



Mini-Circuits

SURFACE MOUNT

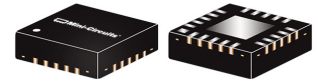
# SPDT RF Switch

## HSWA2-30DR+

50Ω DC to 3000 MHz Absorptive RF Switch with Internal Driver  
Single Supply Voltage, +3 V

### FEATURES

- Very Low Insertion Loss Over Entire Frequency Range
- Super High Isolation Over Entire Frequency Range
- High Input IP3, +55 dBm Typ.
- Single Positive Supply Voltage, +3 V
- Very Low DC Current Consumption, 8 μA
- Immune to Latch-Up
- Unique Design – Simultaneous Switch-Off of RF1 & RF2



CASE STYLE: DG983-1

Generic photo used for illustration purposes only

### +RoHS Compliant

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

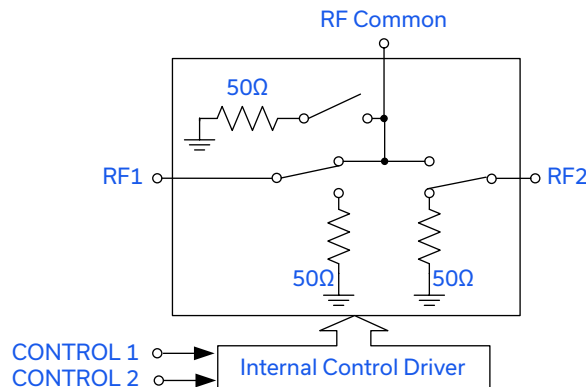
### APPLICATIONS

- Base Station Infrastructure
- Portable Wireless
- CATV & DBS
- MMDS & Wireless LAN
- Band Switch
- Diplexer Switches
- Bypass Switches

### PRODUCT OVERVIEW

The HSWA2-30DR+ is a 50Ω high isolation SPDT RF switch designed for wireless applications, covering a broad frequency range from DC up to 3000 MHz with low insertion loss. The HSWA2-30DR+ operates on a single supply voltage +3 V. See application note AN-80-006 for +5 V supply voltage. This unit includes an internal CMOS control driver with two-pins control. The switch consumes very low supply current, 8 μA typ. The HSWA2-30DR+ switch is in a very small size and low profile package, 4 x 4 mm and 0.9 mm, respectively

### FUNCTIONAL DIAGRAM



REV. K  
ECO-026795  
HSWA2-30DR+  
MCL NY  
260429



**SURFACE MOUNT**

# SPDT RF Switch

**HSWA2-30DR+**50Ω DC to 3000 MHz Absorptive RF Switch with Internal Driver  
Single Supply Voltage, +3 V**RF ELECTRICAL SPECIFICATIONS,  $T_{AMB} = +25^{\circ}\text{C}$ ,  $V_{DD} = +3\text{ V}$** 

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Operating Frequency		DC <sup>1</sup>		3000	MHz
Insertion Loss <sup>2</sup>	1000	-	0.75	1.0	dB
	2000	-	0.95	1.2	
	3000	-	1.2	1.4	
Isolation Between Common Port and RF1/RF2 Ports	1000	55	64	-	dB
	2000	46	50	-	
	3000	40	44	-	
Isolation Between RF1 and RF2 Ports	1000	57	63	-	dB
	2000	54	60	-	
	3000	40	48	-	
Return Loss @ Common Port	1000	-	20	-	dB
	2000	-	17	-	
	3000	-	14	-	
Return Loss @ RF1/RF2 Ports	1000	-	20	-	dB
	2000	-	18	-	
	3000	-	17	-	
Input IP2	5-1000	-	+80	-	dBm
Input IP3 <sup>3</sup>	10-1000	-	+55	-	dBm
	1000-3000	-	+52	-	
Input 1 dB Compression <sup>3,4</sup>	1000	+29	+31	-	dBm

1. Lowest Freq. determined by value of coupling capacitors at RF ports.
2. Insertion loss values are de-embedded from test board Loss.
3. Device linearity degrades below 1 MHz.
4. Note absolute maximum ratings for input power.

**DC ELECTRICAL SPECIFICATIONS**

Parameter	Min.	Typ.	Max.	Units
$V_{DD}$ , Supply Voltage <sup>5</sup>	+2.7	+3	+3.3	V
Supply Current ( $V_{DD} = +3\text{ V}$ ) <sup>6</sup>	-	8	20	$\mu\text{A}$
Control Voltage Low	0	-	+0.3 x $V_{DD}$	V
Control Voltage High	+0.7 x $V_{DD}$	-	$V_{DD}$	V

5. See application note AN-80-006 for +5 V supply voltage.
6. At Control Frequency of 1 kHz. Increases to 21  $\mu\text{A}$  at 10 kHz and 56  $\mu\text{A}$  at 50 kHz typically.

**SWITCHING SPECIFICATIONS**

Parameter	Min.	Typ.	Max.	Units
Switching Time, 50% Control to 90/10% RF	-	2.0	-	$\mu\text{s}$
Video Feed-Through, 5-1000 MHz <sup>7</sup>	-	-	15	mV <sub>p,p</sub>

7. Measured with a 1 ns risetime, 0/+3 V pulse and 500 MHz bandwidth.





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# SPDT RF Switch

## HSWA2-30DR+

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### ABSOLUTE MAXIMUM RATINGS

Parameter	Ratings
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
V <sub>DD</sub> , Supply Voltage	-0.3 V min., +4 V max.
Voltage Control	-0.3 V min., V <sub>DD</sub> + 0.3 V max.
ESD, HBM (ANSI/ESD STM 5.1 - 2001)	+250 V to < +500 V (CLASS 1A)
ESD, MM (ANSI/ESD STM 5.2 - 1999)	+50 V (CLASS M1)
RF Input Power: <sup>8</sup>	-
When the Common Port Is Connected to the RF Port (RF1 or RF2)	+33 dBm
When the RF Port (RF1 or RF2) Is Not Connected to the Common Port	+24 dBm
When the Common Port Is Not Connected to Either RF1 or RF2	+24 dBm

8. See Truth Table below.

The RF switch control bits select the desired switch-state, as shown in **Table 1: Truth Table**.

**TABLE 1: TRUTH TABLE**<sup>9,10,11</sup>

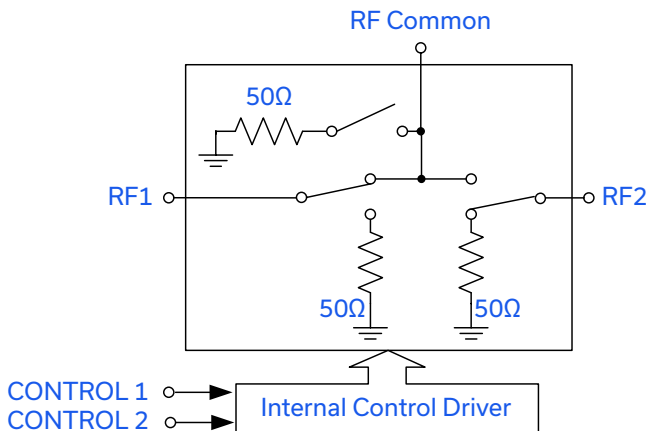
State	Control Input		RF Input / Output	
	Control 1	Control 2	RF1 to RF Common	RF2 to RF Common
1	LOW	LOW	OFF	OFF
2	LOW	HIGH	OFF	ON
3	HIGH	LOW	ON	OFF
4	HIGH	HIGH	N/A	N/A

9. When either of the RF1 or RF2 ports is closed (**ON** state), the closed port is connected to the RF Common port.

10. When either of the RF1 or RF2 ports is open (**OFF** state), the open port is connected to an internal 50Ω termination.

11. When both RF1 and RF2 ports are open (**OFF** state), the all three RF ports are connected to an internal 50Ω termination.

### FUNCTIONAL DIAGRAM - EXAMPLE OF STATE 3

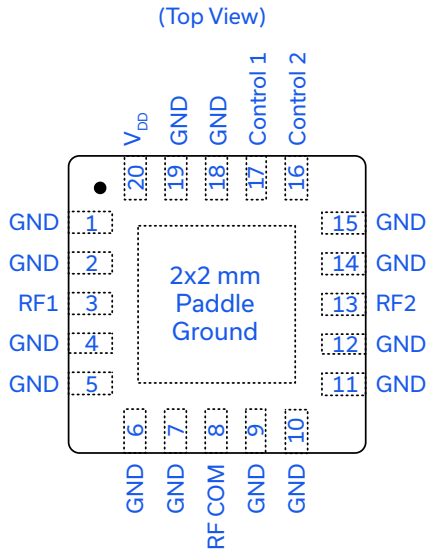




# SPDT RF Switch

50Ω DC to 3000 MHz Absorptive RF Switch with Internal Driver  
Single Supply Voltage, +3 V

## PIN CONFIGURATION



## PIN DESCRIPTION

Function	Pin Number	Description
GND	1	RF Ground
GND	2	RF Ground
RF1	3	RF I/O <sup>12</sup>
GND	4	RF Ground
GND	5	RF Ground
GND	6	RF Ground
GND	7	RF Ground
RF COM	8	RF Common <sup>12</sup>
GND	9	RF Ground
GND	10	RF Ground
GND	11	RF Ground
GND	12	RF Ground
RF2	13	RF I/O <sup>12</sup>
GND	14	RF Ground
GND	15	RF Ground
Control 2	16	Control 2
Control 1	17	Control 1
GND	18	Supply Voltage Ground
GND	19	Digital Ground
V <sub>DD</sub>	20	Supply Voltage
GND	Paddle	RF Ground Pad <sup>13</sup>

12. RF pins 3, 8 and 13 must be at 0 VDC. The RF pins do not require DC blocking capacitors for proper operation if the 0 VDC requirement is met.

13. The exposed solder pad on the bottom of the package (See Pin Configuration) must be grounded for proper device operation.



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# SPDT RF Switch

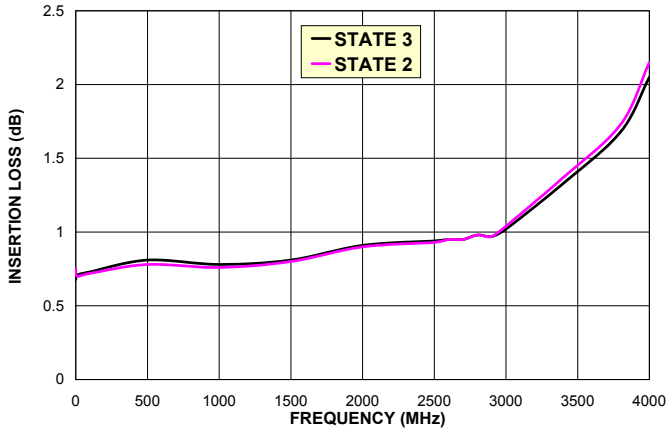
## HSWA2-30DR+

50Ω DC to 3000 MHz Absorptive RF Switch with Internal Driver  
Single Supply Voltage, +3 V

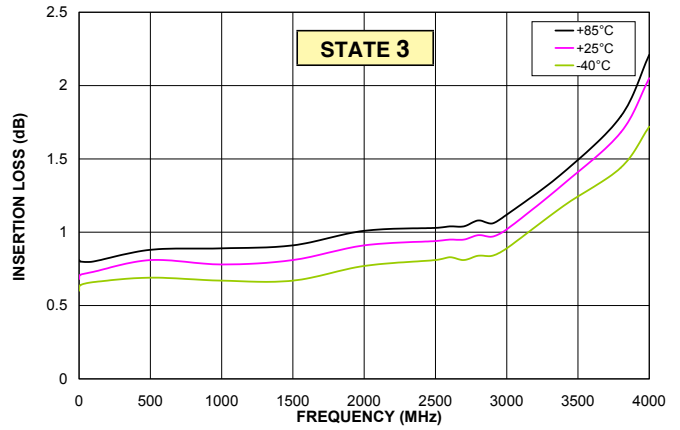
### TYPICAL PERFORMANCE GRAPHS - VARIOUS STATES

For switch state see Truth Table 1 on page 3.

