MMIC REFLECTIONLESS

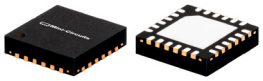
Low Pass Filter

XLF-112H+

50Ω DC to 1050 MHz

THE BIG DEAL

- Match to 50Ω in the stop band, eliminates undesired reflections
- Cascadable
- Good stopband rejection, 39 dB typ.
- Temperature stable, up to +105°C
- Small size, 4 x 4 mm
- Protected by US Patents 8,392,495; 9,705,467, additional patent pending
- Protected by China Patent 201080014266.1
- Protected by Taiwan Patent I581494



Generic photo used for illustration purposes only

CASE STYLE: DG1847

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

APPLICATIONS

- Cellular
- ISM applications
- TV broadcasting
- Public Safety

PRODUCT OVERVIEW

Mini-Circuits' XLF-112H+ three-section reflectionless filter employs a novel filter topology which absorbs and terminates stop band signals internally rather than reflecting them back to the source. This new capability enables unique applications for filter circuits beyond those suited to traditional approaches. Traditional filters are reflective in the stop band, sending signals back to the source at 100% of the power level. These reflections interact with neighboring components and often result in inter-modulation and other interferences. Reflectionless filters eliminate stop band reflections, allowing them to be paired with sensitive devices and used in applications that otherwise require circuits such as isolation amplifiers or attenuators.

KEY FEATURES

Features	Advantages
Reflectionless Technology	Reflectionless filters absorb unwanted signals, preventing reflections back to the source. This reduces generation of additional unwanted signals without the need for extra components like attenuators, improving system dynamic range and saving board space.
50Ω Match in Stopband	Reflectionless filters maintain good impedance matching in the stopband, allowing for integration with high gain, wideband amplifiers without the risk of creating out-of-band instabilities.
Excellent RF Performance Repeatability	Fabricated on a GaAs process, X-series filters are inherently repeatable for large-volume production.
Excellent Stability over temperature	With ±0.3 dB variation over temperature, is ideal for use in wide temperature range applications without the need for additional temperature compensation.
Excellent Power Handling in a Compact Package	High power handling extends the usability of these filters to the transmit path for inter-stage filtering.

REV. A
ECO-020598
XLF-112H+
MCL NY
250407

MMIC REFLECTIONLESS

Low Pass Filter

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50Ω DC to 1050 MHz

ELECTRICAL SPECIFICATIONS[1] AT +25°C

Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Passband	Insertion Loss	DC - F1	DC - 1050	—	1.9	3.0	dB
	Frequency Cut-off	F2	1200	—	3.0	—	
	VSWR	DC - F1	DC - 1050	—	1.3	—	:1
Stopband	Rejection	F3 - F3′	2000 - 2200	14	17	—	dB
		F3′ - F4	2200 - 10000	33	36	—	
		F4 - F5	10000 - 19000	36	39	—	
	VSWR	F3 - F3′	2000 - 2200	—	1.2	—	:1
		F3′ - F4	2200 - 10000	—	1.3	—	
		F4 - F5	10000 - 19000	—	2.1	—	

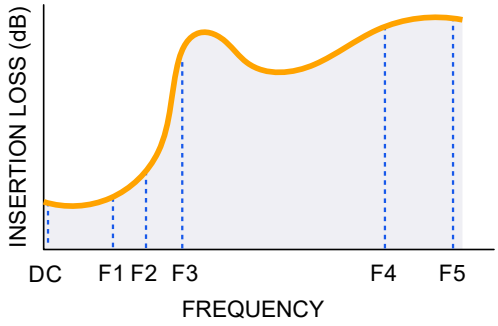
1. Measured on Mini-Circuits Characterization Test Board TB-952-112H+

ABSOLUTE MAXIMUM RATINGS[2]

Parameter	Ratings
Operating Temperature	-55°C to +105°C
Storage Temperature	-65°C to +150°C
RF Power Input, Passband (F3-F5)[2]	7.9 W at +25°C
RF Power Input, Stopband (DC-F3)[3]	1.58 W at +25°C

2. Permanent damage may occur if any of these limits are exceeded.
3. Passband rating derates linearly to 3.9 W at +105°C ambient
4. Stopband rating derates linearly to 0.75 W at +105°C ambient

