

Fast Switching - MMIC SPDT RF Switch

MSW2-50+

50Ω DC to 5000 MHz

The Big Deal

- Very fast switching, 5ns rise/fall time typ.
- High isolation, 53 dB typ. at 1 GHz
- High IP3, +54 dBm typ. at 1 GHz



CASE STYLE: DQ1225

Product Overview

Mini-Circuits' MSW2-50+ is a reflective GaAs MESFET SPDT MMIC Switch supporting a wide range of switching applications from DC to 5000 MHz. This model provides high isolation and ultra-fast switching 5ns Rise/Fall time. It is produced using GaAs MESFET process and comes in a tiny 3x3mm QFN package rated MSL1.

Key Features

Feature	Advantages
Wideband, DC to 5000 MHz	One model can be used in many applications, saving component count. Also ideal for wideband applications such as military and instrumentation.
High Isolation, 53 dB at 1000 MHz	High isolation significantly reduces leakage of power to the OFF port.
High linearity, +54 dBm IP3 at 1000 MHz	High linearity minimizes unwanted intermodulation products which are difficult or impossible to filter out in multi-carrier environments or in the presence of strong interfering signals from adjacent circuitry or received by an antenna.
Very fast switching, 5ns typ. rise/fall time	Fast switching makes this model suitable for applications where extremely fast transition between ports is required such as automated switching networks.
Small size, 3x3mm QFN package	Tiny footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.



Fast Switching - MMIC SPDT RF Switch

50Ω DC - 5000 MHz

Reflective

Product Features

- High Isolation, 53 dB typ. at 1 GHz
- Low insertion loss, 0.7 dB typ. at 1 GHz
- High IP3, 54 dBm typ. at 1 GHz
- Fast switching, Rise/fall time, 5ns typ.
- Low current consumption, 6μA typ.



MSW2-50+

CASE STYLE: DQ1225

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

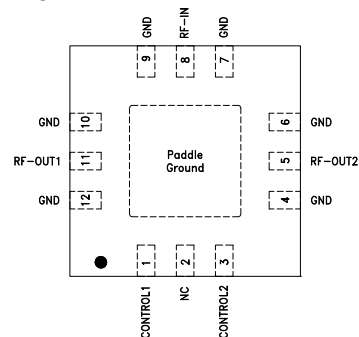
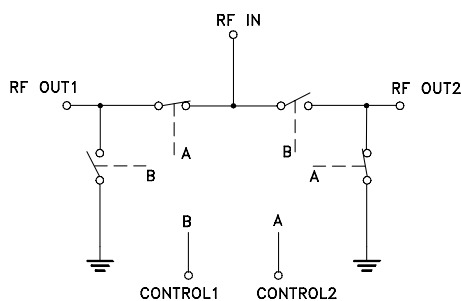
Typical Applications

- Automated switching networks
- Cellular/ PCS infrastructure
- Test instruments
- Military

General Description

Mini-Circuits' MSW2-50+ is a reflective GaAs MESFET SPDT MMIC Switch supporting a wide range of switching applications from DC to 5000 MHz. This model provides high isolation and ultra-fast switching 5ns Rise/Fall time. It is produced using GaAs MESFET process and comes in a tiny 3x3mm QFN package rated MSL1.

Simplified Schematic and Pad Description



Pad Number	Function
8	RF-IN
11	RF-OUT1
5	RF-OUT2
1	Control #1
3	Control #2
2	NO CONNECTION (NC)
4,6,7,9,10,12 & paddle	GROUND (GND)



RF Electrical Specifications¹, DC - 5000 MHz, T_{AMB}=25°C

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units			
Frequency range		DC		5000	MHz			
Insertion loss ²	0.3 - 100	—	0.5	0.8	dB			
	100 - 1000	—	0.6	1.0				
	1000 - 2000	—	0.8	1.3				
	2000 - 4500	—	1.0	1.7				
	4500 - 5000	—	1.5	2.2				
Isolation between Common port and RF1/RF2 Ports	0.3 - 100	60	87	—	dB			
	100 - 1000	43	57	—				
	1000 - 2000	37	47	—				
	2000 - 4500	26	39	—				
	4500 - 5000	23	30	—				
Isolation between RF1 and RF2 ports	0.3 - 100	70	89	—	dB			
	100 - 1000	49	59	—				
	1000 - 2000	40	48	—				
	2000 - 4500	25	36	—				
	4500 - 5000	21	26	—				
Return loss (ON STATE)	0.3 - 100		27		dB			
	100 - 1000		23					
	1000 - 2000		17					
	2000 - 4500		17					
	4500 - 5000		13					
Input Compression 0.1 dB ³	V _{DD} =-5V	10		15	dBm			
		100		21				
		1000		24				
		5000		23				
		10		16				
	V _{DD} =-8V	100		28				
		1000		30				
		5000		29				
		Input IP3	V _{DD} =-5V	10			34	dBm
				100			57	
1000				54				
5000				44				
10				34				
V _{DD} =-8V	100			56				
	1000			58				
	5000			51				

Notes:

1. Tested on Mini-Circuit's test board TB-971+, using Agilent's N5230A network analyzer (see Characterization Test Circuit, Fig.1).
2. Insertion loss values are deembedded from test board loss.
3. Do not exceed RF input power as shown in Absolute Maximum Rating table.

