



Amplifier

ZX60-02203+

THE BIG DEAL

- Ultra Wideband performance
- Medium power, 15dBm P1dB typ.
- High gain broadband performance
- Voltage regulated internally and reverse voltage protected
- Excellent directivity, 20 dB typ.
- Protected by US patent 6,790,049



Generic photo used for illustration purposes only

Model No.	ZX60-02203+
Case Style	GC957
Connectors	SMA

+RoHS Compliant

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

APPLICATIONS

- Microwave point-to-point radios
- Military EW and radar
- Satellite Systems

PRODUCT OVERVIEW

Mini-Circuits' ZX60-02203+ is a wideband connectorized amplifier providing a combination of medium to high gain, medium power, and high IP3 over a very wide frequency range, supporting a diverse range of applications and many systems where high performance over wideband is needed. This design operates on a single 5 V supply and comes in a rugged, compact unibody case (0.74 x 0.75 x 0.46") with SMA connectors, making it an excellent candidate for tough operating conditions and crowded system layouts.

KEY FEATURES

Feature	Advantages
Ultra-wideband 2-20 GHz	Enables a single amplifier to be used in a wide range of applications including EW and communication systems instrumentation and more.
High gain, 20 dB typ.	Reduces the number of gain stages, lowering component count and overall system cost.
Low operating voltage, +5V	The amplifier features low operating voltage
Rugged, unibody construction	Mini-Circuits unibody construction integrates the RF connector into the case body, providing high reliability and excellent survivability in critical applications.



ELECTRICAL SPECIFICATIONS AT 25°C AND +5V, UNLESS NOTED

Parameter	Condition (GHz)	$V_{DD}=5.0$			Units
		Min.	Typ.	Max.	
Frequency Range		2.0		20	GHz
Noise Figure	2.0-6.0	—	8.3	—	dB
	6.0-12.0	—	7.0	—	
	12.0-18.0	—	6.0	—	
	18.0-20.0	—	6.0	—	
Gain	2.0-6.0	20	22	—	dB
	6.0-12.0	17	20	—	
	12.0-18.0	17	19	—	
	18.0-20.0	15.5	18	—	
Input Return Loss	2.0-6.0	—	13.5	—	dB
	6.0-12.0	—	13.0	—	
	12.0-18.0	—	10.0	—	
	18.0-20.0	—	8.0	—	
Output Return Loss	2.0-6.0	—	18.5	—	dB
	6.0-12.0	—	14.0	—	
	12.0-18.0	—	12.0	—	
	18.0-20.0	—	8.5	—	
Output Power at 1dB Compression ¹	2.0-6.0	—	15.2	—	dBm
	6.0-12.0	—	14.7	—	
	12.0-18.0	—	14.5	—	
	18.0-20.0	—	15.0	—	
Output IP3 ²	2.0-6.0	—	28	—	dBm
	6.0-12.0	—	28	—	
	12.0-18.0	—	28	—	
	18.0-20.0	—	26	—	
Device Operating Voltage (V_{DD})	—	4.9	5.0	6.0	V
Device Operating Current (I_{DD})	—	—	154	210	mA

1. Current increases at P1dB

2. OIP3 measured with 0 dBm tones and 1 MHz spacing.

ABSOLUTE MAXIMUM RATINGS³

Parameter	Ratings
Operating Temperature (ground lead)	-40°C to 85°C
Storage Temperature	-55°C to 100°C
Total Power Dissipation	1.2 W
Input Power (CW), $V_d=5V$	17 dBm
DC Voltage	6V

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

Electrical maximum ratings are not intended for continuous normal operation.

