MMIC DIE

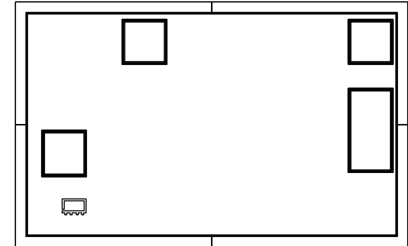
Wide Band Amplifier

PMA3-14LN-D+

50Ω 0.05 to 10 GHz

THE BIG DEAL

- Flat Gain, 22.6 ± 0.7 dB up to 10 GHz
- P1dB, +22 dBm Typ. vs. OIP3, +30.4 dBm Typ. up to 8 GHz
- Low Noise Figure, 1.8 dB Typ.
- Patent Pending



+RoHS Compliant
The +Suffix identifies RoHS Compliance.
See our website for methodologies and qualifications

SEE ORDERING INFORMATION ON THE LAST PAGE

APPLICATIONS

- 5G Infrastructure
- Wi-Fi 6E & IoT
- SatCom
- L, S, C Band Radar
- Test and Measurement Equipment

PRODUCT OVERVIEW

The PMA3-14LN-D+ is a GaAs PHEMT based wide band, low noise MMIC amplifier die with a unique combination of low Noise Figure, high IP3, and high Output Power, over a wide band making it ideal for sensitive, high-dynamic range receiver applications. This design operates on a single supply of +6V, is well matched for 50Ω.

KEY FEATURES

Feature	Advantages
Low Noise, 1.8 dB Typ. up to 10 GHz	Enables lower system Noise Figure performance.
High Dynamic Range • OIP3 +30.4 dBm Typ. up to 8 GHz • P1dB +22 dBm Typ. up to 8 GHz	The PMA3-14LN-D+ matches industry leading IP3 performance relative to device size and power consumption. The combination of the design and PHEMT structure provides enhanced linearity over a board frequency range as evidence in the IP3 being approximately 9-11 dB above the P1dB point. This feature makes this amplifier ideal for use in: • Driver Amplifiers for complex waveform up converter paths • Drivers in linearized transmit systems • Secondary amplifiers in ultra-high dynamic range receivers
Unpackaged Die	Enables user to integrate it directly into hybrids.
Wide bandwidth with flat Gain • ±0.7 dB up to 10 GHz	Enables a single amplifier to be used in many wide band applications including defense, instrumentation and more.

REV. OR
ECO-013912
PMA3-14LN-D+
MCL NY
220627

Wide Band Amplifier PMA3-14LN-D+

ELECTRICAL SPECIFICATIONS[1] AT 25°C, Zo=50Ω AND +6V, UNLESS NOTED OTHERWISE

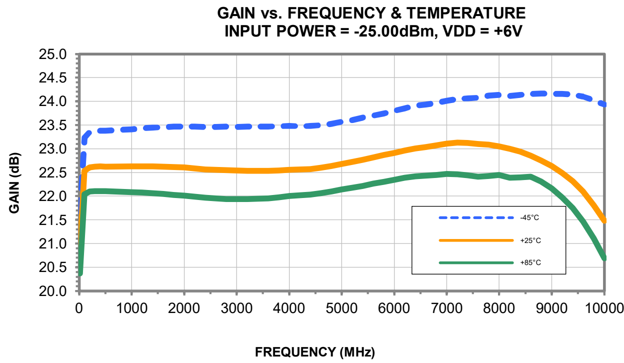
Parameter	Condition (MHz)	VDD = +6V			Units
		Min.	Typ.	Max.	
Frequency Range		50		10000	MHz
Gain	50 2000 4000 8000 10000		22.4 22.6 22.6 23.1 21.6		dB
Input Return Loss	50 2000 4000 8000 10000		20.0 16.0 14.0 20.0 13.0		dB
Isolation	50-10000		27.4		dB
Output Return Loss	50 2000 4000 8000 10000		17.0 20.0 18.0 16.0 18.0		dB
Output Power at 1 dB Compression	50 2000 4000 8000 10000		22.0 22.9 22.0 19.8 16.6		dBm
Output Third-Order Intercept Pout = -5 dBm/Tone	50 2000 4000 8000 10000		31.2 31.8 30.7 28.7 26.0		dBm
Noise Figure	50 2000 4000 8000 10000		1.8 1.0 1.1 1.2 2.1		dB
Device Operating Voltage (VDD)		+5.75	+6.0	+6.25	V
Device Operating Current (IDD)			67	90	mA
Device Current Variation vs. Temperature[2]			-23.1		µA/°C
Device Current Variation vs Voltage[3]			0.032		mA/mV
Thermal Resistance, Junction-to-Ground Lead			53.9		°C/W

