SPDT Reflective Switch
10 MHz - 3 GHz

MASW-011242
Rev. V1

Features

- Insertion Loss:
  - 0.16 dB @ 1 GHz
  - 0.23 dB @ 2 GHz
  - 0.30 dB @ 3 GHz
- Isolation: 25 dB up to 2 GHz
- Input P0.1dB: 33.8 @ 1 GHz
- Input IP3: 57 dBm
- Power Supply Voltage: 1.8 V min.
- Quiescent Current: 8 µA
- Single-ended or Differential Control Inputs
- SC-70 (SOT-363) Package
- RoHS* Compliant

Applications

- ISM/MM

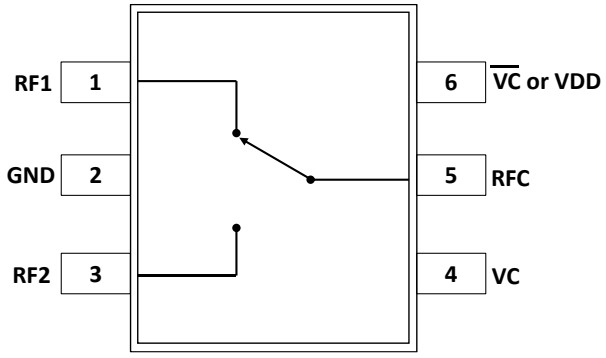
Description

The MASW-011242 is a RF SOI single pole, double throw (SPDT) switch in a low cost, lead-free SC-70 (SOT-363) surface mount plastic package. This Switch is ideally suited for applications where very small size and low cost are required.

Typical applications are dual band systems which require switching between small signal components such as filter banks, single-band LNAs, converters, etc. This part can be used for low power, low loss requirements in all systems operating up to 3 GHz, including PCS, GSM, DCS, Bluetooth, and other receive chain applications.

The MASW-011242 is fabricated using a Silicon-on-Insulator process. The process features full passivation for performance and reliability.

Block Diagram



Pin Configuration[1]

Pin #	Pin Name	Description
1	RF1	RF Input/Output 1
2	GND	Ground
3	RF2	RF Input/Output 2
4	VC	Control
5	RFC	Common RF Input/Output
6	$\overline{VC}$ or VDD[2]	Supply Voltage or Complementary Control Input

1. RF ports are dc-coupled to GND.
2. The functionality of this pin is bias supply VDD in single-ended control mode, and complementary control input to VC in differential control mode.

Ordering Information[3,4]

Part Number	Package
MASW-011242-TR3000	3000 Piece reel
MASW-011242-SMB	Sample Board

3. Reference Application Note M513 for reel size information.
4. All sample boards include 3 loose parts.

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

Electrical Specifications: V_{DD} = +3 V, V_C = 0 V or +3 V, T_B = +25°C, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	1 GHz 2 GHz 3 GHz	dB	—	0.16 0.21 0.30	0.9 1.5 2.0
Isolation, RF1 to RF2	1 GHz 2 GHz 3 GHz	dB	—	36 27 20	—
Isolation, RFC to RF1/RF2	1 GHz 2 GHz 3 GHz	dB	30 20 15	33 25 19	—
RFC Return Loss	1 GHz 2 GHz 3 GHz	dB	—	32 26 24	—
RF1 / RF2 Return Loss	1 GHz 2 GHz 3 GHz	dB	—	29 23 21	—
Input IP3	2.5 GHz 20 dBm per tone, 5 MHz tone spacing	dBm	—	57	—
Input P0.1dB	1.0 GHz, VDD = +2.3 V to +3.3 V 1.0 GHz, VDD = +1.8 V to +2.3 V 2.5 GHz, VDD = +2.3 V to +3.3 V 2.5 GHz, VDD = +1.8 V to +2.3 V	dBm	—	33.8 32.5 33.8 32.5	—
T_{ON} /T_{OFF}	50% control to 10% and 90% RF	µs	—	0.7	—
Video Feedthrough	VC is switched from low to high or high to low in a 50 Ω test set-up, measured with 1 ns risetime pulses and 500 MHz bandwidth	mV_{pp}	—	7	—
Switching Rate	—	kHz	—	—	25
Voltage Supply, VDD	—	V	1.8	3.0	3.3
Logic Voltage, Input Low (V_{IL})	—	V	0.0	—	0.3xVDD
Logic Voltage, Input High (V_{IH})	—	V	0.7xVDD	—	VDD
VDD Quiescent Current	—	µA	—	8	—
Control Leakage Current	—	nA	—	10	—

