Coaxial Reflectionless

High Pass Filter

VXHF-23+

50Ω **2010 to 10100 MHz**

The Big Deal

- Match to 50Ω in the stop band, eliminates undesired reflections
- Cascadable
- Excellent Power handling
- Temperature stable, up to 100°C

Generic photo used for illustration purposes only

CASE STYLE: FF704

+RoHS Compliant

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

Product Overview

Mini-Circuits' VXHF-23+ reflectionless filter employs a novel filter topology which absorbs and terminates stop band signals internally rather than reflecting them back to the source. This new capability enables unique applications for filter circuits beyond those suited to traditional approaches. Traditional filters are reflective in the stop band, sending signals back to the source at 100% of the power level. These reflections interact with neighboring components and often result in inter-modulation and other interferences. Reflectionless filters eliminate stop band reflections, allowing them to be paired with sensitive devices and used in applications that otherwise require circuits such as isolation amplifiers or attenuators.

Key Features

Feature	Advantages
Easy integration with sensitive reflective components, e.g. mixers, multipliers	Reflectionless filters absorb unwanted signals, preventing reflections back to the source. This reduces generation of additional unwanted signals without the need for extra components like attenuators, improving system dynamic range.
Enables stable integration of wideband amplifiers	Because reflectionless filters maintain good impedance in the stop band; they can be integrated with high gain, wideband amplifiers without the risk of creating instabilities in these out of band regions.
Cascadable	Reflectionless filters can be cascaded in multiple sections to provide sharper and higher attenuation, while also preventing any standing waves that could affect pass band signals.
Excellent power handling	High power handling extends the usability of these filters to the transmit path for inter-stage filtering.
Excellent repeatability of RF performance	Through semiconductor IPD process, X-series filters are inherently repeatable for large volume production.
Excellent stability over temperature	With ±0.3 dB variation over temperature ideal for use in wide temperature range applications without the need for additional temperature compensation.
Operating temperature up to 100°C	Suitable for operation close to high power components.
Connectorized package	The connectorized package is easy to interface with other devices and well suited for test setups.

*IPD – Integrated Passive Device, is a GaAs semiconductor process

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Connectors	Model
SMA	VXHF-23+

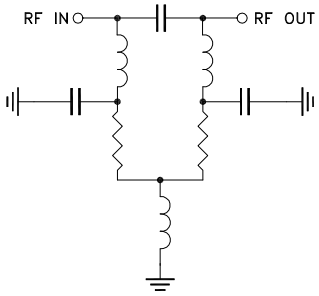
Features

- Match to 50Ω in the stop band, eliminates undesired reflections
- Cascadable
- Excellent power handling
- Temperature stable, up to 100°C
- Protected by US Patent No. 8,392,495

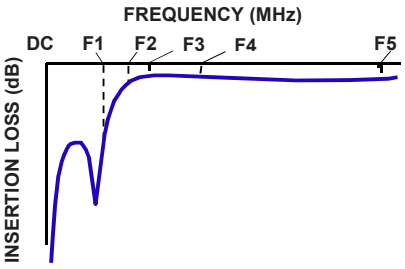
Applications

- Wi-Fi
- WiMax
- Microwave Radio
- Military & Space

Functional Schematic



Typical Frequency Response



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Electrical Specifications at 25°C

Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Stop Band	Rejection Loss	DC-F1	DC-1210	12	14	-	dB
	Freq. Cut-Off	F2	1650	-	3.0	-	dB
	VSWR	DC-F1	DC-1210	-	1.2	-	:1
Pass Band	Insertion Loss	F3-F5	2010-10100	-	1.2	2.0	dB
	VSWR	F3-F4	2010-3200	-	1.6	-	:1
		F4-F5	3200-10100	-	2.0	-	:1

Absolute Maximum Ratings[3]

Parameter	Ratings
Operating Temperature	-55°C to +100°C
Storage Temperature	-55°C to +100°C
RF Power Input, Passband (F3-F5)[1]	2W at 25°C
RF Power Input, Stopband (DC-F3)[2]	0.5W at 25°C

[1] Passband rating derates linearly to 1W at 100°C ambient
[2] Stopband rating derates linearly to 0.25W at 100°C ambient
[3] Permanent damage may occur if any of these limits are exceeded.

