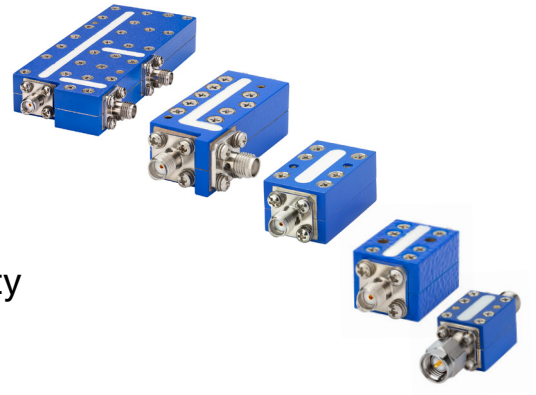
Suspended Substrate Stripline Filters and Multiplexers

50Ω DC to 40 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 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 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-2R8G-S+

50Ω DC to 2800 MHz

Generic photo used for illustration purposes only

CASE STYLE: RA2456

Connectors	Model
SMA-F	ZLSS-2R8G-S+

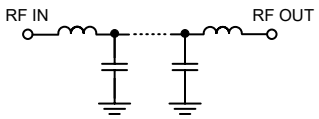
Features

- Low passband IL
- High rejection of 90 dB typ.
- Wider stopband
- Connectorized package and small size

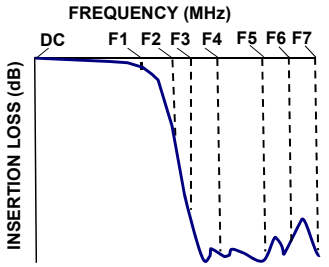
Applications

- Harmonic rejection
- Transmitters / Receivers
- Lab use

Functional Schematic



Typical Frequency Response



+RoHS Compliant

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

Electrical Specifications at 25°C

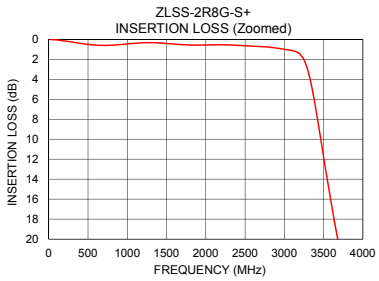
Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Pass Band	Insertion Loss	DC-F1	DC-2800	—	1.0	2.0	dB
	VSWR	DC-F1	DC-2800	—	2.1	—	:1
Stop Band	Insertion Loss	F2-F3	4000-4700	20	30	—	dB
		F3-F4	4700-5800	40	50	—	dB
		F4-F5	5800-8000	60	80	—	dB
		F5-F6	8000-20000	—	90	—	dB
		F6-F7	20000-26500	—	80	—	dB
	VSWR	F2-F7	4000-26500	—	20	—	:1

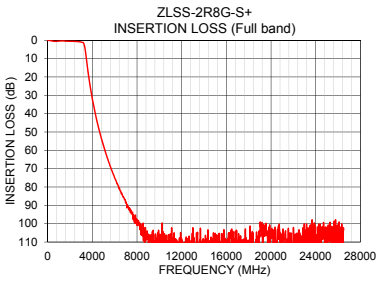
Maximum Ratings	
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input at Passband	10W max. at 25°C

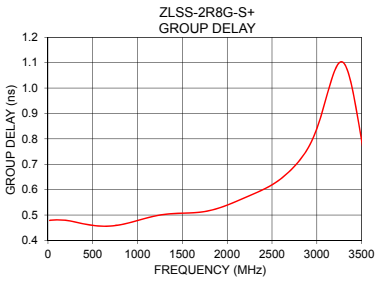
Permanent damage may occur if any of these limits are exceeded.

Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
10	0.01	1.02	10	0.48
100	0.07	1.15	100	0.48
1000	0.47	1.50	200	0.48
2000	0.57	1.33	400	0.47
2800	0.78	1.03	600	0.46
3000	1.00	1.24	800	0.46
3300	3.14	2.70	1000	0.48
3500	11.79	13.49	1200	0.50
3700	20.91	28.28	1400	0.51
3950	30.35	41.26	1600	0.51
4000	32.03	43.55	1800	0.52
4500	46.32	62.47	2000	0.54
4700	51.10	69.41	2100	0.55
5800	71.91	111.83	2200	0.57
8000	98.21	156.76	2300	0.58
15000	105.54	64.97	2400	0.60
20000	105.30	38.03	2500	0.62
23000	105.47	28.45	2600	0.64
25000	105.24	27.69	2700	0.67
26500	103.40	6.54	2800	0.71







