

Purpose & Scope:

The intent of this experiment was to measure the return loss of a Barry chip termination, part number TV0404FA-50R0JN-91, to the upper frequency limit of the Vector Network Analyzer (VNA) used for the test. The range of the VNA used is 40MHz to 65GHz. Barry supplied the following to Engineering Specialty Services Inc. (Bridgewater, MA) to perform the experiment. Engineering Specialty Services Inc. is a reputable third party RF testing service and is compliant with ISO9001



- 3 TV0404FA-50R0JN-91 Chip Terminations Mounted in Fixtures
- DC-65GHz Anritsu Vector Network Analyzer – Model 37397A
- Anritsu 1.85mm Calibration Kit – Model 3654B
- Hasco 1.85mm 18" Male-to-Male Cable – Model HLL-125-VP-VP-18
- Southwest Microwave 1.85mm Female-to-Female Adapter – Model 1832-00SF

Part Design

The TV0404FA-50R0JN-91 is a 50 ohm impedance, 0.04" x 0.04" sized thick film on 0.015" 96% Alumina chip termination. The resistor element is constructed of glass passivated Ruthenium Oxide. Circuit configuration is seen in figure 1. The device features gold input pad for gold wire or ribbon bonding and the ground terminal is constructed of Platinum Palladium Gold for solder or epoxy mounting. The design of the TV0404FA-50R0JN-91 features several sections to enhance performance and minimize reflection and can be seen in figure 2.

Figure 1

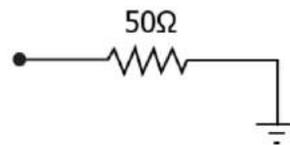
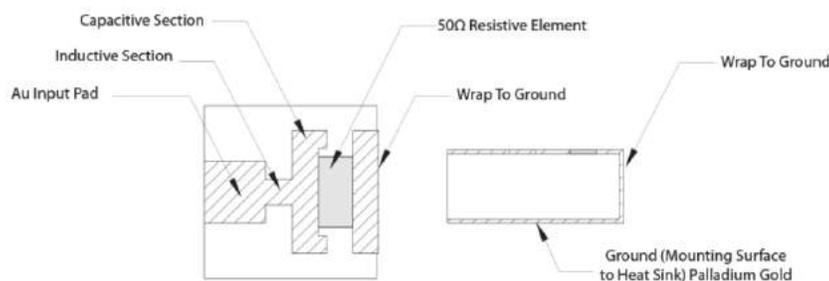


Figure 2



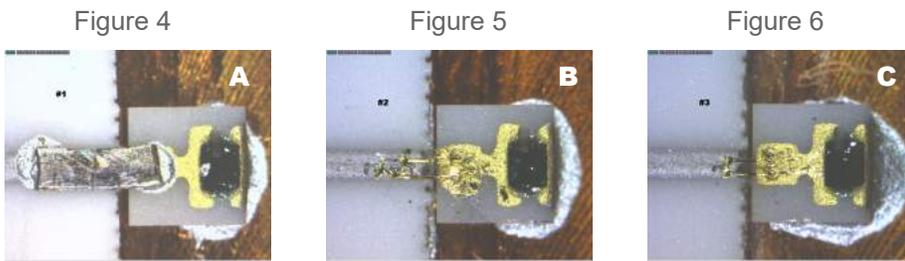
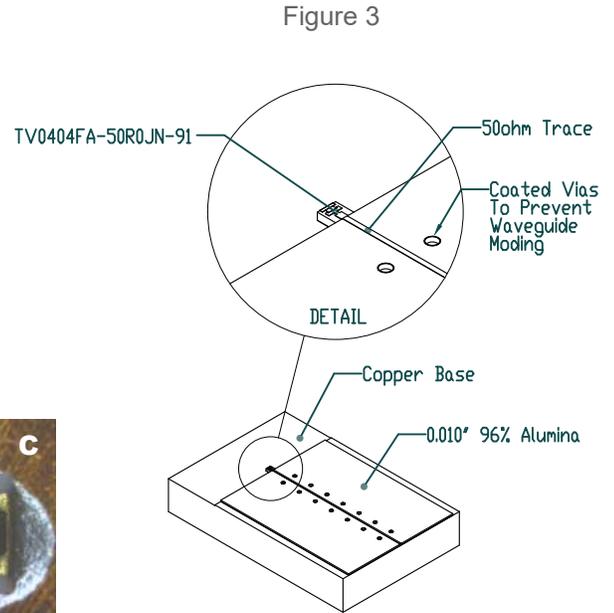
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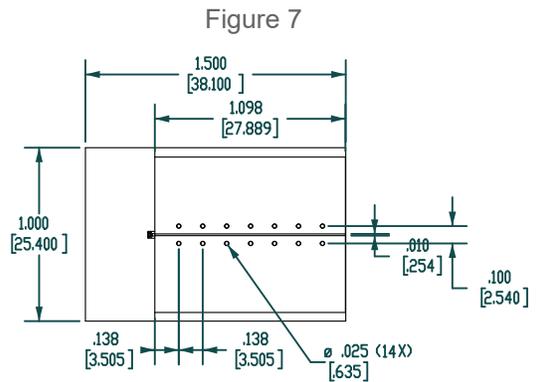
Fixture Design & Chip Attachment:

