

# Coaxial Bandpass Filter

## ZFBP-13.5-S+

50Ω 12 to 15 MHz



Generic photo used for illustration purposes only  
CASE STYLE: H16

### The Big Deal

- High rejection, (50dB from 30-1000 MHz)
- Low frequency bandpass filter
- Connectorized package

### Product Overview

ZFBP-13.5-S+ is a bandpass filter built in rugged connectorized package, covering 12 to 15 MHz. These units offer good matching within the band pass and high rejection. This will find its application in semiconductor processing equipment. It has repeatable performance across production lots and consistent performance across temperature.

### Key Features

Feature	Advantages
Good passband insertion loss and roll-off	Low insertion loss will be used in designs optimized for high performance applications. Good roll-off will attenuate frequencies closer to the passband with good rejection value of >20dB.
Good ultimate rejection	This enables the filters to attenuate spurious signals and reject harmonics for broad band frequency.
Connectorized package	The connectorized packages can easily interface with other devices and well suited for test set-ups.
Good VSWR, 1.3:1 typical in passband	This model has very good return loss for this bandwidth and provides good interface when used with other devices.

#### 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](http://www.minicircuits.com/MCLStore/terms.jsp)



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## ZFBP-13.5-S+

50Ω 12 to 15 MHz



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Connectors	Model
SMA-Female	ZFBP-13.5-S+

### Features

- High stopband Rejection
- Good VSWR, 1.3:1 typical in passband
- Connectorized package

### Applications

- Harmonic Rejection
- Medical Instrumentation
- Industrial process equipments
- Lab use

### Electrical Specifications at 25°C

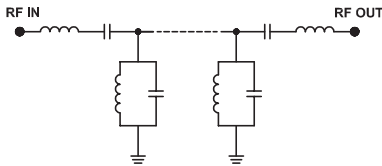
Parameter	F#	Frequency (MHz)	Min.	Typ.	Max.	Unit	
<b>Pass Band</b>	Center Frequency	—	—	13.5	—	MHz	
	Insertion Loss	F1-F2	12 -15	—	1.5	3.0	dB
	VSWR	F1-F2	12 -15	—	1.3	1.7	:1
<b>Stop Band, Lower</b>	Insertion Loss	DC-F3	DC - 8	20	31	—	dB
	VSWR	DC-F3	DC - 8	—	46	—	:1
<b>Stop Band, Upper</b>	Insertion Loss	F4-F5	22 -1600	20	33	—	dB
	VSWR	F4-F5	22 -1600	—	12	—	:1

### Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	0.5W max.

