

DESIGN GUIDELINES

Introduction

TDK’s μPOL[®] range uses standardized packages to simplify application design. For each package series, this guideline provides recommendations on the design of the solder mask, copper pads and tracks, and solder stencil.

Packages are identified by area and footprint. So, for example, the P11F1 series is used for products with an area of approximately 11mm², with F1 identifying the first footprint in this series.

Each package is used by one or more products:

Package Code	Product Code
P11F1 series	FS1403; FS1404; FS1406 FS1703
P24F1 series	FS1412

All dimensions in this guideline are in mm.



P11F1 series

Package description

P11F1 series μ POL[®] products are designed for use with standard surface-mount technology (SMT) population techniques. They have a positive (raised) footprint (Figure 1), with the pads being higher than the surrounding substrate. The finish on the pads is ENIG (Electroless Nickel Immersion Gold), superseded by ENEPIG (Electroless Nickel Electroless Palladium Immersion Gold) on later devices.

As a result of these properties, the package works extremely well in lead-free environments. The surface wets easily and the positive footprint accommodates processing variations.

Board layout

Note: Variations on the suggested PCB design may be applied, depending on application and capabilities.

Solder mask

Non-solder-mask-defined pads are recommended for this package.

In the design shown in Figure 2, the copper pads are 25 μ m larger on each side than the device footprint pads. The solder-mask openings are generally 75 μ m larger on each side than the copper pads; however, those marked with an 'A' are only 50 μ m larger.

Copper pads and tracks

PV_{IN} has been created as a single copper pad connected to all of the PV_{IN} device pads as shown in Figure 3. The main reason is to avoid using a

combination of non-solder-mask-defined and solder-mask-defined pads, which can result in problems if positional tolerances are large.

For best results, the large PGnd and the adjacent large PV_{IN}^{*} pad are connected through to the inner layers of the PCB using filled-via technology, μ Via technology or intrusive reflow technology. Using the PCB to dissipate the thermal energy from the device is extremely effective.

* Effective thermal use of PV_{IN} requires the PV_{IN} pad to be connected to one or more of the inner layers.

Note: V_{SW} should be connected to an isolated pad on the PCB.

Solder stencil

The design shown in Figure 4 is based on a stencil thickness of 0.100mm; it should also work adequately for a thickness of 0.125mm.

As many factors affect soldering performance, experimentation with solder volume may be required to achieve perfect results.

Flux residues

No-clean flux systems

The P11F1 series is compatible with all no-clean flux systems.

Cleanable flux systems

During some processes used to clean flux residues from PCBs, the outer coating of the inductor terminals on the P11F1 series has been observed to peel. Checking the compatibility of any such cleaning process before manufacturing starts is strongly advised.

