

# 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](http://www.minicircuits.com/MCLStore/terms.jsp)



# Suspended substrate stripline Band Pass Filter

## ZBSS-6G-S+

50Ω 4000 to 8000 MHz



Generic photo used for illustration purposes only

CASE STYLE: WD3296  
Connectors Model  
SMA-F ZBSS-6G-S+

### Features

- Wide fractional bandwidth design of 66.7%
- 0.8dB typ. Insertion Loss at Center frequency
- Sharp roll-off
- High rejection floor of 90dB typ.
- Stop band up to 26.5 GHz
- Connectorized package

### Applications

- Satellite communications
- Radiolocation
- Radio Navigation
- Military and defense
- Electronic warfare receiver
- Wideband receivers
- Space Research

### Electrical Specifications at 25°C

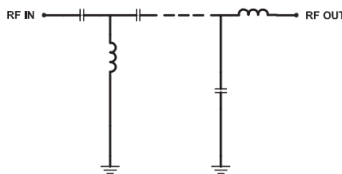
Parameter	F#	Frequency (MHz)	Min.	Typ.	Max.	Unit	
<b>Pass Band</b>	Center Frequency	Fc	6000	-	0.8	-	dB
	Insertion Loss	F1-F2	4000 - 8000	-	1.3	2.5	dB
	VSWR	F1-F2	4000 - 8000	-	1.3	-	:1
<b>Stop Band, Lower</b>	Insertion Loss	DC-F3	DC - 2200	60	90	-	dB
		F3-F4	2200 - 2500	40	60	-	dB
		F4-F5	2500 - 2800	20	40	-	dB
<b>Stop Band, Upper</b>	Insertion Loss	F6-F7	10500 - 12400	20	40	-	dB
		F7-F8	12400 - 15000	40	60	-	dB
		F8-F9	15000 - 25000	60	90	-	dB
		F9-F10	25000 - 26500	-	90	-	dB

### Maximum Ratings

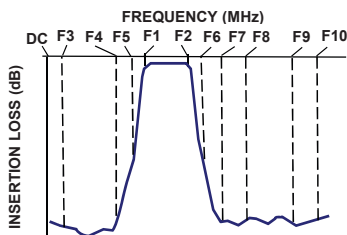
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	10W max. @ 25°C

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

### Functional Schematic



### Typical Frequency Response

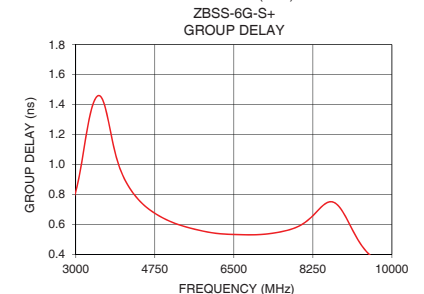
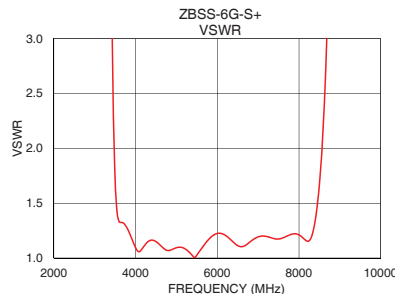
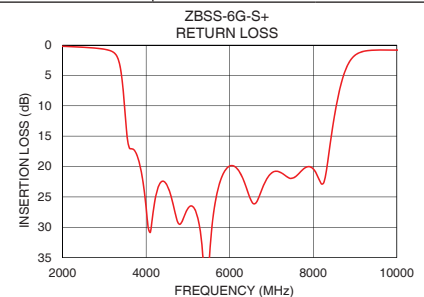
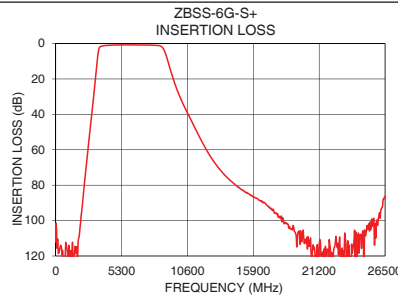


### Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
10	108.23	8482.31	4000	0.96
1000	132.80	388.81	4200	0.84
2200	86.57	65.35	4400	0.76
2500	65.69	47.19	4600	0.71
2800	45.91	33.42	4800	0.66
3000	32.92	25.04	5000	0.63
3200	19.24	15.53	5200	0.61
3450	3.59	2.47	5400	0.59
4000	1.10	1.10	5600	0.57
5000	0.81	1.09	5800	0.56
6000	0.81	1.22	6000	0.54
7000	0.84	1.19	6200	0.54
8000	1.02	1.21	6400	0.53
8700	3.49	3.24	6600	0.53
9500	21.04	20.89	6800	0.53
10500	37.86	21.81	7000	0.53
12400	63.30	39.71	7200	0.53
15000	82.68	35.51	7400	0.54
25000	105.27	18.05	7600	0.55
26500	86.34	1.71	8000	0.60

### +RoHS Compliant

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



### Notes

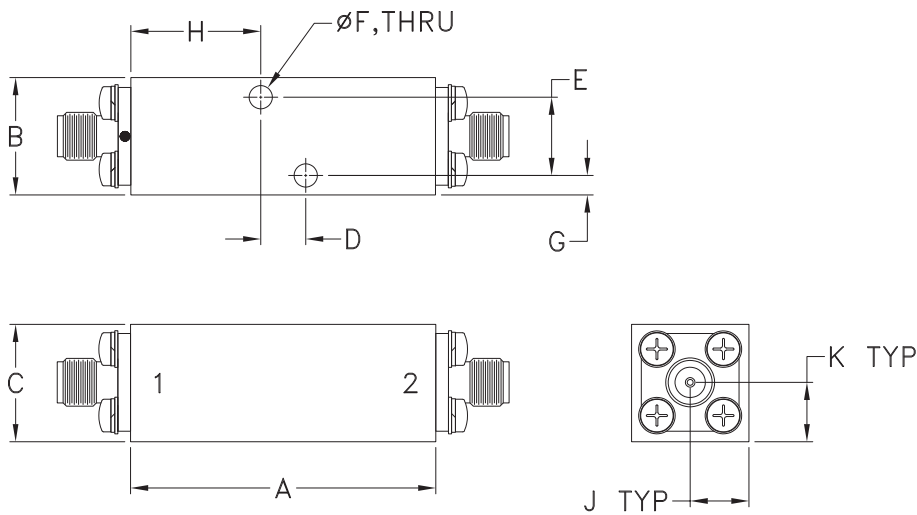
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## Coaxial Connections

PORT - 1	SMA FEMALE
PORT - 2	SMA FEMALE

## Outline Drawing



## Outline Dimensions ( $\frac{\text{inch}}{\text{mm}}$ )

A	B	C	D	E	F
1.56	.60	.60	.230	.400	.110
39.6	15.2	15.2	5.84	10.16	2.80
G	H	J	K	Wt.	
.10	.66	.30	.30	grams	
2.5	16.9	7.6	7.7	72	

Note: Please refer to case style drawing for details

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# Suspended substrate stripline

