

32–45 GHz GaAs MMIC SPDT PIN Switch



AP038R5-00

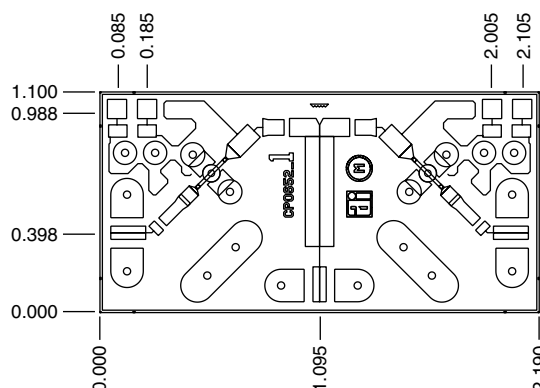
Features

- Broad Bandwidth, 32–45 GHz
- Low Loss, < 1.0 dB
- High Isolation, > 28 dB
- Fast Switching Speed, < 2 ns
- High Power Handling, 37 dBm Peak, 33 dBm CW

Description

Alpha's single pole, double throw PIN diode switch is a robust, high performance switch. It is ideal for low loss, high isolation applications, particularly where broad bandwidths and high power handling is required. The chip uses Alpha's proven PIN diode technology, and is based upon MBE layers for the highest uniformity and repeatability. The diodes employ surface passivation to ensure a rugged, reliable part with through-substrate via holes and gold-based backside metallization to facilitate an epoxy die attach process. The GaAs MMIC employs a shunt PIN diode in each arm and an on-chip bias network. Chips are measured on a 100% basis at 32, 35, 38 and 40 GHz for insertion loss, isolation, input and output return losses and also at DC for diode breakdown voltage and turnon voltage. Characteristics are guaranteed up to 45 GHz.

Chip Outline



Dimensions indicated in mm.
All pads are ≥ 0.07 mm wide.
Chip thickness = 0.1 mm.

Absolute Maximum Ratings

| Characteristic | Value |
|----------------------------------|---------------------|
| Operating Temperature (T_C) | -55°C to +125°C |
| Storage Temperature (T_{ST}) | -65°C to +150°C |
| DC Reverse Bias | -70 V (-10 μ A) |
| DC Forward Bias | +1.3 V (50 mA) |
| Power In (P_{IN}) | 10 W |

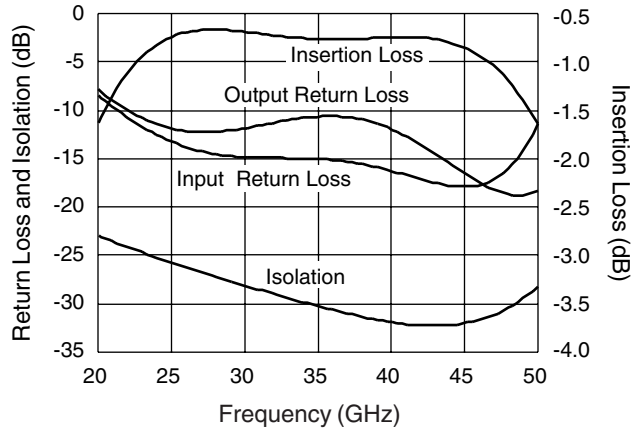
Electrical Specifications at 25°C

| Parameter | Condition | Symbol | Min. | Typ. ² | Max. | Unit |
|---|----------------------------|----------|------|-------------------|------|---------|
| Insertion Loss | F = 32, 35, 38, 40, 45 GHz | IL | | 0.8 | 1.2 | dB |
| Isolation | F = 32, 35, 38, 40, 45 GHz | I_{SO} | 28 | 30 | | dB |
| Input Return Loss | F = 32, 35, 38, 40, 45 GHz | RL_I | | 14 | 11 | dB |
| Output Return Loss | F = 32, 35, 38, 40, 45 GHz | RL_O | | 13 | 10 | dB |
| Leakage Current | V = -50 V | I_{DD} | | 1 | 10 | μ A |
| Switching Speed ¹ | | | | 2 | | ns |
| Output Power at 1 dB Compression ¹ | F = 35 GHz | P_1 dB | | 30 | | dBm |
| Two-Tone Input Third-Order Intercept ¹ | F = 28 GHz | IIP3 | 45 | | | dBm |

