SPDT RF Switch

50Ω 500-6000 MHz

Absorptive RF Switch with internal driver.
Single Supply Voltage, +3V to +5V

VSWA2-63DR+

CASE STYLE: DG1235-1

Product 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.

Typical Applications

- Automated switching networks
- Cellular/ PCS
- ISM, WCDMA, WiMAX, LTE

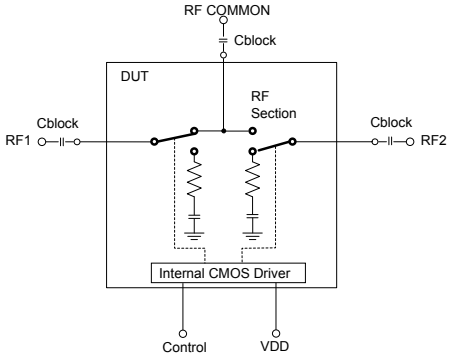
+RoHS Compliant

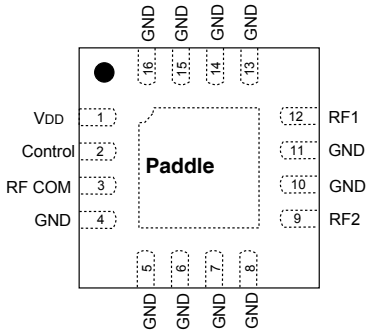
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

General Description

VSWA2-63DR+ is a high isolation absorptive SPDT switch with integral CMOS driver, operates with single positive supply voltage while consuming, 12µA typical. It has been designed for very wideband operation of 500-6000 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 4mm x 4mm x 0.9mm 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 #1/In Port #2, requires DC block (see Fig. 2)
Control	2	CMOS Control IN
VDD	1	Supply Voltage
GND	4,5,6,7,8,10,11 13,14,15,16, paddle	RF Ground

Notes

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RF Electrical Specifications[1], 500 - 6000 MHz, T_{AMB}=25°C, V_{DD}= +3V to +5V

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

DC Electrical Specifications

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

Notes:
1. Tested on Mini-Circuit's test board TB-407+, using Agilent's N5230A network analyzer (see Characterization Test Circuit, Fig.1).
2. Insertion loss values are deembedded from test board loss.
3. Do not exceed RF input power as shown in Absolute Maximum Rating table.
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. 3.5V for V_{DD}=4 to 5V

Switching Specifications

Parameter	Min.	Typ.	Max.	Units
Rise/Fall Time (10 to 90% or 90 to 10% RF)		23		nSec
Switching Time, 50% CTRL to 90/10% RF		35		nSec
Video Feedthrough, (control 0 to 3V, freq.=500 KHz, V_{DD} =5V)		25		mV_{P-P}

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Absolute Maximum Ratings[6]

Parameter	Ratings
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to 150°C
V_{DD}, Supply Voltage	2.7 to 5.5V
Voltage Control	-0.2V Min. V_{DD} Max.
RF input power	1Watt
Dissipated Power at 25°C	350mW

6. 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

Characterization Test Circuit

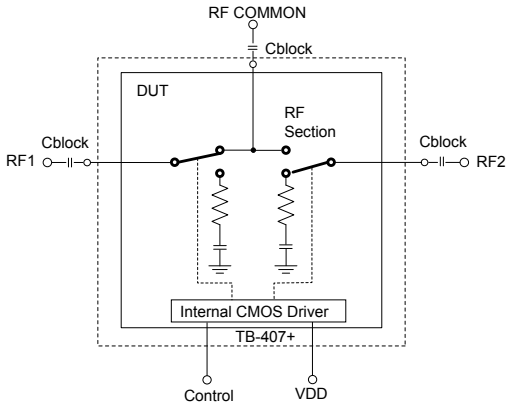

Figure 1: Block Diagram Of Test Circuit Used For Characterization.
(DUT soldered on Mini-Circuit's TB-407+)

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 and +5V, Control= 0 and 3V.
For Insertion loss, isolation and return loss: Pin=0 dBm
For Input IP3: Pin=-5dBm/tone.
For Switching time: RF frequency: 500 MHz at 0 dBm, Control Frequency: 500 KHz and 0 and +3V.

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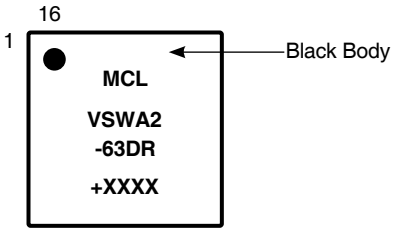
Product Marking



Additional Detailed Technical Information

Additional information is available on our web site. To access this information enter the model number on our web site home page.

Performance data, graphs

Case Style: DG1235-1
Plastic, finish: Nickel Palladium Gold

Tape & Reel: F87
Standard quantities available on reel: *7" reels with 20, 50, 100, 200, 500 devices*
13" reels with 3K devices

Suggested Layout for PCB Design: PL-278

Evaluation Board: TB-486+

Environmental Ratings: ENV41

Recommended Application Circuit

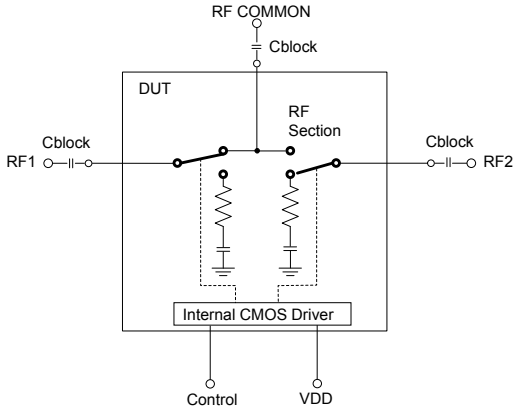


Fig. 2: Evaluation board includes case, connectors and components soldered to PCB.

