SP4T Reflective Switch
0.1 - 12 GHz

MASW-011270
Rev. V1

Features

- Low Insertion Loss:
  - 0.30 dB at 1.0 GHz
  - 0.35 dB at 2.5 GHz
  - 0.40 dB at 5.0 GHz
  - 0.50 dB at 8.0 GHz
- Isolation: 35 dB at 2.5 GHz
- Input P0.1dB: 38.5 dBm at 2.5 GHz
- Input IP3: 73 dBm
- Single Supply: 3.3 V
- Integrated Negative Voltage Generator
- 2 mm 14-Lead QFN Package
- RoHS* Compliant

Applications

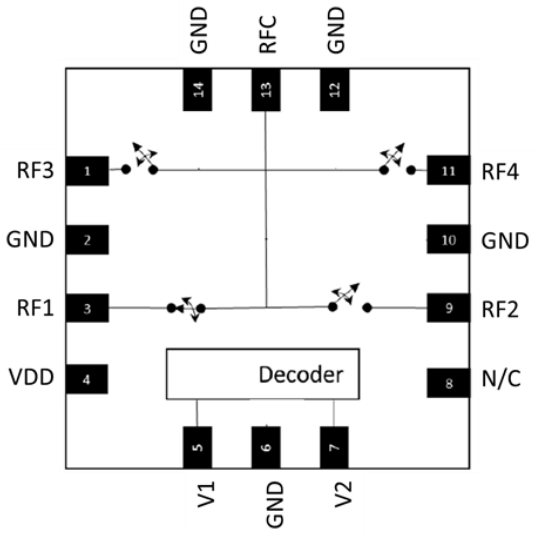
- MILCOM Radios
- Ultra-wideband
- Automotive V2X
- Test and Measurement
- Base Station

Description

The MASW-011270 is a reflective wideband single pole four throw (SP4T) switch with 0.35 dB of insertion loss at 2.5 GHz. The power handling capability is 37 dBm. The logic levels are compatible with standard 1.8 V, 2.5 V, and 3.3 V CMOS.

The MASW-011270 is manufactured on a Silicon-on -Insulator process. The 2 mm QFN package is lead free and RoHS compliant.

Block Diagram



Ordering Information[1]

Part Number	Package
MASW-011270-TR0500	500 part reel
MASW-011270-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.

Pin Names[2]

Pin #	Label
1	RF3
2, 6, 10, 12, 14	GND
3	RF1
4	V_{DD}
5	V_1
7	V_2
8	N/C
9	RF2
11	RF4
13	RFC
Paddle[3]	GND

2. MACOM recommends connecting No Connection (N/C) pins to ground.
3. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

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

Pin Description

Pin #	Name	description
1	RF3	RF3 Port. This pin is DC-coupled to 0 V and AC matched to 50 Ω. No DC blocking capacitor is required when the RF line potential is equal to 0 V DC.
2, 6, 10, 12, 14	GND	Internally connected to ground. Ground these pins with short connections
3	RF1	RF1 Port. This pin is DC-coupled to 0 V and AC matched to 50 Ω. No DC blocking capacitor is required when the RF line potential is equal to 0 V DC.
4	V_{DD}	Supply voltage. Place bypass capacitor as close to pin as possible.
5	V_1	First control logic input. Internally pulled down.
7	V_2	Second control logic input. Internally pulled down.
8	NC	Not connected internally. MACOM recommends grounding this pin with short connection.
9	RF2	RF2 Port. This pin is DC-coupled to 0 V and AC matched to 50 Ω. No DC blocking capacitor is required when the RF line potential is equal to 0 V DC.
11	RF4	RF4 Port. This pin is DC-coupled to 0 V and AC matched to 50 Ω. No DC blocking capacitor is required when the RF line potential is equal to 0 V DC.
13	RFC	RFC Port. This pin is DC-coupled to 0 V and AC matched to 50 Ω. No DC blocking capacitor is required when the RF line potential is equal to 0 V DC.
Paddle	GND	Exposed Pad. This must be connected to a large RF/DC ground island providing thermal capabilities for heat dissipation

AC Electrical Specifications:
P_{IN} = -10 dBm, V_{DD} = +3.3 V, T_C = 25°C, Z_0 = 50 Ω (unless otherwise stated)

