REFLECTIONLESS

High Pass Filter

XHF2-153+

50Ω 15.3 to 30 GHz

THE BIG DEAL

- Match to 50Ω in the stop band, eliminates undesired reflections
- Cascadable
- Excellent Power handling
- Temperature stable, up to +105°C
- Small size, 2 x 2 mm
- Protected by US Patent No. 8,392,495

Generic photo used for illustration purposes only

CASE STYLE: MC1630-1

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

APPLICATIONS

- Wi-Fi
- WiMax
- Microwave Radio
- Military & Space

PRODUCT OVERVIEW

Mini-Circuits' XHF2-153+ 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

Feature	Advantages
Easy integration with sensitive reflective components, e.g. mixers, multipliers	Reflectionless filters absorb unwanted signals falling in filter stopband, 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.
Enables stable integration of wideband amplifiers	Because reflectionless filters maintain good impedance in the stopband; they can be integrated with high gain, wideband amplifiers without the risk of creating instabilities in these out of band regions.
Cascadable	Reflectionless filters can be cascaded in multiple sections to provide sharper and higher attenuation, while also preventing any standing waves that could affect passband signals. Low & highpass filters can be cascaded to realize bandpass filters.
Excellent power handling in a tiny surface mount device	High power handling extends the usability of these filters to the transmit path for inter-stage filtering.
Small size, 2x2mm QFN-Style	Allows replacement of filter/attenuator pairs with a single reflectionless filter, saving board space.
Excellent repeatability of RF performance	Through semiconductor IPD process, X-series filters are inherently repeatable for large volume production.
Operating temperature up to +105˚C	Suitable for operation close to high power components.

IPD – Integrated Passive Device, is a GaAs semiconductor process

REV. C
ECO-021591
XHF2-153+
MCL NY
240423

REFLECTIONLESS

High Pass Filter

XHF2-153+

50Ω 15.3 to 30 GHz

ELECTRICAL SPECIFICATIONS[1] AT +25°C

Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Stop Band	Rejection	DC - F′	DC - 2400	—	6.8	—	dB
		F′ - F1	2400 - 12000	12.0	13.7	—	
	Frequency Cut-off	F2	14200	—	2.9	—	
	VSWR	DC - F′	DC - 2400	—	2.7	—	:1
		F′ - F1	2400 - 12000	—	2.2	—	
Pass Band	Insertion Loss	F3 - F4	15300 - 26000	—	1.8	—	dB
		F4 - F5	26000 - 30000	—	0.7	—	
	VSWR	F3 - F4	15300 - 26000	—	2.1	—	:1
		F4 - F5	26000 - 30000	—	1.6	—	

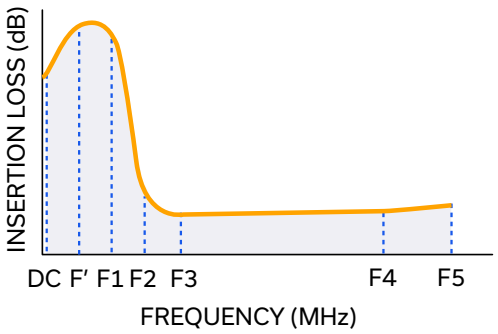
1. Measured on Mini-Circuits Characterization Test Board TB-883-153+

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)[3]	1.26 W at +25°C
RF Power Input, Stopband (DC-F3)[4]	0.16 W at +25°C

2. Permanent damage may occur if any of these limits are exceeded.
3. Passband rating derates linearly to 0.63 W at 105°C ambient
4. Stopband rating derates linearly to 0.08 W at 105°C ambient

