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# FerroTec Ceramic Substrates
# AMB Technology

Design Rule Version 2020.05.REV.A/2

# Group Introduction —

Ferrotec (China) is a diversified enterprise established by the Japanese company Ferrotec Co., LTD. in 1992 in Hangzhou Zhejiang. It is a company that integrates product R&D, manufacturing and sales. Ferrotec (China) manages more than 20 companies all over China, providing domestic and international customers with world-class materials, devices, equipment and system solutions.

Ferrotec (China) is dedicated to "bringing satisfaction to the customers, caring about the environment and providing dreams and vitality to the world". We believe in "Diligence Aspiration Exploration Innovation", and we insist the quality policy of "Quality is vital to our enterprise and essential to our growth; quality is what we used to build our reputation and customer base. Driven by technological innovation and focusing on talent development, the company constantly attracts a large number of talents, introduces and absorbs advanced production technology, researches and develops high-tech products with international standard and suitable for Chinese market demand, and gradually becomes a large diversified enterprise group that severs in various industries.

## FTS Introduction

Shanghai Shenhe Thermo-magnetic Electronics Co., Ltd. (FTS) is a wholly-owned company invested by Ferrotec Holdings Corporation in Shanghai Baoshan City Industrial Park. The company was established on May 18, 1995, with a registered capital of 20.08 billion yen, a land area of 62.8 acres, a construction area of 44024.65 square meters, and more than 1,000 employees. It comprises four departments, semiconductor wafer department, power semiconductor ceramic substrates department, new energy department and thermal material department, mainly R&D, manufacture and sales of products: semiconductor silicon wafers, solar silicon wafer, power semiconductor ceramic substrates(DCB) and semiconductor thermoelectric materials.

## FTJS Introduction

Jiangsu Ferrotec Semiconductor technology Co., Ltd. was set up in March, 2018 with the registered capital of 20 million dollars is a wholly foreign-owned enterprise engaged in R&D, application, manufacture and sales of power semiconductor ceramic substrates (AMB & DCB), which is invested by Ferrotec Holdings Corporation in Dongtai City East New Area. The total investment of project is 1 billion RMB, the new building is 90,000$m^2$, and the annual capacity of power semiconductor ceramic substrates is 12 million master cards.

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# MATERIAL PROPERTIES

## — 1.01 AVAILABLE CERAMIC TYPES AND PROPERTIES

| Items/Types | AlN<br>Aluminum Nitride | $Si_3N_4$<br>Silicon Nitride | Unit |
|---|---|---|---|
| Density | 3.3 | 3.22 | g/m³ |
| Thermal Conductivity | >170 | 80 | W/m.K |
| Coefficient of Thermal Expansion | 4.7<br>(20℃~300℃) | 2.5<br>(20℃~300℃) | $x10^{-6}$/K |
| Bending Strength<br>(Σ0,M>10) | >350 | >700 | MPa |
| Dielectric Loss | 0.0005 | <0.001 | 1MHz |
| Dielectric Constant | 9.0 | 8.0 | 1Mhz |
| Dielectric Strength | >20 | >20 | KV/mm |
| Electrical Resistivity | $>10^{14}$ | $>10^{14}$ | Ω·cm |
| E-Modulus | 320 | 300 | Gpa |

## — 1.02 COPPER PROPERTIES

| Items | Parameters | Unit |
|---|---|---|
| Purity | 99.99 | % |
| $O_2$ Content | OFHC | - |
| Hardness | 60~110 | HV |
| Electrical Conductivity | 58.6 | MS/m |

## — 1.03 AVAILABLE CERAMIC TYPES/THICKNESSES

| | AIN | $Si_3N_4$ |
|---|---|---|
| 0.25mm | ✓ | ✓ |
| 0.32mm | | ✓ |
| 0.38mm | ✓ | |
| 0.63mm | ✓ | |
| 1.0mm | ✓ | |

