

Product Description

The FMA3007 is a high performance 2GHz to 20GHz Gallium Arsenide monolithic travelling wave amplifier. It is suitable for use in broadband communication, instrumentation, and electronic warfare applications. The die is fabricated using RFMD's 0.25µm process.

Features

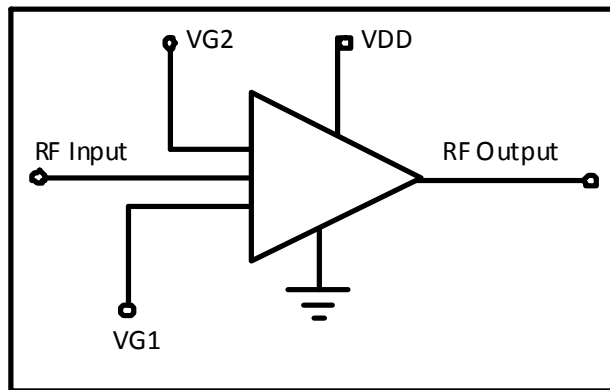
- 17 dBm Output Power
- 11dB Gain
- Input Return Loss < -13dB
- Output Return Loss < -11dB
- Voltage Gain Control

Applications

- Test Instrumentation
- Electronic Warfare
- Broadband Communication Infrastructure

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



Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Electrical Specifications^{1, 2, 3}					
Small Signal Gain	9.5	10.5	11.5	dB	2GHz to 12GHz
	9.5	11.5	12.5	dB	12GHz to 20GHz
Input Return Loss			-13	dB	2GHz to 20GHz
Output Return Loss			-11	dB	2GHz to 20GHz
Reverse Isolation			-27	dB	2GHz to 20GHz
Output Power at 1dB Compression	16	19		dBm	2GHz
	18	19		dBm	10GHz
	14	16		dBm	20GHz
Noise Figure			8.5	dB	2GHz to 4.5GHz
		4.5	5.5	dB	4.5GHz to 20GHz
Drain Current	60	100	150	mA	For V _{DD} =3.5V, V _{G1} =-0.38V, V _{G2} =+1V
Drain Voltage		3.5		V	

Note: ¹T_{AMBIENT} = +25 °C

²Device is biased at constant gate voltage, measured on wafer with Z₀ = 50Ω

³Measurement Conditions V_{G1} = -0.38V, V_{DD} = 3.5V, V_{G2} = +1V.

Absolute Maximum Ratings

Parameter	Rating	Unit
Max Input Power (P_{IN})	+20	dBm
Gain Voltage (V_{G1})	-2	V
Drain Voltage (V_{G2})	+10	V
Total Power Dissipation (P_{TOT})	TBD	
Gain Compression (comp)	TBD	
Thermal Resistivity (Θ_{JC})	38	$^{\circ}\text{C}/\text{W}$
Operating Temperature (T_{OPER})	-40 to 85	$^{\circ}\text{C}$
Storage Temperature (T_{STG})	-55 to 150	$^{\circ}\text{C}$



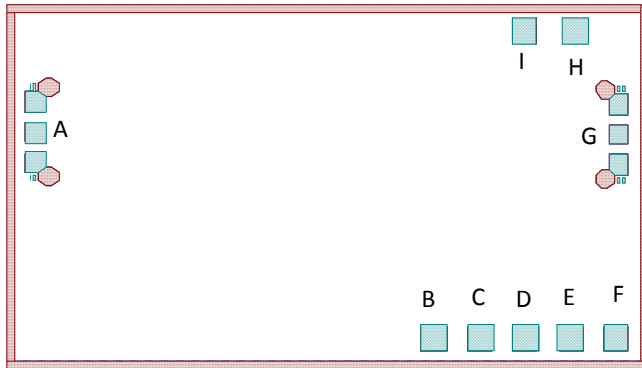
Caution! ESD sensitive device.