ESD rating

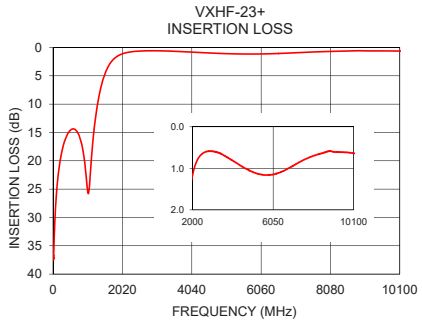
Human body model (HBM): Class 2(2000 to <4000 V) in accordance with ANSI/ESD 5.1-2001

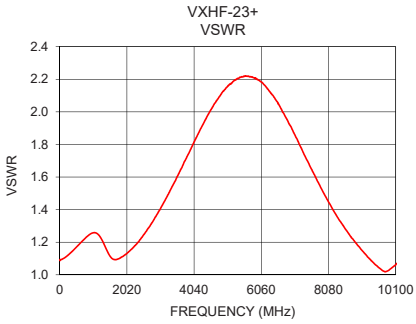
MSL rating

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)
10	37.80	1.09
100	25.65	1.10
500	14.62	1.17
750	15.43	1.22
1000	25.02	1.26
1040	25.53	1.26
1100	21.00	1.26
1210	13.65	1.24
1300	9.83	1.20
1600	3.45	1.09
1650	2.93	1.08
2000	1.17	1.12
2010	1.15	1.12
3200	0.61	1.44
4000	0.80	1.76
5650	1.20	2.24
8000	0.83	1.62
9000	0.70	1.32
10000	0.69	1.10
10100	0.69	1.09





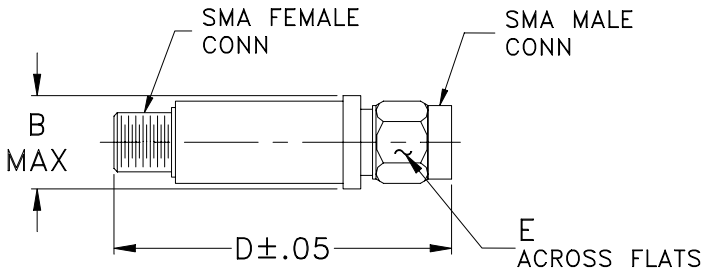
Notes

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

INPUT	SMA-Male
OUTPUT	SMA-Female

Outline Drawing



Outline Dimensions (inch / mm)