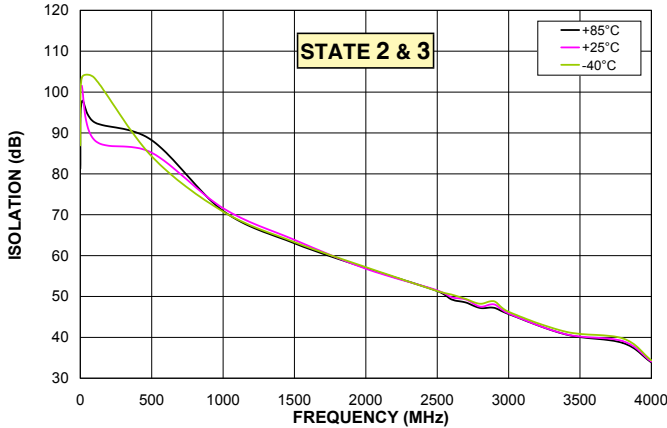
INSERTION LOSS Vs. FREQUENCY @ +25°C



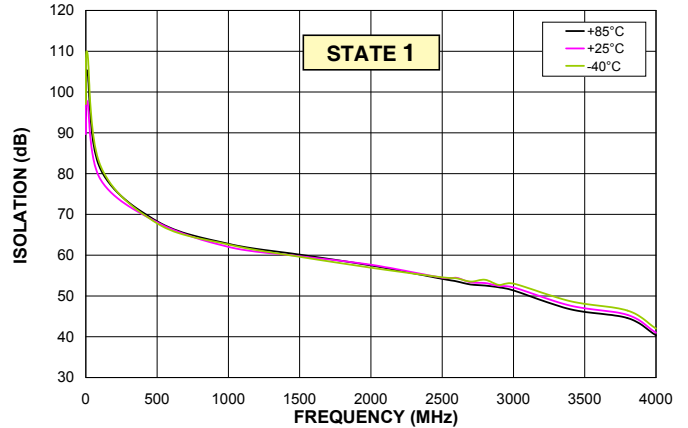
INSERTION LOSS Vs. FREQUENCY



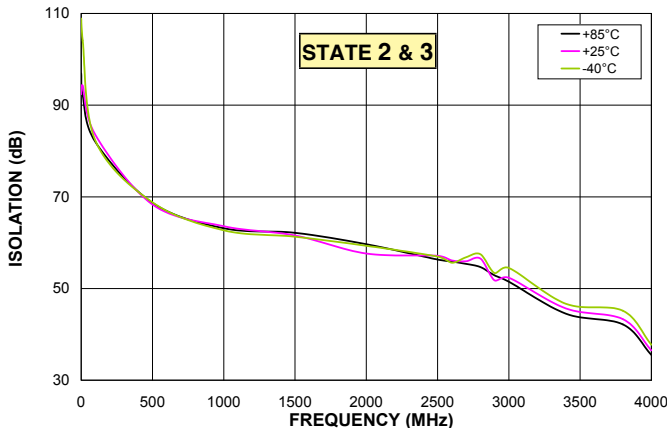
ISOLATION BETWEEN RF1/RF2 TO RF COM Vs. FREQUENCY



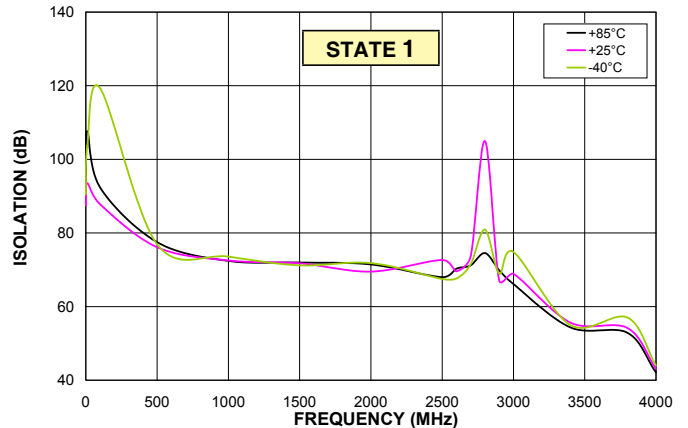
ISOLATION BETWEEN RF1/RF2 TO RF COM Vs. FREQUENCY



ISOLATION BETWEEN RF1 TO RF2 Vs. FREQUENCY



ISOLATION BETWEEN RF1 TO RF2 Vs. FREQUENCY



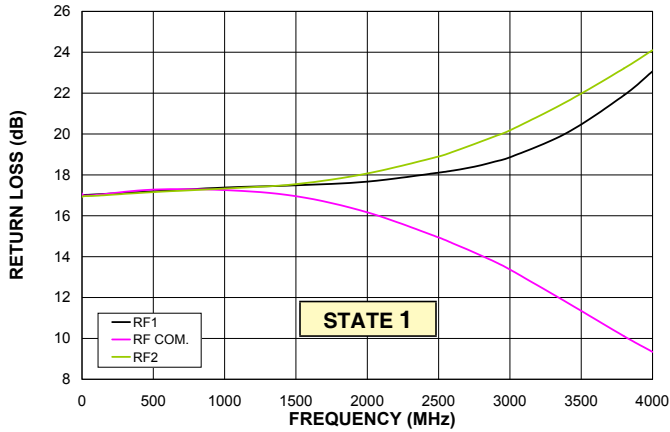


50Ω DC to 3000 MHz Absorptive RF Switch with Internal Driver  
Single Supply Voltage, +3 V

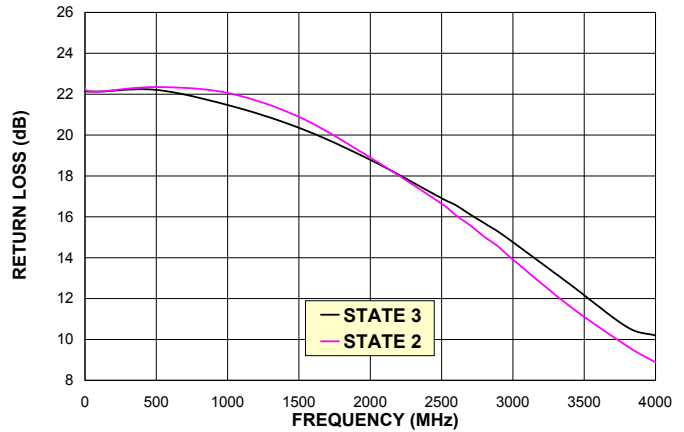
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For switch state see Truth Table 1 on page 3.

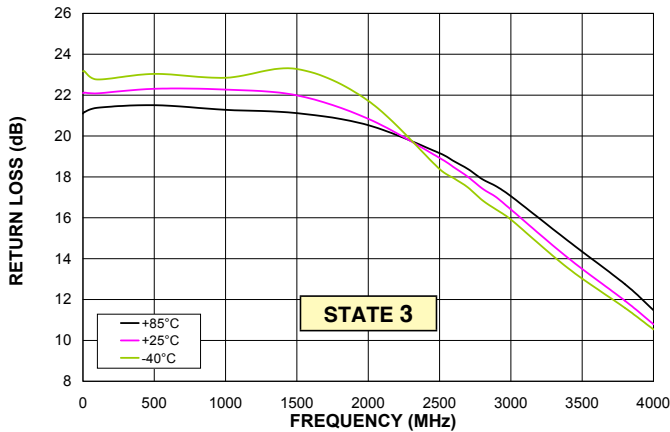
RF RETURN LOSS Vs. FREQUENCY @ +25°C



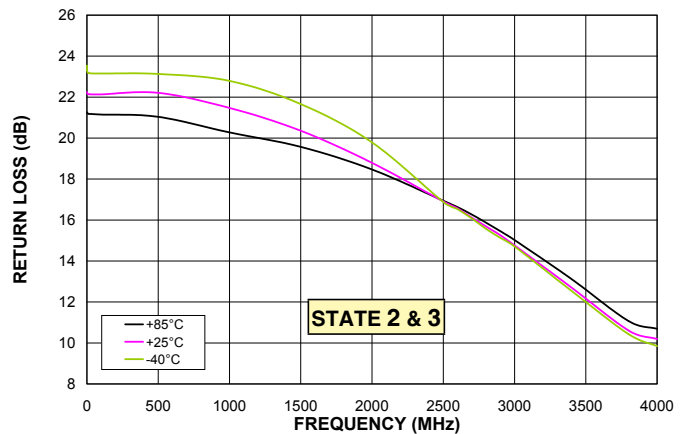
RF COM RETURN LOSS Vs. FREQUENCY @ +25°C



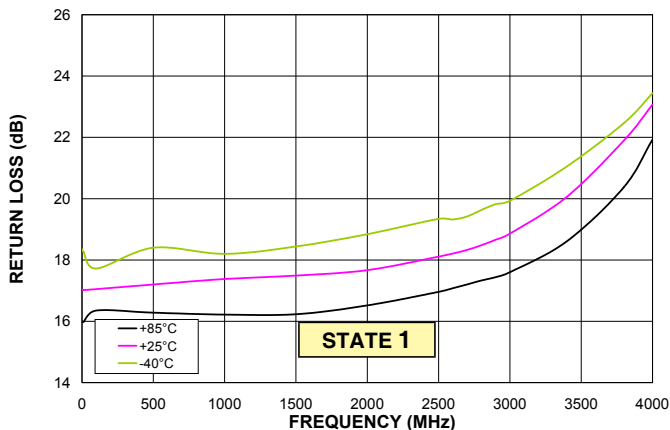
RF1 RETURN LOSS Vs. FREQUENCY



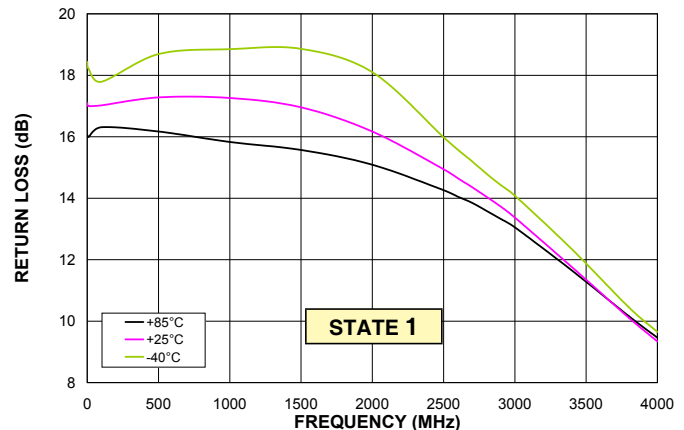
RF COM RETURN LOSS Vs. FREQUENCY



RF1 RETURN LOSS Vs. FREQUENCY



RF COM RETURN LOSS Vs. FREQUENCY



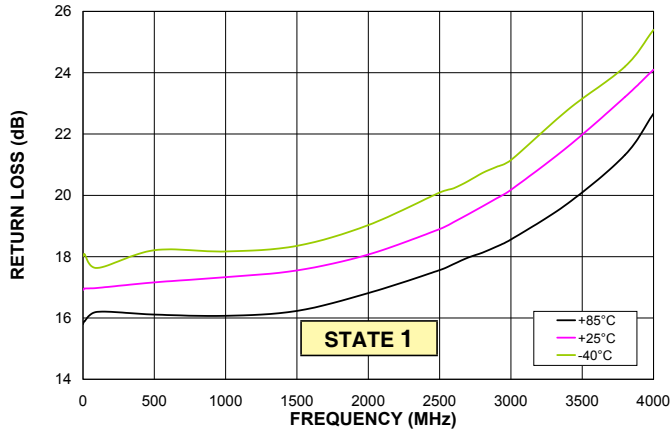


50Ω DC to 3000 MHz Absorptive RF Switch with Internal Driver  
Single Supply Voltage, +3 V

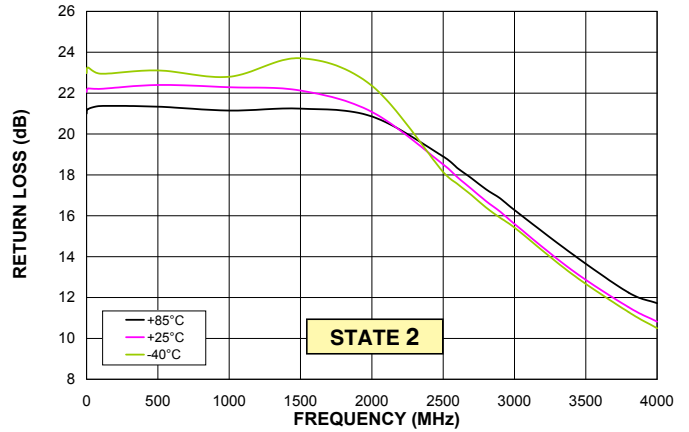
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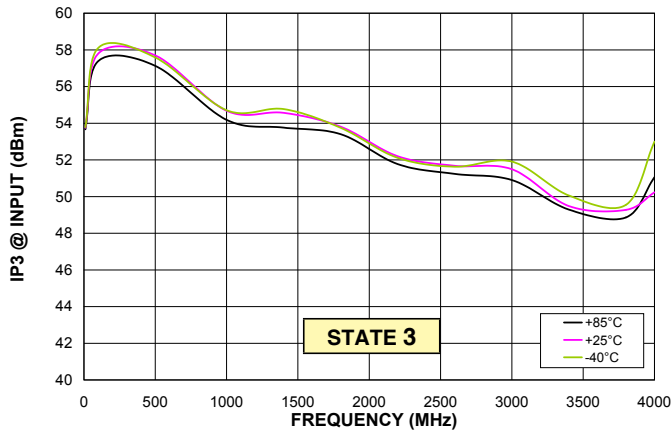
RF2 RETURN LOSS Vs. FREQUENCY



