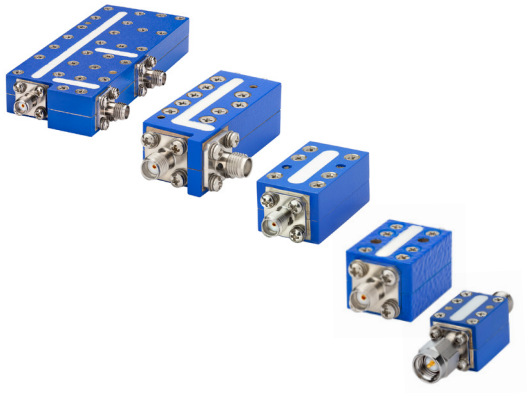
SUSPENDED SUBSTRATE STRIPLINE

Filters and Multiplexers

50Ω DC to 40 GHz



THE BIG DEAL

- Low Insertion Loss
- Ultra-Wide Passband
- Fast Roll-Off With Wide Stopband
- Good Power Handling and Temperature Stability
- Passband Up to 40 GHz
- Stopband Up 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 help 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

SUSPENDED SUBSTRATE STRIPLINE

Low Pass Filter

ZLSS-4R8G-S+

50Ω DC to 4800 MHz SMA-Female

FEATURES

- Low Insertion Loss, 0.5dB Typ.
- High Rejection of 90dB Typ.
- Wider Stopband Up to 20 GHz
- Connectorized Package
- Small Size, 22.86 x 17.78 x 15.24 mm



Generic photo used for illustration purposes only

Model No.	ZLSS-4R8G-S+
Case Style	RA2456
Connectors	SMA-FEMALE

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

APPLICATIONS

- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems

ELECTRICAL SPECIFICATIONS AT 25°C

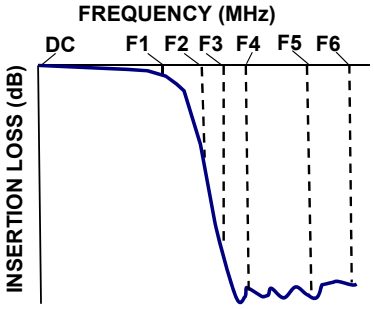
Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Units
Passband	Insertion Loss	DC-F1	DC - 4800	—	0.5	2.0	dB
	Return Loss	DC-F1	DC - 4800	—	15.5	—	dB
Stopband	Rejection	F2-F3	7100 - 8300	20	40	—	dB
		F3-F4	8300 - 10100	40	60	—	
		F4-F5	10100 - 15000	60	80	—	
		F5-F6	15000 - 20000	—	90	—-	

ABSOLUTE MAXIMUM RATINGS

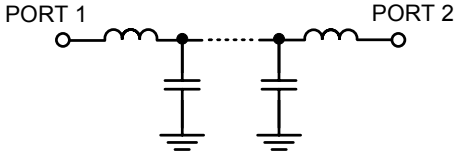
Parameter	Ratings
Operating temperature	-40°C to +85°C
Storage temperature	-55°C to +100°C
RF Power Input at Passband	10W max. at 25°C

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

TYPICAL FREQUENCY RESPONSE



FUNCTIONAL DIAGRAM



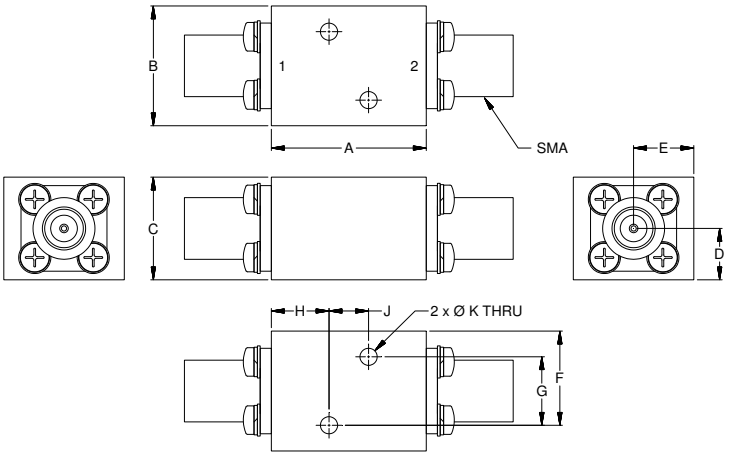
Low Pass Filter

ZLSS-4R8G-S+

COAXIAL CONNECTIONS

PORT 1	SMA-Female
PORT 2	SMA-Female

OUTLINE DRAWING



OUTLINE DIMENSIONS (Inches / mm)

