Ceramic

Bandpass Filter

BFTC-500+

50Ω 400 to 600 MHz

Generic photo used for illustration purposes only
CASE STYLE: FR933-1

The Big Deal

- LTCC construction
- Temperature stable from -40°C to +85°C
- Small size (0.150 x 0.150 x 0.059")

Product Overview

The BFTC-500+ LTCC bandpass filter covers the 400 to 600 MHz passband with 25 dB upper/lower stopband rejection. This model handles up to 4W RF input power and provides a wide operating temperature range from -40 to +85°C. Utilizing LTCC multi-layer construction, the filter achieves excellent repeatability of performance and comes in a tiny ceramic package saving space in dense PCB layouts.

Key Features

Feature	Advantages
LTCC Construction	Provides a rugged package well suited for tough environments such as high humidity and temperature extremes.
Tiny size (0.150 x 0.150 x 0.059”)	Saves space in dense circuit boards and minimizes the effects of parasitics.
Wide operating temperature range, -40 to +85°C	Enables reliable performance in extreme environments

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CASE STYLE: FR933-1

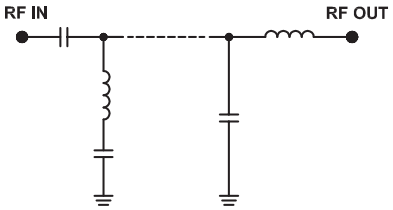
Features

- Good VSWR 1.5 typ. @ passband
- Small size
- Hermetically sealed
- Temperature sable
- LTCC construction

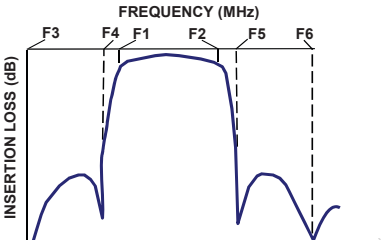
Applications

- Test and measurement
- Harmonic rejection
- Transmitters / Receivers

Functional Schematic



Typical Frequency Response



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

Electrical Specifications[1,2] at 25°C

Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Pass Band	Center Frequency	—	—	—	500	—	MHz
	Insertion Loss	F1-F2	400-600	—	4.0	5.5	dB
	VSWR	F1-F2	400-600	—	1.5	—	:1
Stop Band, Lower	Insertion Loss	F3-F4	1-290	25	38	—	dB
	VSWR	F3-F4	1-290	—	12	—	:1
Stop Band, Upper	Insertion Loss	F5-F6	800-2000	25	33	—	dB
	VSWR	F5-F6	800-2000	—	10	—	:1

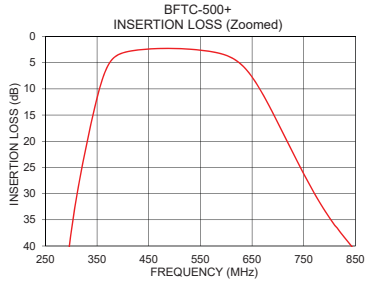
1. Measured on Mini-Circuits Characterization Test Board TB-233
2. This filter is not intended for use as a DC Blocking circuit element. In Application where DC voltage is present at either input or output ports, blocking capacitors are required at the corresponding RF port.

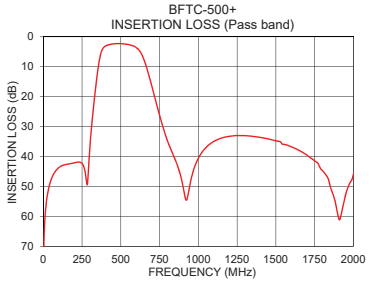
Maximum Ratings	
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input*	4W max @ +25°C

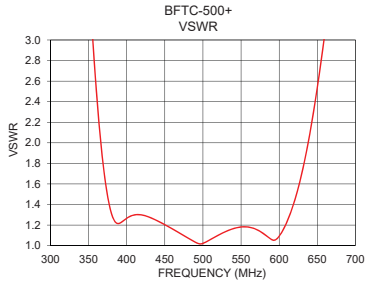
*Passband rating, derate linearly to 2W at 85°C ambient
Permanent damage may occur if any of these limits are exceeded.