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 EU Directive 2002/95/EC (at time of this document revision).

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Pad Layout



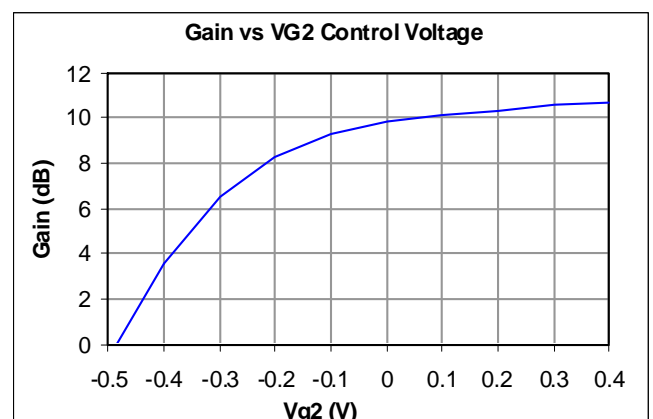
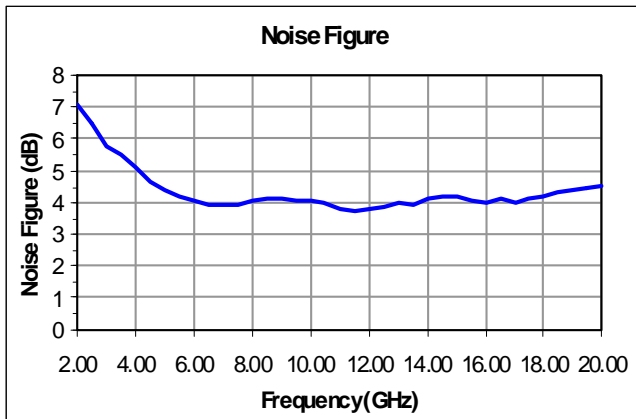
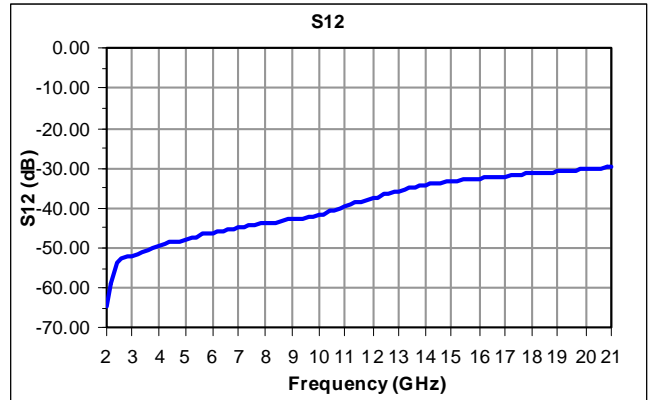
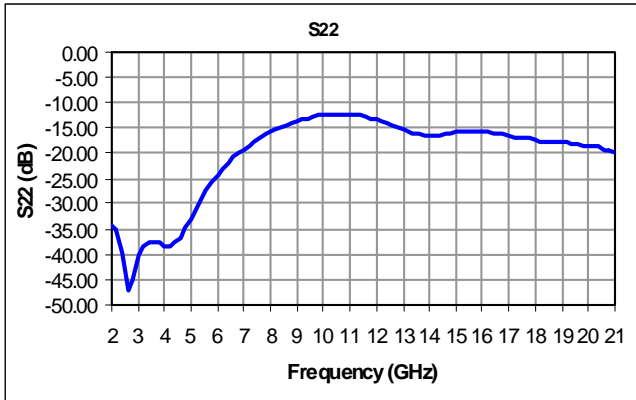
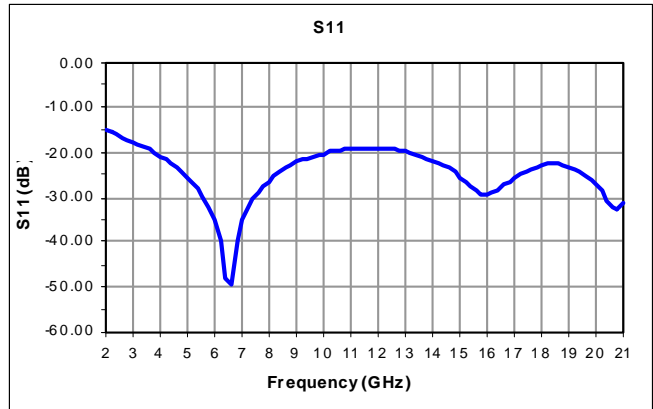