A	B	C	D	E	F	G	H	J	K	Wt.
.90	**.70**	**.60**	**.30**	**.35**	**.55**	**.400**	**.34**	**.230**	**.100**	grams
22.86	17.78	15.24	7.62	8.89	13.97	10.16	8.51	5.84	2.54	55

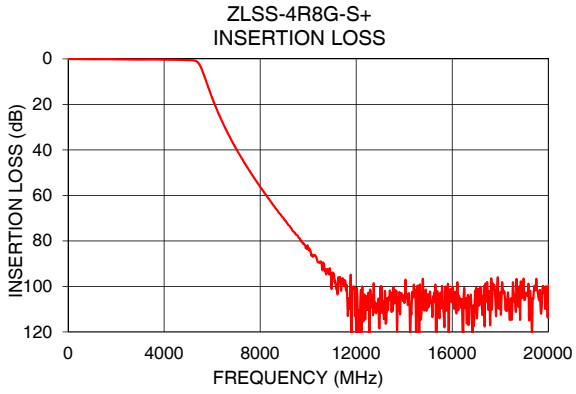
Note. Please refer to case style drawing for details

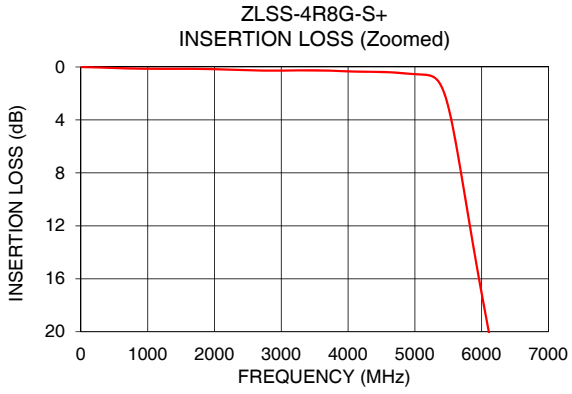
Low Pass Filter

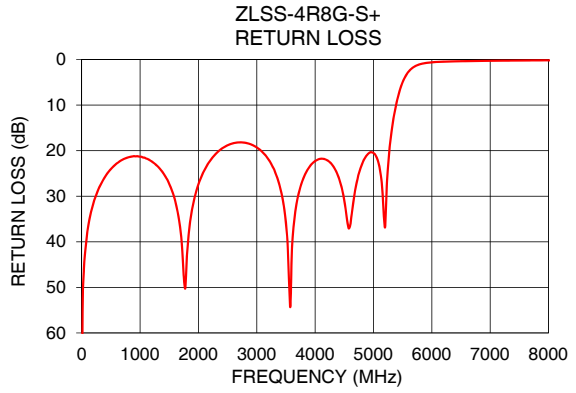
ZLSS-4R8G-S+

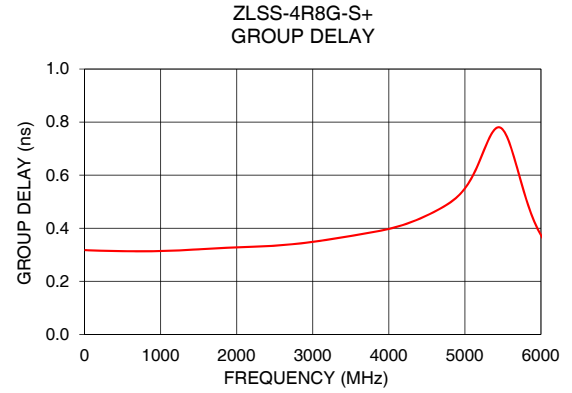
TYPICAL PERFORMANCE DATA AT 25°C

Frequency (MHz)	Insertion Loss (dB)	Return Loss (dB)	Frequency (MHz)	GROUP DELAY (ns)
10	0.01	61.96	10	0.32
100	0.02	37.51	100	0.32
1000	0.14	21.32	500	0.31
2000	0.17	27.36	1000	0.31
4500	0.38	31.00	1300	0.32
4800	0.46	23.08	1600	0.32
5525	3.52	4.21	1900	0.33
6600	31.56	0.34	2200	0.33
7100	41.31	0.26	2500	0.33
6800	35.63	0.31	2800	0.34
8300	60.65	0.14	3100	0.35
10000	82.98	0.08	3400	0.37
10100	84.39	0.09	3700	0.38
15000	103.39	0.14	4000	0.40
20000	100.76	0.39	4800	0.50