SPECIFICATION DEFINITION

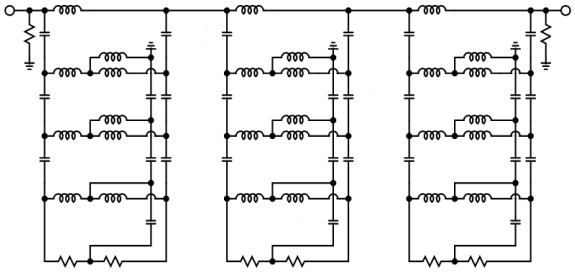


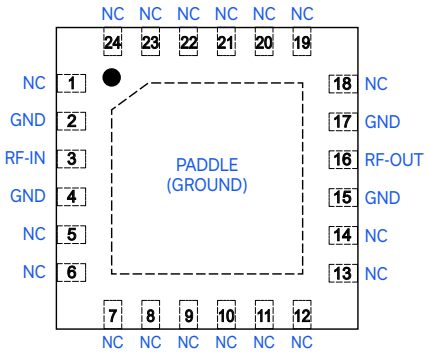
Low Pass Filter

XLF-112H+

50Ω DC to 1050 MHz

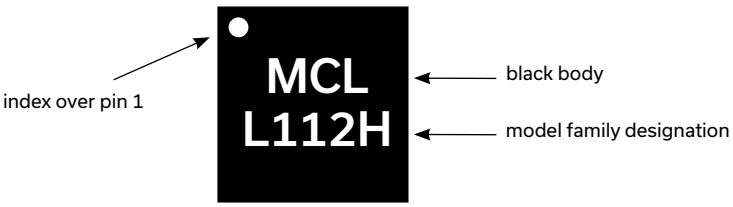
SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION





Function	Pad Number	Description
RF-IN	3	RF Input Pad
RF-OUT	16	RF Output Pad
GND	2,4,15,17 & paddle	Connected to ground
NC (GND Externally)	1, 5-14,18-24	No internal connection

PRODUCT MARKING



Marking may contain other features or characters for internal lot control

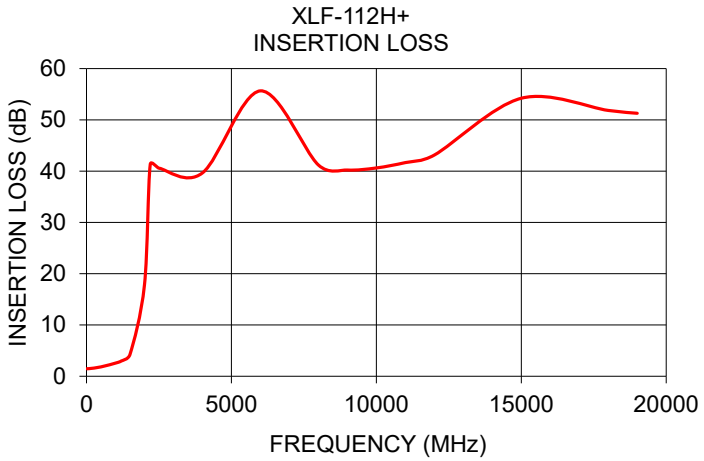
Low Pass Filter

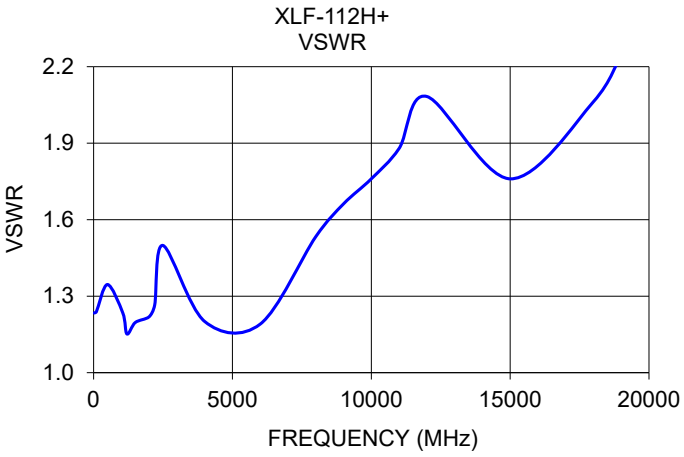
XLF-112H+

50Ω DC to 1050 MHz

TYPICAL PERFORMANCE DATA AT +25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)
10	1.47	1.23
100	1.49	1.24
500	1.83	1.35
1050	2.64	1.23
1200	2.98	1.15
1500	4.25	1.20
2000	17.81	1.22
2200	41.34	1.27
2500	40.58	1.50
4000	39.65	1.20
6000	55.66	1.19
8000	41.20	1.53
9000	40.21	1.66
10000	40.62	1.76
11000	41.67	1.88
12000	43.14	2.08
15000	54.22	1.76
18000	51.84	2.06
19000	51.28	2.25





Low Pass Filter

XLF-112H+

50Ω DC to 1050 MHz

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS CLICK HERE

Performance Data and Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	DG1847 Plastic package, exposed paddle lead finish: matte-tin
Tape & Reel **Standard quantities available on reel**	F68 7" reels with 20, 50, 100, 200, 500 ,1000 devices 13" reels with 2000, 3000, 4000 devices
Suggested Layout for PCB Design	PL-519
Evaluation Board	TB-952-112H+
Environmental Ratings	ENV82

ESD RATING

Human body model (HBM): Class 1A (Pass 250 V) in accordance with ANSI/ESD 5.1-2001

