



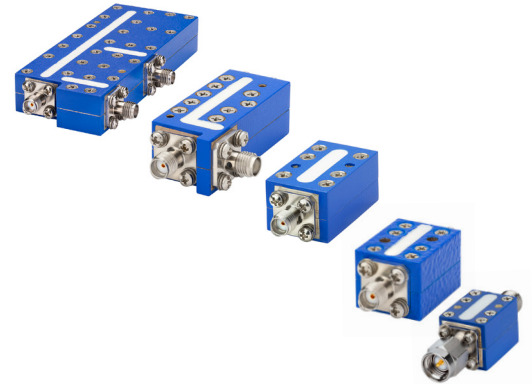
## SUSPENDED SUBSTRATE STRIPLINE

# 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-6R9G-S+

Mini-Circuits

50Ω DC to 6900 MHz SMA-Female

### FEATURES

- Low Insertion Loss, 0.6dB Typ.
- High Rejection of 90dB Typ.
- Stopband Up to 20 GHz
- Connectorized Package
- Small Size, 22.86 x 17.78 x 15.24 mm

### APPLICATIONS

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



Generic photo used for illustration purposes only

Model No.	ZLSS-6R9G-S+
Case Style	RA2456
Connectors	SMA-FEMALE

### +RoHS Compliant

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

### ELECTRICAL SPECIFICATIONS AT 25°C

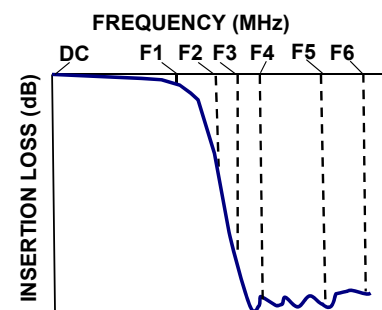
Parameter	F#	Frequency (MHz)	Min.	Typ.	Max.	Units	
Passband	Insertion Loss	DC-F1	DC - 6900	—	0.6	2.0	dB
	Return Loss	DC-F1	DC - 6900	—	15.5	—	dB
Stopband	Rejection	F2-F3	9800 - 11500	20	40	—	dB
		F3-F4	11500 - 13600	40	60	—	
		F4-F5	13600 - 18000	60	80	—	
		F5-F6	18000 - 20000	—	90	—	

### ABSOLUTE MAXIMUM RATINGS

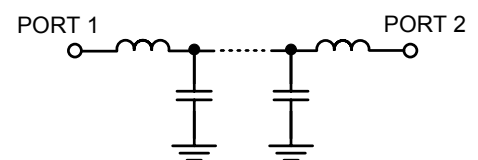
Parameter	Ratings
Operating temperature	-40°C to +85°C
Storage temperature	-55°C to +100°C
RF Power Input at Passband	10W max. at 25°C

