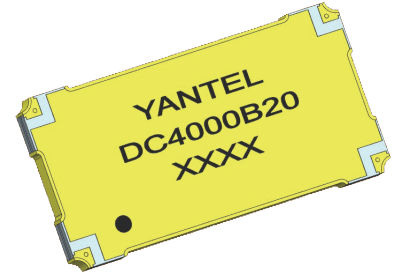


### Description

The DC4000B20 is a low profile, high performance 20dB directional coupler. This component is suitable for feed-forward amplifier and signal sampling circuits where low insertion loss, high directivity is required. It can be used in power applications up to 180 Watts.

Parts have been subjected to rigorous qualification testing and they are using materials with coefficients for thermal expansion (CTE) compatible with common substrates such as FR4, G-10, RF-35, RO4350B and polyimide.



### Features:

- 2000-6000 MHz
- low insertion loss, 0.20 dB Typ.
- excellent return loss, 20 dB Typ.
- high power, up to 180W.
- DC current pass through input to output

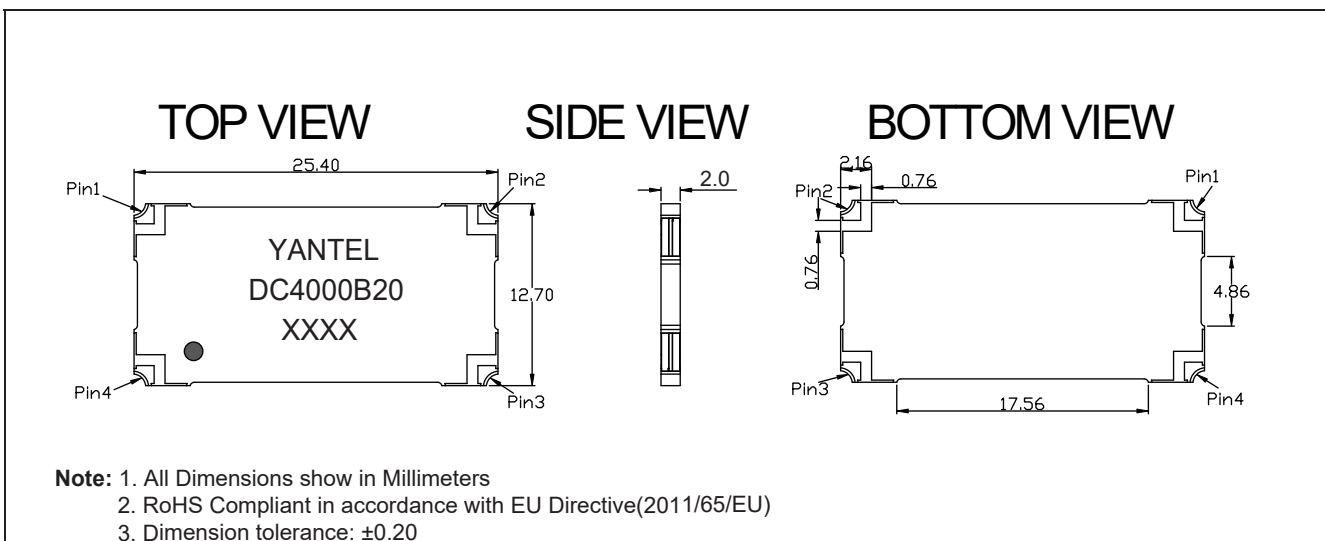
### Electrical Specifications

| Frequency<br>MHz         | Coupling<br>dB         | Directivity<br>dB Min | VSWR<br>Max : 1 |
|--------------------------|------------------------|-----------------------|-----------------|
| 2000~6000                | 19.5±1.0               | 12.5                  | 1.65            |
| Insertion Loss<br>dB Max | Power<br>Avg. CW Watts | Operating Temp.<br>°C |                 |
| 0.60                     | 180                    | -55 to +105           |                 |

### Note:

1. All above test data resulting from specify demo board.
2. Insertion loss has removed the thru board loss.

### Mechanical Outline



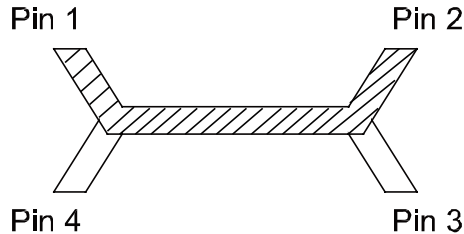
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### Directional Coupler Pin Configuration

The DC4000B20 has an orientation marker to denote Pin 1. Once port one has been identified the other ports are known automatically. Please see the chart below for clarification:



