

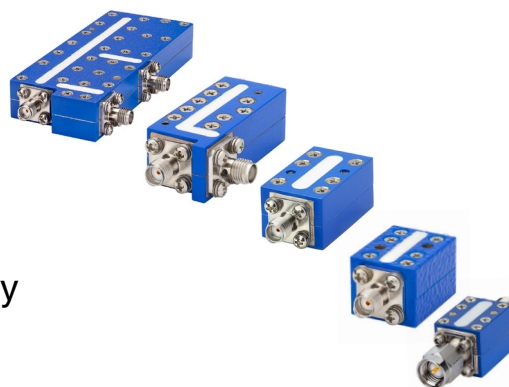
Suspended Substrate Stripline Filters and Multiplexers

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 stop-band 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 Low Pass Filter

50Ω DC to 4000 MHz

ZLSS-4G-S+



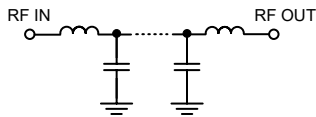
Features

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

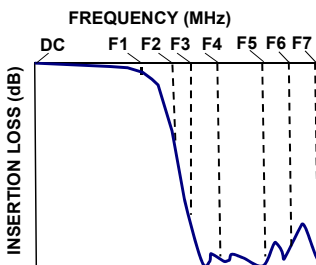
Applications

- 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

Generic photo used for illustration purposes only

CASE STYLE: RA2456

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

Electrical Specifications at 25°C

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

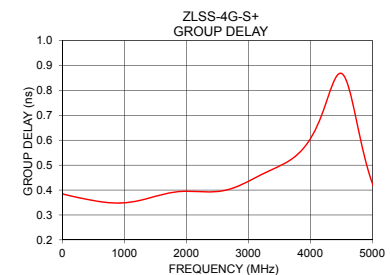
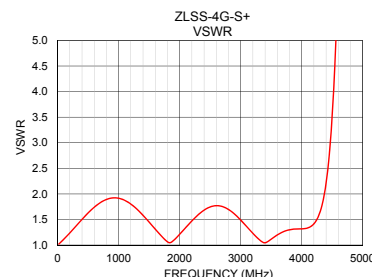
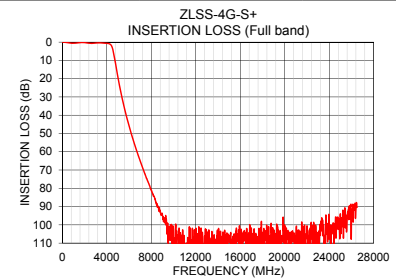
Maximum Ratings

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	1.01	10	0.38
100	0.02	1.11	100	0.38
1000	0.61	1.92	250	0.37
4000	0.67	1.32	500	0.36
4400	1.72	2.21	750	0.35
4500	3.08	3.52	1000	0.35
4800	12.14	18.38	1250	0.36
5050	20.72	37.90	1500	0.37
5400	31.16	59.29	1750	0.39
5500	33.83	63.62	2000	0.40
6000	45.74	80.16	2250	0.39
6300	51.98	84.43	2500	0.39
7500	73.22	77.52	2750	0.41
9500	99.32	50.75	3000	0.43
12500	107.31	52.61	3250	0.47
15000	105.89	80.51	3500	0.50
17500	123.13	349.41	3750	0.53
20000	125.57	161.84	3800	0.54
25000	93.97	111.38	3900	0.57
26500	90.40	1032.92	4000	0.61



Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuits' applicable established test performance criteria and measurement instructions.
- 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



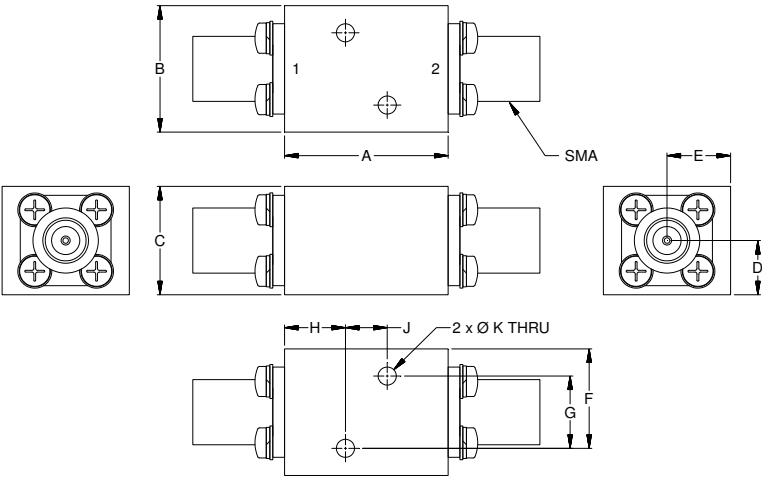
www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

