SP5T AlGaAs PIN Diode Switch
50 MHz - 60 GHz

MASW-011170
Rev. V2

Features

- Broadband Performance, 50 MHz to 60 GHz
- Low Loss: 3 dB @ 57 GHz
- High Isolation: >30 dB @ 57 GHz
- Switching Speed: <20 ns
- Lead Free 5 mm 6-Lead QFN Package
- RoHS* Compliant

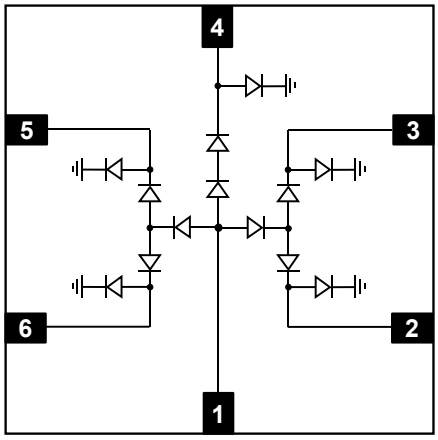
Applications

- 5G
- Point to Point Communications
- Radar Systems
- Radiometers
- Test & Measurement
- High Frequency Applications

Description

The MASW-011170 is an extremely broadband reflective SP5T PIN diode switch in a 5 mm laminate QFN package. The SP5T MMIC utilizes MACOM's proven AlGaAs PIN diode technology. External bias tees are required.

Functional Schematic



Pin Configuration

Pin #	Function
1	RFC
2	RF1
3	RF2
4	RF3
5	RF4
6	RF5
7	GND - Paddle[2]

2. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information[1]

Part Number	Package
MASW-011170-TR0500	500 pc Tape & Reel
MASW-011170-TR0250	250 pc Tape & Reel
MASW-011170-SMB	Sample Board

1. Reference Application Note M513 for reel size information.

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

Electrical Specifications: Freq. = 50 MHz - 60 GHz, T_A = 25°C, I_{CC} = +/-10 mA, Z_0 = 50 Ω

Parameters	Test Condition, Port	Frequency	Units	Min.	Typ.	Max.
Insertion Loss	RFC to RF1- RF5 (ON State)	15 GHz 37 GHz 49 GHz	dB	-1.7 -2.2 —	-1.3 -1.8 -2.2	—
Isolation[3, 4] RFC to RF_{OUT}	RFC to RF1- RF5 (OFF State)	15 GHz 37 GHz 49 GHz	dB	—	-38 -40 -40	-30 -30 —
Input RFC Return Loss	RFC to RF1- RF5 (ON State)	≤ 60 GHz	dB	—	10	—
Output RF_{OUT}[4] Return Loss	RFC to RF1- RF5 (ON State)	≤ 60 GHz	dB	—	10	—
Switching Speed[5]	+/- 5V TTL Compatible PIN Diode Driver, 10 GHz, RFC to RF_{OUT}	—	ns	—	20	—
Diode Forward Voltage	10 mA	—	V	—	1.32	—
Input RF CW Power	10 mA, 85ºC, 32 GHz, RFC to RF_{OUT}	32 GHz	dBm	—	33	—
Output IP3 Input IP3	26 to 34 GHz, 1 GHz step, RFC to RF_{OUT}	26 to 34 GHz	dBm	—	40 44	—
Compression P0.1dB	32 GHz, -40, 25, & 85 ºC, RFC to RF_{OUT}	32 GHz	dBm	—	29	—

3. Isolation is measured from the common port RFC (input) to selected output port RF_{OUT} with an adjacent RF_{OUT} port in the ON state (low loss state). Isolation values shown in the table are the lowest isolation values below 57 GHz.
4. RF_{OUT} - Output Port RF1, RF2, RF3, RF4, and RF5.
5. Typical switching speed is measured from 10% to 90% of the detected RF voltage driven by a +/- 5 V TTL compatible driver. Driver output parallel RC network uses a capacitor between 390 - 560 pF and a resistor between 150 - 220 Ω to achieve 15 ns rise and fall times.

