# High Heat Dissipation Substrate <Physical Properties of Substrates>

| Item | | [unit] | Alumina $Al_2O_3$ | Aluminum Nitride ALN |
|---|---|---|---|---|
| Content rate | | [%] | 96 | 97 |
| Color | | - | White | Gray |
| Density | | [g/cm$^3$] | 3.8 | 3.3 |
| Mechanical Characteristics | Flexural Strength | [MPa] | 350 | 310 |
| | Young's Modulus | [GPa] | 320 | 320 |
| Thermal Characteristics | Thermal Conductivity (20℃) | [W/m･k] | 24 | 170 |
| | Linear Expansion Coefficient | [×10$^{-6}$/K] | 7.2 | 4.6 |
| Electrical Characteristics | Dissipation Factor (1MHz) | [×10$^{-4}$] | 4 | 3 |
| | Volume Resistivity | [Ω･cm] | ＞1014 | ＞1014 |
| | Dielectric Strength (DC) | [kV/mm] | 15 | 14 |

※The above values are reference values

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# High Heat Dissipation Substrate <Design Rules>

<table>
<tr><td>circuit method</td><td>Thin film + Plating</td><td>Thick film Printing</td></tr>
<tr><td>circuit material</td><td>Cu</td><td>Ag,AgPd etc</td></tr>
<tr><td>circuit thickness</td><td>≦50μm</td><td>≦10μm</td></tr>
<tr><td>Base material thickness</td><td colspan="2">0.2mm～1.0mm</td></tr>
<tr><td rowspan="2">L / S</td><td>min.20μm / min.20μm</td><td>min.80μm / min.80μm</td></tr>
<tr><td colspan="2">curcuit tolerance ±10μm</td></tr>
<tr><td rowspan="2">Upper Plating</td><td colspan="2">Ni/Pd/Au(Electroless plating)</td></tr>
<tr><td colspan="2">thickness　Ni:4μm/Pd:0.05μm/Au:0.1μm</td></tr>
<tr><td>Cross section</td><td colspan="2">L ine<br>Space<br>Upper Plating<br>circuit thickness<br>Base material thickness<br>Base material</td></tr>
</table>

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