

## FEATURES

- High Power
- Low Profile Surface Mount Package
- Very Low Insertion Loss
- Excellent Amplitude and Phase Balance
- High Isolation
- RoHS
- Tape and Reel for High Volume Production

## APPLICATIONS

- Power Amplifiers
- Signal Distribution Networks
- Antenna Feeds
- Switch Networks
- High Power Combiners/Splitters
- Phase Shifters

## GENERAL DESCRIPTION

The HDD2F is a high performance 3dB hybrid coupler in a surface mount package. This low profile coupler handles up to 200 watts of CW power. The HDD2F is designed for those demanding applications where low loss, excellent amplitude and phase balance are required.

The HDD2F is manufactured with materials that have thermal expansion characteristics compatible with industry standard board materials like RO3003, RO4350, FR4 and others. The couplers are available in a RoHS complaint finish and packaged in both reel and tube.

## ELECTRICAL SPECIFICATIONS\*

| 3dB HYBRID COUPLER |                    |                         |      |                            |               |                            |             |                          |
|--------------------|--------------------|-------------------------|------|----------------------------|---------------|----------------------------|-------------|--------------------------|
| Frequency MHz      | Isolation dB (min) | Insertion Loss dB (max) | VSWR | Amplitude Balance dB (max) | Phase Error ° | Power Handling ** Watts CW | ΘJC °C/Watt | Operating Temperature °C |
| 800 -1000          | 26                 | 0.15                    | 1.15 | ± 0.30                     | 90 ± 2        | 200                        | 15          | -55 to +85               |
| 811 - 869          | 26                 | 0.12                    | 1.14 | ± 0.25                     | 90 ± 2        | 200                        | 15          | -55 to +85               |
| 870 - 960          | 30                 | 0.14                    | 1.10 | ± 0.20                     | 90 ± 2        | 200                        | 15          | -55 to +85               |