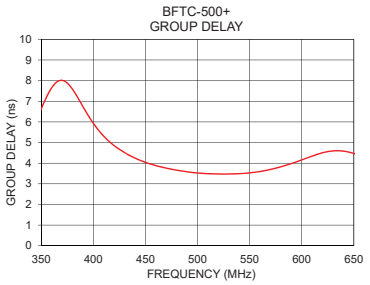
Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
1	81.10	8132.47	400	5.92
10	61.02	2957.25	410	5.30
100	43.72	80.76	420	4.85
290	45.49	11.16	430	4.51
310	30.87	8.78	440	4.25
330	20.48	6.29	450	4.04
350	11.75	3.66	460	3.88
400	3.12	1.27	470	3.76
500	2.28	1.02	480	3.66
600	3.60	1.09	490	3.58
680	12.69	4.22	500	3.53
720	20.44	6.04	510	3.49
776	30.89	7.20	520	3.48
800	34.64	7.57	530	3.48
900	49.71	10.12	540	3.49
1000	40.57	15.32	550	3.53
1250	33.01	30.89	560	3.60
1500	34.78	40.48	570	3.70
1750	41.47	46.67	580	3.83
2000	45.96	48.51	600	4.16









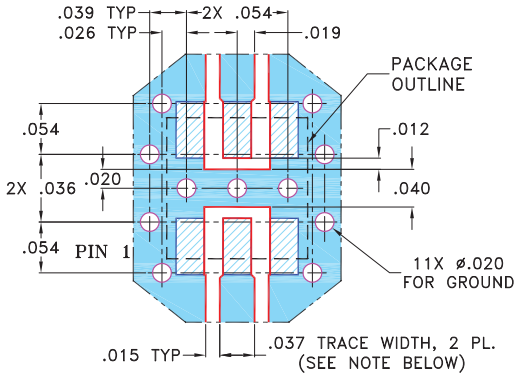
Notes
A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's 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

Pad Connections

RF IN	2
RF OUT	5
GROUND	1,3,4,6

Product Marking: 355

Demo Board MCL P/N: TB-233
Suggested PCB Layout (PL-112)

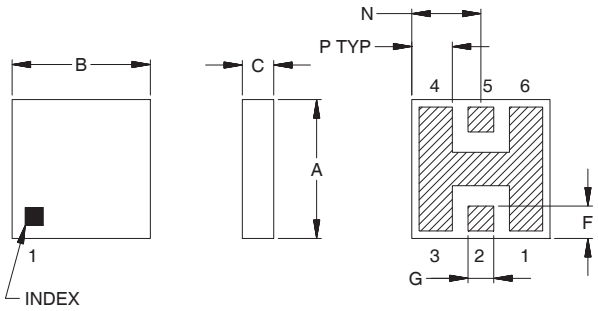


NOTES: 1.TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2.BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

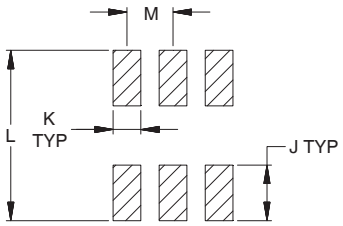
DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Outline Drawing



PCB Land Pattern



Suggeested Layout,
Tolerance to be within±.002

Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H
.150	**.150**	**.059**	**--**	**--**	**.035**	**.028**	**--**
3.81	3.81	1.50	--	--	.89	.71	--

J	K	L	M	N	P	Wt.
.060	**.030**	**.184**	**.050**	**.075**	**.044**	grams
1.52	.76	4.67	1.27	1.91	1.12	0.15

