Surface Mount

Switch

50Ω SPDT, Reflective DC[4] to 2.0 GHz

MSW-2-20+

Generic photo used for illustration purposes only

CASE STYLE: XX211

+RoHS Compliant

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

Available Tape and Reel at no extra cost

Reel Size	Devices/Reel
7"	20, 50, 100, 200, 500, 1000
13"	2000

Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
Input Power	see Note 1
Control Current	see Note 2

Permanent damage may occur if any of these limits are exceeded.

Pin Connections

RF IN	1
RF OUT 1	6
RF OUT 2	3
CONTROL 1	5
CONTROL 2	4
GROUND	2,7,8

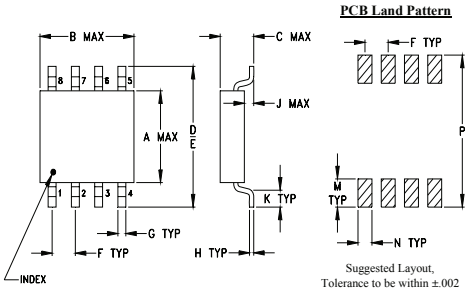
Features

- wideband, DC to 2.0 GHz
- very fast switching, 4ns typ.
- low insertion loss, 0.5 dB typ.
- low video leakage, 15 mVp-p typ.

Applications

- cellular
- PCN
- 2-way radio
- receiver antenna switching

Outline Drawing

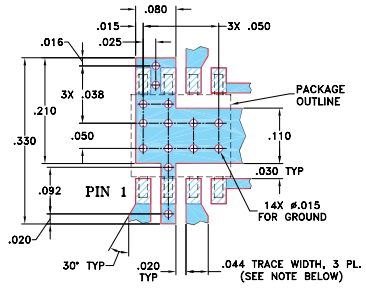


Outline Dimensions (inch / mm)

A	B	C	D	E	F	G
.163	.210	.077	.250	.220	.050	.017
4.14	5.33	1.96	6.35	5.59	1.27	0.43

H	J	K	M	N	P	wt
.009	.025	.030	.050	.030	.270	grams
0.23	0.64	0.76	1.27	0.76	6.86	0.10

Demo Board MCL P/N: TB-203
Suggested PCB Layout (PL-108)



NOTES: 1.TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015"; 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 SOLDER MASK

Electrical Specifications

FREQ.[4] (GHz)		INSERTION LOSS (dB)								1dB COMPR. (dBm)				IN-OUT ISOLATION (dB)							
		DC-100 MHz		100-500 MHz		500-1000 MHz		1000-2000 MHz		DC-100 MHz	100-500 MHz	500-1000 MHz	1000-2000 MHz	DC-100 MHz		100-500 MHz		500-1000 MHz		1000-2000 MHz	
f_L	f_U	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Typ.	Typ.	Typ	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min
DC	2.0	0.30	0.8	0.4	0.9	0.50	1.0	0.75	1.3	22	23	24	25	55	50	43	36	34	28	24	20

Additional Specifications		
Control Voltage	**-8/0 for compression spec, -8 to -5/0 for all other specs**	
Control Current, mA	**0.2 max to -8V, 0.02 max at 0 to -0.2V**	
VSWR(:1)	**DC-1GHz 1.2 typ.**	**1-2GHz 1.4 typ.**
Rise/Fall time (10%-90%), ns	**4 typ.**	
Switching time, 50% of Control to		
90% RF(Turn-on), ns	**10 typ**	
10% RF(Turn-off), ns	**4 typ**	
****Video Leakage, mVp-p 0/-5V Control**	**19 typ.**	

CONTROL LOGIC			
Control Ports		RF outputs	
1	**2**	**1**	**2**
0	-V	Off	On
-V	0	On	Off

** Video leakage or break through is defined as leakage of switching signal to RF output ports.

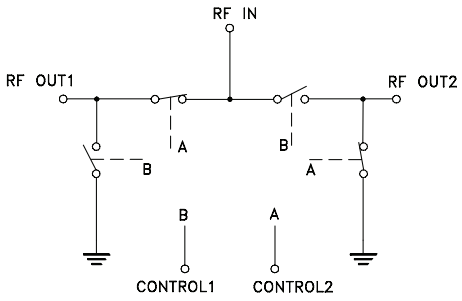
1. RF Power Input(dBm), Max.DC-100MHz100-500MHz500-2000MHz
- **Steady State Control 0/-8V 23 27 31**
- **As a Modulator 11 17 21**