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

### TYPICAL FREQUENCY RESPONSE



### FUNCTIONAL DIAGRAM



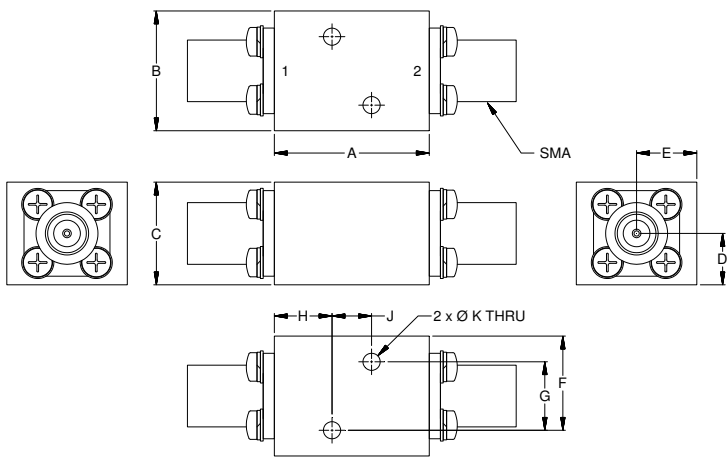
Mini-Circuits



### COAXIAL CONNECTIONS

PORT 1	SMA-Female
PORT 2	SMA-Female

### OUTLINE DRAWING



### OUTLINE DIMENSIONS (Inches/mm)

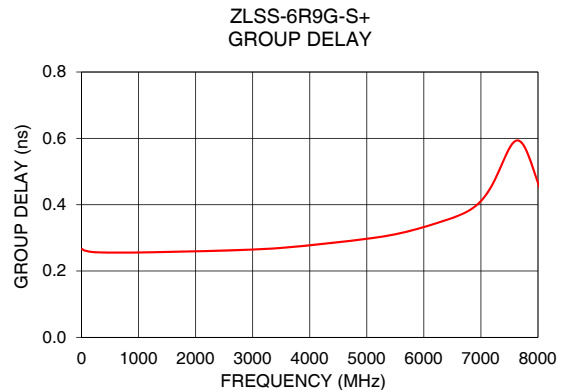
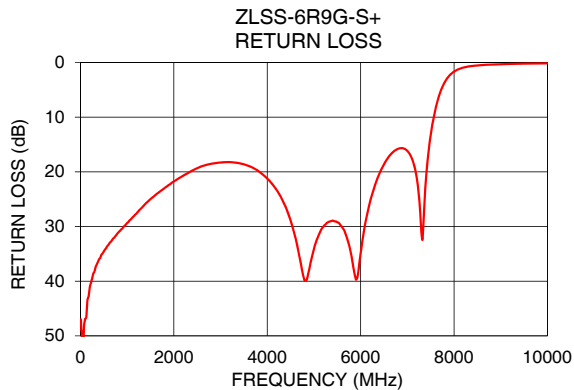
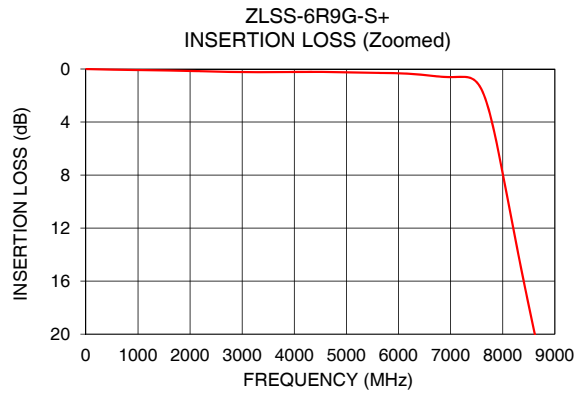
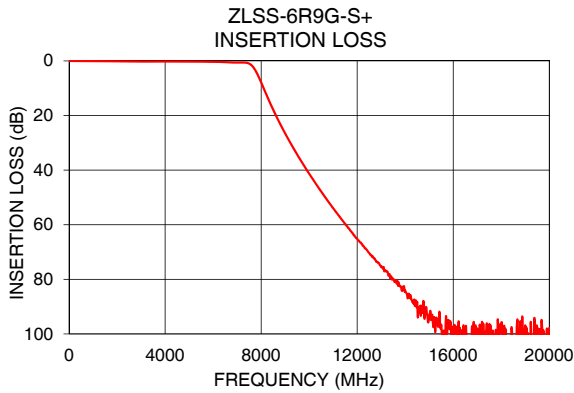
A	B	C	D	E	F	G	H	J	K	Wt.
.90	.70	.60	.30	.35	.55	.400	.34	.230	.100	grams
22.86	17.78	15.24	7.62	8.89	13.97	10.16	8.51	5.84	2.54	55

Note. Please refer to case style drawing for details



### TYPICAL PERFORMANCE DATA AT 25°C

Frequency (MHz)	Insertion Loss (dB)	Return Loss (dB)	Frequency (MHz)	GROUP DELAY (ns)
10	0.00	46.99	10	0.27
100	0.01	46.93	100	0.26
1000	0.08	29.35	700	0.26
4500	0.22	28.91	1000	0.26
5000	0.25	34.07	1400	0.26
6900	0.60	15.69	1800	0.26
7750	3.32	4.47	2200	0.26
8700	21.49	0.42	2600	0.26
9800	38.57	0.17	3000	0.26
10000	41.32	0.15	3400	0.27
11500	59.68	0.08	3800	0.27
13600	81.04	0.09	4000	0.28
14000	84.13	0.09	5000	0.30
18000	95.85	0.18	6000	0.33
20000	97.84	0.22	6900	0.40