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

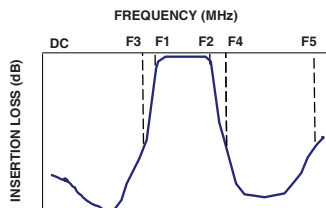
### Functional Schematic



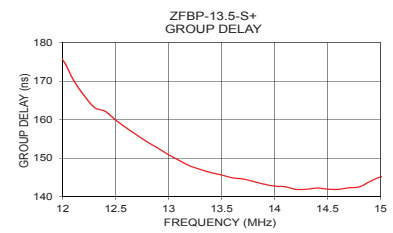
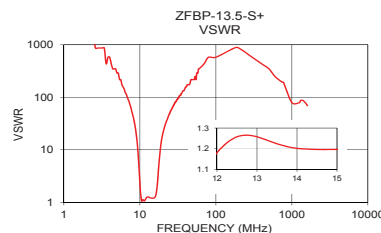
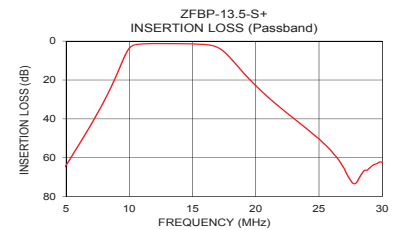
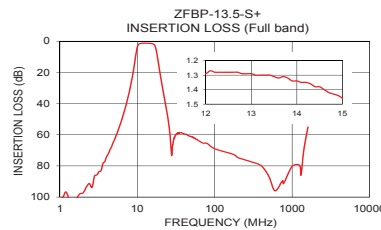
### Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
0.5	102.04	1737.18	12.0	175.55
5.0	63.88	289.53	12.2	166.33
7.0	42.69	91.43	12.4	162.19
8.0	30.99	48.26	12.6	157.87
8.8	20.32	24.14	12.8	154.19
9.2	14.38	14.03	13.0	150.90
9.6	8.31	6.32	13.2	148.00
10.4	1.96	1.16	13.4	146.25
12.0	1.29	1.18	13.5	145.64
13.5	1.31	1.22	13.6	144.92
15.0	1.46	1.20	13.8	143.96
17.0	3.32	2.27	14.0	142.77
17.6	6.10	4.27	14.1	142.59
18.6	13.17	10.50	14.2	141.92
20.0	22.92	20.22	14.3	141.95
22.0	34.52	32.79	14.4	142.26
50.0	61.41	217.15	14.5	141.98
500.0	86.71	347.44	14.6	141.92
1000.0	80.29	78.97	14.8	142.58
1600.0	55.07	69.49	15.0	145.14

### Typical Frequency Response



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



#### Notes

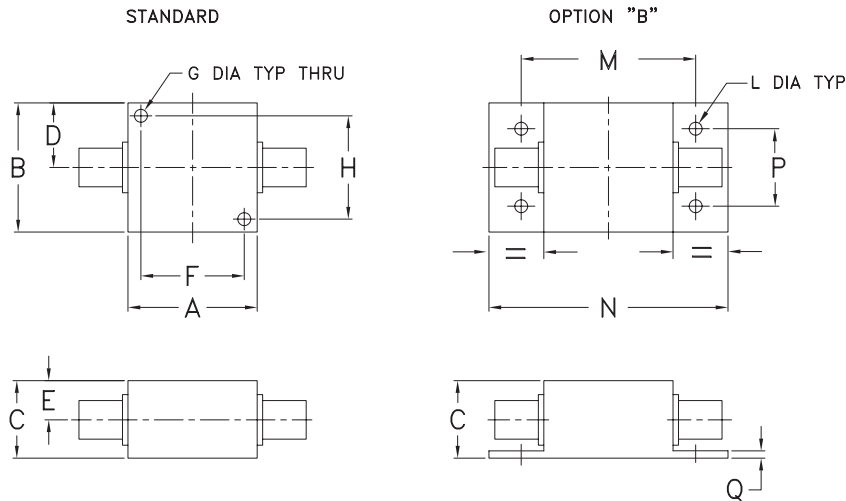
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## Coaxial Connections

PORT - 1	SMA Female
PORT - 2	SMA Female

## Outline Drawing



## Outline Dimensions ( $\frac{\text{inch}}$ / $\text{mm}$ )

A	B	C	D	E	F	G	H
1.25	1.25	.75	.63	.38	1.000	.125	1.000
31.75	31.75	19.05	16.00	9.65	25.40	3.18	25.40
J	K	L	M	N	P	Q	wt
--	--	.125	1.688	2.18	.750	.06	grams
--	--	3.18	42.88	55.37	19.05	1.52	70.0

