MMIC SURFACE MOUNT

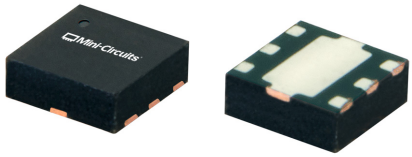
Low Noise Amplifier

PMA1-14LV+

50Ω 0.05 to 10 GHz Wideband Amplifier

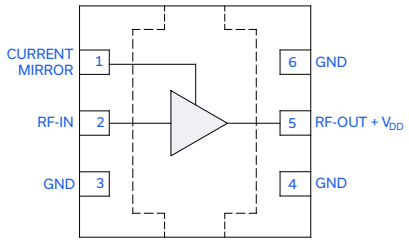
THE BIG DEAL

- High Gain, Typ. 21.9 dB
- Low Noise Figure, Typ. 1.0 dB
- High OIP3, Typ. +28.4 dBm
- High P1dB, Typ. +20.4 dBm
- Single Supply Voltage, +5 V at 60 mA
- 1.5 x 1.5 mm 6-Lead QFN-Style Package



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM (TOP VIEW)



APPLICATIONS

- Test & Measurement Equipment
- Back Haul Radio Systems
- Satellite Communications
- Radar, EW, and ECM Defense Systems
- 5G Wireless Infrastructure

PRODUCT OVERVIEW

The PMA1-14LV+ is a pHEMT-based low noise MMIC amplifier with high IP3 and flat gain. Operating from 0.05 to 10 GHz, this amplifier features high dynamic range with typical 1.0 dB noise figure, 21.9 dB gain, +20.4 dBm P1dB, and +28.4 dBm OIP3. This combination of performance makes it ideal for sensitive, high dynamic range receiver applications. PMA1-14LV+ operates on a single +5 V supply, is well matched to 50Ω, and comes in a small, low profile 1.5 x 1.5 mm QFN-style package for ease of integration into dense circuit board layouts.

KEY FEATURES

Features	Advantages
Low Noise Figure, Typ. 1.0 dB	A 50Ω matched low noise MMIC device enables low system noise figure performance without the need for complicated discrete-based solutions.
Low Power Consumption, Typ. +5 V at 60 mA	At only 60 mA, this amplifier is ideal for applications with limited available power or densely packed applications where thermal and power management is critical.
High OIP3, Typ. +28.4 dBm at 4 GHz	The combination of low noise figure and high OIP3 makes this MMIC amplifier ideal for use in sensitive low noise receiver front ends.
1.5 x 1.5 mm 6-Lead QFN-Style Package	Very small footprint saves space in dense PCB layouts while providing low inductance, repeatable transitions, and excellent thermal contact with the PCB. Industry standard packaging allows for ease of assembly in high volume manufacturing processes.

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ELECTRICAL SPECIFICATIONS[1] AT +25°C, V_{DD} = +5 V, Zo = 50Ω UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	V_{DD} = +5 V Min.	Typ.	Max.	Units
Frequency Range		0.05		10	GHz
Gain	0.05	20.4	21.8		dB
	2	20.4	21.9		
	4	20.4	21.9		
	8	20.2	22.2		
	10	21.0	22.4		
Input Return Loss	0.05		20		dB
	2		15		
	4		13		
	8		7		
	10		17		
Output Return Loss	0.05		20		dB
	2		20		
	4		16		
	8		11		
	10		9		
Isolation	0.05 - 10		26.7		dB
Output Power at 1dB Compression (P1dB)	0.05		+18.9		dBm
	2		+21.0		
	4		+20.4		
	8		+20.0		
	10		+18.0		
Output Third-Order Intercept Point (P_{OUT} = +5 dBm/Tone)	0.05		+30.4		dBm
	2		+30.0		
	4		+28.4		
	8		+25.9		
	10		+24.9		
Output Power at Saturation (P_{SAT})[2]	0.05		+20.7		dBm
	2		+22.8		
	4		+22.0		
	8		+19.2		
	10		+20.5		
Noise Figure	0.05		1.5		dB
	2		0.8		
	4		1.0		
	8		1.4		
	10		1.8		
Device Operating Voltage (V_{DD})		+4.75	+5	+5.25	V
Device Operating Current (I_{DD})[3]			60		mA
DC Current Variation vs. Temperature[4]			-51.0		µA/°C
DC Current Variation vs. Voltage[5]			0.028		mA/mV

