



Mini-Circuits

FAST SWITCHING

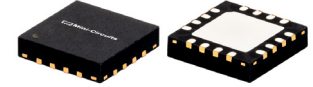
SPDT RF Switch

VSWA2-63DR+

50Ω 500 to 6000 MHz Absorptive RF Switch with Internal Driver
Single Supply Voltage, +3 V to +5 V

FEATURES

- High Isolation, 65 dB Typ. at 1 GHz
- Low Insertion Loss, 1.0 dB Typ. at 1 GHz
- High IP3, +50 dBm Typ. at 1 GHz
- Fast Switching, Rise/Fall Time, 23 ns Typ.
- Low Current Consumption, 12 μA Typ.



Generic photo used for illustration purposes only

CASE STYLE: DG1235-1

+RoHS Compliant

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

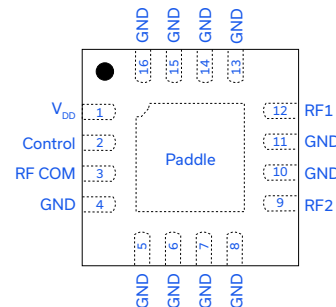
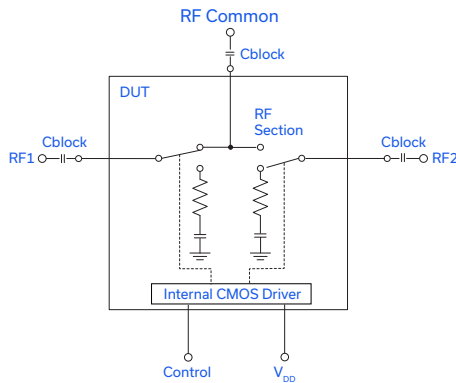
APPLICATIONS

- Automated Switching Networks
- Cellular/ PCS
- ISM, WCDMA, WiMAX, LTE

PRODUCT OVERVIEW

The VSWA2-63DR+ is a high isolation absorptive SPDT switch with integral CMOS driver, operates with single positive supply voltage while consuming, 12 μA typical. It has been designed for very wideband operation of 500 to 6000 MHz for 50Ω systems and yet is usable in 75Ω systems with degraded return loss. This switch is usable over an extended frequencies from 300 kHz to 500 MHz with reflective switch performance. It is packaged in a tiny 4x4x0.9 mm package and is rated MSL1 and class 1A ESD.

SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



Function	Pad Number	Description
RF COM	3	RF Common/SUM Port, Requires DC block (see Fig. 2)
RF1	12	RF Out #1/In Port #1, Requires DC block (see Fig. 2)
RF2	9	RF Out #2/In Port #2, Requires DC block (see Fig. 2)
Control	2	CMOS Control IN
V _{DD}	1	Supply Voltage
GND	4,5,6,7,8,10,11 13,14,15,16 & Paddle	RF Ground

REV. G
ECO-026600
VSWA2-63DR+
MCL NY
250818





FAST SWITCHING

SPDT RF Switch

VSWA2-63DR+

50Ω 500 to 6000 MHz Absorptive RF Switch with Internal Driver
Single Supply Voltage, +3 V to +5 V

RF ELECTRICAL SPECIFICATIONS¹, $T_{AMB} = +25^{\circ}\text{C}$, $V_{DD} = +3\text{ V TO } +5\text{ V}$

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range		500		6000	MHz
Insertion Loss ²	0.3-500		0.7		dB
	500-2000		0.7	1.3	
	2000-3000		0.8	1.5	
	3000-4000		0.9	1.5	
	4000-6000		1.0	1.9	
Isolation Between Common Port and RF1/RF2 Ports	0.3-500		73		dB
	500-2000	56	66		
	2000-3000	50	64		
	3000-4000	45	58		
	4000-6000	38	54		
Isolation Between RF1 and RF2 Ports	0.3-500		74		dB
	500-1000	50	60		
	1000-2000	45	56		
	2000-3000	40	52		
	3000-4000	38	50		
	4000-6000	34	46		
Return Loss (ON STATE)	0.3-500		24		dB
	500-2000		23		
	2000-3000		23		
	3000-4000		22		
	4000-6000		20		
Return Loss @ RF1/RF2 Ports (OFF STATE)	500-2000		23		dB
	2000-3000		33		
	3000-4000		23		
	4000-6000		24		
Input IP3	$V_{DD} = +3\text{ V}$	500-2000	+46		dBm
		2000-6000	+40		
	$V_{DD} = +5\text{ V}$	500-2000	+50		
		2000-6000	+44		
Input Compression ³	1 dB, $V_{DD} = +3\text{ V}$	500-2000	+24		dBm
		2000-6000	+22		
	0.2 dB, $V_{DD} = +5\text{ V}$	500-2000	+30		
		2000-6000	+27		

1. Tested on Mini-Circuit's test board TB-486+, using Agilent's N5230A network analyzer (see Characterization Test Circuit, Fig. 1).

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

3. Do not exceed RF input power as shown in Absolute Maximum Rating table.

DC ELECTRICAL SPECIFICATIONS

Parameter	Min.	Typ.	Max.	Units
V_{DD} , Supply Voltage	+3		+5	V
Supply Current ($V_{DD} = +5\text{ V}$) ⁴		50		μA
Control Voltage Low	0		+0.5	V
Control Voltage High ⁵	+2.7 ⁶		V_{DD}	V
Control Current		5		μA

4. Supply current increases with switching repetition rate. See graph.

5. CMOS interface. Latch up condition may occur when logic high signal is applied prior to power supply.

6. +3.5 V for $V_{DD} = +4\text{ V to } +5\text{ V}$ 

**FAST SWITCHING**

SPDT RF Switch

VSWA2-63DR+

50Ω 500 to 6000 MHz Absorptive RF Switch with Internal Driver
 Single Supply Voltage, +3 V to +5 V

SWITCHING SPECIFICATIONS

Parameter	Min.	Typ.	Max.	Units
Rise/Fall Time (10 to 90% or 90 to 10% RF)		23		ns
Switching Time, 50% CTRL to 90/10% RF		35		ns
Video Feed-Through, (Control 0 to +3 V, Freq. = 500 KHz, $V_{DD} = +5$ V)		25		mV _{p,p}

ABSOLUTE MAXIMUM RATINGS⁷

Parameter	Ratings
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
V_{DD} , Supply Voltage	+2.7 V to +5.5 V
Voltage Control	-0.2 V min., V_{DD} max.
RF Input Power	1 W
Dissipated Power at +25°C	350 mW

7. 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
LOW	ON	OFF
HIGH	OFF	ON

ON - Low Insertion Loss State

OFF - Isolation State





FAST SWITCHING

SPDT RF Switch

VSWA2-63DR+

50Ω 500 to 6000 MHz Absorptive RF Switch with Internal Driver
Single Supply Voltage, +3 V to +5 V

CHARACTERIZATION TEST CIRCUIT

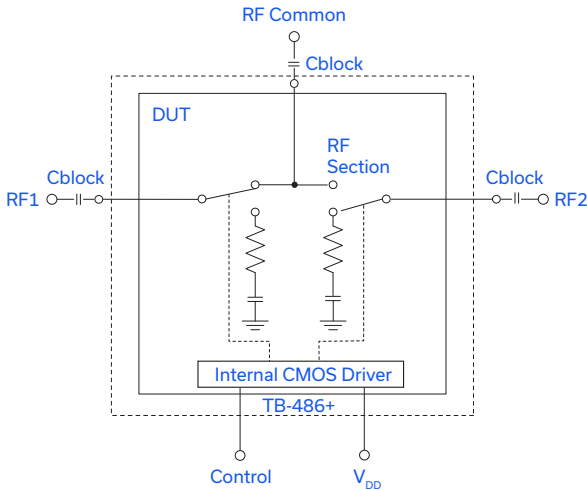


Figure 1. Block Diagram of Test Circuit Used for Characterization (DUT Soldered on Mini-Circuits' TB-486+)

Test Equipment:

For Insertion Loss, Isolation, Return Loss and DC Current:

Agilent's N5230A Network Analyzer, E3631A power supply. Cblock: Internal to network Analyzer.

For Switching Time and DC Current:

Agilent's 54832B oscilloscope, 81110A pulse generator and E3631 A power supply. Cblock: Mini-Circuits BLK-18-S+

For Input IP3:

Mini-Circuits DC blocks: BLK-18-S+ on all ports, Agilent's E8257D signal generators, 437B power meter, N9020A Signal analyzer and E3631 A power supply.

