HMC7447

v00.0913

E-BAND DETECTOR 71 - 86 GHz

Typical Applications

The HMC7447 monitors Tx Output Power for:

- E-Band Communications Systems
- Test Equipment & Sensors
- General Purpose RF Power Detection

Features

Frequency: 71 - 86 GHz

Input Power Range: -0.5 to +23.5 dBm

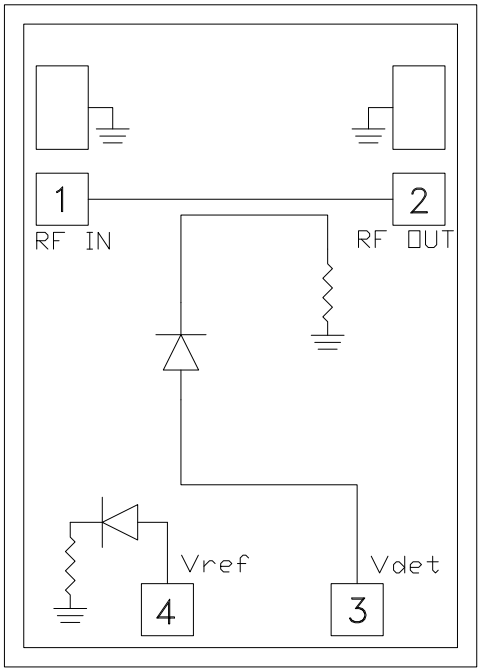
Dynamic Range: 24 dB

Insertion Loss: 0.45 dB

I/Os Matched to 50 Ohms

Die Size: 0.87 x 1.22 x 0.1 mm

Functional Diagram



General Description

The HMC7447 is a high performance E-Band MMIC power detector designed to operate over the 71 to 86 GHz frequency range. The power detector provides a linear output voltage over a -0.5 to +23.5 dBm input power range with low insertion loss of 0.45 dB and typical input return loss of only 19.5 dB. Ideal for monitoring transmitter operation or enabling closed-loop transmitter output power, the detector exhibits excellent sensitivity and flat frequency response of +/- 0.2 dB over the 71 to 76 GHz band and the 81 to 86 GHz band. The HMC7447 power detector also provides excellent repeatabillity and performance over varying temperature and output load variations. It may be interfaced to an op-amp circuit to achieve a slope of 20 mV/dB at the minimum detector input power level. All data is taken with the chip in a 50 Ohm test fixture connected via a 0.025 mm (1mil) diameter double wire bonds of 0.2 mm (8 mils) maximum length.

Electrical Specifications, T_A = +25°C

Parameter	Min.	Typ.	Max.	Units
Frequency Range		71 - 86		GHz
Input Power Range	-0.5		23.5	dBm
Dynamic Range		24		dB
Insertion Loss		0.45		dB
Output Voltage	0.048		1.45	V
Minimum Sensitivity [1]	20			mV/dB
Input Return Loss		19.5		dB
Output Return loss		22		dB
Detector Output Flatness Across Frequency [2]		0.2		dB

[1] After external OpAmp of Gain = 6dB.

[2] Typical flatness 0.2 dB (71 - 76) GHz and 0.2 dB (81 - 86)GHz.

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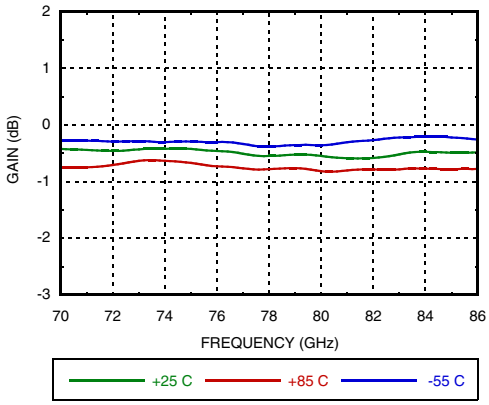
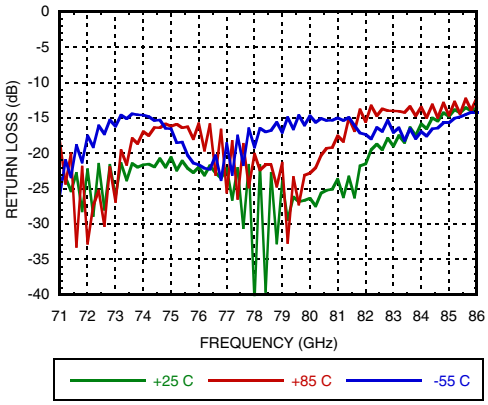
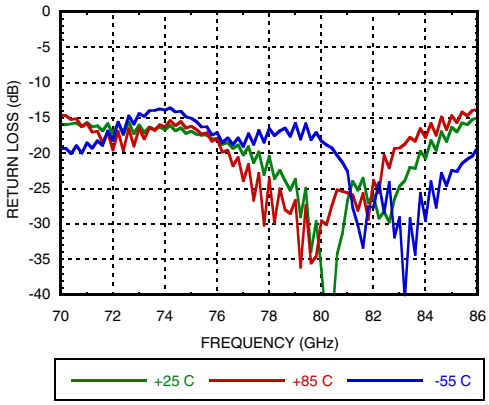
Insertion Loss vs. Temperature