2. Control Current, 500µA (occurs at -9V to -12V typ)

3. OFF state of RF output is low impedance

4. All RF connections must be DC blocked or held at 0V DC.

Electrical Schematic



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/MCLStore/terms.jsp

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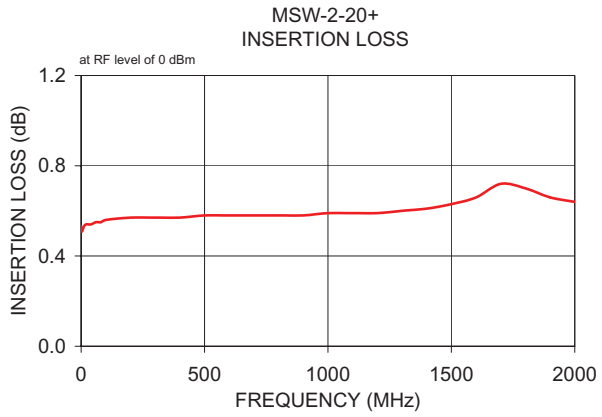
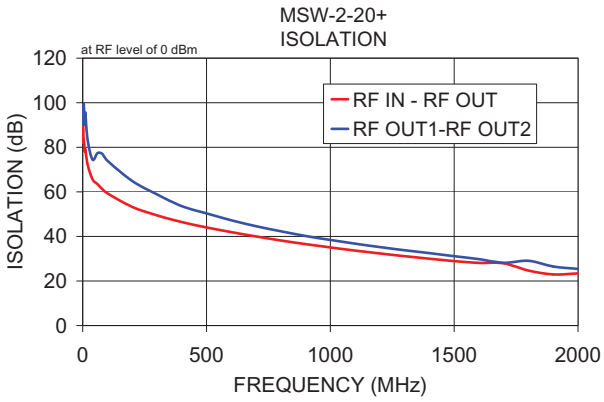
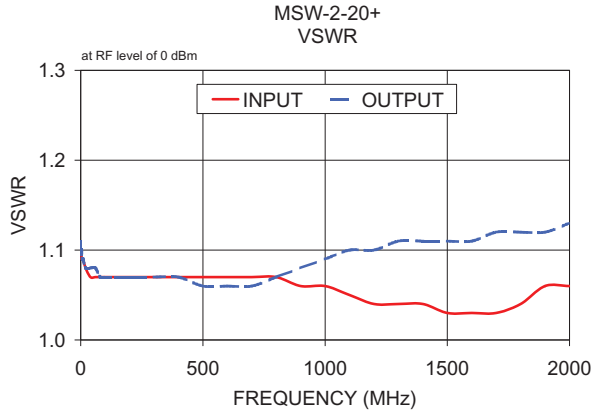
www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

Typical Performance Data

FREQ. (MHz)	ON INSERTION LOSS (dB) Control @ 0V/-5V)	OFF ISOLATION (dB) Control @ 0V/-5V) IN-OUT		VSWR	
				RF IN	RF OUT
	RF IN-RF OUT	RF IN-RF OUT	RF OUT1-RF OUT2		(ON PORT)
0.3	0.52	81.93	93.30	1.10	1.11
1.0	0.52	97.26	97.90	1.10	1.10
100.0	0.56	59.31	73.94	1.07	1.07
200.0	0.57	53.23	64.89	1.07	1.07
300.0	0.57	49.47	58.85	1.07	1.07
400.0	0.57	46.44	53.61	1.07	1.07
500.0	0.58	44.05	50.36	1.07	1.06
600.0	0.58	41.90	47.22	1.07	1.06
700.0	0.58	39.98	44.58	1.07	1.06
800.0	0.58	38.20	42.30	1.07	1.07
900.0	0.58	36.54	40.21	1.06	1.08
1000.0	0.59	35.06	38.40	1.06	1.09
1100.0	0.59	33.66	36.75	1.05	1.10
1200.0	0.59	32.36	35.21	1.04	1.10
1400.0	0.61	29.98	32.49	1.04	1.11
1500.0	0.63	28.91	31.14	1.03	1.11
1600.0	0.66	28.12	29.80	1.03	1.11
1800.0	0.70	24.70	29.05	1.04	1.12
1900.0	0.66	22.96	26.48	1.06	1.12
2000.0	0.64	23.40	25.43	1.06	1.13







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RF Reflective Switch SPDT MSW-2-20+