For Compression:

Mini-Circuits DC blocks: BLK-18-S+ on all ports. ZVE-8G and ZHL-42W amplifier as driver amplifier at RF Common.

Agilent's N5230A Network Analyzer, E3631A power supply

Conditions:

$V_{DD} = +3\text{ V}$ and $+5\text{ V}$, Control = 0 V and $+3\text{ V}$

For Insertion Loss, Isolation and Return Loss: $P_{IN} = 0\text{ dBm}$

For Input IP3: $P_{IN} = -5\text{ dBm/ tone}$

For Switching Time: RF Frequency: 500 MHz at 0 dBm, Control Frequency: 500 KHz and 0 V and $+3\text{ V}$

RECOMMENDED APPLICATION CIRCUIT

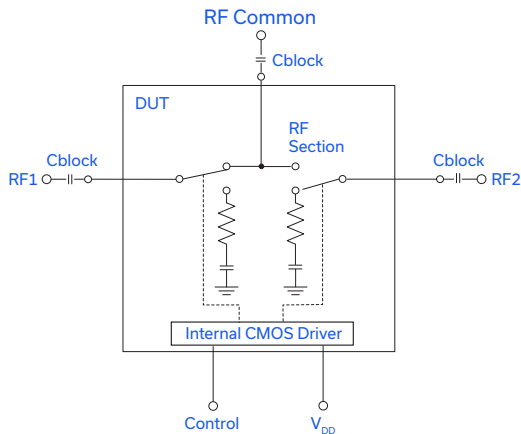
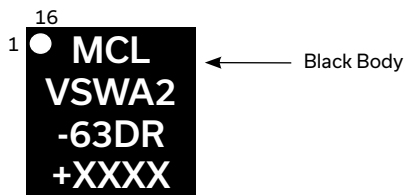


Figure 2. Evaluation board includes case, connectors, and components soldered to PCB.

Frequency (MHz)	Cblock (Suggested Value)
0.3-500	0.1 μF
500-6000	47 pF

Cblock should be free of resonance over frequency of operation.

PRODUCT MARKING



Marking may contain other features or characters for internal lot control.





FAST SWITCHING

SPDT RF Switch

VSWA2-63DR+

50Ω 500 to 6000 MHz Absorptive RF Switch with Internal Driver
Single Supply Voltage, +3 V to +5 V

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

Performance Data	Data Table
	Swept Graphs
Case Style	DG1235-1 Plastic package, Lead Finish: Nickel Palladium Gold
Tape & Reel	F87
Standard Quantities Available on Reel	7" Reels with 20, 50, 100, 200, or 500 devices 13" Reels with 3000 devices
Suggested Layout for PCB Design	PL-278
Evaluation Board	TB-486+
Environmental Ratings	ENV41

ESD RATING

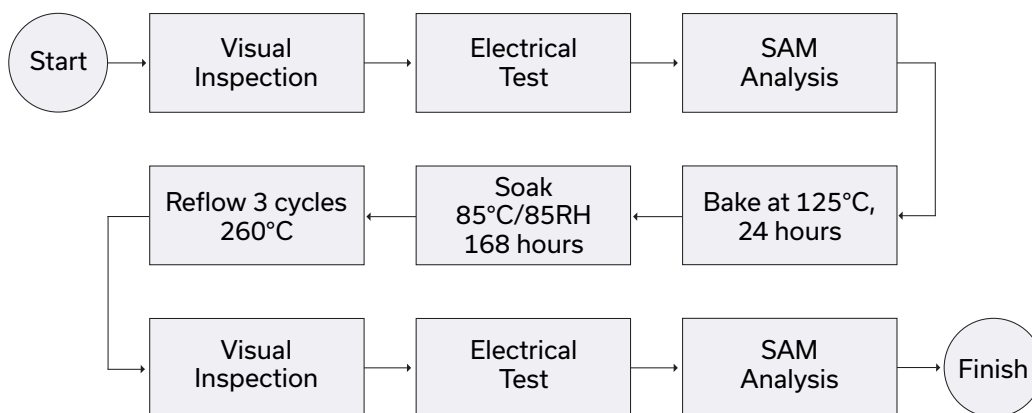
Human Body Model (HBM): Class 1A (250 to < 500 V) in accordance with JESD22-A114

Machine Model (MM): Class A (Passes 50 V) in accordance with JESD22-A115

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

MSL TEST FLOW CHART



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/terms/viewterm.html



RF Switch SPDT

VSWA2-63DR+

Typical Performance Data

RF FREQ (MHz)	INSERTION LOSS				RF FREQ (MHz)	ISOLATION							
	VDD=+3V (dB)		VDD=+5V (dB)			VDD=+3V (dB)		VDD=+5V (dB)		VDD=+3V (dB)		VDD=+5V (dB)	
	RF COM-RF1	RF COM-RF2	RF COM-RF1	RF COM-RF2		RF COM-RF1	RF COM-RF2	RF COM-RF1	RF COM-RF2	RF1-RF2 State LOW*	RF1-RF2 State HIGH*	RF1-RF2 State LOW*	RF1-RF2 State HIGH*
0.3	0.87	0.88	0.86	0.86	0.3	88.66	99.00	89.65	89.93	103.84	93.40	87.91	92.90
0.5	0.90	0.90	0.90	0.89	0.5	96.22	97.27	93.19	92.84	94.19	89.91	92.70	86.59
1.0	0.90	0.89	0.91	0.89	1.0	108.36	100.23	98.89	101.81	101.08	110.13	95.93	106.23
5.0	0.89	0.86	0.91	0.86	5.0	86.99	79.30	90.21	81.62	80.92	87.16	83.46	88.15
10.0	0.88	0.83	0.90	0.84	10.0	82.21	73.18	84.33	74.69	74.47	82.88	75.65	85.82
50.0	0.91	0.83	0.92	0.84	50.0	74.88	60.17	75.61	61.25	61.49	74.64	62.50	75.83
100.0	0.91	0.83	0.93	0.85	100.0	70.60	58.46	71.24	58.97	59.93	69.51	60.39	70.28
200.0	0.92	0.84	0.94	0.86	200.0	69.14	59.86	69.61	60.18	61.63	66.17	61.75	66.61
300.0	0.93	0.85	0.94	0.87	300.0	68.79	61.18	69.09	61.47	62.09	63.81	62.14	64.38
400.0	0.93	0.86	0.95	0.88	400.0	68.93	61.94	69.07	62.21	61.21	62.00	61.20	62.48
500.0	0.94	0.87	0.96	0.89	500.0	69.44	62.60	69.48	62.81	59.82	60.36	59.89	60.85
600.0	0.95	0.88	0.97	0.91	600.0	69.16	62.64	69.18	62.84	58.35	58.85	58.40	59.34
700.0	0.96	0.89	0.98	0.92	700.0	69.23	62.78	69.06	62.91	57.16	57.70	57.24	58.12
800.0	0.96	0.90	0.98	0.92	800.0	69.67	62.66	69.06	62.76	56.08	56.66	56.15	57.07
900.0	0.96	0.90	0.97	0.91	900.0	70.09	62.68	69.45	62.77	55.08	55.67	55.16	56.05
1000.0	0.97	0.91	0.98	0.92	1000.0	70.44	62.61	69.72	62.69	54.22	54.80	54.29	55.21
1200.0	0.99	0.94	1.01	0.96	1200.0	71.00	62.29	69.15	62.03	52.79	53.28	52.85	53.71
1500.0	1.03	0.99	1.05	1.02	1500.0	73.24	62.11	70.68	61.73	50.86	51.27	51.00	51.59
1700.0	1.05	1.00	1.07	1.03	1700.0	78.96	62.42	73.04	61.84	49.74	50.06	49.83	50.38
2000.0	1.09	1.04	1.13	1.08	2000.0	74.87	64.61	79.90	64.20	48.13	48.67	48.15	48.72
2200.0	1.13	1.07	1.16	1.10	2200.0	70.18	64.16	69.96	63.52	47.40	47.86	47.46	48.01
2500.0	1.16	1.10	1.20	1.14	2500.0	64.32	60.98	63.58	60.17	46.47	46.77	46.54	46.90
2700.0	1.18	1.12	1.22	1.17	2700.0	61.66	58.96	61.22	58.56	45.85	45.98	45.84	46.07
3000.0	1.22	1.16	1.28	1.21	3000.0	61.35	57.26	62.47	56.94	44.76	44.60	44.70	44.45
3200.0	1.21	1.14	1.25	1.18	3200.0	58.20	55.31	57.60	55.00	44.21	44.14	44.21	44.12
3500.0	1.21	1.14	1.25	1.19	3500.0	56.58	53.41	56.54	52.90	43.31	43.24	43.28	43.09
3700.0	1.21	1.14	1.25	1.18	3700.0	54.63	52.04	53.88	51.48	42.83	42.71	42.79	42.56
4000.0	1.25	1.16	1.30	1.21	4000.0	52.54	50.50	51.81	50.15	42.07	41.90	41.96	41.66
4200.0	1.26	1.17	1.31	1.22	4200.0	50.91	49.70	50.22	49.14	41.79	41.38	41.70	41.11
4500.0	1.33	1.24	1.37	1.27	4500.0	50.59	48.83	49.74	48.14	41.31	40.61	41.15	40.25
4700.0	1.35	1.25	1.38	1.28	4700.0	49.47	48.11	48.91	47.37	41.17	40.24	40.93	39.89
5000.0	1.43	1.33	1.43	1.33	5000.0	49.00	46.66	47.58	46.01	40.83	39.64	40.52	39.21
5200.0	1.47	1.36	1.46	1.36	5200.0	49.58	45.75	48.16	45.32	40.59	39.47	40.29	38.96
5500.0	1.45	1.37	1.43	1.35	5500.0	50.57	44.72	48.55	44.04	40.05	39.43	39.79	38.81
5700.0	1.45	1.38	1.41	1.35	5700.0	50.68	44.07	48.40	43.28	39.59	39.35	39.34	38.70
6000.0	1.44	1.40	1.39	1.36	6000.0	51.38	44.33	48.09	43.04	38.96	39.22	38.72	38.55

