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FMA3014

12.7GHZ TO 16GHZ MMIC LIMITING AMPLIFIER

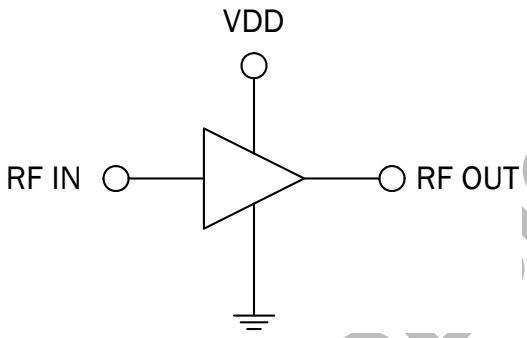
Package Style: Bare Die

Product Description

The FMA3014 is a high performance 12.7GHz to 16GHz Gallium Arsenide monolithic amplifier. It is suitable for use in broadband communication and electronic warfare applications. The FMA3014 is ideally suited as a limiting amplifier where output power is invariant of input power. An example is the reduction of variability of mixer conversion loss to input LO drive level.

Optimum Technology Matching® Applied

- ☐ GaAs HBT
- ☐ GaAs MESFET
- ☐ InGaP HBT
- ☐ SiGe BiCMOS
- ☐ Si BiCMOS
- ☐ SiGe HBT
- ☑ GaAs pHEMT
- ☐ Si CMOS
- ☐ Si BJT
- ☐ GaN HEMT
- ☐ InP HBT
- ☐ RF MEMS
- ☐ LDMOS



Features

- Self-Biased
- Single Supply
- 32dB Gain
- 17dBm Output
- pHEMT Technology
- Input Return Loss<-15dB
- Output Return Loss<-12dB

Applications

- Electronic Warfare
- Broadband Communication Infrastructure
- Cellular Backhaul
- Point-to-Point Radio

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Electrical Specifications					V_{DD}=4.5V
Small Signal Gain	28	32		dB	12.7GHz to 16GHz
Input Return Loss	-8	-15		dB	12.7GHz to 16GHz
Output Return Loss	-8	-12		dB	12.7GHz to 16GHz
P1dB	13	15		dBm	12.7GHz to 16GHz
Saturated Output Power	15	17		dBm	12.7GHz to 16GHz
Noise Figure		6	7	dB	12.7GHz to 16GHz
Self-bias Current		100	130	mA	Small signal

Note: $T_{AMBIENT}$=+25°C, Z_0=50Ω

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Absolute Maximum Ratings

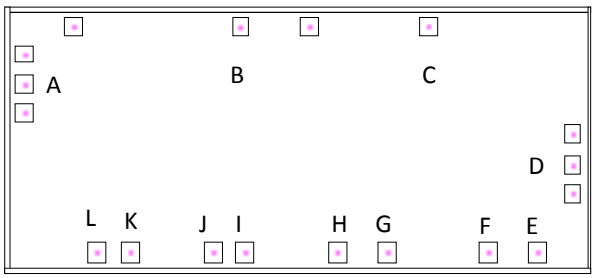
Parameter	Rating	Unit
Max Input Power (P_{IN})	+20	dBm
Gate Voltage (V_{G1})	not required	V
Drain Voltage (V_{DD})	+6	V
Operating Temperature (T_{OPER})	-40 to 85	°C
Storage Temperature (T_{STG})	-55 to 150	°C

Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EUDirective2002/95/EC (at time of this document revision).

Pad Layout



Pad	Name	Description	Pin Coordinates (μm)
A	I	RF input	97, 961
B	B	1st stage drain	1206, 1248
C	D	2nd and 3rd gate	2166, 1248
D	O	2nd drain direct	2904, 550
E	E	2nd drain with resistor	2721, 102
F	F	3rd drain with resistor	2467, 102
G	G	Alt 3rd drain direct	1957, 102
H	H	3rd stage drain direct	1703, 102
I	J	RF output	1225, 102
J	K	3rd stage drain direct	1061, 102
K	L	Alt 3rd drain direct	636, 102
L	M	3rd drain with resistor	472, 102

Note: Coordinates are referenced from the bottom left corner of the die to the center of bond pad opening. pads without identifiers are ground connections used in wafer testing.

