MMIC REFLECTIONLESS

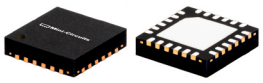
Low Pass Filter

XLF-252H+

50Ω DC to 2500 MHz

THE BIG DEAL

- Match to 50Ω in the stop band, eliminates undesired reflections
- Cascadable
- Excellent stopband rejection, 44 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

- Mobile
- ISM Applications
- Amateur radio
- Space operation & research

PRODUCT OVERVIEW

Mini-Circuits' XLF-252H+ 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. B
ECO-020598
XLF-252H+
MCL NY
240118

Low Pass Filter

XLF-252H+

ELECTRICAL SPECIFICATIONS[1] AT +25°C

Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Passband	Insertion Loss	DC - F1	DC - 2500	—	1.2	2.6	dB
	Frequency Cut-off	F2	3800	—	3.0	—	
	VSWR	DC - F1	DC - 2500	—	1.2	—	:1
Stopband	Rejection	F3 - F4	7000 - 14500	29	38	—	dB
		F4 - F5	14500 - 17000	—	44	—	
	VSWR	F3 - F4	7000 - 14500	—	1.4	—	:1
		F4 - F5	14500 - 17000	—	2.1	—	

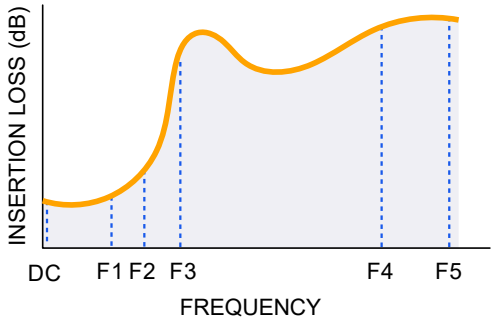
1. Measured on Mini-Circuits Characterization Test Board TB-952-252H+

ABSOLUTE MAXIMUM RATINGS[2]

Parameter	Ratings
Operating Temperature	-55°C to +105°C
Storage Temperature	-65°C to +150°C
RF Power Input, Passband (DC-F1)[2]	7.9 W at 25°C
RF Power Input, Stopband (F2-F5)[3]	1.58 W at 25°C

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

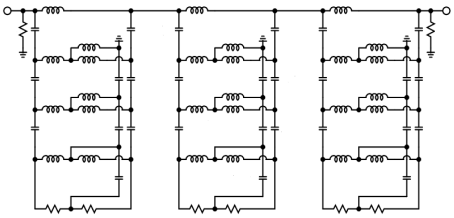
SPECIFICATION DEFINITION

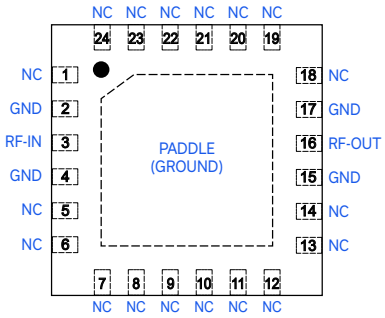


Low Pass Filter

XLF-252H+

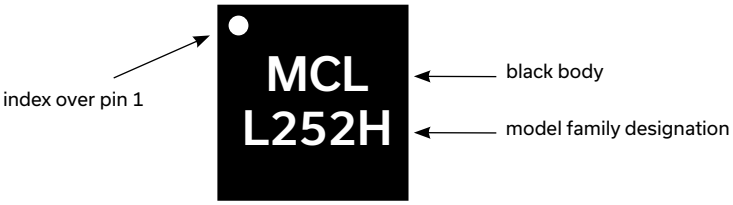
SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION





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



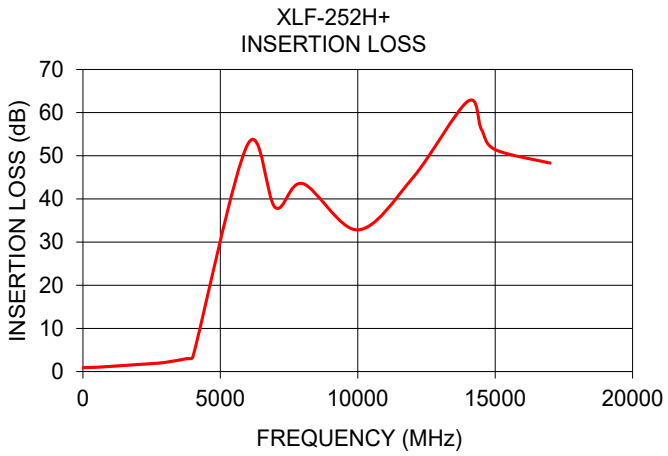
Marking may contain other features or characters for internal lot control

