



COAXIAL

Low Phase Noise Amplifier **ZX60-123LPNR+**

50 Ω 0.05 to 10 GHz SMA Female

KEY FEATURES

- Ultra-Broadband Performance
- Gain, 16 dB Typ.
- Excellent Gain Flatness, ± 0.8 dB, 0.05 to 6 GHz
- Low Additive Phase Noise, Typically -168 dBc/Hz at 10 kHz
- Voltage Regulated Internally and Reverse Voltage Protected
- Protected by US Patent 6,790,049

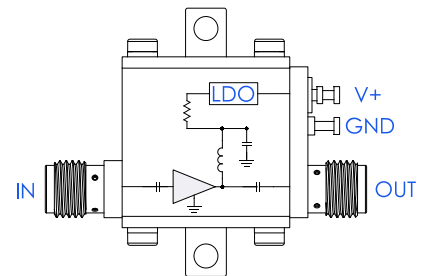


Generic photo used for illustration purposes only

APPLICATIONS

- Low Phase Noise Applications
- Base Station Infrastructure
- Test Instrumentation
- MMDS & Wireless LAN
- Satellite Communications
- Avionics

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' ZX60-123LPNR+ is an advanced ultra-wideband amplifier fabricated using GaAs HBT technology that provides extremely low additive phase noise and offers excellent gain flatness over a broad frequency range. In addition, the ZX60-123LPNR+ exhibits good input and output return loss over the 0.05 to 10 GHz frequency range without the need for external matching components. Housed in a rugged, cost-effective unibody chassis, this amplifier supports a wide variety of applications requiring moderate power output, low distortion, and 50 Ω matched input/output ports.

ELECTRICAL SPECIFICATIONS AT +25 °C BASEPLATE AND $V_S = +6$ V

Parameter	Frequency (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.05		10	GHz
Gain	0.05	-	16.2	-	dB
	2.0	15.2	16.5	-	
	6.0	-	15.5	-	
	8.0	-	15.0	-	
	10.0	-	12.5	-	
Input Return Loss	0.05	-	13.0	-	dB
	2.0	15.0	20.2	-	
	6.0	-	18.0	-	
	8.0	-	15.0	-	
	10.0	-	8.0	-	
Output Return Loss	0.05	-	15.0	-	dB
	2.0	-	22.0	-	
	6.0	-	19.5	-	
	8.0	-	11.5	-	
	10.0	-	7.5	-	



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ELECTRICAL SPECIFICATIONS AT +25 °C BASEPLATE AND $V_S = +6\text{ V}$

Parameter	Frequency (GHz)	Min.	Typ.	Max.	Units
Noise Figure	0.05	-	5.8	-	dB
	2.0	-	3.9	-	
	6.0	-	4.3	-	
	8.0	-	4.5	-	
	10.0	-	5.4	-	
Output Power at 1 dB Compression (P1dB)	0.05	-	+17.5	-	dBm
	2.0	-	+16.2	-	
	6.0	-	+13.5	-	
	8.0	-	+10.6	-	
	10.0	-	+8.3	-	
Directivity (Isolation - Gain)	0.05	-	4.7	-	dB
	6.0	-	6.2	-	
	10.0	-	11.9	-	
Output Third Order Intercept Point (OIP3)	0.05	-	+18.0	-	dBm
	2.0	-	+30.0	-	
	6.0	-	+24.0	-	
	8.0	-	+22.0	-	
	10.0	-	+19.0	-	
Additive Phase Noise ¹	2.0	-	-168.0	-	dBc/Hz
DC Supply Voltage (V_S)	-	+5.5	+6.0	+9	V
DC Current ²	-	-	56	70	mA

