MMIC SURFACE MOUNT

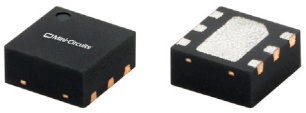
Low Noise Amplifier

PMA2-123LV+

50Ω 0.01 to 12 GHz Low Power Consumption

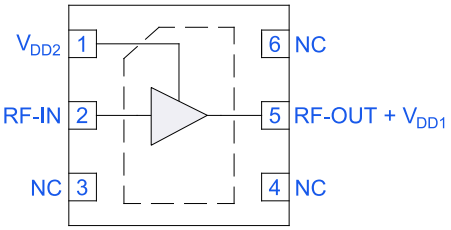
THE BIG DEAL

- Low Noise Figure, Typ. 1.8 dB
- High OIP3, Typ. +22 dBm
- Low Power Consumption, Typ. 120 mW
- Single +3 V Supply Voltage
- 2x2 mm, 6-Lead QFN-Style Package



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

- Test & Measurement Equipment
- WiFi, WAN, UMTS, LTE
- Back Haul Radio Systems
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW

The PMA2-123LV+ is a GaAs pHEMT-based wideband, ultra-low noise MMIC amplifier with high OIP3 and flat gain. Operating from 0.01 to 12 GHz, this amplifier features typical 1.8 dB noise figure, 16.6 dB gain, +11.1 dBm P1dB, and +22 dBm OIP3. This combination of characteristics makes it ideal for sensitive, high dynamic range receiver applications. The PMA2-123LV+ operates on a single +3 V supply, is well matched to 50Ω, and comes in a small, low-profile 2x2 mm QFN-style package for easy integration into dense circuit board layouts.

KEY FEATURES

Feature	Advantages
Low Noise Figure, Typ. 1.8 dB	This ultra-low noise MMIC device enables low system noise figure performance without the need for complicated discrete-based solutions.
High OIP3, Typ. +22 dBm at 6 GHz	High operating OIP3 provides very low in-band distortion products, enabling minimal signal degradation in high fidelity measurement systems and demanding communication systems.
High Input Power Handling	The combination of low noise, high input power handling and OIP3 makes this MMIC amplifier ideal for use in a low-noise receiver front end (RFE), as it provides the user with the advantages of improved sensitivity and two-tone intermodulation (IM) performance at both the lower and upper end of the input dynamic range.
2x2mm 6-Lead QFN-Style Package	Small footprints save space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB. Industry-standard packaging allows for ease of assembly in high-volume manufacturing processes.

Low Noise Amplifier PMA2-123LV+

50Ω 0.01 to 12 GHz Low Power Consumption

ELECTRICAL SPECIFICATIONS[1] AT +25°C, V_{DD} = +3 V, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.01		12	GHz
Gain	0.01	13.9	15.4		dB
	3	14.4	15.5		
	6	13.1	14.7		
	9	13.9	15.0		
	12	14.2	15.1		
Input Return Loss	0.01		9		dB
	3		9		
	6		7		
	9		6		
	12		8		
Output Return Loss	0.01		6		dB
	3		13		
	6		9		
	9		10		
	12		12		
Isolation	0.01-12		24		dB
Output Power at 1 dB Compression (P1dB)	0.01		+9.1		dBm
	3		+14.2		
	6		+12.5		
	9		+11.1		
	12		+11.1		
Output Third-Order Intercept (P_{OUT} = -5 dBm/Tone)	0.01		+22		dBm
	3		+25		
	6		+18		
	9		+18		
	12		+22		
Noise Figure	0.01		6.7		dB
	3		1.7		
	6		2.1		
	9		2.7		
	12		2.9		
Device Operating Voltage (V_{DD})[2]			+3	+4	V
Device Operating Current (I_{DD})[3]			32		mA
DC Current Variation vs. Temperature[4]			-28.1		µA/°C
DC Current Variation vs. Voltage[5]			0.025		mA/mV

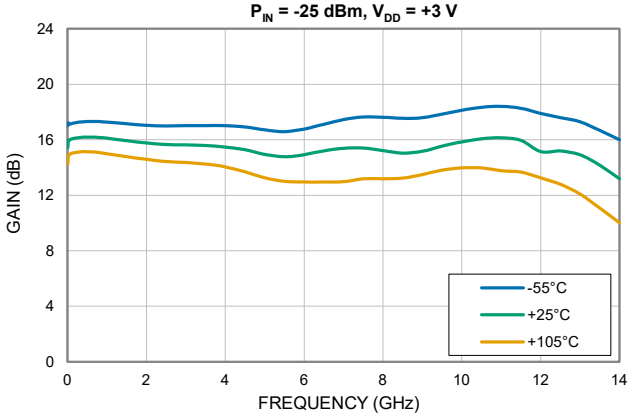
1. Tested on Mini-Circuits Characterization Test Board TB-PMA2-123LVC+. See Figure 2. Board loss de-embedded to the device.
2. $V_{DD} = V_{DD1} = V_{DD2}$.
3. Current at P_{IN} = -25 dBm. Increases to 50 mA at P1dB.
4. (Current at +105°C - Current at -55°C) / (+160°C).
5. (Current at V_{DD} = +4 V - Current at V_{DD} = +3 V) / (+4 V - +3 V).

Low Noise Amplifier PMA2-123LV+

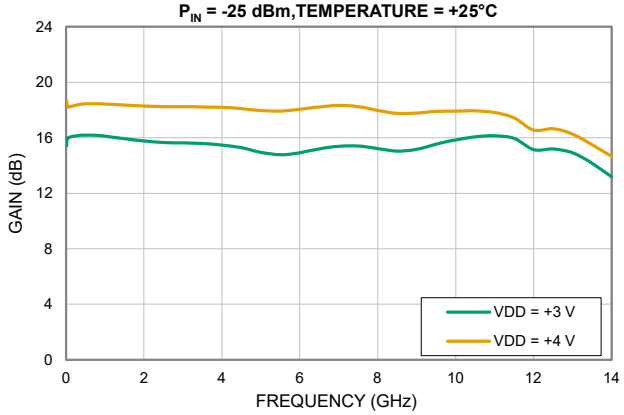
50Ω 0.01 to 12 GHz Low Power Consumption

TYPICAL PERFORMANCE GRAPHS

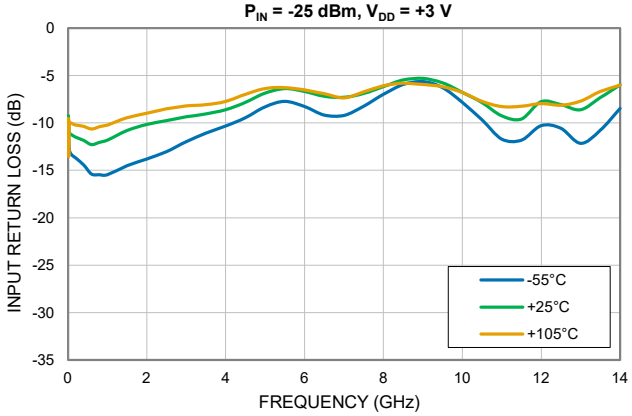
GAIN vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +3 V



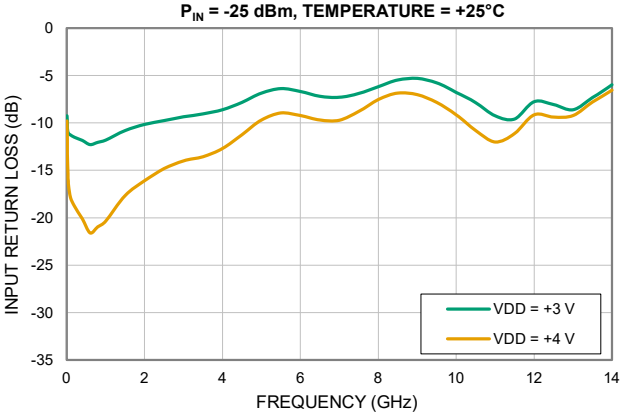
GAIN vs. DEVICE VOLTAGE
P_{IN} = -25 dBm,TEMPERATURE = +25°C



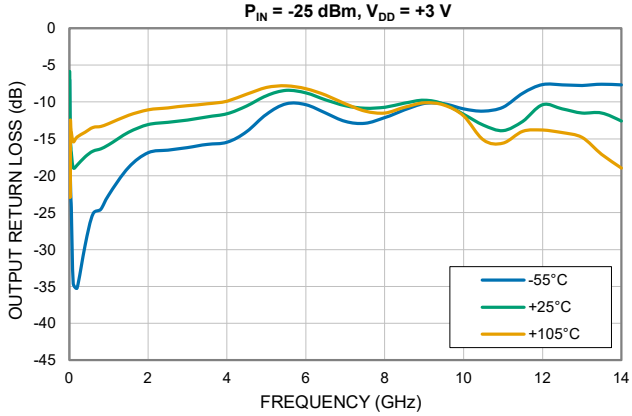
INPUT RETURN LOSS vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +3 V



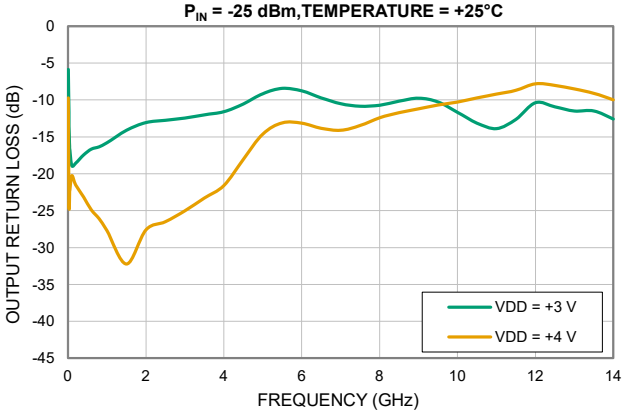
INPUT RETURN LOSS vs. DEVICE VOLTAGE
P_{IN} = -25 dBm, TEMPERATURE = +25°C



