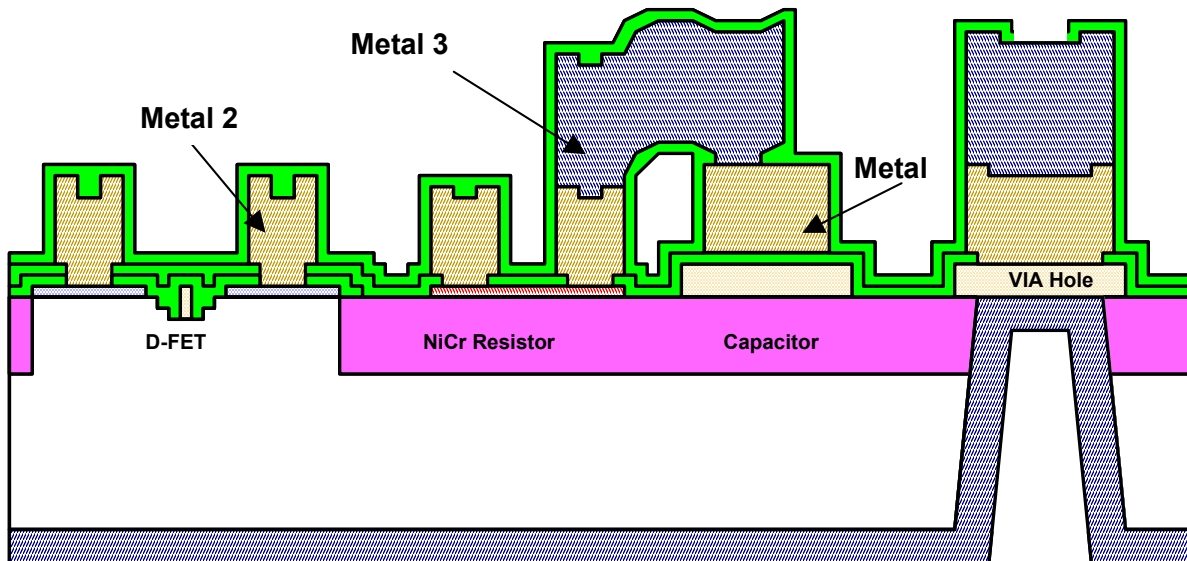


0.5 μm GaAs pHEMT – PH4 Power Foundry Process



PH4 Process Device Feature Cross Section

DESCRIPTION

The high performance PH4 Power Process is based on a Pseudomorphic High Electron Mobility Transistor (pHEMT) epitaxial structure which incorporates patented InGaP etch-stop technology.

This highly refined material configuration results in superior device consistency and ease of manufacture. The unique electron transport characteristics of our 0.5 μm gate length pHEMT power process enables realization of power transistors which are ideal for high power, high gain, and high efficiency amplifiers.

FEATURES

- $f_t = 20 \text{ GHz}$, @ $V_{DS} = 6 \text{ V}$, $I_D = 75\% I_{DSS}$
- Peak $f_t \sim 33 \text{ GHz}$
- $F = 14 \text{ GHz}$, $W = 500 \mu\text{m}$, $V_{DS} = 5 \text{ V}$:
 $P_{OUT} = 22.5 \text{ dBm}$, $PAE = 52\%$,
 $\text{Gain} = 8.6 \text{ dB}$
- $F = 14 \text{ GHz}$, $W = 500 \mu\text{m}$, $V_{DS} = 7 \text{ V}$,
 $I_{DS} = 48 \text{ mA}$:
 $P_{OUT} @ 1 \text{ dBc} = 575 \text{ mW/mm}$,
 $PAE = 44.9\%$, $\text{Gain} = 6.6 \text{ dB}$
- BCB Protection Layer

APPLICATIONS

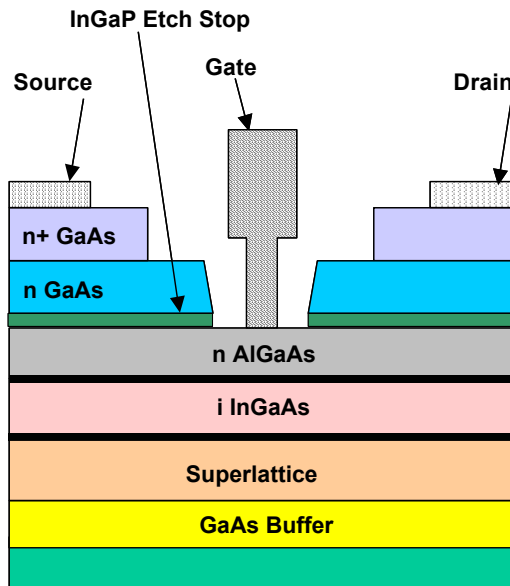
- High efficiency power amplifiers and driver amplifiers for applications up to 16 GHz
- Low loss switches and LNAs for wireless, and infrastructure applications

0.5 μm GaAs pHEMT – PH4 Power Foundry Process (continued)

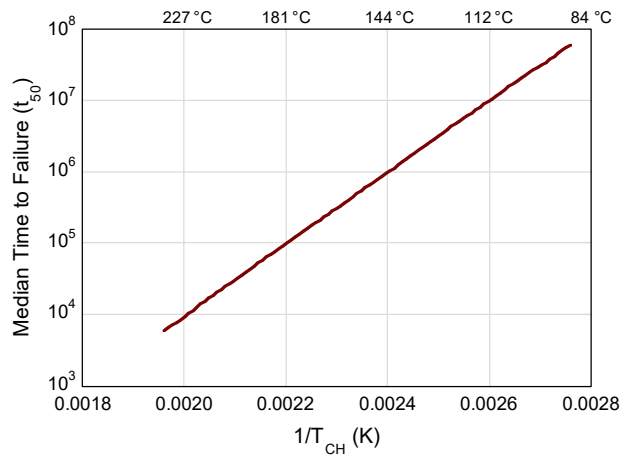
KEY PROCESS PARAMETERS

Element	Parameter	Nominal Value	Units
FET	I_{DSS}	250	mA/mm
	I_{MAX}	525	mA/mm
	G_M (@ 3 V, 1/2 I_{DSS})	290	mS/mm
	BV_{GD}	12	V
	V_P	-1	V
MIM Capacitor	Density	400 or 120	pF/mm ²
Air-Bridge Crossover	—	Yes	—
NiCr Resistor	Sheet Resistance	50	Ω/sq
Substrate VIA	—	30	μm
BCB Protection Layer	—	Yes	—
Substrate	Thickness	4	mil
Pad Size	—	75	μm
Total Mask Number	—	13	—
Metal Number	—	3	—

PH4 pHEMT: Epitaxial Layer Structure



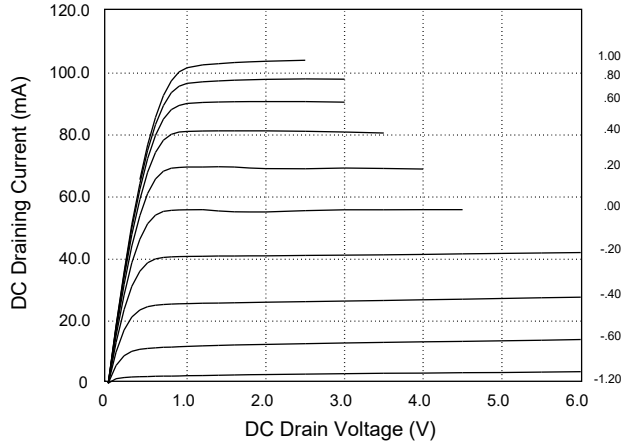
Arrhenius Plot for PH4 Process:
MTTF vs. Temperature, $T_{ch} = 250\text{ °C}$ @ Life Test



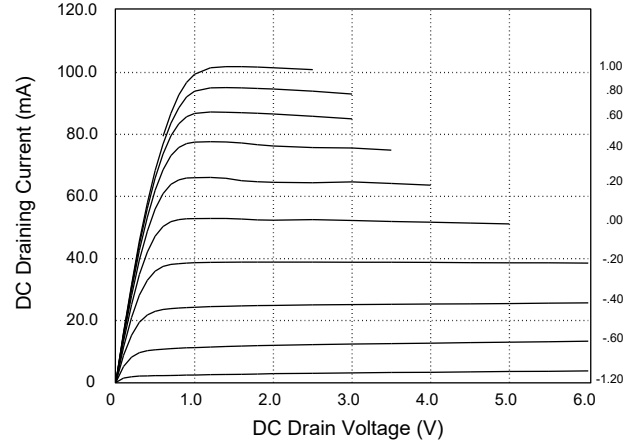
0.5 μm GaAs pHEMT – PH4 Power Foundry Process (continued)

Typical Performance Curves: DC IV 2 x 100 μm FET Characteristics

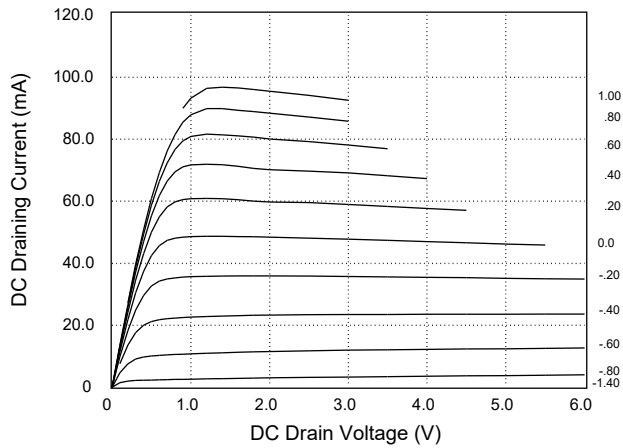
Drain Current vs. Drain Voltage @ -30 °C



Drain Current vs. Drain Voltage @ +27 °C



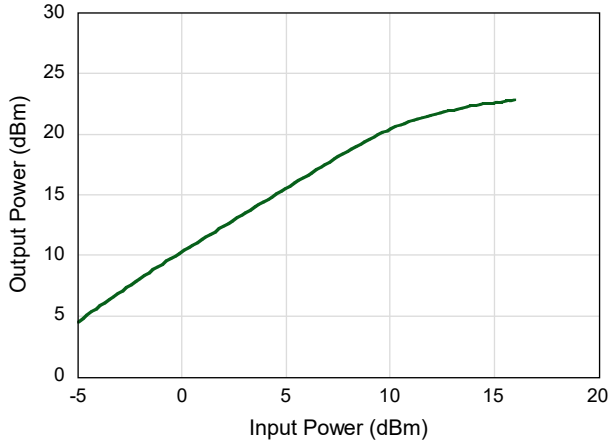
Drain Current vs. Drain Voltage @ +85 °C



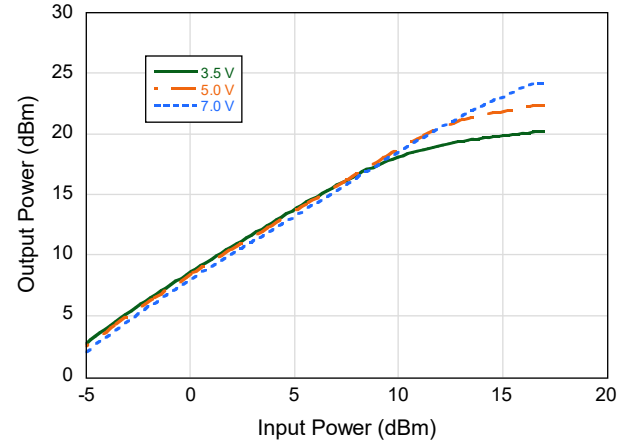
0.5 μm GaAs pHEMT – PH4 Power Foundry Process (continued)

Typical Performance Curves: 14 GHz Load Pull Results

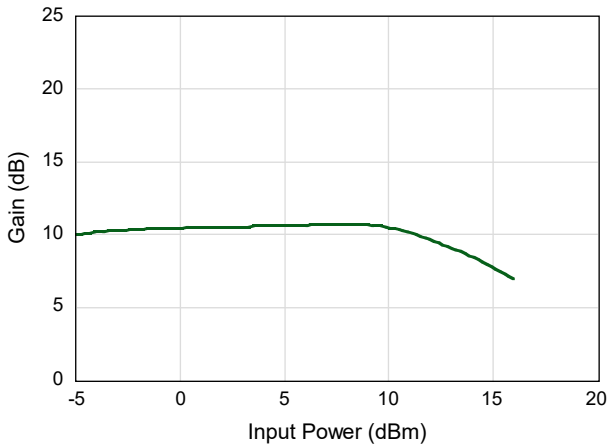
Output Power vs. Input Power



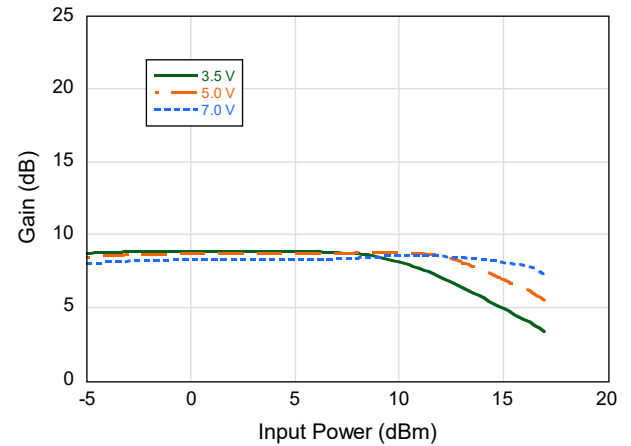
Output Power vs. Input Power, over Voltage



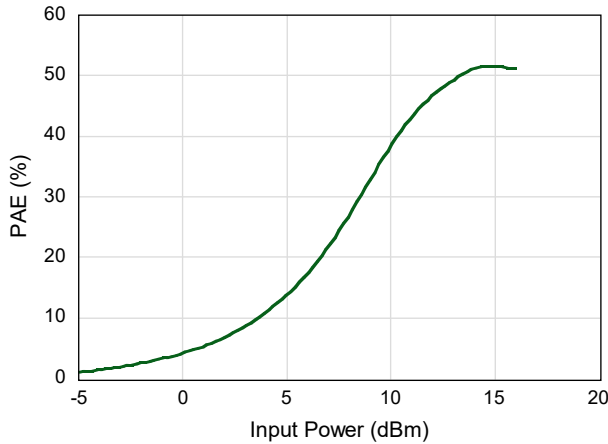
Gain vs. Input Power



Gain vs. Input Power, over Voltage



PAE vs. Input Power



0.5 μm GaAs pHEMT – PH4 Power Foundry Process (continued)

BENEFITS OF USING MACOM AS A FOUNDRY SERVICE:

- Over 17 Years of GaAs MMIC Production Experience
- A Complete Offering of Stable and Mature GaAs Production Processes for Commercial Handset, Infrastructure and Military Applications
- Superior Device Performance to Meet the Most Stringent Specifications
- World-class Testing and Modeling Capabilities
- Shortest Production Cycle Time in the Industry
- Proven Manufacturer of Microwave Components and Systems for more than 50 Years

MACOM FOUNDRY SERVICES INCLUDE:

- Support in:
 - Layout
 - DRC and LVS Checking
 - Technical Consultation
- Provide Design Kit including Transistor Models and Passive Models to Assist Design

FOUNDRY SERVICES AVAILABLE UPON REQUEST:

- Extract Small Signal, Noise, and Large Signal Models
- Provide Transistor Characterization Data in:
 - Small Signal Measurements
 - Load Pull Measurements
- Perform Circuit Test at:
 - Wafer Level
 - Package Level
- Production Qualification Testing