Fuji Electric
Innovating Energy Technology

To Customers

0. PCN MT5ZGC00064

Production expansion at Fuji Electric Shenzhen

1. Scope of PCN

Improvement of production capacity and risk avoidance

2. Products to be affected

Product type name : 7th generation “X-series” M276,M263,M274,M277

3. Description of the products changing and its evaluation results

3-1 Key points

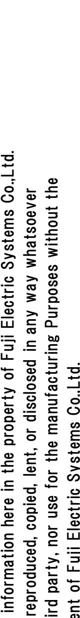
(1) Chemicals & Materials :
The chemicals & materials to be used for the IGBT Module assembling in Fuji Electric Shenzhen (hereinafter SZF) are purchased with same spec as Fuji Electric Power Semiconductor Omachi Factory(hereinafter Omachi factory).

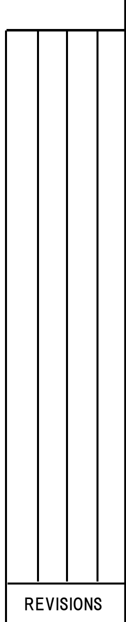
(2) Equipment :
All of the equipment and the test equipment provided for the production & test process in SZF are the same design and performances as compared with Omachi factory. Please refer to table(1).

(3) Process & Conditions :
The process flow, the process conditions and the control limits of the production in SZF are the same as in Omachi factory. Please refer to table(1).

3-2 Intension of the change

In order to correspond the customer’s demand stably, Fuji completed for setting up the assembling production line in SZF in terms of the delivery flexibility and also avoiding the risks of disasters like an earthquake.





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3-3 Qualification test results

(1) Electrical characteristics
As comparison results of VGE(th), VCE(sat) and VF between SZF and Omachi products, no obvious difference was confirmed. Please refer to fig.(1).

(2) Solder joint analysis
The solder joint layers under the DCB substrate and the chips were observed by using scanning acoustic tomography. As results, no obvious difference was confirmed. Please refer to photo(2),(3).

(3) AL-wire bonding characteristics
As comparison results of AL-wire shape and pull force test, no obvious difference was confirmed shown as photo(4).

(4) Reliability test results
Considering the influence of assembly, two kinds of reliability tests were selected and carried out. As a result, SZF products passed all the reliability tests.

(a) Environment test ： Please refer to table(2).

4. Products changing schedule

We would like to start these changing from October 2021.