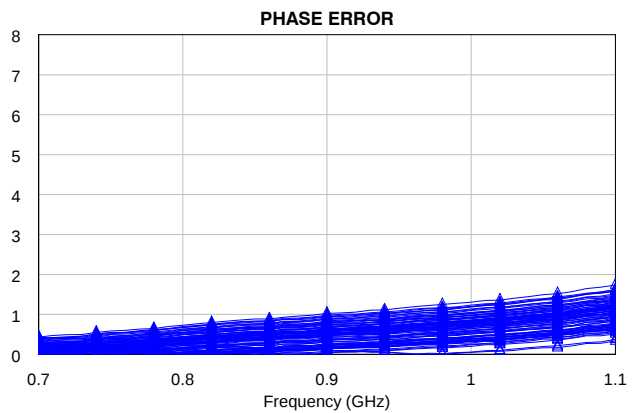
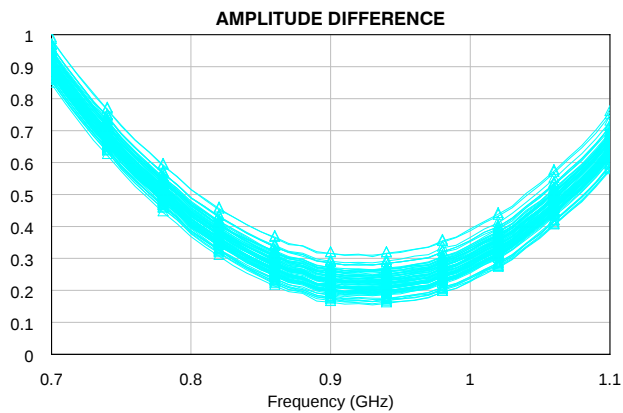
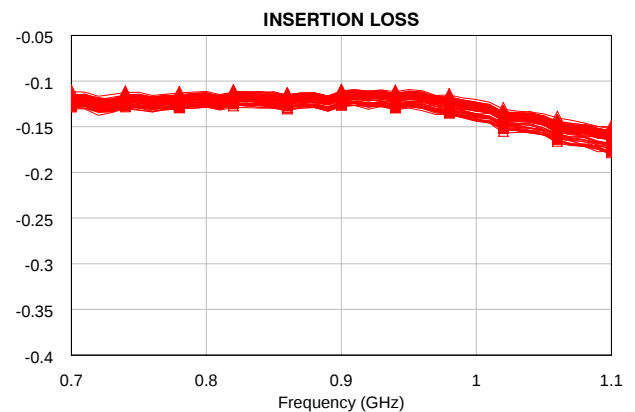
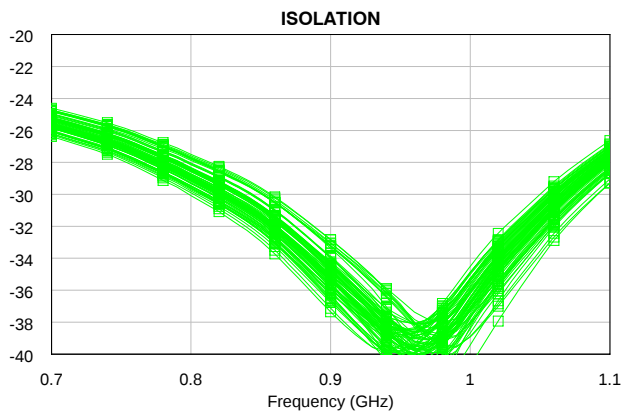
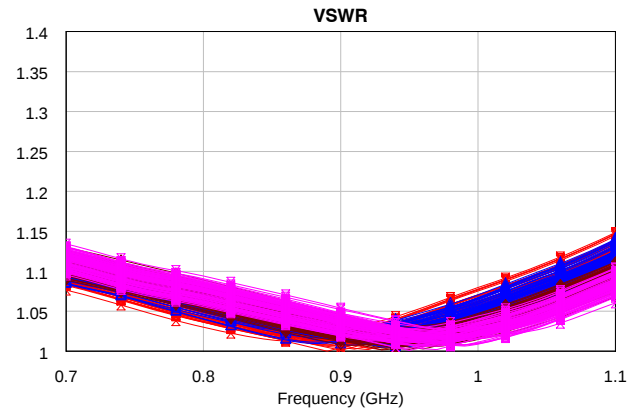
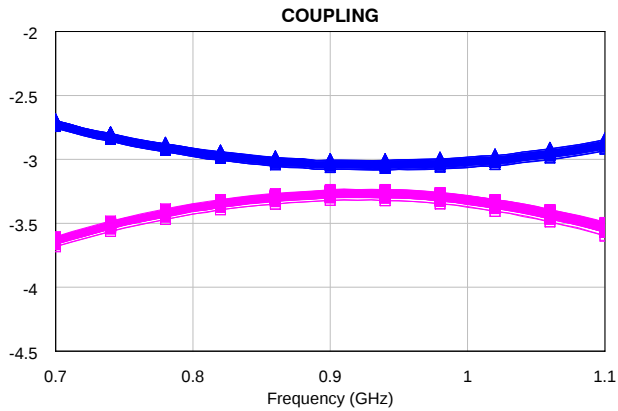
### Specification Notes:

\* Measured on Florida RF Labs test fixture 008-40-077. Specifications are subject to change without notice.

\*\* Power rating is specified at 85°C base temperature

## DATA SHEET HDD2F REV A

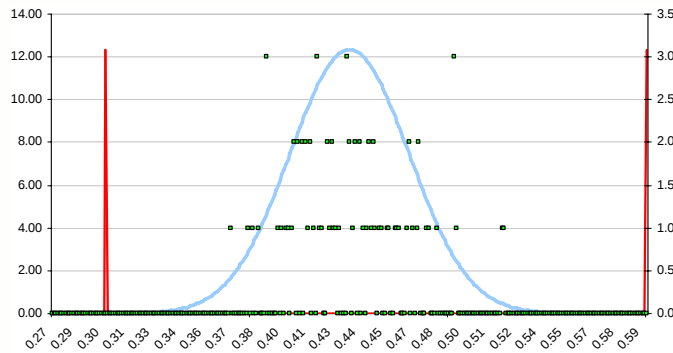
### 700MHZ - 1100MHZ RF PERFORMANCE AT 25°C (78PCS)