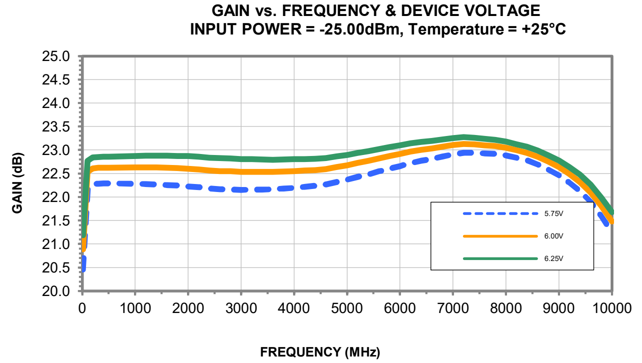
1. Die is soldered in 3x3 mm 12L MCLP and measured on Mini-Circuits Characterization Test Board TB-PMA3-14LN+.
2. Device Current Variation vs. Temperature= (Current in mA at 85°C - Current in mA at -45°C)/130°C
3. Device Current Variation vs. Voltage = (Current in mA at +6.25V – Current in mA at +5.75V) / ((+6.25V-+5.75V) *1000 mA/mV)

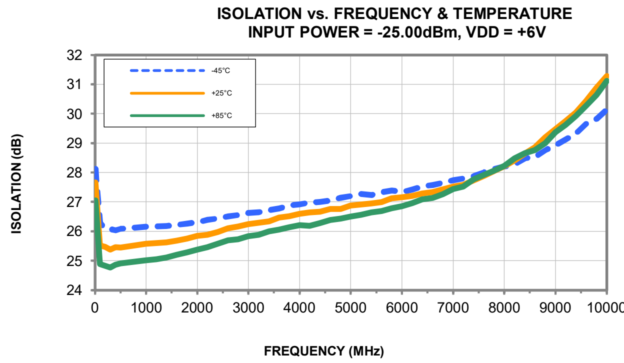
MAXIMUM RATINGS[4]

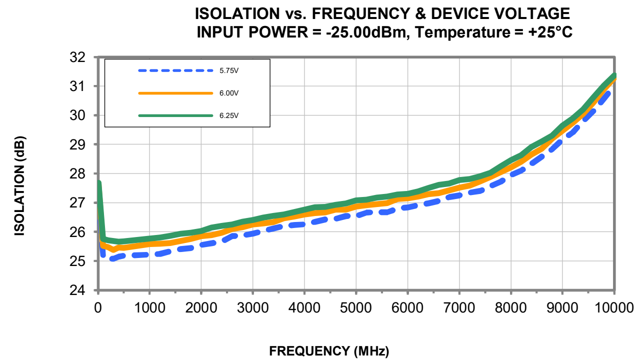
Parameter	Ratings
Operating Temperature (ground lead)	-40°C to 85°C
Junction Temperature	150°C[5]
Total Power Dissipation	1.2 W
Input Power (CW)	+25 dBm (5 minutes max.) +12 dBm (continuous)
DC Voltage at VDD	+8V