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss (All Paths)	1.0 GHz 2.5 GHz 5.0 GHz 8.0 GHz	dB	—	0.3 0.35 0.4 0.5	0.8 — — 1.1
RFC Return Loss (All Paths)	1.0 GHz 2.5 GHz 5.0 GHz 8.0 GHz	dB	—	25 26 25 18	—
RF1/2/3/4 Return Loss (All Paths)	1.0 GHz 2.5 GHz 5.0 GHz 8.0 GHz	dB	—	27 29 25 20	—
RFC - RF1 Isolation[4] (RF2 ON)	1.0 GHz 2.5 GHz 5.0 GHz 8.0 GHz	dB	—	54 44 36 28	—
RFC - RF3 Isolation[5] (RF4 ON)	1.0 GHz 2.5 GHz 5.0 GHz 8.0 GHz	dB	—	51 42 33.7 27.3	—
RFC - RF1 Isolation[6] (RF3 ON)	1.0 GHz 2.5 GHz 5.0 GHz 8.0 GHz	dB	—	43 35 28 25	—
RFC - RF3 Isolation[7] (RF1 ON)	1.0 GHz 2.5 GHz 5.0 GHz 8.0 GHz	dB	—	43 35 27 22.8	35 — — 17
Input P0.1dB	2.5 GHz 5.0 GHz	dBm	—	38.5 38	—
Input IP3	P_{IN} = +26 dBm per tone, Δf = 50 MHz, 2.5 GHz	dBm	—	73	—
Spurious (All Paths)	RFC Port, No RF Applied < 20 MHz >20 MHz	dBm	—	 -120 <-125	—

4. Due to symmetry, RFC - RF2 Isolation is similar when RF1 ON.
5. Due to symmetry, RFC - RF4 Isolation is similar when RF3 ON.
6. Due to symmetry, RFC - RF2 Isolation is similar when RF4 ON.
7. Due to symmetry, RFC - RF4 Isolation is similar when RF2 ON.

DC Electrical Specifications:
V_{DD} = +3.3 V, T_C = 25°C (unless otherwise stated)

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Supply Voltage, V_{DD}	—	V	3.15	3.3	3.45
Supply Current, I_{DD}	—	µA	—	36	—
Logic Control Voltages (pins V_1, V_2)	Logic High Logic Low	V	1.15 -0.3	1.8 0	V_{DD}+0.3 0.6
Logic Control Current (pins V_1, V_2)	V_2/V_1 = +1.8 V V_2/V_1 = 0 V	nA	—	650 1	—

Transient Electrical Specifications:
Freq = 2.5 GHz, P_{IN} = 0 dBm, V_{DD} = 3.3 V

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Switching Time, On	50% control to 90% RF (Peak Voltage)	µs	—	0.7	—
Switching Time, Off	50% control to 10% RF (Peak Voltage)	µs	—	0.5	—
Rise Time, On	10% to 90% RF (Peak Voltage)	µs	—	0.2	—
Fall Time, Off	90% to 10% RF (Peak Voltage)	µs	—	0.25	—

Control Truth Table

Path to RFC	V_1	V_2
RF1	0	0
RF2	1	0
RF3	0	1
RF4	1	1

Recommended Operating Conditions

Parameter	Symbol	Unit	Min.	Typ.	Max.
DC Supply Voltage	V_{DD}	V	3.15	3.3	3.45
Logic Pin Voltages	V_1/V_2	V	-0.3	—	V_{DD}+0.3
Operating Temperature[8]	T_C	°C	-40	—	+105
Junction Temperature[9,10]	T_J	°C	—	—	+125

8. Operating/Case Temperature (T_C) is measured at the exposed pad.
9. Operating at nominal conditions with $T_J \leq +125°C$ will ensure MTTF > 1 x 10^6 hours.
10. Junction Temperature (T_J) = T_C + Θjc * (P_{DISS}).
    Typical thermal resistance (Θjc) = 24.2 °C/W.
    P_{DISS} is the total dissipated DC and RF power.

