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Made in China

FerroTec Ceramic Substrates
DCB Technology

Design Rule Version 2020.05.REV.E/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 90,000m^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	Al_2O_3-ST Alumina Standard	Al_2O_3-HP High Performance	ZTA Alumina 9% ZrO_2 Doped	AIN Aluminium Nitride	Unit
Content	96% Al_2O_3	96% Al_2O_3	90%Al_2O_3 9%ZrO_2	-	%
Density	3.73	3.73	3.95	3.3	g/m^3
Thermal Conductivity	>24	>24	>27	>170	W/m.K
Coefficient of Thermal Expansion	6.8 (20℃~300℃)	6.8 (20℃~300℃)	7.5 (40℃~400℃) 8.4 (40℃~800℃)	4.7 (20℃~300℃)	$x10^{-6}/K$
Bending Strength (Σ0,M>10)	>350	>450	>600	>350	MPa
Dielectric Loss	0.0003	0.0003	0.0003	0.0005	1MHz
Dielectric Constant	9.8	9.8	10.5	9.0	1Mhz
Dielectric Strength	>20	>20	>20	>20	KV/mm
Electrical Resistivity	$>10^{14}$	$>10^{14}$	$>10^{14}$	$>10^{14}$	Ω · cm
E-Modulus	340	340	310	320	Gpa

— 1.02 COPPER PROPERTIES

Items	Parameters	Unit
Purity	99.99	%
O_2 Content	OFHC	-
Hardness	90~110	HV
Electrical Conductivity	58.6	MS/m

— 1.03 AVAILABLE CERAMIC TYPES/THICKNESSES

	Al_2O_3-ST	Al_2O_3-HP	ZTA	AIN
0.25mm		✓	✓	✓
0.32mm		✓	✓	
0.38mm	✓	✓		✓
0.5mm	✓			✓
0.63mm	✓			✓
0.76mm	✓			
0.89mm	✓			
1.0mm	✓			✓

— 1.04 COPPER THICKNESSES

0.127mm 0.20mm 0.25mm 0.30mm 0.40mm
other thicknesses on request, e.g. 0.1mm 0.235mm

— 1.05 AVAILABLE MATERIAL THICKNESS COMBINATIONS

	0.127mm	0.20mm	0.25mm	0.30mm	0.40mm
0.25mm	*HP* *AIN* *ZTA*	**HP** **AIN** **ZTA**	**HP** **AIN** **ZTA**	**ZTA**	/
0.32mm	*HP* *ZTA*	**HP** **ZTA**	**HP** **ZTA**	**HP** **ZTA**	**ZTA**
0.38mm	*ST* *HP* *AIN*	**ST** **HP** **AIN**	**ST** **HP** **AIN**	**ST** **HP** **AIN**	/
0.50mm	*ST* *AIN*	**ST** **AIN**	**ST** **AIN**	**ST** **AIN**	**ST** **AIN**
0.63mm	*ST* *AIN*	**ST** **AIN**	**ST** **AIN**	**ST** **AIN**	**ST** **AIN**
0.76mm	*ST*	**ST**	**ST**	**ST**	**ST**
0.89mm	*ST*	**ST**	**ST**	**ST**	**ST**
1.00mm	*ST*	**ST**	**ST**	**ST**	**ST**

ST Al_2O_3-ST
HP Al_2O_3-HP
ZTA Alumina 9% ZrO_2 Doped
AIN Aluminium Nitride

CERAMIC THICKNESS

COPPER THICKNESS

FONT Available
FONT Standard combinations
FONT SAMPLE ONLY

GENERAL PROPERTIES

— 2.01 DIMENSIONAL TOLERANCES

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

Note: Special tolerances on request.

— 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) only can be determined after initial sample delivery.

Note:

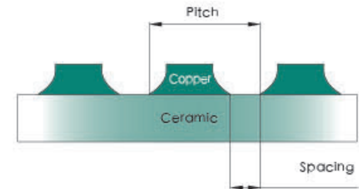
*If warpage is critical for products, please kindly remark on drawings or inform us.