*Note: Please refer to case style drawing for details*

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# Coaxial Band Pass Filter

# ZFBP-13.5-S+

## Typical Performance Data

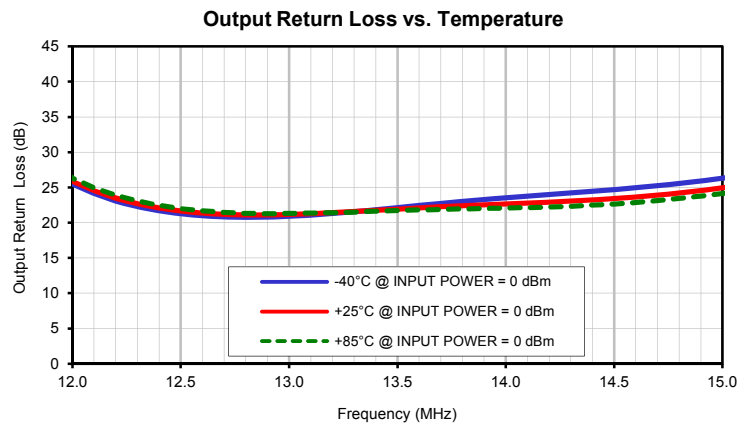
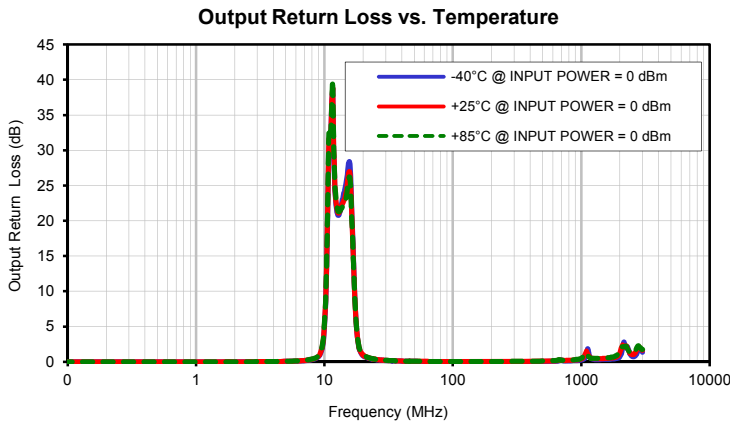
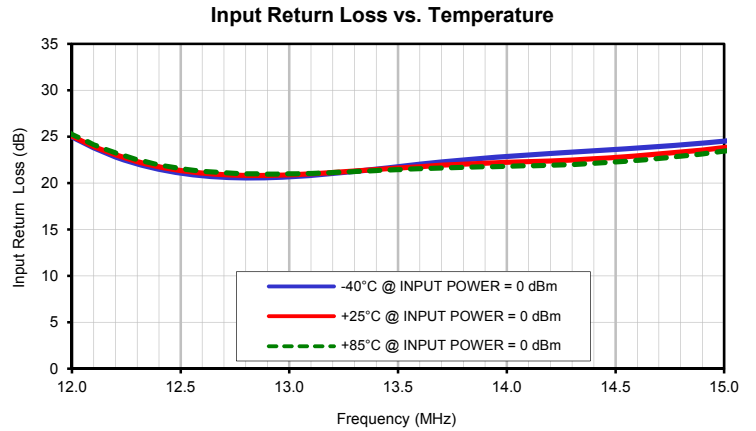
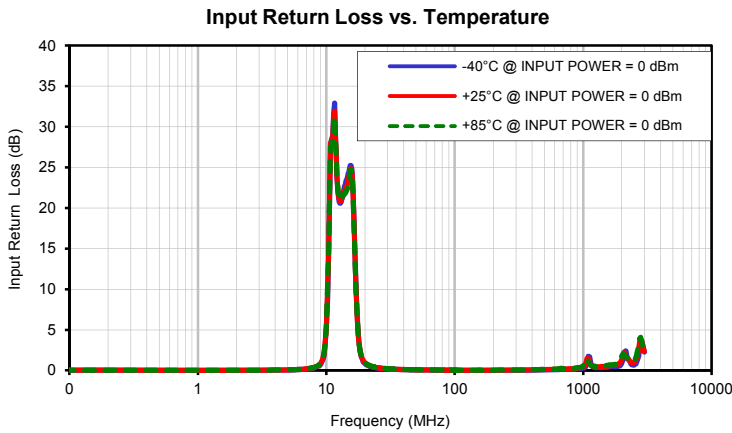
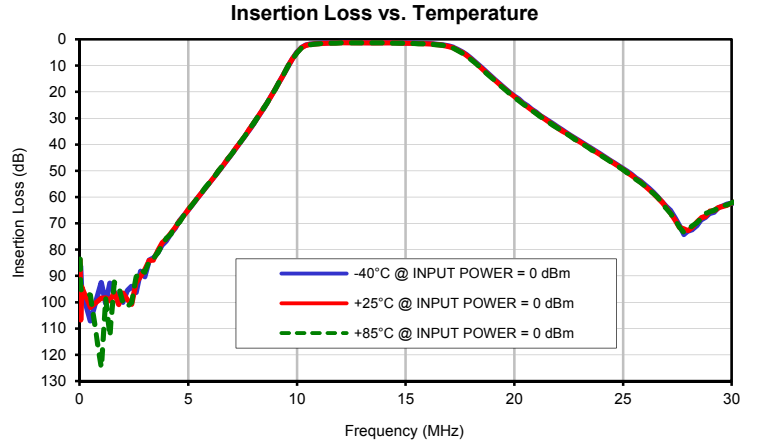
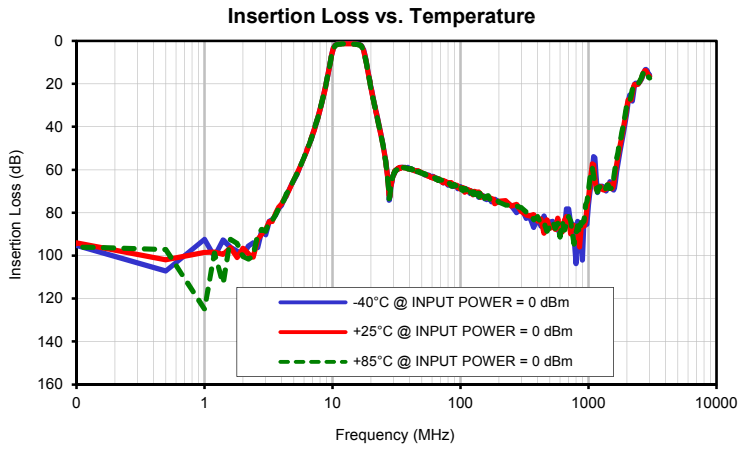
FREQ. (MHz)	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
	(dB)			(dB)			(dB)		
	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C
0.1	95.25	94.07	95.92	0.00	0.00	0.00	0.00	0.00	0.01
0.5	107.13	101.94	97.21	0.00	0.00	0.00	0.00	0.00	0.01
2.0	100.05	96.54	100.49	0.01	0.01	0.01	0.01	0.01	0.01
3.0	90.34	87.67	88.63	0.01	0.02	0.02	0.01	0.02	0.02
4.0	76.60	75.79	75.62	0.03	0.05	0.05	0.03	0.04	0.04
5.0	65.04	64.74	64.71	0.05	0.07	0.06	0.06	0.06	0.08
6.0	54.35	54.38	54.32	0.10	0.11	0.12	0.09	0.11	0.12
7.0	43.65	43.56	43.54	0.16	0.20	0.22	0.15	0.19	0.21
8.0	32.15	32.06	32.04	0.30	0.35	0.39	0.29	0.35	0.38
8.8	21.82	21.74	21.72	0.59	0.68	0.74	0.56	0.66	0.71
9.0	19.01	18.93	18.92	0.72	0.83	0.89	0.71	0.81	0.88
9.2	16.11	16.03	16.03	0.95	1.07	1.14	0.92	1.05	1.12
9.6	10.15	10.11	10.15	1.88	2.08	2.20	1.84	2.04	2.16
10.0	4.92	4.97	5.06	4.94	5.28	5.44	4.86	5.20	5.38
