COAXIAL

Low Phase Noise Amplifier ZX60-123LPN+

50Ω 0.05 to 10 GHz SMA Female

THE BIG DEAL

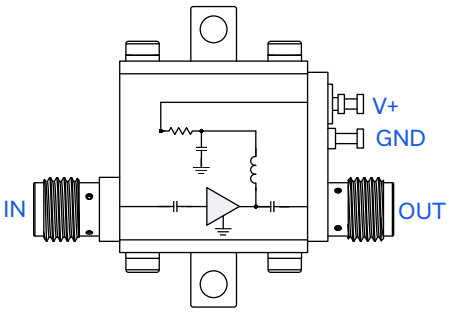
- Ultra Broadband Performance
- Gain, 16 dB Typ.
- Excellent Gain Flatness, ±0.9 dB, 0.05 to 6 GHz
- Excellent Return Loss, 20 dB Typ., 2 GHz
- Low Additive Phase Noise, Typically -168 dBc/Hz at 10 kHz
- Protected by US Patent 6,790,049

Generic photo used for illustration purposes only

APPLICATIONS

- Low Phase Noise Applications
- Base Station Infrastructure
- Test Instruments
- MMDS & Wireless LAN
- Satellite Communication
- Avionics

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' ZX60-123LPN+ 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 ZX60-123LPN+ has good input and output return loss over this 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 50Ω matched input/output ports.

KEY FEATURES

Feature	Advantages
Ultra Broadband, 0.05 to 10 GHz	Broadband covering primary wireless communications bands: Cellular, PCS, LTE, WiMAX in a single amplifier.
Ultra Flat Gain, ±0.9 dB Typ: 0.05 to 6 GHz	Ultra Flat Gain, eliminates need for compensation networks to achieve published results.
Low Additive Phase Noise	Extremely low additive phase noise of -168 dBc/Hz typ. at 10 kHz offset from 2 GHz carrier, with +1 dBm of input power.
Excellent Input and Output Return Loss	ZX60-123LPN+ provides good Input and Output Return Loss of 12 to 28 dB over 0.05 to 6 GHz without the need for any external matching components.
Unconditionally Stable	Capable to operate to a wide range of source and load impedances.
Very Small Size, 0.75x0.75"	The unique unibody size and construction enable the ZX60-123LPN+ to be used in extremely compact connectorized applications.
Rugged, Unibody Construction	Mini-Circuits unibody construction integrates the RF connector into the case body, providing high reliability and excellent survivability in critical applications.

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ELECTRICAL SPECIFICATIONS AT +25 °C

Parameter	Frequency (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.05		10	GHz
Gain	0.05	15.2	16.2		dB
	2.0		16.5		
	6.0		15.5		
	8.0		14.5		
	10.0		11.5		
Input Return Loss	0.05	15.0	13.0		dB
	2.0		20.2		
	6.0		18.4		
	8.0		10.5		
	10.0		7.2		
Output Return Loss	0.05		15.0		dB
	2.0		17.6		
	6.0		20.5		
	8.0		6.50		
	10.0		10.5		
Output Power at 1 dB Compression (P1dB)	0.05		+16.9		dBm
	2.0		+16.2		
	6.0		+13.5		
	8.0		+9.6		
	10.0		+6.7		
Output Third Order Intercept Point (OIP3)	0.05		+19.2		dBm
	2.0		+29.9		
	6.0		+23.3		
	8.0		+21.0		
	10.0		+16.8		
Directivity (Isolation - Gain)	0.05		4.7		dB
	6.0		6.2		
	10.0		11.9		
Noise Figure	0.05		5.8		dB
	2.0		3.9		
	6.0		4.3		
	8.0		4.5		
	10.0		5.4		
Additive Phase Noise[1]	2.0		-168.0		dBc/Hz
DC Supply Voltage		+4.8	+5.0	+5.2	V
DC Current			48	65	mA