B	D	E	wt.
.410	**1.43**	**.312**	grams
10.41	36.32	7.92	10

Note: Please refer to case style drawing for details

MMIC Reflectionless High Pass Filter VXHF-23+

Typical Performance Data

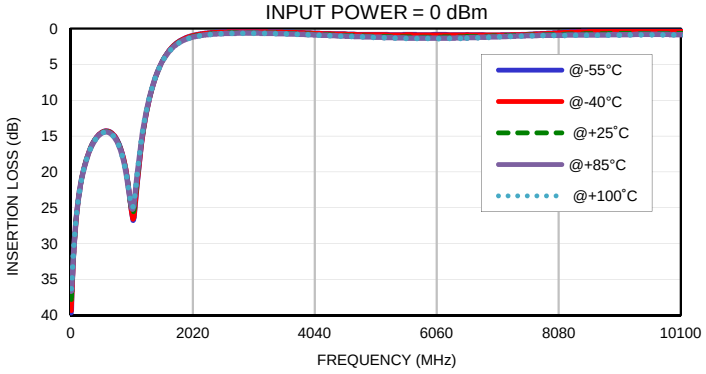
FREQ.	INSERTION LOSS					GROUP DELAY				
(MHz)	(dB)					(nsec)				
	@-55°C	@-40°C	@+25˚C	@+85°C	@+100˚C	@-55°C	@-40°C	@+25˚C	@+85°C	@+100˚C
10	39.69	39.35	37.80	36.65	36.30	-6.58	-5.09	-3.98	-4.49	-4.10
20	37.24	37.02	36.02	35.25	34.99	-2.82	-2.77	-2.66	-2.60	-2.57
30	34.88	34.75	34.13	33.64	33.44	-2.40	-2.41	-2.36	-2.30	-2.28
40	32.89	32.81	32.41	32.08	31.96	-2.00	-2.04	-2.04	-2.00	-1.99
50	31.23	31.19	30.92	30.68	30.56	-1.63	-1.69	-1.73	-1.70	-1.69
60	29.82	29.78	29.59	29.42	29.35	-1.30	-1.36	-1.42	-1.41	-1.41
70	28.60	28.58	28.43	28.30	28.26	-1.01	-1.06	-1.13	-1.15	-1.15
80	27.53	27.50	27.40	27.30	27.26	-0.75	-0.79	-0.87	-0.90	-0.91
100	25.73	25.71	25.65	25.59	25.56	-0.32	-0.36	-0.44	-0.49	-0.50
200	20.17	20.18	20.19	20.20	20.20	0.33	0.32	0.29	0.27	0.26
300	17.20	17.22	17.26	17.29	17.30	0.38	0.38	0.35	0.34	0.33
400	15.47	15.49	15.54	15.58	15.59	0.39	0.39	0.37	0.36	0.35
500	14.54	14.55	14.62	14.67	14.68	0.39	0.38	0.37	0.36	0.35
600	14.28	14.30	14.38	14.44	14.46	0.38	0.38	0.36	0.35	0.34
700	14.73	14.75	14.86	14.94	14.96	0.36	0.36	0.34	0.32	0.31
900	19.09	19.14	19.34	19.45	19.48	-0.02	-0.03	-0.11	-0.17	-0.18
950	21.69	21.74	21.91	21.96	21.96	-0.57	-0.59	-0.67	-0.71	-0.72
1000	25.27	25.25	25.02	24.73	24.60	-1.30	-1.30	-1.28	-1.26	-1.25
1100	21.94	21.74	21.00	20.47	20.30	-1.06	-1.03	-0.91	-0.83	-0.80
1210	13.96	13.89	13.65	13.45	13.39	0.19	0.19	0.18	0.18	0.17
1300	9.96	9.93	9.83	9.74	9.71	0.41	0.40	0.38	0.37	0.37
1500	4.78	4.79	4.85	4.87	4.88	0.48	0.48	0.46	0.45	0.44
1600	3.33	3.35	3.45	3.50	3.51	0.47	0.46	0.44	0.43	0.43
1650	2.80	2.82	2.93	2.99	3.01	0.45	0.45	0.43	0.42	0.41
1700	2.36	2.39	2.50	2.57	2.59	0.44	0.43	0.42	0.40	0.40