Typical Performance Data

Control Voltage: 0V/-5V										
RF FREQ (MHz)	INSERTION LOSS* (dB)		ISOLATION* (dB)				VSWR* (:1)			
	RF IN-RF OUT1	RF IN-RF OUT2	RF IN-RF OUT1	RF IN-RF OUT2	RF OUT1-RFOUT2	RF OUT1-RFOUT2	RF IN	RF IN	RF OUT1	RF OUT2
	RF OUT1 ON	RF OUT2 ON	RF OUT2 ON	RF OUT1 ON	RF OUT1 ON	RF OUT2 ON	RF OUT1 ON	RF OUT2 ON	RF OUT1 ON	RF OUT2 ON
0.3	0.52	0.52	95.48	81.93	86.02	93.30	1.10	1.11	1.11	1.11
0.5	0.53	0.53	93.50	96.98	96.30	91.99	1.10	1.11	1.10	1.10
1.0	0.52	0.53	105.84	97.26	96.68	97.90	1.10	1.10	1.10	1.10
2.0	0.51	0.52	101.67	87.07	90.87	90.04	1.10	1.10	1.10	1.10
4.0	0.51	0.52	97.05	83.22	85.19	99.29	1.09	1.10	1.10	1.10
6.0	0.52	0.53	94.91	81.38	81.93	95.21	1.09	1.09	1.10	1.09
8.0	0.52	0.53	96.45	78.15	80.53	90.19	1.09	1.09	1.09	1.09
10.0	0.53	0.54	93.59	79.27	79.61	95.56	1.09	1.09	1.09	1.09
20.0	0.54	0.55	97.15	72.12	73.11	83.11	1.08	1.08	1.08	1.08
40.0	0.54	0.55	86.74	65.62	68.68	74.42	1.07	1.08	1.08	1.08
60.0	0.55	0.56	76.78	63.45	63.80	77.41	1.07	1.07	1.08	1.08
80.0	0.55	0.57	73.08	61.19	61.30	77.00	1.07	1.07	1.08	1.07
100.0	0.56	0.57	71.49	59.31	59.31	73.94	1.07	1.07	1.08	1.07
200.0	0.57	0.57	63.48	53.23	53.10	64.89	1.07	1.07	1.07	1.07
300.0	0.57	0.57	57.82	49.47	49.25	58.85	1.07	1.06	1.07	1.07
400.0	0.57	0.57	53.43	46.44	46.44	53.61	1.07	1.06	1.07	1.07
500.0	0.58	0.58	49.82	44.05	43.87	50.36	1.07	1.06	1.07	1.06
600.0	0.58	0.57	46.77	41.90	41.82	47.22	1.07	1.06	1.07	1.06
700.0	0.58	0.57	44.21	39.98	39.93	44.58	1.07	1.05	1.07	1.06
800.0	0.58	0.58	41.94	38.20	38.18	42.30	1.07	1.05	1.07	1.07
900.0	0.58	0.58	39.92	36.54	36.60	40.21	1.06	1.05	1.07	1.08
1000.0	0.59	0.59	38.14	35.06	35.13	38.40	1.06	1.04	1.08	1.09
1100.0	0.59	0.59	36.48	33.66	33.71	36.75	1.05	1.04	1.08	1.10
1200.0	0.59	0.60	34.98	32.36	32.37	35.21	1.04	1.05	1.09	1.10
1300.0	0.60	0.61	33.58	31.14	31.11	33.81	1.04	1.05	1.09	1.11
1400.0	0.61	0.62	32.26	29.98	29.93	32.49	1.04	1.05	1.09	1.11
1500.0	0.63	0.64	31.10	28.91	28.59	31.14	1.03	1.05	1.09	1.11
1600.0	0.66	0.65	30.09	28.12	27.78	29.80	1.03	1.06	1.08	1.11
1700.0	0.72	0.69	29.12	27.92	27.10	28.17	1.03	1.06	1.08	1.12
1800.0	0.70	0.72	25.49	24.70	26.69	29.05	1.04	1.06	1.07	1.12
1900.0	0.66	0.67	24.59	22.96	24.52	26.48	1.06	1.10	1.06	1.12
2000.0	0.64	0.65	25.38	23.40	24.07	25.43	1.06	1.12	1.07	1.13

*Note:

CONTROL LOGIC			
Control Ports		RF Outputs	
1	2	1	2
0	-5V	Off	On
-5V	0	On	Off

Typical Performance Data

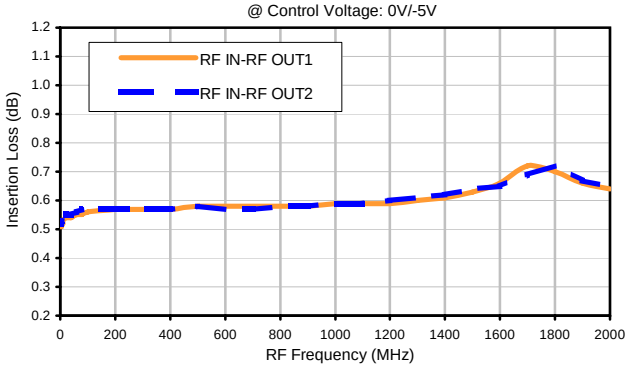
Control Voltage: 0V/-8V										
RF FREQ (MHz)	INSERTION LOSS* (dB)		ISOLATION* (dB)				VSWR* (:1)			
	RF IN-RF OUT1	RF IN-RF OUT2	RF IN-RF OUT1	RF IN-RF OUT2	RF OUT1-RFOUT2	RF OUT1-RFOUT2	RF IN	RF IN	RF OUT1	RF OUT2
	RF OUT1 ON	RF OUT2 ON	RF OUT2 ON	RF OUT1 ON	RF OUT1 ON	RF OUT2 ON	RF OUT1 ON	RF OUT2 ON	RF OUT1 ON	RF OUT2 ON
0.3	0.51	0.51	95.40	105.54	89.64	89.08	1.10	1.10	1.10	1.10
0.5	0.52	0.52	94.63	103.91	97.58	97.84	1.10	1.10	1.10	1.10
1.0	0.51	0.52	102.70	92.24	90.34	99.32	1.09	1.10	1.10	1.09
2.0	0.51	0.51	104.71	87.07	87.58	103.27	1.09	1.09	1.10	1.09
4.0	0.51	0.51	94.84	81.94	83.44	97.72	1.09	1.09	1.09	1.09
6.0	0.51	0.52	94.84	80.61	80.79	93.61	1.08	1.09	1.09	1.09
8.0	0.51	0.52	94.08	77.54	79.83	88.22	1.08	1.08	1.09	1.09
10.0	0.52	0.53	89.72	76.32	78.21	101.29	1.08	1.08	1.09	1.09
20.0	0.53	0.54	94.25	71.90	72.61	82.50	1.08	1.08	1.08	1.08
40.0	0.53	0.54	87.03	65.49	68.56	74.53	1.07	1.08	1.08	1.08
60.0	0.54	0.55	76.80	63.29	63.67	76.71	1.07	1.07	1.08	1.07
80.0	0.54	0.56	73.40	61.03	61.09	77.25	1.07	1.07	1.08	1.07
100.0	0.55	0.56	71.10	59.20	59.18	74.62	1.07	1.07	1.08	1.07
200.0	0.56	0.56	63.57	53.14	52.93	65.45	1.07	1.07	1.07	1.07
300.0	0.56	0.57	57.98	49.41	49.16	59.34	1.07	1.06	1.07	1.07
400.0	0.56	0.56	53.69	46.41	46.35	53.93	1.07	1.06	1.07	1.07
500.0	0.57	0.57	50.06	44.07	43.85	50.72	1.07	1.06	1.07	1.06
600.0	0.57	0.56	47.02	41.97	41.79	47.57	1.07	1.06	1.07	1.06
700.0	0.57	0.56	44.46	40.08	39.94	44.94	1.07	1.05	1.07	1.06
800.0	0.57	0.57	42.21	38.34	38.22	42.64	1.07	1.05	1.07	1.07
900.0	0.57	0.57	40.19	36.71	36.67	40.56	1.06	1.05	1.08	1.08
1000.0	0.58	0.58	38.42	35.25	35.23	38.75	1.06	1.04	1.08	1.08
1100.0	0.58	0.58	36.76	33.86	33.83	37.09	1.05	1.04	1.09	1.09
1200.0	0.58	0.59	35.25	32.58	32.51	35.56	1.05	1.04	1.09	1.10
1300.0	0.59	0.60	33.85	31.37	31.26	34.15	1.04	1.03	1.09	1.10
1400.0	0.60	0.61	32.53	30.21	30.04	32.83	1.04	1.04	1.09	1.10
1500.0	0.61	0.63	31.39	29.16	28.75	31.49	1.03	1.03	1.09	1.10
1600.0	0.64	0.64	30.35	28.37	27.91	30.09	1.03	1.04	1.09	1.10
1700.0	0.71	0.67	29.40	28.30	27.30	28.54	1.04	1.04	1.08	1.10
1800.0	0.69	0.70	25.66	24.95	26.88	29.31	1.04	1.04	1.06	1.10
1900.0	0.64	0.65	24.81	23.19	24.66	26.77	1.04	1.07	1.06	1.09
2000.0	0.63	0.63	25.59	23.61	24.24	25.69	1.04	1.09	1.07	1.10

*Note:

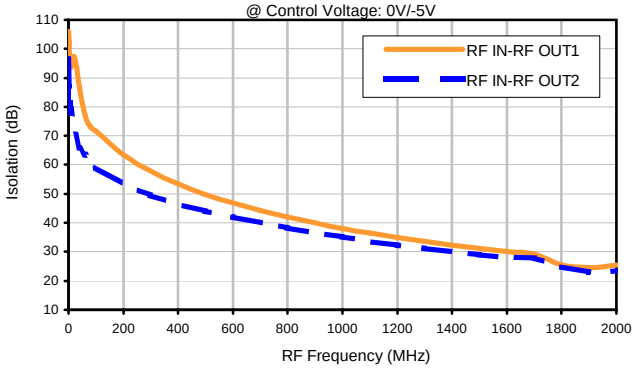
CONTROL LOGIC			
Control Ports		RF Outputs	
1	2	1	2
0	-8V	Off	On
-8V	0	On	Off