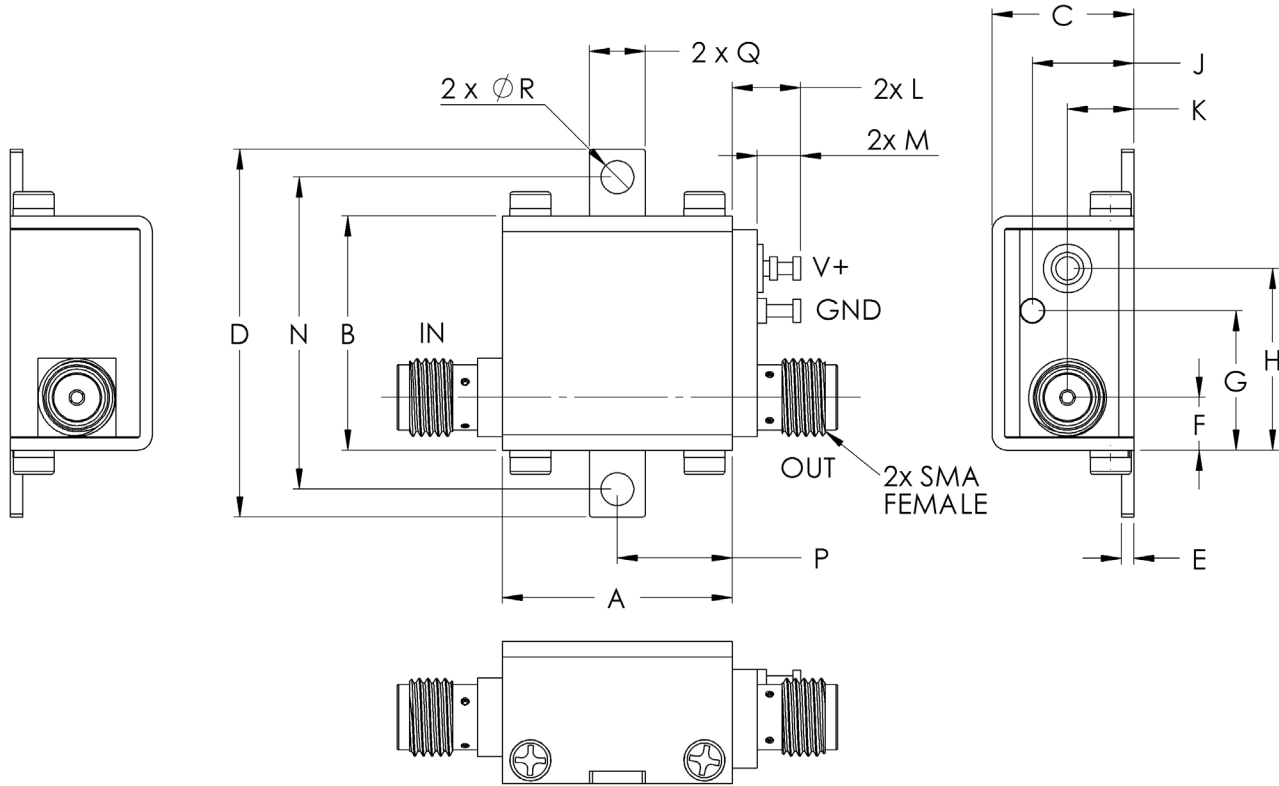


Amplifier

ZX60-02203+

50Ω 2 to 20 GHz SMA Female

OUTLINE DRAWING



⚠ NOTE: When soldering the DC connections, caution must be used to avoid overheating the DC terminal. See Application Note. [AN-40-010](#).

