



Mini-Circuits®

COAXIAL

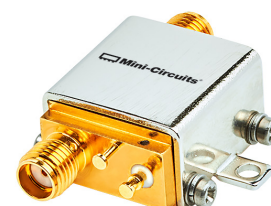
Low Noise Amplifier

ZX60-06223LN+

50Ω 6 to 22 GHz SMA Female

KEY FEATURES

- Wideband Coverage, 6 to 22 GHz
- Usable up to 26 GHz
- High Gain, 22 dB Typ.
- High Output IP3, +22.8 dBm Typ.
- Low Noise Figure, 2.8 dB Typ.
- Excellent Gain Flatness, ± 0.6 dB Typ. over 8 to 20 GHz
- Excellent Directivity, 40 dB Typ.
- Voltage Regulated Internally and Reverse Voltage Protected
- Ideal Evaluation Module for PMA4-6263LN+

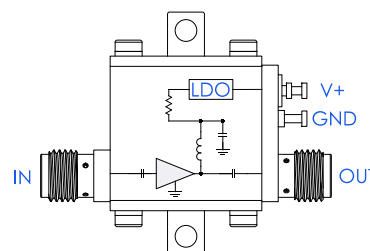


Generic photo used for illustration purposes only

APPLICATIONS

- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems
- 5G MIMO and Back Haul Radio Systems
- Signal Distribution Networks

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' ZX60-06223LN+ is a low noise amplifier utilizing MCL's own GaAs pHEMT-based amplifier, PMA4-6263LN+, offering industry-leading performance from 6 to 22 GHz and capability to 26 GHz. This design operates on a single +5 V supply @ 62 mA and comes in a rugged, compact unibody case (0.74" x 0.75" x 0.46") with integrated SMA female connectors, making it an excellent candidate for demanding operating conditions and use in crowded system layouts.

ELECTRICAL SPECIFICATIONS AT +25°C AND $V_s = +5V$, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range	-	6	-	22	GHz
Gain	6	18	21	-	dB
	10	20	22	-	
	15	19	22	-	
	22	20	23	-	
Gain Flatness	8-20	-	± 0.6	-	dB
	6-22	-	± 1.0	-	
Input Return Loss	6	-	10	-	dB
	10	-	15	-	
	15	-	9	-	
	22	-	6	-	
Output Return Loss	6	-	11	-	dB
	10	-	8	-	
	15	-	15	-	
	22	-	11	-	
Directivity	6-22	-	40	-	dB

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

REV. OR
ECO-027530
ZX60-06223LN+
MCL NY
251203

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ELECTRICAL SPECIFICATIONS AT +25°C AND $V_S = +5V$, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Output Power at 1 dB Compression (P1dB)	6	-	+10	-	dBm
	10	-	+10	-	
	15	-	+12	-	
	22	-	+11	-	
Output Third Order Intercept Point (Output Power = -5 dBm/Tone)	6	-	+20	-	dBm
	10	-	+22	-	
	15	-	+23	-	
	22	-	+23	-	
Noise Figure	6	-	2.9	-	dB
	10	-	2.4	-	
	15	-	2.8	-	
	22	-	3.5	-	
DC Supply Voltage (V_S)	-	+4.6	+5	+7.5	V
DC Current ¹	-	-	62	155	mA

1. Typical current measured under small signal conditions. Max DC current measured at P_{SAT} . DC current increases as amplifier is driven into compression.