Typical Performance Curves

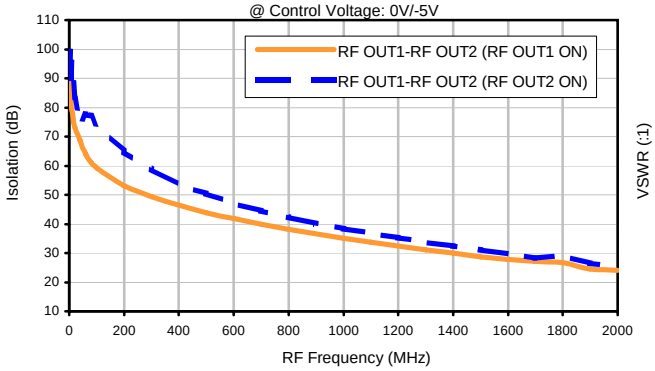
Insertion Loss, RF IN-RF OUTS
@ Control Voltage: 0V/-5V



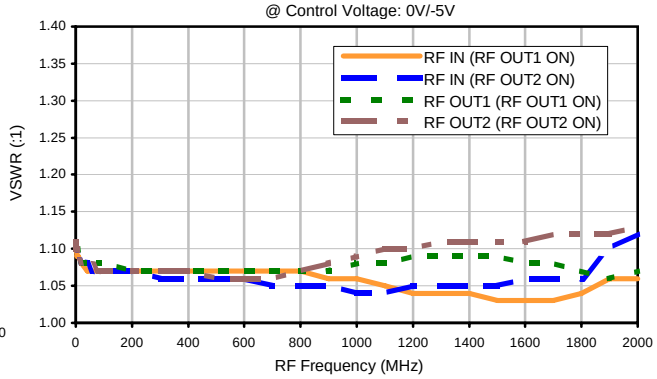
Isolation, RF IN-RF OUTS
@ Control Voltage: 0V/-5V