- 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

## Low Pass Filter

## ZLSS-6R9G-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	0.00	0.00	0.01	46.83	46.99	42.31	46.35	46.72	41.33
20	0.00	0.00	0.01	49.30	49.01	48.60	50.25	50.40	48.36
50	0.00	0.00	0.01	59.48	58.53	53.73	69.94	58.91	49.93
100	0.00	0.01	0.02	50.41	46.93	44.83	53.18	48.34	44.84
150	0.00	0.01	0.02	44.90	43.46	42.58	46.76	44.74	43.16
200	0.01	0.02	0.03	41.10	41.12	40.52	41.83	41.71	41.34
250	0.01	0.02	0.03	38.58	39.51	38.94	39.14	40.02	39.92
500	0.03	0.05	0.06	34.26	34.55	34.37	34.30	34.78	34.61
750	0.04	0.06	0.08	31.19	31.74	31.75	31.04	31.81	31.56
1000	0.05	0.08	0.10	29.02	29.35	29.40	29.00	29.37	29.39
1250	0.06	0.09	0.11	26.88	27.12	27.18	26.96	27.18	27.39
1500	0.07	0.11	0.13	24.87	24.98	25.15	24.96	25.09	25.22
1750	0.09	0.13	0.15	23.28	23.30	23.57	23.10	23.18	23.33
2000	0.11	0.15	0.17	21.59	21.75	21.98	21.42	21.59	21.79
2250	0.13	0.17	0.19	20.33	20.45	20.60	20.31	20.41	20.55
2500	0.15	0.19	0.22	19.19	19.33	19.44	19.19	19.32	19.39
2750	0.17	0.21	0.24	18.44	18.62	18.70	18.36	18.54	18.58
3000	0.18	0.23	0.26	18.09	18.30	18.35	17.98	18.17	18.20
3250	0.19	0.24	0.27	18.11	18.26	18.24	18.09	18.21	18.17
3500	0.18	0.24	0.27	18.55	18.63	18.56	18.62	18.70	18.63
3750	0.17	0.23	0.27	19.55	19.53	19.47	19.67	19.67	19.59
4000	0.16	0.22	0.26	21.36	21.23	21.18	21.60	21.48	21.37
4250	0.15	0.22	0.25	24.47	23.97	23.84	25.10	24.59	24.42
4500	0.15	0.22	0.26	29.95	28.91	28.68	31.69	30.51	30.26
4550	0.15	0.22	0.27	31.58	30.34	30.12	33.93	32.39	32.06
4600	0.15	0.22	0.27	33.35	31.92	31.71	36.89	34.76	34.29
4750	0.16	0.23	0.28	38.58	38.24	38.23	51.47	49.96	47.74
5000	0.18	0.25	0.29	32.23	34.07	34.47	32.10	33.87	34.34
5100	0.18	0.26	0.30	30.46	31.60	31.99	30.20	31.28	31.66
5250	0.19	0.27	0.31	29.19	29.59	29.87	28.85	29.23	29.42
5300	0.20	0.28	0.32	29.01	29.22	29.52	28.58	28.82	28.96
5400	0.20	0.28	0.33	29.08	28.93	29.34	28.65	28.62	28.77
5525	0.21	0.29	0.33	29.82	29.29	29.67	29.37	29.01	29.26
6000	0.24	0.32	0.37	32.95	34.91	35.09	33.54	35.58	36.24
6900	0.49	0.60	0.65	15.63	15.69	15.94	15.56	15.63	15.90
7800	3.71	4.11	4.29	3.70	3.60	3.64	3.66	3.57	3.58
8000	7.39	7.87	8.09	1.63	1.66	1.71	1.58	1.62	1.65
8800	22.82	23.23	23.52	0.28	0.38	0.44	0.24	0.34	0.37
9000	26.19	26.57	26.84	0.21	0.31	0.36	0.18	0.28	0.31
9500	33.94	34.29	34.54	0.11	0.21	0.27	0.08	0.18	0.20
9600	35.40	35.74	36.00	0.10	0.20	0.26	0.07	0.17	0.20
9800	38.24	38.57	38.80	0.07	0.17	0.22	0.05	0.14	0.17
10000	40.99	41.32	41.54	0.06	0.15	0.21	0.03	0.12	0.15
11100	54.78	55.17	55.29	0.01	0.10	0.16	0.03	0.06	0.10
11500	59.37	59.68	59.84	0.00	0.08	0.14	0.04	0.06	0.09
12000	64.69	65.17	65.25	0.01	0.08	0.13	0.04	0.05	0.09
13600	81.19	81.04	80.96	0.01	0.09	0.17	0.05	0.05	0.10
14000	84.34	84.13	85.30	0.01	0.09	0.17	0.03	0.07	0.11
14500	90.12	88.42	88.45	0.01	0.10	0.16	0.03	0.07	0.12
15000	90.60	93.13	92.69	0.00	0.11	0.20	0.04	0.07	0.11
15500	98.77	96.63	106.59	0.02	0.12	0.19	0.03	0.08	0.13
16000	96.09	97.32	100.36	0.03	0.13	0.21	0.04	0.06	0.12
16500	101.48	114.11	99.56	0.04	0.14	0.21	0.02	0.09	0.14
17000	102.16	108.95	100.91	0.06	0.16	0.25	0.02	0.09	0.15
17500	96.22	96.90	110.38	0.08	0.17	0.26	0.03	0.09	0.13
18000	104.84	95.85	99.31	0.08	0.18	0.26	0.01	0.12	0.17
18500	100.75	103.81	98.64	0.09	0.19	0.30	0.01	0.11	0.18
19000	108.40	96.99	109.07	0.09	0.21	0.31	0.01	0.13	0.19
19500	105.65	97.66	101.11	0.08	0.21	0.29	0.04	0.16	0.24
20000	105.49	97.84	102.14	0.09	0.22	0.33	0.02	0.14	0.21