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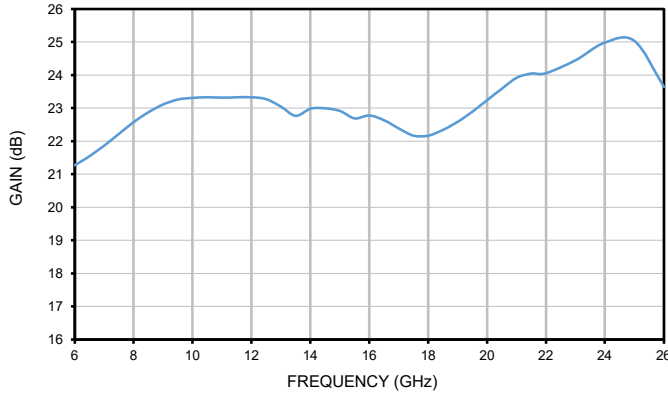
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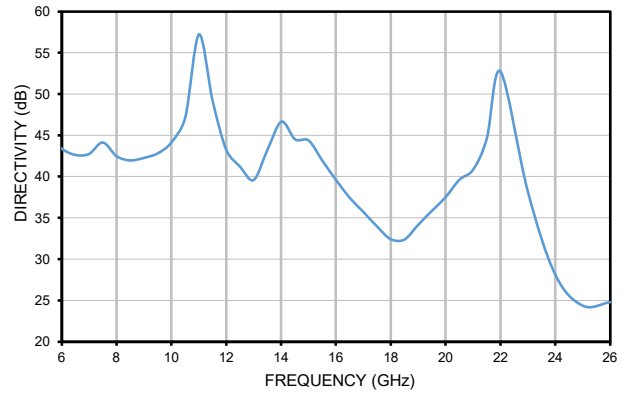
50Ω 6 to 22 GHz SMA Female