Die Size (μm)	Die Thickness (μm)	Min. Bond Pad Pitch (μm)	Min. Bond Pad Opening (μmxμm)
3000x1348	100	150	92x92

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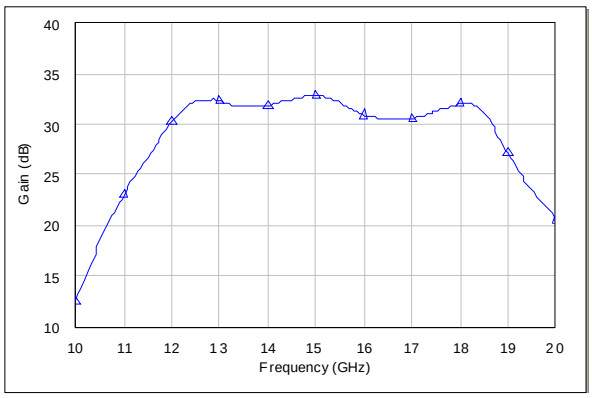
Typical Measured Performance On Wafer

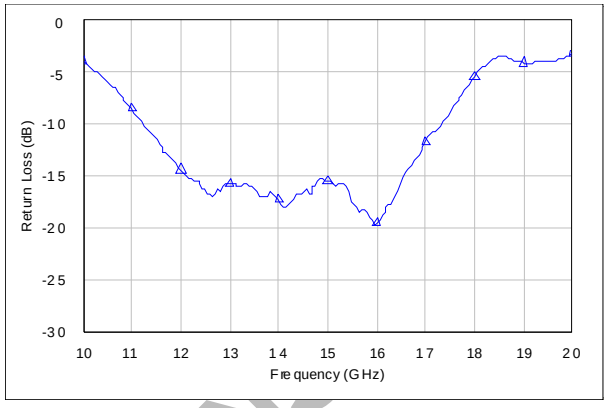
Conducted at lower bias point. Gain increases to the typical value at full bias.