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

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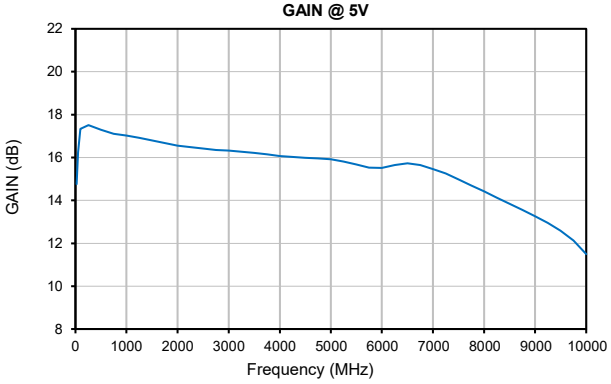
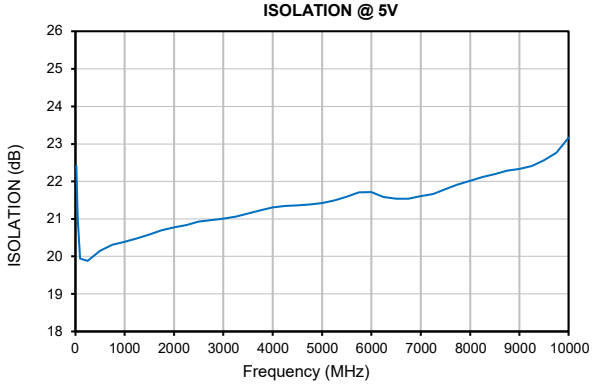
TYPICAL PERFORMANCE GRAPHS

