# HC0312D03

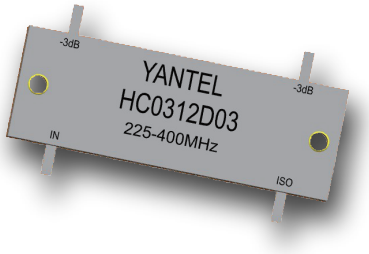
## Hybrid Coupler 3 dB, 90°

Rev A0

### Description

High-power broadband surface-mounted and embedded coupler series, realizing the power synthesis and distribution of microwave high-power amplifier system, signal acquisition and other functions. Used in active phased array radar, microwave transceiver components, microwave amplifiers, radio stations, satellite communications and other projects, to provide standardized and customized high-quality and reliable products.

The performance and reliability indexes are in line with international products, and the pin definition and package size are compatible with international products, realizing 100% in-situ replacement.




### Features:

- **225-400 MHz**
- **High Power**
- **Very Low Loss**
- **Tight Amplitude Balance**
- **High Isolation**
- **Low VSWR**
- **Good Repeatability**
- **RoHS Compliant**
- **Tape & Reel Package available**

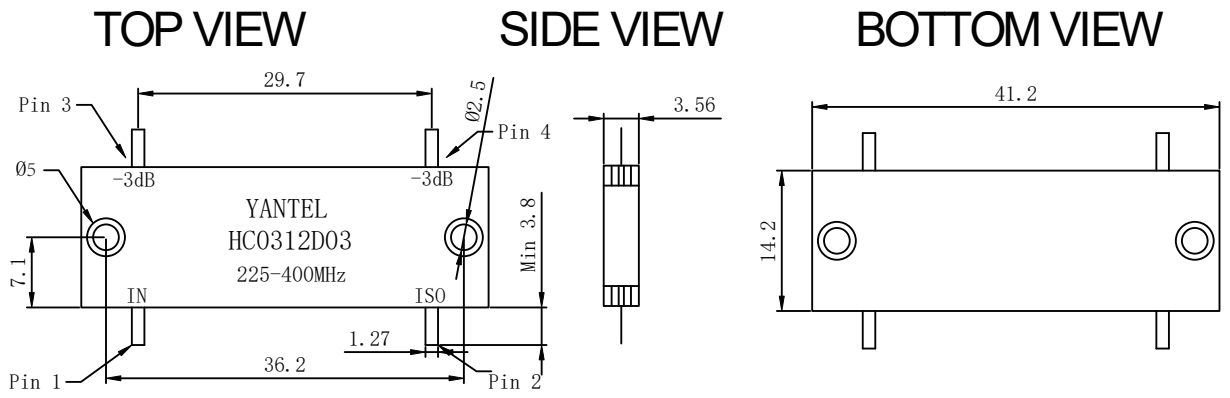
### Electrical Specifications

| Frequency | Isolation | Insertion Loss | Return Loss |
|---|---|---|---|
| *MHz* | *dB Min* | *dB Max* | *dB* |
| 225-400 | 20 | 0.25 | 20 |

| Amplitude Balance | Phase Balance | Power | Operating Temp. |
|---|---|---|---|
| dB Max | *Degrees* | *Avg. CW Watts* | *°C* |
| ±0.50 | 90±5.0 | 200 | -55 to +85 |

Notes:
1. All the above data are based on specified demo board.
2. Insertion loss:Thru board loss has been removed.

### Mechanical Outline




**Note:** 1. All Dimensions show in mm [inch]
2. RoHS Compliant in accordance with EU Directive(2011/65/EU)
3. REACH Compliant in accordance with Regulation (EC) No 1907/2006
4. Dimension tolerance: ±0.20mm[±0.008inch]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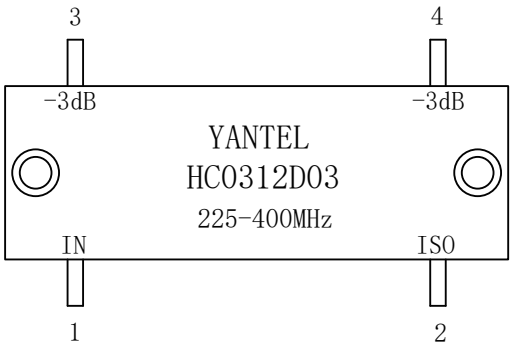
### Hybrid Coupler Pin Configuration




| PORT CONFIGURATION | | | | |
|---|---|---|---|---|
| INPUT | 1 | 2 | 3 | 4 |
| 1 | --- | ISOLATION | -3dB<0 DEG | -3dB<-90 DEG |
| 2 | ISOLATION | --- | -3dB<-90 DEG | -3dB<0 DEG |
| 3 | -3dB<0 DEG | -3dB<-90 DEG | --- | ISOLATION |
| 4 | -3dB<-90 DEG | -3dB<0 DEG | ISOLATION | --- |

