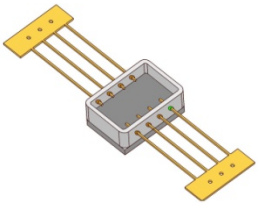
Technotron GmbH
Hermetic Packaging Design Guide

PACKAGE TYPES

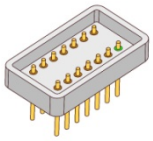
Flatpacks
A flatpack is a type of package in which the leads are in a plane which is parallel to the substrate mounting surface. Side entry packages range in size from 6 x 6mm to 100 x 100mm.
Flatpacks usually have a wall thickness of 1,00mm or thicker (2,00mm), and are usually rectangular or square. They are grouped into three general categories: One-piece or Two-piece.

One-piece (TT)
One-piece side entry packages are formed from one piece of metal in a process called deep drawing. The result is a part with no brazes joints. The bottom thickness normally matches the thickness of the walls but may be reduced by grinding.

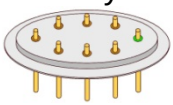


Two-piece (TR)
Two-piece side entry packages have a ring frame and a bottom which is separately stamped. The ring frame and bottom are joined together using a pure copper brazing process before sealing.
Flatpack Design Rules
Glass seal diameter = (wall thickness x 0.7) + lead width or diameter
Minimum distance from lid sealing area to glass >= 1.80mm
Minimum distance from brazing to glass >= 1.80mm
Minimum distance from corners to glass >= 0.75mm
Lead pitch = Pin matrix of 1.27mm with or without ground pins
Maximum height, One-piece = 8mm, Two-piece = 70mm

Plug-in
A plug-in is a type of package in which the leads are perpendicular to the substrate mounting surface. Solid side wall packages range in size from 6 x 6mm to 100 x 100mm.
Plug-ins usually have a wall thickness of 1,00mm or thicker (2,00mm), and are usually rectangular, square or round.
Plug-ins are grouped into one of three general categories: Standard or Flat.



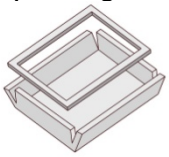
Standard (TT)
Standard solid side wall packages are formed from one piece of metal in a process called deep drawing. The result is a body with no brazes joints.

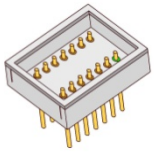


Flat (TB)
Flat plug-in packages are formed using a process called coining. The coining process is capable of producing a thin flange or projection weld for welding.

Plug-in Design Rules
Glass seal diameter = (wall thickness x 0.7) + lead width or diameter
Minimum distance from corners to glass >= 0.75mm
Lead pitch = Pin matrix of 1.27mm with or without ground pins
Maximum height = 8mm

Folded Packages
Technotron patented folding technology allows fast tooling free production of Flatpacks and Plug-in type packages. Folded parts usually have a thickness of 1mm.

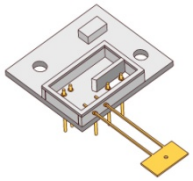




Standard (TS)
Standard packages are formed from one piece of metal folded to form a package and the sealing surface is finished with a welding frame. Any dimension, from 14,70mm to 80,74mm in width and length can be offered without tooling.

Folded Package Design Rules
Glass seal diameter = (wall thickness x 0.7) + lead width or diameter
Minimum distance from lid sealing area to glass >= 1.80mm
Minimum distance from brazing to glass >= 1.80mm
Minimum distance from corners to glass >= 0.75mm
Lead pitch = Pin matrix of 1.27mm with or without ground pins
Maximum height = 18mm

Constructed Packages
Technotron offers packages constructed from single metal parts brazed together, this allows fast tooling free production of Flatpacks, Plug-in type or Machined packages.

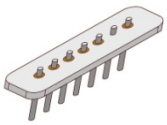


Standard (TSS)
Standard constructed packages can have and form and shape and may include different thicknesses of metal. Any dimension, from 6mm to 100mm in width and length can be offered without tooling.