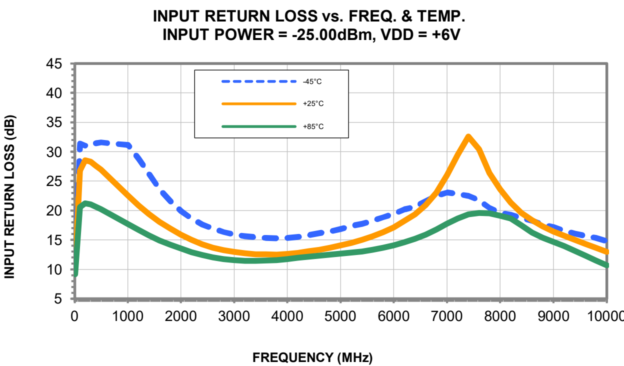
4. Permanent damage may occur if any of those limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.
5. Tj = 85˚C + (VDD)*(IDD)*(ΘJC) = 106˚C. Keeping Tj below 106°C will ensure MTTF >100 Years.

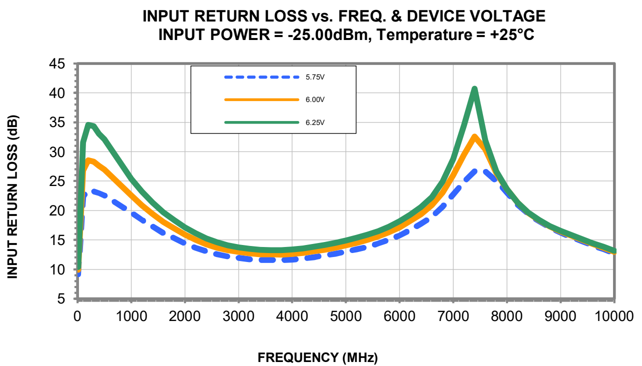

GAIN vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, VDD = +6V
GAIN (dB)
FREQUENCY (MHz)
-45°C
+25°C
+85°C

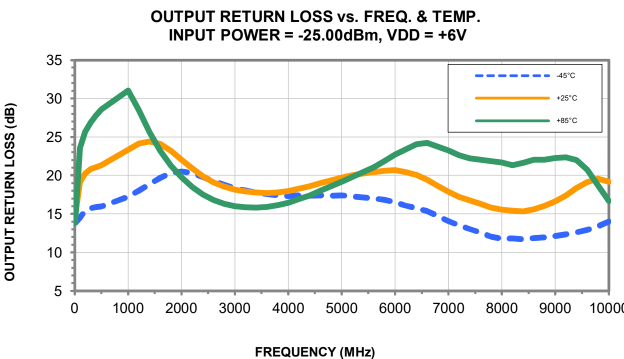

GAIN vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C
GAIN (dB)
FREQUENCY (MHz)
5.75V
6.00V
6.25V

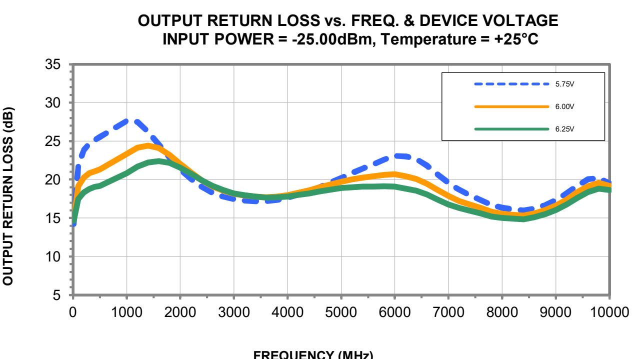

ISOLATION vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, VDD = +6V
ISOLATION (dB)
FREQUENCY (MHz)
-45°C
+25°C
+85°C

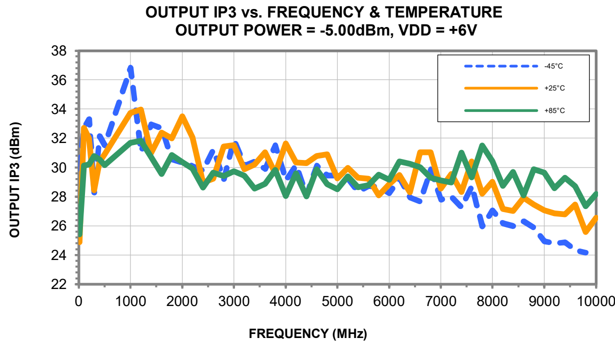

ISOLATION vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C
ISOLATION (dB)
FREQUENCY (MHz)
5.75V
6.00V
6.25V