### Typical Performance Data (@25)

| Frequency (MHz) | Coupling (dB) | Transmission (dB) | Insertion Loss (dB) | Isolation (dB) | Amplitude Balance (dB) | Phase (degree) | Return Loss(dB) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | S11 | S22 | S33 | S44 |
| 225 | -3.25 | -2.91 | -0.07 | -31.24 | -0.17 | -90.49 | -31.22 | -30.70 | -33.06 | -37.28 |
| 234 | -3.16 | -3.00 | -0.07 | -31.38 | -0.08 | -90.52 | -30.71 | -30.20 | -32.60 | -36.58 |
| 243 | -3.09 | -3.07 | -0.07 | -31.07 | -0.01 | -90.54 | -30.39 | -29.67 | -32.11 | -36.14 |
| 251 | -3.02 | -3.14 | -0.07 | -31.19 | 0.06 | -90.60 | -29.93 | -29.13 | -31.41 | -35.15 |
| 260 | -2.96 | -3.21 | -0.07 | -30.84 | 0.12 | -90.66 | -29.49 | -28.84 | -30.97 | -34.05 |
| 269 | -2.92 | -3.26 | -0.08 | -30.59 | 0.17 | -90.69 | -29.01 | -28.48 | -30.38 | -33.35 |
| 278 | -2.88 | -3.31 | -0.08 | -30.13 | 0.21 | -90.77 | -28.74 | -28.16 | -29.80 | -32.66 |
| 286 | -2.85 | -3.35 | -0.08 | -29.68 | 0.25 | -90.79 | -28.33 | -27.89 | -29.18 | -31.92 |
| 295 | -2.83 | -3.38 | -0.09 | -29.29 | 0.27 | -90.84 | -28.07 | -27.53 | -28.73 | -31.14 |
| 304 | -2.82 | -3.41 | -0.09 | -28.94 | 0.28 | -90.92 | -27.49 | -27.33 | -28.24 | -30.49 |
| 313 | -2.81 | -3.42 | -0.09 | -28.50 | 0.29 | -90.97 | -27.22 | -26.82 | -27.75 | -29.84 |