## DATA SHEET HDD2F REV A

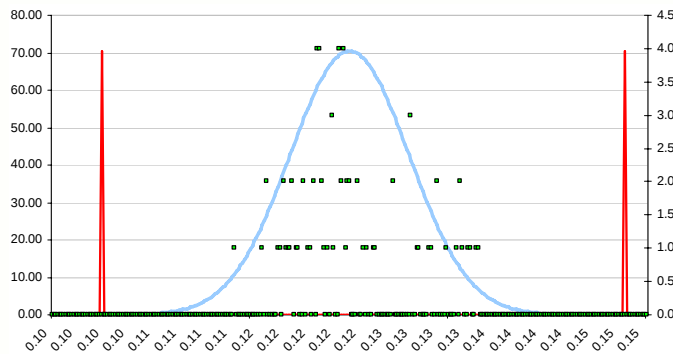
### 800MHZ - 1000MHZ STATISTICAL ANALYSIS AT 25°C (78PCS)

#### AMPLITUDE DIFFERENCE



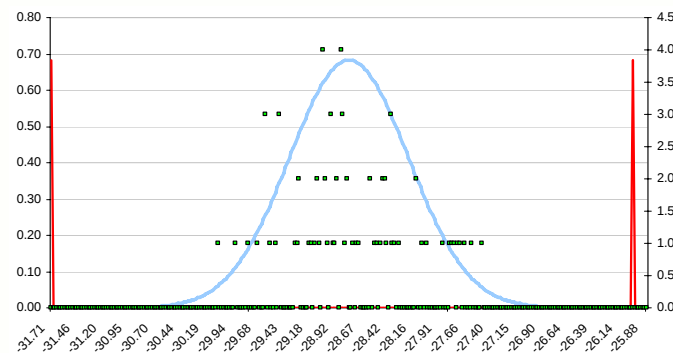
|                    |       |
|--------------------|-------|
| Upper Spec Limit   | 0.600 |
| Lower Spec Limit   | 0.300 |
| Number of Samples  | 78    |
| Mean               | 0.433 |
| Standard Deviation | 0.032 |
| C <sub>p</sub>     | 1.546 |
| C <sub>pk</sub>    | 1.372 |

#### INSERTION LOSS



|                    |       |
|--------------------|-------|
| Upper Spec Limit   | 0.150 |
| Lower Spec Limit   | 0.100 |
| Number of Samples  | 78    |
| Mean               | 0.124 |
| Standard Deviation | 0.006 |
| C <sub>p</sub>     | 1.471 |
| C <sub>pk</sub>    | 1.394 |

#### ISOLATION

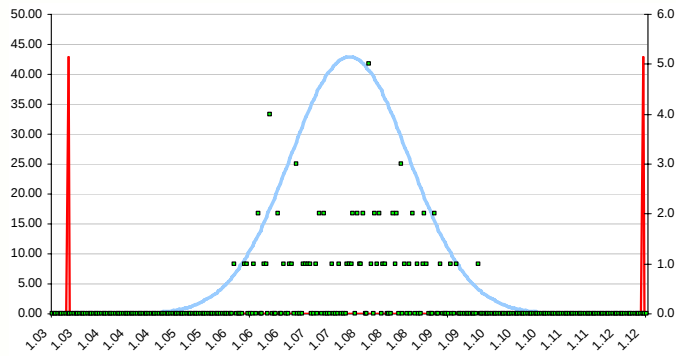


|                    |         |
|--------------------|---------|
| Upper Spec Limit   | -26.000 |
| Lower Spec Limit   | -32.000 |
| Number of Samples  | 78      |
| Mean               | -28.786 |
| Standard Deviation | 0.585   |
| C <sub>p</sub>     | 1.711   |
| C <sub>pk</sub>    | 1.589   |

## DATA SHEET HDD2F REV A

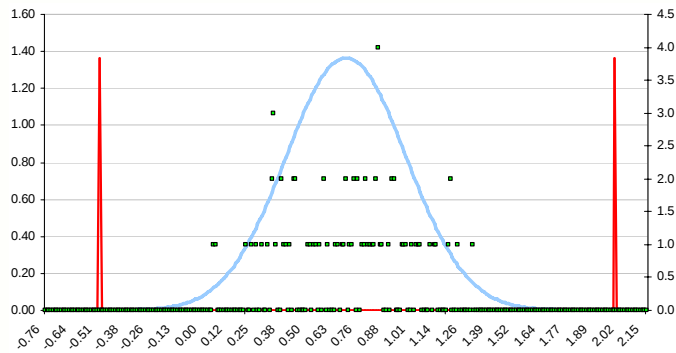
### 800MHZ - 1000MHZ STATISTICAL ANALYSIS AT 25°C (78PCS) CONT'D