# Suspended substrate stripline Low Pass Filter

## ZLSS-6R9G-S+

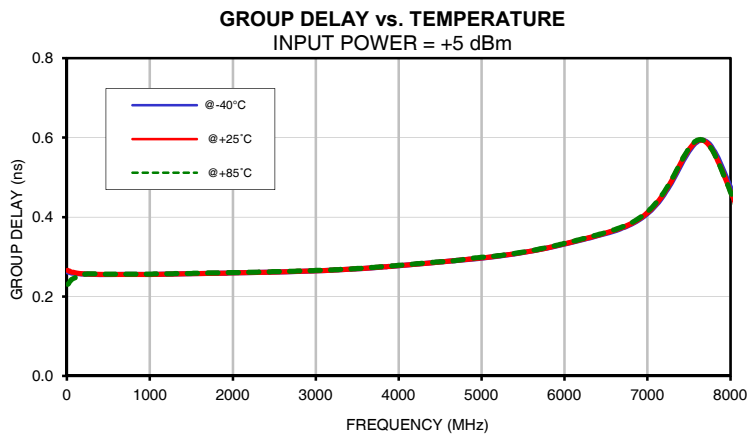
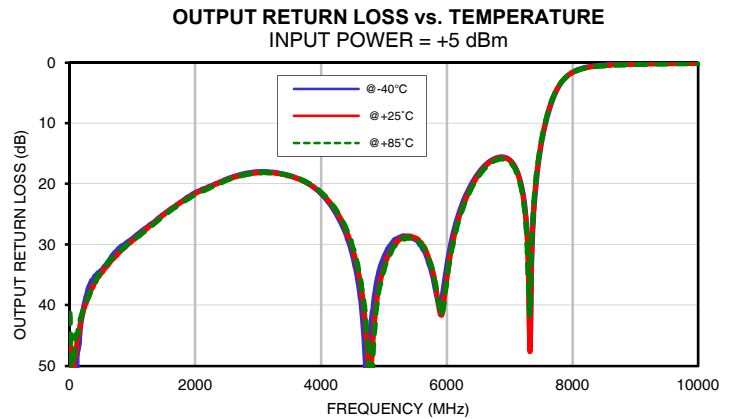
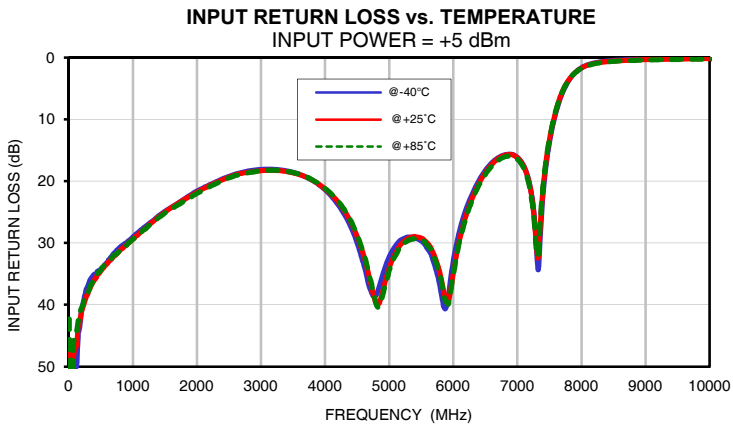
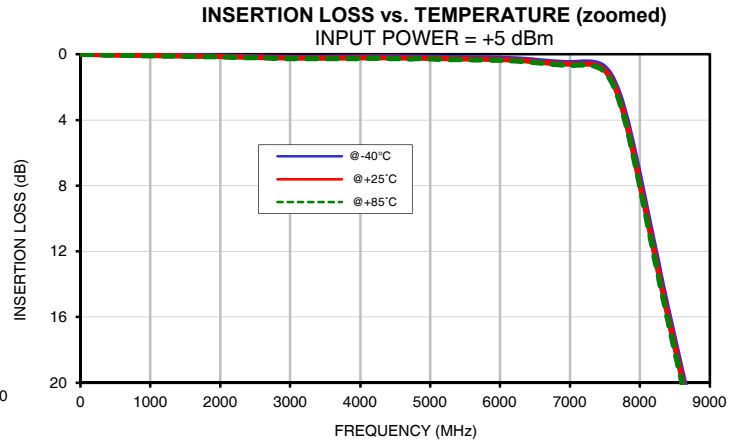
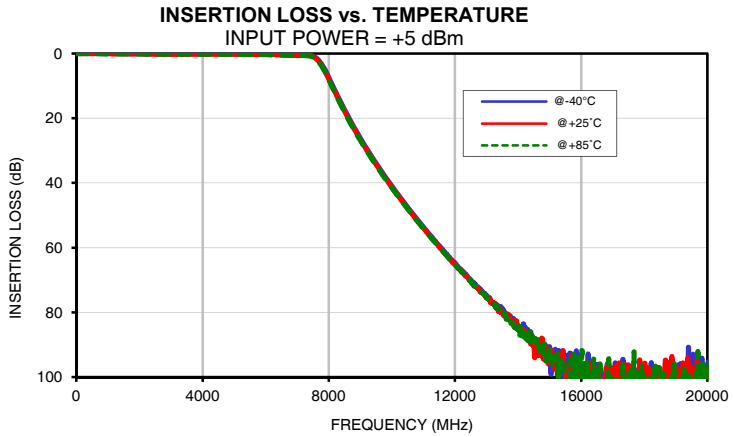
### Typical Performance Data

FREQ.  (MHz)	GROUP DELAY		
	(nsec)		
	@-40°C	@+25°C	@+85°C
10	0.26	0.27	0.23
20	0.26	0.26	0.23
50	0.26	0.26	0.24
100	0.26	0.26	0.25
200	0.26	0.26	0.26
300	0.26	0.26	0.26
400	0.26	0.26	0.26
500	0.26	0.26	0.26
600	0.26	0.26	0.26
700	0.26	0.26	0.26
800	0.26	0.26	0.26
900	0.26	0.26	0.26
1000	0.26	0.26	0.26
1100	0.26	0.26	0.26
1200	0.26	0.26	0.26
1300	0.26	0.26	0.26
1400	0.26	0.26	0.26
1500	0.26	0.26	0.26
1750	0.26	0.26	0.26
2000	0.26	0.26	0.26
2100	0.26	0.26	0.26
2200	0.26	0.26	0.26
2300	0.26	0.26	0.26
2400	0.26	0.26	0.26
2500	0.26	0.26	0.26
2600	0.26	0.26	0.26
2700	0.26	0.26	0.26
2800	0.26	0.26	0.26
2900	0.26	0.26	0.27
3000	0.26	0.26	0.27
3500	0.27	0.27	0.27
3800	0.27	0.27	0.28
4000	0.28	0.28	0.28
4500	0.29	0.29	0.29
4800	0.29	0.29	0.29
5000	0.30	0.30	0.30
5500	0.31	0.31	0.31
6000	0.33	0.33	0.33
6100	0.34	0.34	0.34
6500	0.36	0.36	0.36
6900	0.39	0.40	0.40