*Note

State of Control Voltage	RF Common to	
	RF1	RF2
LOW	ON	OFF
HIGH	OFF	ON
ON - Low insertion loss state		
OFF - Isolation state		



RF Switch SPDT

VSWA2-63DR+

Typical Performance Data

RF FREQ (MHz)	VSWR (:1)								RF FREQ (MHz)	VSWR (:1)			
	VDD=+3V				VDD=+5V					VDD=+3V		VDD=+5V	
	RF COM State LOW*	RF COM State HIGH*	RF1 State LOW*	RF2 State HIGH*	RF COM State LOW*	RF COM State HIGH*	RF1 State LOW*	RF2 State HIGH*		RF1 State HIGH*	RF2 State LOW*	RF1 State HIGH*	RF2 State LOW*
0.3	1.20	1.20	1.20	1.20	1.21	1.21	1.21	1.21	500.0	1.84	1.87	1.86	1.89
0.5	1.20	1.20	1.20	1.20	1.21	1.21	1.21	1.21	600.0	1.80	1.83	1.82	1.85
1.0	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	700.0	1.78	1.80	1.80	1.83
5.0	1.19	1.18	1.19	1.18	1.19	1.18	1.19	1.18	800.0	1.77	1.80	1.79	1.82
10.0	1.17	1.18	1.17	1.18	1.18	1.18	1.18	1.18	900.0	1.77	1.79	1.79	1.82
50.0	1.16	1.18	1.16	1.18	1.16	1.18	1.16	1.18	1000.0	1.77	1.80	1.79	1.83
100.0	1.16	1.18	1.16	1.18	1.16	1.19	1.16	1.19	1200.0	1.78	1.80	1.80	1.83
200.0	1.16	1.19	1.16	1.18	1.17	1.19	1.17	1.19	1500.0	1.80	1.83	1.83	1.86
300.0	1.16	1.19	1.16	1.18	1.17	1.19	1.16	1.19	1700.0	1.82	1.85	1.85	1.89
400.0	1.17	1.19	1.16	1.18	1.18	1.20	1.16	1.19	2000.0	1.84	1.88	1.87	1.92
500.0	1.17	1.20	1.16	1.18	1.18	1.20	1.16	1.19	2200.0	1.85	1.89	1.89	1.93
600.0	1.18	1.20	1.16	1.18	1.19	1.21	1.16	1.18	2500.0	1.86	1.89	1.90	1.93
700.0	1.19	1.21	1.15	1.18	1.19	1.21	1.16	1.18	2700.0	1.85	1.88	1.89	1.92
800.0	1.19	1.21	1.15	1.17	1.19	1.21	1.16	1.18	3000.0	1.82	1.84	1.86	1.89
900.0	1.19	1.21	1.15	1.17	1.19	1.21	1.15	1.17	3200.0	1.78	1.80	1.83	1.85
1000.0	1.19	1.21	1.15	1.17	1.20	1.22	1.15	1.17	3500.0	1.71	1.73	1.75	1.78
1200.0	1.19	1.21	1.14	1.16	1.19	1.21	1.15	1.16	3700.0	1.65	1.67	1.70	1.72
1500.0	1.19	1.21	1.16	1.17	1.20	1.21	1.17	1.18	4000.0	1.56	1.58	1.61	1.63
1700.0	1.21	1.21	1.20	1.21	1.22	1.22	1.21	1.22	4200.0	1.50	1.51	1.54	1.56
2000.0	1.25	1.25	1.28	1.29	1.28	1.27	1.30	1.31	4500.0	1.41	1.41	1.45	1.46
2200.0	1.30	1.30	1.36	1.36	1.32	1.32	1.38	1.39	4700.0	1.35	1.35	1.39	1.40
2500.0	1.36	1.36	1.46	1.47	1.39	1.38	1.49	1.50	5000.0	1.26	1.27	1.30	1.32
2700.0	1.40	1.39	1.52	1.52	1.43	1.42	1.55	1.56	5200.0	1.22	1.24	1.25	1.28
3000.0	1.42	1.41	1.55	1.55	1.47	1.45	1.59	1.59	5500.0	1.16	1.19	1.20	1.24
3200.0	1.40	1.38	1.55	1.54	1.44	1.42	1.59	1.59	5700.0	1.13	1.17	1.17	1.22
3500.0	1.36	1.35	1.49	1.49	1.41	1.39	1.53	1.54	6000.0	1.10	1.17	1.14	1.22
3700.0	1.33	1.32	1.43	1.43	1.38	1.36	1.48	1.48					
4000.0	1.34	1.33	1.37	1.35	1.38	1.36	1.41	1.40					
4200.0	1.37	1.36	1.35	1.32	1.40	1.38	1.39	1.36					
4500.0	1.44	1.43	1.35	1.30	1.45	1.43	1.37	1.32					
4700.0	1.48	1.47	1.36	1.31	1.50	1.47	1.38	1.32					
5000.0	1.50	1.48	1.39	1.32	1.50	1.47	1.39	1.32					
5200.0	1.52	1.49	1.40	1.32	1.52	1.48	1.40	1.32					
5500.0	1.53	1.51	1.39	1.32	1.52	1.49	1.39	1.31					
5700.0	1.52	1.50	1.37	1.29	1.50	1.48	1.36	1.29					
6000.0	1.48	1.48	1.32	1.27	1.44	1.44	1.31	1.27					

*Note

State of Control Voltage	RF Common to	
	RF1	RF2
LOW	ON	OFF
HIGH	OFF	ON
ON - Low insertion loss state		
OFF - Isolation state		