1. Input power +1 dBm, 2 GHz, 10 kHz offset.

2. Current at $P_{IN} = -25\text{ dBm}$. Increases to 98 mA at P_{SAT} .



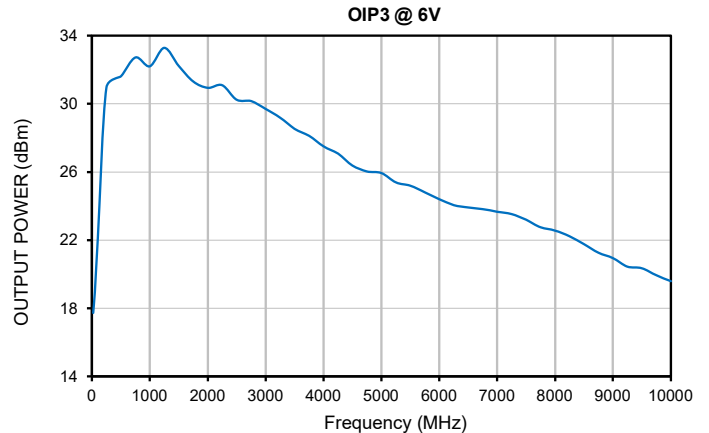
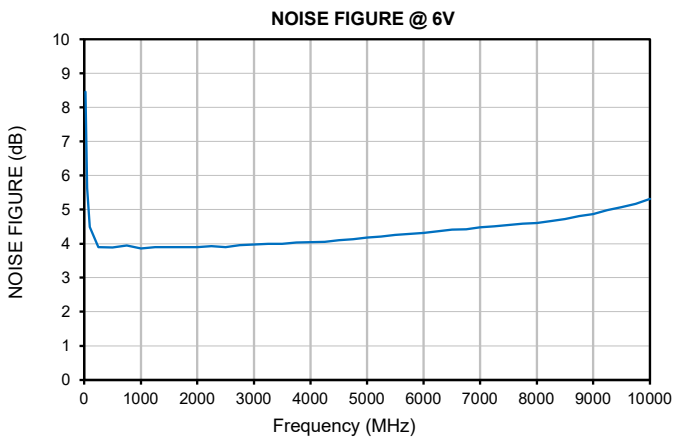
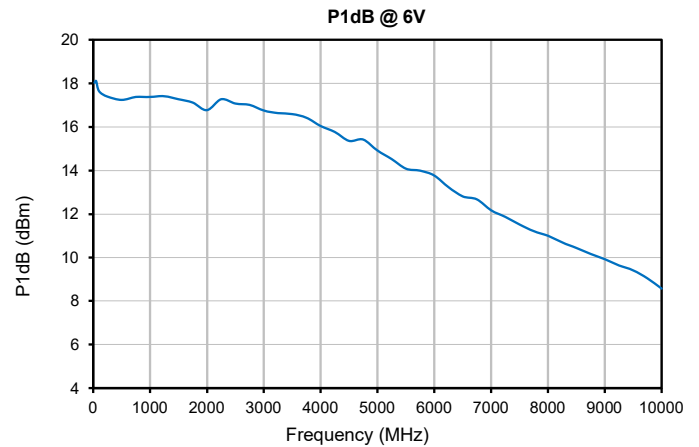