SPECIFICATION DEFINITION

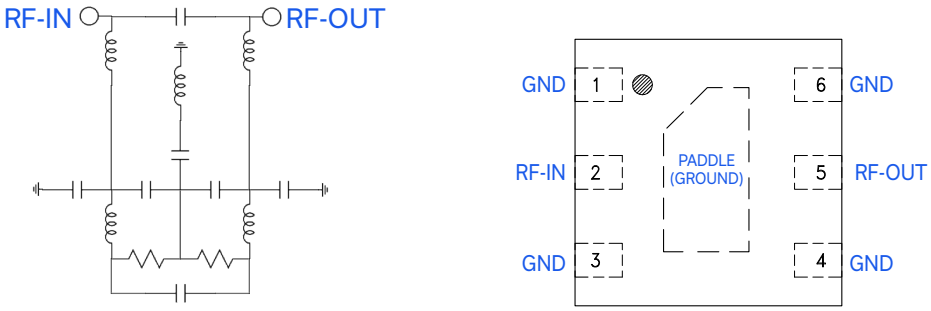


High Pass Filter

XHF2-153+

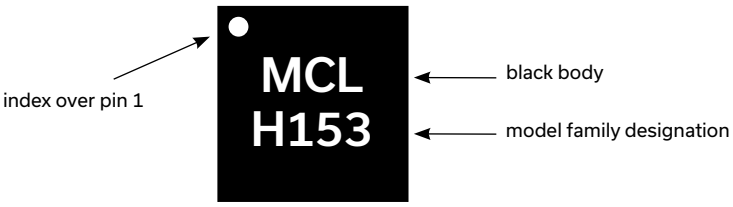
50Ω 15.3 to 30 GHz

SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



Function	Pad Number	Description
RF-IN	2	RF Input Pad
RF-OUT	5	RF Output Pad
GND	1,3,4,6, Paddle	Connected to ground

PRODUCT MARKING



Marking may contain other features or characters for internal lot control

REFLECTIONLESS

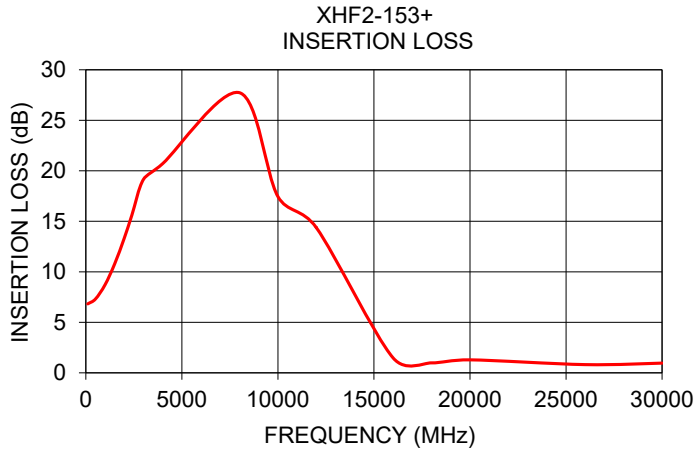
High Pass Filter

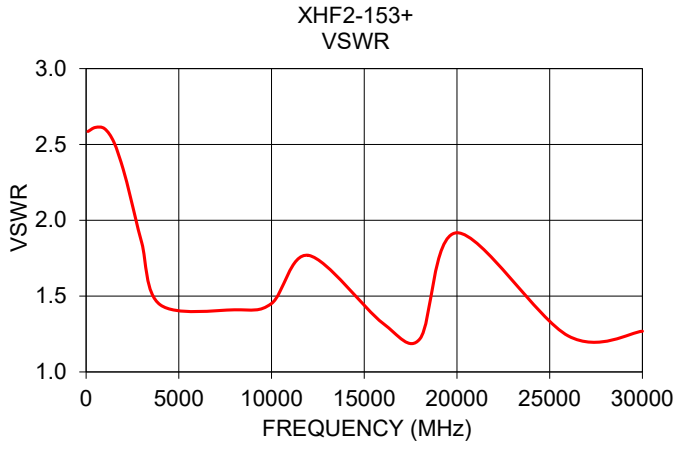
XHF2-153+

50Ω 15.3 to 30 GHz

TYPICAL PERFORMANCE DATA AT +25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)
100	6.83	2.59
500	7.31	2.61
1000	8.72	2.60
1500	10.78	2.51
2000	13.33	2.34
2400	15.63	2.15
3000	19.15	1.85
4000	20.71	1.44
8000	27.73	1.41
10000	17.45	1.45
12000	14.37	1.77
14500	2.72	1.38
16000	1.47	1.32
18000	0.99	1.22
20000	1.29	1.92
26000	0.81	1.24
30000	0.96	1.27





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

Performance Data & Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	MC1630-1 Plastic package, exposed paddle lead finish: matte-tin
Tape & Reel **Standard quantities available on reel**	F66 7" reels with 20, 50, 100, 200, 500 ,1000, 2000 or 3000 devices
Suggested Layout for PCB Design	PL-499
Evaluation Board	TB-883-1352+ (without connectors) TB-883-1352C+ (with connectors) B20-118-F1+ connector sold separately
Environmental Ratings	ENV82

ESD RATING
Human body model (HBM): Class 1A (250 to<500 V) in accordance with ANSI/ESD 5.1-2001

