

# High Power SPDT RF Switch

## HSW2-272VHDR+

RF Switch with internal driver  
Single Supply Voltage, +2.3V to +5.5V

### The Big Deal

- High power handling, 32W @ 850 MHz - Pulsed
- High IIP3, +81 dBm
- Immune to latch-up



CASE STYLE: JY2179

### Product Overview

Mini-Circuits' HSW2-272VHDR+ is a MMIC SPDT reflective switch with an internal driver designed for wideband operation from 30 to 2700 MHz with high RF input power handling. This model provides high linearity, low insertion loss, fast switching speed and low current consumption in a tiny 5x5mm 32-lead MCLP package. Produced using a unique CMOS process on silicon, it offers the performance of GaAs with the advantages of conventional CMOS devices. HSW2-272VHDR+ provides a high level of ESD protection and excellent repeatability. The switch operates on a single positive supply voltage with very low current consumption of 120 $\mu$ A (typical).

### Key Features

Feature	Advantages
Wideband, 30 to 2700 MHz	One model can be used in many applications, saving component count. Also ideal for wideband applications such as military and instrumentation.
High power: <ul style="list-style-type: none"><li>• 32W @ 850 MHz Pulsed</li><li>• 20W @ 850 MHz CW</li></ul>	Suitable for signal routing applications with high power requirement such as antenna feeds in transmit systems and more.
Low insertion loss: <ul style="list-style-type: none"><li>• 0.25 dB @ 850 MHz</li><li>• 0.4 dB @ 2000 MHz</li></ul>	Provides excellent transmission of signal power from input to output and minimizes overall system loss.
High isolation: <ul style="list-style-type: none"><li>• 34 dB at 1000 MHz</li><li>• 27 dB at 2700 MHz</li></ul>	High isolation significantly reduces leakage of power into OFF ports.
High linearity, +85 dBm IIP3	High linearity minimizes unwanted inter-modulation products which are difficult or impossible to filter in multi-carrier environments, or in the presence of strong interfering signal from adjacent circuitry or received by antenna.
Small size, 5 x 5mm QFN package	Small footprint for a high power switch saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.



# High Power SPDT RF Switch

50Ω 30 - 2700 MHz

RF Switch with internal driver  
Single Supply Voltage, +2.3V to +5.5V

## Product Features

- High Power  
45 dBm (32W) at 850 MHz, 44 dBm (25W) at 2 GHz - Pulsed
- High IIP3  
85 dBm at 850 MHz, 81 dBm at 2.7 GHz
- Low Insertion Loss  
0.25 dB at 850 MHz, 0.4 dB at 2 GHz
- Low current consumption, 120 μA typ.
- Immune to latch up

## Typical Applications

- Defense
- Communication Infrastructure
- Test and Measurements

## General Description

HSW2-272VHDR+ is a high power reflective SPDT switch with integral CMOS driver, operates with single positive supply voltage while consuming, 120 μA typical. It has been designed for wideband operation. It is packaged in a tiny 5mm x 5mm, 32-lead package and is rated MSL3 and passes 1.5KV for ESD (HBM).



Generic photo used for illustration purposes only

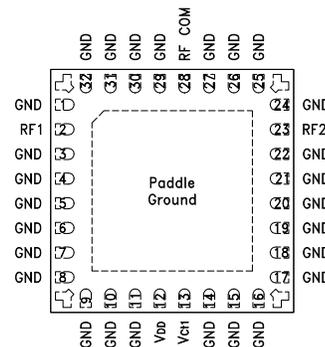
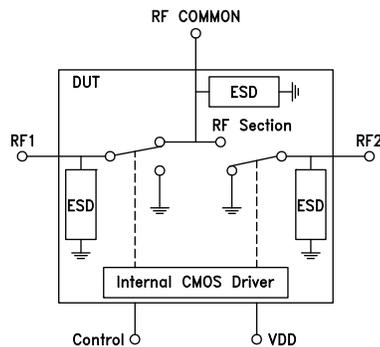
## HSW2-272VHDR+

CASE STYLE: JY2179

### +RoHS Compliant

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

## Simplified Schematic and Pad Description



Function	Pad Number	Description
RF COM	28	RF common/ SUM port*
RF1	2	RF out #1/In port #1*
RF2	23	RF out #1/In port #2*
Control	13	CMOS Control IN
VDD	12	Supply voltage
GND	1,3-11,14-22, 24-27, 29-32, paddle	RF ground

\*Must be held at 0V DC. If required add DC blocking capacitors on these ports.