1800	1.72	1.75	1.88	1.95	1.97	0.40	0.40	0.39	0.38	0.37
1900	1.29	1.33	1.46	1.53	1.55	0.37	0.37	0.36	0.35	0.34
2000	1.01	1.04	1.17	1.25	1.27	0.35	0.35	0.33	0.32	0.32
2010	0.99	1.02	1.15	1.23	1.25	0.35	0.34	0.33	0.32	0.32
2020	0.96	1.00	1.13	1.20	1.23	0.34	0.34	0.33	0.32	0.32
2050	0.90	0.94	1.07	1.14	1.17	0.34	0.34	0.32	0.31	0.31
2100	0.81	0.85	0.98	1.06	1.08	0.33	0.32	0.31	0.30	0.30
2200	0.68	0.71	0.85	0.92	0.95	0.31	0.31	0.29	0.29	0.28
2400	0.52	0.55	0.69	0.76	0.79	0.28	0.28	0.27	0.26	0.26
2500	0.48	0.51	0.65	0.72	0.74	0.27	0.27	0.26	0.25	0.25
2600	0.45	0.48	0.62	0.69	0.71	0.26	0.26	0.25	0.24	0.24
2700	0.43	0.46	0.60	0.67	0.69	0.26	0.26	0.24	0.24	0.23
2800	0.42	0.45	0.59	0.66	0.68	0.25	0.25	0.24	0.23	0.23
2900	0.42	0.45	0.59	0.65	0.68	0.25	0.24	0.23	0.22	0.22
3000	0.42	0.45	0.59	0.65	0.68	0.24	0.24	0.23	0.22	0.22
3100	0.43	0.46	0.60	0.66	0.68	0.24	0.24	0.22	0.22	0.21
3200	0.44	0.48	0.61	0.67	0.69	0.23	0.23	0.22	0.21	0.21
3300	0.45	0.49	0.62	0.69	0.71	0.23	0.23	0.22	0.21	0.21
3500	0.49	0.52	0.67	0.73	0.75	0.22	0.22	0.21	0.20	0.20
3600	0.51	0.55	0.69	0.76	0.78	0.22	0.22	0.21	0.20	0.20
3700	0.53	0.56	0.72	0.79	0.81	0.22	0.22	0.21	0.20	0.20
3800	0.55	0.59	0.74	0.82	0.84	0.22	0.22	0.21	0.20	0.20
3900	0.59	0.62	0.77	0.85	0.87	0.22	0.21	0.20	0.20	0.19
4000	0.63	0.66	0.80	0.88	0.91	0.21	0.21	0.20	0.19	0.19
4500	0.74	0.78	0.96	1.05	1.09	0.21	0.21	0.19	0.19	0.18
5000	0.81	0.86	1.10	1.20	1.24	0.20	0.20	0.19	0.18	0.18
5500	0.84	0.90	1.18	1.33	1.38	0.20	0.20	0.19	0.18	0.17
6000	0.84	0.90	1.20	1.36	1.42	0.20	0.20	0.18	0.17	0.17
6500	0.85	0.90	1.16	1.31	1.37	0.20	0.20	0.18	0.17	0.17
7000	0.89	0.93	1.06	1.17	1.22	0.19	0.19	0.18	0.18	0.17
8000	0.60	0.65	0.83	0.94	0.98	0.20	0.20	0.19	0.18	0.18
9000	0.35	0.41	0.70	0.87	0.94	0.20	0.20	0.19	0.18	0.18
9500	0.38	0.44	0.68	0.83	0.90	0.20	0.20	0.19	0.18	0.18
10000	0.38	0.44	0.69	0.85	0.92	0.20	0.20	0.19	0.18	0.18
10100	0.37	0.43	0.69	0.86	0.93	0.20	0.20	0.19	0.18	0.18

