COAXIAL

Low Noise Amplifier ZX60-06183LN+

50Ω 6 to 18 GHz SMA Female

THE BIG DEAL

- Low Noise Figure, 2.8 dB Typ.
- Excellent Gain Flatness, ±1.3 dB
- High Gain, 20 dB Typ.
- Voltage Regulated Internally and Reverse Voltage Protected
- Excellent Directivity, 20 dB Typ.
- Medium Power with Good Linearity, +15 dBm Typ. P1dB, +26 dBm Typ. OIP3
- Protected by US Patent 6,790,049

Generic photo used for illustration purposes only

Model No.	ZX60-06183LN+
Case Style	GC957
Connectors	SMA female

+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' ZX60-06183LN+ is a wideband low noise connectorized amplifier providing a unique combination of low noise figure, high IP3 and flat gain over a very wide frequency range, supporting a wide range of sensitive, high-dynamic range receiver 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 (0.74x0.75x0.46") with SMA connectors, making it an excellent candidate for tough operating conditions and crowded system layouts.

KEY FEATURES

Feature	Advantages
Ultra-Wideband with Excellent Gain Flatness, ±1.3 dB for 8 to 18 GHz	Enables a single amplifier to be used in a wide range of applications including EW and communication systems instrumentation and more.
Broadband Low Noise Amplifier	Broadband amplification of the desired signal's power while adding as little noise and distortion as possible.
High Gain, 18 dB Typ.	Reduces the number of gain stages, lowering component count and overall system cost.
High IP3 +25 dBm Typ. Over 6 to 12 GHz +26 dBm Typ. Over 12 to 18 GHz	The combination of low noise and high IP3 makes the ZX60-06183LN+ ideal for use in low noise receiver front end (RFE) as it gives the user the advantages of sensitivity and two-tone IM performance at both ends of the dynamic range.
Excellent Directivity (Isolation-Gain), 20 dB Typ.	Buffer amplifier reduces need for adjacent circuits.
Low Operating Voltage, +5 V	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.

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

Parameter	Condition (GHz)	V_{DD} = +5.0 V			Units
		Min.	Typ.	Max.	
Frequency Range		6		18	GHz
Noise Figure	6-8		2.2		dB
	8-12		2.2		
	12-16		2.9		
	16-18		3.1		
Gain	6-8		21		dB
	8-12	16	20		
	12-16	16	20		
	16-18	15	19		
Input Return Loss	6-8		12		dB
	8-12		11		
	12-16		8		
	16-18		12		
Output Return Loss	6-8		9		dB
	8-12		12		
	12-16		14		
	16-18		15		
Output Power at 1 dB Compression[1]	6-8		+14		dBm
	8-12		+15		
	12-16		+15		
	16-18		+15		
Output IP3[2]	6-8		+25		dBm
	8-12		+26		
	12-16		+26		
	16-18		+26		
Device Operating Voltage (V_{DD})		+4.9	+5.0	+6.0	V
Device Operating Current (I_{DD})			110	150	mA

1. Current increases at P1dB.
2. OIP3 measured with 0 dBm tones and 1 MHz spacing.

ABSOLUTE MAXIMUM RATINGS[3]

Parameter	Ratings
Operating Temperature (Ground Lead)	-40 °C to +85 °C
Storage Temperature	-55 °C to +100 °C
Total Power Dissipation	0.7 W
Input Power (CW), V_D = +5 V	+17 dBm
DC Voltage	+9 V

