AN-79 Application Note

InSOP-24 and HSOP-28 Wave Soldering Design Guide

Note: these guidelines apply to InSOP-24 packages WITHOUT bottom exposed pads (such as InSOP-24D). InSOP-24 packages WITH bottom exposed pads (such as InSOP-24B, InSOP-24C) must be board mounted using IR/convection reflow.

Solder Pad Layout Design Recommendations for Wave Soldering

Power Integrations recommends the use of IR/convection reflow for surface-mount attach of the InSOP-24 and HSOP-28 packages. However, both packages were designed with wave soldering in-mind in case IR/convection reflow is not available or not preferred. Both InSOP-24 and HSOP-28 have ≥0.75 mm lead pitch and narrow leads (0.25 mm – 0.35 mm) to allow adequate spacing between leads, and can be successfully attached when using wave soldering equipment with state-of-the-art features that prevent solder bridging. However, for older or less sophisticated wave soldering equipment, special PCB/footprint layout considerations are recommended in this document.

Maximum Spacing Between Solder Pads

The spacing between the solder pads should be as large as possible to deter solder bridging, but care must also be taken to ensure that the selected pad layout and wave-soldering process results in good quality solder fillets on all sides of the lead "foot". The InSOP-24 solder pad can be designed as narrow as 0.30 mm in width, allowing up to 0.45 mm of pad-to-pad spacing, and the HSOP-28 as narrow as 0.40 mm with 0.40 mm spacing. Table 1 compares package and solder pad layout dimensions to other well-known wave solderable packages.

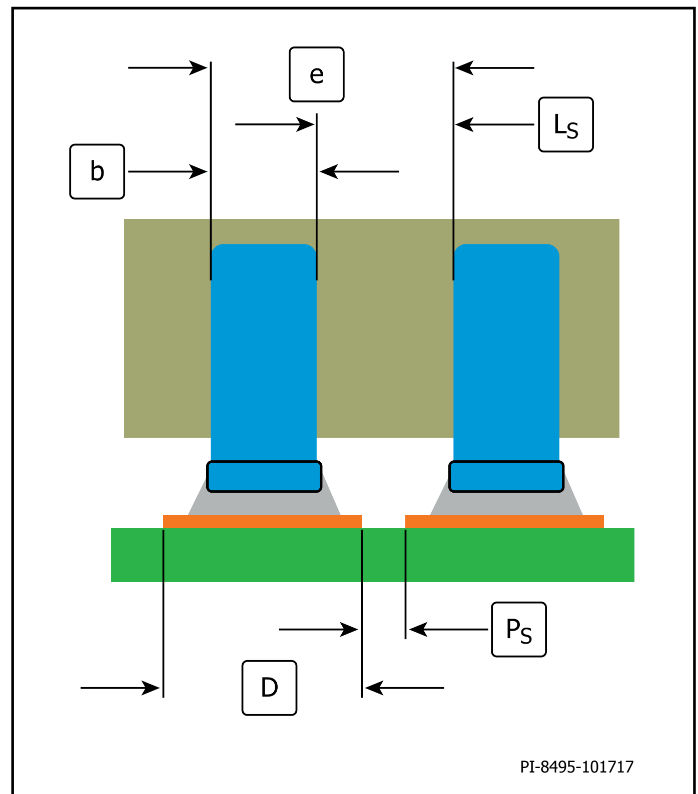

Figure 1. Solder Pad Spacing.

Layout Dimensions for Common and Finer-Pitch Wave-Solderable Leaded Packages

Package Type	Lead Pitch (e)	Lead Width (b)	Lead Metal-to-Metal Spacing (L_S)	Recommended Solder Pad Width for Wave Soldering (D)	Solder Pad Metal-to-Metal Spacing (P_S)
InSOP-24	0.75	0.25	0.50	0.30 - 0.35	0.40 - 0.45
InSOP-T28	0.63	Not Wave-Solderable			
InSOP-T32	0.54	Not Wave-Solderable			
HSOP-28	0.80	0.35	0.45	0.40	0.40
TSSOP-24	0.65	0.25	0.40	0.30	0.35
SSOP-36	0.80	0.36	0.44	0.40	0.40
TQFP-32	0.80	0.35	0.45	0.40	0.40
Standard SOIC	1.27	0.40	0.87	0.60	0.67

Table 1. Layout Dimensions for Common & Finer-Pitch Wave-Solderable Leaded Packages. All dimensions are mm.