## Band Pass Filter

## ZBSS-6G-S+

### Typical Performance Data

FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
	(dB)			(dB)			(dB)		
	(MHz)	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C
10	104.75	108.23	102.18	0.00	0.00	0.00	0.00	0.00	0.00
50	103.16	104.32	101.41	0.00	0.00	0.00	0.00	0.00	0.00
100	120.46	115.56	126.29	0.00	0.00	0.00	0.00	0.00	0.00
200	125.30	118.60	118.49	0.01	0.00	0.01	0.01	0.01	0.01
300	120.66	116.29	116.73	0.01	0.00	0.01	0.00	0.02	0.03
400	111.76	113.96	125.98	0.01	0.00	0.02	0.02	0.04	0.05
500	119.47	119.40	125.92	0.01	0.01	0.02	0.05	0.07	0.09
600	117.47	124.64	116.04	0.01	0.01	0.03	0.08	0.11	0.12
700	124.92	123.37	113.20	0.00	0.02	0.04	0.12	0.15	0.17
800	129.20	112.57	120.59	0.00	0.03	0.04	0.16	0.20	0.22
900	131.31	116.04	117.50	0.01	0.04	0.05	0.20	0.24	0.27
1000	124.59	132.80	119.56	0.01	0.04	0.06	0.23	0.28	0.31
1100	112.16	125.71	119.40	0.02	0.06	0.08	0.25	0.30	0.33
1200	118.19	116.98	122.74	0.03	0.07	0.09	0.26	0.32	0.34
1500	114.95	118.45	114.25	0.07	0.11	0.13	0.25	0.31	0.34
1800	114.64	111.31	118.04	0.12	0.17	0.19	0.23	0.30	0.33
2000	100.21	100.90	102.01	0.16	0.21	0.24	0.27	0.34	0.38
2200	87.08	86.57	86.33	0.20	0.27	0.30	0.36	0.44	0.48
2500	66.09	65.69	65.50	0.29	0.37	0.41	0.57	0.67	0.72
2800	46.30	45.91	45.74	0.43	0.52	0.57	0.71	0.84	0.90
3000	33.31	32.92	32.75	0.57	0.69	0.76	0.75	0.88	0.96
3200	19.66	19.24	19.06	0.93	1.12	1.22	1.01	1.20	1.31
3300	12.45	12.04	11.88	1.55	1.85	2.01	1.67	1.99	2.16
3450	3.61	3.59	3.60	6.59	7.47	7.90	7.50	8.63	9.21
4000	0.94	1.10	1.18	25.82	26.81	27.31	28.41	30.44	31.66
4500	0.77	0.91	0.98	22.69	23.09	23.23	21.11	21.45	21.57
5000	0.68	0.81	0.88	25.97	26.90	27.23	24.03	24.62	24.84
5500	0.63	0.76	0.83	39.31	37.20	35.57	34.57	33.50	32.18
5800	0.65	0.79	0.85	21.62	21.91	22.02	20.14	20.39	20.45
6000	0.68	0.81	0.87	19.41	19.91	20.24	18.32	18.81	19.08
6200	0.67	0.81	0.87	20.03	20.54	21.07	19.49	20.13	20.59
6500	0.64	0.78	0.85	25.59	25.40	25.94	28.60	28.71	29.45
7000	0.69	0.84	0.91	20.83	21.09	21.28	19.61	20.05	20.32
7500	0.73	0.89	0.96	22.10	21.91	22.02	24.51	24.27	24.27
8000	0.84	1.02	1.10	20.09	20.41	19.95	19.07	19.52	19.40
8700	3.02	3.49	3.74	5.74	5.54	5.40	5.74	5.49	5.29
9050	9.99	10.61	10.88	1.31	1.44	1.52	1.17	1.24	1.27
9500	20.48	21.04	21.24	0.67	0.83	0.93	0.31	0.41	0.46
10000	29.87	30.34	30.52	0.67	0.83	0.92	0.16	0.27	0.32
10500	37.42	37.86	38.03	0.63	0.80	0.87	0.13	0.24	0.29
11000	44.41	44.87	45.01	0.49	0.64	0.73	0.11	0.24	0.29
11500	51.42	51.91	52.05	0.35	0.50	0.59	0.09	0.22	0.29
12000	58.09	58.52	58.75	0.30	0.45	0.53	0.09	0.21	0.30
12400	62.93	63.30	63.51	0.29	0.44	0.51	0.10	0.21	0.31
13000	69.09	69.34	69.58	0.31	0.44	0.52	0.09	0.20	0.32
13500	73.20	73.60	73.75	0.31	0.45	0.53	0.07	0.18	0.32
14000	76.79	77.11	77.20	0.31	0.45	0.54	0.10	0.21	0.35
14500	79.81	80.11	80.18	0.28	0.46	0.54	0.09	0.19	0.34
15000	82.45	82.68	82.95	0.30	0.49	0.58	0.07	0.18	0.32
16000	86.24	87.04	87.31	0.45	0.64	0.73	0.06	0.18	0.31
17000	90.85	91.53	91.55	0.57	0.74	0.87	0.07	0.19	0.30
18000	97.85	97.76	97.65	0.37	0.57	0.67	0.07	0.19	0.28
19000	104.91	104.55	107.95	0.37	0.55	0.65	0.07	0.21	0.28
20000	110.08	112.99	111.53	0.48	0.65	0.76	0.09	0.23	0.30
21000	128.98	117.88	114.33	0.46	0.63	0.74	0.10	0.24	0.32
22000	113.02	110.97	114.57	0.25	0.45	0.56	0.08	0.24	0.31
23000	111.60	117.01	125.31	0.21	0.43	0.54	0.07	0.24	0.31
24000	117.07	111.81	124.26	0.46	0.67	0.78	0.08	0.24	0.32
25000	116.23	105.27	105.91	0.79	0.96	1.08	0.09	0.24	0.33
26500	86.28	86.34	86.98	10.92	11.59	10.51	0.13	0.28	0.39

