

# MMIC SP2T RF Switch

## HSWA2-63DR+

Absorptive RF Switch with internal driver  
Single Supply Voltage, +2.7V to +5.5V

### The Big Deal

- High Isolation, 69 dB at 1.0 GHz
- High Input IP3, +65 dBm
- Fast switching, 300 ns
- Tiny Size, 4x4mm



CASE STYLE: DG983-3

### Product Overview

Mini-Circuits' HSWA2-63DR+ is a MMIC SPDT absorptive switch with an internal driver designed for wideband operation from 100 MHz to 6.0 GHz supporting many applications requiring high performance across a wide frequency range. This model provides excellent isolation, fast switching speed and high linearity in a tiny 4x4mm 20-Lead MCLP package. Produced using a unique CMOS process on silicon, it offers the performance of GaAs with the advantages of conventional CMOS devices. HSWA2-63DR+ provides a high level of ESD protection and excellent repeatability.

### Key Features

| Feature   | Advantages   |
|---|--|
| Wideband, 100 MHz to 6.0 GHz<br>Usable over 1kHz to 6 GHz     | One model can be used in many applications, saving component count. Also ideal for wideband applications such as military and instrumentation.<br>With lower input power it can operate over 1kHz to 6 GHz covering even wider applications        |
| Absorptive switch   | In the off condition, RF output ports which are not switched ON are terminated into 50Ω. This enables proper impedance termination of the circuitry following the RF output ports, preventing any unintended action such as oscillation.           |
| High Isolation:<br>• 71 dB at 1000 MHz<br>• 48 dB at 6000 MHz | High isolation significantly reduces leakage of power into OFF ports.  |
| High linearity, +65 dBm IIP3                                  | 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. |
| Tiny size, 4 x 4mm MCLP package                               | Tiny footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.  |



# SP2T RF Switch

50Ω 100 MHz - 6 GHz

Absorptive RF Switch with internal driver  
Single Supply Voltage, +2.7V to +5.5V

## Product Features

- High Isolation, 69 dB typ. at 1 GHz
- Low insertion loss, 0.95 dB typ. at 1 GHz
- High Input IP3, 65 dBm typ.
- Fast switching time, 300 ns typ.
- Low current consumption, 120 μA typ.
- Wide bandwidth, 100-6000 MHz, usable over 1kHz-6000 MHz



CASE STYLE: DG983-3

## HSWA2-63DR+

### +RoHS Compliant

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

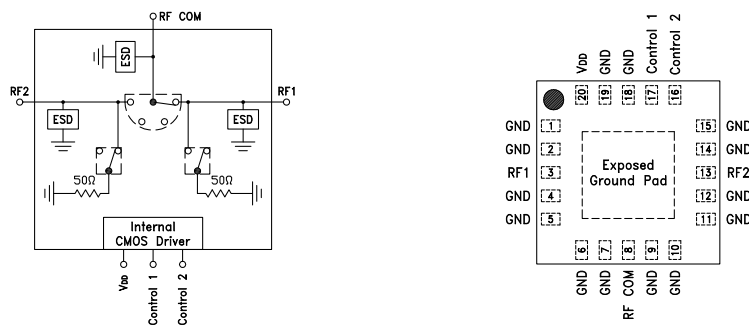
## Typical Applications

- Defense
- Test and Measurements
- Switch matrices

## General Description

HSWA2-63DR+ is a high isolation absorptive SP2T switch with integral CMOS driver, operates with single positive supply voltage while consuming, 120 μA typical. It has been designed for very wide band operation. It is packaged in a 4mm x 4mm x0.9mm 20-lead MCLP package and is rated MSL3.

