

0.15- μm 3MI Process Cross Section

General Description

The 0.15- μm LN mHEMT 3MI (3-metal-interconnect) process utilizes T-gates in conjunction with a mHEMT material structure optimized for low-noise operation. It is suitable for applications through 100 GHz. These depletion-mode transistors demonstrate the lowest noise figure available in a TriQuint Texas process, with a high level of available gain. The 0.15- μm LN mHEMT 3MI process has demonstrated excellent performance in low-noise amplifiers, small-signal gain block amplifiers, driver amplifiers, wideband data amplifiers and transimpedance amplifiers. The capacitor-over-via process aids in size compaction and offers excellent grounds at higher frequencies.

Features

- 0.15- μm amplifier transistors
- 0.15- μm switch transistors
- High Q passives
- 3 MIM capacitance densities
- TaN resistors
- High-density interconnects
- 3 metal layers
- Air bridges
- Substrate vias
- Protective overcoat
- Operation up to $V_d = 1.5 \text{ V}$

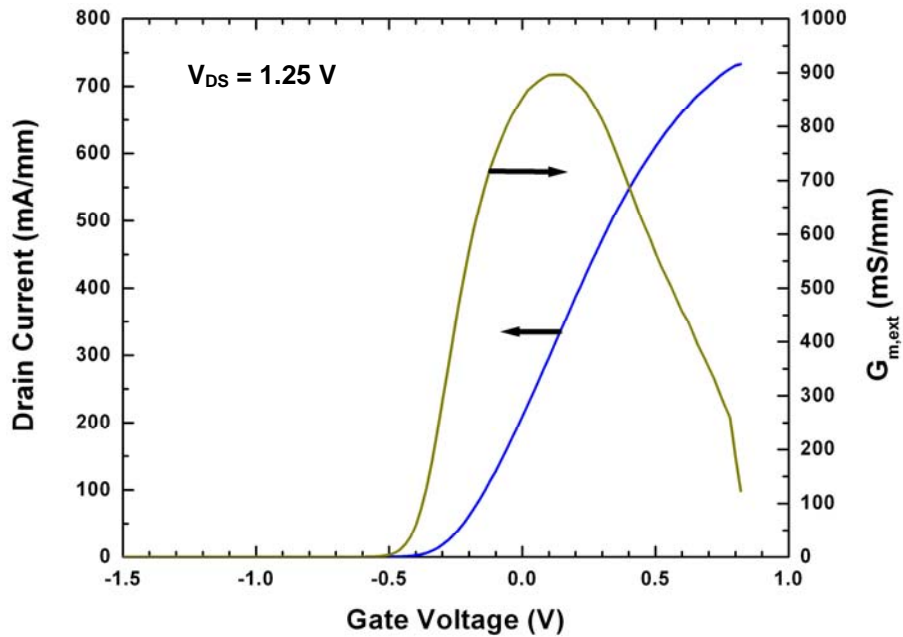
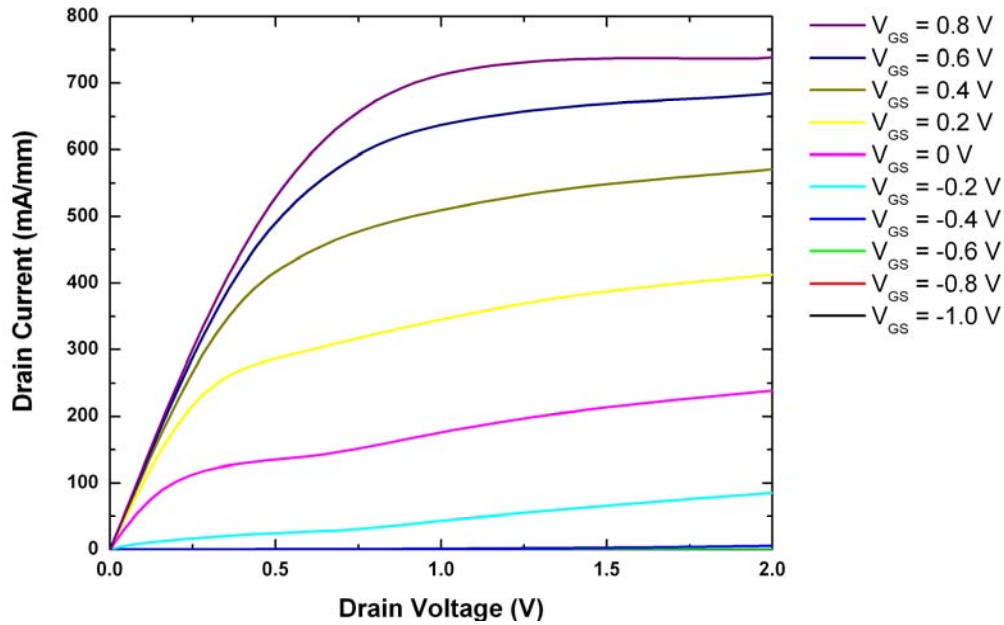
Applications

- Up to 100 GHz
- Communications
- Military
- Low-noise amplifiers
- Driver amplifiers
- AGC amplifiers
- Limiting amplifiers
- Transimpedance amplifiers
- Differential amplifiers
- Switches
- Broadband data amplifiers
- VCOs
- Multipliers
- Mixers (up and down converters)
- Point-to-point radio
- Point-to-multipoint radio
- Automotive radar