| 321 | -2.81 | -3.42 | -0.10 | -28.03 | 0.29 | -91.05 | -26.83 | -26.52 | -27.25 | -29.27 |
| 330 | -2.83 | -3.42 | -0.10 | -27.50 | 0.29 | -91.12 | -26.32 | -26.32 | -26.65 | -28.62 |
| 339 | -2.85 | -3.41 | -0.11 | -27.05 | 0.27 | -91.21 | -25.93 | -25.79 | -26.35 | -28.04 |
| 348 | -2.87 | -3.39 | -0.11 | -26.59 | 0.25 | -91.28 | -25.46 | -25.37 | -25.92 | -27.34 |
| 356 | -2.91 | -3.36 | -0.12 | -26.22 | 0.22 | -91.36 | -24.98 | -24.82 | -25.46 | -26.87 |
| 365 | -2.95 | -3.32 | -0.12 | -25.75 | 0.18 | -91.49 | -24.56 | -24.43 | -24.92 | -26.19 |
| 374 | -3.01 | -3.28 | -0.13 | -25.21 | 0.14 | -91.57 | -24.07 | -23.86 | -24.42 | -25.66 |
| 383 | -3.07 | -3.23 | -0.14 | -24.63 | 0.08 | -91.68 | -23.63 | -23.46 | -23.91 | -25.25 |
| 391 | -3.14 | -3.17 | -0.15 | -24.13 | 0.02 | -91.81 | -23.26 | -23.14 | -23.35 | -24.64 |
| 400 | -3.23 | -3.10 | -0.15 | -23.66 | -0.06 | -91.95 | -22.86 | -22.63 | -22.78 | -24.22 |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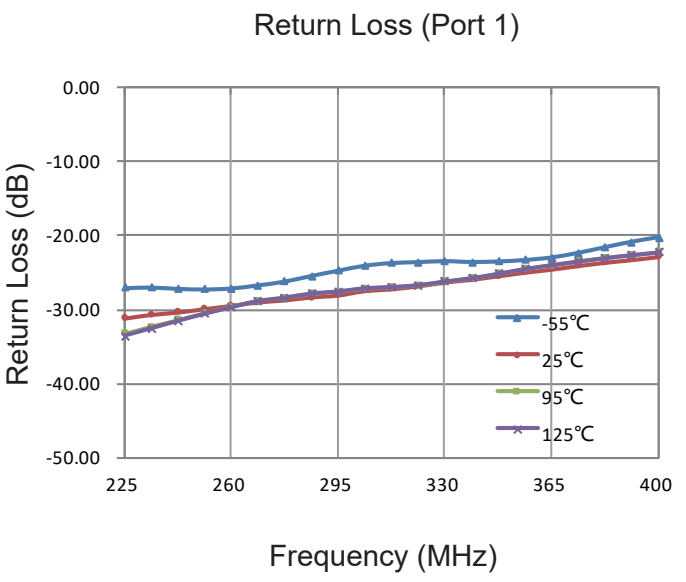
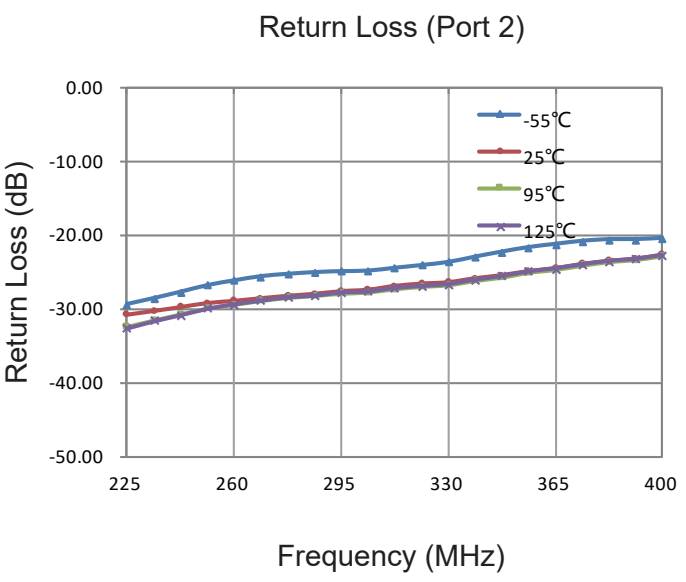
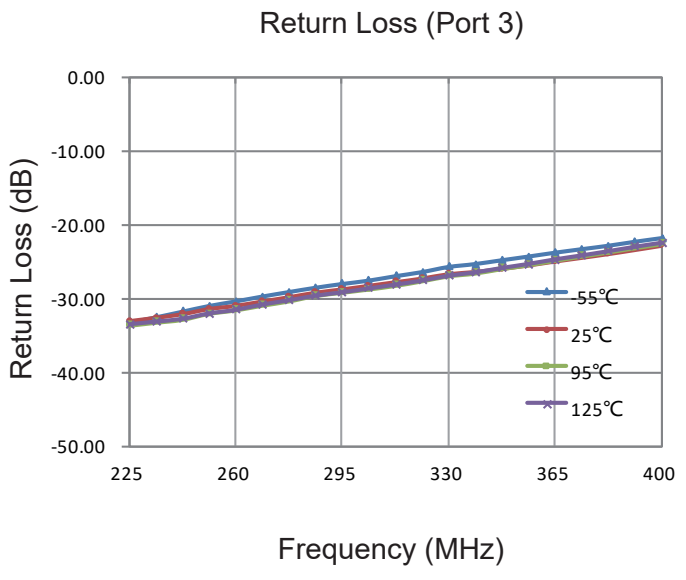
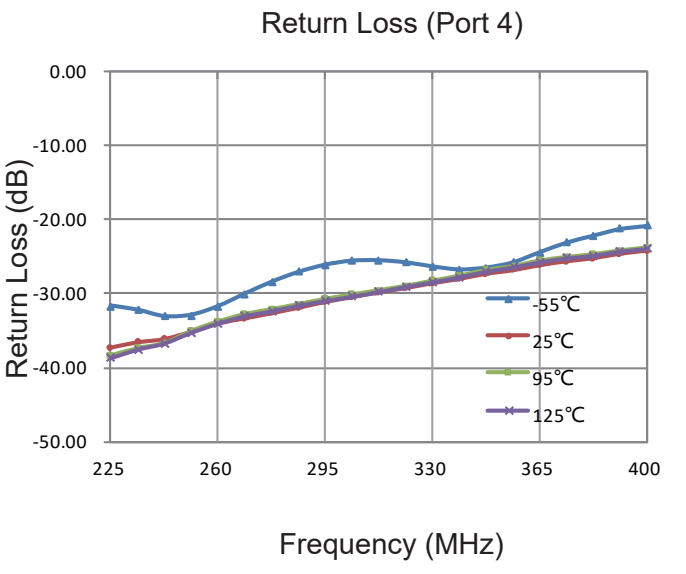
**Typical Performance (-55°C, 25°C, 95°C,125°C: 225-400 MHz)**