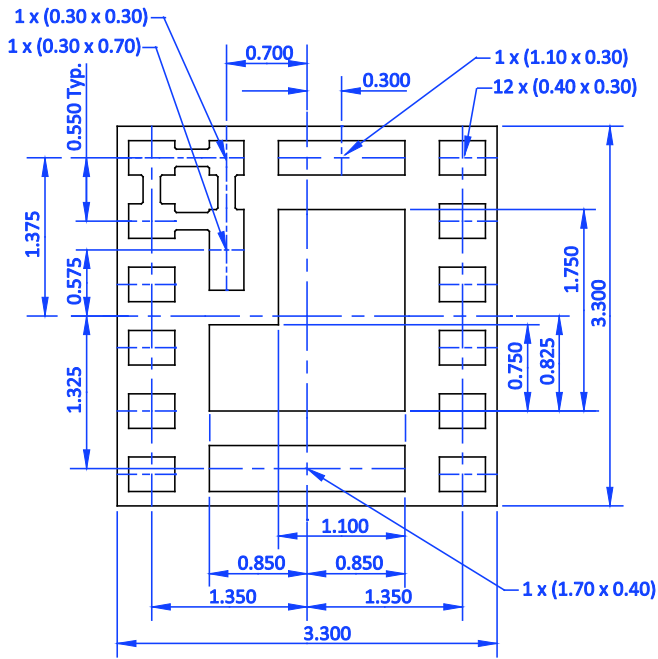
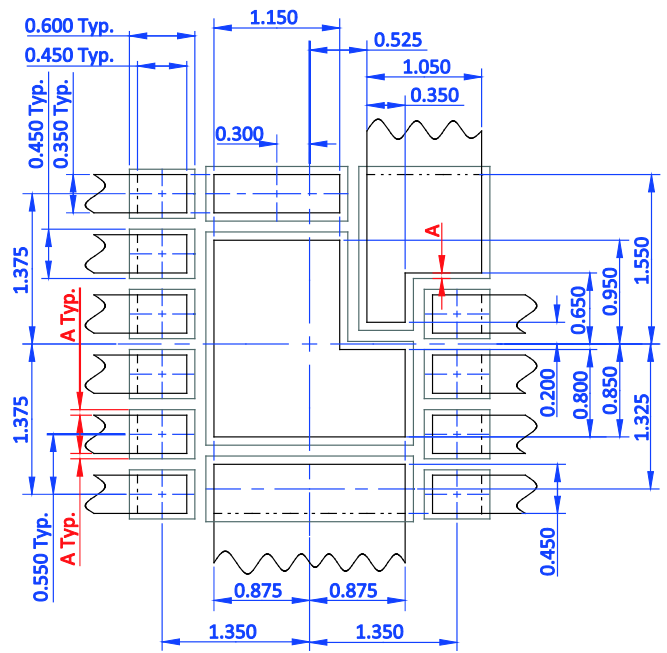
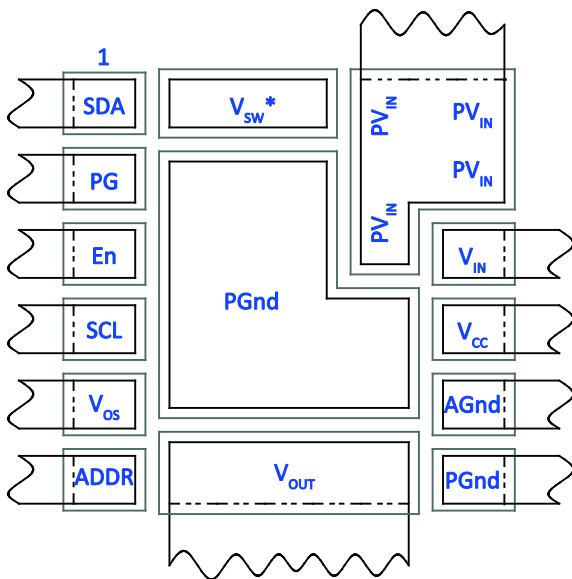


Figure 1 Package footprint (bottom view)



Copper pads are 25 μ m larger on each side than device footprint pads. Solder-mask openings are 75 μ m larger on each side than copper pads (50 μ m where marked 'A').

Figure 2 PCB layout



* V_{SW} should be connected to an isolated pad on the PCB.

Figure 3 Copper pads and tracks

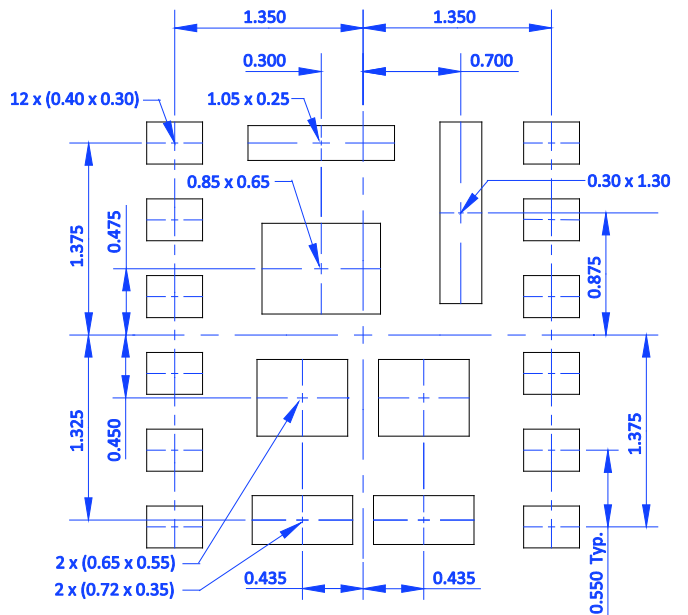


Figure 4 Solder stencil

Pick-and-place cycle

Center of mass

The pick point for the P11F1 series may be either the geometric center of the inductor or the center of mass of the package. Figure 5 and Figure 6 show the location of the center of mass.