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

Cblock should be free of resonance over frequency of operation.

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ESD Rating

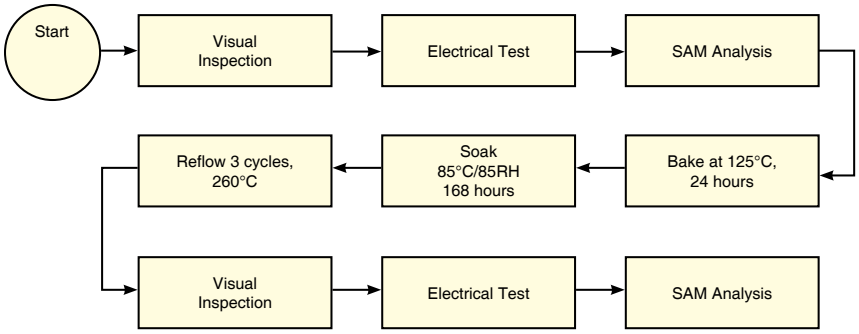
Human Body Model (HBM): Class 1A (250 to < 500V) in accordance with JESD22-A114

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

MSL Rating

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

MSL Test Flow Chart



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Typical Performance Data

RF FREQ (MHz)	INSERTION LOSS			
	VDD=+3V (dB)		VDD=+5V (dB)	
	RF COM-RF1	RF COM-RF2	RF COM-RF1	RF COM-RF2
0.3	0.87	0.88	0.86	0.86
0.5	0.90	0.90	0.90	0.89
1.0	0.90	0.89	0.91	0.89
5.0	0.89	0.86	0.91	0.86
10.0	0.88	0.83	0.90	0.84
50.0	0.91	0.83	0.92	0.84
100.0	0.91	0.83	0.93	0.85
200.0	0.92	0.84	0.94	0.86
300.0	0.93	0.85	0.94	0.87
400.0	0.93	0.86	0.95	0.88
500.0	0.94	0.87	0.96	0.89
600.0	0.95	0.88	0.97	0.91
700.0	0.96	0.89	0.98	0.92
800.0	0.96	0.90	0.98	0.92
900.0	0.96	0.90	0.97	0.91
1000.0	0.97	0.91	0.98	0.92
1200.0	0.99	0.94	1.01	0.96
1500.0	1.03	0.99	1.05	1.02
1700.0	1.05	1.00	1.07	1.03
2000.0	1.09	1.04	1.13	1.08
2200.0	1.13	1.07	1.16	1.10
2500.0	1.16	1.10	1.20	1.14
2700.0	1.18	1.12	1.22	1.17
3000.0	1.22	1.16	1.28	1.21
3200.0	1.21	1.14	1.25	1.18
3500.0	1.21	1.14	1.25	1.19
3700.0	1.21	1.14	1.25	1.18
4000.0	1.25	1.16	1.30	1.21
4200.0	1.26	1.17	1.31	1.22
4500.0	1.33	1.24	1.37	1.27
4700.0	1.35	1.25	1.38	1.28
5000.0	1.43	1.33	1.43	1.33
5200.0	1.47	1.36	1.46	1.36
5500.0	1.45	1.37	1.43	1.35
5700.0	1.45	1.38	1.41	1.35
6000.0	1.44	1.40	1.39	1.36

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

Typical Performance Data

RF FREQ (MHz)	VSWR (:1)							
	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*
0.3	1.20	1.20	1.20	1.20	1.21	1.21	1.21	1.21
0.5	1.20	1.20	1.20	1.20	1.21	1.21	1.21	1.21
1.0	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
5.0	1.19	1.18	1.19	1.18	1.19	1.18	1.19	1.18
10.0	1.17	1.18	1.17	1.18	1.18	1.18	1.18	1.18
50.0	1.16	1.18	1.16	1.18	1.16	1.18	1.16	1.18
100.0	1.16	1.18	1.16	1.18	1.16	1.19	1.16	1.19
200.0	1.16	1.19	1.16	1.18	1.17	1.19	1.17	1.19
300.0	1.16	1.19	1.16	1.18	1.17	1.19	1.16	1.19
400.0	1.17	1.19	1.16	1.18	1.18	1.20	1.16	1.19
500.0	1.17	1.20	1.16	1.18	1.18	1.20	1.16	1.19
600.0	1.18	1.20	1.16	1.18	1.19	1.21	1.16	1.18
700.0	1.19	1.21	1.15	1.18	1.19	1.21	1.16	1.18
800.0	1.19	1.21	1.15	1.17	1.19	1.21	1.16	1.18
900.0	1.19	1.21	1.15	1.17	1.19	1.21	1.15	1.17
1000.0	1.19	1.21	1.15	1.17	1.20	1.22	1.15	1.17
1200.0	1.19	1.21	1.14	1.16	1.19	1.21	1.15	1.16
1500.0	1.19	1.21	1.16	1.17	1.20	1.21	1.17	1.18
1700.0	1.21	1.21	1.20	1.21	1.22	1.22	1.21	1.22
2000.0	1.25	1.25	1.28	1.29	1.28	1.27	1.30	1.31
2200.0	1.30	1.30	1.36	1.36	1.32	1.32	1.38	1.39
2500.0	1.36	1.36	1.46	1.47	1.39	1.38	1.49	1.50
2700.0	1.40	1.39	1.52	1.52	1.43	1.42	1.55	1.56
3000.0	1.42	1.41	1.55	1.55	1.47	1.45	1.59	1.59
3200.0	1.40	1.38	1.55	1.54	1.44	1.42	1.59	1.59
3500.0	1.36	1.35	1.49	1.49	1.41	1.39	1.53	1.54
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