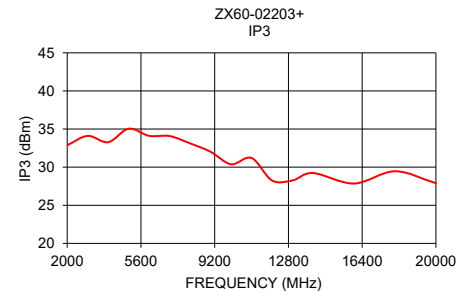
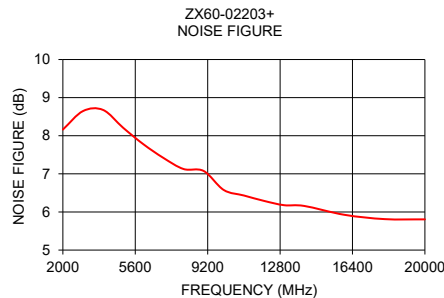
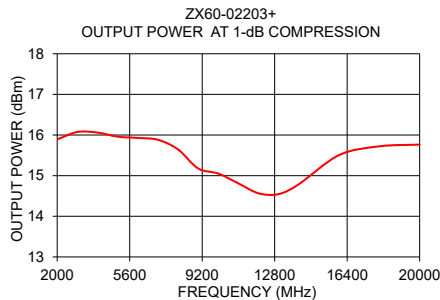
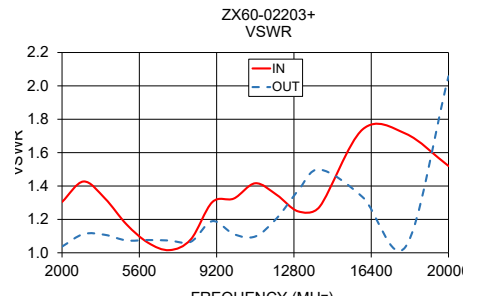
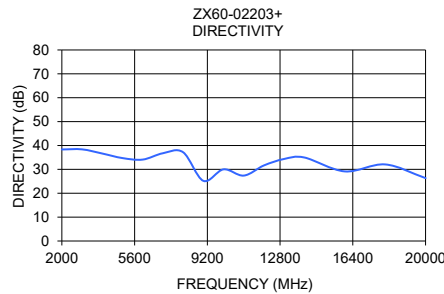
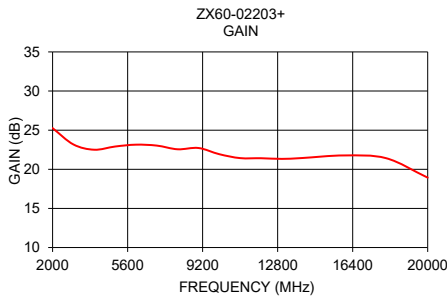
OUTLINE DIMENSIONS (Inches) mm

A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	wt
.74	.75	.46	1.18	.04	.17	.45	.59	.33	.21	.22	.14	1.00	.37	.18	.106	grams
18.80	19.1	11.68	30.0	1.02	4.32	11.4	14.99	8.38	5.33	5.59	3.56	25.40	9.40	4.57	2.69	23.0



TYPICAL PERFORMANCE DATA/CURVES

Frequency (MHz)	Gain (dB)	Directivity (dB)	VSWR (:1) 5V		Power Out @ 1 dB COMPR. (dBm)	Noise Figure (dB)	IP3 (dBm)
	5V	5V	IN	OUT	5V	5V	5V
2000	24.82	38.77	1.30	1.04	15.89	8.16	27.63
3000	22.48	39.07	1.43	1.11	16.08	8.65	27.83
4000	21.77	37.36	1.33	1.11	16.06	8.68	28.29
5000	22.91	34.72	1.17	1.07	15.96	8.21	28.48
6000	23.15	34.09	1.06	1.08	15.93	7.78	29.01
7000	21.50	38.28	1.02	1.07	15.88	7.42	28.41
8000	20.93	38.80	1.08	1.07	15.65	7.13	28.77
9000	20.44	27.48	1.30	1.19	15.18	7.08	29.26
10000	20.00	31.94	1.32	1.11	15.05	6.58	29.21
11000	19.42	29.40	1.42	1.10	14.81	6.43	30.07
12000	19.41	33.65	1.35	1.21	14.57	6.29	28.63
13000	19.36	36.32	1.25	1.37	14.55	6.18	27.75
14000	19.54	36.88	1.28	1.50	14.79	6.16	27.66
16000	19.63	31.29	1.74	1.33	15.51	5.93	27.22
18000	19.04	34.45	1.71	1.04	15.72	5.81	26.66
20000	16.07	29.20	1.52	2.06	15.76	5.81	25.92