The TV0404FA-50R0JN-91 was mounted directly on a Copper block adjacent to a 0.010" 96% Alumina substrate with 50 ohm trace leading from the test probe to the chip. The input terminal of the chip was kept on the same plane as the input trace as seen in figure 3. This was made possible by placing the chip on a 0.005" recessed 'shelf'.

One of the chips tested (chip A) was connected using a silver ribbon as seen in figure 4 and the other 2 chips tested (chips B & C) were connected using Gold wirebonds as seen in figures 5 & 6.



Coated vias were placed at along the 50 ohm trace connecting the input probe to the chip to prevent waveguide moding. This is important since coupling to dielectric waveguide modes in the substrate could cause spurious absorption peaks in the return loss data that are not due to the effects of the device under test. Exact dimensions of the vias can be seen in figure 7.



Testing Procedure

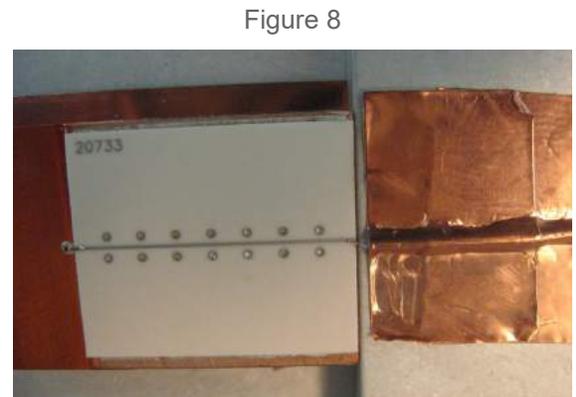
After 1.85mm female to female adapter, male to male cables and probe fixture were properly installed, the VNA was properly calibrated using the calibration kit.

The fixture was probed using 1.85 mm to 0.047 semi-rigid probe as seen in figure 8.

Time domain gating was used to de-embed the fixture and move the reference plane through probe and fixture line to the input of the DUT. The proper time location for gating was determined by moving a small dielectric along the 50 ohm trace while monitoring the S11 time response.

Once the proper calibration and time gate were applied, we were able to evaluate the de-embedded performance of the TV0404FA-50R0JN-91. A bit of time margin at the input was included to ensure the entire DUT was captured.

All measurements were taken from a single 40MHz to 64GHz sweep.