Isolation, RF OUT1-RF OUT2
@ Control Voltage: 0V/-5V



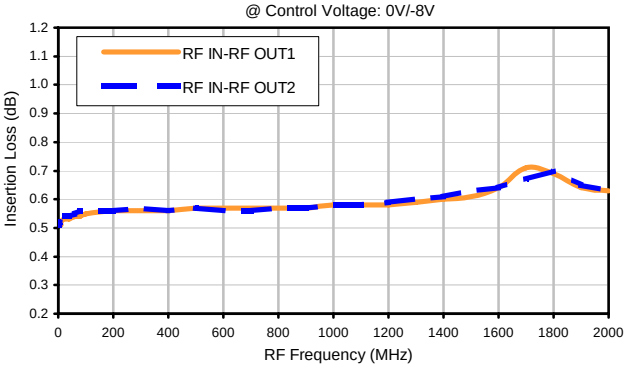
VSWR
@ Control Voltage: 0V/-5V



Typical Performance Curves

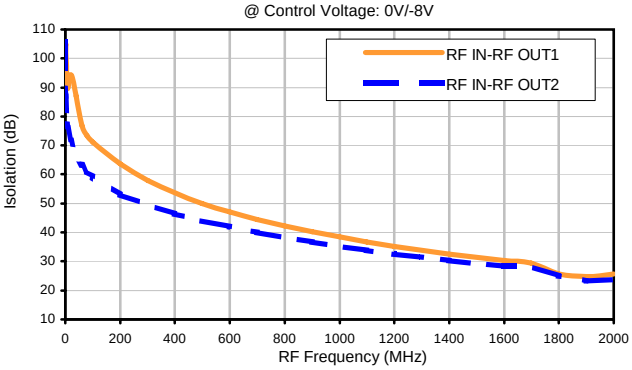
Insertion Loss. RF IN-RF OUTS

@ Control Voltage: 0V/-8V



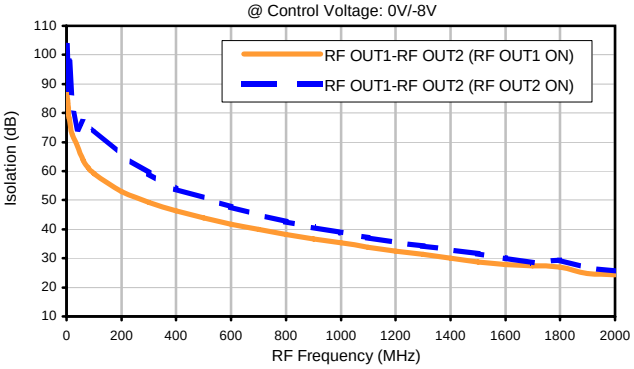
Isolation, RF IN-RF OUTS

@ Control Voltage: 0V/-8V



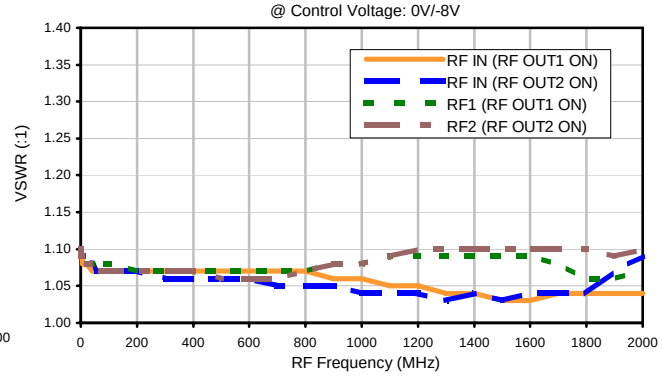
Isolation, RF OUT1-RF OUT2

@ Control Voltage: 0V/-8V



VSWR

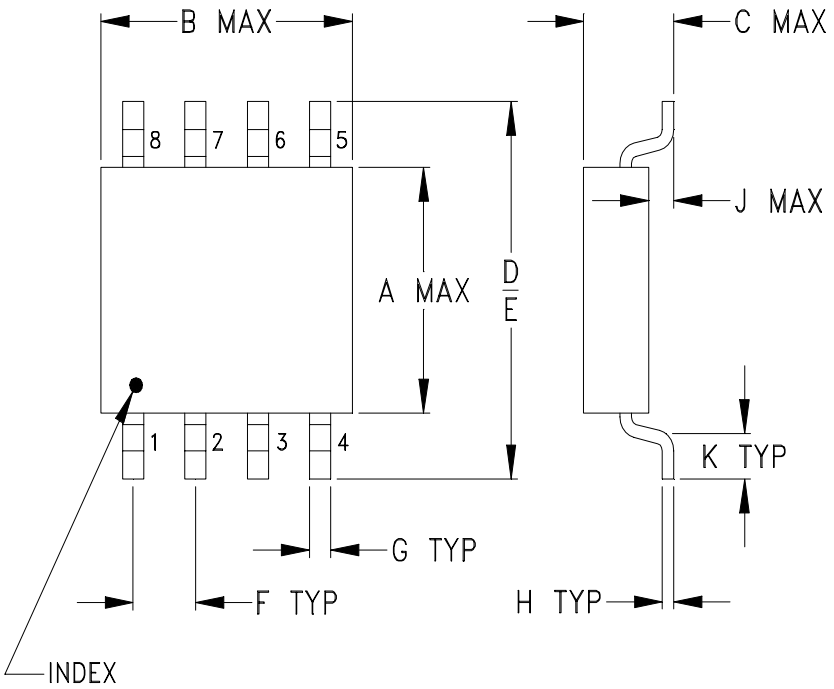
@ Control Voltage: 0V/-8V



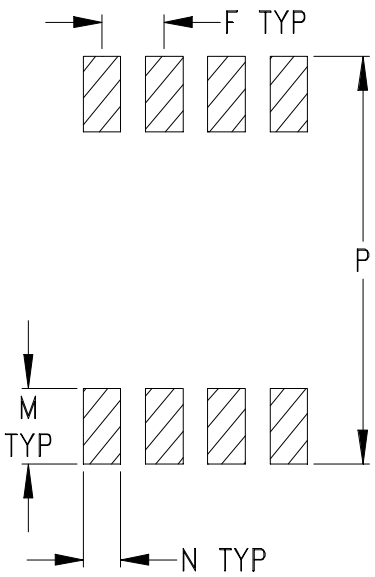
Case Style XX

XX211

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K	L	M	N	P
XX211	.163 (4.14)	.210 (5.33)	.077 (1.96)	.250 (6.35)	.220 (5.59)	.050 (1.27)	.017 (0.43)	.009 (0.23)	.025 (0.64)	.030 (0.76)	-- --	.050 (1.27)	.030 (0.76)	.270 (6.86)

CASE #	Q	R	S	WT. GRAM
XX211	-- --	-- --	-- --	.10

Dimensions are in inches (mm). Tolerances: 2 Pl. ± .03; 3 Pl. ± .015

Notes:

1. Case material: Plastic.
2. Termination finish:
   For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier. All models, (+) suffix. ⊗
   For RoHS-5 Case Styles: Tin-Lead plate. All models, No (+) suffix.
3. Special Tolerances: Termination width ± .005 inch, termination thickness ± .003 inch.

