

Solderable AlGaAs Flip Chip PIN

Rev. V7

Features

- Low Series Resistance
- Ultra Low Capacitance
- Millimeter Wave Switching & Cutoff Frequency
- Useable up to 70 GHz
- 2 Nanosecond Switching Speed
- Can be Driven by a Buffered TTL
- Silicon Nitride Passivation
- Polyimide Scratch Protection
- RoHS Compliant

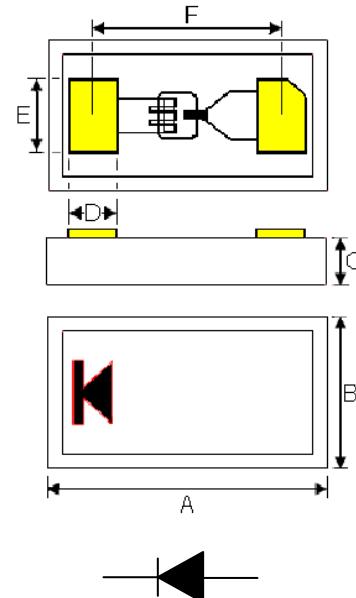
Description

The MADP-000907-14020 is a solderable, flip-chip Aluminum Gallium Arsenide (AlGaAs) PIN diode. It is fabricated with MOCVD grown epitaxy using a process and design that optimizes device to device uniformity and produces extremely low parasitics. The diode exhibits an exceptionally low RC product (0.1 ps) and a 2-3 ns switching speed. The chips are fully passivated with silicon nitride and have an added BCB polymer layer for scratch protection. The BCB protective coating prevents damage to the diode junction area and anode air-bridge during handling and assembly.

The ultra low capacitance of the MADP-000907-14020 allows for operation at millimeter wave frequencies for RF switches and phase shifter applications. The diode is designed to be used in pulsed or CW applications, where single digit ns switching speed is required. The low capacitance of the PIN diode makes it ideal for use in many microwave multi-throw switch assemblies, where the series capacitance of each "off" port adversely loads the input and affects VSWR.

Ordering Information

| Part Number | Package |
|--------------------|---------------|
| MADP-000907-14020W | Waffle Pack |
| MADP-000907-14020P | Tape and Reel |



1. Backside metal: 0.2 μ m gold over 4 μ m nickel.
2. Yellow hatched areas indicate backside ohmic gold contacts.

Outline Dimension

| DIM | INCHES | | MM | |
|-----|--------|--------|-------|-------|
| | Min. | Max. | Min. | Max. |
| A | 0.026 | 0.027 | 0.660 | 0.686 |
| B | 0.014 | 0.015 | 0.343 | 0.368 |
| C | 0.007 | 0.008 | 0.165 | 0.191 |
| D | 0.004 | 0.005 | 0.109 | 0.135 |
| E | 0.007 | 0.0073 | 0.173 | 0.185 |
| F | 0.018 | 0.019 | 0.462 | 0.488 |

* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

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Electrical Specifications: $T_A = +25^\circ\text{C}$

| Symbol | Parameter | Conditions | Units | Min | Typ | Max |
|-----------------------|--------------------------------------|---------------|----------|-----|-------|-------|
| C_T | Total Capacitance | -10 V, 1 MHz | pF | — | 0.025 | 0.030 |
| R_S | Series Resistance | 10 mA, 1 GHz | Ω | — | 5.2 | 7.0 |
| V_F | Forward Voltage | 10 mA | V | — | 1.33 | 1.45 |
| I_R | Reverse Leakage Current ³ | $V_R = -45$ V | nA | — | — | 50 |
| T_{RISE} / T_{FALL} | Switching Speed ⁴ | 10 GHz | ns | — | 2 | — |

3. The max rated $V_R(-45V)$ is sourced and the resultant reverse leakage current, I_R , is measured to be <50nA

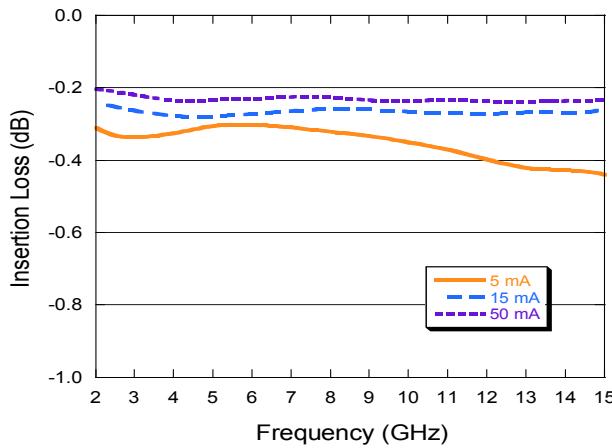
4. Switching speed is measured between 10% and 90% or 90% to 10% RF voltage for a single series mounted diode. Driver delay is not included.

