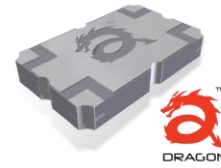


Hybrid Couplers Application Note



Hybrid couplers are used in many RF and microwave circuit designs for power combining and power dividing. Typical construction of a hybrid coupler consists of two transmission lines in close proximity. RF energy travelling through one of the transmission lines couples to the other transmission line. There is a 90° phase difference between the output ports of a hybrid coupler. Hybrid couplers can be also viewed as directional couplers with a -3 dB coupling factor.

Most surface-mount hybrid couplers use a multilayered broadside coupling constriction in comparison to a microstrip edge coupled structure. The multilayered hybrid couplers offer better insertion loss, higher isolation, and smaller footprint. Most surface-mount hybrid couplers are made with high frequency PTFE materials.

Standard hybrid couplers pin configuration

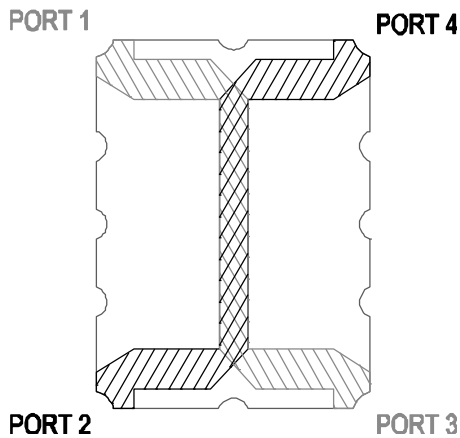


TABLE 1: SPLITTER CONFIGURATION*

PORT 1	PORT 2	PORT 3	PORT 4
IN	ISO	-90°	0°
ISO	IN	0°	-90°
-90°	0°	IN	ISO
0°	-90°	ISO	IN

* Signals will split into -3dB amplitude in quadrature. A small fraction of the signal will appear at the isolated port due to non-ideal isolation.

TABLE 2: COMBINER CONFIGURATION†

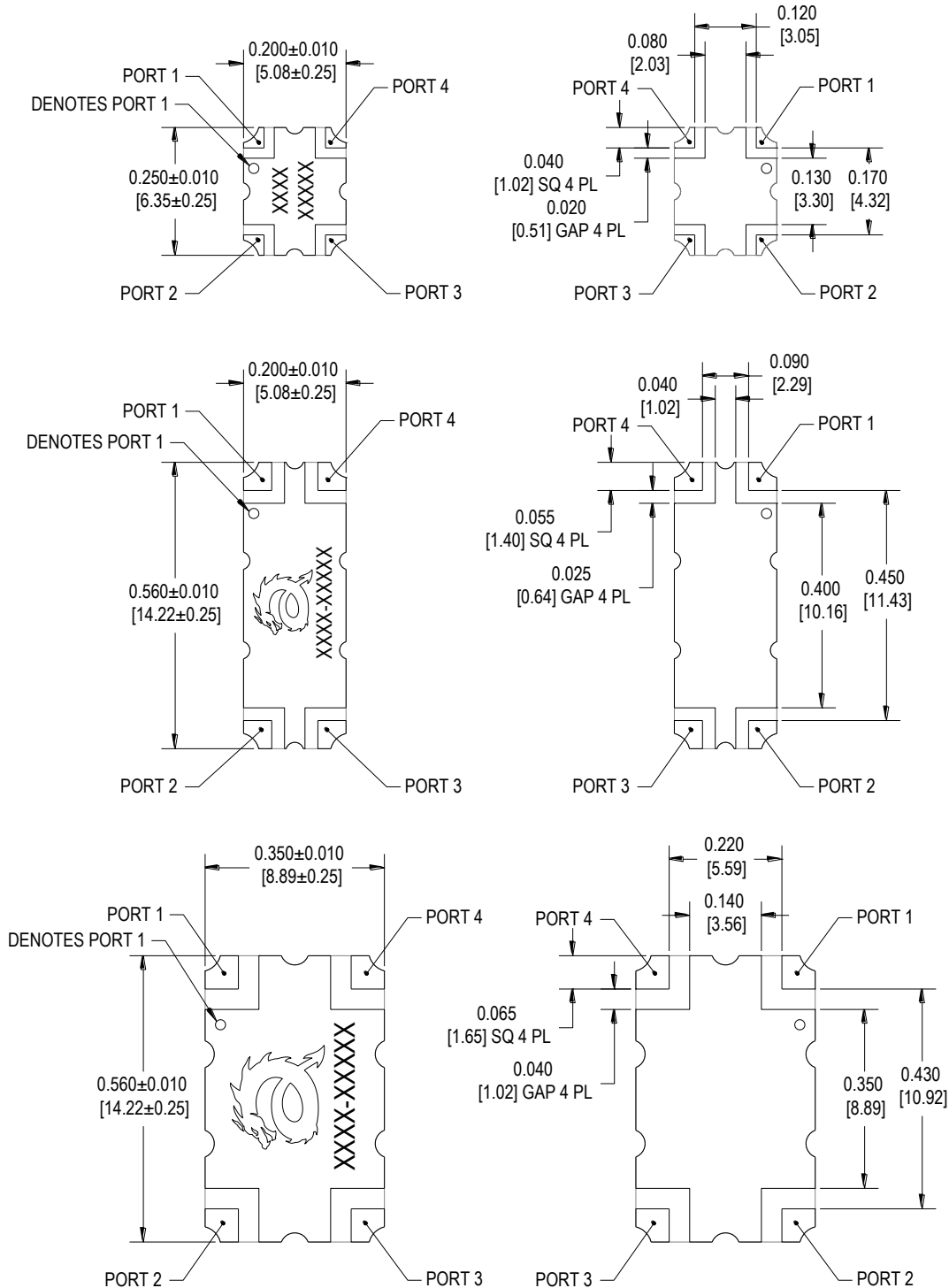
PORT 1	PORT 2	PORT 3	PORT 4
-90°	0°	ISO	OUT
0°	-90°	OUT	ISO
ISO	OUT	-90°	0°
OUT	ISO	0°	-90°

