



APPLICATION NOTE

Hand Soldering Guidelines for VPT
DC-DC Converters and Accessory
Products

DC-DC CONVERTERS AND ACCESSORIES

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Introduction

VPT, Inc., a HEICO company, is dedicated to the highest level of quality. With expert, experienced personnel, state-of-the-art technology, and strict quality procedures, VPT produces reliable power supply products for the demanding environments of avionics, military, and space environments.

VPT's Hybrid Thick-film DC-DC Converters and Accessory Products are hermetically sealed to keep moisture and/or contaminants from entering the package cavity. Products of this type use a projection weld or seam weld process to create the hermetic seal between the lid and the package body. Depending on lead (pin) diameter/length and package configuration, products of this type will use either a matched or compression glass or brazed ceramic disc to create a hermetic seal between the lead and package body. This glass or ceramic seal also serves the dual purpose of electrically isolating the lead from the package body.

VPT Series Metal Packaged Hi-Rel COTS DC-DC Converters and Accessory Products are internally conformal coated and housed in a six-sided non-hermetic rugged metal enclosure to reduce moisture and contaminants from entering the package cavity. Products of this type use a non-electrically conductive isolator to create a seal between the lead and package body. This isolator also serves the dual purpose of electrically isolating the lead from the package body. These products should not be exposed to aqueous cleaning systems to avoid moisture ingress into the package that could potentially cause catastrophic failure.

VXR and VPT Series Fully Encapsulated Hi-Rel COTS DC-DC Converters and Accessory Products utilize VPT patented V-Shield® technique. This technique uses a hard epoxy fill that is more compatible with aqueous cleaning systems.

This document details the proper processes for hand soldering products into systems and applications while ensuring product safety and maintaining functional integrity. VPT welcomes inquiries into any areas not specifically covered in this document. Please contact your sales representative or the VPT Sales Department for more information.



Hand Soldering

VPT products can be mounted and connected in systems in many different configurations with various processes. The most popular and well controlled soldering method for PCB attachment is wave soldering. In many systems, however, this is not a viable option because of limiting configurations, resources, or hard wiring. This usually leaves hand soldering using a soldering iron, hot air system, or other method as the best option. Using a wave soldering or selective soldering machine process that simulates the preheating and hand soldering process described below is also a viable option.

At no time during soldering operations should any VPT product or pin be exposed more than 270°C. Additionally, at no time during soldering operations should any VPT product or pin be exposed to these high temperatures for more than 10 seconds. This can compromise the solder inside of the unit, causing internal solder joint, inducing electrical and mechanical failures, latent defects and attachment failures. VPT performs 100% external visual inspection and electrical verification testing after hand soldering operations to verify that the leads and internal components have not been damaged as part of the process. VPT recommends that all products are inspected to ensure solder process has passed industry standards and no damage occurred when performing any hand soldering process.

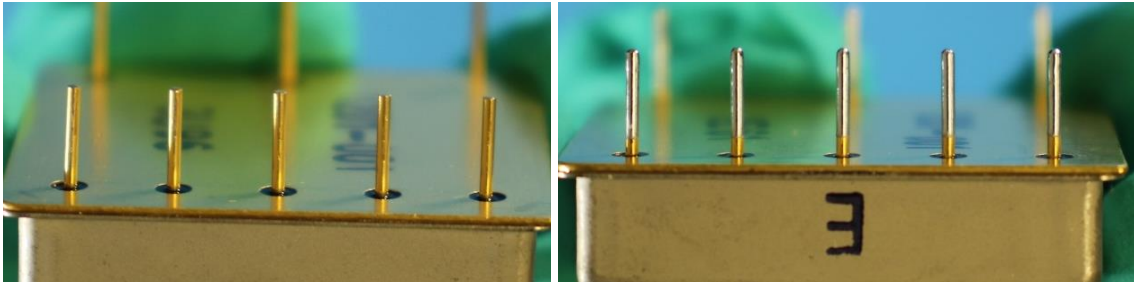
VPT recommends following these steps when hand soldering products into PCBs and systems:

Note: For mounting side leaded packages with Lead Extenders, please refer to the Soldering Lead Extenders section below first.

