SP4T Absorptive Switch
DC - 10 GHz

MASW-011226
Rev. V1

Features

- Wideband: 9 kHz to 10 GHz
- Insertion Loss: 1.35 dB @ 3.5 GHz
- Isolation: 50 dB @ 3.5 GHz
- Input P1dB: 28 dBm
- Input IP3: 51 dBm
- No Low Frequency Spurious
- Compatible with 1.8, 2.5, and 3.3 V CMOS Logic
- 4 mm 20 Lead QFN Package
- RoHS* Compliant

Applications

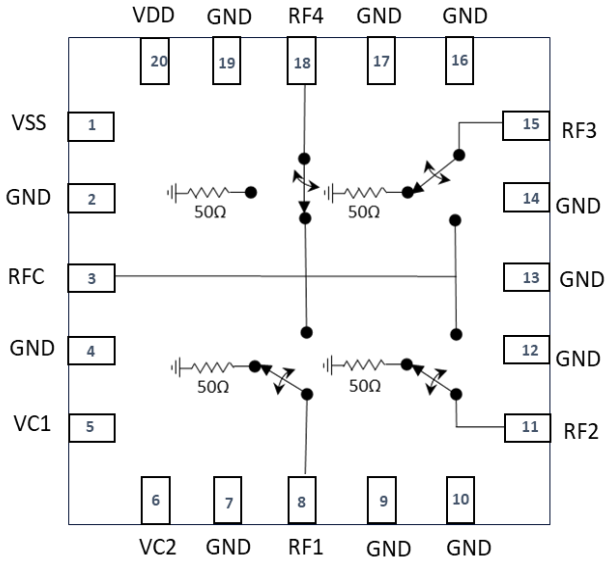
- 5G Base Station
- Portable Wireless
- Test & Measurement
- ISM & Multi Market

Description

The MASW-011226 is an absorptive, wideband single pole four throw (SP4T) switch with 1.35 dB of insertion loss and 50 dB isolation at 3.5 GHz. The RF output ports are terminated in 50 Ω in the isolated path. The power handling capability is 28 dBm. The input and output return losses in the thru path are typically 13 dB. The logic levels are compatible with standard 1.8, 2.5, or 3.3 V CMOS. Required bias supplies are +3.3 V and -3.3 V.

The MASW-011226 is manufactured on a Silicon-on-Insulator process. The 4 mm QFN package is lead free and RoHS compliant.

Functional Schematic



Pin Names[2]

Pin #	Function
1	Negative Supply
2, 4, 7, 9, 10, 12-14, 16, 17, 19	Ground
3	Common RF Input/Output
5	Control Voltage 1
6	Control Voltage 2
8	RF Input/Output 1
11	RF Input/Output 2
15	RF Input/Output 3
18	RF Input/Output 4
20	Positive Supply
21	Exposed Pad[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-011226-TR1000	1000 Piece Reel
MASW-011226-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.

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

Pin Description

Pin #	Name	Description
1	VSS	-3.3 V Negative Supply Voltage. Bypass capacitors required at this pin. See application schematic for details.
2, 4, 7, 9, 10, 12-14, 16, 17, 19	GND	Grounded internally. Recommend to ground these externally.
3	RFC	Common RF Input/Output DC-coupled to GND. There is no internal DC blocking capacitor.
5	VC1	Control Voltage 1. Internally pulled down to GND with 100 kΩ resistor. Bypass capacitors required at this pin. See application schematic for details.
6	VC2	Control Voltage 2. Internally pulled down to GND with 100 kΩ resistor. Bypass capacitors required at this pin. See application schematic for details.
8	RF1	RF Input/Output 1 DC-coupled to GND. There is no internal DC blocking capacitor.
11	RF2	RF Input/Output 2 DC-coupled to GND. There is no internal DC blocking capacitor.
15	RF3	RF Input/Output 3 DC-coupled to GND. There is no internal DC blocking capacitor.
18	RF4	RF Input/Output 4 DC-coupled to GND. There is no internal DC blocking capacitor.
20	VDD	+3.3 V Positive Supply Voltage. Bypass capacitors required at this pin. See application schematic for details.
Paddle	Paddle	Paddle should be connected to RF, Thermal and DC ground