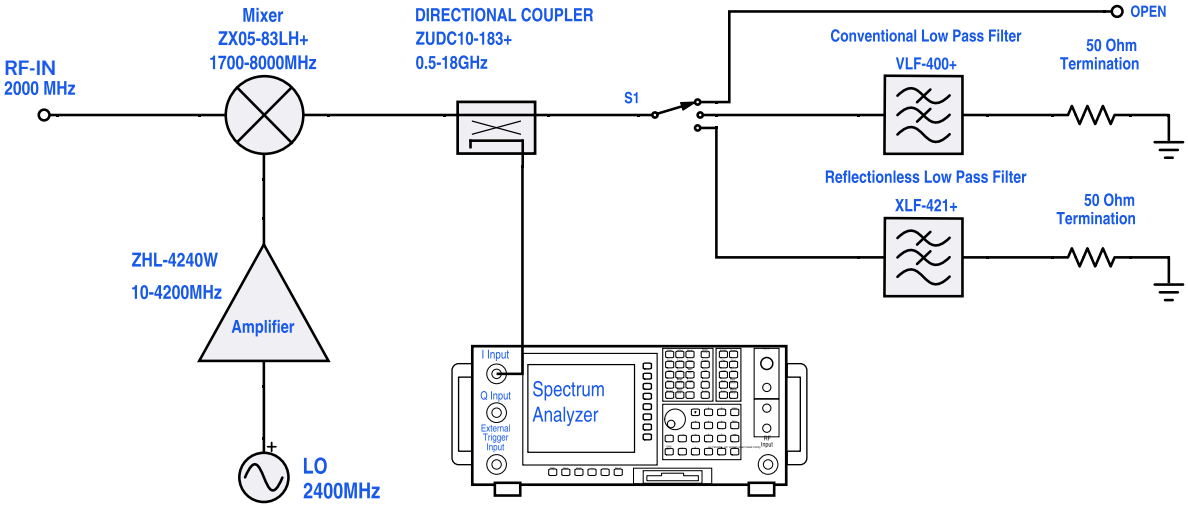
Low Pass Filter

XLF-112H+

50Ω DC to 1050 MHz

REFLECTIONLESS FILTER APPLICATION NOTE

Application Circuit Example: Pairing mixers with reflectionless filters to improve system dynamic range



Test block diagram: IF output reflection spectrum with single input frequency

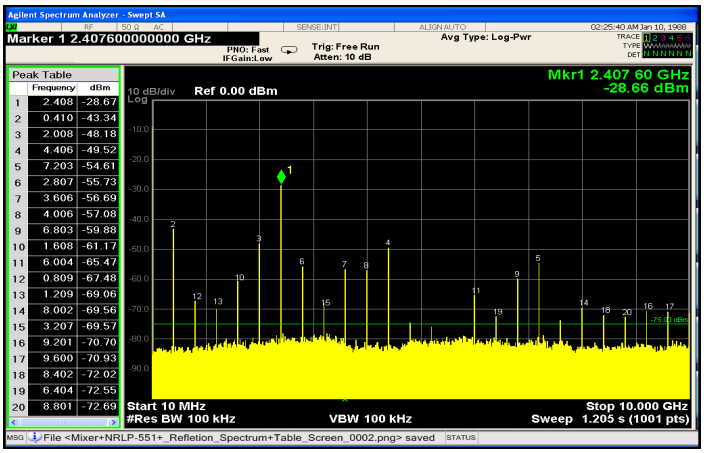


Figure 1. IF output reflection spectrum without filter

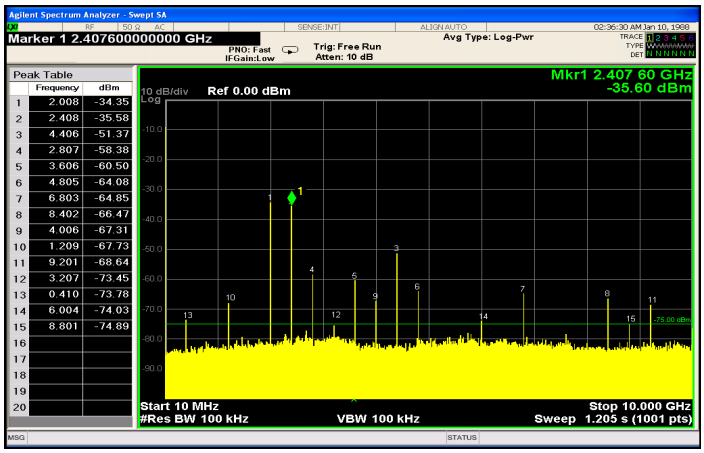
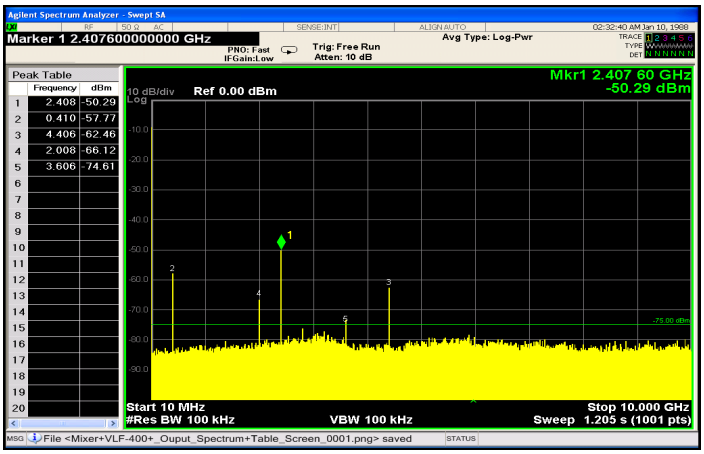


Figure 2. IF output reflection spectrum with conventional filter



An application circuit was assembled to measure the IF reflection spectrum at the output of a mixer when the mixer was paired with a conventional filter versus a reflectionless filter.