1. Tested on Mini-Circuits Characterization Test Board TB-PMA1-14LVC+. See Figure 2. Board loss de-embedded to the device.
2. P_{SAT} defined as when the Output Power changes 0.1 dB per 1 dB change in Input Power.
3. Current at P_{IN} = -25 dBm. Increases to 90 mA at P1dB.
4. (Current at +105°C - Current at -45°C) / (+105°C - -45°C)
5. (Current at +5.25 V - Current at +4.75V) / (+5.25 V - +4.75 V)

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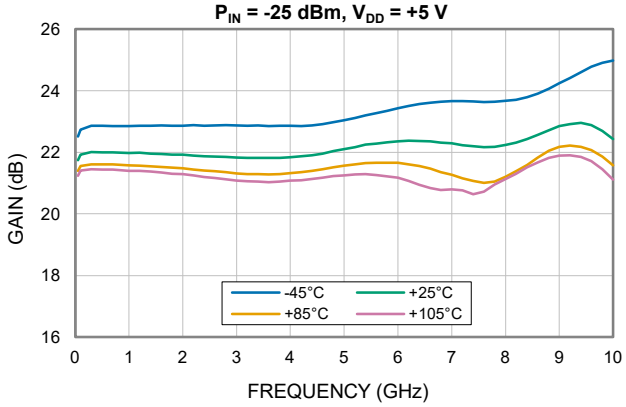
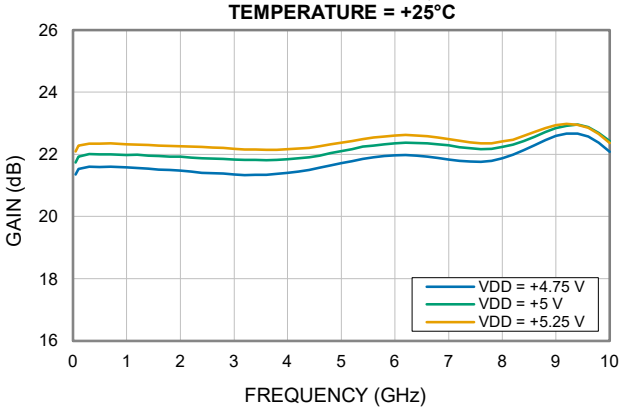
TYPICAL PERFORMANCE GRAPHS

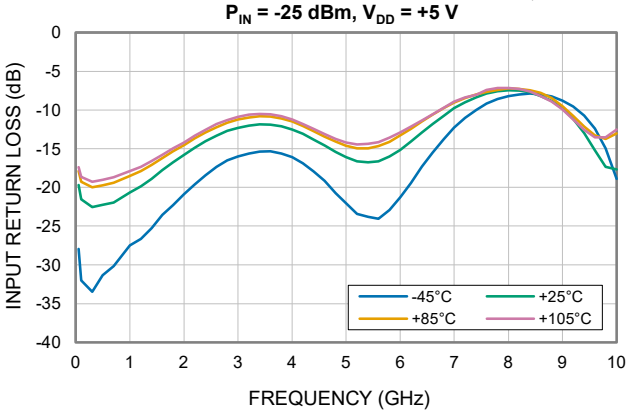
GAIN vs. TEMPERATURE,
P_{IN} = -25 dBm, V_{DD} = +5 V



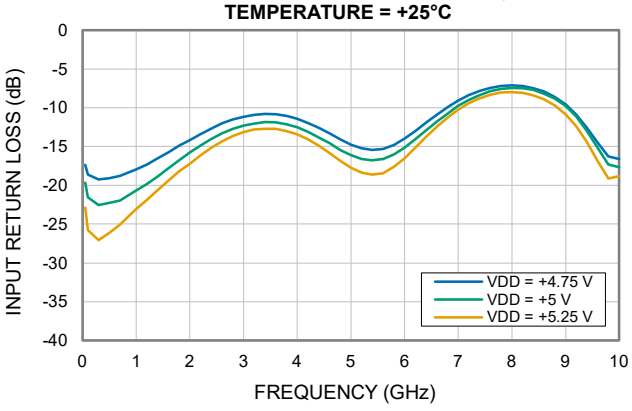
GAIN vs. VOLTAGE,
TEMPERATURE = +25°C



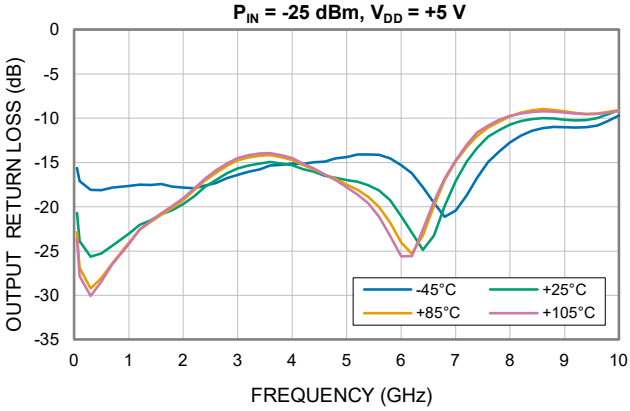
INPUT RETURN LOSS vs.TEMPERATURE,
P_{IN} = -25 dBm, V_{DD} = +5 V



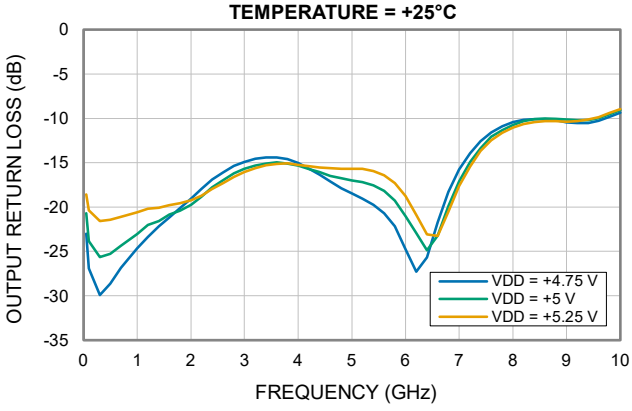
INPUT RETURN LOSS vs. VOLTAGE,
TEMPERATURE = +25°C



OUTPUT RETURN LOSS vs. TEMPERATURE,
P_{IN} = -25 dBm, V_{DD} = +5 V



OUTPUT RETURN LOSS vs. VOLTAGE,
TEMPERATURE = +25°C



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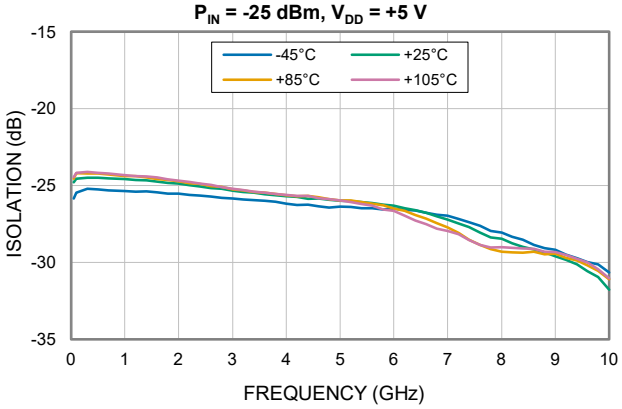
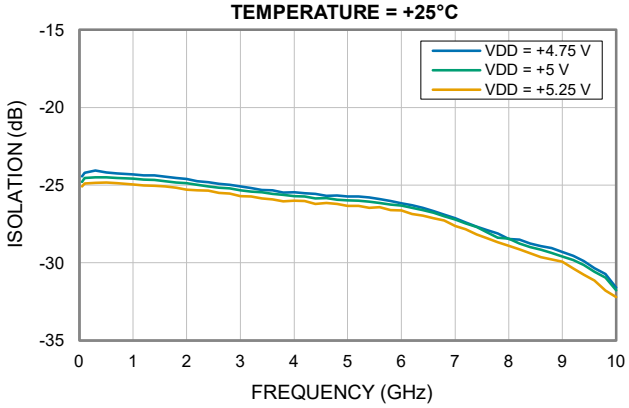
TYPICAL PERFORMANCE GRAPHS

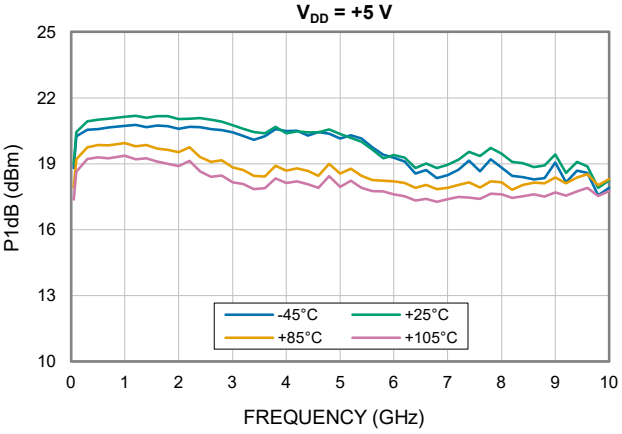
ISOLATION vs.TEMPERATURE,
P_{IN} = -25 dBm, V_{DD} = +5 V



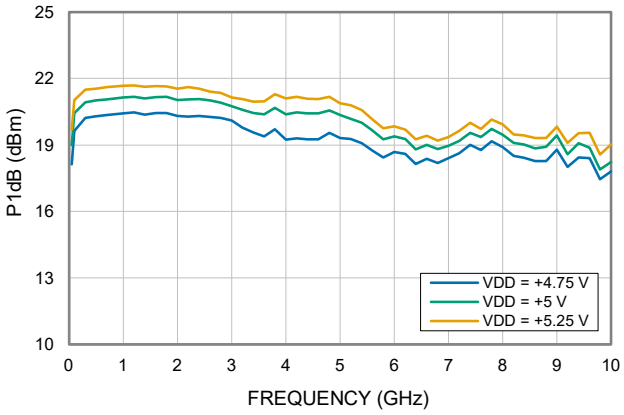
ISOLATION vs. VOLTAGE,
TEMPERATURE = +25°C



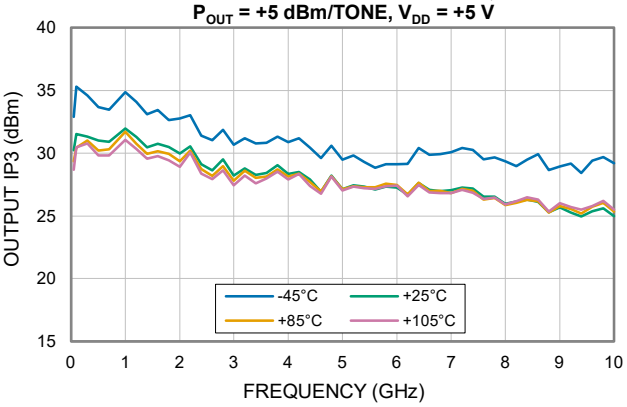
P1dB vs.TEMPERATURE,
V_{DD} = +5 V



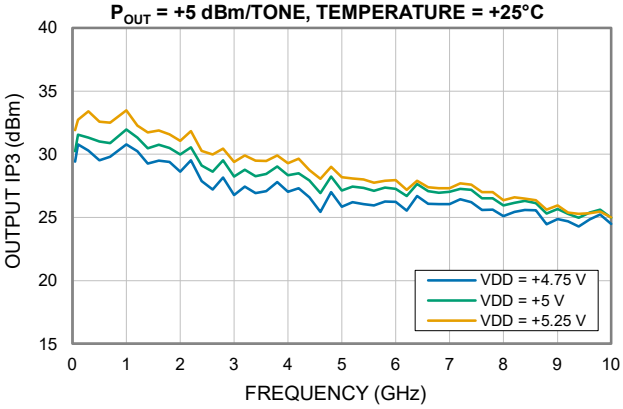
P1dB vs. VOLTAGE,
TEMPERATURE = +25°C



OUTPUT IP3 vs. TEMPERATURE,
P_{OUT} = +5 dBm/TONE, V_{DD} = +5 V



OUTPUT IP3 vs. VOLTAGE,
P_{OUT} = +5 dBm/TONE, TEMPERATURE = +25°C



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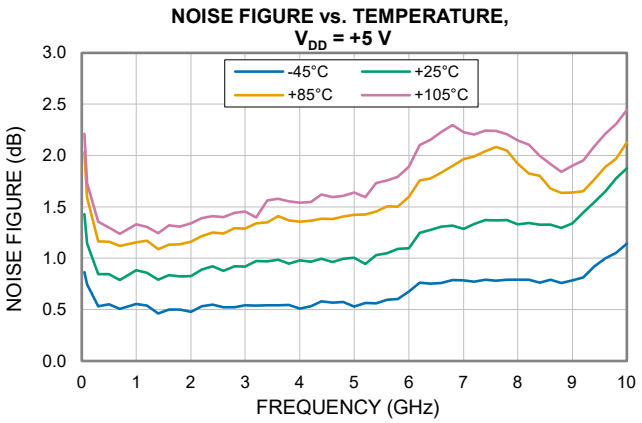
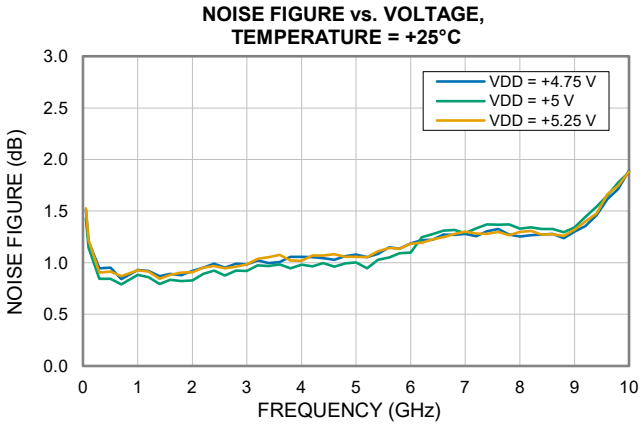
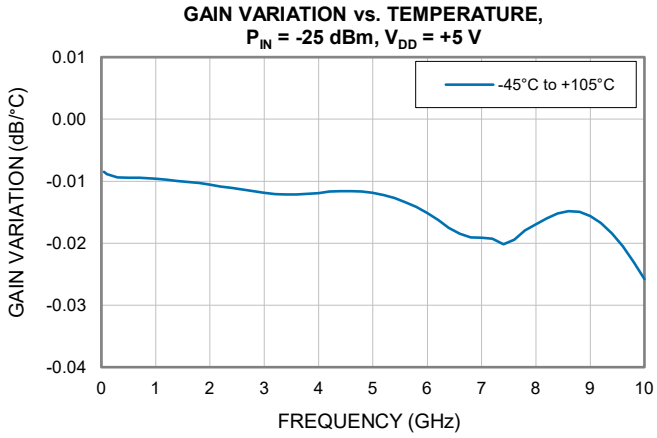
TYPICAL PERFORMANCE GRAPHS







ABSOLUTE MAXIMUM RATINGS[6]

Parameter	Ratings
Operating Temperature	-45°C to +105°C
Storage Temperature	-65°C to +150°C
Junction Temperature[7]	+150°C
Total Power Dissipation	0.82 W
Input Power (CW), V_{DD} = +5 V	+25 dBm
DC Voltage at V_{DD}	+9 V
DC Current I_{DD}	140 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]	54.9°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-002-2022

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 (TOP VIEW)

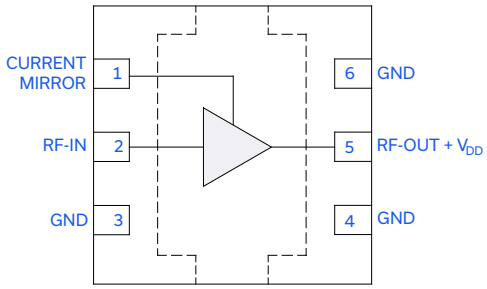

Figure 1. PMA1-14LV+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-IN	2	RF-IN Pad connects to RF Input port.
RF-OUT+V_{DD}	5	RF-OUT Pad connects to RF Output port. V_{DD} is applied via external bias tee.
CURRENT MIRROR[9]	1	Current Mirror Pad. Supplies gate voltage to RF-IN via L1. See details in Figure 2.
GND	3, 4, 6 & Paddle	Connects to ground.

9. To achieve specified performance, follow the current mirror circuit described in Figure 2. A feedback loop to RF-IN must be present for the part to operate.