AC Electrical Specifications: Freq. = 3.5 GHz, T_C = 25°C, V_{DD} = +3.3 V, V_{SS} = -3.3 V, P_{IN} = -5 dBm Z_0 = 50 Ω, unless otherwise specified

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	0.3 GHz 3.5 GHz 5.0 GHz 7.2 GHz	dB	—	1.05 1.35 1.35 1.35	— 2 2 —
Isolation, Between RF1 / RF2 / RF3 / RF4	0.3 GHz 3.5 GHz 5.0 GHz 7.2 GHz	dB	—	70 50 48 44	—
Isolation, RFC to RF1 / RF2 / RF3 / RF4	0.3 GHz 3.5 GHz 5.0 GHz 7.2 GHz	dB	— 44 40 —	70 51 48 44	—
RFC Return Loss	DC - 10 GHz	dB	—	15	—
Return Loss, Thru Port RF1/RF2/RF3/RF4	DC - 10 GHz	dB	—	13	—
Return Loss, Isolated Port RF1/RF2/RF3/RF4	DC - 10 GHz	dB	—	13	—
Input P0.1dB	DC - 10 GHz	dBm	—	27.5	—
Input P1dB	DC - 10 GHz	dBm	—	28	—
Input IP3	Two tone, P_{IN}/tone = +14 dBm 1 MHz tone spacing 10 MHz - 10 GHz	dBm	—	51	—
T_{ON}	50% control to 90% RF (Peak Voltage)	µs	—	0.95	—
T_{RISE}	10% to 90% RF (Peak Voltage)	µs	—	0.4	—
T_{OFF}	50% control to 10% RF(Peak Voltage)	µs	—	0.16	—
T_{FALL}	90% to 10% RF (Peak Voltage)	µs	—	0.03	—

DC Electrical Specifications: T_C = 25°C, P_{IN} = -5 dBm

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Voltage Supply, VDD	—	V	+3.15	+3.3	+3.45
Supply Current, VDD	V_{DD} = 3.3 V, V_{SS} = -3.3 V. VC1 = VC2 = 0 V	mA	—	0.3	—
Voltage Supply, VSS	—	V	-3.45	-3.3	-3.15
Supply Current, VSS	V_{DD} = 3.3 V, V_{SS} = -3.3 V. VC1 = VC2 = 0 V	mA	—	-0.65	—
Logic Control Voltage (pins VC1 & VC2)	Logic Low, V_{IL} Logic High, V_{IH}	V	0.0 +1.2	—	+0.6 VDD
Logic Input Current (pins VC1 & VC2)	Logic Low, V_{IL} Logic High, V_{IH}	µA	—	0 18	—

Control Truth Table

Control 1	Control 2	Condition of Switch			
VC1	VC2	RF1	RF2	RF3	RF4
V_{IL}	V_{IL}	On	Off	Off	Off
V_{IH}	V_{IL}	Off	On	Off	Off
V_{IL}	V_{IH}	Off	Off	On	Off
V_{IH}	V_{IH}	Off	Off	Off	On

Power Supplies

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

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 1C and CDM Class C3 devices.