1. Careful insertion. Insert the unit into the PCB. Be sure to place the product straight into the mounting holes to prevent bent leads or seal damage.
2. Thermal Conductivity (Heat Sink). VPT products require a path to dissipate heat. Good contact with the base plate is required. VPT has custom cut thermal gap pads that can be used to ensure good thermal conductivity. The TP series of accessory thermal pads provide an effective method of ensuring a low thermal resistance path, good thermal performance, and excellent isolation between the DC-DC converter and the mounting plane. <https://www.vptpower.com/vpt-products/thermal-mounting-pads/> Thermal compounds can be used as well. The Hi-Rel COTS products that utilize the VPT V-Shield (VXR and VPT – W packages) can have the heat dissipated from the top or bottom.
3. Solder Dipping (Optional). If the application requires the pins to be de-golded or needs better wettability to attach into the PCB assembly, VPT products can be solder dipped.

The gold thickness of VPT product pins is provided in Appendix B. The pins should first be dipped in flux and then can be dipped in a solder pot, at a temperature of 270°C, for 5 seconds. If icicles or excess solder remains, re-dip the pins in flux and then solder for an additional 3 seconds.

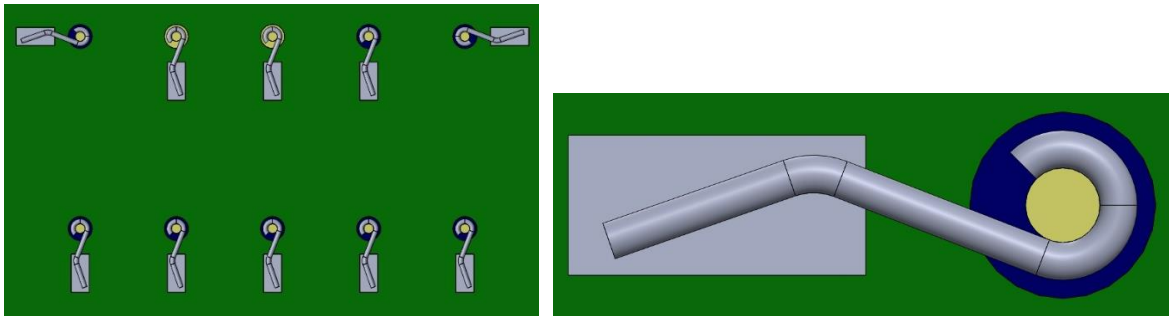
VPT products are also available with solder dipped pins. Please contact VPT Sales about such enquiries.



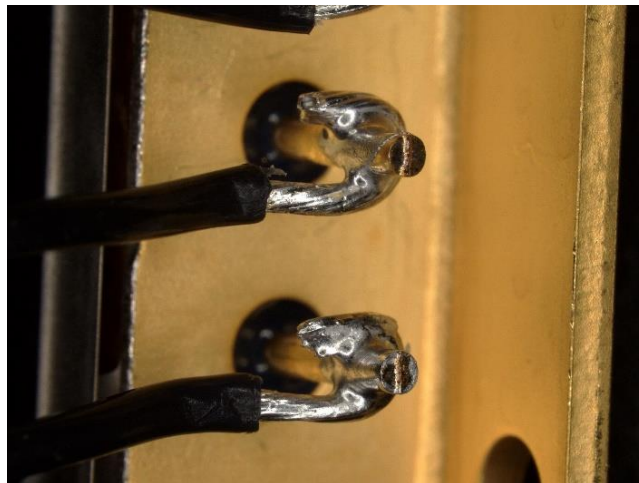
4. Pre-heating PCB Assembly. If the PCB may be too thick or have solder pads that are too large, or simply need more heat for soldering in this case the PCB assembly may need to be pre-heated before soldering to ensure that the soldering iron can achieve solder melt temperature quickly enough.
Furthermore, it is best to get the full PCB assembly (including VPT products) heated to minimize the temperature delta. Assemblies can be heated in an oven or by using a hot plate until they reach a steady state. The temperature of the oven/hot plate is limited by either the storage temperature of the VPT products or the temperature limitation of the rest of the PCB assembly. The storage temperatures for VPT products are as follows:
 1. Hybrids: 150°C
 2. Fully Encapsulated V-Shield® COTS: 125°C
 3. Metal Packaged COTS: 125°C
5. Pre-heating Solder Pad. Heat the area around the lead to be soldered (PCB pad, plane, relief, etc.) with a high quality, heat-controlled soldering iron. Ensure that no contact is made with the lead itself. Wire solder (electronic grade with a non-corrosive - RMA, no-clean, etc. - flux core) should be held to the area (not the tip of the soldering iron) until it starts to melt and can be moved over the pad with the soldering iron. It is helpful to pre-tin the solder pads before the product is installed to help with solder transfer.
6. Applying solder to the leads. As soon as the solder starts to melt, move the soldering iron into contact with the lead (while maintaining contact with the solder pad), add enough solder to complete the joint, and remove.
7. Wire Wrapped Leads/Through Hole Devices (Optional). In applications where the assembly would experience high vibrations wire wrapped leads could be used. Wire

wrapped leads is a good way to decrease the stress on the glass seals of the VPT products and provide mechanical relief to the leads. Please see figures below on how to wire wrap.