REV.B
ECO-011269
ZLSS-4G-S+
EDU2930
URJ
220330
Page 2 of 3

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

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-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	0.01	0.01	0.01	47.16	43.72	55.96	59.48	44.37	48.55
20	0.01	0.01	0.01	35.97	39.43	39.49	35.99	39.50	38.97
50	0.01	0.01	0.01	29.49	31.34	32.82	29.57	31.29	32.97
100	0.02	0.02	0.02	24.61	25.38	26.24	24.54	25.43	26.20
150	0.03	0.04	0.05	22.42	21.90	22.25	22.40	21.93	22.26
200	0.06	0.08	0.08	20.63	19.47	19.22	20.70	19.48	19.28
250	0.08	0.11	0.13	18.92	17.61	17.11	18.94	17.62	17.13
500	0.32	0.34	0.37	12.37	12.42	12.15	12.38	12.44	12.18
750	0.51	0.54	0.57	10.37	10.40	10.30	10.37	10.40	10.31
1000	0.56	0.61	0.63	10.12	10.06	10.13	10.12	10.06	10.14
1250	0.47	0.53	0.53	11.19	11.24	11.55	11.19	11.25	11.57
1500	0.30	0.35	0.36	14.50	14.74	15.36	14.53	14.78	15.42
1750	0.17	0.23	0.26	24.02	25.15	26.63	24.17	25.56	27.47
2000	0.20	0.28	0.32	21.22	20.37	20.14	21.14	20.37	20.19
2250	0.37	0.47	0.50	13.78	13.54	13.69	13.76	13.52	13.68
2500	0.55	0.64	0.66	11.23	11.32	11.61	11.23	11.31	11.59
2750	0.58	0.65	0.68	11.09	11.45	11.86	11.09	11.44	11.83
3000	0.45	0.53	0.57	13.43	14.11	14.67	13.42	14.10	14.64
3250	0.30	0.41	0.48	21.66	22.18	23.11	21.72	22.31	23.32
3500	0.32	0.44	0.52	26.21	25.25	24.98	27.04	26.09	25.79
3750	0.43	0.56	0.63	18.12	18.10	18.54	18.13	18.11	18.44
4000	0.53	0.67	0.74	16.59	17.26	18.17	16.50	17.13	17.78
4250	0.76	0.94	1.04	13.89	13.95	14.46	14.07	14.13	14.60
4500	2.66	3.08	3.29	5.23	5.07	5.10	5.33	5.15	5.17
4550	3.67	4.14	4.39	3.84	3.77	3.78	3.93	3.82	3.84
4600	4.93	5.45	5.72	2.78	2.77	2.81	2.86	2.81	2.84
4750	9.83	10.37	10.63	1.10	1.19	1.25	1.13	1.20	1.25
5000	18.71	19.08	19.26	0.41	0.51	0.55	0.40	0.51	0.55
5100	21.97	22.33	22.49	0.33	0.42	0.46	0.31	0.41	0.45
5250	26.53	26.90	27.02	0.25	0.34	0.37	0.24	0.33	0.37
5300	28.00	28.36	28.47	0.23	0.32	0.35	0.22	0.32	0.35
5400	30.83	31.16	31.25	0.20	0.29	0.32	0.19	0.29	0.32
5500	33.52	33.83	33.90	0.18	0.27	0.30	0.16	0.27	0.30
6000	45.37	45.74	45.77	0.10	0.22	0.26	0.08	0.21	0.27
6300	51.61	51.98	52.03	0.08	0.21	0.27	0.05	0.19	0.26
7000	64.53	64.93	65.02	0.05	0.21	0.31	0.03	0.16	0.29
7500	73.03	73.22	73.11	0.04	0.22	0.37	0.05	0.15	0.31
8000	81.23	81.15	81.72	0.06	0.25	0.43	0.07	0.15	0.34
8500	87.71	88.35	87.55	0.07	0.28	0.49	0.06	0.15	0.38
9000	95.24	94.33	96.13	0.09	0.32	0.54	0.05	0.17	0.41
9500	98.31	99.32	106.51	0.10	0.34	0.58	0.05	0.17	0.44
10000	103.12	112.25	102.24	0.10	0.36	0.61	0.03	0.19	0.46
10500	103.32	102.03	111.71	0.09	0.37	0.62	0.01	0.20	0.47
11000	103.99	111.39	108.64	0.07	0.37	0.63	0.00	0.20	0.48
11500	110.90	101.87	122.63	0.04	0.36	0.62	0.01	0.18	0.46
12000	108.31	104.19	103.69	0.01	0.35	0.61	0.03	0.17	0.44
13000	119.80	103.82	117.58	0.04	0.31	0.59	0.04	0.13	0.39
14000	108.96	105.20	112.49	0.08	0.26	0.53	0.08	0.12	0.32
15000	122.63	105.89	112.16	0.13	0.22	0.45	0.07	0.13	0.27
16000	103.82	102.92	102.40	0.20	0.16	0.35	0.00	0.13	0.23
17000	111.82	101.91	108.43	0.28	0.09	0.28	0.17	0.06	0.17
18000	112.79	104.31	108.44	0.30	0.01	0.24	0.41	0.07	0.17
19000	108.75	112.07	105.44	0.27	0.05	0.23	0.36	0.15	0.10
20000	112.90	125.57	113.82	0.23	0.11	0.24	0.20	0.17	0.12
21000	111.12	106.46	109.55	0.17	0.15	0.23	0.06	0.14	0.11
22000	102.68	100.53	104.27	0.14	0.16	0.25	0.01	0.07	0.17
23000	102.68	104.25	103.60	0.07	0.16	0.26	0.06	0.01	0.23
25000	102.14	93.97	103.02	0.10	0.16	0.25	0.08	0.01	0.26
26000	97.01	95.41	93.91	0.13	0.15	0.33	0.13	0.06	0.32
26500	97.78	90.40	95.67	0.35	0.02	0.51	0.36	0.17	0.39