Constructed Package Design Rules
Glass seal diameter = (wall thickness x 0.7) + lead width or diameter

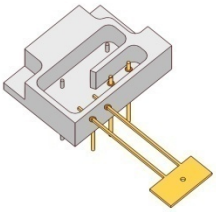
Minimum distance from lid sealing area to glass >= 1.80mm
Minimum distance from brazing to glass >= 1.80mm
Minimum distance from corners to glass >= 0.75mm
Lead pitch = Pin matrix of 1.27mm with or without ground pins
Maximum height = 70mm

Feedthroughs
Hermetic feedthroughs in various materials and designs can be produced without tooling with very short delivery times.



Multi-pin Feedthroughs (TD)
Solderable multi-pin feedthroughs can be used in large machined packages to reduce costs. Pin count and geometry can be selected to fit any application.

Single-pin Feedthroughs (TD)
Single-pin feedthroughs with specific electrical or pressure requirements can be soldered into any other packages.
Glass seal diameter = (base thickness x 0.7) + lead width or diameter
Lead pitch = Pin matrix of 1.27mm with or without ground pins



Machined Housings
Machined housings may take nearly any shape. The leads on machined housings may pass through the sidewalls or the bottom of the package or both. Machined packages have been produced with every type of lead and/or connector available.

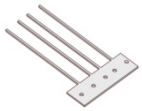
MATERIALS

Common materials
ASTM F-15 alloy is an iron-nickel-cobalt, controlled expansion alloy to assure uniform thermal expansion properties. It is the most common material used in matched seals. There are a number of other alloys such as Alloy 42 or Alloy 48 with slightly different characteristics but with the similar thermal expansion properties.
Alloy 52 is a 50/50 nickel-iron alloy developed for glass-to-metal seals. It is often used as pin material in compression seals.
CRS is plain carbon steel and is the most common non alloy used in hermetic applications. It has the advantage of a low cost material however it has poor corrosion resistance properties. It is often used in low cost compression seals.
OFC is oxygen free copper has very good heat dissipating and current capacity properties. It is not suitable for direct sealing however provides a suitable base material.

Mo30Cu is a copper (30%) molybdenum (70%) alloy good heat dissipating and current capacity properties. It is not suitable for direct sealing however provides a suitable base material.

Material	Density (g/cc)	CTE (ppm/°C)(300°C)	TC (W/m/°K)
ASTM F-15 (Kovar®)	8.30	5.0	17
Alloy 42	8.15	4.7	12
Alloy 48	8.20	8.7	16
Alloy 52	8.20	9.8	14
Copper	8.96	16.7	385
Molybdenum-Copper	9.27	7.5	183
Molybdenum	10.22	6.0	138
CRS	7.85	14.7	50
Stainless Steel	8.01	17.1	14

LEADS (I/O)



Standard leadframes
Standard leadframes are used for side entry seals. The standard leadframe consists of parallel leads connected to a common tie bar which is used for electroplating contact. The lead portion of the leadframe is 0,25mm thick and 0,38mm wide and has an overall length of either 15mm.

Special leadframes
Special leadframes may be thinner, thicker, longer or two thicknesses.

Round pins
Round pins are used for all package styles are typically 0,46mm in diameter but many other sizes are available upon request. When round pins are used in flatpacks, they usually will have one end flattened to create a bonding area.

Nailhead pins
Nailhead pins are used for plug-in type packages. Nailhead pins have a larger diameter wire bond surface formed at one end. Nailhead leads are typically 0,46mm in diameter with a nailhead of 0.90mm diameter and 0,20mm thick. As with round leads, nailhead leads are available in many sizes.

High Power Leads

Often there is a need to transmit high current signals through sealed conductors. There are many materials that are able to conduct high current but many are not suitable for glass sealing. For compression seals copper cored Alloy 52 pins are often used (1/3 copper 2/3 Alloy 52). Technotron also offers Kovar sealed tube with copper soldered feedthroughs for match seals.

	Pin diameters (Amps)						
	2.3mm	2.0mm	1.5mm	1.3mm	1.0mm	0.8mm	0.5mm
ASTM F-15 (Kovar®)	20	15	10	7	5	3.2	1.3
Alloy 52	22	16	11	8	5.5	3.5	1.5
Alloy 52-Cu Cored	31	22	16	11.2	8.2	4.5	2.5
Copper	65	51	29	20	12.5	7.2	3.2

Values given are in AMPS

Special Connectors

Technotron can create custom connectors or integrate many existing hermetic connectors.