### Port Function Configurations

| Input | Output | Coupled Forward | Coupled Reverse |
|-------|--------|-----------------|-----------------|
| 1     | 2      | 4               | 3               |
| 2     | 1      | 3               | 4               |
| 3     | 4      | 2               | 1               |
| 4     | 3      | 1               | 2               |

### Typical Performance Data (@25°C)

| Frequency (MHz) | Coupling (dB) | Transmission (dB) | Insertion Loss (dB) | Directivity (dB) | Return Loss(dB) |        |        |        |
|-----------------|---------------|-------------------|---------------------|------------------|-----------------|--------|--------|--------|
|                 |               |                   |                     |                  | S11             | S22    | S33    | S44    |
| 2000            | -19.32        | -0.15             | -0.09               | -23.89           | -23.53          | -23.65 | -32.08 | -31.75 |
| 2200            | -19.07        | -0.18             | -0.12               | -23.47           | -20.90          | -21.22 | -25.43 | -25.45 |
| 2400            | -19.07        | -0.19             | -0.14               | -21.23           | -19.06          | -19.28 | -21.63 | -21.73 |
| 2600            | -19.08        | -0.21             | -0.15               | -19.53           | -18.57          | -18.46 | -19.86 | -19.75 |
| 2800            | -19.15        | -0.22             | -0.17               | -19.81           | -19.02          | -18.60 | -18.93 | -19.01 |
| 3000            | -19.14        | -0.20             | -0.15               | -19.80           | -21.15          | -20.51 | -19.73 | -19.54 |
| 3200            | -19.36        | -0.17             | -0.11               | -18.91           | -26.36          | -25.30 | -22.46 | -22.36 |
| 3400            | -19.52        | -0.14             | -0.09               | -20.05           | -31.89          | -33.56 | -27.76 | -27.63 |
| 3600            | -19.74        | -0.17             | -0.12               | -21.09           | -21.85          | -22.12 | -24.28 | -24.13 |
| 3800            | -19.94        | -0.24             | -0.19               | -22.25           | -17.11          | -16.95 | -18.47 | -18.23 |
| 4000            | -20.20        | -0.32             | -0.28               | -22.16           | -14.63          | -14.26 | -15.28 | -14.96 |
| 4200            | -20.33        | -0.38             | -0.34               | -22.17           | -13.16          | -12.80 | -13.47 | -13.32 |
| 4400            | -20.41        | -0.41             | -0.36               | -19.25           | -13.12          | -12.62 | -13.03 | -12.83 |
| 4600            | -20.17        | -0.38             | -0.33               | -17.00           | -14.07          | -13.46 | -13.68 | -13.32 |
| 4800            | -20.17        | -0.29             | -0.24               | -15.38           | -16.32          | -15.83 | -15.67 | -15.41 |
| 5000            | -19.94        | -0.23             | -0.18               | -14.42           | -21.10          | -21.07 | -20.54 | -19.82 |
| 5200            | -19.75        | -0.20             | -0.15               | -13.56           | -44.73          | -35.89 | -29.49 | -26.60 |
| 5400            | -19.66        | -0.27             | -0.22               | -13.34           | -21.62          | -21.30 | -20.28 | -19.50 |
| 5600            | -19.87        | -0.35             | -0.30               | -13.75           | -16.48          | -16.37 | -15.34 | -14.86 |
| 5800            | -19.90        | -0.40             | -0.35               | -13.38           | -14.39          | -14.26 | -13.14 | -12.63 |
| 6000            | -19.85        | -0.53             | -0.48               | -13.90           | -13.11          | -12.95 | -12.41 | -12.13 |