Absolute Maximum Ratings[11,12]

Parameter	Symbol	Unit	Min.	Max.
Input Power, 5 GHz	P_{IN}	dBm	—	38
DC Supply Voltage	V_{DD}	V	-0.5	3.6
Logic Voltages	V_1/V_2	V	-0.5	4.1
Junction Temperature	T_J	°C	—	+135
Operating Temperature	T_C	°C	-40	+105
Storage Temperature	-	°C	-65	+125

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

Handling Procedures

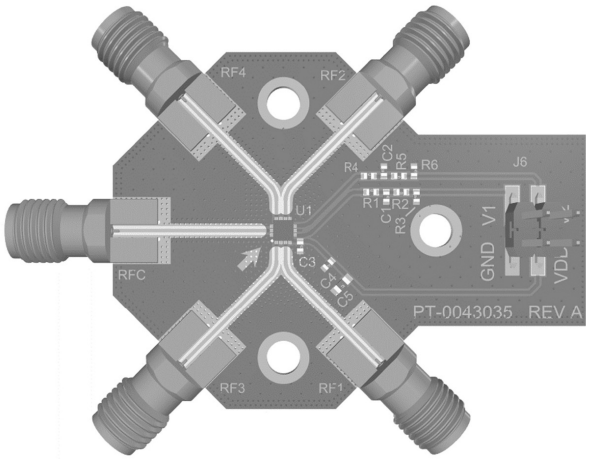
Please observe the following precautions to avoid damage:

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 devices.

Parameter	Rating	Standard
Human Body Model (HBM)	1000 V (Class 1C)	ESDA/JEDEC JS-001
Charged Device Model (CDM)	1000 V (Class C3)	ESDA/JEDEC JS-002

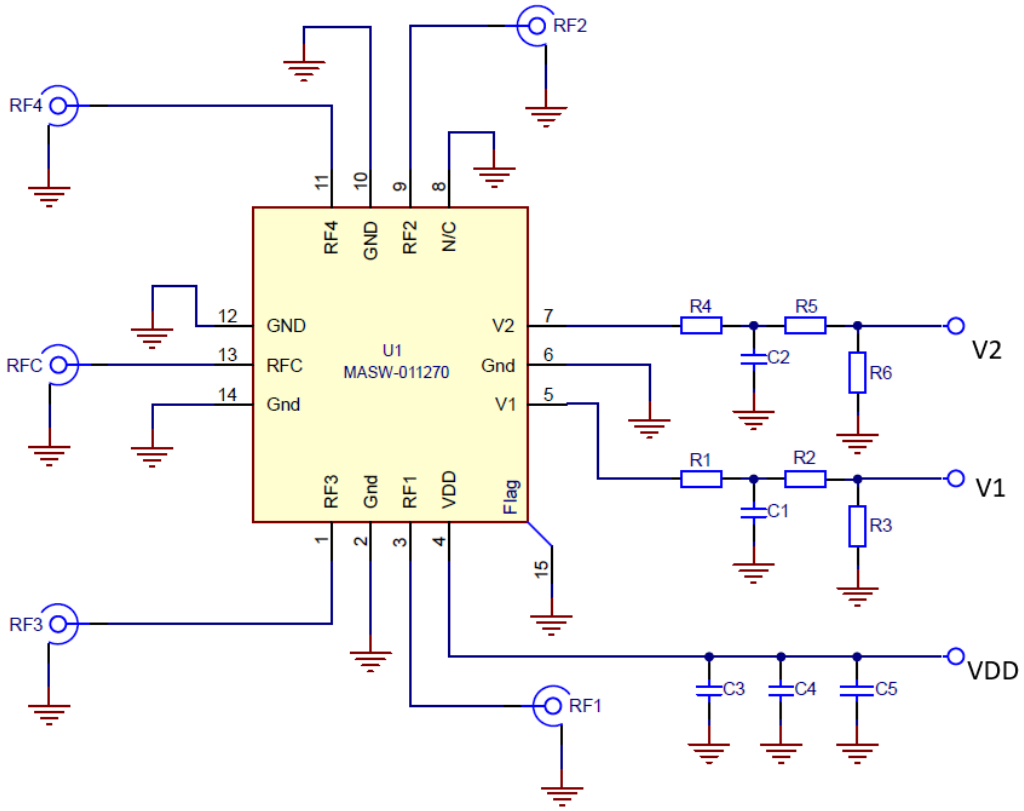
SMB Layout & Assembly



Parts List

Part	Value	Case Style
R1, R4,	1 kΩ	0402
R2, R5	0 Ω	0402
R3, R6	Do Not Place	0402
C1, C2	10 pF	0402
C3	470 pF	0402
C4	10 nF	0402
C5	10 µF	0603
RF1 - 4, RFC	142-0761-841	SMA End Launch