Approval				
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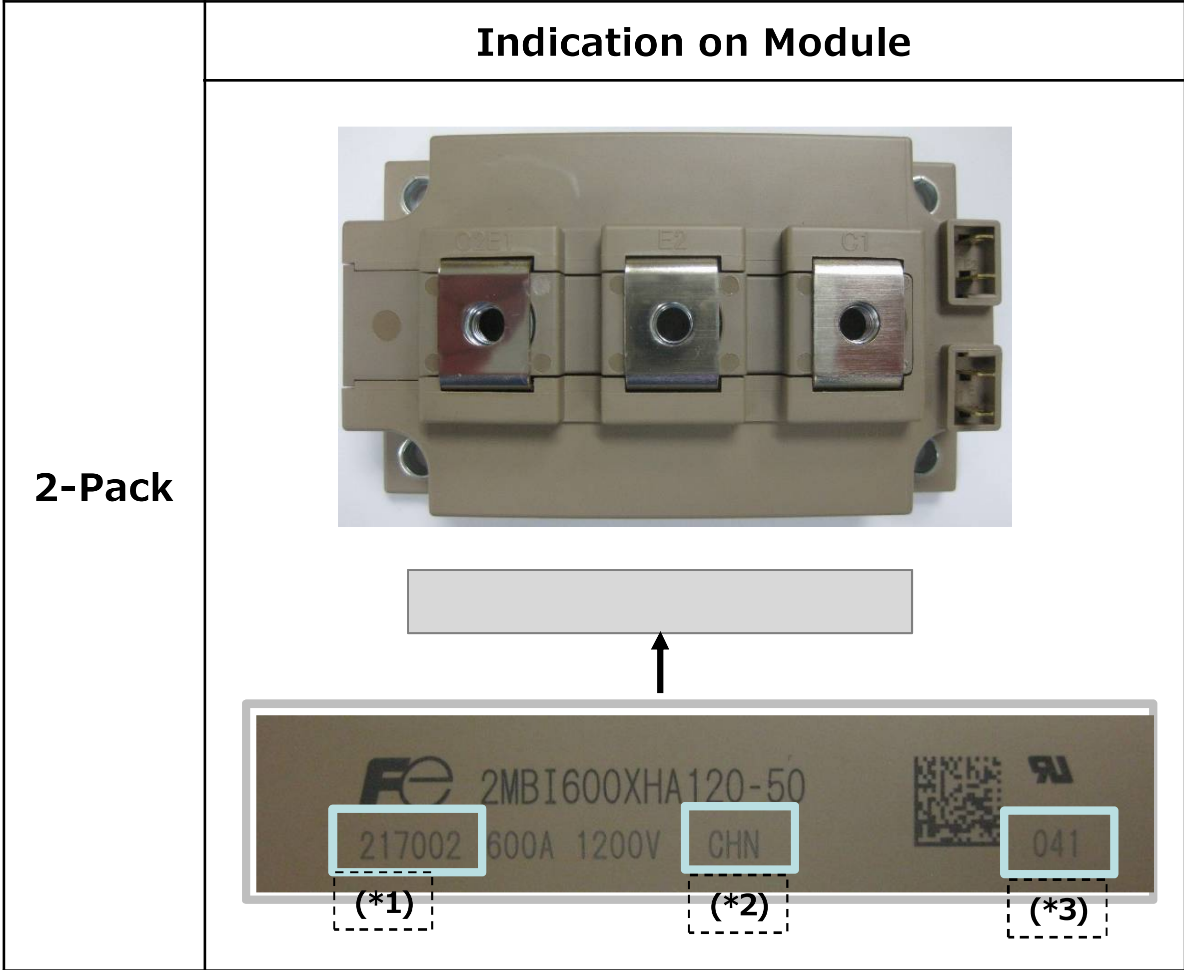
2-Pack	Indication on Module



(*1)

	1st 2 digit	Next 1 digit	Next 3 digit
Omachi products	Last 2 digit of product year	Product month	Production LOT number
SZF products	Last 2 digit of product year	Product month	Production LOT number

(*2)

Omachi products : JAPAN O
SZF products : CHN

(*3)

	3 digit
Omachi products	Serial number in the production Lot
SZF products	Serial number in the production Lot

Photo(1) Indication on Module

Table(1) Process comparison between Omachi and SZF

Process flow	Process name	Process condition & control limit etc	At present facilities
▽IGBT,FWD chips ▽DCB substrate ▽Solderplate ▽Cu plate			
○	Chip mounting and Soldering	Same as Omachi	Same design as Omachi
○	AL-wire bonding_1	Same as Omachi	Same design as Omachi
○	AL-wire bonding_2	Same as Omachi	Same design as Omachi
▽Terminal ▽Cream solder			
○	Terminal Soldering	Same as Omachi	Same design as Omachi
▽Case ▽Silicone glue			
○	Case gluing	Same as Omachi	Same design as Omachi
○	Laser marking	Same as Omachi	Same design as Omachi
▽Silicone gel			
○	Silicone gel injection and gel curing	Same as Omachi	Same design as Omachi
▽Nut glove ▽Flange nut			
○	Nut glove assembly	Same as Omachi	Same design as Omachi
◇	Outgoing test, Visual inspection	Same as Omachi	Same design as Omachi
▽	Packing, Shipment	Same as Omachi	Same design as Omachi

