

# Suspended Substrate Stripline Filters and Multiplexers

50Ω DC to 26 GHz

## The Big Deal

- Low insertion loss
- Ultra-wide passband width
- Fast roll-off with wide stopband
- Good power handling and temperature stability
- Passband up to 26 GHz
- Stopband up to 26.5 GHz can extend to 40 GHz



## Product Overview

Mini-Circuits' Suspended Substrate Stripline filters offer low insertion loss by implementing printed circuit board suspended between two parallel ground planes, providing high Q. Low insertion loss combined with wide stopband makes them an excellent choice for wideband instruments and systems like ECM, ECCM, ELINT and ultra-broadband receivers.

Low pass, high pass, band pass, band stop, diplexer and multiplexer designs can be realized with this technology. Advanced filter design and construction can achieve stopband width greater than 6x the center frequency, and temperature stability will be better than other printed circuit realizations because the fields are mainly in the air rather than in a dielectric. The inside walls of the housing hold the circuit and prevent movement that could be caused by vibration or mechanical shock, making these designs excellent candidates for harsh operating environments.

Suspended substrate stripline filters can be realized in small form factors with high-quality, precise machining for applications where size is critical. Excellent repeatability across units is achieved through precise tuning and process control.

## Key Features

Feature	Advantages
Low insertion loss	Low signal loss results in better SNR in receiver front end and better power delivery to antenna in transmitters
Fast roll-off	Higher selectivity results in better adjacent channel rejection and dynamic range
Wide stopband	Wide, spur-free stop band results in better receiver sensitivity
High power handling	Well suited for transmitter applications
Excellent temperature stability	Ensures minimal variation in electrical performance across temperature

### 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)



# Suspended substrate stripline Band Pass Filter

## ZBSS-15G-S+

50Ω 12000 to 18000 MHz



Generic photo used for illustration purposes only

CASE STYLE:WK3305

Connectors Model

SMA - F ZBSS-15G-S+

### Features

- Wide fractional bandwidth design of 40%
- 1.3dB typ. Insertion Loss at Center frequency
- Sharp roll-off
- High rejection floor of 90dB typ. up to 8GHz
- Stop band up to 26.5 GHz
- Connectorized package

### Applications

- Satellite communications
- Test Equipment
- Radiolocation
- Radio Navigation
- Military and defense
- Electronic warfare receiver
- Wideband receivers
- Space Research

### Electrical Specifications at 25°C

Parameter	F#	Frequency (MHz)	Min.	Typ.	Max.	Unit	
<b>Pass Band</b>	Center Frequency	Fc	15000	-	1.3	-	dB
	Insertion Loss	F1-F2	12000 - 18000	-	2.0	3.5	dB
	VSWR	F1-F2	12000 - 18000	-	1.5	-	:1
<b>Stop Band, Lower</b>	Insertion Loss	DC-F3	DC - 8000	60	90	-	dB
		F3-F4	8000 - 9300	40	60	-	dB
		F4-F5	9300 - 9700	20	40	-	dB
<b>Stop Band, Upper</b>	Insertion Loss	F6-F7	20500 - 21500	20	40	-	dB
		F7-F8	21500 - 26500	-	40	-	dB

### Maximum Ratings

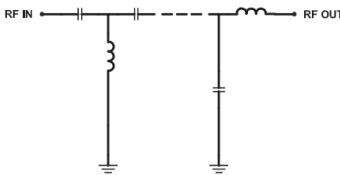
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	5W max. @ 25°C

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

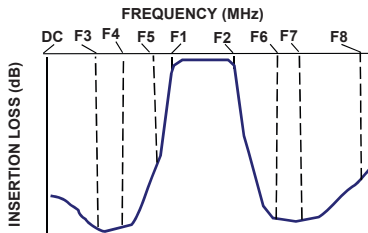
### Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
10	102.54	33152.25	12000	0.58
2000	105.33	383.82	12300	0.55
8000	98.02	60.85	12600	0.52
9300	65.41	53.12	12900	0.50
9700	48.80	43.99	13200	0.48
10100	31.15	27.86	13500	0.47
10300	21.01	17.05	13800	0.46
10650	3.31	1.43	14100	0.46
12000	1.21	1.25	14400	0.46
14000	1.02	1.04	14700	0.45
15000	1.17	1.30	15000	0.45
16000	1.32	1.34	15300	0.45
18000	2.07	1.21	15600	0.46
18550	3.04	1.37	15900	0.46
19250	20.16	7.66	16200	0.47
19500	29.77	11.90	16500	0.49
20500	55.39	17.61	16800	0.50
21500	62.41	19.48	17200	0.53
23000	63.20	27.07	17500	0.56
26500	58.05	22.76	18000	0.63