RF Electrical Specifications<sup>1</sup>, T<sub>AMB</sub>=25°C, 50Ω, V<sub>DD</sub>= +3.3V

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency range		30		2700	MHz
Insertion loss <sup>2,4</sup>	30 - 1000	—	0.3	0.45	dB
	1000 - 2000	—	0.4	0.60	
	2000 - 2700	—	0.7	0.95	
Isolation between Common port and RF1/RF2 Ports	30 - 1000	34	35	—	dB
	1000 - 2000	27	28	—	
	2000 - 2700	23	24	—	
Isolation between RF1 and RF2 ports	30 - 1000	34	37	—	dB
	1000 - 2000	27	30	—	
	2000 - 2700	23	26	—	
Return loss (ON STATE)	30 - 1000	—	30	—	dB
	1000 - 2000	—	20	—	
	2000 - 2700	—	20	—	
Harmonics	2f=+45 dBm pulsed at 1 GHz	—	-94	-90	dBc
	3f=+45 dBm pulsed at 1 GHz	—	-84	-80	
Input IP3	850	—	85	—	dBm
	2700	—	81	—	
Input 0.1 dB Compression <sup>3</sup>	30 - 2000	—	35.5	—	W
	2000 - 2700	—	28.2	—	
RF Input Power Operating CW <sup>6</sup> (Cold Switching)	30 - 2000	—	—	20.0	W
	2000 - 2700	—	—	15.8	
Hot Switching	30 - 2700	—	—	1.0	
RF Input Power Operating pulsed <sup>5,7</sup>	30 - 2000	—	—	31.6	W
	2000 - 2700	—	—	25.1	
Thermal Resistance Junction to case	—	—	35.6	—	°C/W
Operating Junction Temperature	—	—	—	140	°C

## Notes:

1. Tested on Mini-Circuits' test board TB-923+, using Agilent's N5230A network analyzer (see Characterization test circuit, Fig.1).

2. Insertion loss values are de-embedded from test board loss.

3. 0.1 dB Compression is a measure of linearity. For continuous operation do not exceed RF input power operating specs.

4. Insertion loss and return loss are improved by external matching, see Test board drawing.

5. 10% duty cycle, 4620 μ period.

6. Derate linearly to 10W (over 30-2000 MHz) and 8W (over 2000-2700 MHz) at 85°C

7. Derate linearly to 15.8W (over 30-2000 MHz) and 12.5W (over 2000-2700 MHz) at 85°C

8. Maximum control voltage high also cannot exceed V<sub>DD</sub>

## DC Electrical Specifications

Parameter	Min.	Typ.	Max.	Units
Supply voltage, V <sub>DD</sub>	2.3		5.5	V
Supply current	—	130	200	μA
Control voltage Low	-0.3		0.6	V
Control voltage High <sup>8</sup>	1.17		3.6	V
Control current	—	2.0	—	μA

## Switching Specifications

Parameter	Condition	Min.	Typ.	Max.	Units
Switching time 50% Control to 90%/10% RF	Control 0 to 3.4V Frequency: 10 kHz V <sub>DD</sub> =2.3/3 4/5.5V	—	15	25	μSec
Switching time 50% Control to 0.01 dB	V <sub>CTRL</sub> =100Hz, 0 to 3V V <sub>DD</sub> =3.3V	—	41	—	μSec
Video feed-through	Control 0 to 3.4V Frequency: 10 kHz V <sub>DD</sub> =2.3/3 4/5.5V	—	27	—	mV <sub>P-P</sub>
Rise/Fall Time 10 to 90% or 90 to 10%	Control 0 to 3.4V Frequency: 10 kHz V <sub>DD</sub> =2.3/3 4/5.5V	—	14	—	μSec