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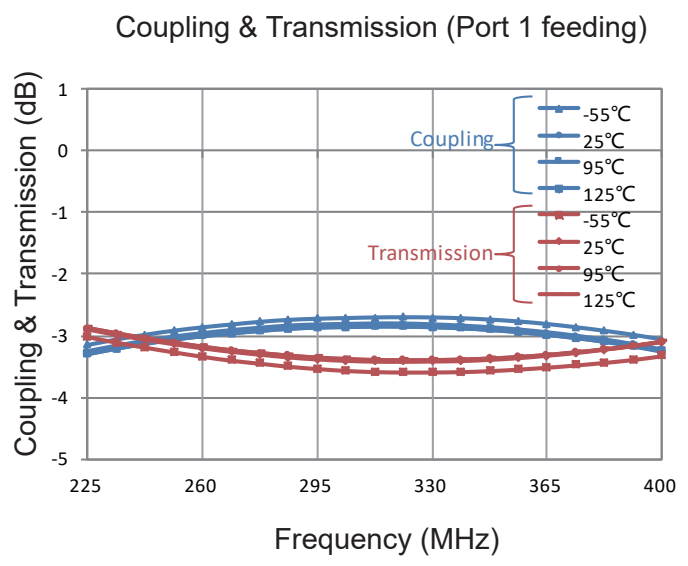
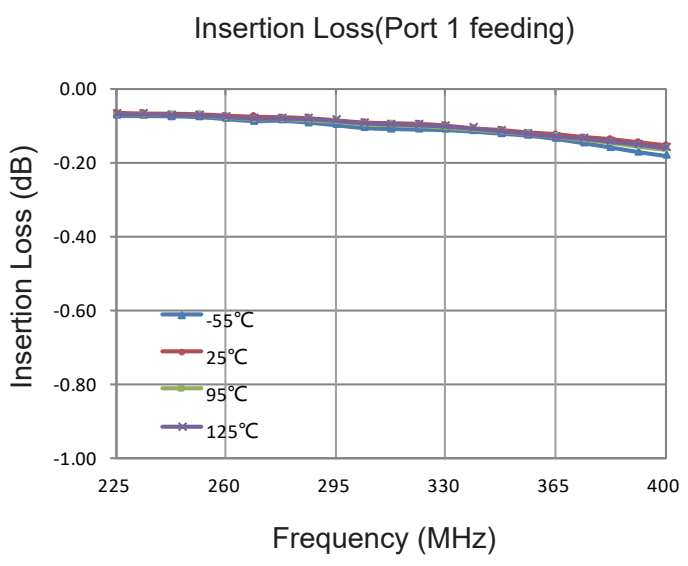
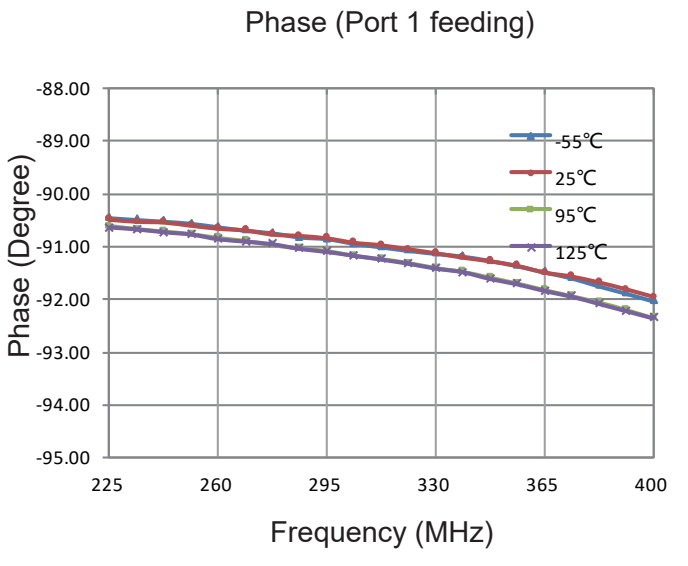
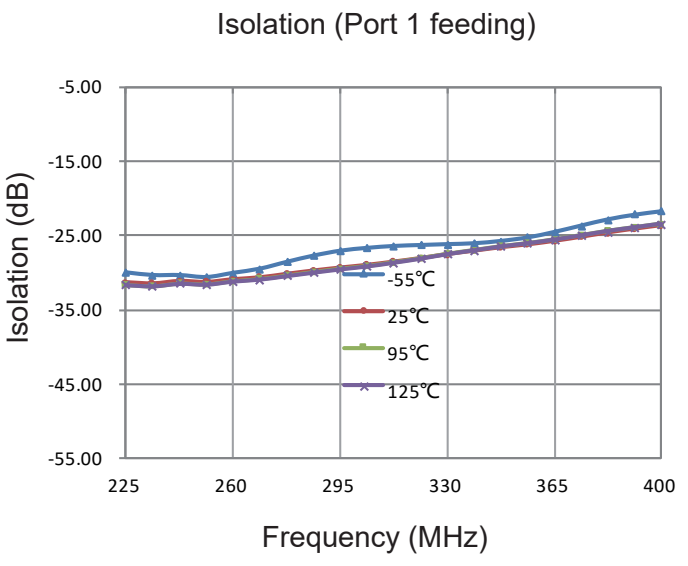
## Typical Performance (-55°C, 25°C, 95°C,125°C: 225-400 MHz)