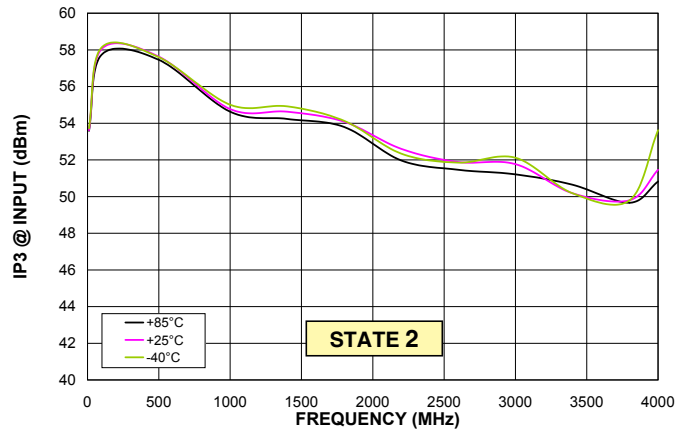
RF2 RETURN LOSS Vs. FREQUENCY



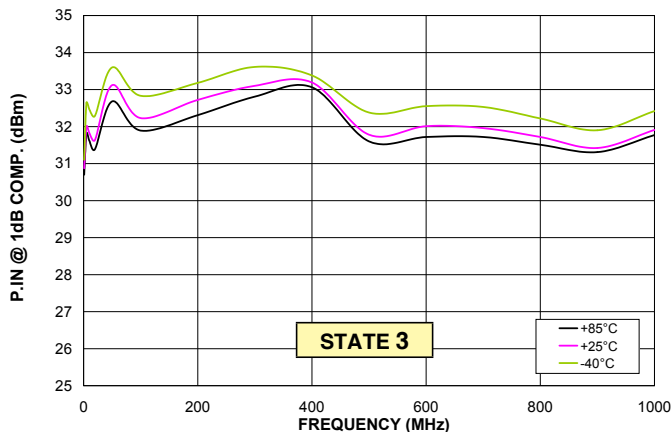
INPUT IP3 Vs. FREQUENCY



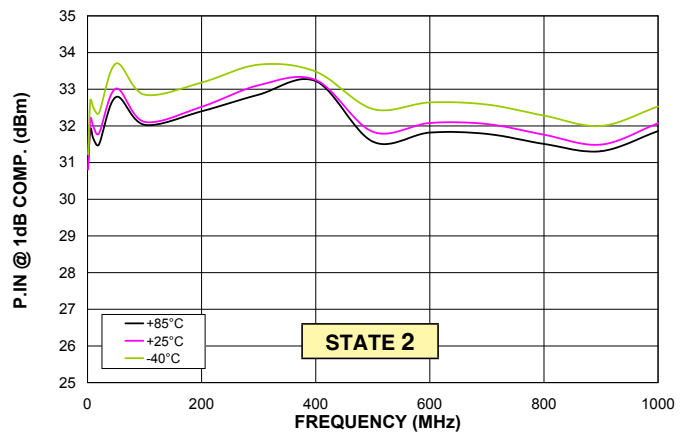
INPUT IP3 Vs. FREQUENCY



POWER IN @ 1dB COMPRESSION Vs. FREQUENCY



POWER IN @ 1dB COMPRESSION Vs. FREQUENCY





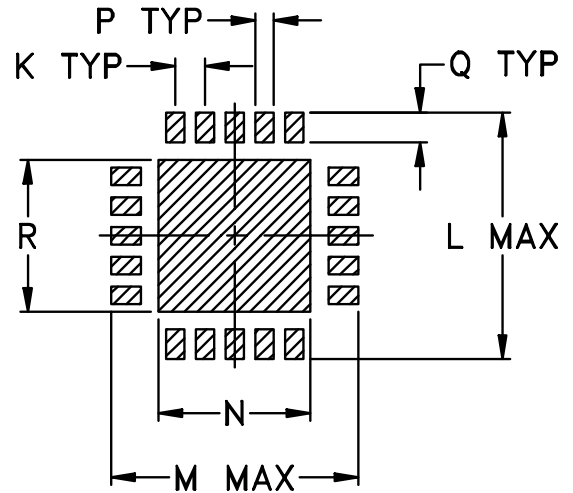
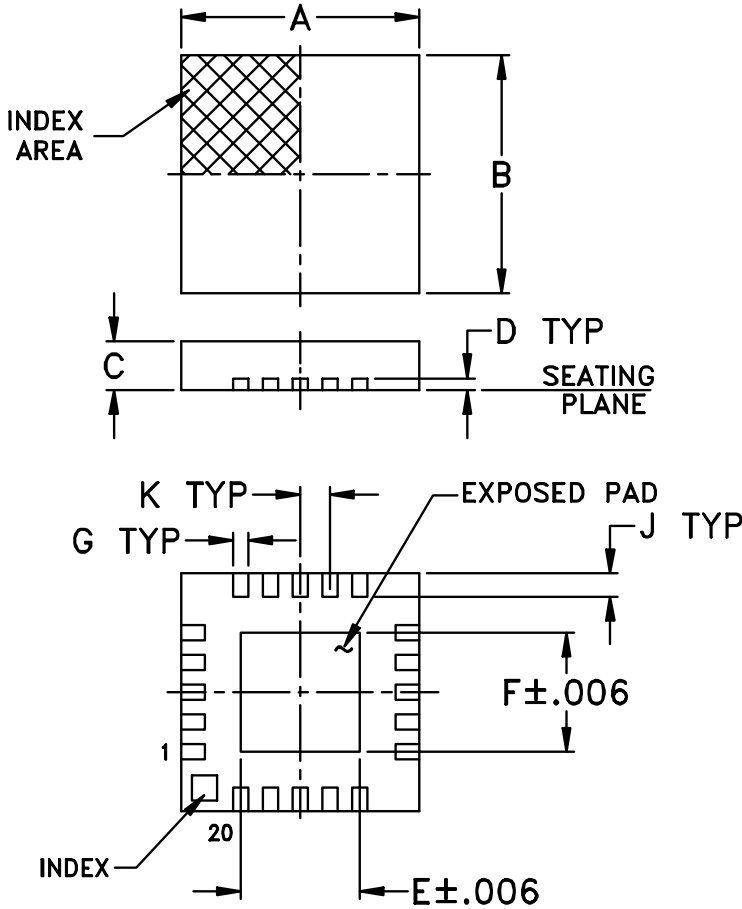
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# SPDT RF Switch

## HSWA2-30DR+

50Ω DC to 3000 MHz Absorptive RF Switch with Internal Driver  
Single Supply Voltage, +3 V

### CASE STYLE DRAWING



**SUGGESTED LAYOUT FOR PCB LAND PATTERN**  
PATTERN TO BE WITHIN  $\pm 0.002$

**TOLERANCES**

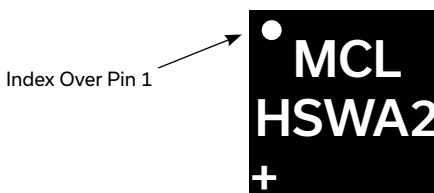
$\pm 0.005$

UNLESS OTHERWISE SPECIFIED

### OUTLINE DIMENSIONS (Inches/mm)

A	B	C	D	E	F	G	H	J
.157	.157	.035	.008	.081	.081	.010	--	.022
4.00	4.00	0.90	0.20	2.06	2.06	0.25	--	0.56
K	L	M	N	P	Q	R	wt	
.020	.177	.177	.081	.010	.032	.081	grams	
0.50	4.50	4.50	2.06	0.25	0.81	2.06	0.04	

### PRODUCT MARKING



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





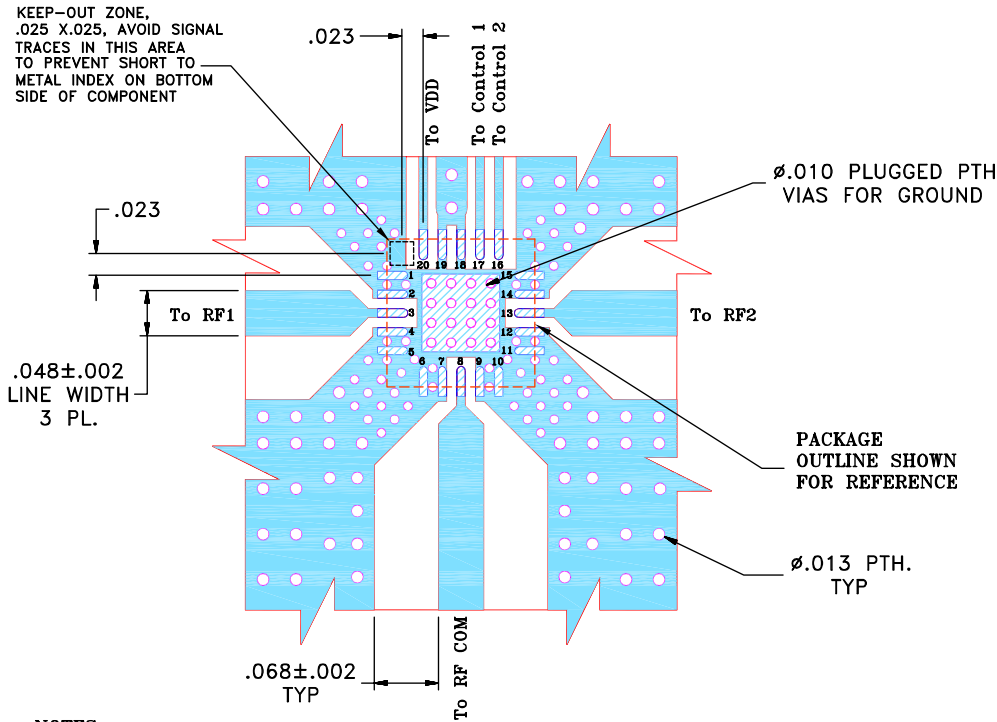
**SURFACE MOUNT**

# SPDT RF Switch

## HSWA2-30DR+

50Ω DC to 3000 MHz Absorptive RF Switch with Internal Driver  
Single Supply Voltage, +3 V

### SUGGESTED LAYOUT FOR PCB DESIGN (PL-206)



**NOTES:**

1. TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS. .025"±.002". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH 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 SOLDERMASK

**Recommended Layout for PCB Design**

The amount of vias surrounding the device in the suggested PCB layout are critical for obtaining the specified isolation performance for the device shown in the datasheet.



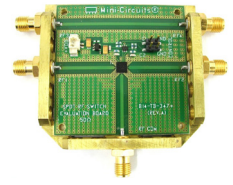
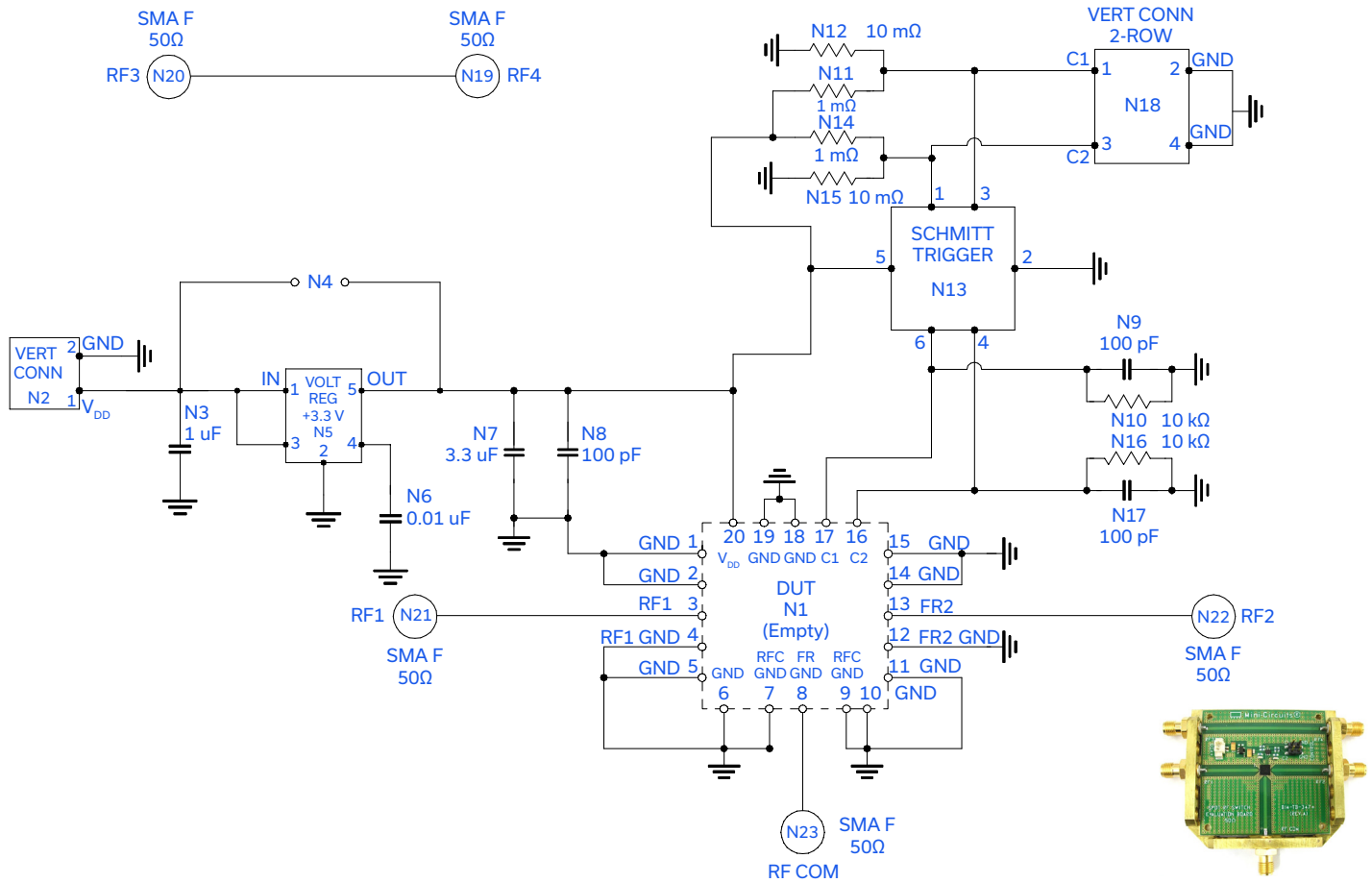
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# SPDT RF Switch