⊗ Model BP4C+ will be supplied with either Tin finish or Tin-Silver-Nickel finish until Tin finish inventory is depleted.

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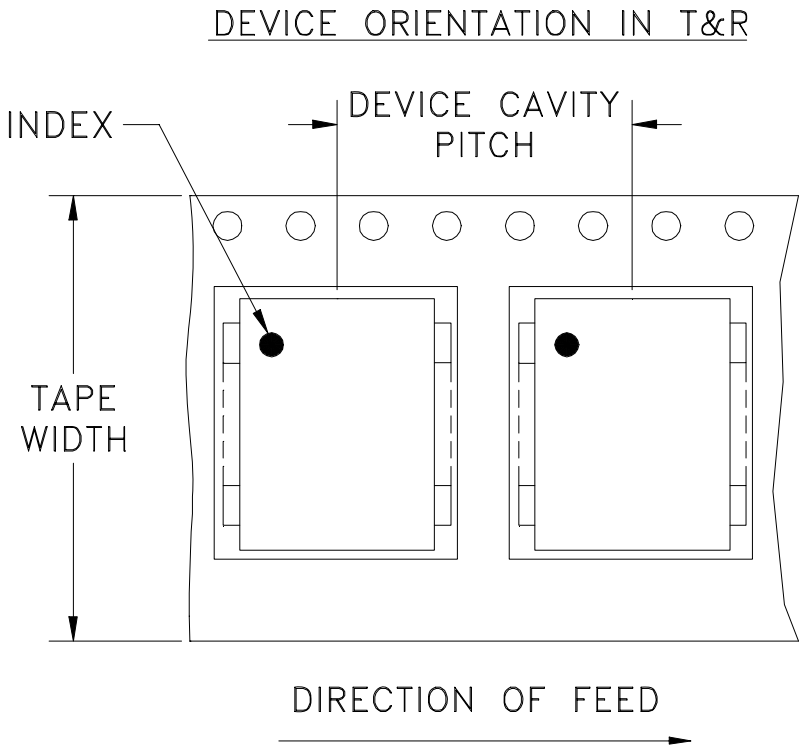
Tape & Reel Packaging TR-F16



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
			Standard	1000*
		13	Standard	2000**

Note : Please Consult individual model data sheet to determine device per reel availability
* BP models only
** MSW and MSWA models

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

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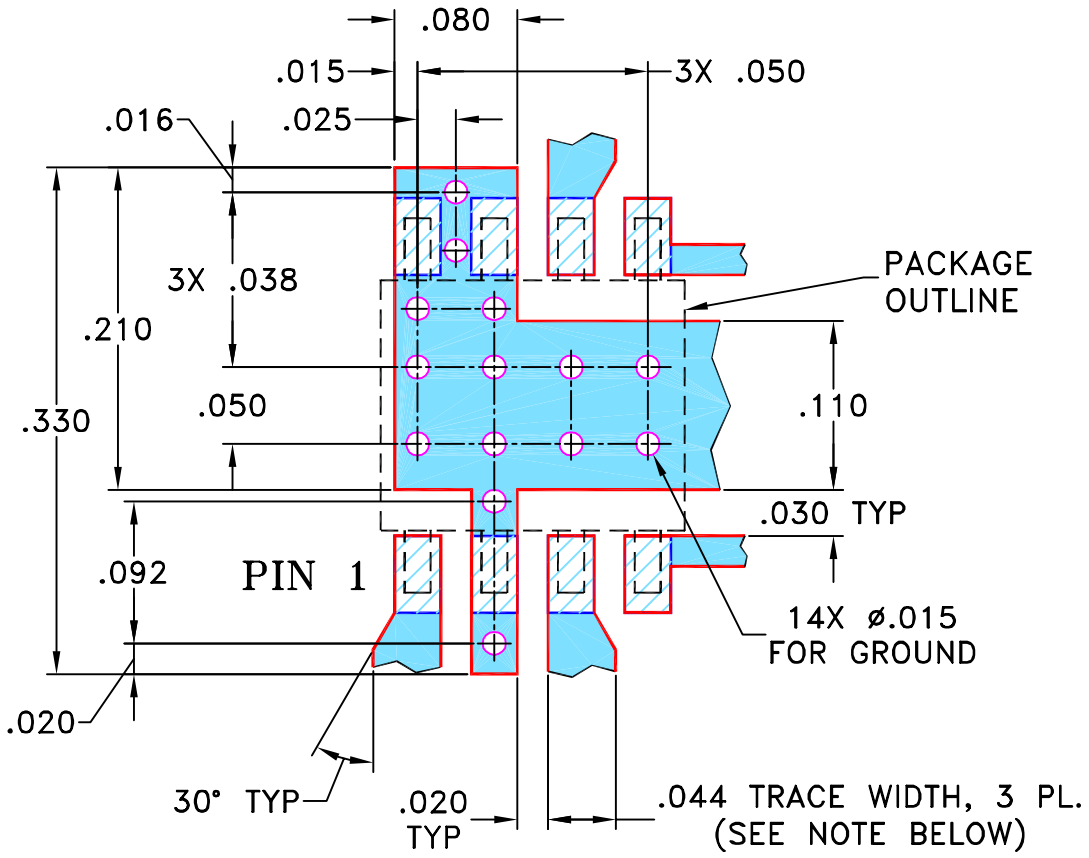
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M82408	NEW RELEASE	09/12/02	MMG	WP
A	M102713	ADDED "...WITH SMOBC"	01/14/06	GF	IL

