



# 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
- Low insertion loss, 0.95 dB typ. at 1 GHz
- High Input IP3, +65 dBm
- Fast switching, 300 ns typ.
- Tiny Size, 4x4mm
- Immune to latch-up

### APPLICATIONS

- Defense
- Test and Measurements
- Switch matrices



CASE STYLE: DG983-3

*Generic photo used for illustration purposes only*

#### +RoHS Compliant

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

### 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 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. 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: <ul style="list-style-type: none"> <li>• 71 dB at 1000 MHz</li> <li>• 48 dB at 6000 MHz</li> </ul>	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.
Immune to Latch-up	Unlike conventional CMOS devices, HSWA is immune to latch-up
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.



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## SP2T RF Switch

HSAWA2-63DR+

Absorptive RF Switch with internal driver  
Single Supply Voltage, +2.7V to +5.5VRF 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</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.

## SWITCHING SPECIFICATIONS

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

## Power On/ Power Off Sequence:

## Power On:

Note: Vctrl and V<sub>DD</sub> voltages are independent from one another. Vctrl voltages may be turned on in any order and at any time in this sequence.

1. Make sure RF power is OFF.
2. Set VDD to 0V.
3. Set VDD from 0V to recommended supply voltage range between +2.7V to +5.5V in a single voltage step with transition time <500 usec. Do not use intermediate voltage steps.
4. Turn ON RF power.

## Power Off:

Note: Vctrl and V<sub>DD</sub> voltages are independent from each other. Vctrl voltages can be turned off or set to 0V in any order and at any time in this sequence.

1. Turn OFF RF power.
2. Set V<sub>DD</sub> from selected operating voltage to 0V or off in a single voltage step. Do not use intermediate voltage steps.





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### MAXIMUM RATINGS<sup>4</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>5</sup>	+28 dBm
RF Power into output ports <sup>5</sup>	+20 dBm
Maximum Die Junction Temperature	150°C

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

5. 100% Duty Cycle, all band, 50Ω

### POWER RATING

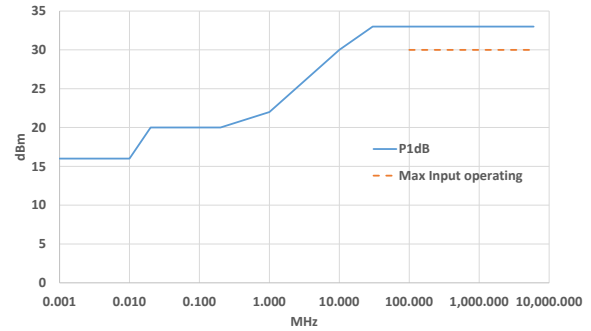


Figure 1. P1dB and Max Input Operating Power vs. Frequency

### 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



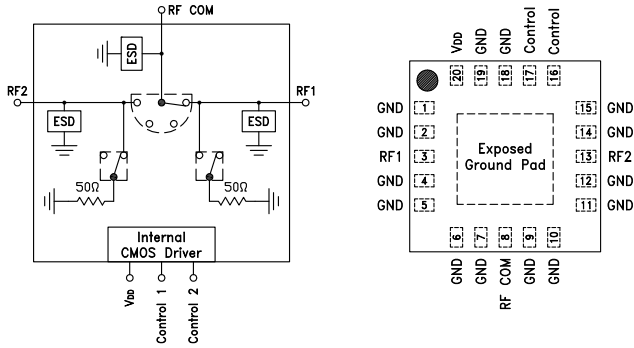
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### SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



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
V <sub>DD</sub>	20	Supply voltage
GND	1,2,4,7,9,10-12,14,15,18,19	Ground

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

### CHARACTERIZATION & APPLICATION CIRCUIT

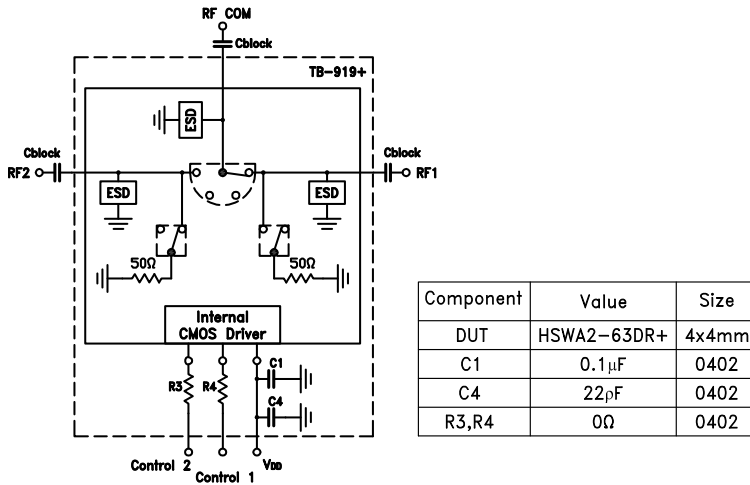


Figure 2. Block Diagram of test Circuit used for characterization (DUT soldered on Mini-Circuits' TB-919+)  
Note: Cblock is required only when DC is present on RF ports.

### PRODUCT MARKING



Marking may contain other features or characters for internal lot control





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ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS [CLICK HERE](#)

Performance Data	Data Table Swept Graphs
Case Style	DG983-3 Plastic package, exposed paddle , termination finish=NiPdAu
Tape & Reel Standard quantities available on reel	F87 7" reels with 20, 50, 100, 200, 500, 1000 & 3000 devices
Suggested Layout for PCB Design	PL-510
Evaluation Board	TB-919+
Environmental Ratings	ENV83

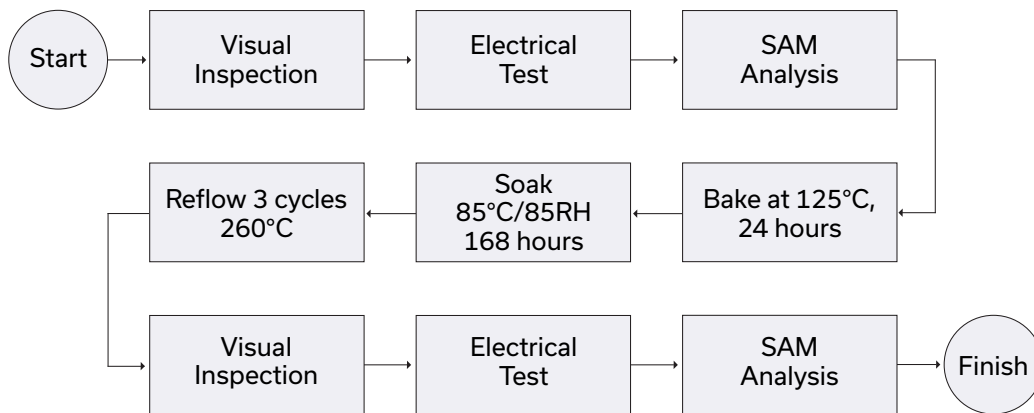
### ESD RATING

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

### MSL TEST FLOW CHART



- 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/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)



