SP4T RF Switch

JSW4-23DR-75+

75 Ω High Power 3W 5 to 2000 MHz

The Big Deal

- High Port count in super small size
- High Power P0.1dB, 3W
- Low Insertion Loss, 0.7 dB at 1 GHz



Product Overview

JSW4-23DR-75+ is a high power reflective SP4T RF switch, with reflective short on output ports in the off condition. Made using Silicon-on-Insulator process, it has very high IP3, a built-in CMOS driver and negative voltage generator. Its tiny 2x2mm, 14-lead case enables wideband performance in tight spaces and dense PCB layouts.

Feature	Advantages			
Wideband operation 5-2000 MHz	Enables a single component to be used in a vast array of applications from VHF up to 2.0 GHz.			
High IIP3: 55 dBm typ.	Results in little or negligible inter-modulation generation, meeting requirements for digital communication signals.			
Low Loss, 0.7 dB at 1 GHz High input power, 3W	Low loss and high power capability enable a single switch to be used for a variety of applications, saving inventory.			
Built in negative voltage generator	Operates with a single positive supply voltage; no need for DC blocking capacitors, un- less external DC is present at the RF ports.			
Built-in CMOS driver	No need for external driver, saving PCB space and cost.			
Tiny MCLP package 2 x 2mm, 14-lead	Provides low inductance, repeatable transitions, and excellent thermal contact to PCB.			

Key Features

SP4T RF Switch

Reflective RF Switch with internal driver. Single Supply Voltage, +2.5V to +4.8V, High Power 3W

Product Features

- High Isolation, 38 dB typ. at 1 GHz
- Low insertion loss, 0.7 dB typ. at 1 GHz
- High IP3, 59 dBm typ. at 1 GHz
- Low current consumption, 40 µA typ.
- High Power, P0.1dB 3W

Typical Applications

- CATV systems
- SATCOM system
- Automated Test Stations
- Telecom systems

General Description

JSW4-23DR-75+ CASE STYLE: MT1817

75Ω 5-2000 MHz

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

JSW4-23DR-75+ is a high power 3W reflective SP4T switch with integral driver, operates with single positive supply voltage while consuming, 40 μ A typical. It has been designed for very wideband operation of 5-2000 MHz. It is packaged in a tiny 14-lead 2mm x 2mm x 0.55mm package and is rated MSL1 and class 1B ESD.

Simplified Schematic and Pad Description



Function	Pad Number	Description	Function	Pad Number	Description
RF COM	13	RF Common/ SUM Port	Control #1	7	Control IN #1
RF1	3	RF Out #1/In Port #1	Control #2	6	Control IN #2
RF2	9	RF Out #2/In Port #2	Control #3	5	Control IN #3
Ground	2	Ground Externally	VDD	4	Supply Voltage
Ground	10	Ground Externally	Ground	Paddle	Ground Externally
RF3	1	RF Out #5/In Port #5	Not Used	8,12,14	No Connection
RF4	11	RF Out #6/In Port #6			

SP4T RF Switch

JSW4-23DR-75+

Parameter	Condition (MHz)	Min.	Тур.	Max.	Units
Frequency Range		5		2000	MHz
	5 to 1000	_	0.7	0.9	
Insertion Loss ⁽²⁾ (ON STATE)	1000 to 1500	_	0.8	1.0	dB
	1500 to 2000	—	1.1	1.3	
	5 to 1000	35	38	_	
Isolation between Common Port and RF1 to RF4 Ports ⁽³⁾	1000 to 1500	29	32	_	dB
	1500 to 2000	22	25	_	
	5 to 1000	_	15	_	
Return Loss (ON STATE) RF-COM, RF1 to RF4 Ports	1000 to 1500	_	14	_	dB
	1500 to 2000	_	10	_	
Input IP3 V _{DD} =2.5 to	4.8V 5 to 500	_	55	_	dDm
VDD	=3.0V 1000 to 2000	_	59	_	UDIII
0.1dB Input Compression ⁽⁴⁾	5 to 2000	_	35	_	dBm

RF Electrical Specifications⁽¹⁾, 5 - 2000 MHz, T_{AMB} =25°C, V_{DD} = +2.5 to 4.8V

DC Electrical Specifications

Parameter	Min.	Тур.	Max.	Units
VDD, Supply Voltage	2.5	3.0	4.8	V
Supply Current ($V_{DD} = 3V$)		40		μΑ
Control Voltage Low	0		0.4	V
Control Voltage High ⁽⁵⁾	1.35	1.8	2.7	V
Control Current		0.5	1.0	μA
Shutdown Current at V _{DD} = 3V		5		μA

Notes:

As measured in Mini-Circuit's test board TB-722-4-F+ (see Characterization Test Circuit, Fig.1).
 Insertion loss values are de-embedded from test board loss.