# Suspended substrate stripline Low Pass Filter

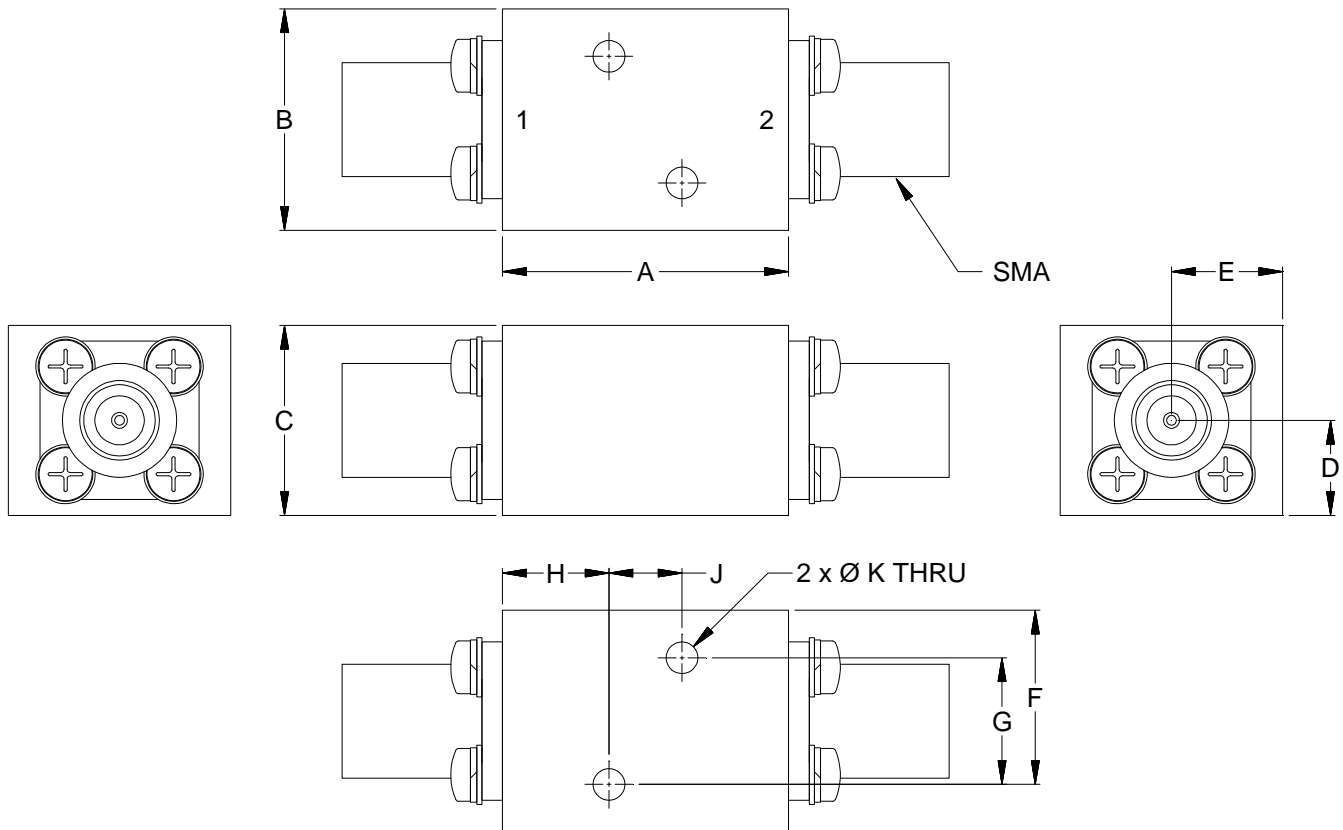
## ZLSS-6R9G-S+

### Typical Performance Curves



## 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.  $\pm .05$ ; 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](http://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