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

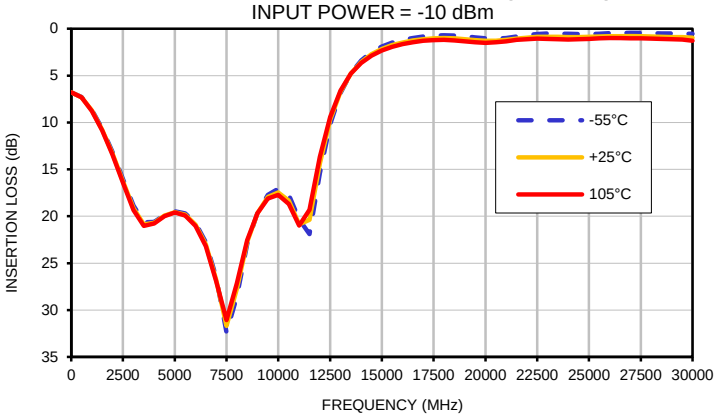
MMIC Reflectionless High Pass Filter XHF2-153+

Typical Performance Data

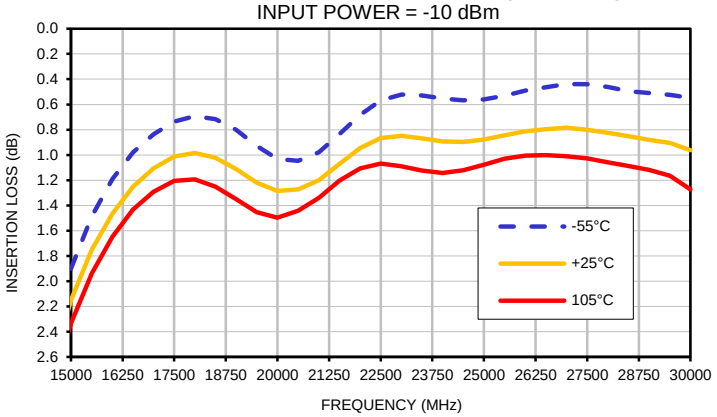
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-55°C	@25°C	@+105°C	@-55°C	@+25°C	@+105°C	@-55°C	@+25°C	@+105°C
10	6.78	6.81	6.80	7.10	7.10	7.08	7.13	7.11	7.14
500	7.27	7.30	7.33	6.98	7.01	7.03	6.97	7.01	7.03
1000	8.64	8.72	8.76	7.03	7.07	7.11	6.98	7.03	7.08
1500	10.65	10.77	10.86	7.32	7.39	7.44	7.23	7.31	7.37
2000	13.14	13.33	13.44	7.93	8.06	8.14	7.80	7.95	8.03
2500	15.99	16.23	16.40	8.91	9.12	9.26	8.78	9.01	9.15
3000	18.85	19.14	19.36	10.34	10.63	10.84	10.21	10.49	10.71
3500	20.64	20.85	21.02	12.26	12.60	12.84	12.12	12.44	12.71
4000	20.60	20.71	20.77	14.51	14.87	15.12	14.48	14.84	15.09
4500	19.87	19.94	19.98	16.55	17.12	17.44	16.89	17.47	17.72
5000	19.47	19.56	19.61	17.53	18.57	19.14	18.28	19.31	20.06
5500	19.70	19.83	19.92	17.48	18.76	19.69	18.10	19.57	20.76
6000	20.69	20.90	21.02	16.90	18.06	19.03	17.38	18.74	19.70
6500	22.76	23.01	23.19	16.31	17.21	17.94	16.73	17.71	18.25
7000	26.52	26.76	26.94	15.87	16.56	17.09	15.99	16.72	17.06
7500	32.40	31.69	31.07	15.55	16.17	16.63	15.29	15.86	16.25
8000	28.57	27.73	27.17	15.52	16.14	16.61	14.91	15.39	15.93
8500	22.96	22.73	22.54	15.78	16.44	16.91	14.86	15.30	15.88
9000	19.61	19.66	19.67	16.08	16.75	17.11	14.85	15.36	15.79
9500	17.72	17.96	18.10	15.73	16.28	16.57	14.68	15.30	15.61
10000	17.06	17.45	17.72	14.34	14.72	15.09	14.07	14.70	15.11
10500	17.74	18.33	18.71	12.52	12.80	13.12	13.01	13.56	13.95
11000	20.35	20.86	21.01	11.02	11.25	11.48	11.87	12.23	12.51
11500	21.90	20.39	19.30	10.28	10.55	10.70	11.11	11.45	11.59
12000	15.43	14.37	13.68	10.68	11.13	11.29	11.15	11.71	11.86
12500	10.19	9.73	9.41	12.85	13.81	14.18	12.76	13.85	14.25
13000	6.86	6.72	6.60	17.85	20.67	22.37	16.65	18.99	20.83
13500	4.75	4.79	4.80	24.62	27.29	26.59	21.93	24.72	26.68
14000	3.39	3.55	3.65	19.53	18.62	17.46	19.21	19.07	17.97
14500	2.50	2.72	2.88	16.59	16.00	15.04	16.37	16.18	15.24
15000	1.90	2.15	2.33	15.82	15.44	14.65	15.50	15.35	14.55
15500	1.49	1.75	1.94	16.33	16.05	15.41	15.90	15.70	15.10
16000	1.19	1.46	1.65	17.93	17.72	17.34	17.42	17.18	16.80
16500	0.98	1.25	1.43	20.97	21.03	21.08	20.34	20.17	20.13
17000	0.84	1.11	1.29	26.81	28.52	30.63	25.98	26.34	26.86
17500	0.74	1.01	1.20	40.74	31.94	27.98	35.57	29.95	26.47
18000	0.69	0.98	1.19	22.90	20.40	18.67	22.20	20.15	18.39
18500	0.72	1.02	1.25	16.70	15.48	14.40	16.20	15.26	14.18
19000	0.80	1.11	1.35	13.14	12.67	11.98	12.70	12.45	11.75
19500	0.93	1.22	1.45	10.90	11.00	10.71	10.53	10.75	10.44
20000	1.03	1.29	1.50	9.76	10.27	10.37	9.48	10.05	10.11
20500	1.05	1.27	1.44	9.56	10.42	10.95	9.31	10.20	10.71
21000	0.98	1.20	1.34	10.23	11.41	12.52	9.97	11.11	12.17
21500	0.83	1.07	1.20	12.03	13.64	15.75	11.81	13.21	15.15
22000	0.68	0.95	1.11	15.38	17.95	22.09	15.09	16.96	19.83
22500	0.57	0.87	1.07	22.15	27.97	29.00	20.72	22.15	22.11
23000	0.52	0.85	1.09	32.34	25.16	19.76	23.86	21.21	18.07
23500	0.53	0.87	1.12	20.88	18.57	16.13	18.93	17.43	15.40
24000	0.55	0.89	1.14	17.18	16.15	14.87	16.05	15.51	14.39
24500	0.57	0.90	1.12	15.59	15.28	15.00	14.87	14.96	14.74
25000	0.56	0.88	1.08	15.36	15.63	16.51	14.75	15.34	16.28
25500	0.53	0.84	1.03	16.13	17.07	19.35	15.86	17.15	19.56
26000	0.49	0.81	1.01	18.12	19.49	23.38	18.33	20.05	25.16
26500	0.46	0.80	1.00	21.03	22.91	26.36	22.17	25.10	37.00
27000	0.44	0.78	1.01	24.98	26.10	25.28	30.40	37.50	30.26
27500	0.44	0.80	1.03	23.51	22.80	22.50	25.88	25.50	24.26
28000	0.46	0.83	1.06	19.94	19.84	20.68	20.63	21.05	21.95
28500	0.50	0.85	1.09	17.71	18.14	19.43	18.20	19.54	21.45
29000	0.51	0.88	1.12	17.23	17.99	19.64	17.90	20.13	23.59
29500	0.52	0.90	1.17	18.10	18.85	19.63	20.14	24.55	33.03
30000	0.55	0.96	1.27	19.32	18.54	17.22	29.52	33.71	23.04