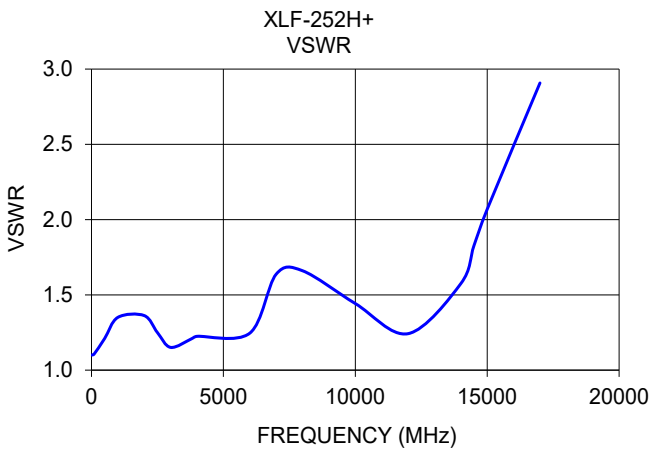
Low Pass Filter

XLF-252H+

TYPICAL PERFORMANCE DATA AT +25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)
10	0.91	1.10
100	0.92	1.11
500	1.00	1.21
1000	1.20	1.35
2000	1.63	1.36
2500	1.84	1.25
3000	2.13	1.15
3800	3.03	1.21
4000	3.40	1.22
6000	52.71	1.25
7000	38.00	1.64
8000	43.56	1.66
10000	32.82	1.44
12000	44.87	1.24
14000	62.60	1.57
14500	56.11	1.83
15000	51.42	2.07
17000	48.32	2.91





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

Performance Data and Graphs	Data Table Swept 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-952-252H+
Environmental Ratings	ENV82

ESD RATING

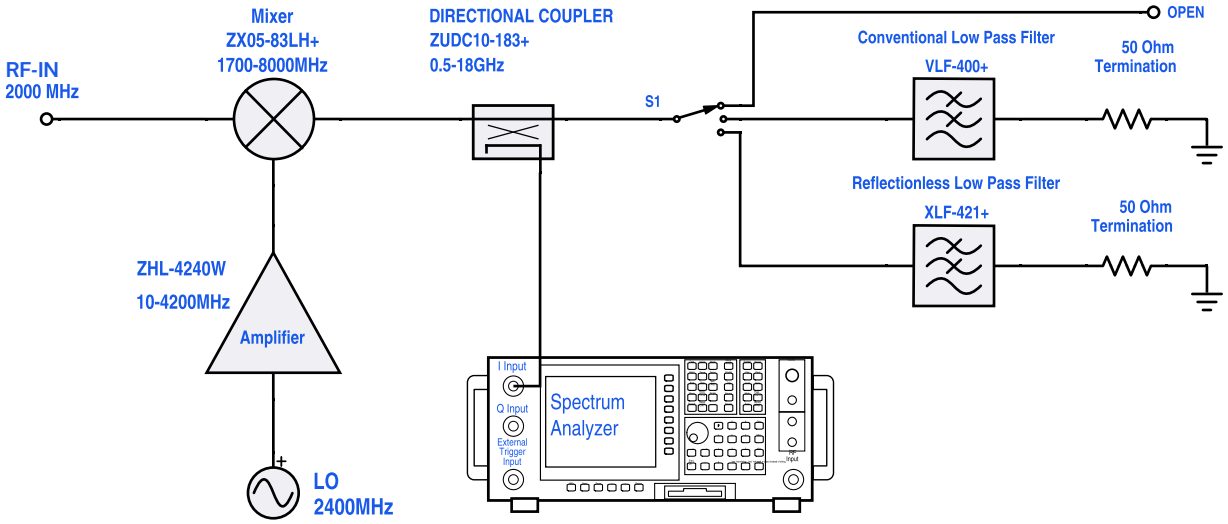
Human body model (HBM): Class 1A (Pass 250V) in accordance with ANSI/ESD 5.1-2001

