

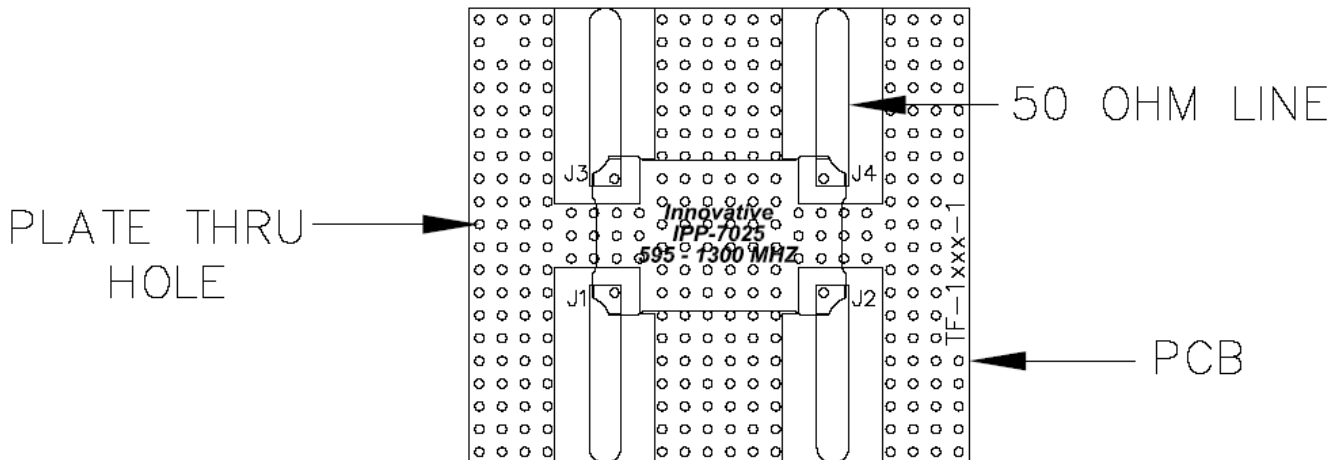
# IPP 90 Degree, SMD, 3dB Hybrid Application Note

## ❖ General Notes:

- o Data and specifications apply when part is mounted in IPP test fixture and terminated into 50 Ohms with >30dB return loss.
- o Keep unclad channel between RF port contact pads and ground plane clean for high peak power applications to prevent voltage arcing.
- o To insure proper grounding and heat-sinking the bottom ground plane surface of coupler must lay flat on mounting surface with good solder contact.
- o Assure good solder attach of the RF port pads to the RF pcb 50 ohm lines using a lead free or Sn63 solder alloy.
- o Operating temperature is -55°C to +85°C base plate, non-condensing.
- o Storage Temperature is 10°C to 60°C. The moisture sensitivity level (MSL) is 1. Normal precautions should be taken to prevent surface oxidation.

## Input Output Relationships for -3dB, 90° Hybrid Couplers

INPUT	OUTPUT			
	J1	J2	J3	J4
J1	N/A	Isolation Port	-3dB <0°	-3dB <-90°
J2	Isolation Port	N/A	-3dB <-90°	-3dB <0°
J3	-3dB <0°	-3dB <-90°	N/A	Isolation Port
J4	-3dB <-90°	-3dB <0°	Isolation Port	N/A



MOUNTING, TOP VIEW

## Electrical Specifications

### ❖ VSWR (Voltage Standing Wave Ratio)

- The voltage standing wave ratio is a measure of how well a load is impedance-matched to a source. The value of VSWR is always expressed as a ratio with 1 in the denominator (2:1, 3:1, 10:1, etc.) It is a scalar measurement only (no angle). A perfect impedance match corresponds to a VSWR 1:1 meaning you will get all the power from source to load.

- $VSWR (\sigma) = V_{max}/V_{min}$

### ❖ Insertion Loss (IL)

- The insertion loss is the amount of power (P) lost when transmitted through the coupler from the input port to the other ports.