Absolute Maximum Ratings[6,7]

Parameter	Absolute Maximum
DC Reverse Bias Voltage + RF Peak Voltage	80 V
Forward Bias Current	+/-15 mA
CW Incident RF Power	34 dBm @ +85°C, 32 GHz
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

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

Handling Procedures

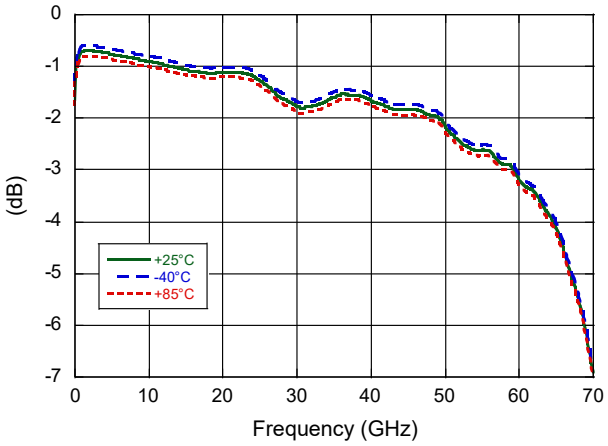
Please observe the following precautions to avoid damage:

Static Sensitivity

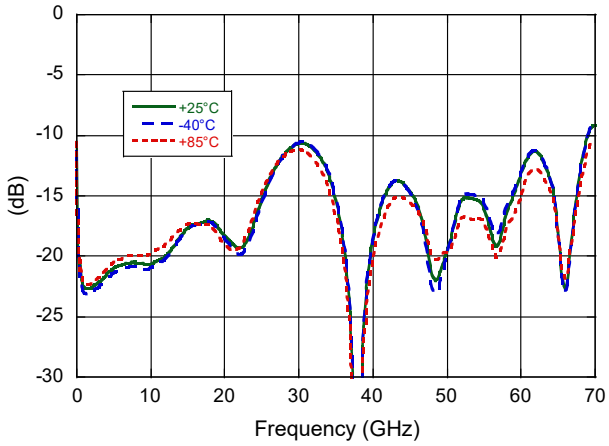
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM class 1B and CDM class C5 devices.