RF FREQ (MHz)	VSWR (:1)			
	VDD=+3V		VDD=+5V	
	RF1 State HIGH*	RF2 State LOW*	RF1 State HIGH*	RF2 State LOW*
500.0	1.84	1.87	1.86	1.89
600.0	1.80	1.83	1.82	1.85
700.0	1.78	1.80	1.80	1.83
800.0	1.77	1.80	1.79	1.82
900.0	1.77	1.79	1.79	1.82
1000.0	1.77	1.80	1.79	1.83
1200.0	1.78	1.80	1.80	1.83
1500.0	1.80	1.83	1.83	1.86
1700.0	1.82	1.85	1.85	1.89
2000.0	1.84	1.88	1.87	1.92
2200.0	1.85	1.89	1.89	1.93
2500.0	1.86	1.89	1.90	1.93
2700.0	1.85	1.88	1.89	1.92
3000.0	1.82	1.84	1.86	1.89
3200.0	1.78	1.80	1.83	1.85
3500.0	1.71	1.73	1.75	1.78
3700.0	1.65	1.67	1.70	1.72
4000.0	1.56	1.58	1.61	1.63
4200.0	1.50	1.51	1.54	1.56
4500.0	1.41	1.41	1.45	1.46
4700.0	1.35	1.35	1.39	1.40
5000.0	1.26	1.27	1.30	1.32
5200.0	1.22	1.24	1.25	1.28
5500.0	1.16	1.19	1.20	1.24
5700.0	1.13	1.17	1.17	1.22
6000.0	1.10	1.17	1.14	1.22

***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			
	VDD=+3V (dBm)		VDD =+5V (dBm)	
	RF COM-RF1	RF COM-RF2	RF COM-RF1	RF COM-RF2
500.0	48.68	48.14	52.14	51.26
700.0	47.74	47.96	50.23	50.23
900.0	46.29	45.98	50.14	49.78
1000.0	46.09	45.75	50.44	50.05
1250.0	45.26	45.10	49.31	49.06
1500.0	45.12	44.89	49.65	49.35
1750.0	44.62	44.46	49.20	48.88
2000.0	43.65	43.55	47.62	47.78
2500.0	42.40	42.22	46.94	47.01
3000.0	40.70	40.68	45.78	45.68
3500.0	38.61	38.61	43.12	43.33
4000.0	38.09	38.20	42.75	43.01
4500.0	35.62	35.98	40.94	41.53
5000.0	36.21	36.61	40.71	41.32
5500.0	33.90	34.19	38.28	38.96
6000.0	34.14	34.38	39.72	40.31

DC Current vs Repetition Rate		
IDD (micro A)		
Typ.		
Rep Rate (MHz)	VDD=+3V	VDD=+5V
0.0005	0.8	6.4
1.0	62.5	93.8
2.0	121.3	176.0
3.0	175.3	252.5
4.0	233.5	334.0
5.0	282.5	409.3
6.0	319.0	462.0
7.0	386.5	559.5
8.0	432.8	614.8
9.0	491.0	729.5
10.0	540.5	776.8

RF FREQ (MHz)	INPUT 1dB COMPRESSION	
	VDD=+3V (dBm) Pin	VDD =+5V (dBm) Pin
500.0	24.52	30.90
600.0	23.99	30.51
700.0	24.29	30.86
800.0	23.99	30.59
900.0	23.84	30.39
1000.0	23.86	30.51
1100.0	23.86	30.53
1200.0	23.77	30.58
1300.0	24.58	30.95
1400.0	24.46	30.75
1500.0	24.36	30.92
1600.0	24.41	31.02
1700.0	24.56	31.37
1800.0	24.27	31.07
1900.0	24.17	30.97
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

Typical Performance Data

RF FREQ (MHz)	INSERTION LOSS @ VDD=+5V OVER TEMPERTURE					
	RF COM-RF1 (dB)			RF COM-RF2 (dB)		
	-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
0.5	0.56	0.75	0.83	0.56	0.72	0.81
1.0	0.57	0.76	0.84	0.57	0.73	0.82
5.0	0.59	0.77	0.85	0.56	0.71	0.80
10.0	0.61	0.77	0.85	0.57	0.71	0.79
50.0	0.67	0.80	0.85	0.57	0.71	0.79
100.0	0.67	0.80	0.86	0.57	0.72	0.80
200.0	0.69	0.82	0.88	0.58	0.74	0.82
300.0	0.69	0.83	0.90	0.59	0.76	0.85
400.0	0.69	0.84	0.92	0.59	0.77	0.87
500.0	0.69	0.85	0.93	0.60	0.78	0.89
600.0	0.69	0.85	0.94	0.60	0.79	0.90
700.0	0.69	0.86	0.96	0.61	0.81	0.92
800.0	0.69	0.87	0.97	0.62	0.82	0.94
900.0	0.69	0.89	0.99	0.62	0.83	0.95
1000.0	0.70	0.90	1.00	0.63	0.85	0.97
1200.0	0.71	0.92	1.03	0.65	0.88	1.01
1500.0	0.73	0.97	1.09	0.68	0.93	1.07
1700.0	0.75	0.99	1.13	0.71	0.96	1.11
2000.0	0.77	1.03	1.17	0.73	1.00	1.16
2200.0	0.81	1.08	1.20	0.76	1.04	1.17
2500.0	0.84	1.13	1.25	0.79	1.09	1.22
2700.0	0.89	1.18	1.29	0.86	1.13	1.27
3000.0	0.96	1.22	1.36	0.92	1.18	1.34
3200.0	0.93	1.22	1.36	0.88	1.17	1.33
3500.0	0.94	1.23	1.37	0.91	1.20	1.36
3700.0	0.93	1.22	1.38	0.88	1.19	1.36
4000.0	0.93	1.22	1.40	0.90	1.21	1.40
4200.0	0.88	1.23	1.42	0.87	1.21	1.41
4500.0	0.92	1.27	1.45	0.90	1.24	1.44
4700.0	0.94	1.33	1.52	0.91	1.30	1.49
5000.0	1.08	1.45	1.66	1.03	1.42	1.63
5200.0	1.09	1.50	1.73	1.10	1.49	1.72
5500.0	1.13	1.55	1.77	1.15	1.54	1.77
5700.0	1.07	1.51	1.77	1.11	1.51	1.80
6000.0	1.03	1.47	1.74	1.10	1.50	1.82