Typical Performance Data

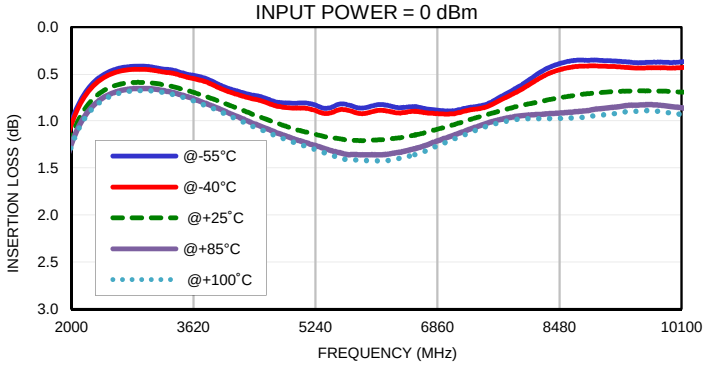
FREQ.	INPUT RETURN LOSS					OUTPUT RETURN LOSS				
(MHz)	(dB)					(dB)				
	@-55°C	@-40°C	@+25°C	@+85°C	@+100°C	@-55°C	@-40°C	@+25°C	@+85°C	@+100°C
10	28.92	28.62	27.42	26.53	26.26	28.79	28.48	27.29	26.45	26.14
20	28.75	28.48	27.33	26.51	26.24	28.67	28.38	27.29	26.49	26.21
30	28.52	28.27	27.28	26.50	26.25	28.44	28.18	27.25	26.50	26.25
40	28.23	28.01	27.20	26.51	26.28	28.19	27.98	27.22	26.57	26.35
50	27.89	27.73	27.10	26.52	26.34	27.84	27.71	27.12	26.63	26.45
60	27.58	27.46	27.02	26.56	26.42	27.54	27.41	27.05	26.71	26.59
70	27.31	27.22	26.96	26.62	26.54	27.23	27.14	26.98	26.80	26.74
80	27.03	26.96	26.88	26.68	26.64	26.96	26.90	26.91	26.91	26.92
100	26.53	26.51	26.69	26.72	26.78	26.52	26.50	26.78	27.08	27.21
200	26.09	25.95	25.60	25.59	25.57	26.60	26.42	25.94	26.13	26.18
300	26.53	26.14	24.40	23.54	23.17	26.80	26.43	24.94	24.18	23.85
400	24.01	23.94	23.25	22.34	21.98	24.64	24.52	23.99	23.34	23.09
500	22.02	22.12	22.21	21.61	21.36	23.58	23.58	23.06	22.55	22.39
600	21.18	21.27	21.29	20.89	20.66	22.12	22.21	22.06	21.38	21.14
700	20.44	20.45	20.45	20.18	20.00	20.42	20.51	21.08	20.45	20.23
900	19.18	19.22	19.16	19.40	19.47	19.41	19.49	19.52	19.37	19.30
950	19.00	19.05	18.95	19.29	19.41	19.15	19.19	19.18	19.13	19.07
1000	18.82	18.86	18.82	19.24	19.41	18.81	18.83	18.89	18.97	18.96
1100	18.41	18.48	18.85	19.40	19.67	18.11	18.24	18.56	18.96	19.08
1210	18.38	18.61	19.51	20.17	20.51	18.09	18.22	18.70	19.48	19.76
1300	19.29	19.54	20.70	21.34	21.64	18.81	18.88	19.41	20.49	20.92
1500	23.64	24.02	25.34	25.60	25.53	21.25	21.43	22.65	24.09	24.62
1600	26.50	26.73	27.39	27.25	26.95	23.68	23.78	24.70	25.70	25.95
1650	27.68	27.78	27.80	27.39	27.05	24.50	24.79	25.64	26.19	26.28
1700	28.10	28.19	27.83	27.16	26.83	24.99	25.45	26.45	26.51	26.43
1800	27.54	27.52	27.15	26.18	25.87	25.90	26.17	27.14	26.30	25.95
1900	27.14	26.97	26.13	24.97	24.64	26.76	26.79	26.71	25.53	25.12
2000	26.22	26.18	25.14	23.89	23.56	26.24	26.30	25.82	24.62	24.25