## Simplified Schematic and Pad Description



| Function  | Pad Number                     | Description           |
|-----------|--------------------------------|-----------------------|
| RF COM    | 8                              | RF common/ SUM port*  |
| RF1       | 3                              | RF out #1/In port #1* |
| RF2       | 13                             | RF out #1/In port #2* |
| Control 1 | 17                             | CMOS Control IN #1    |
| Control 2 | 16                             | CMOS Control IN #2    |
| VDD       | 20                             | Supply voltage        |
| GND       | 1,2,4-7,9,10-12<br>14,15,18,19 | Ground                |

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



**RF Electrical Specifications<sup>1</sup>, 100 MHz - 6 GHz, T<sub>AMB</sub>=25°C, V<sub>DD</sub>= +3.0V, 50 Ohms**

| Parameter                                       | Condition (MHz) | Min. | Typ. | Max. | Units |
|---|-----------------|------|------|------|-------|
| Frequency range                                 |                 | 100  |      | 6000 | MHz   |
| Insertion loss <sup>2,4</sup>                   | 100 - 1000      | —    | 0.95 | 1.15 | dB    |
|   | 1000 - 2000     | —    | 0.95 | 1.15 |       |
|   | 2000 - 3000     | —    | 1.0  | 1.2  |       |
|   | 3000 - 4000     | —    | 1.15 | 1.35 |       |
|   | 4000 - 5000     | —    | 1.25 | 1.55 |       |
|   | 5000 - 6000     | —    | 1.60 | 1.90 |       |
| Isolation between Common port and RF1/RF2 Ports | 100 - 1000      | 69   | 71   | —    | dB    |
|   | 1000 - 2000     | 65   | 67   | —    |       |
|   | 2000 - 3000     | 63   | 68   | —    |       |
|   | 3000 - 4000     | 62   | 67   | —    |       |
|   | 4000 - 5000     | 52   | 57   | —    |       |
|   | 5000 - 6000     | 44   | 48   | —    |       |
| Isolation between RF1 and RF2 Ports             | 100 - 1000      | 67   | 69   | —    | dB    |
|   | 1000 - 2000     | 63   | 64   | —    |       |
|   | 2000 - 3000     | 59   | 62   | —    |       |
|   | 3000 - 4000     | 60   | 64   | —    |       |
|   | 4000 - 5000     | 54   | 60   | —    |       |
|   | 5000 - 6000     | 44   | 50   | —    |       |
| Return loss (All Ports)                         | 100 - 4000      | —    | 20   | —    | dB    |
|   | 4000 - 5000     | —    | 15   | —    |       |
|   | 5000 - 6000     | —    | 13   | —    |       |
| Input IP2                                       | 100 - 6000      | —    | 110  | —    | dBm   |
| Input IP3                                       | 100 - 6000      | 60   | 65   | —    | dBm   |
| 1.0 dB Input compression <sup>3</sup>           | 100 - 6000      | 33   | 35   | —    | dBm   |
| Thermal Resistance, junction-to-ambient         |                 |      | 78   |      | °C/W  |

**DC Electrical Specifications**

| Parameter                       | Min. | Typ. | Max. | Units |
|---------------------------------|------|------|------|-------|
| Supply voltage, V <sub>DD</sub> | 2.7  |      | 5.5  | V     |
| Supply current                  |      | 120  | 200  | μA    |
| Control voltage Low             | -0.3 |      | 0.6  | V     |
| Control voltage High            | 1.17 |      | 3.6  | V     |
| Control current                 |      | 9    | 12   | μA    |

Notes:

1. Tested on Mini-Circuits' test board TB-919+, using Agilent's N5230A network analyzer (see Characterization test circuit, Fig.2).
2. Insertion loss values are de-embedded from test board loss.
3. Do not exceed RF input power as shown in Absolute Maximum Ratings table.
4. Insertion loss and return loss can be improved by external matching.