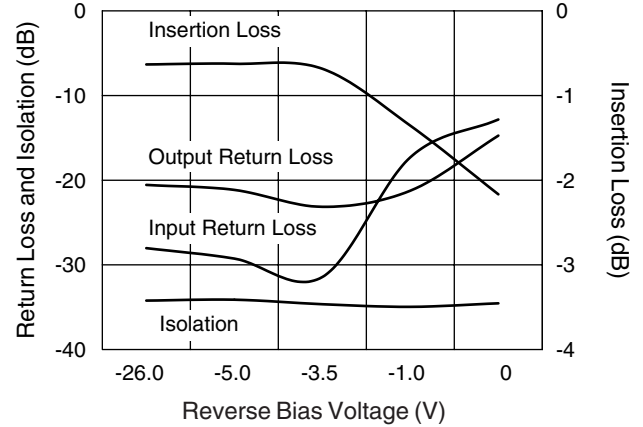
1. Not measured on a 100% basis.

2. Typical represents the median parameter value across the specified frequency range for the median chip.

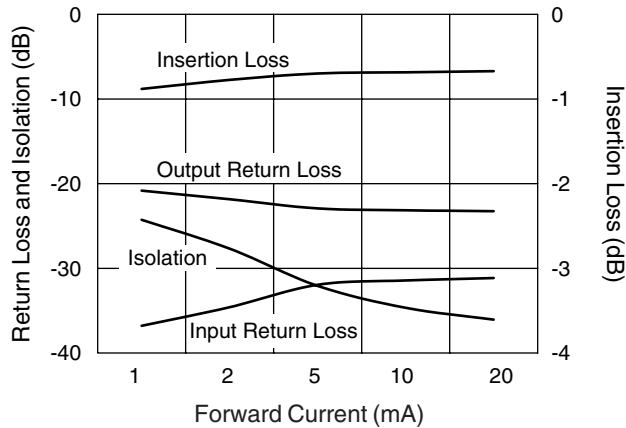
Typical Performance Data



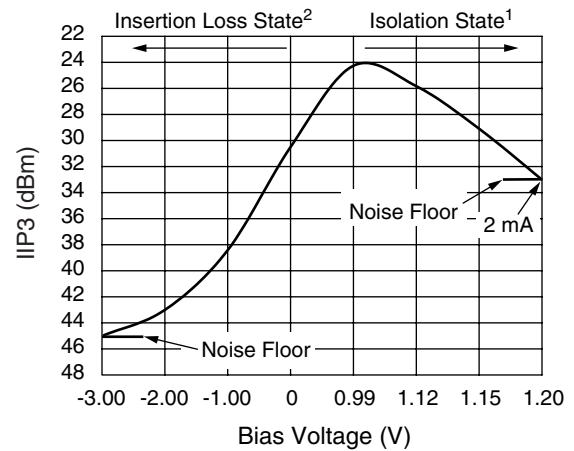
Performance vs. Frequency
Bias Conditions $I_F = 10 \text{ mA}$, $V_R = -5 \text{ V}$



Forward Current
 $F = 28 \text{ GHz}$



$F = 28 \text{ GHz}$, Reverse Voltage = -3.5 V



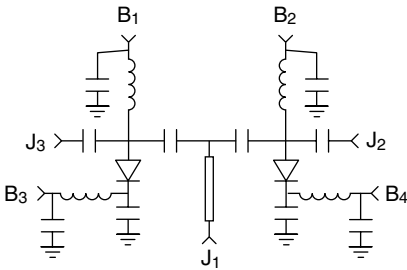
Two-Tone Input Third-Order Intercept @ 28 GHz

1. Isolation arms are biased with 10 mA (1.25 V) where IIP3 is below the noise floor.
2. Insertion loss arms are biased with -5 V where IIP3 is below the noise floor.

Truth Table

| B ₁ | B ₂ | J ₁ –J ₂ | J ₁ –J ₃ |
|----------------|----------------|--------------------------------|--------------------------------|
| +10 mA | -5 V | Insertion Loss | Isolation |
| -5 V | +10 mA | Isolation | Insertion Loss |

Circuit Schematic



Bias Arrangement