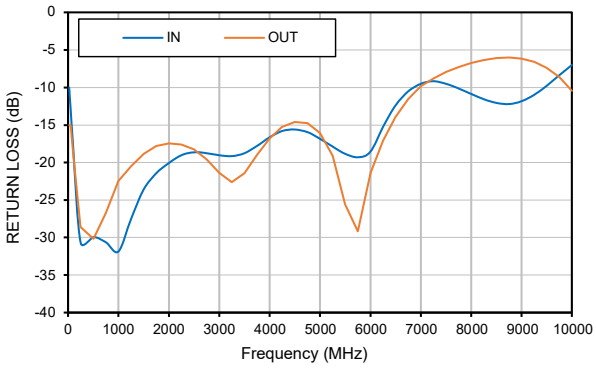
GAIN @ 5V



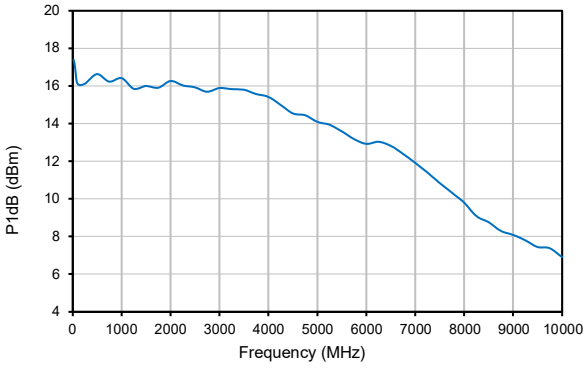
ISOLATION @ 5V



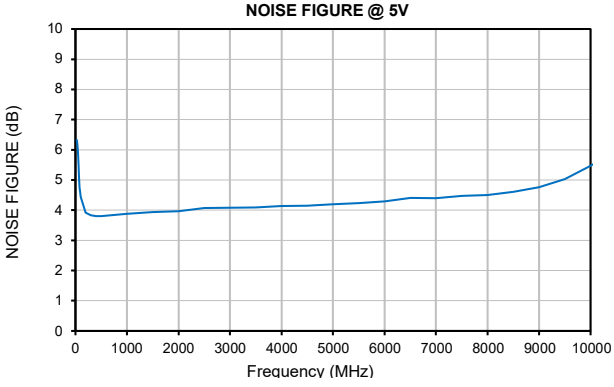
RETURN LOSS @ 5V



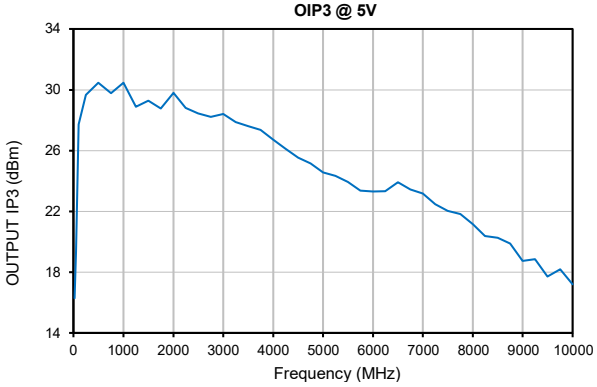
P1dB @ 5V



NOISE FIGURE @ 5V

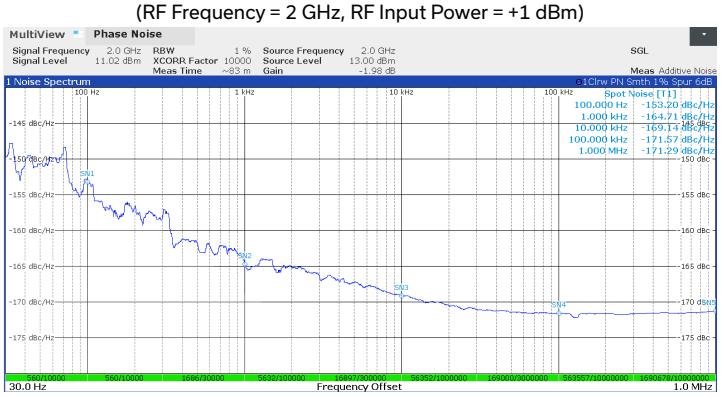


OIP3 @ 5V



ADDITIVE PHASE NOISE vs. OFFSET FREQUENCY

(RF Frequency = 2 GHz, RF Input Power = +1 dBm)



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ABSOLUTE MAXIMUM RATINGS

Parameter	Ratings
Operating Temperature (Ground Lead)	-40 °C to +85 °C
Storage Temperature	-65 °C to +150 °C
