MASW-000932

HMIC™ PIN Diode SPDT 80 Watt Switch for 0.01 - 4.0 GHz Higher Power Applications

Rev. V1

Features

- Exceptional Broadband Performance
- Low Loss: T_X = 0.25 dB @ 2010 MHz
- High Isolation: Rx = 43 dB @ 2010 MHz
- Suitable for High Power LTE, TD-SCDMA, WiMAX, and Military Radio Applications
- Surface Mount 4mm PQFN Package
- RoHS* Compliant and 260°C Reflow Compatible
- Class 2 ESD Rating (HBM 2kv)

Description

The MASW-000932 is a SPDT high power, broadband, high linearity, PIN diode T/R switch for 0.01 - 4.0 GHz applications, including WiMAX & WiFi. The device is provided in an industry standard lead free 4mm PQFN plastic package. This device incorporates a PIN diode die fabricated with M/A-COM Technology Solutions' patented Silicon-Glass HMIC™ process. This chip features two silicon pedestals embedded in a low loss, low dispersion glass. The diodes are formed on the top of each pedestal. The topside is fully encapsulated with silicon nitride and has an additional polymer passivation layer. These polymer protective coatings prevent damage and contamination during handling and assembly.

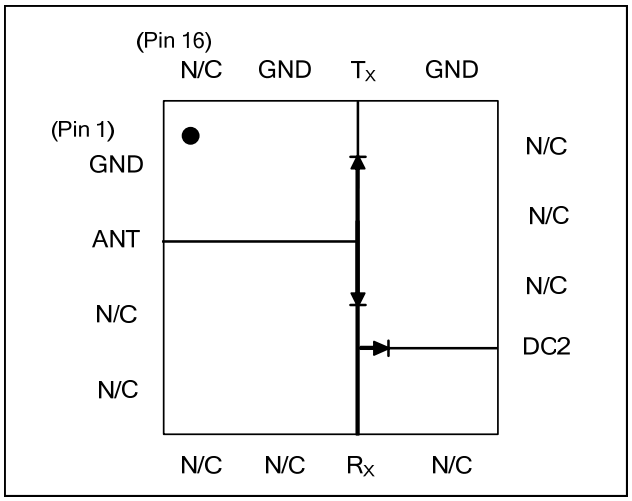
This compact 4mm PQFN packaged SPDT switch offers wideband 0.05 - 4.0 GHz performance with excellent isolation to loss ratio for both T_X and R_X states. The PIN diode provides 45 W C.W. power handling at an 85°C baseplate temperature and 72 dBm IIP3 at 2010 MHz for maximum switch performance.

Ordering Information[1]

Part Number	Package
MASW-000932-13560T	Tape and Reel (1K)
MASW-000932-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.

Functional Diagram (Top View)



Pin Configuration[2]

Pin	Function	Pin	Function
1	GND	9	DC2
2	ANT	10	N/C
3	N/C	11	N/C
4	N/C	12	N/C
5	N/C	13	GND
6	N/C	14	TX
7	RX	15	GND
8	N/C	16	N/C

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

* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

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HMIC™ PIN Diode SPDT 80 Watt Switch for 0.01 - 4.0 GHz Higher Power Applications

Electrical Specifications[3]: Freq. = 2.0, 2.7, 3.5 GHz, T_A = 25°C, Bias = 100 mA / 28 V

Parameter	100 mA / 28V Conditions	Units	Min.	Typ.	Max.
Insertion Loss[3], R_X Pin= 0 dBm	R_X, 2.0 GHz T_X, 2.0 GHz R_X, 2.7 GHz T_X, 2.7 GHz R_X, 3.5 GHz T_X, 3.5 GHz	dB	— — — — — —	.60 .25 .72 .35 .80 .45	.80 — .90 — .95 —
Isolation[3] Pin= 0 dBm	R_X to Antenna, 2.0 GHz T_X to Antenna, 2.0 GHz R_X to Antenna, 2.7 GHz T_X to Antenna, 2.7 GHz R_X to Antenna, 3.5 GHz T_X to Antenna, 3.5 GHz	dB	40.0 — 39.0 — 34.0 —	43.0 14.0 41.5 12.0 35.0 10.0	— — — — — —
Input Return Loss[3]	Pin= 0 dBm R_X T_X	dB	—	34 17	—
T_X Input P0.1dB	T_X to Antenna	dBm	—	49	—
T_X 2nd Harmonic	Pin = + 30 dBm	dBc	—	80	—
T_X 3rd Harmonic	Pin = + 30 dBm	dBc	—	95	—
T_X IIP3	Pin = +10 dBm, F1 = 2010 MHz, F2 = 2020 MHz	dBm	—	72	—
T_X C.W. Input Power	25°C Base plate, 2.01 GHz	dBm W	—	49 80	—
T_X C.W. Input Power	85°C Base plate, 2.01 GHz	dBm W	—	46.5 45	—
R_X C.W. Input Power	—	dBm W	—	41.5 14	—
T_X RF Switching Speed	(10-90% RF Voltage) 1 MHz Rep Rate in Modulating Mode	ns	—	200	—

3. See Bias Table

Absolute Maximum Ratings [4,5]