CHARACTERIZATION TEST BOARD

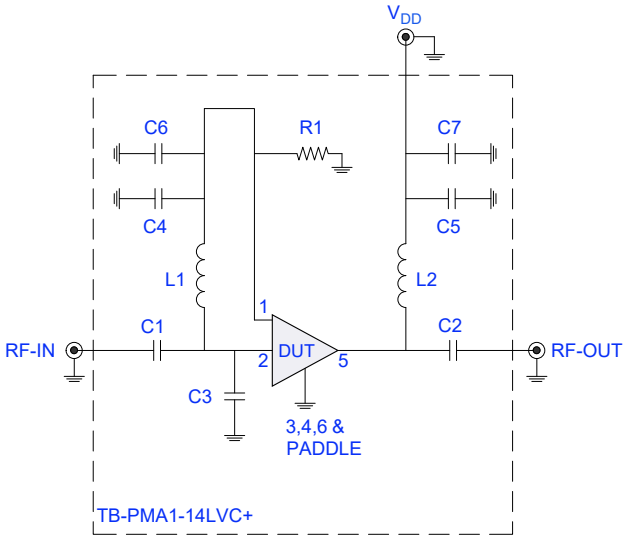

Figure 2. PMA1-14LV+ Characterization and Application Circuit

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

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

Component	Value	Size	Part Number	Manufacturer
C1, C2	0.01 µF	0402	GRM155R71H103KA88D	Murata
C3	0.2 pF	0402	GJM1555C1HR20WB01D	Murata
C4, C5	100 pF	0402	GRM1555C1H101JA01D	Murata
C6, C7	0.1 µF	0402	GRM155R71H104KE14J	Murata
L1[9], L2	900 nH	0402	0402DF-901XJRU	Coilcraft
R1	5.6k Ω	0402	RK73H1ETTP5601F	KOA Speer

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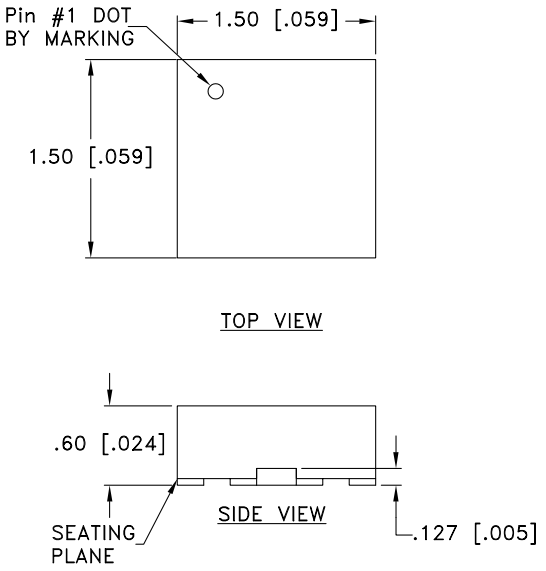
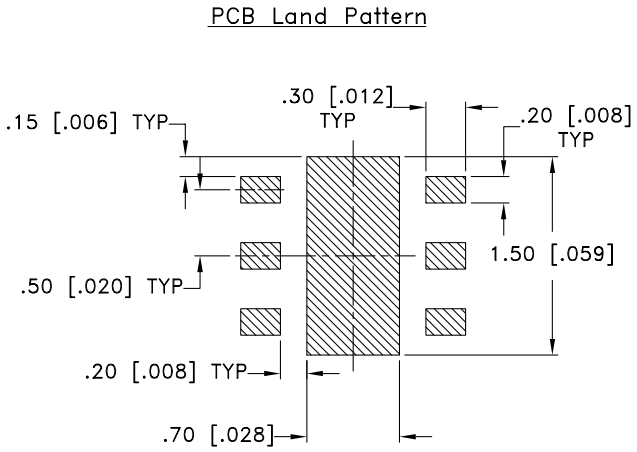
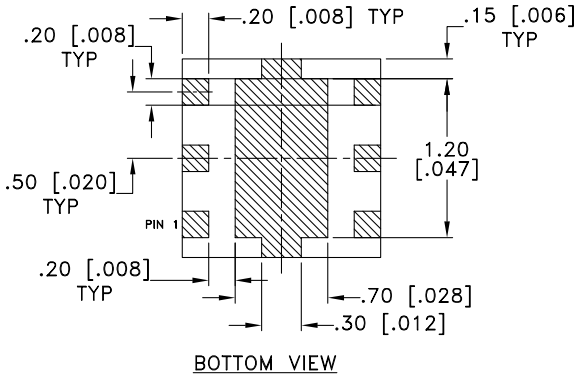
CASE STYLE DRAWING







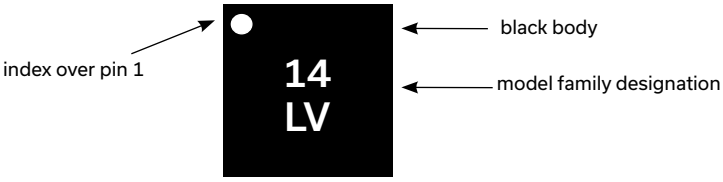
NOTES:

1. ▨ DENOTES METALLIZATION

Weight: .0036 grams

Dimensions are in mm [inches]. Tolerances: 2 Pl.± 0.05 mm

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	KC3009 Plastic package, exposed paddle, Lead Finish: Nickel-Palladium-Gold
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-850
Evaluation Board	TB-PMA1-14LVC+ 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-Circuits' 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 https://www.minicircuits.com/terms/viewterm.html