

Nitride Epitaxy Products

CREE produces GaN, Al_xGa_{1-x}N and In_yGa_{1-y}N epitaxial layers on up to 100 mm diameter sapphire and SiC substrates. Unless noted otherwise on the product quotation, the epitaxial layer structure will meet or exceed the following specifications (1). Additional comments, terms and conditions may be found at the end of this document.

Nitride Epitaxial Layer Specifications – Structural

Property	Value or Range	Precision	Measurement Technique
Substrate	Al ₂ O ₃ SiC (n-type or Semi-Insulating)	—	—
Composition	Al _x In _y Ga _{1-x-y} N, 0 ≤ x ≤ 0.4, 0 ≤ y ≤ 0.4, certain restrictions apply	Δ x = ± 0.03, Δ y = ± 0.03	XRD peak splitting – wafer center
Target thickness (2)	0.001 μm to 5.0 μm (GaN) 0.001 μm to 3.0 μm (AlInGaN)	Average thickness within ± 15% of selected thickness and uniformity < 15%. (3)	X-ray or optical technique
GaN crystallinity	< 300 arcsec (3 μm layer on Al ₂ O ₃ substrate) < 250 arcsec (3 μm layer on SiC substrate (5))	—	XRD (0006 rocking curve) FWHM (center point)
Al _{0.25} Ga _{0.75} N	< 700 arcsec (3 μm layer on Al ₂ O ₃ substrate) < 500 arcsec (3 μm layer on SiC substrate (5))	—	XRD (0006) FWHM (center point) (4)
Morphology	Smooth	—	Differential interference microscopy (5 site)
Visible Defects	< 4 defects < 1mm ² and < 1 defect < 3mm ²	< 1 defect between 0.3 and 1mm ² per 500 mm ²	Optical inspection
Particle concentration	< 20 defects cm ⁻² ranging in size from 1 x 1 μm ² to 20 x 20 μm ²	—	Optical inspection

Nitride Epitaxial Layer Specifications – Electrical

Property	Value or Range	Precision	Measurement Technique
Dopant type	n-type (Si) p-type (Mg)	—	—
Carrier concentration (undoped, substrate dependent)	< 1E16 cm ⁻³ , n-type	—	CV measurement
Carrier concentration (n-type, Si doped)	1E17 to 2E19 cm ⁻³	< 50%	Hg probe CV (wafer center, room temperature)
Carrier concentration (p-type, Mg doped)	1E17 to 5E17 cm ⁻³	< 50%	Hall measurement (5)
Mobility of thick layers formed on SiC or Al ₂ O ₃	μ _{GaN} ≥ 300 cm ² V ⁻¹ s ⁻¹ (n-type, CC = 5E17 cm ⁻³) μ _{AlGaN} ≥ 60 cm ² V ⁻¹ s ⁻¹ (n-type, CC = 5E18 cm ⁻³ , 25% Al)	—	Hall mobility measurement (5)
Mobility (device) (6)	Structure dependent	—	Hall mobility measurement
Sheet resistivity (6)	< 5% uniformity (3)	—	Contactless sheet resist



1. Certain additional restrictions may apply and will be presented on the product quotation.
2. Range given for undoped layers. Maximum achievable thickness for doped layers or heterostructures will be reduced.
3. Precision specification applies only to layers $\geq 0.01 \mu\text{m}$ thick. Uniformity = $(100 \times \text{standard deviation} / \text{mean})$.
4. Property not measured on customer's wafer, but metric wafers are regularly run and tested to ensure process is stable and specifications are met.
5. Hall mobility and carrier concentration values are based on room-temperature measurements made on thick epilayers.
6. Electron mobility in device structures is a function of the device design and, consequently, cannot be specified. A mobility specification may be developed for repeat or large-volume orders. Please contact Cree, Inc. or one of our representatives to discuss. Uniformity specification does not apply to certain structures.

Additional Comments, Terms and Conditions

GaN wafers are offered subject to the Cree, Inc. Sales Terms and Conditions, a copy of which may be obtained by contacting a Cree representative or by downloading from www.cree.com/ftp/pub/termsandconditionsread.pdf. In particular, the recipient may not use purchased GaN or SiC wafers in the bulk growth of silicon carbide or Group III-nitride-based materials or in the development of processes for bulk growth of such materials.

Specification sheets may change without notice. Please contact Cree, Inc. or one of our representatives if an updated specification sheet is desired. Current specification sheets are available for download at www.cree.com. A detailed description of measurement procedures is available upon request.