10.4	2.24	2.36	2.47	13.24	13.73	13.88	13.09	13.64	13.89
11.0	1.45	1.57	1.66	28.50	28.20	27.85	31.46	31.85	32.27
12.0	1.22	1.32	1.39	24.98	25.09	25.24	25.46	25.85	26.31
12.2	1.19	1.30	1.36	22.81	23.04	23.24	23.09	23.49	23.89
12.4	1.19	1.29	1.36	21.49	21.77	21.98	21.70	22.10	22.45
12.6	1.19	1.29	1.35	20.80	21.09	21.29	21.00	21.38	21.68
12.8	1.19	1.29	1.35	20.58	20.84	21.01	20.77	21.11	21.34
13.0	1.19	1.29	1.36	20.69	20.90	21.01	20.91	21.17	21.30
13.2	1.19	1.29	1.36	21.03	21.14	21.16	21.29	21.41	21.43
13.4	1.20	1.30	1.36	21.51	21.46	21.36	21.84	21.75	21.63
13.5	1.21	1.31	1.37	21.78	21.62	21.46	22.14	21.93	21.72
13.6	1.22	1.31	1.39	22.04	21.78	21.56	22.44	22.10	21.81
13.8	1.21	1.32	1.38	22.51	22.04	21.70	23.03	22.41	21.95
14.0	1.23	1.33	1.39	22.90	22.24	21.81	23.55	22.67	22.08
14.2	1.25	1.34	1.41	23.20	22.41	21.93	24.00	22.91	22.23
14.4	1.26	1.37	1.42	23.48	22.64	22.14	24.44	23.22	22.48
14.6	1.28	1.38	1.44	23.79	22.94	22.45	24.93	23.63	22.86
14.8	1.30	1.41	1.48	24.13	23.35	22.91	25.57	24.21	23.43
15.0	1.34	1.44	1.51	24.54	23.85	23.46	26.33	24.94	24.14
16.0	1.55	1.69	1.76	23.58	23.24	23.23	26.43	25.21	24.69
17.0	2.56	2.77	2.88	11.24	11.04	11.04	11.67	11.41	11.36
17.6	4.70	5.02	5.17	5.52	5.49	5.54	5.70	5.66	5.69
18.0	7.09	7.46	7.63	3.40	3.45	3.50	3.51	3.55	3.60