Recommended Operating Conditions

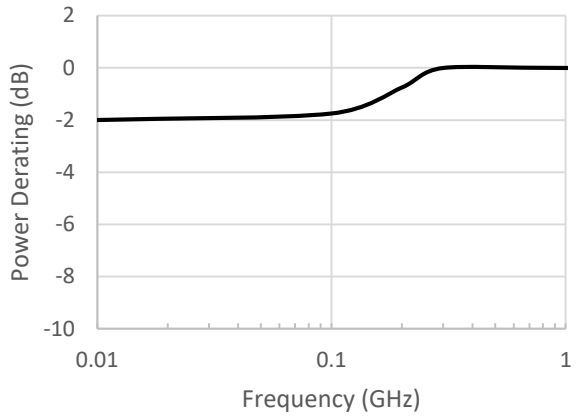
Parameter	Symbol	Unit	Min.	Typ.	Max.
Input Power, 300 MHz to 10 GHz, RFC Port[3] RF1 / RF2 / RF3 / RF4 Port[3]	—	dBm	—	—	26 26
DC Positive Voltage Supply	VDD	V	+3.15	+3.3	+3.45
DC Negative Voltage Supply	VSS	V	-3.45	-3.3	-3.15
Logic Control Voltages Logic Low Logic High	VC1 / VC2	V	-0.3 +1.2	— —	+0.6 +3.45
Operating Temperature[4]	T_C	°C	-40	—	+105
Storage Temperature	—	°C	-65	—	+150

Absolute Maximum Ratings[5,6]

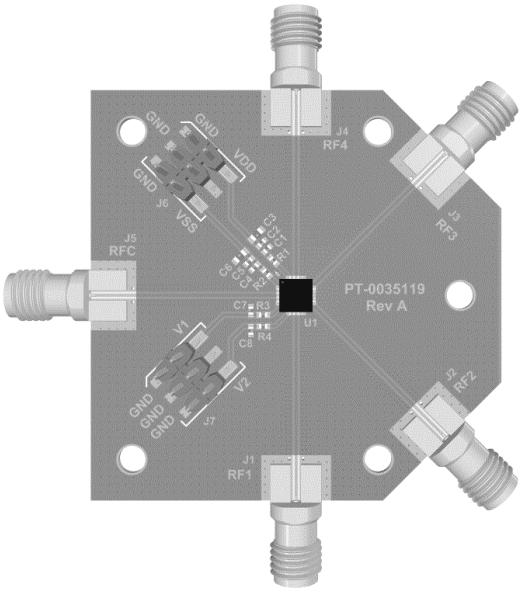
Parameter	Symbol	Unit	Min	Max
Input Power, 300 MHz to 10 GHz, RFC Port[3] RF1 / RF2 / RF3 / RF4 Port[3]	—	dBm	—	27 dBm 27 dBm
DC Positive Voltage Supply	VDD	V	-0.3	+3.6
DC Negative Voltage Supply	VSS	V	-3.6	+0.3
Logic Control Voltages	VC1 / VC2	V	-0.3	+3.6
Operating Temperature	T_C	°C	—	+125
Storage Temperature	—	°C	-65	+150

3. T_C = 105 ºC. See power derating curves for details.
4. Operating/Case Temperature (T_C) is measured at the exposed pad.
5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.

Low Frequency Power Derating Detail[3]