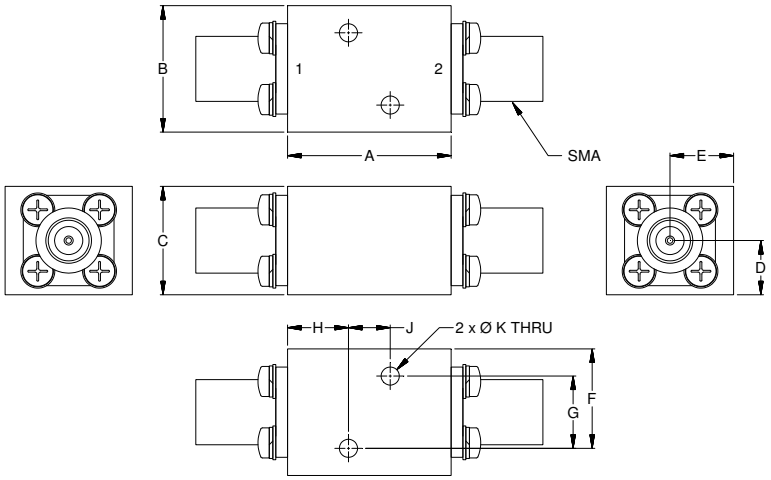
Notes

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

Coaxial Connections

PORT - 1	SMA FEMALE
PORT - 2	SMA FEMALE

Outline Drawing



Outline Dimensions (inch / 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

Suspended substrate stripline

Low Pass Filter ZLSS-2R8G+

Typical Performance Data

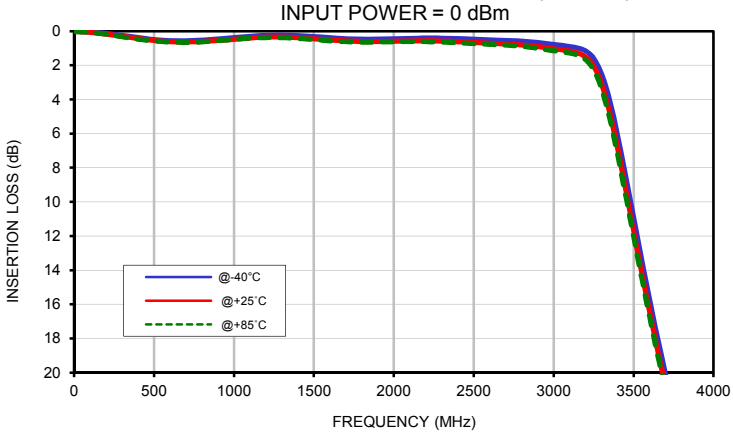
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C
10	0.01	0.02	0.02	39.20	41.35	35.45	42.67	42.52	38.51
20	0.02	0.02	0.02	34.97	37.18	41.18	34.47	37.09	39.81
50	0.03	0.04	0.04	27.20	28.87	30.54	27.24	28.83	30.32
100	0.05	0.07	0.07	22.45	22.76	23.59	22.46	22.75	23.61
150	0.08	0.11	0.11	20.18	19.32	19.39	20.14	19.30	19.39
200	0.12	0.17	0.18	18.08	16.92	16.56	18.03	16.90	16.53
250	0.17	0.23	0.25	16.05	15.20	14.59	16.03	15.18	14.57
500	0.49	0.54	0.57	10.91	11.04	10.84	10.90	11.04	10.83
750	0.56	0.63	0.65	10.73	10.85	10.83	10.74	10.86	10.84
1000	0.38	0.47	0.48	14.14	14.19	14.69	14.17	14.21	14.71
1250	0.24	0.34	0.37	27.10	29.14	35.00	27.00	28.83	33.27
1500	0.32	0.44	0.49	19.07	18.50	17.87	19.06	18.44	17.80
1750	0.46	0.59	0.62	14.53	14.50	14.82	14.58	14.52	14.84
2000	0.45	0.59	0.62	16.26	16.64	17.75	16.37	16.73	17.89
2500	0.47	0.66	0.73	25.58	23.67	23.27	26.03	24.07	23.69
2800	0.59	0.80	0.88	35.32	30.86	27.57	40.74	34.30	29.19
3000	0.77	1.03	1.14	20.03	18.93	17.87	19.73	18.73	17.72
3200	1.15	1.51	1.66	23.31	20.12	19.46	18.43	17.10	16.51
3300	2.52	3.10	3.38	7.75	7.29	7.06	7.33	6.90	6.63
3400	6.09	6.87	7.24	2.82	2.83	2.82	2.71	2.70	2.66
3500	10.92	11.69	12.04	1.21	1.37	1.42	1.18	1.31	1.33
3600	15.72	16.44	16.73	0.67	0.86	0.91	0.67	0.83	0.86
3700	20.10	20.82	21.05	0.46	0.63	0.69	0.47	0.62	0.65
3800	24.15	24.83	25.02	0.35	0.52	0.57	0.36	0.51	0.53
3950	29.73	30.25	30.38	0.24	0.42	0.46	0.27	0.42	0.44
4000	31.44	31.94	32.03	0.22	0.40	0.44	0.25	0.40	0.42
