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

Suspended substrate stripline

Band Pass Filter

50Ω 6000 to 12000 MHz

ZBSS-9G-S+

Generic photo used for illustration purposes only

CASE STYLE: WD3296

Connectors	Model
SMA - F	ZBSS-9G-S+

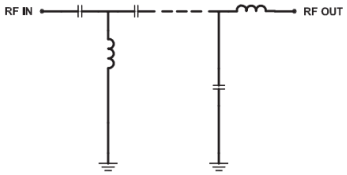
Features

- Wide fractional bandwidth design of 66.7%
- 1dB typ. Insertion Loss at Center frequency
- Sharp roll-off
- High rejection floor of 90dB typ.
- Stop band up to 26.5 GHz
- Connectorized package

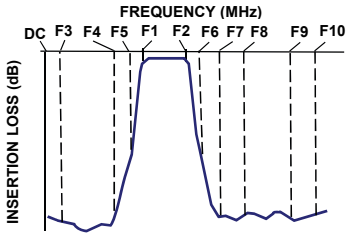
Applications

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

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

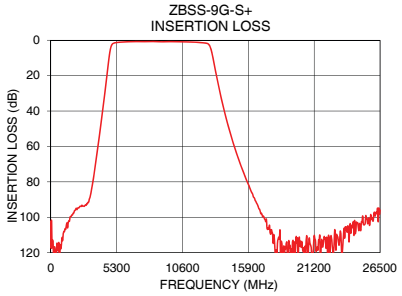
Parameter		F#	Frequency (MHz)	Min.	Typ.	Max.	Unit
Pass Band	Center Frequency	Fc	9000	-	1.0	-	dB
	Insertion Loss	F1-F2	6000 - 12000	-	1.5	2.5	dB
	VSWR	F1-F2	6000 - 12000	-	1.5	-	:1
Stop Band, Lower	Insertion Loss	DC-F3	DC - 3300	60	90	-	dB
		F3-F4	3300 - 3700	40	60	-	dB
		F4-F5	3700 - 4100	20	40	-	dB
Stop Band, Upper	Insertion Loss	F6-F7	14200 - 15000	20	40	-	dB
		F7-F8	15000 - 16500	40	60	-	dB
		F8-F9	16500 - 25000	60	90	-	dB
		F9-F10	25000 - 26500	-	90	-	dB

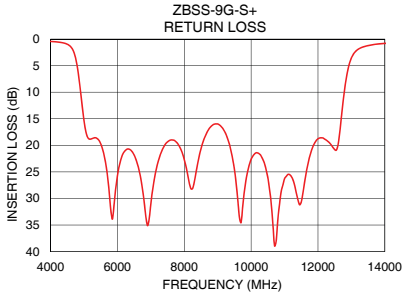
Maximum Ratings	
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power Input	10W max.@ 25°C

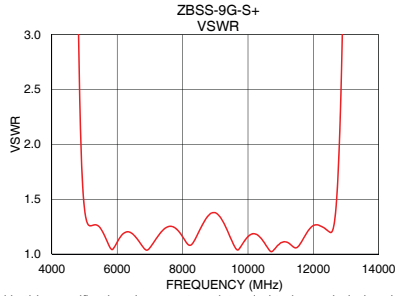
Permanent damage may occur if any of these limits are exceeded.

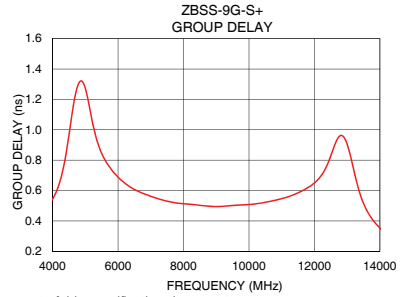
Typical Performance Data at 25°C

Frequency (MHz)	Insertion Loss (dB)	VSWR (:1)	Frequency (MHz)	Group Delay (nsec)
10	102.52	8474.04	6000	0.69
100	116.83	15278.61	6300	0.63
1000	109.48	892.23	6600	0.60
3300	83.45	62.97	6900	0.57
3700	64.79	48.54	7200	0.55
4100	43.78	35.17	7500	0.53
4500	20.86	17.83	7800	0.52
4850	3.62	2.47	8100	0.51
6000	0.95	1.11	8400	0.51
8000	0.79	1.16	8700	0.50
9000	0.91	1.38	9000	0.49
10000	0.88	1.16	9300	0.50
12000	1.33	1.26	9600	0.50
12800	3.30	2.05	9900	0.51
13350	20.65	11.72	10200	0.51
14200	46.38	23.61	10500	0.52
15000	64.91	28.83	10800	0.54
16500	91.00	44.36	11100	0.55
25000	102.55	36.86	11500	0.59
26500	95.99	44.51	12000	0.65