While the conventional filter reduces the reflections present when the mixer is used alone (no filter), the reflectionless filter virtually eliminates those reflections altogether.

The reflected signal at marker 1 in the figures above exhibits a reduction of more than 20 dB from -28.7 dBm to -50.3 dBm when the reflectionless filter is used as compared to the conventional filter, thus eliminating unwanted spurious mixing products and improvingsystem dynamic range.

For more information, refer to application note AN-75-007

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.

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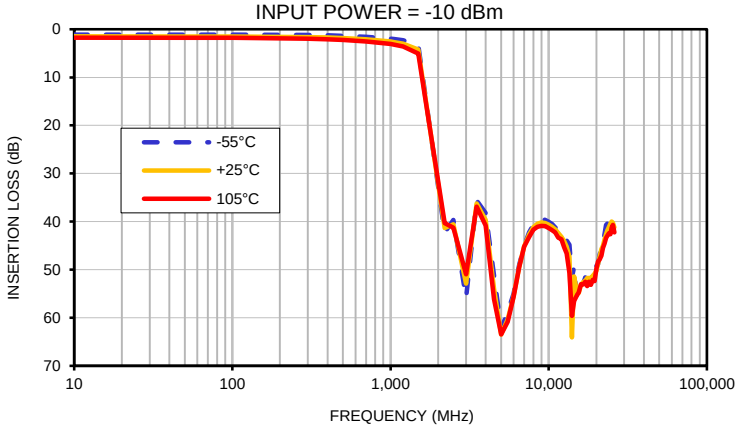
MMIC Reflectionless Low Pass Filter XLF-112H+