- 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/terms/viewterm.html

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.00V, Id = 138.14mA @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
					K	Measure			
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
2000	24.82	64.21	17.43	29.77	45.75	1.02	27.63	16.09	7.85
2500	23.63	62.16	15.19	23.86	40.75	1.03	27.82	16.11	8.12
3000	22.48	60.77	14.20	21.80	39.26	1.03	27.83	16.13	8.34
3500	21.88	59.56	14.36	21.00	36.60	1.03	27.83	16.23	8.47
4000	21.77	58.41	15.53	20.89	32.76	1.02	28.29	16.14	8.44
4500	21.84	57.40	17.29	21.41	29.24	1.01	28.61	16.01	8.23
5000	21.94	56.75	19.63	21.88	27.07	1.00	28.48	16.08	8.03
5500	21.94	56.34	23.13	21.90	25.96	1.00	29.08	15.89	7.74
6000	21.86	56.20	28.69	22.02	25.88	0.99	29.01	15.96	7.57
6500	21.71	56.82	32.59	22.44	28.29	0.99	28.97	15.99	7.35
7000	21.50	58.26	26.77	23.91	34.21	1.00	28.41	16.00	7.25
7500	21.23	59.40	22.53	26.82	40.19	1.00	28.65	15.90	7.03
8000	20.93	61.92	19.98	31.79	55.45	1.01	28.77	15.87	6.86
8500	20.61	63.59	18.19	37.58	69.31	1.01	29.13	15.61	6.71
9000	20.44	53.72	16.24	35.60	22.51	1.02	29.26	15.35	6.67
9500	20.44	48.80	14.54	28.83	12.62	1.03	29.04	15.28	6.55
10000	20.00	51.32	15.13	27.03	17.81	1.03	29.21	15.23	6.34
10500	19.60	52.12	14.90	26.80	20.41	1.03	30.41	14.57	6.29
11000	19.42	48.01	13.72	22.63	12.81	1.04	30.07	14.26	6.17
11500	19.48	47.13	13.12	17.59	11.27	1.03	29.20	14.25	5.99
12000	19.41	49.31	14.35	15.12	14.57	1.01	28.63	13.90	5.99
12500	19.37	51.44	16.64	13.64	18.78	0.98	28.67	14.16	5.83
13000	19.36	53.19	21.19	12.47	23.02	0.95	27.75	13.76	5.80
13500	19.43	54.42	32.59	12.04	26.32	0.94	27.83	13.84	5.65
14000	19.54	55.04	21.29	12.17	27.75	0.95	27.66	14.32	5.63
14500	19.63	55.21	14.90	12.52	27.44	0.97	27.49	14.59	5.65
15000	19.74	54.87	11.25	13.91	25.37	1.03	27.50	15.11	5.62
15500	19.73	53.80	9.17	16.24	21.75	1.09	27.32	15.21	5.64
16000	19.63	52.11	8.01	18.70	17.52	1.14	27.22	15.37	5.54
16500	19.48	51.03	7.58	22.32	15.51	1.17	27.07	15.69	5.48
17000	19.27	49.77	7.66	23.10	13.80	1.17	27.04	15.69	5.38
17500	19.32	47.36	8.35	17.51	10.59	1.12	26.66	15.57	5.30
18000	19.04	44.50	9.47	13.01	7.99	1.05	26.66	15.61	5.31
18500	18.46	42.20	10.53	10.46	6.50	0.98	26.67	15.38	5.47
19000	18.08	41.18	13.74	9.56	6.16	0.92	26.34	15.28	5.30
19500	17.36	40.68	19.93	8.29	6.23	0.85	26.04	15.33	5.10
20000	16.07	40.13	16.94	7.33	6.46	0.82	25.92	15.64	5.22