4500	45.82	46.21	46.22	0.08	0.27	0.31	0.11	0.27	0.29
4700	50.63	50.98	50.97	0.04	0.23	0.28	0.08	0.24	0.26
5000	57.05	57.47	57.45	0.00	0.20	0.26	0.03	0.21	0.23
5500	66.32	66.79	66.73	0.04	0.17	0.25	0.02	0.17	0.21
5800	71.32	71.81	71.76	0.07	0.16	0.26	0.05	0.16	0.21
6000	74.30	74.84	74.78	0.09	0.16	0.26	0.05	0.16	0.21
7000	87.41	88.74	88.99	0.15	0.15	0.32	0.12	0.14	0.25
8000	98.77	98.48	100.07	0.16	0.17	0.40	0.14	0.16	0.31
9000	107.27	107.33	109.82	0.12	0.23	0.51	0.11	0.21	0.39
10000	104.79	104.10	104.31	0.08	0.28	0.60	0.08	0.26	0.47
11000	116.35	123.12	112.42	0.08	0.30	0.62	0.08	0.28	0.48
12000	108.22	102.96	107.07	0.07	0.27	0.59	0.08	0.27	0.45
13000	113.35	106.87	119.50	0.06	0.23	0.53	0.09	0.25	0.42
14000	111.70	105.80	103.61	0.05	0.18	0.42	0.06	0.23	0.34
15000	105.66	109.06	105.98	0.09	0.17	0.35	0.09	0.22	0.27
16000	106.98	111.71	117.02	0.21	0.19	0.35	0.12	0.21	0.20
17000	102.43	110.54	115.67	0.37	0.19	0.34	0.12	0.20	0.05
18000	107.61	112.15	102.81	0.38	0.15	0.31	0.13	0.19	0.03
19000	101.53	98.83	103.19	0.35	0.10	0.30	0.20	0.15	0.05
20000	102.81	99.44	102.66	0.30	0.05	0.28	0.13	0.17	0.08
21000	112.25	106.60	99.51	0.18	0.10	0.33	0.10	0.22	0.06
22000	99.71	100.66	103.87	0.38	0.03	0.26	0.18	0.23	0.07
23000	105.03	110.00	110.25	0.47	0.04	0.18	0.24	0.21	0.00
23500	96.65	99.46	101.28	0.53	0.04	0.15	0.30	0.20	0.02
23750	95.29	103.96	99.39	0.55	0.02	0.12	0.31	0.21	0.01
24000	95.69	102.46	103.84	0.58	0.01	0.12	0.30	0.21	0.03
24250	95.41	97.49	101.91	0.60	0.03	0.15	0.30	0.22	0.01
24500	99.56	99.66	98.81	0.63	0.04	0.16	0.26	0.23	0.02
24750	116.91	103.31	98.70	0.62	0.07	0.21	0.32	0.26	0.02
25000	96.87	108.60	101.05	0.61	0.11	0.24	0.37	0.27	0.02
25250	94.64	100.99	90.85	0.63	0.13	0.28	0.27	0.28	0.02
25500	98.68	102.32	111.00	0.62	0.14	0.38	0.31	0.23	0.04
26000	96.99	104.57	96.60	0.60	0.30	0.74	0.32	0.23	0.04
26500	94.04	96.73	99.35	1.63	1.14	0.72	0.07	0.41	0.10