RF FREQ (MHz)	ISOLATION @ VDD=+5V OVER TEMPERTURE											
	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
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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		

Typical Performance Data

RF FREQ (MHz)	VSWR @ VDD=+5V OVER TEMPERTURE (:1)											
	RF COM			RF COM			RF1			RF2		
	State LOW*			State HIGH*			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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

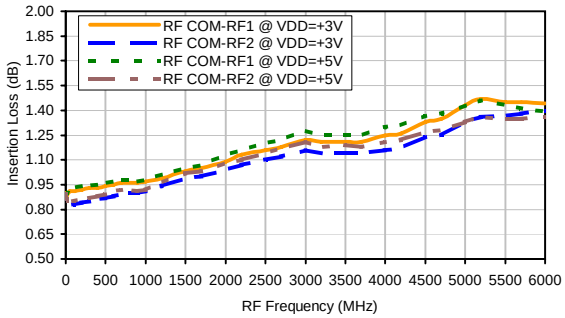
RF FREQ (MHz)	VSWR @ VDD=+5V OVER TEMPERTURE (:1)					
	RF1			RF2		
	State HIGH*			State LOW*		
	-55°C	+25°C	+100°C	-55°C	+25°C	+100°C
500.0	1.59	1.70	1.84	1.57	1.69	1.83
600.0	1.51	1.65	1.79	1.49	1.63	1.78
700.0	1.46	1.61	1.76	1.44	1.59	1.75
800.0	1.42	1.59	1.75	1.41	1.57	1.73
900.0	1.40	1.57	1.74	1.38	1.55	1.71
1000.0	1.39	1.57	1.74	1.36	1.54	1.71
1200.0	1.37	1.56	1.73	1.34	1.53	1.70
1500.0	1.36	1.56	1.74	1.34	1.53	1.71
1700.0	1.37	1.57	1.75	1.33	1.54	1.71
2000.0	1.38	1.59	1.76	1.35	1.55	1.71
2200.0	1.39	1.59	1.76	1.37	1.56	1.73
2500.0	1.42	1.61	1.76	1.38	1.57	1.73
2700.0	1.42	1.61	1.76	1.41	1.58	1.73
3000.0	1.43	1.60	1.72	1.42	1.58	1.70
3200.0	1.45	1.60	1.71	1.42	1.57	1.70
3500.0	1.44	1.56	1.65	1.42	1.54	1.63
3700.0	1.46	1.55	1.63	1.43	1.52	1.60
4000.0	1.45	1.49	1.55	1.42	1.48	1.53
4200.0	1.45	1.47	1.51	1.41	1.44	1.47
4500.0	1.45	1.42	1.43	1.42	1.39	1.40
4700.0	1.44	1.38	1.38	1.39	1.36	1.34
5000.0	1.45	1.35	1.33	1.40	1.31	1.27
5200.0	1.42	1.31	1.26	1.41	1.28	1.23
5500.0	1.44	1.29	1.23	1.40	1.24	1.18
5700.0	1.42	1.25	1.17	1.40	1.23	1.15
6000.0	1.42	1.23	1.14	1.38	1.20	1.10

***Note**

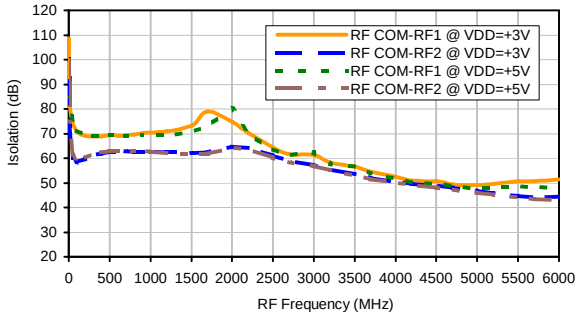
State of Control Voltage	RF Common to			
	RF1		RF2	
LOW	ON		OFF	
HIGH	OFF		ON	
ON - Low insertion loss state OFF - Isolation state				

