# SP4T RF Switch JSW4-272DR+

50Ω 5 to 2700 MHz High Power 3W

## The Big Deal

- High Port count in super small size
- Single Positive Supply Voltage, 2.5 – 4.8V
- High Power P0.1dB, 3W typ.
- Low Insertion Loss, 0.6 dB at 1 GHz



CASE STYLE: MT1817

## Product Overview

JSW4-272DR+ 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.

## Key Features

| Feature | Advantages |
|---|---|
| Wideband operation<br>5-2700 MHz | Enables a single component to be used in a vast array of applications from VHF up to 2.7 GHz. |
| High IIP3:<br>55 dBm typ. | Results in little or negligible inter-modulation generation, meeting requirements for digital communication signals. |
| Low Loss, 0.6 dB at 1 GHz<br>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, unless 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<br>2 x 2mm, 14-lead | Provides low inductance, repeatable transitions, and excellent thermal contact to PCB. |

# SP4T RF Switch

50Ω 5-2700 MHz

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

## Product Features

- High Isolation, 37 dB typ. at 1 GHz
- Low insertion loss, 0.6 dB typ. at 1 GHz
- High IP3, 59 dBm typ. at 1 GHz
- Low current consumption, 40 μA typ.
- High Power, P0.1dB 3W typ.



**JSW4-272DR+**

CASE STYLE: MT1817

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

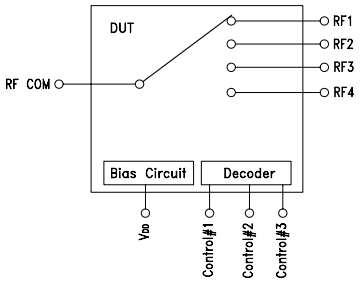
## Typical Applications

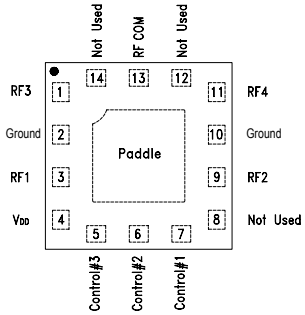
- CATV systems
- SATCOM system
- Automated Test Stations
- Telecom systems

## General Description

JSW4-272DR+ is a high power 3W reflective SP4T switch with integral driver, operates with single positive supply voltage while consuming, 40 μA typical. It has been designed for very wideband operation of 5-2700 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 |
|---|---|---|
| RF COM | 13 | RF Common/ SUM Port |
| RF1 | 3 | RF Out #1/In Port #1 |
| RF2 | 9 | RF Out #2/In Port #2 |
| Ground | 2 | Ground Externally |
| Ground | 10 | Ground Externally |
| RF3 | 1 | RF Out #5/In Port #5 |
| RF4 | 11 | RF Out #6/In Port #6 |

| Function | Pad Number | Description |
|---|---|---|
| Control #1 | 7 | Control IN #1 |
| Control #2 | 6 | Control IN #2 |
| Control #3 | 5 | Control IN #3 |
| VDD | 4 | Supply Voltage |
| Ground | Paddle | Ground Externally |
| Not Used | 8,12,14 | No Connection |

### RF Electrical Specifications[1], 5 - 2700 MHz, $T_{AMB}$=25°C, $V_{DD}$= +2.5 to 4.8V

| Parameter | Condition (MHz) | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Frequency Range | | 5 | | 2700 | MHz |
| Insertion Loss[2] | 5 to 1000 | — | 0.6 | 0.8 | dB |
| | 1000 to 2000 | — | 0.6 | 0.8 | |
| | 2000 to 2700 | — | 0.6 | 0.8 | |
| Isolation between Common Port and RF1 to RF4 Ports [3] | 5 to 1000 | 35 | 37 | — | dB |
| | 1000 to 2000 | 28 | 30 | — | |
| | 2000 to 2700 | 25 | 27 | — | |
| Return Loss (ON STATE) RF-COM, RF1 to RF4 Ports | 5 to 1000 | — | 15.5 | — | dB |
| | 1000 to 2000 | — | 14.2 | — | |
| | 2000 to 2700 | — | 14.3 | — | |
| Input IP3 $V_{DD}$=2.5 to 4.8V | 5 to 500 | — | 55 | — | dBm |
| $V_{DD}$=3.0V | 1000 to 2700 | — | 59 | — | |
| 0.1dB Input Compression[4] | 5 to 2700 | — | 35 | — | dBm |