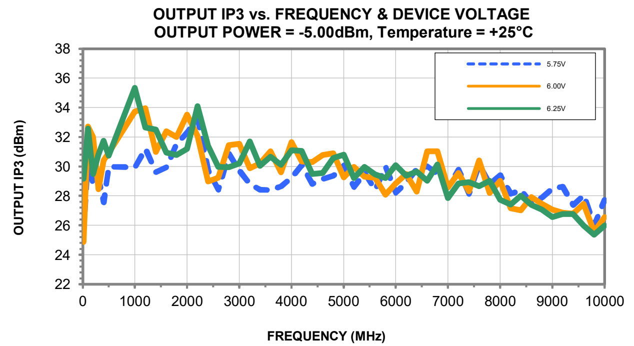

INPUT RETURN LOSS vs. FREQ. & TEMP.
INPUT POWER = -25.00dBm, VDD = +6V
INPUT RETURN LOSS (dB)
FREQUENCY (MHz)
-45°C
+25°C
+85°C

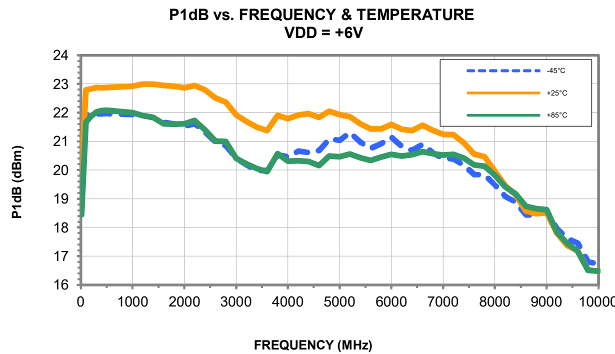

INPUT RETURN LOSS vs. FREQ. & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C
INPUT RETURN LOSS (dB)
FREQUENCY (MHz)
5.75V
6.00V
6.25V

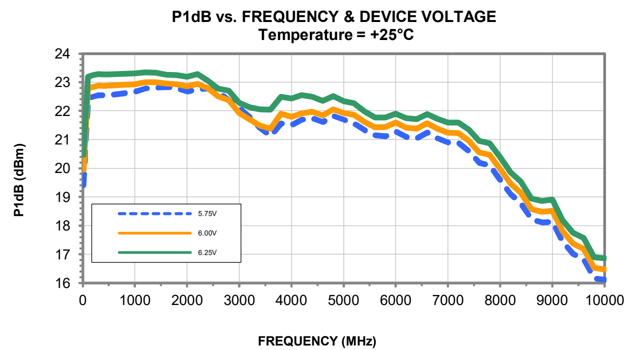

OUTPUT RETURN LOSS vs. FREQ. & TEMP.
INPUT POWER = -25.00dBm, VDD = +6V
OUTPUT RETURN LOSS (dB)
FREQUENCY (MHz)
-45°C
+25°C
+85°C

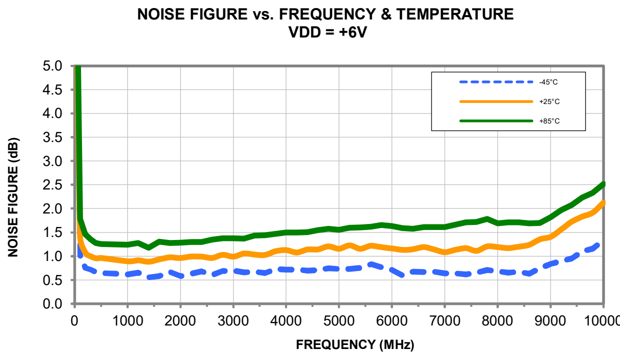

OUTPUT RETURN LOSS vs. FREQ. & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C
OUTPUT RETURN LOSS (dB)
FREQUENCY (MHz)
5.75V
6.00V
6.25V