## Typical Performance Data

RF FREQ (GHz)	INSERTION LOSS (dB)		RF FREQ (GHz)	ISOLATION (dB)			
	VDD=+3V			VDD=+3V		VDD=+3V	
	RF COM- RF1	RF COM- RF2		RF COM- RF1	RF COM- RF2	RF1-RF2 State 1*	RF1-RF2 State 2*
0.1	0.83	0.85	0.1	86.9	89.1	86.4	86.0
0.5	0.87	0.88	0.5	75.1	75.9	73.8	74.0
1.0	0.90	0.90	1.0	71.0	71.0	68.6	69.0
1.2	0.91	0.91	1.2	69.5	69.7	67.6	68.0
1.4	0.93	0.93	1.4	69.0	69.0	66.5	66.9
1.6	0.94	0.94	1.6	68.5	68.4	65.6	66.0
1.8	0.95	0.94	1.8	68.1	68.0	65.0	65.4
2.0	0.95	0.95	2.0	68.0	67.5	64.4	64.8
2.2	0.95	0.95	2.2	68.0	67.2	63.8	64.4
2.4	0.94	0.94	2.4	68.0	66.8	63.4	64.0
2.6	0.96	0.95	2.6	67.7	65.7	62.6	63.1
2.8	0.95	0.94	2.8	68.2	66.0	62.4	62.5
3.0	0.95	0.96	3.0	71.2	67.5	61.9	62.7
3.2	0.97	0.96	3.2	78.6	68.8	61.9	64.7
3.4	0.98	0.98	3.4	76.8	68.0	62.5	65.5
3.6	1.00	1.01	3.6	76.6	68.0	62.9	66.6
3.8	1.06	1.03	3.8	75.2	67.3	63.0	67.7
4.0	1.12	1.09	4.0	69.8	66.7	63.2	69.0
4.2	1.15	1.14	4.2	66.2	65.6	64.0	71.9
4.4	1.19	1.17	4.4	62.9	64.1	64.5	74.7
4.6	1.23	1.23	4.6	60.5	63.0	64.2	77.9
4.8	1.27	1.30	4.8	58.7	61.7	62.7	77.1
5.0	1.29	1.33	5.0	57.5	60.7	60.9	68.0
5.2	1.36	1.38	5.2	55.8	57.4	58.5	62.3
5.4	1.39	1.42	5.4	53.8	54.9	56.3	58.6
5.6	1.45	1.45	5.6	52.1	53.4	54.7	56.1
5.8	1.49	1.48	5.8	50.1	51.8	53.2	53.7
6.0	1.54	1.51	6.0	48.3	50.2	52.4	51.6
6.5	1.75	1.64	6.5	46.3	47.1	49.6	48.8

\*Note:

State	State of Control Voltage		RF Common to	
	Control 1	Control 2	RF1	RF2
1	HIGH	LOW	ON	OFF
2	LOW	HIGH	OFF	ON
3	LOW	LOW	OFF	OFF
4	HIGH	HIGH	UNSUPPORTED	

## Typical Performance Data

RF FREQ (GHz)	VSWR (:1)				RF FREQ (GHz)	VSWR (:1)	
	VDD=+3V					VDD=+3V	
	RF COM		RF1 (ON)	RF2 (ON)		RF1 (OFF)	RF2 (OFF)
	State 1*	State 2*	State 1*	State 2*		State 2*	State 1*
0.01	1.16	1.16	1.15	1.16	0.01	1.17	1.19
0.05	1.16	1.17	1.16	1.16	0.05	1.18	1.19
0.1	1.18	1.16	1.19	1.17	0.1	1.19	1.20
0.3	1.19	1.14	1.20	1.19	0.3	1.19	1.21
0.5	1.20	1.12	1.22	1.21	0.5	1.19	1.21
0.7	1.21	1.11	1.24	1.22	0.7	1.18	1.20
1.0	1.23	1.10	1.24	1.23	1.0	1.16	1.20
1.3	1.24	1.11	1.24	1.24	1.3	1.14	1.18
1.5	1.25	1.11	1.23	1.25	1.5	1.11	1.17
1.7	1.24	1.12	1.21	1.24	1.7	1.07	1.15
2.0	1.23	1.13	1.17	1.23	2.0	1.04	1.13
2.3	1.22	1.14	1.13	1.21	2.3	1.03	1.12
2.5	1.21	1.15	1.10	1.19	2.5	1.06	1.12
2.7	1.22	1.16	1.08	1.18	2.7	1.10	1.13
3.0	1.22	1.19	1.10	1.17	3.0	1.14	1.14
3.3	1.24	1.22	1.13	1.18	3.3	1.18	1.16
3.5	1.26	1.27	1.17	1.18	3.5	1.22	1.19
3.7	1.29	1.32	1.22	1.21	3.7	1.25	1.21
4.0	1.31	1.37	1.26	1.24	4.0	1.28	1.24
4.3	1.34	1.41	1.30	1.27	4.3	1.30	1.27
4.5	1.37	1.46	1.33	1.31	4.5	1.31	1.28
4.7	1.40	1.51	1.36	1.34	4.7	1.31	1.30
5.0	1.43	1.54	1.37	1.37	5.0	1.31	1.31
5.3	1.45	1.56	1.38	1.39	5.3	1.29	1.31
5.5	1.48	1.58	1.38	1.41	5.5	1.28	1.32
5.7	1.50	1.58	1.37	1.44	5.7	1.27	1.33
6.0	1.54	1.58	1.38	1.45	6.0	1.28	1.34
6.3	1.58	1.57	1.41	1.47	6.3	1.30	1.35
6.5	1.73	1.54	1.57	1.52	6.5	1.44	1.37

\*Note:

State	State of Control Voltage		RF Common to	
	Control 1	Control 2	RF1	RF2
1	HIGH	LOW	ON	OFF
2	LOW	HIGH	OFF	ON
3	LOW	LOW	OFF	OFF
4	HIGH	HIGH	UNSUPPORTED	

ON - Low insertion loss state  
OFF - Isolation state

Typical Performance Data

RF FREQ (GHz)	INSERTION LOSS (dB) @ VDD=+3V OVER TEMPERATURE						RF FREQ (GHz)	ISOLATION (dB) @ VDD=+3V OVER TEMPERATURE											
	RF COM-RF1			RF COM-RF2				RF COM-RF1			RF COM-RF2			RF1-RF2 State 1*			RF1-RF2 State 2*		
	-40°C	+25°C	+105°C	-40°C	+25°C	+105°C		-40°C	+25°C	+105°C	-40°C	+25°C	+105°C	-40°C	+25°C	+105°C	-40°C	+25°C	+105°C
0.01	0.79	0.86	0.95	0.79	0.86	0.95	0.01	81.25	81.30	80.66	81.25	81.30	80.66	85.82	85.09	84.39	85.82	85.09	84.39
0.05	0.80	0.87	0.95	0.80	0.87	0.95	0.05	81.22	81.19	80.53	81.22	81.19	80.53	85.09	84.39	83.75	85.09	84.39	83.75
0.1	0.80	0.87	0.96	0.80	0.87	0.96	0.1	81.08	80.93	80.25	81.08	80.93	80.25	83.93	83.29	82.68	83.93	83.29	82.68
0.3	0.82	0.89	0.97	0.82	0.89	0.97	0.3	80.06	79.43	78.80	80.06	79.43	78.80	79.29	78.86	78.50	79.29	78.86	78.50
0.5	0.83	0.90	0.99	0.83	0.90	0.99	0.5	75.90	75.22	74.54	75.90	75.22	74.54	74.37	73.97	73.64	74.37	73.97	73.64
0.7	0.85	0.92	1.01	0.85	0.92	1.01	0.7	73.56	72.84	72.22	73.56	72.84	72.22	71.60	71.23	70.92	71.60	71.23	70.92
1.0	0.87	0.94	1.04	0.87	0.94	1.04	1.0	71.25	70.59	69.96	71.25	70.59	69.96	68.96	68.66	68.40	68.96	68.66	68.40
1.3	0.89	0.96	1.07	0.89	0.96	1.07	1.3	69.74	69.14	68.49	69.74	69.14	68.49	67.22	66.99	66.77	67.22	66.99	66.77
1.5	0.90	0.98	1.08	0.90	0.98	1.08	1.5	69.17	68.54	67.96	69.17	68.54	67.96	66.37	66.12	65.95	66.37	66.12	65.95
1.7	0.91	0.99	1.10	0.91	0.99	1.10	1.7	68.80	68.20	67.64	68.80	68.20	67.64	65.56	65.34	65.23	65.56	65.34	65.23
2.0	0.93	1.01	1.12	0.93	1.01	1.12	2.0	68.63	68.09	67.59	68.63	68.09	67.59	64.65	64.51	64.46	64.65	64.51	64.46
2.3	0.95	1.03	1.15	0.95	1.03	1.15	2.3	68.82	68.34	67.99	68.82	68.34	67.99	64.02	63.91	63.96	64.02	63.91	63.96
2.5	0.96	1.05	1.17	0.96	1.05	1.17	2.5	69.15	68.76	68.49	69.15	68.76	68.49	63.69	63.60	63.75	63.69	63.60	63.75
2.7	0.98	1.07	1.19	0.98	1.07	1.19	2.7	69.67	69.33	69.16	69.67	69.33	69.16	63.35	63.38	63.56	63.35	63.38	63.56
3.0	1.00	1.10	1.22	1.00	1.10	1.22	3.0	71.06	70.91	70.93	71.06	70.91	70.93	63.01	63.16	63.47	63.01	63.16	63.47
3.3	1.03	1.13	1.26	1.03	1.13	1.26	3.3	73.76	74.02	74.14	73.76	74.02	74.14	63.08	63.37	63.95	63.08	63.37	63.95
3.5	1.05	1.15	1.28	1.05	1.15	1.28	3.5	75.66	75.74	75.45	75.66	75.74	75.45	63.44	63.90	64.68	63.44	63.90	64.68
3.7	1.07	1.18	1.31	1.07	1.18	1.31	3.7	76.14	75.74	74.46	76.14	75.74	74.46	63.99	64.66	65.80	63.99	64.66	65.80
4.0	1.10	1.21	1.36	1.10	1.21	1.36	4.0	72.77	71.46	69.43	72.77	71.46	69.43	65.14	66.28	68.32	65.14	66.28	68.32
4.3	1.13	1.25	1.40	1.13	1.25	1.40	4.3	66.87	65.55	63.90	66.87	65.55	63.90	66.49	68.23	71.24	66.49	68.23	71.24
4.5	1.15	1.27	1.42	1.15	1.27	1.42	4.5	63.44	62.34	60.97	63.44	62.34	60.97	66.61	68.52	71.42	66.61	68.52	71.42
4.7	1.17	1.29	1.44	1.17	1.29	1.44	4.7	60.62	59.70	58.50	60.62	59.70	58.50	65.65	67.26	69.20	65.65	67.26	69.20
5.0	1.18	1.31	1.47	1.18	1.31	1.47	5.0	57.07	56.27	55.31	57.07	56.27	55.31	62.76	63.26	63.51	62.76	63.26	63.51
5.3	1.18	1.31	1.47	1.18	1.31	1.47	5.3	56.83	56.05	55.11	56.83	56.05	55.11	62.56	62.98	63.12	62.56	62.98	63.12
5.5	1.18	1.31	1.47	1.18	1.31	1.47	5.5	56.61	55.83	54.90	56.61	55.83	54.90	62.36	62.71	62.77	62.36	62.71	62.77
5.7	1.18	1.31	1.47	1.18	1.31	1.47	5.7	56.38	55.61	54.70	56.38	55.61	54.70	62.18	62.44	62.43	62.18	62.44	62.43
6.0	1.18	1.31	1.47	1.18	1.31	1.47	6.0	56.16	55.40	54.50	56.16	55.40	54.50	61.99	62.19	62.10	61.99	62.19	62.10
6.3	1.18	1.31	1.47	1.18	1.31	1.47	6.3	55.94	55.19	54.30	55.94	55.19	54.30	61.81	61.94	61.80	61.81	61.94	61.80
6.5	1.19	1.32	1.48	1.19	1.32	1.48	6.5	55.73	54.99	54.11	55.73	54.99	54.11	61.63	61.69	61.50	61.63	61.69	61.50

