

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

Suspended substrate stripline High Pass Filter

50Ω 4000 to 24000 MHz

ZHSS-4G-S+



Generic photo used for illustration purposes only

CASE STYLE: RP2464

Connectors Model
SMA-F ZHSS-4G-S+

Electrical Specifications at 25°C

Parameter	F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Stop Band Rejection Loss	DC-F1	DC - 1000	-	80	-	dB
	F1-F2	1000 - 2000	40	55	-	dB
	F2-F3	2000 - 2500	20	30	-	dB
Pass Band	F4-F5	4000 - 20000	-	1	2	dB
	F5-F6	20000 - 24000	-	2	-	dB
	F4-F6	4000 - 24000	-	2	-	:1

Maximum Ratings

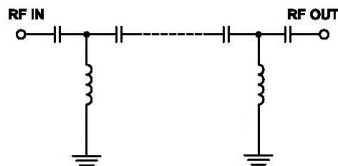
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	5 W @ 25°C

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

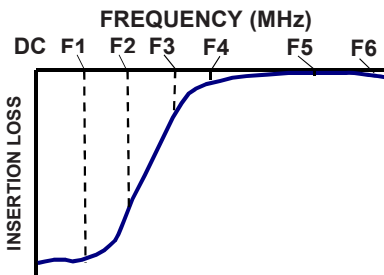
Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (ns)
10	78.89	45501.70	4000	0.42
100	81.23	5358.62	5000	0.30
600	105.33	9833.57	6000	0.24
700	97.33	4211.95	7000	0.20
1000	100.56	1277.01	8000	0.19
1500	85.41	407.26	9000	0.18
2000	58.90	184.23	10000	0.17
2500	34.42	86.83	11000	0.17
2750	21.77	48.00	12000	0.16
3000	7.52	9.31	13000	0.16
3080	3.54	3.73	14000	0.16
4000	0.73	1.71	15000	0.16
5000	0.34	1.16	16000	0.16
10000	0.23	1.13	17000	0.16
11000	0.23	1.14	18000	0.15
15000	0.28	1.27	19000	0.15
20000	0.28	1.10	20000	0.16
21000	0.31	1.13	21000	0.16
23000	0.71	1.80	22000	0.16
24000	0.78	1.89	24000	0.16

Functional Schematic

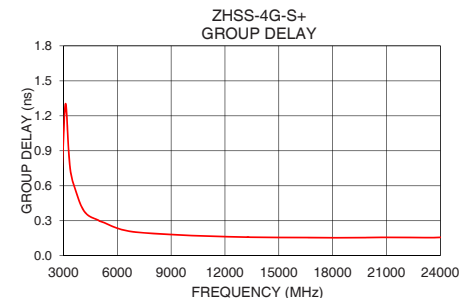
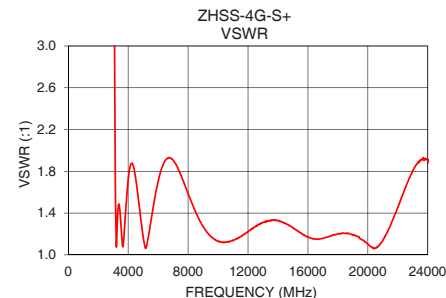
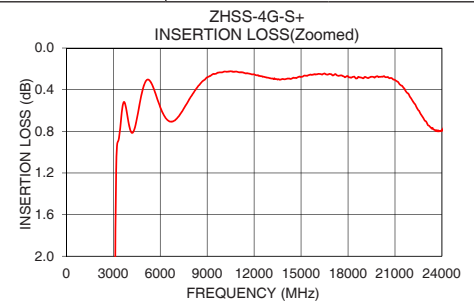
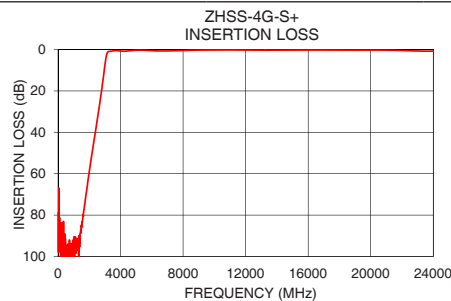