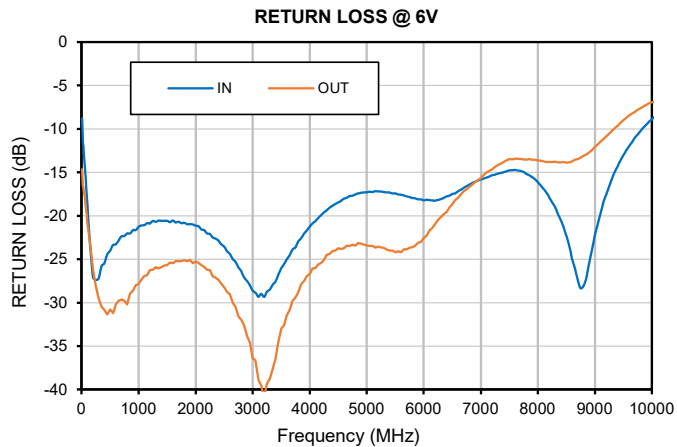
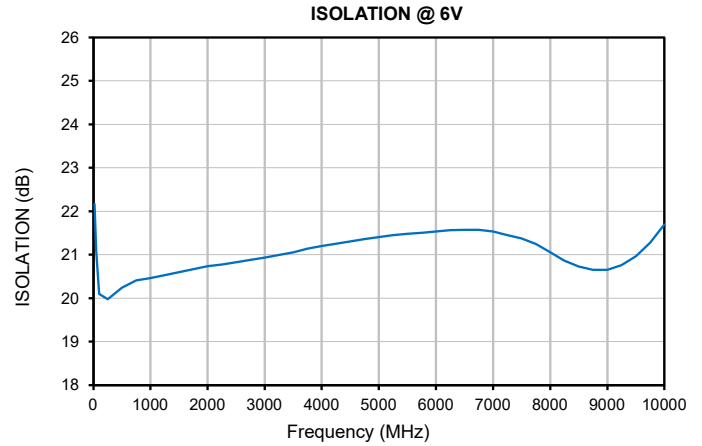
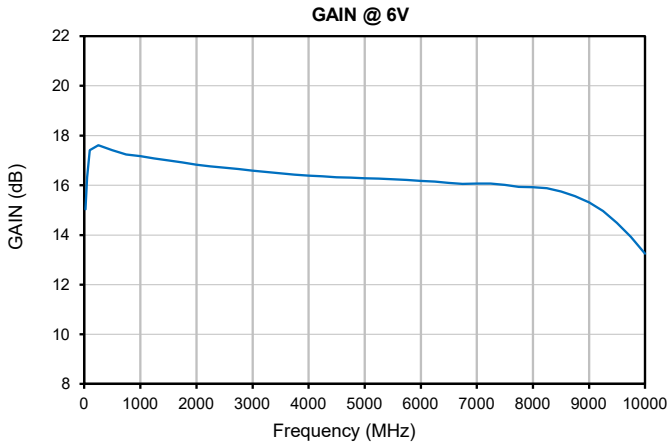
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Low Phase Noise Amplifier **ZX60-123LPCR+**