Solder Thieves and Orientation Through The Wave

The well-known method of designing "solder thieves" on the PCB layout has been shown to be effective in providing good wave soldering results for the InSOP-24 and HSOP-28 packages. The general concept is shown in Figure 2, and includes large pads at the end of each row of fine-pitch solder pads combined with proper orientation of the layout through the wave. The large pads, called "solder thieves", act to draw excess solder, ensuring clean/bridge-free solder joints along the entire row of solder pads.

Utilizing solder thieves with both InSOP-24 and HSOP-28 packages requires a couple special considerations due to unique features on both packages. For InSOP-24, depending on the flexibility for laying out the PCB and the orientation of the package, it may be possible to save some board space by combining the solder thief pad with the wide solder pad required for the wide "batwing lead" of the InSOP-24. The orientation of the package through the wave MUST be with the leads perpendicular to the PCB travel direction, so the two layout options for InSOP-24 are shown in Figure 3.

For HSOP-28, the leads are symmetrically designed, so there is only one option for the solder thief design. Figure 4 shows the recommended wave soldering footprint.

Thief-Pad Design is Dependent on PCB Travel Directions

Exact size, location and shape of the solder thief pads may need to be modified compared to what is shown in this document depending on the type of solder wave system utilized. However, if the general principles described here are applied, the InSOP-24 and HSOP-28 packages can very successfully be used with a wave soldering process.

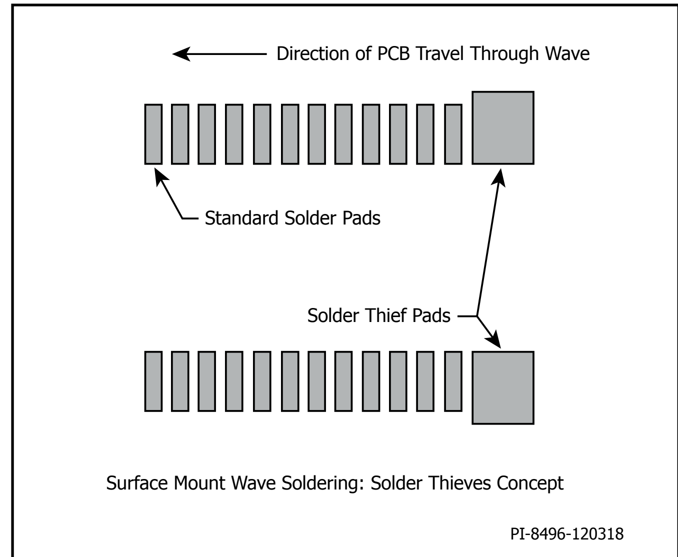

Figure 2. Solder Thieves Concept.

≥1.65
8.25
12
1
≥1.90
0.40
0.75 TYP
0.30 - 0.35 TYP
Direction of PCB Travel Through Wave
12.72
Solder Thief Pads
2.78
0.40 - 0.45
≥1.58 TYP
13
24
8.25
InSOP-24D Wave Soldering Footprint Recommendation
Option 1: Preferred Orientation, Pin #1 & 24 First

≥1.65
8.25
12
1
≥1.90
0.75 TYP
0.40
0.30 - 0.35 TYP
12.72
Direction of PCB Travel Through Wave
Solder Thief Pads
2.78
0.40 - 0.45
≥1.58 TYP
≥2.40
13
24
8.25
InSOP-24D Wave Soldering Footprint Recommendation
Option 2: Alternate Orientation, Pin #12 & 13 First

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Figure 3. InSOP-24 Wave Soldering Footprint Recommendations – Preferred and Alternate Orientations.