\*Note:

State	State of Control Voltage		RF Common to	
	Control 1	Control 2	RF1	RF2
1	HIGH	LOW	ON	OFF
2	LOW	HIGH	OFF	ON
3	LOW	LOW	OFF	OFF
4	HIGH	HIGH	UNSUPPORTED	

ON - Low insertion loss state  
OFF - Isolation state



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IF/RF MICROWAVE COMPONENTS



## Typical Performance Data

RF FREQ (GHz)	VSWR (:1) @ VDD=+3V OVER TEMPERATURE												RF FREQ (GHz)	VSWR (:1) @ VDD=+3V OVER TEMPERATURE					
	RF COM						RF1			RF2				RF1			RF2		
	State 1*			State 2*			State 1*			State 2*				State 2*			State 1*		
	-40°C	+25°C	+105°C	-40°C	+25°C	+105°C	-40°C	+25°C	+105°C	-40°C	+25°C	+105°C		-40°C	+25°C	+105°C	-40°C	+25°C	+105°C
0.01	1.15	1.16	1.18	1.15	1.17	1.18	1.15	1.16	1.18	1.15	1.16	1.18	0.01	1.12	1.21	1.31	1.12	1.21	1.31
0.05	1.15	1.16	1.18	1.15	1.16	1.18	1.15	1.16	1.18	1.15	1.16	1.18	0.05	1.12	1.21	1.31	1.12	1.21	1.31
0.1	1.15	1.16	1.18	1.15	1.16	1.18	1.15	1.16	1.18	1.15	1.16	1.18	0.1	1.12	1.21	1.31	1.12	1.21	1.31
0.3	1.14	1.16	1.18	1.15	1.16	1.18	1.15	1.16	1.18	1.15	1.16	1.18	0.3	1.12	1.21	1.31	1.12	1.21	1.31
0.5	1.14	1.15	1.17	1.14	1.16	1.17	1.15	1.16	1.18	1.15	1.16	1.18	0.5	1.12	1.21	1.31	1.12	1.21	1.31
0.7	1.13	1.15	1.16	1.14	1.15	1.17	1.15	1.16	1.18	1.15	1.16	1.18	0.7	1.12	1.21	1.31	1.12	1.21	1.31
1.0	1.12	1.13	1.15	1.13	1.15	1.16	1.14	1.16	1.18	1.14	1.16	1.18	1.0	1.12	1.20	1.31	1.12	1.20	1.31
1.3	1.11	1.12	1.14	1.12	1.14	1.16	1.13	1.15	1.17	1.13	1.15	1.17	1.3	1.12	1.20	1.31	1.12	1.20	1.31
1.5	1.10	1.12	1.14	1.11	1.13	1.15	1.12	1.14	1.15	1.12	1.14	1.15	1.5	1.12	1.20	1.30	1.12	1.20	1.30
1.7	1.10	1.11	1.13	1.11	1.12	1.15	1.11	1.12	1.14	1.11	1.12	1.14	1.7	1.12	1.20	1.30	1.12	1.20	1.30
2.0	1.09	1.10	1.13	1.09	1.10	1.13	1.08	1.09	1.11	1.08	1.09	1.11	2.0	1.11	1.19	1.29	1.11	1.19	1.29
2.3	1.08	1.10	1.12	1.07	1.09	1.12	1.05	1.06	1.08	1.05	1.06	1.08	2.3	1.10	1.18	1.28	1.10	1.18	1.28
2.5	1.08	1.10	1.13	1.07	1.09	1.12	1.04	1.05	1.07	1.04	1.05	1.07	2.5	1.10	1.18	1.27	1.10	1.18	1.27
2.7	1.08	1.10	1.13	1.08	1.10	1.12	1.04	1.05	1.07	1.04	1.05	1.07	2.7	1.10	1.17	1.27	1.10	1.17	1.27
3.0	1.09	1.11	1.14	1.10	1.12	1.14	1.06	1.08	1.09	1.06	1.08	1.09	3.0	1.10	1.17	1.26	1.10	1.17	1.26
3.3	1.11	1.13	1.16	1.13	1.14	1.16	1.09	1.10	1.12	1.09	1.10	1.12	3.3	1.11	1.17	1.26	1.11	1.17	1.26
3.5	1.12	1.14	1.17	1.16	1.17	1.19	1.11	1.12	1.14	1.11	1.12	1.14	3.5	1.12	1.17	1.26	1.12	1.17	1.26
3.7	1.13	1.16	1.19	1.20	1.21	1.22	1.12	1.14	1.16	1.12	1.14	1.16	3.7	1.12	1.18	1.26	1.12	1.18	1.26
4.0	1.16	1.19	1.22	1.25	1.26	1.27	1.15	1.16	1.18	1.15	1.16	1.18	4.0	1.14	1.18	1.26	1.14	1.18	1.26
4.3	1.20	1.23	1.26	1.29	1.30	1.32	1.17	1.19	1.20	1.17	1.19	1.20	4.3	1.16	1.18	1.26	1.16	1.18	1.26
4.5	1.23	1.25	1.29	1.33	1.34	1.35	1.19	1.21	1.22	1.19	1.21	1.22	4.5	1.18	1.19	1.26	1.18	1.19	1.26
4.7	1.26	1.28	1.31	1.36	1.37	1.38	1.22	1.23	1.25	1.22	1.23	1.25	4.7	1.19	1.21	1.27	1.19	1.21	1.27
5.0	1.30	1.33	1.35	1.38	1.40	1.41	1.26	1.28	1.29	1.26	1.28	1.29	5.0	1.23	1.24	1.28	1.23	1.24	1.28
5.3	1.31	1.33	1.36	1.39	1.40	1.41	1.27	1.28	1.29	1.27	1.28	1.29	5.3	1.23	1.24	1.29	1.23	1.24	1.29
5.5	1.31	1.33	1.36	1.39	1.40	1.42	1.27	1.29	1.30	1.27	1.29	1.30	5.5	1.23	1.24	1.29	1.23	1.24	1.29
5.7	1.31	1.34	1.36	1.39	1.40	1.42	1.27	1.29	1.30	1.27	1.29	1.30	5.7	1.23	1.24	1.29	1.23	1.24	1.29
6.0	1.32	1.34	1.37	1.39	1.40	1.42	1.28	1.29	1.30	1.28	1.29	1.30	6.0	1.24	1.24	1.29	1.24	1.24	1.29
6.3	1.32	1.34	1.37	1.39	1.40	1.42	1.28	1.30	1.30	1.28	1.30	1.30	6.3	1.24	1.25	1.29	1.24	1.25	1.29
6.5	1.32	1.35	1.37	1.39	1.40	1.42	1.28	1.30	1.31	1.28	1.30	1.31	6.5	1.24	1.25	1.29	1.24	1.25	1.29