TYPICAL PERFORMANCE GRAPHS

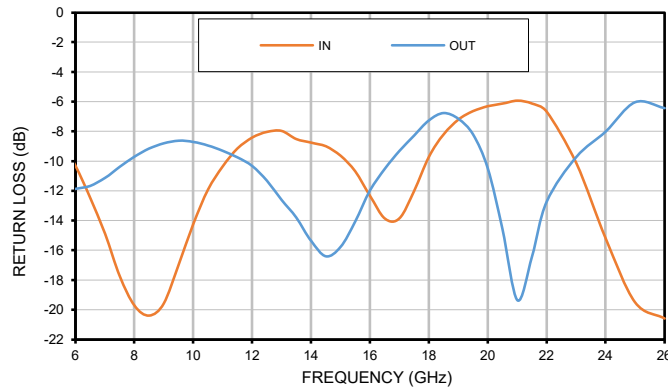
GAIN



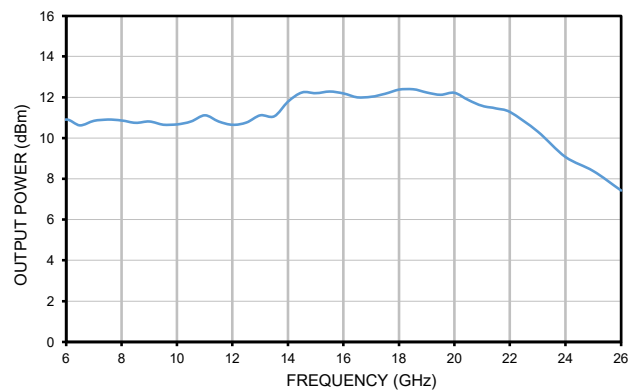
DIRECTIVITY



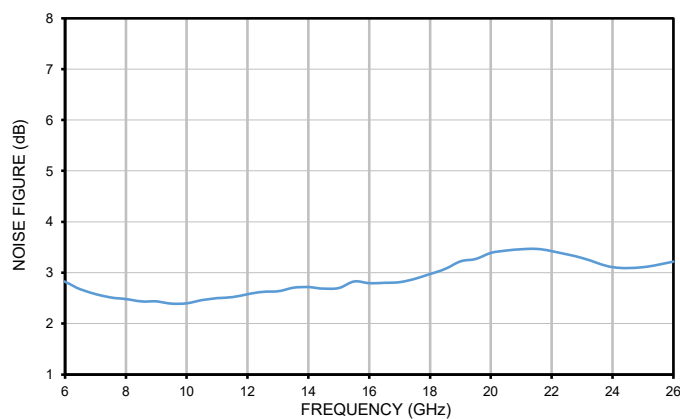
RETURN LOSS



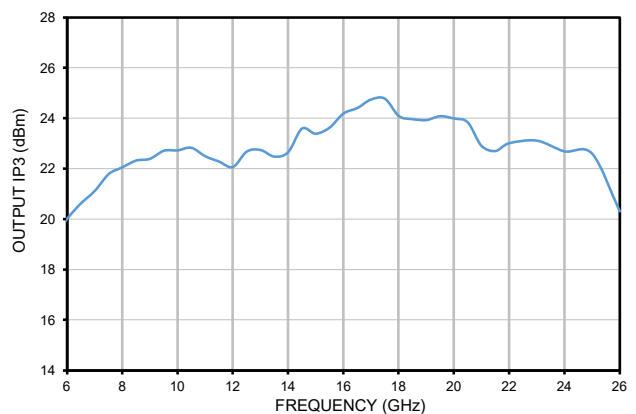
OUTPUT POWER AT 1dB COMPRESSION



NOISE FIGURE



OUTPUT IP3



ABSOLUTE MAXIMUM RATINGS^{2,3}

Parameter	Ratings
Operating Temperature (Case)	-40°C to +85°C
Storage Temperature	-55 °C to +100°C
Total Power Dissipation ⁴	1.21 W
RF Input Power (CW)	+10 dBm
DC Operating Voltage	+8.0 V

2. Specified under matched load to 50 ohms.

3. Continuous operation is not recommended at these extremes. Permanent damage may occur if any of these limits are exceeded.