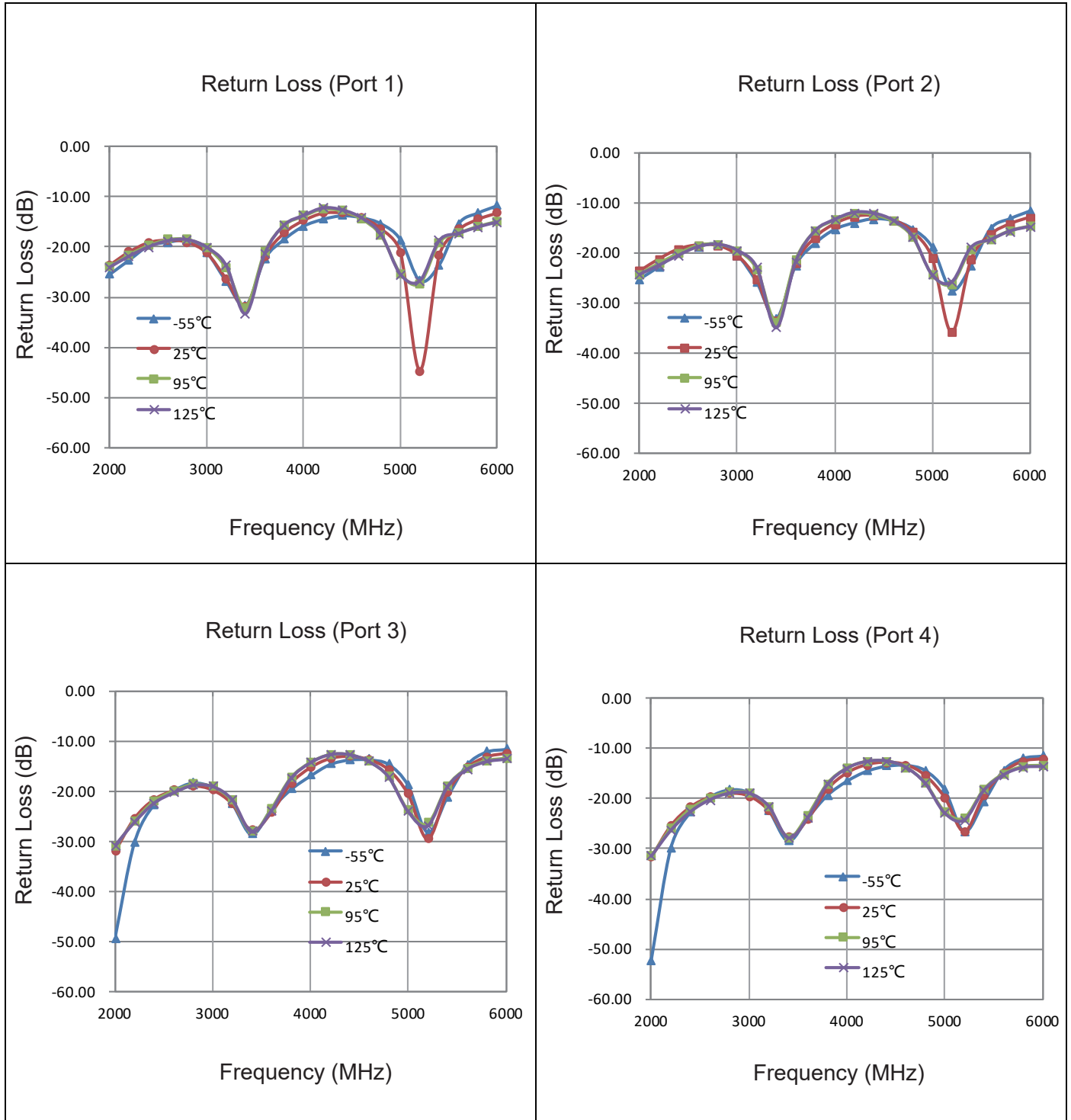
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### Typical Performance (-55°C,25°C,95°C,125°C: 2000-6000 MHz)