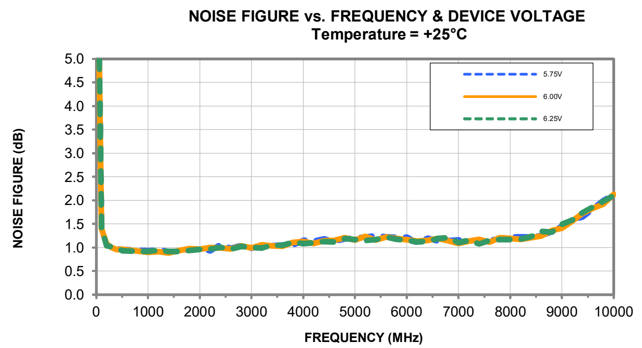




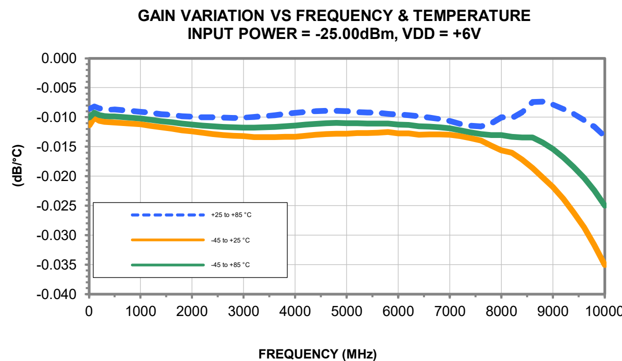




*Typical Noise Figure 1.8dB at 50MHz



*Typical Noise Figure 1.8dB at 50MHz



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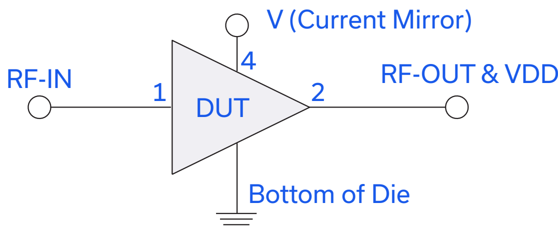
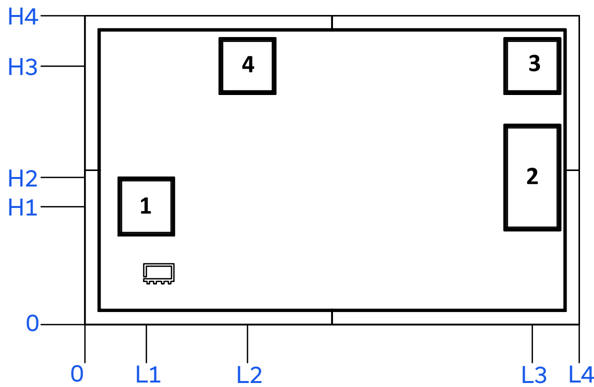
PMA3-14LN-D+

SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



Function	Pad Number	Description
RF-IN	1	RF-Input Pad. Connects to RF-IN port via C1.
RF-OUT & DC-IN	2	RF Output Pad and DC Pad. Connects to VDD via L2 & connects to RF-OUT Port via blocking capacitor C2.
NC	3	Keep the pad floating for normal operation.
V (Current Mirror)	4	Current Mirror Pad. Connects to RF-IN port via L1
Ground	Bottom of Die	Ground pad on the bottom of the die does not require any wire-bond connections.