Suspended substrate stripline

Low Pass Filter

ZLSS-4G-S+

Typical Performance Data

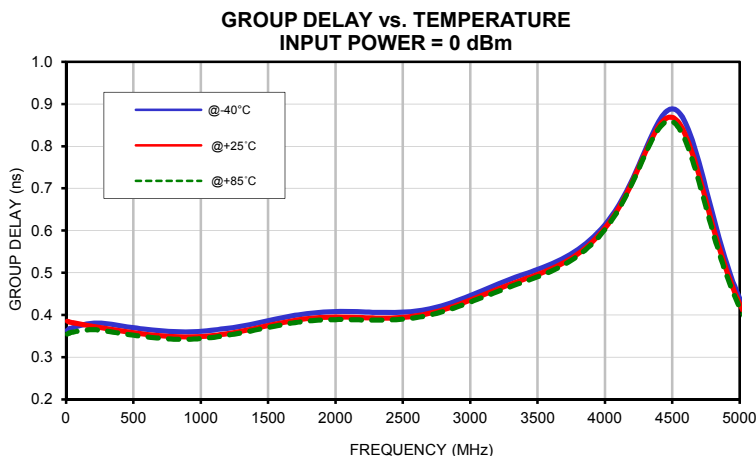
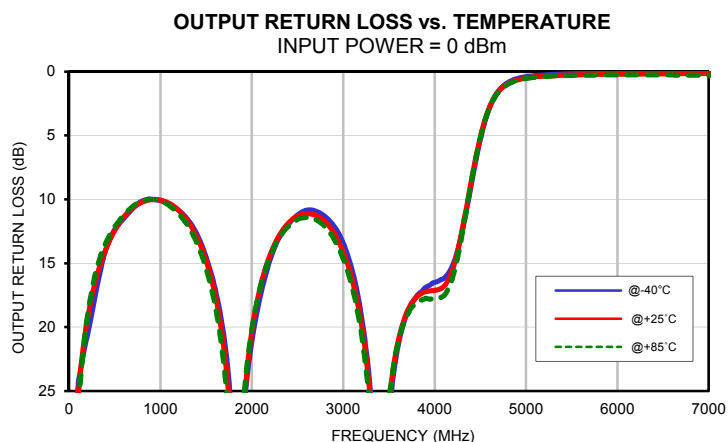
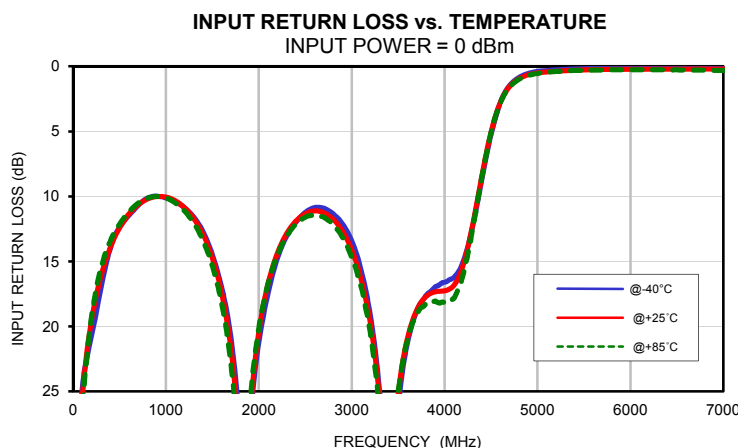
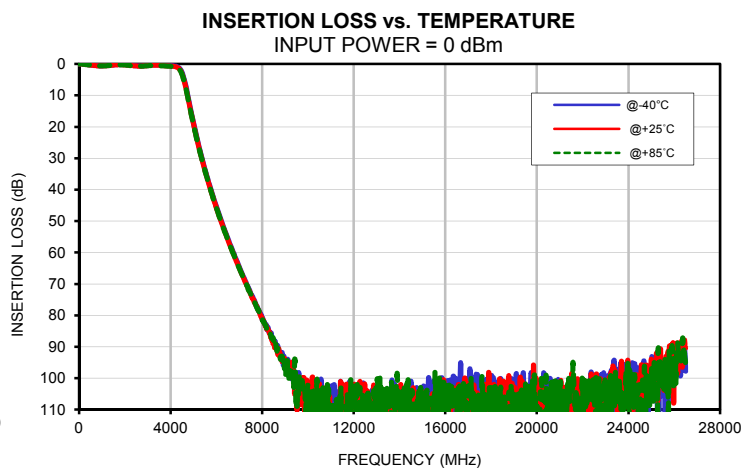
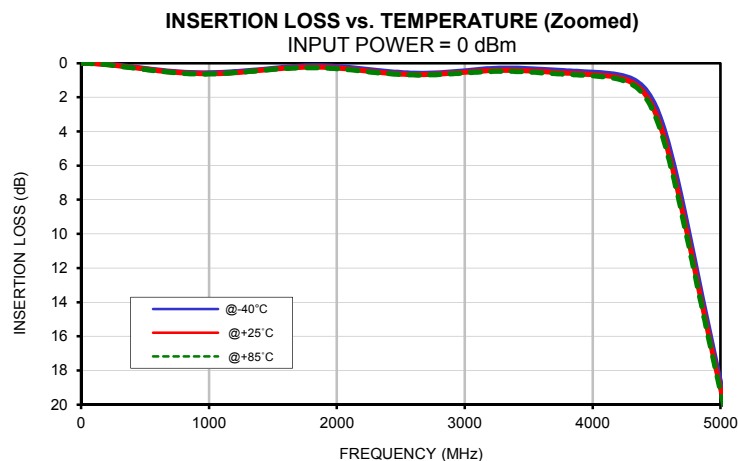
FREQ.	GROUP DELAY		
(MHz)	(nsec)		
	@-40°C	@+25°C	@+85°C
10	0.36	0.38	0.35
20	0.37	0.38	0.36
50	0.37	0.38	0.36
100	0.37	0.38	0.36
200	0.38	0.37	0.37
300	0.38	0.37	0.36
400	0.37	0.36	0.36
500	0.37	0.36	0.35
600	0.37	0.35	0.35
700	0.36	0.35	0.34
800	0.36	0.35	0.34
900	0.36	0.35	0.34
1000	0.36	0.35	0.34
1100	0.36	0.35	0.35
1200	0.37	0.36	0.35
1300	0.37	0.36	0.36
1400	0.38	0.37	0.36
1500	0.39	0.37	0.37