Total Power Dissipation	0.34 W
RF Input Power (CW)	+28 dBm (5 minutes max.) +11 dBm (continuous)
DC Voltage	+6 V[2]
Operating Current at	+5.2 V (V+) 65 mA

2. No protection against application of reverse voltage.
Permanent damage may occur if any of these limits are exceeded.

DETERMINING MAXIMUM THERMAL RESISTANCE OF USERS' EXTERNAL HEATSINK

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

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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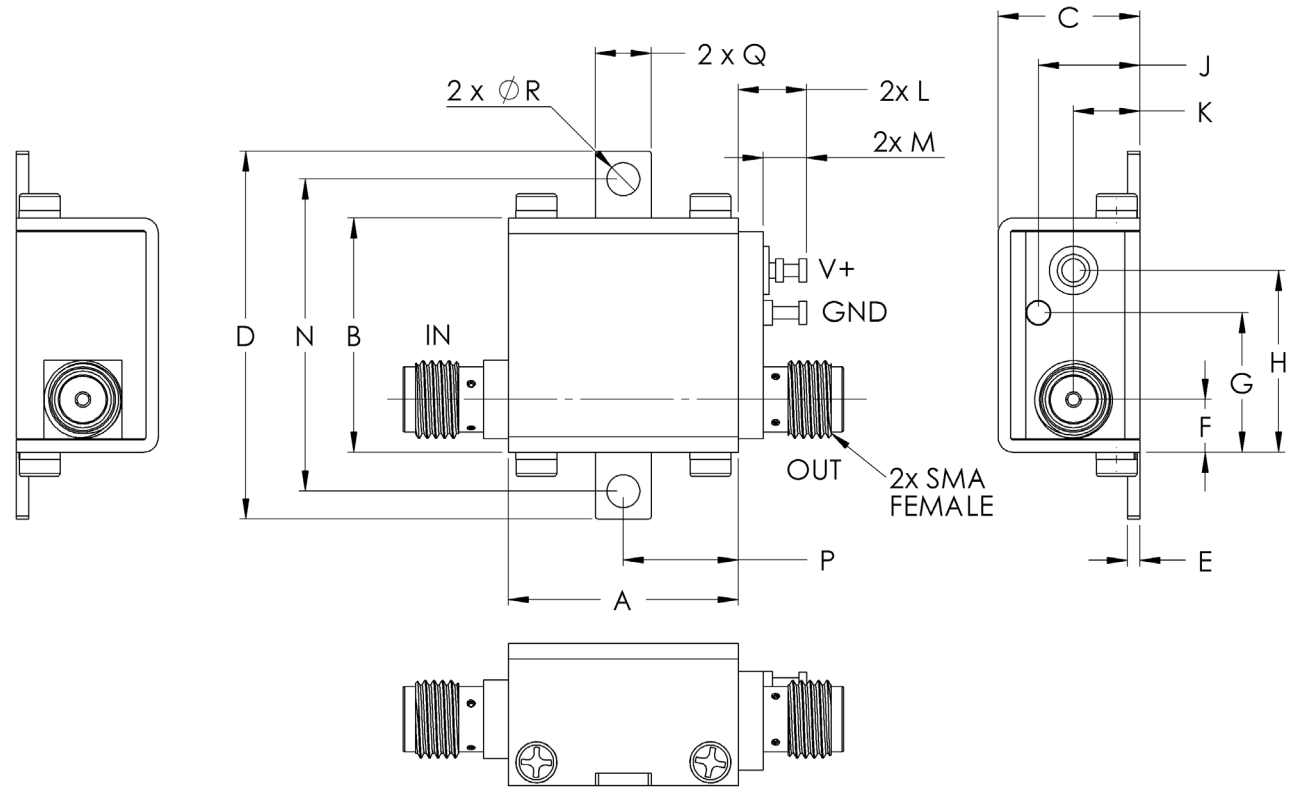
OUTLINE DRAWING