Typical Frequency Response



+RoHS Compliant

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



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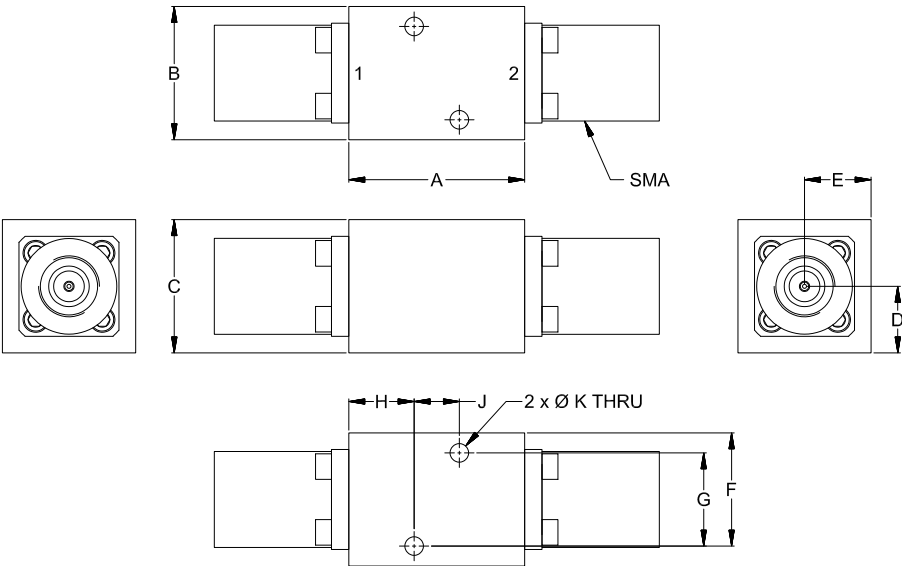
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Page 2 of 3

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
Max	Max	Max	-	-	-
.70	.50	.50	.25	.25	.43
17.8	12.7	12.7	6.4	6.4	10.9
G	H	J	K		Wt.
-	-	-	-		grams
.350	.25	.170	.065		30
8.89	6.4	4.32	1.65		

Note: Please refer to case style drawing for details

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Suspended substrate stripline