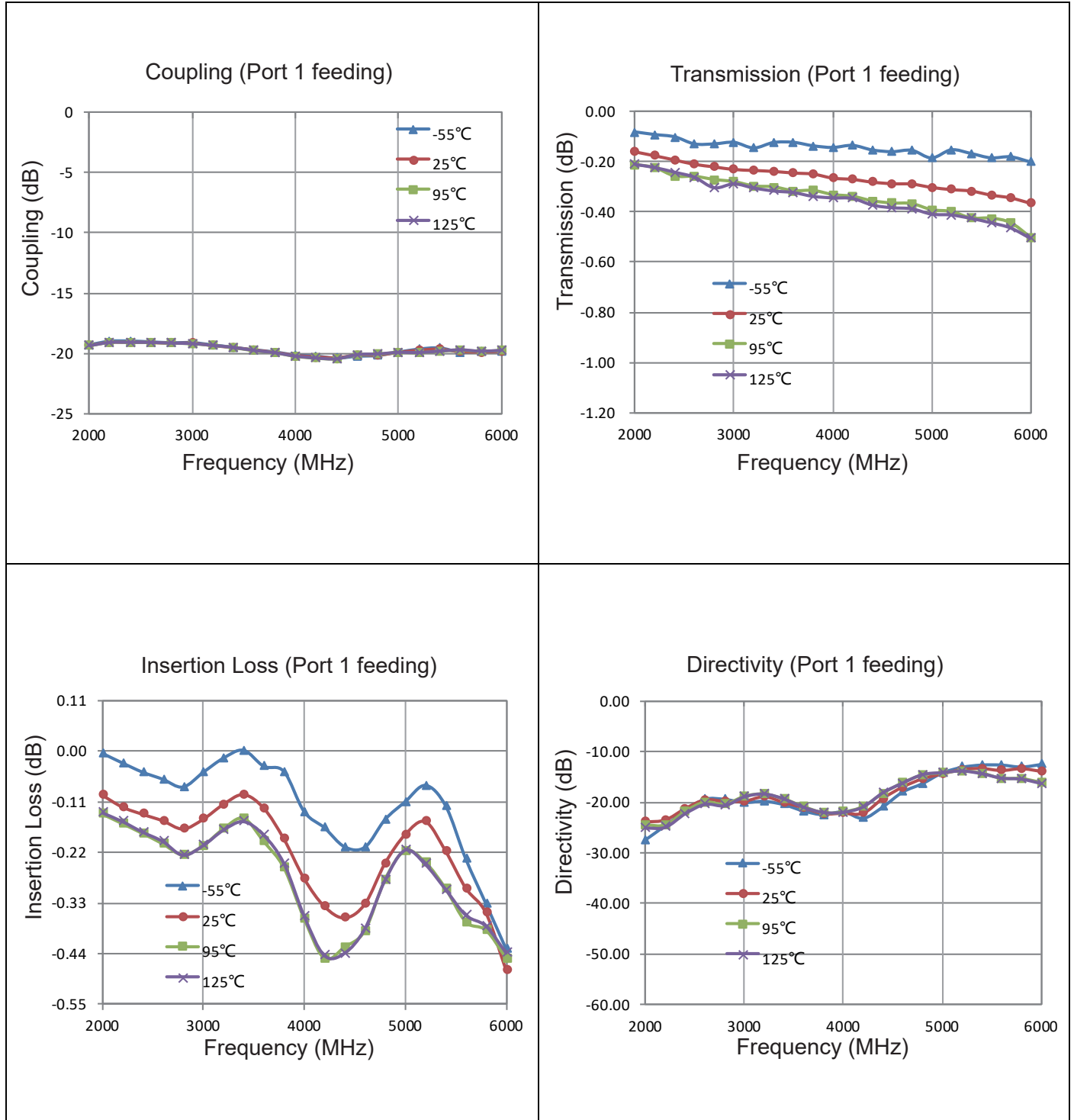
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### Description of Measured Specifications

| Parameter             | Description  |
|-----------------------|--|
| <b>VSWR</b>           | Voltage standing wave ratio, the impedance match to 50 $\Omega$ , the ideal value is 1:1.        |
| <b>Return Loss</b>    | Loss of signal power resulting from the reflection caused by discontinuity of transmission line. |
| <b>Insertion Loss</b> | The input power divided by sum of power at the coupling port & transmission port.                |
| <b>Coupling</b>       | The input power divided by the power at coupling port.   |
| <b>Transmission</b>   | The input power divided by the power at transmission port.                                       |
| <b>Directivity</b>    | The power at the coupling port divided by the power at the isolated.                             |

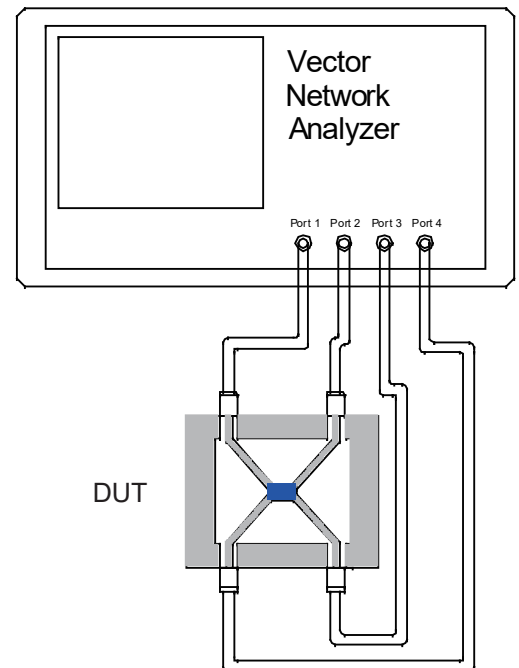
### Test Method

1. Calibrating your vector network analyzer.
2. Connect the VNA 4 Port to DUT respectively.
3. Measure the data of coupling through port 1 to port 4(S41).
4. Measure the data of transmission through port 1 to port 2(S21).
5. Measure the data of isolation through port 1 to port 3(S31).
6. Measure the data of return loss port 1, port 2, port 3 & port 4.
7. According to the above data to calculate insertion loss, directivity.