Truth Table, Single-ended Control Mode

Control Input	Condition of Switch	
VC	RFC - RF1 Path	RFC - RF2 Path
V_{IH}	On	Off
V_{IL}	Off	On

Truth Table, Differential Control Mode

Control Inputs		Condition of Switch	
VC	$\overline{VC}$	RFC - RF1 Path	RFC - RF2 Path
V_{IH}	V_{IL}	On	Off
V_{IL}	V_{IH}	Off	On

Power Supply

For single-ended control mode, bypass capacitors should be placed at the VDD supply pin to minimize noise and fast transients. Supply voltage for initial power on should have a slew rate smaller than 1 V / 20 µs. With the recommended bypassing capacitor circuit, the slew rate should meet this requirement. In addition, the control pin VC should remain at 0 V and no RF power should be applied while the supply voltage ramps.

For differential control mode, some bypass capacitors such as C1 and C4 are still recommended. Supply voltage of the control pin for initial power on should have a slew rate smaller than 1 V / 20 µs while the other control pin should remain at 0 V and no RF power should be applied while the supply voltage ramps.

Handling Procedures

Please observe the following precautions to avoid damage:

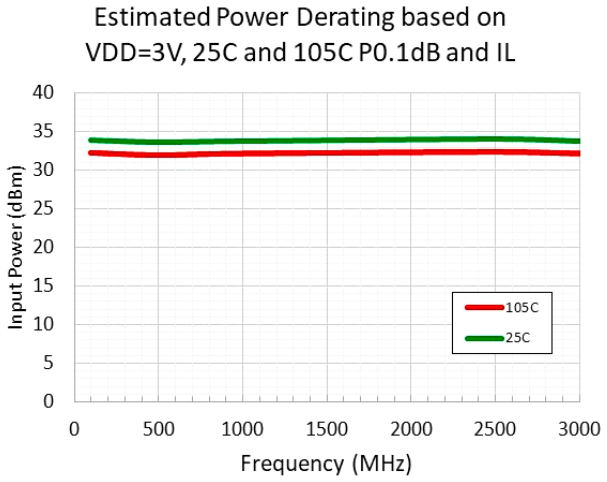
Static Sensitivity

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.

Maximum Operating Ratings

Parameter	Absolute Maximum
RF Input Power	See max. power handling curve
VDD	-0.3 to +3.45 V
VC	-0.3 to VDD
Operating Temperature	-40 to +105°C

Maximum Power Handling

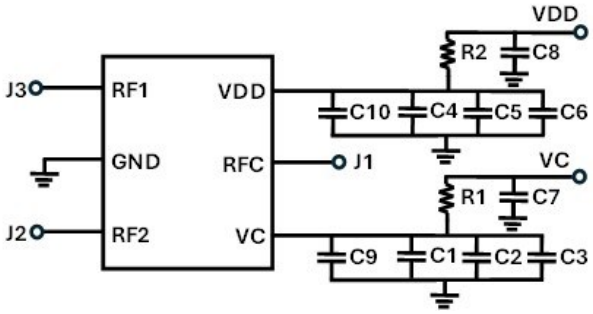


Absolute Maximum Ratings[5,6,7]

Parameter	Absolute Maximum
RF input Power	34.5 dBm
VDD	-0.3 to +3.6 V
VC	-0.3 to +3.45V
Junction Temperature	-55 to +135°C
Storage Temperature	-65 to +150°C

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.
7. Based on testing with input power applied for 30 seconds.

Application Schematic

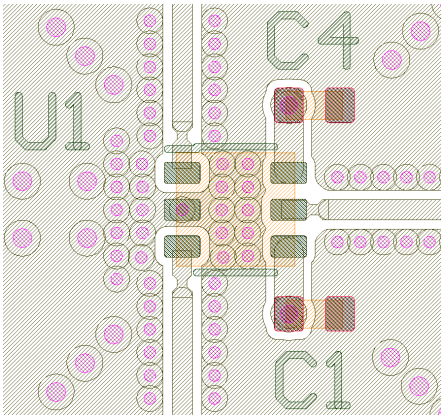


Part	Value	Case Style
C1, C4	Capacitor, 100 pF, 50 V	0402
C2, C3, C6, C7, C9, C10	D0 Not Populate	—
C5	Capacitor, 10 nF, 25 V	0402
C6	Capacitor, 10 µF, 25 V	0603
R1	Resistor, 47 Ω	0402
R2	Resistor, 0 Ω	0402
J1 - J3	Southwest 1492-04A-6	End Launch
J6	DC Connector	—
U1	MASW-011242	SC70 6L