1750	0.40	0.39	0.38
2000	0.41	0.40	0.39
2100	0.41	0.39	0.39
2200	0.41	0.39	0.39
2300	0.41	0.39	0.39
2400	0.41	0.39	0.39
2500	0.41	0.39	0.39
2600	0.41	0.40	0.39
2700	0.41	0.40	0.40
2800	0.42	0.41	0.41
2900	0.43	0.42	0.42
3000	0.45	0.43	0.43
3100	0.46	0.45	0.44
3200	0.47	0.46	0.46
3300	0.48	0.47	0.47
3400	0.50	0.48	0.48
3500	0.51	0.50	0.49
3600	0.52	0.51	0.50
3700	0.54	0.52	0.52
3800	0.56	0.54	0.54
3900	0.58	0.57	0.57
3950	0.60	0.59	0.58
4000	0.61	0.61	0.60

Suspended substrate stripline

Low Pass Filter

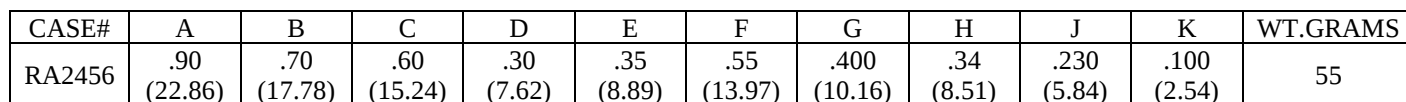
ZLSS-4G-S+

Typical Performance Curves



RA

RA2456



Sheet 1 of 1



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