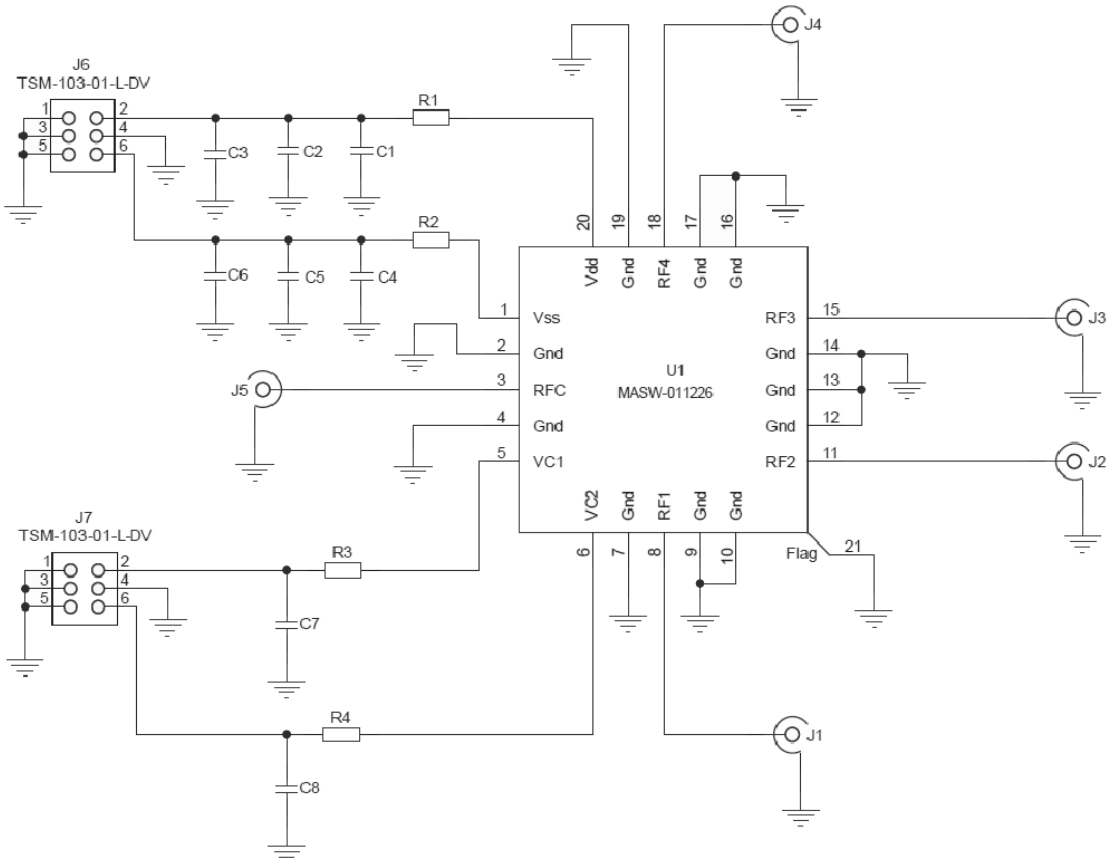
PCB Layout



Parts List

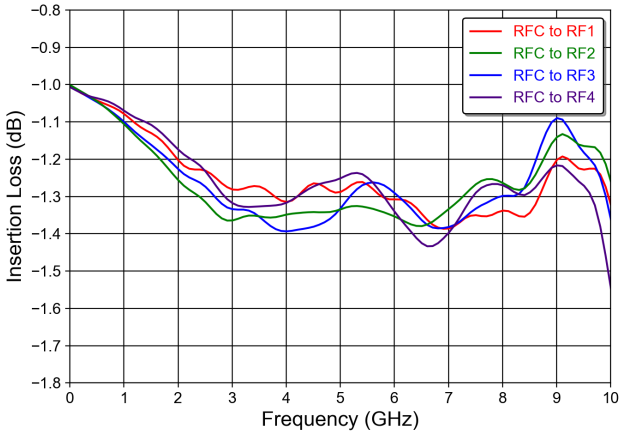
Part	Value	Case Style
R1-R4	0 Ω	0402
C1, C4	10 pF	0402
C2, C5	1 nF	0402
C3, C6	100 nF	0603
C7, C8	5 pF	0402

Application Schematic

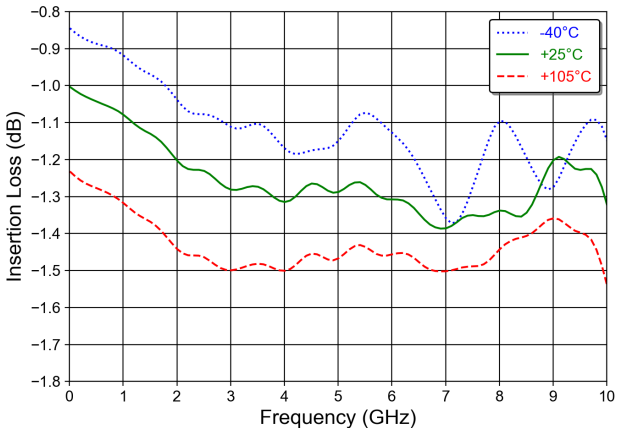


Typical Performance Curves: T_C = 25 °C, V_{DD} = 3.3V, V_{SS} = -3.3V, P_{IN} = -5 dBm, Z_o = 50 Ω, unless otherwise specified