#### VSWR



|                    |       |
|--------------------|-------|
| Upper Spec Limit   | 1.120 |
| Lower Spec Limit   | 1.030 |
| Number of Samples  | 78    |
| Mean               | 1.074 |
| Standard Deviation | 0.009 |
| C <sub>p</sub>     | 1.614 |
| C <sub>pk</sub>    | 1.580 |

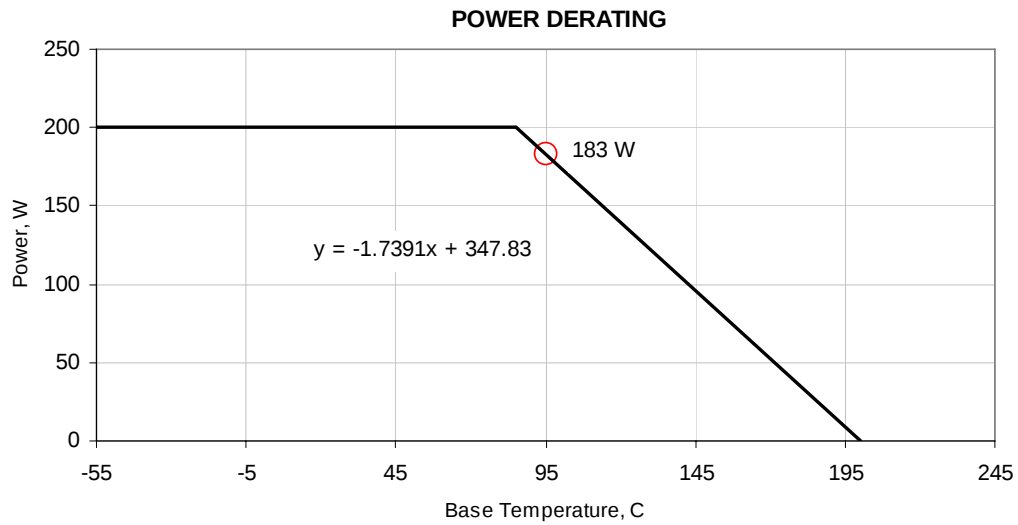
#### PHASE ERROR



|                    |        |
|--------------------|--------|
| Upper Spec Limit   | 2.000  |
| Lower Spec Limit   | -0.500 |
| Number of Samples  | 78     |
| Mean               | 0.697  |
| Standard Deviation | 0.292  |
| C <sub>p</sub>     | 1.427  |
| C <sub>pk</sub>    | 1.367  |

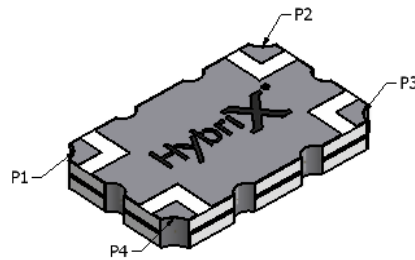
## DATA SHEET HDD2F REV A

### POWER

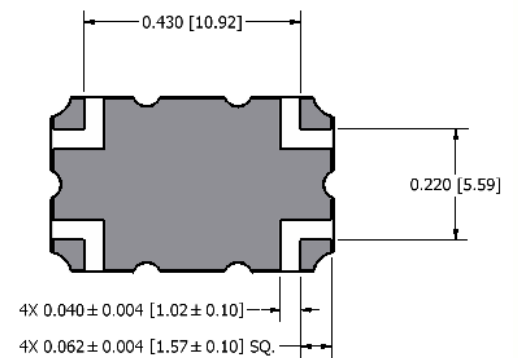
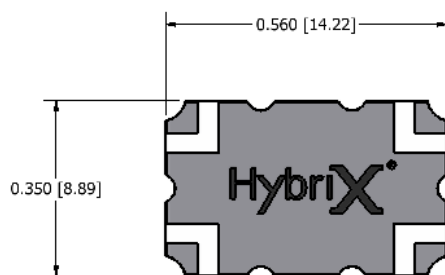