3. Isolations for other port combinations, see Tables 1 & 2 4. Do not exceed RF input power as shown in Absolute Maximum Rating table. 5. If V_{DD} <2.7V, then Max Control Voltage high= V_{DD}

Switching Specifications

Parameter	Min.	Тур.	Max.	Units
Rise/Fall Time (10 to 90% or 90 to 10% RF)	_	0.42 (Rise Time) 0.84 (Fall Time)	_	µSec
Switching Time, 50% CTRL to 90/10% RF (ON/OFF)	_	1.9 (ON Time) 1.4 (OFF Time)	_	µSec
Video Feedthrough, (control 0 to 1.8V, freq.=10 KHz, V_{DD} =3V)	—	4.0	—	mV _{P-P}

	Frequency		Isolation Typ. (dB)			
	(GHz)	"ON" Port				
RF Com to Port		RF1	RF2	RF3	RF4	
RF1	0.01-1.0		49	47	48	
RF1	1.0-1.5		45	42	44	
RF1	1.5-2.0		42	39	41	
RF2	0.01-1.0	49		48	47	
RF2	1.0-1.5	45		43	41	
RF2	1.5-2.0	42		40	38	
RF3	0.01-1.0	41	41		42	
RF3	1.0-1.5	35	37		38	
RF3	1.5-2.0	33	35		35	
RF4	0.01-1.0	41	41	42		
RF4	1.0-1.5	37	36	38		
RF4	1.5-2.0	35	33	35		

Table 1. Isolation Matrix (RF-COM to RF1 to RF4 Ports)

Table 2. Isolation Matrix (Between Output Ports)

	Frequency (GHz)	Isolation Typ. (dB) "ON" Port & to Port			
		RF1	RF2	RF3	RF4
From Port					
RF1	0.01-1.0		52	32	52
RF1	1.0-1.5		48	28	48
RF1	1.5-2.0		44	27	44
RF2	0.01-1.0	51		52	34
RF2	1.0-1.5	47		47	31
RF2	1.5-2.0	43		44	26
RF3	0.01-1.0	40	49		53
RF3	1.0-1.5	36	45		46
RF3	1.5-2.0	34	44		43
RF4	0.01-1.0	50	42	53	
RF4	1.0-1.5	45	38	47	
RF4	1.5-2.0	44	34	43	

Absolute Maximum Ratings⁽⁶⁾

Parameter	Ratings
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to 150°C
V _{DD} , Supply Voltage	5.0V
Voltage Control	-0.5V Min. 3.0 Max.
RF input power ⁽⁷⁾	5 Watt

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

7. Derate linearly to 2.5W at 85°C.

Truth Table⁽⁸⁾ (State of control voltage selects the desired switch state)

State of Control Voltages			RF Common to				
	Control #1	Control #2	Control #3	RF1	RF2	RF3	RF4
	L	L	L	ON	—	—	—
	L	L	Н	—	ON	—	—
	Н	L	L	—	—	ON	—
	Н	L	Н	—	—	—	ON
	н	н	н		Shut	down	

8. Any control state not defined above, places the switch in an undefined state, but will not damage the switch.

UNMP-5075-33+(6 PL) - 75Ω 50Ω RF1 \mathbf{h} DUT 75Ω 50Ω \odot RF2 0 UNMP-5075-33+ 0 - 75Ω 50Ω \odot RF3 RF COM 🔶 50Ω 75Ω 0 _______ 50Ω 🗩 RF4 Bias Circuit Decoder 1k0 Control#1 0-/// Vbb 0~~~~~~ ă≷ă Control#2 0-Control#3 O-

Characterization Test Circuit

Figure 1: Block Diagram Of Test Circuit Used For Characterization. (DUT soldered on Mini-Circuits' TB-722-4-F+)

Test Equipment:

 For Insertion loss, Isolation, Return loss:
 Agilent's N5230A Network Analyzer , E3631A power supply. Mini-Circuits matching pads UNMP-5075-33+

 For Switching Time and Video Feed through
 Agilent's HP81110A pulse generator, 54833A Oscilloscope, E3631A power supply.

 Agilent's N9020A Spectrum Analyzer , E8257D Generator, E3631A power supply
 For Compression:

 R&S Network Analyzer ZVA24, E3631A power supply.
 R&S Network Analyzer ZVA24, E3631A power supply.

 Conditions:
 V_{DD} = +2.5, +3.0 and +4.8V, Control= 0 and 1.35V.

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

For Input IP3: Pin=+10dBm/tone at VDD=3V

For Switching time: RF frequency: DC at 200mV, Control Frequency: 10 KHz and 0 and +8V.



Product Marking



Recommended Application Circuit



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

Additional Detailed Technical Information additional information is available on our dash board. To access this information <u>click here</u>			
Performance Data	Data Table		
	Swept Graphs		
Case Style	MT1817 Plastic package; Lead finish: Matte Tin		
ape & Reel F108			
Standard quantities available on reel	7" reels with 20, 50, 100, 200, 500, 1K or 3K devices		
Suggested Layout for PCB Design	ign PL-459		
Evaluation Board	TB-722-4-F+		
Environmental Ratings	ENV75		

ESD Rating

Human Body Model (HBM): Class 1B (500 to < 1000V) in accordance with JESD22-A114

Machine Model (MM): Class A (Pass 100V) in accordance with JESD22-A115

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.
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