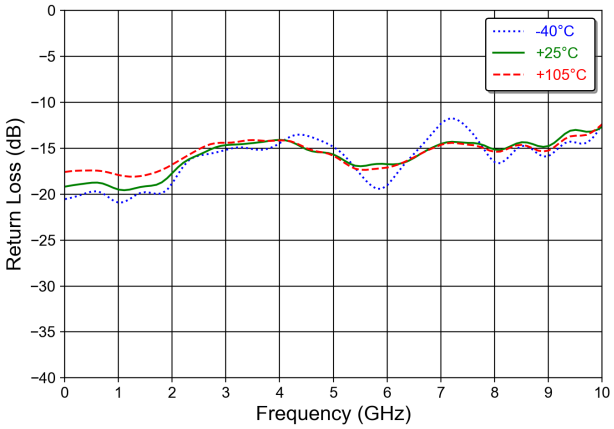
Insertion Loss[7]



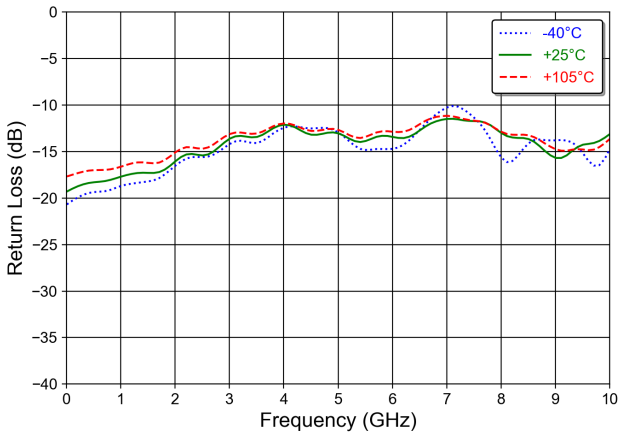
RFC to RF1 Insertion Loss over Temperature[7]