Low Pass Filter

XLF-252H+

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

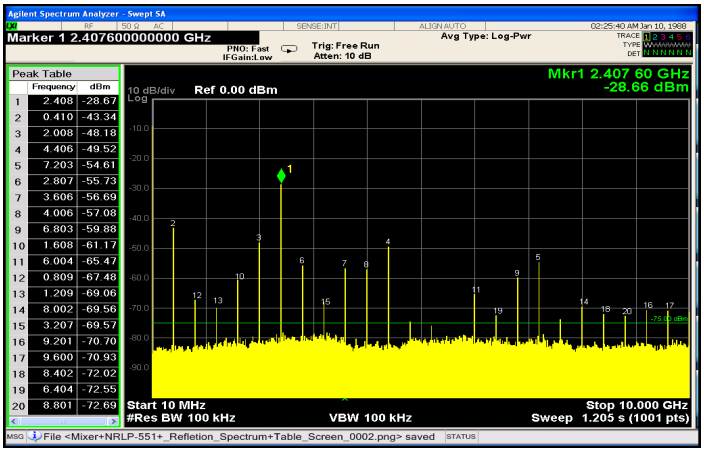


Figure 1. IF output reflection spectrum without filter

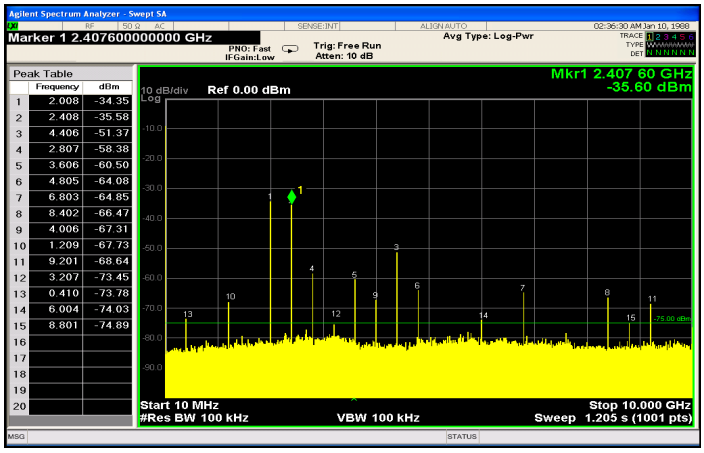
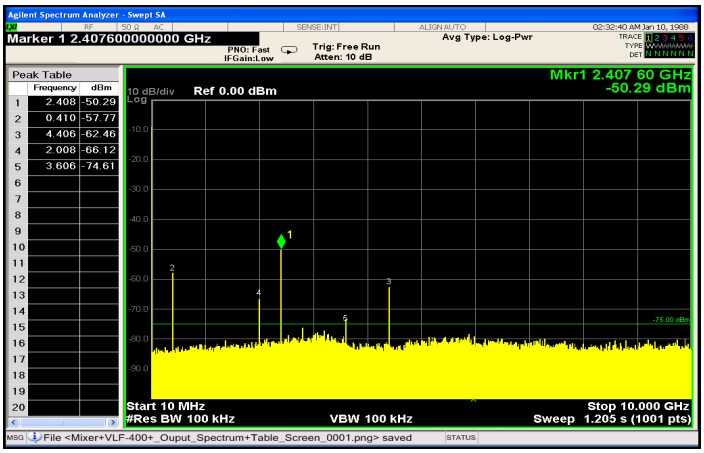


Figure 2. IF output reflection spectrum with conventional filter



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.
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

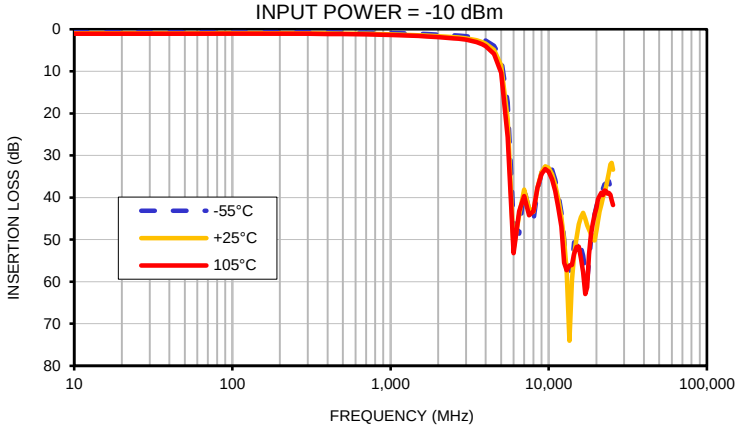
MMIC Reflectionless Low Pass Filter XLF-252H+