## HSWA2-30DR+

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Single Supply Voltage, +3 V

### TB-HSWA2-30DR+ EVALUATION BOARD SCHEMATIC DIAGRAM



TB-HSWA2-30DR+

Bill of Materials		
N#	Description	Qty.
N3	Capacitor Tantalum 1206 1 μF +/-10%	1
N6	Capacitor X7R 0402 0.01 μF +/-10%	1
N7	Capacitor Tantalum 1206 3.3 μF +/-10%	1
N8,N9,N17	Capacitor 0603 NPO 100 pF +/-5%	3
N11,N14	Resistor 0603 1 MOHM +/-1%	2
N12,N15	Resistor 0603 10 MOHM +/-1%	2
N10,N16	Resistor 0603 10 KOHM +/-1%	2
N5	LDO Voltage Regulator +3.3 V MAX8878	1
N13	Dual Non-inverted Schmitt Trigger SN74LVC2G17	1
N1	Empty (location for HSWA2-30DR+)	1
N4	Empty	1

#### How to Use Evaluation Board TB-HSWA2-30DR+

The Evaluation board TB-HSWA2-30DR+ was designed to evaluate the electrical performance of the HSWA2-30DR+ SPDT switch.

RF3 and RF4 SMA 50Ω connectors are connected through a 50Ω transmission line that is used to estimate the evaluation board loss for de-embedding purposes. The transmission lines were designed using a coplanar waveguide with ground plane. For details, please see suggested PCB layout on Page 8. The number of vias surrounding the switch is critical for obtaining the specified isolation.

The TB-HSWA2-30DR+ operates from +2.7 V to +6.5 V applied to V<sub>DD</sub> connector. IC1 voltage regulator limits the supply voltage to the switch to +3.3 V. IC2 is a Schmitt trigger & buffer which prevents an overload of switch control inputs from high level control signals (up to +5.5 V) and prevents from noise and transient spikes during switching process.

The control connector is used for computer control mode or manual operation mode. In manual control mode connect Control 1 and/or Control 2 to ground to set Control 1 and/or Control 2 to logic low, respectively. When jumpers are removed, the digital control input pulled up to V<sub>DD</sub> for logic high.

For computer control mode the software & cable are supplied. The cable should be connected between computer LPT port and evaluation board control connector.





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Single Supply Voltage, +3 V

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD.

[CLICK HERE](#)

Performance Data	Data Table Swept Graphs
Case Style	DG983-1 Plastic package, exposed paddle, Termination Finish: NiPdAu
Tape & Reel Standard Quantities Available on Reel	F87 7" Reels with 20, 50, 100, 200, 500, or 1000 devices 13" Reels with 3000 devices
Suggested Layout for PCB Design	PL-206
Evaluation Board	TB-HSWA2-30DR+
Environmental Ratings	ENV33

#### 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*

FREQ (MHz)	INSERTION LOSS @ Vdd=+3V OVER TEMPERATURE						FREQ (MHz)	ISOLATION @ Vdd=+3V OVER TEMPERATURE														
	RF COM-RF1 (dB)			RF COM-RF2 (dB)				RF COM-RF1 (dB)			RF COM-RF2 (dB)			RF1-RF2 (dB)			RF1-RF2 (dB)			RF1-RF2 (dB)		
	STATE 3*			STATE 2*				STATE 2*			STATE 3*			STATE 3*			STATE 2*			STATE 1*		
	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C		-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C
0.03	0.60	0.68	0.81	0.69	0.75	0.88	0.03	86.96	101.14	81.22	83.71	83.39	99.47	108.91	92.36	96.89	81.51	80.78	85.41	90.43	87.46	94.14
0.10	0.62	0.70	0.81	0.64	0.71	0.82	0.10	93.01	91.42	90.61	102.61	95.95	90.16	101.12	90.88	102.87	87.24	94.27	92.95	93.43	90.56	88.32
1.00	0.63	0.71	0.81	0.63	0.70	0.80	1.00	105.35	91.72	98.17	102.82	98.35	105.71	97.14	102.22	99.27	96.14	94.95	95.35	95.72	101.92	110.17
10.00	0.64	0.71	0.80	0.62	0.70	0.79	10.00	103.50	101.51	97.57	101.09	98.64	101.96	104.13	94.21	92.11	95.59	94.83	94.34	103.69	93.52	107.63
50.00	0.66	0.73	0.82	0.64	0.72	0.82	50.00	92.50	96.44	98.14	92.77	100.44	92.30	85.28	84.75	89.07	87.76	85.68	93.73	94.45	100.02	97.80
100.00	0.66	0.73	0.80	0.64	0.72	0.80	100.00	103.43	88.22	92.60	89.11	97.07	91.83	82.23	83.50	81.96	79.77	82.75	81.00	119.37	87.83	92.40
200.00	0.66	0.75	0.81	0.66	0.74	0.79	200.00	87.07	92.18	110.11	89.98	98.20	88.52	76.42	74.34	75.57	76.75	74.33	76.94	87.15	87.59	85.54
300.00	0.65	0.76	0.83	0.64	0.74	0.82	300.00	91.28	88.75	92.66	83.44	89.64	87.20	72.17	71.75	72.41	72.64	72.83	73.94	81.00	81.95	80.82
400.00	0.69	0.79	0.88	0.69	0.79	0.86	400.00	90.91	90.12	91.87	81.76	80.32	87.81	70.09	69.68	70.69	70.65	70.29	70.22	82.71	79.02	80.47
500.00	0.69	0.81	0.88	0.69	0.78	0.87	500.00	84.29	85.17	88.24	79.04	79.49	79.99	68.79	68.33	68.68	68.26	67.91	68.75	76.92	76.11	77.51
600.00	0.69	0.79	0.89	0.67	0.78	0.88	600.00	79.88	81.13	80.84	79.11	76.79	76.55	67.42	66.78	67.82	66.64	67.80	67.46	80.21	76.22	77.97
700.00	0.68	0.79	0.89	0.67	0.77	0.87	700.00	77.18	78.93	79.38	73.92	74.36	73.26	65.65	66.19	65.83	64.96	65.94	65.71	75.38	75.49	75.15
800.00	0.68	0.79	0.90	0.67	0.78	0.88	800.00	75.19	76.35	77.94	70.85	70.73	71.24	65.18	65.63	65.47	65.04	65.71	64.99	75.06	76.01	74.80
900.00	0.67	0.79	0.89	0.65	0.78	0.87	900.00	72.35	73.60	74.05	68.80	68.57	68.82	63.81	64.40	64.31	63.85	64.25	64.19	73.10	72.43	72.80
1000.00	0.67	0.78	0.89	0.65	0.76	0.87	1000.00	70.76	71.58	70.92	67.99	66.78	67.74	62.70	63.58	63.15	63.79	64.08	63.89	73.57	72.54	72.41
1100.00	0.65	0.78	0.90	0.65	0.76	0.88	1100.00	68.34	70.20	70.36	64.72	65.24	64.97	62.78	62.77	62.96	62.50	62.66	63.04	71.67	71.46	73.39
1200.00	0.66	0.79	0.91	0.66	0.78	0.90	1200.00	67.34	67.54	67.30	63.83	63.09	63.58	61.74	62.28	62.63	61.87	62.79	62.89	71.83	71.04	73.62
1300.00	0.65	0.80	0.92	0.65	0.78	0.90	1300.00	66.04	66.53	66.59	61.90	61.71	61.21	61.50	62.06	62.51	62.12	61.93	62.60	72.68	70.84	71.69
1400.00	0.67	0.81	0.91	0.66	0.79	0.91	1400.00	65.72	65.42	65.44	60.73	60.65	60.72	61.40	61.78	61.82	61.90	62.02	61.98	70.66	72.25	72.34
1500.00	0.67	0.81	0.91	0.66	0.80	0.90	1500.00	63.30	63.86	63.01	59.24	59.03	59.59	61.31	61.59	62.14	61.80	61.62	61.87	71.20	71.77	71.98
1600.00	0.7	0.84	0.94	0.69	0.82	0.92	1600.00	60.67	60.36	60.42	58.25	58.25	58.27	60.89	61.10	61.63	61.40	61.44	61.94	71.74	73.31	73.00
1700.00	0.72	0.86	0.95	0.69	0.84	0.94	1700.00	60.15	60.01	59.91	56.82	57.16	56.98	59.64	60.09	60.88	59.63	59.90	60.32	70.69	70.95	69.86
1800.00	0.73	0.87	0.97	0.71	0.85	0.95	1800.00	59.78	59.48	59.28	55.71	56.17	55.64	59.69	60.52	60.66	59.65	59.75	60.16	70.97	70.92	70.96
1900.00	0.74	0.88	0.97	0.71	0.85	0.95	1900.00	58.16	57.65	57.02	54.73	54.64	54.56	60.39	60.40	60.25	61.04	61.01	60.37	70.82	69.83	70.25
2000.00	0.77	0.91	1.01	0.75	0.90	0.98	2000.00	57.17	56.78	56.95	53.21	52.82	54.15	59.32	57.63	59.68	59.39	59.13	60.49	71.82	69.49	71.45
2100.00	0.79	0.94	1.02	0.77	0.91	1.01	2100.00	54.44	53.75	53.64	52.70	52.13	52.20	61.07	59.98	60.14	62.08	60.66	59.61	79.05	76.39	74.50
2200.00	0.81	0.96	1.05	0.80	0.95	1.03	2200.00	53.69	52.85	52.56	54.46	54.43	53.22	56.85	56.72	56.70	55.77	55.17	56.24	66.88	66.28	65.69
2300.00	0.85	0.98	1.07	0.84	0.98	1.07	2300.00	49.62	48.91	48.94	52.00	53.91	57.00	52.30	53.43	53.11	53.42	53.17	53.57	61.27	61.82	61.63
2400.00	0.85	0.97	1.06	0.85	0.99	1.07	2400.00	47.62	48.25	49.12	55.80	56.38	59.42	53.37	54.23	55.40	53.03	53.18	54.29	63.23	63.56	64.60
2500.00	0.81	0.94	1.03	0.81	0.93	1.03	2500.00	51.33	51.50	51.35	53.70	52.35	52.98	56.96	57.15	56.32	52.10	55.06	55.38	67.48	72.66	67.99
2600.00	0.83	0.95	1.04	0.82	0.95	1.04	2600.00	50.47	49.82	49.29	49.90	49.44	49.07	55.63	56.12	55.89	55.62	54.91	55.75	67.61	69.59	70.31
2700.00	0.81	0.95	1.04	0.81	0.95	1.04	2700.00	49.38	49.27	48.53	48.68	48.03	47.92	56.81	55.95	55.38	56.39	56.08	55.27	71.50	73.65	71.21
2800.00	0.84	0.98	1.08	0.85	0.98	1.07	2800.00	48.23	47.52	47.19	47.35	46.71	46.32	57.48	56.55	54.68	57.51	55.67	54.95	80.91	104.96	74.54
2900.00	0.84	0.97	1.06	0.84	0.97	1.08	2900.00	48.82	48.06	47.22	45.60	45.81	45.84	53.36	51.79	52.86	53.98	52.23	53.14	68.95	67.10	69.88
3000.00	0.89	1.02	1.12	0.90	1.04	1.15	3000.00	46.26	45.83	45.70	45.22	44.57	44.38	54.48	52.34	51.48	54.26	52.00	51.25	74.83	68.87	66.11