OUTPUT RETURN LOSS vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +3 V



OUTPUT RETURN LOSS vs. DEVICE VOLTAGE
P_{IN} = -25 dBm,TEMPERATURE = +25°C



Low Noise Amplifier PMA2-123LV+

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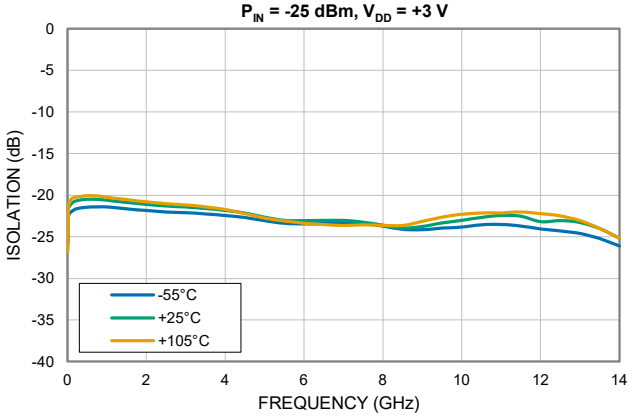
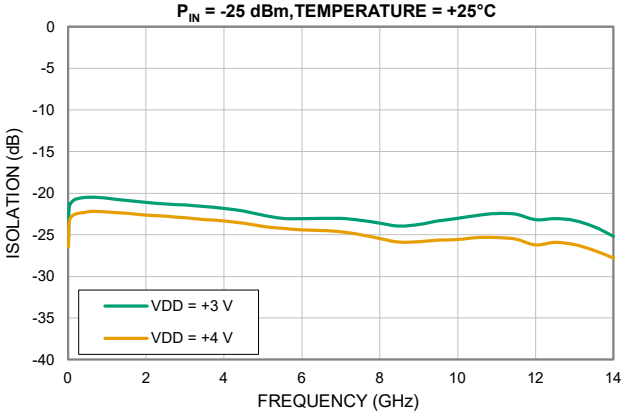
TYPICAL PERFORMANCE GRAPHS

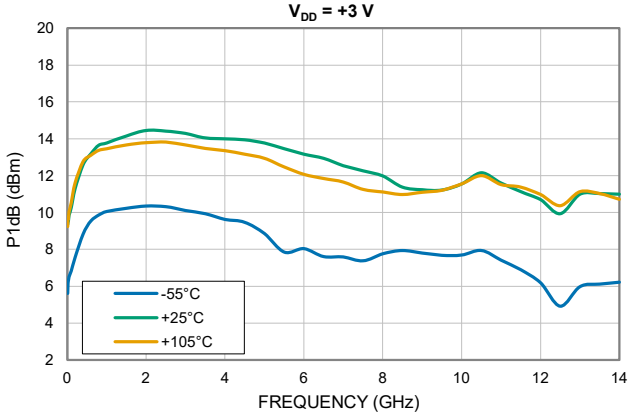
ISOLATION vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +3 V



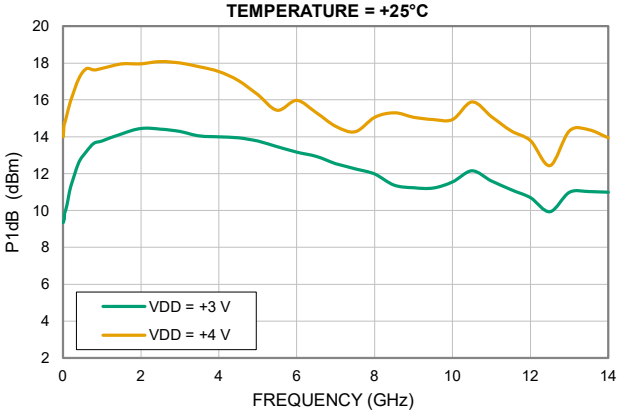
ISOLATION vs. DEVICE VOLTAGE
P_{IN} = -25 dBm,TEMPERATURE = +25°C



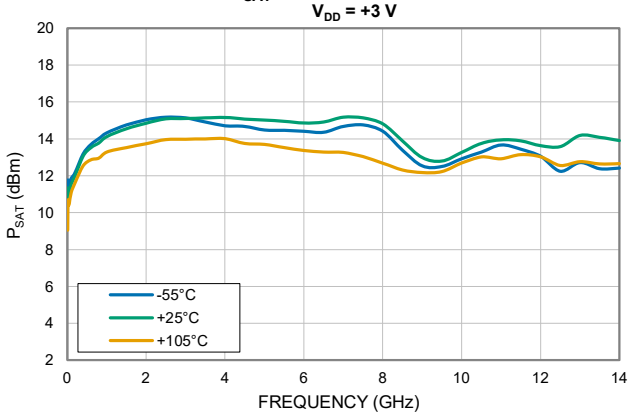
P1dB vs. TEMPERATURE
V_{DD} = +3 V



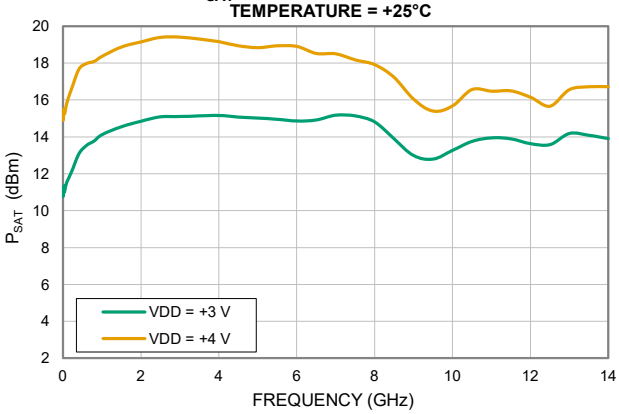
P1dB vs. DEVICE VOLTAGE
TEMPERATURE = +25°C



P_{SAT} vs. TEMPERATURE
V_{DD} = +3 V



P_{SAT} vs. DEVICE VOLTAGE
TEMPERATURE = +25°C



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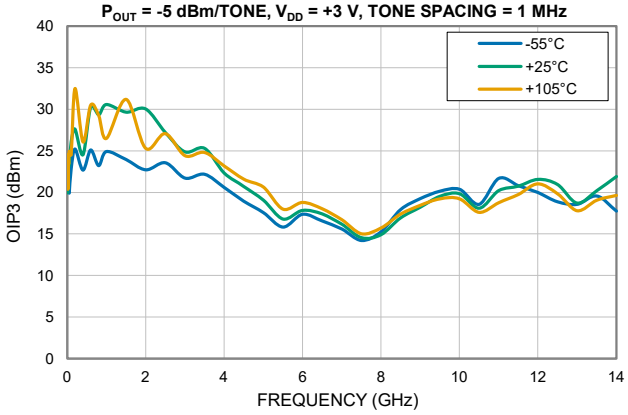
TYPICAL PERFORMANCE GRAPHS

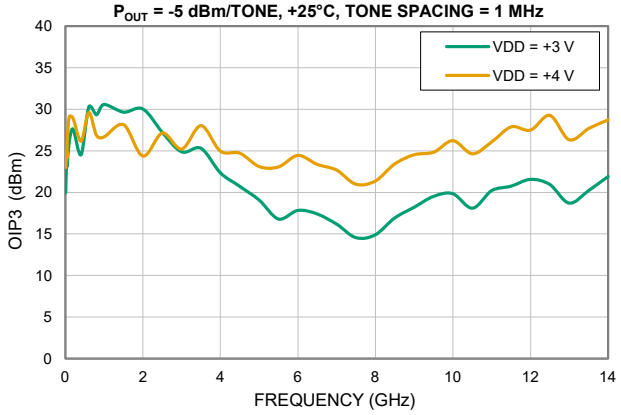
OIP3 vs. TEMPERATURE

P_{OUT} = -5 dBm/TONE, V_{DD} = +3 V, TONE SPACING = 1 MHz



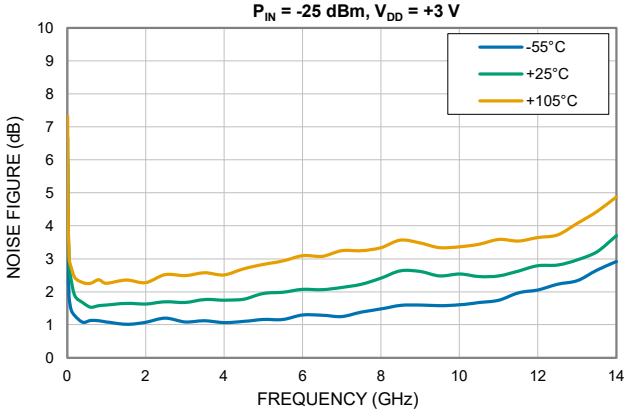
OIP3 vs. DEVICE VOLTAGE

P_{OUT} = -5 dBm/TONE, +25°C, TONE SPACING = 1 MHz



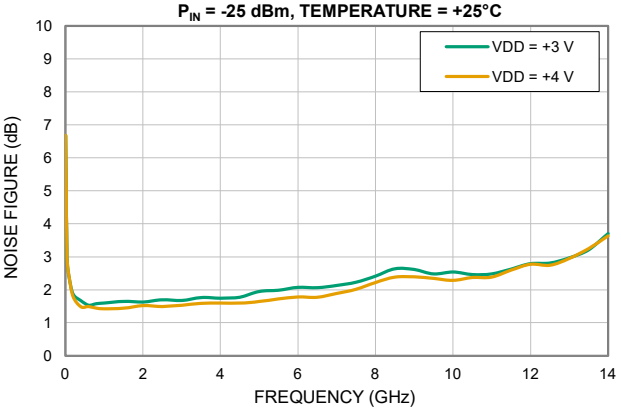
NOISE FIGURE vs. TEMPERATURE

P_{IN} = -25 dBm, V_{DD} = +3 V



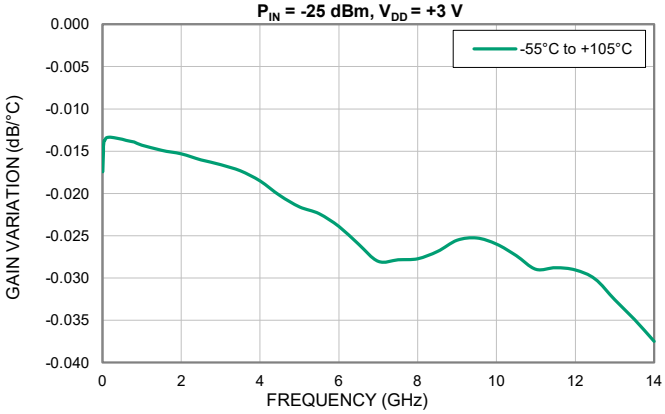
NOISE FIGURE vs. DEVICE VOLTAGE

P_{IN} = -25 dBm, TEMPERATURE = +25°C



GAIN VARIATION vs. TEMPERATURE

P_{IN} = -25 dBm, V_{DD} = +3 V



ABSOLUTE MAXIMUM RATINGS[6]

Parameter	Ratings
Operating Temperature	-55°C to +105°C
Storage Temperature	-65°C to +150°C
Junction Temperature[7]	+175°C
Total Power Dissipation	0.68 W
Input Power (CW), $V_{DD} = V_{DD1} = V_{DD2}$ = +3 V	+27 dBm
DC Voltage at $V_{DD} = V_{DD1} = V_{DD2}$	+8 V
Current I_{DD}	150 mA

6. Permanent damage may occur if any of these limits are exceeded. Maximum ratings are not intended for continuous normal operation.
7. Peak temperature on top of Die.