† Combining signals are applied in quadrature with equal amplitude. Unequal amplitude signals will generate small signal appearing at the isolated port.

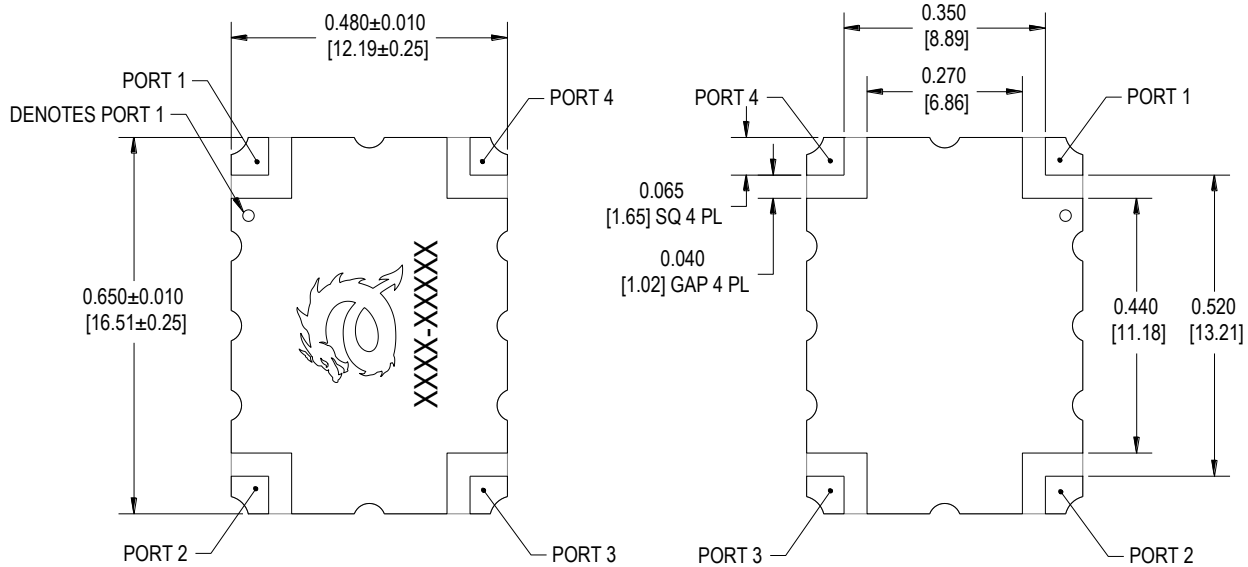
Hybrid Couplers Application Note

Standard Mechanical outline for hybrid couplers

* Dimensions are *inches [millimeters]*. Actual part may differ; additional vias may be added and markings may vary.



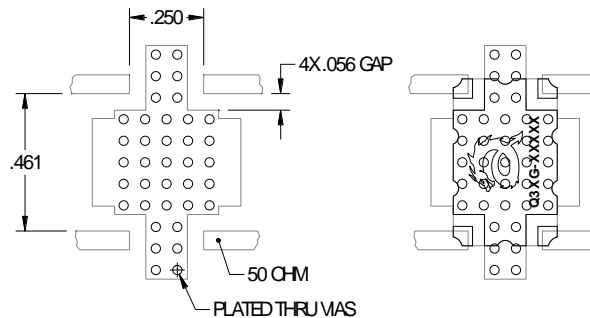
Hybrid Couplers Application Note



Mounting Instructions

To ensure proper operation of a hybrid coupler, good solder connections must be established between the device terminals and transmission lines on the PCB. In addition, the bottom ground plane of the device must be in a good contact with the PCB ground pads. Grounding is very important and can affect the electrical performance of the hybrid coupler. Grounding can be improved by increasing the number of vias (minimizing inductance) on the PCB board. Increasing the number of vias will also provide good thermal conduction path for the coupler.