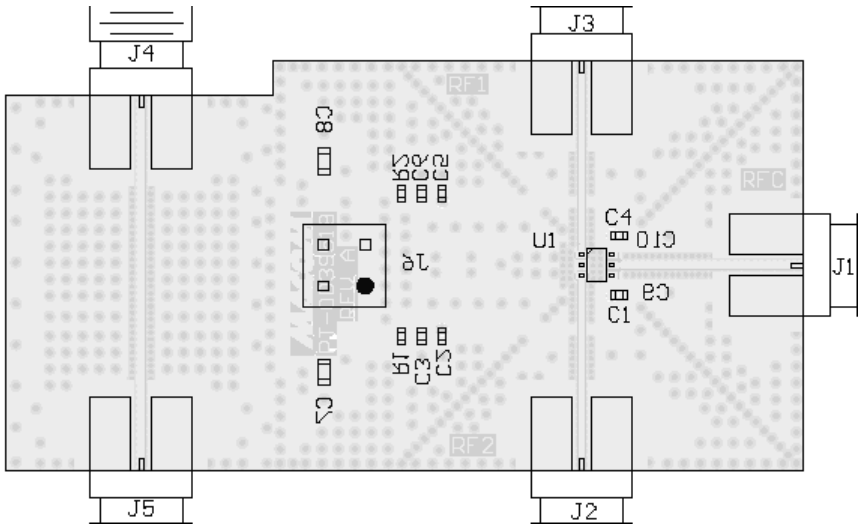
Evaluation Board Material

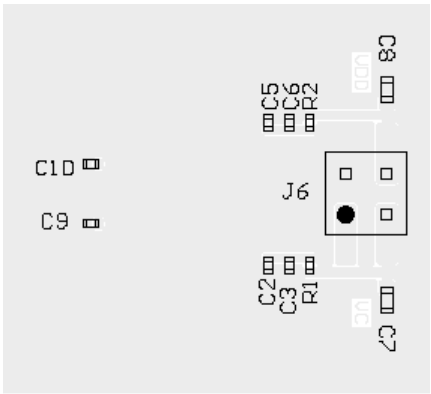
MASW-011242-SMB is a 4-layer printed circuit board (PCB) with 8 mil Rogers RO4003 dielectric material and 1 oz. copper for the top layer. The remaining inter-level dielectric material is FR4 along with 0.5 oz. copper for the inter-level conductor layers. The bottom conductor layer is 1oz copper. The 50 Ω RF transmission lines are CPWG of 14 mil width with 6.5 mil gap.

The package ground pin is internally connected to ground die attach paddle. Solder this ground pin to a PCB pad that uses multiple ground vias as close to the pin as possible to provide heat transfer out of the device into the PCB ground planes. These multiple ground vias are also required to achieve the specified RF performance.