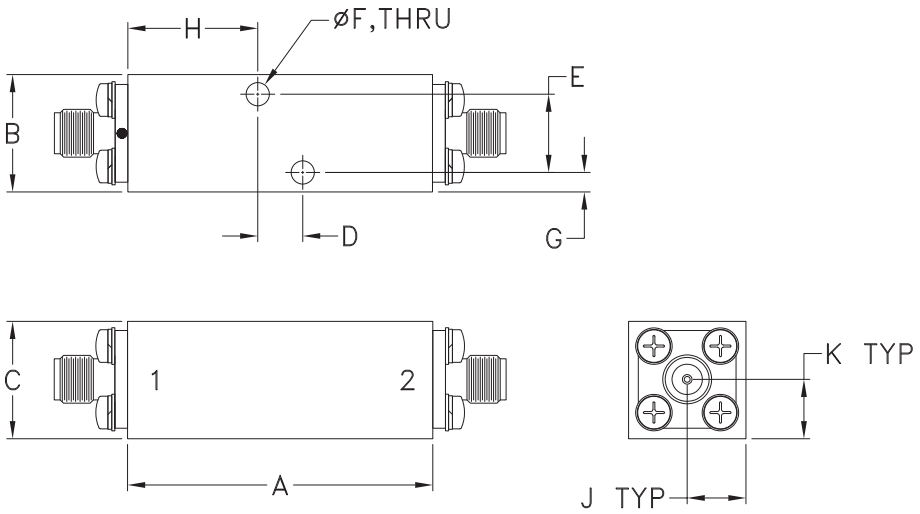
Notes

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
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