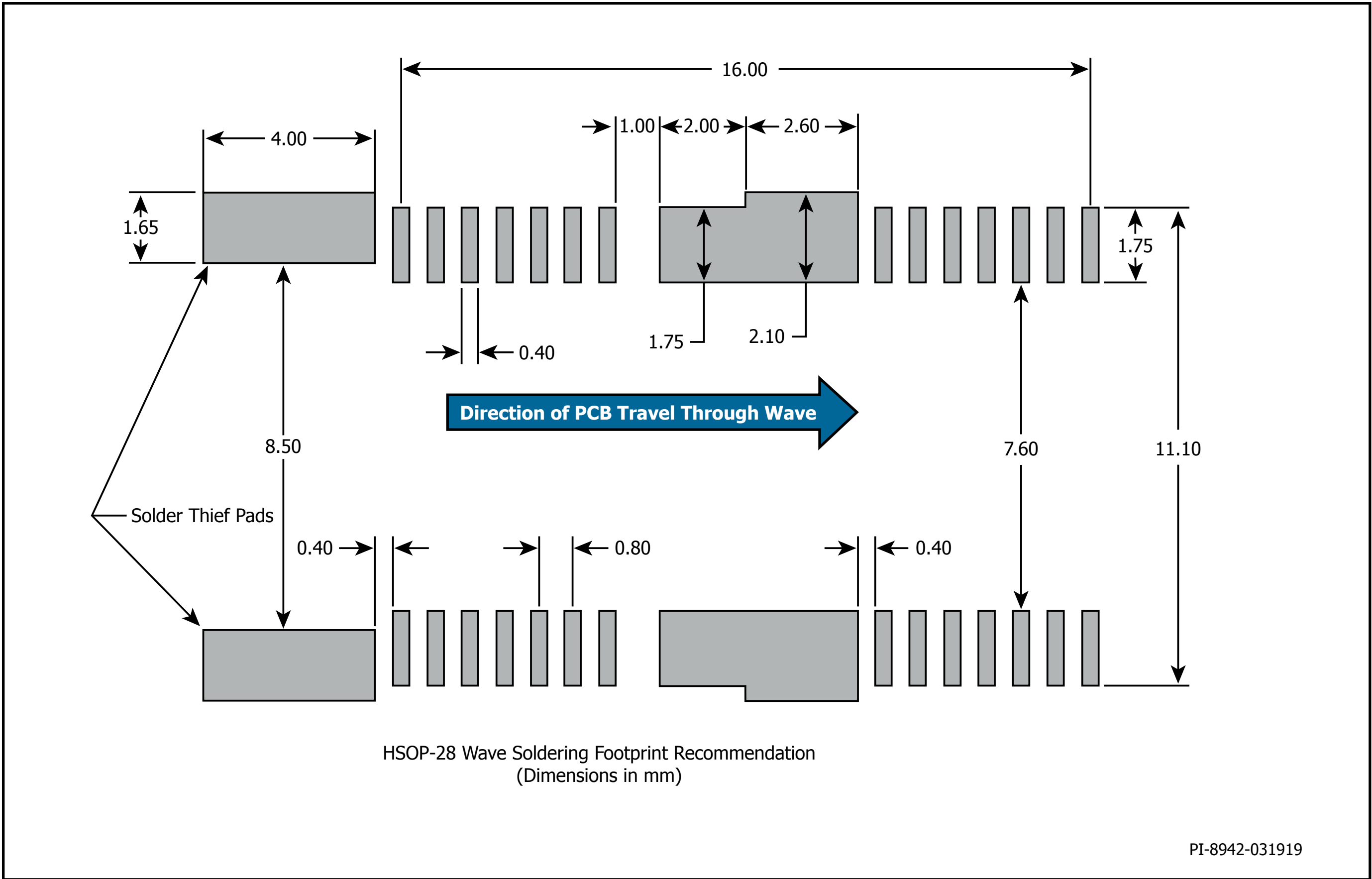
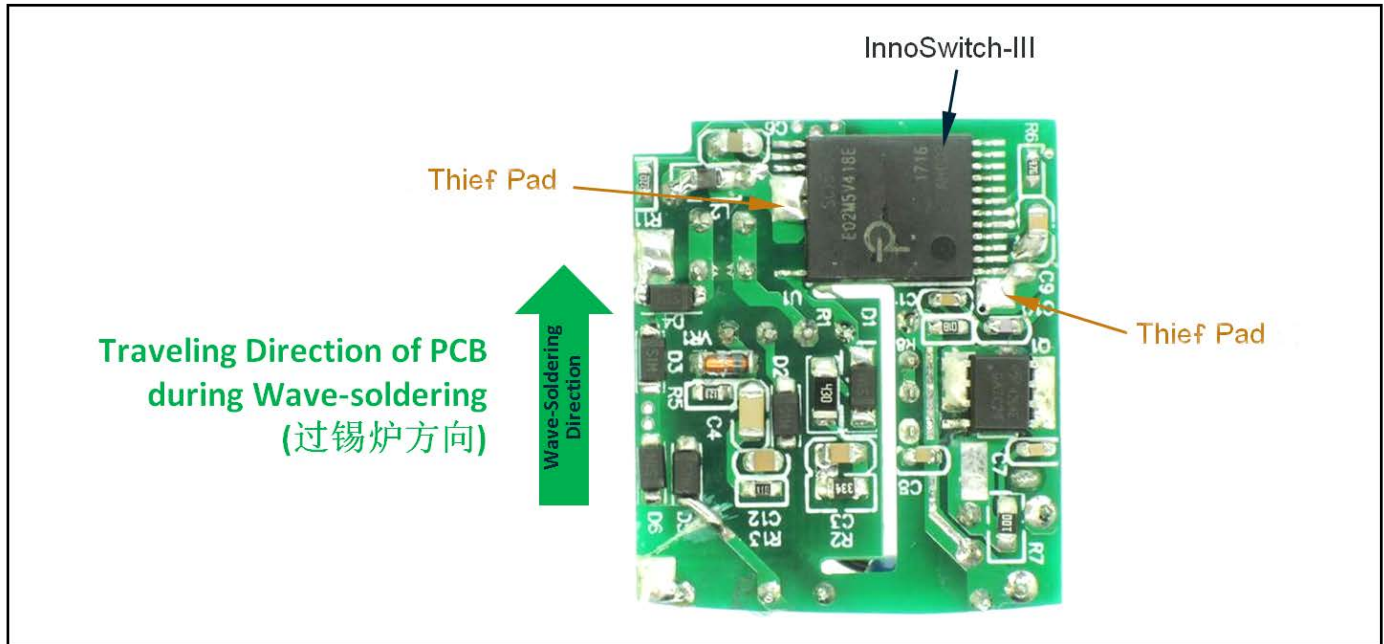