Application Schematic

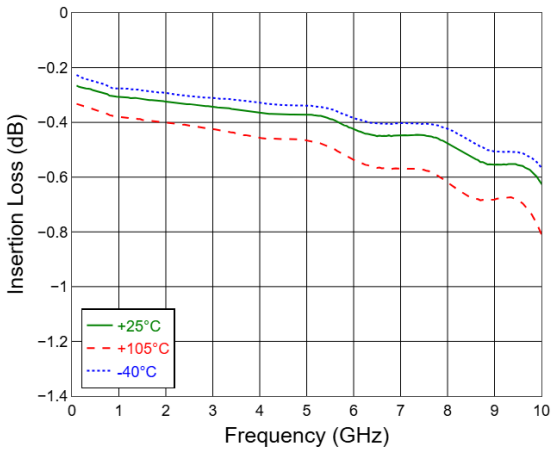


Power Supplies

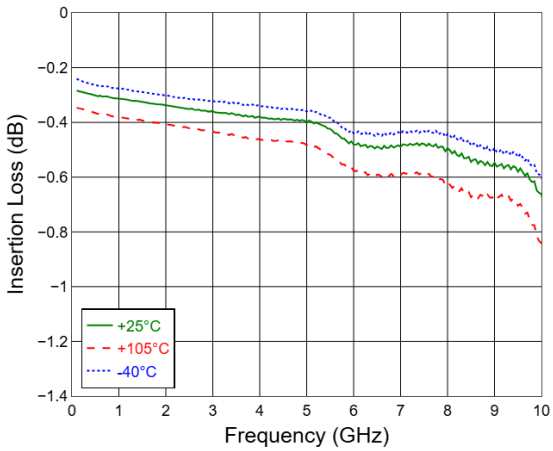
De-coupling capacitors should be placed at the V_{DD} pin to minimize noise and fast transients. Supply voltage change or transients should have a slew rate smaller than 1 V / 10 µs. In addition, all control pins should remain at 0 V (+/- 0.3 V) and no RF power should be applied while the supply voltage ramps or while it returns to zero.

Typical SMB Performance Curves: P_{IN} = -10 dBm, V_{DD} = 3.3 V, T_C = 25°C, Z_0 = 50 Ω

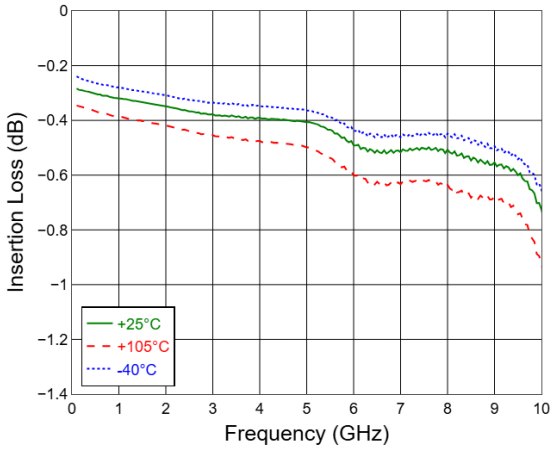
Insertion Loss[13] over Temperature, RFC to RF1



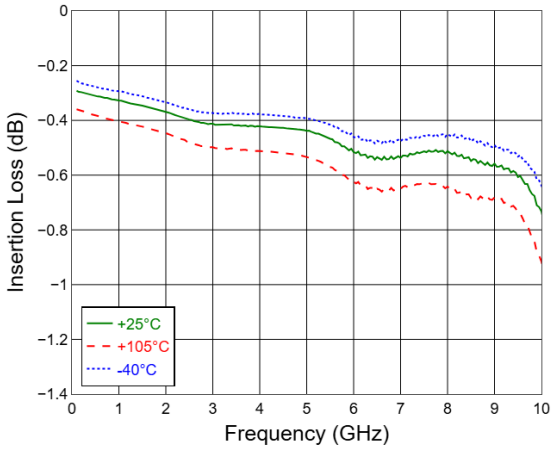
Insertion Loss[13] over Temperature, RFC to RF2



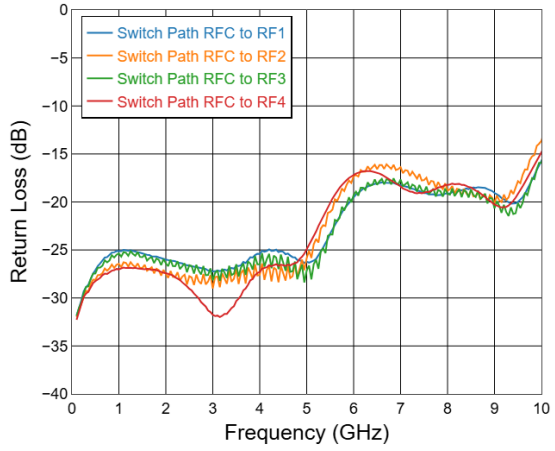
Insertion Loss[13] over Temperature, RFC to RF3