$T_{AMBIENT}$=25°C, I_D=110mA, V_{DD}=4.5V

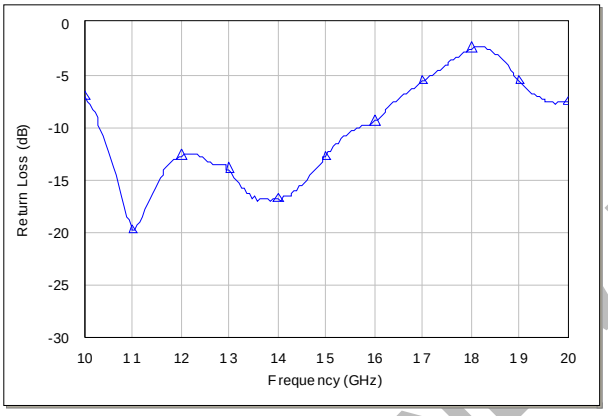
Gain



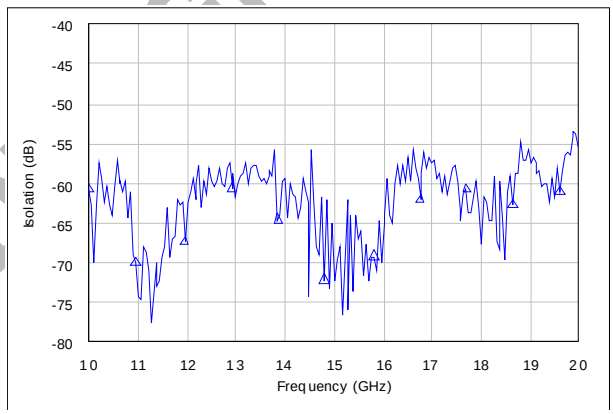
Input Return Loss



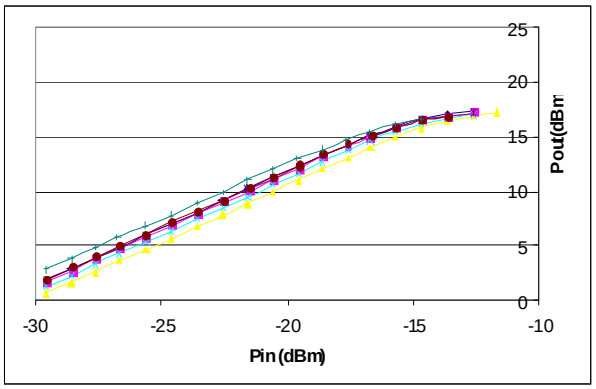
Output Return Loss



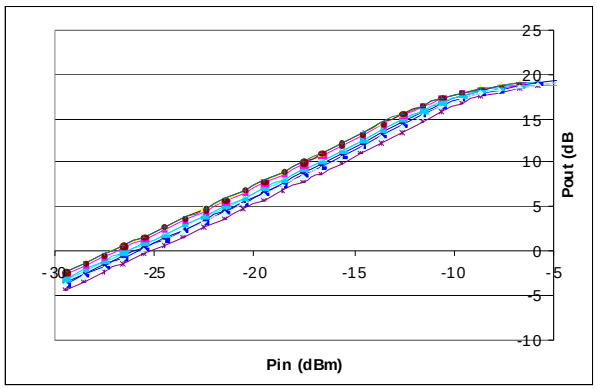
Reverse Isolation



Typical Measured Performance for 10Site On Wafer Power Transfer Characteristic

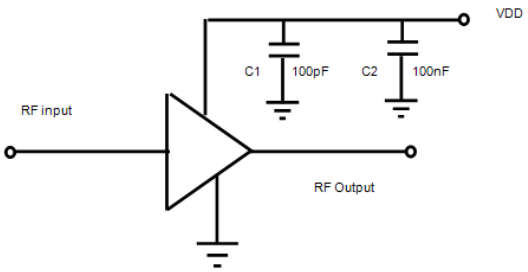


V_{DD}=4.5V, I_D=110mA (typ)

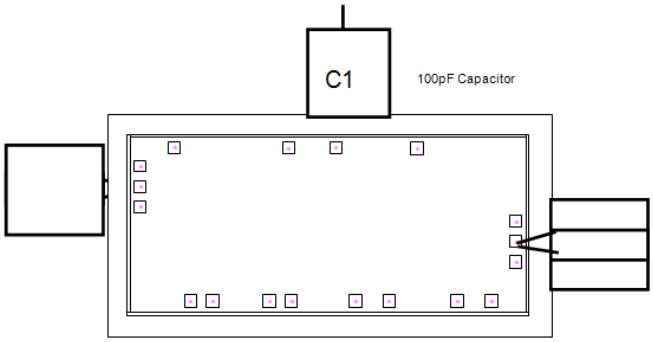


V_{DD}=6V, I_D=110mA (typ)

Biasing Circuit Schematic



Assembly Diagram



Note: Bond Wire length should be kept to a minimum

Bill of Materials

All RF tracks should be 50Ω characteristic material.		
C1 Capacitor	100 pF	Chip Capacitor
C2 Capacitor	100 nF	0402

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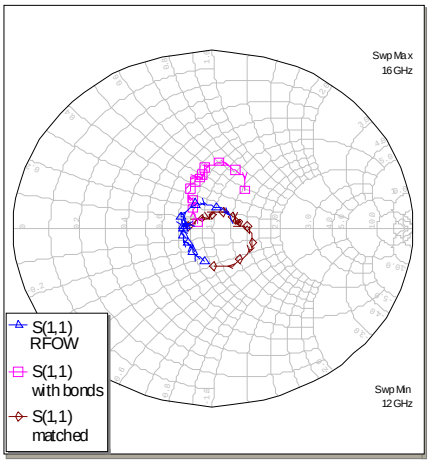
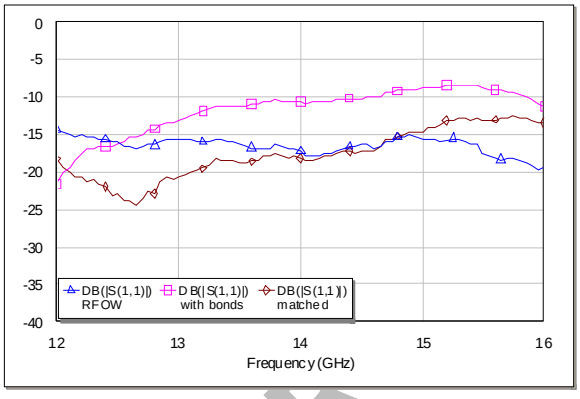
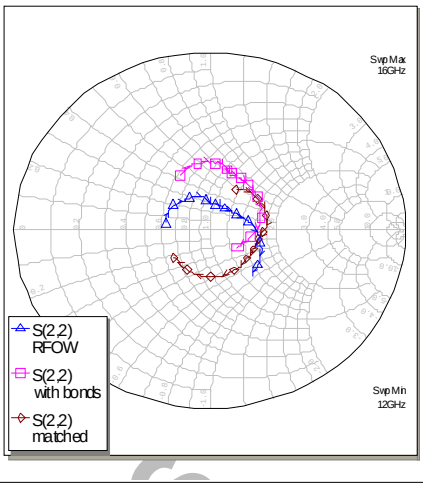
Effect of Bondwires and Bond Compensation