18.6	11.45	11.85	12.01	1.86	1.94	2.01	1.92	2.01	2.06
19.0	14.46	14.83	15.00	1.38	1.47	1.53	1.43	1.51	1.57
19.6	18.80	19.15	19.30	1.00	1.08	1.13	1.04	1.11	1.16
20.0	21.52	21.84	22.00	0.85	0.93	0.97	0.87	0.95	1.00
20.6	25.35	25.66	25.81	0.69	0.76	0.80	0.71	0.78	0.81
21.0	27.75	28.06	28.21	0.63	0.69	0.72	0.64	0.70	0.74
21.6	31.19	31.49	31.63	0.55	0.60	0.63	0.56	0.61	0.64
22.0	33.38	33.67	33.82	0.50	0.55	0.57	0.51	0.56	0.59
25.0	49.21	49.54	49.63	0.31	0.34	0.35	0.31	0.34	0.36
30.0	62.37	62.29	62.21	0.18	0.21	0.21	0.18	0.21	0.22
50.0	61.35	61.54	61.50	0.06	0.07	0.08	0.07	0.07	0.08
200.0	75.17	74.66	75.04	0.00	0.03	0.03	0.01	0.03	0.04
400.0	82.99	83.91	81.84	0.03	0.07	0.09	0.03	0.07	0.08
500.0	84.37	87.39	86.51	0.05	0.10	0.12	0.04	0.10	0.11
600.0	86.02	88.55	91.28	0.08	0.14	0.16	0.07	0.13	0.15
800.0	103.65	86.78	89.58	0.14	0.22	0.26	0.14	0.21	0.24
1000.0	76.23	73.17	69.69	0.28	0.45	0.56	0.26	0.40	0.51
1200.0	69.26	68.74	68.14	0.41	0.49	0.52	0.44	0.49	0.50
1400.0	68.93	67.55	67.23	0.37	0.49	0.54	0.32	0.45	0.50
1600.0	68.76	64.02	61.34	0.44	0.61	0.67	0.36	0.50	0.58
1800.0	48.94	46.42	44.72	0.47	0.64	0.76	0.41	0.60	0.72
2000.0	32.75	30.53	29.84	0.84	1.37	1.75	0.70	1.24	1.66
2600.0	17.72	17.24	16.93	0.90	1.42	1.77	0.74	1.15	1.40
3000.0	15.83	16.60	17.25	2.28	2.36	2.42	1.36	1.62	1.77