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{JC})[8]	97.7°C/W

8. Θ_{JC}= (Hot Spot Temperature on Die - Temperature at Ground Lead) / Dissipated Power

ESD RATING

	Class	Voltage Range	Reference Standard
HBM	1B	500 V to <1000 V	ANSI/ESDA/JEDEC JS-001-2023
CDM	C3	≥1000 V	ANSI/ESDA/JEDEC JS-001-2022

ESD HANDLING PRECAUTION: This device is designed to be Class 1B for HBM. Static charges may easily produce potentials higher than this with improper handling and can discharge into DUT and damage it. As a preventive measure Industry standard ESD handling precautions should be used at all times to protect the device from ESD damage.

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020E/JEDEC J-STD-033C

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FUNCTIONAL DIAGRAM

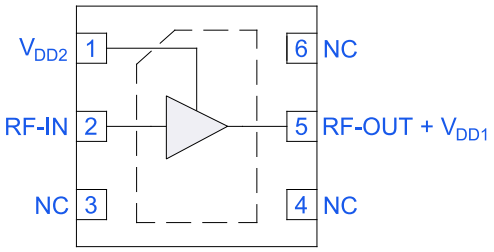

Figure 1. PMA2-123LV+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-IN	2	RF-IN Pad connects to RF-Input port.
RF-OUT + V_{DD1}	5	RF-OUT Pad connects to RF-Output port.
V_{DD2}	1	DC Input Pad connects to bias voltage input port V_{DD2}.
GND	Paddle	Connects to ground.
NC	3-4, 6	Not used internally. Connected to ground on test board.

CHARACTERIZATION TEST BOARD

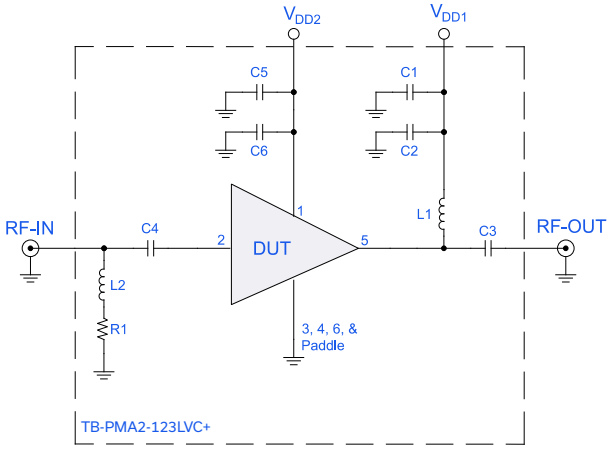

Figure 2. PMA2-123LV+ Characterization and Application Circuit.

Electrical Parameters and Conditions
Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3), and Noise Figure measured using N5242A PNA-X Microwave Network Analyzer.

Conditions:
a. Gain and Return Loss: P_{IN} = -25 dBm
b. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, -5 dBm/Tone at output.
c. $V_{DD} = V_{DD1} = V_{DD2}$ = +3 V

Component	Vendor	Vendor P/N	Value	Size
C1, C5	Murata	GRM155R71H104KE14J	0.1 µF	0402
C2, C6	Murata	GRM1555C1H101JA01D	100 pF	0402
C3	Murata	GRM155R71E103KA01D	0.01 µF	0402
C4	Murata	GRM155C81E105KE11D	1 µF	0402
L1, L2	Coilcraft	0402DF-901XJRU	900 nH	0402
R1	KOA Speer	RK73B1ETTP820J	82 Ω	0402

Power ON/Power OFF Sequence:
Parts are not sensitive to power ON/OFF sequence. V_{DD1} and V_{DD2} can be applied in any order, but it is recommended to turn on V_{DD2} first.

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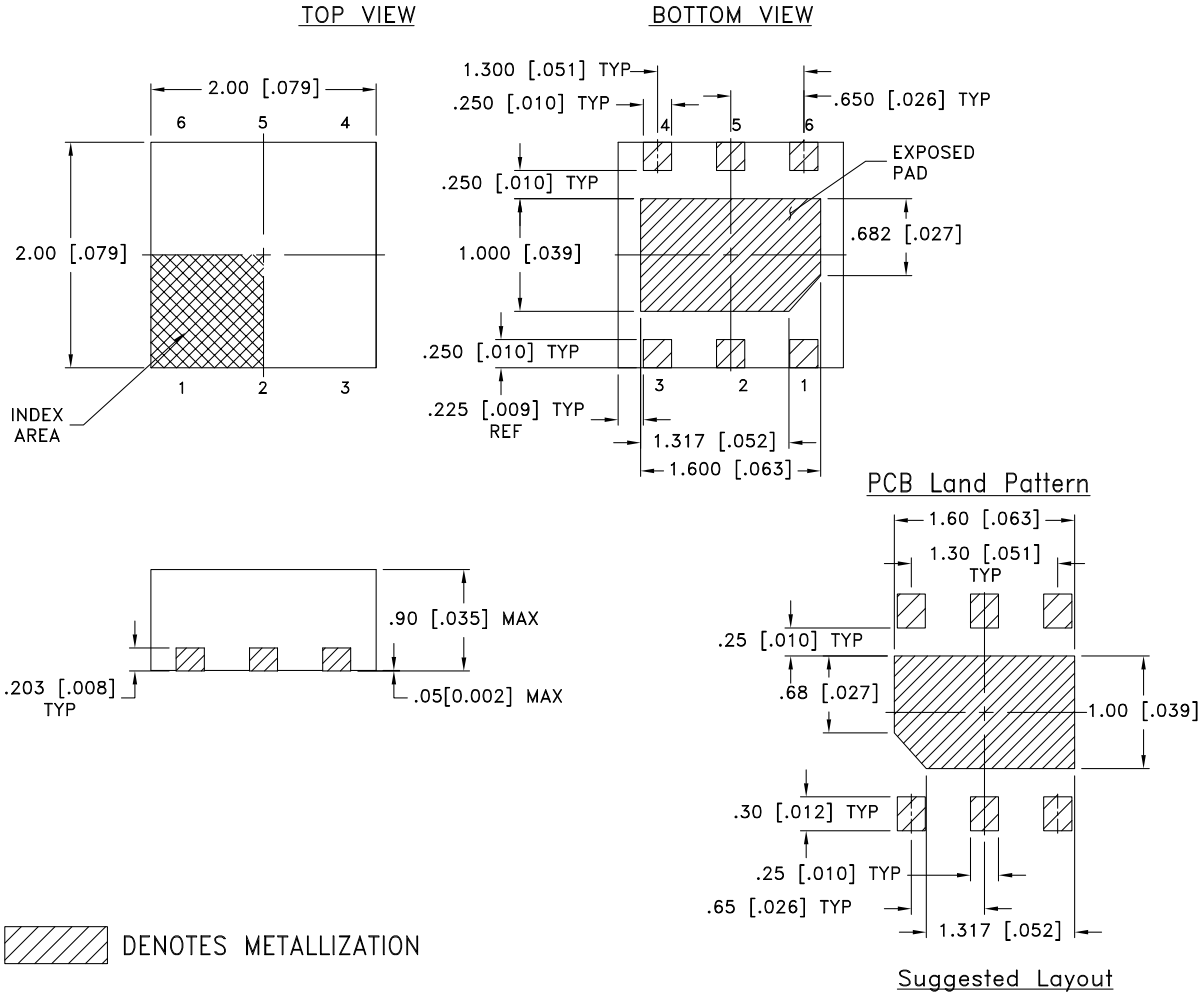
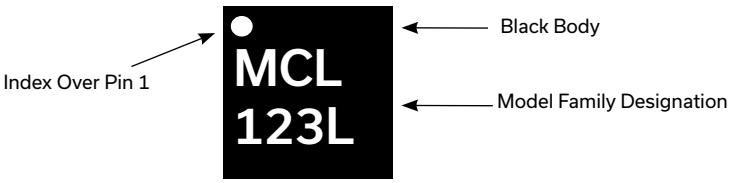
CASE STYLE DRAWING



Weight: 0.0108 grams
Dimensions are in mm [Inches]. Tolerances: 2 Pl.±0.25 [0.01]; 3 Pl.±.0.127 [0.005] mm [Inches]

PRODUCT MARKING



Marking may contain other features or characters for internal lot control.

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ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD CLICK HERE

Performance Data & Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	MC1630-2 Plastic package, exposed paddle, Lead Finish: Matte-Tin
RoHS Status	Compliant
Tape & Reel **Standard Quantities Available on Reel**	F66 7" Reels with 20, 50, 100, 200, 500, 1000, 2000, or 3000 devices
Suggested Layout for PCB Design	PL-829
Evaluation Board	TB-PMA2-123LVC+ Gerber File
Environmental Ratings	ENV08T1