High Pass Filter

ZHSS-4G-S+

Typical Performance Data

FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C
10	72.60	78.89	76.45	0.00	0.00	0.00	0.00	0.00	0.00
20	81.18	79.82	76.30	0.00	0.00	0.00	0.00	0.00	0.01
50	66.39	66.97	66.82	0.00	0.00	0.00	0.01	0.01	0.00
100	80.64	81.23	80.77	0.00	0.00	0.00	0.01	0.00	0.00
150	89.87	92.29	86.79	0.01	0.00	0.00	0.01	0.00	0.00
200	86.82	87.23	87.20	0.01	0.00	0.01	0.01	0.00	0.00
250	84.09	83.80	82.31	0.01	0.00	0.01	0.01	0.00	0.00
500	99.47	103.04	99.03	0.02	0.00	0.01	0.02	0.00	0.01
750	101.45	98.99	98.56	0.01	0.01	0.03	0.02	0.01	0.02
1000	92.20	100.56	95.23	0.01	0.02	0.04	0.01	0.01	0.03
1100	95.33	93.66	97.22	0.01	0.02	0.04	0.01	0.02	0.03
1200	93.67	94.18	96.72	0.00	0.03	0.05	0.00	0.02	0.04
1300	92.15	91.13	91.82	0.00	0.03	0.06	0.00	0.03	0.05
1400	89.09	92.61	91.19	0.01	0.04	0.06	0.00	0.04	0.05
1500	86.98	85.41	85.96	0.01	0.05	0.07	0.01	0.04	0.06
1600	80.76	79.79	81.71	0.02	0.06	0.08	0.02	0.05	0.07
1700	75.21	75.31	75.29	0.03	0.07	0.09	0.02	0.06	0.08
1800	69.99	69.60	69.30	0.03	0.08	0.10	0.03	0.07	0.09
1900	64.55	64.24	64.00	0.04	0.09	0.11	0.04	0.08	0.11
2000	59.20	58.90	58.76	0.05	0.10	0.13	0.05	0.09	0.12
2100	54.13	53.81	53.80	0.07	0.11	0.14	0.06	0.11	0.14
2200	49.11	48.93	48.81	0.08	0.13	0.16	0.08	0.13	0.16
2300	44.27	44.10	43.98	0.10	0.15	0.19	0.10	0.15	0.18
2400	39.47	39.26	39.15	0.12	0.18	0.22	0.12	0.17	0.20
2500	34.64	34.42	34.31	0.15	0.21	0.25	0.15	0.20	0.24
2600	29.72	29.49	29.38	0.19	0.26	0.30	0.19	0.24	0.28
2700	24.64	24.41	24.28	0.26	0.33	0.38	0.24	0.31	0.35
2800	19.31	19.06	18.92	0.38	0.47	0.53	0.36	0.44	0.49
3000	7.77	7.52	7.41	1.75	2.00	2.15	1.65	1.87	2.01
3080	3.66	3.54	3.51	4.57	5.10	5.41	4.30	4.77	5.04
3200	0.98	1.07	1.14	21.67	24.37	26.05	16.61	17.23	17.48
4000	0.65	0.73	0.78	11.53	11.59	11.66	11.56	11.63	11.69
5000	0.27	0.34	0.39	21.48	21.78	21.85	22.03	22.40	22.51
6000	0.49	0.57	0.61	11.56	11.70	11.83	11.57	11.70	11.83
6500	0.62	0.70	0.74	10.00	10.11	10.21	10.02	10.12	10.21
7000	0.60	0.69	0.74	10.07	10.13	10.13	10.09	10.14	10.15
7500	0.49	0.58	0.64	11.13	11.13	11.03	11.17	11.16	11.05
8000	0.37	0.46	0.52	12.87	12.85	12.60	12.96	12.94	12.68
8500	0.27	0.35	0.42	15.29	15.32	14.97	15.35	15.38	15.01
9000	0.19	0.28	0.34	18.23	18.41	18.07	18.28	18.45	18.08
9500	0.16	0.25	0.30	21.31	21.79	21.62	21.24	21.71	21.52
10000	0.14	0.23	0.28	23.65	24.32	24.75	23.54	24.22	24.64
10500	0.13	0.22	0.27	24.18	24.79	25.62	24.12	24.76	25.56
11000	0.14	0.23	0.28	23.35	23.59	24.45	23.22	23.47	24.24
11500	0.14	0.24	0.30	22.01	21.89	22.28	21.74	21.64	22.01
12000	0.15	0.25	0.31	20.36	20.09	20.10	20.14	19.87	19.87
12500	0.16	0.27	0.33	18.78	18.48	18.26	18.62	18.32	18.11
13000	0.18	0.29	0.36	17.60	17.38	17.05	17.49	17.25	16.93
13500	0.19	0.30	0.37	17.06	16.94	16.65	16.89	16.76	16.46
14000	0.19	0.30	0.36	17.08	17.01	16.91	16.95	16.87	16.76
14500	0.17	0.28	0.34	17.67	17.72	17.90	17.42	17.43	17.58
15000	0.17	0.28	0.33	18.62	18.85	19.44	18.28	18.48	19.07
15500	0.15	0.26	0.31	19.79	20.36	21.57	19.26	19.72	20.85
16000	0.14	0.25	0.31	20.95	21.96	23.38	20.09	20.86	22.11
16500	0.13	0.24	0.31	21.83	23.06	23.88	20.67	21.47	22.24
17000	0.14	0.26	0.33	21.89	22.65	22.73	20.63	21.11	21.31
17500	0.13	0.26	0.34	21.56	21.58	21.53	20.37	20.32	20.33
20000	0.14	0.28	0.35	23.62	26.18	27.61	23.40	26.73	28.97
22000	0.29	0.48	0.57	15.50	14.64	14.25	15.61	14.69	14.29
24000	0.70	0.78	0.83	9.34	10.19	10.55	9.34	10.20	10.61