Mini-Circuits

50Ω 0.05 to 10 GHz SMA Female

TYPICAL PERFORMANCE GRAPHS AT +25 °C





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Low Phase Noise Amplifier **ZX60-123LPCR+**

50Ω 0.05 to 10 GHz SMA Female

ABSOLUTE MAXIMUM RATINGS³

Parameter	Ratings
Operating Temperature	-40 °C to +65 °C Baseplate
Storage Temperature	-55 °C to +100 °C
Total Power Dissipation	1.0 W
RF Input Power (CW)	+11 dBm
DC Operating Voltage ⁴	+10.0 V

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

4. No protection against reverse voltage.

DETERMINING MAXIMUM THERMAL RESISTANCE OF USERS' EXTERNAL HEATSINK

$\text{MAXIMUM THERMAL RESISTANCE} = \frac{\text{MAXIMUM OPERATING CASE TEMP} - \text{MAXIMUM USER AMBIENT TEMP}}{\text{POWER DISSIPATION}}$	
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

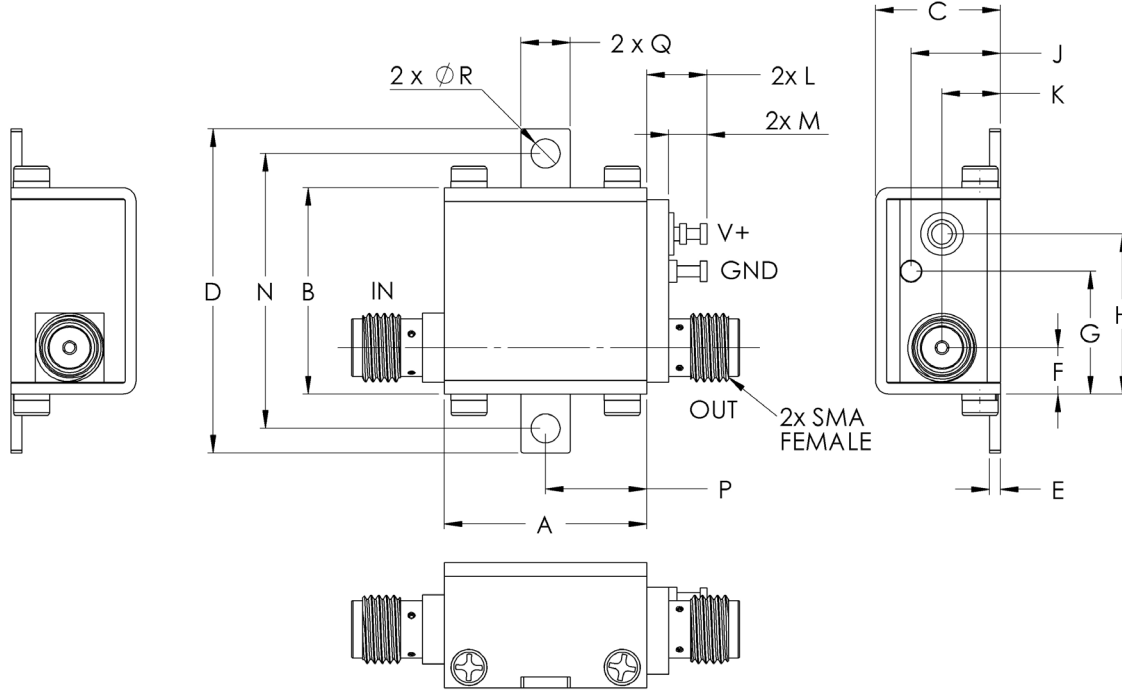


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Low Phase Noise Amplifier **ZX60-123LPNR+**

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CASE STYLE 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 (Inch/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	19.15	11.61	30.07	1.02	4.32	11.40	14.86	8.31	5.44	5.59	3.56	25.4	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	ENV23T35
Export Information	ECCN# EAR99

ORDERING INFORMATION

Model No. Link	ZX60-123LPNR+
Product Marking	ZX60-123LPNR+
Case Style	GC957
Connector	IN SMA female / OUT SMA female