Evaluation Board Layout

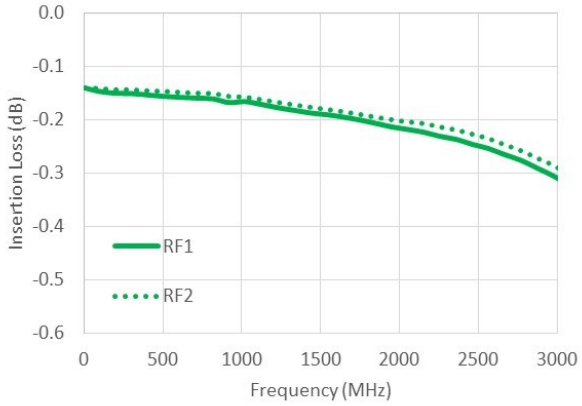




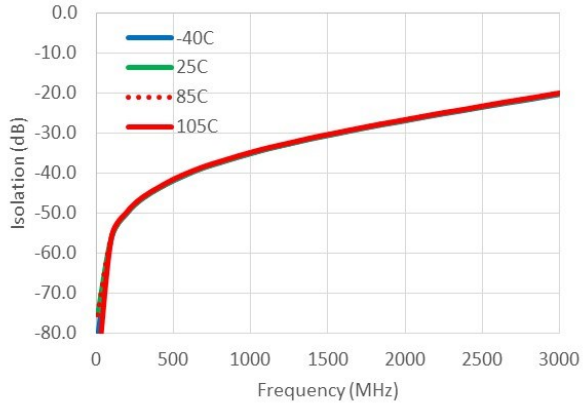
Bottom Side

Typical Performance Curves

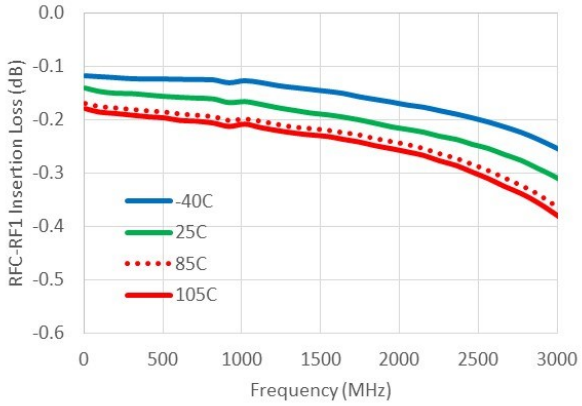
Insertion Loss at 25°C and VDD = 3 V



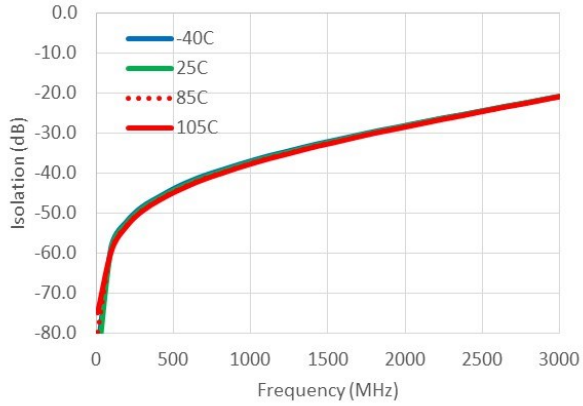
RFC to RF1 / RF2 Isolation over Temperature