\*Note:

STATE	CONTROL INPUT		RF Com to RF1	RF Com to RF2
	Control 1	Control 2		
1	Low	Low	OFF	OFF
2	Low	High	OFF	ON
3	High	Low	ON	OFF



*Typical Performance Data*

FREQ (MHz)	VSWR @ Vdd=+3V OVER TEMPERATURE																																
	RF COM (:1)			RF COM (:1)			RF1 (:1)			RF1 (:1)			RF2 (:1)			RF2 (:1)			RF COM (:1)			RF1 (:1)			RF2 (:1)								
	STATE 3*			STATE 2*			STATE 3*			STATE 2*			STATE 3*			STATE 2*			STATE 1*			STATE 1*			STATE 1*								
	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C			
0.03	1.14	1.17	1.19	1.14	1.16	1.19	1.15	1.17	1.19	1.28	1.33	1.38	1.29	1.33	1.38	1.15	1.17	1.20	1.27	1.32	1.37	1.28	1.33	1.38	1.29	1.33	1.39	1.28	1.33	1.38	1.29	1.33	1.39
0.10	1.14	1.17	1.19	1.14	1.17	1.19	1.15	1.17	1.19	1.28	1.33	1.38	1.29	1.33	1.38	1.15	1.17	1.19	1.28	1.33	1.38	1.28	1.33	1.38	1.28	1.33	1.38	1.28	1.33	1.38	1.29	1.33	1.39
1.00	1.15	1.17	1.19	1.15	1.17	1.19	1.15	1.17	1.19	1.28	1.33	1.38	1.29	1.33	1.38	1.15	1.17	1.19	1.28	1.33	1.38	1.28	1.33	1.38	1.28	1.33	1.38	1.28	1.33	1.38	1.29	1.33	1.38
10.00	1.15	1.17	1.19	1.15	1.17	1.19	1.15	1.17	1.19	1.28	1.33	1.38	1.29	1.33	1.38	1.15	1.17	1.19	1.28	1.33	1.38	1.28	1.33	1.38	1.28	1.33	1.38	1.28	1.33	1.38	1.29	1.33	1.38
50.00	1.15	1.17	1.19	1.15	1.17	1.19	1.15	1.17	1.19	1.29	1.33	1.37	1.29	1.33	1.38	1.15	1.17	1.19	1.29	1.33	1.37	1.28	1.33	1.37	1.29	1.33	1.37	1.29	1.33	1.38	1.29	1.33	1.38
100.00	1.15	1.17	1.19	1.16	1.17	1.18	1.16	1.17	1.19	1.30	1.33	1.36	1.30	1.33	1.37	1.15	1.17	1.19	1.30	1.33	1.36	1.30	1.33	1.36	1.30	1.33	1.36	1.30	1.33	1.36	1.30	1.33	1.37
200.00	1.16	1.17	1.19	1.17	1.17	1.17	1.15	1.17	1.18	1.30	1.33	1.35	1.31	1.33	1.35	1.16	1.17	1.18	1.30	1.33	1.35	1.30	1.33	1.35	1.31	1.33	1.35	1.31	1.33	1.35	1.31	1.33	1.35
300.00	1.16	1.17	1.19	1.15	1.17	1.18	1.15	1.17	1.19	1.28	1.32	1.36	1.29	1.33	1.36	1.15	1.17	1.19	1.28	1.32	1.36	1.28	1.33	1.36	1.29	1.33	1.36	1.29	1.33	1.36	1.29	1.33	1.36
400.00	1.15	1.17	1.19	1.14	1.17	1.19	1.16	1.17	1.19	1.28	1.32	1.37	1.28	1.33	1.37	1.15	1.16	1.19	1.26	1.32	1.37	1.28	1.32	1.37	1.28	1.32	1.37	1.28	1.32	1.37	1.28	1.32	1.37
500.00	1.15	1.17	1.19	1.14	1.17	1.19	1.15	1.17	1.18	1.27	1.32	1.36	1.28	1.32	1.37	1.15	1.16	1.19	1.26	1.32	1.37	1.27	1.32	1.36	1.28	1.32	1.36	1.28	1.32	1.37	1.28	1.32	1.37
600.00	1.15	1.17	1.20	1.14	1.16	1.19	1.15	1.17	1.18	1.27	1.32	1.36	1.27	1.32	1.36	1.15	1.16	1.19	1.26	1.32	1.37	1.27	1.32	1.36	1.27	1.32	1.36	1.27	1.32	1.37	1.28	1.32	1.37
700.00	1.15	1.17	1.20	1.14	1.17	1.19	1.15	1.17	1.19	1.27	1.32	1.36	1.28	1.32	1.36	1.15	1.16	1.19	1.26	1.32	1.37	1.27	1.32	1.36	1.27	1.32	1.36	1.27	1.32	1.37	1.28	1.32	1.37
800.00	1.16	1.18	1.21	1.15	1.17	1.20	1.15	1.16	1.19	1.27	1.32	1.36	1.28	1.32	1.37	1.15	1.16	1.19	1.26	1.32	1.38	1.27	1.32	1.36	1.28	1.32	1.36	1.28	1.32	1.37	1.28	1.32	1.37
900.00	1.16	1.18	1.21	1.15	1.17	1.20	1.15	1.17	1.19	1.27	1.31	1.37	1.28	1.32	1.37	1.15	1.17	1.19	1.26	1.32	1.38	1.27	1.31	1.37	1.28	1.32	1.37	1.28	1.32	1.37	1.28	1.32	1.37
1000.00	1.16	1.18	1.21	1.14	1.17	1.21	1.16	1.17	1.19	1.28	1.31	1.36	1.28	1.32	1.37	1.16	1.17	1.19	1.26	1.32	1.39	1.28	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37
1100.00	1.17	1.19	1.22	1.15	1.17	1.21	1.15	1.17	1.19	1.28	1.31	1.37	1.28	1.31	1.37	1.15	1.17	1.19	1.26	1.32	1.39	1.28	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37
1200.00	1.17	1.19	1.22	1.15	1.18	1.21	1.15	1.17	1.19	1.28	1.31	1.37	1.28	1.31	1.37	1.15	1.17	1.19	1.26	1.32	1.39	1.27	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37
1300.00	1.17	1.20	1.23	1.15	1.18	1.22	1.15	1.17	1.19	1.28	1.31	1.37	1.28	1.31	1.37	1.15	1.17	1.19	1.26	1.32	1.40	1.28	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37
1400.00	1.17	1.21	1.23	1.15	1.19	1.22	1.14	1.17	1.19	1.27	1.31	1.37	1.28	1.31	1.37	1.14	1.17	1.19	1.26	1.33	1.40	1.27	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37
1500.00	1.18	1.21	1.23	1.16	1.20	1.22	1.15	1.17	1.19	1.27	1.31	1.36	1.28	1.31	1.36	1.14	1.17	1.19	1.26	1.33	1.40	1.27	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37	1.28	1.31	1.37
1600.00	1.19	1.22	1.24	1.17	1.21	1.23	1.15	1.18	1.20	1.27	1.31	1.36	1.27	1.30	1.36	1.14	1.17	1.19	1.26	1.34	1.40	1.27	1.31	1.36	1.27	1.30	1.36	1.27	1.30	1.36	1.27	1.30	1.36
1700.00	1.20	1.23	1.25	1.18	1.22	1.24	1.15	1.18	1.20	1.27	1.31	1.36	1.27	1.30	1.35	1.14	1.18	1.19	1.27	1.34	1.41	1.27	1.31	1.36	1.27	1.30	1.36	1.27	1.30	1.36	1.27	1.30	1.36
1800.00	1.20	1.24	1.25	1.18	1.23	1.25	1.16	1.19	1.20	1.27	1.30	1.36	1.27	1.30	1.35	1.14	1.18	1.19	1.26	1.35	1.41	1.27	1.31	1.36	1.27	1.30	1.35	1.27	1.30	1.35	1.27	1.30	1.35
1900.00	1.21	1.25	1.26	1.19	1.24	1.26	1.16	1.19	1.20	1.27	1.30	1.35	1.26	1.29	1.34	1.15	1.19	1.20	1.27	1.36	1.42	1.27	1.30	1.35	1.26	1.29	1.34	1.27	1.30	1.35	1.26	1.29	1.34
2000.00	1.23	1.26	1.27	1.22	1.26	1.27	1.18	1.20	1.21	1.26	1.30	1.35	1.25	1.29	1.34	1.16	1.19	1.20	1.28	1.37	1.43	1.26	1.30	1.35	1.25	1.29	1.34	1.26	1.30	1.35	1.25	1.29	1.34
2100.00	1.25	1.27	1.28	1.24	1.27	1.28	1.19	1.21	1.22	1.26	1.30	1.35	1.24	1.28	1.33	1.18	1.20	1.20	1.30	1.38	1.44	1.26	1.30	1.35	1.24	1.28	1.33	1.26	1.30	1.35	1.24	1.28	1.33
2200.00	1.26	1.28	1.29	1.25	1.29	1.30	1.21	1.22	1.22	1.25	1.30	1.34	1.24	1.28	1.32	1.20	1.21	1.21	1.31	1.39	1.45	1.25	1.30	1.35	1.23	1.27	1.32	1.26	1.30	1.35	1.23	1.27	1.32
2300.00	1.28	1.29	1.29	1.29	1.31	1.32	1.24	1.24	1.24	1.25	1.29	1.34	1.23	1.27	1.32	1.23	1.22	1.21	1.33	1.41	1.46	1.25	1.29	1.34	1.23	1.27	1.32	1.26	1.30	1.35	1.23	1.27	1.32
2400.00	1.31	1.31	1.32	1.32	1.33	1.32	1.26	1.24	1.24	1.25	1.29	1.34	1.22	1.27	1.31	1.25	1.24	1.23	1.36	1.42	1.47	1.24	1.29	1.34	1.22	1.27	1.31	1.26	1.30	1.35	1.22	1.27	1.31
2500.00	1.33	1.33	1.33	1.34	1.35	1.34	1.27	1.26	1.25	1.25	1.28	1.33	1.22	1.26	1.30	1.28	1.27	1.26	1.38	1.44	1.48	1.24	1.28	1.33	1.22	1.26	1.31	1.26	1.30	1.35	1.22	1.26	1.31
2600.00	1.35	1.35	1.35	1.37	1.37	1.36	1.29	1.27	1.26	1.25	1.28	1.33	1.22	1.25	1.30	1.31	1.29	1.28	1.40	1.45	1.49	1.24	1.28	1.33	1.22	1.25	1.30	1.26	1.30	1.35	1.22	1.25	1.30
2700.00	1.37	1.37	1.36	1.40	1.40	1.39	1.31	1.29	1.27	1.24	1.28	1.32	1.21	1.24	1.29	1.33	1.32	1.29	1.42	1.47	1.51	1.24	1.28	1.32	1.21	1.24	1.29	1.26	1.30	1.35	1.22	1.25	1.30
2800.00	1.40	1.39	1.38	1.43	1.43	1.41	1.34	1.31	1.29	1.24	1.27	1.32	1.20	1.23	1.28	1.36	1.34	1.32	1.44	1.49	1.53	1.23	1.27	1.31	1.20	1.23	1.28	1.26	1.30	1.35	1.22	1.25	1.30
2900.00	1.42	1.42	1.41	1.46	1.46	1.44	1.36	1.33	1.31	1.23	1.26	1.31	1.20	1.23	1.27	1.38	1.37	1.34	1.47	1.52	1.55	1.23	1.26	1.31	1.20	1.23	1.28	1.26	1.30	1.35	1.22	1.25	1.30
3000.00	1.45	1.45	1.43	1.51	1.51	1.48	1.38	1.36	1.33	1.23	1.26	1.30	1.19	1.22	1.27	1.41	1.40	1.36	1.49	1.55	1.57	1.22	1.26	1.30	1.19	1.22	1.27	1.26	1.30	1.35	1.22	1.25	1.30

\*Note:

STATE	CONTROL INPUT		RF Com to RF1	RF Com to RF2
	Control 1	Control 2		
1	Low	Low	OFF	OFF
2	Low	High	OFF	ON
3	High	Low	ON	OFF