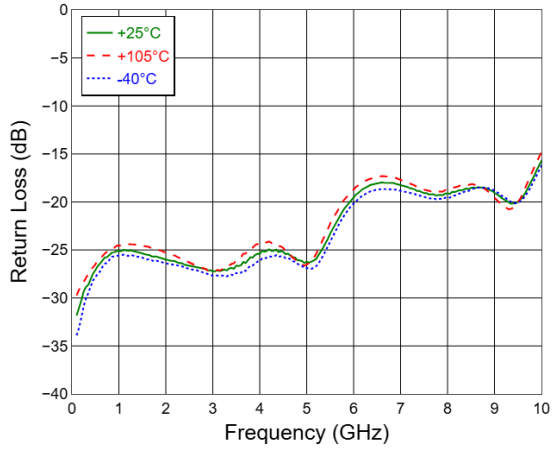
Insertion Loss[13] over Temperature, RFC to RF4



Return Loss, RFC Port, All Paths, 25°C

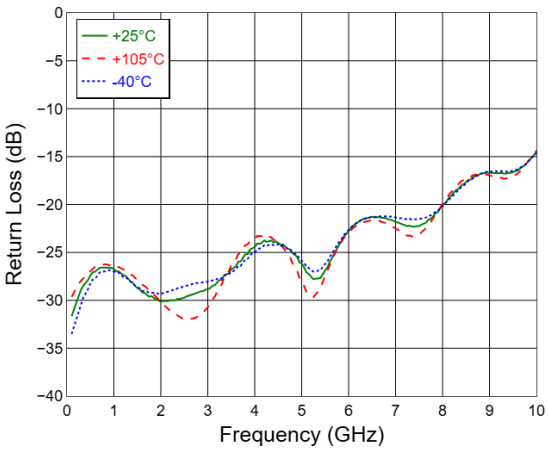


Return Loss over Temperature, RFC Port, Switch Path RFC to RF1

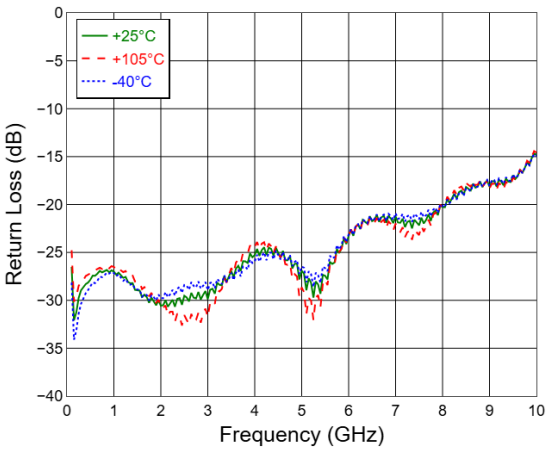


Typical SMB Performance Curves: P_{IN} = -10 dBm, V_{DD} = 3.3V, T_C = 25°C, Z_0 = 50 Ω

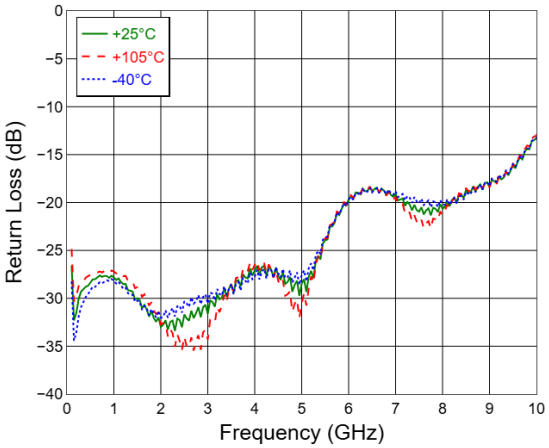
Return Loss, RF1 Port, Switch Path RFC to RF1