Typical Performance Data

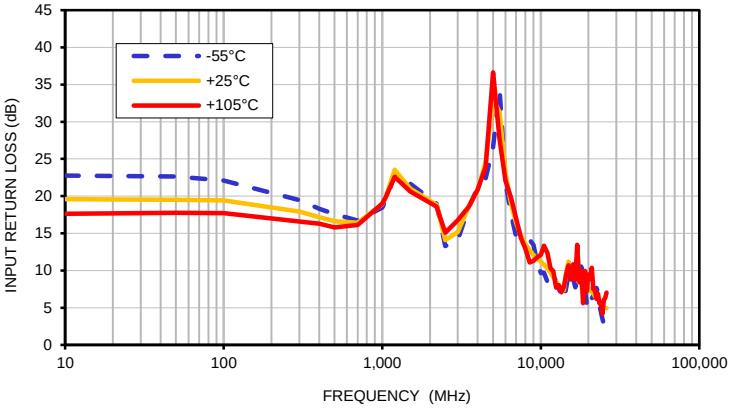
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-55˚C	@25°C	@+105°C	@-55°C	@+25˚C	@+105°C	@-55°C	@+25˚C	@+105°C
10	1.14	1.47	1.75	22.77	19.60	17.63	22.62	19.63	17.57
50	1.14	1.48	1.77	22.65	19.52	17.75	22.54	19.77	17.64
100	1.14	1.49	1.78	22.08	19.43	17.71	21.97	19.44	17.66
300	1.21	1.62	1.95	19.49	17.93	16.60	19.48	17.90	16.57
400	1.28	1.71	2.07	18.28	17.18	16.30	18.20	17.17	16.19
500	1.36	1.83	2.21	17.57	16.64	15.81	17.61	16.63	15.83
700	1.57	2.09	2.52	16.69	16.40	16.12	16.66	16.32	16.12
1000	1.95	2.55	3.07	18.45	18.92	19.01	18.36	18.67	19.01
1050	2.02	2.64	3.18	19.42	19.83	19.85	19.40	19.58	19.99
1200	2.29	2.98	3.59	22.88	23.56	22.61	23.28	23.04	22.66
1500	3.32	4.25	5.09	21.66	21.01	20.65	21.60	20.96	20.41
2200	42.28	41.34	40.33	18.98	18.85	18.59	18.94	18.62	18.20
2500	39.64	40.58	41.29	13.30	14.10	15.09	13.25	14.00	14.63
3000	55.89	52.89	50.98	14.03	15.16	16.74	13.78	15.40	16.54
3500	35.58	36.27	36.87	18.43	18.53	18.54	19.48	19.25	19.71
4000	38.22	39.63	40.85	21.10	20.80	20.83	21.82	22.55	21.39
4500	51.24	53.97	56.12	22.41	24.57	23.94	23.16	27.23	26.42
5000	62.27	63.49	63.46	26.59	33.08	36.63	31.76	34.64	39.18
5500	58.85	60.33	60.83	34.29	31.28	27.62	30.27	26.64	24.26
6000	55.02	55.52	55.68	21.82	23.07	22.07	20.03	21.21	21.18
6500	49.03	49.50	49.50	17.60	19.00	19.77	16.13	17.88	16.68
7000	45.07	45.18	45.22	14.59	16.43	17.04	14.53	15.84	16.93
7500	42.26	42.68	43.21	14.36	14.70	14.34	13.75	14.54	14.05
8000	40.63	41.17	41.68	14.32	13.53	12.96	15.16	13.67	13.67
8500	39.71	40.44	41.11	14.13	12.75	11.07	14.09	13.08	12.16
9000	39.34	40.18	40.92	13.45	12.09	11.30	14.75	12.64	11.97
9500	39.66	40.30	40.96	11.13	11.65	11.78	12.29	12.40	12.54
10000	40.02	40.62	41.34	9.67	11.20	12.11	11.18	12.26	12.32
10500	40.50	41.05	41.78	9.71	10.79	13.35	10.26	12.00	14.02
11000	41.18	41.62	42.27	8.48	10.30	12.37	10.19	11.57	12.94
11500	41.56	42.35	43.34	9.60	9.74	10.29	10.25	10.90	11.74
12000	41.92	43.14	43.65	9.60	9.09	9.91	10.35	10.11	11.15
12500	43.10	44.05	45.33	8.36	8.48	7.69	9.18	9.35	8.85
13000	43.95	45.23	46.62	7.51	7.86	8.04	9.73	8.70	8.88
13500	44.85	47.36	50.70	6.79	7.48	7.09	7.08	8.15	7.48
14000	51.58	64.08	59.64	6.09	7.38	7.80	7.86	7.99	9.13
14500	49.39	51.44	56.52	7.84	9.92	9.56	7.80	10.38	10.69
15000	55.80	54.17	55.50	9.42	11.20	10.69	11.15	11.89	11.13
15500	55.08	54.86	54.70	10.27	10.28	8.78	8.78	10.66	10.72
16000	52.86	53.16	52.99	8.92	10.03	10.84	8.53	10.17	10.86
16500	52.95	52.57	53.07	7.76	10.07	8.75	9.08	9.95	9.43
17000	51.59	52.29	52.50	9.66	9.87	13.45	9.89	9.83	11.70
17500	52.33	51.70	53.39	9.17	9.64	8.42	11.79	9.62	8.64
18000	50.94	51.75	52.49	10.52	9.19	9.94	9.91	9.27	11.46
18500	51.16	51.73	53.18	8.92	8.82	5.60	6.97	8.73	5.87
19000	50.88	51.28	52.14	7.32	8.30	9.95	8.28	8.46	9.44
19500	49.85	50.83	52.35	5.43	7.99	7.20	5.13	8.05	9.34
20000	49.22	50.19	49.76	5.16	7.66	9.44	5.54	7.67	10.44
20500	48.89	48.81	48.31	4.85	7.52	8.86	5.17	7.35	8.16
21000	46.92	47.37	47.92	6.22	7.08	10.38	6.60	7.13	8.75
21500	45.35	45.72	47.10	6.60	7.00	7.48	5.93	6.98	7.21
22000	44.27	44.99	45.48	7.02	6.54	7.35	6.55	6.95	8.50
22500	42.64	43.74	44.59	7.65	6.40	6.21	6.28	6.88	7.71
23000	40.69	42.61	43.38	6.99	6.04	6.86	7.11	6.80	7.30
23500	40.42	41.84	42.98	5.29	5.79	5.57	6.51	6.54	6.72
24000	41.02	41.15	42.41	4.31	5.52	5.43	4.67	6.15	4.75
24500	40.61	40.42	42.64	3.55	5.28	4.16	4.90	5.65	5.20
25000	40.96	39.96	41.25	2.69	5.08	6.07	3.54	5.21	4.56
25500	40.72	40.24	40.72	3.04	4.98	6.27	3.09	4.90	5.37
26000	41.17	41.18	42.23	3.23	4.94	7.03	2.84	4.73	5.32

Typical Performance Curves

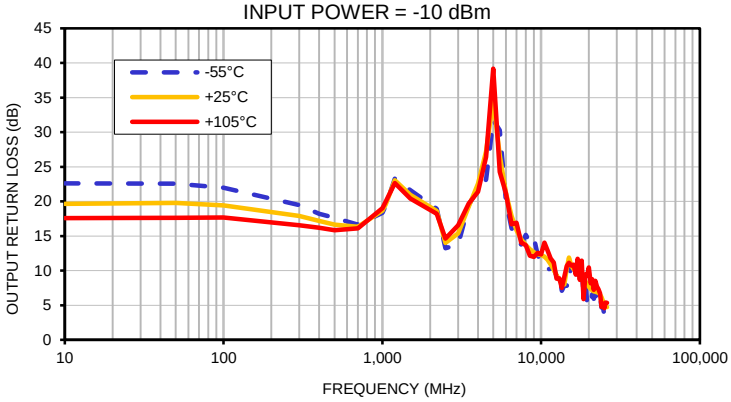
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = -10 dBm



INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = -10 dBm



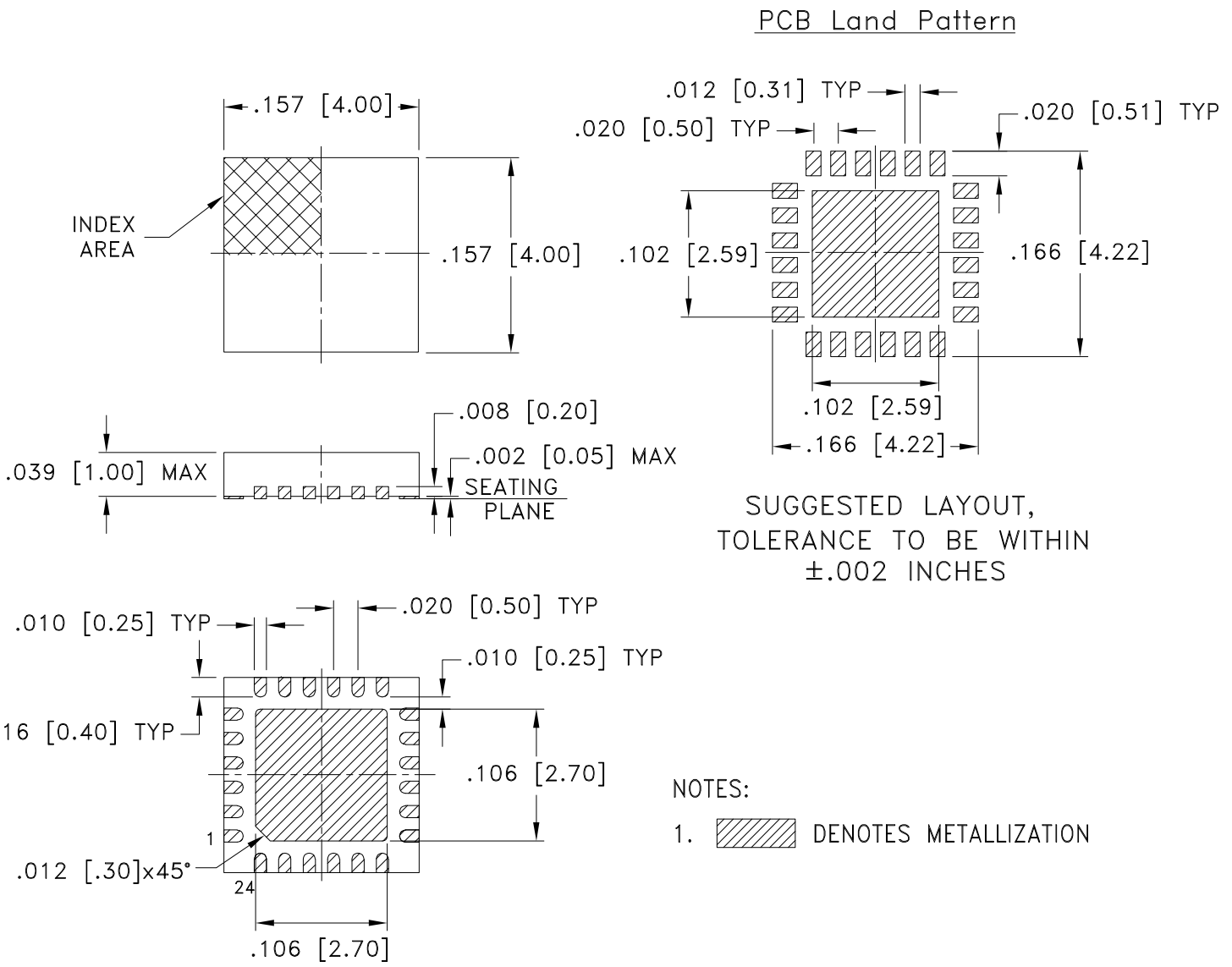
OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = -10 dBm



Case Style DG

Outline Dimensions

DG1847



Weight: .04 grams

Dimensions are in inches [mm]. Tolerances: 2 Pl.±.01; 3 Pl.±.005 Inches

Notes:

1. Case material: Plastic.
2. Termination finish:

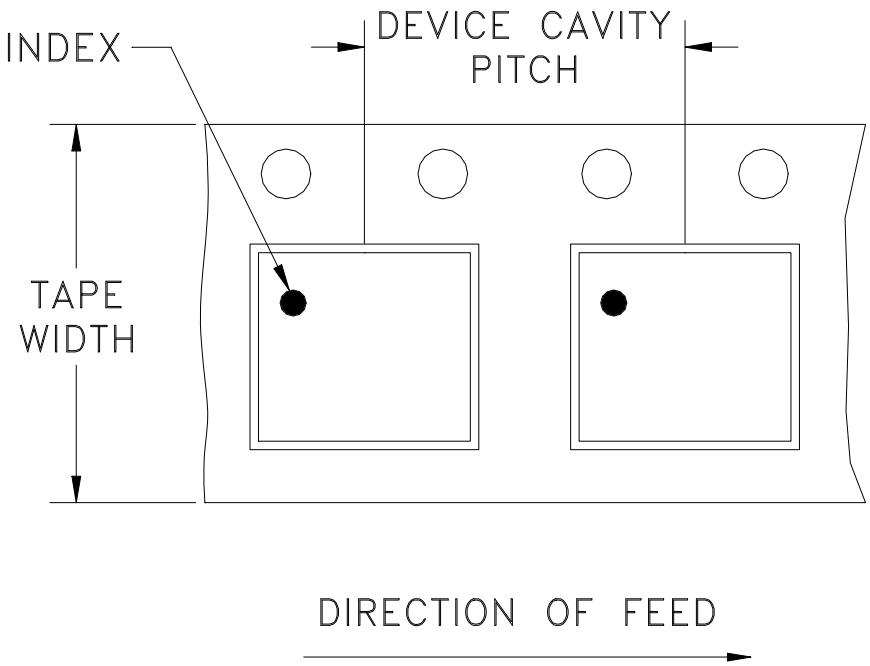
For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier or Matte-Tin or NiPdAu All models, (+) suffix. See model Data sheet.