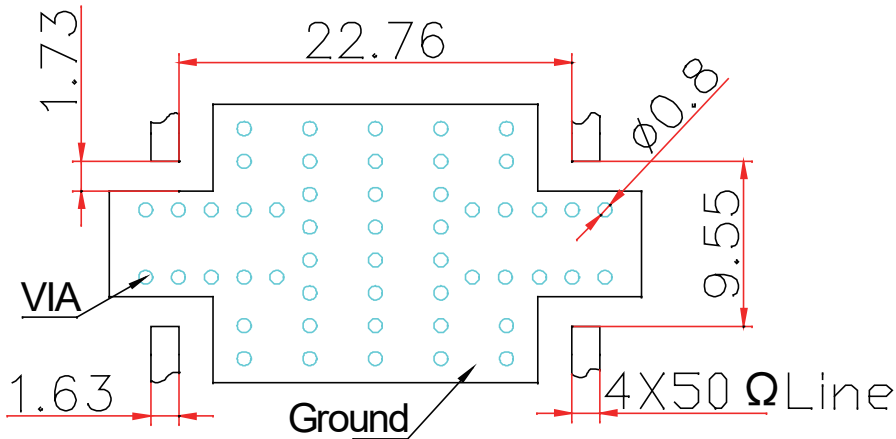
Note:

1. When calculating insertion loss at room temperature, coupling & transmission data both need remove demo board loss. Please see demo board loss data below the table :

| Frequency Range(MHz) | Demo Board Loss (dB) @25°C |
|----------------------|----------------------------|
| <b>470-860</b>       | 0.06~0.10                  |
| <b>800-1000</b>      | 0.10~0.15                  |
| <b>1200-1700</b>     | 0.15~0.20                  |
| <b>1700-2000</b>     | 0.20~0.25                  |
| <b>2000-2300</b>     | 0.20~0.25                  |
| <b>2300-2700</b>     | 0.25~0.30                  |



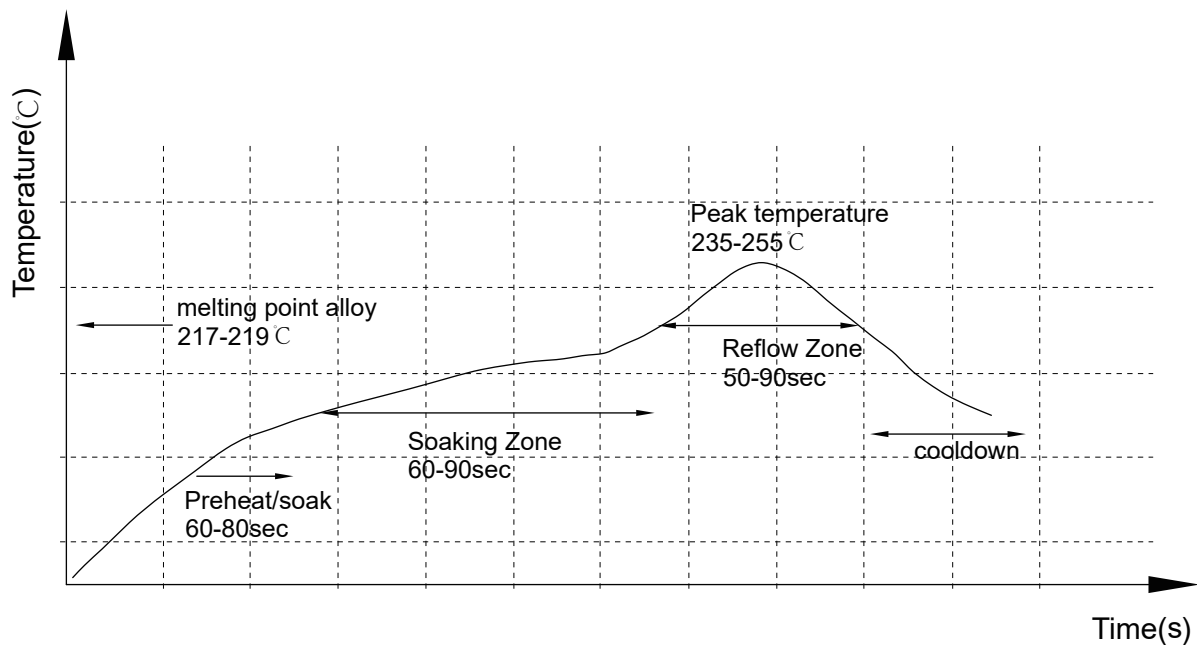
### Recommended PCB Layout



#### NOTE:

1. 50  $\Omega$  line width is shown above designing from RO4350B dielectric thickness 0.762mm; copper 1 OZ
2. Bottom side of the PCB is continuous ground plane.
3. All dimensions shown in mm.