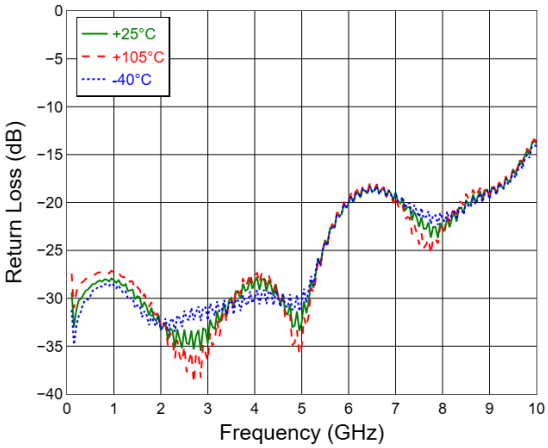
Return Loss, RF2 Port, Switch Path RFC to RF2



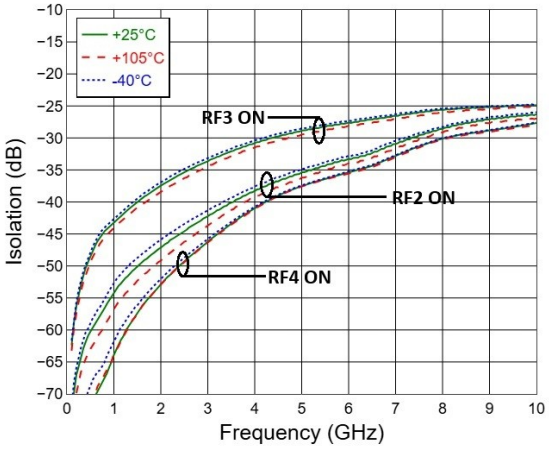
Return Loss, RF3 Port, Switch Path RFC to RF3



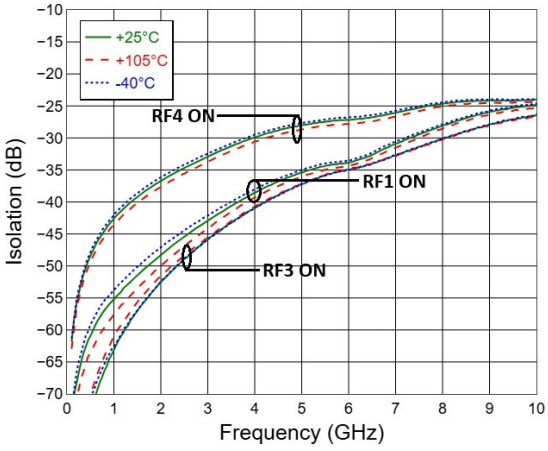
Return Loss, RF4 Port, Switch Path RFC to RF4