- $IS(dB) = 10\log(P_{in}/(P_{thru} + P_{coupled} + P_{iso}))$

### ❖ Isolation (ISO)

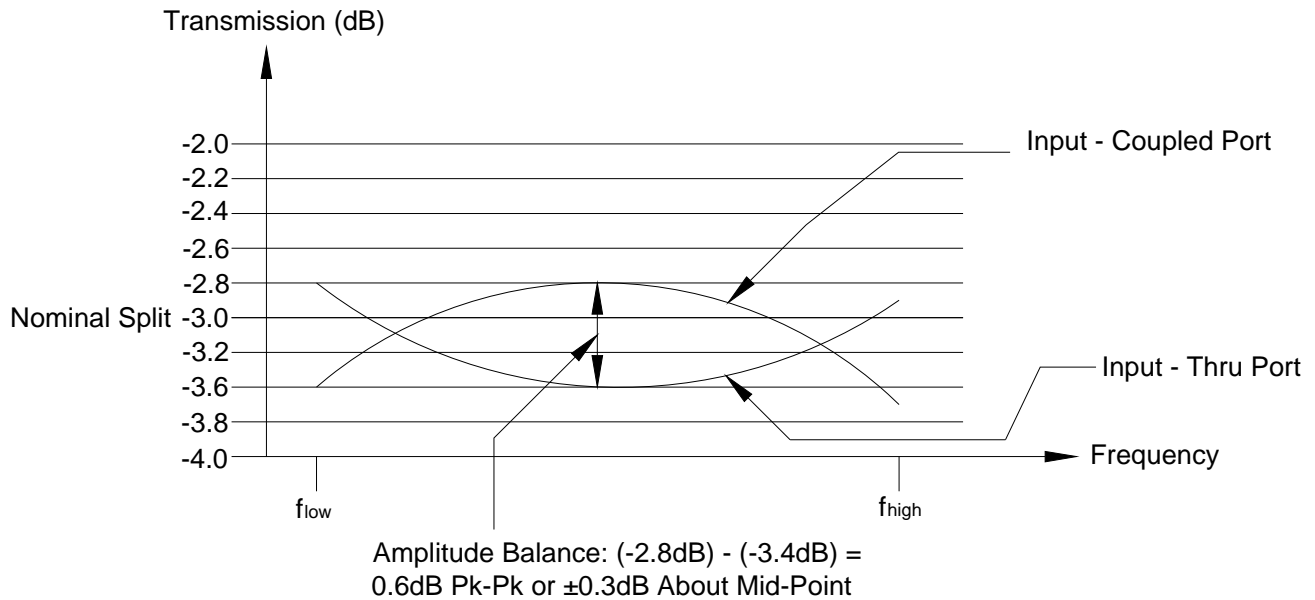
- The isolation is the amount of power at the input port divided by the amount of power at the isolation port when the other two ports are terminated into 50 Ohms.

- $ISO(dB) = 10\log(P_{in}/P_{iso})$

### ❖ Amplitude Balance (AB)

- The amplitude balance is the difference in the power levels at any given frequency for the same input level when measured at the coupled and thru ports.

- $AB(dB) = |10\log(P_{coupled}/P_{thru})|$



## Typical Amplitude Balance Response for 1-Section Coupler

### ❖ Phase Balance (PB)

- The phase balance is the difference in phase angle between the power at the thru port and the power at the coupled port. The nominal difference being  $90^\circ$ .

- $PB(^{\circ}) = \angle P_{\text{coupled}} - \angle P_{\text{thru}}$

### ❖ Power (P)

- The maximum total CW input power is the sum of the CW input power at each port.