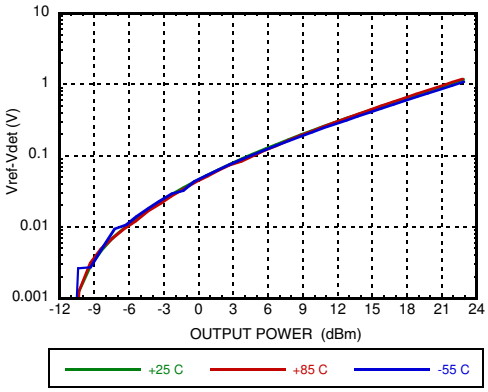
Input Return Loss vs. Temperature



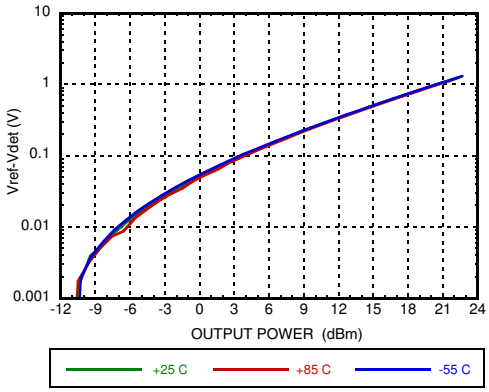
Output Return Loss vs. Temperature



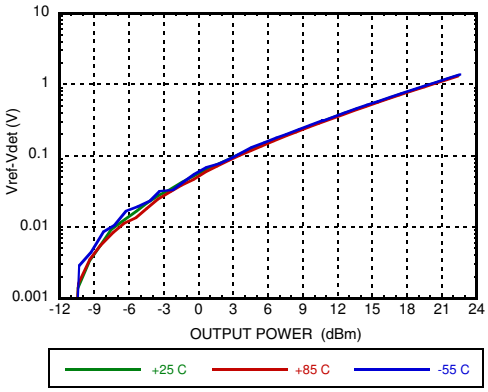
Detector Voltage vs. Temperature, Frequency = 71 GHz



Detector Voltage vs. Temperature, Frequency = 73 GHz



Detector Voltage vs. Temperature, Frequency = 75 GHz



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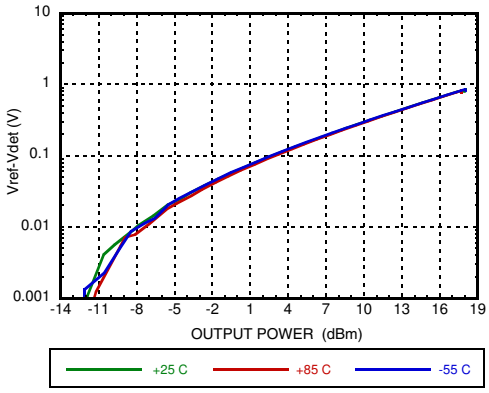
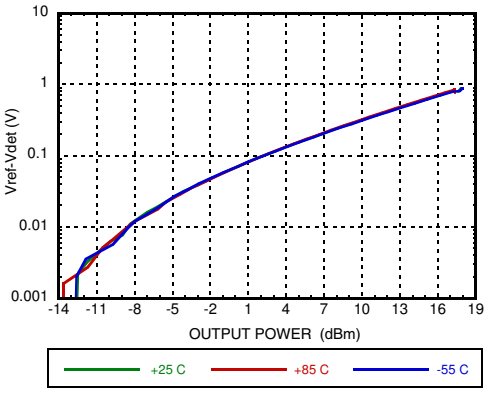
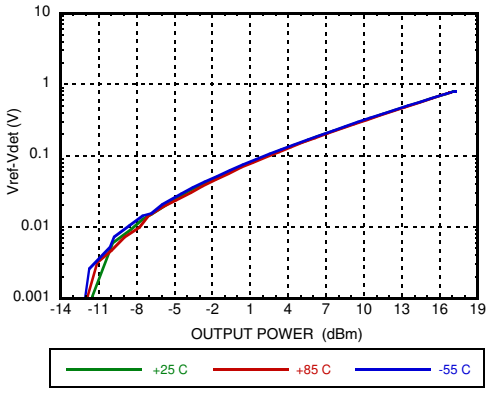
Detector Voltage vs. Temperature, Frequency = 81 GHz