Note: Position accurate to $\pm 50\mu\text{m}$.

Consistent results, without pick-and-place failures, have been achieved in assembly trials using the center of the inductor as the pick point and a round pick-up tool with an outside diameter of 2 mm. While the round pick-up tool used in the trials was adequate, a rectangular pick-up tool would be ideal for the package geometry.

Self-alignment

In the assembly trials, devices were deliberately misplaced on the X-Y axis and rotated. Even when misplaced by $200\mu\text{m}$ and rotated by up to 5° , the devices demonstrated excellent self-alignment properties.

Side 1 placement

If required, the P11F1 series can be placed on the first side of the PCB. In the assembly trials, no movement of the package, or of the passive components within it, was detected between the first and second reflow processes. Devices remained in place during the second reflow process without any adhesive. The surface tension of the molten solder is sufficient to hold in place the very low mass of the package ($49\text{ mg} \pm 5\%$).

Note: The trials also included tests with adhesive (information is available on request).

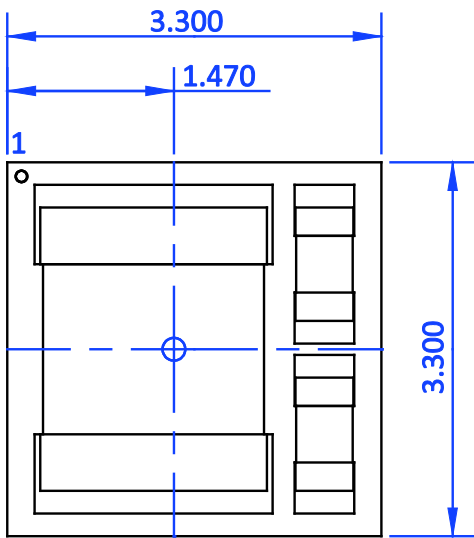


Figure 5 Center of mass (top view)

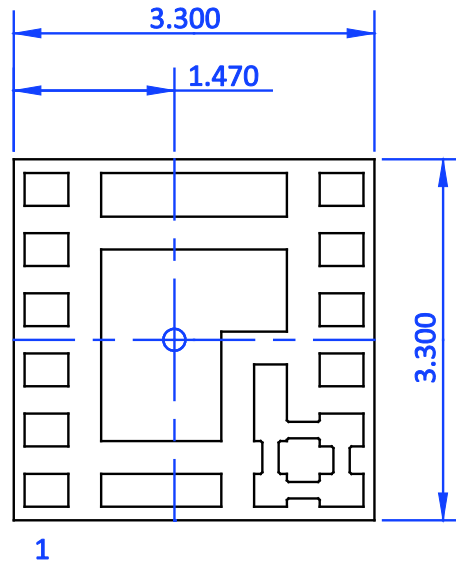


Figure 6 Center of mass (bottom view)

P24F1 series

Package description

P24F1 series μ POL[®] products are designed for use with standard surface-mount technology (SMT) population techniques. They have a positive (raised) footprint (Figure 7), with the pads being higher than the surrounding substrate. The finish on the pads is ENEPIG (Electroless Nickel Electroless Palladium Immersion Gold).

As a result of these properties, the package works extremely well in lead-free environments. The surface wets easily and the positive footprint accommodates processing variations.

Board layout

Solder mask

Non-solder-mask-defined pads are recommended for this package.