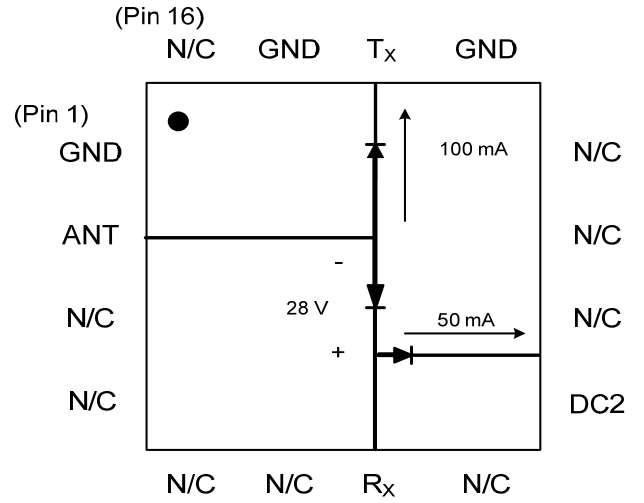
@ T_A = +25 °C (unless otherwise specified)

Parameter	Absolute Maximum
Forward Current	125 mA
Reverse Voltage (RF & D.C.)	-200 V
Operating Temperature	-40 °C to +85 °C
Storage Temperature	-55 °C to +150 °C
Junction Temperature	+175 °C
T_X Incident C.W. Power	80 W (49 dBm) [6] @ 2010MHz
T_X Peak Incident Power	>2000 W, 5 µs, 1% duty[7]

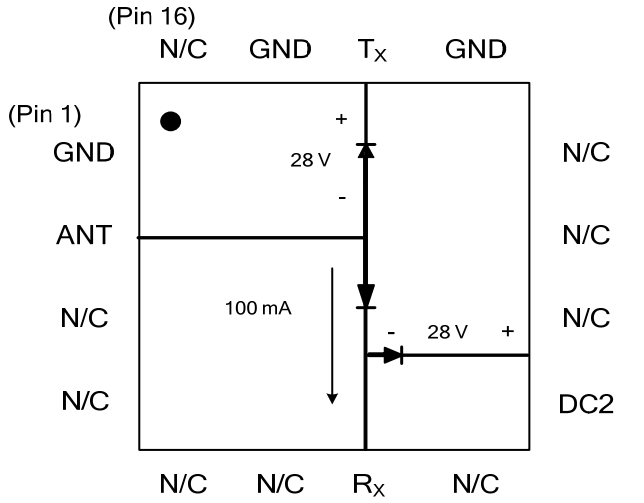
4. Exceeding these limits may cause permanent damage.
5. M/A-COM Technology Solutions does not recommend sustained operation near these survivability limits.
6. Baseplate temperature must be controlled to a constant +25°C.
7. This rating is guaranteed if the RF ports are terminated.

Bias Diagrams & Tables

T_X-ANT Insertion Loss
R_X-ANT Isolation



R_X-ANT Insertion Loss
T_X-ANT Isolation



Bias Table	T_X	R_X	DC2	ANT
Pin	**Pin 14**	**Pin 7**	**Pin 9**	**Pin 2**
T_X-ANT Isolation	+28 V, 0 mA	-100 mA	+28 V, 0 mA	0V
T_X-ANT Insertion Loss	-100 mA	+28 V, 0 mA	-50 mA	0V
R_X-ANT Isolation	-100 mA	+28 V, 0 mA	-50 mA	0V
R_X-ANT Insertion Loss	+28 V, 0 mA	-100 mA	+28 V, 0 mA	0V

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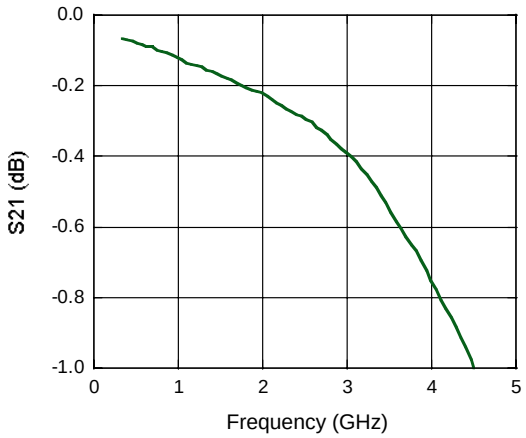
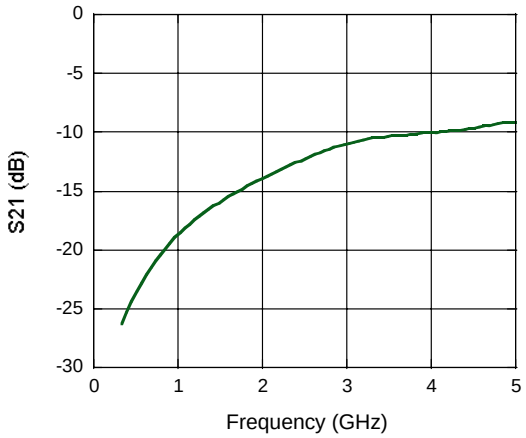
Typical Performance Curves, T_X (100 mA Bias Current)