## Typical Performance Data

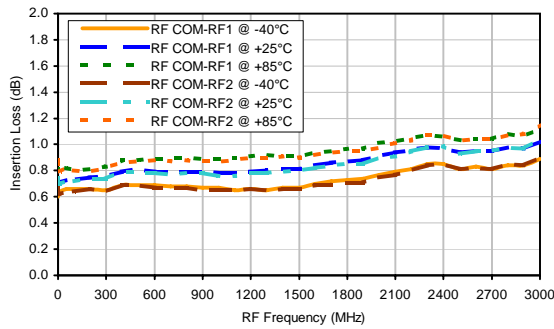
FREQ (MHz)	INPUT IP3 @ Vdd=+3V OVER TEMPERATURE						FREQ (MHz)	INPUT 1dB COMPRESSION @ Vdd=+3V OVER TEMPERATURE					
	RF COM-RF1 (dBm) STATE 3*			RF COM-RF2 (dBm) STATE 2*				RF COM-RF1 (dBm) STATE 3*			RF COM-RF2 (dBm) STATE 2*		
	-40°C	+25°C	+85°C	-40°C	+25°C	+85°C		-40°C	+25°C	+85°C	-40°C	+25°C	+85°C
	10.00	53.78	53.75	53.67	53.72	53.61		53.58	1.00	31.10	30.87	30.70	31.22
20.00	57.08	56.98	57.15	57.09	57.09	56.94	5.00	32.64	32.00	31.81	32.70	32.20	31.91
50.00	65.36	63.62	62.16	65.48	64.30	63.36	10.00	32.47	31.83	31.62	32.51	31.99	31.66
100.00	58.10	57.79	57.38	58.14	58.05	57.74	20.00	32.29	31.64	31.39	32.35	31.79	31.49
200.00	63.99	62.37	60.65	64.45	62.91	61.42	50.00	33.60	33.12	32.68	33.70	33.02	32.79
300.00	63.70	65.38	64.59	63.29	64.80	64.86	100.00	32.83	32.23	31.89	32.85	32.11	32.03
400.00	58.78	59.20	58.73	58.65	58.83	58.98	200.00	33.18	32.72	32.31	33.18	32.52	32.40
500.00	57.59	57.70	57.13	57.60	57.63	57.46	300.00	33.61	33.10	32.81	33.67	33.11	32.85
600.00	55.92	55.92	55.08	55.93	55.87	55.48	400.00	33.38	33.19	33.06	33.48	33.25	33.22
700.00	57.60	57.56	57.79	57.52	57.55	57.15	500.00	32.38	31.78	31.60	32.46	31.84	31.57
800.00	59.23	59.88	60.00	59.37	59.56	61.69	600.00	32.55	32.01	31.72	32.64	32.08	31.82
900.00	56.35	56.56	56.06	56.38	56.35	56.42	700.00	32.53	31.96	31.72	32.58	32.05	31.78
1000.00	54.71	54.68	54.18	55.01	54.77	54.63	800.00	32.22	31.72	31.51	32.28	31.76	31.51
1200.00	53.68	53.53	53.06	54.01	53.75	53.38	900.00	31.90	31.42	31.31	32.00	31.49	31.31
1400.00	54.77	54.57	53.76	54.92	54.63	54.23	1000.00	32.42	31.91	31.77	32.53	32.07	31.86
1600.00	55.32	55.36	54.61	55.48	55.73	55.29							
1800.00	53.75	53.81	53.40	54.13	54.08	53.79							
2000.00	52.61	52.56	52.21	52.84	52.88	52.63							
2200.00	52.11	52.20	51.77	52.34	52.60	51.97							
2400.00	51.79	51.21	50.81	52.84	53.30	52.15							
2600.00	51.63	51.68	51.24	51.85	51.88	51.46							
2800.00	51.61	51.51	50.94	51.95	51.81	51.34							
3000.00	51.91	51.49	50.90	52.12	51.77	51.21							

\*Note:

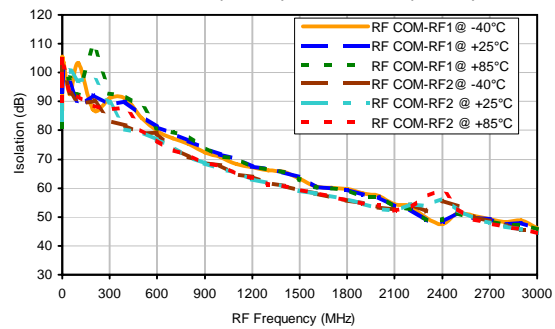
STATE	CONTROL INPUT		RF Com to RF1	RF Com to RF2
	Control 1	Control 2		
1	Low	Low	OFF	OFF
2	Low	High	OFF	ON
3	High	Low	ON	OFF

## Typical Performance Curves

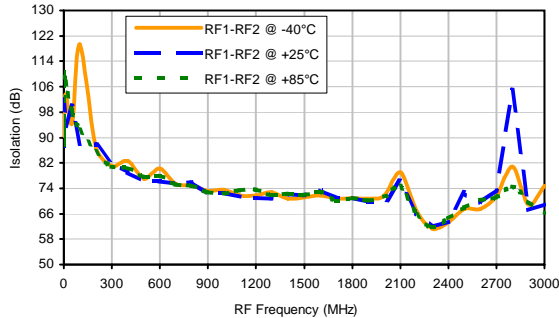
**Insertion Loss @ Vdd=+3V over Temperature**  
RF COM-RF1 (State 3\*) & RF COM RF2 (State 2\*)



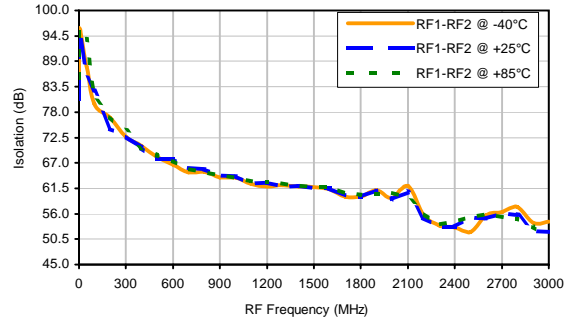
**Isolation @ Vdd=+3V over Temperature**  
RF COM-RF1 (State 2\*) & RF COM RF2 (State 3\*)



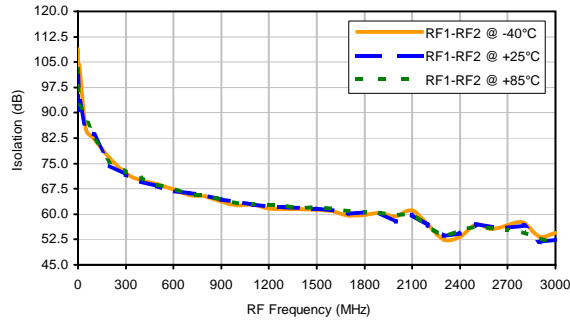
**Isolation @ Vdd=+3V over Temperature**  
RF1-RF2 (State 1\*)



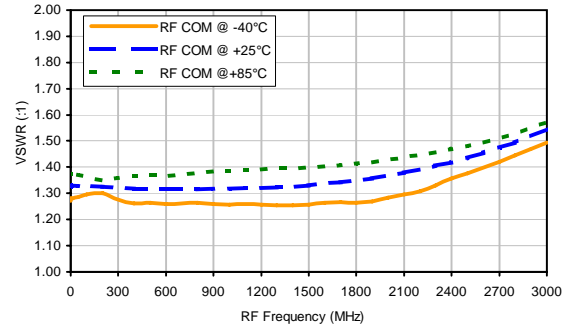
**Isolation @ Vdd=+3V over Temperature**  
RF1-RF2 (State 2\*)



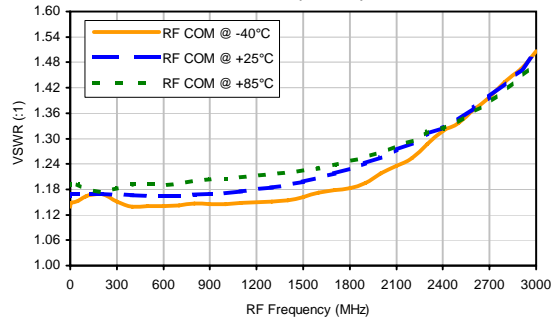
**Isolation @ Vdd=+3V over Temperature**  
RF1-RF2 (State 3\*)



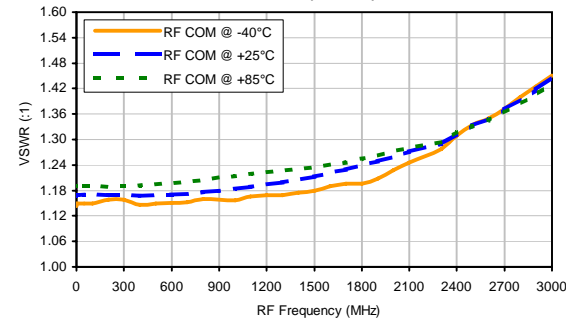
**VSWR @ Vdd=+3V over Temperature**  
RF COM (State 1\*)



**VSWR @ Vdd=+3V over Temperature**  
RF COM (State 2\*)



**VSWR @ Vdd=+3V over Temperature**  
RF COM (State 3\*)

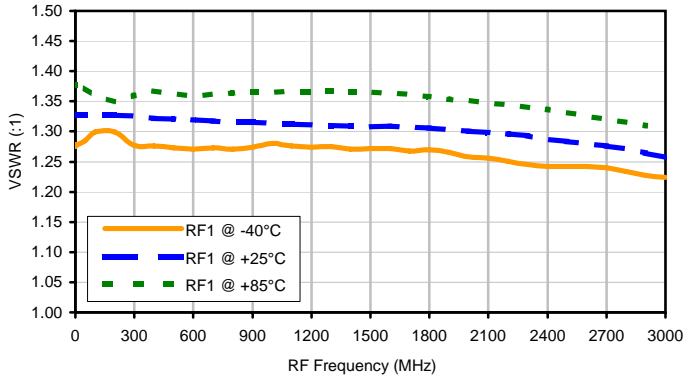


\*Note:

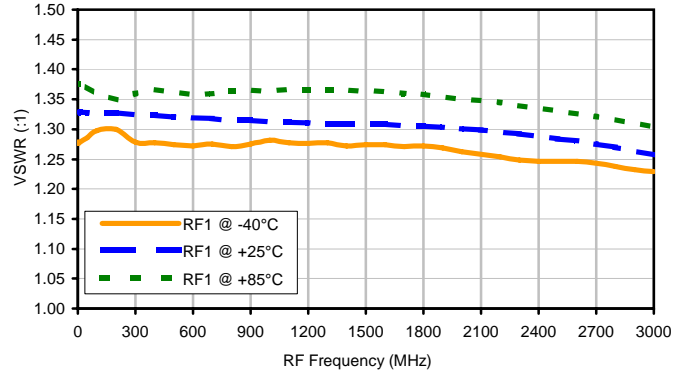
STATE	CONTROL INPUT		RF Com to RF1	RF Com to RF2
	Control 1	Control 2		
1	Low	Low	OFF	OFF
2	Low	High	OFF	ON
3	High	Low	ON	OFF

## Typical Performance Curves

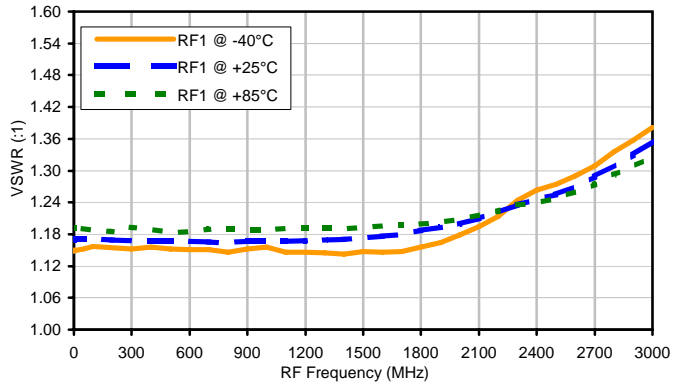
**VSWR @ Vdd=+3V over Temperature  
RF1 (State 1\*)**



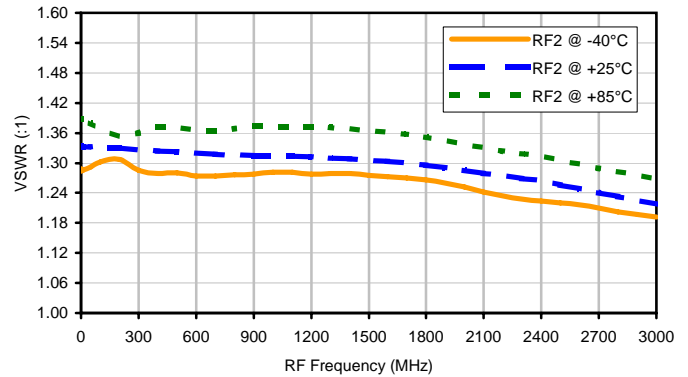
**VSWR @ Vdd=+3V over Temperature  
RF1 (State 2\*)**



