

Fast Switching

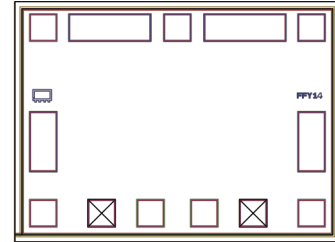
SPDT RF Switch Die

M3SW-250DRA-D+

50Ω, DC to 4500 MHz, Reflective Switch with internal driver

The Big Deal

- High Isolation, 48 dB typ.
- High Input IP3, +47.3 dBm typ
- Low insertion loss, 0.6 dB typ
- Fast Rise/Fall time, 3.3 ns / 4.6 ns typ.



Product Overview

Mini-Circuits' M3SW-250DRA-D+ is a MMIC SPDT reflective switch die with an internal driver designed for wideband operation from DC to 4.5 GHz supporting many applications requiring fast switching across a wide frequency range. This model provides excellent isolation, fast switching speed and high linearity.

Key Features

Feature	Advantages
Wideband, DC to 4.5 GHz	One model can be used in many applications, saving component count. Also ideal for wideband applications such as military and instrumentation.
High Isolation: <ul style="list-style-type: none">• 52 dB at 1000 MHz• 36 dB at 4500 MHz	High isolation significantly reduces leakage of power into OFF ports.
High linearity: Input power at P1dB, 25 dBm typ. Input IP3, +47.3 dBm typ.	High linearity minimizes unwanted intermodulation products which are difficult or impossible to filter in multi-carrier environments such as CATV, or in the presence of strong interfering signal from adjacent circuitry or received by antenna.
Unpackaged die	Enables user to integrate it directly into hybrids.



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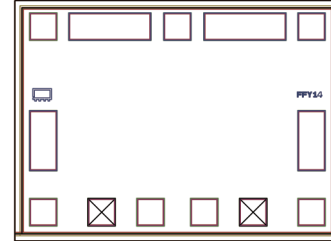
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Typical Applications

- Defense
- Communication Infrastructure
- Test and Measurements



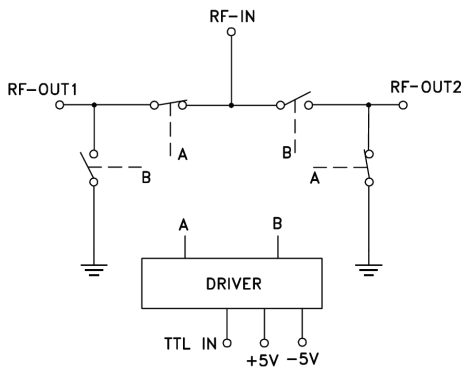
+RoHS Compliant
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Ordering Information: Refer to Last Page

General Description

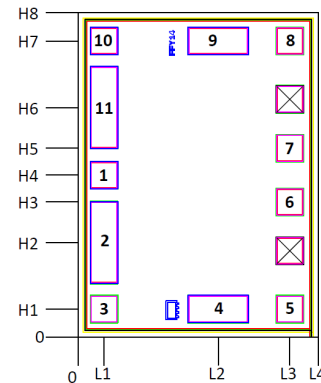
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Simplified Schematic and Pad description



Pad#	Function
1	RF-IN
3	V _{EE}
4	RF OUT 1
6	TTL
7	TTL GROUND
9	RF OUT 2
10	V _{DD}
2,5,8,11	GROUND

Bonding Pad Position



Dimensions in μm, Typical

L1	L2	L3	L4	H1	H2	H3	H4	H5	H6	H7	H8
76	408	617	700	83	278	397	475	554	673	867	950

Thickness	Die size	Pad Size 1,3,5,6,7,8 & 10	Pad size 2&11	Pad size 4&9
100	700 x 950	74 x 74	74 x 234	169x74