Typical Performance Data

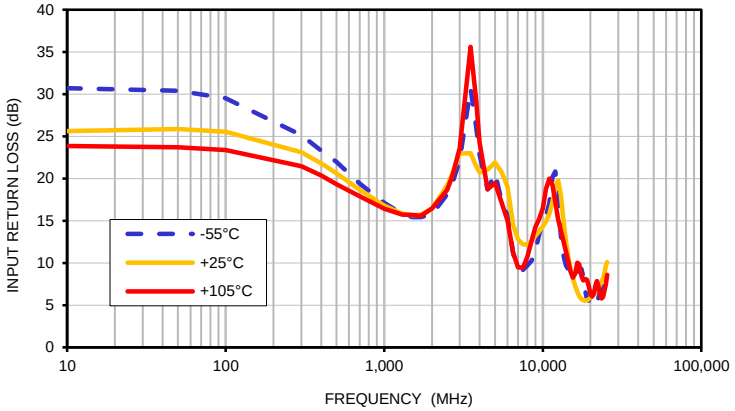
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-55˚C	@25°C	@+105°C	@-55°C	@+25˚C	@+105°C	@-55°C	@+25˚C	@+105°C
10	0.71	0.94	1.06	30.70	25.62	23.86	30.66	25.69	23.77
50	0.70	0.96	1.05	30.39	25.86	23.71	29.89	26.11	23.73
100	0.70	0.95	1.05	29.52	25.56	23.38	28.66	25.68	23.73
300	0.71	0.98	1.09	25.13	23.13	21.47	25.34	23.12	21.94
400	0.72	1.00	1.12	23.29	21.79	20.36	23.34	21.77	20.93
500	0.74	1.03	1.15	21.98	20.62	19.32	21.86	20.52	19.95
700	0.78	1.10	1.23	19.41	18.67	17.88	20.00	18.54	18.26
1000	0.89	1.22	1.36	17.12	16.78	16.43	17.45	16.63	17.01
1300	1.00	1.35	1.52	15.81	15.83	15.72	16.25	15.71	15.79
1500	1.08	1.44	1.61	15.44	15.64	15.70	15.73	15.55	16.04
1700	1.15	1.52	1.72	15.45	15.74	15.58	15.68	15.70	16.15
2000	1.26	1.64	1.87	15.75	16.44	16.48	16.04	16.56	16.70
2500	1.44	1.85	2.14	18.14	19.17	18.68	17.54	19.86	18.88
2700	1.52	1.95	2.26	19.53	20.63	20.41	18.78	22.02	20.01
3000	1.68	2.14	2.50	22.21	22.98	23.58	20.08	25.69	21.86
3500	2.05	2.60	3.05	30.64	23.02	35.60	22.86	24.60	22.72
3800	2.39	3.02	3.55	26.15	21.46	29.26	21.97	22.14	21.81
4000	2.70	3.39	4.01	22.81	20.73	24.26	20.12	21.22	20.18
4500	3.95	4.90	5.87	18.69	21.07	18.74	17.50	21.73	16.96
5000	6.93	8.60	10.34	20.66	21.89	19.47	17.62	22.41	17.42
5500	17.37	21.43	25.63	17.36	20.78	17.16	15.12	20.68	16.86
6000	45.73	52.18	53.25	15.66	19.05	15.04	14.63	18.91	14.36
6500	48.57	44.18	43.24	11.18	14.57	11.22	11.21	14.14	11.22
7000	37.77	38.08	39.64	9.31	12.79	9.49	9.78	12.33	10.37
7500	42.88	42.59	44.20	9.17	12.18	9.43	9.79	11.83	10.44
8000	45.49	43.43	43.29	9.68	12.19	10.71	9.96	12.12	10.94
8500	38.51	37.72	37.62	10.27	12.60	12.66	10.91	12.86	12.75
9000	34.08	33.93	34.42	11.41	13.21	14.26	12.32	13.79	15.38
9500	32.12	32.54	33.24	13.37	13.75	15.21	12.78	14.72	17.49