SUGGESTED MOUNTING CONFIGURATION FOR XX211 CASE STYLE, "et" PIN CONNECTION



NOTES: 1.TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015"; 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 SOLDER MASK

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	MMG	09/03/02
TOLERANCES ON:	CHECKED	AV	09/12/02
2 PL DECIMALS ±	APPROVED	WP	09/12/02
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

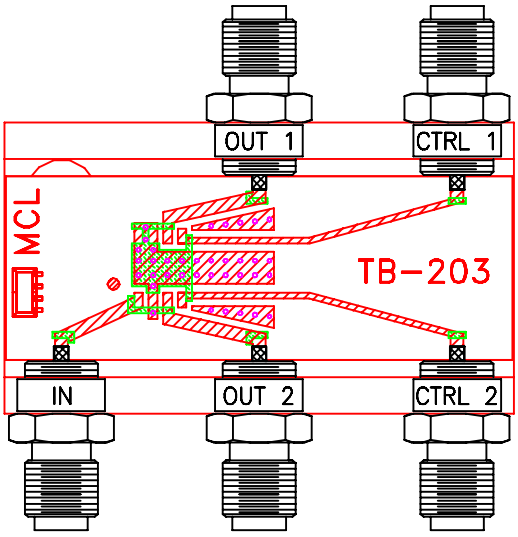
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, et, XX211, MSW, TB-203

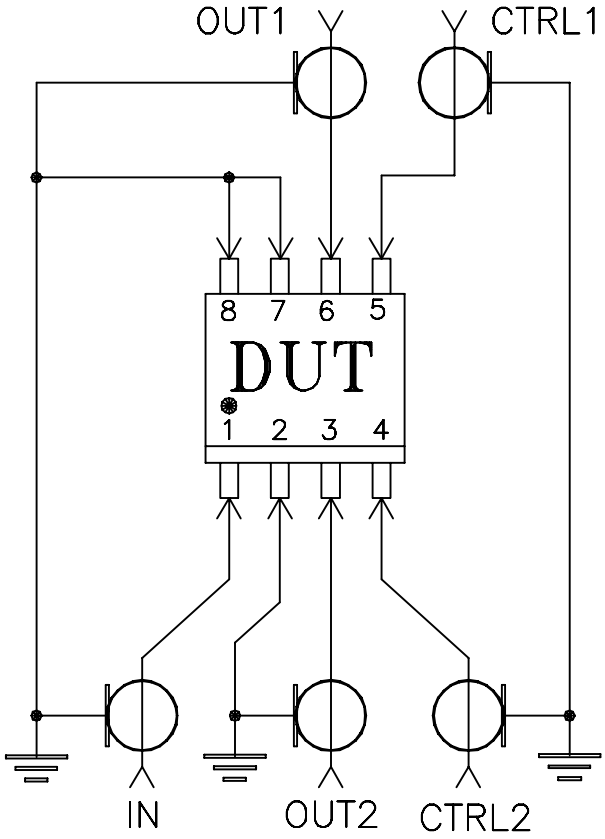
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-108	A

FILE:	SCALE:	SHEET:
98PL108	8:1	1 OF 1

Evaluation Board and Circuit



TB-203



Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: Rogers RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.020 inch.

Mini-Circuits®

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Environmental Specifications ENV17

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	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Temperature Cycling	-55° to 100°C, 100 cycles	MIL-STD-883, Method 1010, Condition B, except 100°C
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102-C, Condition C
HAST	130°C, 85% RH, 96 hours	JESD22-A110
Solder Reflow Heat	Sn-Pb Eutetic Process: 240°C peak Pb-Free Process: 260°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Vibration (High Frequency)	20g peak, 20-2000 Hz, 2 times in each of three perpendicular directions (total 6)	MIL-STD-883, Method 2007. 3, Condition A, Except 2X number of cycles
Mechanical Shock	50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes	MIL-STD-202, Method 213, Condition A
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C	MIL-STD-202, Method 215