### Functional Schematic

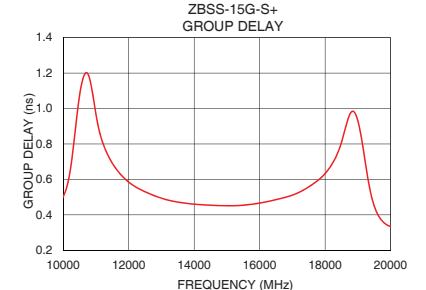
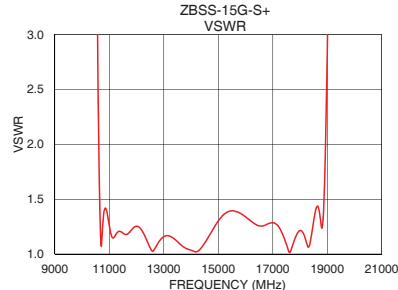
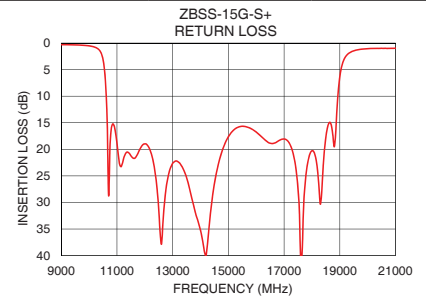
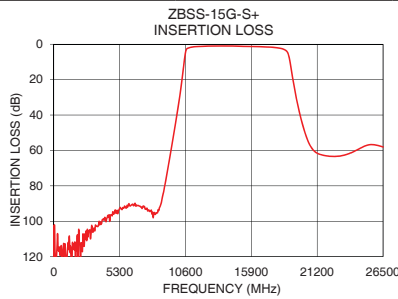


### Typical Frequency Response



#### +RoHS Compliant

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



#### Notes

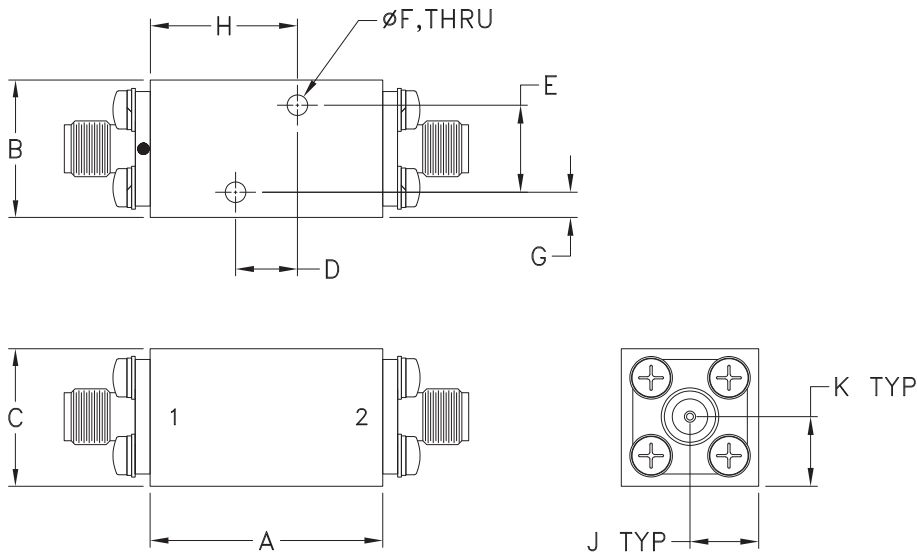
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## Coaxial Connections

PORT - 1	SMA FEMALE
PORT - 2	SMA FEMALE

## Outline Drawing



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

A	B	C	D	E	F
1.02	.60	.60	.270	.380	.090
25.8	15.2	15.2	6.86	9.65	2.29
G	H	J	K		Wt.
.11	.64	.30	.30		grams
2.8	16.3	7.6	7.7		47