**Switching Specifications**

| Parameter                                 | Condition  | Min. | Typ. | Max. | Units             |
|---|--|------|------|------|-------------------|
| Switching time<br>50% control to 90/10%RF | fctrl=1KHz<br>V <sub>DD</sub> =3V<br>Vctrl High=1.8V<br>Vctrl Low=0V | —    | 300  | 400  | nS                |
| Video feed-through                        |  | —    | 27   | —    | mV <sub>P-P</sub> |
| Rise/Fall time<br>10 to 90% or 90 to 10%  |  | —    | 67   | —    | ns                |

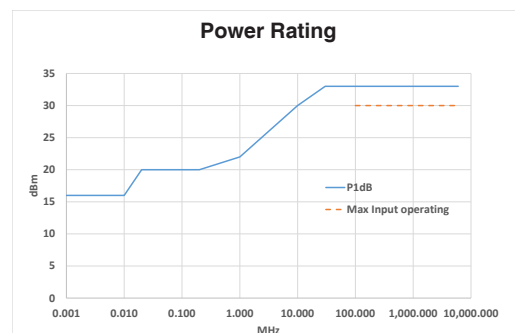


Figure 1. P1dB and Max Input Operating Power vs. Frequency

**Absolute Maximum Ratings<sup>5</sup>**

| Parameter                               | Ratings             |
|---|---------------------|
| Operating temperature                   | -40°C to +105°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 <sup>6</sup>         | +30 dBm             |
| RF Power into output ports <sup>6</sup> | +20 dBm             |
| Maximum Die Junction Temperature        | 150°C               |

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

6. 100% Duty Cycle, all band, 50Ω

**Truth Table**

| Mode          | State of Control voltage |           |
|---------------|--------------------------|-----------|
|               | Control 1                | Control 2 |
| RF COM-RF1 ON | HIGH                     | LOW       |
| RF COM-RF2 ON | LOW                      | HIGH      |
| ALL OFF       | LOW                      | LOW       |
| Unsupported   | HIGH                     | HIGH      |

**Characterization / Application Test Circuit**

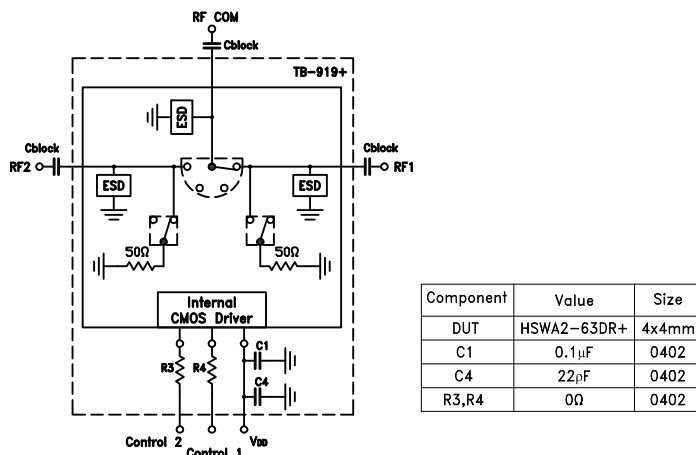
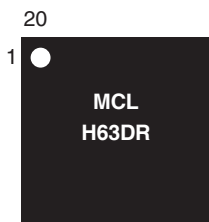


Figure 2. Block Diagram of test Circuit used for characterization (DUT soldered on Mini-Circuits' TB-919+)

Note: Cblock is required only when DC is present on RF ports.

## Product Marking



## 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>   | DG983-3 <i>Plastic package, exposed paddle</i><br><i>Termination finish: NiPdAu</i> |
| <b>Tape &amp; Reel</b><br>Standard quantities available on reel | F87<br><i>7" reels with 20, 50, 100, 200, 500, 1000 &amp; 3000 devices</i>          |
| <b>Suggested Layout for PCB Design</b>                          | PL-510  |
| <b>Evaluation Board</b>   | TB-919+   |
| <b>Environmental Ratings</b>                                    | ENV83   |

## ESD Rating

Human Body Model (HBM): Class 2 (Pass 2000V) 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)