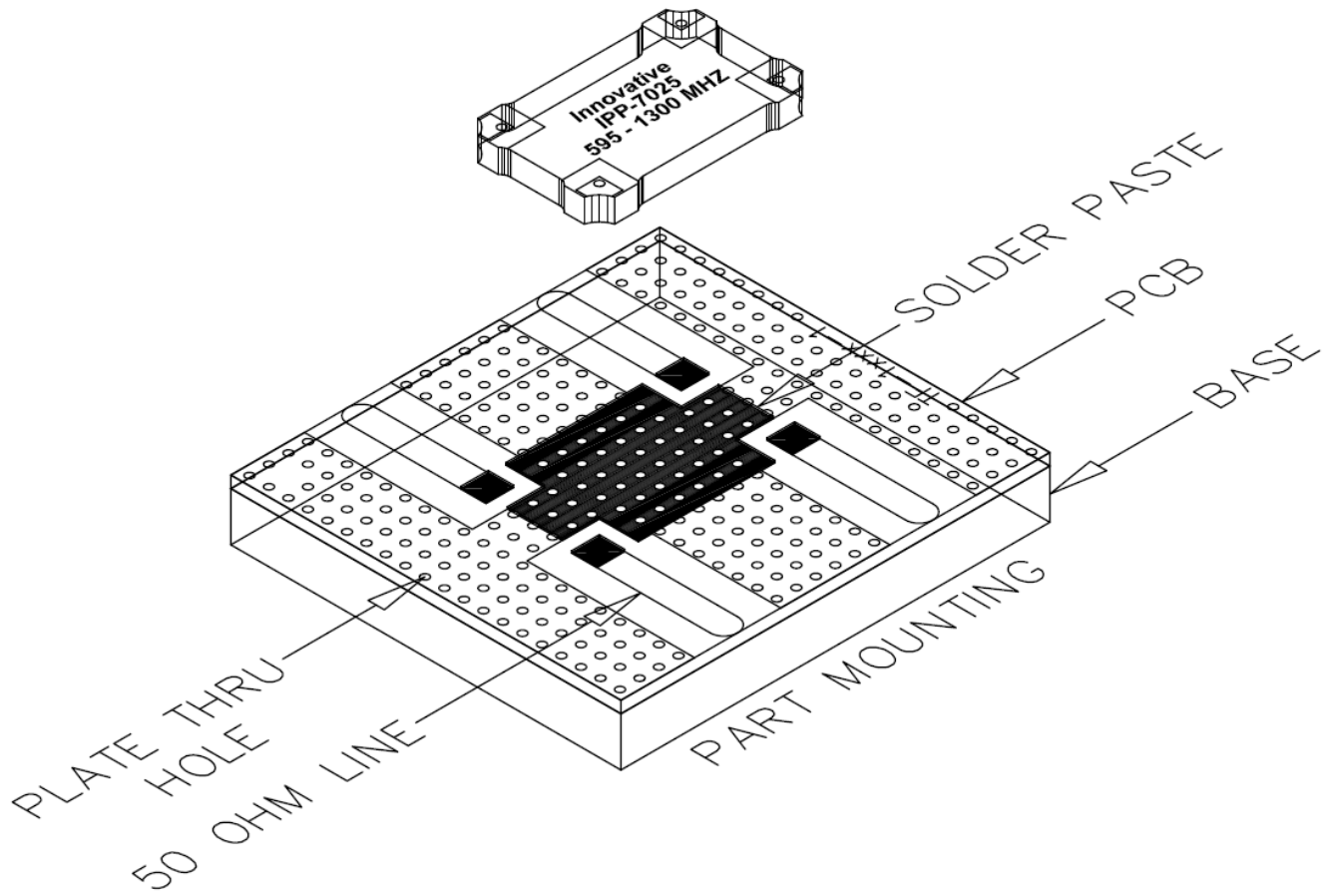
- $P_{\text{total Max}} = P_{\text{in}} + P_{\text{thru}} + P_{\text{coupled}} + P_{\text{iso}}$

## SMD Coupler Mounting

### ❖ Mounting, General

- The couplers are designed to be surface mounted to standard types of RF pcbs using tin-lead or lead-free solder. The couplers are available in three finishes, Tin, Tin-Lead or Gold.
- For best performance the ground area of the coupler should be fully soldered to the pcb ground. The pcb should have sufficient plated thru holes to provide a good, low inductance ground at the coupler while also providing a low thermal resistance to the heat sink.
- 50 Ohm lines are required to bring the RF signal to and from the couplers port solder pads. Do not allow the 50 Ohm lines to encroach into the air gap between the coupler RF port pads and the ground plane as this will reduce the breakdown voltage.
- Solder paste should be applied to the pcb using a stencil or dispensing gun. The solder paste should cover the complete coupler ground plane area as well as the RF port pad area where the coupler interfaces with the pcb.
- Placement of the coupler into the solder paste can be done by hand or pick and place machine. Care should be taken to place the coupler as close to the final required alignment as possible. Misalignment of the coupler after solder reflow can result in RF shorts or reduced performance.
- After couplers are reflow soldered and then cleaned a dry out period is recommended to remove any cleaning solvents before RF signals are applied.
- The Couplers are tested in IPP test fixtures. Use of pcbs other than what is used on the IPP test fixture is allowed however some minor matching of the 50 Ohm lines may be required to achieve the best performance. The extent of the matching is usually a narrowing of the line. The narrowing is directly related to the value of the parasitic capacitor created below the RF port pads to the ground plane. Thin pcb materials with high dielectric constants create larger capacitors which require the narrowing. Thicker pcb materials with lower Er require little or no narrowing of the line.