Note: Please refer to case style drawing for details

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# Suspended substrate stripline Band Pass Filter

## ZBSS-15G-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
10	107.69	102.54	93.87	0.00	0.00	0.00	0.00	0.00	0.00
50	109.90	102.05	107.42	0.00	0.00	0.00	0.00	0.00	0.00
100	109.30	118.94	111.22	0.00	0.00	0.00	0.00	0.00	0.00
200	116.28	121.01	115.83	0.01	0.00	0.01	0.00	0.01	0.01
300	120.61	107.00	117.52	0.01	0.00	0.01	0.01	0.01	0.01
400	109.29	117.04	122.06	0.01	0.00	0.02	0.01	0.01	0.02
500	120.01	119.32	112.42	0.01	0.00	0.02	0.00	0.02	0.03
800	127.11	112.70	116.45	0.01	0.01	0.02	0.03	0.05	0.06
1000	113.04	124.90	112.60	0.01	0.01	0.03	0.06	0.09	0.10
1500	110.36	112.30	114.72	0.00	0.03	0.05	0.14	0.18	0.20
2000	117.20	105.33	105.12	0.01	0.05	0.07	0.19	0.24	0.26
2500	106.40	107.22	106.23	0.02	0.07	0.09	0.20	0.25	0.28
3000	105.10	106.87	107.44	0.04	0.09	0.12	0.16	0.22	0.25
3500	101.65	102.95	103.30	0.06	0.12	0.15	0.13	0.20	0.23
4000	99.25	98.65	101.16	0.08	0.14	0.18	0.16	0.23	0.26
5000	94.22	95.49	94.30	0.13	0.20	0.24	0.37	0.45	0.49
6000	91.38	90.81	90.94	0.17	0.24	0.28	0.45	0.56	0.60
8000	94.25	98.02	94.48	0.19	0.29	0.33	0.53	0.66	0.72
9300	65.94	65.41	65.35	0.21	0.33	0.38	0.73	0.92	0.98
9700	49.46	48.80	48.65	0.26	0.39	0.45	0.78	0.99	1.08
10100	31.88	31.15	30.88	0.44	0.62	0.71	0.93	1.16	1.28
10300	21.83	21.01	20.69	0.75	1.02	1.17	1.17	1.45	1.60
10500	10.24	9.47	9.22	2.32	3.11	3.53	2.46	3.14	3.45
10650	3.28	3.31	3.40	11.51	14.97	16.62	9.88	12.05	12.57
12000	0.99	1.21	1.34	18.62	18.98	18.54	18.40	18.68	18.21
13000	0.83	1.05	1.17	22.37	22.63	22.21	23.53	23.83	23.16
13500	0.81	1.03	1.14	24.37	25.31	26.94	24.73	25.74	27.22
14000	0.79	1.02	1.13	33.74	35.24	40.18	40.81	43.97	55.12
14500	0.82	1.05	1.18	27.32	26.40	25.82	25.84	25.71	25.42
15000	0.93	1.17	1.29	17.74	17.62	17.93	19.49	19.54	20.05
15500	1.03	1.27	1.39	15.36	15.65	16.25	17.42	17.89	18.66
16000	1.07	1.32	1.46	16.21	16.75	17.07	17.35	18.11	18.38
16500	1.11	1.39	1.54	18.52	18.85	18.98	21.74	22.14	22.65
17000	1.26	1.55	1.72	17.10	18.06	17.92	17.77	18.73	18.67
18000	1.68	2.07	2.29	19.03	20.28	20.41	18.72	19.74	19.66
18550	2.47	3.04	3.36	16.49	16.09	16.39	14.10	13.73	13.64
19000	7.54	9.52	10.54	7.27	6.36	6.18	4.39	4.05	3.95
19250	18.18	20.16	21.16	2.07	2.28	2.40	1.90	2.13	2.27
19500	28.10	29.77	30.64	1.19	1.46	1.59	1.57	1.82	1.97
20000	43.55	44.88	45.54	0.79	1.06	1.20	1.41	1.63	1.78
20500	54.35	55.39	55.85	0.74	0.99	1.14	1.24	1.42	1.55
20800	58.32	59.09	59.44	0.76	1.00	1.15	1.08	1.25	1.37
21000	60.00	60.62	60.92	0.72	0.97	1.10	0.97	1.13	1.24
21300	61.56	61.95	62.19	0.71	0.95	1.07	0.77	0.93	1.02
21500	62.14	62.41	62.56	0.66	0.89	1.01	0.65	0.81	0.91
21700	62.57	62.75	62.87	0.61	0.85	0.97	0.55	0.71	0.81
22000	63.09	63.12	63.13	0.53	0.77	0.90	0.42	0.59	0.69
22300	63.34	63.36	63.29	0.48	0.72	0.86	0.33	0.51	0.61
22500	63.40	63.39	63.32	0.45	0.69	0.83	0.29	0.47	0.57
22700	63.39	63.34	63.25	0.43	0.67	0.81	0.26	0.44	0.54
23000	63.19	63.20	63.06	0.40	0.64	0.78	0.22	0.41	0.51
23300	62.79	62.79	62.70	0.41	0.65	0.78	0.22	0.40	0.51
23500	62.38	62.41	62.32	0.40	0.64	0.77	0.20	0.39	0.49
23700	61.92	61.94	61.88	0.41	0.66	0.78	0.19	0.38	0.47
24000	61.06	61.14	61.14	0.45	0.70	0.81	0.20	0.38	0.48
24300	59.99	60.08	60.20	0.54	0.78	0.89	0.18	0.37	0.46
24500	59.23	59.38	59.49	0.60	0.84	0.96	0.18	0.37	0.46
25000	57.40	57.63	57.68	0.80	1.07	1.22	0.17	0.35	0.45
25500	56.45	56.71	56.74	0.88	1.20	1.39	0.18	0.35	0.44
26500	57.65	58.05	58.24	0.50	0.76	0.88	0.15	0.32	0.42