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

NOTE: Use PDF Bookmarks to view DATA at required conditions

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

TEST CONDITIONS: V_{DD} = +3 V @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Psat Output	Noise Figure	OIP3 Output
(GHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)	(dBm)
0.01	17.62	26.60	9.25	8.85	1.32	0.79	9.58	12.00	6.77	23.50
0.02	17.62	23.43	12.26	20.42	1.16	0.78	10.27	12.33	4.68	22.04
0.03	17.51	23.01	13.79	26.84	1.15	0.76	10.51	12.46	3.91	23.64
0.04	17.46	22.75	14.54	26.45	1.14	0.74	10.87	12.78	3.20	22.15
0.05	17.43	22.71	14.93	25.43	1.14	0.74	11.02	12.92	2.85	25.93
0.1	17.44	22.33	15.55	24.07	1.12	0.71	11.07	12.94	2.20	23.79
0.2	17.51	22.10	16.22	24.72	1.11	0.68	11.75	13.56	1.83	25.44
0.4	17.61	21.85	17.17	27.15	1.10	0.65	13.04	14.72	1.54	24.37
0.6	17.64	21.77	17.49	29.18	1.10	0.64	13.70	15.30	1.43	25.38
0.8	17.63	21.78	17.31	31.12	1.11	0.64	13.95	15.44	1.41	24.13
1.0	17.60	21.84	16.93	32.95	1.11	0.65	14.08	15.58	1.37	24.38
1.5	17.49	22.02	15.55	31.93	1.13	0.69	14.20	15.95	1.51	23.41
2.0	17.38	22.27	14.38	26.82	1.15	0.72	14.18	15.95	1.41	25.19
2.5	17.30	22.44	13.86	24.74	1.17	0.74	14.14	15.98	1.42	24.58
3.0	17.23	22.61	13.82	24.40	1.19	0.76	14.00	16.10	1.40	24.16
3.5	17.15	22.82	13.48	23.45	1.21	0.79	13.85	16.16	1.47	23.18
4.0	17.01	23.12	12.30	20.86	1.24	0.82	13.54	16.12	1.55	23.77
4.5	16.80	23.46	10.69	17.47	1.27	0.85	12.89	15.90	1.67	23.49
5.0	16.59	23.86	9.28	14.57	1.30	0.87	12.01	15.82	1.78	20.66
5.5	16.49	24.13	8.60	12.98	1.32	0.87	11.27	15.75	1.85	20.64
6.0	16.54	24.24	8.75	12.95	1.33	0.87	10.51	15.86	1.85	22.36
6.5	16.73	24.31	9.49	14.46	1.36	0.87	10.53	15.80	1.84	19.66
7.0	16.87	24.39	10.11	17.35	1.37	0.89	10.62	15.65	1.86	20.37
7.5	16.79	24.67	9.58	20.29	1.40	0.94	10.37	15.37	1.96	19.89
8.0	16.54	25.02	8.49	20.95	1.43	0.99	10.22	15.00	2.14	19.21
8.5	16.34	25.31	7.73	17.39	1.45	1.01	10.77	14.14	2.30	19.84
9.0	16.32	25.30	7.56	14.36	1.45	0.98	11.18	13.37	2.42	20.89
9.5	16.46	25.09	7.93	13.51	1.44	0.94	11.76	13.20	2.43	20.70
10.0	16.59	24.79	9.25	14.22	1.44	0.91	11.66	13.34	2.48	22.76
10.5	16.66	24.49	11.22	14.14	1.44	0.87	11.97	13.69	2.65	21.59
11.0	16.44	24.56	12.15	12.40	1.47	0.85	11.70	13.70	2.71	22.94
11.5	15.94	24.82	10.92	11.47	1.53	0.87	11.30	13.52	2.45	22.48
12.0	15.58	25.00	9.72	11.02	1.57	0.89	10.80	13.39	2.41	22.36
12.5	15.36	24.96	9.34	11.66	1.60	0.92	11.41	13.88	2.37	22.96
13.0	14.92	25.24	9.17	11.49	1.70	0.93	11.53	13.99	2.51	22.80
13.5	14.15	25.89	8.57	11.06	1.92	0.96	11.02	13.72	2.87	24.42
14.0	13.19	26.83	7.28	10.87	2.20	1.02	10.73	13.49	3.26	22.07

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions

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

TEST CONDITIONS: V_{DD} = +2 V @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Psat Output	Noise Figure	OIP3 Output
(GHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)	(dBm)
0.01	8.78	25.22	8.17	3.02	1.74	0.49	5.67	6.67	6.41	12.06
0.02	10.05	20.91	6.92	5.23	1.36	0.64	5.44	6.79	4.69	9.97
0.03	10.38	19.88	6.39	6.29	1.29	0.69	5.17	6.69	4.16	8.30
0.04	10.54	19.57	6.13	6.82	1.24	0.71	5.68	7.01	3.52	8.41
0.05	10.63	19.36	5.96	7.13	1.22	0.72	6.04	7.22	3.15	8.33
0.1	10.78	18.93	5.68	7.55	1.18	0.73	5.90	7.10	2.65	7.11
0.2	10.87	18.71	5.69	7.60	1.17	0.72	6.58	7.43	2.49	10.23
0.4	10.87	18.55	5.77	7.50	1.16	0.70	7.68	8.04	2.40	9.95
0.6	10.81	18.57	5.79	7.43	1.17	0.70	8.33	8.44	2.30	13.59
0.8	10.71	18.63	5.76	7.32	1.18	0.70	8.49	8.57	2.37	12.61
1.0	10.59	18.72	5.73	7.22	1.19	0.71	8.68	8.66	2.26	12.88
1.5	10.24	19.00	5.62	7.02	1.23	0.73	9.07	8.95	2.49	12.67
2.0	9.91	19.26	5.59	6.95	1.28	0.76	8.83	8.84	2.38	12.65
2.5	9.65	19.32	5.47	6.90	1.30	0.78	8.81	8.84	2.58	12.63
3.0	9.52	19.29	5.41	6.86	1.31	0.79	8.91	9.00	2.49	12.70
3.5	9.30	19.33	5.34	6.81	1.33	0.80	8.96	9.09	2.57	12.45
4.0	8.81	19.56	5.20	6.47	1.37	0.81	9.23	9.26	2.57	12.32
4.5	8.16	19.96	4.89	5.98	1.43	0.81	8.84	8.98	2.78	12.17
5.0	7.47	20.41	4.68	5.61	1.51	0.81	8.90	8.99	2.98	11.08
5.5	6.96	20.66	4.68	5.49	1.60	0.82	8.36	8.72	3.11	11.26
6.0	6.81	20.54	4.91	5.74	1.66	0.84	8.52	8.79	3.14	11.03
6.5	6.96	20.18	5.41	6.34	1.68	0.84	8.57	8.86	3.15	10.02
7.0	7.06	19.82	5.97	7.11	1.70	0.87	8.25	8.68	3.26	10.29
7.5	6.91	19.66	6.07	7.61	1.71	0.92	8.27	8.79	3.41	9.86
8.0	6.58	19.73	5.80	7.35	1.70	0.95	7.83	8.58	3.63	8.57
8.5	6.15	19.81	5.38	6.72	1.71	0.93	7.48	8.15	3.80	7.13
9.0	5.94	19.63	5.08	6.26	1.68	0.90	6.72	7.43	4.02	6.91
9.5	6.22	18.93	4.90	6.56	1.58	0.90	7.14	7.96	3.96	7.45
10.0	6.69	18.11	5.39	7.66	1.54	0.92	7.25	8.61	3.99	8.69
10.5	7.14	17.24	6.17	10.28	1.50	0.98	7.57	8.90	3.82	9.52
11.0	7.35	16.75	6.80	14.26	1.49	1.01	7.86	9.42	3.81	8.24
11.5	7.11	16.69	6.67	20.21	1.49	1.07	7.88	9.67	3.78	10.82
12.0	7.23	16.25	6.34	22.62	1.42	1.11	8.04	9.91	3.57	11.04
12.5	7.14	16.13	6.21	20.52	1.41	1.13	8.01	9.76	3.56	12.63
13.0	7.02	16.06	6.35	19.76	1.43	1.14	7.75	9.51	3.78	13.23
13.5	6.57	16.32	6.46	18.98	1.48	1.16	7.42	9.38	3.89	13.68
14.0	5.70	17.15	5.92	18.14	1.64	1.19	7.43	9.50	4.19	15.00

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions

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

TEST CONDITIONS: V_{DD} = +4 V @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Psat Output	Noise Figure	OIP3 Output
(GHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)	(dBm)
0.01	19.90	27.34	9.75	12.97	1.25	0.84	14.77	16.54	7.29	26.72
0.02	19.61	24.97	13.66	23.51	1.14	0.76	15.44	16.97	4.84	28.56
0.03	19.37	24.45	16.35	17.34	1.13	0.71	15.68	17.05	3.88	27.12
0.04	19.28	24.37	17.73	15.74	1.12	0.70	15.94	17.26	3.15	27.80
0.05	19.23	24.19	18.86	15.03	1.12	0.68	16.02	17.34	2.79	30.92
0.1	19.22	23.98	20.69	14.39	1.11	0.65	16.09	17.33	2.11	29.58
0.2	19.30	23.73	21.75	14.77	1.10	0.63	16.73	17.91	1.76	29.12
0.4	19.42	23.38	22.79	15.93	1.09	0.59	17.86	18.89	1.46	31.98
0.6	19.47	23.28	23.67	16.76	1.09	0.58	18.19	19.21	1.36	29.28
0.8	19.49	23.28	23.70	17.49	1.09	0.59	18.23	19.30	1.34	31.40
1.0	19.49	23.32	23.14	18.41	1.10	0.60	18.29	19.44	1.27	31.50
1.5	19.45	23.46	21.91	20.85	1.11	0.63	18.30	19.71	1.37	28.61
2.0	19.41	23.66	19.68	23.38	1.13	0.67	18.32	19.78	1.30	31.13
2.5	19.37	23.82	18.00	25.67	1.14	0.69	18.26	19.86	1.33	27.21
3.0	19.32	23.98	17.40	26.81	1.15	0.71	18.13	20.07	1.36	25.09
3.5	19.27	24.17	16.56	27.90	1.17	0.73	18.01	20.09	1.43	28.15
4.0	19.21	24.39	15.19	38.34	1.19	0.76	17.63	20.02	1.46	29.71
4.5	19.10	24.67	13.40	28.49	1.22	0.79	17.35	19.97	1.57	27.76
5.0	18.99	24.95	11.68	21.27	1.24	0.82	16.64	19.66	1.63	26.87
5.5	18.97	25.19	10.67	18.16	1.25	0.83	16.58	19.55	1.66	26.63
6.0	19.04	25.44	10.59	17.60	1.27	0.84	16.21	19.51	1.68	27.10
6.5	19.18	25.55	11.11	18.37	1.28	0.84	15.98	19.25	1.70	24.95
7.0	19.19	25.78	11.31	18.06	1.30	0.85	16.16	19.22	1.81	25.25
7.5	19.04	26.14	10.03	16.46	1.34	0.89	15.63	18.89	1.92	25.66
8.0	18.75	26.58	8.68	16.65	1.39	0.94	15.30	18.57	2.07	24.29
8.5	18.50	27.00	7.95	15.85	1.44	0.97	14.89	17.57	2.23	25.30
9.0	18.36	27.13	7.76	14.19	1.47	0.96	14.96	16.80	2.34	26.04
9.5	18.42	26.84	8.36	13.11	1.45	0.92	15.05	16.47	2.31	25.28
10.0	18.40	26.76	9.88	12.09	1.48	0.87	14.76	16.41	2.29	25.89
10.5	18.31	26.54	11.45	10.78	1.48	0.82	15.09	16.87	2.30	25.11
11.0	17.99	26.63	11.37	9.61	1.52	0.81	14.63	16.83	2.37	27.01
11.5	17.35	26.99	10.05	9.15	1.60	0.84	14.47	16.73	2.39	26.30
12.0	17.00	26.97	9.33	8.93	1.62	0.85	13.77	16.50	2.40	25.12
12.5	16.70	26.98	9.20	9.42	1.68	0.88	14.71	17.03	2.38	25.72
13.0	16.27	27.13	9.09	9.96	1.81	0.91	14.86	17.12	2.69	25.53
13.5	15.44	27.65	8.42	10.83	2.04	0.96	14.21	16.80	2.96	25.23
14.0	14.46	28.40	7.13	10.67	2.33	1.03	13.86	16.55	3.36	25.08