Typical Performance Data

RF FREQ (MHz)	INPUT IP3				DC Current vs Repetition Rate			RF FREQ (MHz)	INPUT 1dB COMPRESSION	
	VDD=+3V		VDD =+5V		IDD (micro A)				VDD=+3V	VDD =+5V
	(dBm)		(dBm)		Typ.				(dBm)	(dBm)
	RF COM-RF1	RF COM-RF2	RF COM-RF1	RF COM-RF2	Rep Rate (MHz)	VDD=+3V	VDD=+5V		Pin	Pin
500.0	48.68	48.14	52.14	51.26	0.0005	0.8	6.4	500.0	24.52	30.90
700.0	47.74	47.96	50.23	50.23	1.0	62.5	93.8	600.0	23.99	30.51
900.0	46.29	45.98	50.14	49.78	2.0	121.3	176.0	700.0	24.29	30.86
1000.0	46.09	45.75	50.44	50.05	3.0	175.3	252.5	800.0	23.99	30.59
1250.0	45.26	45.10	49.31	49.06	4.0	233.5	334.0	900.0	23.84	30.39
1500.0	45.12	44.89	49.65	49.35	5.0	282.5	409.3	1000.0	23.86	30.51
1750.0	44.62	44.46	49.20	48.88	6.0	319.0	462.0	1100.0	23.86	30.53
2000.0	43.65	43.55	47.62	47.78	7.0	386.5	559.5	1200.0	23.77	30.58
2500.0	42.40	42.22	46.94	47.01	8.0	432.8	614.8	1300.0	24.58	30.95
3000.0	40.70	40.68	45.78	45.68	9.0	491.0	729.5	1400.0	24.46	30.75
3500.0	38.61	38.61	43.12	43.33	10.0	540.5	776.8	1500.0	24.36	30.92
4000.0	38.09	38.20	42.75	43.01				1600.0	24.41	31.02
4500.0	35.62	35.98	40.94	41.53				1700.0	24.56	31.37
5000.0	36.21	36.61	40.71	41.32				1800.0	24.27	31.07
5500.0	33.90	34.19	38.28	38.96				1900.0	24.17	30.97
6000.0	34.14	34.38	39.72	40.31				2000.0	24.70	31.29
								2250.0	23.80	29.86
								2500.0	23.65	29.78
								2750.0	23.42	29.71
								3000.0	22.64	29.22
								3250.0	21.99	28.40
								3500.0	22.15	28.31
								3750.0	22.26	28.17
								4000.0	22.00	27.80
								4250.0	21.09	27.36
								4500.0	19.90	26.68
								4750.0	20.31	26.60
								5000.0	20.84	26.87
								5250.0	21.02	26.80
								5500.0	20.85	26.92
								5750.0	21.15	27.43
								6000.0	21.01	27.32

RF Switch SPDT

VSWA2-63DR+

Typical Performance Data

RF FREQ (MHz)	INSERTION LOSS @ VDD=+5V OVER TEMPERTURE						RF FREQ (MHz)	ISOLATION @ VDD=+5V OVER TEMPERTURE											
	RF COM-RF1 (dB)			RF COM-RF2 (dB)				RF COM-RF1 (dB)			RF COM-RF2 (dB)			RF1-RF2 (ON1) (dB)			RF1-RF2 (ON2) (dB)		
														State LOW*			State HIGH*		
	-55°C	+25°C	+100°C	-55°C	+25°C	+100°C		-55°C	+25°C	+100°C	-55°C	+25°C	+100°C	-55°C	+25°C	+100°C	-55°C	+25°C	+100°C
0.3	0.56	0.75	0.83	0.55	0.73	0.81	0.3	114.38	103.15	115.23	99.44	89.97	100.82	101.92	95.87	91.16	106.53	114.92	93.32
0.5	0.56	0.75	0.83	0.56	0.72	0.81	0.5	111.04	109.99	102.14	105.42	96.46	97.30	108.02	100.24	92.77	102.89	102.75	109.94
1.0	0.57	0.76	0.84	0.57	0.73	0.82	1.0	105.33	101.91	101.32	103.86	98.76	92.11	107.16	96.99	92.04	108.97	103.86	104.47
5.0	0.59	0.77	0.85	0.56	0.71	0.80	5.0	88.99	90.50	90.90	83.47	82.25	81.01	83.35	83.21	81.69	88.63	89.64	91.09
10.0	0.61	0.77	0.85	0.57	0.71	0.79	10.0	79.77	81.92	83.52	74.96	74.34	74.02	75.07	75.63	74.96	80.09	82.34	83.26
50.0	0.67	0.80	0.85	0.57	0.71	0.79	50.0	77.90	77.19	76.54	61.43	60.87	60.74	62.44	62.27	62.27	78.26	77.34	76.93
100.0	0.67	0.80	0.86	0.57	0.72	0.80	100.0	71.75	71.84	71.72	57.72	58.23	58.85	58.78	59.65	60.42	70.77	71.40	71.31
200.0	0.69	0.82	0.88	0.58	0.74	0.82	200.0	70.32	70.24	70.21	58.19	59.36	60.30	59.73	61.12	62.24	67.86	68.07	68.32
300.0	0.69	0.83	0.90	0.59	0.76	0.85	300.0	69.36	70.06	69.70	59.62	60.78	61.82	61.22	62.35	63.25	65.62	66.14	66.40
400.0	0.69	0.84	0.92	0.59	0.77	0.87	400.0	69.64	69.97	70.02	60.53	61.73	62.39	61.91	62.72	63.19	64.32	64.58	64.70
500.0	0.69	0.85	0.93	0.60	0.78	0.89	500.0	68.84	69.64	69.93	61.19	62.22	62.84	61.54	61.89	61.95	63.29	63.06	63.19
600.0	0.69	0.85	0.94	0.60	0.79	0.90	600.0	70.18	70.53	70.18	62.22	63.03	63.61	60.83	60.98	60.75	61.44	61.72	61.67
700.0	0.69	0.86	0.96	0.61	0.81	0.92	700.0	70.83	70.93	71.18	62.91	63.47	63.43	60.05	59.97	59.93	60.26	60.53	60.61
800.0	0.69	0.87	0.97	0.62	0.82	0.94	800.0	69.27	70.40	69.80	64.34	64.27	64.08	59.12	59.14	58.75	59.65	59.57	59.58
900.0	0.69	0.89	0.99	0.62	0.83	0.95	900.0	71.95	72.66	71.72	64.31	64.12	63.50	58.18	58.06	57.87	58.27	58.56	58.65
1000.0	0.70	0.90	1.00	0.63	0.85	0.97	1000.0	71.58	74.07	71.80	65.13	63.73	63.63	57.15	57.35	56.97	57.48	57.50	57.79
1200.0	0.71	0.92	1.03	0.65	0.88	1.01	1200.0	74.51	75.55	74.72	66.25	64.39	62.97	55.80	55.66	55.71	55.81	56.05	56.20
1500.0	0.73	0.97	1.09	0.68	0.93	1.07	1500.0	74.28	80.61	76.49	67.00	64.35	62.77	53.98	54.04	53.97	53.68	54.03	54.07
1700.0	0.75	0.99	1.13	0.71	0.96	1.11	1700.0	68.23	75.16	80.20	68.73	65.33	62.72	52.65	52.81	53.04	52.13	52.61	52.82
2000.0	0.77	1.03	1.17	0.73	1.00	1.16	2000.0	67.45	73.04	76.95	67.74	65.42	63.97	51.09	51.37	51.43	50.97	51.18	51.49
2200.0	0.81	1.08	1.20	0.76	1.04	1.17	2200.0	62.91	68.48	70.37	64.88	64.98	61.66	50.51	50.68	51.16	49.72	50.34	50.23
2500.0	0.84	1.13	1.25	0.79	1.09	1.22	2500.0	60.94	63.49	64.71	62.89	62.33	63.91	49.02	49.71	49.62	49.46	49.54	49.90
2700.0	0.89	1.18	1.29	0.86	1.13	1.27	2700.0	57.46	61.67	66.90	60.17	61.63	61.46	48.67	48.94	49.09	48.99	48.63	49.14
3000.0	0.96	1.22	1.36	0.92	1.18	1.34	3000.0	57.98	59.31	62.38	56.63	59.26	58.88	48.05	48.27	48.68	47.08	47.63	47.93
3200.0	0.93	1.22	1.36	0.88	1.17	1.33	3200.0	56.21	57.76	59.54	55.71	58.34	58.40	47.22	47.60	47.78	46.36	47.13	46.83
3500.0	0.94	1.23	1.37	0.91	1.20	1.36	3500.0	56.90	56.26	59.15	52.68	56.69	56.29	46.14	46.44	47.07	45.10	45.80	45.53
3700.0	0.93	1.22	1.38	0.88	1.19	1.36	3700.0	52.49	55.21	54.36	54.74	54.40	60.01	45.26	46.13	46.29	44.67	45.49	45.16
4000.0	0.93	1.22	1.40	0.90	1.21	1.40	4000.0	53.45	54.51	55.04	51.21	53.61	55.24	45.41	45.35	45.62	44.41	44.66	45.05
4200.0	0.88	1.23	1.42	0.87	1.21	1.41	4200.0	51.70	53.41	51.92	51.71	53.35	61.44	44.48	45.04	45.05	43.79	44.01	44.02
4500.0	0.92	1.27	1.45	0.90	1.24	1.44	4500.0	53.18	51.76	54.38	50.33	52.90	52.46	43.85	44.52	44.54	43.56	43.63	43.95
4700.0	0.94	1.33	1.52	0.91	1.30	1.49	4700.0	50.63	49.95	52.40	49.10	52.02	54.83	43.61	44.28	44.75	42.92	43.05	42.76
5000.0	1.08	1.45	1.66	1.03	1.42	1.63	5000.0	46.65	50.23	48.38	52.01	52.20	52.22	43.62	44.18	44.66	42.16	42.41	42.65
5200.0	1.09	1.50	1.73	1.10	1.49	1.72	5200.0	48.86	50.35	50.09	48.78	51.42	51.17	43.68	43.73	44.18	42.16	42.04	41.91
5500.0	1.13	1.55	1.77	1.15	1.54	1.77	5500.0	50.24	50.56	52.69	50.01	50.55	50.21	43.61	43.51	43.94	41.52	41.72	41.52
5700.0	1.07	1.51	1.77	1.11	1.51	1.80	5700.0	49.56	50.77	50.84	47.72	49.74	51.45	43.46	43.03	43.38	41.56	41.28	41.24
6000.0	1.03	1.47	1.74	1.10	1.50	1.82	6000.0	48.67	50.89	51.40	46.62	49.04	50.54	42.79	42.21	42.31	41.12	40.77	41.00