*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	SPACINGS	MIN. PITCH
0.127mm	0.3mm	0.6mm
0.2mm	0.35mm	0.7mm
0.25mm	0.4mm	0.8mm
0.3mm	0.45mm	0.9mm
0.4mm	0.55mm	1.1mm

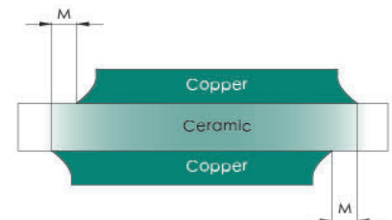


— 3.02 CERAMIC EDGE PERIMETER

COPPER THICKNESS	DISTANCE
≤0.2mm	A≥0.2mm
0.3mm	A≥0.3mm
0.4mm	A≥0.4mm

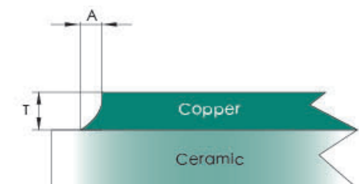
— 3.03 MISALIGNMENT COPPER PATTERN FRONT/BACK

DISTANCE
M≤0.2mm



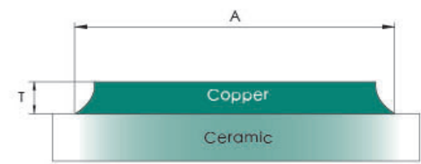
— 3.04 ETCHING FACTOR

ETCHING FACTOR
F=T/A>2



— 3.05 ETCHING TOLERANCE

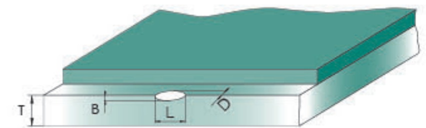
A±0.15mm @T⩽0.25mm
A±0.20mm @T⩽0.30mm
A±0.25mm @T⩽0.40mm



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

— 3.06 CERAMIC EDGE CHIP OFF

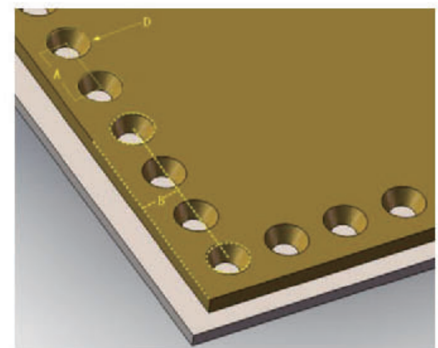
Length: MAX . 1×T
Width: MAX. 1/2×T
Depth: MAX. 1/2×T



L: Length
W: Width
D: Depth
T: Ceramic Thickness

— 3.07 DIMPLES

COPPER THICKNESS	DIMPLE DIAMETER -D-	DIMPLE PITCH -A-	HOLE CENTER TO COPPER EDGE -B-
0.127mm	0.35mm	0.50mm	0.35mm
0.20mm	0.45mm	0.65mm	0.42mm
0.25mm	0.50mm	0.70mm	0.48mm
0.30mm	0.60mm	0.80mm	0.50mm
0.40mm	0.70mm	1.00mm	0.60mm



Special Note: 10% of total dimple quantity with edge defects is acceptable.

— 3.08 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
$R_a \leqslant 3\mu m$; $R_z \leqslant 16\mu m$; $R_{max}=50\mu m$

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] ⩾1mm [copper thickness >0.4mm]
Temperature resistance	⩽320° C/10s (test in acc.with IPC-TM-650,2.6.8)

DCB SUBSTRATE PROPERTIES

— **5.01** PEELING STRENGTH

>5.0N/mm on Al_2O_3
>4.0N/mm on AIN

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

— **5.02** APPLICATION TEMPERATURE

-55° C~+850° C depending on time and atmosphere

Note: Critical at H_2 with> 400° C.

— **5.03** VOID

Front side	No visible void in bonding area Void diameter ≤φ2mm in soldering area
Back side	Void diameter ≤φ3mm

— **5.04** THERMAL CYCLE

45 cycles (0.3Cu / 0.38 Al_2O_3 / 0.3Cu,without dimple)
60 cycles (0.3Cu / 0.635 Al_2O_3 / 0.3Cu,without dimple)
35 cycles (0.3Cu / 0.635 ALN / 0.3Cu,without dimple)

Condition: -55° C~+150° C,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.

— **5.05** SOLDERABILITY

>95% Solder preforms Sn / Ag 3.5/ Cu0.5+Ni,Ge 100% H_2

— **5.06** 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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