Isolation[13] over Temperature, RFC to RF1

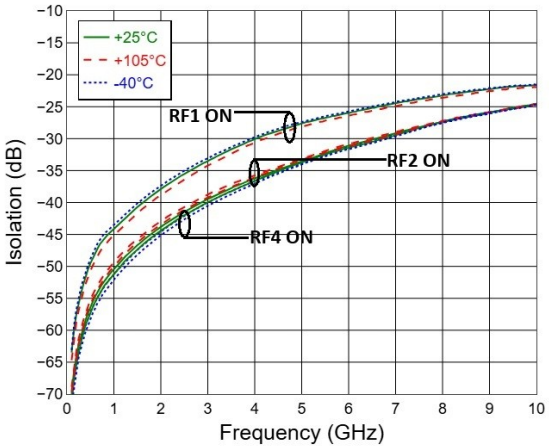


Isolation[13] over Temperature, RFC to RF2

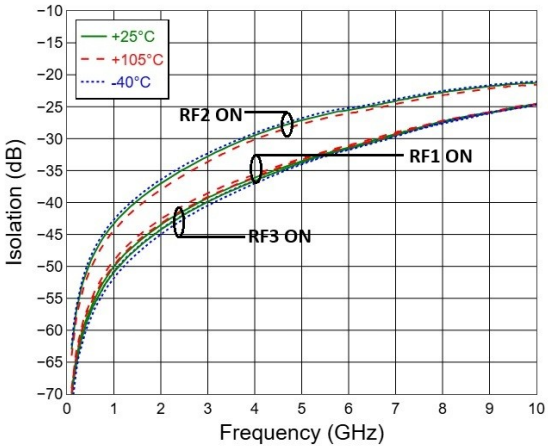


Typical SMB Performance Curves: P_{IN} = -10 dBm, V_{DD} = 3.3V, Z_0 = 50 Ω

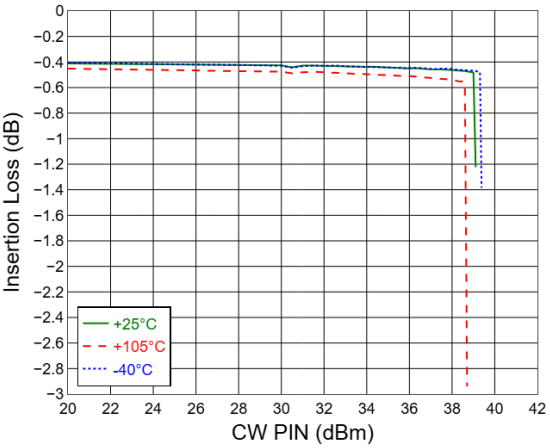
Isolation[13] over Temperature, RFC to RF3



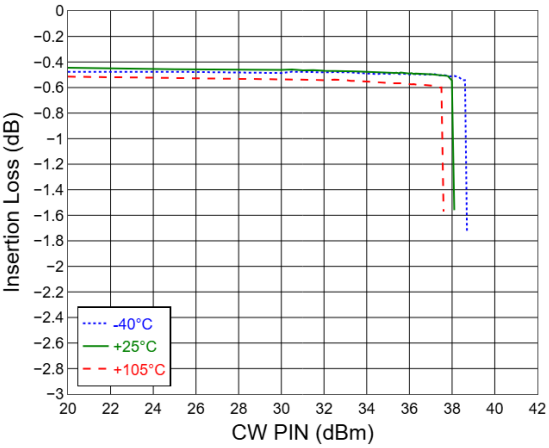
Isolation[13] over Temperature, RFC to RF4



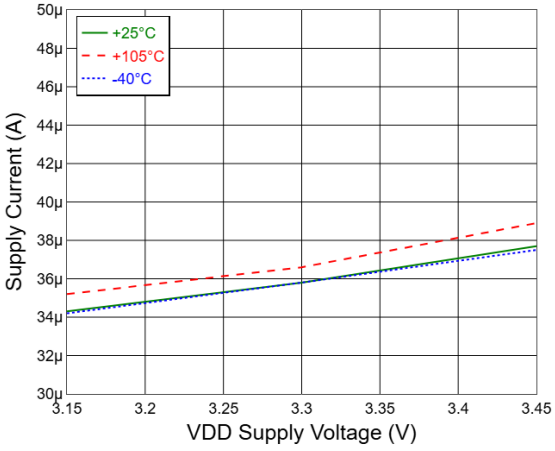
Compression[13] Performance, 2.5 GHz (CW), RFC to RF1



Compression[13] Performance, 5.0 GHz (CW), RFC to RF1



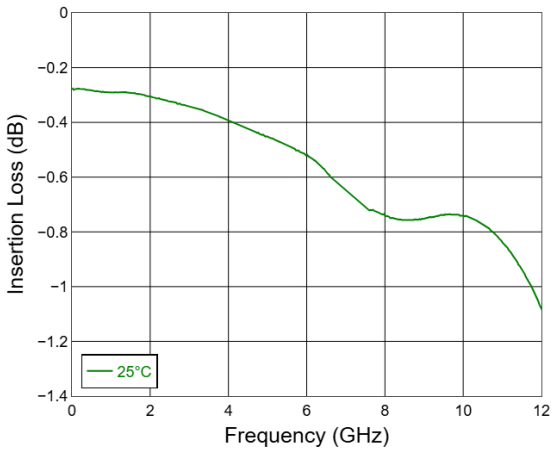
Supply Current



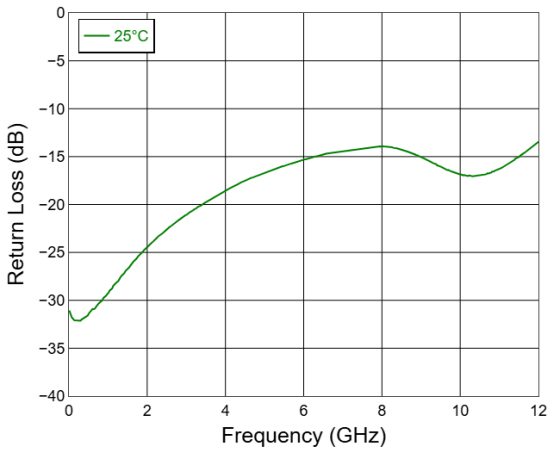
13. For insertion loss, isolation, and compression plots, RF trace and connector losses are de-embedded.