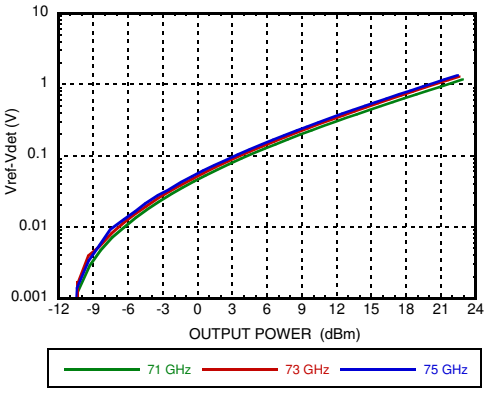
Detector Voltage vs. Temperature, Frequency = 83 GHz



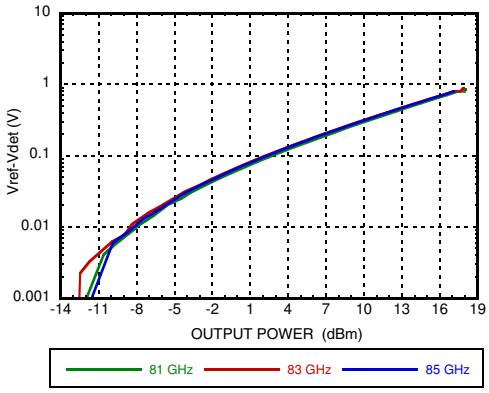
Detector Voltage vs. Temperature, Frequency = 85 GHz



Detector Voltage vs. Frequency, Frequency = 71 - 75 GHz



Detector Voltage vs. Frequency, Frequency = 81 - 85 GHz



Reference Node Voltage vs. Pout, Frequency = 75 GHz

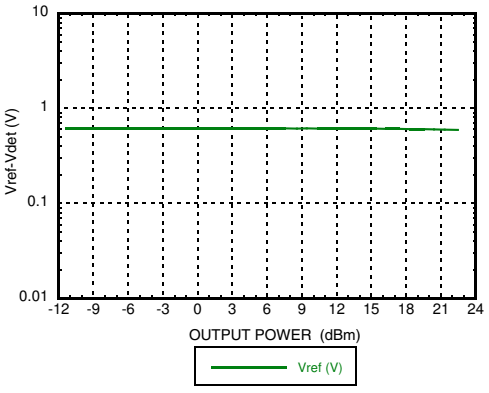


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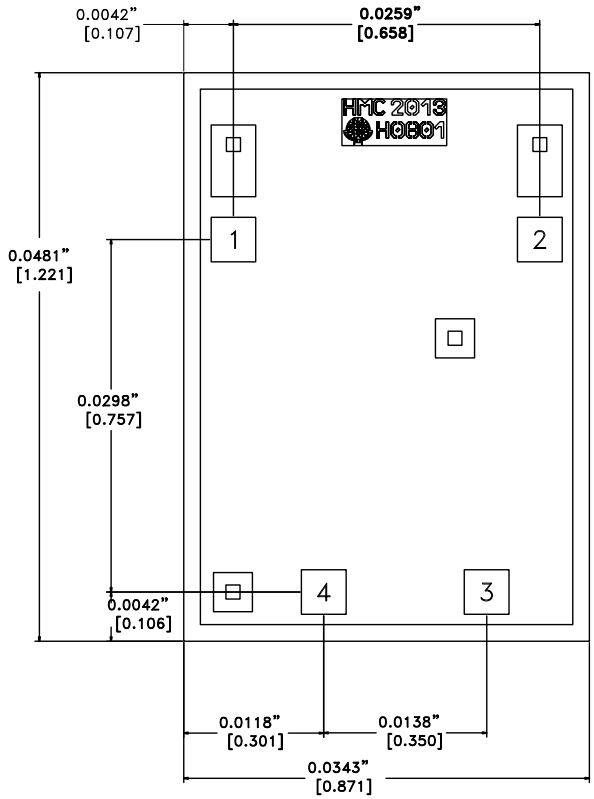
Table 1. Absolute Maximum Ratings