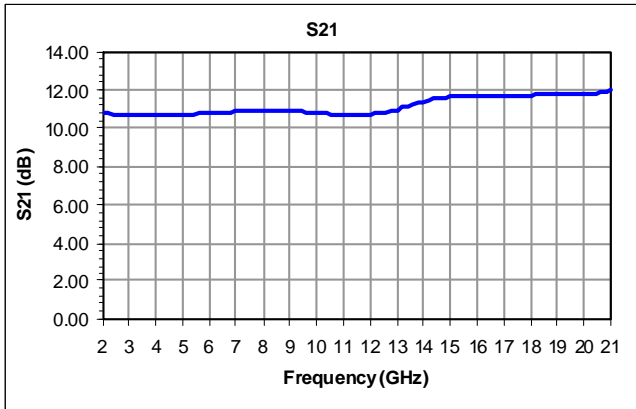
Pad	Name	Description	Pin Coordinates (μm)
A	RF IN	RF input	140, 1153
B	VDP	(+Ve) temperature monitoring diode	2097, 140
C	VDN	(-Ve) temperature monitoring diode	2321, 140
D	GND	Ground	2545, 140
E	VG1	Gate control	2769, 140
F	VG2	Gain control	2993, 140
G	RF OUT	RF output	3004, 1141
H	GND	Ground	2800, 1650
I	VDD	Drain voltage	2550, 1650