NOTES

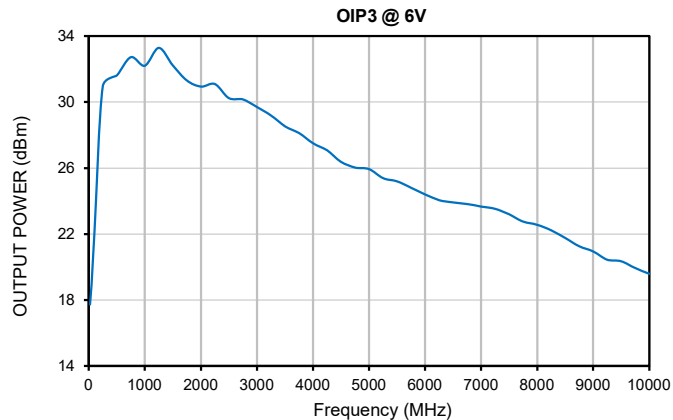
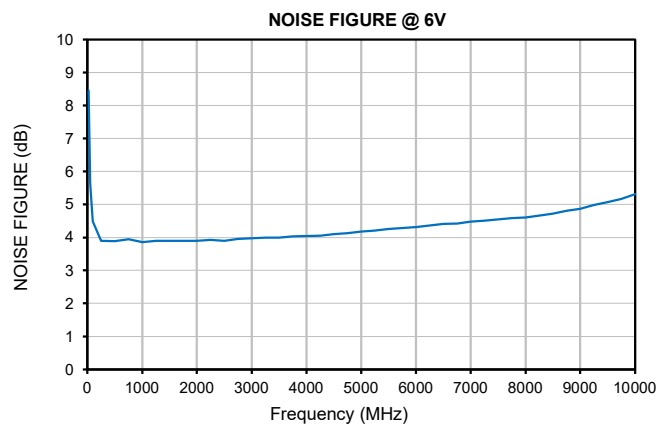
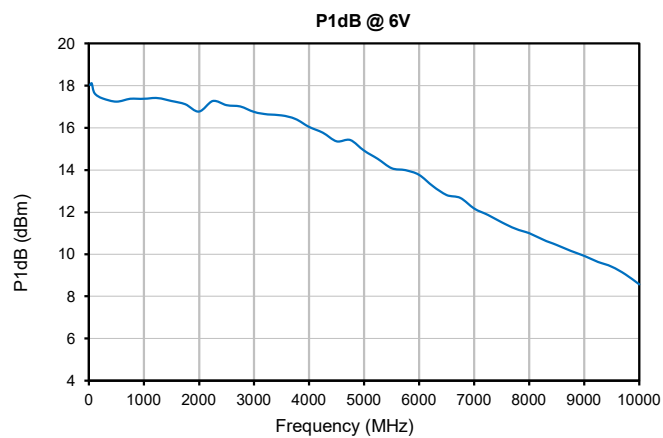
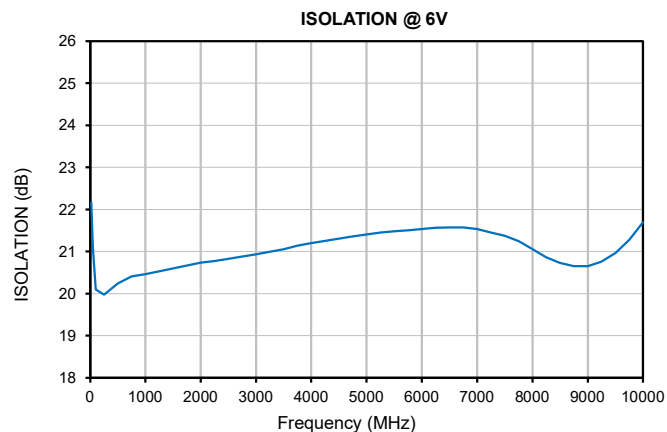
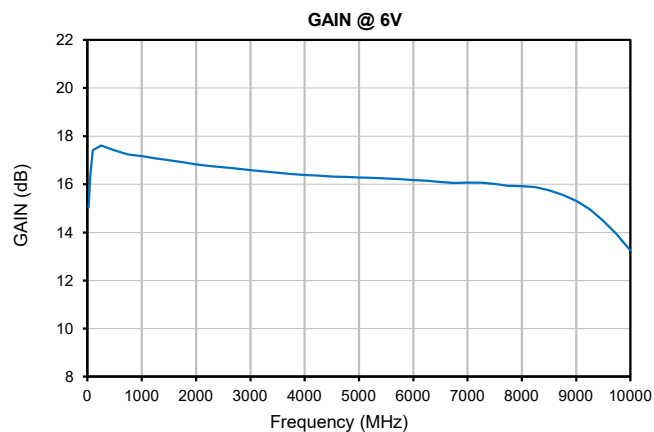
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- Electrical specifications and performance data contained in this specification document are based on Mini-Circuits' applicable established test performance criteria and measurement instructions.
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Typical Performance Data