3. Permanent damage may occur if any of these limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.

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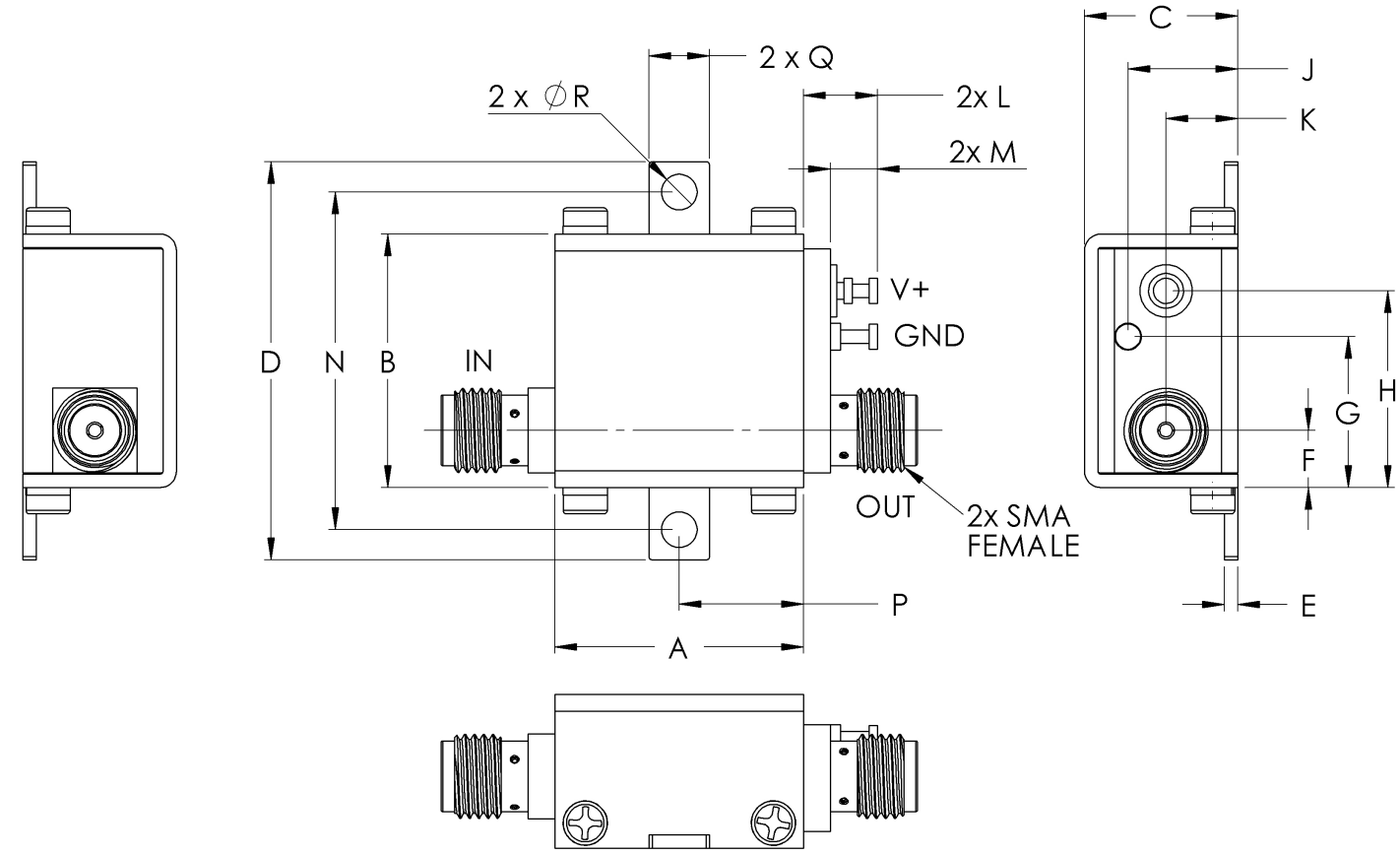
OUTLINE DRAWING



⚠ 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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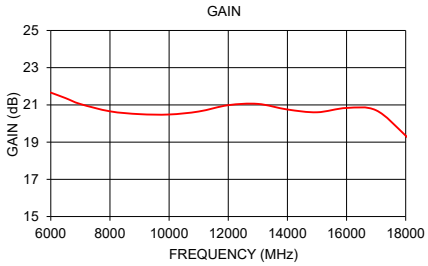
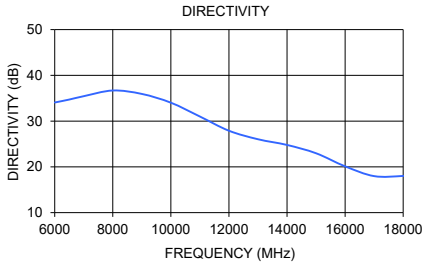
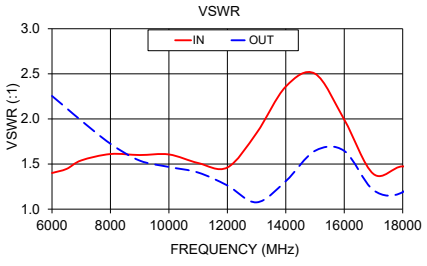
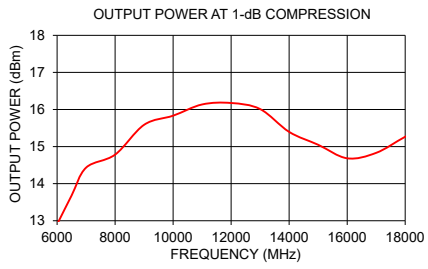
TYPICAL PERFORMANCE DATA/CURVES

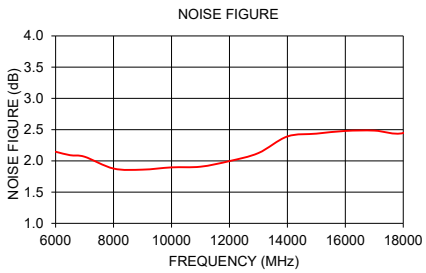
Frequency (MHz)	Gain (dB)	Directivity (dB)	VSWR (:1) +5 V		Power Out at 1 dB COMPR. (dBm)	Noise Figure (dB)	IP3 (dBm)
	+5 V	+5 V	IN	OUT	+5 V	+5 V	+5 V
6000	21.66	34.07	1.40	2.25	12.90	2.15	23.60
6500	21.36	34.71	1.45	2.12	13.68	2.09	24.48
7000	21.05	35.45	1.54	1.98	14.43	2.07	25.72
8000	20.65	36.69	1.61	1.72	14.78	1.88	25.80
9000	20.50	35.94	1.60	1.54	15.59	1.86	27.01
10000	20.48	34.02	1.61	1.47	15.83	1.90	27.13
11000	20.64	31.00	1.51	1.41	16.14	1.91	27.80
12000	20.98	27.90	1.46	1.26	16.18	2.00	27.70
13000	21.05	26.04	1.84	1.08	16.01	2.13	27.39
14000	20.75	24.79	2.36	1.31	15.40	2.39	26.49
15000	20.60	22.97	2.50	1.65	15.05	2.44	26.18
16000	20.84	20.12	1.99	1.65	14.68	2.48	25.70
17000	20.71	17.98	1.39	1.21	14.83	2.48	25.80
18000	19.35	18.02	1.47	1.19	15.26	2.45	26.51

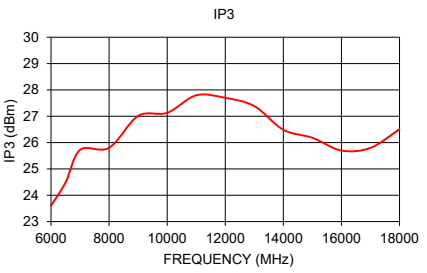












NOTES

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

Low Noise Amplifier ZX60-06183LN+

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 = 103.49mA @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(GHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
4.0	14.87	56.14	3.83	5.77	24.64	1.04	15.08	5.89	3.22
4.5	19.10	60.72	5.22	6.33	32.20	1.00	18.98	8.77	2.66
5.0	21.12	57.57	8.19	7.01	22.67	0.92	21.18	10.81	2.37
5.5	21.73	56.08	12.51	7.67	20.50	0.87	22.58	12.02	2.23
6.0	21.66	55.73	15.55	8.28	20.97	0.87	23.60	12.90	2.15
6.5	21.36	56.08	14.78	8.91	22.95	0.90	24.48	13.68	2.09
7.0	21.05	56.49	13.45	9.65	25.21	0.93	25.72	14.43	2.07
7.5	20.80	56.86	12.74	10.51	27.39	0.96	26.14	15.00	1.93
8.0	20.65	57.34	12.61	11.50	30.00	0.98	25.80	14.78	1.88
8.5	20.56	57.09	12.72	12.55	29.96	0.99	26.69	15.37	1.82
9.0	20.50	56.44	12.74	13.47	28.35	1.01	27.01	15.59	1.86
9.5	20.48	55.62	12.66	14.09	26.00	1.01	27.25	15.79	1.87
10.0	20.48	54.51	12.66	14.44	22.96	1.01	27.13	15.83	1.90
10.5	20.53	53.19	13.00	14.77	19.77	1.01	27.31	16.15	1.88
11.0	20.64	51.65	13.82	15.46	16.57	1.01	27.80	16.14	1.91
12.0	20.98	48.88	14.54	18.70	11.85	1.02	27.70	16.18	2.00
12.5	21.09	47.87	12.70	22.68	10.32	1.04	27.07	15.81	2.02
13.0	21.05	47.09	10.55	28.78	9.16	1.08	27.39	16.01	2.13
13.5	20.92	46.32	8.91	23.05	8.10	1.12	27.03	15.63	2.19
14.0	20.75	45.54	7.86	17.42	7.17	1.14	26.49	15.40	2.39
14.5	20.63	44.62	7.35	14.09	6.28	1.13	26.86	15.34	2.44
15.0	20.60	43.58	7.35	12.24	5.52	1.10	26.18	15.05	2.44
15.5	20.69	42.30	8.03	11.61	4.86	1.05	25.71	14.77	2.57
16.0	20.84	40.95	9.59	12.25	4.37	1.02	25.70	14.68	2.48
16.5	20.91	39.70	12.38	14.72	4.05	1.00	25.59	14.73	2.56
17.0	20.71	38.69	15.75	20.44	3.88	1.00	25.80	14.83	2.48
18.0	19.35	37.36	14.35	21.28	3.88	1.01	26.51	15.26	2.45

Low Noise Amplifier ZX60-06183LN+

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 = 112.60mA @ Temperature = -45°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(GHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
4.0	16.36	55.34	3.45	5.53	17.20	1.05	17.33	7.33	2.47
4.5	20.75	59.67	4.88	6.03	22.22	1.00	21.15	10.21	1.94
5.0	22.85	56.85	8.18	6.74	16.81	0.91	23.41	12.25	1.69
5.5	23.44	55.39	13.33	7.52	15.61	0.86	24.77	13.49	1.59
6.0	23.31	55.14	17.05	8.25	16.33	0.86	25.67	14.31	1.40
6.5	22.94	55.37	15.01	8.95	17.70	0.90	26.48	15.07	1.45
7.0	22.55	56.00	12.92	9.62	19.91	0.94	27.67	15.65	1.45
7.5	22.23	56.47	11.86	10.37	21.85	0.97	27.82	16.18	1.29
8.0	22.05	57.19	11.49	11.24	24.54	0.99	27.67	16.09	1.20
8.5	21.95	57.17	11.45	12.21	25.18	1.01	28.32	16.54	1.19
9.0	21.88	56.83	11.48	13.13	24.73	1.02	28.58	16.71	1.19
9.5	21.84	56.10	11.42	13.75	22.97	1.03	28.79	16.86	1.21
10.0	21.82	55.15	11.37	13.97	20.69	1.03	28.71	16.95	1.25
10.5	21.85	53.83	11.63	14.09	17.82	1.02	28.69	17.19	1.29
11.0	21.97	52.22	12.51	14.64	14.87	1.02	29.38	17.07	1.24
12.0	22.40	49.17	13.56	17.69	10.29	1.02	29.35	17.18	1.29
12.5	22.56	48.10	11.87	21.71	8.83	1.05	29.08	17.10	1.33
13.0	22.55	47.25	9.73	29.12	7.70	1.10	29.34	17.21	1.38
13.5	22.45	46.46	8.13	23.29	6.72	1.14	29.07	17.02	1.42
14.0	22.32	45.68	7.16	17.71	5.90	1.16	28.87	16.91	1.53
14.5	22.26	44.74	6.73	14.68	5.15	1.16	29.10	16.78	1.52
15.0	22.33	43.62	6.77	12.95	4.47	1.13	28.55	16.61	1.60
15.5	22.54	42.17	7.51	12.39	3.86	1.08	28.04	16.42	1.72
16.0	22.77	40.74	9.10	12.74	3.43	1.03	27.95	16.35	1.61
16.5	22.90	39.42	11.92	14.41	3.14	0.99	27.84	16.34	1.67
17.0	22.73	38.30	16.46	18.25	2.99	0.98	27.87	16.38	1.61
18.0	21.42	36.64	15.01	21.90	2.88	0.99	28.24	16.61	1.61

Low Noise Amplifier ZX60-06183LN+

Typical Performance Data

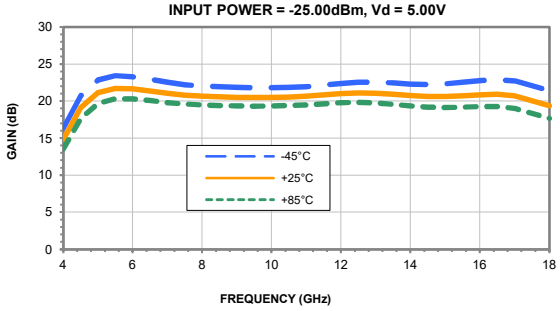
Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.00V, Id = 97.02mA @ Temperature = +85°C

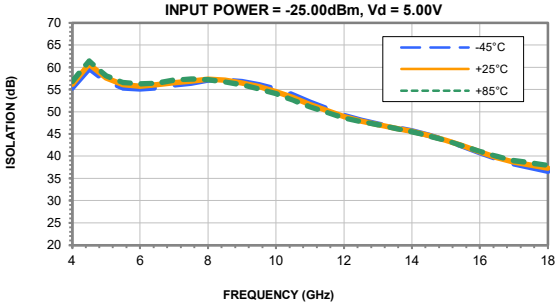
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(GHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
4.0	13.55	56.83	4.07	5.91	32.64	1.04	13.54	4.74	3.86
4.5	17.70	61.45	5.45	6.42	42.41	0.99	17.54	7.62	3.26
5.0	19.69	58.07	8.29	7.04	28.45	0.92	19.77	9.69	2.87
5.5	20.33	56.56	12.14	7.67	25.31	0.88	21.14	10.97	2.74
6.0	20.32	56.30	14.88	8.26	25.98	0.88	22.18	11.90	2.62
6.5	20.08	56.46	14.79	8.90	27.81	0.90	23.06	12.71	2.59
7.0	19.81	57.14	13.87	9.65	31.44	0.93	24.21	13.45	2.56
7.5	19.61	57.38	13.57	10.58	33.76	0.95	24.67	14.03	2.44
8.0	19.49	57.22	13.69	11.71	34.38	0.97	24.32	13.84	2.34
8.5	19.41	56.72	13.90	12.90	33.40	0.99	25.22	14.47	2.35
9.0	19.36	56.06	13.81	13.88	31.47	1.00	25.51	14.71	2.42
9.5	19.34	55.14	13.51	14.37	28.43	1.01	25.73	14.91	2.40
10.0	19.34	54.04	13.36	14.51	25.04	1.01	25.68	14.95	2.47
10.5	19.40	52.63	13.76	14.64	21.27	1.00	25.78	15.25	2.47
11.0	19.51	51.09	14.83	15.31	17.85	1.00	26.13	15.26	2.47
12.0	19.80	48.63	15.52	19.23	13.29	1.01	26.01	15.28	2.59
12.5	19.84	47.79	13.14	24.52	11.88	1.04	25.39	14.86	2.65
13.0	19.74	47.10	10.87	29.07	10.72	1.08	25.63	15.01	2.76
13.5	19.56	46.28	9.25	20.84	9.49	1.11	25.22	14.55	2.87
14.0	19.36	45.48	8.24	16.06	8.42	1.12	24.81	14.25	3.03
14.5	19.21	44.59	7.77	13.31	7.44	1.11	25.03	14.17	3.10
15.0	19.16	43.59	7.80	11.81	6.59	1.08	24.42	13.83	3.17
15.5	19.21	42.36	8.49	11.42	5.86	1.04	23.98	13.55	3.30
16.0	19.29	41.13	9.98	12.21	5.34	1.02	23.98	13.46	3.35
16.5	19.28	39.96	12.34	14.63	4.99	1.01	23.93	13.54	3.31
17.0	19.03	39.06	14.77	19.73	4.84	1.01	24.26	13.69	3.16
18.0	17.70	37.97	13.81	22.26	4.98	1.02	24.89	14.19	3.22

Typical Performance Curves

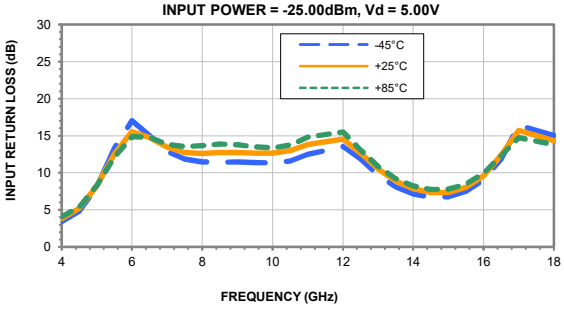
GAIN vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Vd = 5.00V



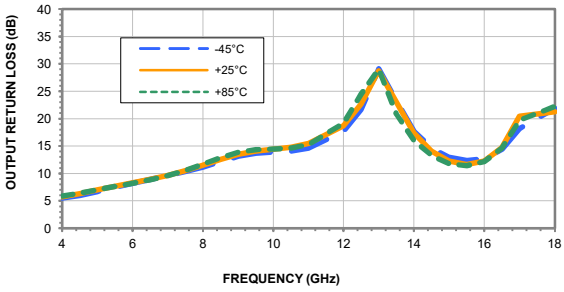
ISOLATION vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Vd = 5.00V



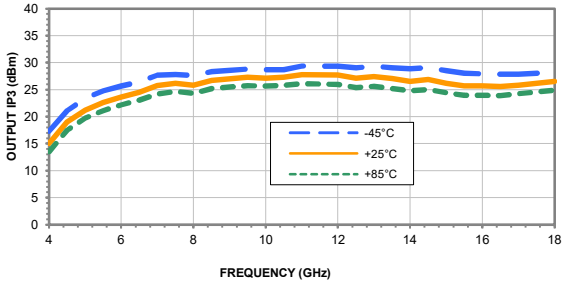
INPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Vd = 5.00V



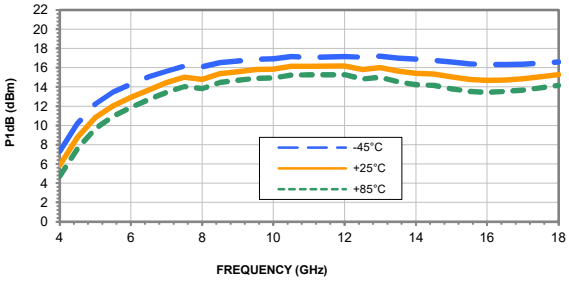
OUTPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE.
INPUT POWER = -25.00dBm, Vd = 5.00V



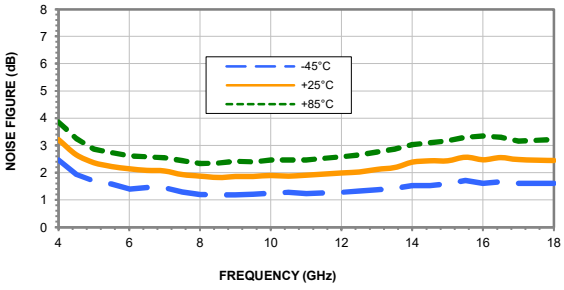
OUTPUT IP3 vs. FREQUENCY & TEMPERATURE
INPUT POWER = 0.00dBm, Vd = 5.00V



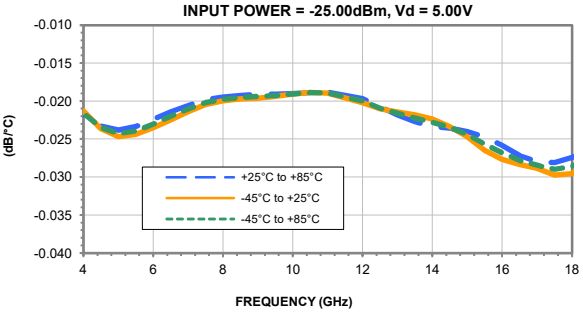
P1dB vs. FREQUENCY & TEMPERATURE
Vd = 5.00V



NOISE FIGURE vs. FREQUENCY & TEMPERATURE
Vd = 5.00V



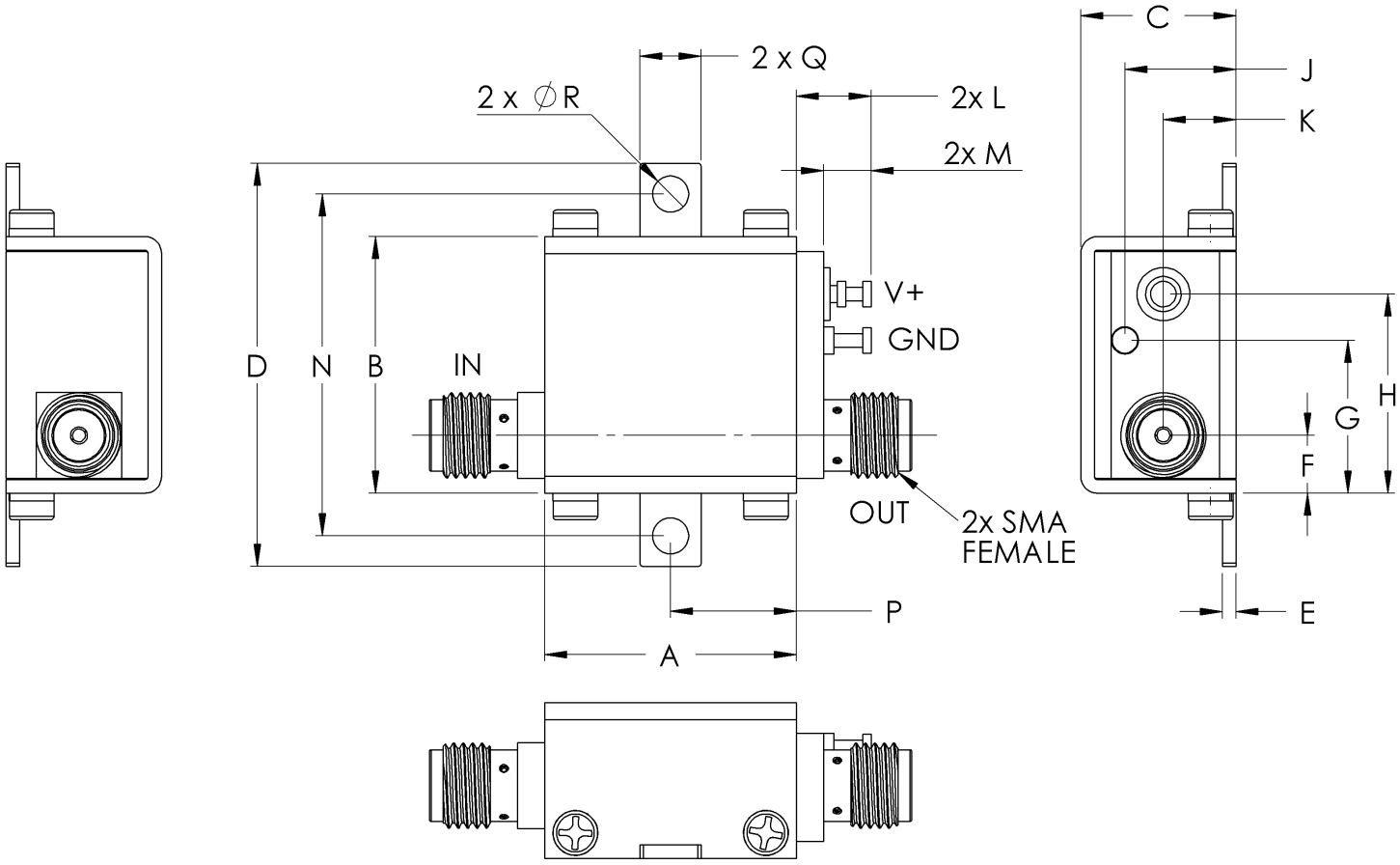
GAIN VARIATION vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Vd = 5.00V



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®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010
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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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