Note: Please refer to case style drawing for details

Ceramic Band Pass Filter BFTC-500+

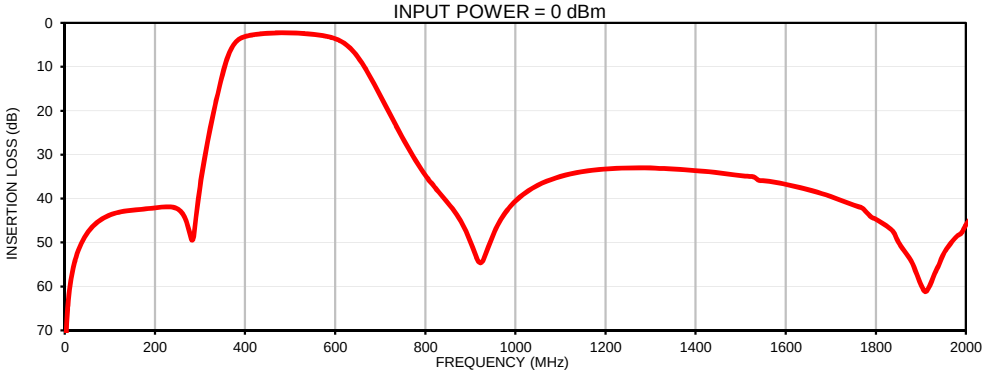
Typical Performance Data

FREQ. (MHz)	Insertion Loss (dB)	Input Return Loss (dB)	Output Return Loss (dB)
1	81.10	0.00	0.00
10	61.02	0.00	0.01
20	55.13	0.01	0.01
50	47.81	0.03	0.06
100	43.72	0.10	0.22
150	42.64	0.24	0.44
175	42.40	0.34	0.57
200	42.12	0.46	0.72
220	41.90	0.59	0.85
240	41.95	0.73	0.99
250	42.33	0.81	1.08
252	42.44	0.83	1.10
268	44.70	0.99	1.26
286	48.60	1.20	1.50
290	45.49	1.26	1.56
296	40.34	1.35	1.67
310	30.87	1.61	1.99
320	25.41	1.85	2.31
330	20.48	2.19	2.78
340	15.90	2.72	3.54
350	11.75	3.64	4.87
360	8.25	5.26	7.27
380	4.29	11.08	17.36
400	3.12	15.27	18.61
450	2.38	18.12	20.69
500	2.28	20.90	39.26
550	2.60	17.14	21.60
600	3.60	13.07	27.16
650	7.73	5.46	7.23
700	16.51	2.70	3.35
720	20.44	2.36	2.90
750	26.24	2.09	2.58
770	29.86	1.97	2.46
772	30.21	1.96	2.45
780	31.56	1.92	2.41
800	34.64	1.82	2.31
820	37.29	1.73	2.21
850	40.99	1.59	2.04
900	49.71	1.38	1.72
1000	40.57	1.03	1.14
1050	36.95	0.92	0.94
1100	34.96	0.84	0.80
1150	33.83	0.78	0.69
1200	33.26	0.75	0.62
1250	33.01	0.72	0.56
1300	33.03	0.70	0.52
1350	33.28	0.70	0.49
1400	33.63	0.70	0.46
1450	34.11	0.69	0.44
1500	34.78	0.71	0.43
1550	35.91	0.71	0.41
1600	36.76	0.71	0.40
1650	37.97	0.72	0.39
1700	39.51	0.73	0.38
1750	41.47	0.74	0.37
1800	44.68	0.76	0.37
1850	49.91	0.78	0.37
1900	59.55	0.79	0.35
1950	52.62	0.81	0.36
2000	45.96	0.84	0.36

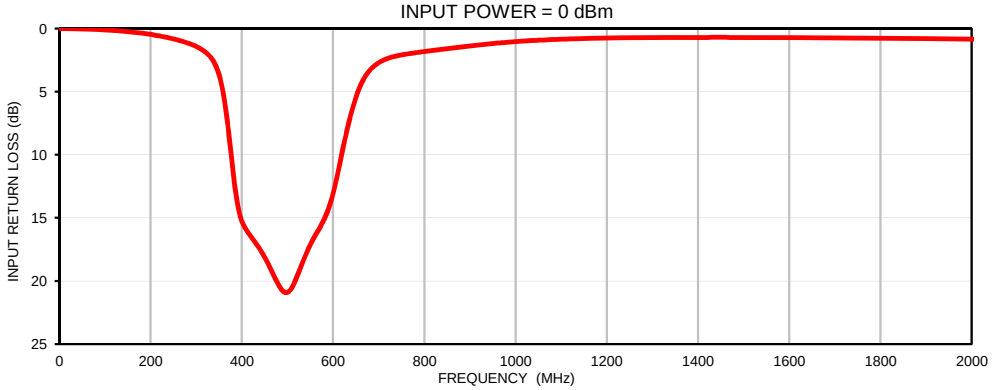
FREQ. (MHz)	Group Delay (ns)
400	5.92
404	5.65
408	5.41
412	5.20
416	5.01
420	4.85
424	4.70
428	4.57
432	4.45
436	4.34
440	4.25
444	4.16
448	4.08
452	4.00
456	3.94
460	3.88
464	3.83
468	3.78
472	3.74
476	3.70
480	3.66
484	3.63
488	3.60
492	3.57
496	3.55
500	3.53
502	3.51
504	3.51
506	3.50
508	3.49
510	3.49
512	3.49
514	3.49
516	3.48
518	3.48
520	3.48
522	3.47
524	3.48
526	3.48
528	3.48
530	3.48
532	3.48
534	3.48
536	3.48
538	3.49
540	3.49
542	3.50
544	3.50
546	3.51
548	3.52
550	3.53
552	3.54
554	3.55
556	3.57
558	3.58
560	3.60
570	3.70
580	3.83
590	3.98
600	4.16