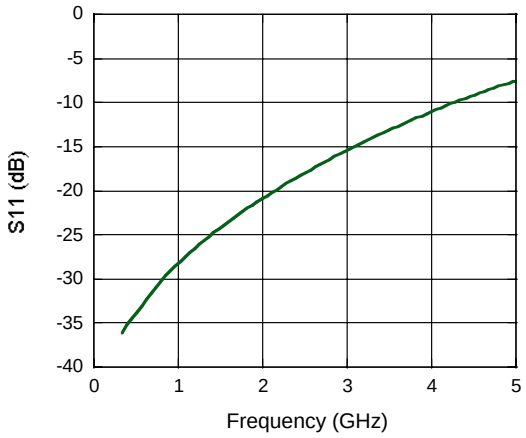
Insertion Loss, T_X



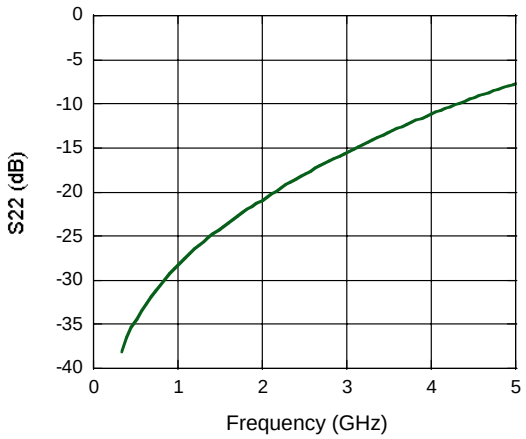
Isolation, T_X



Input Return Loss, T_X



Output Return Loss, T_X



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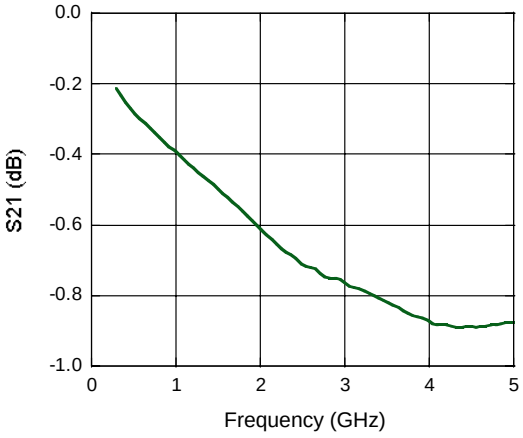
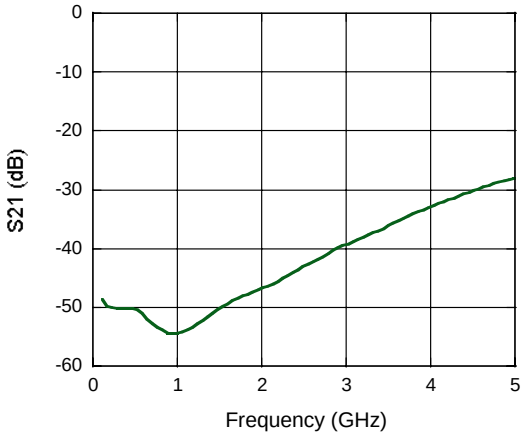
Typical Performance Curves, R_X (100 mA Bias Current)

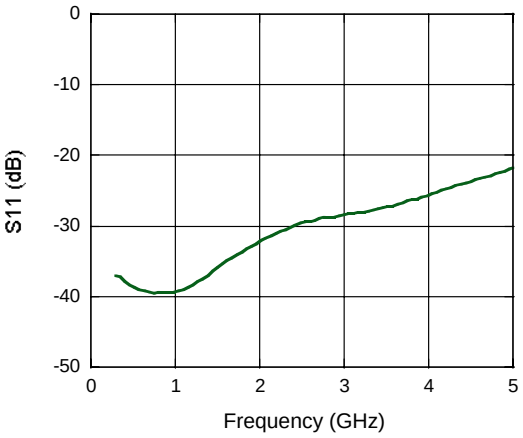
Insertion Loss, R_X



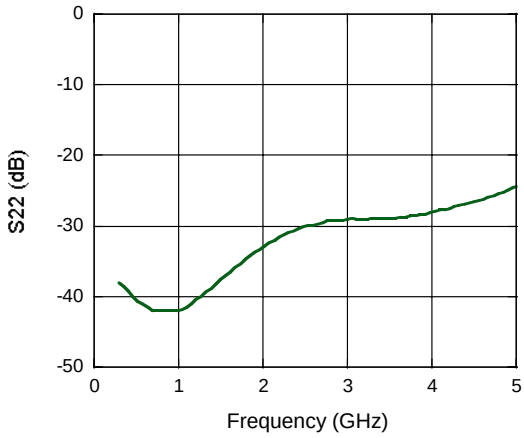
Isolation, R_X



Input Return Loss, R_X



Output Return Loss, R_X



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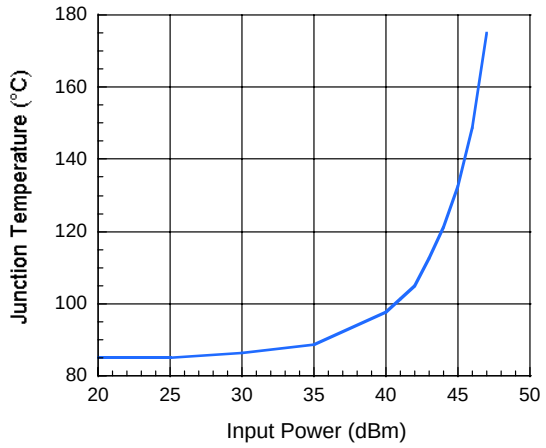
Typical Performance Curves[8]: 85°C base plate temperature, 2000 MHz