RF Input	+25 dBm
Operating Temperature	-55 to +85 °C
Storage Temperature	-65 to 150 °C
ESD Sensitivity (HBM)	Class 1A, passed 250V

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:
1. ALL DIMENSIONS ARE IN INCHES [MM].
2. DIE THICKNESS IS 0.004"
3. BOND PADS 1, 2, 3 & 4 ARE 0.0038" [0.096] X 0.0038" [0.096].
4. BACKSIDE METALLIZATION: GOLD.
5. BOND PAD METALLIZATION: GOLD.
6. BACKSIDE METAL IS GROUND.
7. CONNECTION NOT REQUIRED FOR UNLABELED BOND PADS.
8. OVERALL DIE SIZE ± 0.002

Table 2. Die Packaging Information [1]

Standard	Alternate
GP-1 (Gel Pack)	[2]

[1] For more information refer to the "Packaging information" Document in the Product Support Section of our website.
[2] For alternate packaging information contact Hittite Microwave Corporation.

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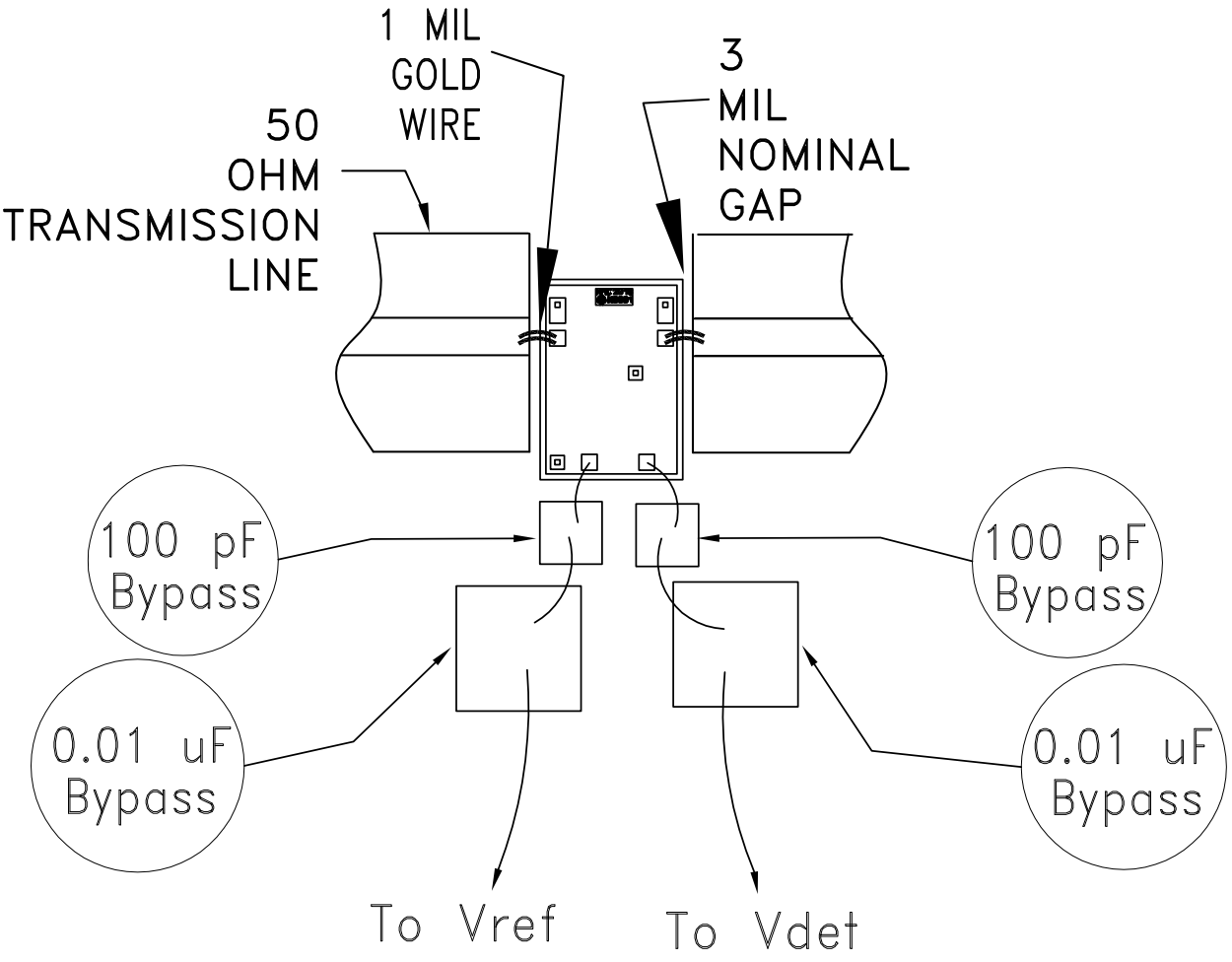
Pin Descriptions