Typical Performance Curves

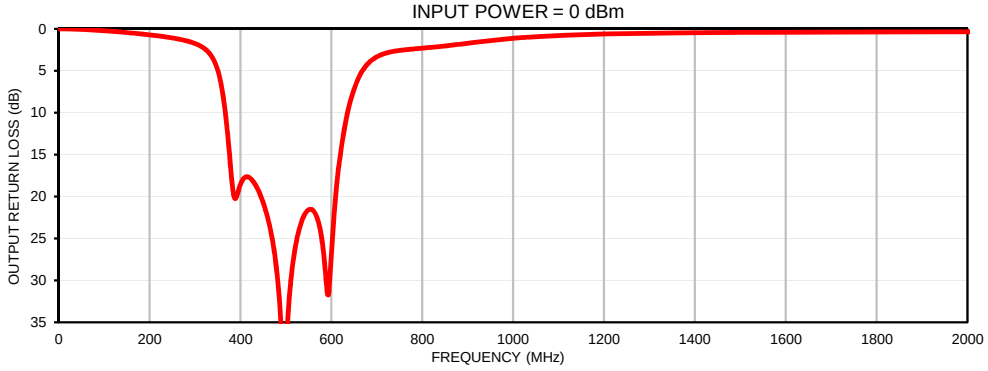
INSERTION LOSS
INPUT POWER = 0 dBm



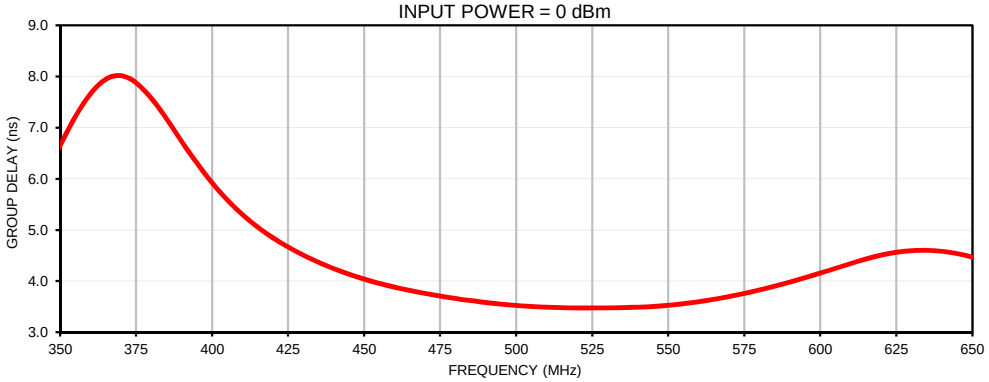
INPUT RETURN LOSS
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS
INPUT POWER = 0 dBm