Typical Performance Curves

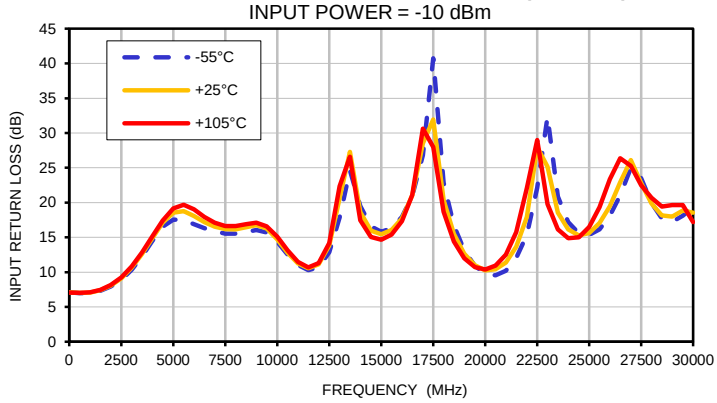
INSERTION LOSS vs. TEMPERATURE (Full Band)
INPUT POWER = -10 dBm



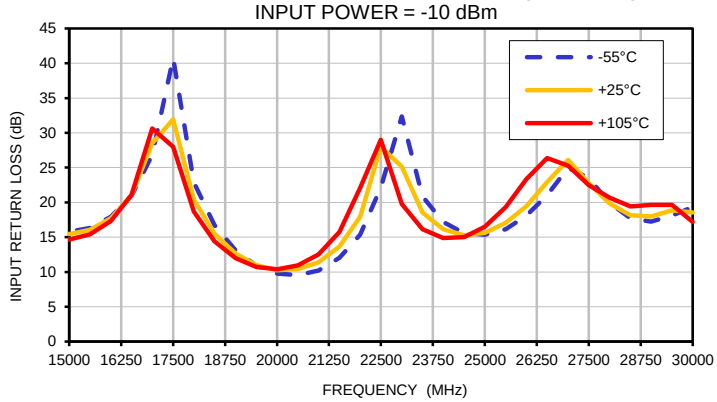
INSERTION LOSS vs. TEMPERATURE (Pass Band)
INPUT POWER = -10 dBm