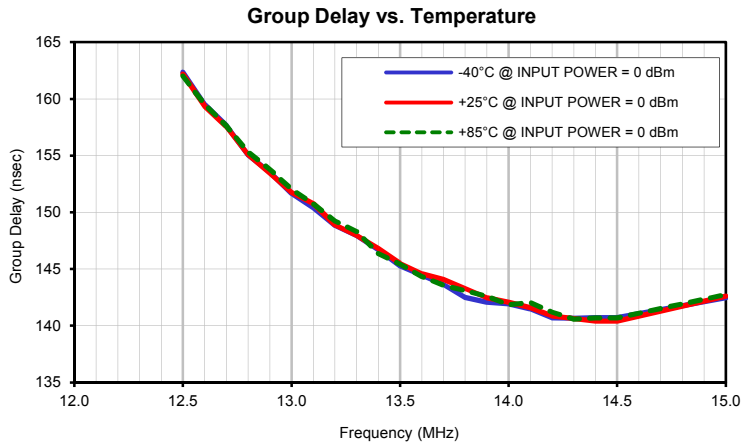
*Typical Performance Data*

FREQ.  (MHz)	GROUP DELAY		
	(nsec)		
	@-40°C	@+25°C	@+85°C
12.5	162.35	162.18	162.01
12.6	159.51	159.36	159.52
12.7	157.64	157.56	157.61
12.8	155.04	155.07	155.29
12.9	153.53	153.44	153.77
13.0	151.67	151.76	152.02
13.1	150.40	150.77	150.74
13.2	148.84	148.90	149.25
13.3	147.95	147.96	148.31
13.4	146.69	146.81	146.36
13.5	145.26	145.49	145.42
13.6	144.44	144.57	144.33
13.7	143.61	144.08	143.56
13.8	142.50	143.29	143.10
13.9	142.08	142.46	142.60
14.0	141.94	142.06	141.86
14.1	141.48	141.60	142.03
14.2	140.69	140.85	141.20
14.3	140.67	140.63	140.57
14.4	140.73	140.42	140.70
14.5	140.73	140.42	140.70
15.0	142.46	142.60	142.76