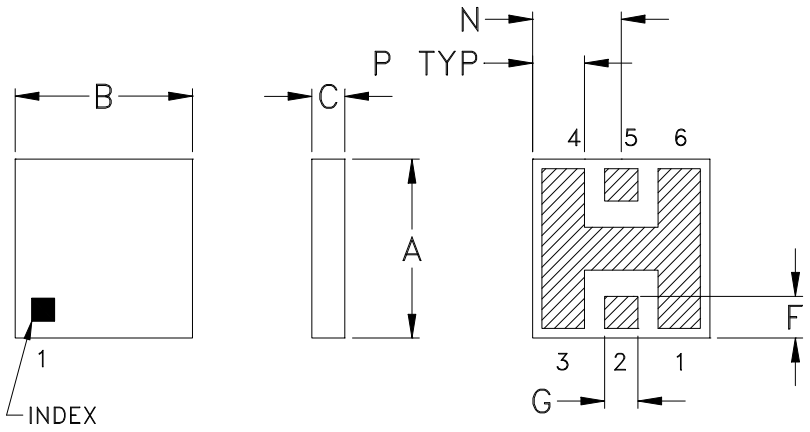
GROUP DELAY
INPUT POWER = 0 dBm



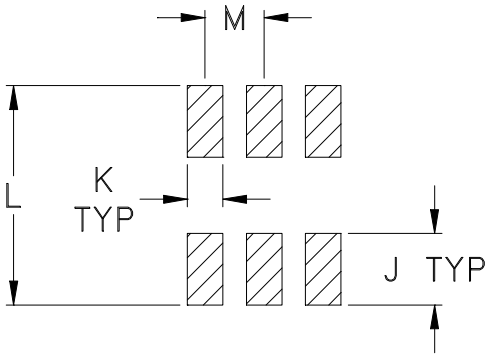
Case Style FR

FR933-1

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
FR933-1	.150 (3.81)	.150 (3.81)	.059 (1.50)	-- --	-- --	.035 (0.89)	.028 (0.71)	-- --	.060 (1.52)	.030 (0.76)	.184 (4.67)	.050 (1.27)

CASE #	N	P	WT. GRAM
FR933-1	.075 (1.91)	.044 (1.12)	0.15

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

Notes:
1. Open style, Ceramic Base.
2. Termination finish: Palladium Silver.

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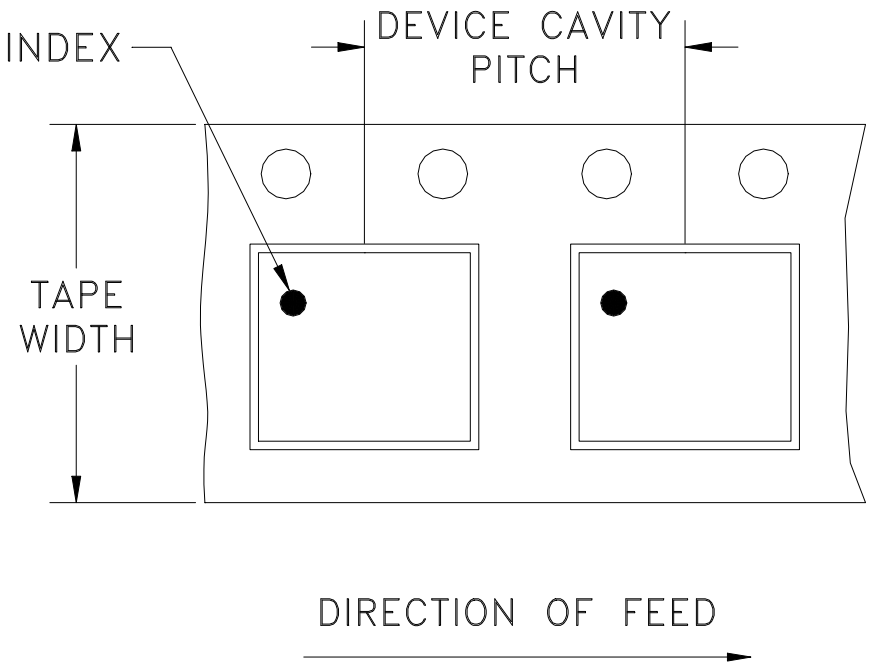
Tape & Reel Packaging TR-F68

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.