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

Low Pass Filter ZLSS-4R8G-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	0.00	0.01	0.01	48.18	61.96	59.82	46.91	55.45	53.95
20	0.01	0.01	0.01	49.26	50.87	53.12	49.02	51.76	53.12
50	0.00	0.01	0.01	41.90	43.49	44.40	41.53	43.21	43.77
100	0.00	0.02	0.02	36.71	37.51	38.35	36.04	37.13	37.48
150	0.00	0.02	0.02	33.82	34.04	34.61	33.12	33.64	33.78
200	0.01	0.03	0.03	31.74	31.51	31.85	31.11	31.16	31.14
250	0.02	0.04	0.04	30.16	29.66	29.85	29.54	29.33	29.21
500	0.05	0.08	0.09	24.12	24.03	24.12	24.00	23.92	24.00
750	0.08	0.12	0.13	21.81	21.67	21.64	21.92	21.66	21.74
1000	0.09	0.14	0.15	21.41	21.32	21.32	21.26	21.17	21.16
1250	0.09	0.14	0.15	22.74	22.83	22.84	22.30	22.46	22.41
1500	0.09	0.14	0.15	26.82	27.33	27.22	26.32	26.75	26.73
1750	0.09	0.15	0.16	45.56	47.76	45.71	40.99	43.51	42.66
2000	0.11	0.17	0.19	27.29	27.36	27.59	27.61	27.71	27.99
2250	0.15	0.21	0.23	21.27	21.37	21.41	21.60	21.59	21.71
2500	0.19	0.25	0.27	18.62	18.80	18.86	18.61	18.82	18.82
2750	0.21	0.27	0.30	17.94	18.19	18.22	17.77	18.05	18.04
3000	0.21	0.28	0.30	19.07	19.30	19.25	18.89	19.09	19.07
3250	0.19	0.26	0.29	22.95	22.97	22.80	22.53	22.59	22.46
3500	0.18	0.26	0.29	37.65	35.98	35.19	33.64	33.56	32.87
3750	0.21	0.29	0.32	26.84	27.82	28.17	27.70	28.66	29.12
4000	0.25	0.33	0.37	21.75	22.27	22.48	21.91	22.46	22.61
4250	0.27	0.36	0.40	22.32	22.52	22.62	22.12	22.36	22.41
4500	0.28	0.38	0.42	31.64	31.00	30.94	31.34	31.01	30.79
4550	0.28	0.38	0.42	36.77	35.46	35.57	38.37	37.02	36.52
4600	0.29	0.39	0.43	36.43	36.46	37.59	45.20	45.02	47.58
4800	0.36	0.46	0.50	22.34	23.08	23.43	22.81	23.45	23.82
5000	0.44	0.55	0.59	19.50	20.51	20.85	19.82	20.78	21.14
5100	0.46	0.57	0.62	21.86	23.46	23.99	22.26	23.77	24.35
5250	0.54	0.68	0.75	25.17	23.17	22.60	25.10	22.79	22.21
5300	0.65	0.82	0.90	17.75	16.70	16.45	17.63	16.54	16.24
5400	1.24	1.49	1.59	9.65	9.18	9.12	9.56	9.10	9.00
5525	3.14	3.52	3.65	4.38	4.21	4.24	4.32	4.17	4.16
6000	16.61	17.11	17.24	0.55	0.61	0.66	0.45	0.54	0.57
6300	24.32	24.83	24.96	0.35	0.42	0.47	0.25	0.35	0.37
6500	28.90	29.41	29.55	0.30	0.37	0.41	0.19	0.28	0.30
6600	31.05	31.56	31.71	0.28	0.34	0.39	0.15	0.25	0.26
7100	40.84	41.31	41.47	0.19	0.26	0.30	0.02	0.12	0.14
7600	49.48	49.90	50.07	0.12	0.20	0.24	0.03	0.07	0.08
8000	55.84	56.21	56.38	0.09	0.17	0.22	0.09	0.02	0.03
8300	60.36	60.65	60.85	0.06	0.14	0.19	0.12	0.01	0.00
9000	70.33	70.59	70.46	0.01	0.09	0.14	0.13	0.02	0.01
10000	83.45	82.98	83.99	0.00	0.08	0.13	0.17	0.06	0.04
10100	84.20	84.39	83.56	0.01	0.09	0.14	0.16	0.05	0.03
11500	100.75	99.80	101.63	0.01	0.08	0.13	0.17	0.06	0.04
12000	101.34	121.63	110.81	0.01	0.09	0.15	0.15	0.03	0.01
13000	104.73	100.15	104.51	0.00	0.09	0.16	0.13	0.02	0.02
13500	104.04	105.07	116.26	0.01	0.12	0.19	0.11	0.00	0.04
14000	98.81	107.22	111.01	0.01	0.12	0.20	0.09	0.02	0.06
14500	113.97	123.30	106.72	0.02	0.13	0.21	0.08	0.04	0.08
15000	103.82	103.39	114.36	0.02	0.14	0.23	0.07	0.06	0.09
15500	102.18	102.84	115.75	0.05	0.16	0.24	0.06	0.05	0.10
16000	101.49	102.41	100.65	0.07	0.17	0.26	0.04	0.08	0.13
16500	100.66	100.74	104.36	0.10	0.19	0.28	0.02	0.10	0.15
17000	108.13	100.53	109.18	0.13	0.22	0.31	0.00	0.12	0.17
17500	98.68	110.21	107.73	0.17	0.25	0.34	0.00	0.12	0.17
18000	105.03	102.63	103.85	0.17	0.26	0.35	0.01	0.14	0.19
18500	105.21	109.44	103.47	0.19	0.30	0.40	0.03	0.17	0.22
19000	107.22	105.92	107.71	0.23	0.35	0.45	0.03	0.17	0.22
20000	121.85	100.76	113.01	0.24	0.39	0.50	0.07	0.22	0.26