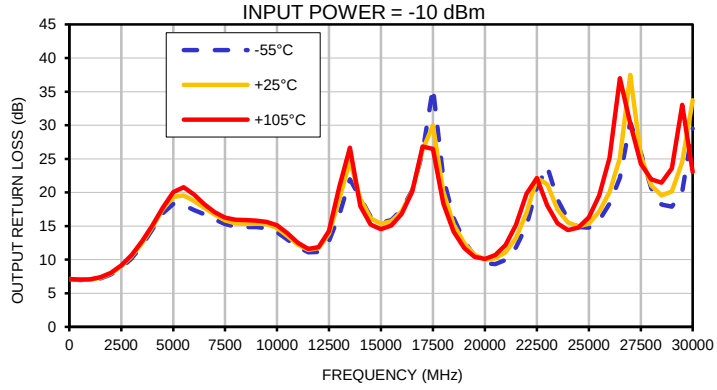
INPUT RETURN LOSS vs. TEMPERATURE (Full band)
INPUT POWER = -10 dBm



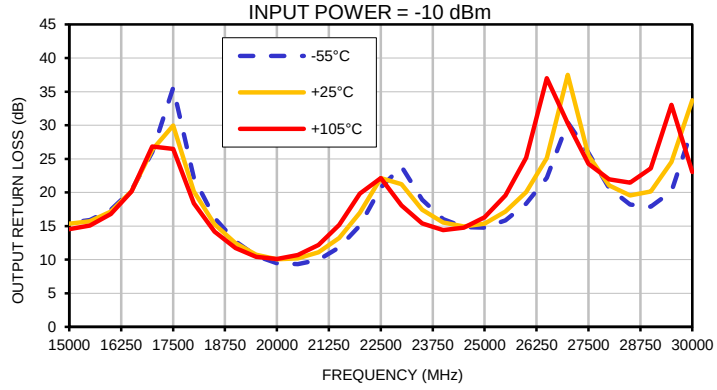
INPUT RETURN LOSS vs. TEMPERATURE (Pass band)
INPUT POWER = -10 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE (Full band)
INPUT POWER = -10 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE (Pass band)
INPUT POWER = -10 dBm