Typical Performance Data

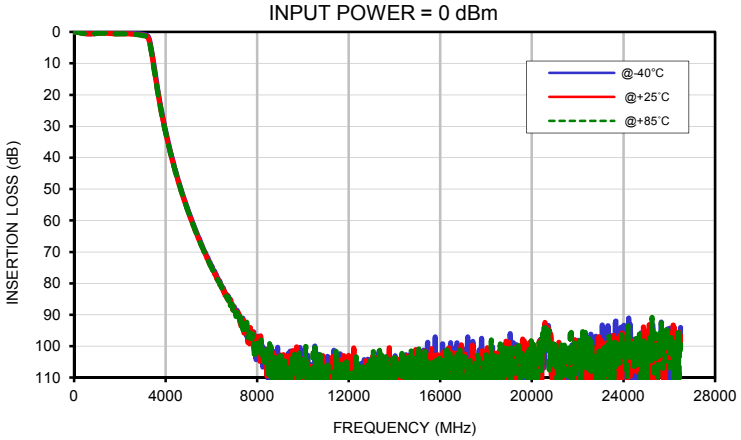
FREQ. (MHz)	GROUP DELAY (nsec)		
	@-40°C	@+25°C	@+85°C
10	0.51	0.50	0.51
20	0.50	0.50	0.51
50	0.50	0.50	0.50
100	0.50	0.49	0.49
150	0.50	0.49	0.48
200	0.50	0.48	0.48
250	0.49	0.48	0.47
300	0.49	0.47	0.46
350	0.48	0.47	0.46
400	0.48	0.46	0.45
450	0.47	0.46	0.45
500	0.47	0.46	0.45
550	0.47	0.46	0.45
600	0.47	0.46	0.45
650	0.47	0.46	0.45
700	0.47	0.46	0.45
750	0.47	0.46	0.45
800	0.48	0.46	0.45
850	0.48	0.47	0.46
900	0.48	0.47	0.46
1000	0.49	0.48	0.47
1100	0.50	0.49	0.48
1200	0.51	0.50	0.49
1300	0.52	0.50	0.49
1400	0.52	0.51	0.50
1500	0.52	0.51	0.50
1600	0.52	0.51	0.50
1700	0.52	0.51	0.50
1800	0.53	0.52	0.51
1900	0.54	0.53	0.52
2000	0.55	0.54	0.53
2100	0.57	0.55	0.55
2200	0.58	0.57	0.56
2300	0.60	0.58	0.57
2400	0.61	0.60	0.59
2500	0.63	0.62	0.61
2550	0.64	0.63	0.62
2600	0.66	0.64	0.63
2700	0.68	0.67	0.67
2750	0.70	0.69	0.68
2775	0.71	0.70	0.69
2800	0.72	0.71	0.70

Typical Performance Curves

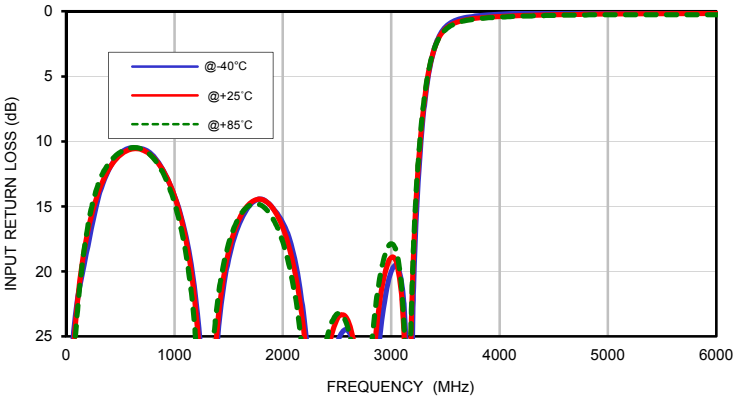
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



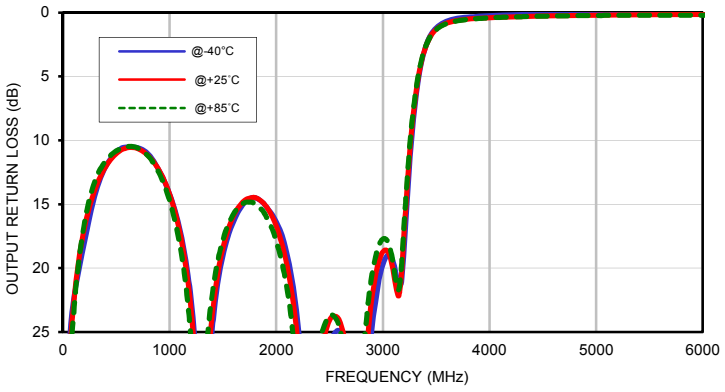
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