Return Loss Results & Findings:

TV0404FA-50R0JN-91 Test 1 - Ribbon Bonded Chip A

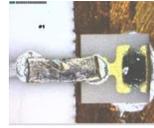
Start: 0.0400GHz
Stop: 64.040GHz

Gate Start: 567.2429 ps
Gate Stop: 934.2825 ps
Gate: Nominal
Window: Nominal

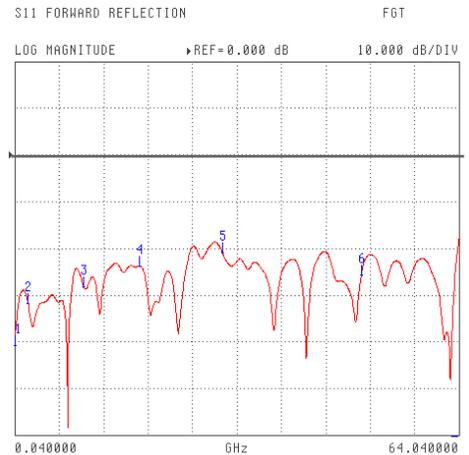
Reference Plane: 5.1100mm

Marker 1: 0.0400GHz
-54.778dB
Marker 2: 2.0000GHz
-37.672dB
Marker 3: 10.000GHz
-27.160dB

Marker 4: 18.000GHz
-23.822dB
Marker 5: 30.000GHz
-20.823dB
Marker 6: 50.000GHz
-25.652dB



Test 1 - Ribbon Bonded Chip



TV0404FA-50R0JN-91 Test 2 - Wirebonded Chip B

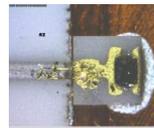
Start: 0.0400GHz
Stop: 64.040GHz

Gate Start: 567.2429 ps
Gate Stop: 934.2825 ps
Gate: Nominal
Window: Nominal

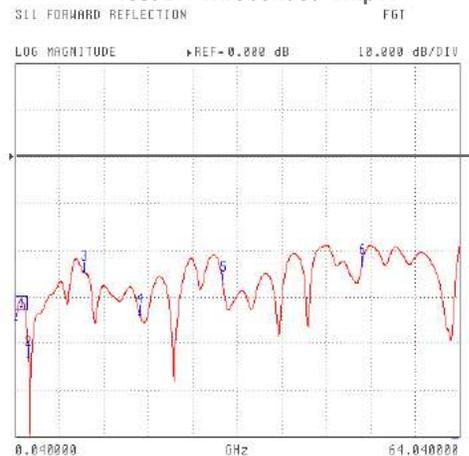
Reference Plane: 5.1100mm

Marker 1: 0.0400GHz
-45.944dB
Marker 2: 2.0000GHz
-45.457dB
Marker 3: 10.000GHz
-24.730dB

Marker 4: 18.000GHz
-33.344dB
Marker 5: 30.000GHz
-28.827dB
Marker 6: 50.000GHz
-23.683dB



Test 2 - Wirebonded Chip A



TV0404FA-50R0JN-91 Test 3 - Wirebonded Chip C

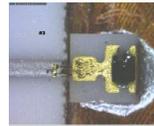
Start: 0.0400GHz
Stop: 64.040GHz

Gate Start: 567.2429 ps
Gate Stop: 934.2825 ps
Gate: Nominal
Window: Nominal

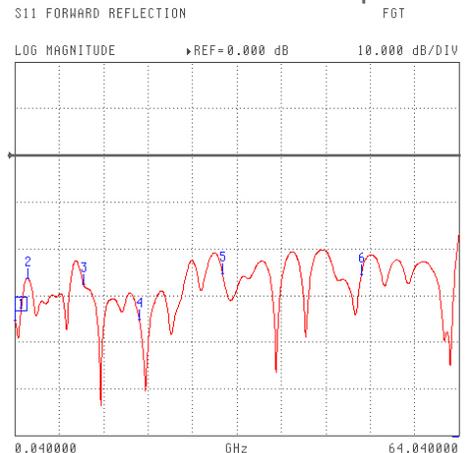
Reference Plane: 5.1100mm

Marker 1: 0.0400GHz
-51.842dB
Marker 2: 2.0000GHz
-34.445dB
Marker 3: 10.000GHz
-26.096dB

Marker 4: 18.000GHz
-34.873dB
Marker 5: 30.000GHz
-25.421dB
Marker 6: 50.000GHz
-25.653dB



Test 3 - Wirebonded Chip B



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