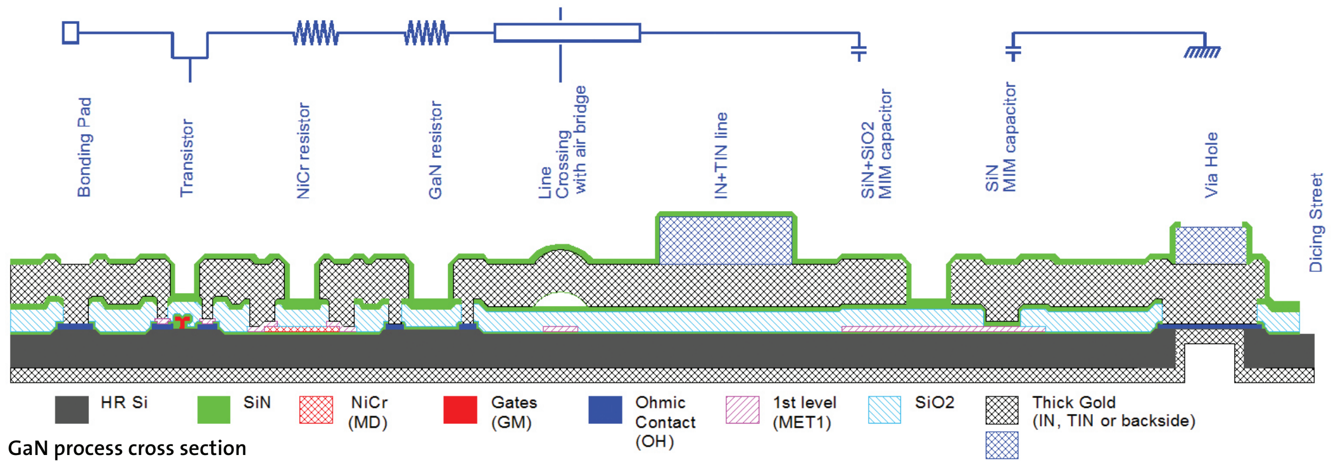
D01GH-006GH: Fabrication Technology

Processing: Introductions



GaN process cross section

This GaN process has been developed and optimised for microwave and millimeterWave applications, including power amplifiers, robust low noise amplifiers and multifunctionaL chips. It is available with 2 gate lengths, 100 nm (D01GH) and 60 nm (D0006GH)

•**D**: Depletion mode transistor

•**01** or **006**: 0.1 µm or 0.06 µm gate length

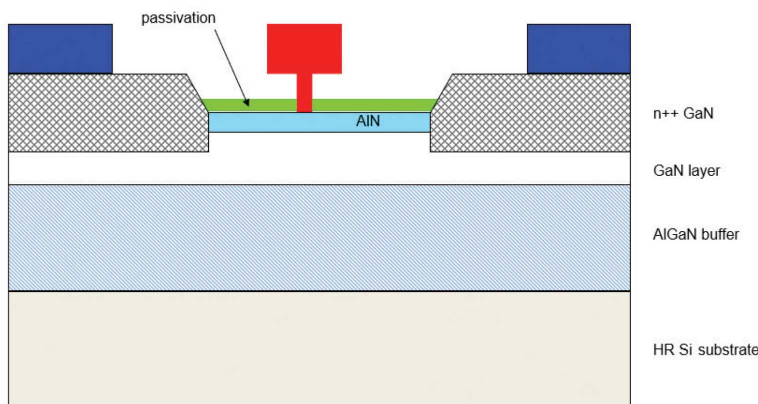
•**GH**: GaN HEMT layer

•**/Si**: Silicon

STARTING MATERIAL AND ACTIVE LAYER

High Resistivity Silicon (5 kΩ.cm) is used as starting material below the active layer epitaxy.

The active layer based on AlN/GaN/AlGaN has been specially developed for high quality transistors and good interface with the bulk substrate. The passivation layers ensure low lag, low drain current collapse and low memory effects.



GAN active layer profile

FEATURES

- AlN-GaN-AlGaN Double Heterostructure Field Effect Transistor (DHFET) active layer
- High Resistivity Silicon substrate and associated epitaxial buffer layer
- Depletion mode transistors
- Regrown non-alloyed ohmic contacts for ultra low resistance
- Mushroom gates for high frequency and low noise
- Diodes for mixing, level shifting, or varactors, using the transistor diodes
- Resistors, using a thin film metal layer (NiCr), or the transistor active layer
- Full Si_3N_4 protection ensuring high reliability and low lag and memory effects
- 2 types of MIM capacitors, using theSi_3N_4 layer or the Si_3N_4 + SiO_2 layers.
- SiO_2/Si_3N_4 + air bridge isolation between metal lines to reduce the parasitic capacitances.
- 1.25 µm thick gold metallisation for interconnections and spiral inductors. Possibility of 2.5 µm thick lines to reduce series resistances or allow more DC current.
- Via holes through the 100 µm substrate to reduce parasitic inductances to ground.

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D01GH-006GH: Fabrication Technology (continued)

KEY PROCESS PARAMETERS

Parameter	Description	Value for D01GH (100 nm)	Value for D006GH (60 nm)
Ft	Frequency Cutoff	57 GHz	63 GHz
MSG30	Maximum Stable Gain @ 30 GHz	13 dB	13.5 dB
Gm	Transconductance	8000 mS/mm	950 mS/mm
IMax	Maximum Drain Source Current (Vgs = +0.8 V, Vds = 3 V)	1.3 A/mmV	1.5 A/mm
Vt	Threshold Voltage	-1.4 V	-1.4 V
NF	Minimum Noise Figure	1.5 dB @ 40 GHz	1.1 dB @ 40GHz
Pout	RF Power Density	3 mW/mm	3 mW/mm
CMIM_SiN	SiN MIM Capacitors	400 pF/mm^2	
CMIM_SiO_2	SiO_2 MIM Capacitors	50 pF/mm^2	
RKN	Semiconductor Resistor Sheet Resistance	400 Ω^2	
RKMD	Metal Resistor Sheet Resistance	40 Ω^2	