⚠ 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

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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

ORDERING INFORMATION

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

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

Coaxial Amplifier ZX60-123LPN+

Typical Performance Data

FREQUENCY (MHz)	GAIN (dB) 5V	ISOLATION (dB) 5V	RETURN LOSS (dB) IN 5V	RETURN LOSS (dB) OUT 5V	STABILITY K	STABILITY MEASURE	Pout @ 1 dB COMPRESSION (dBm) 5V	OIP3 (dBm) 5V
20	14.76	22.42	10.0	15.0	1.2	0.92	17.4	16.28
50	16.24	20.99	12.9	15.0	1.1	0.66	17.0	19.35
100	17.33	19.94	18.1	18.9	1.0	0.43	16.1	27.73
250	17.51	19.88	30.8	28.6	1.0	0.42	16.1	29.67
500	17.30	20.15	29.9	30.2	1.1	0.48	16.6	30.46
750	17.11	20.32	30.6	26.7	1.1	0.52	16.2	29.78
1000	17.03	20.39	31.9	22.5	1.1	0.53	16.4	30.47
1250	16.91	20.48	27.5	20.5	1.1	0.55	15.9	28.90
1500	16.79	20.59	23.6	18.9	1.1	0.56	16.0	29.28
1750	16.68	20.69	21.4	17.8	1.1	0.58	15.9	28.78
2000	16.55	20.77	20.1	17.4	1.1	0.60	16.3	29.80
2250	16.48	20.84	19.0	17.6	1.1	0.61	16.0	28.80
2500	16.42	20.93	18.6	18.3	1.1	0.63	15.9	28.45
2750	16.36	20.97	18.8	19.6	1.1	0.64	15.7	28.22
3000	16.32	21.01	19.0	21.4	1.1	0.65	15.9	28.41
3250	16.28	21.06	19.2	22.6	1.1	0.67	15.8	27.87
3500	16.22	21.14	18.8	21.4	1.2	0.67	15.8	27.61
3750	16.15	21.23	17.8	18.9	1.2	0.68	15.6	27.35
4000	16.07	21.30	16.6	16.8	1.2	0.68	15.4	26.71
4250	16.02	21.35	15.8	15.3	1.2	0.67	15.0	26.12
4500	15.99	21.36	15.61	14.59	1.17	0.67	14.54	25.55
4750	15.96	21.39	15.95	14.74	1.18	0.67	14.44	25.15
5000	15.92	21.42	16.85	16.07	1.19	0.69	14.09	24.56
5250	15.82	21.50	17.88	19.10	1.21	0.72	13.93	24.34
5500	15.68	21.60	18.84	25.59	1.23	0.75	13.59	23.93
5750	15.53	21.70	19.32	29.18	1.25	0.77	13.18	23.37
6000	15.51	21.71	18.58	21.36	1.25	0.76	12.92	23.32
6250	15.65	21.58	15.26	17.11	1.22	0.73	13.03	23.32
6500	15.72	21.54	12.37	13.95	1.19	0.71	12.82	23.91
6750	15.66	21.54	10.53	11.56	1.16	0.68	12.39	23.44
7000	15.46	21.61	9.52	9.85	1.14	0.67	11.91	23.18
7250	15.25	21.66	9.18	8.81	1.13	0.66	11.40	22.47
7500	14.98	21.79	9.51	7.94	1.13	0.65	10.84	22.04
7750	14.69	21.92	10.12	7.28	1.14	0.64	10.32	21.82
8000	14.41	22.01	10.87	6.76	1.14	0.63	9.80	21.15
8250	14.13	22.12	11.57	6.36	1.15	0.62	9.08	20.38
8500	13.85	22.20	12.07	6.10	1.17	0.62	8.76	20.26
8750	13.56	22.29	12.21	6.01	1.19	0.63	8.30	19.87
9000	13.26	22.34	11.84	6.15	1.21	0.67	8.09	18.73
9250	12.95	22.41	10.97	6.59	1.24	0.73	7.79	18.85
9500	12.58	22.56	9.78	7.37	1.29	0.82	7.45	17.71
9750	12.12	22.76	8.36	8.64	1.35	0.93	7.37	18.18
10000	11.50	23.17	7.01	10.42	1.45	1.06	6.90	17.19