FREQUENCY (MHz)	GAIN (dB) 6V	ISOLATION (dB) 6V	RETURN LOSS (dB)		STABILITY		Pout @ 1 dB COMPRESSION (dBm) 6V	OIP3 (dBm) 6V	NOISE FIGURE (dB) 6V
			IN 6V	OUT 6V	K	MEASURE			
20	15.03	22.17	11.0	16.5	1.2	0.90	17.4	17.72	8.45
50	16.32	21.10	13.7	17.5	1.1	0.69	17.0	18.94	5.64
100	17.40	20.10	18.6	20.6	1.0	0.45	16.1	22.14	4.49
250	17.61	19.98	27.4	28.0	1.0	0.42	16.1	30.95	3.89
500	17.40	20.24	24.0	30.8	1.1	0.48	16.6	31.61	3.89
750	17.24	20.41	22.3	29.8	1.1	0.52	16.2	32.71	3.95
1000	17.17	20.46	21.3	27.9	1.1	0.53	16.4	32.20	3.86
1250	17.08	20.53	20.6	26.2	1.1	0.55	15.9	33.28	3.89
1500	17.00	20.60	20.6	25.7	1.1	0.56	16.0	32.22	3.89
1750	16.91	20.67	20.9	25.2	1.1	0.58	15.9	31.31	3.90
2000	16.82	20.74	21.2	25.3	1.1	0.59	16.3	30.93	3.90
2250	16.76	20.78	22.1	26.3	1.1	0.60	16.0	31.08	3.92
2500	16.70	20.83	23.6	28.2	1.1	0.61	15.9	30.23	3.89
2750	16.64	20.88	25.9	31.6	1.1	0.62	15.7	30.15	3.96
3000	16.59	20.94	28.6	36.4	1.1	0.63	15.9	29.70	3.97
3250	16.53	20.99	28.8	39.3	1.1	0.64	15.8	29.18	3.98
3500	16.48	21.06	26.1	32.9	1.1	0.65	15.8	28.54	4.00
3750	16.43	21.14	23.6	29.4	1.1	0.66	15.6	28.11	4.03
4000	16.39	21.20	21.2	26.7	1.2	0.67	15.4	27.50	4.04
4250	16.35	21.25	19.6	25.1	1.2	0.68	15.0	27.07	4.06
4500	16.33	21.31	18.5	23.7	1.2	0.68	14.54	26.38	4.09
4750	16.31	21.36	17.7	23.3	1.2	0.69	14.44	26.02	4.13
5000	16.28	21.41	17.3	23.4	1.2	0.70	14.09	25.94	4.18
5250	16.26	21.45	17.2	23.6	1.2	0.71	13.93	25.38	4.21
5500	16.24	21.48	17.4	24.2	1.2	0.72	13.59	25.20	4.26
5750	16.22	21.51	17.9	23.7	1.2	0.72	13.18	24.81	4.52
6000	16.18	21.54	18.2	22.6	1.2	0.73	12.92	24.40	4.32
6250	16.14	21.56	18.2	20.5	1.2	0.73	13.03	24.06	4.36
6500	16.09	21.57	17.5	18.7	1.2	0.73	12.82	23.91	4.41
6750	16.06	21.57	16.6	17.0	1.2	0.73	12.39	23.82	4.42
7000	16.06	21.54	15.8	15.6	1.1	0.72	11.91	23.66	4.48
7250	16.07	21.45	15.3	14.4	1.1	0.70	11.40	23.53	4.51
7500	16.00	21.38	14.8	13.5	1.1	0.70	10.84	23.19	4.55
7750	15.93	21.24	15.0	13.5	1.1	0.69	10.32	22.75	4.58
8000	15.92	21.05	16.2	13.7	1.1	0.68	9.80	22.56	4.60
8250	15.87	20.87	18.5	13.8	1.1	0.66	9.08	22.23	4.67
8500	15.75	20.73	22.3	13.9	1.1	0.66	8.76	21.76	4.72
8750	15.56	20.65	28.3	13.3	1.1	0.65	8.30	21.26	4.80
9000	15.30	20.65	22.3	12.1	1.1	0.65	8.09	20.95	4.87
9250	14.95	20.76	16.6	10.6	1.1	0.65	7.79	20.44	4.99
9500	14.48	20.96	13.0	9.0	1.2	0.65	7.45	20.36	5.07
9750	13.93	21.28	10.6	7.8	1.2	0.66	7.37	19.93	5.16
10000	13.25	21.70	8.9	7.0	1.2	0.69	6.90	19.60	5.31