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.00V, Id = 136.57mA @ Temperature = -45°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
					K	Measure			
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
2000	26.11	64.17	17.31	34.94	39.25	1.02	30.34	15.06	6.68
2500	24.94	61.91	15.33	28.01	34.22	1.03	30.81	15.10	6.89
3000	23.75	60.66	14.33	25.35	33.65	1.03	30.81	15.12	7.14
3500	23.16	59.39	14.50	24.47	31.15	1.03	31.07	15.19	7.28
4000	23.10	58.04	15.62	24.08	27.06	1.02	31.79	15.17	7.23
4500	23.25	57.27	17.22	23.96	24.56	1.01	32.16	15.07	7.01
5000	23.40	56.47	19.64	23.31	22.17	1.01	31.87	15.10	6.84
5500	23.44	56.08	23.15	21.85	21.19	1.00	32.18	15.08	6.57
6000	23.38	55.95	28.12	20.81	21.07	0.99	32.87	15.01	6.33
6500	23.23	56.55	30.32	20.43	22.95	0.99	32.83	14.99	6.16
7000	23.02	57.76	27.08	21.19	27.03	0.99	32.16	15.00	6.08
7500	22.75	58.95	23.35	22.31	31.96	1.00	32.50	14.98	5.84
8000	22.44	61.12	20.99	23.85	42.43	1.00	32.44	15.01	5.72
8500	22.12	61.48	19.10	25.37	45.75	1.01	32.30	14.82	5.53
9000	21.93	53.35	16.50	24.01	18.13	1.02	31.88	14.66	5.51
9500	22.04	47.93	13.61	21.88	9.37	1.04	31.94	14.59	5.39
10000	21.60	50.21	13.92	26.21	12.90	1.04	32.26	14.58	5.24
10500	21.17	51.87	14.24	29.54	16.49	1.04	30.53	14.09	5.18
11000	20.95	48.21	13.35	24.88	10.97	1.04	29.54	13.85	5.03
11500	21.09	46.32	12.31	18.17	8.46	1.04	29.30	13.93	4.93
12000	21.08	48.33	13.64	15.39	10.70	1.01	28.10	13.56	4.88
12500	21.06	50.35	16.14	13.67	13.60	0.98	29.03	13.72	4.74
13000	21.06	52.14	21.05	12.34	16.73	0.95	27.71	13.58	4.62
13500	21.16	53.35	36.57	11.79	19.01	0.93	27.76	13.49	4.54
14000	21.30	53.94	22.42	11.66	19.85	0.94	27.94	13.95	4.48
14500	21.46	53.89	15.06	12.12	19.01	0.97	27.93	14.24	4.57
15000	21.64	53.50	11.03	13.32	17.22	1.03	28.68	14.46	4.46
15500	21.75	52.72	8.68	15.16	14.88	1.10	28.80	14.47	4.43
16000	21.72	50.96	7.40	18.05	11.74	1.16	28.66	14.67	4.33
16500	21.59	49.77	6.69	20.99	10.01	1.20	28.68	14.95	4.33
17000	21.33	48.64	6.99	21.08	9.19	1.19	28.55	15.08	4.27
17500	21.46	46.62	7.88	16.69	7.43	1.14	28.06	15.12	4.19
18000	21.30	43.93	9.23	12.93	5.75	1.05	27.98	15.15	4.13
18500	20.61	41.39	9.92	10.16	4.58	0.97	27.36	15.00	4.46
19000	20.15	40.14	11.81	9.80	4.29	0.93	27.14	14.91	4.14
19500	19.49	39.48	16.47	9.15	4.37	0.88	27.16	14.94	3.89
20000	18.30	39.03	16.55	7.85	4.54	0.84	27.39	15.29	3.92