## Typical Performance Curves

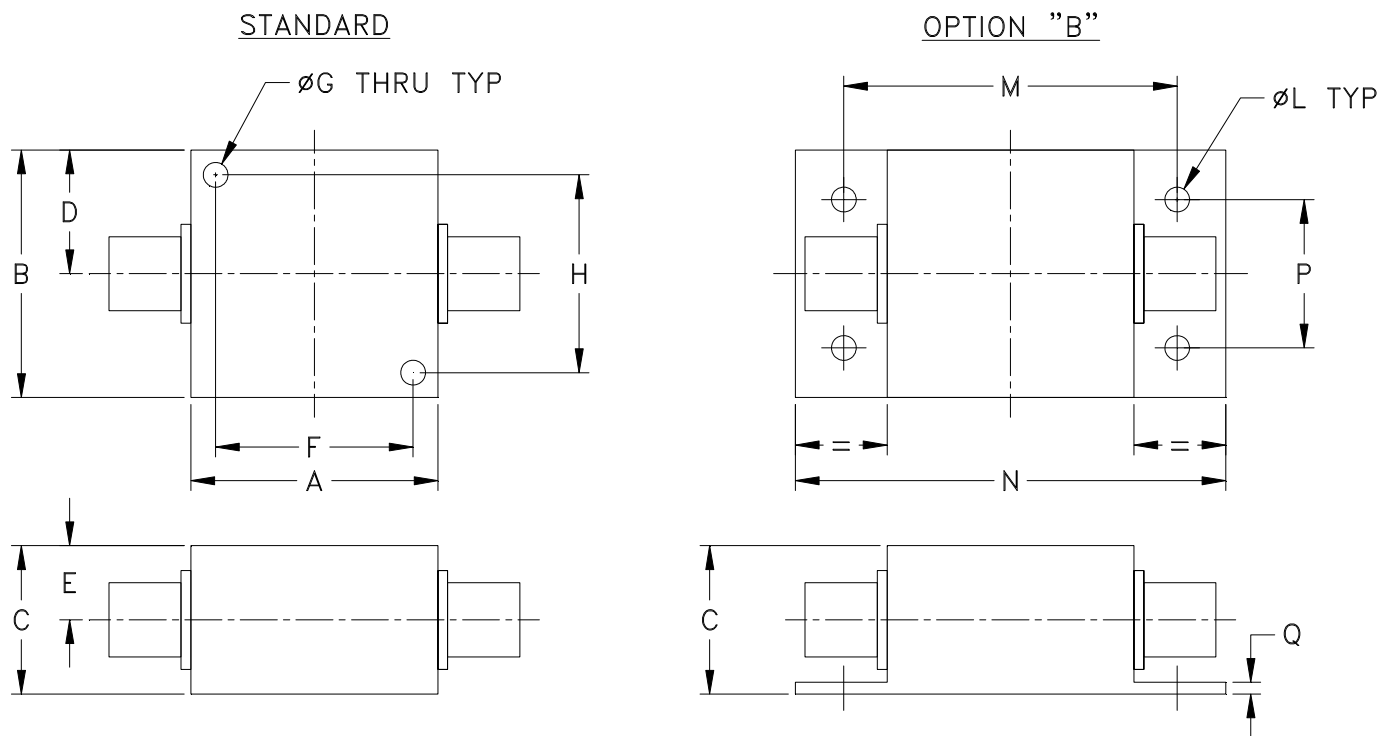


## Typical Performance Curves



## Outline Dimensions

H16



CASE#	A	B	C	D	E	F	G	H	J	K	L	M	N
H16	1.25 (31.75)	1.25 (31.75)	.750 (19.05)	.63 (16.00)	.38 (9.65)	1.000 (25.40)	.125 (3.18)	1.000 (25.40)	--	--	.125 (3.18)	1.688 (42.88)	2.18 (55.37)

CASE#	P	Q	WT.GRAMS
H16	.750 (19.05)	.06 (1.52)	70

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

### Notes:

1. Case material: Aluminum alloy.
2. Case finish:  
For RoHS Case Styles: Clear chemical conversion coating, non-chrome or trivalent chrome based.
3. Mounting bracket available on request. Add suffix B to part number.
4. Bracket version, option B, dimension "C" changes from .75 to .94 inches when connectors are type N.
5. Refer to the individual model data sheet for the type of connectors available.

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RF/IF MICROWAVE COMPONENTS





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	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Barometric Pressure	100,000 Feet	MIL-STD-202, Method 105, Condition D
Humidity	90% RH, 65°C Units may require bake-out after humidity to restore full performance.	MIL-STD-202, Method 103
Thermal Shock	-65° to 125°C, 5 cycles	MIL-STD-202, Method 107, Condition B
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	100g, 6ms sawtooth, 3 shocks each direction 3 axes (total 18)	MIL-STD-202, Method 213, Condition I