Typical Performance Curves (Probed Data on a Sample Board), I_{BIAS} = +/-10 mA

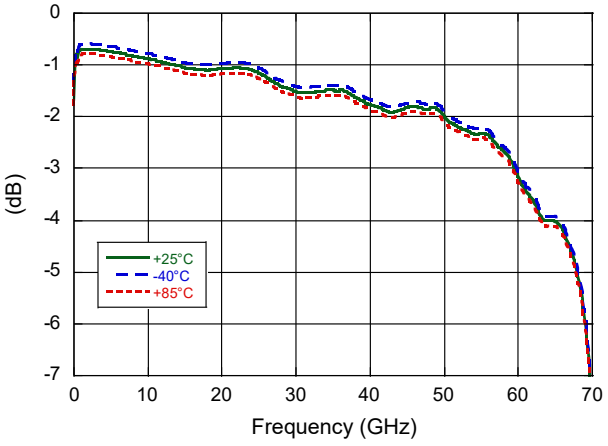
Insertion Loss: RF1 (RF5) over Temp



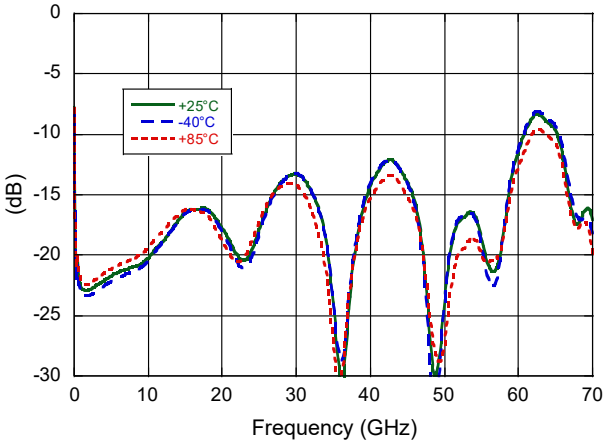
Input Return Loss: RF1 (RF5) over Temp



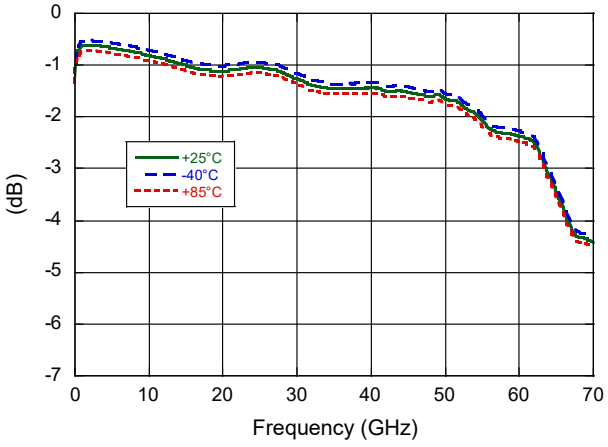
Insertion Loss: RF2 (RF4) over Temp



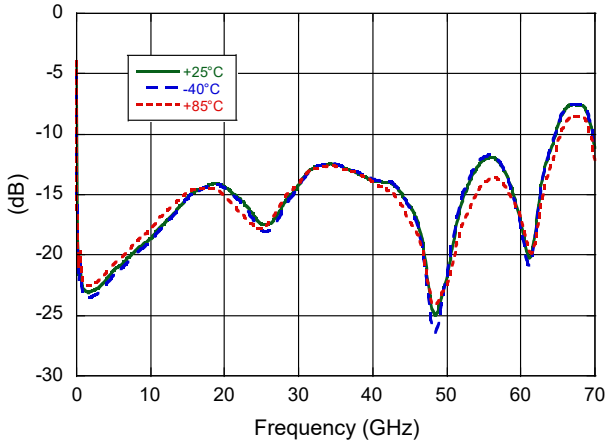
Input Return Loss: RF2 (RF4) over Temp



Insertion Loss: RF3 over Temp

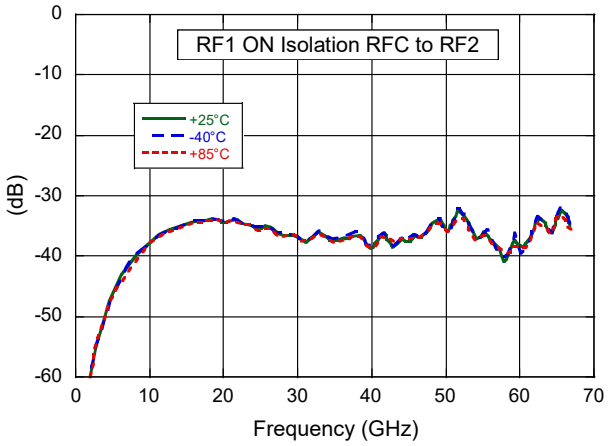


Input Return Loss: RF3 over Temp

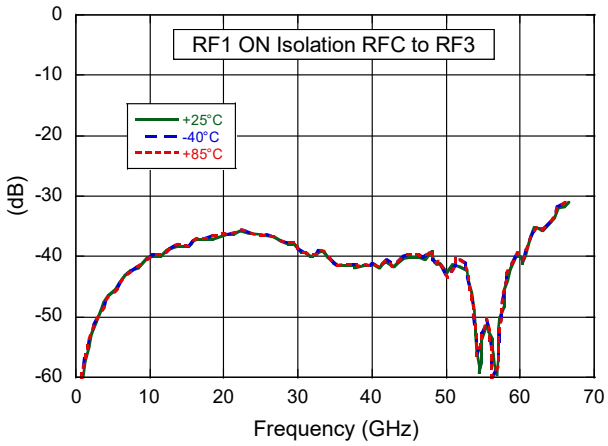


Typical Performance Curves (Connectorized Sample Board Data), I_{BIAS} = +/-10 mA

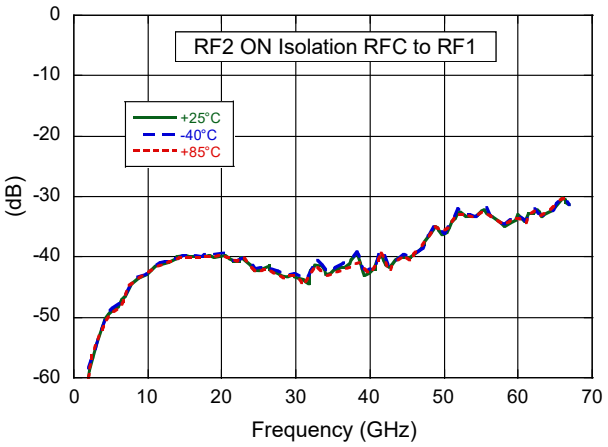
Isolation: RFC to RF2 (RF4) over Temp @ RF1 (RF5) ON



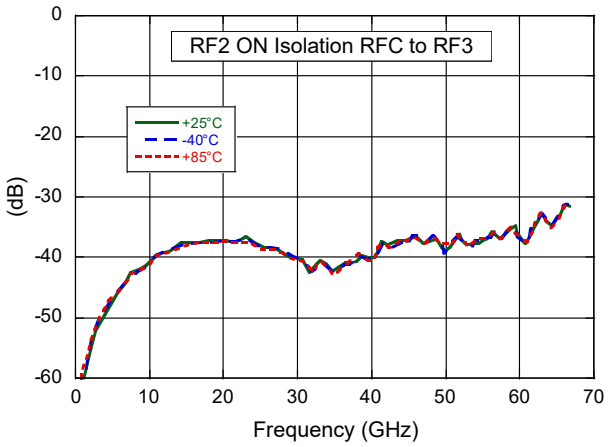
Isolation: RFC to RF3 over Temp @ RF1 (RF5) ON



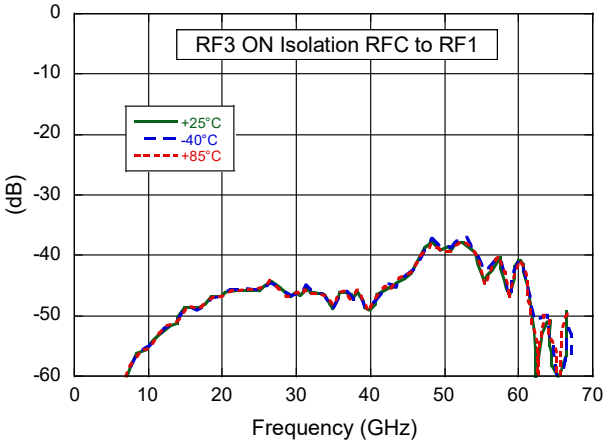
Isolation: RFC to RF1 (RF5) over Temp @ RF2 (RF4) ON



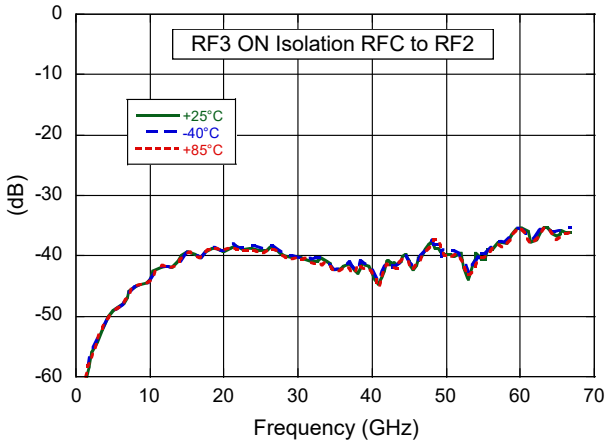
Isolation: RFC to RF3 over Temp @ RF2 (RF4) ON