FREQUENCY (MHz)	NOISE FIGURE (dB) 5V
20	6.31
30	6.33
40	6.13
50	5.86
60	5.43
70	5.15
80	4.75
90	4.61
100	4.44
200	3.92
300	3.83
400	3.81
500	3.80
1000	3.88
1500	3.94
2000	3.97
2500	4.07
3000	4.08
3500	4.09
4000	4.14
4500	4.15
5000	4.19
5500	4.23
6000	4.29
6500	4.40
7000	4.40
7500	4.47
8000	4.50
8500	4.61
9000	4.76
9500	5.03
10000	5.47
-	-
-	-
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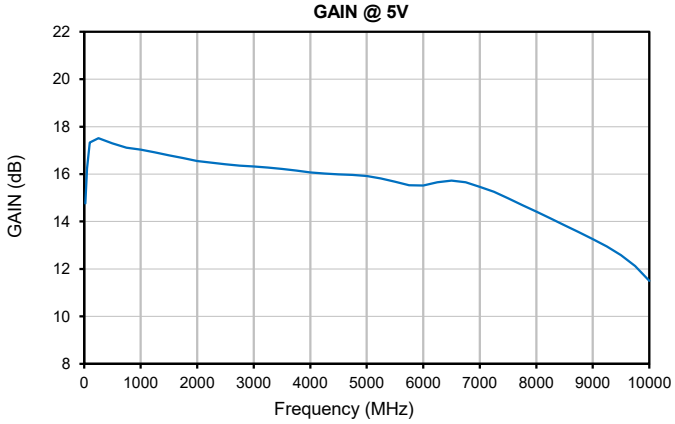
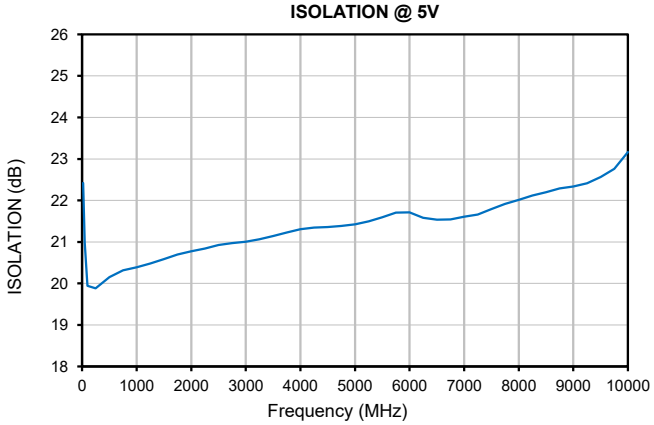
Typical Performance Curves