2010	26.08	26.05	25.03	23.79	23.46	26.16	26.22	25.72	24.54	24.18
2020	25.99	25.96	24.97	23.73	23.39	26.05	26.10	25.60	24.44	24.09
2050	25.61	25.57	24.69	23.45	23.11	25.77	25.77	25.26	24.13	23.81
2100	25.02	24.89	24.18	22.96	22.65	25.44	25.33	24.73	23.67	23.37
2200	24.24	23.98	23.19	22.09	21.77	24.79	24.54	23.55	22.62	22.36
2400	22.05	21.92	21.16	20.42	20.13	22.14	22.00	21.26	20.64	20.41
2500	20.94	20.79	20.20	19.69	19.45	20.99	20.86	20.22	19.78	19.58
2600	19.94	19.76	19.31	19.02	18.84	19.91	19.74	19.25	18.96	18.82
2700	18.86	18.74	18.46	18.36	18.23	18.78	18.66	18.36	18.21	18.09
2800	17.84	17.77	17.65	17.68	17.59	17.73	17.69	17.53	17.47	17.36
2900	17.00	16.91	16.89	17.05	17.00	16.95	16.87	16.77	16.81	16.74
3000	16.14	16.09	16.19	16.45	16.47	16.15	16.08	16.06	16.19	16.16
3100	15.20	15.26	15.52	15.86	15.93	15.25	15.29	15.40	15.58	15.60
3200	14.48	14.57	14.91	15.25	15.34	14.53	14.59	14.78	14.95	14.98
3300	13.99	14.03	14.31	14.62	14.71	14.09	14.11	14.21	14.35	14.38
3500	12.88	12.96	13.24	13.48	13.58	12.99	13.04	13.18	13.28	13.33
3600	12.47	12.50	12.76	12.94	13.05	12.57	12.58	12.71	12.78	12.83
3700	12.19	12.20	12.33	12.46	12.55	12.26	12.25	12.26	12.29	12.33
3800	11.80	11.82	11.92	12.01	12.08	11.86	11.86	11.87	11.87	11.91
3900	11.27	11.30	11.52	11.58	11.63	11.31	11.34	11.49	11.48	11.51
4000	10.80	10.85	11.17	11.19	11.23	10.85	10.89	11.16	11.12	11.14
4500	9.67	9.66	9.74	9.74	9.73	9.70	9.69	9.73	9.71	9.70
5000	9.10	9.04	8.85	8.88	8.88	9.11	9.06	8.85	8.87	8.87
5500	8.91	8.85	8.43	8.37	8.34	8.93	8.87	8.46	8.35	8.31
6000	8.97	8.91	8.43	8.40	8.34	8.96	8.90	8.48	8.38	8.31
6500	8.95	8.99	8.85	8.88	8.82	8.98	9.01	8.90	8.85	8.78
7000	8.69	8.85	9.67	9.93	10.02	8.77	8.92	9.74	9.92	9.99
8000	11.63	11.72	12.47	12.86	13.12	11.69	11.78	12.61	13.15	13.49
9000	19.33	19.37	17.26	15.69	15.26	18.79	18.82	17.11	16.19	15.97
9500	18.23	18.71	21.01	21.82	21.53	18.17	18.56	20.01	20.87	21.02
10000	19.67	20.53	26.17	31.61	30.04	20.11	20.73	22.72	23.16	23.26
10100	20.35	21.35	27.33	27.36	25.44	20.94	21.62	23.08	22.20	21.82