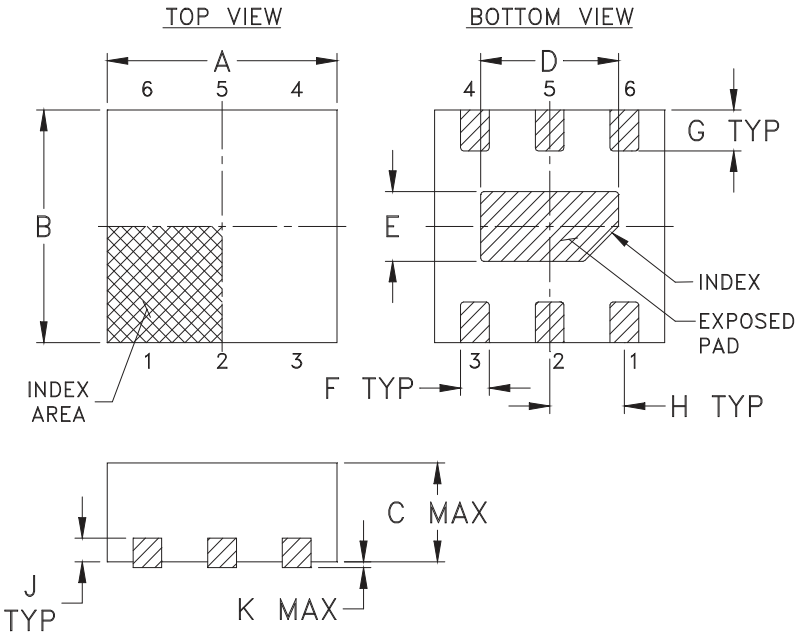


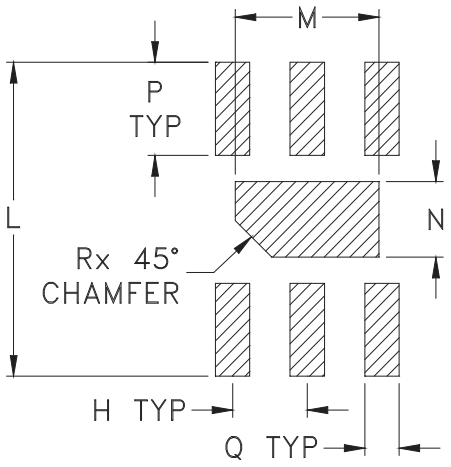
Case Style MC

MC1630-1

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
MC1630-1	.079 (2.00)	.079 (2.00)	.039 (1.00)	.047 (1.20)	.024 (.60)	.010 (.25)	.014 (.35)	.026 (.65)	.008 (.20)	.002 (.05)	.106 (2.70)	.049 (1.25)	.026 (.65)	.031 (.80)

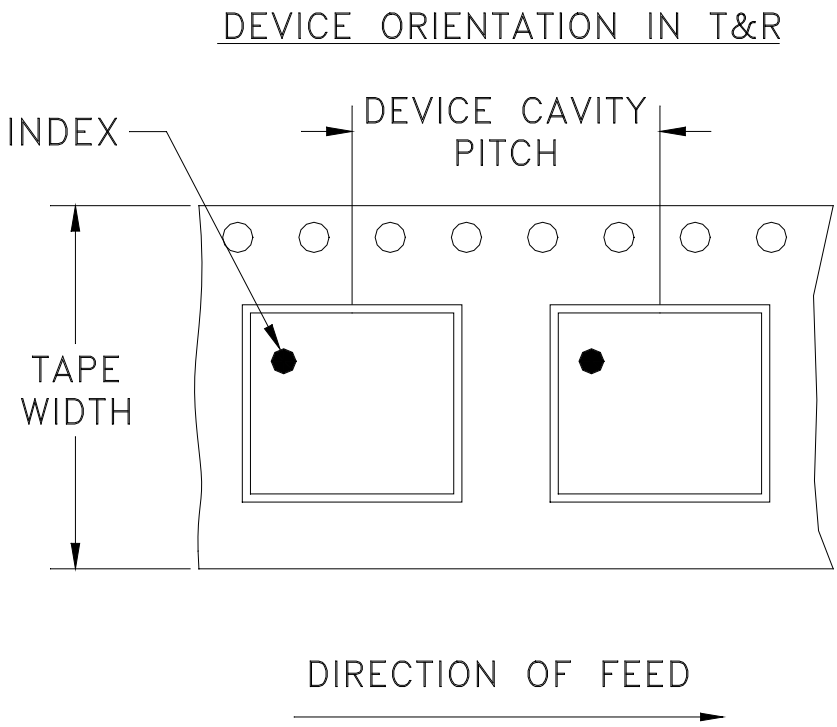
CASE #.	Q	R	WT, GRAM
MC1630-1	.012 (.30)	.012 (.30)	.006

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 over Nickel plated or Matte-Tin plated (See Data sheet).
   All models, (+) suffix.
3. Lead #1 identifier shall be located in the cross-hatched area shown.
   Identifier may be either a molded or marked feature.

Tape & Reel Packaging TR-F66



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
8	4	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000, 2000, 3000

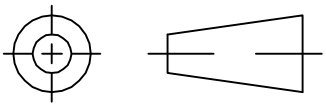
Note: Please consult individual model data sheet to determine device per reel availability.