10000	32.04	32.95	33.85	14.91	14.33	16.50	15.15	15.57	17.63
10500	33.38	34.45	35.69	15.58	14.92	18.77	17.15	16.53	17.45
11000	35.70	36.94	38.41	17.14	15.83	19.99	16.08	17.88	20.74
11500	39.03	40.39	42.35	20.18	17.22	19.23	20.89	20.05	18.08
12000	43.45	44.76	46.89	20.82	18.89	17.24	19.74	23.08	17.04
12500	49.93	50.27	55.49	17.35	19.81	15.19	14.55	24.41	18.04
13000	57.35	57.51	57.28	13.25	18.02	13.81	13.12	20.87	13.65
13500	57.37	74.04	56.15	10.97	15.20	12.64	11.70	16.84	11.75
14000	56.08	59.77	55.99	9.75	12.69	11.40	9.87	13.92	10.99
14500	50.67	53.54	53.37	9.21	10.74	10.19	9.02	11.86	9.99
15000	51.67	49.52	51.75	9.35	9.25	8.99	8.38	10.33	9.09
15500	49.85	46.37	51.67	10.05	8.15	8.27	8.18	9.23	7.68
16000	51.78	44.67	54.39	9.90	7.28	8.73	8.51	8.38	7.51
16500	53.78	43.65	57.74	9.04	6.60	10.03	6.75	7.75	8.59
17000	57.39	45.03	62.94	8.96	6.07	9.85	5.82	7.22	8.31
17500	59.72	46.59	61.34	9.31	5.73	8.49	8.13	6.96	6.72
18000	55.40	47.59	53.50	8.40	5.58	7.94	9.50	6.69	7.18
18500	50.36	48.68	48.96	6.75	5.53	8.10	6.67	6.62	8.92
19000	46.94	50.06	46.30	5.73	5.57	8.01	6.41	6.42	7.51
19500	44.03	50.18	44.04	5.55	5.72	7.23	7.32	6.49	7.61
20000	42.10	47.81	42.44	5.95	5.83	6.34	5.16	6.43	10.19
20500	40.74	45.58	40.36	6.37	6.09	6.03	5.10	6.60	9.52
21000	38.73	43.36	39.66	6.16	6.26	6.36	6.06	6.63	7.43
21500	38.91	41.64	38.84	5.44	6.57	7.26	6.50	6.76	6.98
22000	37.89	40.01	39.45	5.37	6.73	7.84	8.45	6.84	6.30
22500	36.83	38.70	38.35	5.85	7.02	7.24	7.25	6.99	6.23
23000	36.72	37.43	38.43	6.67	7.37	6.30	4.60	7.20	6.59
23500	36.25	35.97	39.05	7.18	7.77	5.78	6.17	7.53	6.02
24000	36.07	34.09	38.88	7.24	8.20	6.00	7.46	7.89	7.31
24500	37.55	32.15	39.36	6.63	8.75	6.67	4.47	8.53	9.61
25000	38.85	31.72	40.63	5.93	9.69	7.50	4.99	9.14	8.12
25500	39.43	33.38	41.76	6.38	10.08	8.59	8.23	10.00	7.21
26000	39.73	35.42	43.12	7.96	9.86	8.85	8.36	10.61	8.82