## — 1.04 COPPER THICKNESSES

0.20mm  0.25mm  0.30mm  0.40mm  0.50mm  0.80mm

## — 1.05 AVAILABLE MATERIAL THICKNESS COMBINATIONS

| | 0.20mm | 0.25mm | 0.30mm | 0.40mm | 0.50mm | 0.80mm |
|---|---|---|---|---|---|---|
| 0.25mm | $Si_3N_4$ AIN | $Si_3N_4$ AIN | $Si_3N_4$ | $Si_3N_4$ | $Si_3N_4$ | $Si_3N_4$ |
| 0.32mm | $Si_3N_4$ | $Si_3N_4$ | $Si_3N_4$ | $Si_3N_4$ | $Si_3N_4$ | $Si_3N_4$ |
| 0.38mm | AIN | AIN | AIN | - | - | - |
| 0.63mm | AIN | AIN | AIN | AIN | AIN | - |
| 1.00mm | AIN | AIN | AIN | AIN | AIN | AIN |

CERAMIC THICKNESS

COPPER THICKNESS

$Si_3N_4$ Silicon Nitride

AIN Aluminium Nitride

**Note:**

*For discrepant copper thickness combination, on request.

*Front and back copper thickness discrepancy must less than 0.15mm.

# GENERAL PROPERTIES

## — 2.01 DIMENSIONAL TOLERANCES

| Dimension Tolerance | +0.2/-0.05mm |
|---|---|
| Master Card | 138*190mm +/-1.5% |
| Copper Edge to Ceramic Edge | +/-0.15mm |
| Total Thickness | +/-7% |
| Laser Through Hole Diameter | +/-0.1mm |
| Laser Depth | +/-30μm |

## — 2.02 MAX USABLE AERA

Laser scribed 127×178mm

## — 2.03 DELIVERY FORM

| Single Parts | Minimum dimension 15×15mm edge length,smaller on requst |
|---|---|
| Master Card | With or without laser scribing; defect parts marked |

## — 2.04 WARPAGE

Warpage of single DBC or master cards cannot be guaranteed , due to several uncertain factors , e.g. copper/ceramic combinations , front and back side copper coverage , different aspect ratio of dimensions . Warpage(not 100% inspected) can be determined after initial sample delivery.

**Note:**

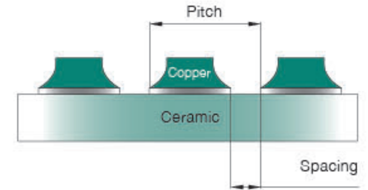
*If warpage is critical for products, please kindly remark on drawings or inform us.

*For the ultimate warpage, eg initial sample quantity is insufficient,not enough for analysis,FTS propose which will be determined after following two or three batches data being collected.

# DESIGN FEATURES

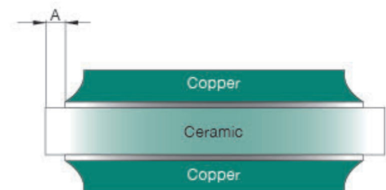
## — 3.01 PATTERN MIN. WIDTH/SPACING DIMENSION

| COPPER THICKNESS | MIN. SPACINGS | MIN. PITCH |
| --- | --- | --- |
| 0.20mm | 0.35mm | 0.7mm |
| 0.25mm | 0.40mm | 0.8mm |
| 0.30mm | 0.50mm | 1.0mm |
| 0.40mm | 0.60mm | 1.2mm |
| 0.50mm | 0.70mm | 1.4mm |
| 0.80mm | 1.00mm | 2.0mm |



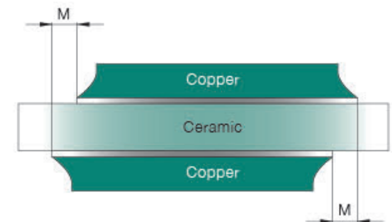

## — 3.02 CERAMIC EDGE PERIMETER

| COPPER THICKNESS | DISTANCE |
| --- | --- |
| 0.20mm | A⩾0.20mm |
| 0.25mm | A⩾0.25mm |
| 0.30mm | A⩾0.30mm |
| 0.40mm | A⩾0.40mm |
| 0.50mm | A⩾0.45mm |
| 0.80mm | A⩾0.50mm |



