

RADITEK INC.

Application note: Microstrip Isolators & Circulators

General Notes

Use in hermetic/sealed enclosures only.

Material Hexagonal Ferrite

Temperature range -40 to 70C (3-40GHz), -10° to 80°C (66-77GHz) 0-50C (90-98GHz), with about +6 C of temperature gradient to the back side of your isolator

Max Temperature If Curing adhesive do not exceed 120 °C for up to 10 min. or 130 °C for up to 5 min. Do not heat above 130° C.

Max Storage Temperature 130°C, Devices with higher storage temperatures are available by special request.

Thermal shock spec. 5°C/min. over the full temperature range.

Circuit plating: 0.5 micron (micro meter) Chrome, 2.0 micron Copper, 2.0 micron Gold (.28GHz)

4.0 micron Copper, 2.0 micron Gold (MSS family).

Suitable for all kinds of gold wire and tin lead solder bonds

Integration: We can supply as a single substrate for customer to add components to, if required

Environmental testing. Shock: Built to withstand the harsh Aerospace environment of shock and vibration. The units have low mass and are very robust. We also make devices for military aircraft and spacecraft

Devices have been tested under the following environmental conditions:

- operational temperature: -60 to +85degrees C
- sinusoidal vibration: 1-2000 Hz at amplitude 20g
- single shock: 150g at pulse duration 0.1-2.0 ms
- multiple shocks: 10g at duration 1.0-2.0 ms
- linear acceleration: 20g
- absence of resonant frequencies at 1-4000 Hz

Magnet: Weight typically 0.2Grams it is attached with epoxy, Magnet is rare Earth type typically Samarium Cobalt, Considering low mass, we have good experience with shock and vibration

No Coefficient of Thermal Expansion problems within the storage temperature range

Cleaning processes for the materials prior to bonding: Alcohol recommended

Thermal resistance: Must be <10-4 m2K/W Between isolator and "heat sink" surface

Surface flatness/finish for the carrier: 0.02mm

Handling: Handle with care, the ferrite is very fragile, use only non-magnetic tools.

Observe anti static rules to protect circuits it may be connected to. **NOTE:** There may be fragile, coated miniature **tuning elements** on the isolator surface, DO NOT TOUCH with anything! particularly important >60GHz

Mounting: Microstrip Tabs and the mating circuitry should be in the same plane (same height)

Connection with 50 ohm Microstrip of adjacent circuits: minimize any gap between the isolator and adjacent customer circuits, Use good, low inductance bonding techniques

Microstrip Isolators & Circulators in Cavities

Some simple rules need to be followed to avoid specification degradation resulting from "Modeing" radiation in the cavity.

1. Distance from the top of the magnet to cavity roof/cover >0.5mm.
2. Distance from the top surface of the Microstrip to the cavity roof/cover
 - a. >3x ferrite thickness
 - b. Eg. If ferrite thickness is 0.7 mm
 - c. 3 x 0.7 mm +>2.1mm
3. Minimize any change of height/step on the joint.

Minimize any gap between the isolator and the customer's circuitry/substrate.

Mounting : Distance between units No additional magnetic shielding is required if the distance between two devices is kept to a minimum of 2.54 mm with face to face, back to back, or face to back The minimum distance between two microstrip devices shoulder to shoulder is "0"mm

Connection tabs: Tabs should be narrower (about 10% less) than the Microstrip line, (typically 0.08-0.12mm wide). (eg 13.82 mils (0,35mm wide at 13GHz), The tabs should not exceed 0.4 mm total length and in no case protrude 0.2mm over the device end. Tabs must be flat against substrate, and must not lean over the edge. Tabs thickness should be 20-25 micrometers, (0.6 mils / 0.006") We recommend using annealed gold tabs. {width of the tabs shouldn't exceed width of the input/output line of Microstrip device,

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Interconnection All thin film isolator circuits are gold on copper, suitable for soldering (very easy with regular tin-lead solder), (silver solder preferred), or gold thermo-compression bonding

Bonding: Suitable for all kinds of gold wire/ribbon and tin lead solder bonds. Don't use excessive heat, force or ultrasonic, when bonding as the ferrite is very fragile.

Parallel gap impulse welding. We recommend parallel gap impulse welding for connection of our standard thin film Microstrip devices with PCB. *{set to Pulse amplitude 0.8 / pulse duration 20usec max}*

Soldering: Reflow: Maximum temperature during reflow soldering process is +200°C for 5 seconds.

Soldering: Hand: Use temperature controlled soldering iron set to 220-230°C for 2-3 seconds.

MSS Substrate units

Integration: We can supply as a single substrate for customer to add components to, on request. (in production volume)

Mounting substrate type Microstrip devices (MSS) metal base

Substrate type microstrip devices should be mounted on metal base with the minimum thickness of 1mm.

If non-magnetic mounting (-NM) is specified, mount only on non-ferromagnetic material, ie Aluminum

If magnetic (-M) (default) mounting is specified, mount only on ferromagnetic material ie steel or Kovar

Mounting Surface should be smooth with surface roughness <0.4 micron.

Mounting substrate type Microstrip devices (MSS) method

Non conductive epoxy is standard,

Solder in units (with no added tuning tabs) can be specified for high volume units (>1000)

Soldering. Any solder material that does not contain Lead or Tin could be used for mounting of standard substrate type Microstrip devices on the metal base. Temperature of the metal base should not exceed +150°C during 60 seconds.

Adhesive: Non conductive epoxy is recommended, the Glue (epoxy) should be a high quality extended temperature type and have a dielectric constant less than 4.0 and glue thickness <3-8 micron. Excessive insertion loss will result if the glue is too thick.

If conductive epoxy is used, great care must be taken to ensure non is extruded on the sides at any input or output. (excess will degrade VSWR) or at the load side where excess will degrade isolation

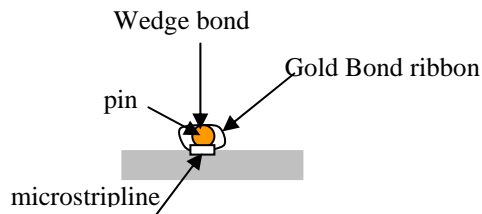
Max Temperature: If Curing adhesive: do not exceed 120 °C for up to 10 min. or 130 °C for up to 5 min. Do not heat above 130° C.

94 GHz MSS Circulators and Isolators.

In addition to the common instructions above, these devices are extremely fragile, with ferrite substrate only 0.11mm thick
Do not place near a magnetic field greater than 1 KOe, device could become demagnetized.

Connecting Microstrip Line to Pin Connector

Description: The isolator input will be used with 0.025" thick Alumina (thin film) with 0.010" wide microstripline. Output will be to a 0.012 diameter connector pin glass feedthru.



Units passed all shock and vibration test.

We have exhaustively tested the Microstrip Drop in's.

The units have low mass and are very robust.

- Vibration in frequency range 1-5000Hz with acceleration 400m/sec² (40g)
- repeated shocks with acceleration 1500m/sec² (150g) and duration 1-5msec
- single shock with acceleration 15000m/sec² (1500g) and duration 0.1-2msec
- linear centrifugal acceleration 5000m/sec²
- acoustic noise 50-10000Hz at sound pressure level up to 170dB
- absence of resonance in frequency range 1-100Hz