*Note

State of Control Voltage	RF Common to	
	RF1	RF2
LOW	ON	OFF
HIGH	OFF	ON
ON - Low insertion loss state		
OFF - Isolation state		

RF Switch SPDT

VSWA2-63DR+

Typical Performance Data

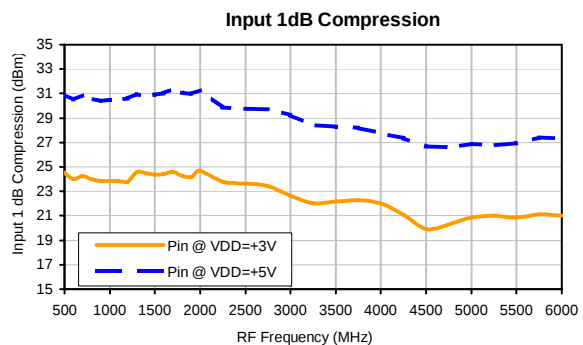
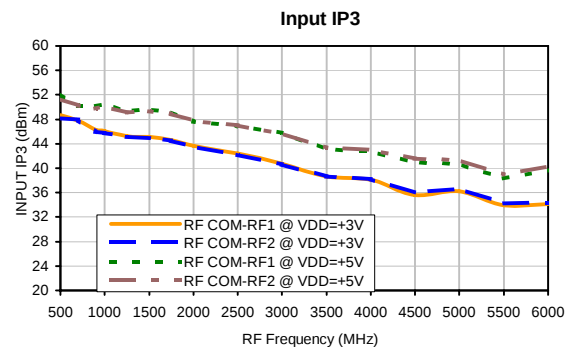
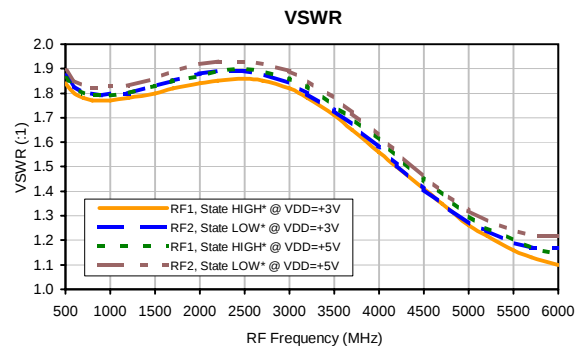
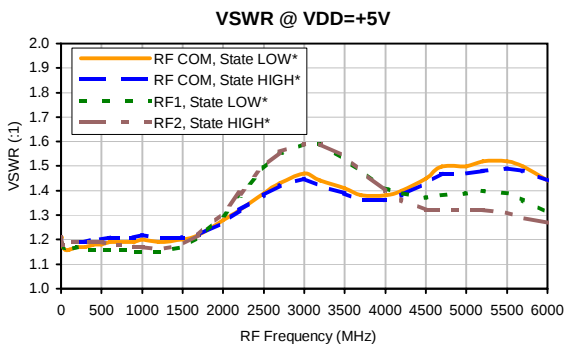
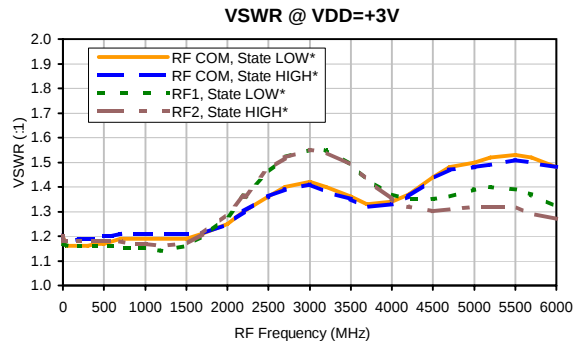
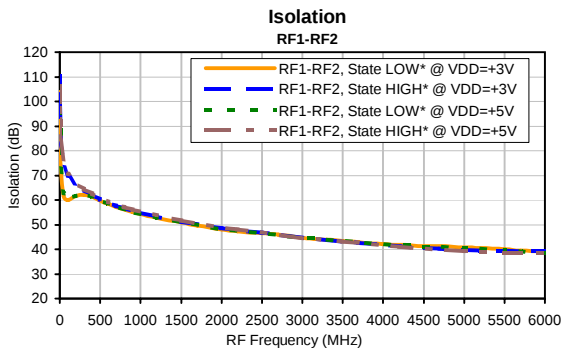
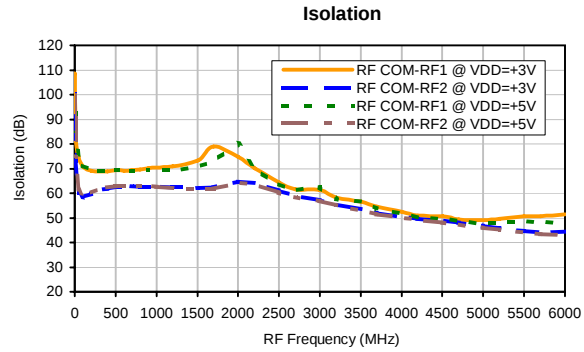
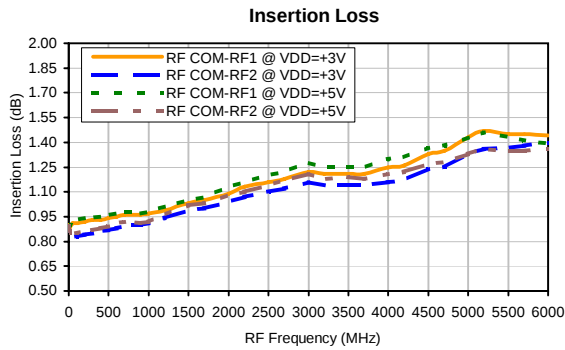
RF FREQ (MHz)	VSWR @ VDD=+5V OVER TEMPERTURE (:1)												RF FREQ (MHz)	VSWR @ VDD=+5V OVER TEMPERTURE (:1)					
	RF COM			RF COM			RF1			RF2				RF1			RF2		
	State LOW*			State HIGH*			State LOW*			State HIGH*				State HIGH*			State LOW*		
	-55°C	+25°C	+100°C	-55°C	+25°C	+100°C	-55°C	+25°C	+100°C	-55°C	+25°C	+100°C		-55°C	+25°C	+100°C	-55°C	+25°C	+100°C
0.3	1.13	1.17	1.20	1.14	1.17	1.19	1.13	1.17	1.20	1.14	1.17	1.19	500.0	1.59	1.70	1.84	1.57	1.69	1.83
0.5	1.13	1.18	1.20	1.13	1.17	1.19	1.14	1.18	1.20	1.13	1.17	1.19	600.0	1.51	1.65	1.79	1.49	1.63	1.78
1.0	1.14	1.18	1.20	1.13	1.17	1.19	1.14	1.18	1.21	1.13	1.17	1.19	700.0	1.46	1.61	1.76	1.44	1.59	1.75
5.0	1.13	1.18	1.20	1.13	1.16	1.19	1.14	1.18	1.20	1.13	1.16	1.19	800.0	1.42	1.59	1.75	1.41	1.57	1.73
10.0	1.14	1.17	1.19	1.15	1.18	1.20	1.14	1.18	1.20	1.14	1.18	1.20	900.0	1.40	1.57	1.74	1.38	1.55	1.71
50.0	1.11	1.14	1.17	1.13	1.16	1.19	1.11	1.15	1.17	1.13	1.16	1.19	1000.0	1.39	1.57	1.74	1.36	1.54	1.71
100.0	1.10	1.14	1.17	1.13	1.16	1.19	1.11	1.14	1.16	1.13	1.16	1.18	1200.0	1.37	1.56	1.73	1.34	1.53	1.70
200.0	1.10	1.13	1.16	1.12	1.16	1.18	1.10	1.13	1.16	1.12	1.15	1.17	1500.0	1.36	1.56	1.74	1.34	1.53	1.71
300.0	1.10	1.14	1.16	1.13	1.16	1.18	1.09	1.13	1.15	1.11	1.14	1.17	1700.0	1.37	1.57	1.75	1.33	1.54	1.71
400.0	1.11	1.15	1.17	1.13	1.17	1.19	1.09	1.12	1.15	1.11	1.14	1.16	2000.0	1.38	1.59	1.76	1.35	1.55	1.71
500.0	1.12	1.16	1.19	1.14	1.18	1.21	1.08	1.12	1.14	1.10	1.13	1.16	2200.0	1.39	1.59	1.76	1.37	1.56	1.73
600.0	1.13	1.17	1.21	1.16	1.19	1.23	1.08	1.12	1.14	1.09	1.13	1.15	2500.0	1.42	1.61	1.76	1.38	1.57	1.73