Power



8. Maximum Junction Temperature for this device is 175°C.

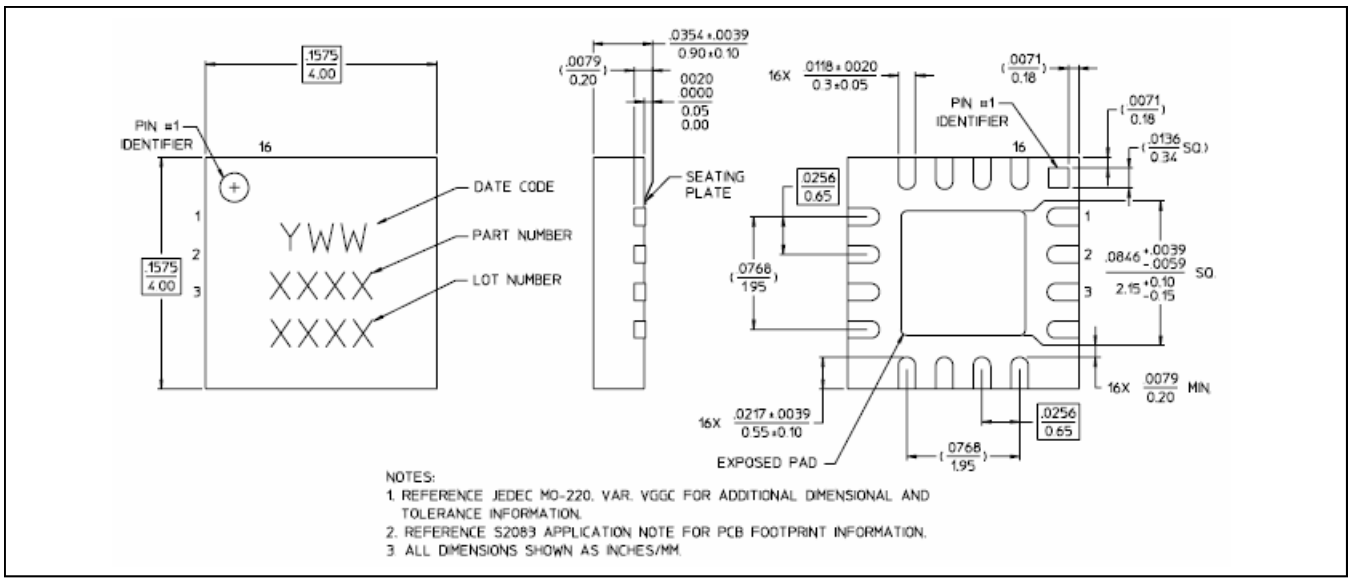
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Silicon 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 Class 2 devices.

Lead Free 4 mm 16-Lead PQFN †



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.

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MASW-000936

PIN Diode SPDT 120 Watt Switch for 0.05 - 6.0 GHz Higher Power Applications

Rev. V2

Features

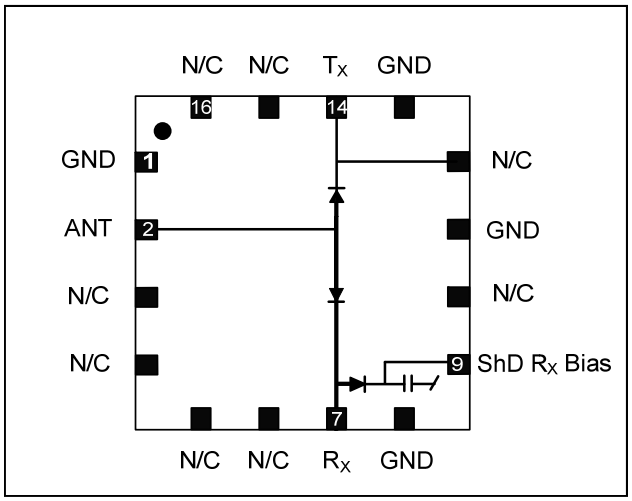
- Exceptional Broadband Performance
- Low Insertion Loss: T_X = 0.20 dB @ 2.7 GHz
- High Isolation: Rx = 51 dB @ 2.7 GHz
- High T_X RF Input Power = 120 W C.W. @ 2.7 GHz, 85°C
- Suitable for High Power LTE, TD-SCDMA, WiMAX, and Military Radio Applications
- Surface Mount 4mm PQFN Package
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MASW-000936 is a SPDT high power, broadband, high linearity, PIN diode T/R switch for 0.05 – 6.0 GHz applications, including WiMAX & WiFi. The device is provided in an industry standard lead free 4mm PQFN plastic package.

This device incorporates PIN diode die fabricated with M/A-COM Technology Solutions' Low Loss, High Isolation Switching Diode processes.

Functional Diagram (Top View)



Ordering Information[1]

Part Number	Package
MASW-000936-14000T	Tape and Reel (1K)
MASW-000936-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.

Pin Configuration[2]

Pin	Pin Name	Description
1	GND	Ground
2	ANT	Antenna
3	N/C	Connect to Ground
4	N/C	No Connection
5	N/C	No Connection
6	N/C	Connect to Ground
7	RX	Receive
8	GND	Ground
9	ShD R_X Bias	ShD R_X Bias
10	N/C	No Connection
11	GND	Ground
12[3]	N/C	Do Not Use
13	GND	Ground
14	TX	Transmit
15	N/C	Connect to Ground
16	N/C	No Connection

2. The exposed pad centered on the package bottom must be connected to RF, DC and Thermal ground.
3. Do not connect to ground or other metal trace.

* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

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PIN Diode SPDT 120 Watt Switch for 0.05 - 6.0 GHz Higher Power Applications

Electrical Specifications[4]: Freq. = 2.0, 2.7, 3.5 GHz, T_A = 25°C, Bias = 100 mA / 28 V

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss[4] Pin= 0 dBm	R_X, 0.8 GHz T_X, 0.8 GHz R_X, 2.0 GHz T_X, 2.0 GHz R_X, 2.7 GHz T_X, 2.7 GHz R_X, 3.5 GHz T_X, 3.5 GHz	dB	—	0.20 0.07 0.35 0.15 0.50 0.20 0.70 0.25	— — 0.55 — 0.75 — 0.90 —
Isolation[4] Pin= 0 dBm	R_X to Antenna, 2.0 GHz T_X to Antenna, 2.0 GHz R_X to Antenna, 2.7 GHz T_X to Antenna, 2.7 GHz R_X to Antenna, 3.5 GHz T_X to Antenna, 3.5 GHz	dB	41 — 40 — 33 —	45 16 50 13 40 11	—
Input Return Loss[4] Pin= 0 dBm	R_X T_X	dB	—	23 34	—
T_X Input P0.1dB	T_X to Antenna	dBm	—	>50	—
T_X IIP3 Pin = +30 dBm	F1 = 2010 MHz, F2 = 2020 MHz	dBm	—	72	—
T_X C.W. Input Power	85°C Base plate 2.0 GHz 2.7 GHz 3.5 GHz	dBm / W dBm / W dBm / W	—	50.8 / 120 50 / 100 49 / 80	—
R_X C.W. Input Power	—	dBm W	—	41.5 14	—
T_X RF Switching Speed	(10-90% RF Voltage) 1 MHz Rep Rate in Modulating Mode	ns	—	200	—

4. See Bias Table

Absolute Maximum Ratings [5,6]

@ T_A = +25 °C (unless otherwise specified)

Parameter	Absolute Maximum
Forward Current	150 mA
Reverse Voltage (RF & D.C.)	160 V
Operating Temperature	-40 °C to +85 °C
Storage Temperature	-55 °C to +150 °C
Junction Temperature	+175 °C
T_X Incident C.W. Power	50.8 dBm (120 W)[7] @ 2.0 GHz, 85°C

5. Exceeding these limits may cause permanent damage.
6. M/A-COM Technology Solutions does not recommend sustained operation near these survivability limits.
7. Base-plate temperature must be controlled to a constant +85°C.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Silicon 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 Class 1C Human Body devices.

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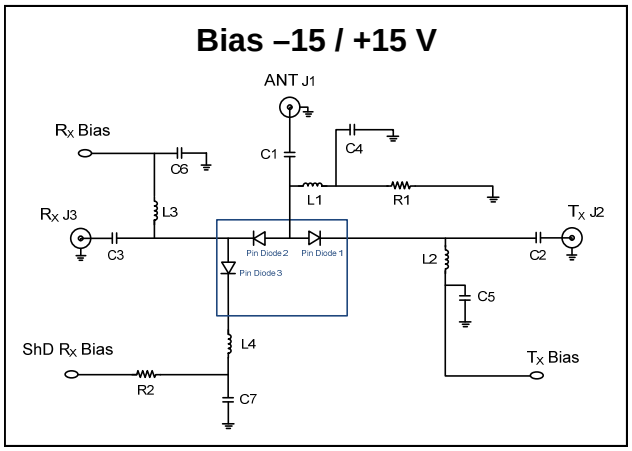
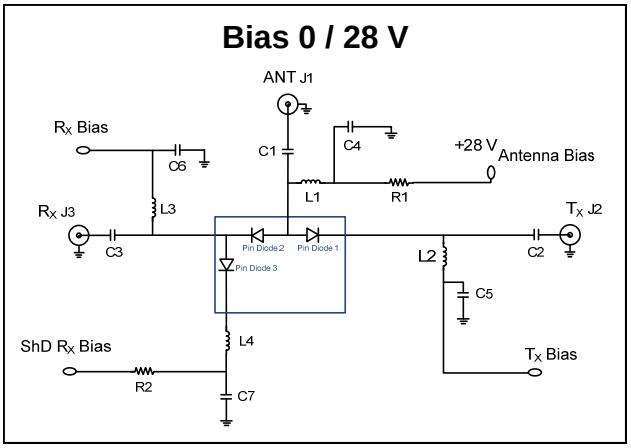
Bias Diagrams & Tables