**Absolute Maximum Ratings<sup>9</sup>**

Parameter	Ratings	
Operating temperature	-40°C to +85°C	
Storage temperature	-65°C to 150°C	
V <sub>DD</sub> , Supply voltage	-0.3 to 5.5V	
Voltage control	-0.3V Min. 3.6 Max.	
RF Input power, CW	0.03 - 2 GHz	35.5W
	2 - 2.7 GHz	28.2W
Junction Temperature	200°C (10s max)	

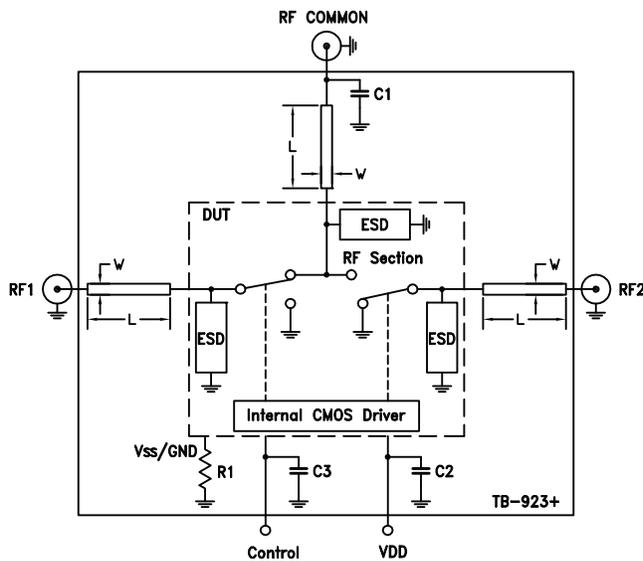
9. Operation of this device above any of these conditions may cause permanent damage.

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

State of Control voltage	RF common to	
	RF1	RF2
High	ON	OFF
Low	OFF	ON

ON- low insertion loss state OFF- Isolation State

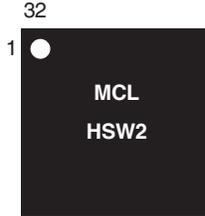
**Characterization Test Circuit**



Component	Value	Size	Manufacturer	Remarks
C1	0.2 pF	0402	Various	—
C2	0.01 μF	0603	Various	—
C3	100 pF	0603	Various	—
R1	0Ω	0603	Various	—
L	—	0.195"	—	See PL drawing
W	—	0.012"	—	See PL drawing

**Figure 1.** Block Diagram of test Circuit used for characterization (DUT soldered on Mini-Circuit's TB-923+)

## Product Marking



Marking may contain other features or characters for internal lot control

## Additional Detailed Technical Information

additional information is available on our dash board. To access this information [click here](#)

<b>Performance Data</b>	Data Table
	Swept Graphs
<b>Case Style</b>	JY2179 <i>Plastic package, exposed paddle</i>
<b>Tape &amp; Reel</b> Standard quantities available on reel	F68 <i>7" reels with 20, 50, 100, 200, 500, 1000 devices</i> <i>13" reels with 3K devices</i>
<b>Suggested Layout for PCB Design</b>	PL-494
<b>Evaluation Board</b>	TB-923+
<b>Environmental Ratings</b>	ENV83

## ESD Rating

Human Body Model (HBM): Class 1C (pass 1000V) in accordance with MIL-STD-883, Method 3015

## MSL Rating

Moisture Sensitivity: MSL3 in accordance with IPC/JEDEC J-STD-020D

## Additional Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- 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](http://www.minicircuits.com/MCLStore/terms.jsp)