700.0	1.14	1.18	1.22	1.17	1.21	1.24	1.08	1.11	1.14	1.09	1.12	1.14	2700.0	1.42	1.61	1.76	1.41	1.58	1.73
800.0	1.16	1.20	1.23	1.18	1.22	1.25	1.07	1.10	1.13	1.08	1.11	1.13	3000.0	1.43	1.60	1.72	1.42	1.58	1.70
900.0	1.17	1.21	1.24	1.20	1.24	1.27	1.06	1.09	1.12	1.07	1.10	1.12	3200.0	1.45	1.60	1.71	1.42	1.57	1.70
1000.0	1.18	1.23	1.26	1.22	1.26	1.29	1.06	1.09	1.11	1.06	1.09	1.11	3500.0	1.44	1.56	1.65	1.42	1.54	1.63
1200.0	1.21	1.25	1.28	1.25	1.29	1.31	1.03	1.06	1.09	1.03	1.06	1.08	3700.0	1.46	1.55	1.63	1.43	1.52	1.60
1500.0	1.25	1.30	1.32	1.29	1.33	1.35	1.04	1.05	1.08	1.03	1.04	1.07	4000.0	1.45	1.49	1.55	1.42	1.48	1.53
1700.0	1.27	1.31	1.33	1.31	1.35	1.37	1.10	1.10	1.11	1.09	1.08	1.09	4200.0	1.45	1.47	1.51	1.41	1.44	1.47
2000.0	1.33	1.36	1.38	1.35	1.38	1.40	1.22	1.21	1.22	1.20	1.19	1.19	4500.0	1.45	1.42	1.43	1.42	1.39	1.40
2200.0	1.40	1.41	1.43	1.40	1.42	1.43	1.29	1.29	1.29	1.26	1.26	1.26	4700.0	1.44	1.38	1.38	1.39	1.36	1.34
2500.0	1.48	1.48	1.48	1.46	1.47	1.47	1.43	1.42	1.41	1.39	1.39	1.38	5000.0	1.45	1.35	1.33	1.40	1.31	1.27
2700.0	1.55	1.53	1.51	1.54	1.51	1.50	1.52	1.50	1.48	1.50	1.47	1.46	5200.0	1.42	1.31	1.26	1.41	1.28	1.23
3000.0	1.58	1.54	1.50	1.57	1.52	1.49	1.60	1.58	1.54	1.59	1.56	1.53	5500.0	1.44	1.29	1.23	1.40	1.24	1.18
3200.0	1.57	1.52	1.47	1.54	1.49	1.46	1.64	1.61	1.58	1.61	1.59	1.57	5700.0	1.42	1.25	1.17	1.40	1.23	1.15
3500.0	1.49	1.45	1.40	1.47	1.44	1.40	1.55	1.54	1.50	1.53	1.53	1.51	6000.0	1.42	1.23	1.14	1.38	1.20	1.10
3700.0	1.44	1.40	1.37	1.42	1.39	1.37	1.50	1.48	1.44	1.48	1.46	1.45							
4000.0	1.41	1.37	1.36	1.39	1.37	1.37	1.41	1.38	1.34	1.37	1.37	1.35							
4200.0	1.39	1.38	1.39	1.39	1.39	1.39	1.39	1.35	1.32	1.36	1.33	1.31							
4500.0	1.42	1.45	1.47	1.44	1.46	1.47	1.42	1.39	1.36	1.39	1.35	1.33							
4700.0	1.49	1.52	1.55	1.49	1.53	1.55	1.47	1.43	1.40	1.42	1.41	1.37							
5000.0	1.60	1.65	1.65	1.60	1.65	1.65	1.59	1.55	1.52	1.54	1.50	1.45							
5200.0	1.64	1.68	1.69	1.66	1.69	1.68	1.61	1.57	1.53	1.58	1.52	1.47							
5500.0	1.69	1.72	1.73	1.71	1.71	1.71	1.65	1.58	1.56	1.60	1.52	1.47							
5700.0	1.69	1.70	1.73	1.73	1.71	1.72	1.60	1.54	1.52	1.58	1.50	1.46							
6000.0	1.61	1.63	1.66	1.66	1.66	1.67	1.56	1.49	1.47	1.53	1.46	1.42							

