

High Power Reflective SPDT PIN Diode Switch 6 - 18 GHz



MASW-011108-DIE

Rev. V1

Features

- Low Loss: 0.6 dB @ 12 GHz
- High Isolation: 44 dB @ 12 GHz
- Up to 14 W CW Power Handling, +85°C
- Switching Speed: <115 ns
- Integrated DC Blocks and RF Bias Networks
- Optional Bias Resistors
- Die with G-S RF Pads and DC Bias Pads
- RoHS* Compliant

Applications

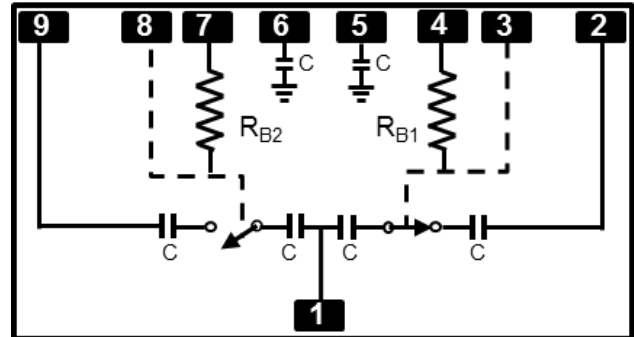
- Point-to-Point , Radar, Radiometers, Test & Instrumentation Equipment and High Frequency Applications

Description

The MASW-011108-DIE is a high power symmetrical SPDT PIN diode switch. This broadband, reflective, high linearity, switch was developed for 6 - 18 GHz applications that require up to 14 W of power handling while maintaining low insertion loss and high isolation.

The SPDT MMIC utilizes MACOM's proven AlGaAs PIN diode technology. The switch is fully passivated with silicon nitride and has an added polymer layer for scratch protection. The protective coating prevents damage to the junctions and the anode air-bridges during handling and assembly. The die has backside metallization to facilitate an epoxy die attach process.

Functional Schematic



Pin Configuration¹

Pin #	Function
1	RF Common
2	RF1
3	Bias 3
4	Bias 1
5, 6	DC, N/C, RF GND
7	Bias 2
8	Bias 4
9	RF2

1. The die backside must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	Package
MASW-011108-DIE	Gel Pack

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

High Power Reflective SPDT PIN Diode Switch

6 - 18 GHz



MASW-011108-DIE

Rev. V1

Electrical Specifications: $T_A = +25^\circ\text{C}$, $V_F^2 = 5\text{ V}$, $V_R^3 = -15\text{ V}$, $Z_0 = 50\ \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss (RF _{COMMON} to RFx ON state)	6 GHz	dB	—	0.80	1.25
	8 GHz			0.55	0.95
	12 GHz			0.60	1.00
	14 GHz			0.70	—
	18 GHz			0.90	—
Isolation (RF _{COMMON} to RFx OFF state) ⁴	6 GHz	dB	35	42	—
	8 GHz		35	44	
	12 GHz		35	44	
	14 GHz		—	42	
	18 GHz		—	38	
Return Loss (RF _{COMMON})	6 GHz	dB	—	12	8
	8 GHz			16	12
	12 GHz			19	15
	14 GHz			18	—
	18 GHz			18	—
Return Loss (RF1, RF2 ON state)	6 GHz	dB	—	12	10
	8 GHz			18	14
	12 GHz			17	14
	14 GHz			17	—
	18 GHz			19	—
CW Power Handling (ON state) ³	6.2 GHz, +85°C @ V _R = -15 V	dBm / W	—	39 / 8	—
	6.2 GHz, +85°C @ V _R = -33 V			41.5 / 14	
Switching Speed T _{ON} / T _{OFF} T _{RISE} / T _{FALL}	50% DC to 90% RF / 50% DC to 10% RF 10% to 90% RF / 90% to 10% RF	ns	—	115 / 25	—
				75 / 16	
Reverse Bias Current	V _R = -15 V	nA	—	25	—

- Forward bias current (I_F) is set to 10 mA @ 5 V with internal bias resistors R_{B1} = R_{B2} = 98 Ohm
- Reverse bias voltage (V_R) should be determined based on working conditions. For example, -33 V @ 41.5 dBm input power. For lower power applications, a less negative voltage can be used. R. Caverly and G. Hiller, "Establishing the Minimum Reverse Bias for a PIN Diode in a High Power Switch," IEEE Transactions on Microwave Theory and Techniques, Vol.38, No.12, December 1990.
- Isolation defined with 1 port in low loss state.

Absolute Maximum Ratings^{5,6}

Parameter	Absolute Maximum
Reverse Bias Voltage	-50 V
Forward Bias Current	25 mA
CW Incident Power	42 dBm @ +85°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

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

Truth Table

RF _{COMMON} Path	Bias 1	Bias 2
RF1 Insertion Loss RF2 Isolation	-15 V	5 V
RF2 Insertion Loss RF1 Isolation	5 V	-15 V

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 1A devices.