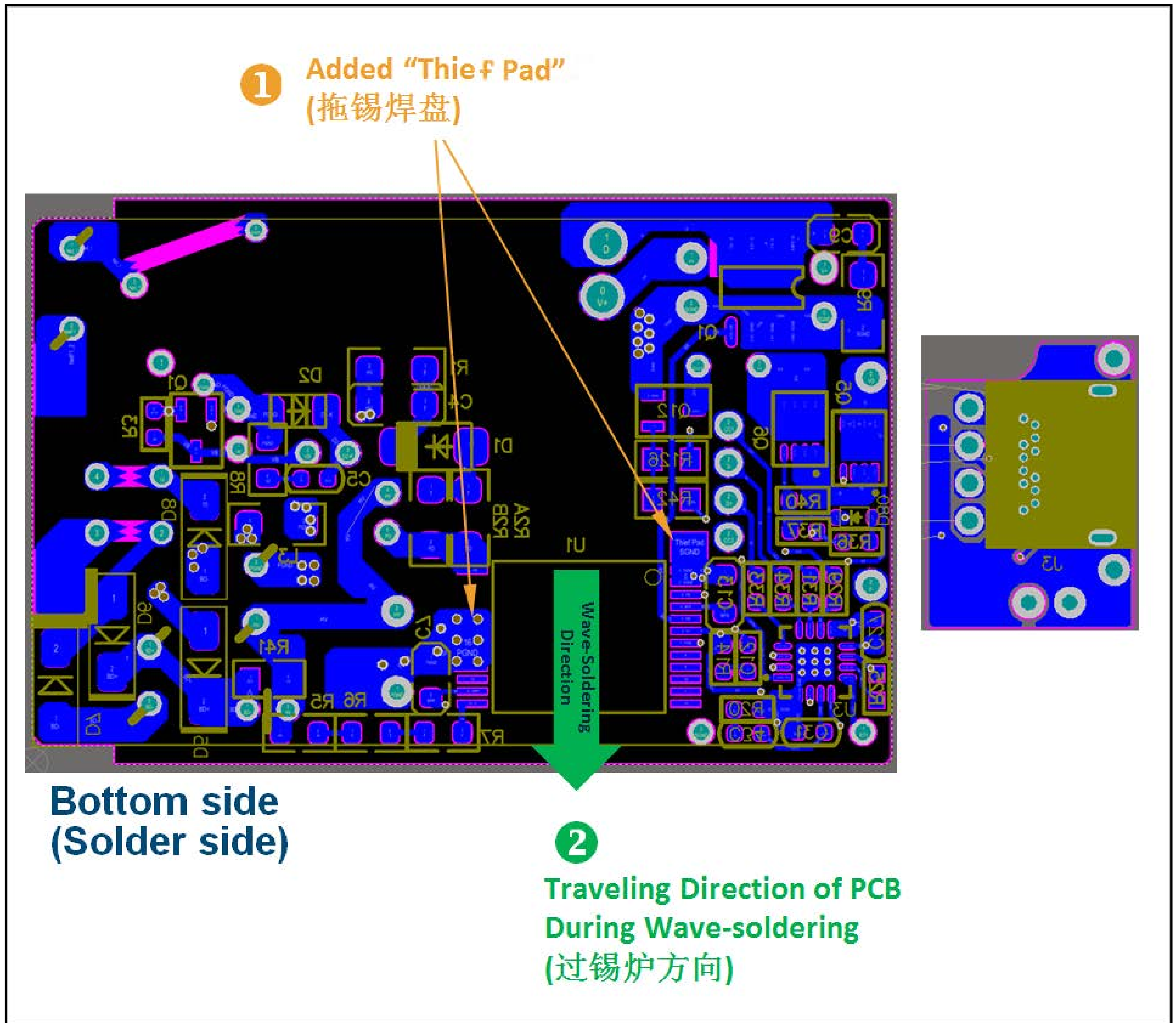
Figure 4. HSOP-28 Wave Soldering Footprint Recommendation.