4. Total power dissipation determined at $V_s = +8\text{ V}$ with the amplifier operating in saturation.

DETERMINING MAXIMUM THERMAL RESISTANCE OF USERS' EXTERNAL HEAT SINK

$\text{MAXIMUM THERMAL RESISTANCE}$	$= \frac{\text{MAXIMUM OPERATING CASE TEMP} - \text{MAXIMUM USER AMBIENT TEMP}}{\text{POWER DISSIPATION}}$
Example:	MAXIMUM OPERATING CASE TEMP = +50°C (CHECK MAXIMUM RATINGS TABLE FOR THIS VALUE) MAXIMUM USER AMBIENT TEMP = +30°C (USER DEFINED) POWER DISSIPATION = 10 WATTS (CHECK MAXIMUM RATINGS TABLE FOR THIS VALUE) THEN MAXIMUM ALLOWABLE THERMAL RESISTANCE = 2°C/W



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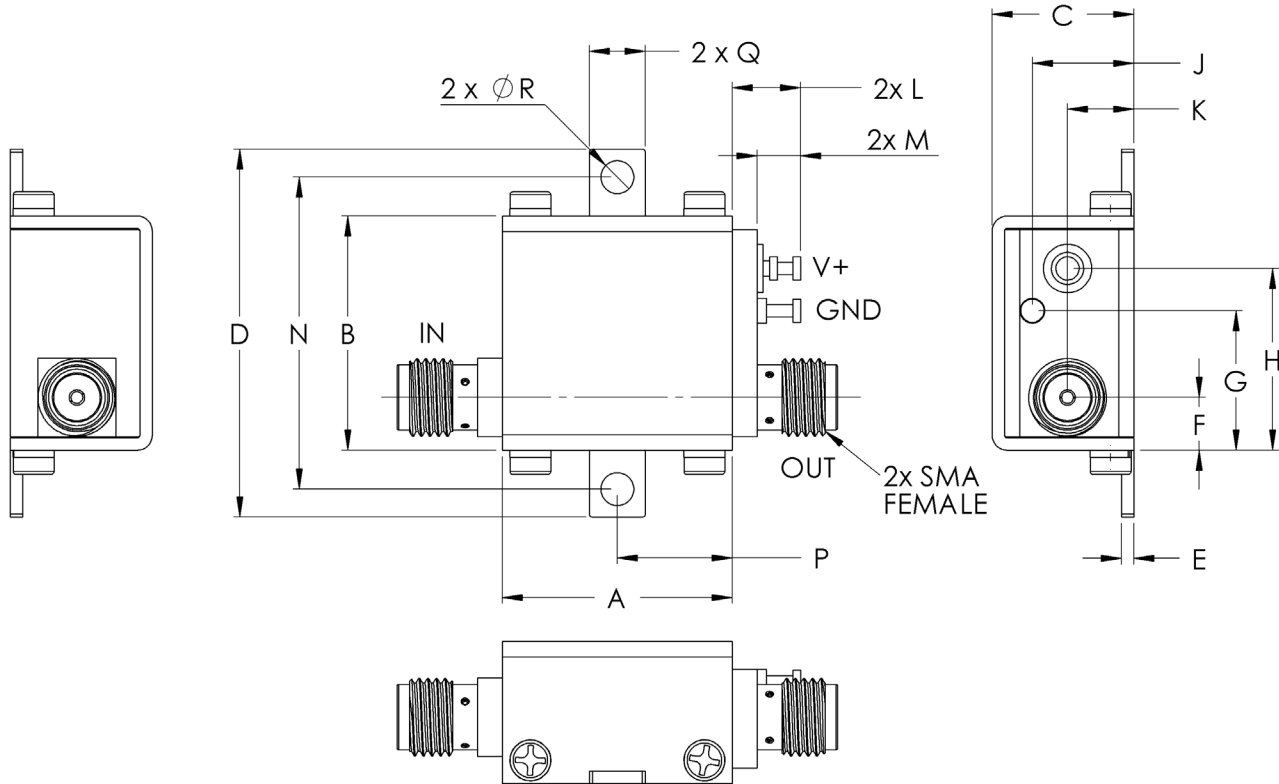
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Low Noise Amplifier