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

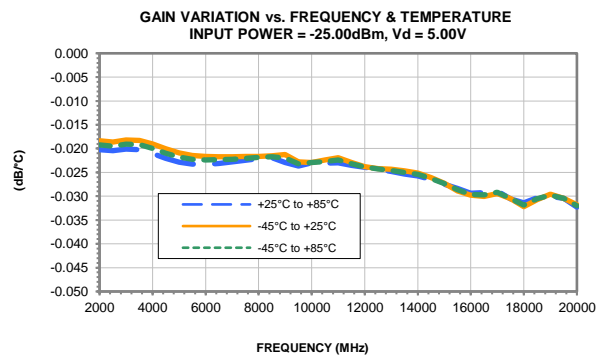
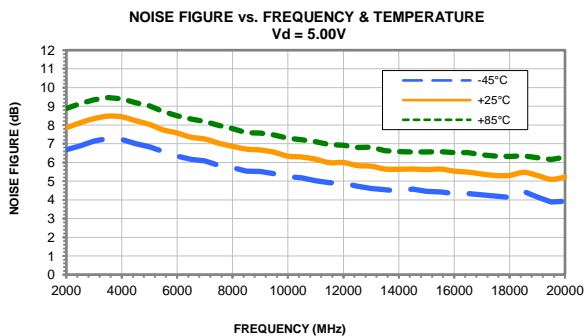
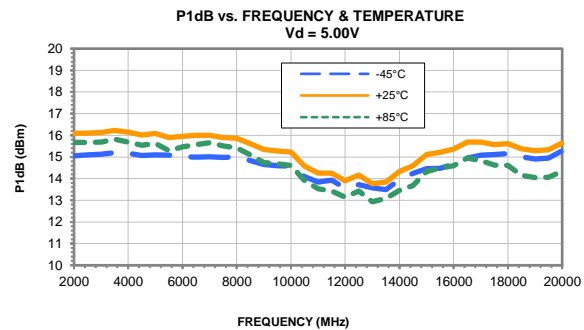
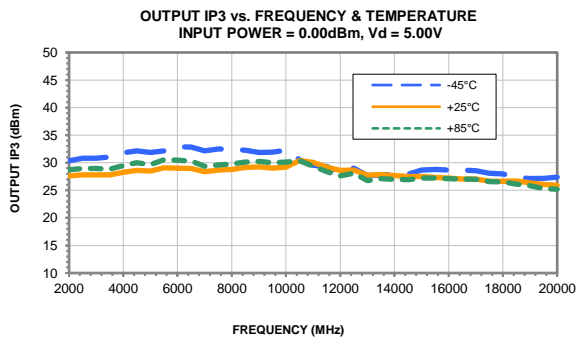
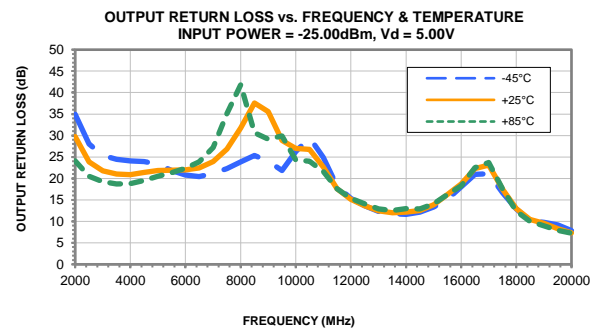
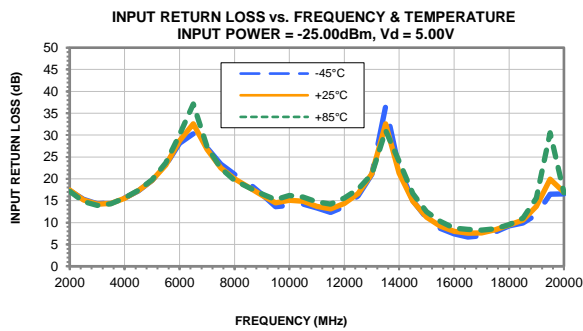
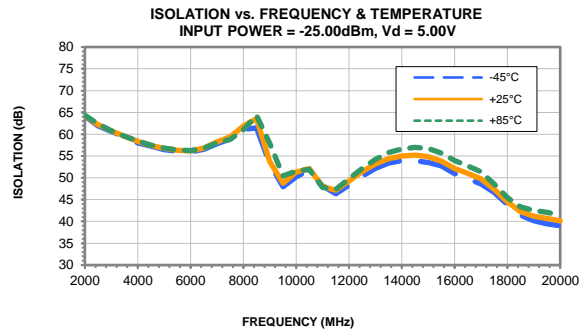
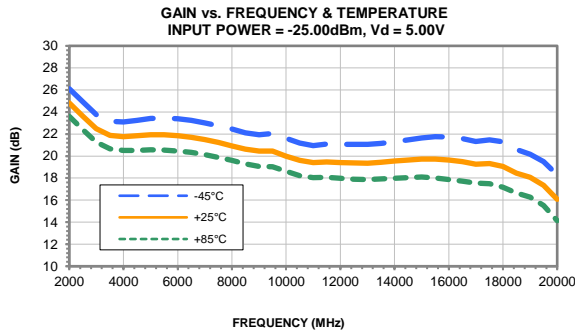
Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.00V, Id = 135.12mA @ Temperature = +85°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
					K	Measure			
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
2000	23.60	64.35	17.18	24.10	53.24	1.02	28.70	15.68	8.88
2500	22.40	62.31	14.82	20.53	47.43	1.02	28.99	15.67	9.14
3000	21.27	60.80	13.94	19.21	44.87	1.03	28.97	15.69	9.36
3500	20.67	59.53	14.29	18.75	41.67	1.02	28.87	15.82	9.47
4000	20.50	58.47	15.60	18.78	37.96	1.01	29.50	15.68	9.40
4500	20.52	57.53	17.37	19.54	34.42	1.01	29.98	15.54	9.20
5000	20.57	56.82	19.78	20.48	31.89	1.00	29.64	15.63	9.02
5500	20.55	56.40	23.67	21.30	30.65	1.00	30.55	15.28	8.72
6000	20.46	56.28	30.10	22.36	30.69	0.99	30.46	15.47	8.50
6500	20.32	56.76	37.12	23.86	33.03	1.00	30.28	15.57	8.32
7000	20.13	57.98	27.32	27.19	38.90	1.00	29.39	15.66	8.19
7500	19.88	58.80	22.43	35.13	43.85	1.01	29.59	15.51	7.98
8000	19.60	61.00	19.63	41.83	58.08	1.01	29.77	15.43	7.81