InSOP-24 Design Examples

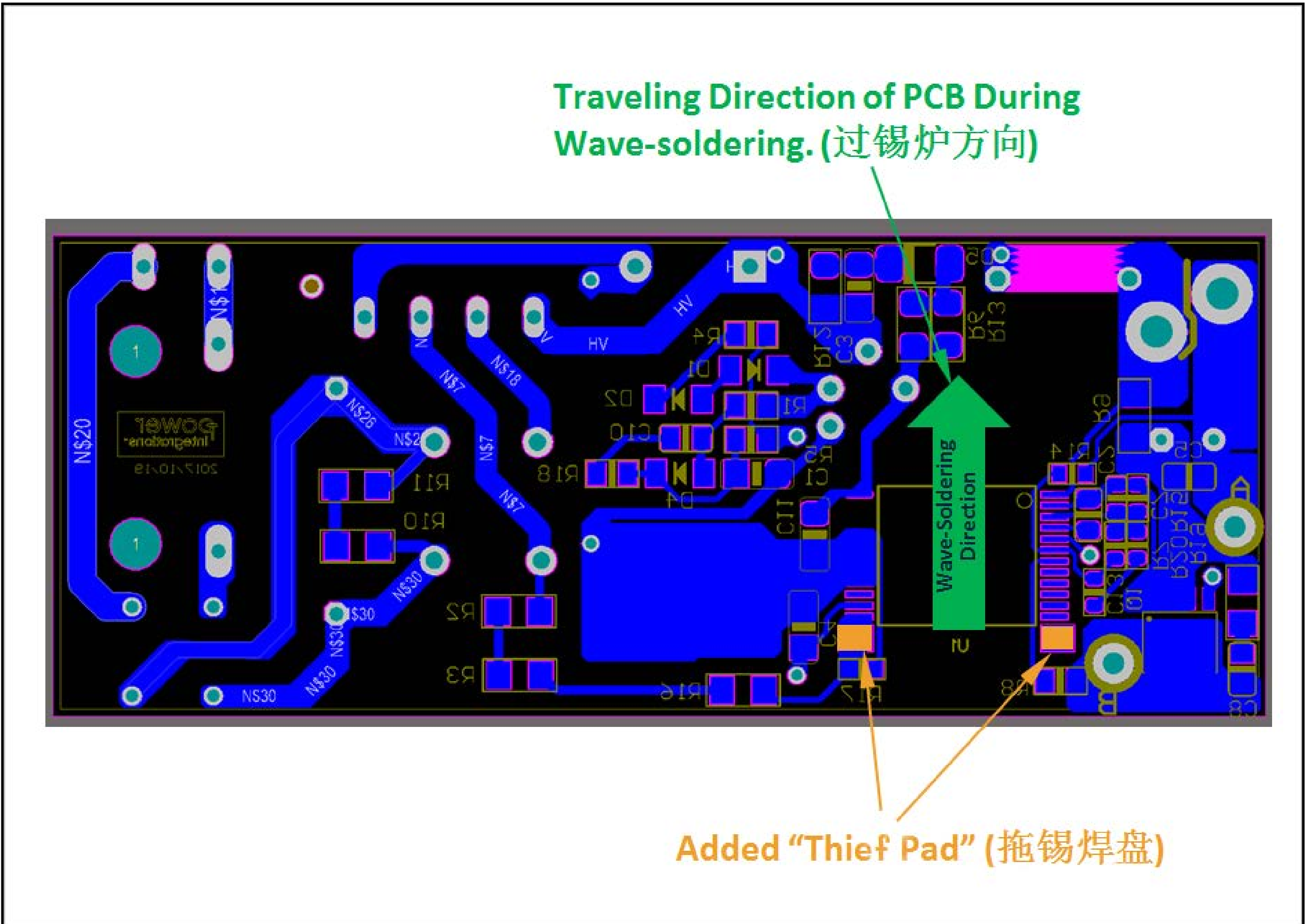
A. 10 W, 5 V / 2 A Design



B. 27 W USB-PD Design



C. 45 W, Single 19 V / 2.37 A Design



Notes

Revision	Notes	Date
A	Initial release.	12/18
B	Minor text changes and new Figure 4 added.	03/19
C	Package identifiers clarified throughout document.	03/23

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