Care should be taken not to bend or put pressure on the pins. This could bend or crack the glass seal on hermetic packages that could compromise the device, allowing moisture ingress that can induce a latent failure.



8. Side leaded Packages (Optional). The VPT products with side leads can be attached using the same technique. Stranded wire should be pre-tinned and formed in a J hook bend as shown below.

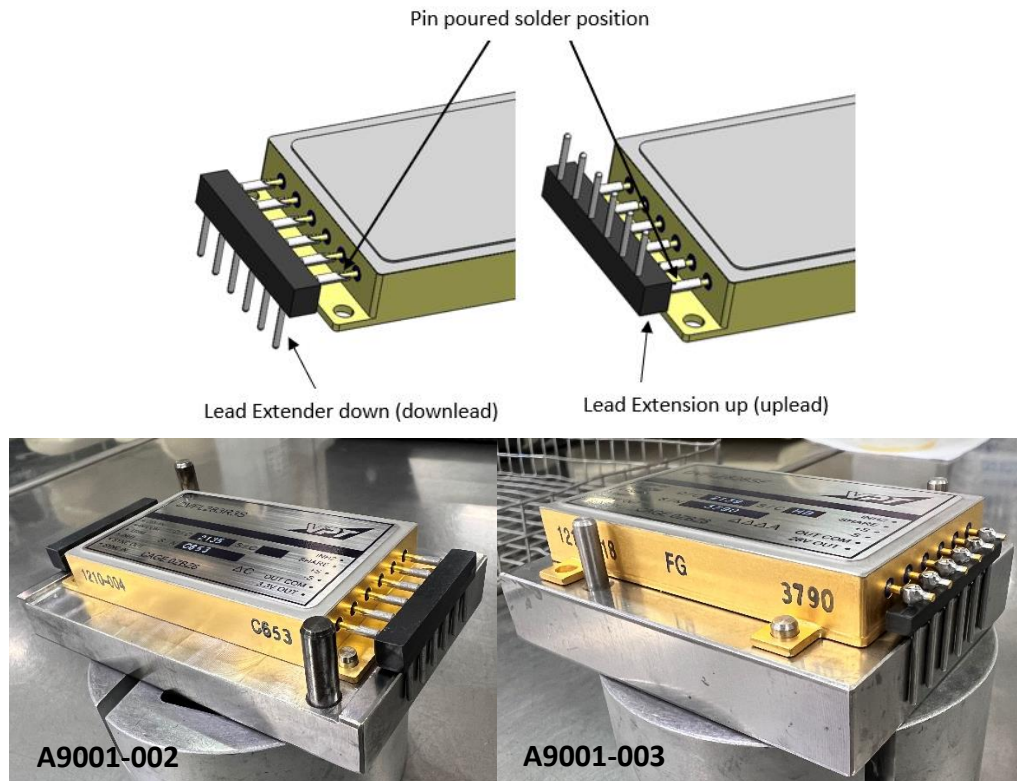


9. Test for success. After soldering is completed, VPT recommends a visual inspection to verify solder joint acceptability and attachment to the PCB. Remaining flux from the soldering operation should be cleaned to ensure all flux residue is removed. VPT's Hybrid and Fully Encapsulated V-Shield® COTS products are resistant to water and cleaning solvents. For Metal Packaged COTS, wipe the VPT unit using Isopropyl alcohol (IPA).

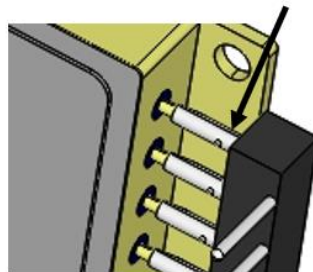
VPT has an application video explaining topics covered in this application note. To refer to the video please use the link on our web page under the Resources Tab labeled "Video Labs" and play the video lab titled "Mounting and Thermal Considerations".