Note: Coordinates are referenced from the bottom left corner of the die to the center of bond pad opening.

Die Size (μm)	Die Thickness (μm)	Min. Bond Pad Pitch (μm)	Min. Bond Pad Opening ($\mu\text{m} \times \mu\text{m}$)
3150x1780	100	150	100x100

Typical Measured Performance On Wafer

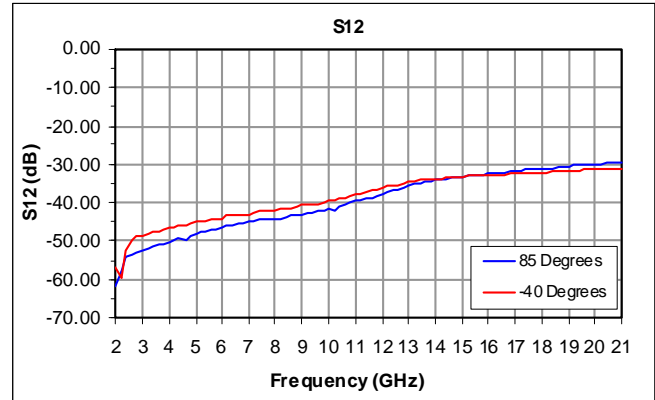
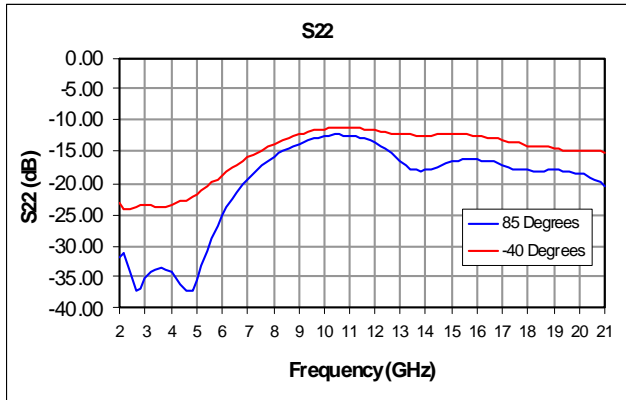
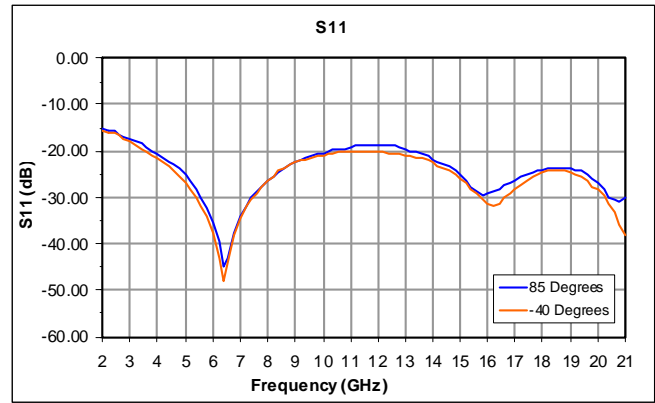
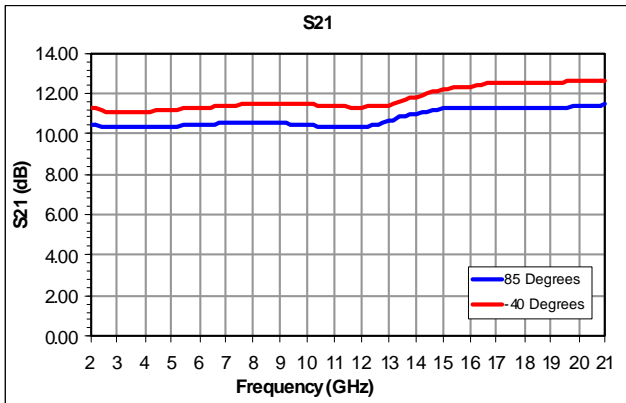
$T_{AMBIENT} = 25^{\circ}C$; ($V_{G1} = -0.38V$, $V_{DD} = 3.5V$, $V_{G2} = +1V$).



Frequency=10GHz

Typical Measured Performance On Wafer

$T_{AMBIENT} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$; ($V_{G1} = -0.38\text{V}$, $V_{DD} = 3.5\text{V}$, $V_{G2} = +1\text{V}$).



S-Parameters

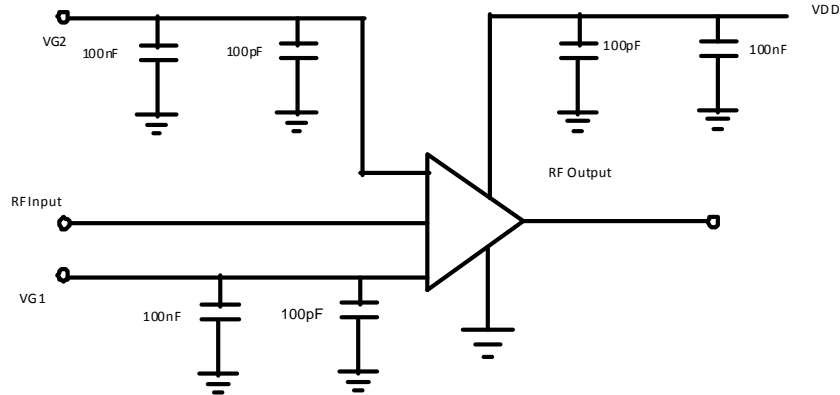
$V_{G1} = -0.38V, V_{DD} = 3.5V, V_{G2} = +1V$

