APPLICATION NOTE

How to Test Drop-In Circulators and Isolators

Introduction
This Application Note describes recommended practices and guidelines for the successful testing of Skyworks drop-in circulators and isolators.

Handling and Storage Precautions
Handle drop-in circulators and isolators with care when the devices are removed from their shipping tray, when a device is placed in a test fixture, or when a device is removed from the test fixture. Careful handling avoids damaging the connection tabs on the device. Although Skyworks drop-in circulators and isolators have sufficient magnetic shielding, devices should not be stacked directly on top of each other or close to unshielded magnetic sources.

Component Construction
All of Skyworks drop-in circulators and isolators are designed for a lead-free, hand soldering operation. Lead-free reflow soldering of drop-in circulators and isolators can only be carried out with devices that have been specifically constructed for reflow solder processes.

Measurement Requirements
Skyworks drop-in circulators and isolators are tested using precision 50 Ω microstrip fixtures (see Figure 1). A Vector Network Analyzer (VNA) is used to measure the electrical characteristics of the device. A block diagram of the test setup is shown in Figure 2.

VNA Calibration
The VNA is calibrated according to the schedule recommended by the equipment manufacturer. Full two-port error correction provides the best accuracy when RF and microwave components are measured. However, if a non-insertable device is used (such as a typical drop-in circulator with two SMA female connectors), its test ports cannot be directly connected during calibration. Use of electronic calibration (Ecal) modules is the simplest and fastest non-insertable calibration method in existence, and this is the recommended calibration method. This method uses an ECal module with the same connectors that match the test fixture in use. Full two-port error correction, defined at the test ports, is achievable.

If an ECal module is not available, it is recommended to replace one of the SMA male adapters with an SMA female adapter that has the same electrical length for the four transmission measurements of the calibration.

Once the full two-port calibration is complete, a through-block (as shown in Figure 3) is used to remove the test fixture insertion loss from the insertion loss of the measurement.

Testing
Connect the test fixture to the VNA and place the drop-in onto the test fixture. Ensure that the device is well grounded using at least two screws to hold the device in place (see Figure 4).

It is also important to ensure that there is sufficient contact between the device tabs and the substrates on the test fixture. It is recommended to NOT solder the device tabs to the substrates on the test fixture since repeated soldering and de-soldering changes the characteristics of the test fixture. This results in inaccurate measurements.
Figure 1. Precision 50 Ω Test Fixture

Figure 2. Test Setup

Figure 3. Through-Block to Remove Fixture Losses From Measurement
Figure 4. Circulator Mounted on Test Fixture

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