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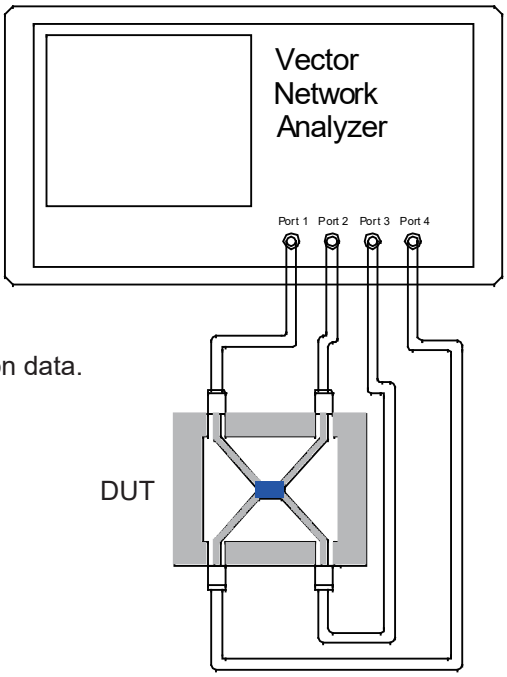
**Definition of Measured Specifications**

| Parameter | Definition | Mathematical Representation |
|---|---|---|
| **VSWR (Voltage Standing Wave Ratio)** | The impedance match of the coupler to a 50Ω system. A VSWR of 1:1 is optimal. | $VSWR = \frac{V_{max}}{V_{min}}$<br>Vmax = voltage maxima of a standing wave<br>Vmin = voltage minima of a standing wave |
| **Return Loss** | The impedance match of the coupler to a 50Ω system. Return Loss is an alternate means to express VSWR. | Return Loss (dB)= $20\log \frac{VSWR+1}{VSWR-1}$ |
| **Insertion Loss** | The input power divided by the sum of the power at the two output ports. | Insertion Loss(dB)= $10\log \frac{P_{in}}{P_{cpl}+P_{transmission}}$ |
| **Isolation** | The input power divided by the power at the isolated port. | Isolation(dB)= $10\log \frac{P_{in}}{P_{iso}}$ |
| **Phase Balance** | The difference in phase angle between the two output ports. | Phase at coupled port – Phase at transmisson port |
| **Amplitude Balance** | The power at each output divided by the average power of the two outputs. | $10\log \frac{P_{cpl}}{\left(\frac{P_{cpl}+P_{transmission}}{2}\right)}$ or $10\log \frac{P_{transmission}}{\left(\frac{P_{cpl}+P_{transmission}}{2}\right)}$ |

**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 3(S31).
5. Measure the data of isolation through port 1 to port 2(S21).
6. Measure the data of phase port 4 & port 3(port 1 feeding).
7. Measure the data of return loss port 1, port 2, port 3 & port 4.
8. According to the above data to calculate insertion loss, amplitude balance & phase.




