TABLE OF CONTENTS

TEXTS MARKED WITH i CONSTITUTE IMPORTANT HINTS – MAKE SURE TO READ

NOTE
All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters. Unless otherwise specified, dimensions have a tolerance of ±0.1mm and angles have a tolerance of ± 2 °. Figures and illustrations are for identification only and are not drawn to scale.

NOTE
The visualizations in this document are of a schematical nature, have been adjusted for their respective purposes, and may not be to scale. For exact product representations please refer to product drawings and CAD models, which can be found on our website (www.te.com) or requested from TE directly.

1. INTRODUCTION

This specification covers the requirements for application of Power Element SMD and Power Element with massive press-fit zone.

Used for an electrical signal and power connection in combination with printed boards and cable.

The Power Element with a massive press-fit zone is available:

M3 M4 M5 M6 M8 M10 M12.

As a One-part and two-part.

With Male thread, female tread, right angle female tread.

Full pin population, circular pin population, two row pin population.

The Power Element for SMD soldering technology is available:

M3 M4 M5 M6 M8 M10.

Male thread, female thread, female through-hole tread.

With or without centering pins.

For the Power Element with massive press-fit zone a twist and contact protection for male thread is available.

Specially designed for placement on the Power Element pins.

To avoid short circuits to adjacent components.

To enable smaller distances between adjacent Power Element.

NOTE
Intended use of Power Element is internal wiring inside a protecting housing.

NOTE
Power Element is intended to be applied solely with suitable cable lug

When corresponding with personnel, use the terminology provided in this specification to facilitate inquiries for information.

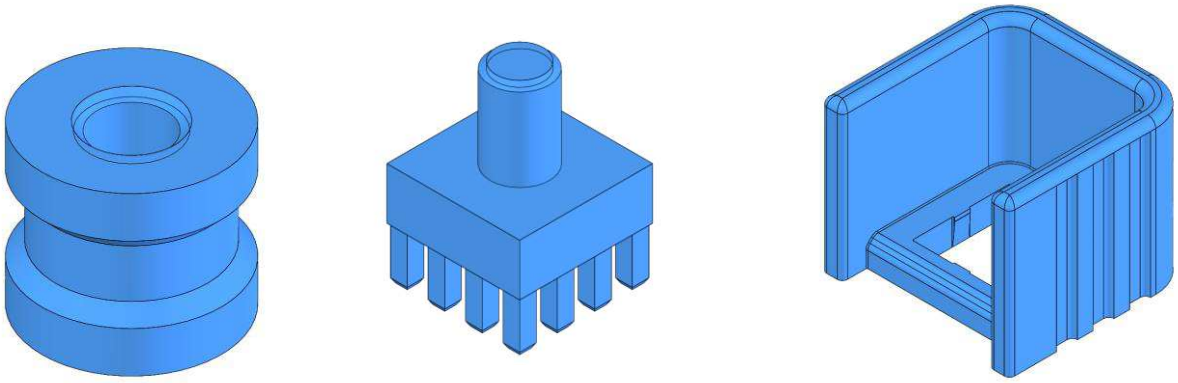


Figure 1

Power Element female tread SMD 225859-E *Power Element male tread Pressfit 225676-E* *Power Element protection 225859-E*

2. REFERENCE MATERIAL

2.1. Revision Summary

Initial release of application specification.

2.2. Terms and Abbreviations

TERMS

Male Thread	according to DIN 13
Female Thread	according to DIN 13
pin number	number of the pin to be connected with the PCB holes.

ABBREVIATION

SMD	Surface Mount Device

2.3. Customer Assistance

Reference products with part numbers 225859-E and 225676-E are representative of Power Element.

Use of these numbers will identify the product line and help you to obtain product and tooling information when visiting www.te.com.

2.4. Drawings

Customer drawings for product part numbers are available: download from www.te.com.

Information contained in the customer drawing takes priority.

2.5. TE Specifications

108-161211	Product Specification, provides product performance and test results (upon availability)

107-161211	Product packaging specification (upon availability)
501-1106_IND	Qualification Test Report (upon availability).

2.6. Standards References

IPC/WHMA-A-620 [formerly IPC-A-620]
Requirements and Acceptance of Cable and Wire Harness Assemblies

DIN EN IEC 60352-5
Lötfreie Verbindungen - Teil 5: Einpressverbindungen - Allgemeine Anforderungen, Prüfverfahren und Anwendungshinweise (IEC 60352-5) Deutsche Fassung EN IEC 60352-5
[Solderless connections - Part 5: Pressin connections - General requirements, test methods and practical guidance]

3. REQUIREMENTS

3.1. Storage

A. Ultraviolet Light

Prolonged exposure to ultraviolet light may deteriorate the chemical composition used in the product material.

B. Shelf Life

The product should remain in the shipping containers until ready for use to prevent deformation to components. The product should be used on a first in, first out basis to avoid storage contamination that could adversely affect performance.

C. Mechanical appearance

Before using the product check if the Power Element is free of any damages.

3.2. Wire Selection and Preparation

In general, the Power Element accept cables with cable lug.

NOTE
For suitability of other cable types get in contact with TE Connectivity.

The cable lug must be clean and free of contaminates, such as dust or other substances that can influence the connection.

The cable lug assembled with the Power Element is like this:

Figure 2

NOTE
The above illustrations display cable lug with a Power Element.

3.3. Printed circuit board for Power Element with a Massive Press-fit zone, SMD, soldering.

ERNI Power Elements are designed for very high current-carrying capacities. This means it is crucial that the Power Elements are only applied in combination with printed circuit boards that feature wide conductor tracks or wide-spread copper arrangements. No narrow conductor tracks may run through the area of the via sleeves. It is recommended to use multi-layer printed circuit boards with thick copper layers. In order to achieve the highest current carrying capabilities. Moreover, care should be taken to ensure that the via sleeves in the printed circuit board have a copper thickness of 25 µm to 60 µm. The copper thickness should usually be 35 µm. Ensures that the printed circuit board structure is sufficiently stable for mounting Power Elements.

The printed circuit boards should preferably be made of FR4 base materials. Other base materials and/or other fillers should undergo sufficient testing prior to their application. The printed circuit board should be at least 2 mm thick.

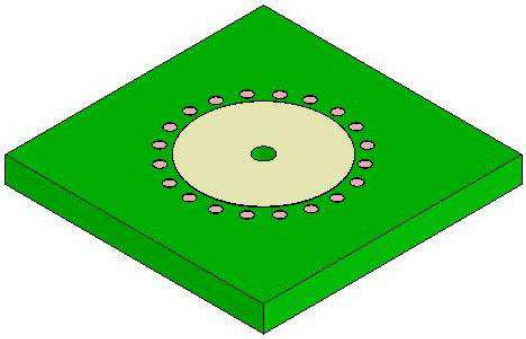
Soldering ovens with inert gas (nitrogen) are strongly recommended for soldering SMD Power Elements. This minimizes oxidation during the soldering process, which improves wetting and thereby helps to ensure more homogenous solder joints.

The soldering parameters and the solder paste should be selected so that as few as possible voids occur within the solder joints. This is necessary to achieve sufficient shear strength and low electrical and thermal resistance.

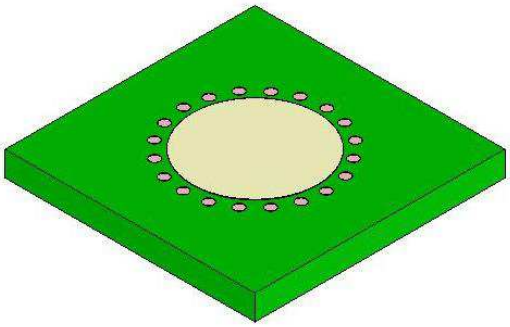
The soldering profile should correspond to the standard requirements stipulated in IPC/JEDEC-STD-020.

- The pad diameter (soldering surface) should typically be 0.5mm larger than the diameter of the Power Element.
- Vias around the pad ensure greater current-carrying capacity.
- Recommended solder paste thickness: 150 µm
- The solder paste should only be applied to approximately 50 percent of the soldering surface. Otherwise the electrical and thermal resistance between Power Element and pad might be too high for the application.

A greater number of vias positively influences the current-carrying capacity. Hence, we recommend providing a sufficient amount of vias already during the design phase.