Typical Performance Curves

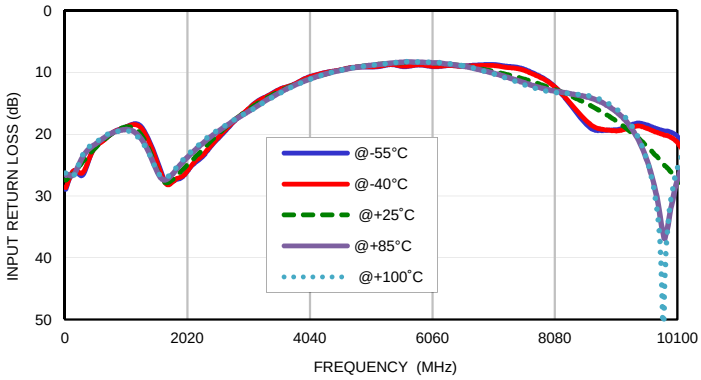
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



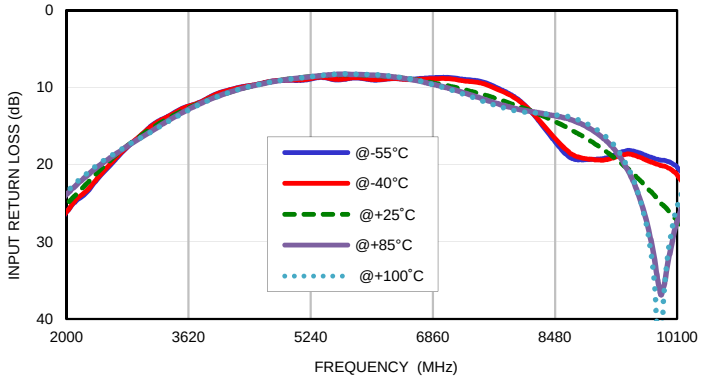
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



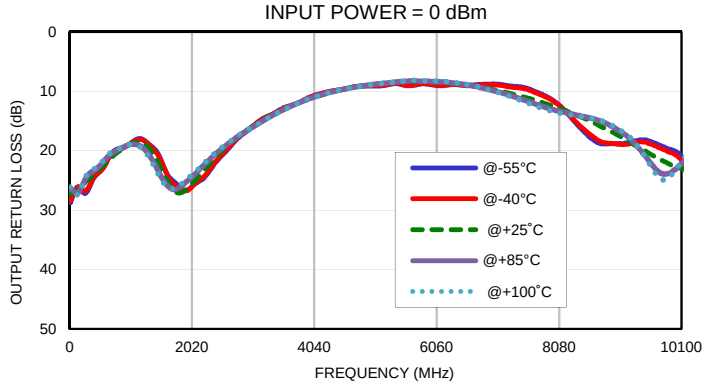
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



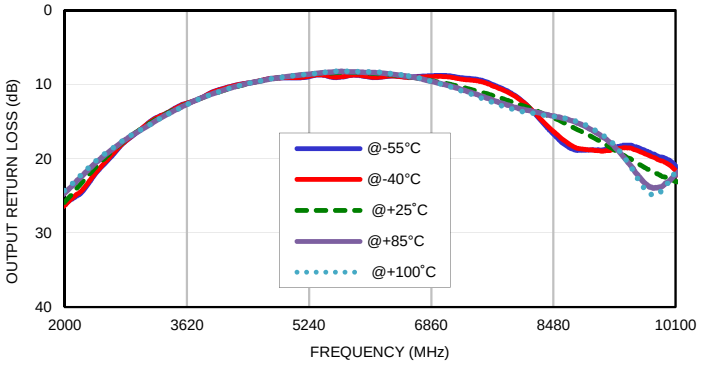
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



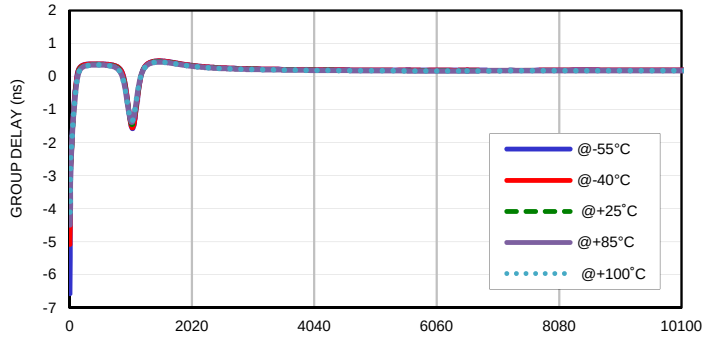
OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