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### COUPLER PIN CONFIGURATION AND MECHANICAL OUTLINE



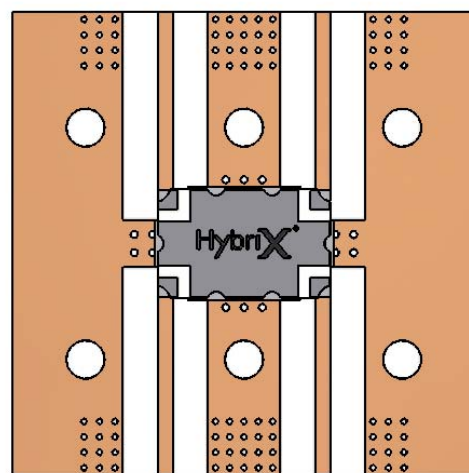
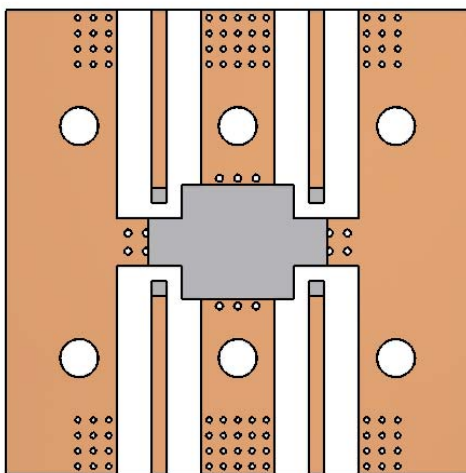
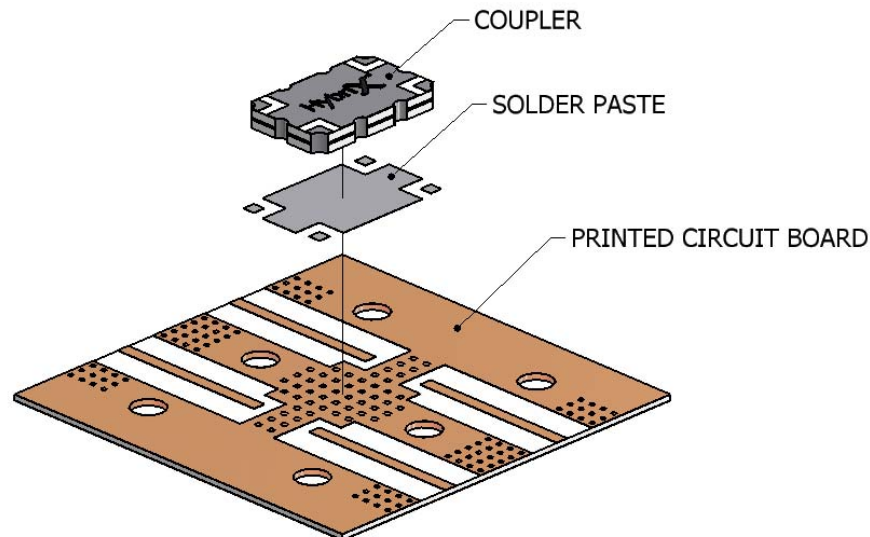
| PHASE TABLE |      |      |      |      |
|-------------|------|------|------|------|
| PORTS       | P1   | P2   | P3   | P4   |
| P1          | -    | ISO  | -90° | 0°   |
| P2          | ISO  | -    | 0°   | -90° |
| P3          | -90° | 0°   | -    | ISO  |
| P4          | 0°   | -90° | ISO  | -    |



## DATA SHEET HDD2F REV A

### MOUNTING INSTRUCTIONS

To ensure proper operation, all transmission lines must have a characteristic impedance of  $50\Omega$ . Grounding is also vital for proper performance. Grounding can be improved by increasing the number of vias to minimize ground inductance. In creased vias allow for low impedance ground connection and good thermal conduction. The device is attached to the PCB by using solder paste positioned at the location where RF terminals come into contact with the trace and where the device contact ground. The coupler is then positioned in such a way that the RF terminals must come into contact and align with the PCB trace and solder. In addition, the device ground plane must align with the solder to have good connection to ground. The conventional reflow method, where controlled temperature hot air is used to cause solder reflow, is the recommended to attach the device to the PCB. The max reflow temperature should never exceed  $260^{\circ}\text{C}$ . The use of conventional irons may cause damage to the device and should be avoided.