Frequency	S11		S21		S12		S22	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
2	0.17	7.23	3.47	-36.35	0.00	-63.41	0.02	-48.45
2.19	0.17	2.14	3.45	-42.93	0.00	-29.52	0.02	-37.80
2.38	0.16	-4.69	3.43	-48.73	0.00	72.59	0.01	-33.00
2.57	0.15	-10.51	3.42	-54.29	0.00	42.47	0.00	27.64
2.76	0.14	-15.56	3.42	-59.82	0.00	27.49	0.01	-38.27
2.95	0.13	-20.19	3.42	-65.28	0.00	13.11	0.01	-44.59
3.14	0.12	-24.56	3.42	-70.67	0.00	4.32	0.01	21.28
3.33	0.11	-28.52	3.42	-75.97	0.00	-3.76	0.01	15.31
3.52	0.11	-32.28	3.42	-81.24	0.00	-11.28	0.01	13.40
3.71	0.10	-36.00	3.41	-86.45	0.00	-17.93	0.01	13.67
3.9	0.09	-39.67	3.42	88.39	0.00	-24.95	0.01	-16.72
4.09	0.08	-43.21	3.42	83.29	0.00	-30.94	0.01	-6.18
4.28	0.08	-46.86	3.42	78.22	0.00	-40.08	0.01	-65.06
4.47	0.07	-50.51	3.42	73.16	0.00	-45.92	0.02	-53.62
4.66	0.06	-53.98	3.43	68.10	0.00	-50.32	0.02	-44.57
4.85	0.05	-57.63	3.43	63.07	0.00	-56.49	0.02	-39.29
5.04	0.05	-60.76	3.44	58.02	0.00	-63.05	0.03	-37.33
5.23	0.04	-63.54	3.44	52.99	0.00	-67.95	0.04	-37.85
5.42	0.03	-66.22	3.45	47.95	0.00	-74.11	0.04	-39.95
5.61	0.02	-68.53	3.46	42.91	0.00	-79.14	0.05	-42.71
5.8	0.02	-68.00	3.47	37.87	0.00	-83.92	0.06	-45.73
5.99	0.01	-64.51	3.48	32.78	0.01	18.48	0.07	-49.38
6.18	0.00	-42.62	3.48	27.71	0.01	84.14	0.08	-53.42
6.37	0.00	39.78	3.49	22.64	0.01	80.03	0.09	-57.88
6.56	0.01	17.49	3.50	17.55	0.01	73.81	0.10	-62.71
6.75	0.02	16.81	3.51	12.44	0.01	68.78	0.11	-67.57
6.94	0.02	15.13	3.51	7.30	0.01	64.80	0.12	-72.36
7.13	0.03	84.08	3.52	2.14	0.01	60.68	0.13	-77.27
7.32	0.04	82.14	3.52	-3.01	0.01	55.34	0.14	-82.39
7.51	0.04	79.53	3.52	-8.15	0.01	49.63	0.15	-51.70
7.7	0.05	76.81	3.53	-13.28	0.01	47.53	0.16	87.01
7.89	0.05	74.57	3.53	-18.47	0.01	41.87	0.17	81.73
8.08	0.06	72.42	3.52	-23.66	0.01	38.81	0.18	76.45
8.27	0.07	69.51	3.52	-28.79	0.01	35.08	0.19	71.34
8.46	0.07	66.45	3.51	-33.90	0.01	30.21	0.20	65.86
8.65	0.08	64.01	3.51	-39.00	0.01	27.00	0.21	60.25
8.84	0.08	60.83	3.51	-44.12	0.01	21.43	0.22	54.28
9.03	0.09	58.56	3.50	-49.28	0.01	17.73	0.22	48.57
9.22	0.09	55.69	3.49	-54.36	0.01	16.35	0.23	42.85
9.41	0.09	52.28	3.48	-59.39	0.01	11.43	0.23	36.83
9.6	0.10	48.64	3.47	-64.39	0.01	8.25	0.24	30.81
9.79	0.10	45.29	3.46	-69.39	0.01	4.95	0.24	24.23
9.98	0.10	41.97	3.45	-74.39	0.01	2.14	0.24	17.61
10.17	0.11	38.97	3.45	-79.32	0.01	-1.56	0.24	10.75
10.36	0.11	36.22	3.44	-84.20	0.01	-5.54	0.24	3.94
10.55	0.11	33.38	3.43	-17.05	0.01	-10.51	0.24	-3.27
10.74	0.11	30.10	3.43	86.12	0.01	-14.21	0.24	-10.81
10.93	0.11	26.91	3.43	81.37	0.01	-19.00	0.24	-18.81