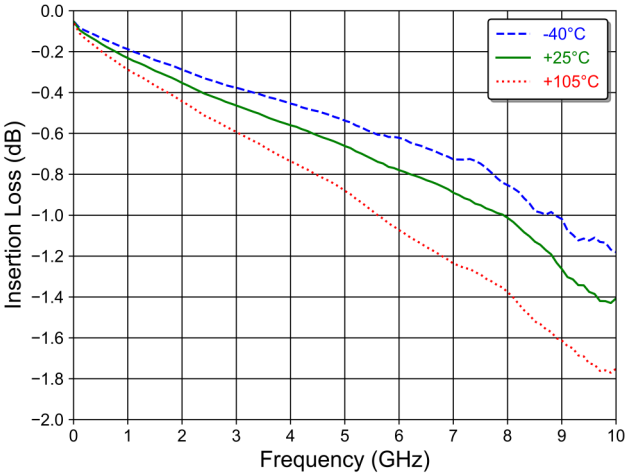
RFC Return Loss



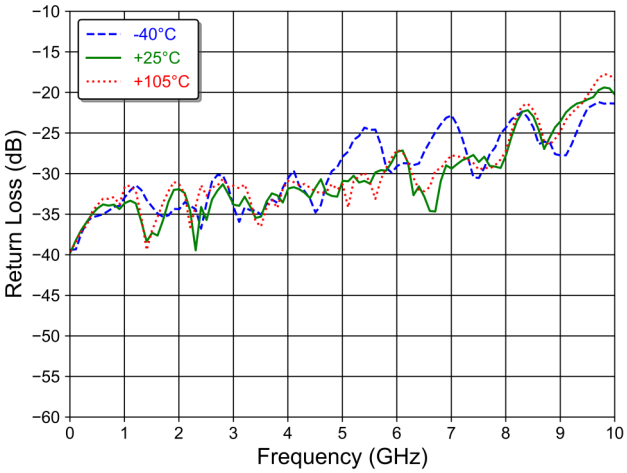
RF1/RF2/RF3/RF4 Return Loss



Evaluation Board Thru Line Insertion Loss



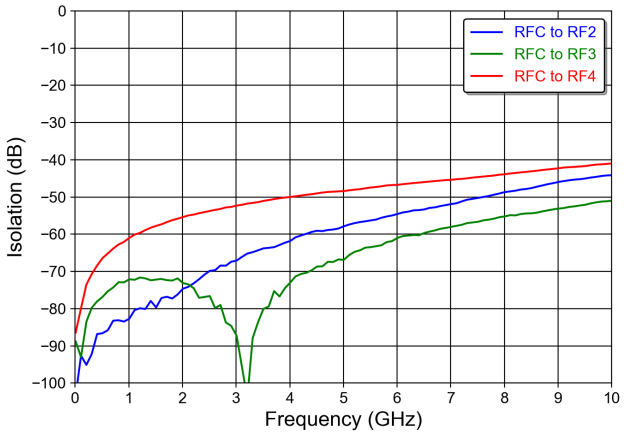
Evaluation Board Thru Line Return Loss



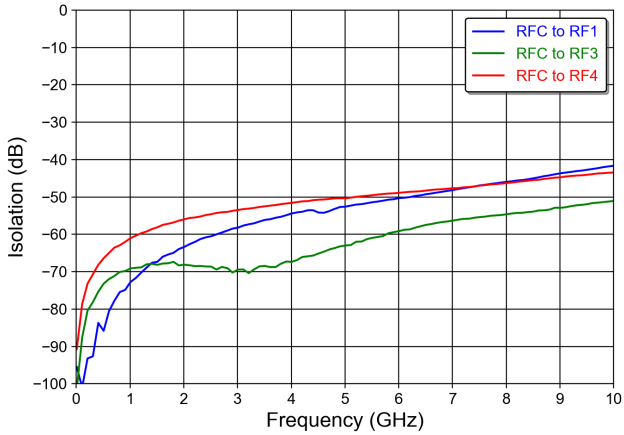
7. Insertion Loss and Isolation were measured using connectorized evaluation board with impedance match on RF transmission lines, and calibrated using the insertion loss of the 50Ω thru line.

Typical Performance Curves: T_C = 25 °C, V_{DD} = 3.3V, V_{SS} = -3.3V, P_{IN} = -5 dBm, Z_o = 50 Ω, unless otherwise specified

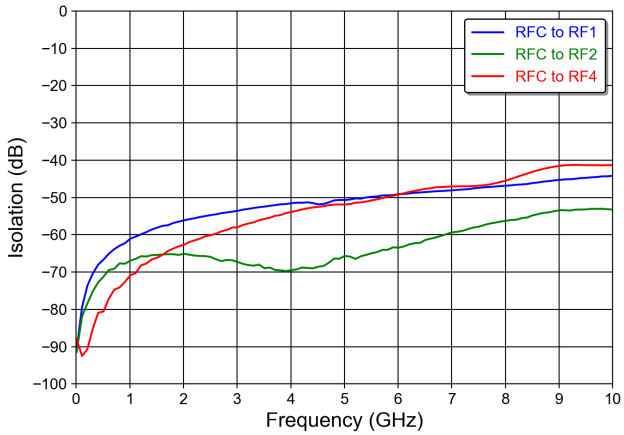
RFC to RF2 / RF3 / RF4 Isolation, RFC to RF1 On[7]



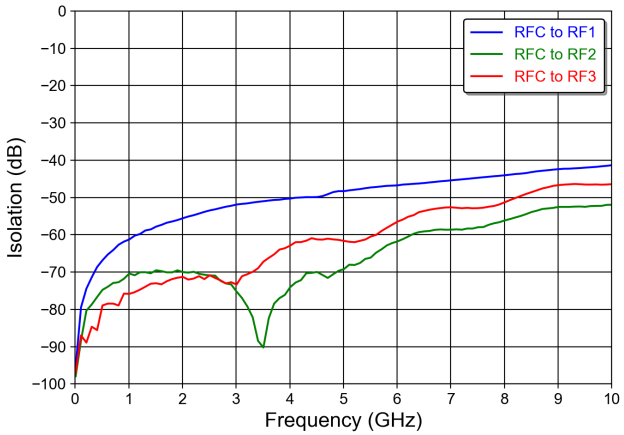
RFC to RF1 / RF3 / RF4 Isolation, RFC to RF2 On[7]