RF Electrical Specifications¹, T_{AMB}=25°C, 50Ω, V_{DD}= +5V, V_{EE}= -5V

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range ³		DC		4500	MHz
Insertion Loss	10-100		0.5		dB
	100-1000		0.5		
	1000-2000		0.6		
	2000-4000		0.7		
	4000-4500		1.4		
Isolation between Output Port 1 & 2	10-100		78		dB
	100-1000		59		
	1000-2000		48		
	2000-4000		40		
	4000-4500		34		
Isolation between Common Port & Output Ports	10-100		79		dB
	100-1000		59		
	1000-2000		48		
	2000-4000		39		
	4000-4500		35		
Input Return Loss	10-100		30		dB
	100-1000		30		
	1000-2000		25		
	2000-4000		21		
	4000-4500		21		
Output Return Loss (ON STATE)	10-100		29		dB
	100-1000		27		
	1000-2000		21		
	2000-4000		18		
	4000-4500		13		
Output Return Loss (OFF STATE)	10-100		3		dB
	100-1000		3		
	1000-2000		3		
	2000-4000		3		
	4000-4500		3		
Input Power at P1dB ²	10-100		18.8		dBm
	100-1000		24.1		
	1000-2000		25		
	2000-4000		24.8		
	4000-4500		23.6		
Input IP3 (Pout =0dBm/Tone)	10-100		38.5		dBm
	100-1000		45.3		
	1000-2000		47.3		
	2000-4000		44.9		
	4000-4500		40.2		
Thermal Resistance (Junction-to-ground Lead at 85°C stage temperature)			34.2		degC/W

DC Electrical Specifications

Parameter	Min.	Typ.	Max.	Units
Positive Supply Voltage, V _{DD}	4.75	5	5.25	V
Negative Supply voltage, V _{EE}	-5.25	-5	-4.75	V
Positive Supply Current, I _{DD}	—	5	9	mA
Negative Supply Current, I _{EE}	-9	-3	—	mA
Control Voltage Low	—	0	0.8	V
Control Voltage High	2.1	2.3	5	V
Control Current Low	—	0	0.2	mA
Control Current High	—	0.4	5	mA

Notes:

- Die is packaged in 3.25 x 3.25mm, 8-lead MCLP package and soldered on TB-M3SW-250DRA+.
- Input Power at P1dB compression drops to 13 dBm at 10 MHz.
- All RF-ports must be DC blocked or held at 0V DC.

Switching Specifications

Parameter	Condition	Min.	Typ.	Max.	Units	
ON Time, 50% control to 90% RF	RF Pin= 0 dBm RF Freq.= 500 MHz Control Freq.= 500 KHz Control High= 2.3V Control Low= 0V		14.4		ns	
OFF Time, 50% control to 10% RF			11.3		ns	
Video Leakage				42.5		mV
Rise Time, 10% RF to 90% RF 10 to 90% or 90 to 10%				3.3		ns
Fall Time, 90% RF to 10% RF				4.6		ns



Absolute Maximum Ratings⁴

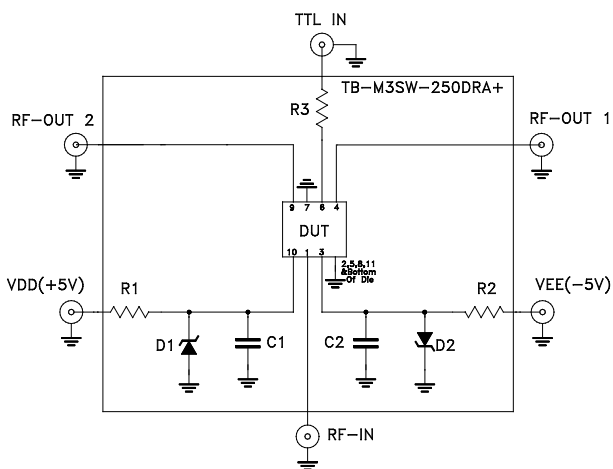
Parameter	Ratings
Operating temperature	-55°C to +100°C
Storage temperature	-55°C to +100°C
RF Input power	+24 dBm
Junction Temperature	134°C
Total Power Dissipation	0.4W
DC Voltage, Pad 10	+6V
DC Voltage, Pad 3	-6V

4. Permanent damage may occur if any of these limits are exceeded. Electrical Maximum ratings are not intended for continuous normal operation.