Isolation: RFC to RF1 (RF5) over Temp @ RF3 ON

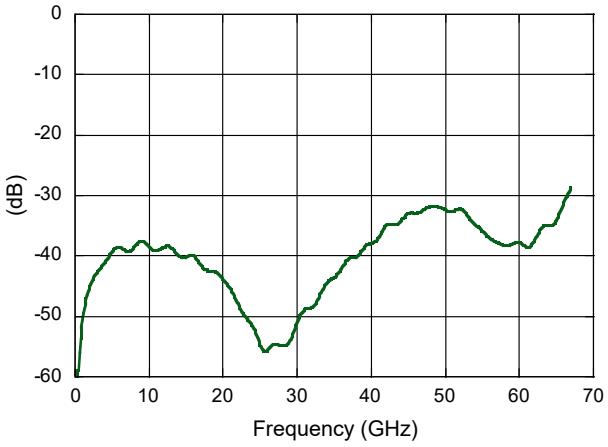


Isolation: RFC to RF2 (RF4) over Temp @ RF3 ON

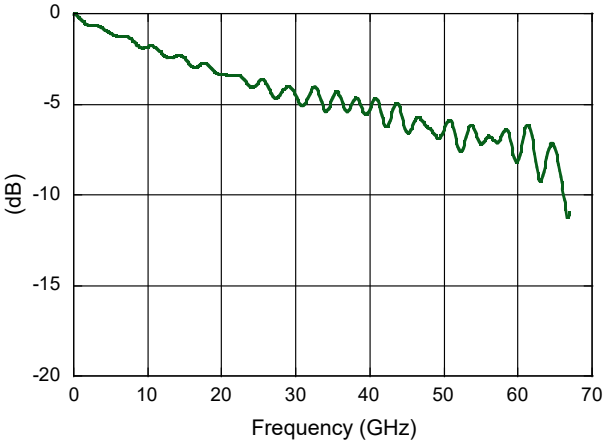


Typical Performance Curves in Unbiased Condition @ +25°C, I_{BIAS} = 0 mA, P_{IN} = -10 dBm (Connectorized Sample Board Data)

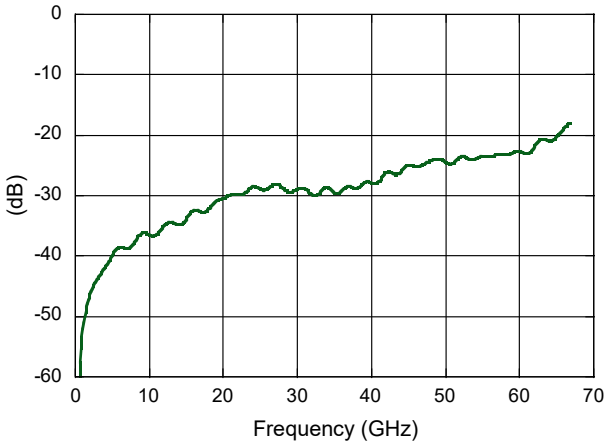
Unbiased Insertion Loss: RFC to RF1 (RF5)



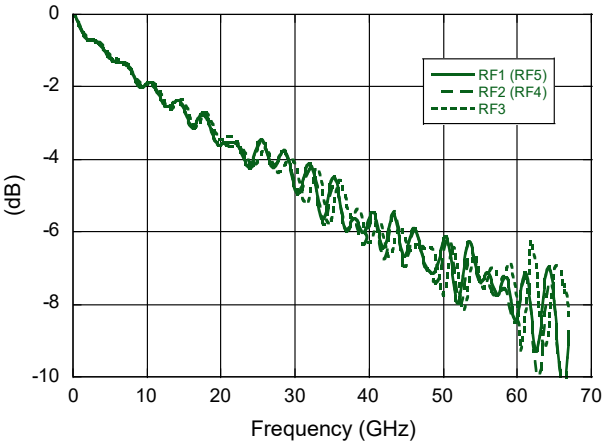
Unbiased Input Return Loss: RFC @ RFout ON



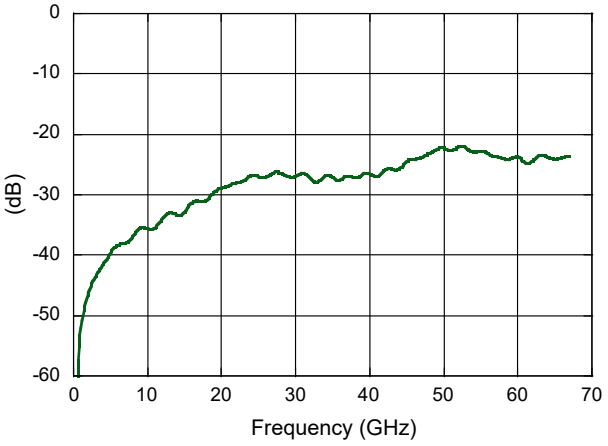
Unbiased Insertion Loss: RFC to RF2 (RF4)