Typical Performance Data

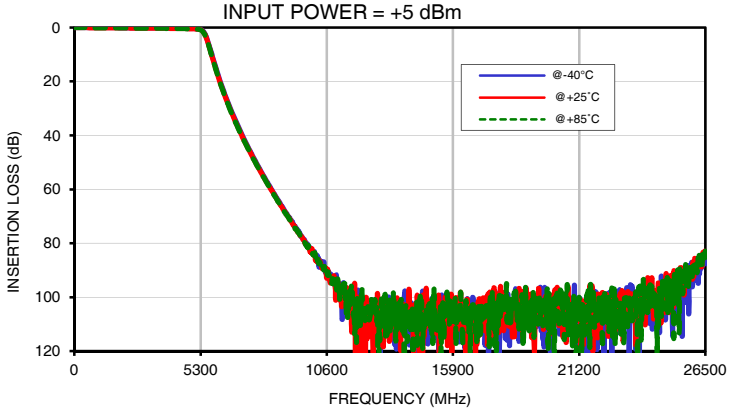
FREQ. (MHz)	GROUP DELAY (nsec)		
	@-40°C	@+25°C	@+85°C
10	0.33	0.32	0.32
20	0.33	0.32	0.32
50	0.32	0.32	0.32
100	0.32	0.32	0.32
200	0.32	0.32	0.32
300	0.31	0.31	0.32
400	0.31	0.31	0.32
500	0.31	0.31	0.31
600	0.31	0.31	0.31
700	0.31	0.31	0.31
800	0.31	0.31	0.31
900	0.31	0.31	0.31
1000	0.31	0.31	0.31
1100	0.31	0.31	0.32
1200	0.32	0.32	0.32
1300	0.32	0.32	0.32
1400	0.32	0.32	0.32
1500	0.32	0.32	0.32
1750	0.32	0.32	0.33
2000	0.33	0.33	0.33
2100	0.33	0.33	0.33
2200	0.33	0.33	0.33
2300	0.33	0.33	0.33
2400	0.33	0.33	0.33
2500	0.33	0.33	0.34
2600	0.34	0.34	0.34
2700	0.34	0.34	0.34
2800	0.34	0.34	0.34
2900	0.34	0.35	0.35
3000	0.35	0.35	0.35
3100	0.35	0.35	0.35
3200	0.36	0.36	0.36
3300	0.36	0.36	0.36
3400	0.37	0.37	0.37
3500	0.37	0.37	0.37
3600	0.38	0.38	0.38
3700	0.38	0.38	0.38
3800	0.38	0.39	0.39
4000	0.40	0.40	0.40
4500	0.45	0.45	0.45
4800	0.49	0.50	0.50