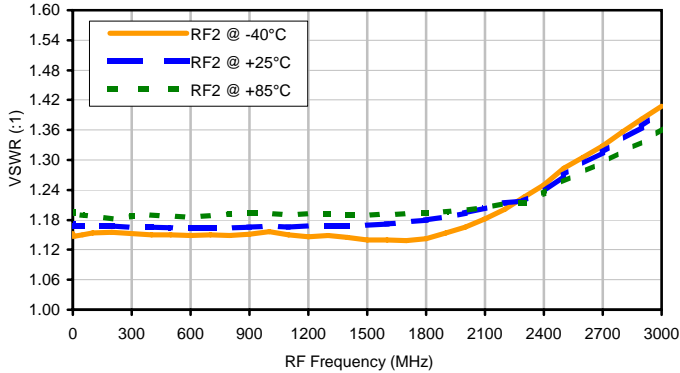
**VSWR @ Vdd=+3V over Temperature  
RF1 (State 3\*)**



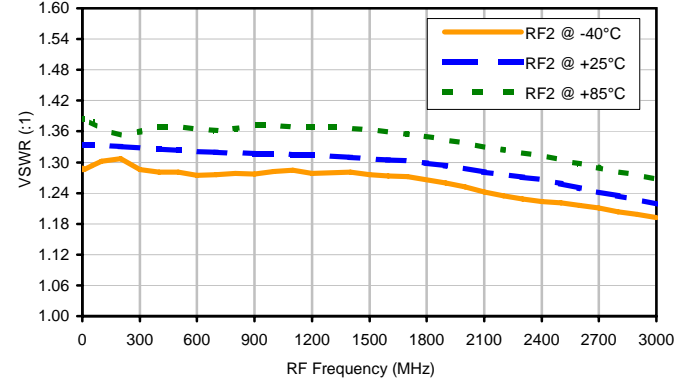
**VSWR @ Vdd=+3V over Temperature  
RF2 (State 1\*)**



**VSWR @ Vdd=+3V over Temperature  
RF2 (State 2\*)**



**VSWR @ Vdd=+3V over Temperature  
RF2 (State 3\*)**

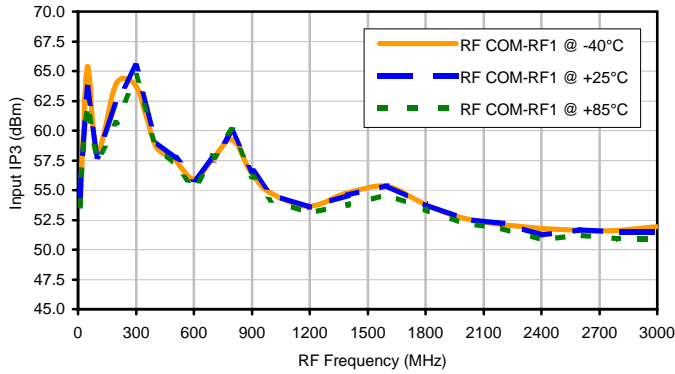


\*Note:

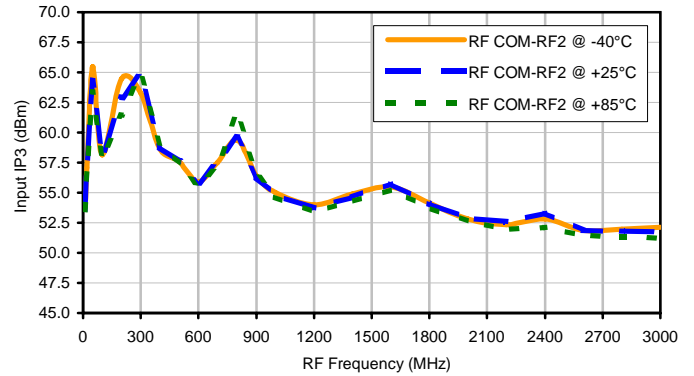
STATE	CONTROL INPUT		RF Com to RF1	RF Com to RF2
	Control 1	Control 2		
1	Low	Low	OFF	OFF
2	Low	High	OFF	ON
3	High	Low	ON	OFF

## Typical Performance Curves

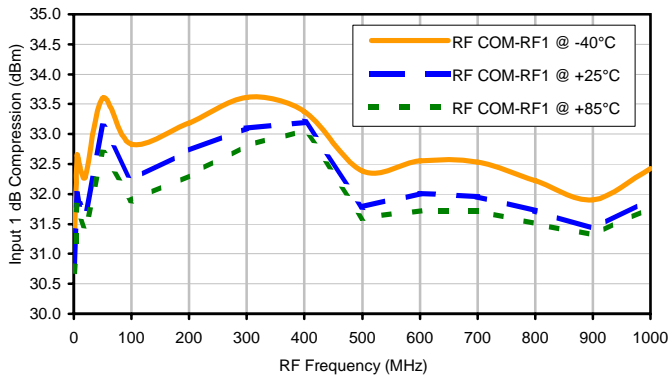
Input IP3 @ Vdd=+3V over Temperature  
RF COM-RF1 (State 3\*)



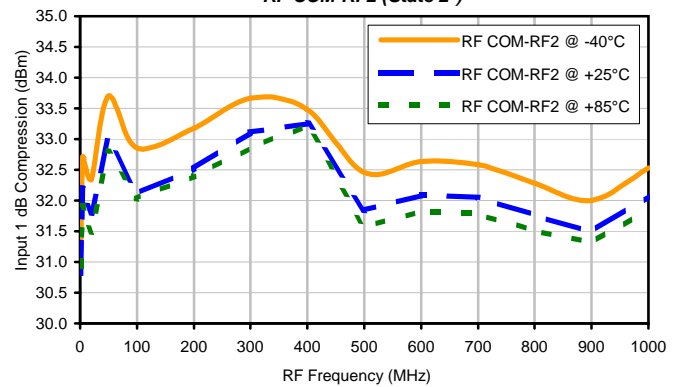
Input IP3 @ Vdd=+3V over Temperature  
RF COM -RF2 (State 2\*)



Input 1dB Compression @ Vdd=+3V over Temperature  
RF COM-RF1 (State 3\*)



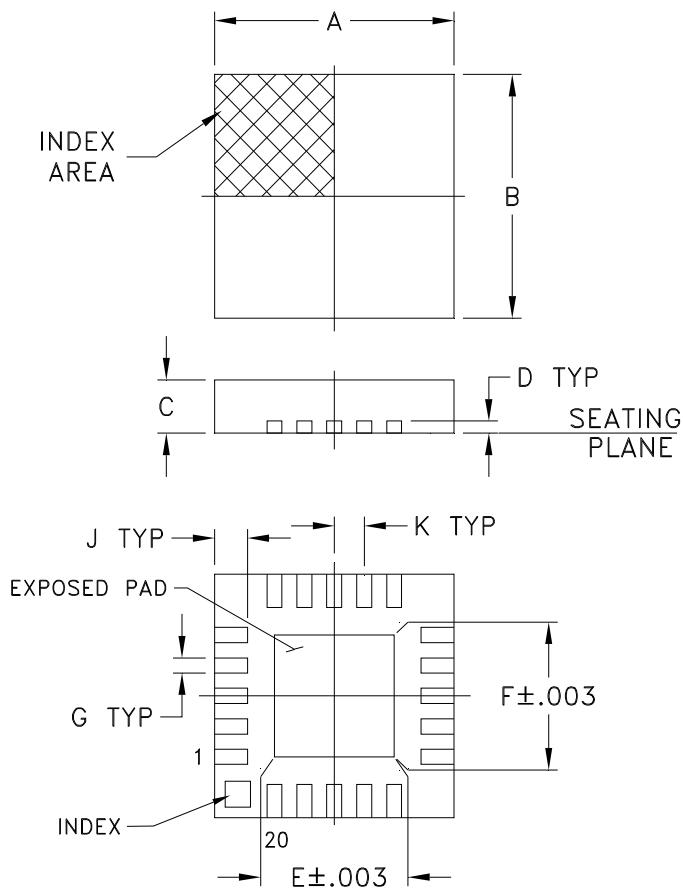
Input 1dB Compression @ Vdd=+3V over Temperature  
RF COM-RF2 (State 2\*)



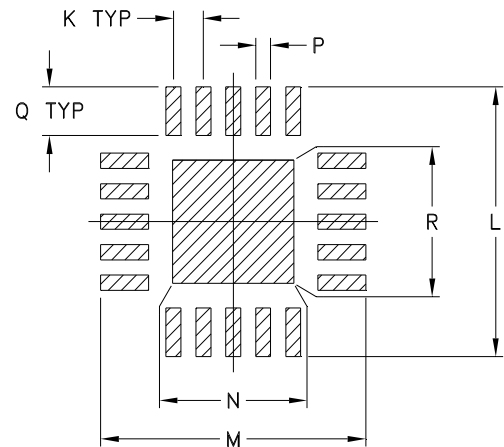
**\*Note:**

STATE	CONTROL INPUT		RF Com to RF1	RF Com to RF2
	Control 1	Control 2		
1	Low	Low	OFF	OFF
2	Low	High	OFF	ON
3	High	Low	ON	OFF

### Outline Dimensions



### PCB Land Pattern



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

CASE #	A	B	C	D	E	F	G	H	J	K
DG983-1	.157 (4.00)	.157 (4.00)	.035 (0.90)	.008 (0.20)	.081 (2.06)	.081 (2.06)	.010 (0.25)	-- --	.022 (0.56)	.020 (0.50)

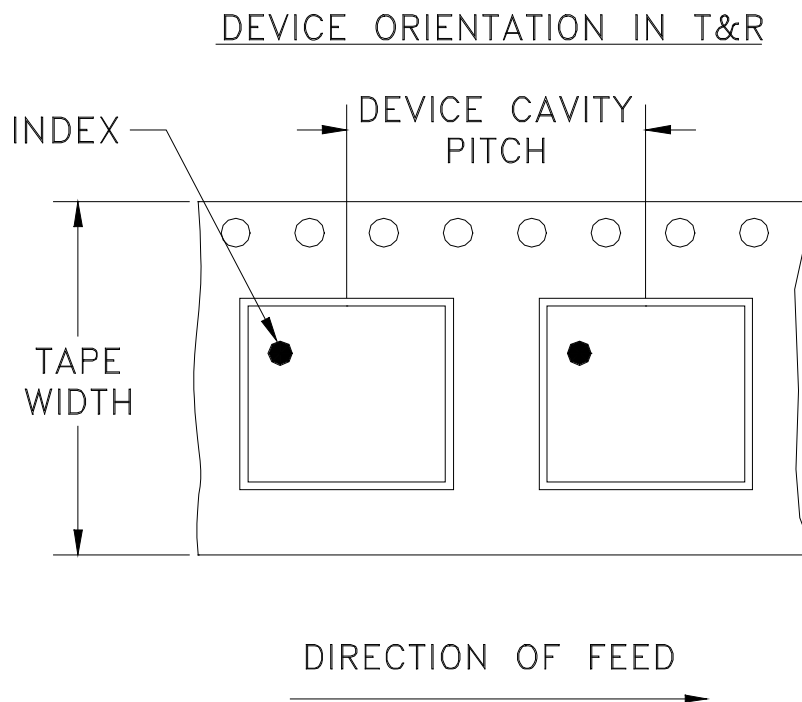
CASE #	L	M	N	P	Q	R	WT. GRAM
DG983-1	.177 (4.50)	.177 (4.50)	.081 (2.06)	.010 (0.25)	.032 (0.81)	.081 (2.06)	.04

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

#### Notes:

- Case material: Plastic.
- Termination finish:  
For RoHS Case Styles: Tin plate. 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)