Unbiased Output Return Loss: RF1 (RF5), RF2 (RF4), RF3

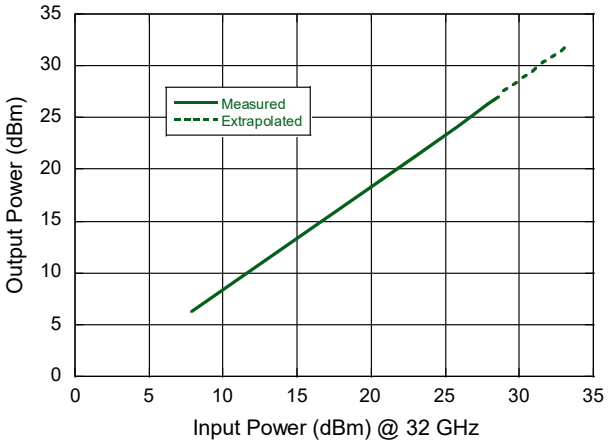


Unbiased Insertion Loss: RFC to RF3



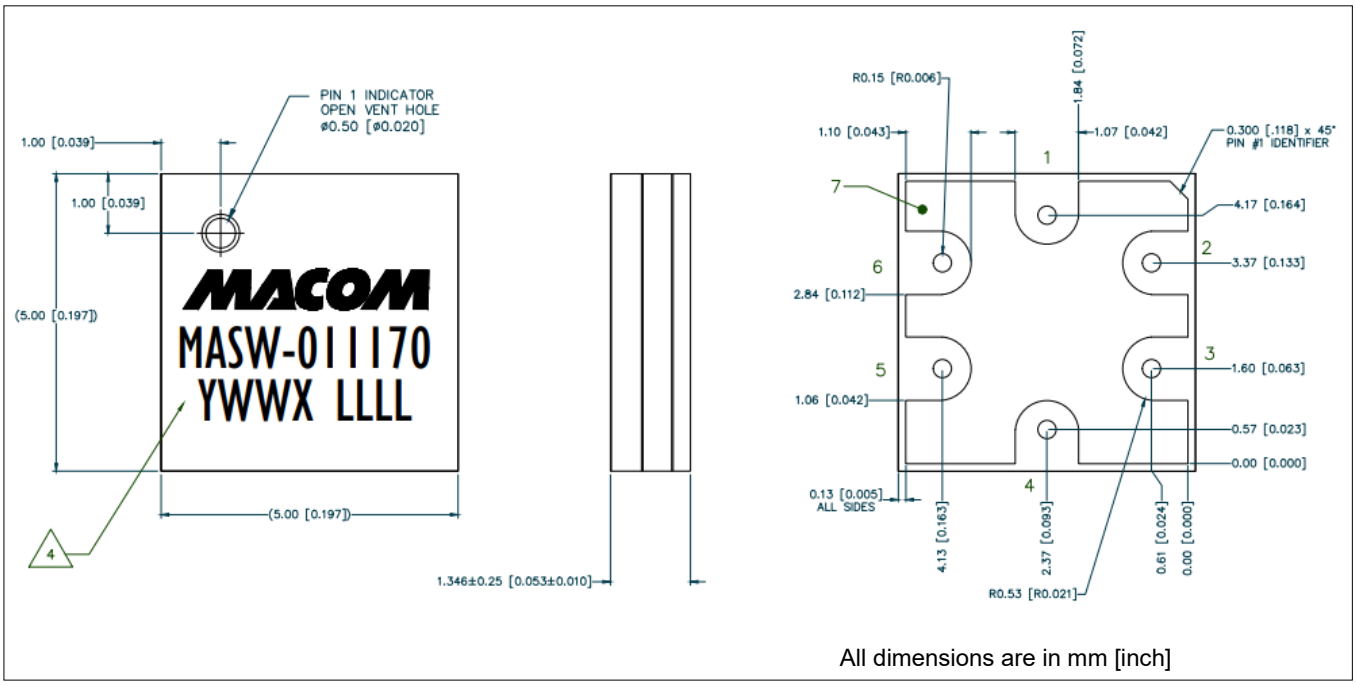
Typical Performance Curves (Connectorized Sample Board Data) @ +25°C, I_{BIAS} = +/-10 mA