Pad Number	Function	Description	Pad Schematic
1	RF IN	These ports are matched to 50 Ohms.	RF IN ○——○ RF OUT
2	RF OUT		
3	Vdet	DC voltage representing RF output power rectified by diode which is biased through an external resistor. See application circuit.	▷○ Vdet
4	Vref	DC voltage of diode biased through external resistor used for temperature compensation of Vdet. See application circuit.	▷○ Vref
Die Bottom	GND	Die bottom must be connected to RF/DC ground.	○ GND ⏚

Assembly Diagram



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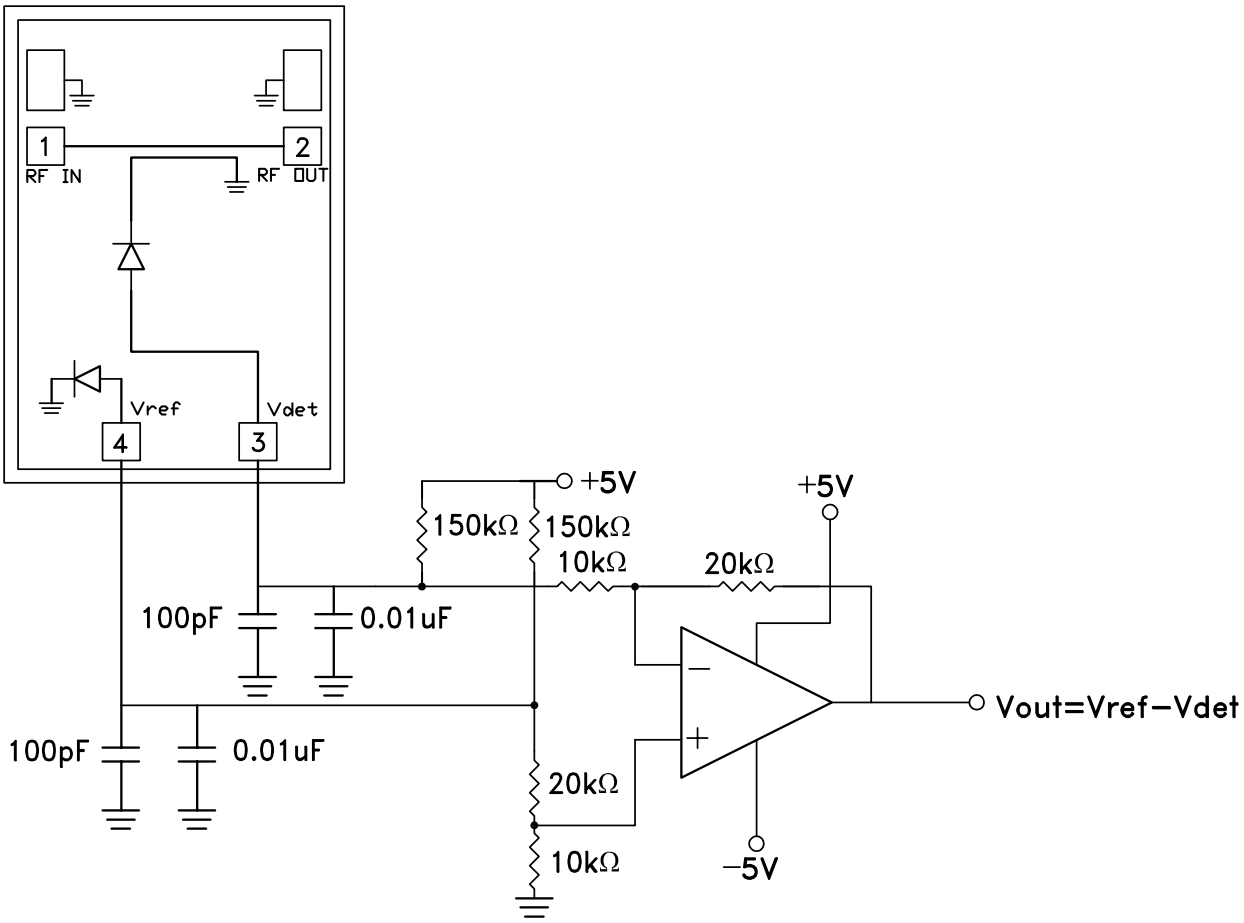
Application Circuit