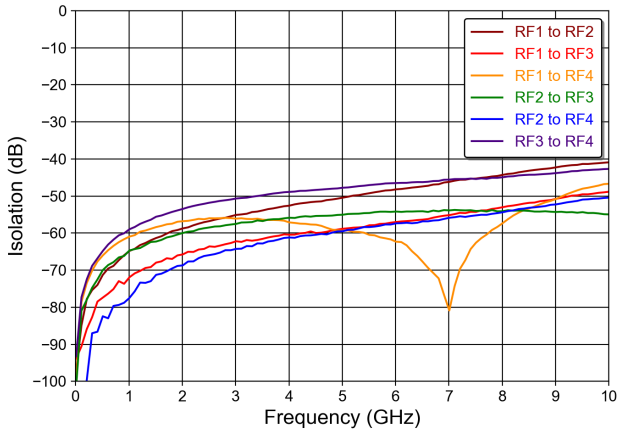
RFC to RF1 / RF2 / RF4 Isolation, RFC to RF3 On[7]



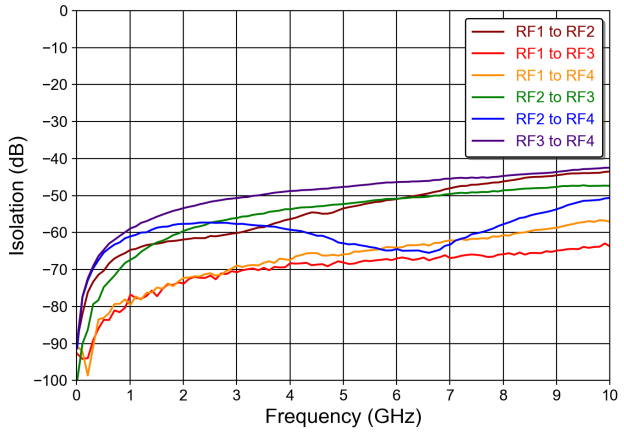
RFC to RF1 / RF2 / RF3 Isolation, RFC to RF4 On[7]



Isolation between RF1 / RF2 / RF3 / RF4, RFC to RF1 On[7]

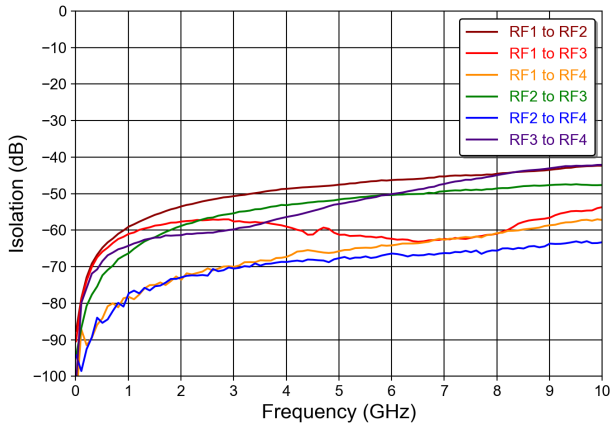


Isolation between RF1 / RF2 / RF3 / RF4, RFC to RF2 On[7]