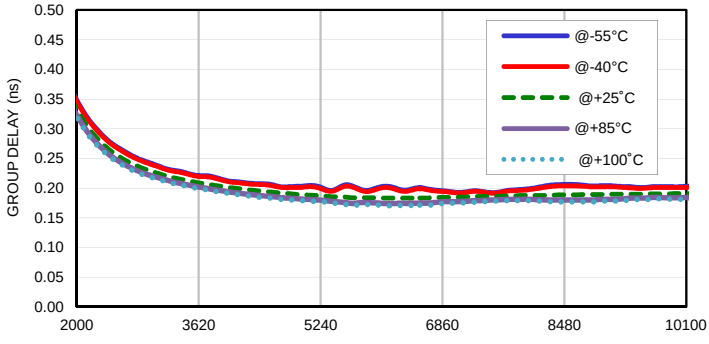
OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



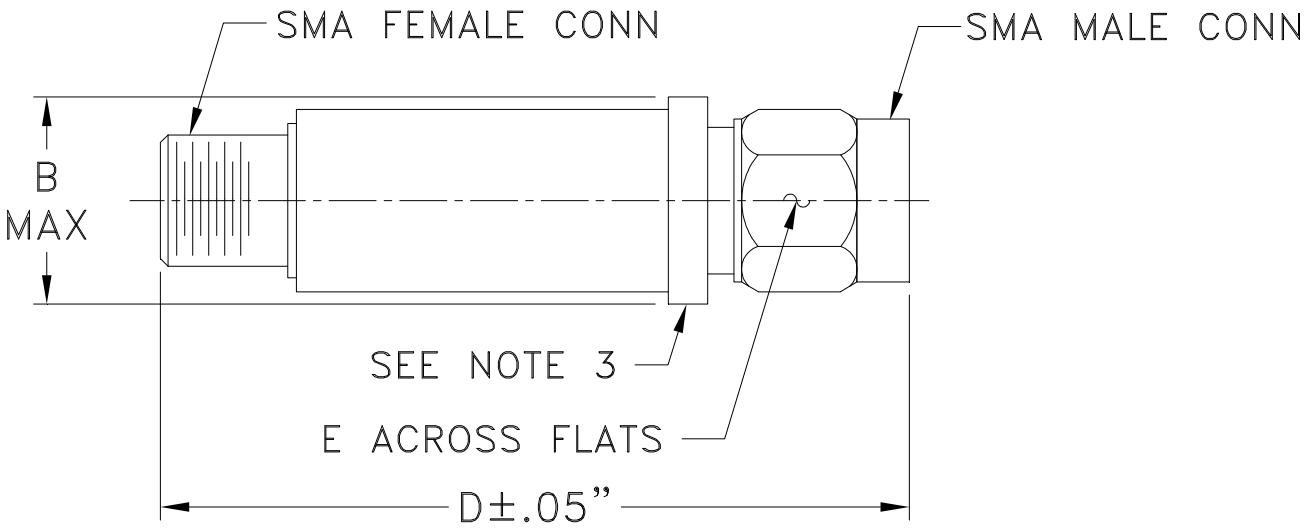
GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



Case Style FF

FF704

Outline Dimensions



CASE #.	A	B	C	D	E	WT GRAMS
FF704	-- --	.410 (10.41)	-- --	1.43 (36.32)	.312 (7.92)	10.0

Dimensions are in inches (mm). Tolerances: 2Pl. ± .04; 3Pl. ± .030

Notes:

1. Case material: Stainless steel.
2. Case finish: Gold plated.
3. Round Flange may have .312 Across Flats in some models.

Mini-Circuits

Environmental Specifications ENV28

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
Barometric Pressure	100,000 Feet	MIL-STD-202, Method 105, Condition D
Humidity	90% RH, 65°C Units may require bake-out after humidity to restore full performance.	MIL-STD-202, Method 103
Thermal Shock	-65° to 125°C, 5 cycles	MIL-STD-202, Method 107, Condition B
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	100g, 6ms sawtooth, 3 shocks each direction 3 axes (total 18)	MIL-STD-202, Method 213, Condition I