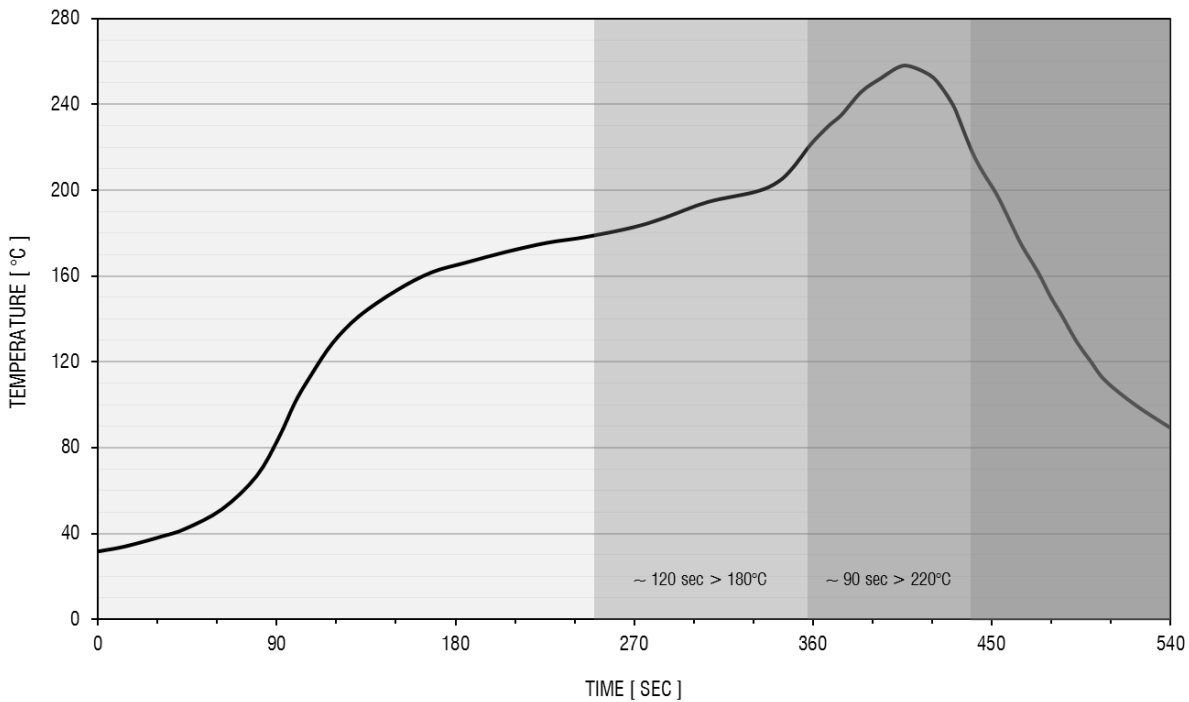
The multilayered PTFE hybrid couplers are designed for pick-and-place and conveyor reflow oven assembly process in mind. Hybrid couplers can also be soldered manually with hot air reflow and the use of conventional soldering iron is not recommended since it can cause damage to the device. Most standard solders and conductive epoxies can be used for device attachment. The thermal expansion characteristics (TEC) of multi-layered PTFE couplers are compatible with most high frequency substrates like: FR4, RO3003, and RO4350.



Hybrid Couplers Application Note

Standard Attachment Materials			
Material	Composition	Thermal Conductivity (Watts/cm/°C)	Melting Temperature (°C)
Lead-Free Solder	99.3% Tin - 0.7% Copper	N/A	227
Lead-Free Solder	96.5% Tin / 3.5% Silver	0.33	221
Tin-Lead Solder	63% Tin / 37% Lead	0.49	183
Conductive Epoxy	Silver Filled	0.01 to 0.29	N/A

LEAD-FREE SOLDER PROFILE



Hybrid Couplers Application Note

Power De-rating

Number of factors limits the maximum power handling of a hybrid coupler. The major factors are operating temperature, insertion loss, and materials used in the construction of the coupler. Typical maximum operating temperature for a PTFE type coupler is 95°C.

The diagram below illustrates the recommended power de-rating curve for the Dragon hybrid couplers. Input power is de-rated linearly to 0 W at 205°C.