**Mini-Circuits**<sup>®</sup>

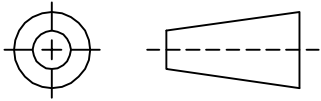
INTERNET <http://www.minicircuits.com>

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

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

THIRD ANGLE PROJECTION

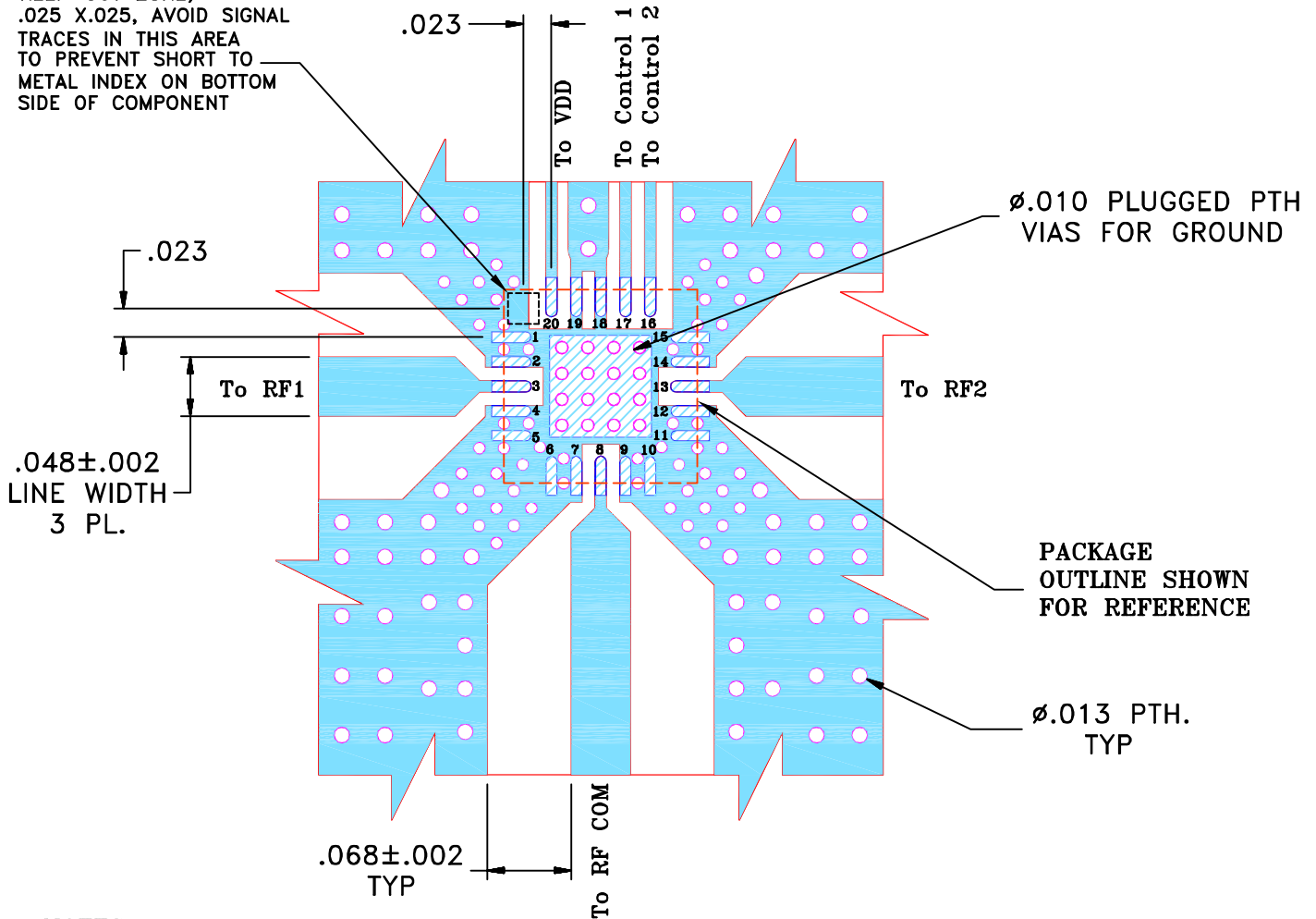


REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
B	M101674	UPDATE LAYOUT	11/05	DK	HH
C	M118768	UPDATE DIMENSION	07/08	HB	KN
D	M124175	PLUG VIAS UNDER UNIT	08/09	EM	HH
D	R77446	PLUG VIAS UNDER UNIT	08/09	EM	HH

**SUGGESTED MOUNTING CONFIGURATION**  
**FOR DG983-1 CASE STYLE, ra PIN CONNECTIONS, 50 Ω.**

KEEP-OUT ZONE,  
 .025 X.025, AVOID SIGNAL  
 TRACES IN THIS AREA  
 TO PREVENT SHORT TO  
 METAL INDEX ON BOTTOM  
 SIDE OF COMPONENT



**NOTES:**

- TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS. .025"±.002". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
- 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 SOLDERMASK

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN HB	23.07.08
TOLERANCES ON:	CHECKED YB	23.07.08
2 PL DECIMALS ±	APPROVED KN	23.07.08
3 PL DECIMALS ± .005		
ANGLES ±		
FRACTIONS ±		



**Mini-Circuits®**

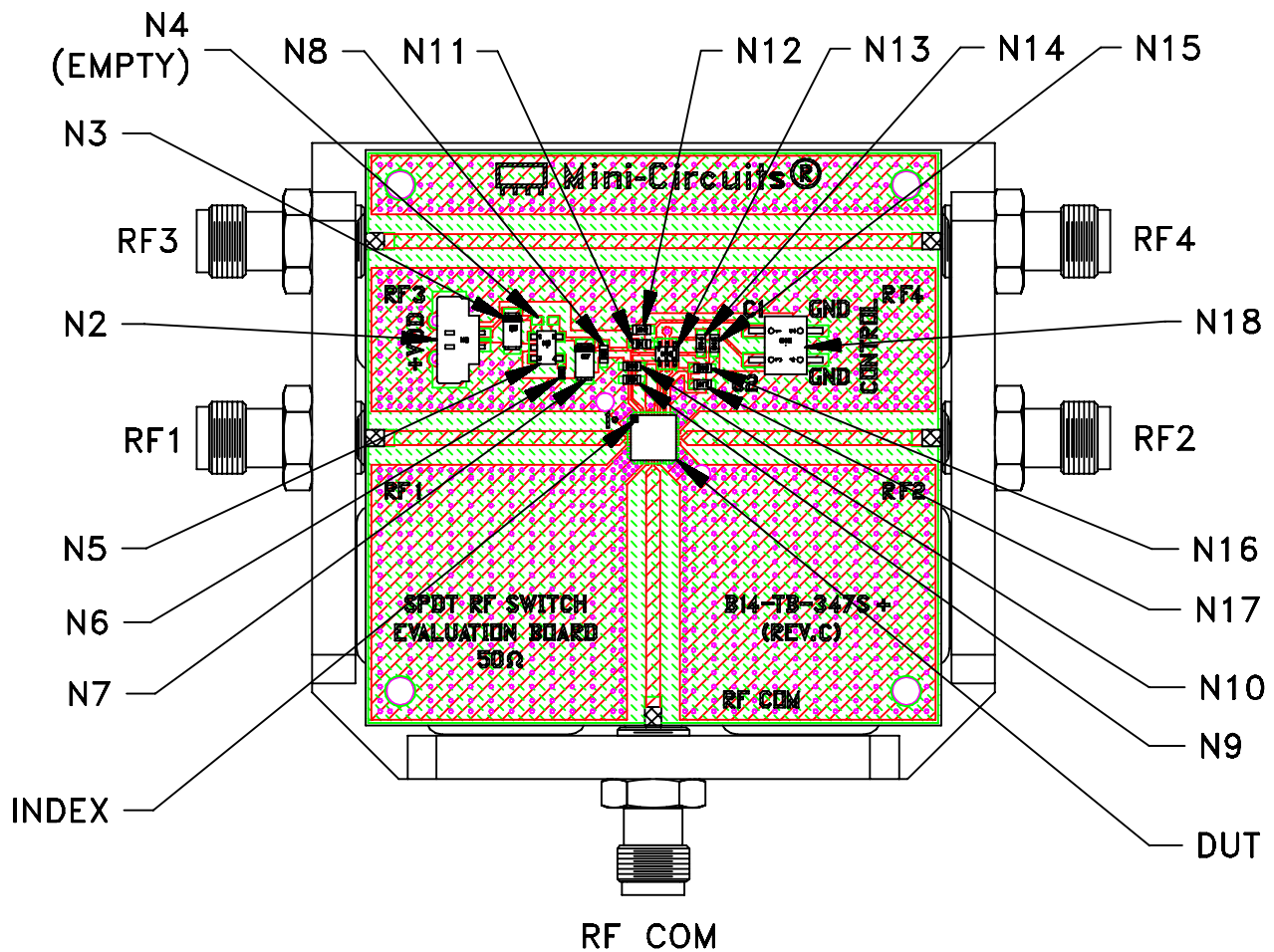
13 Neptune Avenue  
 Brooklyn NY 11235

PL, ra, DG983-1, HSWA  
 TB-347 (50 Ω)

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-206	D
FILE:	98PL206	SCALE: 7:1	SHEET: 1 OF 1

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# Evaluation Board and Circuit

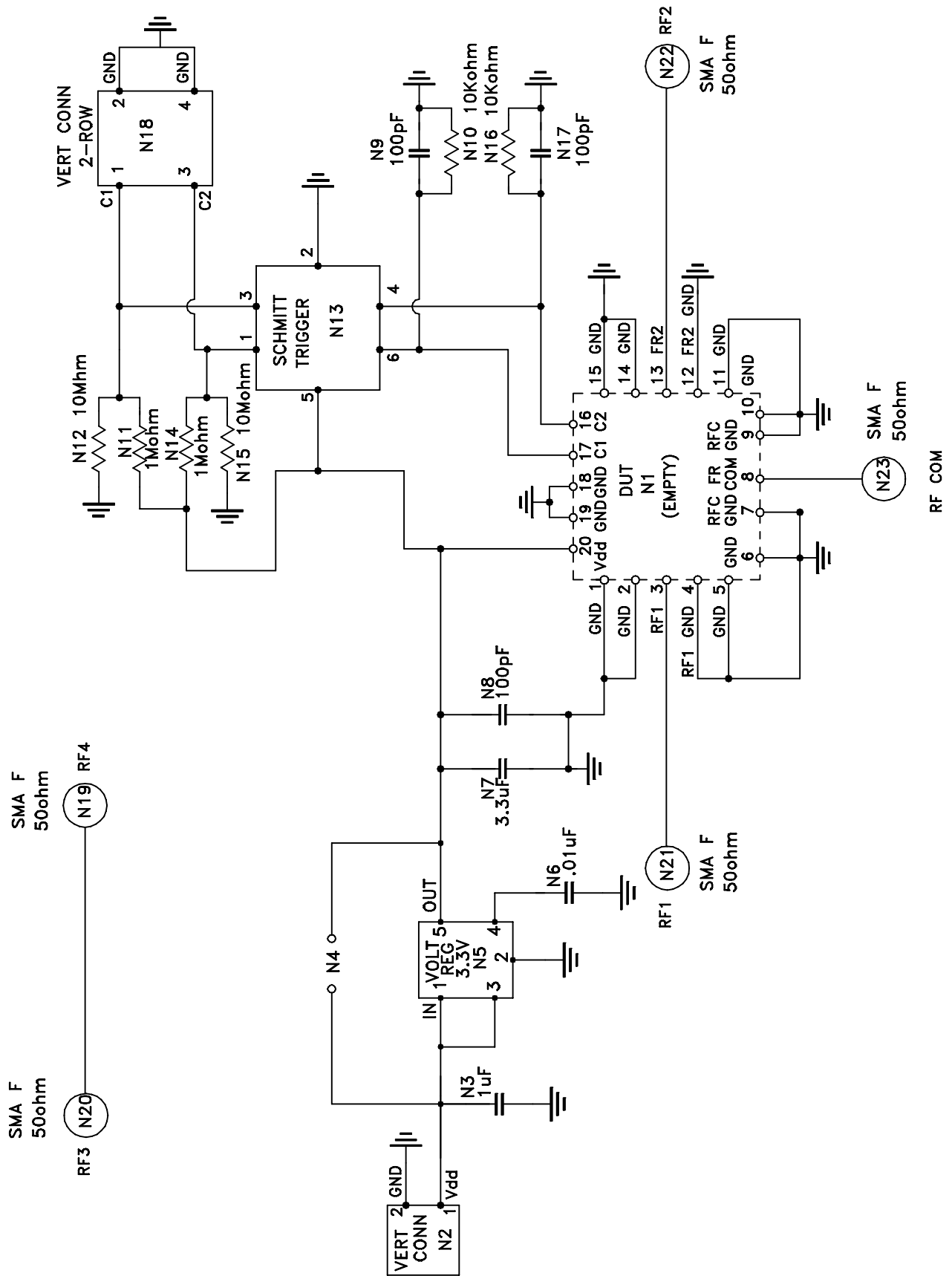


TB-347

## Notes:

1. SMA Female connectors.
2. PCB Material: FR4 Grade IT 180TC (ITEQ Corporation) or equivalent, Dielectric Constant=4.5, Thickness=.025 inch.

 Mini-Circuits®



Schematic Diagram

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.

<b>Specification</b>	<b>Test/Inspection Condition</b>	<b>Reference/Spec</b>
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 Humidity Bias	85°C, 85% RH, 96 hours	JESD22-A101B
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Solder Reflow Heat	Pb-Free Process: 260°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Solderability	10X magnification, 95% coverage	JESD22-B102, Method 1: Dip and Look Test
Marking Resistance to Solvents	Laser marked, visual observation	Mini-Circuits D4-Q4T0-04