High Power Reflective SPDT PIN Diode Switch 6 - 18 GHz

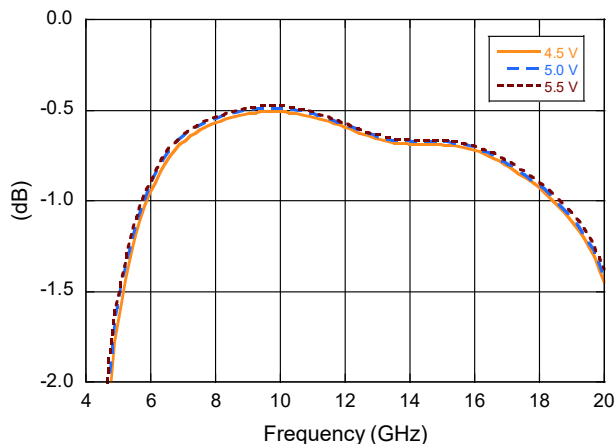


MASW-011108-DIE

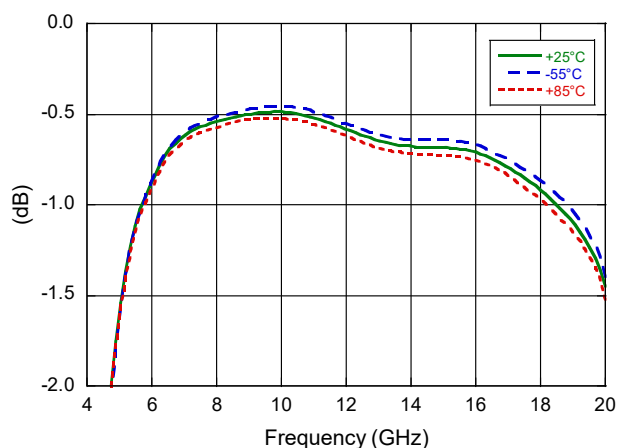
Rev. V1

Typical Performance Curves of a Die including Bond Wires (probed on a test PCB) Reverse Bias Voltage = -15 V

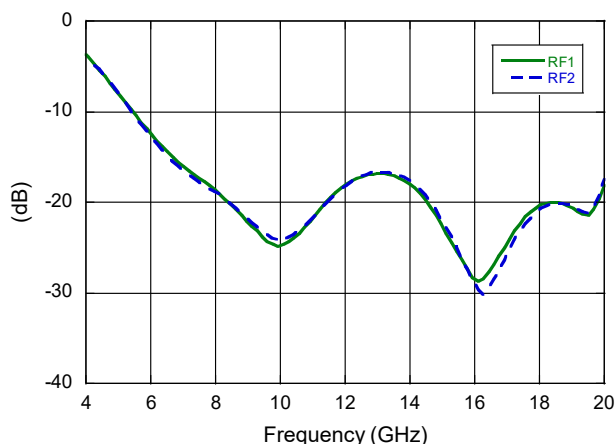
Insertion Loss over Forward Bias Voltage



