

0.25- μm 3MI Process Cross Section

General Description

The 0.25- μm mmW pHEMT 3MI (3-Metal-Interconnect) process combines high power density and gain per stage performance. The process is optimized for high-power and low-noise operation through 50 GHz. Passives include 3 thick-metal interconnect layers, precision TaN resistors, GaAs resistors, through-substrate vias and 3 MIM capacitance densities. The via-under-cap process aids in size compaction and offers excellent grounds at higher frequencies. Air bridges produce minimal interconnect capacitance and the protective overcoat layer provides environmental robustness.

Features

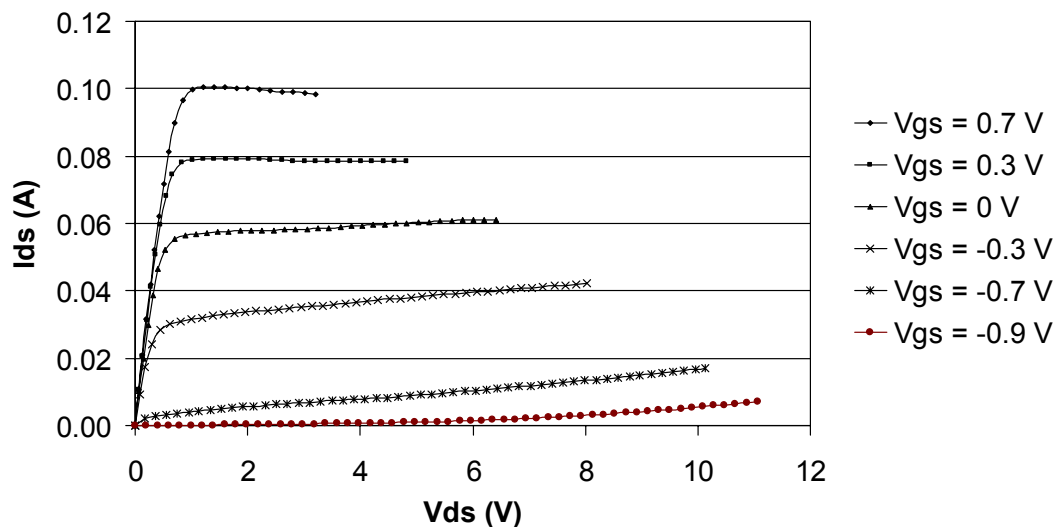
- 0.25- μm amplifier transistors
- 0.25- μm switch transistors
- 0.25- μm , 2- μm and 4- μm diodes
- High-Q passives
- 3 MIM capacitance densities
- TaN resistors
- GaAs resistors
- High-density interconnects
- 3 metal layers
- Air bridges
- Substrate vias
- Protective overcoat
- Operation up to $V_d = 8\text{ V}$

Applications

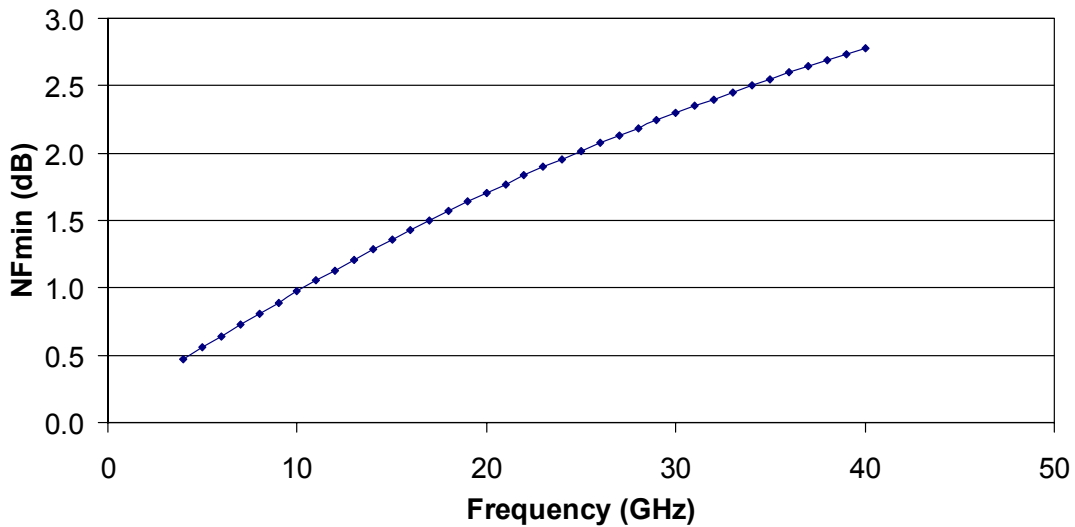
- Up to 50 GHz
- Communications
- Military
- Power amplifiers
- Driver amplifiers
- Low-noise amplifiers
- AGC amplifiers
- Limiting amplifiers
- Transimpedance amplifiers
- Differential amplifiers
- Digital and analog phase shifters
- Digital and analog attenuators
- Mixers (up and down converters)
- Point-to-point radio
- Point-to-multipoint radio
- Switches
- Oscillators
- Multipliers