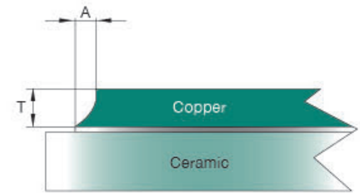

## — 3.03 MISALIGNMENT COPPER PATTERN FRONT/BACK

| DISTANCE |
| --- |
| M⩽0.2mm |

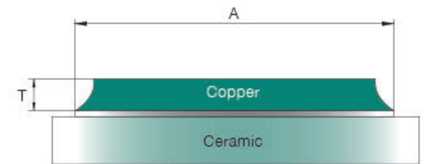


## — 3.04 ETCHING FACTOR

| ETCHING FACTOR |
| --- |
| F=T/A>2 |




## — 3.05 ETCHING TOLERANCE

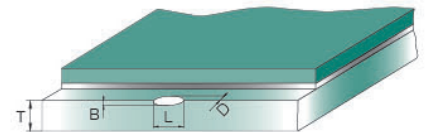



| | |
| --- | --- |
| A±0.15mm | @T⩽0.20mm |
| A±0.20mm | @T⩽0.25mm |
| A±0.20mm | @T⩽0.30mm |
| A±0.25mm | @T⩽0.40mm |
| A±0.30mm | @T⩽0.50mm |
| A±0.35mm | @T⩽0.80mm |

**Note:** Reference point is measured at bottom side of the copper.

## — 3.06 CERAMIC EDGE CHIP OFF

| |
| --- |
| Length: MAX . 1×T |
| Width: MAX. 1/2×T |
| Depth: MAX. 1/2×T |




## — 3.07 CERAMIC THROUGH HOLE/CONTOUR

| |
| --- |
| Min. hole diameter 1mm,smaller on request |
| Ceramic Arc shape or special contour on request |

# SURFACE PROPERTIES

## — 4.01 COPPER SURFACE

| SURFACE ROUGHNESS |
|---|
| $R_a \leqslant 1.5\mu m$ ; $R_z \leqslant 10\mu m$ ; $R_{max}=50\mu m$ |

**Note:** Lower roughness on request.

## — 4.02 SURFACE FINISH

| | |
|---|---|
| Bare copper | - |
| Anti-oxidation | - |
| Electroless Ni | 2~8μm (6~10% P content) |
| Electroless NiAu | Au: 0.01~0.1μm ; Ni:2~8μm |
| Electroless Ag | Ag: 0.1~0.6μm |

**Note:** Other thickness or special plating on request.

## — 4.03 SOLDERMASK

| | |
|---|---|
| Pattern width | Min. 0.3mm +/-0.2mm |
| Position tolerance | +/-0.2mm |
| Min. spacing between soldermask pattern | ⩾0.3mm |
| Min. Distance from soldermask edge to copper edge | ⩾0 mm [copper thickness⩽0.3mm]<br>⩾1mm [copper thickness >0.4mm] |
| Temperature resistance | ⩽320° C/10s (test in acc.with IPC-TM-650,2.6.8) |

# AMB SUBSTRATE PROPERTIES

## — 5.01 PEELING STRENGTH

>10N/mm on AlN and $Si_3N_4$

**Note:** Ferrotec internal Test condition @ 50mm/min @0.3mm Cu-thickness.

## — 5.02 APPLICATION TEMPERATURE

-55° C~+650° C depending on time and atmosphere

## — 5.03 THERMAL CYCLE

| |
|---|
| >60cycles @AlN thickness 0.635mm; Copper thickness≤0.3mm |
| >5000cycles @$Si_3N_4$ thickness 0.32mm; Copper thickness 0.3mm |

**Condition:** -55℃~+150℃,hot/cold chamber system,15min at min/max. Transfer time <30s.
**Note:** Tested by using Ferrotec internal layout,different design layout may influence the test result.

## — 5.04 SOLDERABILITY

>95% Solder preforms Sn / Ag 3.5/ Cu0.5+Ni, Ge 100% H2

## — 5.05 WIRE BONDING

Shearing strength≥1000gf
Aluminium Residue after shearing≥50%

**Condition:** Al wire 300μm; Shear speed 500μm/s; Shear height≤30μm.

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This specification is only a reference for customized designs.
The parameters are standard . For any special needs please contact with us

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