Suspended substrate stripline

High Pass Filter

ZHSS-4G-S+

Typical Performance Data

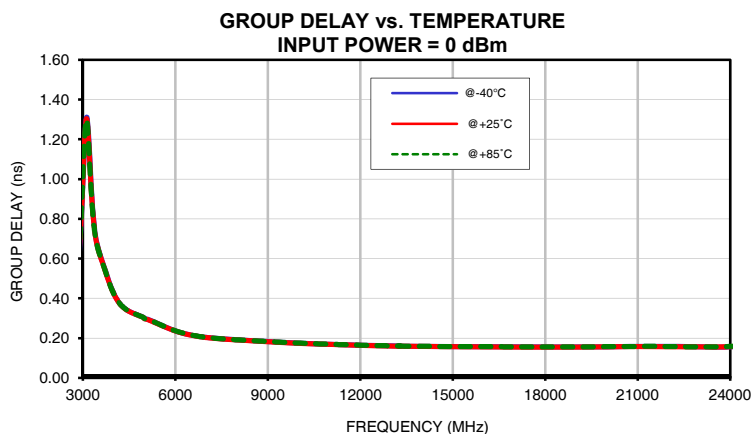
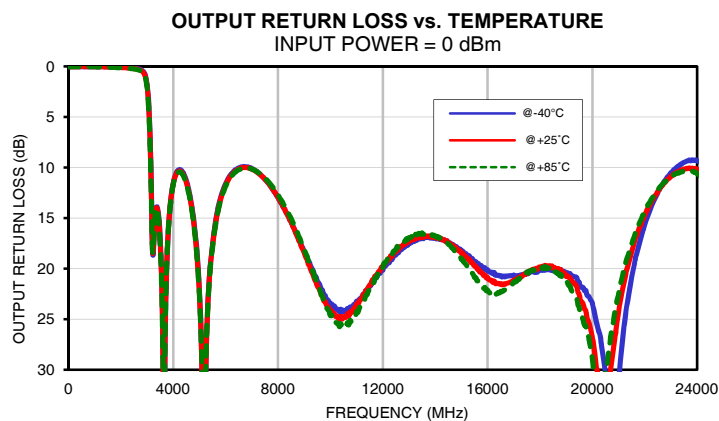
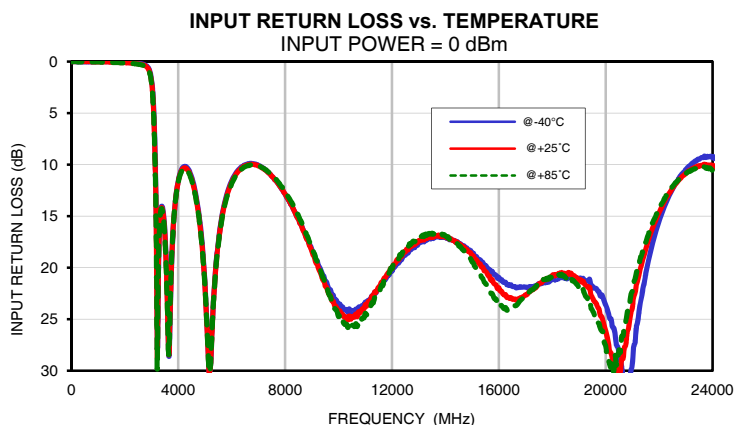
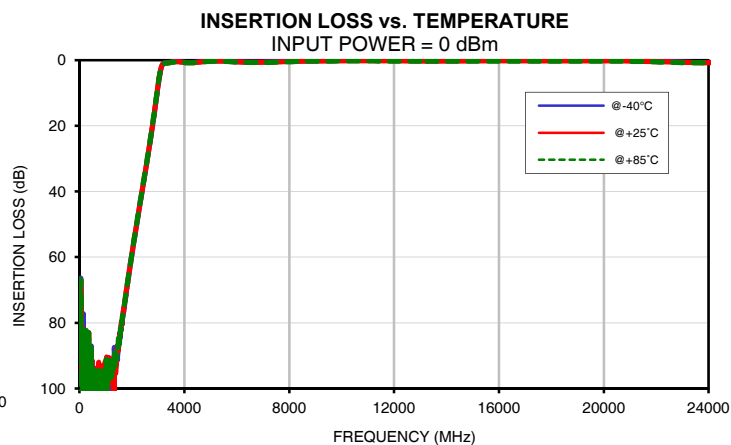
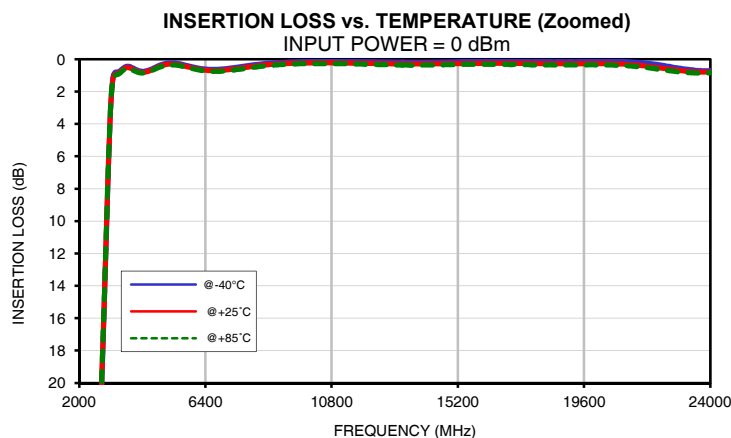
FREQ.	GROUP DELAY		
(MHz)	(nsec)		
	@-40°C	@+25°C	@+85°C
4000	0.43	0.42	0.42
4200	0.37	0.37	0.37
4400	0.34	0.34	0.34
5000	0.30	0.30	0.30
5500	0.27	0.27	0.27
6000	0.24	0.24	0.24
6500	0.22	0.21	0.22
7000	0.20	0.20	0.20
7500	0.20	0.20	0.20
8000	0.19	0.19	0.19
8500	0.19	0.19	0.19
9000	0.18	0.18	0.18
9500	0.18	0.18	0.18
10000	0.17	0.17	0.18
10500	0.17	0.17	0.17
11000	0.17	0.17	0.17
11500	0.17	0.17	0.17
12000	0.16	0.16	0.16
12500	0.16	0.16	0.16
13000	0.16	0.16	0.16
13500	0.16	0.16	0.16
14000	0.16	0.16	0.16
14500	0.16	0.16	0.16
15000	0.16	0.16	0.16
15500	0.16	0.16	0.16
16000	0.16	0.16	0.16
16500	0.16	0.16	0.16
17000	0.16	0.16	0.16
17500	0.16	0.15	0.16
18000	0.16	0.15	0.16
18500	0.16	0.15	0.16
19000	0.16	0.15	0.16
19500	0.16	0.16	0.16
20000	0.16	0.16	0.16
20500	0.16	0.16	0.16
21000	0.16	0.16	0.16
21500	0.16	0.16	0.16
22000	0.16	0.16	0.16
22500	0.16	0.16	0.16
23000	0.16	0.16	0.16
24000	0.16	0.16	0.16