Truth Table

State of Control Voltage	RF-IN to RF-OUT1	RF-IN to RF-OUT 2
LOW	ON	OFF
HIGH	OFF </td <td>ON</td>	ON

Characterization & Application Circuit



Component	Size	Value	P/N	Manufacturer
DUT	3.25x3.25	N/A	M3SW-2-50DRA+	MCL
D1, D2	SOD-123	Vz = 5.6V	MMSZ4690T1G	ON Semiconductor
R1, R2	0603	11.5Ω	RK73H1JTTD11R5F	KOA
R3	0603	100Ω	RK73H1JTTD1000F	KOA
C1, C2	0603	10pF	06031A100GAT2A	AVX

Note: D1&D2 are optional.

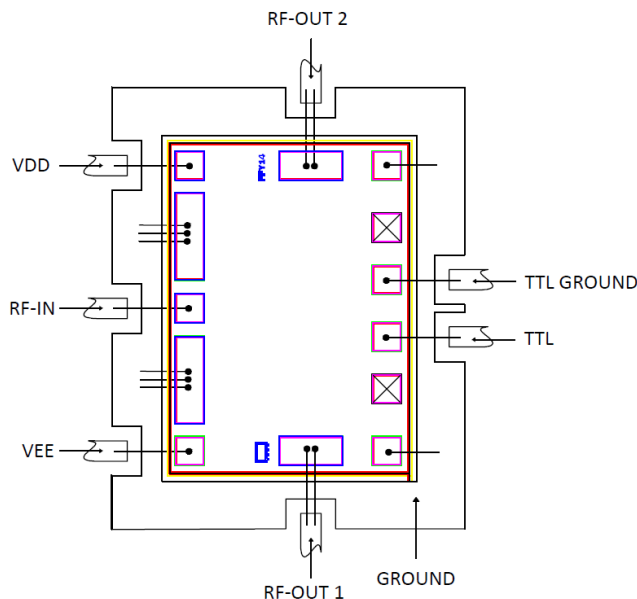
Figure 1. Characterization & Application Circuit

Note: (DUT is packaged in 3.25x3.25mm, 8-lead MCLP package and soldered on Mini-Circuits Characterization & Application Test Board TB-M3SW-250DRA+). Insertion Loss, Amplitude Unbalance, Isolation, Return Loss, Input Power at 1dB Compression (P1dB) & Input IP3 tested using E5071C microwave network analyzer.

Condition:

1. Insertion Loss, Amplitude Unbalance, Isolation & Return Loss: Pin = 0dBm
2. Input IP3(IIP3): Two tones, spaced 1 MHz apart, 0dBm/tone output.

Assembly Diagram



Assembly and Handling Procedure

1. Storage

Dice should be stored in a dry nitrogen purged desiccators or equivalent.

2. ESD

MMIC SPDT Reflective Switch dice are susceptible to electrostatic and mechanical damage. Dice are supplied in antistatic protected material, which should be opened in clean room conditions at an appropriately grounded anti-static workstation. Devices need careful handling using correctly designed collets, vacuum pickup tips or sharp antistatic tweezers to deter ESD damage to dice.

3. Die Attach

The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are DieMat DM6030HK-PT/H579 or Ablestik 84-1LMISR4. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total die periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. It is recommended to use antistatic die pick up tools only.

4. Wire Bonding

Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermosonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1 mil diameter. Bonds must be made from the bond pads on the die to the package or substrate. All bond wires should be kept as short as low as reasonable to minimize performance degradation due to undesirable series inductance.

Additional Detailed Technical Information*additional information is available on our dash board.*

Performance Data	Data Table	
	Swept Graphs	
	S-Parameter (S2P Files) Data Set with and without port extension(.zip file)	
Case Style	Die	
Die Ordering and packaging information	Quantity, Package Small, Gel - Pak: 5,10,50,100 KGD* Medium†, Partial wafer: KGD*<1880 Large†, Full Wafer	Model No. M3SW-250DRA-DG+ M3SW-250DRA-DP+ M3SW-250DRA-DF+
	†Available upon request contact sales representative Refer to AN-60-067	
Environmental Ratings	ENV80	

*Known Good Dice ("KGD") means that the dice in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such dice fall within a predefined range. While DC testing is not definitive, it does help to provide a higher degree of confidence that dice are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

ESD Rating**

Human Body Model (HBM): Class 0 (Pass 100V) in accordance with ANSI/ESD STM 5.1 - 2001

** Tested in industry standard MCLP 3.25x3.25 mm, 8-lead package.

Additional Notes

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