Coaxial

IMPEDANCE FORMULA SINGLE COAX LINE 50 OHMS

$$Z = \left(\frac{138}{\sqrt{E}}\right)(log10)\left(\frac{D}{d}\right)$$

Z = IMPEDANCE

E = DIELECTRIC CONSTANT

D = HOLE DIAMETER

d = LEAD DIAMETER

Dielectric Constants of some commonly used glasses

7052 - 4.9 7070 - 4.1 9010 – 6.3 AIR = 1 (used as reference)

Pin Diameter	7052 Glass Glass Ø	7070 Glass Glass Ø	Air	9010 Glass Glass Ø
0.254/0.279	1.60	1.37	0.58	2.06
0.305	1.93	1.65	0.69	2.46
0.381	2.41	2.06	0.86	3.10
0.457	2.90	2.46	1.04	3.71
0.508	3.23	2.74	1.17	4.15

Special pins

Rounded pins
Rounded pins can be used for all package styles, but are most commonly used in combination with connectors. These pins may be rounded at either one end of the pin or at both ends.

Stepped pins
Stepped pins are pins that have a thicker diameter and then “step down” to a thinner diameter. These pins can be used on all types of packages, where a thicker diameter may be required inside the package but is not necessary externally.

Flattened pins
Flattened pins are used in flatpacks and machined packages where the leads exit through the sidewall of the housing. The flattening of the pin creates a bondable area. There are three dimensions that govern the size of a flattened end of a pin: Pin flat thickness, Pin flat width and Pin flat length. The most common way to dimension a pin flat is to specify the minimum pin flat length and minimum width which will be used as the area used for wire-bonding.

SEALS

Glass

Matched
Matched seals rely on glass and metal combinations with similar coefficients of thermal expansion to form an oxide bond that results in a hermetic seal. This design produces a stress free robust.

Compression
Compression seals rely on glass and metal combinations that due to the greater coefficient of thermal expansion of the metallic case will create a mechanical bond that provides the hermetic seal. This design is well suited when the design parameters of the final package fall outside of the matched seal glass and metal combinations.

TOLERANCES

Body
Standard tolerances on tooled bodies are as follows:
Length = ± 0,13mm
Width = ± 0,13mm
Wall thickness = ± 0,13mm
Bottom thickness = ± 0,10mm
Hole diameter = ± 0,10mm
Hole pitch = ± 0,50mm (non-accumulative)
Flatness = ± 0,05mm per 25,40mm

Leads
Standard tolerance on leads dimensions are as follows:
Flatpack external lead length = Minimum (from wall of case to near edge of tie bar)
Flatpack internal lead length = ± 0,10mm

Plug-in external lead length = ± 0,25mm
Plug-in internal lead length = ± 0,10mm
Rectangular lead width = ± 0,07mm
Rectangular lead thickness = 0,05mm
Round pin diameter =± 0,05mm

Seals
Standard glass meniscus is 0,25mm max.

BRAZE & SOLDER

Braze
Brazing is the process of joining two or more materials using a metal alloy with a lower melting point than that of the materials being joined. This is done through a heating process that can vary greatly in temperature, depending upon the materials and alloys involved.

Copper
Copper is commonly used to join a frame to a base and also to join a fiber optic tube to housing. It is most commonly used to braze materials with very similar CTE due to the temperature at which the operation is performed. Copper (99.99%) has a melting temperature of 1083° C.

Palladium/Silver/Copper
PdAgCu braze is another alloy that is available as a brazing option. It can be used to join dissimilar metals with varying CTE's, such as a Kovar frame to a Copper/Molybdenum base. Also commonly used for brazing of ground pins during sealing process.

Solder
Soldering is defined as the joining of two or more metallic components through the use of any fusible alloy. Technotron distinguishes soldering from brazing by the lower temperatures of less than 450°C for soldering. Most soldering operations are performed after all plating operations have been completed. In this way, soldering can be used to produce parts which would be difficult or impossible to plate after assembly. Gold/Tin and Lead free solders are used.