ZX60-06223LN+

50Ω 6 to 22 GHz SMA Female

CASE STYLE DRAWING



Weight: 23.0 grams

Dimensions are in inches [mm]. Tolerances: 1 Pl. ± 0.1 ; 2 Pl. ± 0.03 ; 3 Pl. ± 0.015 Inches

 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





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ADDITIONAL INFORMATION IS AVAILABLE ON OUR DASHBOARD.

Performance Data & Graphs	Data
	Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
RoHS Status	Compliant
Environmental Ratings	ENV23T10
Export Information	ECCN# EAR99

ORDERING INFORMATION

Model No. Link	ZX60-06223LN+
Case Style	GC957
Connector	IN: SMA Female OUT: SMA Female

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/terms/viewterm.html



Coaxial Amplifier

ZX60-06223LN+

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 = 5V, Id = 62mA @ Temperature = +25°C

FREQUENCY	GAIN	DIRECTIVITY	RETURN LOSS (dB)		STABILITY		Pout @ 1 dB COMPRESSION	NOISE FIGURE	OIP3
(GHz)	(dB)	(dB)	IN	OUT	K	Measure	(dBm)	(dB)	(dBm)
4.0	16.5	56.1	4.9	21.6	213.67	1.32	7.1	5.0	17.0
4.5	19.7	52.1	5.6	14.3	140.54	1.23	9.9	3.7	18.6
5.0	20.8	47.7	6.9	12.4	91.32	1.14	10.5	3.2	18.9
5.5	21.1	44.9	8.5	12.0	71.09	1.07	10.5	2.9	19.3
6.0	21.3	43.4	10.3	11.9	62.54	1.02	10.9	2.8	20.0
6.5	21.6	42.6	12.4	11.7	59.47	0.98	10.6	2.7	20.6
7.0	21.9	42.8	14.9	11.1	61.42	0.95	10.8	2.6	21.1
7.5	22.2	44.2	17.7	10.4	72.03	0.92	10.9	2.5	21.8
8.0	22.6	42.5	19.7	9.7	58.83	0.90	10.9	2.5	22.1
8.5	22.9	42.0	20.4	9.2	54.71	0.89	10.8	2.4	22.3
9.0	23.1	42.3	19.6	8.8	55.85	0.88	10.8	2.4	22.4
9.5	23.3	42.8	16.9	8.6	58.65	0.88	10.7	2.4	22.7
10.0	23.3	44.2	14.2	8.7	67.32	0.90	10.7	2.4	22.7
10.5	23.3	47.2	11.9	8.9	93.15	0.93	10.8	2.5	22.8
11.0	23.3	57.2	10.4	9.3	290.74	0.96	11.1	2.5	22.5
11.5	23.3	49.2	9.1	9.7	113.15	1.00	10.8	2.5	22.3
12.0	23.3	43.2	8.4	10.3	56.38	1.04	10.7	2.6	22.1
12.5	23.3	41.2	8.0	11.3	44.96	1.07	10.8	2.6	22.7
13.0	23.1	39.6	8.0	12.6	38.02	1.10	11.1	2.6	22.7
13.5	22.8	43.2	8.5	13.8	59.61	1.09	11.1	2.7	22.5
14.0	23.0	46.7	8.8	15.4	90.61	1.10	11.8	2.7	22.7
14.5	23.0	44.5	9.0	16.4	71.89	1.10	12.2	2.7	23.6
15.0	22.9	44.4	9.6	15.8	71.79	1.08	12.2	2.7	23.4
15.5	22.7	41.9	10.7	14.1	54.89	1.04	12.3	2.8	23.6
16.0	22.8	39.6	12.3	12.0	42.06	0.99	12.2	2.8	24.2
16.5	22.6	37.4	13.9	10.5	32.49	0.95	12.0	2.8	24.4
17.0	22.4	35.7	13.8	9.3	25.79	0.92	12.0	2.8	24.8
17.5	22.2	34.0	12.0	8.3	19.82	0.91	12.2	2.9	24.8
18.0	22.2	32.4	9.7	7.3	15.07	0.90	12.4	3.0	24.1
18.5	22.3	32.4	8.2	6.8	13.87	0.91	12.4	3.1	24.0
19.0	22.6	34.2	7.2	7.2	16.79	0.96	12.2	3.2	23.9
19.5	22.9	35.9	6.6	8.2	20.79	1.03	12.1	3.3	24.1
20.0	23.2	37.5	6.3	10.5	26.39	1.12	12.2	3.4	24.0
20.5	23.6	39.6	6.1	14.6	35.08	1.20	11.9	3.4	23.8
21.0	23.9	40.9	5.9	19.4	40.61	1.24	11.6	3.5	22.9
21.5	24.0	44.6	6.1	16.4	62.97	1.22	11.5	3.5	22.7
22.0	24.1	52.7	6.7	12.7	161.01	1.15	11.3	3.4	23.0
23.0	24.5	38.2	10.1	9.7	32.79	0.98	10.3	3.3	23.1
24.0	25.0	28.1	15.2	8.0	10.30	0.87	9.1	3.1	22.7
25.0	25.0	24.4	19.5	6.0	6.17	0.76	8.4	3.1	22.6
26.0	23.6	24.8	20.6	6.4	6.66	0.78	7.4	3.2	20.3



