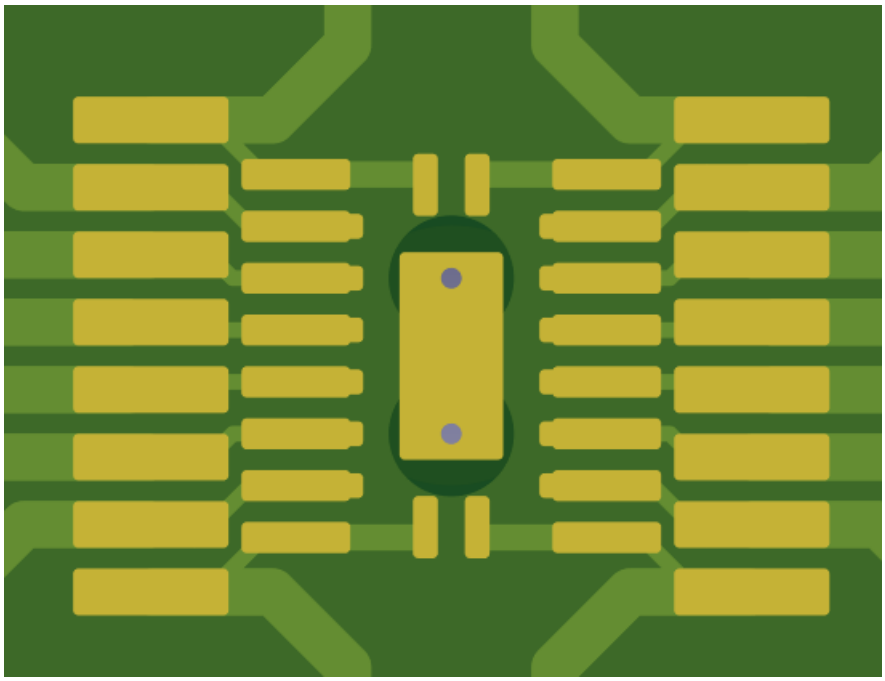

Figure 1-3. TSSOP (PW)-SOT-23-Thin (DYY)-WQFN (BQB)

The routing is more involved but the small size of the UQFN allows for the required spacing within the TSSOP footprint. The pinout for each package match in this configuration.

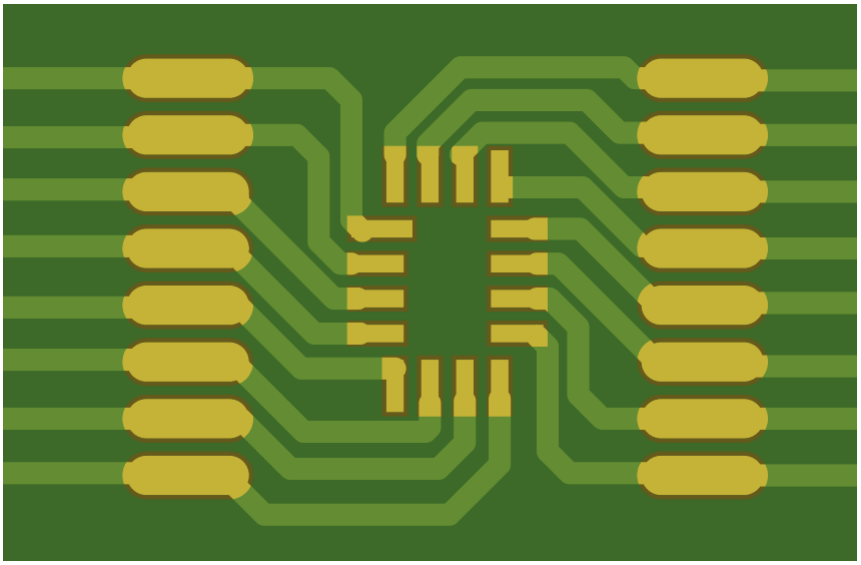

Figure 1-4. TSSOP (PW)-UQFN (RSV)

Differences in pinout between the packages shown in this configuration. The TMUX6208 was used as the example device.