\*Note:

State	State of Control Voltage		RF Common to	
	Control 1	Control 2	RF1	RF2
1	HIGH	LOW	ON	OFF
2	LOW	HIGH	OFF	ON
3	LOW	LOW	OFF	OFF
4	HIGH	HIGH	UNSUPPORTED	

ON - Low insertion loss state  
OFF - Isolation state



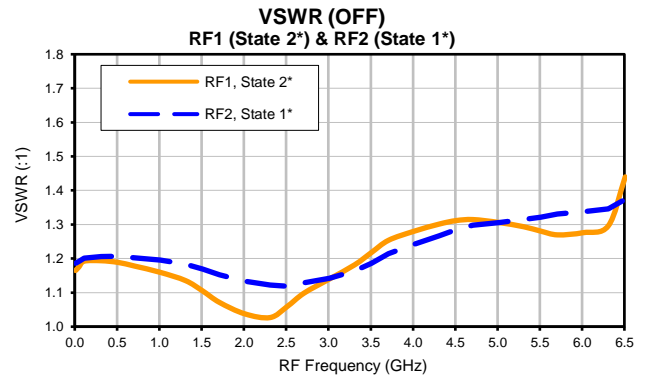
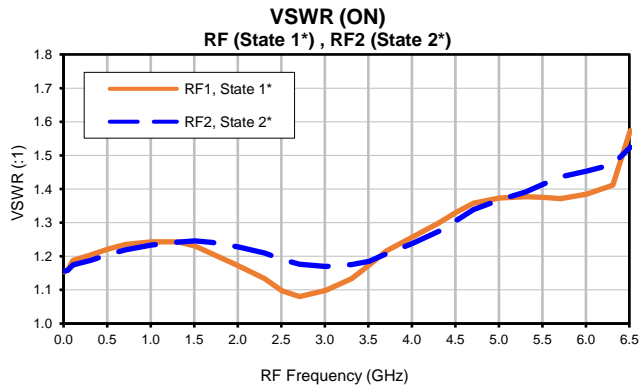
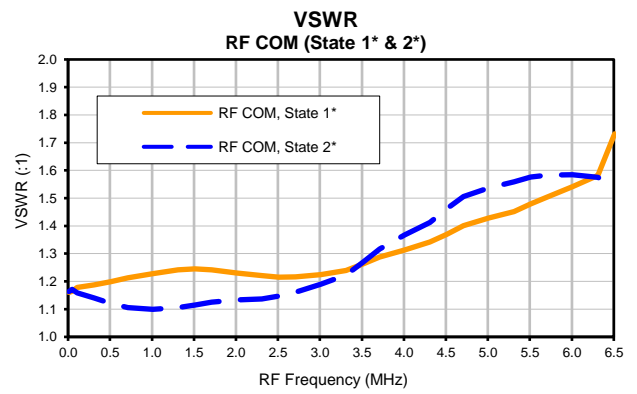
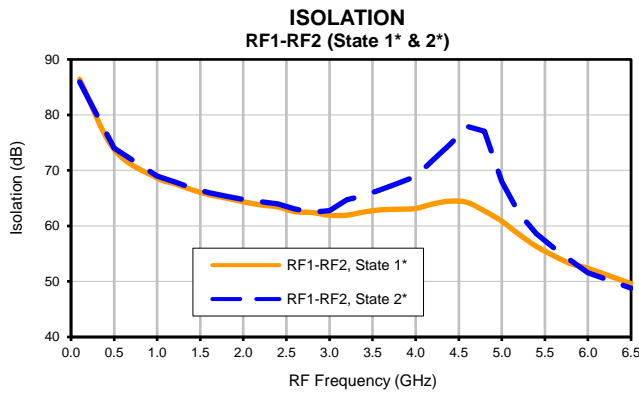
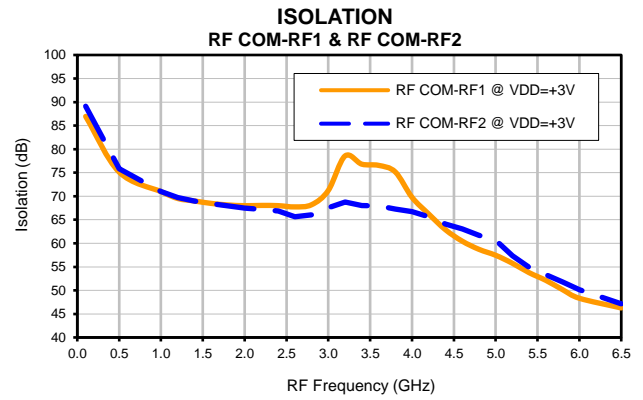
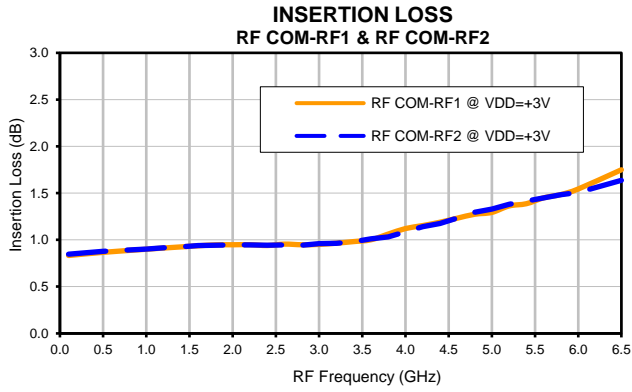
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IF/RF MICROWAVE COMPONENTS

## Typical Performance Curves



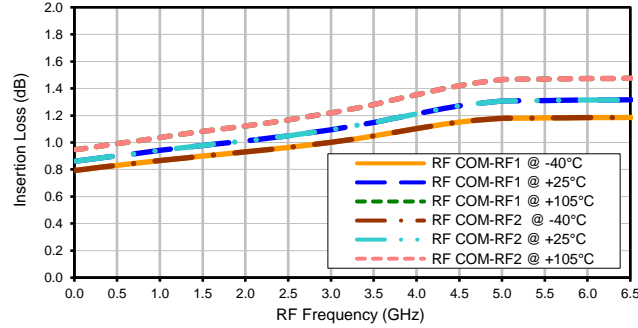
\*Note:

State	State of Control Voltage		RF Common to	
	Control 1	Control 2	RF1	RF2
1	HIGH	LOW	ON	OFF
2	LOW	HIGH	OFF	ON
3	LOW	LOW	OFF	OFF
4	HIGH	HIGH	UNSUPPORTED	