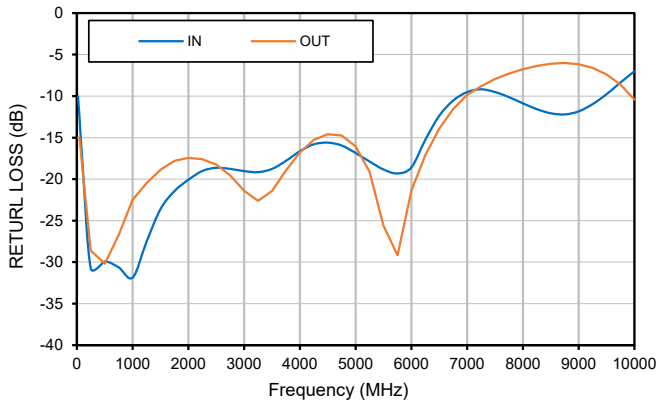
GAIN @ 5V



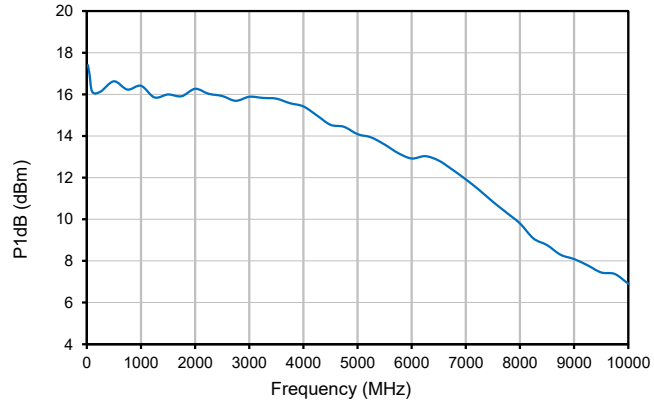
ISOLATION @ 5V



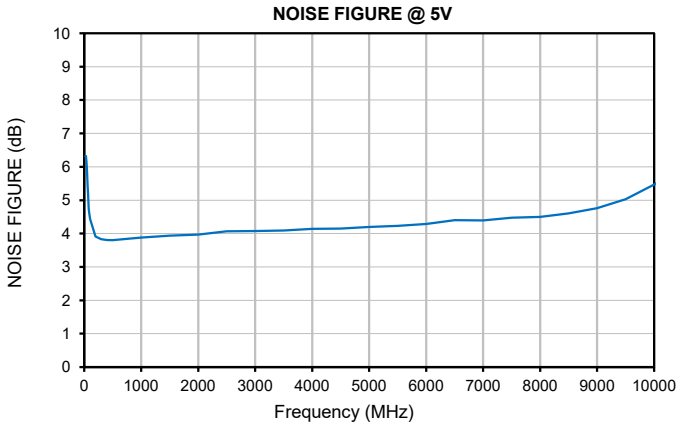
RETURN LOSS @ 5V



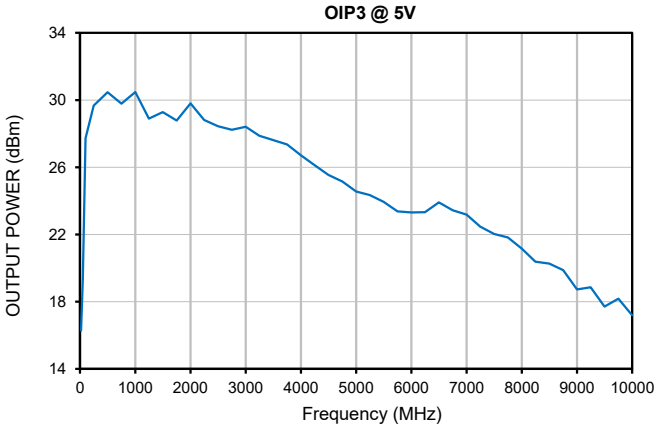
P1dB @ 5V



NOISE FIGURE @ 5V



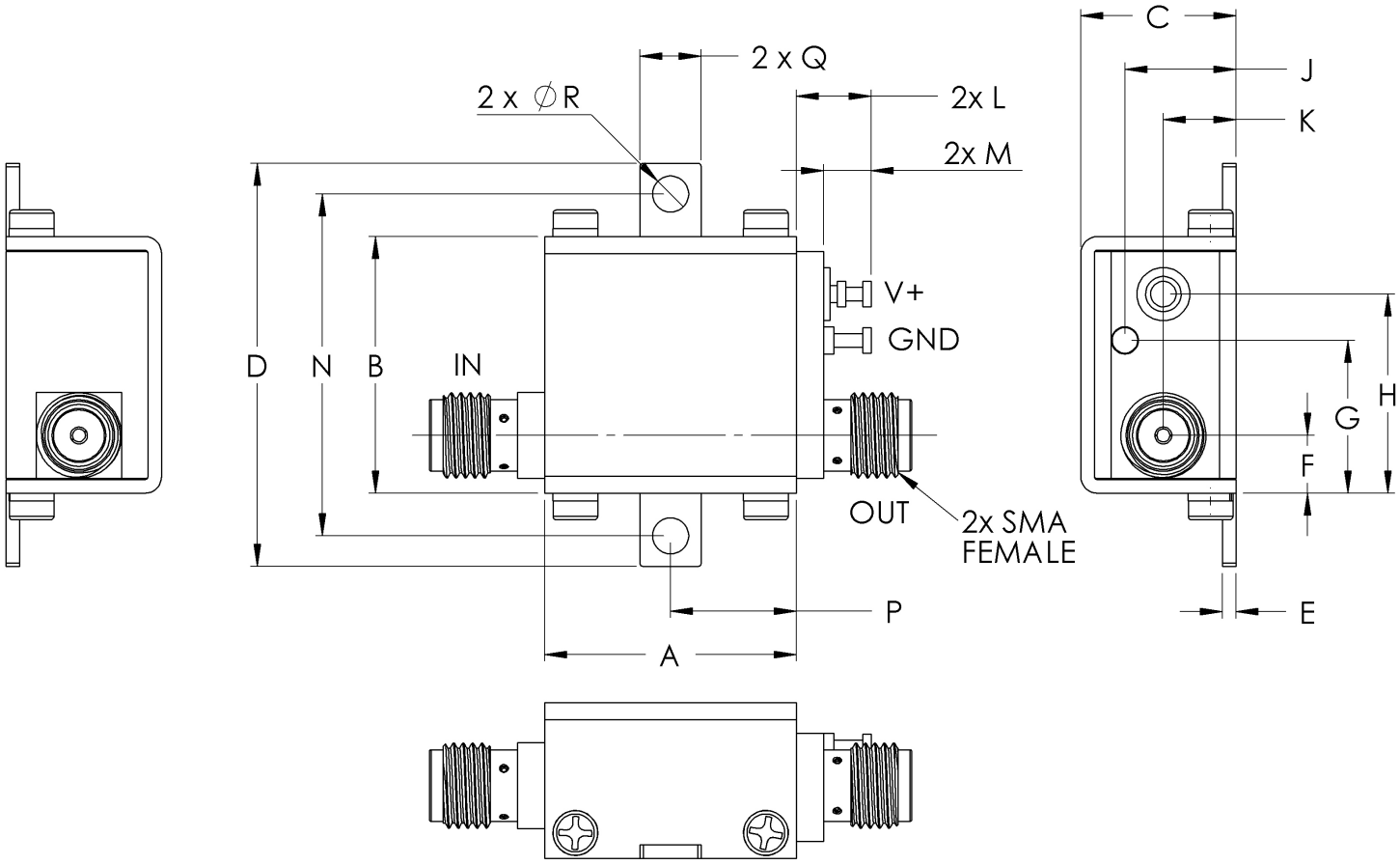
OIP3 @ 5V



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. ± .03; 3Pl. ± .015
Tolerance on hole size and interaxes dimensions to be ± .005.

Note:

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

Mini-Circuits®
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Mini-Circuits

Environmental Specifications ENV23T10

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

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