Bias –15 / +15 V



Bias 0 / 28 V



Bias –15 / +15 V

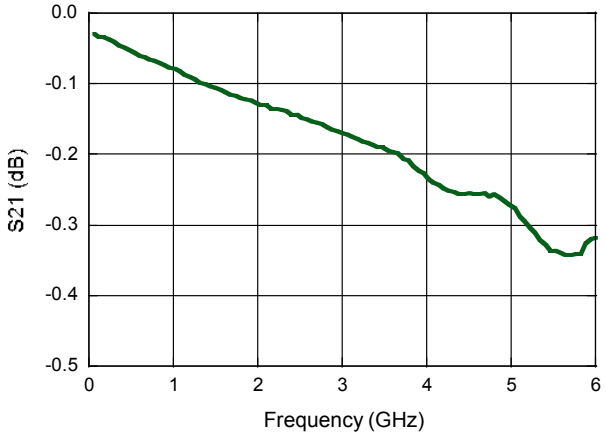
Bias Table	T_X	R_X	R_X ShDBias	ANT
Pin	**Pin 14**	**Pin 7**	**Pin 9**	**Pin 2**
T_X-ANT Isolation	(+15 V), 0 mA	(-15 V), -100 mA	GND	GND
T_X-ANT Insertion Loss	(-15 V), -100 mA	(+15 V), 100 mA	GND	GND
R_X-ANT Isolation	(-15 V), -100 mA	(+15 V), 100 mA	GND	GND
R_X-ANT Insertion Loss	(+15 V), 0 mA	(-15 V), 100 mA	GND	GND

Bias 0 / 28 V

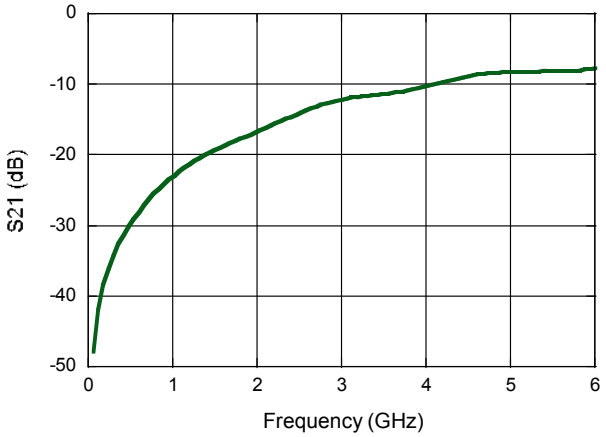
Bias Table	T_X	R_X	R_X ShDBias	ANT
Pin	**Pin 14**	**Pin 7**	**Pin 9**	**Pin 2**
T_X-ANT Isolation	(+28 V), 0 mA	(GND), -100 mA	(+28 V), 0 mA	+28 V
T_X-ANT Insertion Loss	(GND), -100 mA	(+28 V), 100 mA	(GND), -100 mA	+28 V
R_X-ANT Isolation	(GND), -100 mA	(+28 V), 100 mA	(GND), -100 mA	+28 V
R_X-ANT Insertion Loss	(+28 V), 0 mA	(GND), -100 mA	(+28 V), 0 mA	+28 V

Typical Performance Curves (RF-probed parts), T_X (100 mA Bias Current)