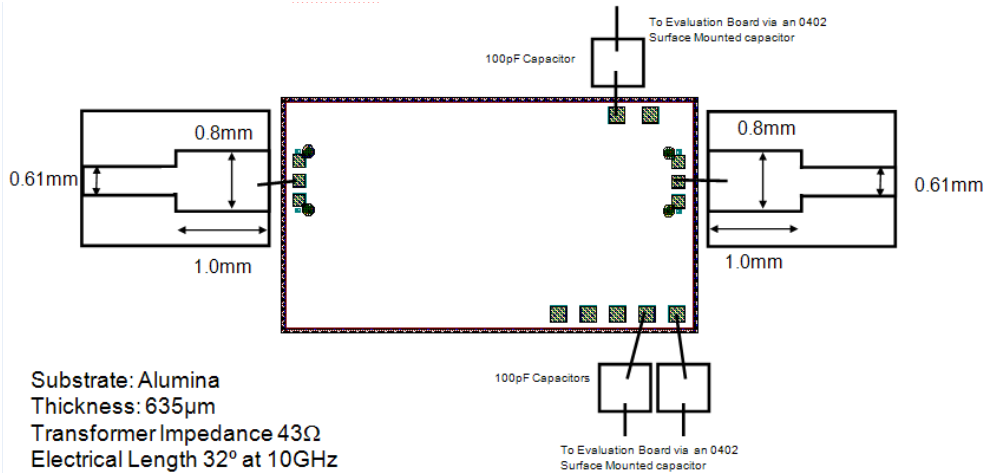
S-Parameters, continued

Frequency	S11		S21		S12		S22	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
11.12	0.11	22.84	3.43	76.53	0.01	-22.37	0.23	-27.22
11.31	0.11	19.06	3.43	71.78	0.01	-27.33	0.22	-36.26
11.5	0.11	14.69	3.44	67.04	0.01	-31.55	0.21	-45.16
11.69	0.11	9.79	3.45	62.28	0.01	-37.22	0.21	-55.08
11.88	0.11	6.23	3.47	57.43	0.01	-42.25	0.20	-65.94
12.07	0.11	1.32	3.49	52.51	0.01	-48.26	0.19	-77.17
12.26	0.10	-2.75	3.52	47.60	0.02	-52.88	0.18	-17.48
12.45	0.10	-7.08	3.54	42.70	0.02	-57.45	0.17	77.51
12.64	0.10	-11.05	3.58	37.72	0.02	-64.77	0.16	63.15
12.83	0.10	-15.83	3.62	32.50	0.02	-71.06	0.16	48.80
13.02	0.09	-20.74	3.65	27.22	0.02	-76.93	0.15	33.57
13.21	0.09	-26.37	3.68	21.86	0.02	-82.74	0.15	17.88
13.4	0.08	-33.12	3.72	16.46	0.02	-16.85	0.15	1.73
13.59	0.08	-39.86	3.75	11.01	0.02	85.12	0.15	-13.77
13.78	0.07	-46.40	3.78	5.41	0.02	79.01	0.15	-28.48
13.97	0.07	-54.81	3.80	-0.34	0.02	73.33	0.15	-41.98
14.16	0.06	-64.08	3.81	-6.03	0.02	68.29	0.16	-54.27
14.35	0.05	-72.76	3.82	-11.60	0.02	62.69	0.16	-65.54
14.54	0.05	-47.47	3.84	-17.22	0.02	57.29	0.16	-76.15
14.73	0.04	47.91	3.85	-22.91	0.02	51.71	0.17	-50.08
14.92	0.04	71.00	3.85	-28.64	0.02	46.06	0.17	48.74
15.11	0.03	53.20	3.84	-34.30	0.02	40.76	0.16	76.52
15.3	0.03	33.02	3.84	-39.83	0.02	34.90	0.16	69.26
15.49	0.04	13.93	3.85	-45.39	0.02	29.64	0.16	62.48
15.68	0.04	-4.28	3.85	-51.01	0.02	24.41	0.16	56.54
15.87	0.04	-18.94	3.85	-56.69	0.02	19.88	0.16	50.74
16.06	0.05	-30.60	3.85	-62.28	0.02	14.12	0.15	45.36
16.25	0.05	-41.49	3.85	-67.91	0.03	8.67	0.15	41.50
16.44	0.06	-51.22	3.86	-73.44	0.03	3.54	0.14	37.88
16.63	0.06	-59.08	3.87	-79.17	0.03	-3.05	0.14	35.17
16.82	0.07	-68.00	3.87	-84.87	0.03	-7.81	0.14	31.98
17.01	0.07	-76.62	3.87	-18.55	0.03	-13.42	0.14	28.68
17.2	0.07	-83.90	3.87	83.72	0.03	-18.83	0.13	25.14
17.39	0.07	17.35	3.87	77.99	0.03	-24.46	0.13	22.71
17.58	0.07	82.44	3.88	72.22	0.03	-29.63	0.13	20.43
17.77	0.07	76.96	3.89	66.41	0.03	-35.63	0.13	18.02