### Reflow Profile

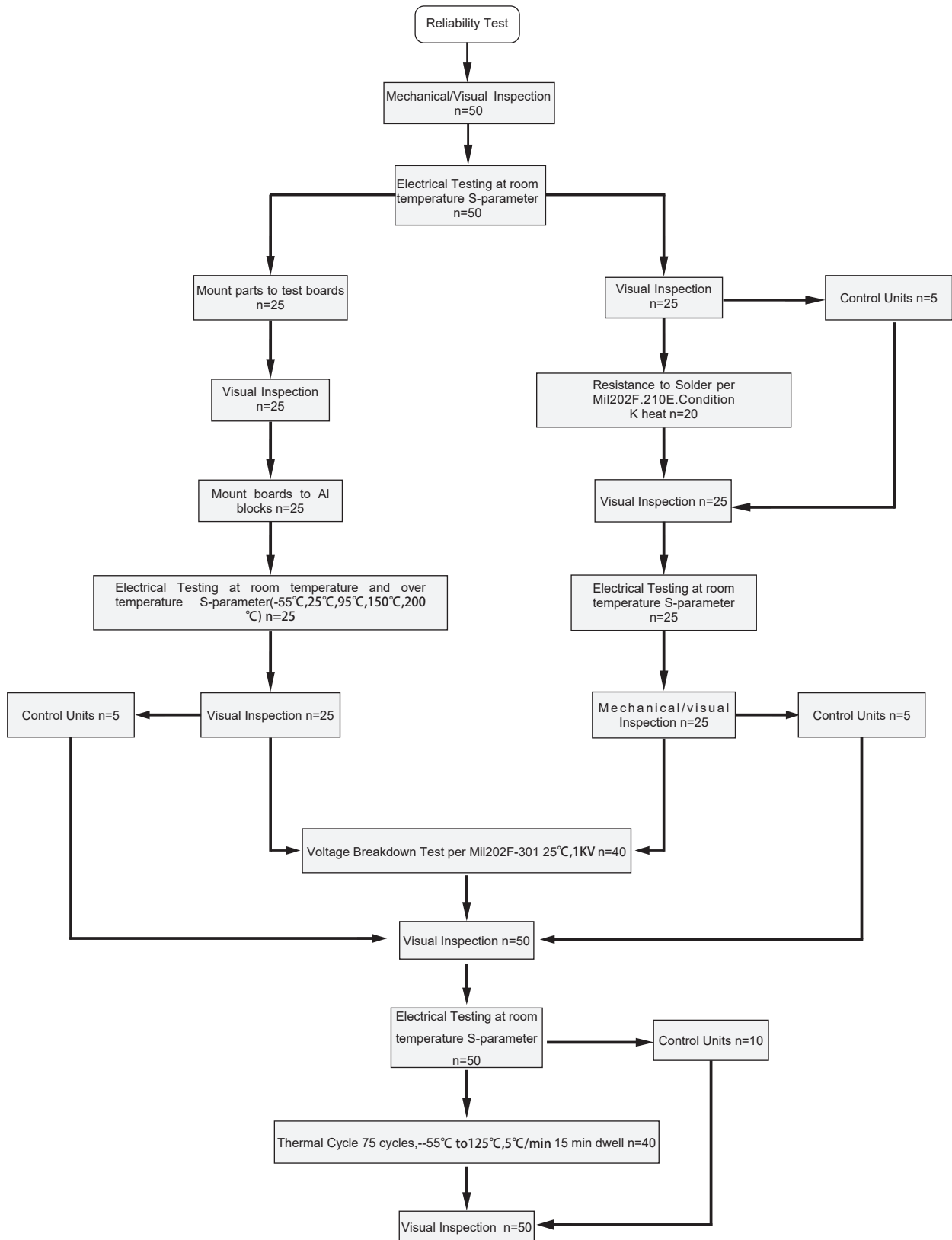


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