Suspended substrate stripline

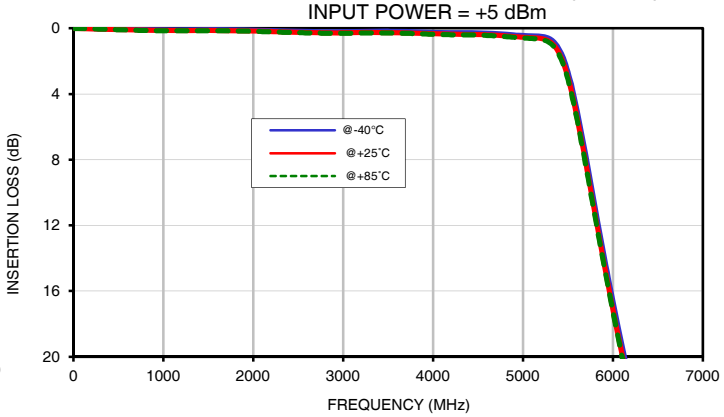
Low Pass Filter ZLSS-4R8G-S+

Typical Performance Curves

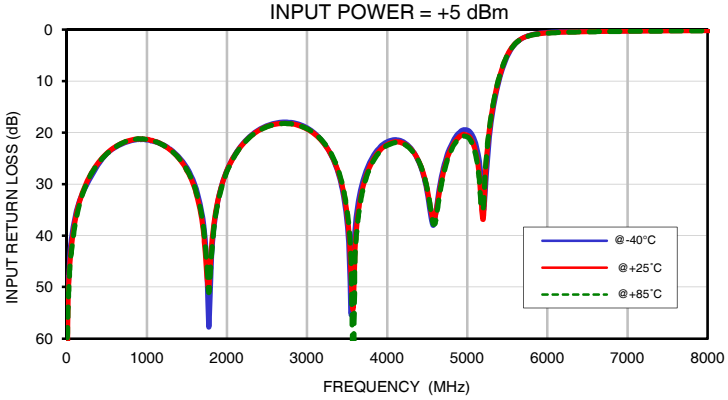
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = +5 dBm



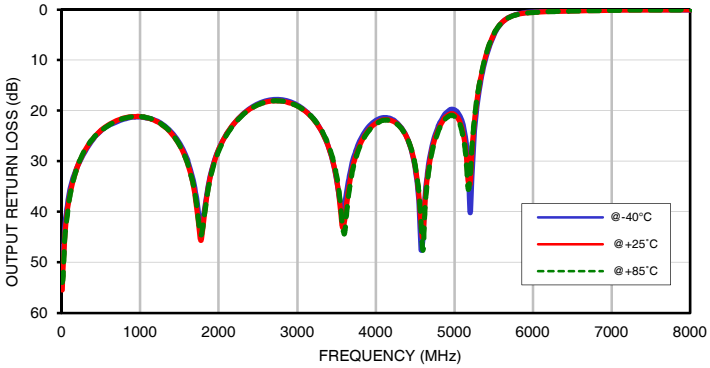
INSERTION LOSS vs. TEMPERATURE (zoomed)
INPUT POWER = +5 dBm



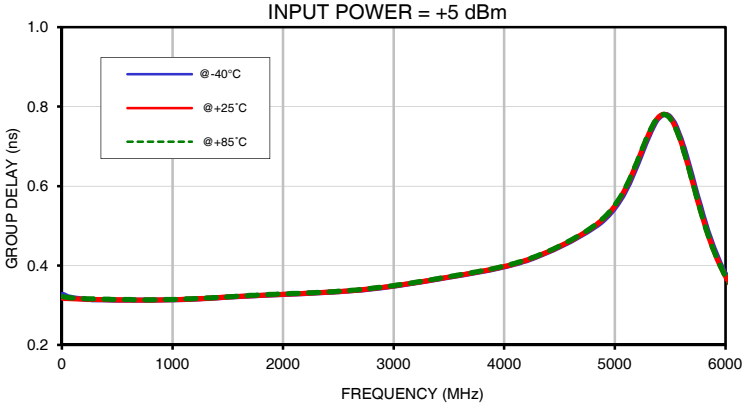
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = +5 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = +5 dBm