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

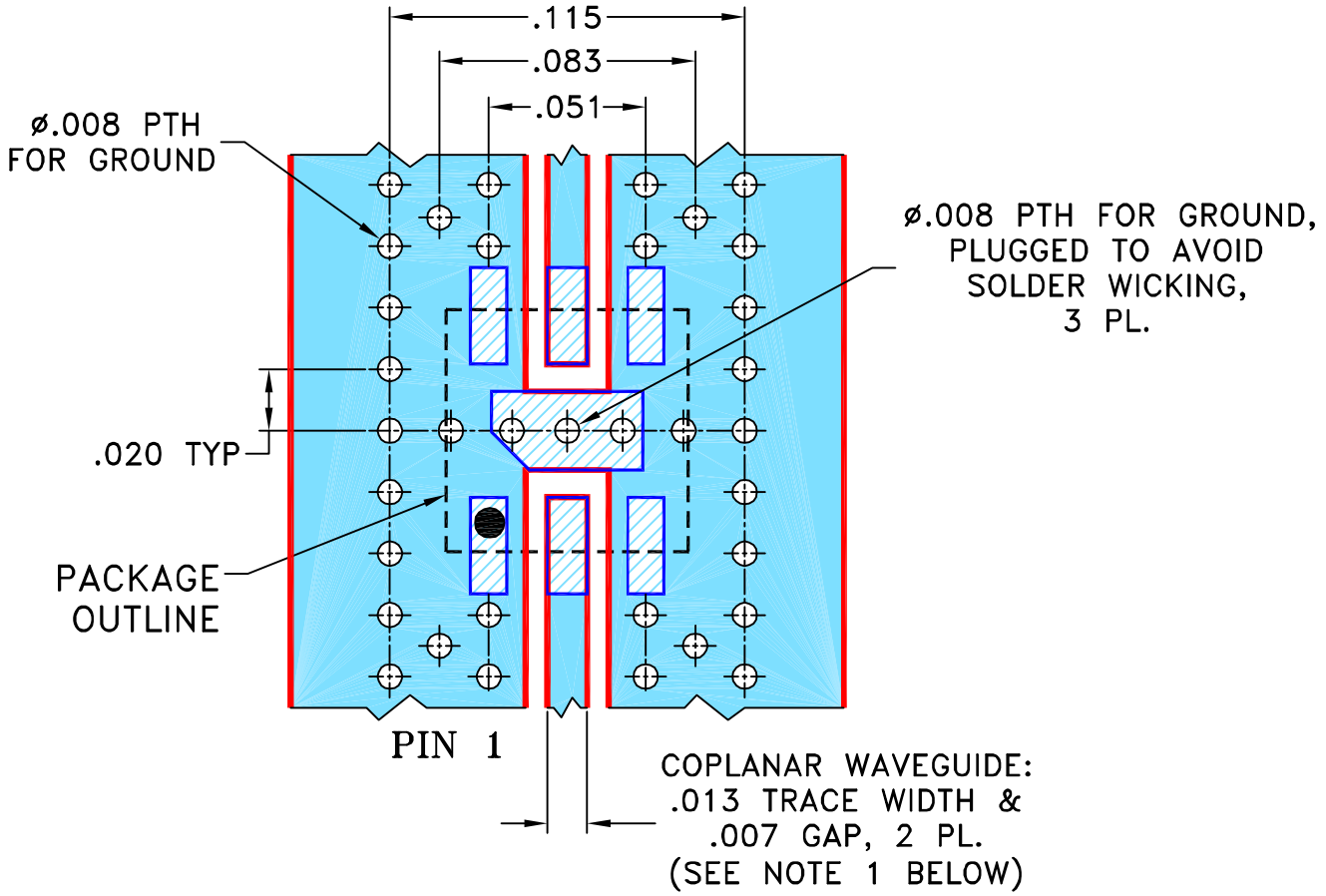
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010
Mini-Circuits ISO 9001 & ISO 14001 Certified

THIRD ANGLE PROJECTION



REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M160396	NEW RELEASE	02/23/17	GF	RS

SUGGESTED MOUNTING CONFIGURATION FOR MC1630-1 CASE STYLE, "06FL03" PIN CODE



NOTES:

1. COPLANAR WAVEGUIDE IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .0066" ± .0007"; 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	02/20/17
TOLERANCES ON:	CHECKED	ITG	02/22/17
2 PL DECIMALS ±	APPROVED	RS	02/23/17
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

Mini-Circuits®

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

Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

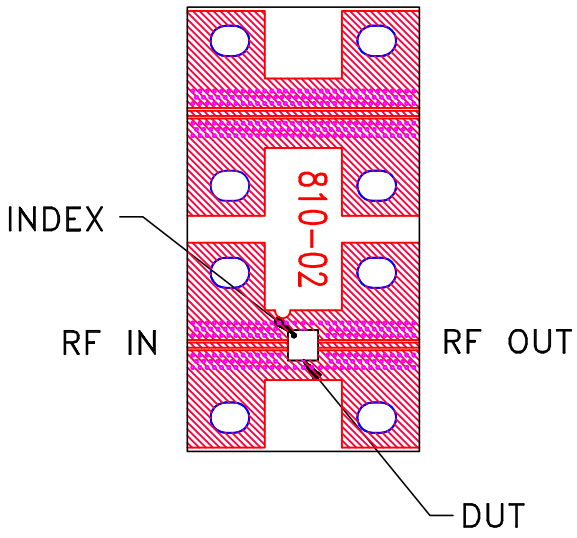
PL, 06FL03, MC1630-1, TB-883-XX+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-499	OR