### DC Electrical Specifications

| Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| VDD, Supply Voltage | 2.5 | 3.0 | 4.8 | V |
| Supply Current ($V_{DD}$ = 3V) | | 40 | | µA |
| 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:
1. As measured in Mini-Circuit's test board TB-724-4+ (see Characterization Test Circuit, Fig.1).
2. 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. | Typ. | Max. | Units |
|---|---|---|---|---|
| Rise/Fall Time (10 to 90% or 90 to 10% RF) | — | 0.42 (Rise Time)<br>0.84 (Fall Time) | — | µSec |
| Switching Time, 50% CTRL to 90/10% RF | — | 1.9 (ON Time)<br>1.4 (OFF Time) | — | µSec |
| Video Feedthrough, (control 0 to 1.65V, freq.=10 KHz) | — | 3.0 | — | $mV_{P-P}$ |

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

| | Frequency (GHz) | Isolation Typ. (dB) "ON" Port | | | |
|---|---|---|---|---|---|
| RF Com to Port | | RF1 | RF2 | RF3 | RF4 |
| RF1 | 0.01-1.0 | --- | 49 | 53 | 49 |
| RF1 | 1.0-2.0 | --- | 43 | 38 | 43 |
| RF1 | 2.0-2.7 | --- | 40 | 34 | 39 |
| RF2 | 0.01-1.0 | 48 | --- | 48 | 50 |
| RF2 | 1.0-2.0 | 43 | --- | 42 | 38 |
| RF2 | 2.0-2.7 | 39 | --- | 39 | 33 |
| RF3 | 0.01-1.0 | 44 | 39 | --- | 40 |
| RF3 | 1.0-2.0 | 33 | 34 | --- | 34 |
| RF3 | 2.0-2.7 | 28 | 31 | --- | 31 |
| RF4 | 0.01-1.0 | 39 | 41 | 40 | --- |
| RF4 | 1.0-2.0 | 33 | 32 | 34 | --- |
| RF4 | 2.0-2.7 | 31 | 28 | 31 | --- |

## Table 2. Isolation Matrix (Between Output Ports)

| | Frequency (GHz) | Isolation Typ. (dB) "ON" Port & to Port | | | |
|---|---|---|---|---|---|
| From Port | | RF1 | RF2 | RF3 | RF4 |
| RF1 | 0.01-1.0 | --- | 54 | 37 | 55 |
| RF1 | 1.0-2.0 | --- | 45 | 32 | 46 |
| RF1 | 2.0-2.7 | --- | 41 | 28 | 42 |
| RF2 | 0.01-1.0 | 54 | --- | 55 | 37 |
| RF2 | 1.0-2.0 | 44 | --- | 45 | 32 |
| RF2 | 2.0-2.7 | 40 | --- | 41 | 29 |
| RF3 | 0.01-1.0 | 44 | 58 | --- | 48 |
| RF3 | 1.0-2.0 | 37 | 45 | --- | 40 |
| RF3 | 2.0-2.7 | 32 | 42 | --- | 37 |
| RF4 | 0.01-1.0 | 45 | 44 | 48 | --- |
| RF4 | 1.0-1.5 | 38 | 37 | 39 | --- |
| RF4 | 1.5-2.0 | 36 | 32 | 37 | --- |

## 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 | H | — | ON | — | — |
| H | L | L | — | — | ON | — |
| H | L | H | — | — | — | ON |
| H | H | H | Shutdown | | | |

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

## Characterization Test Circuit

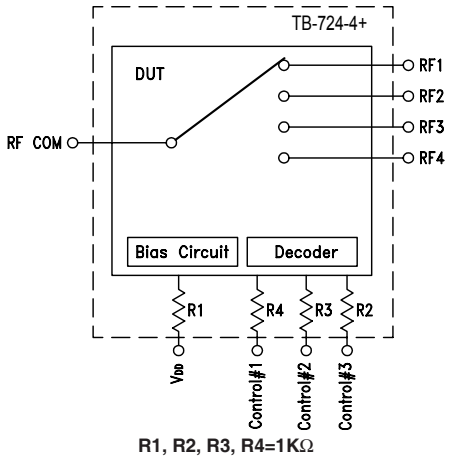



Figure 1: Block Diagram Of Test Circuit Used For Characterization.
(DUT soldered on Mini-Circuits' TB-724-4+)

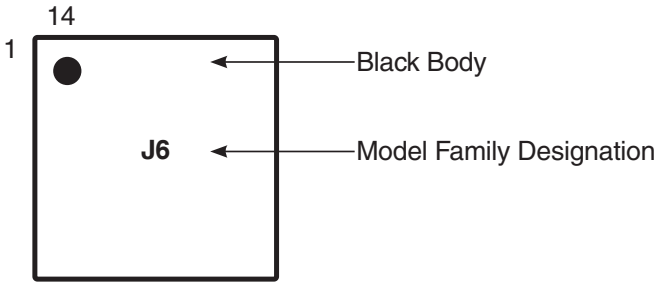
**Test Equipment:**

**For Insertion loss, Isolation, Return loss:**
Agilent's N5230A Network Analyzer , E3631A power supply.
**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.