For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

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RF/IF MICROWAVE COMPONENTS

Tape & Reel Packaging TR-F68

DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
12	8	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000
		13	Standard	2000
				3000
				4000

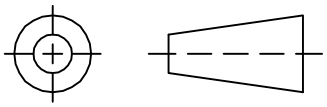
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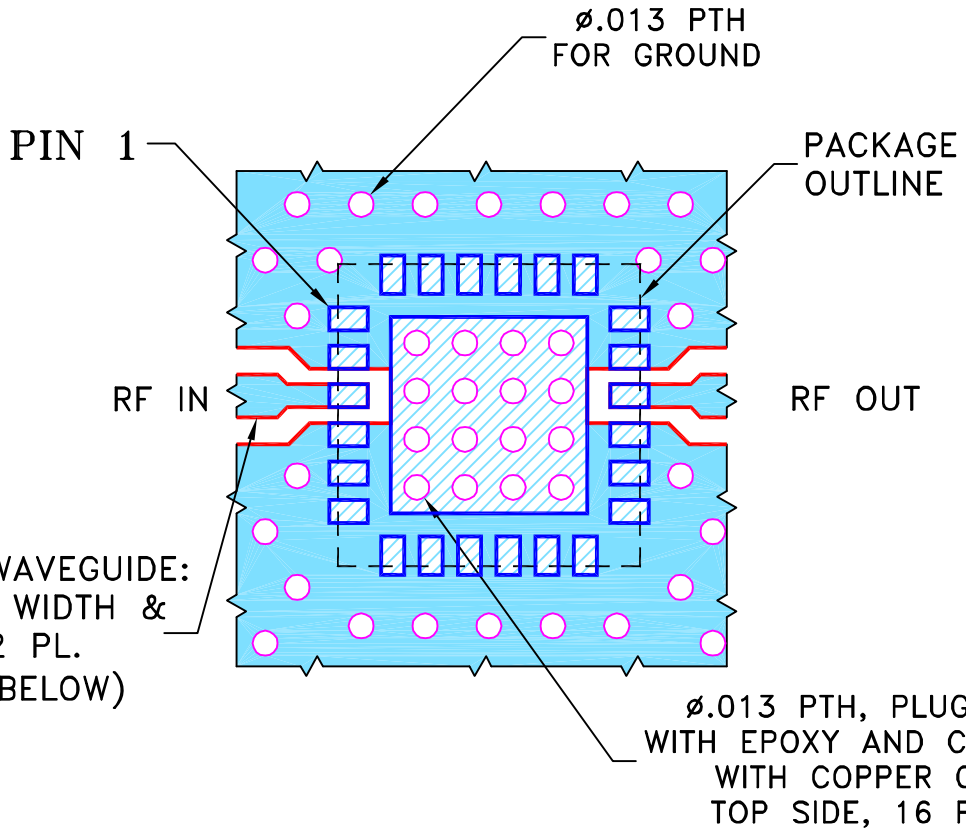
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THIRD ANGLE PROJECTION



REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M162496	NEW RELEASE	06/15/17	GF	RS

SUGGESTED MOUNTING CONFIGURATION FOR DG1847 CASE STYLE, "24FL01" PIN CONNECTION



NOTES:

1. TRACE WIDTH & GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010" ± .001"; 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	GF	06/14/17
TOLERANCES ON:	CHECKED	IL	06/15/17
2 PL DECIMALS ±	APPROVED	RS	06/15/17
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