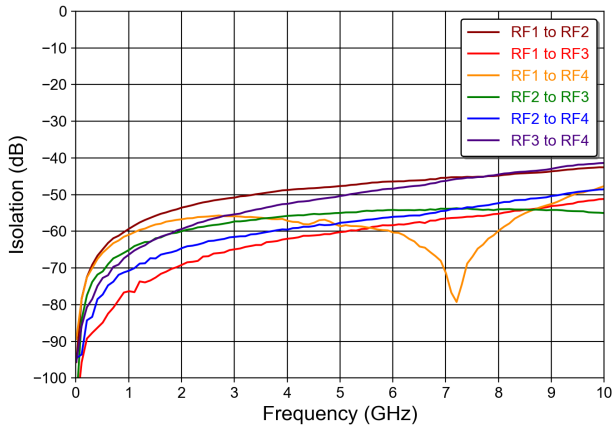


Typical Performance Curves: T_C = 25 °C, V_{DD} = 3.3V, V_{SS} = -3.3V, P_{IN} = -5 dBm, Z_o = 50 Ω, unless otherwise specified

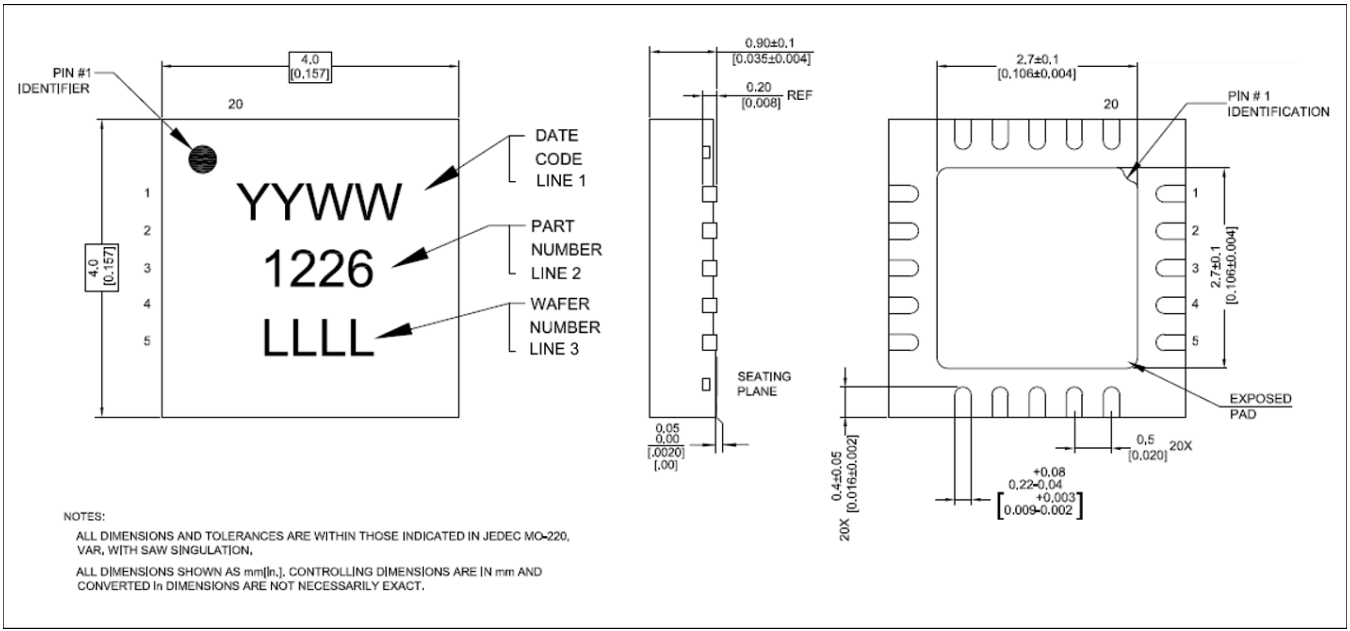
Isolation between RF1 / RF2 / RF3 / RF4, RFC to RF3 On[7]



Isolation between RF1 / RF2 / RF3 / RF4, RFC to RF4 On[7]



Lead-Free 4 mm 20-Lead PQFN†



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements in accordance to JEDEC J-STD-020D.
Plating is NiPdAuAg over Copper

Revision History

Rev.	Date	Change Description
V1	Dec. 2023	Initial Release