Typical Performance Curves

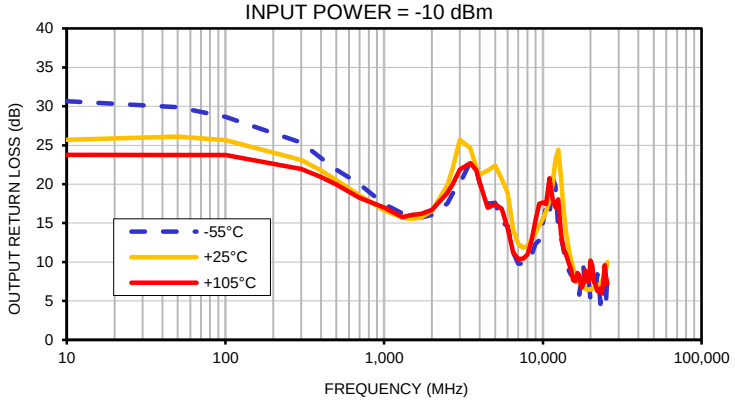
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = -10 dBm



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



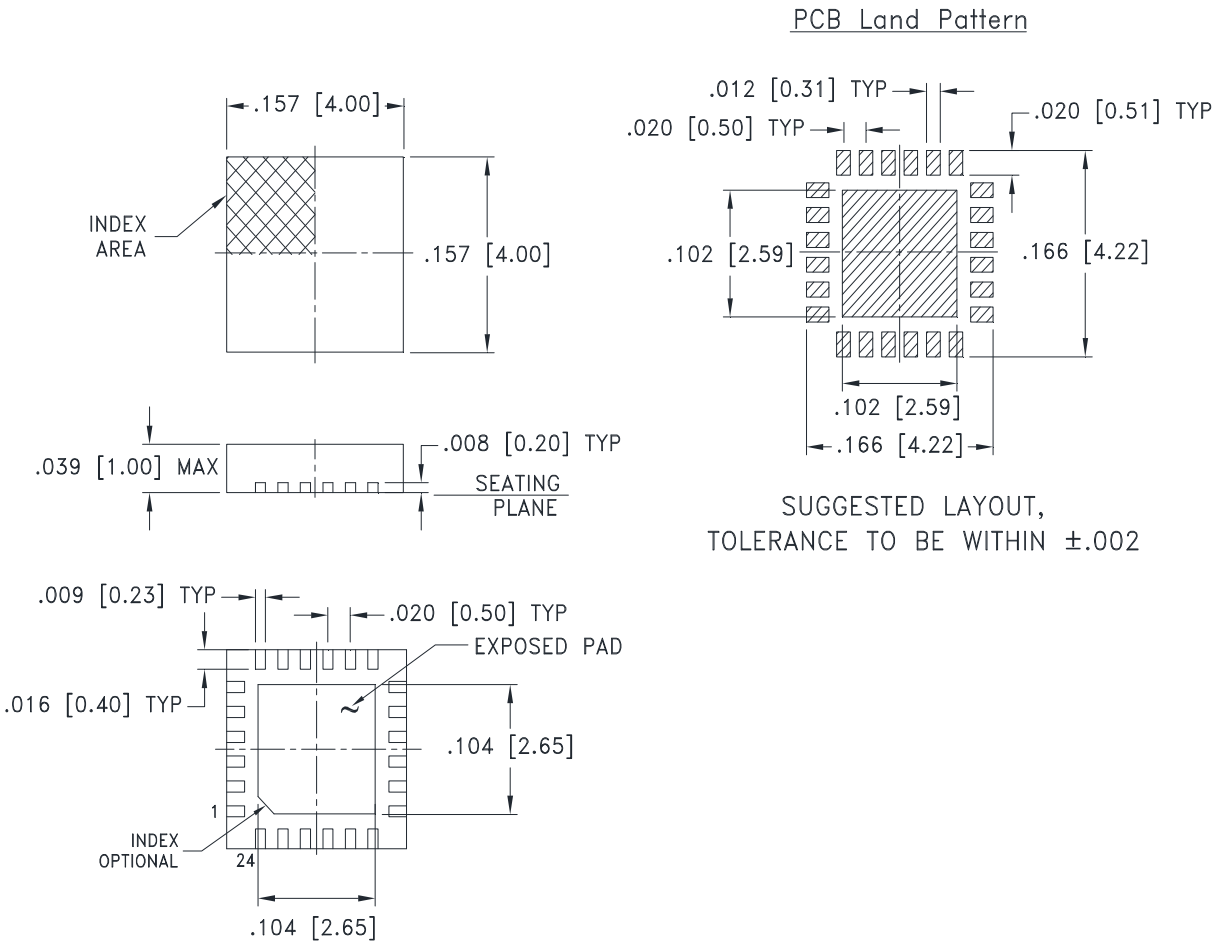
OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = -10 dBm



Case Style DG

DG1847

Outline Dimensions



Weight: .04 Grams

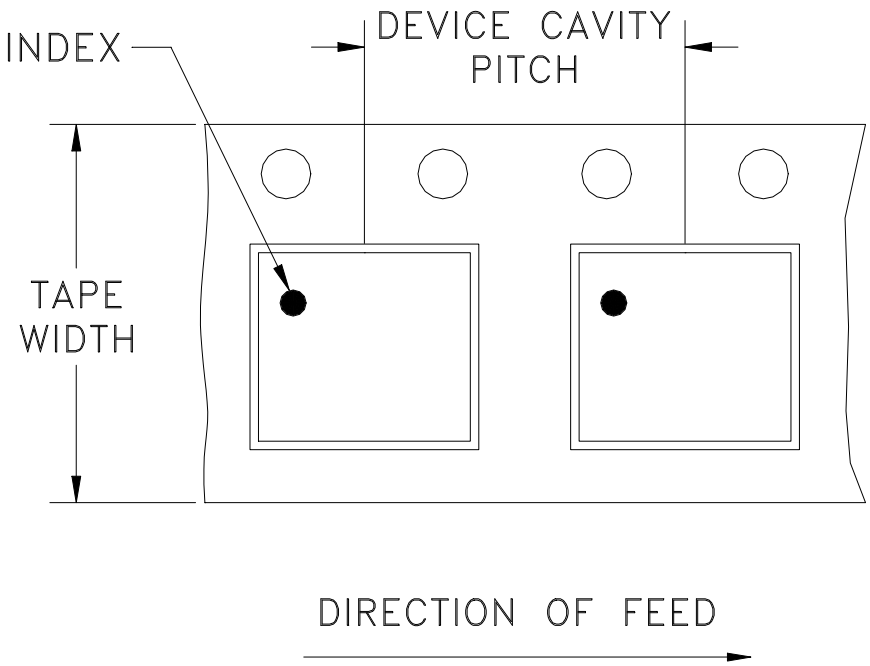
Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