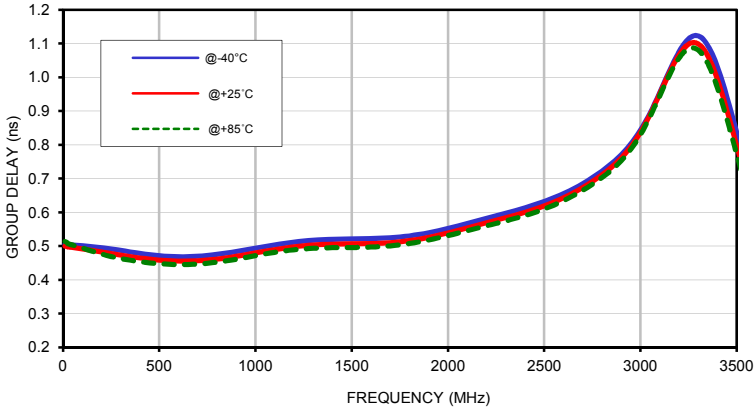
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



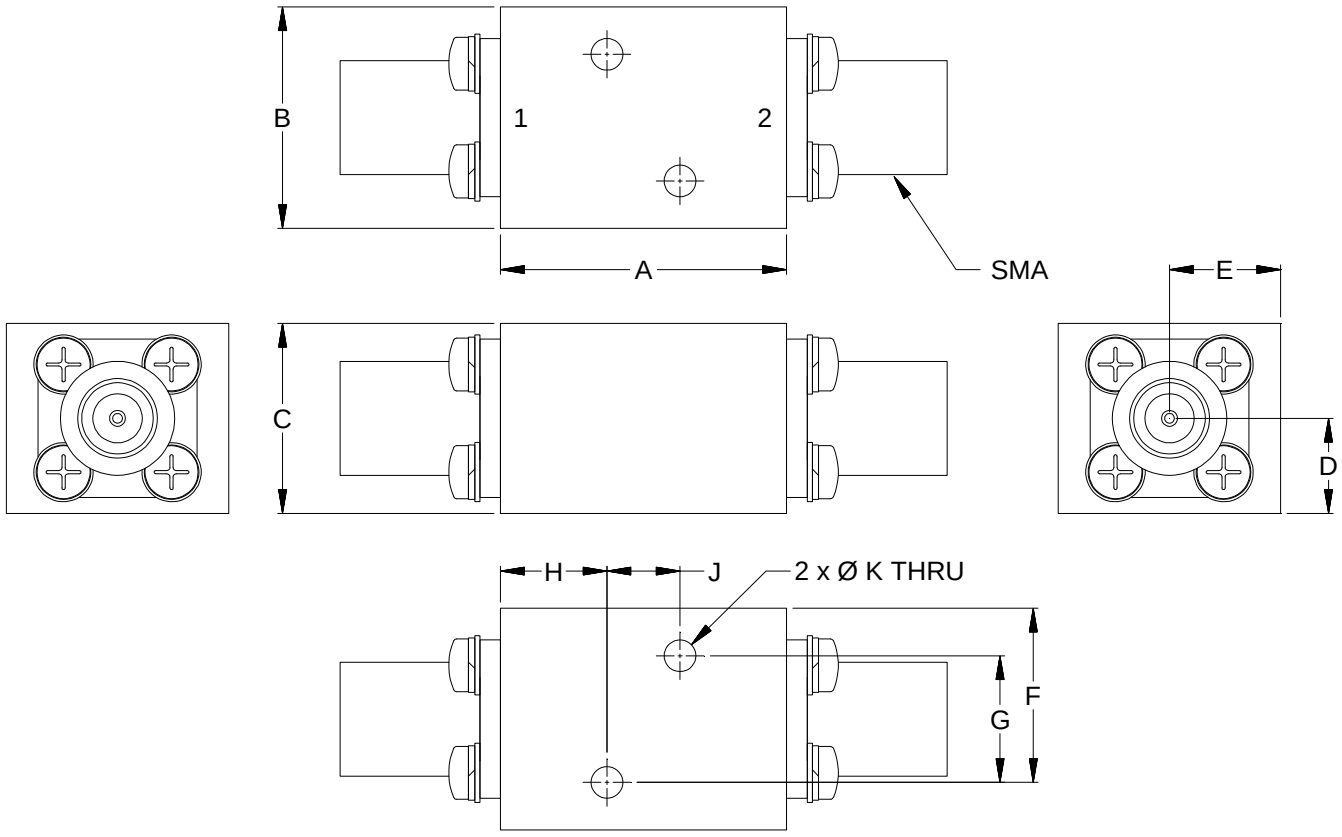
GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



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.

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