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions

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

TEST CONDITIONS: V_{DD} = +3 V @ Temperature = -55°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Psat Output	Noise Figure	OIP3 Output
(GHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)	(dBm)
0.01	18.48	26.71	9.25	8.89	1.23	0.78	7.59	10.13	5.86	20.40
0.02	18.36	23.88	13.04	20.82	1.14	0.76	8.05	10.92	3.53	23.15
0.03	18.18	23.32	15.31	24.87	1.14	0.72	8.21	11.35	2.68	23.37
0.04	18.11	23.02	16.30	23.66	1.12	0.70	8.53	11.80	2.04	23.81
0.05	18.08	22.96	17.01	22.64	1.13	0.70	8.66	11.98	1.80	25.06
0.1	18.06	22.72	17.95	21.63	1.12	0.67	8.59	12.00	1.34	25.11
0.2	18.10	22.53	18.50	22.00	1.11	0.65	9.07	12.52	1.19	26.00
0.4	18.19	22.29	20.11	22.52	1.10	0.62	10.29	13.80	1.00	25.16
0.6	18.22	22.15	20.69	23.30	1.09	0.61	11.20	14.69	0.96	26.10
0.8	18.24	22.14	20.89	24.03	1.09	0.61	11.50	14.93	0.92	25.35
1.0	18.24	22.13	20.62	24.86	1.10	0.61	11.69	15.21	0.87	24.91
1.5	18.20	22.28	18.62	30.86	1.11	0.64	11.91	15.52	0.97	24.20
2.0	18.14	22.47	16.92	43.54	1.13	0.67	11.91	15.51	0.87	24.58
2.5	18.09	22.61	16.31	33.08	1.14	0.69	11.89	15.51	0.83	25.06
3.0	18.07	22.77	16.63	35.24	1.15	0.71	11.73	15.53	0.83	22.54
3.5	18.05	22.97	16.67	35.84	1.17	0.73	11.64	15.48	0.87	24.26
4.0	17.98	23.22	15.07	28.83	1.19	0.76	11.43	15.29	0.94	23.55
4.5	17.84	23.51	12.49	21.92	1.21	0.79	11.06	14.86	0.99	23.13
5.0	17.69	23.91	10.35	16.89	1.23	0.82	10.63	14.38	1.14	20.21
5.5	17.61	24.19	9.34	14.04	1.24	0.82	9.93	14.27	1.12	20.14
6.0	17.70	24.31	9.64	12.99	1.25	0.79	9.78	14.54	1.11	21.62
6.5	17.95	24.38	10.69	13.44	1.26	0.78	9.53	14.53	1.11	19.44
7.0	18.20	24.40	11.63	15.01	1.25	0.79	9.76	14.43	1.14	19.88
7.5	18.32	24.55	11.12	15.89	1.24	0.82	9.61	14.12	1.19	19.91
8.0	18.28	24.83	9.52	17.73	1.24	0.88	9.49	13.88	1.29	19.29
8.5	18.30	25.10	8.40	19.30	1.25	0.92	9.30	13.08	1.38	20.77
9.0	18.42	25.14	7.91	14.32	1.24	0.87	9.50	12.31	1.44	21.70
9.5	18.64	24.95	7.75	11.77	1.20	0.80	9.69	12.02	1.51	21.84
10.0	18.85	24.91	8.89	11.51	1.20	0.76	9.69	11.99	1.58	23.45
10.5	19.01	24.65	11.51	10.87	1.18	0.71	9.68	12.07	1.75	22.73
11.0	18.88	24.79	13.84	8.96	1.18	0.65	9.21	11.79	1.88	24.18
11.5	18.71	24.93	14.04	7.85	1.18	0.62	8.62	11.46	1.68	22.04
12.0	18.58	24.98	13.67	7.75	1.19	0.63	7.94	10.98	1.66	22.31
12.5	18.44	25.01	13.38	7.95	1.21	0.65	8.21	11.33	1.81	21.50
13.0	18.13	25.24	12.68	7.52	1.24	0.65	8.24	11.48	1.92	21.92
13.5	17.47	25.84	11.42	6.77	1.33	0.66	7.88	11.15	2.25	22.09
14.0	16.78	26.71	9.07	6.14	1.45	0.68	7.55	10.92	2.54	19.26

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions

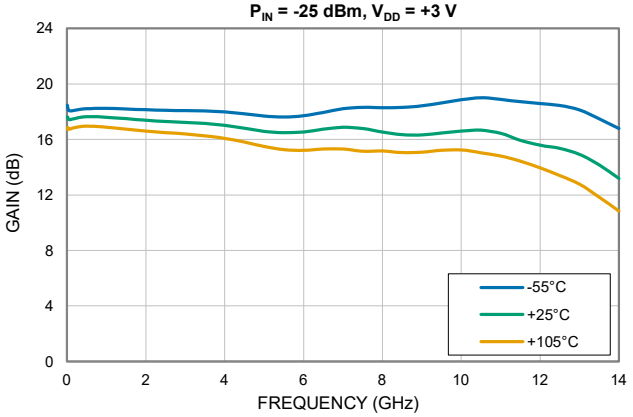
Definitions:
Input Return Loss = S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = S12 (dB)
Output Return Loss = S22 (dB)

TEST CONDITIONS: V_{DD} = +3 V @ Temperature = +105°C

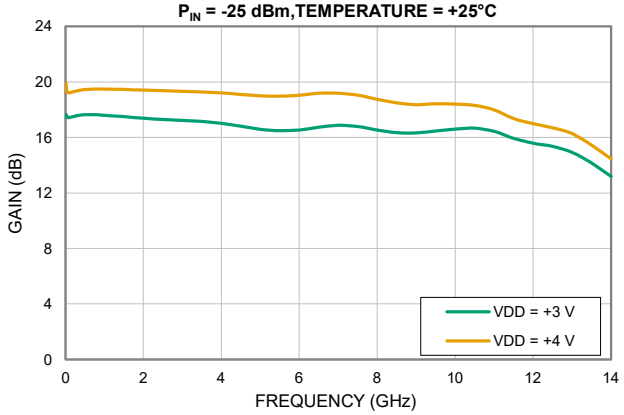
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Psat Output	Noise Figure	OIP3 Output
(GHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)	(dBm)
0.01	16.75	25.88	9.30	8.35	1.33	0.77	9.84	11.98	7.32	22.05
0.02	16.86	22.98	11.47	17.63	1.18	0.78	10.42	12.29	4.88	21.23
0.03	16.78	22.49	12.54	24.23	1.16	0.77	10.66	12.40	4.03	23.53
0.04	16.75	22.30	13.01	28.70	1.15	0.77	11.03	12.70	3.33	23.15
0.05	16.74	22.16	13.24	31.60	1.15	0.76	11.20	12.85	3.08	25.03
0.1	16.76	21.90	13.75	33.78	1.13	0.73	11.35	12.91	2.61	23.82
0.2	16.85	21.63	14.36	33.40	1.12	0.70	12.15	13.57	2.37	25.48
0.4	16.95	21.37	14.93	31.99	1.11	0.67	13.29	14.49	2.12	23.15
0.6	16.95	21.36	15.00	29.82	1.11	0.67	13.79	14.85	2.02	25.47
0.8	16.93	21.37	14.72	27.72	1.12	0.67	13.87	14.98	1.95	24.72
1.0	16.88	21.45	14.38	25.88	1.12	0.68	13.95	15.06	1.93	25.29
1.5	16.74	21.66	13.42	22.69	1.15	0.71	14.08	15.32	2.05	23.87
2.0	16.60	21.86	12.69	21.16	1.17	0.75	14.02	15.36	1.97	25.20
2.5	16.49	22.08	12.24	20.29	1.18	0.77	13.97	15.42	2.00	25.55
3.0	16.39	22.27	11.91	19.35	1.20	0.80	13.93	15.50	1.99	24.53
3.5	16.26	22.50	11.43	17.82	1.22	0.82	13.80	15.52	2.10	23.42
4.0	16.08	22.82	10.65	16.02	1.26	0.85	13.53	15.41	2.16	23.47
4.5	15.81	23.19	9.65	14.13	1.31	0.87	12.83	15.11	2.29	22.83
5.0	15.48	23.63	8.64	12.44	1.36	0.88	12.29	15.00	2.47	20.55
5.5	15.26	24.01	8.12	11.69	1.41	0.90	11.37	14.84	2.55	20.04
6.0	15.21	24.17	8.33	12.27	1.45	0.91	10.76	14.88	2.56	21.75
6.5	15.30	24.26	8.99	14.27	1.50	0.94	10.81	14.78	2.56	18.84
7.0	15.30	24.36	9.42	17.49	1.53	0.97	10.92	14.61	2.68	20.05
7.5	15.14	24.61	9.12	19.94	1.57	1.01	10.70	14.33	2.86	19.65
8.0	15.16	24.58	8.13	19.87	1.52	1.04	10.77	13.93	2.86	19.39
8.5	15.05	24.73	7.81	17.45	1.54	1.04	11.27	13.35	3.00	20.23
9.0	15.08	24.50	7.88	15.66	1.52	1.01	11.56	13.01	3.12	21.31
9.5	15.21	24.13	8.11	15.44	1.49	0.98	12.11	13.26	3.05	21.41
10.0	15.24	23.84	9.15	17.15	1.50	0.96	12.04	13.38	3.10	22.70
10.5	15.04	23.75	10.51	17.74	1.56	0.94	12.27	13.58	3.29	20.94
11.0	14.80	23.73	11.06	14.60	1.59	0.92	12.31	13.68	3.43	23.28
11.5	14.43	23.86	10.09	12.88	1.62	0.92	12.03	13.66	3.07	23.05
12.0	13.94	24.08	9.19	13.07	1.70	0.96	11.41	13.38	2.91	23.90
12.5	13.40	24.33	8.77	13.95	1.81	1.00	11.97	13.68	3.08	23.56
13.0	12.77	24.78	8.62	14.04	2.02	1.03	11.85	13.69	3.28	23.92
13.5	11.83	25.54	8.15	13.65	2.36	1.06	11.15	13.27	3.76	23.45
14.0	10.85	26.51	6.79	13.37	2.72	1.12	10.77	13.00	4.10	23.02

Typical Performance Curves

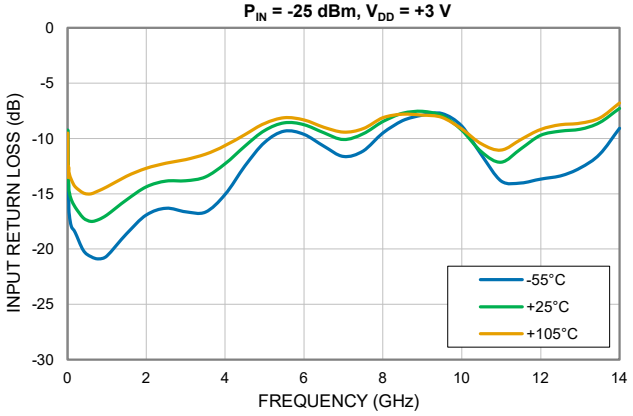
GAIN vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +3 V



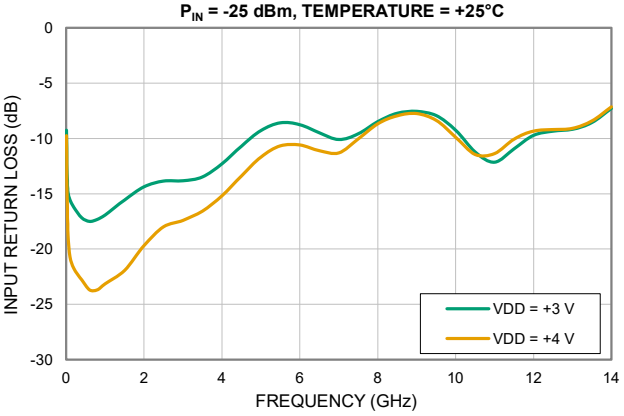
GAIN vs. DEVICE VOLTAGE
P_{IN} = -25 dBm,TEMPERATURE = +25°C



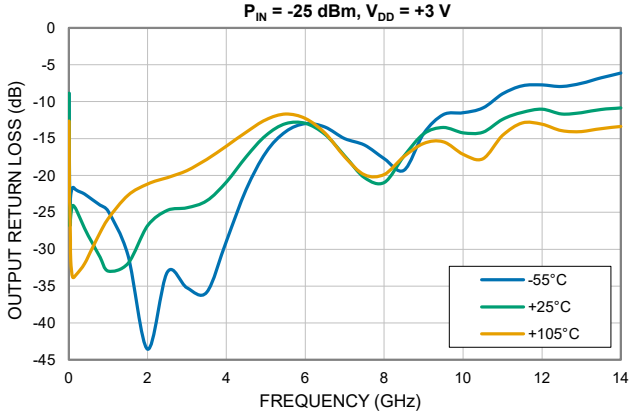
INPUT RETURN LOSS vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +3 V



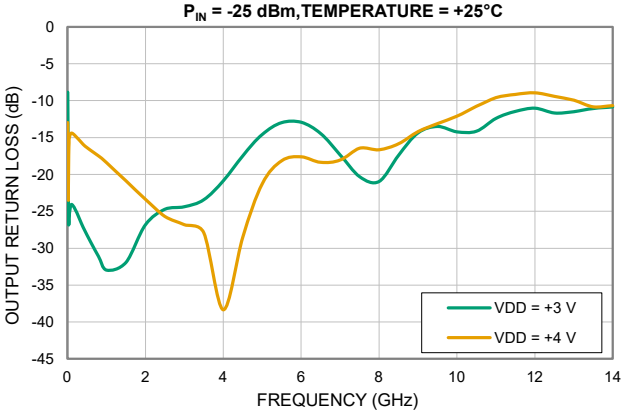
INPUT RETURN LOSS vs. DEVICE VOLTAGE
P_{IN} = -25 dBm, TEMPERATURE = +25°C



OUTPUT RETURN LOSS vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +3 V

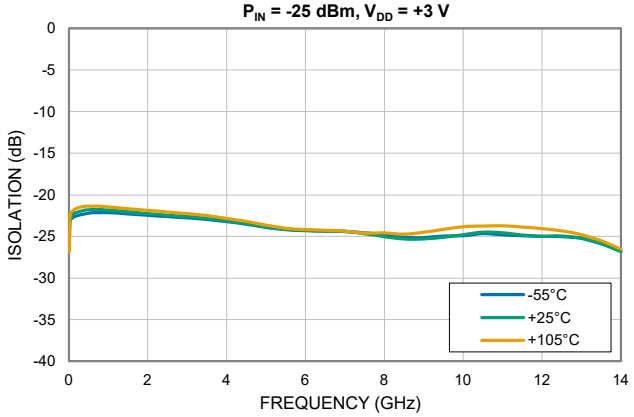


OUTPUT RETURN LOSS vs. DEVICE VOLTAGE
P_{IN} = -25 dBm,TEMPERATURE = +25°C

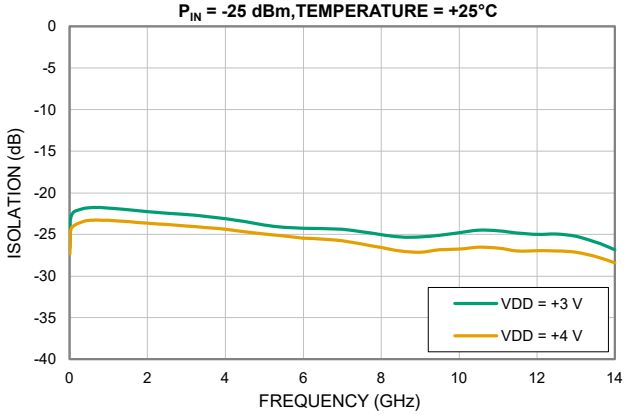


Typical Performance Curves

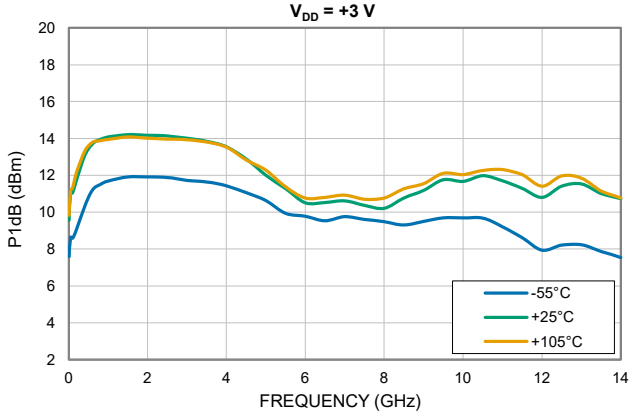
ISOLATION vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +3 V



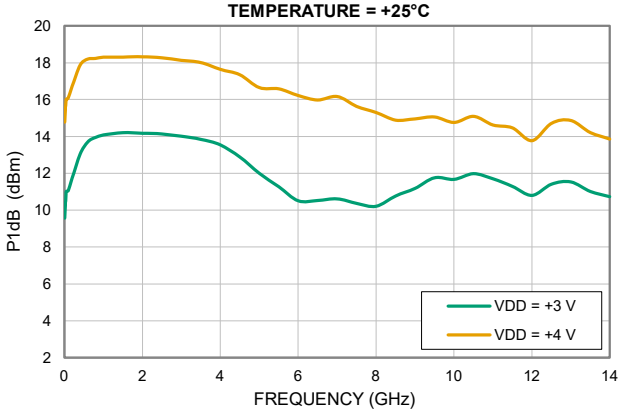
ISOLATION vs. DEVICE VOLTAGE
P_{IN} = -25 dBm,TEMPERATURE = +25°C



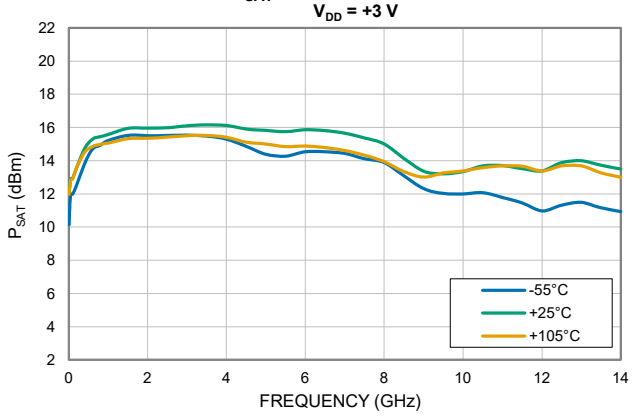
P1dB vs. TEMPERATURE
V_{DD} = +3 V



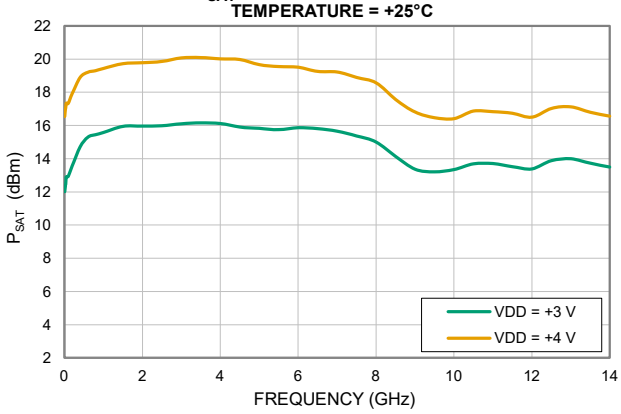
P1dB vs. DEVICE VOLTAGE
TEMPERATURE = +25°C



P_{SAT} vs. TEMPERATURE
V_{DD} = +3 V

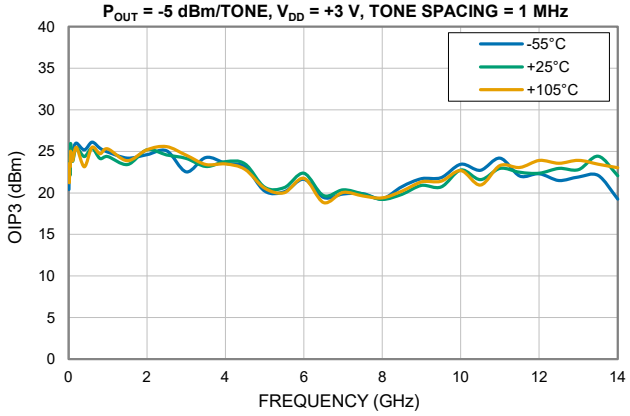


P_{SAT} vs. DEVICE VOLTAGE
TEMPERATURE = +25°C

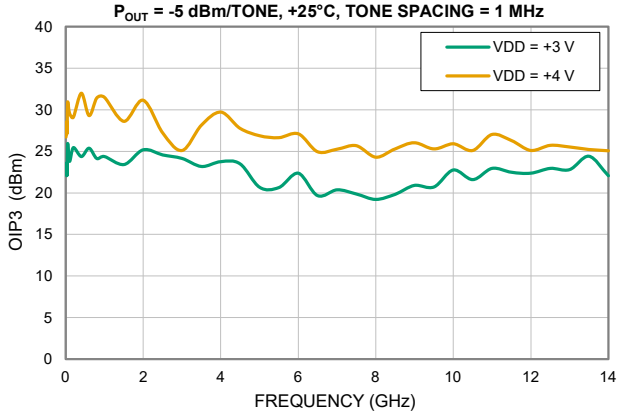


Typical Performance Curves

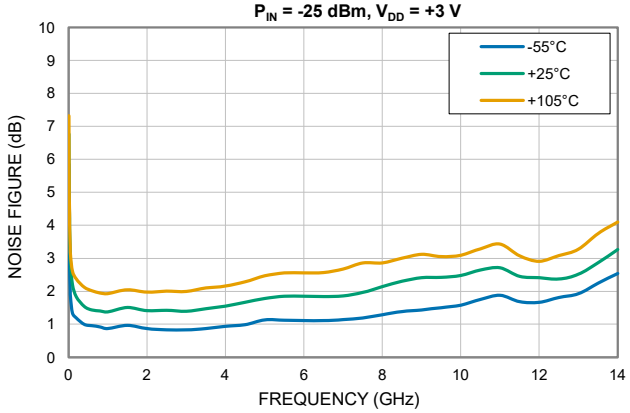
OIP3 vs. TEMPERATURE
P_{OUT} = -5 dBm/TONE, V_{DD} = +3 V, TONE SPACING = 1 MHz



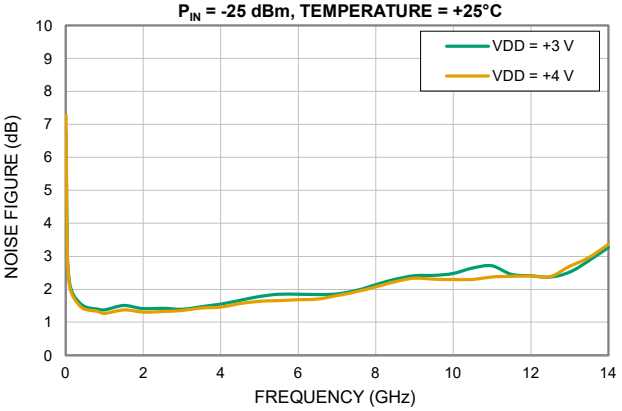
OIP3 vs. DEVICE VOLTAGE
P_{OUT} = -5 dBm/TONE, +25°C, TONE SPACING = 1 MHz



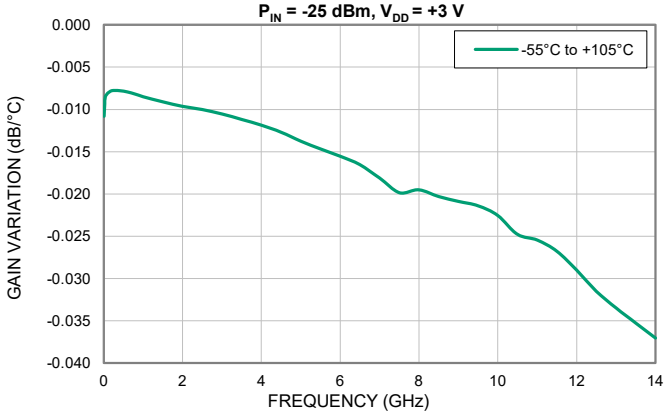
NOISE FIGURE vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +3 V



NOISE FIGURE vs. DEVICE VOLTAGE
P_{IN} = -25 dBm, TEMPERATURE = +25°C



GAIN VARIATION vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +3 V

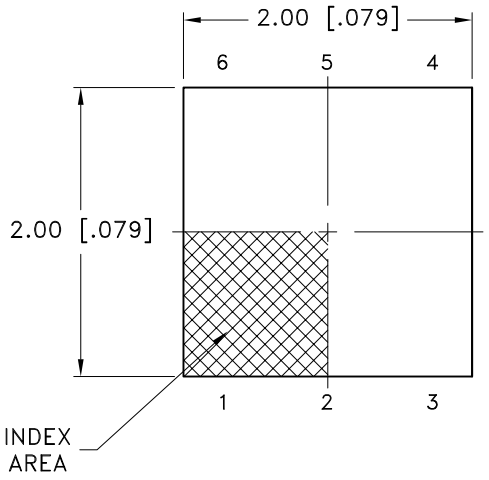


Case Style MC

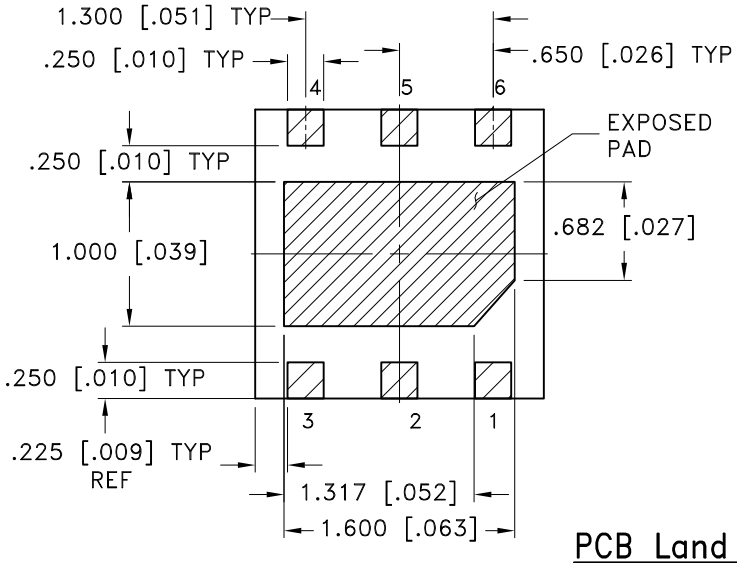
Outline Dimensions

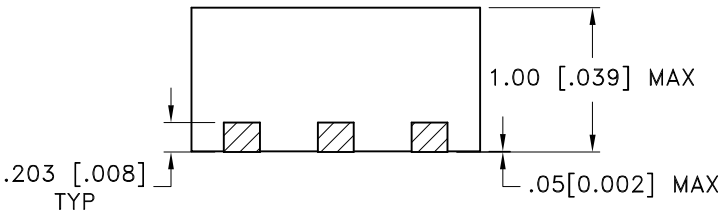
MC1630-2

TOP VIEW

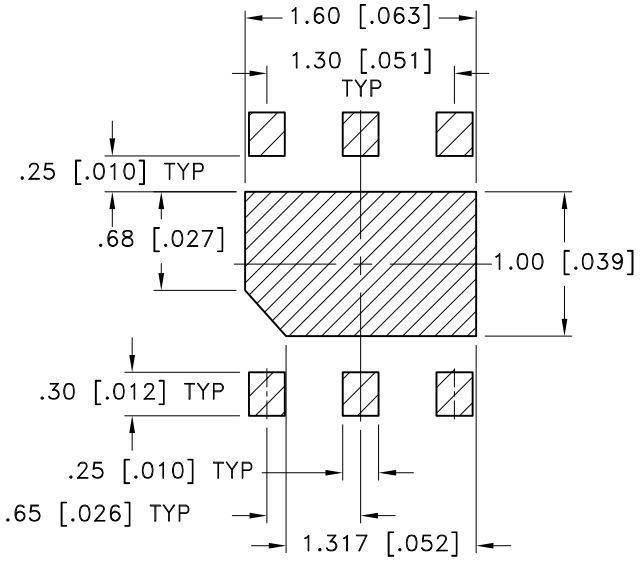


BOTTOM VIEW





PCB Land Pattern



Suggested Layout

DENOTES METALLIZATION

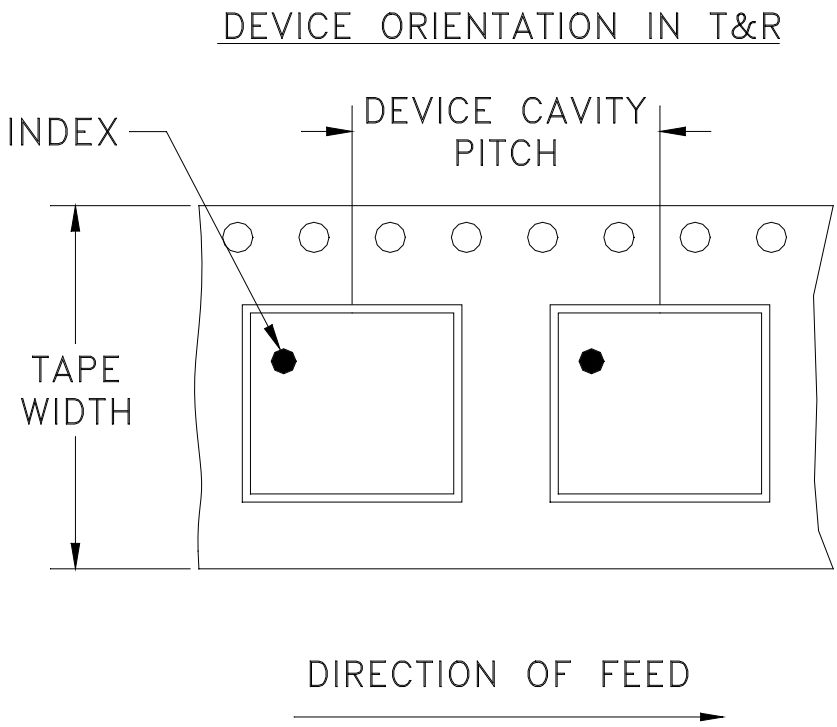
Weight: 0.0108 grams

Dimensions are in mm [inches]. Tolerances: 2 Pl. and 3 Pl.±0.05[0.002] mm[Inches]

Notes:

1. Case material: Plastic.
2. Termination finish:
   For RoHS Case Styles: Matte-Tin plated.
   All models, (+) suffix.
3. Lead #1 identifier shall be located in the cross-hatched area shown.
   Identifier may be either a molded or marked feature.

Tape & Reel Packaging TR-F66



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
8	4	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000, 2000, 3000

Note: Please consult individual model data sheet to determine device per reel availability.

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf

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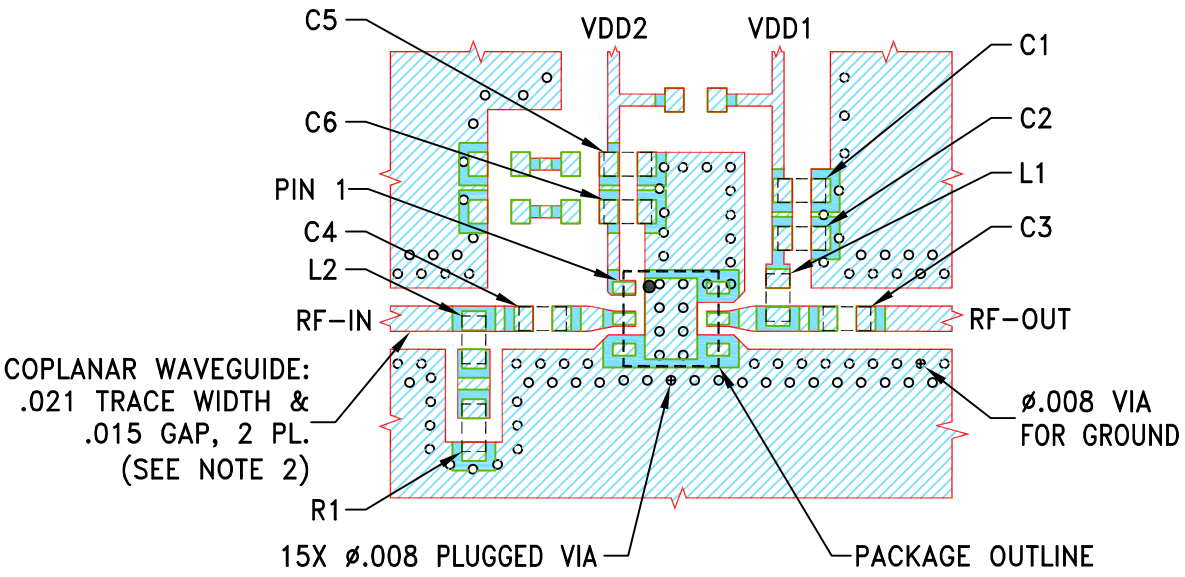
THIRD ANGLE PROJECTION

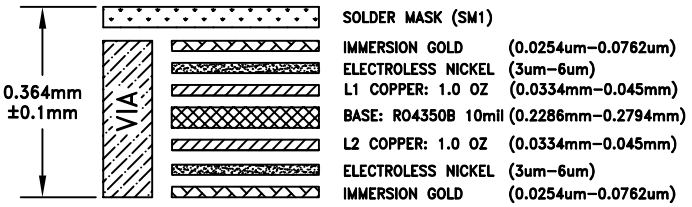
REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-025873	NEW RELEASE	06/12/25	ITG	IL

SUGGESTED MOUNTING CONFIGURATION FOR MC1631-2 CASE STYLE



COMPONENT	SIZE
C1-C6	0402
L1, L2	0402
R1	0402

2 LAYER STACK-UP DETAIL



NOTES:
1. PCB IS 2 LAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010".
   COPPER: 1 OZ. EACH LAYER. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
3. CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE, FOR COMPONENT VALUES REFER TO TB-PMA2-123LV+.
4. LAYERS 2 OF PCB ARE CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	ITG	06/12/25
TOLERANCES ON:	CHECKED	GF	06/12/25
2 PL DECIMALS ±	APPROVED	IL	06/12/25
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

ASHEETA1.DWG REV:A DATE:01/12/95

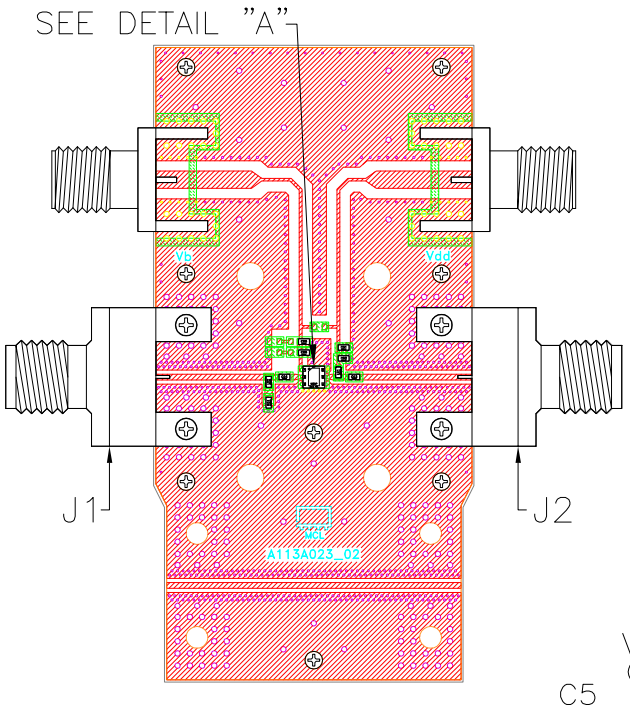
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

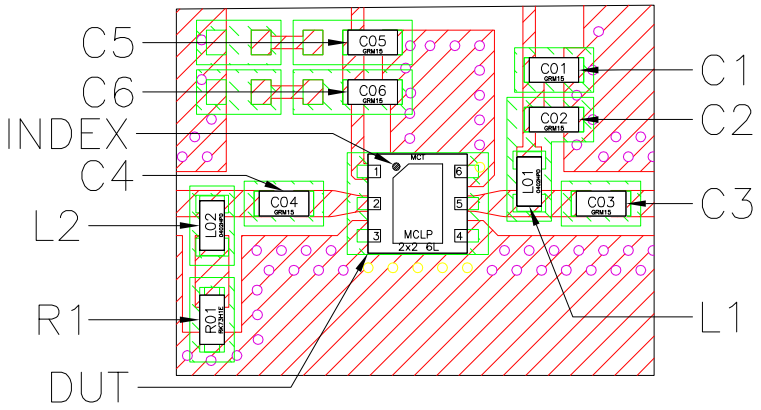
PL, MC1630-2,TB-PMA2-123LV(C)+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-829	OR

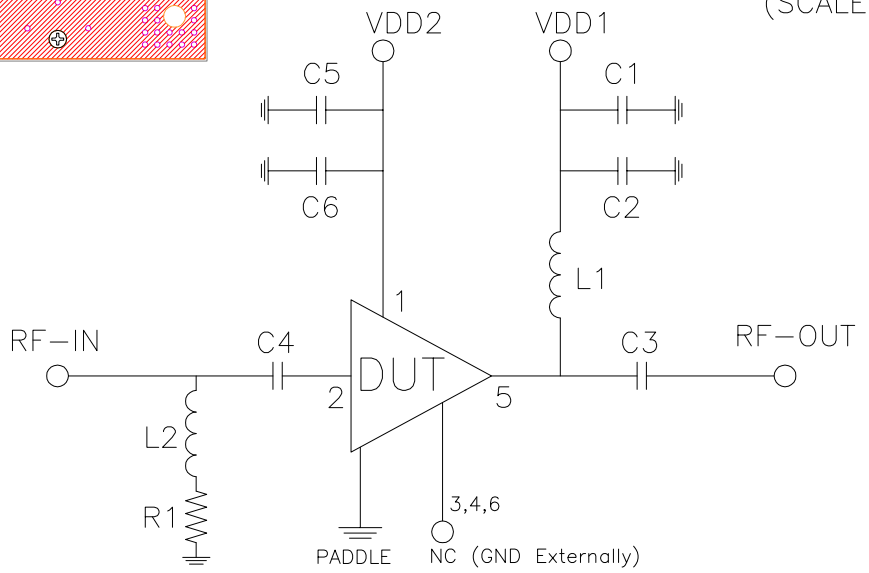
FILE:	SCALE:	SHEET:
98PL829	6:1	1 OF 1

Evaluation Board and Circuit





DETAIL "A"
LOCATION OF
UNITS COMPONENTS
(SCALE 5:1)



SCHEMATIC DIAGRAM

Component	Size	Value	Part Number	Manufacturer
C1,C5	0402	0.1uF	GRM155R71H104KE14J	Murata
C2,C6	0402	100pF	GRM1555C1H101JA01D	Murata
C3	0402	0.01uF	GRM155R71E103KA01D	Murata
C4	0402	1uF	GRM155C81E105KE11D	Murata
L1,L2	0402	900nH	0402DF-901XJRU	Coilcraft
R1	0402	820hm	RK73B1ETTP820J	KOA Speer
J1,J2	N/A	N/A	1092-01A-5	Southwest

Notes:

1. 2.92mm Female Connectors.
2. PCB Material: Roger RO4350B or equivalent, Dielectric constant=3.5, Thickness=0.010 inch

Mini-Circuits®

Mini-Circuits

Environmental Specifications **ENV08T1**

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 or -45° to 85° C or -55° to 105° C or -40° to 105° C or -40° to 95° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C or -65° to 150° Ambient Environment	Individual Model Data Sheet
HTOL	1000 hours at 125°C	MIL-STD-883, Method 1005, Condition B
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Mechanical Shock	1.5Kg, 0.5 ms, 5 shock pulses, Y1 direction only	MIL-STD-883, Method 2002, Condition B, except Y1 direction only
Vibration (Variable Frequency)	50g peak	MIL-STD-883, Method 2007, Condition B
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102, Condition C
HAST	130°C, 85% RH, 96 hours	JESD22-A110
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Solder Reflow Heat	Sn-Pb Eutetic Process: 240°C peak Pb-Free Process: 260°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Moisture Sensitivity: Level 1	Bake at 125°C for 24 hours Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 260°C peak	J-STD-020

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
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C	MIL-STD-202, Method 215