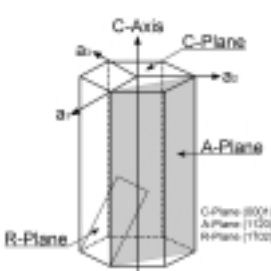


# Specification of Polished Substrates for LED

(Version: 1.5)

## Basic Material Properties

Commodity:	<b>Mono-crystalline Synthetic Sapphire (Al<sub>2</sub>O<sub>3</sub>)</b>
Purity:	≥ 99.99%
Poisson ratio:	0.25 - 0.30
Density:	3.98g/cm <sup>3</sup>
Hardness:	9 (Mohs)
Young's Modulus:	345GPa (60° orientation to C-axis)
Tensile Strength:	400MPa at 25°C
Melting Point:	2040 °C
Resistivity:	10 <sup>11</sup> - 10 <sup>16</sup> Ωcm at 20 - 500°C
Thermal Conductivity:	42W/mK at 20°C (60° orientation to C-axis) 25W/mK at 100°C (60° orientation to C-axis)
Thermal Expansion Coefficient:	5.3 x 10 <sup>-6</sup> /°C parallel to C-axis at 25°C 6.8 x 10 <sup>-6</sup> /°C parallel to C-axis at 50°C 4.5 x 10 <sup>-6</sup> /°C perpendicular to C-axis at 25°C 5.2 x 10 <sup>-6</sup> /°C perpendicular to C-axis at 50°C

Specification Item	Value	Tolerance	Remark(s):	
	Standard Orientation	C-Plane	± 0.3° (0001)	
	Special Orientation	C +0.2° to A	± 0.1° on request	
	Primary Flat Orientation	A-Plane	± 0.3° (11-20)	
	Primary Flat Length	16.0mm	± 1.0mm	
	Secondary Flat			on request
Diameter	50.80mm	± 0.15mm		
Thickness (center point)	330 - 430μm	± 25μm		
Total Thickness Variation (TTV)	≤ 15μm			
Local Thickness Variation (LTV)	≤ 5μm, 95%		5mm x 5mm	
Bow	≤ 20μm			
Front Surface Roughness (Ra)	≤ 5Å		MIL standard	
Backside Surface Roughness (Ra)	≤ 1.0μm		ground	
Chips	3 x < 0.2mm		max.	
Wafer Edge Bevel	≤ 150μm at 45°			
Cleanliness	no stains and finger prints, ready for epi			
Packaging	cassettes of 25pcs or individually			