DC Electrical Specifications

Parameter	Min.	Typ.	Max.	Units
Control voltage Low (V _L)	-0.2		0	V
Control voltage High (V _H)	-8		-5	V
Control Current at V _L		9		μA
Control Current at V _H		75		μA

Switching Specifications

Parameter	Min.	Typ.	Max.	Units
Rise/Fall Time (10 to 90% or 90 to 10% RF)		4		nSec
Switching Time, 50% CTRL to 90/10% RF		7		nSec
Video Feedthrough, (control 0 to -5V, freq.=500 KHz)		21		mV _{P-P}



Absolute Maximum Ratings⁶

Parameter	Ratings
Operating temperature	-40°C to + 85°C
Storage temperature	-65°C to +150°C
Control Voltage	-8.5V
RF Input Power	31dBm

6. Operation of this device above any of these conditions may cause permanent damage.

Truth Table (State of control voltage selects the desired switch state)

Control Voltage #1	Control Voltage #2	RF-IN	
		RF-Out 1	RF-Out 2
0	-5/-8	OFF	ON
-5/-8	0	ON	OFF

ON- low insertion loss state OFF- reflective State

Characterization Test Circuit

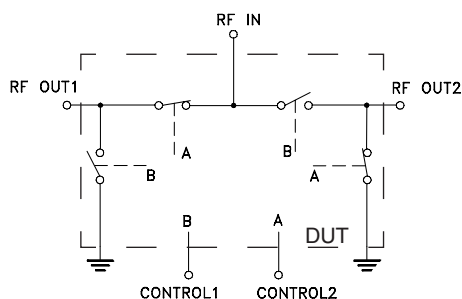


Figure 1. Block Diagram of test Circuit used for characterization (DUT soldered on Mini-Circuit's TB-971+)

Test Equipment:

For Insertion loss, Isolation, Return loss and DC current:

Agilent's N5230A Network Analyzer, E3631A power supply. Cblock: Internal to network Analyzer.

For Switching Time and DC Current:

Agilent's 54832B oscilloscope, 81110A pulse generator and E3631 A power supply. Cblock: Mini-Circuits BLK-18-S+

For Input IP3:

Mini-Circuits DC blocks: BLK-18-S+ on all ports, Agilent's E8257D signal generators, 437B power meter, N9020A Signal analyzer and E3631 A power supply.

For Compression:

Mini-Circuits DC blocks: BLK-18-S+ on all ports. ZVE-8G and ZHL-42W amplifier as driver amplifier at RF Common. Agilent's N5230A Network Analyzer, E3631A power supply

Conditions:

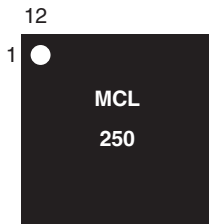
Control Voltage = 0 and -5V/-8V

For Insertion loss, isolation and return loss: Pin=0 dBm

For Input IP3: Pin=-5dBm/tone.

For Switching time: RF frequency: 500 MHz at 0 dBm, Control Frequency: 500 KHz and 0 and -5V/-8V.

Product Marking



Marking may contain other features or characters for internal lot control

Recommended Application Circuit

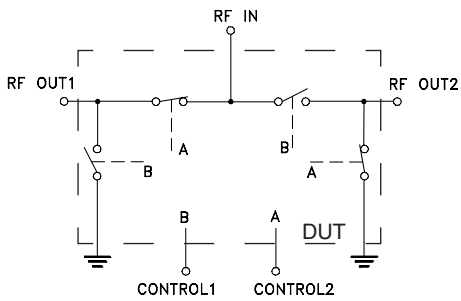


Fig. 2: Evaluation board includes case, connectors and components soldered to PCB.

Additional Detailed Technical Information	
<i>additional information is available on our dash board. To access this information click here</i>	
Performance Data	Data Table
	Swept Graphs
Case Style	DQ1225 <i>Plastic package; Lead finish: Matte tin</i>
Tape & Reel	F66
Standard quantities available on reel	<i>7" reels with 20, 50, 100, 200, 500, 1K, 2K devices</i>
Suggested Layout for PCB Design	PL-545
Evaluation Board	TB-971+
Environmental Ratings	ENV12

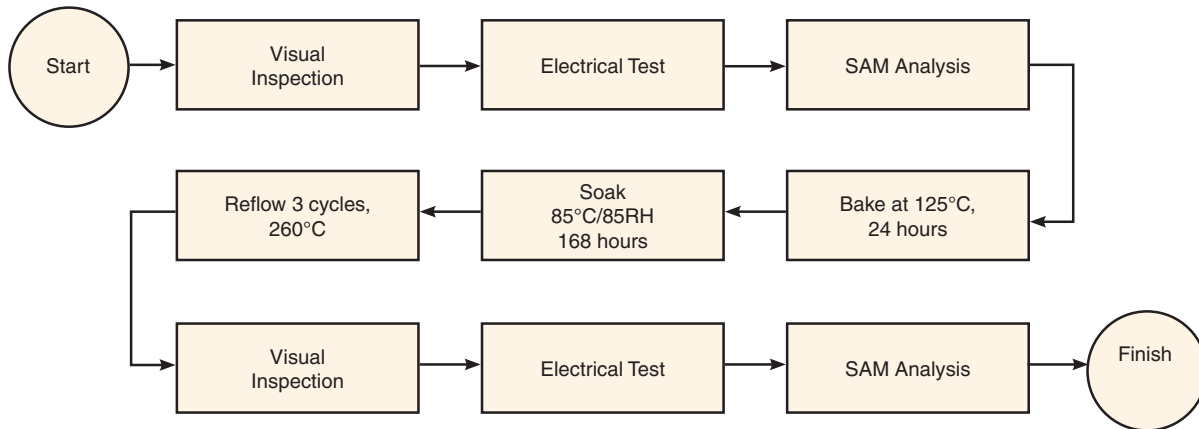
ESD Rating

Human Body Model (HBM): Class 1A (250V to <500V) in accordance with ANSI/ESD STM 5.1-2001

MSL Rating

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

MSL Test Flow Chart



Additional Notes

- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp