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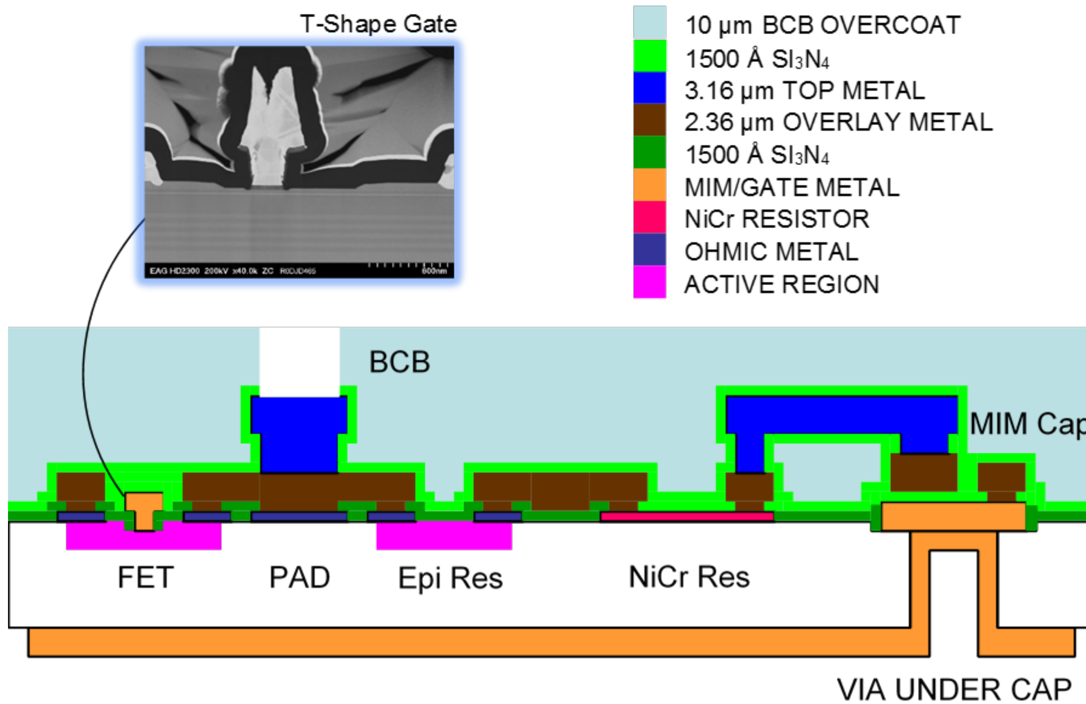
0.35 µm GaAs pHEMT – PH6 Foundry Process



DESCRIPTION

PH6 is a 100 mm optical lithography 0.35 µm GaAs PH6 is a 100 mm optical lithography 0.35 µm GaAs pHEMT process used for low noise and power applications up to Ka-Band. The process features a high breakdown 0.35 µm T-gate pHEMT depletion mode FET on a 100 µm thick GaAs substrate with through VIA holes. Individual source VIAs are also available. Passives include two thick-metal interconnect layers, NiCr thin film and EPI resistors, MIM capacitors and MIM capacitors on VIA. The process of MIM capacitors on VIA greatly enhance circuit integration and grounding at high frequency. The protective BCB overcoat layer provides environmental robustness and repeatable packaged performances.

Typical Ft at V_{DS} = 2 V is 51 GHz and typical NF min at 3 V and 50 mA/mm is less than 1 dB at 10 GHz for a 400 µm FET.

Simple to use, and highly competitive, PH6 is ideal for both commercial and military mmWave applications up to Ku-Band.

FEATURES

- MIM Capacitors and Capacitors Over VIA
- 20 & 50 Ω/sq NiCr Resistors
- EPI Resistors
- High-Q Passive Devices
- DC Diodes
- ESD Diodes
- Two Thick Metal Interconnects
- Air Bridges
- Substrate VIAs
- BCB Protective Overcoat
- 4 mils Substrate Thickness

APPLICATIONS

- Up to 18 GHz
- High Power Amplifiers
- Driver Amplifiers
- Low Noise Amplifiers
- Digital & Analog Phase Shifters
- Control Products
- Up/Down Converters
- Multipliers

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KEY PROCESS PARAMETERS

Element	Parameter	Nominal Value	Units	Condition
FET	I_{DSS}	250	mA/mm	V_{GS} = 0 V, V_{DS} = 3 V
	I_{MAX}	520	mA/mm	I_{GS} = 1 mA/mm, V_{DS} = 2 V
	g_m	310	mS/mm	I_{DS} = 50 % I_{DSS}, V_{DS} = 3 V
	V_{BDS}	22	V	Gate-drain at 1 mA/mm
	V_P	-1.1	V	V_{DS} = 3 V, I_{DS} = 2.5 % I_{DSS}
	FT	23	GHz	V_{DS} = 8 V, I_{DS} = 100 mA/mm
	FT	55	GHz	Peak
MIM Capacitor	Density	400	pF/mm2	—
MIM Capacitor over VIA	—	Yes	—	—
NiCr Resistor	Sheet Resistance	20	Ω/sq	—
	—	50	Ω/sq	—
EPI Resistor	Sheet Resistance	195	Ω/sq	—
Substrate VIA	—	Yes	—	—
Substrate	Thickness	100	µm	—

4 mils Samples Available upon Request

EXAMPLES OF APPLICATION:

- **MAAP-011068**, X-Band 5 W High Power Amplifier: This amplifier provides 20 dB of small signal gain, 5 W saturated output power and 35% efficiency in pulsed mode from 7 to 11 GHz while biased at 9 V. It is ideally suited for both commercial and military radar applications.
- **MAMF-011015**, X-Band Multifunction Core Chip: This integrated core chip packaged in a 7 x 7 mm surface mount plastic package features a 6-bits phase shifter and a 4-bits attenuator in the common leg, 26 dB and 9 dB of overall gain respectively through the receive and transmit paths. The device is integrated with a CMOS logic controller within the QFN package. It is ideally suited for commercial radar applications such as early detection and warning for severe impending weather.
- **MAMF-011030**, Ku-Band TR Module: This 14 to 15.5 GHz transmitter/receiver module features a 6-bits phase shifter in the common leg, a 4-bits attenuator, 19 dB and 20 dB of overall gain respectively through the receive and transmit paths. It is encapsulated in a 7 x 7 mm surface mount plastic package. It is ideal for both commercial and military Ku-Band communication links.

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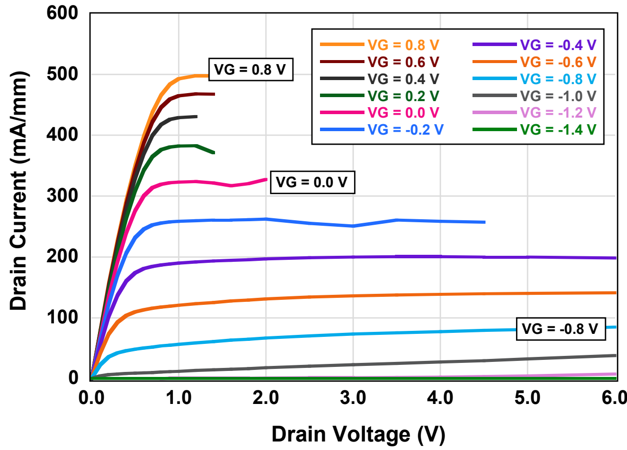
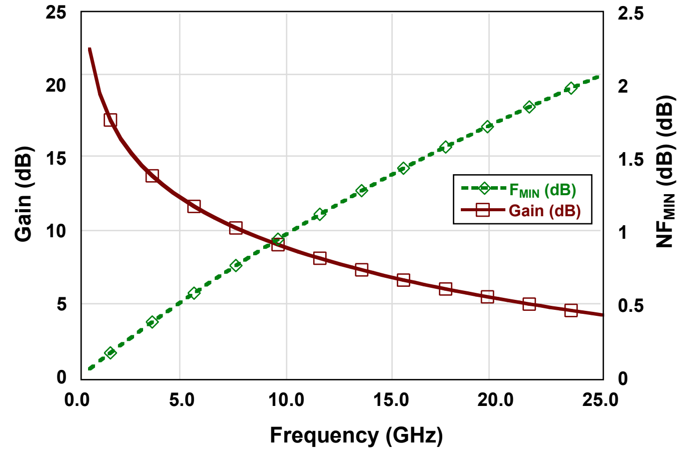
Typical Performance Curves

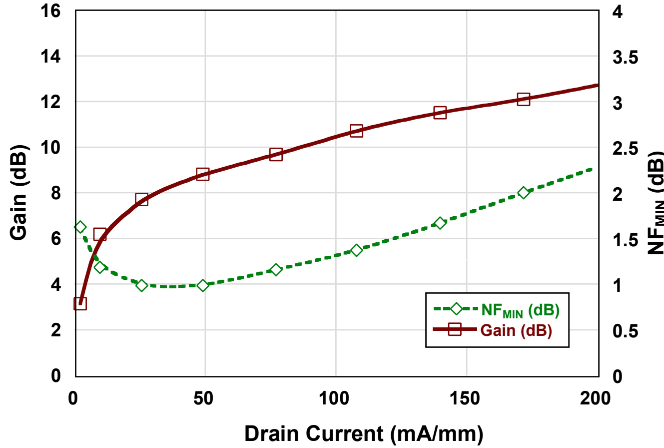
DC Characteristics



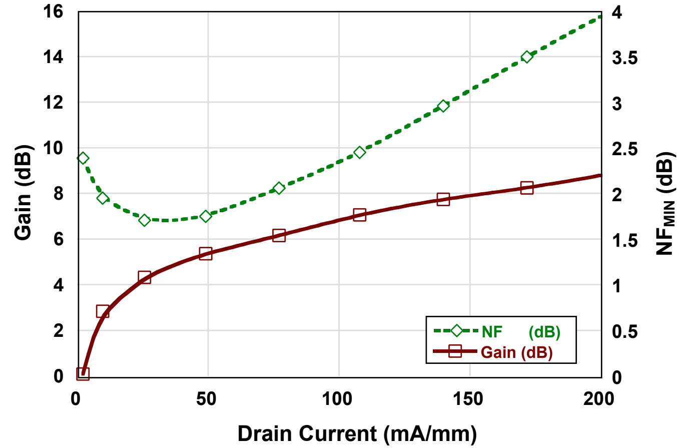
Noise Performances vs Frequency
400 µm pHEMT, V_{DS} = 3 V, 50 mA/mm



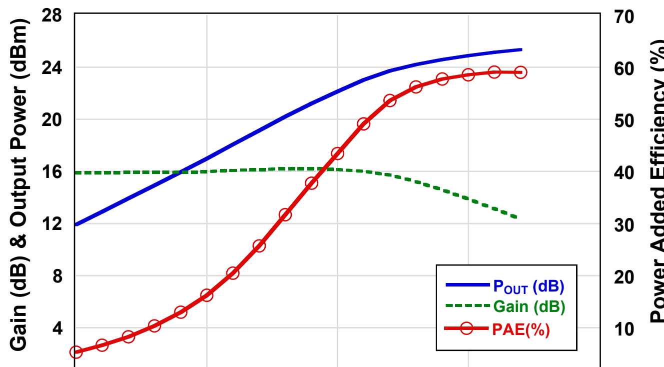
Noise Performances vs Drain Current
400 µm pHEMT, V_{DS} = 3 V, 10 GHz



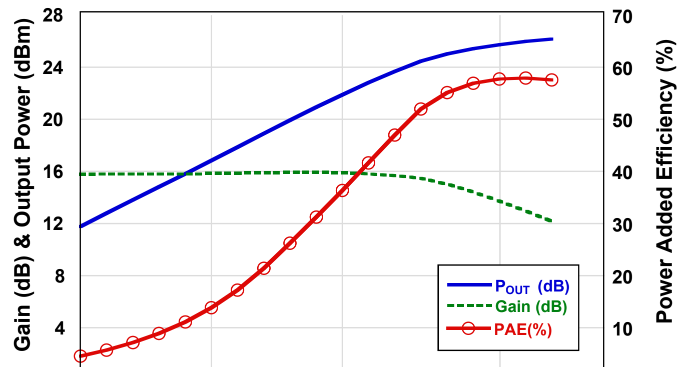
Noise Performances vs Drain Current
400 µm pHEMT, V_{DS} = 3 V, 20 GHz



Power Performance (Load Optimized for PAE)
400 µm pHEMT, V_{DS} = 8 V, I_{DS} = 35 mA, 10 GHz



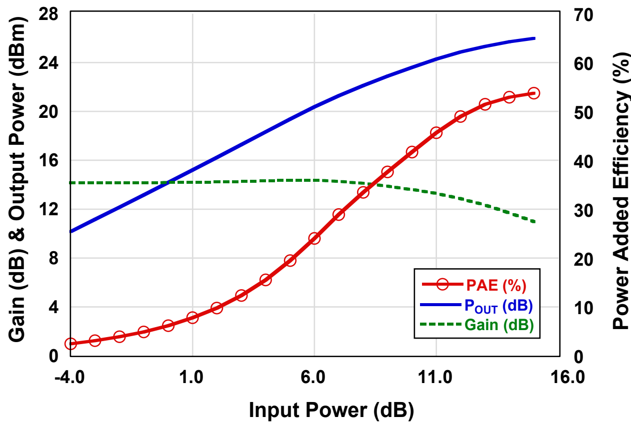
Power Performance (Load Optimized for PAE)
400 µm pHEMT, V_{DS} = 9 V, I_{DS} = 35 mA, 10 GHz



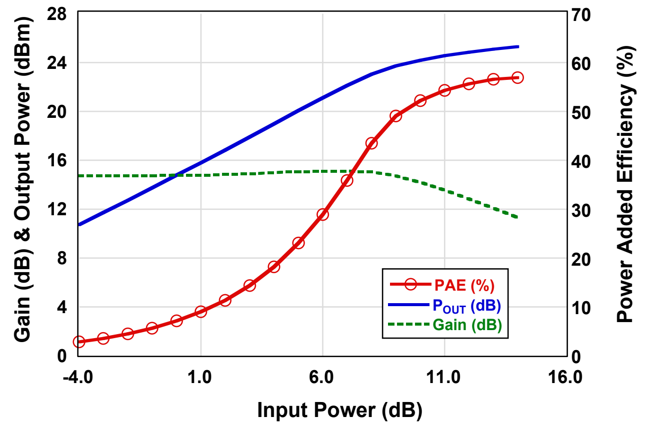
0.35 µm GaAs pHEMT – PH6 Foundry Process (continued)

Typical Performance Curves

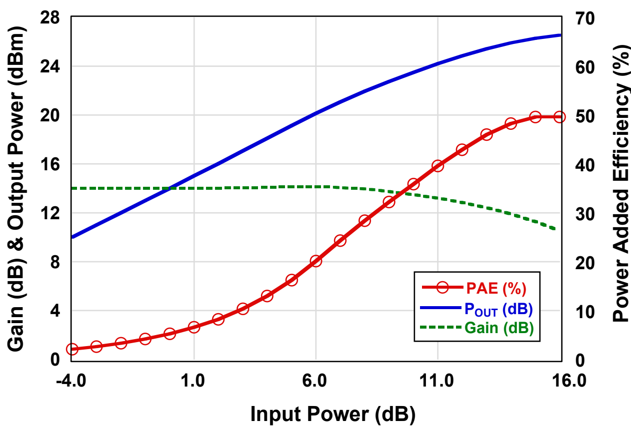
Power Performance (Load Optimized for Power)
400 µm pHEMT, V_{DS} = 8 V, I_{DS} = 50 mA, 10 GHz



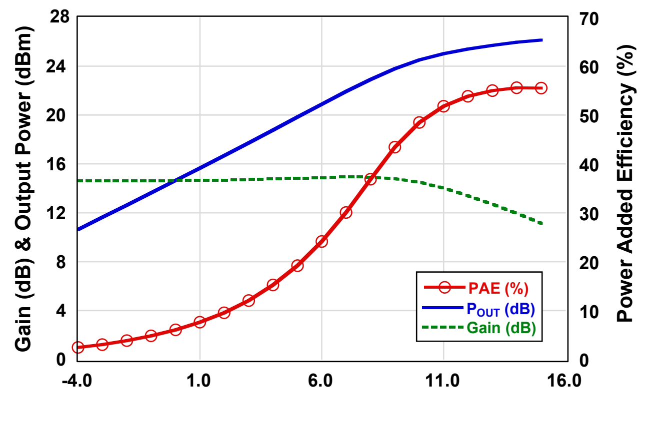
Power Performance (Load Optimized for PAE)
400 µm pHEMT, V_{DS} = 8 V, I_{DS} = 50 mA, 10 GHz



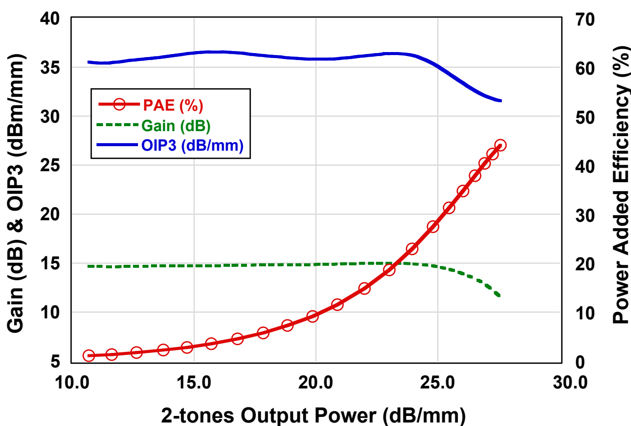
Power Performance (Load Optimized for Power)
400 µm pHEMT, V_{DS} = 9 V, I_{DS} = 50 mA, 10 GHz



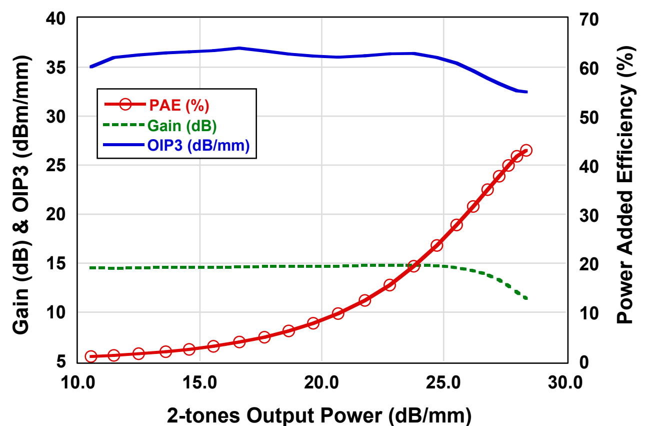
Power Performance (Load Optimized for PAE)
400 µm pHEMT, V_{DS} = 9 V, I_{DS} = 50 mA, 10 GHz



Linearity Performance
1 mm pHEMT, V_{DS} = 8 V, I_{DS} = 125 mA/mm, 10 GHz



Linearity Performance
1 mm pHEMT, V_{DS} = 9 V, I_{DS} = 125 mA/mm, 10 GHz



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