Typical Performance Curves

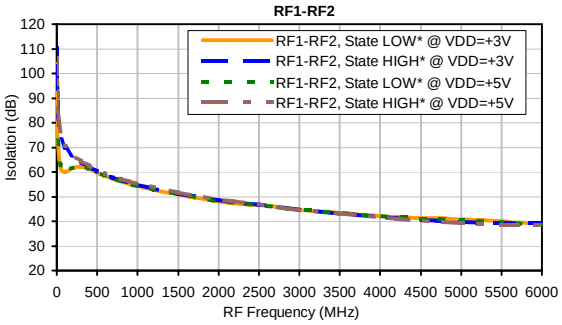
Insertion Loss



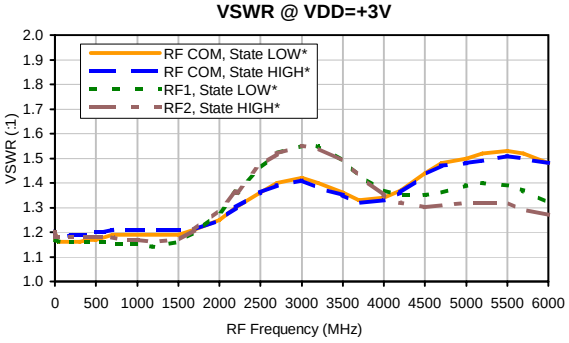
Isolation



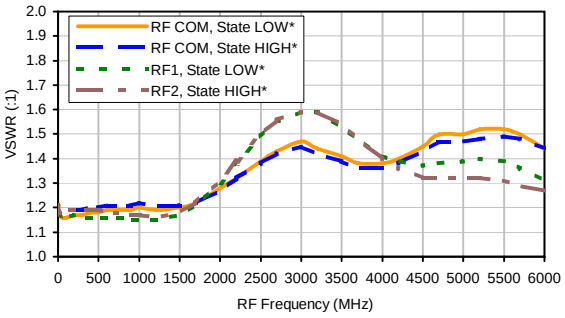
Isolation RF1-RF2



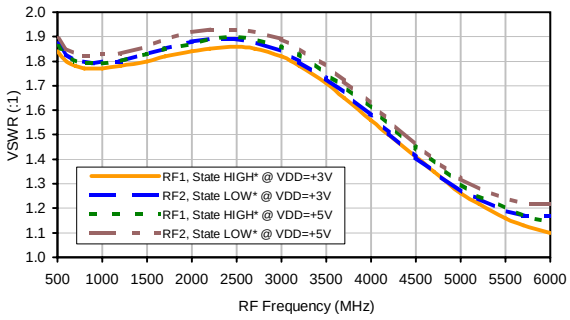
VSWR @ VDD=+3V



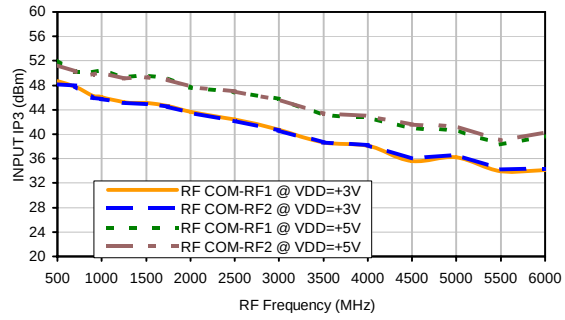
VSWR @ VDD=+5V



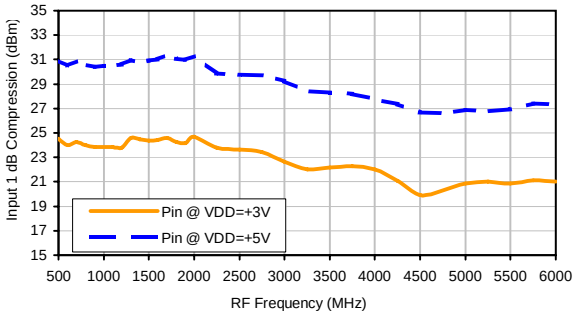
VSWR



Input IP3



Input 1dB Compression

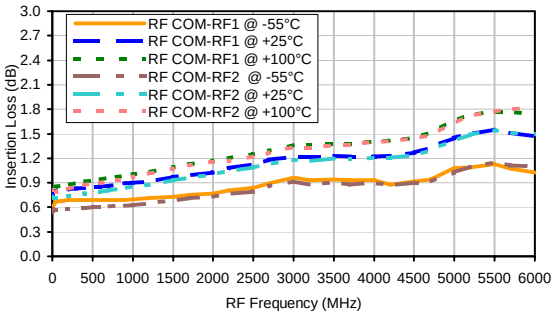


***Note**

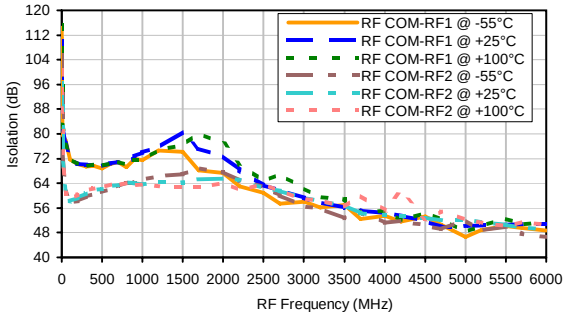
State of Control Voltage	RF Common to	
	RF1	RF2
LOW	ON	OFF
HIGH	OFF	ON
ON - Low insertion loss state		
OFF - Isolation state		