PCB layout for SMD
Power Elements with peg



PCB layout for SMD
Power Elements without peg

PCB

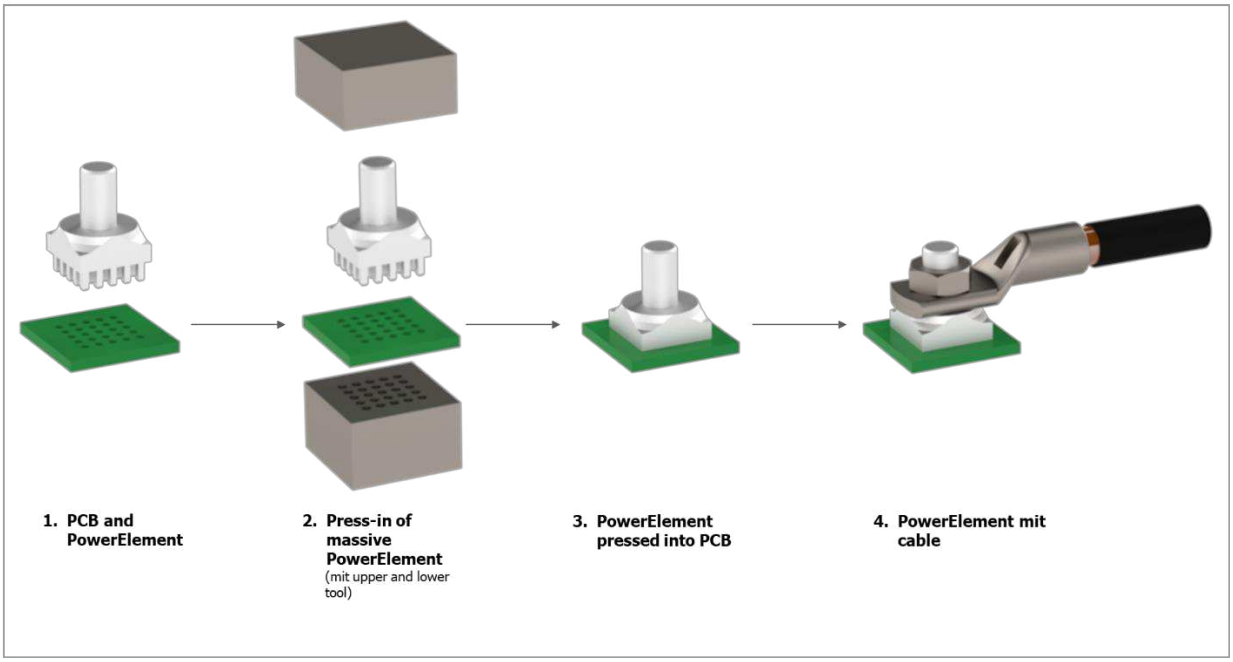
layout for SMD Power Elements

Once a pressing cycle has started, it shall not be interrupted.

A. Assembly Press-fit Power Elements

For the press-fit process a suitable press and suitable tools (upper and lower supporting tools) are required. The upper tools must be designed in such a way that the flat surfaces serve as supports; male threads are not suitable as supports and should be recessed with suitable drill holes. Flat punches are suitable for mounting Power Elements with a flat surface on the top, such as Power Elements with a female thread. The press-fit base (PFB) should consist of a stable support plate that features drill holes that are as narrow as possible at the positions that correspond to the press-fit pins. The drill holes need to be adapted to the respective press-fit pins and should have a diameter that is 0.1mm greater than the pin diagonal.
(Example: press-fit pin edge length: 1.1 x 1.1 mm, press-fit pin diagonal: 1.6mm.

Drill hole in the PFB: 1.7 mm.)



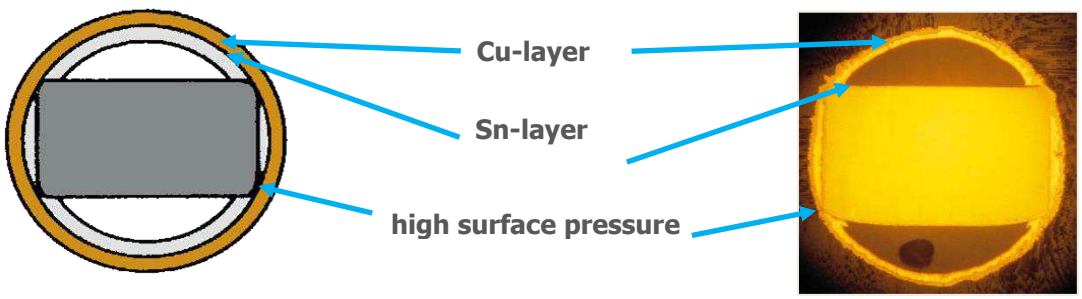
Press-in of massive Power Elements

Using a correct press-fit base (PFB) greatly restricts the 'jet effect' (see explanation further below), since this partially supports printed circuit board sleeves during mounting.