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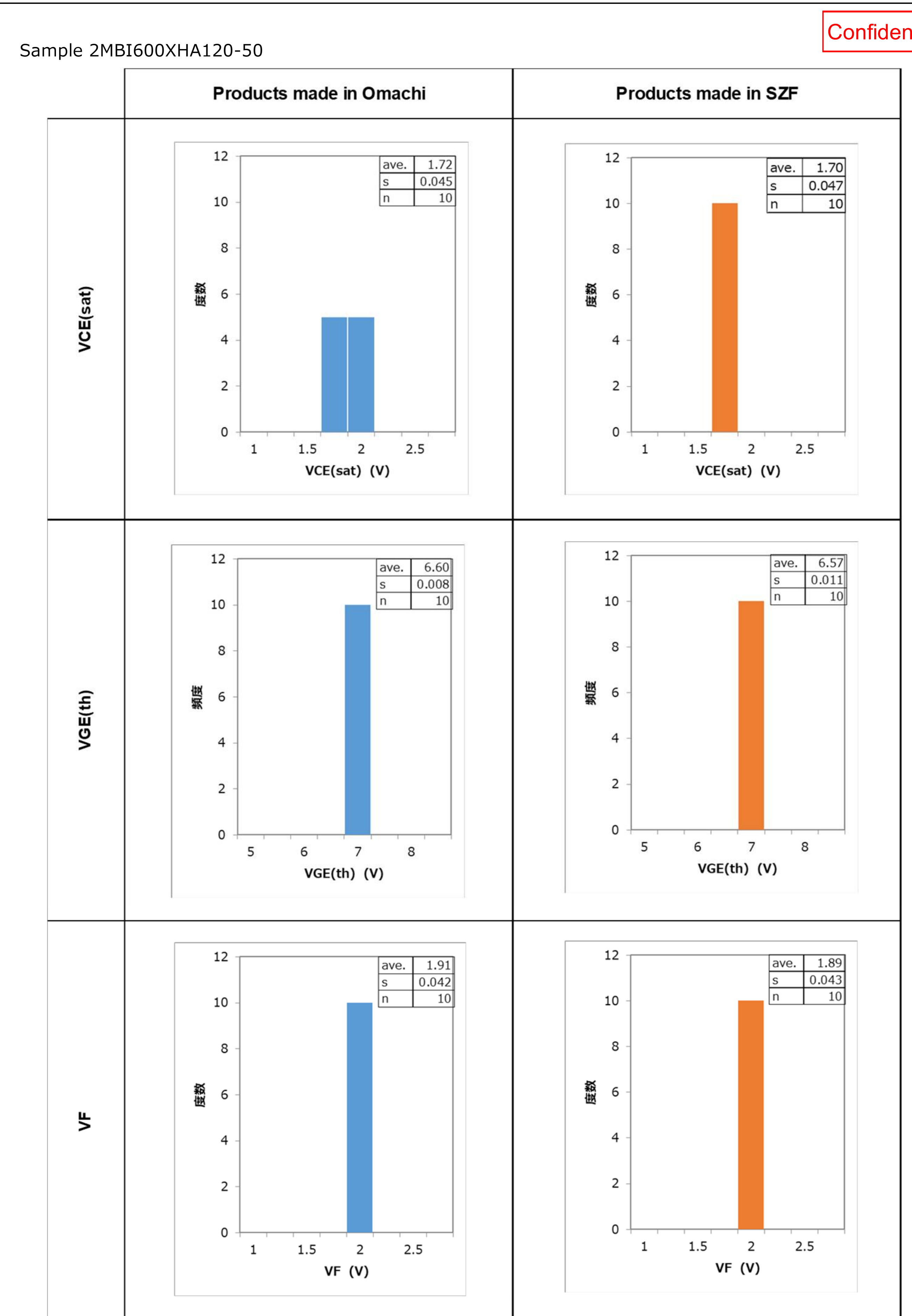
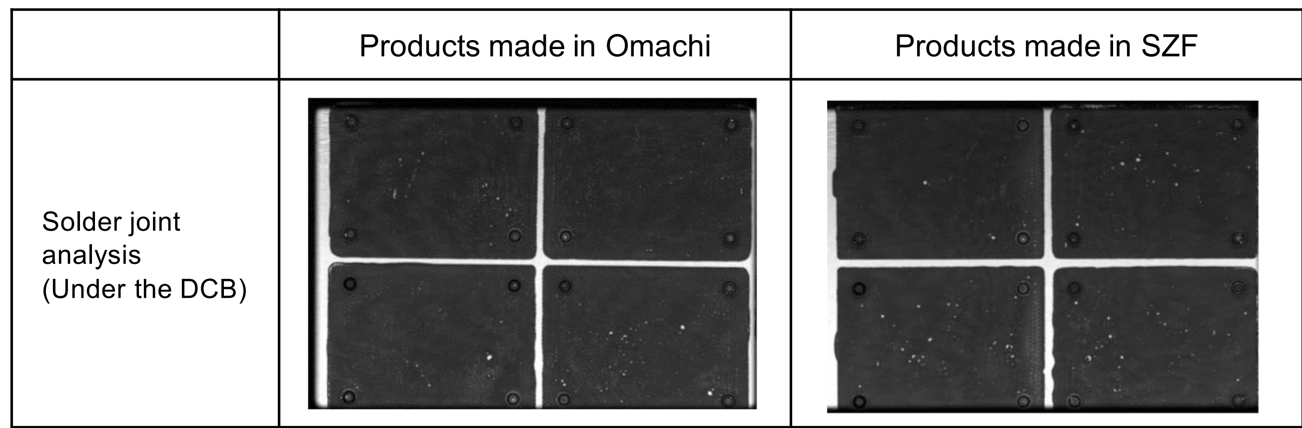
Sample 2MBI600XHA120-50