8500	19.30	64.30	18.13	30.65	87.50	1.01	30.12	15.09	7.59
9000	19.07	57.97	16.59	29.18	43.03	1.02	30.26	14.74	7.57
9500	19.02	50.43	15.21	29.89	18.03	1.03	30.03	14.68	7.46
10000	18.62	51.52	16.18	24.31	21.48	1.02	30.14	14.61	7.29
10500	18.22	51.90	15.81	24.05	23.44	1.02	30.38	13.92	7.21
11000	18.04	47.83	14.77	21.62	14.82	1.03	29.35	13.54	7.10
11500	18.07	47.40	14.24	17.58	13.83	1.02	28.37	13.43	6.96
12000	17.98	49.82	15.61	15.35	18.45	1.00	27.62	13.15	6.93
12500	17.91	52.14	17.69	14.10	24.30	0.98	28.08	13.43	6.81
13000	17.87	54.19	21.12	12.92	30.84	0.96	26.75	12.93	6.81
13500	17.91	55.81	31.06	12.52	37.03	0.94	27.10	13.09	6.64
14000	18.00	56.63	24.02	12.96	40.39	0.95	26.97	13.46	6.57
14500	18.04	56.96	16.67	12.89	40.97	0.97	26.91	13.67	6.56
15000	18.09	56.78	12.45	14.12	39.01	1.02	27.20	14.32	6.56
15500	18.03	55.68	10.24	16.23	33.78	1.07	27.19	14.49	6.58
16000	17.87	53.98	8.74	18.26	27.33	1.12	27.13	14.59	6.52
16500	17.73	52.75	8.46	22.55	24.03	1.14	27.06	14.95	6.52
17000	17.54	51.43	8.27	23.75	20.95	1.14	26.98	14.83	6.40
17500	17.49	48.55	8.55	17.62	15.11	1.12	26.57	14.63	6.35
18000	17.16	45.49	9.57	12.42	11.02	1.04	26.52	14.61	6.32
18500	16.64	43.33	11.02	10.00	9.06	0.96	26.14	14.15	6.35
19000	16.28	42.52	15.63	8.96	8.76	0.89	25.82	14.04	6.26
19500	15.53	42.07	30.55	7.94	8.93	0.84	25.28	14.06	6.16
20000	14.14	41.44	16.78	7.25	9.29	0.82	25.20	14.34	6.28