The Power Element press-fit pins penetrate the printed circuit board's copper sleeves during assembly at the four edges of the square cross section and can also partially penetrate the printed circuit board.

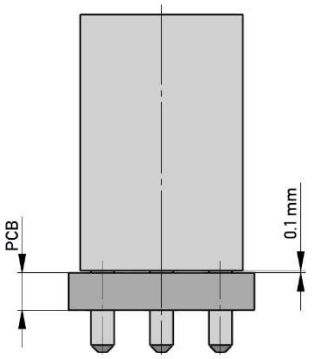
This means that the maximum conductor pattern deformation of 50 µm stipulated by IEC 60352-5 Section 5.2.2.5 cannot be ensured in every case for Power Elements (IPC-A-610 Class 3 not possible).

For reliable electrical connection, at least 75 percent of the edges should contact the copper sleeve.



Contacting Power Element in PCB hole.

During the press-fit process one-part Power Elements should be positioned at a distance of 0.1 (-0.1) mm from the printed circuit board surface. The press in speed is 100-250mm/min.



Press-in conditions: distance between Power Element and PCB surface.

The high force during the press-fit process in conjunction with the massive press-fit pins can generate a so-called ‘jet effect’. This means that the copper on the via sleeve is displaced and its functional connection faces are slightly lifted from the printed circuit board (lifted pads). The conductor connections must not be separated from the through-hole plating sleeve.

During the press-fit process for the massive pins, the via sleeve as well as parts of the FR4 base material are slightly deformed. Delamination may occur in the base material. However, this does not detrimentally affect quality or reliability, since all of the Power Element pins have the same electrical potential.

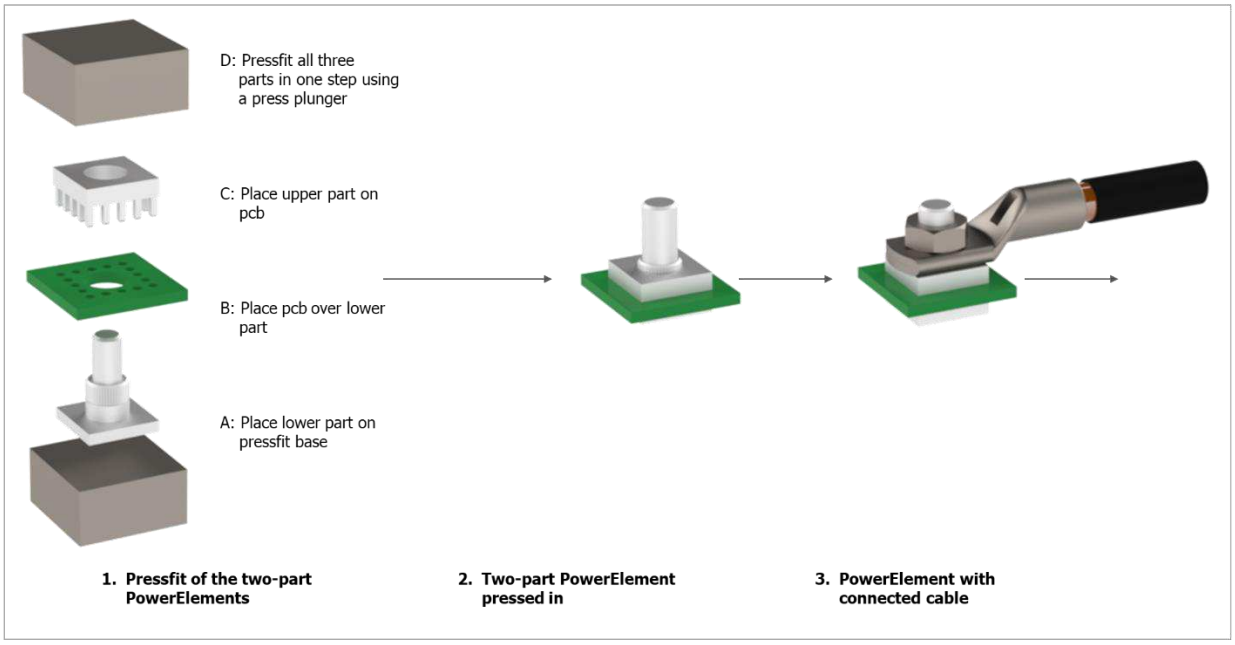
The pins can scrape off material when pressed in and thus generate chips and flakes. If this chip formation in the application is to be classified as critical for neighbor electronics, appropriate measures should be taken to remove or fix the chips or abrasion. To achieve technical cleanliness, subsequent cleaning or varnishing is recommended.