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

Band Pass Filter ZBSS-9G-S+

Typical Performance Data

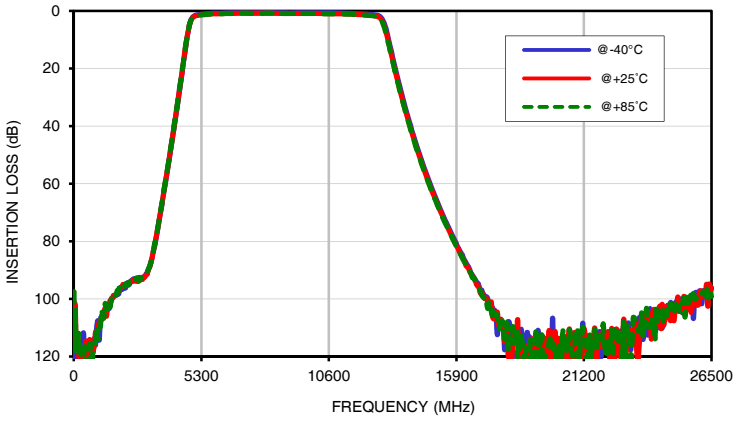
FREQ. (MHz)	INSERTION LOSS (dB)			INPUT RETURN LOSS (dB)			OUTPUT RETURN LOSS (dB)		
	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C	@-40°C	@+25°C	@+85°C
10	100.94	102.52	97.49	0.01	0.00	0.00	0.00	0.00	0.00
50	107.73	101.66	103.79	0.00	0.00	0.00	0.00	0.00	0.00
100	117.14	116.83	117.96	0.00	0.00	0.00	0.01	0.00	0.00
200	126.20	118.39	111.98	0.02	0.00	0.00	0.02	0.00	0.01
300	117.00	116.91	121.16	0.03	0.01	0.01	0.04	0.01	0.02
400	111.75	121.06	123.71	0.03	0.00	0.01	0.03	0.02	0.02
500	128.49	114.69	136.59	0.03	0.00	0.00	0.01	0.04	0.00
600	121.93	118.74	119.16	0.03	0.00	0.00	0.02	0.07	0.04
700	116.09	132.03	115.58	0.03	0.00	0.00	0.06	0.10	0.09
800	118.63	117.88	116.42	0.02	0.01	0.01	0.09	0.14	0.13
900	116.02	111.50	114.16	0.02	0.01	0.02	0.12	0.18	0.16
1000	107.64	109.48	114.02	0.01	0.02	0.02	0.14	0.21	0.19
1500	100.64	102.27	102.94	0.02	0.06	0.07	0.15	0.24	0.22
1800	98.30	97.73	97.08	0.05	0.10	0.11	0.13	0.22	0.19
2000	96.73	95.56	96.32	0.06	0.12	0.13	0.13	0.23	0.19
2500	92.92	93.23	93.08	0.11	0.17	0.19	0.29	0.40	0.39
3000	91.32	91.56	91.47	0.16	0.23	0.25	0.36	0.52	0.47
3300	83.82	83.45	83.27	0.20	0.28	0.30	0.36	0.49	0.47
3700	65.09	64.79	64.58	0.27	0.36	0.39	0.33	0.50	0.47
4100	44.12	43.78	43.53	0.39	0.49	0.54	0.60	0.78	0.79
4350	30.08	29.72	29.45	0.55	0.69	0.75	0.93	1.16	1.17
4500	21.21	20.86	20.61	0.80	0.98	1.07	1.23	1.50	1.53
4700	9.51	9.28	9.13	2.17	2.54	2.75	2.54	3.00	3.16
4850	3.56	3.62	3.62	6.71	7.46	7.84	7.17	8.07	8.42
6000	0.75	0.95	0.97	27.35	25.71	25.21	24.42	23.58	23.20
7000	0.61	0.79	0.81	33.42	30.99	28.97	35.23	32.48	30.33
7500	0.63	0.81	0.84	18.87	19.34	19.11	18.11	18.49	18.25
8000	0.60	0.79	0.81	21.77	22.71	23.84	21.46	22.38	23.78
8500	0.61	0.81	0.84	20.68	20.64	20.45	20.23	20.30	19.99
9000	0.71	0.91	0.92	15.72	15.98	16.48	14.87	15.25	15.59
9500	0.62	0.83	0.85	24.18	24.52	24.66	25.87	26.44	26.89
10000	0.65	0.88	0.90	22.59	22.62	22.97	20.31	20.47	20.75
10500	0.67	0.91	0.94	25.57	26.09	25.86	25.53	25.98	26.10
11000	0.74	0.99	1.02	26.63	26.26	25.98	23.53	23.12	22.97
12000	1.04	1.33	1.38	18.66	18.77	18.69	16.67	16.62	16.52
12800	2.61	3.30	3.57	9.99	9.29	9.00	9.85	9.11	8.52
13050	8.78	9.91	10.39	2.83	2.93	2.97	1.98	2.10	1.97
13350	19.58	20.65	21.09	1.25	1.49	1.57	0.50	0.76	0.70
13650	29.61	30.59	30.94	0.84	1.05	1.14	0.21	0.48	0.40
13900	37.19	38.11	38.43	0.67	0.87	0.95	0.13	0.39	0.31
14200	45.50	46.38	46.68	0.55	0.74	0.82	0.10	0.35	0.28
14700	57.69	58.49	58.79	0.46	0.63	0.70	0.01	0.29	0.18
15000	64.15	64.91	65.21	0.43	0.60	0.68	0.00	0.26	0.16
16000	82.55	83.22	83.42	0.30	0.47	0.55	0.00	0.23	0.15
16500	90.91	91.00	90.90	0.20	0.39	0.47	0.02	0.22	0.14
17000	97.96	98.48	99.11	0.18	0.37	0.45	0.05	0.20	0.12
17500	104.06	106.08	105.43	0.19	0.40	0.47	0.10	0.17	0.07
18000	108.84	113.09	108.40	0.28	0.49	0.57	0.08	0.19	0.11
18500	111.97	127.15	114.55	0.43	0.63	0.72	0.15	0.15	0.05
19000	119.38	114.00	114.38	0.56	0.74	0.86	0.14	0.17	0.07
19500	119.51	113.16	127.23	0.59	0.79	0.90	0.15	0.17	0.07
20000	115.80	111.22	117.38	0.49	0.71	0.82	0.19	0.12	0.02
20500	114.33	123.30	117.74	0.28	0.52	0.60	0.08	0.21	0.12
21000	116.39	120.85	122.17	0.14	0.37	0.46	0.14	0.18	0.08
21500	122.19	118.57	121.10	0.15	0.38	0.48	0.14	0.18	0.06
22000	111.97	110.92	108.61	0.39	0.60	0.72	0.07	0.24	0.15
23000	114.40	109.82	109.53	0.84	1.00	1.06	0.05	0.25	0.16
24000	113.01	113.94	107.97	0.54	0.79	0.84	0.08	0.26	0.17
25000	101.74	102.55	102.33	0.22	0.47	0.60	0.04	0.32	0.25
26500	96.35	95.99	99.14	0.15	0.39	0.53	0.55	1.10	1.16