Typical Performance Curves

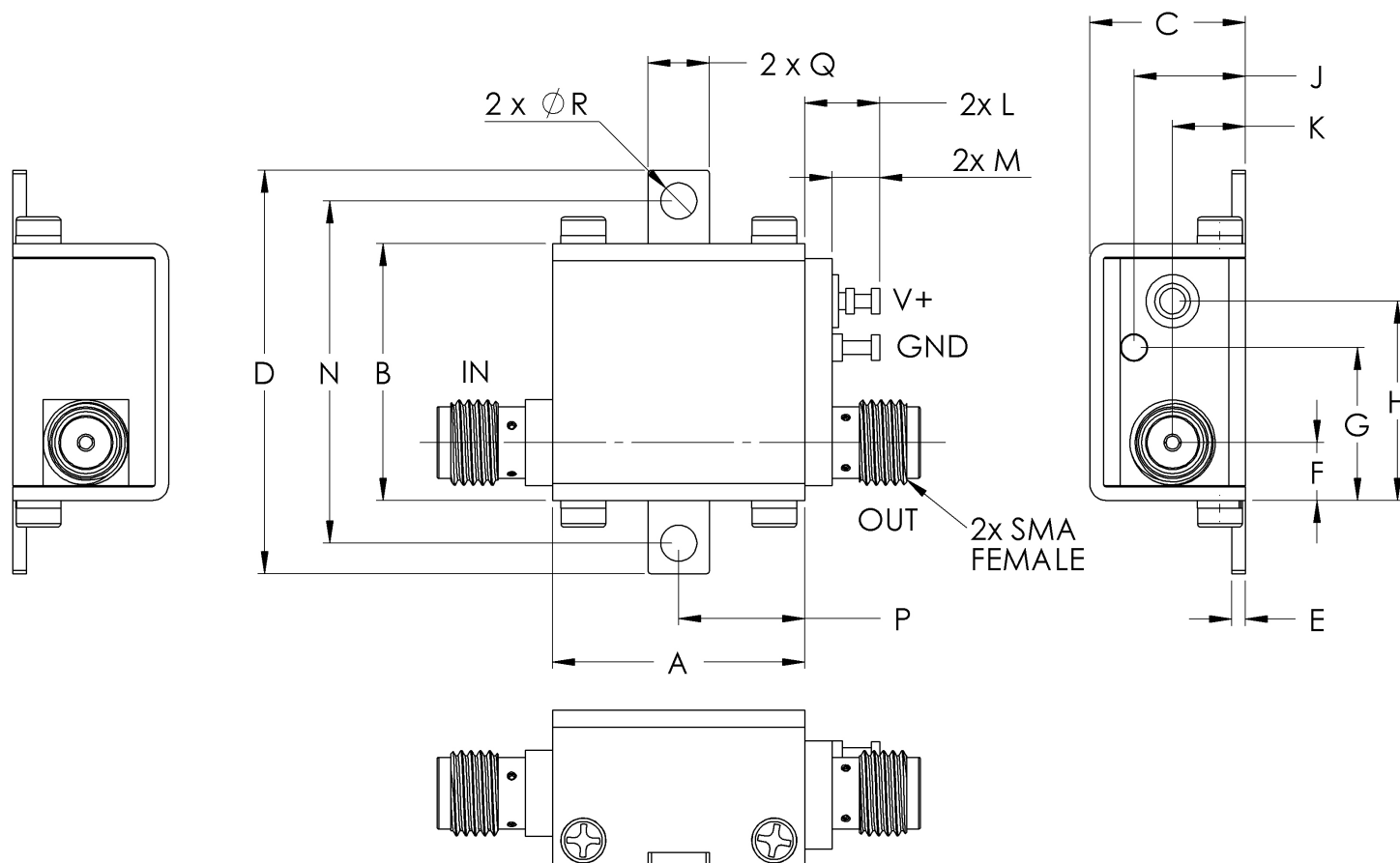


Case Style

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:

- Case material: Brass
- Case finish: Nickel plate



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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