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IF/RF MICROWAVE COMPONENTS

REV. OR  
ZBSS-15G-S+  
211119

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# Suspended substrate stripline

## Band Pass Filter

## ZBSS-15G-S+

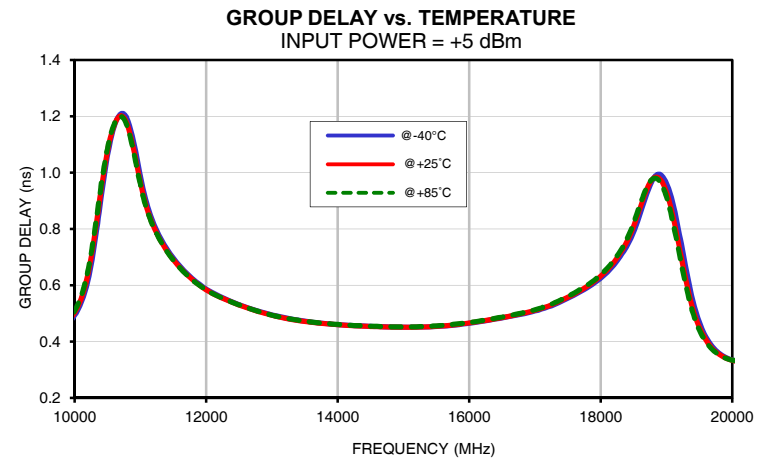
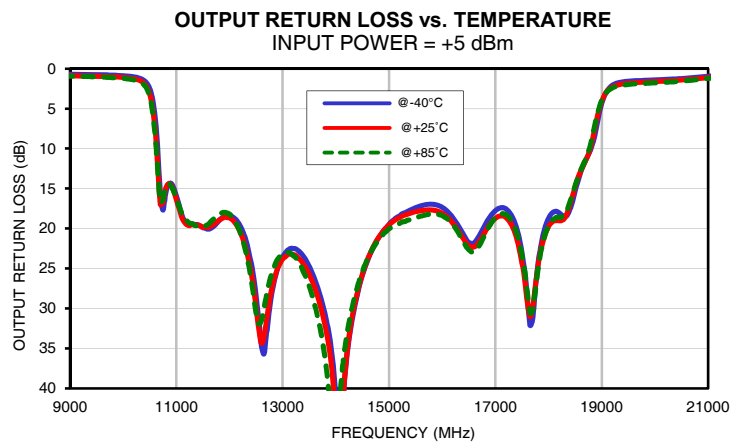
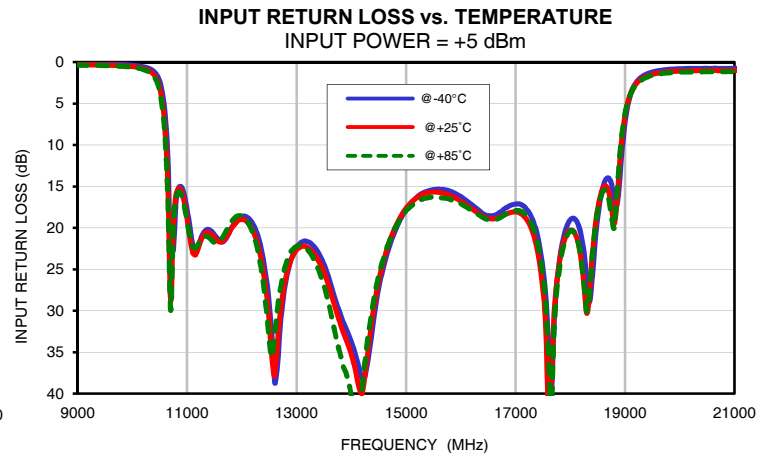
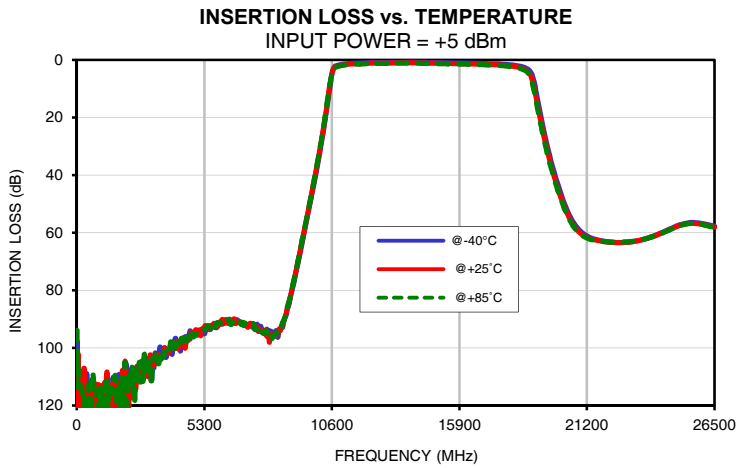
### Typical Performance Data

FREQ.  (MHz)	GROUP DELAY		
	(nsec)		
	@-40°C	@+25°C	@+85°C
12000	0.59	0.58	0.58
12150	0.57	0.56	0.56
12300	0.55	0.55	0.55
12450	0.54	0.53	0.54
12600	0.52	0.52	0.52
12750	0.51	0.51	0.51
12900	0.50	0.50	0.50
13050	0.49	0.49	0.49
13200	0.48	0.48	0.48
13350	0.48	0.48	0.48
13500	0.47	0.47	0.47
13650	0.47	0.47	0.47
13800	0.46	0.46	0.47
13950	0.46	0.46	0.46
14100	0.46	0.46	0.46
14250	0.46	0.46	0.46
14400	0.46	0.46	0.46
14550	0.45	0.45	0.45
14700	0.45	0.45	0.45
14850	0.45	0.45	0.45
15000	0.45	0.45	0.45
15150	0.45	0.45	0.45
15300	0.45	0.45	0.45
15450	0.45	0.45	0.46
15600	0.46	0.46	0.46
15750	0.46	0.46	0.46
15900	0.46	0.46	0.47
16050	0.47	0.47	0.47
16200	0.47	0.47	0.48
16350	0.48	0.48	0.48
16500	0.48	0.49	0.49
16650	0.49	0.49	0.49
16800	0.50	0.50	0.50
16950	0.51	0.51	0.51
17100	0.52	0.52	0.52
17250	0.53	0.53	0.53
17400	0.54	0.55	0.55
17550	0.56	0.56	0.57
17700	0.58	0.58	0.59
17850	0.60	0.61	0.61
18000	0.63	0.63	0.64