Various qualification tests were carried out to confirm the quality and reliability of the press-fit connections of Power Elements.

B. Assembly Press-fit Power Elements 2-part Elements

Two-part Power Elements are pressed into the printed circuit board from both sides. The support surfaces on either side protect the printed circuit board against mechanical strains during assembly in the installation space. Moreover, a far lower height is required when using two-part Power Elements.

Two-part Power Elements must be pressed “on block” using a force limit switch; that means the pins on the upper component must touch the top of the bottom component.



Press-in of two-part Power Elements

3.4. Installation of cables and other components

For screw connections between cable lugs, components, or other coupling elements with the Power Elements, the following considerations need to be considered:

- The component that needs to be screwed must have plane-parallel surfaces.
- The Power Elements and the components that need to be screwed must be free from oils, fats, or other lubricants.
- Maximum tightening torques for Power Elements must be considered.:

A. Maximum tightening torques for Power Elements

Thread	Tightening Torque
M3	0,5 Nm
M4	1,2 Nm
M5	2,2 Nm
M6	3,9 Nm
M8	9,0 Nm
M10	17,0 Nm
M12	35,0 Nm

Tolerance ranges for tightening torques: +0 / -20 %

- During fastening, only torques are to be applied to the screwing elements; additional bending forces, e.g. Due to unilaterally acting spring washers, are to be avoided. To decouple bending forces on screwing tools, flexible shafts or universal joints inserted between hand lever and screw drive, for example, are suitable.
- Only shear forces may act on the press-fit pins during screwing; forces along the press-fit direction of the pins must be avoided. In the case of Power Elements with thread or through-hole at right angles to the press-fit direction (for examples, see the following figure), the Power Elements must be held in place, e.g., by holding them with an open-ended wrench.

B. Inspections after Processing

The requirements are to be ensured by suitable variable and attributive tests/inspections:

— SMD quality
— Position of the Pin to the PCB
— PCB integrity
— Cable position
— Complete engagement
— Dimensions of Power Element
— Integrity of the cable
— Continuity

1. Visual Inspection: Power Element / Cable / Cable lug / PCB

All pins in the PCB must be visible on the opposite side and must not be damaged.

2. Electrical Inspection (Electrical Test)

Must be defined by customer.

3.5. Replacement and Repair

The Power Elements with massive press-fit zone are not designed to be repaired.

A soldering process after assembly is not allowed.

Attempts to repair defective products must not be undertaken. A cable can only be connected once at a certain location.

4. TOOLING

A I APPROVED TOOL FOR PRESS-FIT ZONE TYPE

Id.-No.:	Upper Tool	Lower Tool
225675-E	230287-E	230293-E
225676-E	230288-E	230294-E
225677-E	230289-E	230294-E
225678-E	230290-E	230295-E
225679-E	230291-E	230295-E
225680-E	230292-E	230296-E
225681-E	230298-E	230293-E
225682-E	230300-E	230294-E
225683-E	230302-E	230294-E
225684-E	230303-E	230295-E
225685-E	230305-E	230295-E
225686-E	230306-E	230296-E
225687-E	230297-E	230293-E
225688-E	230299-E	230294-E
225689-E	230301-E	230294-E
225690-E	230304-E	230295-E
225691-E	230305-E	230295-E
225692-E	230306-E	230296-E
225693-E	230298-E	230293-E
225694-E	230300-E	230294-E
225695-E	230302-E	230294-E
225696-E	230304-E	230295-E
225699-E	230307-E	230293-E
225700-E	230308-E	230294-E
225701-E	230308-E	230294-E
225702-E	230309-E	230295-E
225703-E	230309-E	230295-E
225706-E	230308-E	230294-E
225711-E	230307-E	230293-E
225712-E	230308-E	230294-E
225713-E	230308-E	230294-E
225714-E	230309-E	230295-E
225715-E	230309-E	230295-E
554009-E	230300-E	230294-E

A II TOOLS FROM TE CONNECTIVITY

Use of these numbers will identify the tooling when visiting www.te.com .