Suggested Circuit

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Mounting & Bonding Techniques for Millimeterwave GaAs MMICs

The die should be attached directly to the ground plane eutectically or with conductive epoxy (see HMC general Handling, Mounting, Bonding Note).

50 Ohm Microstrip transmission lines on 0.127mm (5 mil) thick alumina thin film substrates are recommended for bringing RF to and from the chip (Figure 1). If 0.254mm (10 mil) thick alumina thin film substrates must be used, the die should be raised 0.150mm (6 mils) so that the surface of the die is coplanar with the surface of the substrate. One way to accomplish this is to attach the 0.102mm (4 mil) thick die to a 0.150mm (6 mil) thick molybdenum heat spreader (moly-tab) which is then attached to the ground plane (Figure 2).

Microstrip substrates should be located as close to the die as possible in order to minimize bond wire length. Typical die-to-substrate spacing is 0.076mm to 0.152 mm (3 to 6 mils).

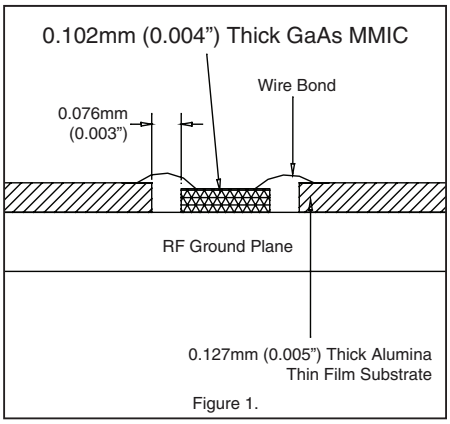

Figure 1.

Handling Precautions

Follow these precautions to avoid permanent damage.

Storage: All bare die are placed in either Waffle or Gel based ESD protective containers, and then sealed in an ESD protective bag for shipment. Once the sealed ESD protective bag has been opened, all die should be stored in a dry nitrogen environment.

Cleanliness: Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems.

Static Sensitivity: Follow ESD precautions to protect against > ± 250V ESD strikes.

Transients: Suppress instrument and bias supply transients while bias is applied. Use shielded signal and bias cables to minimize inductive pick-up.

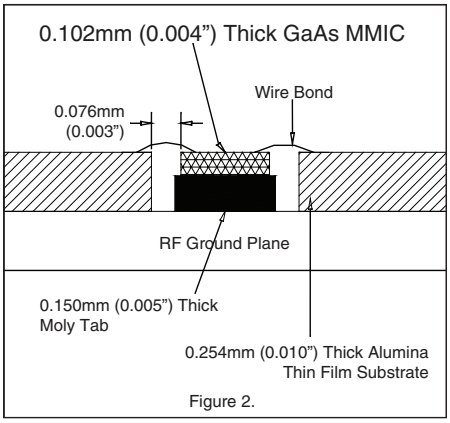

Figure 2.

General Handling: Handle the chip along the edges with a vacuum collet or with a sharp pair of bent tweezers. The surface of the chip may have fragile air bridges and should not be touched with vacuum collet, tweezers, or fingers.

Mounting

The chip is back-metallized and can be die mounted with AuSn eutectic preforms or with electrically conductive epoxy. The mounting surface should be clean and flat.

Eutectic Die Attach: A 80/20 gold tin preform is recommended with a work surface temperature of 255 °C and a tool temperature of 265 °C. When hot 90/10 nitrogen/hydrogen gas is applied, tool tip temperature should be 290 °C. DO NOT expose the chip to a temperature greater than 320 °C for more than 20 seconds. No more than 3 seconds of scrubbing should be required for attachment.

Epoxy Die Attach: Apply a minimum amount of epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer's schedule.

Wire Bonding

Ball or wedge bond with 0.025mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31mm (12 mils).

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- Подбор аналогов;
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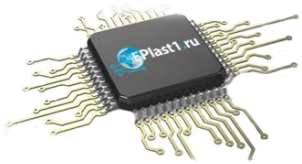

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