# Suspended substrate stripline Band Pass Filter

## ZBSS-6G-S+

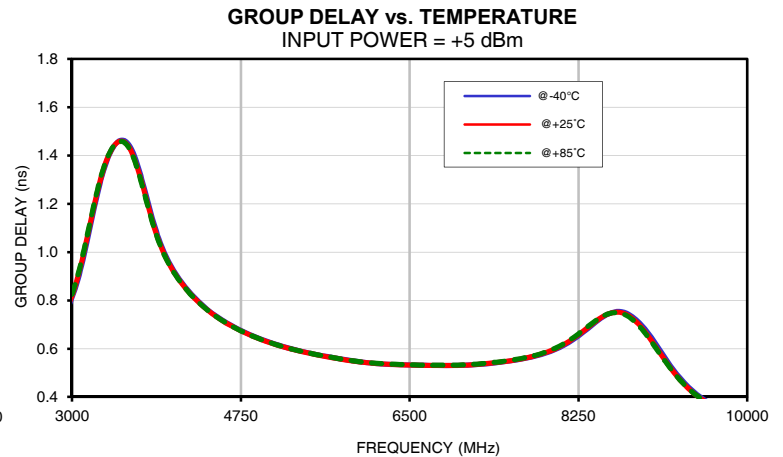
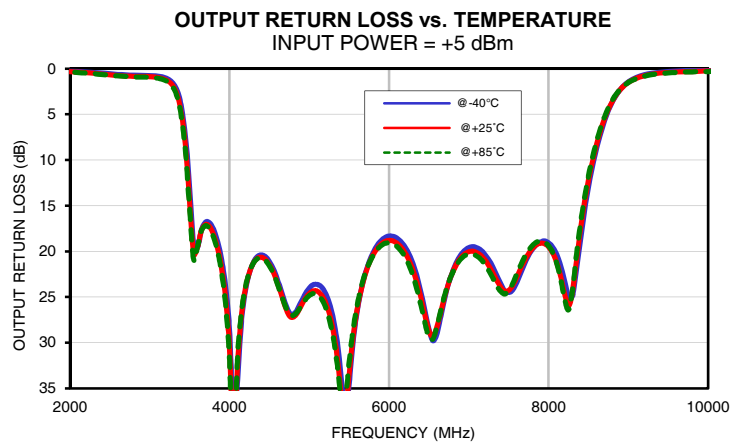
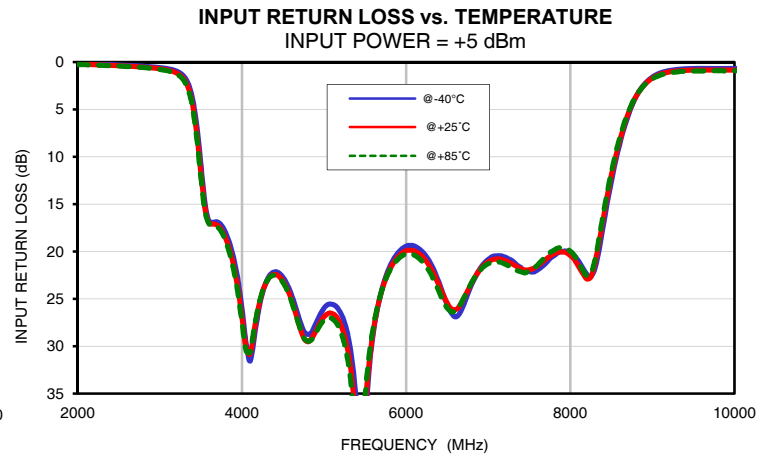
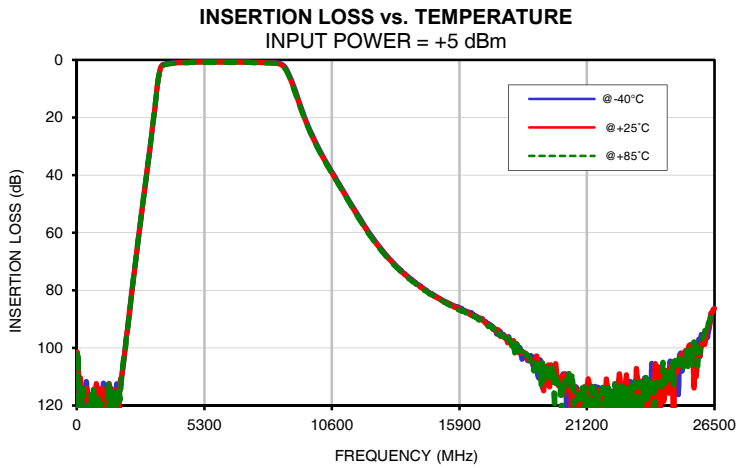
### Typical Performance Data