Typical Probed Performance Curves: P_{IN} = -10 dBm, V_{DD} = 3.3V, T_C = 25°C, Z_0 = 50 Ω

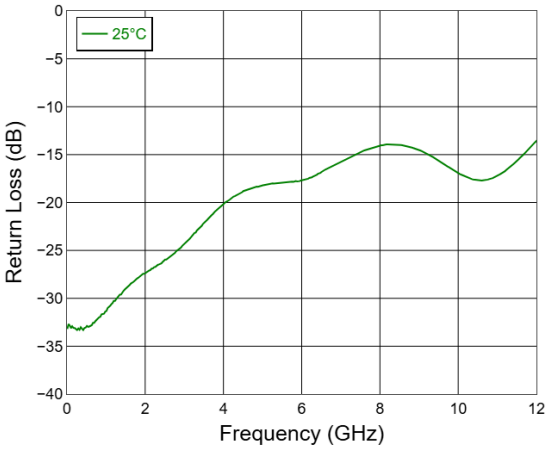
Probed[14] Insertion Loss, RFC to RF4.



Probed[14] Return Loss, RFC Port, Switch Path RFC to RF4

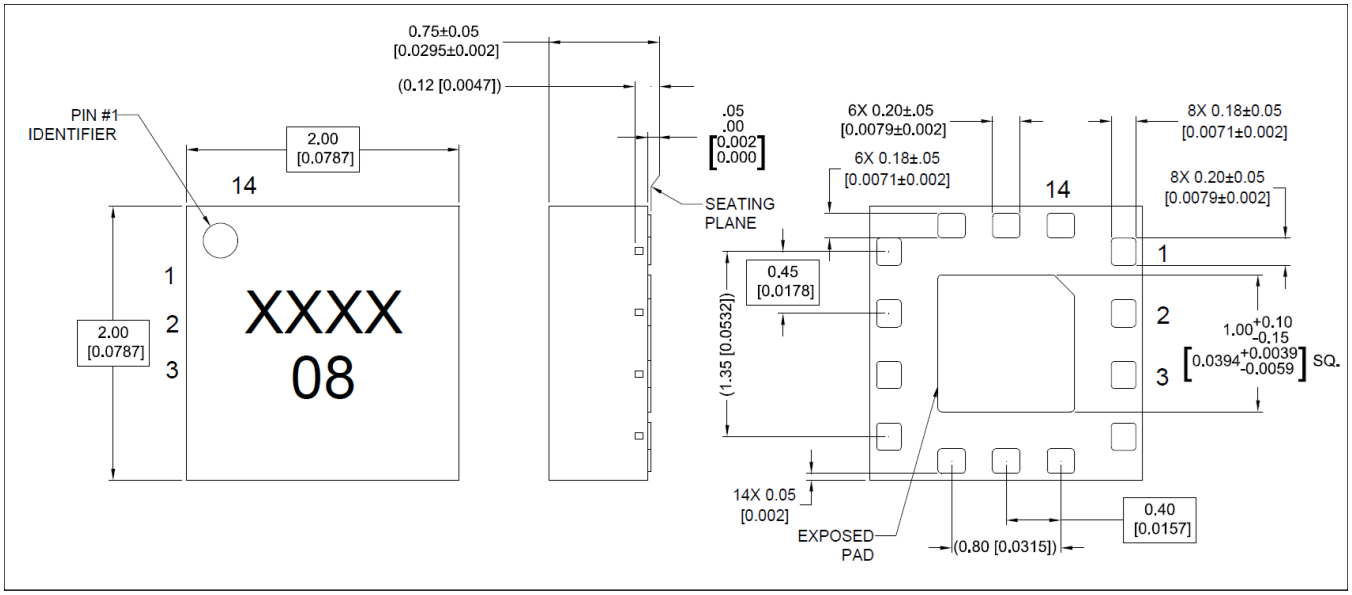


Probed[14] Return Loss, RF4 Port, Switch Path RFC to RF4



14. Raw S-parameter data captured from unit mounted on SMB and RF probes placed close to pins.

Lead-Free 2 mm 14-Lead PQFN†



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Plating is NiPdAu over Copper

Revision History

Rev.	Date	Change Description
V1	Sept 2025	Final Release