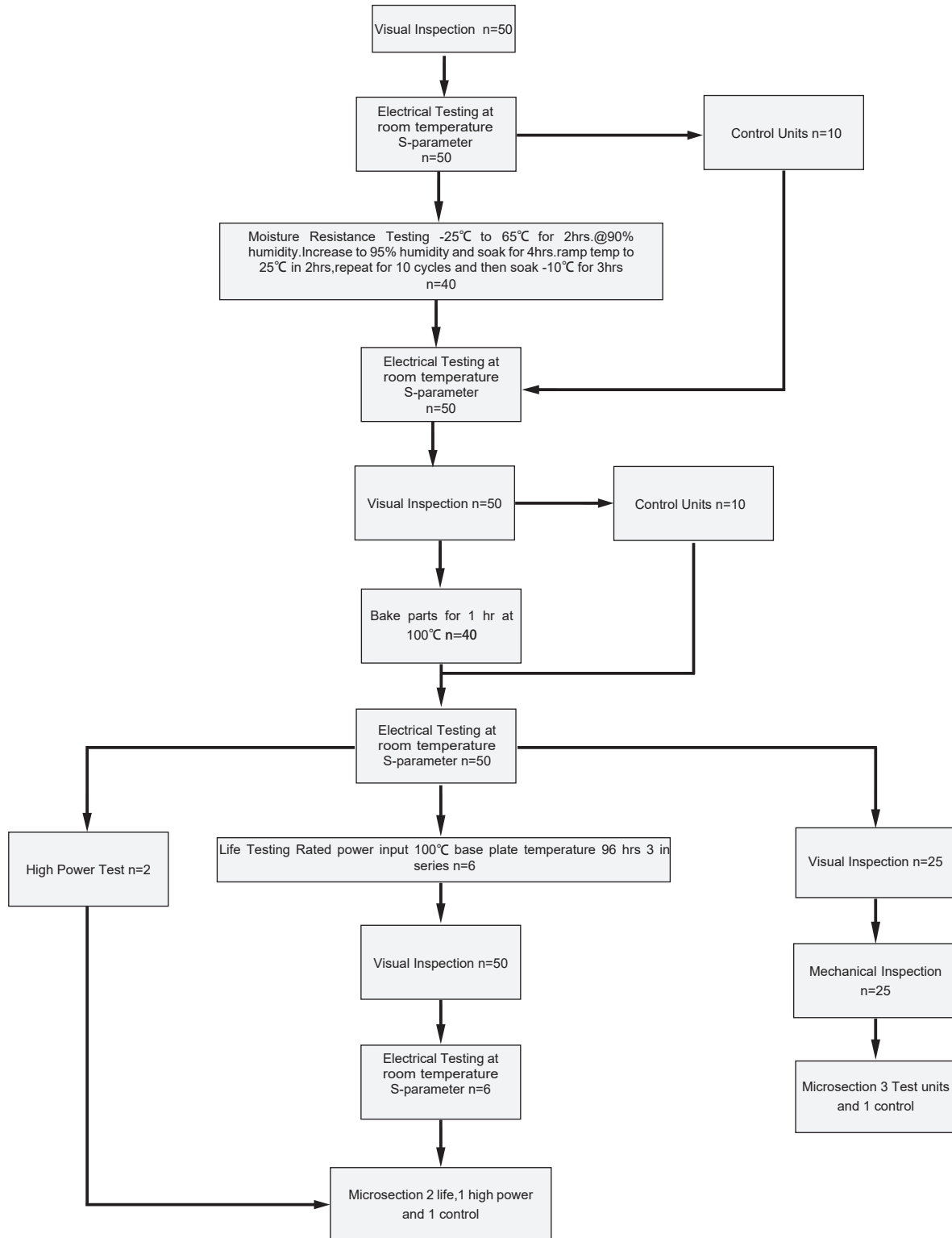
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### Reliability Test Flow