0.25- μm mmW pHEMT 3MI Process Details			
Element	Parameter	Typical Value	Units
FETs	I_{dss}	300	mA/mm
	G_m	400	mS/mm
	V_{bd}	-15	V
	V_p	-1	V
	F_t (peak)	55	GHz
MIM capacitors	density	240	pF/mm ²
		300	pF/mm ²
		1200	pF/mm ²
Capacitors over vias		yes	
TaN resistors	sheet resistance	50	Ohms/sq
GaAs resistors	sheet resistance	160	Ohms/sq
Vias		yes	
Substrate	thickness	100	μm

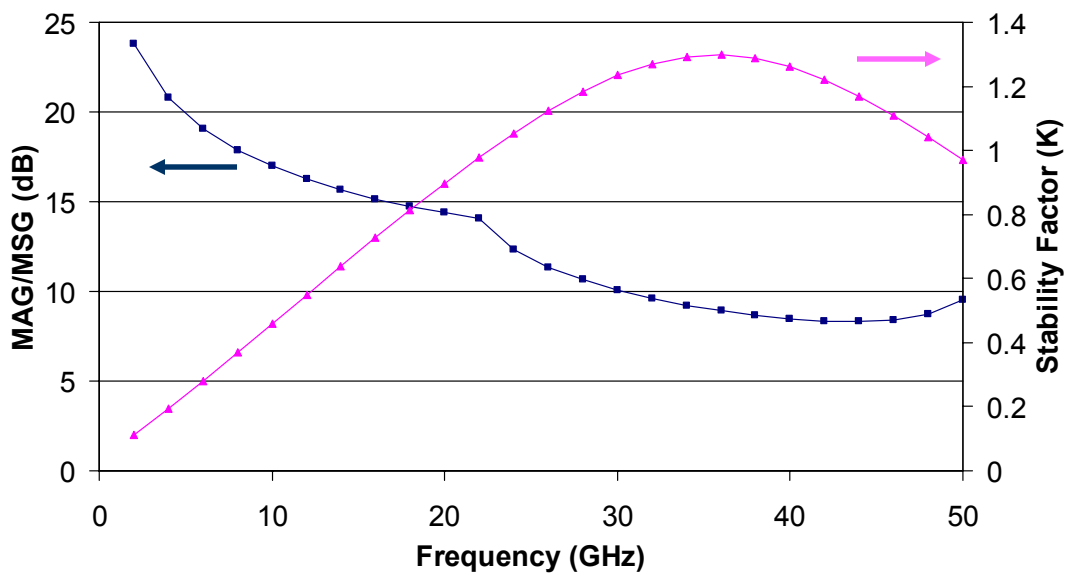
0.25- μm mmW 3MI pHEMT DC Characteristics 200- μm FET



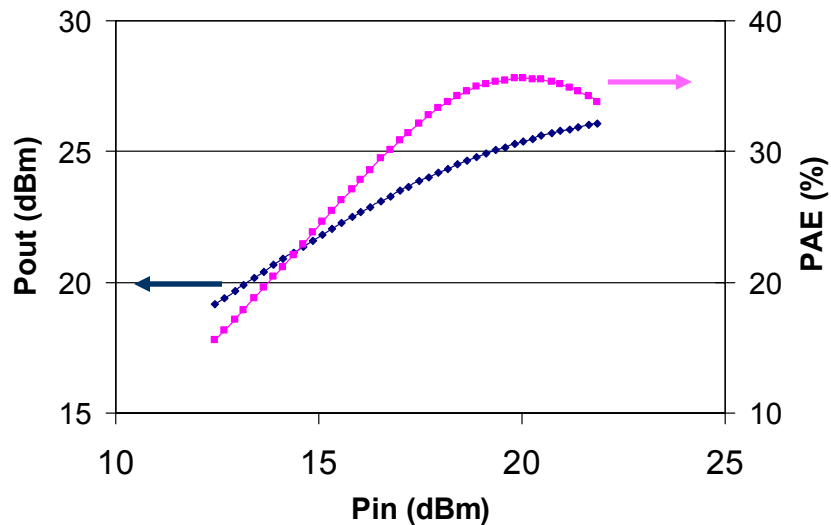
0.25- μ m mmW pHEMT 3MI
Minimum Noise Figure
200- μ m FET @ 3 Volts, 15 mA