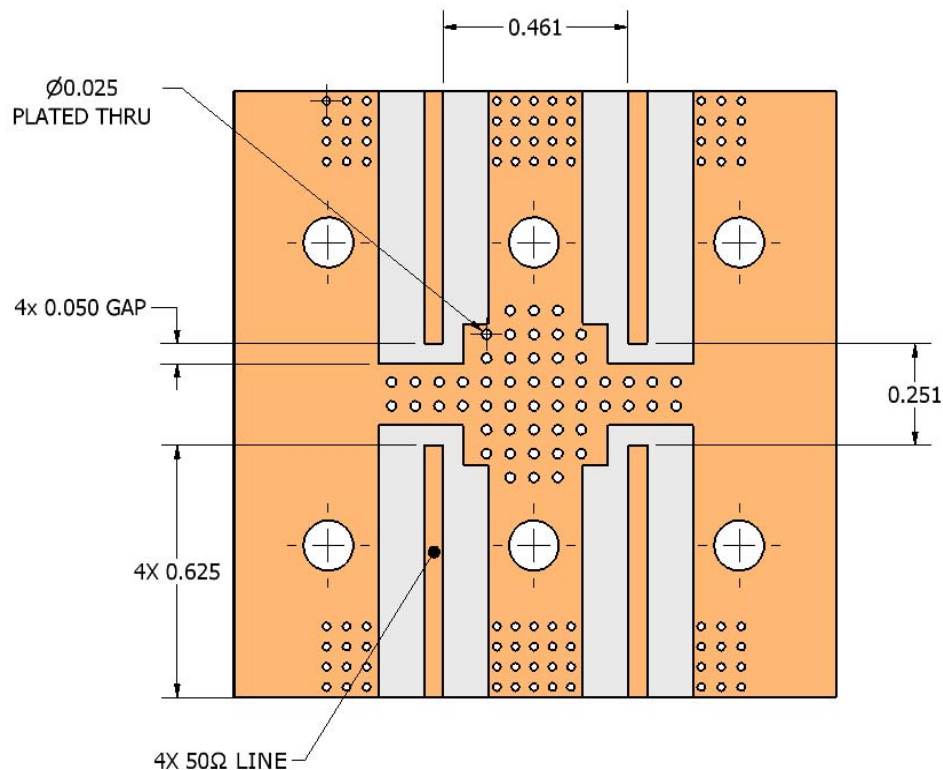
## DATA SHEET HDD2F REV A

### COMMONLY USED ATTACHMENT MATERIALS

| Material         | Composition                         | Thermal Conductivity<br>( Watts/cm/°C ) | Melting Temperature<br>( °C ) |
|------------------|-------------------------------------|-----------------------------------------|-------------------------------|
| Gold-Tin Solder  | 80% Gold / 20% Tin                  | 0.58                                    | 280                           |
| Lead-Free Solder | 99.3% Tin – 0.7% Copper             | N/A                                     | 227                           |
| Lead-Free Solder | 96.5% Tin / 3.5% Silver             | 0.33                                    | 221                           |
| Lead-Free Solder | 96.5% Tin / 3% Silver / 0.5% Copper | N/A                                     | 217 - 220                     |
| Sn63 Solder      | 63% Tin / 37% Lead                  | 0.49                                    | 183                           |
| Conductive Epoxy | Silver Filled                       | 0.01 to 0.29                            | N/A                           |

### CIRCUIT BOARD LAYOUT

In order to achieve the specified RF performance, an optimized RF test board must be used for testing this hybrid coupler. Florida RF Labs test board (008-40-077) constructed with Rogers RO3003 high frequency board material is shown below.



## DATA SHEET HDD2F REV A

### SOLDERING PROFILE