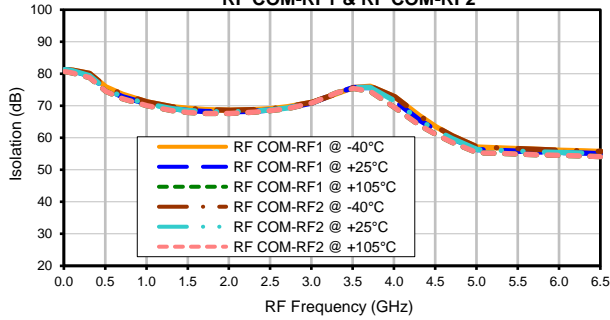
ON - Low insertion loss state  
OFF - Isolation state

## Typical Performance Curves

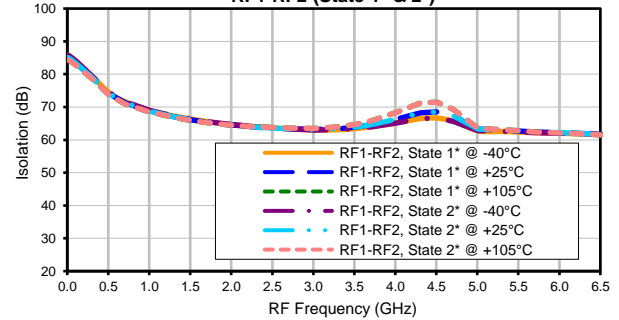
**Insertion Loss vs. Frequency & Temperature**  
RF COM-RF1 & RF COM-RF2



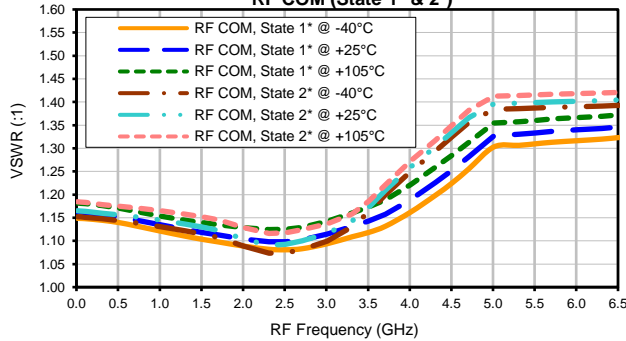
**Isolation vs. Frequency & Temperature**  
RF COM-RF1 & RF COM-RF2



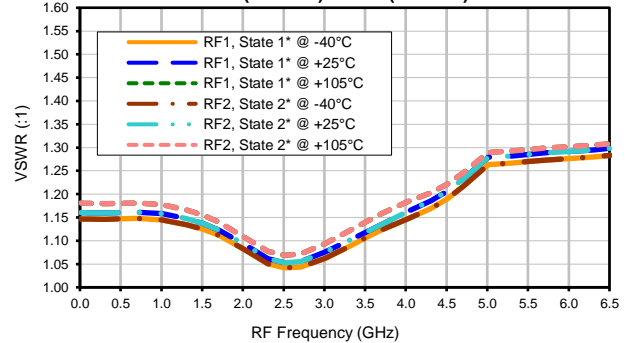
**Isolation vs. Frequency & Temperature**  
RF1-RF2 (State 1\* & 2\*)



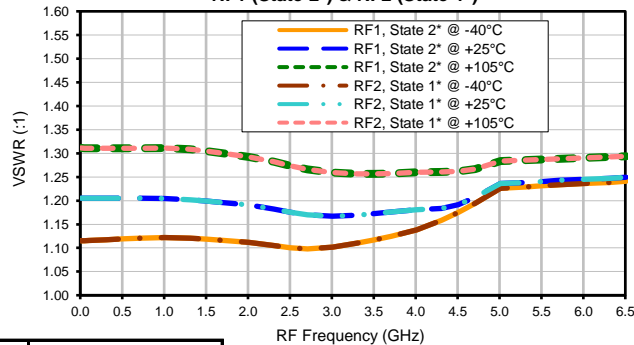
**VSWR vs. Frequency & Temperature**  
RF COM (State 1\* & 2\*)



**VSWR (ON) vs. Frequency & Temperature**  
RF1 (State 1\*) & RF2 (State 2\*)



**VSWR (OFF) vs. Frequency & Temperature**  
RF1 (State 2\*) & RF2 (State 1\*)



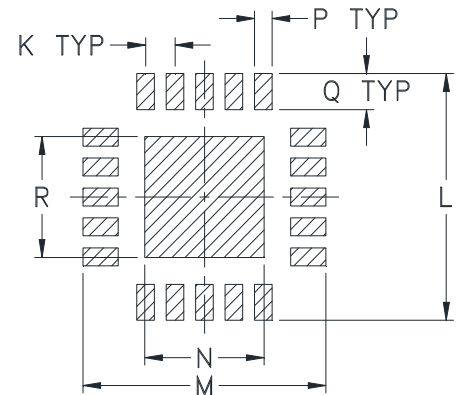
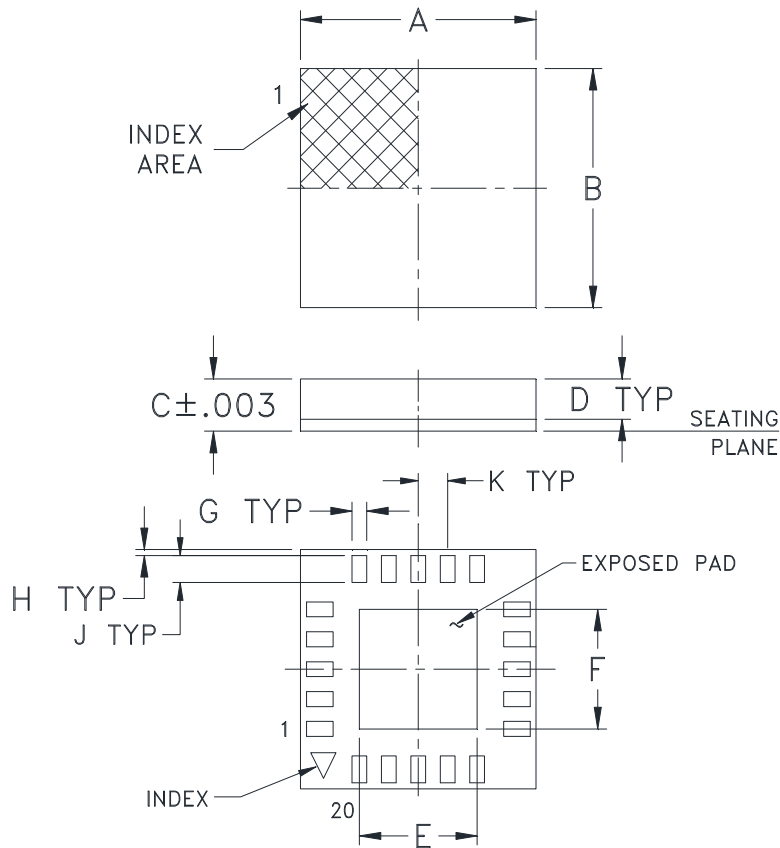
\*Note:

State	State of Control Voltage		RF Common to	
	Control 1	Control 2	RF1	RF2
1	HIGH	LOW	ON	OFF
2	LOW	HIGH	OFF	ON
3	LOW	LOW	OFF	OFF
4	HIGH	HIGH	UNSUPPORTED	

ON - Low insertion loss state  
OFF - Isolation state

### Outline Dimensions

### PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm .002$

CASE #	A	B	C	D	E	F	G	H	J	K
DG983-3	.157 (4.00)	.157 (4.00)	.037 (0.94)	.028 (0.70)	.079 (2.00)	.079 (2.00)	.010 (0.26)	.004 (0.10)	.016 (0.40)	.020 (0.50)