Typical Performance Data

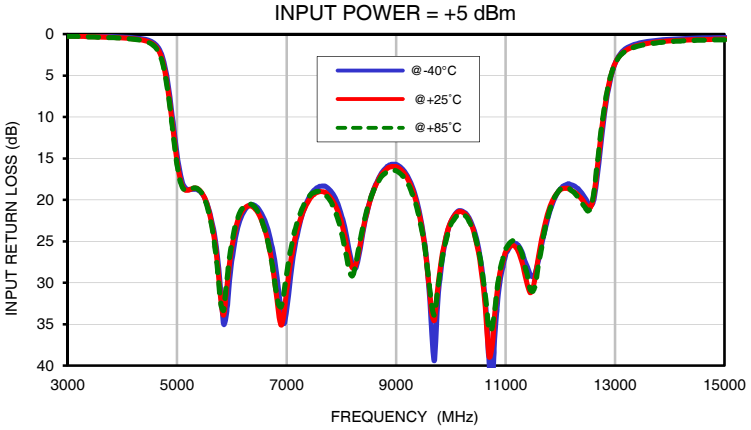
FREQ. (MHz)	GROUP DELAY (nsec)		
	@-40°C	@+25°C	@+85°C
6000	0.69	0.69	0.69
6150	0.66	0.66	0.66
6300	0.64	0.63	0.63
6450	0.61	0.61	0.61
6600	0.60	0.60	0.60
6750	0.58	0.58	0.58
6900	0.57	0.57	0.57
7050	0.56	0.56	0.56
7200	0.55	0.55	0.55
7350	0.54	0.54	0.54
7500	0.53	0.53	0.53
7650	0.52	0.52	0.52
7800	0.52	0.52	0.52
7950	0.51	0.51	0.51
8100	0.51	0.51	0.51
8250	0.51	0.51	0.51
8400	0.51	0.51	0.51
8550	0.50	0.50	0.50
8700	0.50	0.50	0.50
8850	0.50	0.50	0.50
9000	0.49	0.49	0.50
9150	0.49	0.50	0.50
9300	0.50	0.50	0.50
9450	0.50	0.50	0.50
9600	0.50	0.50	0.50
9750	0.51	0.51	0.51
9900	0.51	0.51	0.51
10050	0.51	0.51	0.51
10200	0.51	0.51	0.51
10350	0.52	0.52	0.52
10500	0.52	0.52	0.52
10650	0.53	0.53	0.53
10800	0.54	0.54	0.54
10950	0.54	0.54	0.54
11100	0.55	0.55	0.55
11250	0.56	0.56	0.56
11400	0.57	0.58	0.58
11550	0.59	0.59	0.59
11700	0.60	0.61	0.61
11850	0.62	0.63	0.63
12000	0.65	0.65	0.65

Typical Performance Curves

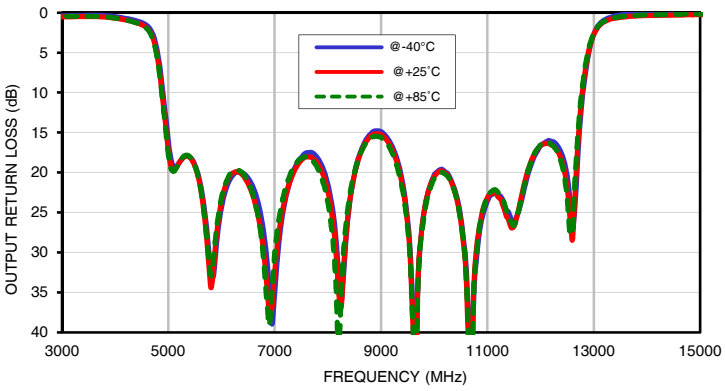
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = +5 dBm