Note:

1. When calculating insertion loss at room temperature, demo board loss should be removed from both coupling & transmission data.

Please refer to the below table for demo board loss :

| Frequency Range(MHz) | Demo Board Loss (dB) @25℃ |
|---|---|
| **470-860** | 0.07 |
| **800-1000** | 0.10 |
| **1200-1700** | 0.15 |
| **1700-2000** | 0.15 |
| **2000-2300** | 0.20 |
| **2300-2700** | 0.25 |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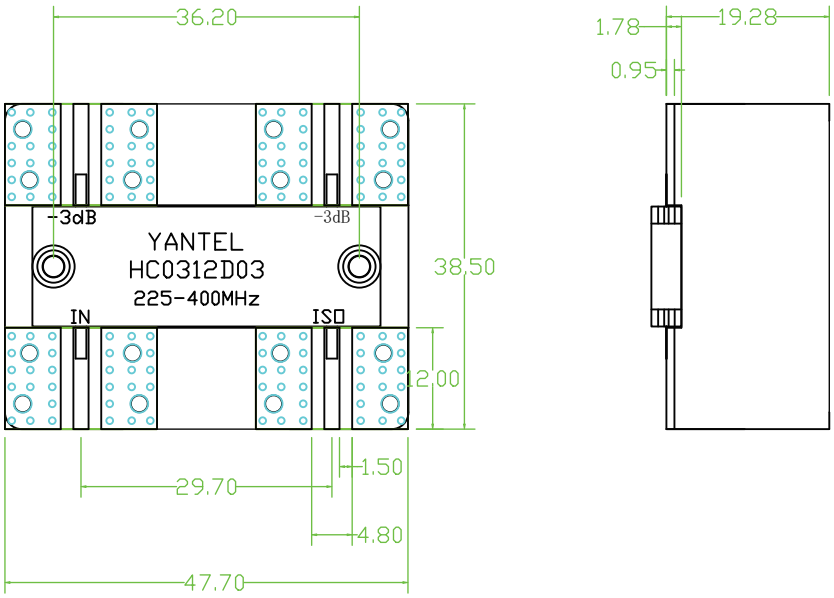
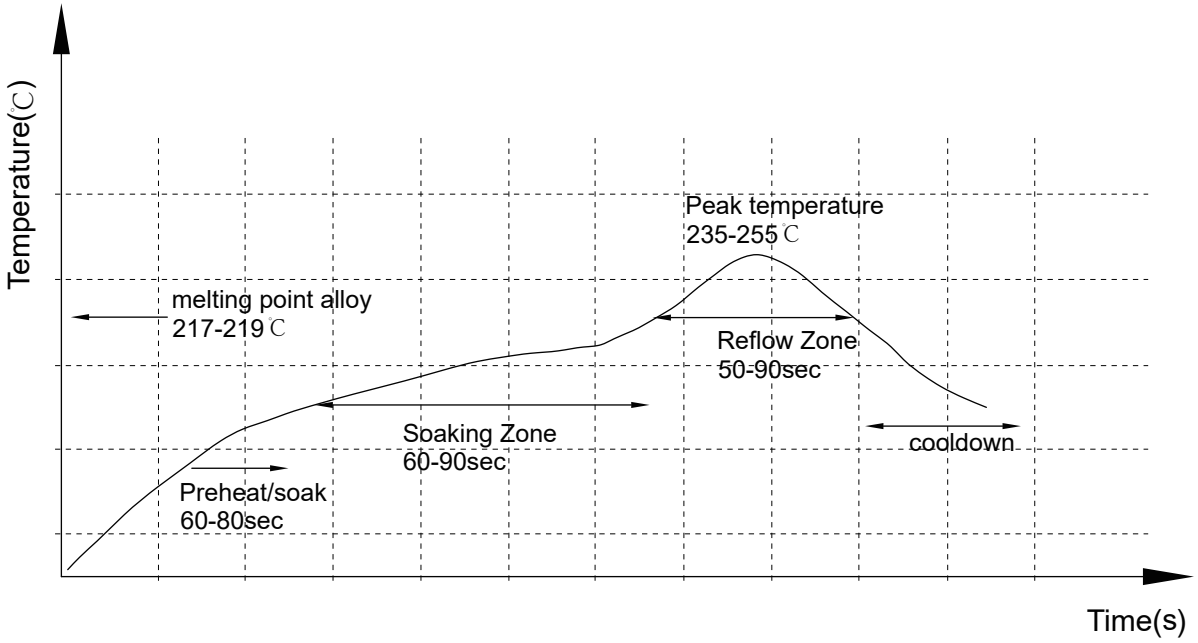
## Recommended PCB Layout