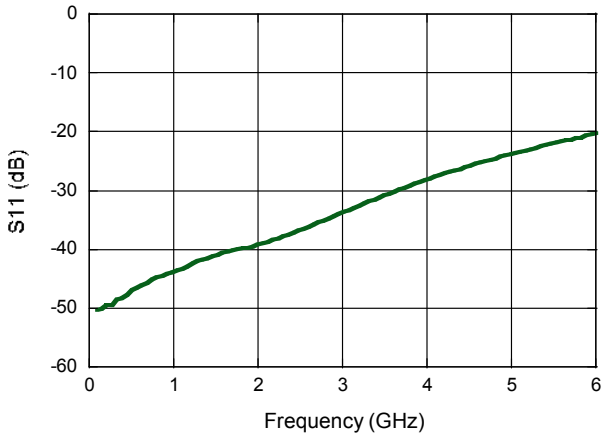
Insertion Loss, T_X



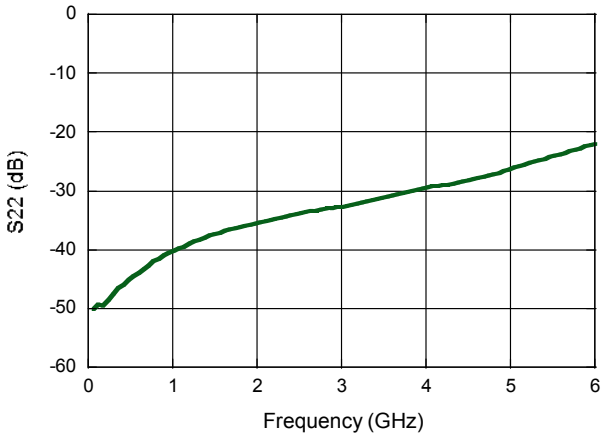
Isolation, T_X



Input Return Loss, T_X



Output Return Loss, T_X



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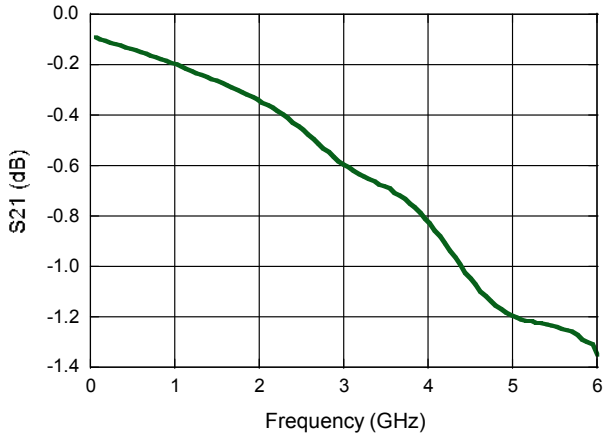
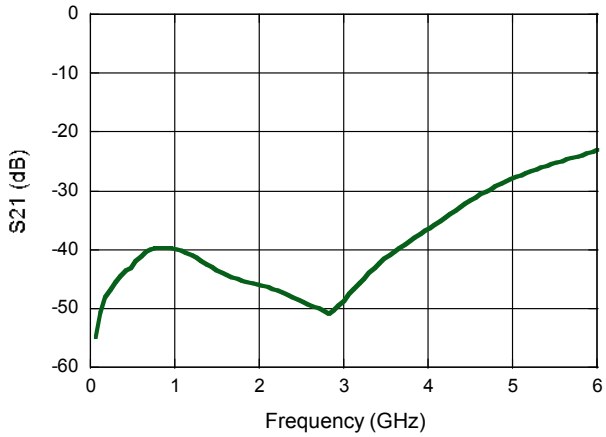
Typical Performance Curves (RF-probed parts), R_X (100 mA Bias Current)

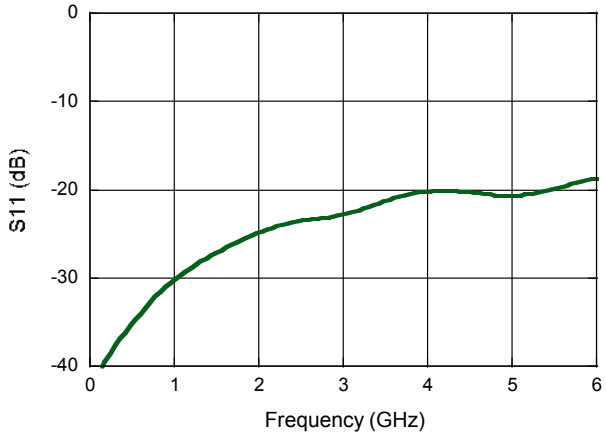
Insertion Loss, R_X



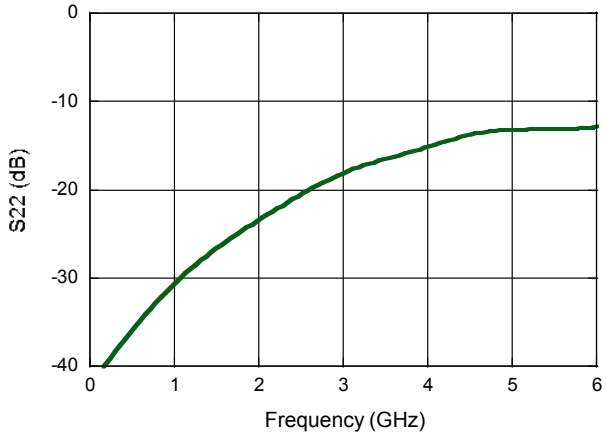
Isolation, R_X



Input Return Loss, R_X



Output Return Loss, R_X



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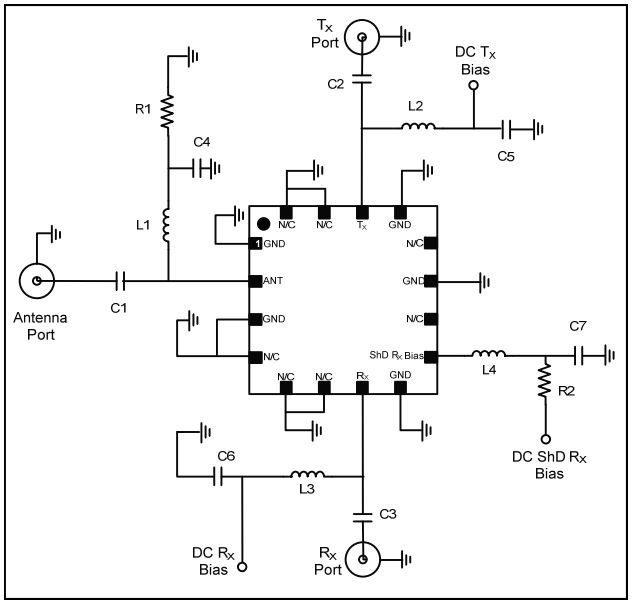
PIN Diode SPDT 120 Watt Switch for 0.05 - 6.0 GHz Higher Power Applications