BONDING PAD POSITION

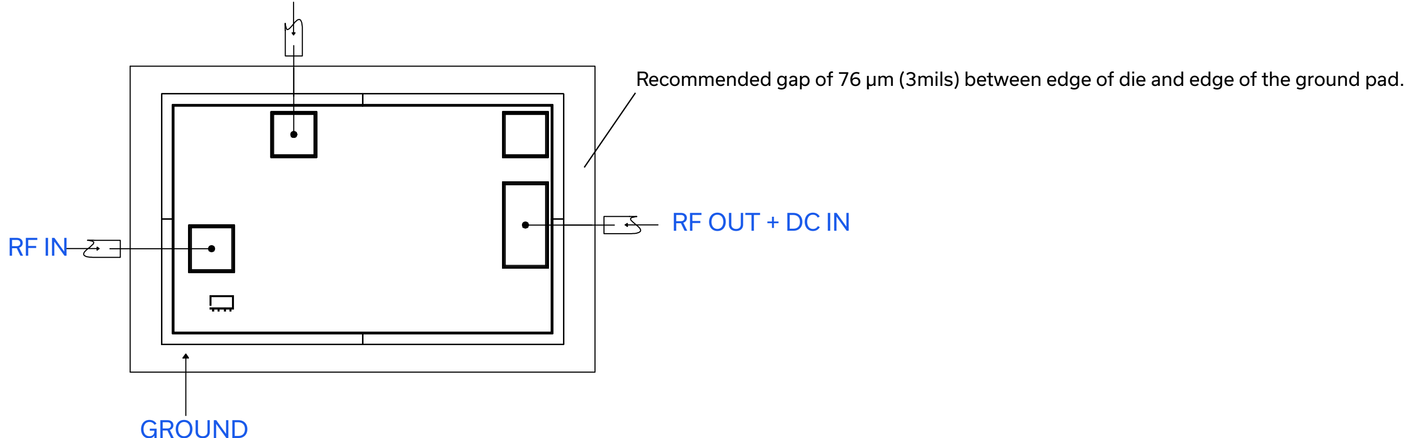


DIMENSION IN µm, TYP.

L1	L2	L3	L4	H1	H2	H3	H4
93	245	675	746	178	222	290	466

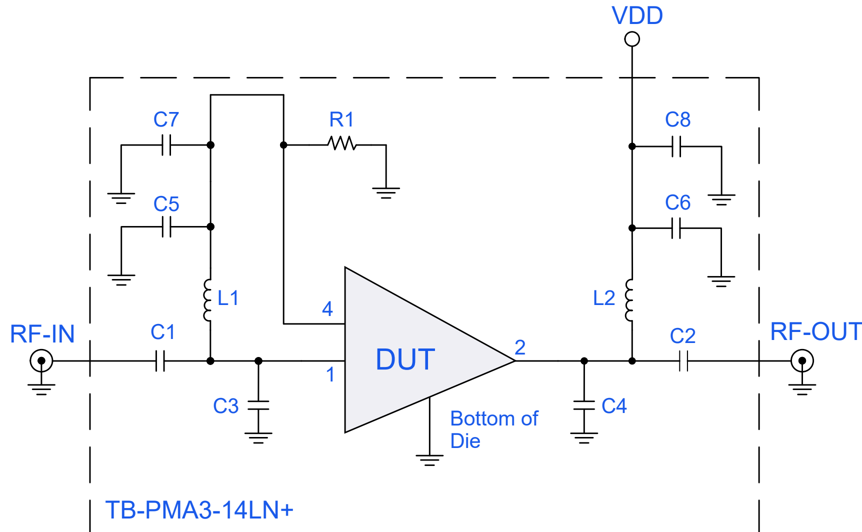
Thickness	Die size	Pad size 1	Pad size 2	Pad Size 3 & 4
100	746 x 466	75 x 78	75 x 150	75 x 75

ASSEMBLY DIAGRAM



1. Recommended bond length for RF-IN: 635 µm
2. Recommended bond length for V (Current Mirror): 838 µm
3. Recommended bond length for RF OUT + DC IN: 1168 µm