Notes:

1. Case material: Plastic.
2. Termination finish:
   For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier or Matte-Tin. All models, (+) suffix. See model Data sheet.
   For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

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

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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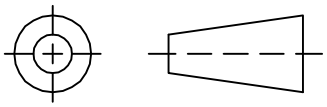
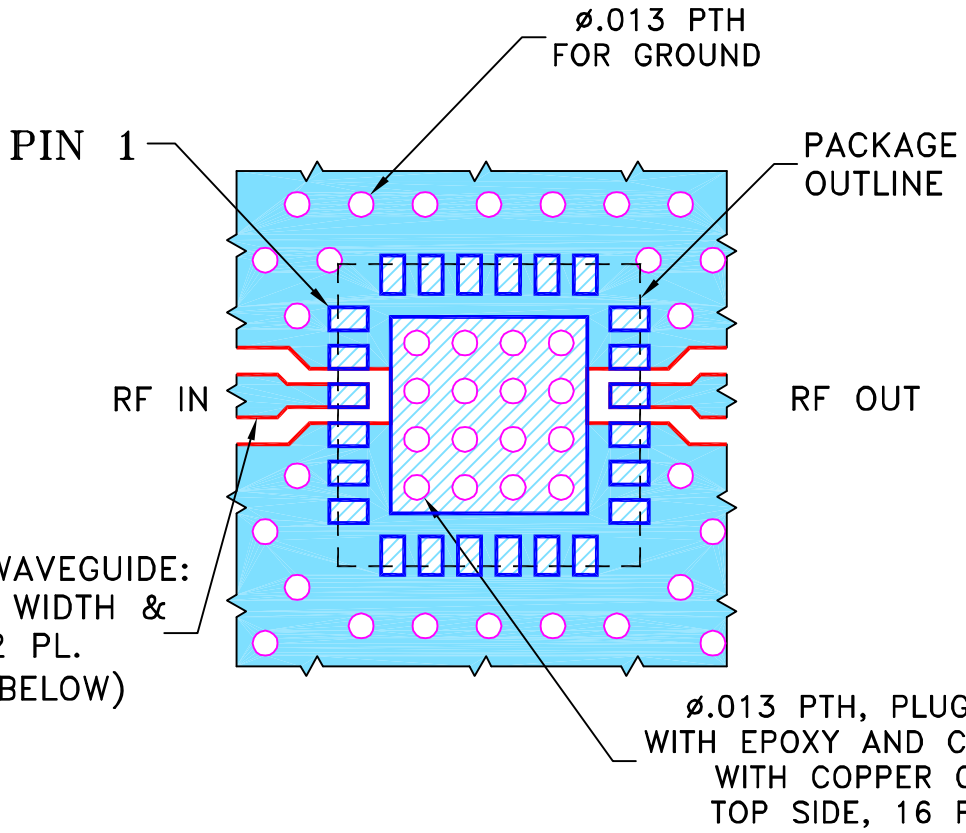
THIRD ANGLE PROJECTION



REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	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 ±			