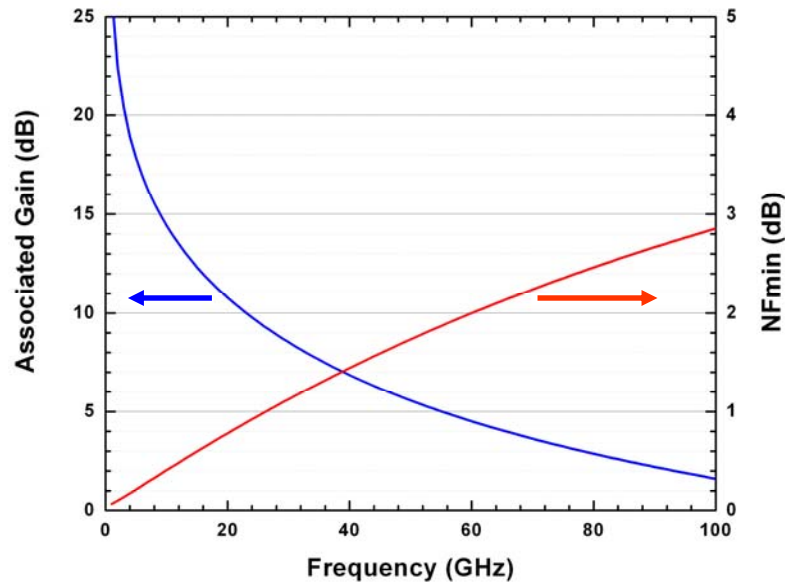
0.15- μm LN mHEMT 3MI Process Details

Element	Parameter	Typical Value	Units
FETs	I_{dss}	225	mA/mm
	G_m	800	mS/mm
	V_{bd}	-3	V
	V_p	-0.4	V
	F_t (peak)	135	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	Ω /sq
Vias		yes	
Substrate	thickness	100	μm

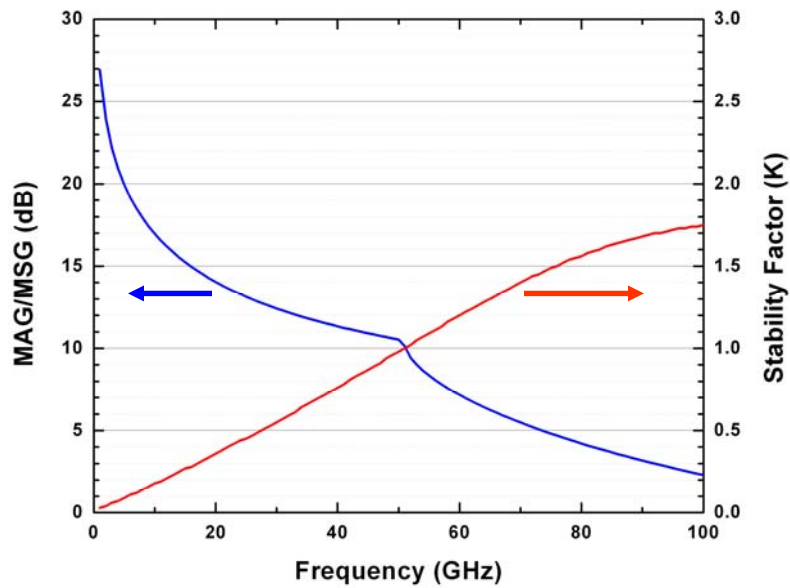
0.15- μm LN mHEMT 3MI
DC Characteristics
100- μm FET



Minimum Noise Figure and Associated Gain
200- μm FET @ 1 V, 10 mA



Maximum Available/Stable Gain (MAG/MSG)
200- μm FET @ 1 V, 15 mA



Application Examples

40G Transimpedance Amplifier TGA4812:

This wideband transimpedance amplifier provides 235 Ohm single-ended transimpedance into a 50 Ohm termination. Typical output return loss is > 18 dB and the average equivalent input noise current is $15 \text{ pA/Hz}^{1/2}$ (1 GHz to 40 GHz). Typical 3 dB bandwidth is 30 KHz to 43 GHz with 0.065 pF of photodiode capacitance. Applications include OC768 receivers.

DC to 65 GHz Low-Noise Amplifier TGA4811:

This wideband amplifier has 3.5-dB typical noise figure with a 14-dB gain. Applications include point-to-point radios, point-to-multipoint radios and fiber-optic systems.

X-Band Low-Noise Amplifier TGA2600:

This low-noise amplifier has approximately 30dB gain and an exceptionally low noise figure of 0.5dB at X-band. The amplifier has radar applications as well as other X-band applications where extremely low noise is a requirement.

FET Models Available		
Gate Pitch (μm)	Gate Fingers	FET Sizes (μm)
12 18	4	40, 50, 100, 200 & 300
20 20	4	100 & 200

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 resistors
 - Capacitors
 - Inductors
- Agilent ADS design kit
- MASC Library
- AWR Microwave Office library
- When using the mHEMT process, please refer to the Design for ESD Protection Design Guide Chapter, which provides recommendations to protect these devices from ESD

Training

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

Process Status

- 0.15- μ m LN mHEMT 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 on-wafer testing
- Final visual inspection