MA4PBL027

HMIC Silicon Beam Lead PIN Diode

Rev. V3

Features

- No Wirebonds Required
- Rugged Silicon-Glass Construction
- Silicon Nitride Passivation
- Polymer Scratch and Impact Protection
- Low Parasitic Capacitance and Inductance
- Ultra Low Capacitance < 40 fF
- Excellent RC Product < 0.10 ps
- High Switching Cutoff Frequency > 110 GHz
- 110 Nanosecond Minority Carrier Lifetime
- Driven by Standard +5 V TTL PIN Diode Driver

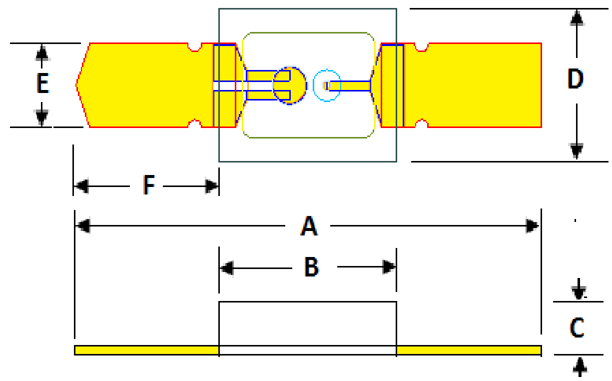
Description

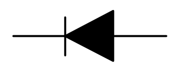
The MA4PBL027 is a silicon beam lead PIN diode fabricated with MACOM's HMIC™ process. It features one silicon pedestal embedded in a low loss, low dispersion glass which supports the beam-leads. The diode is formed on the top of the pedestal, and air-bridges connect the diode to the beam-leads. The topside is fully encapsulated with silicon nitride and also has an additional polymer layer for scratch and impact protection. These protective coatings prevent damage to the diode junction and air-bridge during handling and assembly. The diodes exhibit low series resistance, low capacitance, and extremely fast switching speed.

Applications

The ultra low capacitance, low RC product and low profile of the MA4PBL027 makes it an ideal choice for use in microwave and millimeter wave switch designs, where low insertion loss and high isolation are required. The low bias levels of 10 mA in the low loss state and 0 V in the isolation state allows the use of a simple 5 V TTL gate driver. These diodes can be used as switching arrays on radar systems, high speed ECM circuits, optical switching networks, instrumentation, and other wideband multi-throw switch assemblies.

Outline Drawing and Dimensions





DIM	INCHES		MM	
	MIN.	MAX.	MIN.	MAX.
A	0.033	0.035	0.838	0.889
B	0.0148	0.0164	0.376	0.416
C	0.004	0.006	0.1016	0.1524
D	0.0115	0.0135	0.2921	0.343
E	0.0048	0.0065	0.1220	0.165
F	0.0082	0.010	0.208	0.254

Ordering Information

Part Number	Package
MA4PBL027	100 piece Gel Pack[1]

1. Parts packed circuit side down.

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

Electrical Specifications at T_A = +25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Total Capacitance	-10 V, 1 MHz -40 V, 1 MHz -10 V,100 MHz -40 V,100 MHz	pF	—	0.030 0.026 0.018 0.015	0.040 — — —
Series Resistance	10 mA / 100 MHz 20 mA, 100 MHz 10 mA, 1 GHz	Ω	—	3.5 3.0 3.5	4.0 — —
Forward Voltage	20 mA	V	0.7	0.91	0.95
Leakage Current	-90 V	µA	—	—	1
Minority Carrier Lifetime	I_F = +10 mA, I_R = 6 mA	ns	—	150	200

2. Total capacitance (C_T) is equivalent to the sum of Junction Capacitance (C_J) and Parasitic Capacitance (C_{PAR}).
3. Series resistance (R_S) is equivalent to the total diode resistance: R_S = Junction Resistance (R_J) + Ohmic Resistance (R_C).

Absolute Maximum Ratings[4,5]

Parameter	Absolute Maximum
Forward Current	100 mA
Reverse Voltage	90 V
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +150°C
Junction Temperature	+175°C
RF CW Incident Power	30 dBm CW
RF & DC Dissipated Power	150 mW
Mounting Temperature	235°C for 10 sec.

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. MACOM does not recommend sustained operation near these survivability limits.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

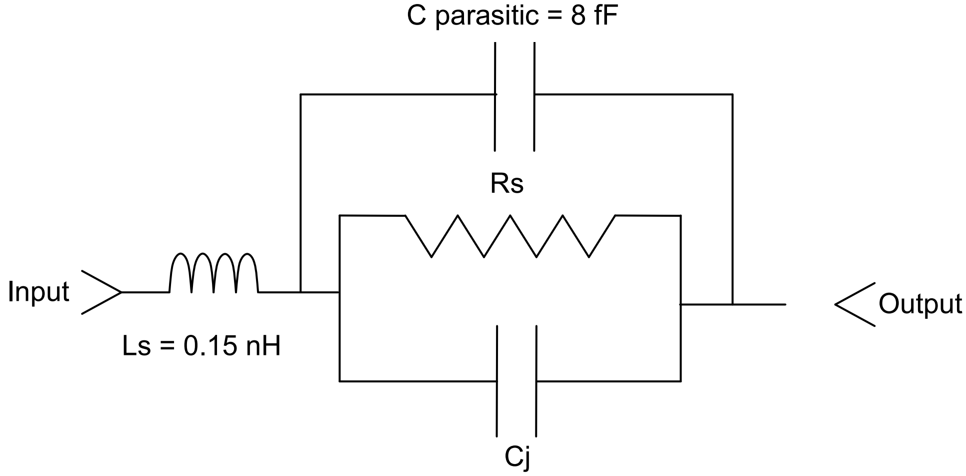
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM class 1 devices.

General Handling

A polymer layer provides scratch protection for the diode junction area and anode air bridge. However, the leads of beam lead devices are very fragile and must be handled with extreme care. The leads can easily be distorted or broken by the normal pressures if not careful while handling with tweezers. A vacuum pencil with a #27 tip is the preferred choice for picking and placing.

Attachment

These devices were designed to be inserted onto hard or soft substrates. Recommended methods of attachment include thermo-compression bonding, parallel-gap welding and electrically conductive silver epoxy.



MA4PBL027 SPICE Model

NLPINM1	wBv= 90 V
Is=1.0E-14 A	wPmax= 150 mW
Vi=0.0 V	Ffe= 1.0
Un = 900 cm^2/V-sec	M= 0.5
Wi= 14 um	Fc= 0.5
Rr= 100 KΩ	Imax= 1.1E+5 A/m^2
Cjmin= 0.030 pF	Kf= 0.0
Tau= 110 nsec	Af=1.0
Rs(I)= Rc + Rj(I) = 0.05 Ω	Vj= 0.7 V
Cj0= 0.040 pF	