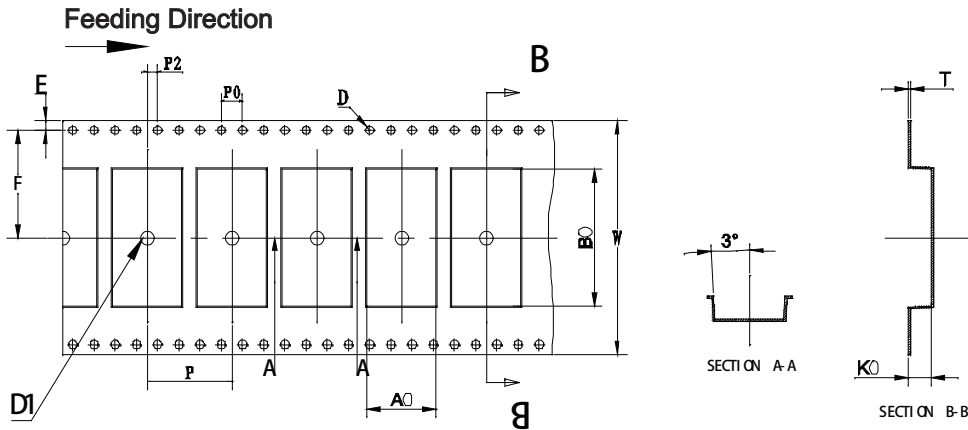


### Reliability Test Flow





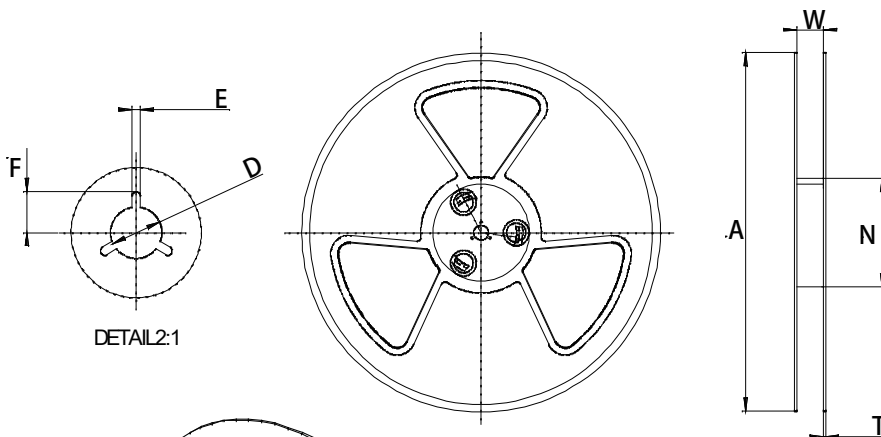
### Tape and Reel Drawing



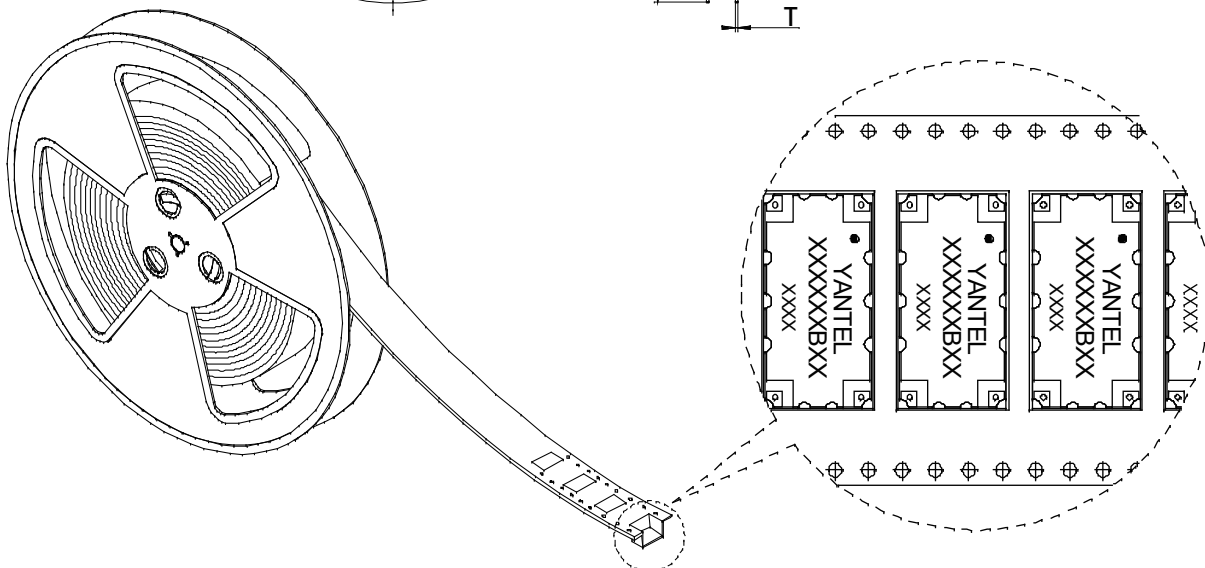
Notice:

- A.10 Sprocket hole pitch cumulative tolerance is 0.2mm.
- B. Carrier camber shall be not more than 1mm per 100mm through a length of 250mm.
- C. All dimensions meet EIA-418-B requirements.
- D. A0 & B0 measured as indicated.
- E. K0 measured from a place on the inside bottom of the pocket to top surface of carrier.
- F. Material: PE 100
- G. Thickness:  $0.40 \pm 0.05$ mm
- H. 400 units (maximum) / T&R

| ITEM    | W              | A0             | B0             | K0             | P              | F              | E              | D              | D1             | P0             | P2             | T              | 13"     |
|---------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------|
| DIM(mm) | 44.00          | 13.2           | 25.90          | 3.60           | 16.00          | 20.20          | 1.75           | 1.50           | 1.50           | 4.00           | 2.00           | 0.40           | P/R     |
| TOLE    | +0.30<br>-0.30 | +0.10<br>-0.10 | +0.10<br>-0.10 | +0.10<br>-0.10 | +0.10<br>-0.10 | +0.10<br>-0.10 | +0.10<br>-0.10 | +0.10<br>-0.00 | +0.10<br>-0.00 | +0.10<br>-0.10 | +0.15<br>-0.15 | +0.05<br>-0.05 | 400 pcs |



| Symbol | Dimensions(mm)       |
|--------|----------------------|
| W      | $44.5 \pm 0.4$       |
| A      | $330 \pm 0.5$        |
| N      | $100 \pm 0.3$        |
| T      | $1.8 \pm 0.2$        |
| E      | $2.1 \pm 0.3$        |
| F      | $10.75 \pm 0.3$      |
| D      | $13.5 + 0.5 / - 0.2$ |



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