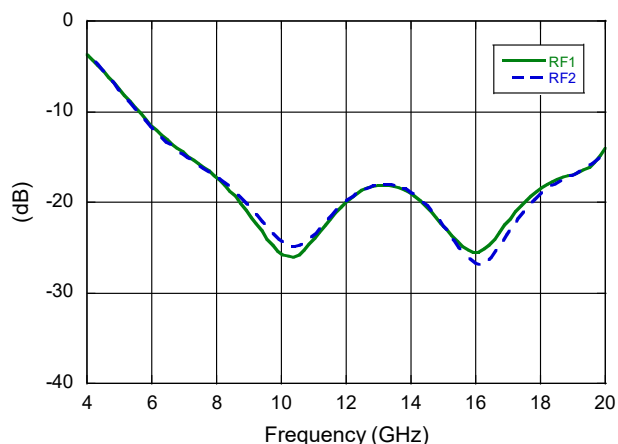
Insertion Loss over Temp



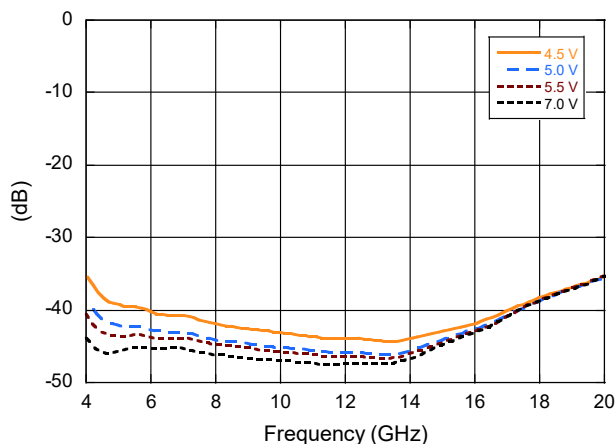
RF-C to RF1/2 Return Loss



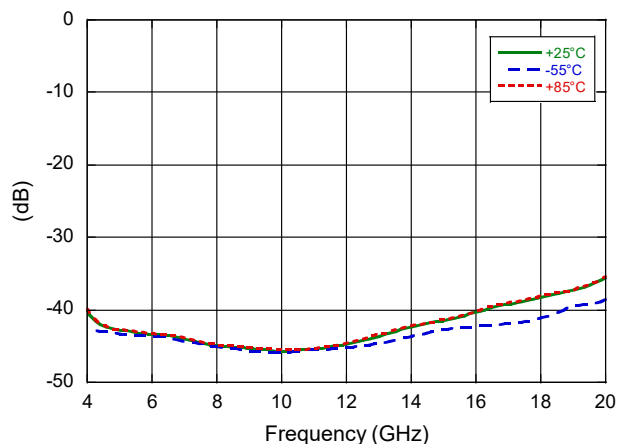
RF1/2 Return Loss



Isolation over Forward Bias Voltage



Isolation over Temp



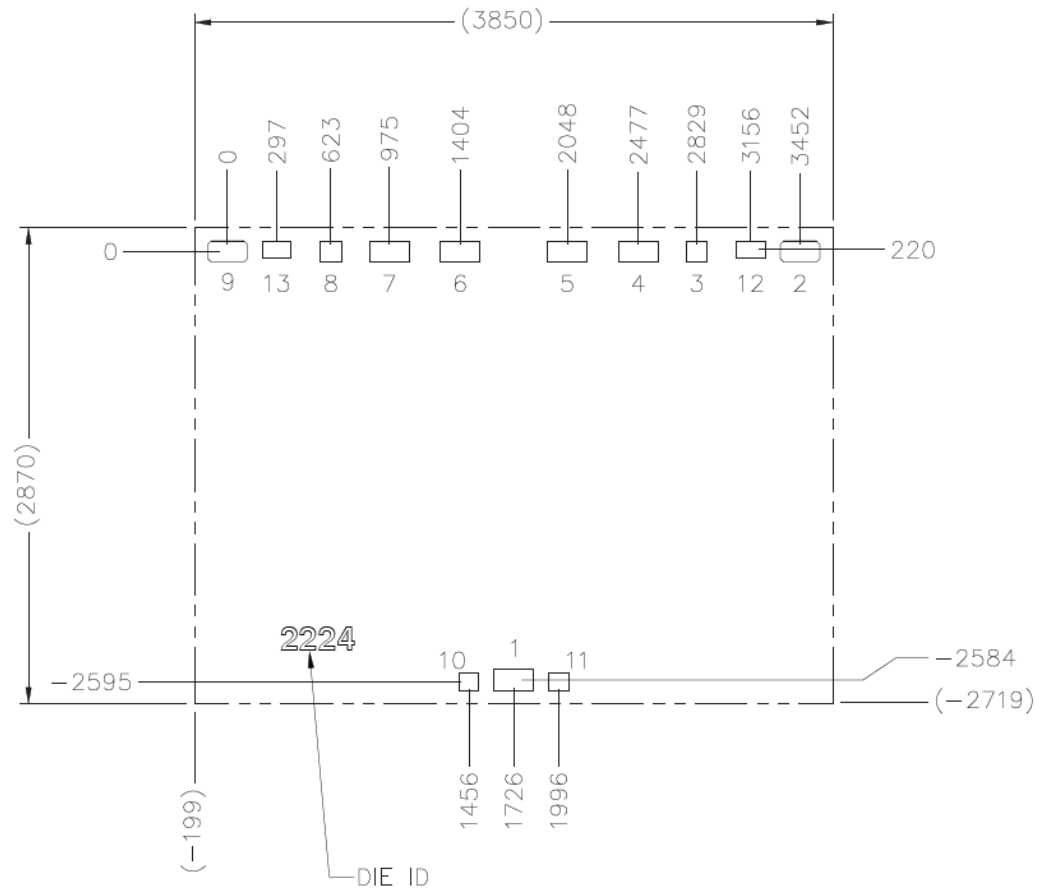
High Power Reflective SPDT PIN Diode Switch 6 - 18 GHz



MASW-011108-DIE

Rev. V1

Die Outline Drawing†



Notes:

- Unless otherwise specified all dimensions shown as μm with a tolerance of $\pm 5 \mu\text{m}$
- Die thickness is $100 \pm 10 \mu\text{m}$
- Bond Pad/backside metallization: Gold

Bond Pad Dimensions (μm)

Pad	X	Y
1, 2, 9	238	126
3, 8	126	126
4, 5, 6, 7	240	126
10, 11	120	104
12, 13	175	104

High Power Reflective SPDT PIN Diode Switch

6 - 18 GHz



MASW-011108-DIE

Rev. V1

MACOM Technology Solutions Inc. ("MACOM"). All rights reserved.

These materials are provided in connection with MACOM's products as a service to its customers and may be used for informational purposes only. Except as provided in its Terms and Conditions of Sale or any separate agreement, MACOM assumes no liability or responsibility whatsoever, including for (i) errors or omissions in these materials; (ii) failure to update these materials; or (iii) conflicts or incompatibilities arising from future changes to specifications and product descriptions, which MACOM may make at any time, without notice. These materials grant no license, express or implied, to any intellectual property rights.

THESE MATERIALS ARE PROVIDED "AS IS" WITH NO WARRANTY OR LIABILITY, EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHT, ACCURACY OR COMPLETENESS, OR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.