*Note

State of Control Voltage	RF Common to			
	RF1		RF2	
LOW	ON		OFF	
HIGH	OFF		ON	

ON - Low insertion loss state
OFF - Isolation state

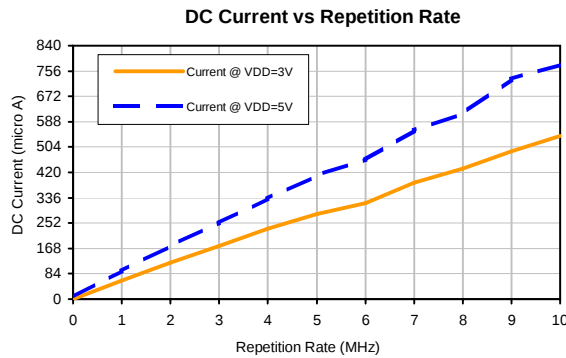
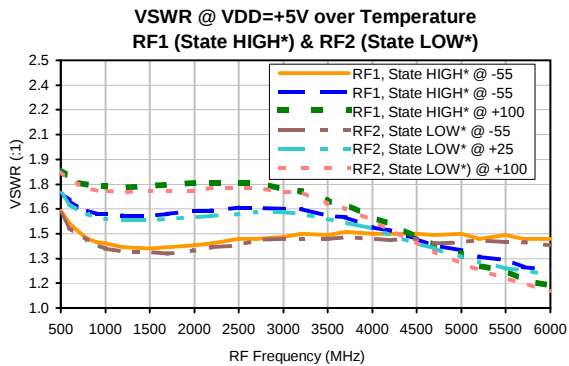
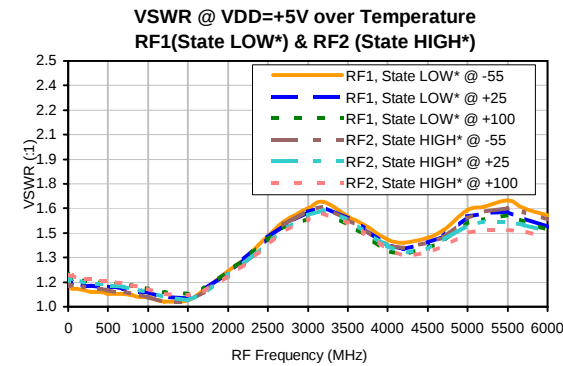
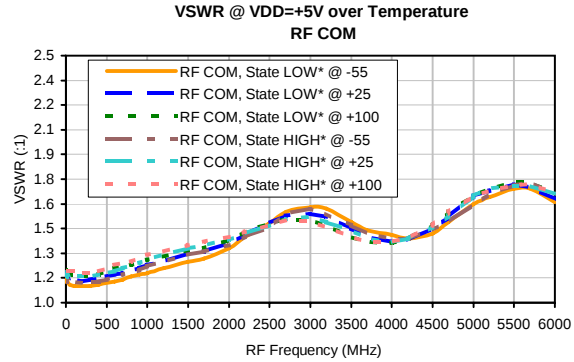
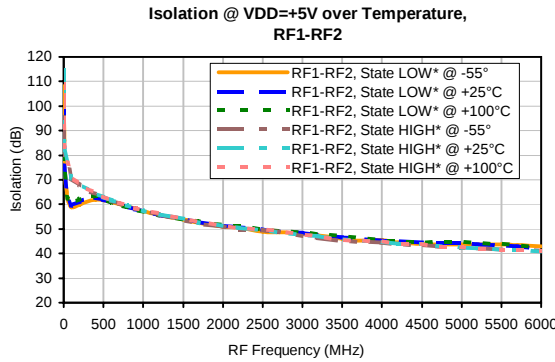
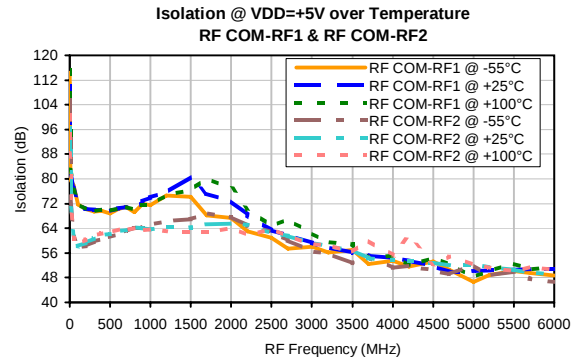
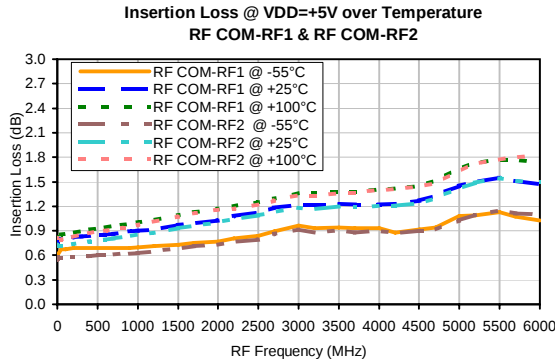
Typical Performance Curves



*Note

State of Control Voltage	RF Common to	
	RF1	RF2
LOW	ON	OFF
HIGH	OFF	ON
ON - Low insertion loss state		
OFF - Isolation state		

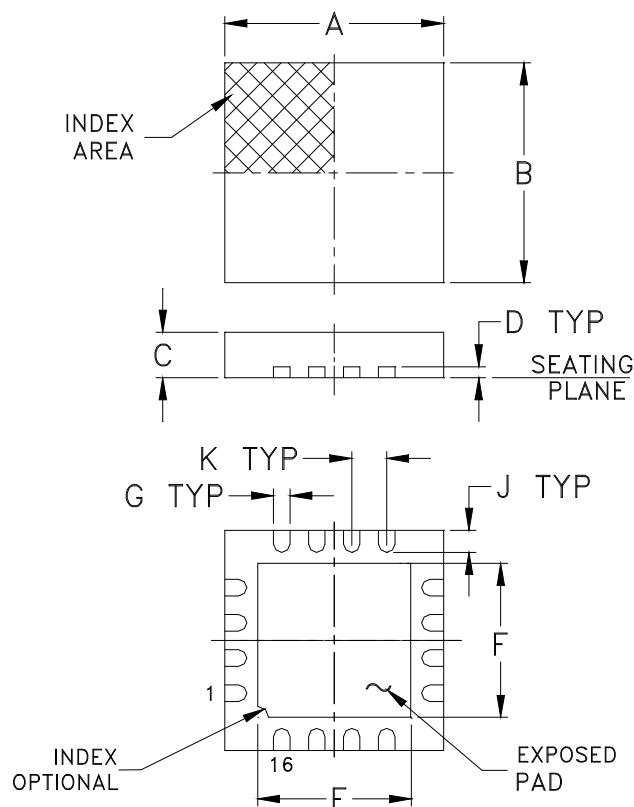
Typical Performance Curves



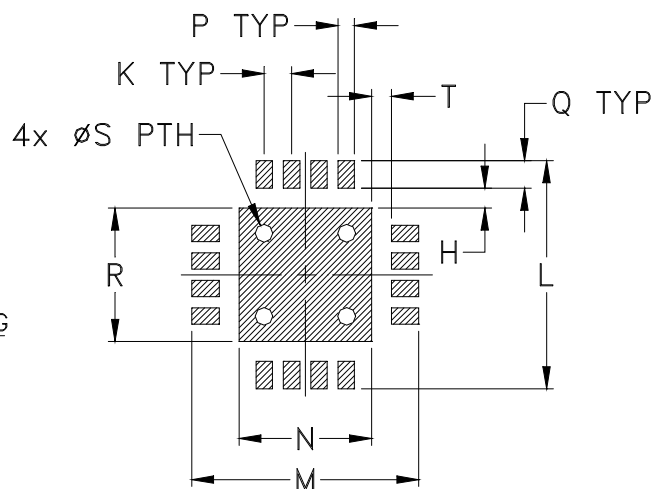
*Note

State of Control Voltage	RF Common to	
	RF1	RF2
LOW	ON	OFF
HIGH	OFF	ON
ON - Low insertion loss state		
OFF - Isolation state		

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ± 0.002

CASE #	A	B	C	D	E	F	G	H	J	K
DG1235-1	.157 (4.00)	.157 (4.00)	.035 (0.90)	.008 (0.20)	.106 (2.70)	.106 (2.70)	.012 (0.30)	.019 (0.48)	.016 (0.40)	.026 (0.65)

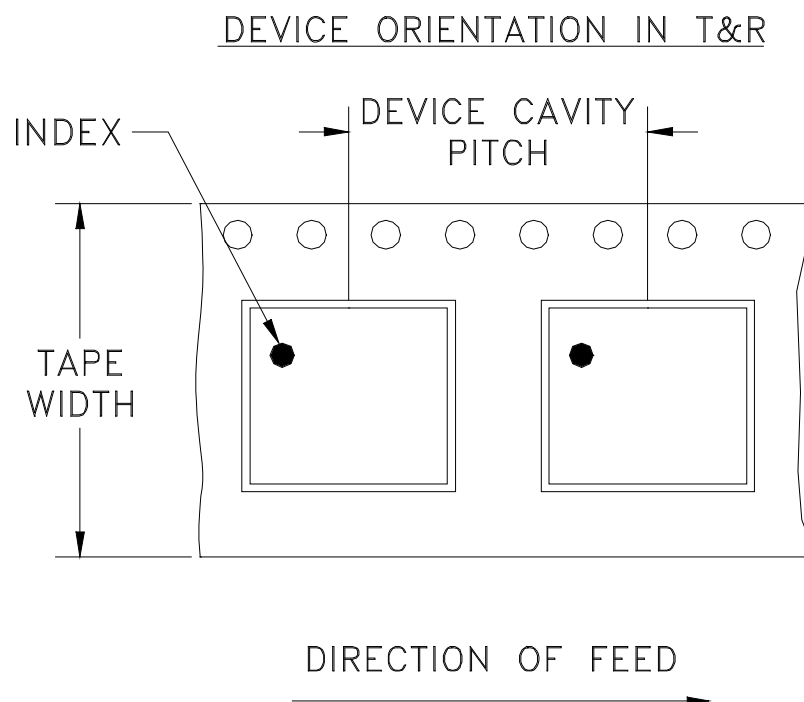
CASE #	L	M	N	P	Q	R	S	T	WT. GRAM
DG1235-1	.185 (4.70)	.185 (4.70)	.085 (2.16)	.014 (0.36)	.031 (0.79)	.085 (2.16)	.013 (0.33)	.019 (0.48)	.04

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

Notes:

- Case material: Plastic.
- Termination finish:
For RoHS Case Styles: NiPdAu. 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



Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M116142	NEW RELEASE	04/08/09	MMG	RD
A	M124875	MODIFIED LAYOUT, CHANGED "TB"	10/30/09	AV	RD
B	M153891	MODIFIED LAYOUT TO DG1235-1	01/22/16	ITG	RD

The top view diagram illustrates the internal layout of the package. Key features include:

- To RF1**: Indicated by an arrow pointing to a specific area at the top.
- To RF2**: Indicated by an arrow pointing to another area at the top.
- Ø.015 PTH FOR GROUND**: Dimensioned as .044.
- .037 TYP**: Dimension indicating typical thickness or width.
- .047 3 PL.**: Dimension indicating thickness or layer count.
- PIN 1**: Labeled near the bottom center.
- PACKAGE OUTLINE**: Indicated by an arrow pointing to the outer boundary.
- To VDD**: Indicated by an arrow pointing to a connection point at the bottom left.
- To Control**: Indicated by an arrow pointing to a connection point at the bottom center.
- To RF COM**: Indicated by an arrow pointing to a connection point at the bottom right.
- COPLANAR WAVEGUIDE: .020 TRACE WIDTH & .010 GAP, 3 PL. (SEE NOTE 1)**: Describes the waveguide structure.
- 4X Ø.015 PTH, PLUGGED WITH EPOXY**: Points to four specific through-hole locations.