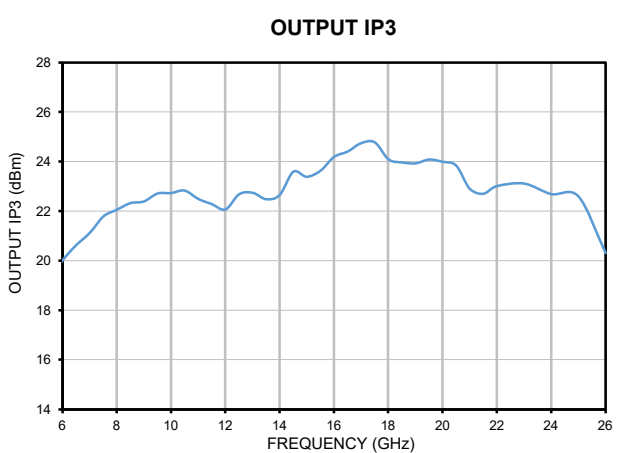
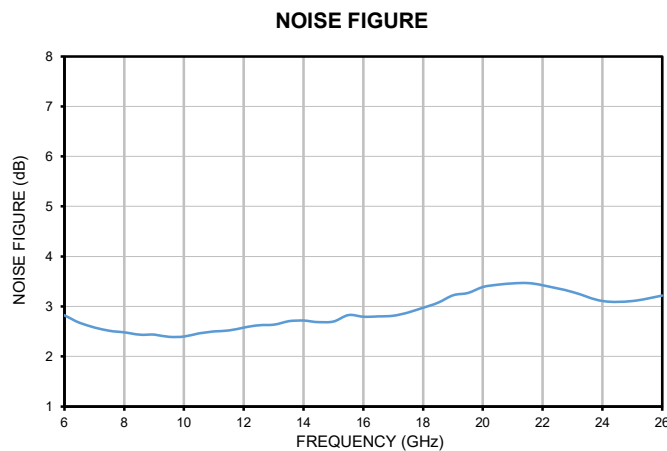
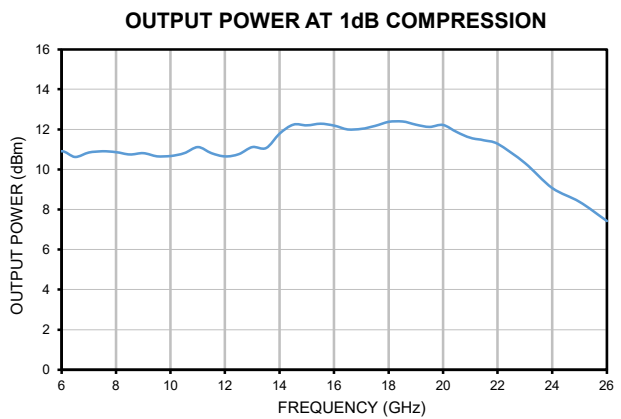
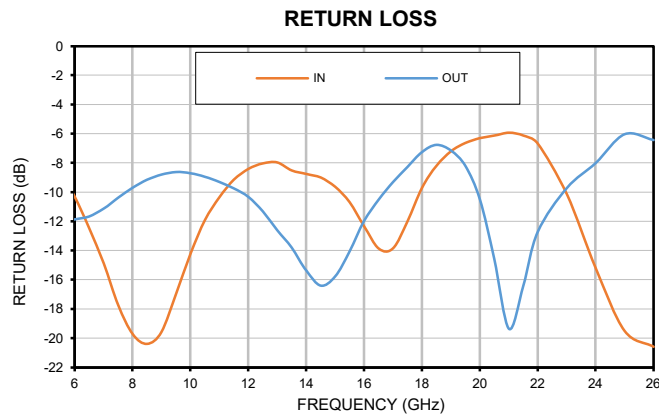
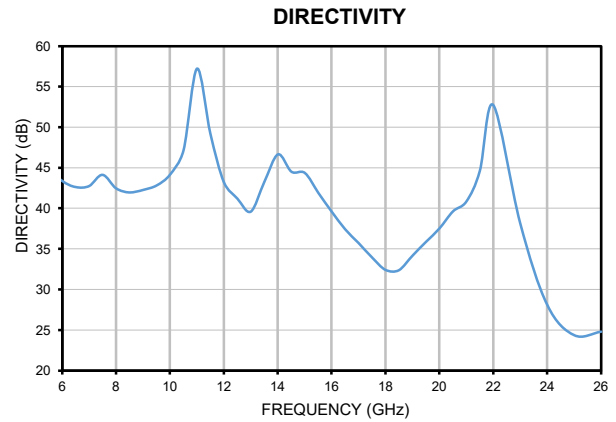
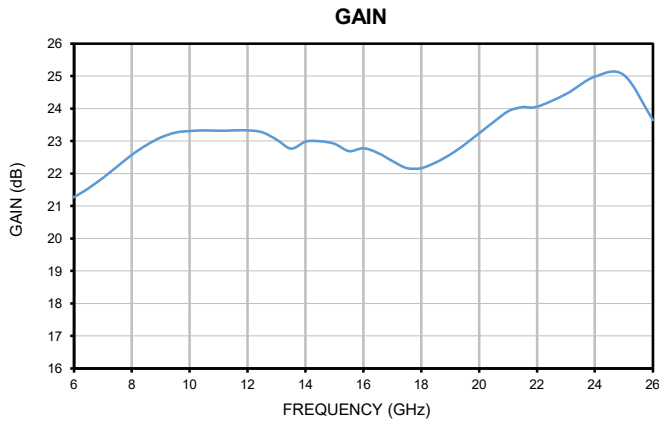
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 • Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site
 The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