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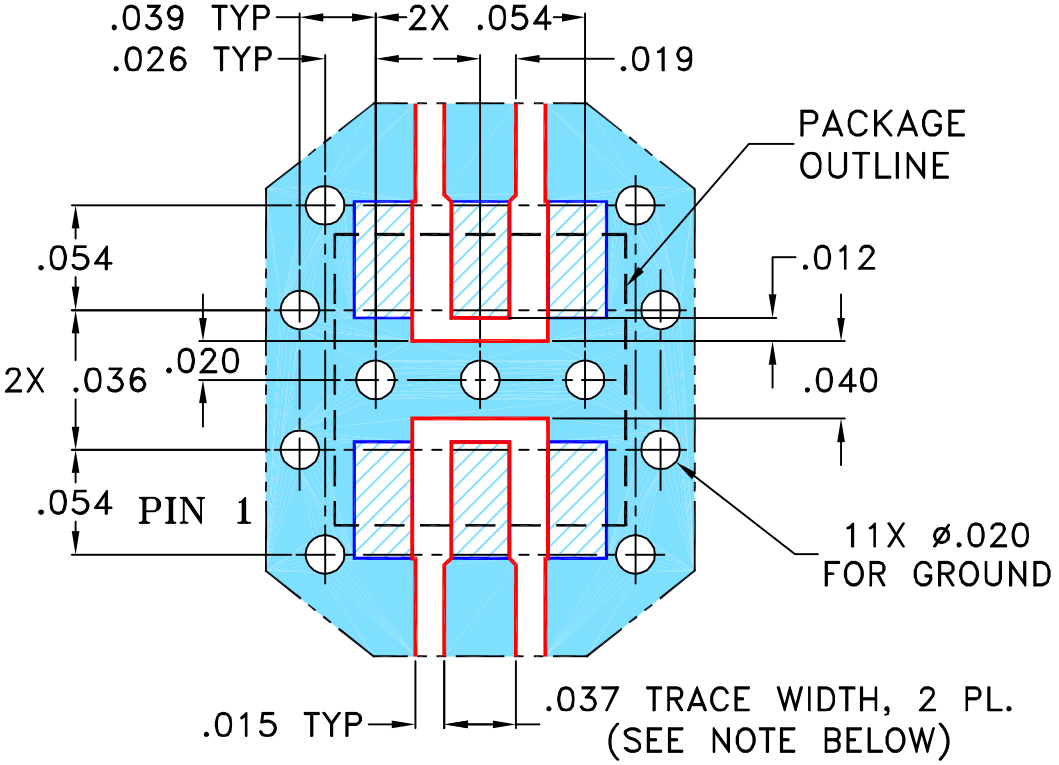
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M83007	NEW RELEASE	09/04/02	MMG	LER
A	M83501	CNG LAYOUT AS PER B14-TB-233	10/01/02	MMG	ABD
B	M102713	ADDED "...WITH SMOBC"	01/14/06	GF	IL
C	M164713	ADDED "933-1 & 06FL03"	11/15/17	CA	IL

SUGGESTED MOUNTING CONFIGURATION
FOR FR932/933/933-1 CASE STYLE, "06FL03" 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	09/04/02
TOLERANCES ON:	CHECKED		
2 PL DECIMALS ±	APPROVED	LER(BC)	09/04/02
3 PL DECIMALS ±			
ANGLES ±			
FRACTIONS ±			

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

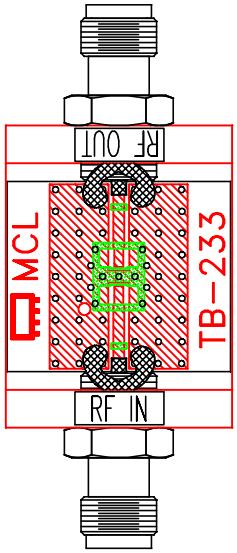
Mini-Circuits®
13 Neptune Avenue
Brooklyn NY 11235

PL, 06FL03, FR932/933/933-1, TB-233

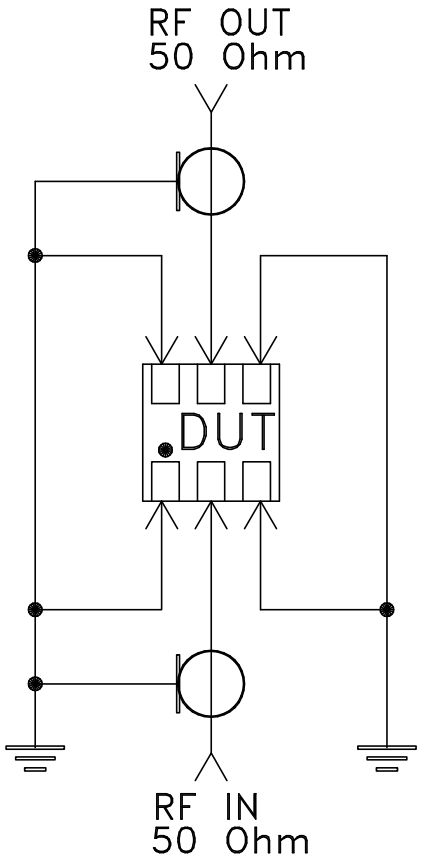
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-112	C

FILE:	SCALE:	SHEET:
98PL112	10:1	1 OF 1

Evaluation Board and Circuit



TB-233



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 ENV02T1

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
Humidity	90 to 95% RH, 240 hours, 50°C	MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Solder Reflow Heat	Sn-Pb Eutetic Process: 225°C peak Pb-Free Process 245° - 250°C peak	J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1
Solderability	10X Magnification	J-STD-002, 95% Coverage
Vibration (High Frequency)	20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)	MIL-STD-202, Method 204, Condition D
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