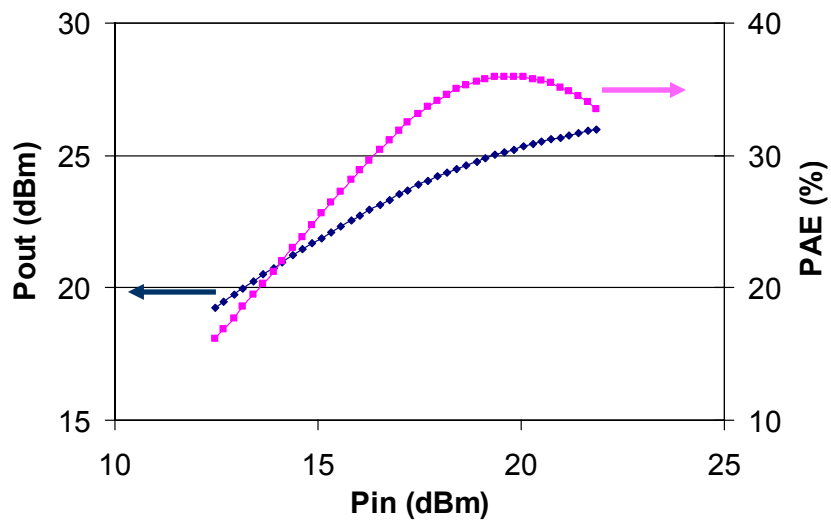
0.25- μ m mmW pHEMT 3MI
Maximum Available Gain/Stable Gain (MAG/MSG)
600- μ m FET @ 6 Volts, 60 mA



0.25- μ m mmW pHEMT 3MI
Power Tuned Load
600- μ m FET @ 6 Volts, 30 GHz



0.25- μ m mmW pHEMT 3MI
Efficiency Tuned Load
600- μ m FET @ 6 Volts, 30 GHz



FET Models Available		
Gate Pitch (μ m)	Gate Fingers	FET Sizes (μ m)
07 07	4	100, 200 & 300
07 07	8	200, 400 & 600
12 18	4	100, 200 & 300
12 18	8	200, 400 & 600
12 18	10	600
20 20	4	100, 200 & 300
20 20	8	400 & 600
20 20	10	600 & 900
20 20	12	900
26 26	4	300
26 26	8	600

Application Examples

0.2 to 18 GHz Down Converter TGC1452:

The TriQuint TGC1452-EPU is a double-balanced MMIC mixer which supports a variety of communication system applications including satellite systems and point-to-point radio.

20 to 40 GHz X2 Frequency Multiplier TGC1430F:

Input frequencies range from 10 to 20 GHz with 25 dB fundamental isolation. The conversion loss is 12 ± 2 dB with 18 dBm of input drive power. This multiplier is used primarily for point-to-point radio and point-to-multipoint communications.

29 to 37 GHz Compact Driver Amplifier TGA4510:

The greater than 16 dB nominal small-signal gain at 30 GHz and 16 dBm nominal P_{sat} are key features of this driver amplifier. Applications include LMDS, point-to-point and base stations.

Prototyping and Development

- Prototype Chip Option (PCO)
 - Shared mask set
 - Run often
 - Backside via process included
 - PCM (process control monitor) qualified wafers
 - For PCO schedules, please visit http://www.triquint.com/prodserv/divisions/foundry/new/proto_sched_pco.cfm
- Prototype Wafer Option (PWO)
 - Customer-specific masks
 - Customer schedule
 - 2 wafers delivered
 - Backside vias included
 - PCM (process control monitor) qualified wafers

Design Tools

- Device libraries of circuit elements:
 - FETs
 - Thin-film and implanted resistors
 - Capacitors
 - Inductors
- Agilent ADS design kit
- MASC Library
- AWR Microwave Office library

Training

- GaAs design classes:
 - Half-day introduction upon request
 - 3-day technical training upon request at the TriQuint Texas facility

Process Status

- 0.25- μ m mmW pHEMT 3MI is fully released and qualified
- Contact TriQuint or visit <http://www.triquint.com/company/quality/> for more information on quality and reliability.

Applications Services

- Tiling of GDSII stream files including PCM (process control monitor)
- Design rule checking
- Layout versus schematic checking
- Engineering:
 - On-wafer DC test
 - On-wafer RF test
 - Thermal analysis
 - Yield enhancement
- Part qualification
- Failure analysis

Manufacturing Services

- Mask making
- Wafer thinning
- Wafer dicing
- Substrate vias
- DC die-sort testing
- RF die-sort testing
- Final visual inspection