Soldering Lead Extenders

1. Very carefully insert the lead extenders (VPT Part Number: A9001-002 or A9001-003) onto the pins on one side of the header, either pointing up or down depending on the requirement. Press the lead extenders on to the pins until it stops. VPT uses fixtures to ensure that the lead extenders are inserted with the right spacing. See figures below

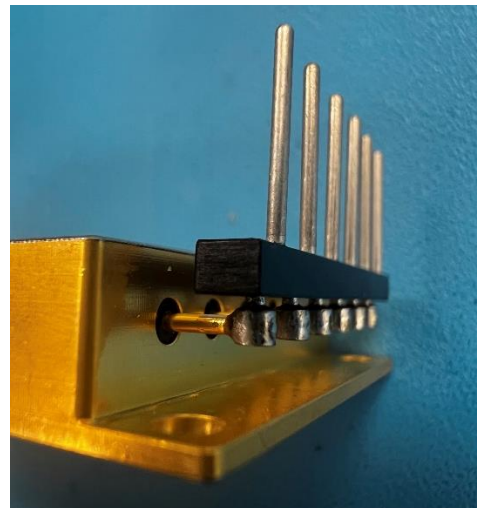
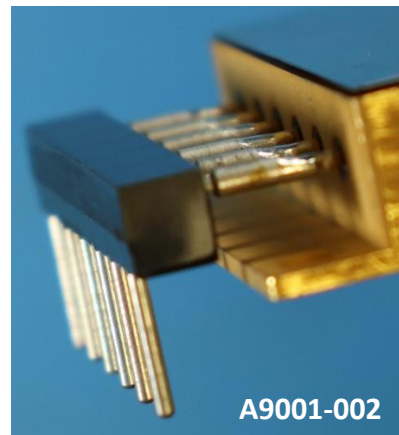
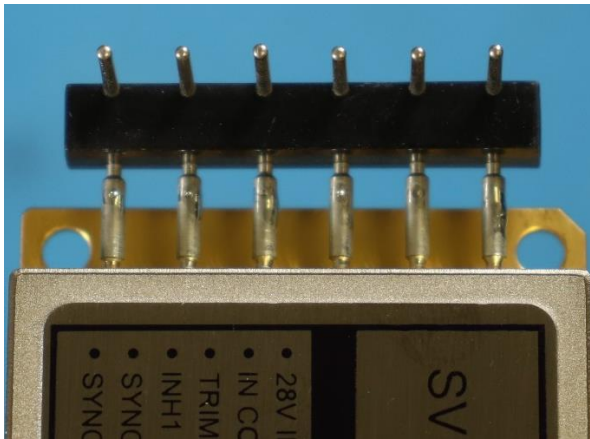


2. Flux can be used to improve solderability.
3. Apply soldering iron to the side of up/downlead near the attach area or pour area (pour area is specific to A9001-002, as shown in figure below) to heat the pin and lead extenders. The temperature of the soldering iron should not exceed 270°C.



4. Wait for a few seconds (do not exceed 3 seconds) to allow both pin and lead extenders to get enough heat to melt the solder. For A9001-002, apply solder wire to the poured solder position of the pin and lead extenders to make a good solder connection all the way around the pin. If using A9001-003, ensure a proper solder fillet is seen on both sides as seen in the image below.

Do not apply solder wire to the tip of solder iron because this might cause a cold solder joint that can compromise the electrical connection potentially causing a failure or the device not to meet the performance required.



Please note: If the device is damaged during this process, it is outside the warranty of the product. Also note that many of VPT's side leaded packages can be purchased with installed lead extenders, contact VPT sales for a quote.



Contact Information

For further information about any of VPT's products, policies, or programs contained herein, or to request a quotation or place orders please contact your sales representative or the VPT Inc. Sales Department at:

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Blacksburg, VA 24060, USA

Appendix A

Please see table below which recommends hole size and annular ring size based on the pin size of respective VPT products.

| Pin Diameter | Hole Diameter | Recommended Annular Ring Diameter |
|-------------------|----------------|-----------------------------------|
| 0.080" +/- 0.002" | .088" to .093" | .115" to .120" |
| 0.040" +/- 0.002" | .045" to .050" | .075" to .080" |
| 0.039" +/- 0.002" | .045" to .050" | .075" to .080" |
| 0.030" +/- 0.002" | .042" | .065" to .070" |
| 0.025" +/- 0.002" | .035" | .060" to .065" |
| 0.018" +/-0.002" | .025" | .053" to .058" |

Appendix B

Please see table below for Gold-Plating and Nickel-Plating Thickness measurements for various VPT packages respectively. Unit of measurement is in microinches (μin).

| Package Type | Gold-Plating Thickness (μin) | Nickel-Plating Thickness (μin) |
|-------------------|---|---|
| Hybrid Thick-Film | 50-150 | 80-140 |
| Hi-Rel COTS | 60-100 | 80-140 |