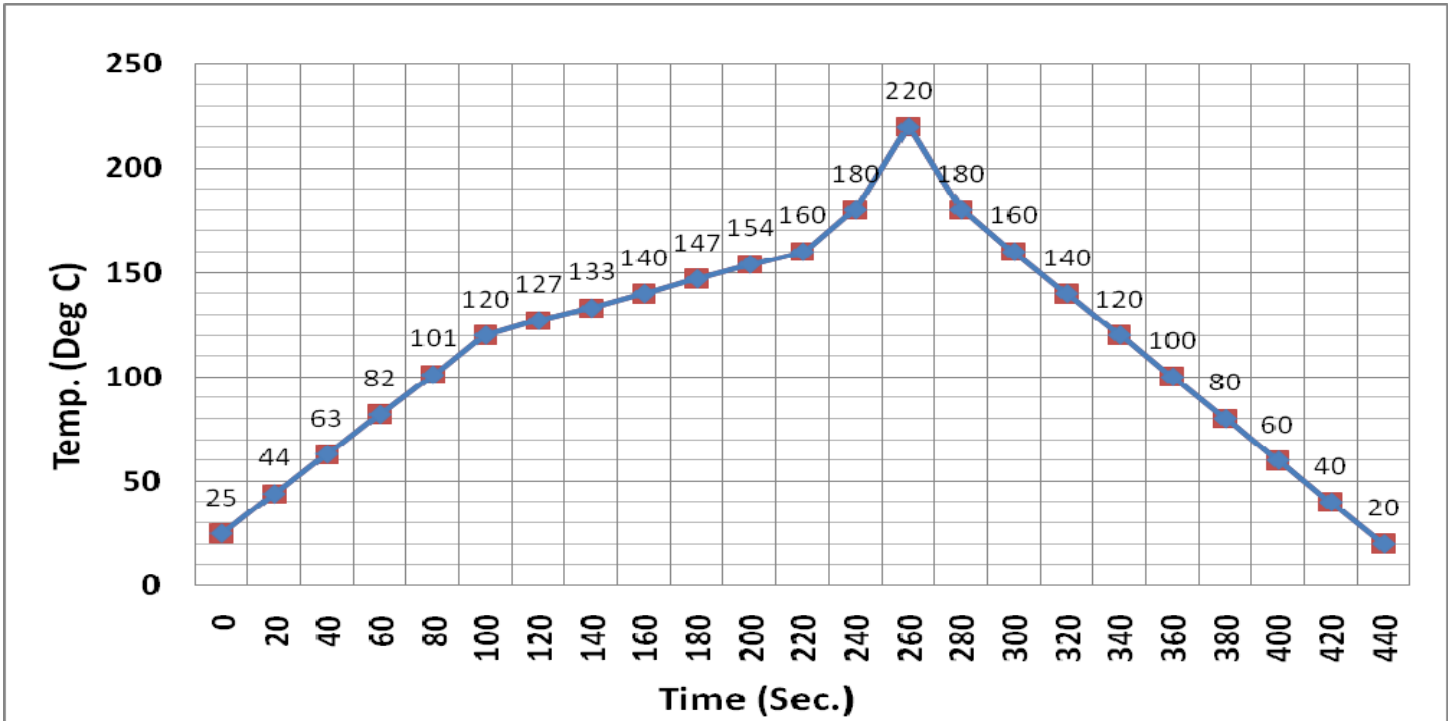
## SMD Coupler Mounting



# Solder Profiles

(Do Not Exceed Max Reflow Temperature Noted on Outline Drawing)

## SN63 Solder Reflow Profile



## Lead Free Solder Reflow Profile