Copper pads and tracks

The copper layer of the board has been biased by 25 μ m on each side. The copper area should ideally be the same size or just little larger than the device footprint on the top surface. The solder mask should not extend onto the copper surface under the device footprint.

For best results, the large PGnd and the adjacent large PV_{IN}^{*} pad are connected through to the inner layers of the PCB using filled-via technology, μ Via technology or intrusive reflow technology. Using the PCB to dissipate the thermal energy from the device is extremely effective.

* Effective thermal use of PV_{IN} requires the PV_{IN} pad to be connected to one or more of the inner layers.

Note: CB is usually connected to an isolated pad on the PCB. However, if extra capacitance is required, this connection may be extended and extra capacitors connected between CB and V_{SW1}.

The smaller PV_{IN} pad is not electrically connected to the device internally.

Solder stencil

The design shown in Figure 10 is based on a stencil thickness of 0.100mm; it should also work adequately for a thickness of 0.125mm.

As many factors affect soldering performance, experimentation with solder volume may be required to achieve perfect results.

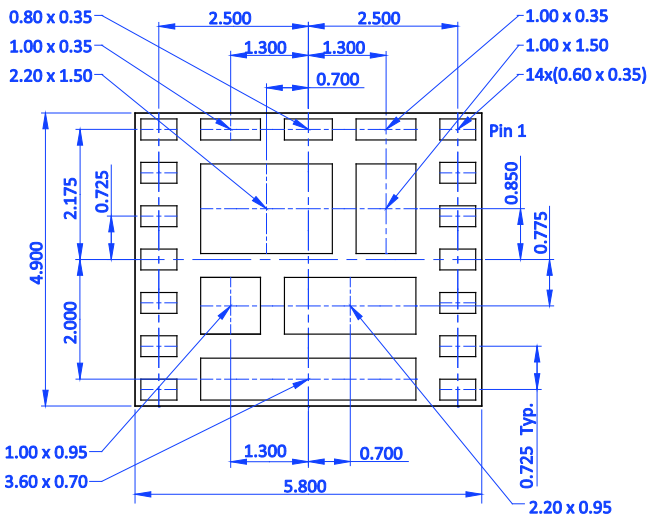


Figure 7 Package footprint (bottom view)

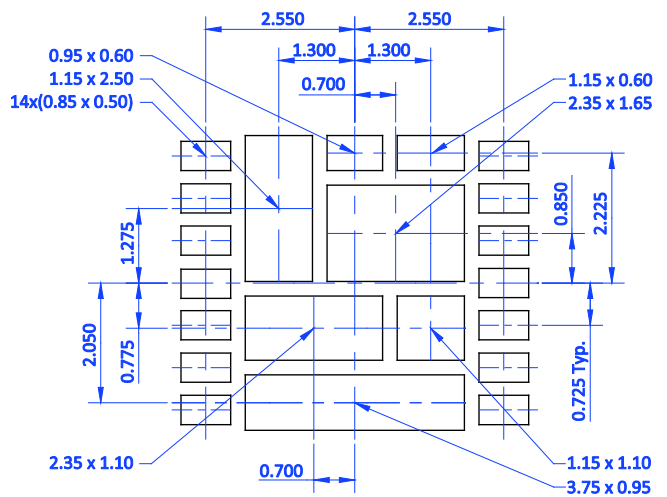
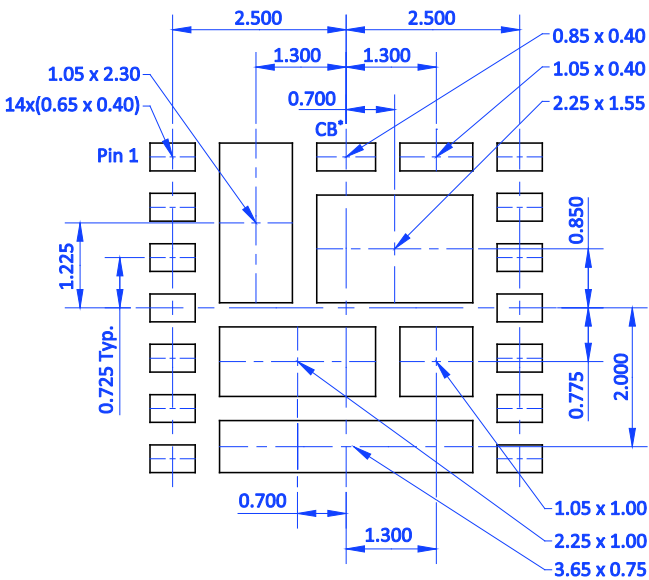