Suspended substrate stripline

High Pass Filter

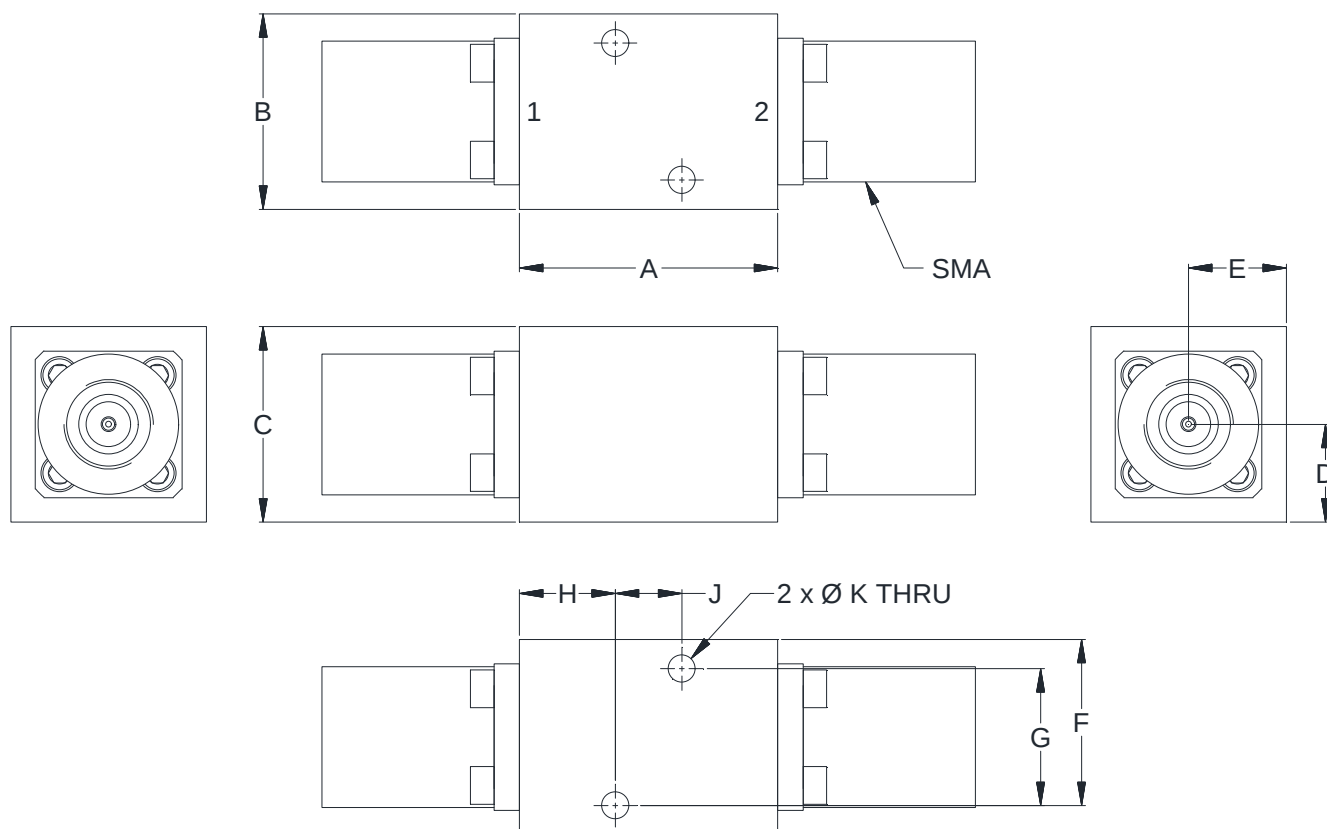
ZHSS-4G-S+

Typical Performance Curves



Outline Dimensions

RP2464



CASE#	A	B	C	D	E	F	G	H	J	K	WT. GRAMS
	(Max)	(Max)	(Max)								
RP2464	.70 (17.8)	.50 (12.7)	.50 (12.7)	.25 (6.4)	.25 (6.4)	.43 (10.9)	.350 (8.89)	.25 (6.4)	.170 (4.32)	.065 (1.65)	30

Dimensions are in inches (mm). Tolerances: 2 Pl. $\pm .10$; 3 Pl. $\pm .015$

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.



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

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