1. TRACE WIDTH AND GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010"±.001"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.



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 TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ±		DRAWN	MMG	04/08/09	
		CHECKED	IL	04/08/09	
		APPROVED	RD	04/08/09	

11

Mini-Circuits®

13 Neptune Avenue
Brooklyn NY 11235

PL, 16SW02, DG1235-1, TB-486+

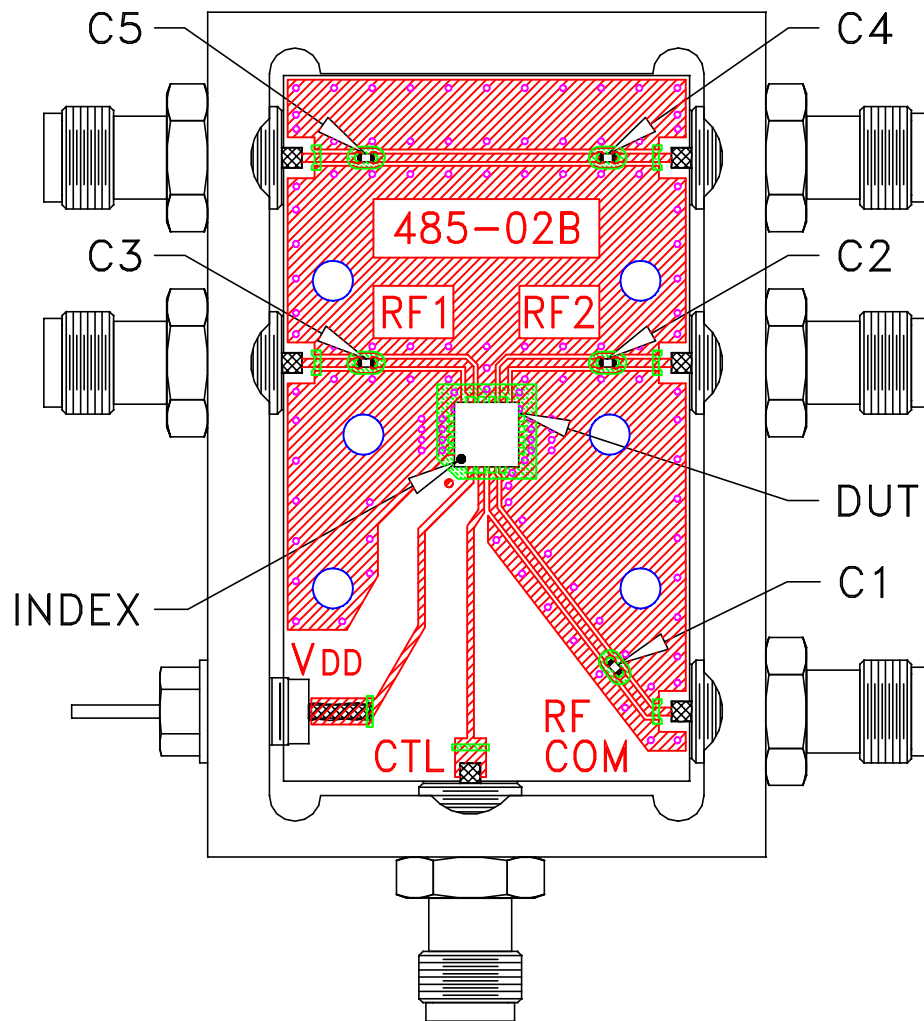
THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS. EXCEPT FOR USE EXPRESSLY GRANTED, IN WRITING, TO ITS VENDORS, VENDEE AND THE UNITED STATES GOVERNMENT, MINI-CIRCUITS RESERVES ALL PROPRIETARY DESIGN, USE , MANUFACTURING AND REPRODUCTION RIGHTS THERETO. THESE CONTENTS SHALL NOT BE USED, DUPLICATED OR DISCLOSED TO ANY OUTSIDE PARTY, IN WHOLE OR IN PART, WITHOUT WRITTEN PERMISSION OF MINI-CIRCUITS.

 Mini-Circuits®

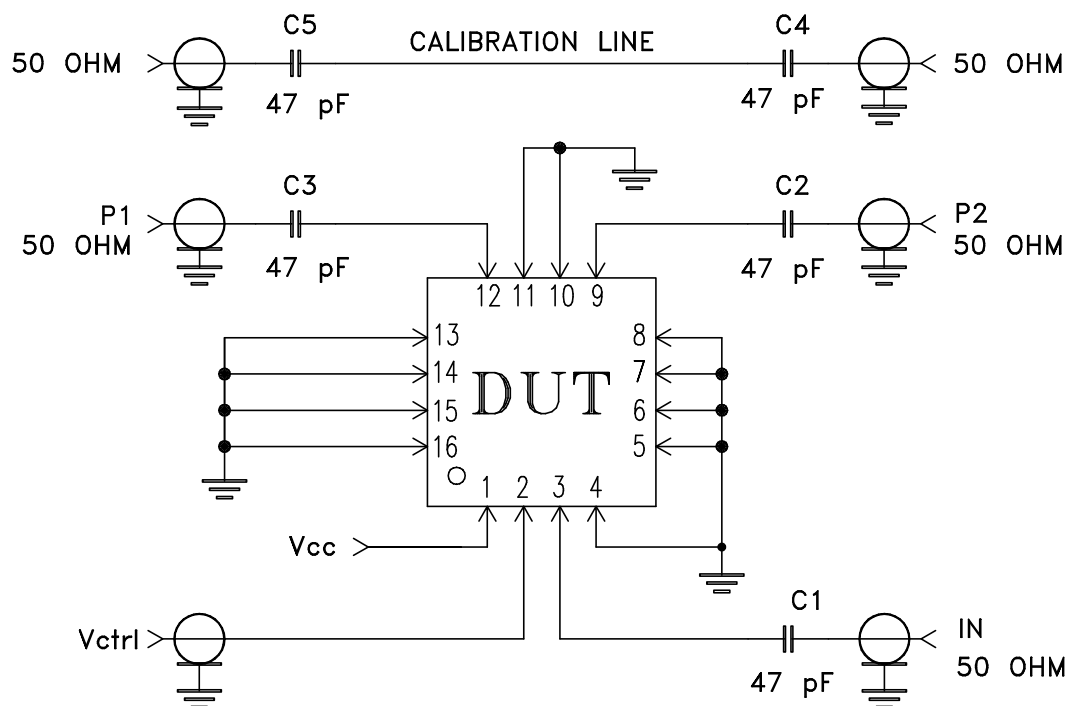
ASHEETA1.DWG REV:A DATE:01/12/95

SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-278		REV: B
FILE: 98PL278		SCALE: 10:1	SHEET: 1 OF 1	

Evaluation Board and Circuit



TB-486+



NOTES:

1. 50 Ohm SMA Female connectors.
2. PCB Material: R04350 or equivalent,
Dielectric Constant=3.5, Thickness=.010 inch.

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
Autoclave	121°C, 100% RH, 30 PSIA, 96 hours, unbiased	JESD22-A102
High Temp Storage	150°C 1008 hours	JESD22-A103
Solderability	Per Reference Spec	JESD22-B102
Resistance to Solvent	Per Reference Spec	MIL-STD-202, Method 215J
Moisture Sensitivity: Level 1	Bake at 125°C for 24 hours Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 260°C peak	JESD22-A113