Figure 8 Solder mask



* The CB pad is usually connected to an isolated pad on the PCB. However, if extra capacitance is required, this connection may be extended and extra capacitors connected between CB and V_{SW1} .

Figure 9 Copper pads and tracks

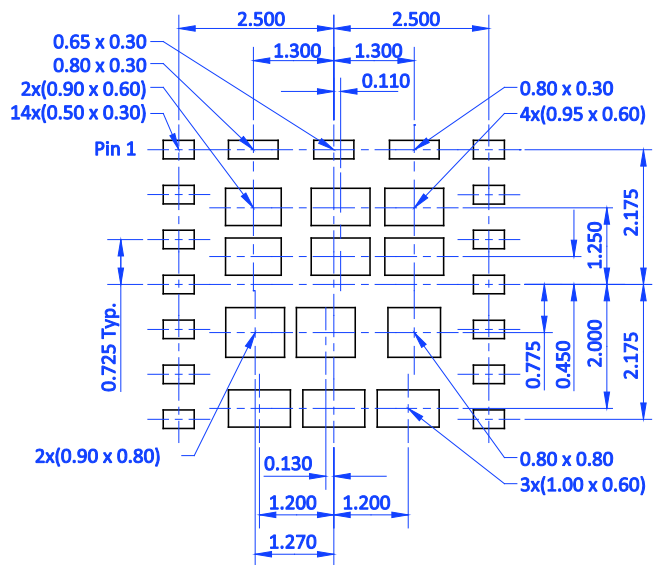


Figure 10 Solder stencil

REMINDERS FOR USING THESE PRODUCTS

Before using these products, be sure to request the delivery specifications.

SAFETY REMINDERS

Please pay sufficient attention to the warnings for safe designing when using these products.

REMINDER

The products listed on this specification sheet are intended for use in general electric equipment (AV equipment, telecommunication equipment, home appliances, amusement equipment, computer equipment, personal equipment, office equipment, measurement equipment, industrial robots) under a normal condition and use condition.

The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require a more stringent level of safety or reliability, or whose failure, malfunction or trouble could cause serious damage to sociality, person or property. Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below or for any other use exceeding the range or conditions set forth in this specification sheet.

1. Aerospace/Aviation equipment
2. Transportation equipment (cars, electric trains, ships, etc.)
3. Medical equipment
4. Power-generation control equipment
5. Atomic energy related equipment
6. Seabed equipment
7. Transportation control equipment
8. Public Information-processing equipment
9. Military equipment
10. Electric heating apparatus, burning equipment
11. Disaster prevention/crime prevention equipment
12. Safety equipment
13. Other applications that are not considered general-purpose applications

When using this product in general-purpose application, you are kindly requested to take into consideration securing protection circuit/ equipment or providing backup circuits, etc., to ensure higher safety.

Some μPOL® products are subject to a license from Power One, Inc. related to digital power technology patents owned by Power One, Inc. Power One, Inc. technology is protected by patents including:

AU 3287379M 3287437AA 3290643AA 3291357AA

CN 10371856C 10452610C 10458656C 10459360C 10465848C 1069332A 11124619A 11346682A 1685299A 1685459A 1685582A 1685583A 1698023A 1802619A

EP 1561156A1 1561268A2 1576710A1 1576711A1 1604254A4 1604264A4 1714369A2 1745536A4 1769382A4 1899789A2 1984801A2

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WO 04044718A1 04045042A3 04045042C1 04062061A1 04062062A1 04070780A3 04084390A3 04084391A3 05079227A3 05081771A3 06019569A3 2007001584A3 2007094935A3