Mini-Circuits®

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

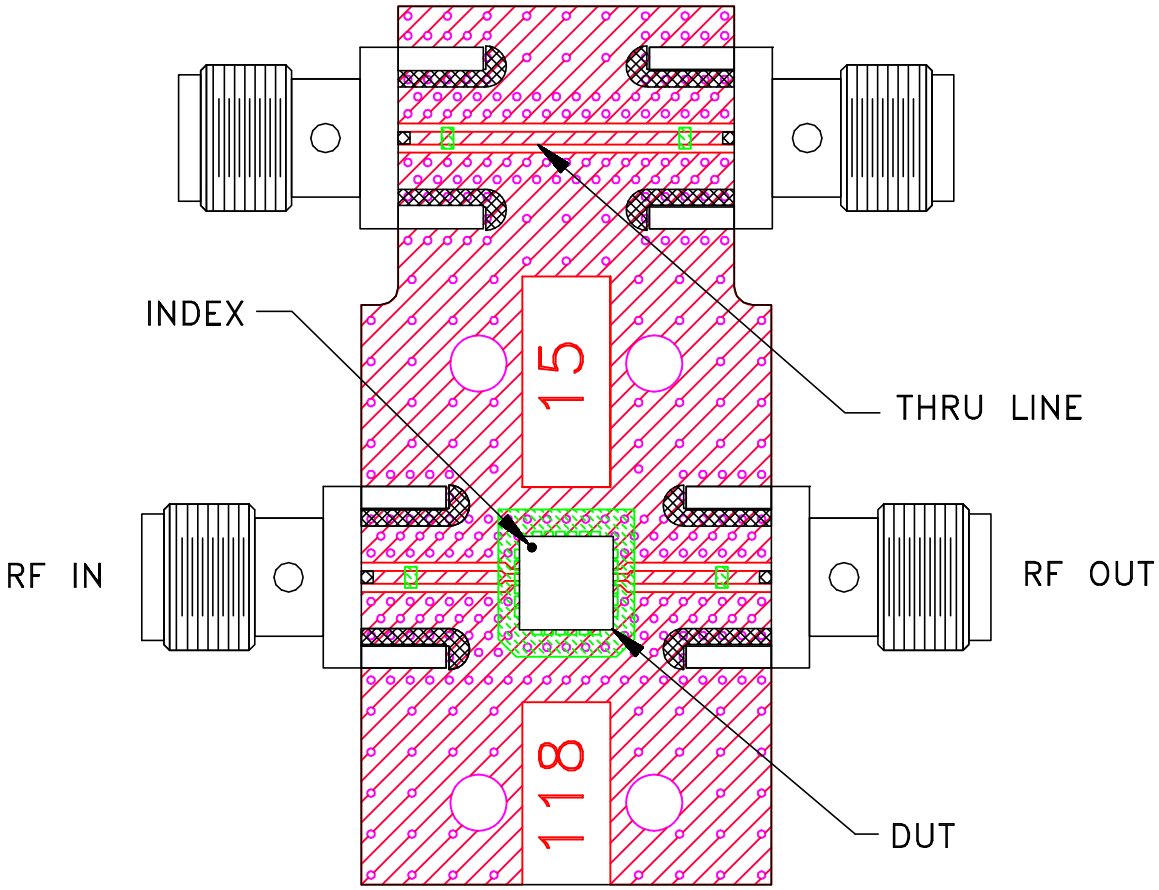
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 24FL01, DG1847, TB-952+

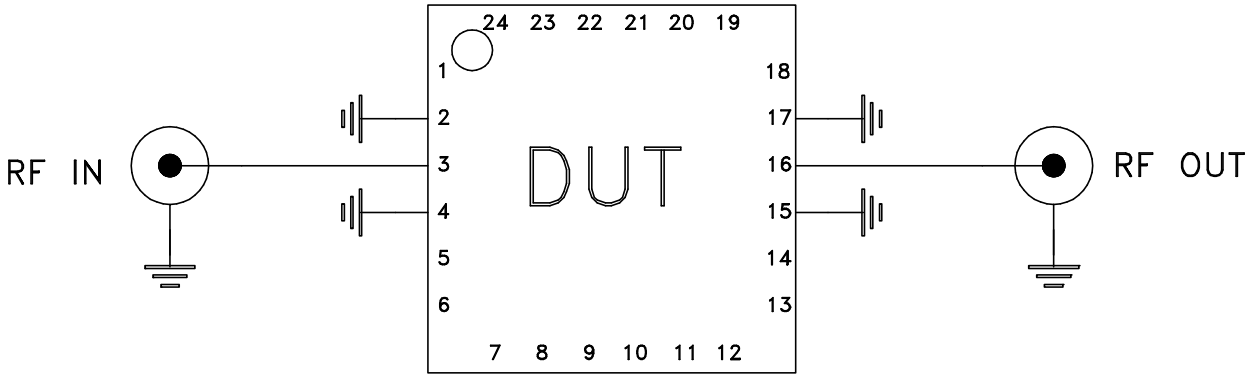
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-519	OR

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

Evaluation Board and Circuit



TB-952-252H+



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.

Mini-Circuits®

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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