CASE #	L	M	N	P	Q	R	WT. GRAM
DG983-3	.165 (4.20)	.165 (4.20)	.081 (2.05)	.012 (0.31)	.024 (0.60)	.081 (2.05)	.04

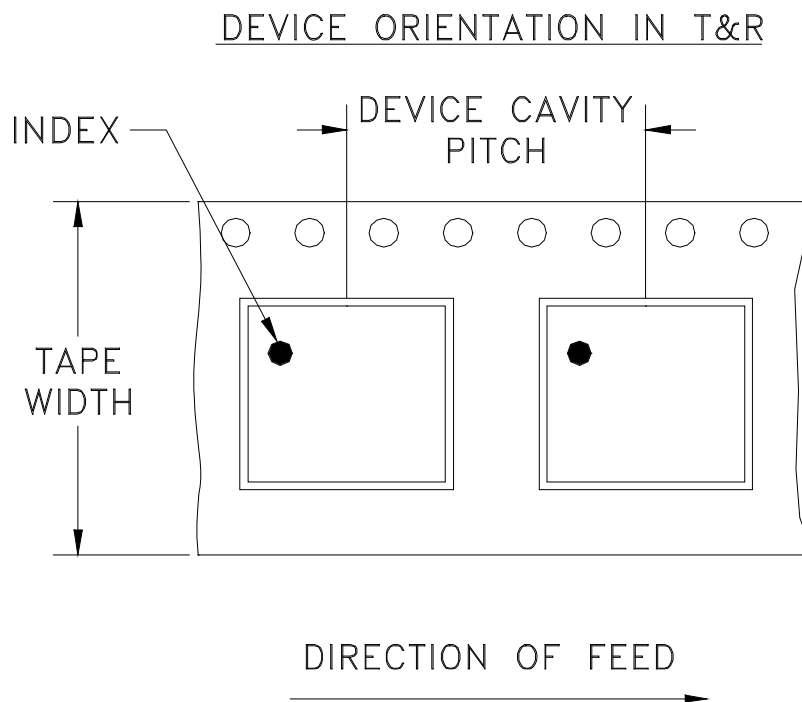
Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .01$ ; 3 Pl.  $\pm .005$

#### Notes:

- Case material: Plastic.
- Termination finish:
  - For RoHS Case Styles: 0.2  $\mu$ inches of Gold (Au) over 0.1  $\mu$ inches of Palladium (Pd) over 10  $\mu$ inches of Nickel (Ni). All models, (+) suffix.
  - For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.



# Tape & Reel Packaging TR-F87



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
12	8	7	Small quantity standards (see note)	20
				50
				100
				200
				500
		1000		
		13	Standard	3000

**Note : Please Consult individual model data sheet to determine device per reel availability**

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: [www.minicircuits.com/pages/pdfs/tape.pdf](http://www.minicircuits.com/pages/pdfs/tape.pdf)

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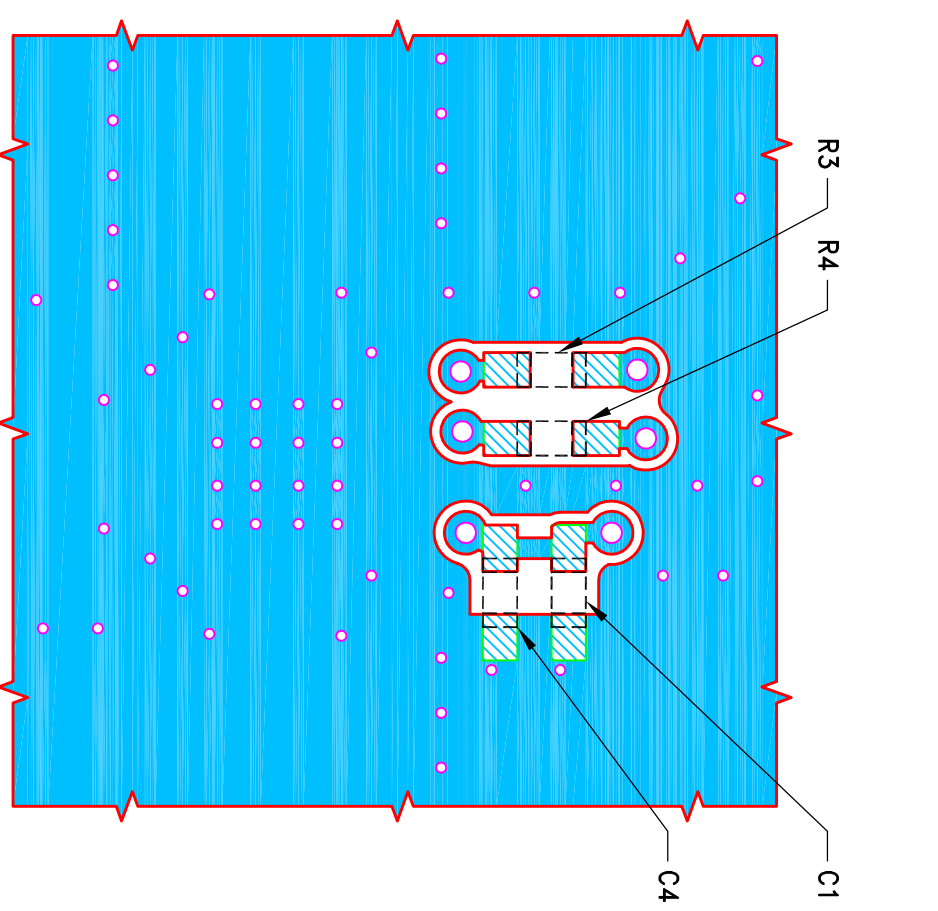
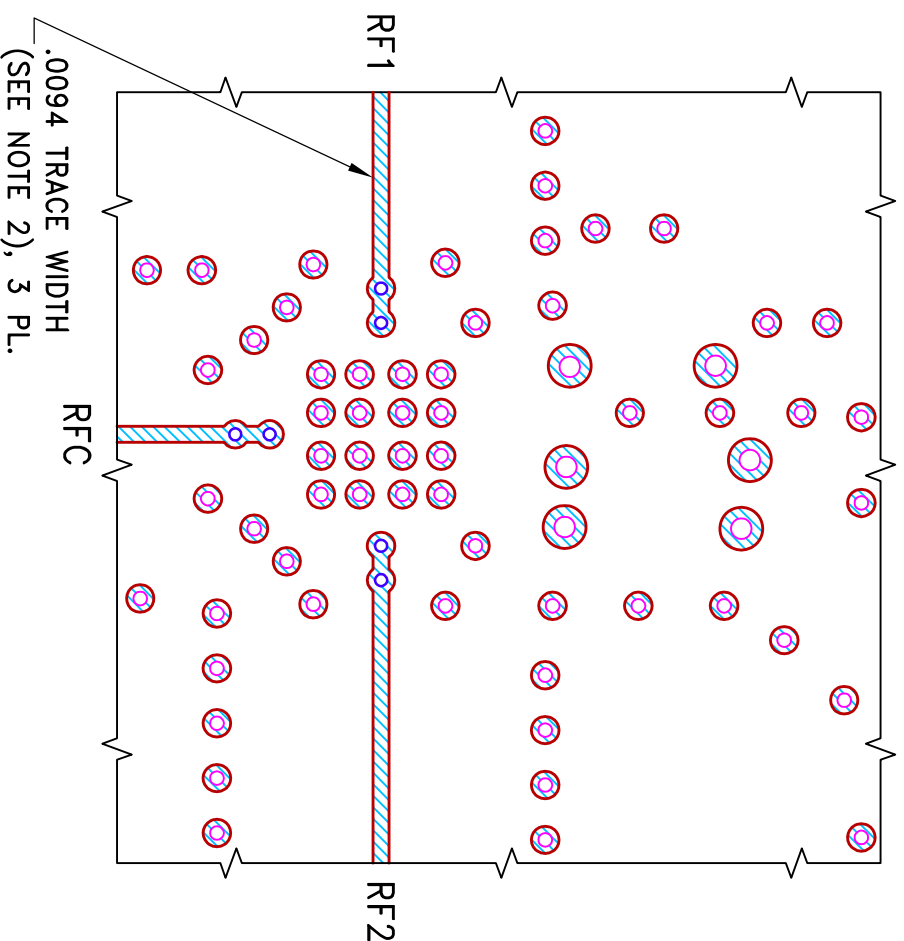
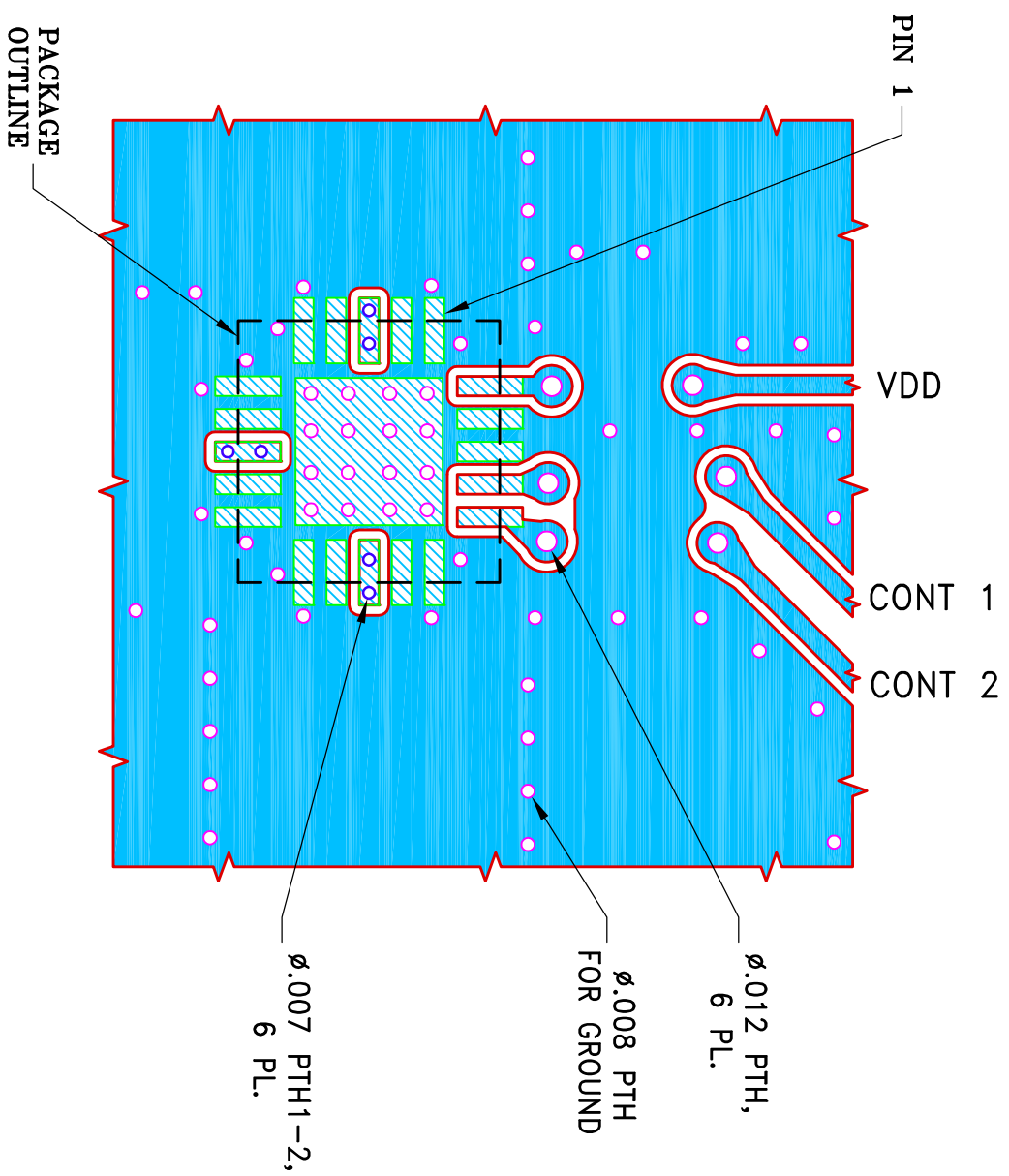
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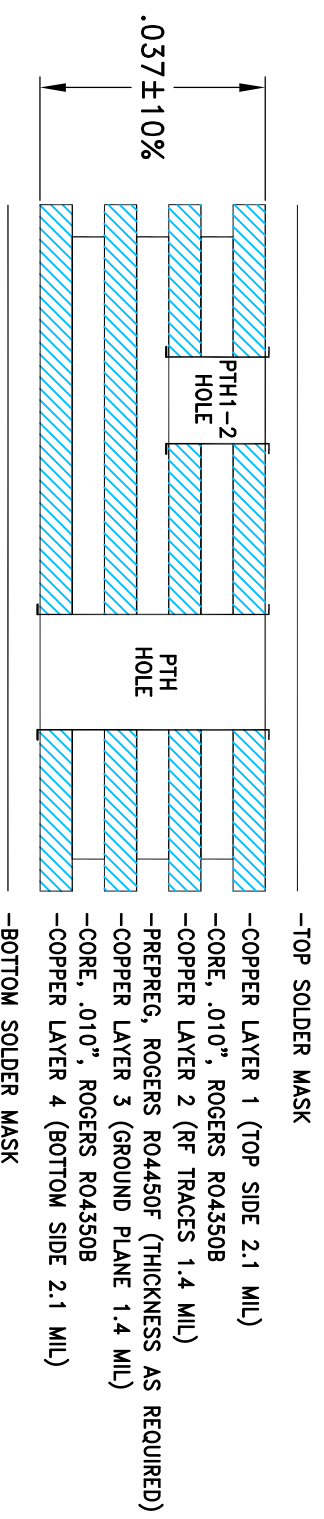
Mini-Circuits ISO 9001 & ISO 14001 Certified