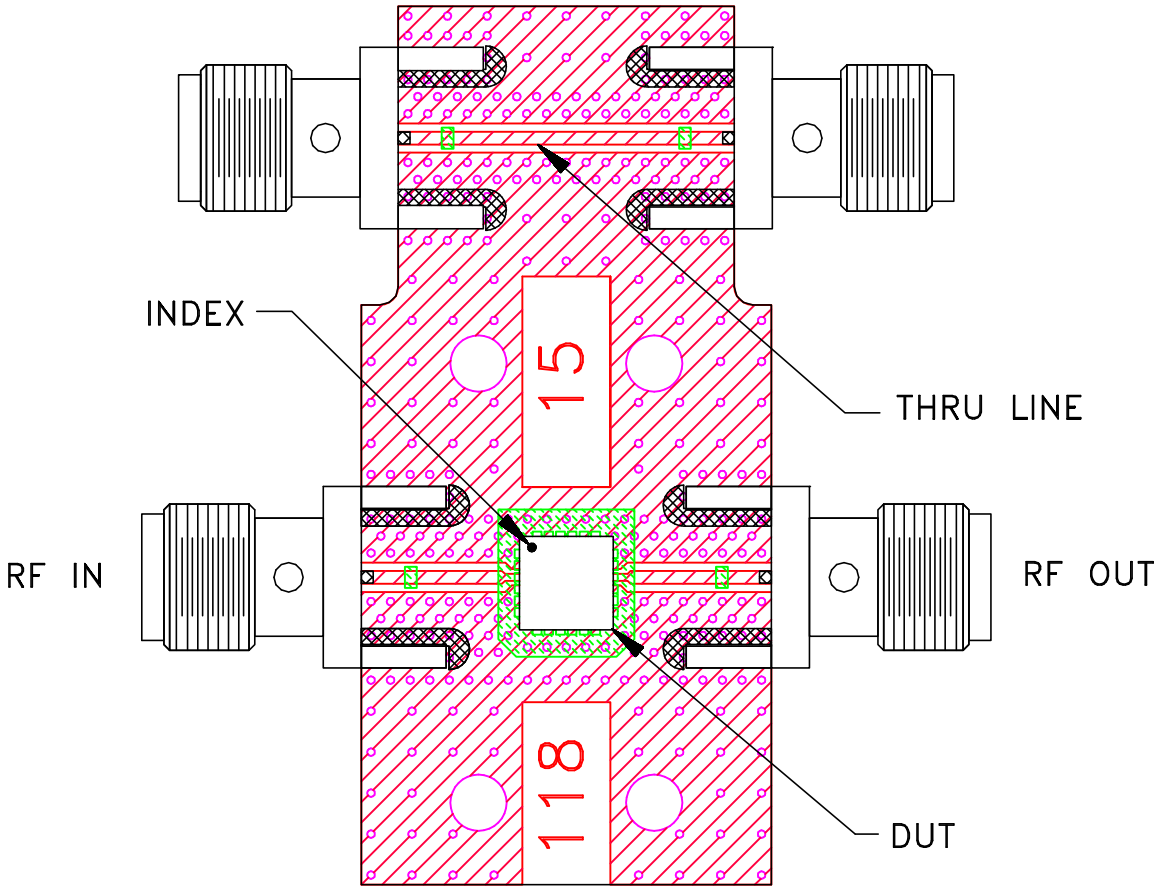
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 24FL01, DG1847, TB-952+

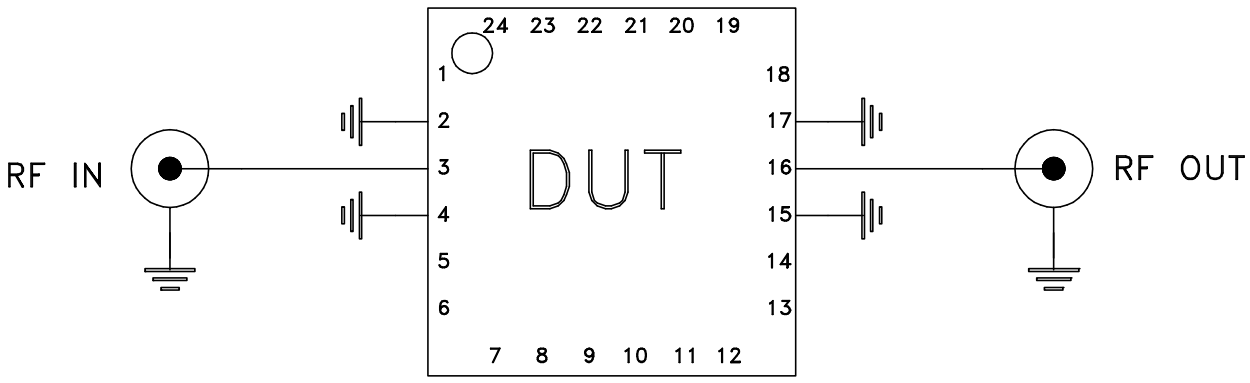
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-519	OR

FILE:	SCALE:	SHEET:
98PL519	10:1	1 OF 1

Evaluation Board and Circuit



TB-952-112H+



PINS 1,5-14,18-24 - NOT CONNECTED.

Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.010 inch.

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Environmental Specifications ENV82

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	-55° to 105°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-65° to 150° C Ambient Environment	Individual Model Data Sheet
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102-C, Condition C
Temperature Cycling	-65° to 150°C, 100 cycles	JESD22-A104
Temperature Humidity	85°C/ 85% RH, 168 hours	JESD22-113
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
Moisture Sensitivity: Level 1	Bake at 125°C for 24 hours Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 240°C peak (Non-RoHS) or 260°C (RoHS)	J-STD-020C
Solderability	10X magnification, 95% coverage	JESD22-B102, Method 1: Dip and Look Test
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

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