Typical Performance Curves

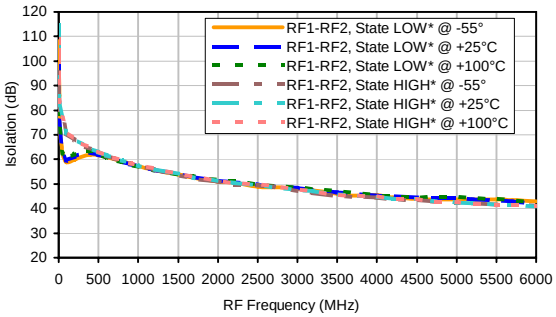
Insertion Loss @ VDD=+5V over Temperature
RF COM-RF1 & RF COM-RF2



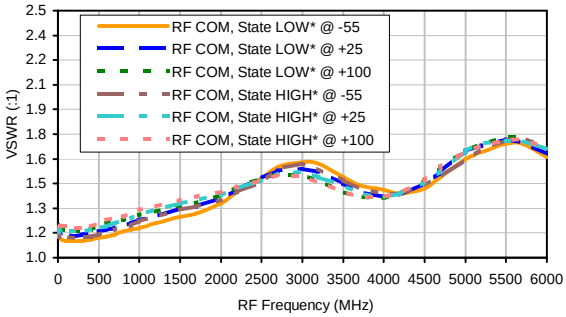
Isolation @ VDD=+5V over Temperature
RF COM-RF1 & RF COM-RF2



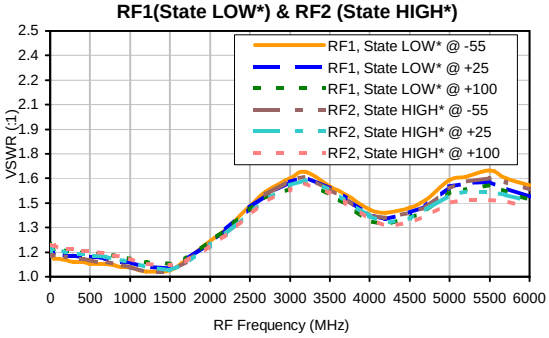
Isolation @ VDD=+5V over Temperature,
RF1-RF2



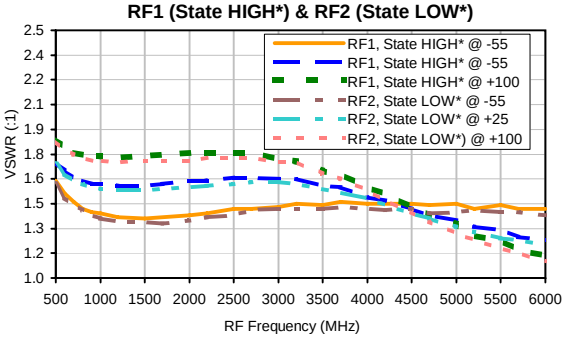
VSWR @ VDD=+5V over Temperature
RF COM



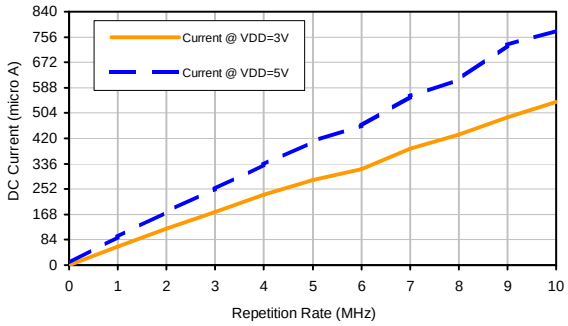
VSWR @ VDD=+5V over Temperature
RF1(State LOW*) & RF2 (State HIGH*)



VSWR @ VDD=+5V over Temperature
RF1 (State HIGH*) & RF2 (State LOW*)