FREQ.  (MHz)	GROUP DELAY		
	(nsec)		
	@-40°C	@+25°C	@+85°C
4000	0.96	0.96	0.95
4100	0.90	0.89	0.89
4200	0.84	0.84	0.84
4300	0.80	0.80	0.80
4400	0.76	0.76	0.76
4500	0.73	0.73	0.73
4600	0.71	0.71	0.71
4700	0.69	0.68	0.68
4800	0.67	0.66	0.66
4900	0.65	0.65	0.65
5000	0.63	0.63	0.63
5100	0.62	0.62	0.62
5200	0.61	0.61	0.61
5300	0.60	0.60	0.60
5400	0.59	0.59	0.59
5500	0.58	0.58	0.58
5600	0.57	0.57	0.57
5700	0.56	0.56	0.56
5800	0.56	0.56	0.56
5900	0.55	0.55	0.55
6000	0.54	0.54	0.55
6100	0.54	0.54	0.54
6200	0.54	0.54	0.54
6300	0.54	0.53	0.54
6400	0.53	0.53	0.53
6500	0.53	0.53	0.53
6600	0.53	0.53	0.53
6700	0.53	0.53	0.53
6800	0.53	0.53	0.53
6900	0.53	0.53	0.53
7000	0.53	0.53	0.53
7100	0.53	0.53	0.53
7200	0.53	0.53	0.54
7300	0.54	0.54	0.54
7400	0.54	0.54	0.54
7500	0.55	0.55	0.55
7600	0.55	0.55	0.56
7700	0.56	0.56	0.56
7800	0.57	0.57	0.57
7900	0.58	0.58	0.58
8000	0.59	0.60	0.60

# Suspended substrate stripline Band Pass Filter

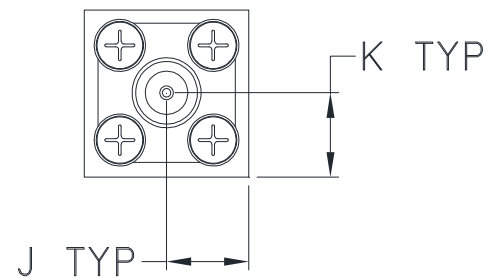
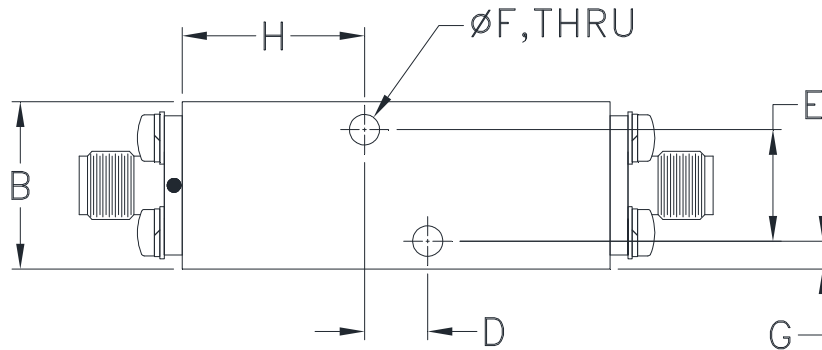
## ZBSS-6G-S+

### Typical Performance Curves



## Outline Dimensions

WD3296



CASE#	A	B	C	D	E	F
WD3296	1.56 (39.6)	.60 (15.2)	.60 (15.2)	.230 (5.84)	.400 (10.16)	.110 (2.79)

CASE#	G	H	J	K	WT. GRAMS
WD3296	.10 (2.5)	.66 (16.9)	.30 (7.6)	.30 (7.7)	72

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .100$ ; 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



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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