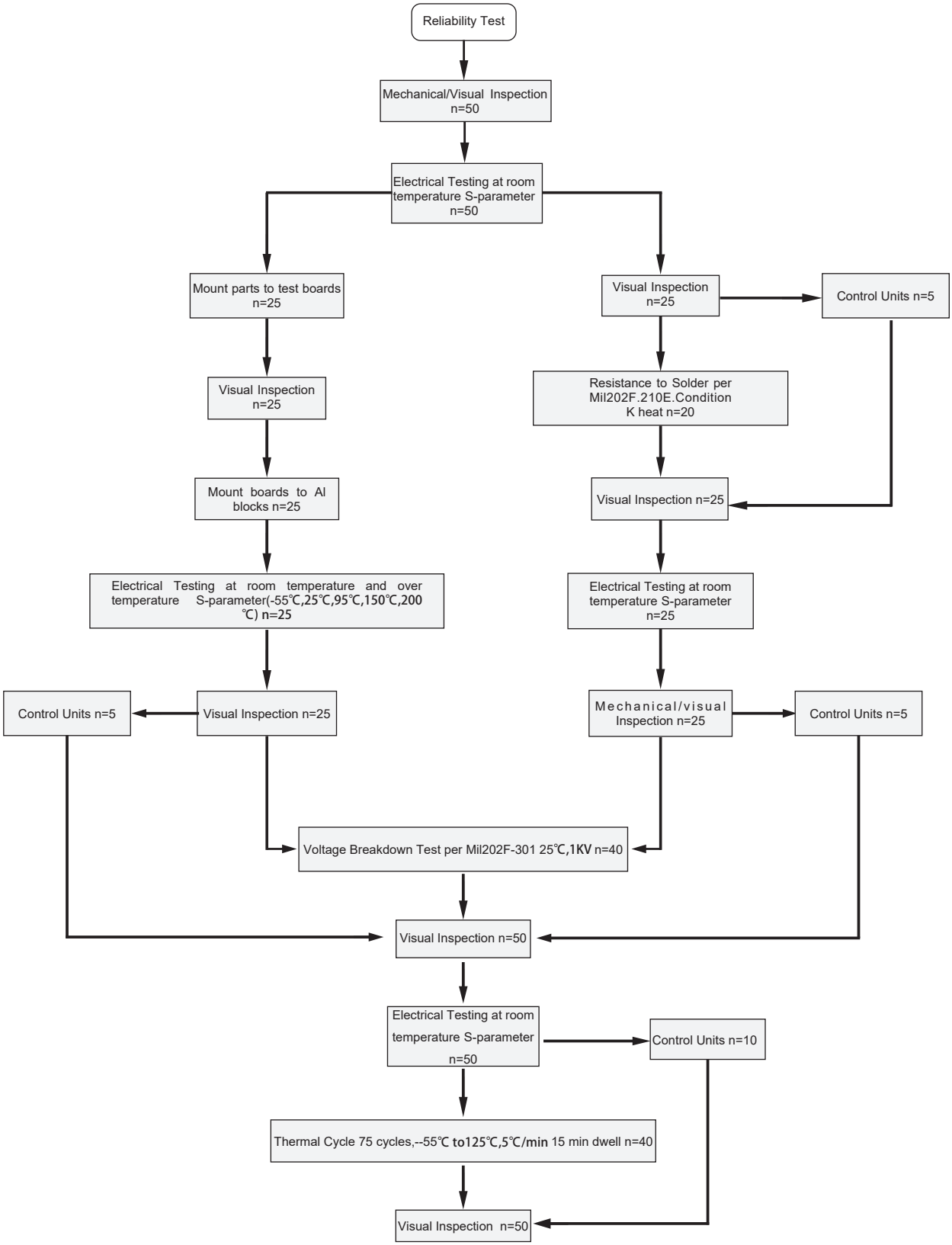
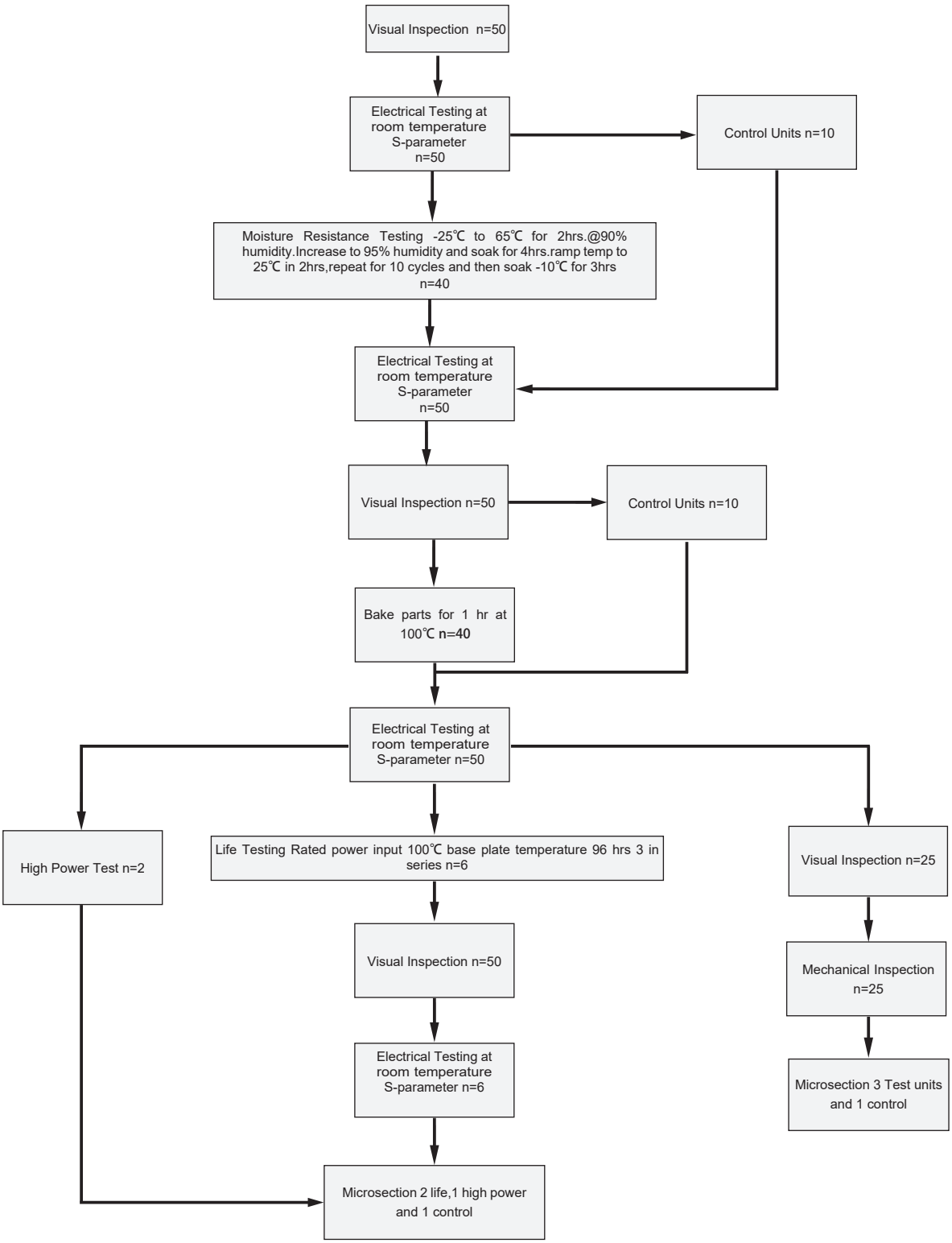

NOTE:AA

TRACE WIDTH IS SHOWN FOR ROGERS RO4003 WITH DIELECTRIC THICKNESS 32mil; COPPER: 1 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

## Reflow Profile



## Reliability Test Flow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