DC Current vs Repetition Rate



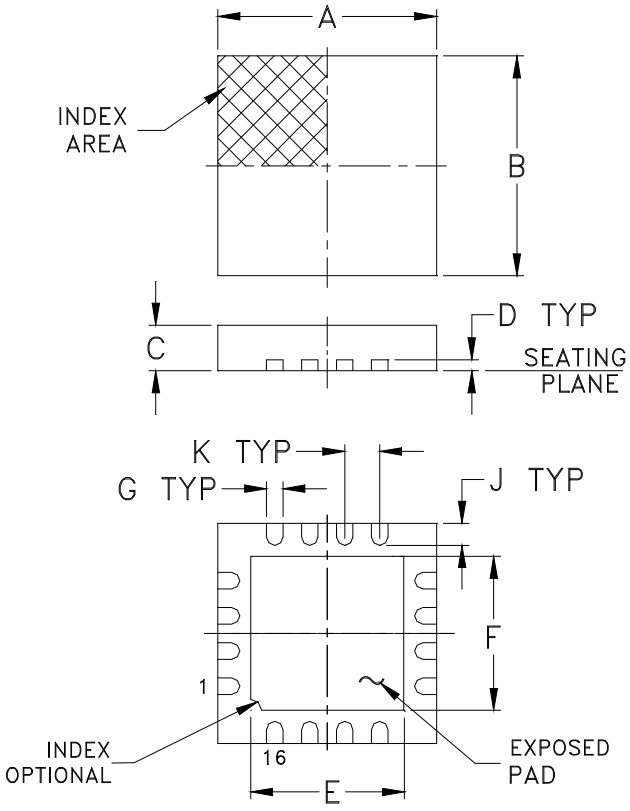
***Note**

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

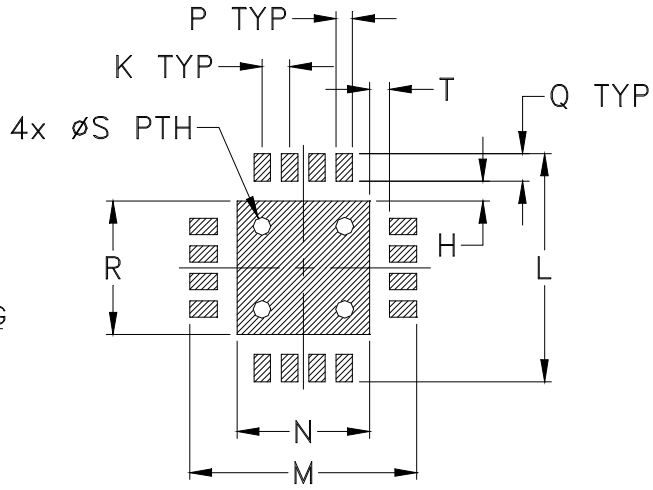
Case Style DG

DG1235-1

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.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. ± .01; 3 Pl. ± .005

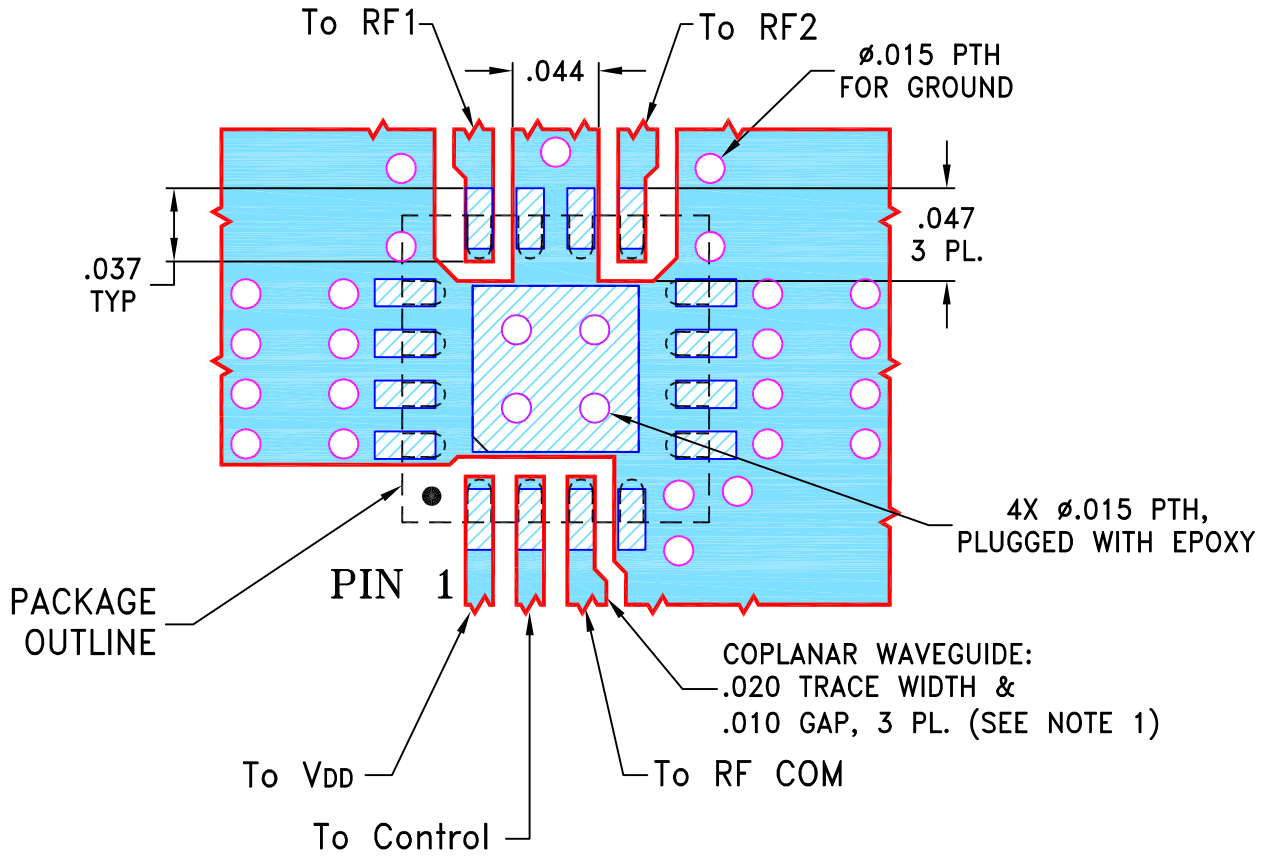
Notes:

1. Case material: Plastic.
2. Termination finish:
   For RoHS Case Styles: NiPdAu. All models, (+) suffix.
   For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

THIRD ANGLE PROJECTION

REVISIONS					
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

SUGGESTED MOUNTING CONFIGURATION FOR DG1235-1 CASE STYLE, "16SW02" PIN CODE



NOTES:

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	DRAWN	MMG	04/06/09
TOLERANCES ON:	CHECKED	IL	04/08/09
2 PL DECIMALS ±	APPROVED	RD	04/08/09
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