Rev. V2

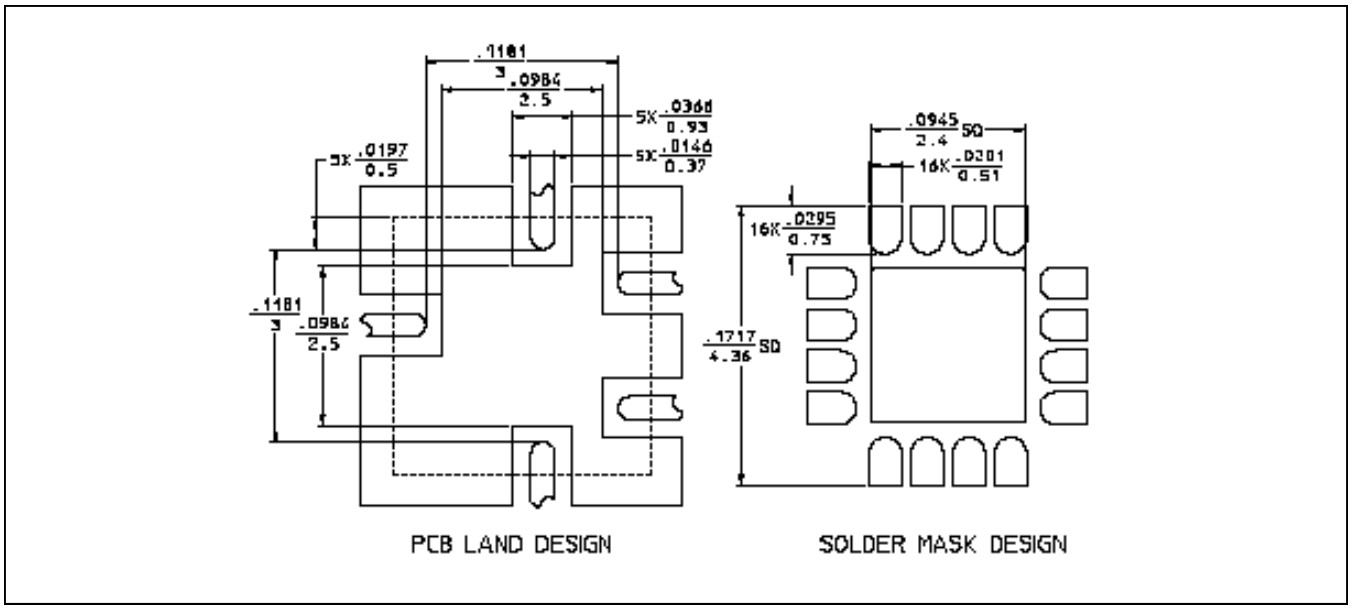
Application Schematic



Parts List

Component	Value	Package
C1-C3	22 pF	0603
C4-C6	27 pF	0603
L1-L4	68 nH	0603
R1, R2	137 Ω	0603

PCB Footprint



ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.
PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

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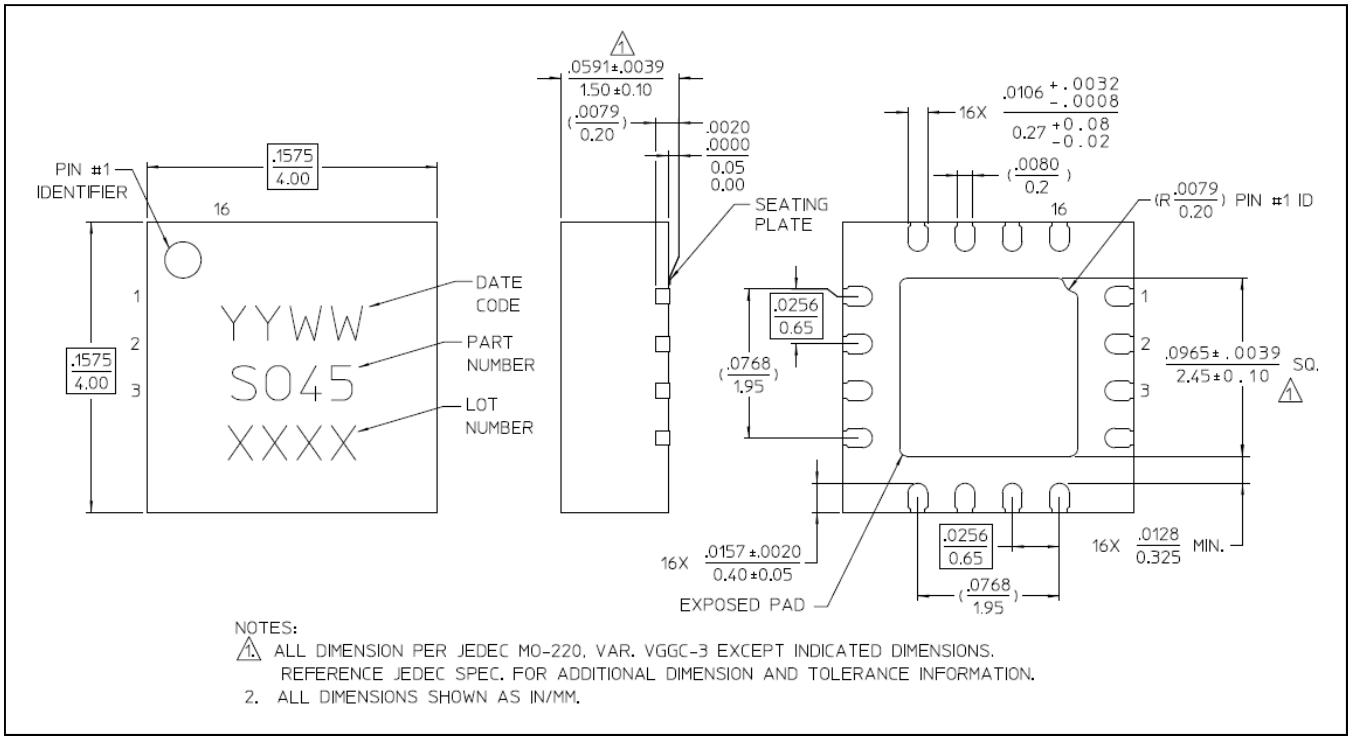
Lead Free 4 mm 16-Lead PQFN †



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is NiPdAuAg.

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