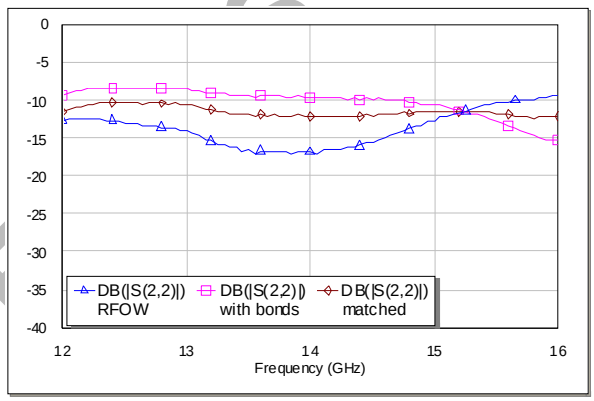
A pair of bondwires in the V formation as shown in the figure above should, if kept reasonably short, yield a combined inter-connect inductance of below 0.25nH. The FMA3014 has excellent return losses (blue triangles) and these are modified by the addition of a 0.25nH bondwire inductance (pink squares) as shown in the figures below.



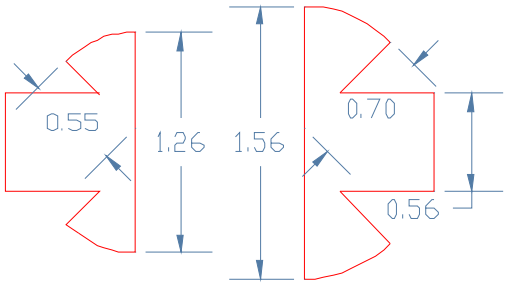


Once bonded the return losses are still at a reasonable level. They can be improved with simple compensation networks. The figures also show the effect of this bondwire compensation network (brown diamonds). The network is shown at the end of this section.





Dimensions in mm. Material is 10 thou 4350 Er=3.38.



Input Output

Preferred Assembly Instructions

GaAs devices are fragile and should be handled with great care. Specially designed collets should be used where possible.

The back of the die is metallized and the recommended mounting method is by the use of conductive epoxy or solder. If conductive epoxy is used it should be applied to the attachment surface uniformly and sparingly to avoid encroachment of epoxy on to the top face of the die and ideally should not exceed half the chip height. For automated and manual dispense Ablebond 8350M is recommended. Ablestick 84-1 can be used as an alternative. These should be cured at a temperature of 150°C for 1 hour in an oven especially set aside for epoxy curing only. If possible the curing oven should be flushed with dry nitrogen. The gold-tin (80% Au 20% Sn) eutectic die attach has a melting point of approximately 280 °C but the absolute temperature being used depends on the leadframe material used and the particular application. The maximum time at used should be kept to a minimum.

This part has gold (Au) bond pads requiring the use of gold (99.99% pure) bondwire. It is recommended that 25.4µm diameter gold wire is used. For thermosonic ball bonding a nominal stage temperature of 150°C and a bonding force of 40g has been shown to give effective results for 25µm wire. Ultrasonic energy shall be kept to a minimum. For this bonding technique, stage temperature should not be raised above 200 °C and bond force should not be raised above 60g. Thermosonic wedge bonding and thermocompression wedge bonding can also be used to achieve good wire bonds.

Bonds should be made from the die first and then to the mounting substrate or package. The physical length of the bondwires should be minimized especially when making RF or ground connections.

Handling Precautions

To avoid damage to the devices, care should be exercised during handling. Proper Electrostatic Discharge (ESD) precautions should be observed at all stages of storage, handling, assembly, and testing.

ESD/MSL Rating

These devices should be treated as Class 0 (0V to 250V) as defined in JEDEC Standard No. 22-A114. Further information on ESD control measures can be found in MIL-STD-1686 and MIL-HDBK-263. This is an unpackaged part and therefore no MSL rating applies.

Application Notes and Design Data

Application Notes and design data including S-parameters, noise data, and large signal models are available on request at www.rfmd.com.

Reliability

An MTTF of 4.2 million hours at a channel temperature of 150 °C is achieved for the process used to manufacture this device.

Disclaimers

This product is not designed for use in any space-based or life-sustaining/supporting equipment.

Ordering Information

Quantity	Ordering Code
Standard order quantity (waffle pack)	FMA3014-000
Small quantity (25)	FMA3014-000SQ
Sample quantity (3)	FMA3014-000S3

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