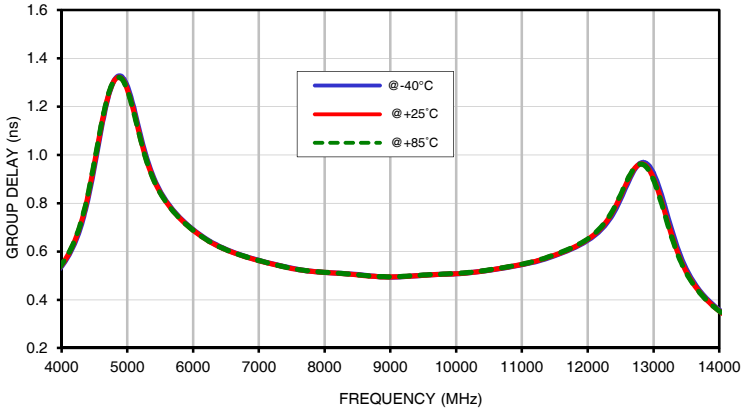
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = +5 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = +5 dBm



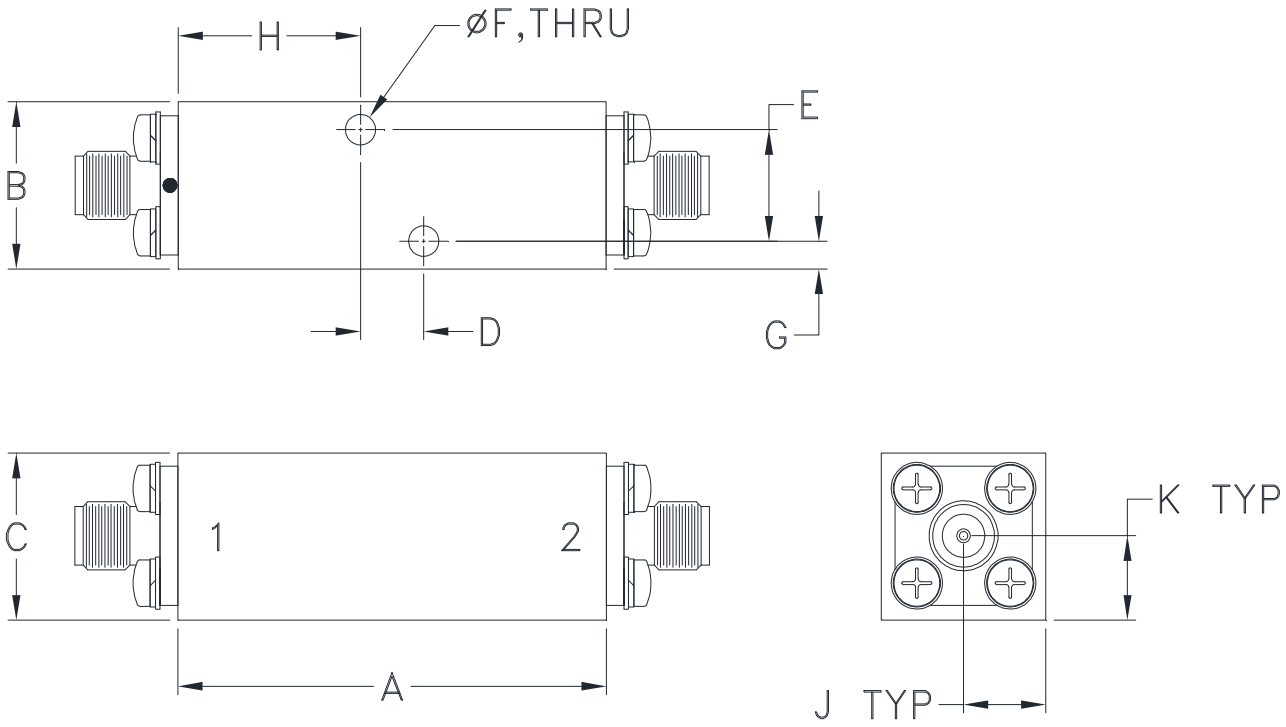
GROUP DELAY vs. TEMPERATURE
INPUT POWER = +5 dBm



Case Style WD

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. ± .100; 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®
ISO 9001 ISO 14001 CERTIFIED
ALL NEW minicircuits.com
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
RF/IF MICROWAVE COMPONENTS

This document and its contents are the property of Mini-Circuits

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

This document and its contents are the property of Mini-Circuits.