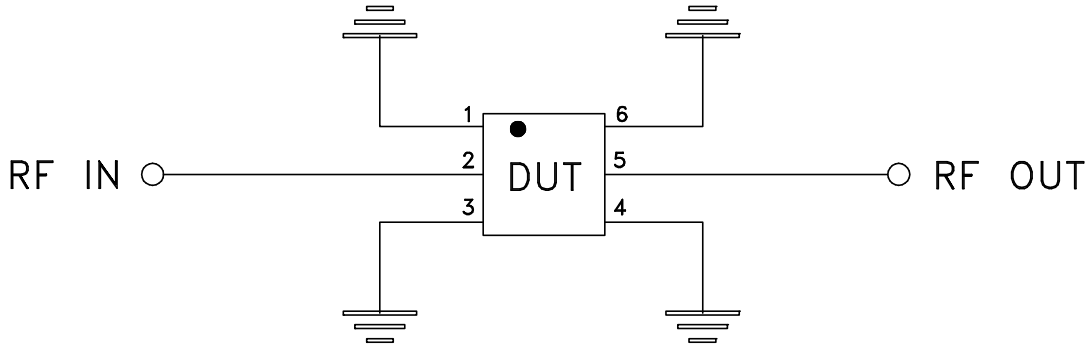
FILE:	SCALE:	SHEET:
98PL499	16:1	1 OF 1

Evaluation Board and Circuit

To be used with Mini-Circuits 50 Ohm 2.92 connectors B20-118-F1+.
Connectors are sold separately.



TB-883-153+



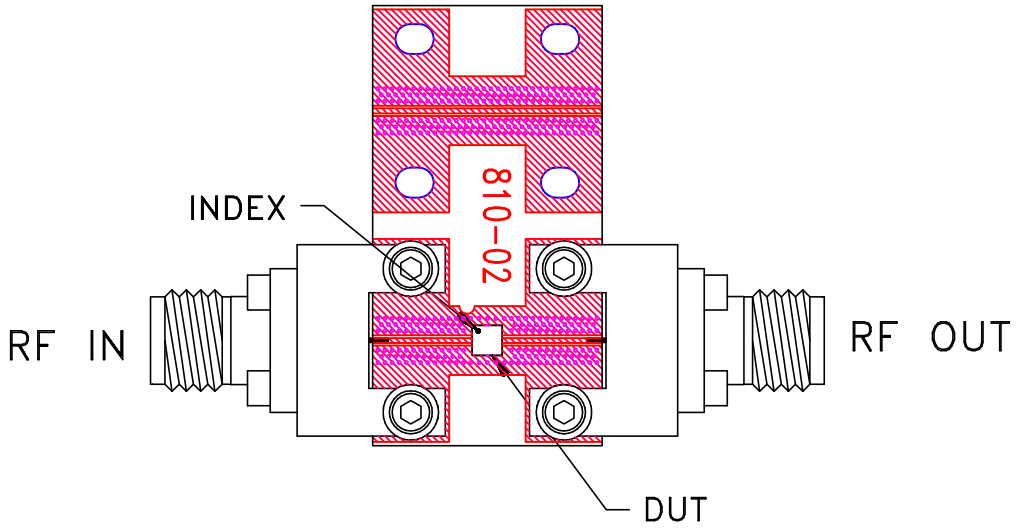
Schematic Diagram

Note:

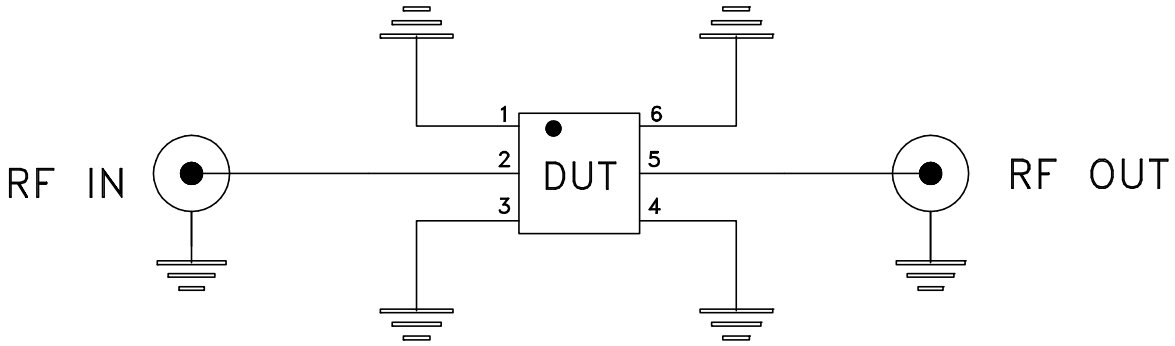
PCB Material: RO4350 or equivalent,
Dielectric Constant=3.5, Thickness=.0066 inch.

Mini-Circuits®

Evaluation Board and Circuit



TB-883-153C+



Schematic Diagram

Notes:

1. 50 Ohm 2.92mm Female end launch connectors.
2. PCB Material: RO4350 or equivalent,
   Dielectric Constant=3.5, Thickness=.0066 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