SUGGESTED MOUNTING CONFIGURATION FOR  
DG983-3 CASE STYLE, "20SW01" PIN CODE

COMPONENT	SIZE
C1,C4,R3,R4	0402



STACK-UP DIAGRAM



-PTH HOLES PRESENT FROM COPPER LAYER 1 TO 4.  
-PTH1-2 HOLES PRESENT FROM COPPER LAYER 1 TO 2.

- TOP SOLDER MASK
- COPPER LAYER 1 (TOP SIDE 2.1 MIL)
- CORE, .010", ROGERS R04350B
- COPPER LAYER 2 (RF TRACES 1.4 MIL)
- PREPREG, ROGERS R04450F (THICKNESS AS REQUIRED)
- COPPER LAYER 3 (GROUND PLANE 1.4 MIL)
- CORE, .010", ROGERS R04350B
- COPPER LAYER 4 (BOTTOM SIDE 2.1 MIL)
- BOTTOM SOLDER MASK

NOTES:

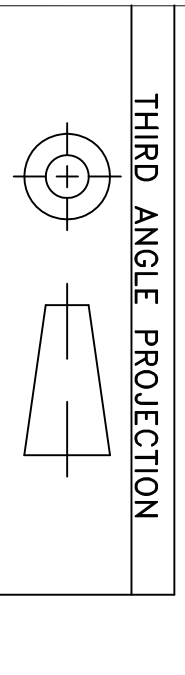
1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .010"±.001"; COPPER: SEE STACK-UP DIAGRAM. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
3. CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE.

- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
- DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED	INITIALS		DATE	
DIMENSIONS ARE IN INCHES	DRAWN	TTG	04/19/17	04/19/17
TOLERANCES ON:	CHECKED	IL	04/19/17	04/19/17
2 PL DECIMALS ±	APPROVED	RS	04/19/17	
3 PL DECIMALS ±	FRACTIONS ±			
ANGLES ±				
	Mini-Circuits			