IF/RF MICROWAVE COMPONENTS



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 ZX60-06223LN+
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Typical Performance Curves

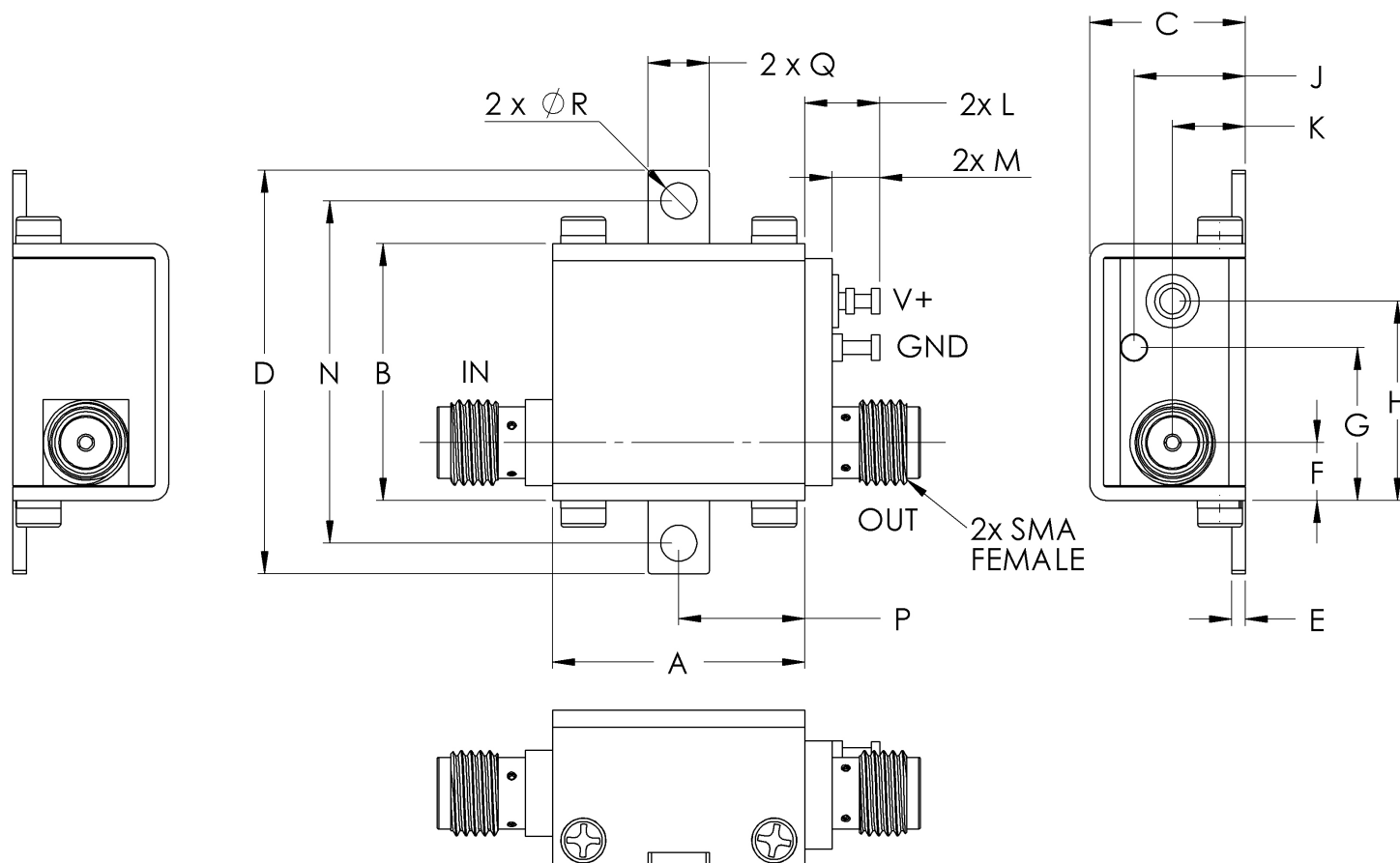


Case Style

Outline Dimensions

GC

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



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Mini-Circuits ISO 9001 & ISO 14001 Certified

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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