Typical Performance Curves

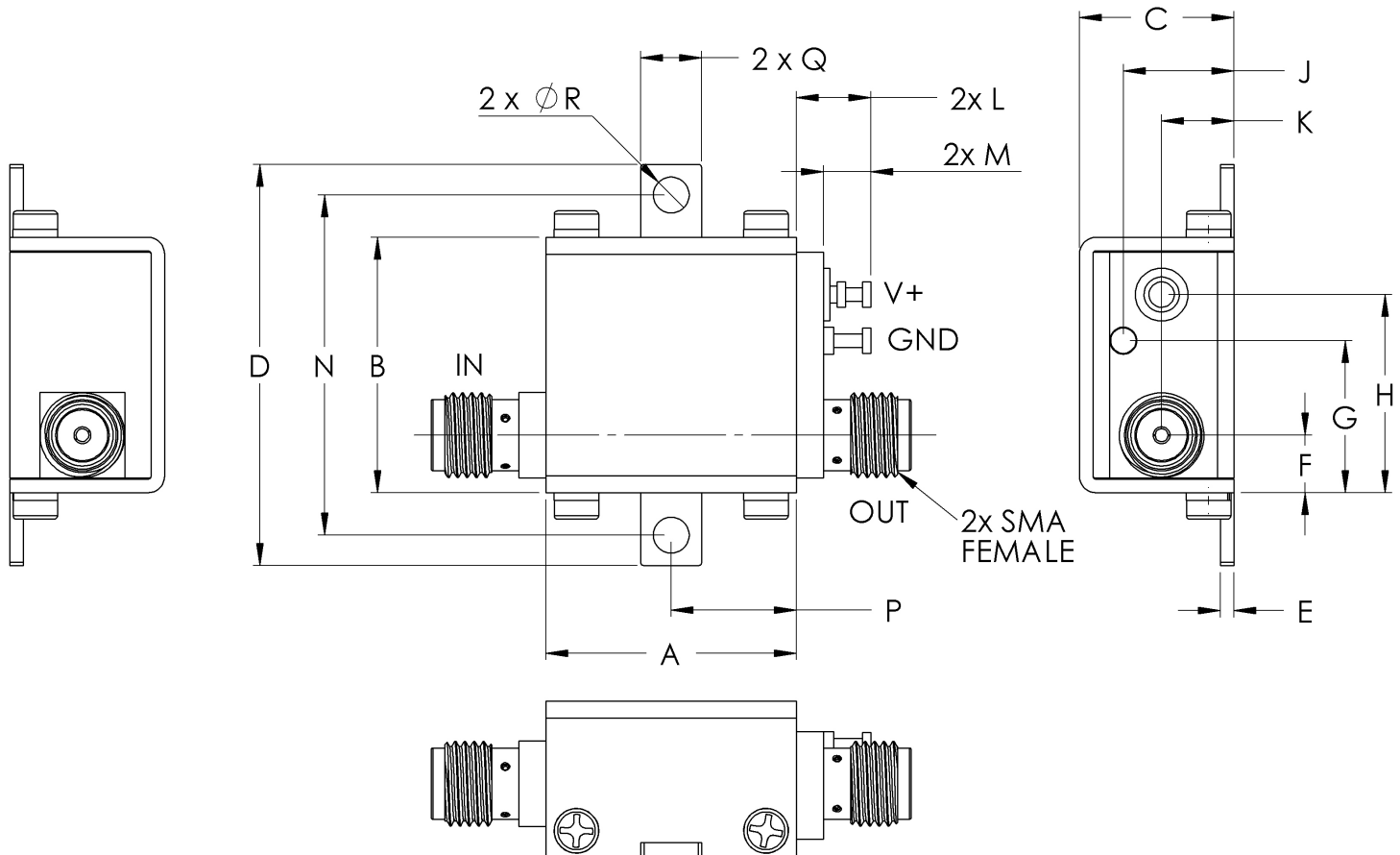


Case Style

GC

Outline Dimensions

GC957



CASE #.	A	B	C	D	E	F	G	H	J	K	L	M	N
GC957	.74 (18.80)	.75 (19.15)	.46 (11.61)	1.18 (30.07)	.04 (1.02)	.17 (4.32)	.45 (11.40)	.59 (14.86)	.33 (8.31)	.21 (5.44)	.22 (5.59)	.14 (3.56)	1.00 (25.4)

CASE #.	P	Q	R	WT GRAMS
GC957	.37 (9.40)	.18 (4.57)	.106 (2.69)	23.0

Dimensions are in inches (mm). Tolerances: 2Pl. $\pm .03$; 3Pl. $\pm .015$
Tolerance on hole size and interaxes dimensions to be $\pm .005$.

Note:

1. Case material: Brass
2. Case finish: Nickel plate

Mini-Circuits[®]

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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	-40° to 85° C Case Temperature	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Stabilization Bake	(non-operating) 125°C, 24 hours	- - -
Burn-in at Elevated Temp.	(DC on) 160 hours at 85° C	MIL-STD-202, Method 108
Thermal Shock	-55° to 100°C, 5 cycles	MIL-STD-202, Method 107, Condition A, except 100°C