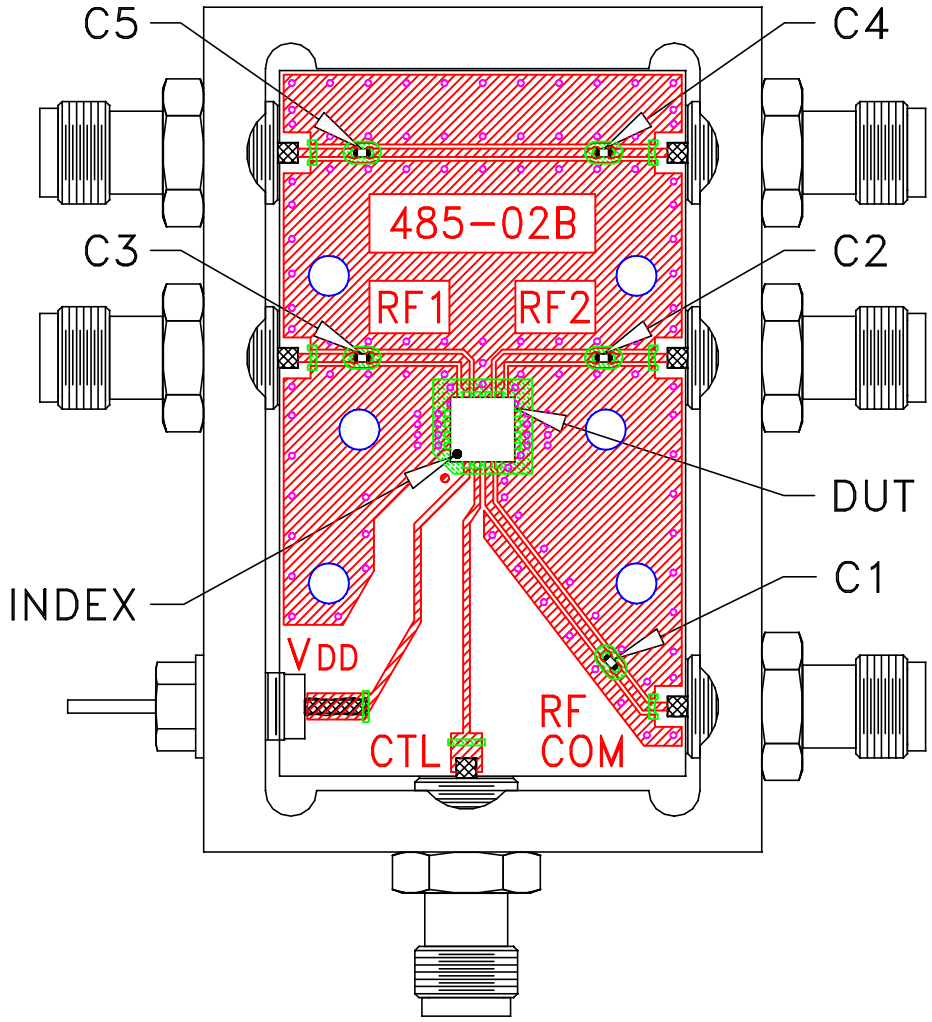
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

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

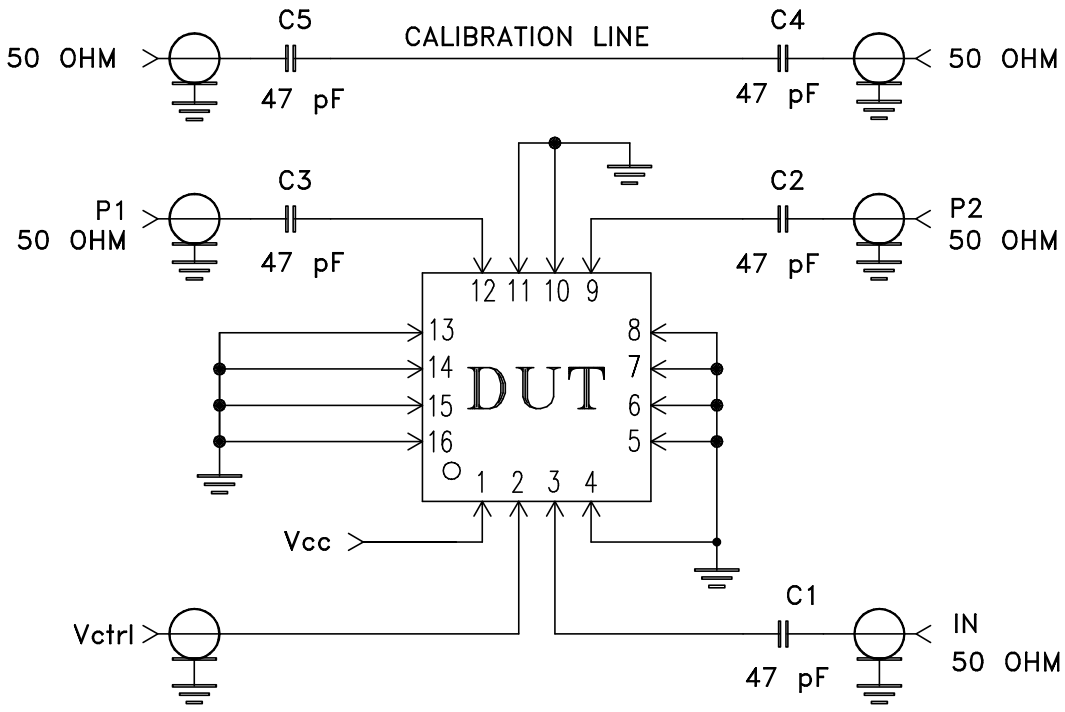
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-278	B

FILE:	SCALE:	SHEET:
98PL278	10:1	1 OF 1

Evaluation Board and Circuit



TB-486+



Schematic Diagram

NOTES:

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

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Environmental Specifications ENV41

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

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