Output Power



Lead-Free 5 mm 6-LD Laminate Package†

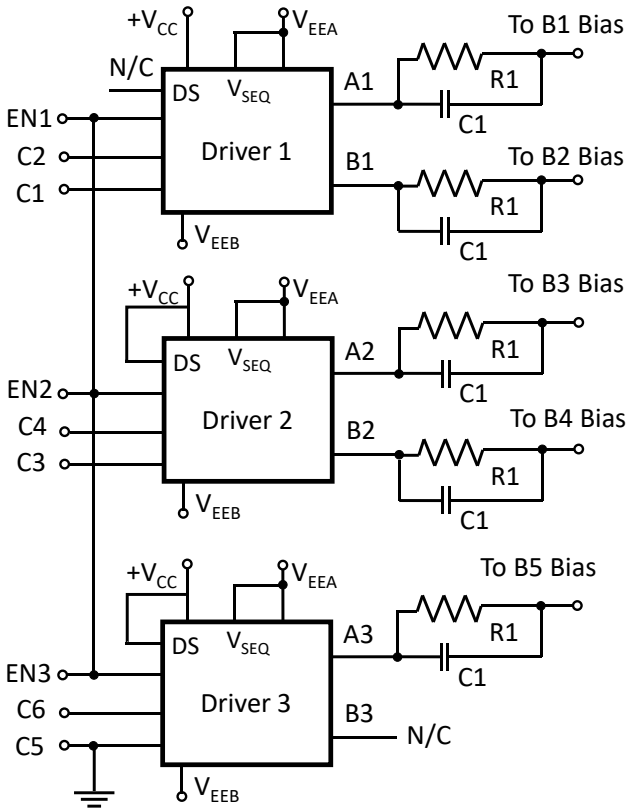
(*Size, lead count and position subject to change*)

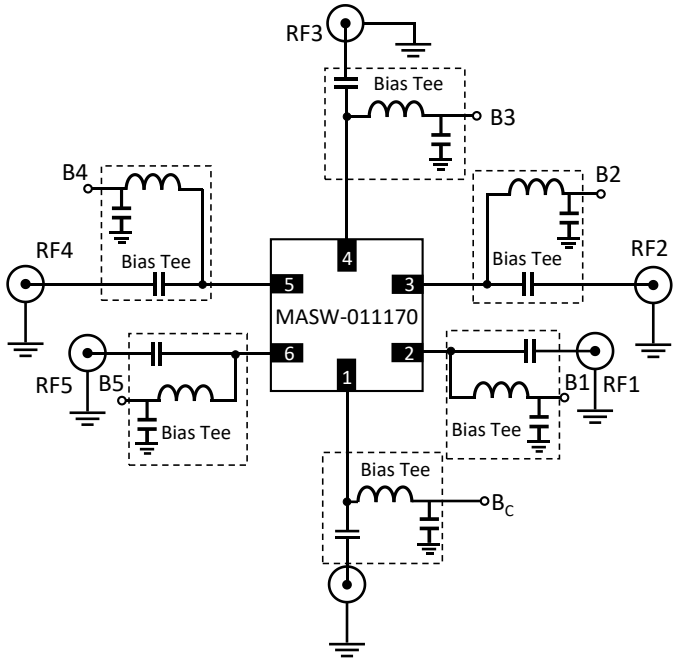


All dimensions are in mm [inch]

† This is not a JEDEC standard package
Reference Application Note M538 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
This device is non-hermetic, with an open vent hole. MACOM does not recommended performing aqueous cleaning processes post-assembly unless the vent hole has been filled post-reflow.
Plating is ENEPIG

MASW-011170 with MADR-011022 / MADR-011020[9] Driver Application Schematic - (One Possible Configuration Example)





Parts List

Parameter	Value	Parameter	Value
C1 [10]	520 pF	V_{CC} [12]	5 V
R1 [10]	180 Ω	V_{EEA} , V_{EEB} [13]	-10 V
B_C [11]	-5 V		

An Example of the Logic Truth Table MADR-011022 / MADR-011020

Inputs							Outputs						RF Output
EN1	C2	C1	C4	C3	C6	C5	A1	B1	A2	B2	A3	B3	
1	X	X	X	X	X	0	H	H	H	H	H	X	ALL OFF
0	0	0	0	0	0	0	L	H	H	H	H	X	RF1 - ON
0	0	1	0	1	0	0	H	L	H	H	H	X	RF2 - ON
0	1	0	1	0	0	0	H	H	L	H	H	X	RF3 - ON
0	1	1	1	1	0	0	H	H	H	L	H	X	RF4 - ON
0	1	1	0	X	1	0	H	H	H	H	L	X	RF5 - ON

9. The application details of the MADR-011022 / MADR-011020 driver are in their Data Sheets.
10. C1, R1 - Exemplary values. For more option contact MACOM technical support.
11. B_C - Common Port Bias - Exemplary voltage, one of many possible option. For more option how to connect the B_C contact MACOM technical support.
12. V_{CC} at the driver should be 0.4 V higher than the required forward bias voltage V_B at the bias input A1/B1, A2/B2, A3/B3.
13. V_{EEA} , V_{EEB} - Exemplary voltage. For details see Data Sheet of the used driver.