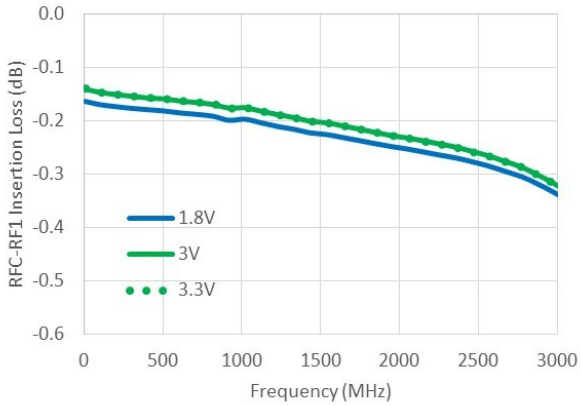
Insertion Loss vs Temperature



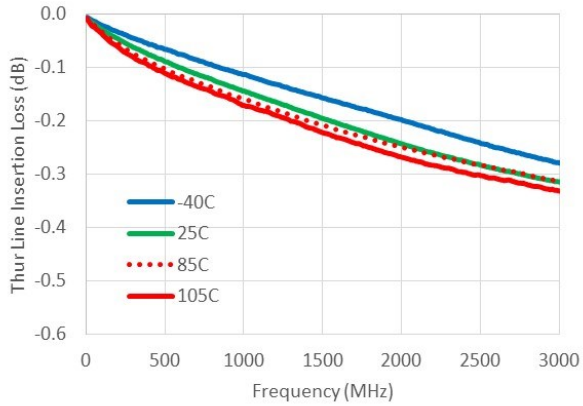
RF1 to RF2 Isolation over Temperature



Insertion Loss vs Supply Voltage

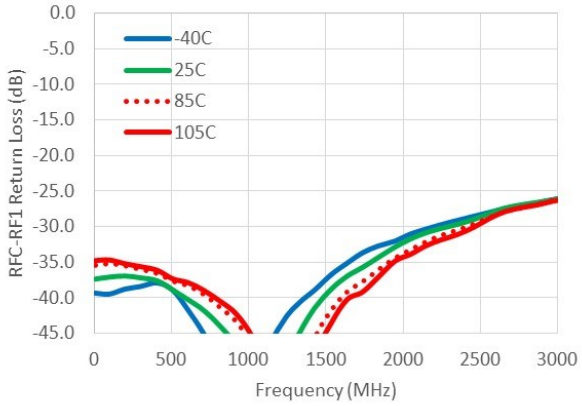


Evaluation Board Thru Line Insertion Loss

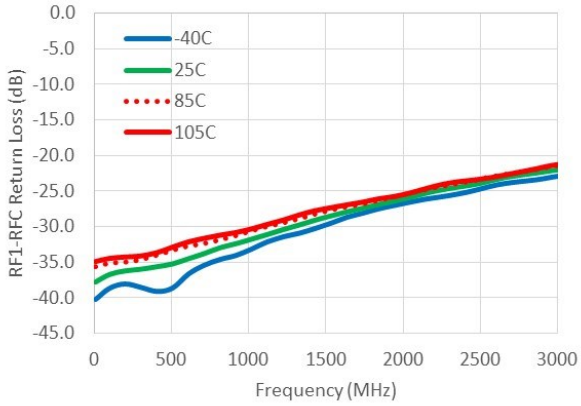


Typical Performance Curves

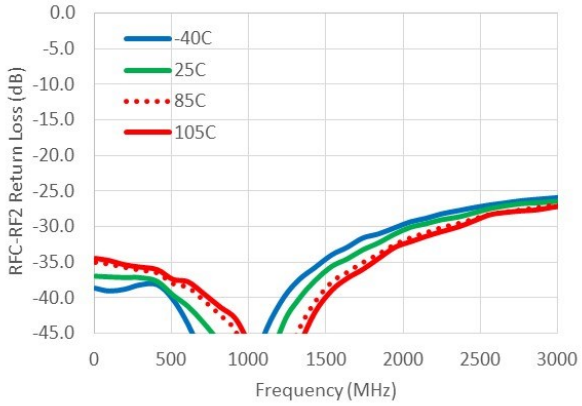
Return Loss at RFC with RF1 ON



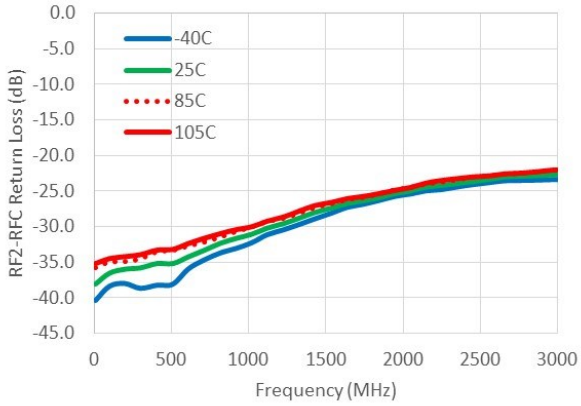
Return Loss at RF1 with RF1 ON



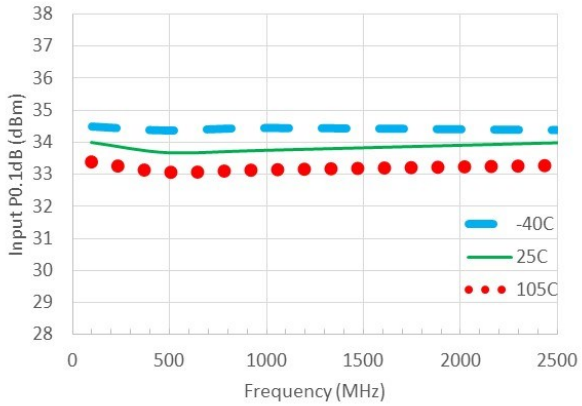
Return Loss at RFC with RF2 ON



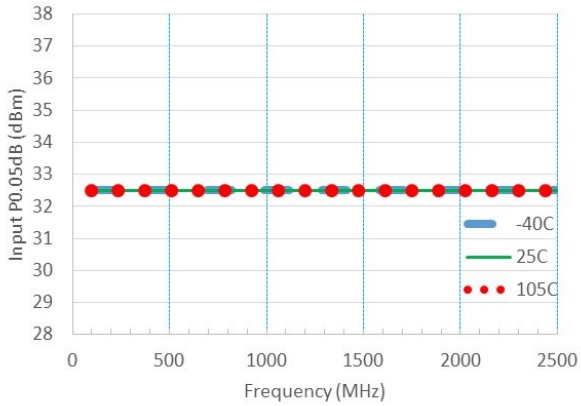
Return Loss at RF2 with RF2 ON



Input P0.1dB VDD = 3 V



Input P0.05dB VDD = 1.8 V



Lead-Free SC-70 (SOT-363), 6 Lead Package