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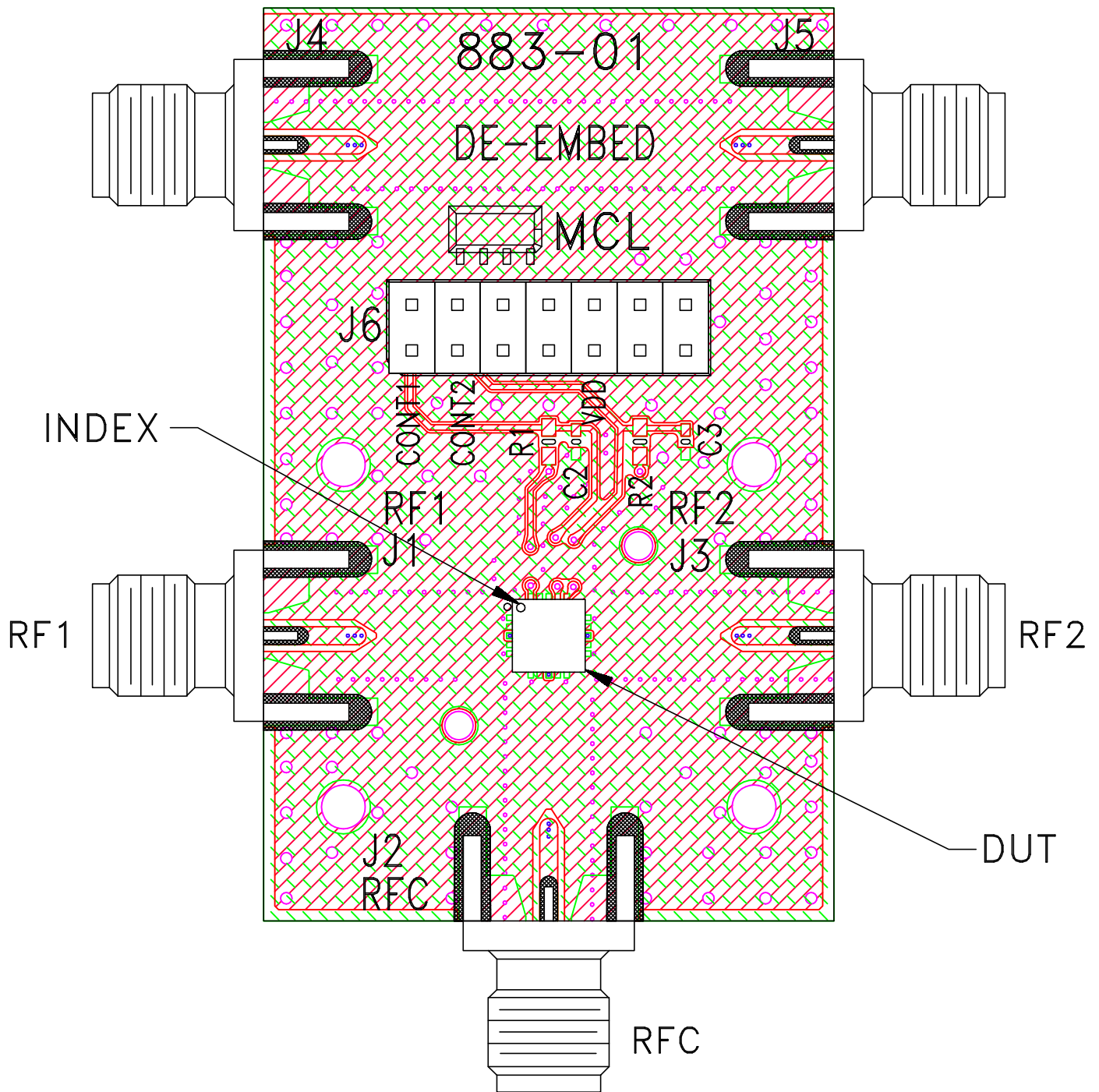
OR	NEW RELEASE	04/19/17	TTG	RS
REV	DESCRIPTION	DATE	DR	AUTH
M161288				
ECN No.				



REVISIONS		DATE		AUTH	
FILE:	98PL510	SCALE:	8:1	SHEET:	1 OF 1
SIZE	CODE IDENT	DRAWING NO:	REV:		
B	15542	98-PL-510	OR		
<b>Mini-Circuits</b> 13 Neptune Avenue Brooklyn NY 11235					
<b>PL, 20SW01, DG983-3, TB-919+</b>					




# Evaluation Board and Circuit



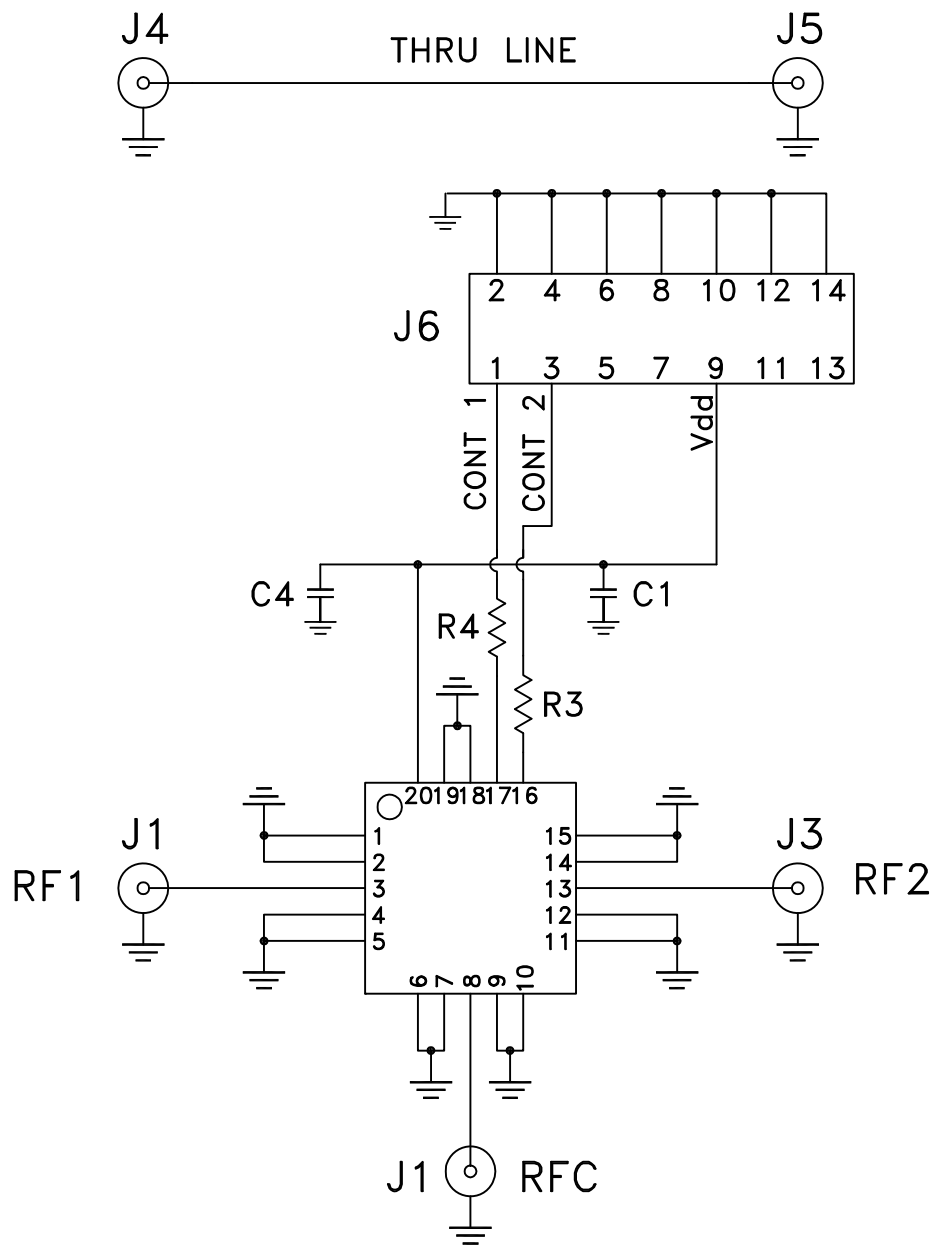
TB-919+

## Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.037 inch.


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# Evaluation Board and Circuit



COMPONENT	VALUE	SIZE
DUT	HSWA2-63DR+	4X4 MM
C1	0.1 uF	0402
C4	22 pF	
R3,R4	0 Ohm	

SCHEMATIC DIAGRAM

 Mini-Circuits®





All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

Specification	Test/Inspection Condition	Reference/Spec
Operating Temperature	-40° to 85° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-65° to 150° C Ambient Environment	Individual Model Data Sheet
Temperature Cycling	-65° to 150°C, 500 cycles	JESD22-A104, condition C
HAST	130°C, 85% RH, 33 PSIA, 96 hours, nominal bias	JESD22-A110
High Temp Storage	150°C 1000 hours	JESD22-A103
Solderability	Per Reference Spec	JESD22-B102
Moisture Sensitivity: Level 3	Bake at 125°C for 24 hours. Soak at 30°C/60%RH for 192 hours, Reflow at 260°C peak	J-STD-020