Absolute Maximum Ratings: $T_A = 25^\circ\text{C}$

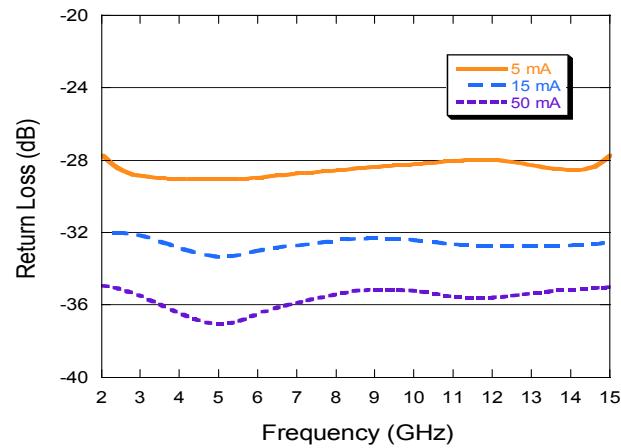
| Parameter | Absolute Maximum |
|----------------------------|-----------------------|
| Reverse Voltage | 45V |
| Operating Temperature | -55°C to +125°C |
| Storage Temperature | -55°C to +150°C |
| Junction Temperature | +175°C |
| Dissipated Power (RF + DC) | 100mW |
| C.W. Incident Power | +23 dBm |
| Mounting Temperature | +280°C for 10 seconds |

Typical Performance Curves

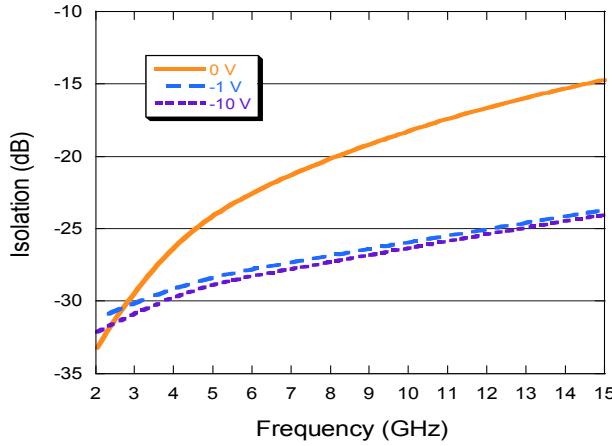
Insertion Loss vs. Frequency



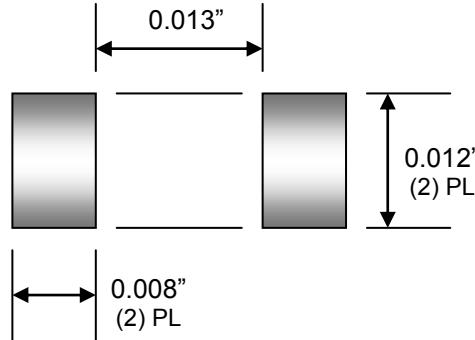
Return Loss vs. Frequency



Isolation vs. Frequency



Circuit Pad Layout



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Device Installation Guidelines

Cleanliness

This device should be handled in a clean environment. The chip is resistant to solvents and may be cleaned using approved industry standard practices and chemicals.

Static Sensitivity

Aluminum Gallium Arsenide PIN diodes are ESD sensitive and can be damaged by static electricity. Proper ESD handling techniques should be used. These devices are rated Class 1A, (0-250 V) HBM.

General Handling

The die has a BCB, polymer layer which provides scratch protection for the junction area and the anode air bridge. Die can be handled with plastic tweezers or picked and placed with a #27 tip vacuum pencil.

Assembly Requirements using Electrically Conductive Silver Epoxy

The MADP-000907-14020 is designed to be inserted onto hard or soft substrates with the junction/pad side down. It may be mounted onto a silk-screened circuit using electrically conductive silver epoxy, approximately 1-2 mils in thickness and cured at approximately 90°C to 150°C per manufacturer's schedule. For extended cure times, >30 minutes, temperatures must be kept below 200°C.

Eutectic Solder Die Attached

63/37 Sn/Pb or any RoHS compliant solder may be used for diode attachment. It is recommended that the attachment surface be preheated to 100°C prior to re-flow in order to minimize CTE mismatches. Gradual temperature ramp up and ramp down is also recommended with a maximum soldering temperature of 280°C for less than 10 seconds. See [Application Note M538](#) for recommended soldering profile.

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