**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 $V_{DD}$=3V
**For Switching time:** RF frequency: DC at 200mV, Control Frequency: 10 KHz and 0 and +8V.

## Product Marking




## Recommended Application Circuit

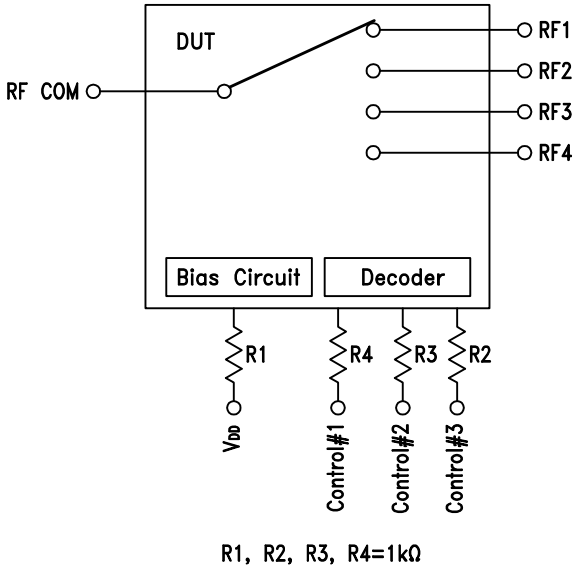



Fig. 2: Evaluation board includes case, connectors and components soldered to PCB.

| Additional Detailed Technical Information<br>*additional information is available on our dash board. To access this information click here* | |
|---|---|
| **Performance Data** | Data Table |
| | Swept Graphs |
| **Case Style** | MT1817 *Plastic package; Lead finish: Matte Tin* |
| **Tape & Reel**<br>**Standard quantities available on reel** | F108<br>*7" reels with 20, 50, 100, 200, 500, 1K or 3K devices* |
| **Suggested Layout for PCB Design** | PL-462 |
| **Evaluation Board** | TB-724-4+ |
| **Environmental Ratings** | ENV75 |

## ESD Rating

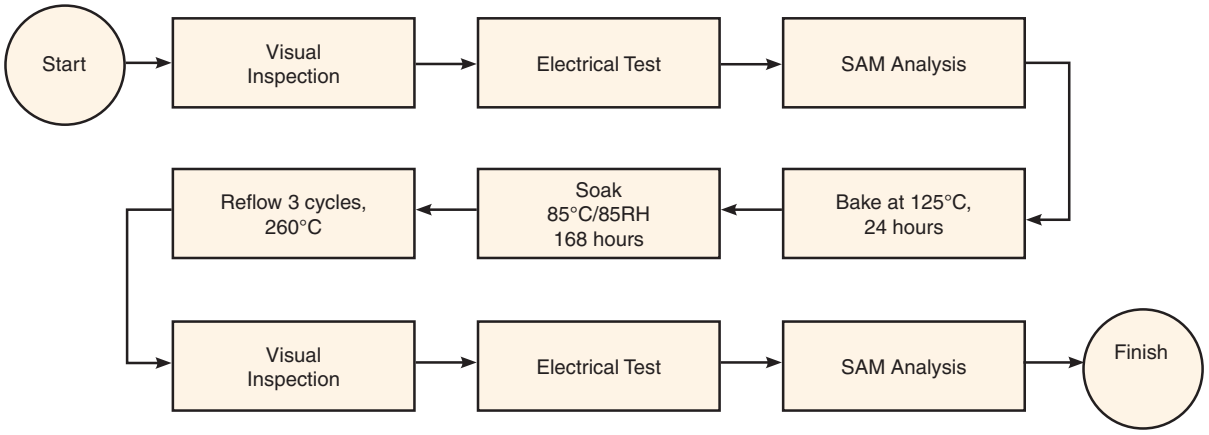
Human Body Model (HBM): Class 1B (500 to < 1000V) in accordance with JESD22-A114

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.

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