CHARACTERIZATION, APPLICATION CIRCUIT & ASSEMBLY DRAWING

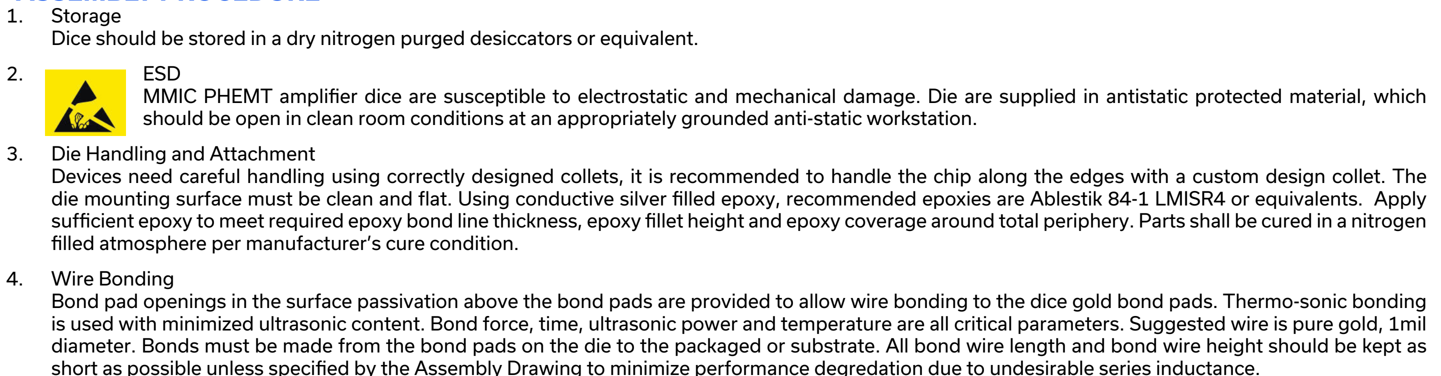


Component	Size	Value	Part Number	Manufacturer
C1 & C2	0402	0.01uF	GRM155R71H103KA88D	Murata
C3	0402	0.2pF	GJM1555C1HR20WB01D	Murata
C4	0402	0.1pF	GJM1555C1HR10WB01D	Murata
C5 & C6	0402	100pF	GRM1555C1H101JA01D	Murata
C7 & C8	0402	0.1uF	GRM155R71H104KE14J	Murata
L1 & L2	0402	900nH	0402DF-901XJRU	Coilcraft
R1	0402	510Ω	RK73H1ETTP5100F	KOA

Fig 1. Application and Characterization Circuit
Note: This block diagram is used for characterization.
(DUT is soldered onto a 3x3 12L MCLP and measured on Mini-Circuits Characterization test board TB-PMA3-14LN+) Gain, Return Loss, Output Power at 1dB Compression (P1dB), Output IP3 (OIP3) and Noise Figure are measured using Agilent's N5242A PNA-X Microwave Network Analyzer.

Conditions:
1. VDD=+6V
2. Gain and Return loss: Pin= -25 dBm
3. Output IP3 (OIP3): Two Tones, Spaced 1 MHz apart, -5 dBm/Tone at Output

ASSEMBLY PROCEDURE



1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC PHEMT amplifier dice are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be open in clean room conditions at an appropriately grounded anti-static workstation.
3. Die Handling and Attachment
   Devices need careful handling using correctly designed collets, it is recommended to handle the chip along the edges with a custom design collet. The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are Ablestik 84-1 LMISR4 or equivalents. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition.
4. Wire Bonding
   Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermo-sonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1mil diameter. Bonds must be made from the bond pads on the die to the packaged or substrate. All bond wire length and bond wire height should be kept as short as possible unless specified by the Assembly Drawing to minimize performance degredation due to undesirable series inductance.

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD.

Performance Data	Data Table Swept Graphs S-Parameter (S2P Files) Data Set with and without port extension(.zip file)
Case Style	Die
Die Ordering and packaging information	Quantity, Package — Model No. Gel – Pak: 5, 10, 50, 100, 200, — PMA3-14LN-DG+ Medium†, Partial wafer: KGD*<2565 — PMA3-14LN-DP+ Full Wafer — PMA3-14LN-DF+ †Available upon request contact sales representative Refer to AN-60-067
Die Marking	IEY06A2
Environmental Ratings	ENV80

*Known Good Die ('KGD') means that the dice in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such dice fall within a predefined range. While DC testing is not definitive, it does provide a higher degree of confidence that die are capable of meeting typical RF electrical performance specified by Mini-Circuits.

ESD RATING**

Human Body Model (HBM): Class 1B(500V) in accordance with ANSI/ESD STM 5.1 - 2001

**Tested in 3x3 12L MCLP Package

NOTES

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