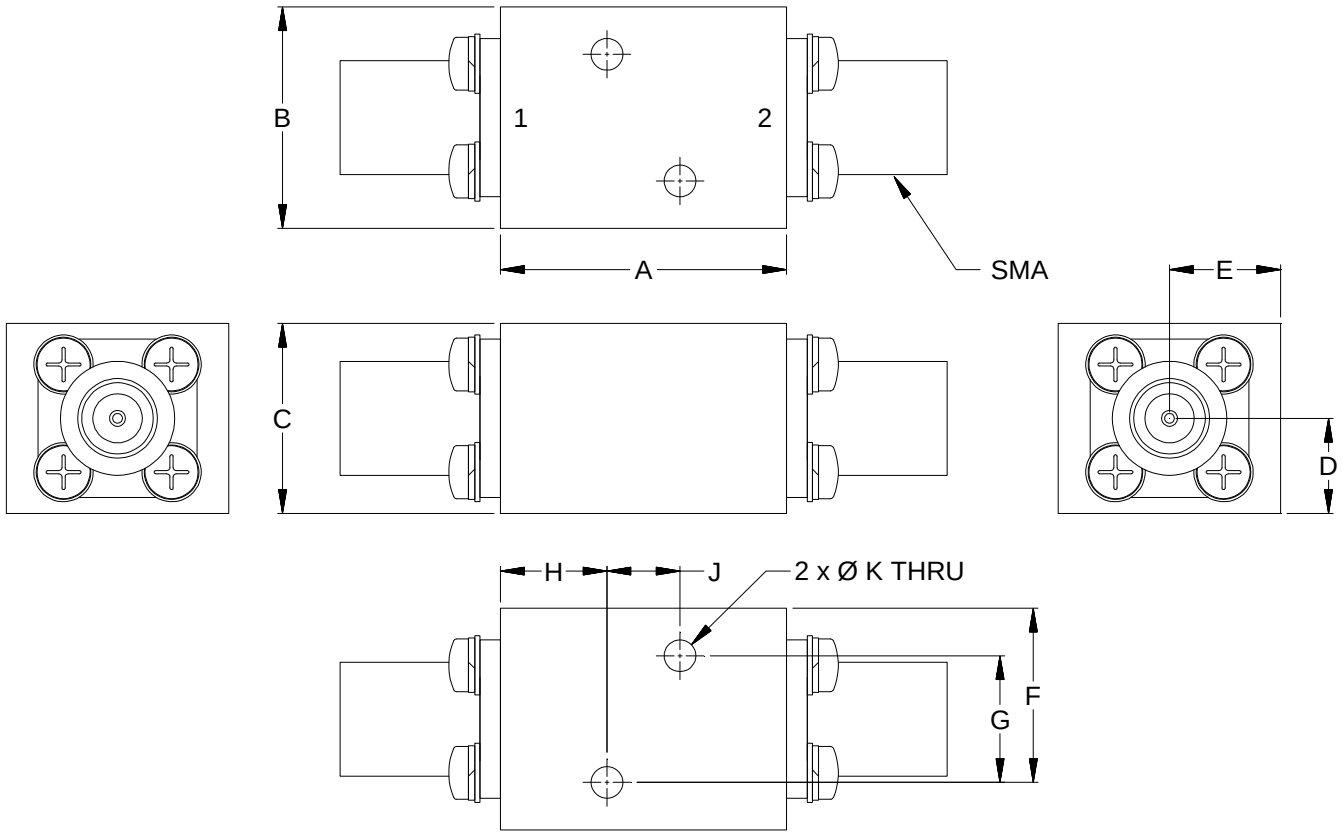
GROUP DELAY vs. TEMPERATURE
INPUT POWER = +5 dBm



Case Style RA

Outline Dimensions

RA2456



CASE#	A	B	C	D	E	F	G	H	J	K	WT.GRAMS
RA2456	.90 (22.86)	.70 (17.78)	.60 (15.24)	.30 (7.62)	.35 (8.89)	.55 (13.97)	.400 (10.16)	.34 (8.51)	.230 (5.84)	.100 (2.54)	55

Dimensions are in inches (mm). Tolerances: 2 Pl. ± .05; 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

Mini-Circuits

Environmental Specifications ENV46

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, Condintion 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

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