17.96	0.07	70.63	3.89	60.59	0.03	-40.03	0.13	15.16
18.15	0.07	62.97	3.89	54.74	0.03	-46.04	0.13	11.60
18.34	0.07	54.75	3.89	48.84	0.03	-51.04	0.13	7.77
18.53	0.06	45.09	3.90	42.97	0.03	-56.89	0.12	4.20
18.72	0.06	34.89	3.90	37.06	0.03	-61.73	0.12	1.11
18.91	0.05	25.38	3.90	31.13	0.03	-67.11	0.12	-3.30
19.1	0.04	14.08	3.91	25.16	0.03	-72.52	0.12	-7.78
19.29	0.04	-0.07	3.91	19.10	0.03	-78.57	0.12	-12.88
19.48	0.03	-17.44	3.92	13.14	0.03	-84.34	0.12	-19.22
19.67	0.02	-45.86	3.93	6.99	0.03	-17.99	0.11	-24.90
19.86	0.02	-13.12	3.95	0.89	0.03	84.17	0.10	-30.45
20	0.03	61.43	3.96	-5.39	0.03	78.45	0.10	-37.05

Biasing Circuit Schematic



Assembly Diagram



It is recommended that the RF connections be made using two bond wires 25 μ m in diameter and a maximum length of 300 μ m. Improved input return loss can be achieved, to compensate for bond wire length, with the addition of a microstrip transformer as shown above.

Bill of Materials

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

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 metalized and the recommended mounting method is by the use of conductive epoxy. Epoxy 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 dispense Ablestick LMISR4 is recommended, and for manual dispense Ablestick 84-1 LMI or 84-1 LMIT are recommended. 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 be used. Recommended lead bond technique is thermocompression wedge bonding with 0.001" (25µm) diameter wire. Bond force, time stage temperature, and ultrasonics are all critical parameters and the settings are dependent on the setup and application being used. Ultrasonic or thermosonic bonding is not recommended.

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) using the human body model 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 and noise parameters are available on request from 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)	FMA3007-000
Small quantity (25)	FMA3007-000SQ
Sample quantity (3)	FMA3007-000S3