# Suspended substrate stripline Band Pass Filter

## ZBSS-15G-S+

### Typical Performance Curves

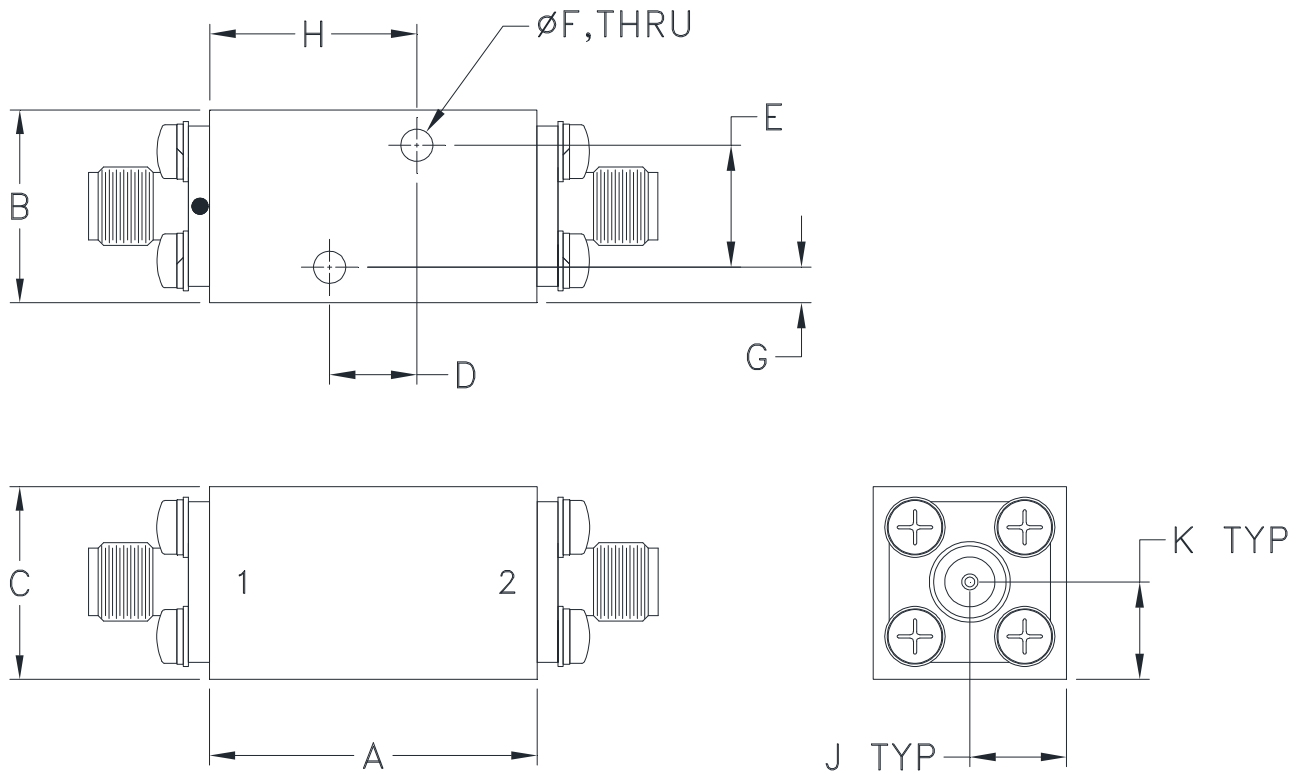


# Case Style

# WK

## Outline Dimensions

### WK3305



CASE#	A	B	C	D	E	F
WK3305	1.02 (25.8)	.60 (15.2)	.60 (15.2)	.270 (6.86)	.380 (9.65)	.090 (2.29)

CASE#	G	H	J	K	WT. GRAMS
WK3305	.11 (2.8)	.64 (16.3)	.30 (7.6)	.30 (7.7)	47

Dimensions are in inches (mm). Tolerances: 2 Pl. ± .100; 3 Pl. ± .015

### Notes:

1. Case material: Brass.
2. Case Finish: Powder coated over silver plating.
3. 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	-55° to 100°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Humidity	90 to 95% RH, 40°C, 96 hours; Units may require bake-out after humidity to restore full performance.	MIL-STD-202, Method 103, Condition B
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
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, 11ms half-sine, 3 shocks each direction 3 axes (total 18)	MIL-STD-202, Method 213, Condition A