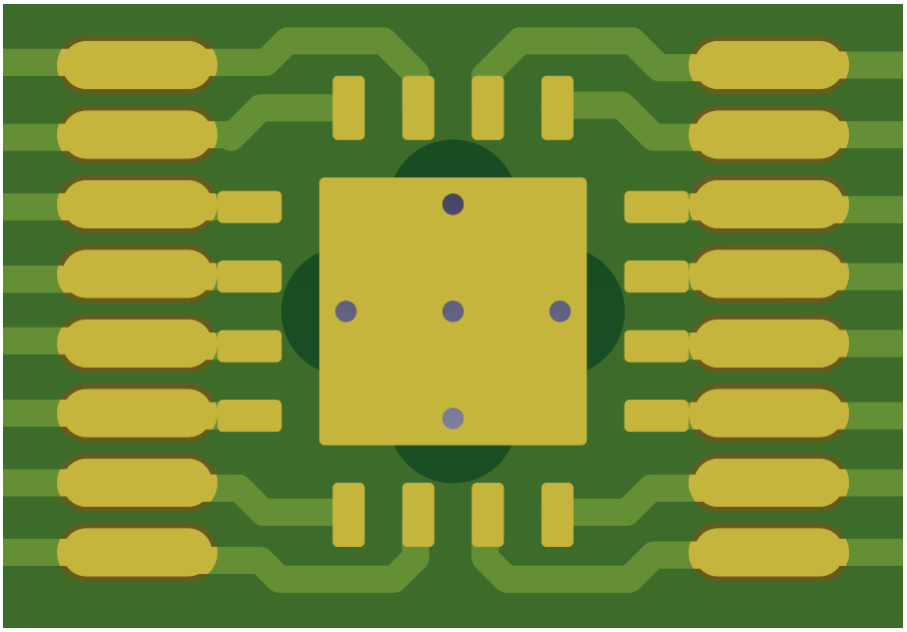

Figure 1-5. TSSOP (PW) - WQFN (RUM)

1.4 Using Multiple Devices to Create Desired Multiplexer Configuration

With increasingly smaller package sizes being offered, more options exist to replace higher pin count devices with multiple lower pin count devices to achieve the same multiplexer configuration. Smaller package sizes also allow designers to build their desired configuration using multiple devices without sacrificing board space. For example, using two UQFN 8:1 devices instead of a single TSSOP or WQFN 16:1 saves on board space since the RSV package (UQFN) is 10 mm2 when combined versus the PW (TSSOP) is 62 mm2 and the RTV (WQFN) is 25 mm2. The drain pin on each UQFN device need to be connected together and the digital logic pins can share I/O controls from the MCU. The enable pins are then used to select which device and switch path will be connected. This configuration can be shown in Figure 1-6.

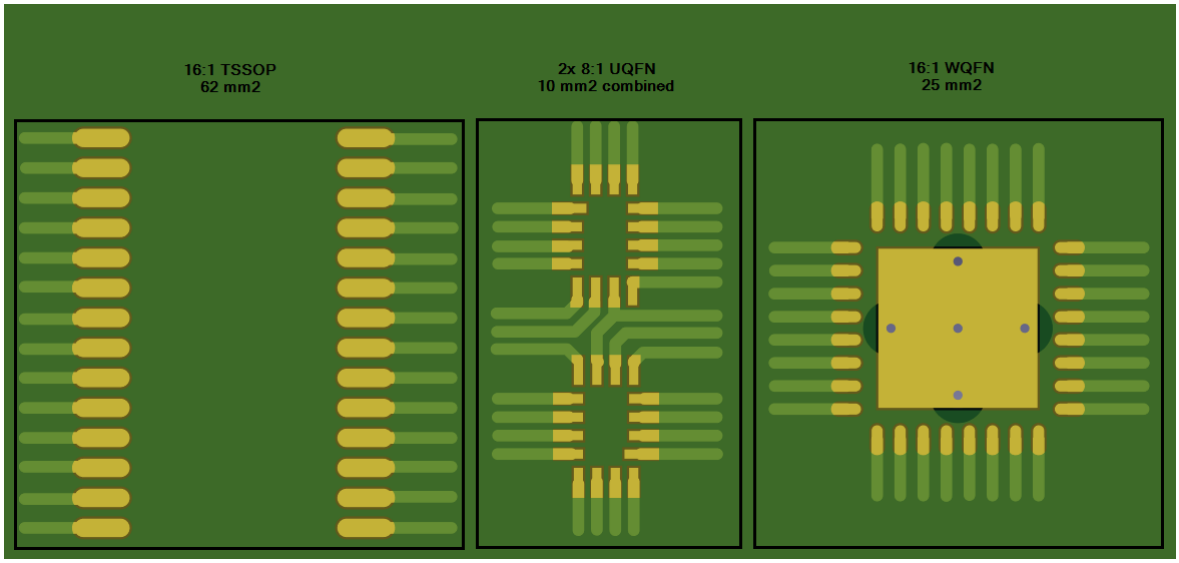

Figure 1-6. PCB Space Savings Using Two 8:1 Devices Instead of One 16:1 Device

2 Summary

Using multiple footprints in your design is a creative method that has multiple benefits, from a more flexible sourcing strategy to BOM cost savings. TI's extensive multiplexer and signal switches portfolio can solve your projects demands.

3 References

- Texas Instruments, *Second-Sourcing Options for Small-Package Amplifiers*, analog design journal

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