Fig(1) Comparison results of electrical characteristic

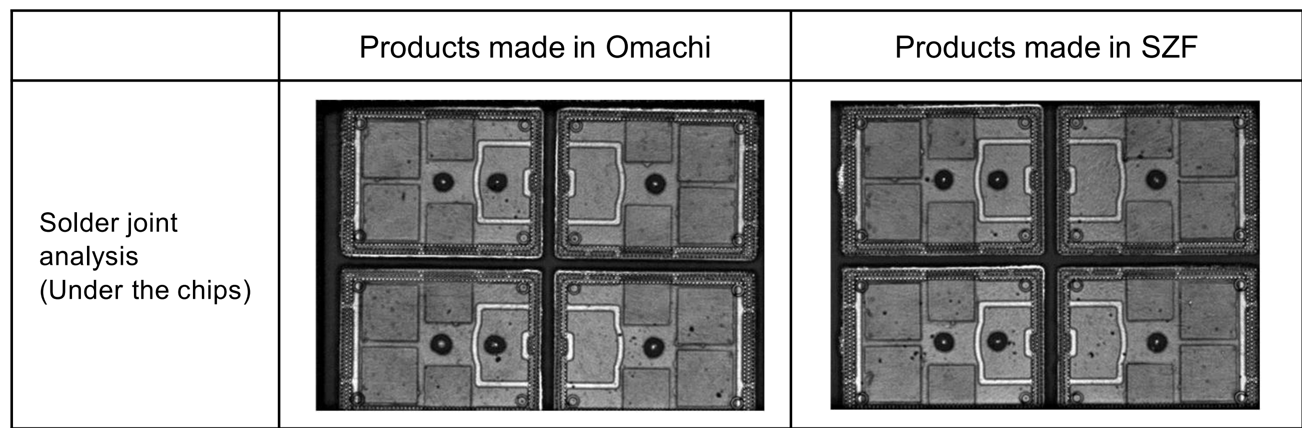
Sample 2MBI600XHA120-50



	Products made in Omachi	Products made in SZF
Solder joint analysis (Under the DCB)		

Photo(2) Comparison results of solder joint analysis(Under the DCB)

Sample 2MBI600XHA120-50



	Products made in Omachi	Products made in SZF
Solder joint analysis (Under the chips)		

Photo(3) Comparison results of solder joint analysis(Under the chips)

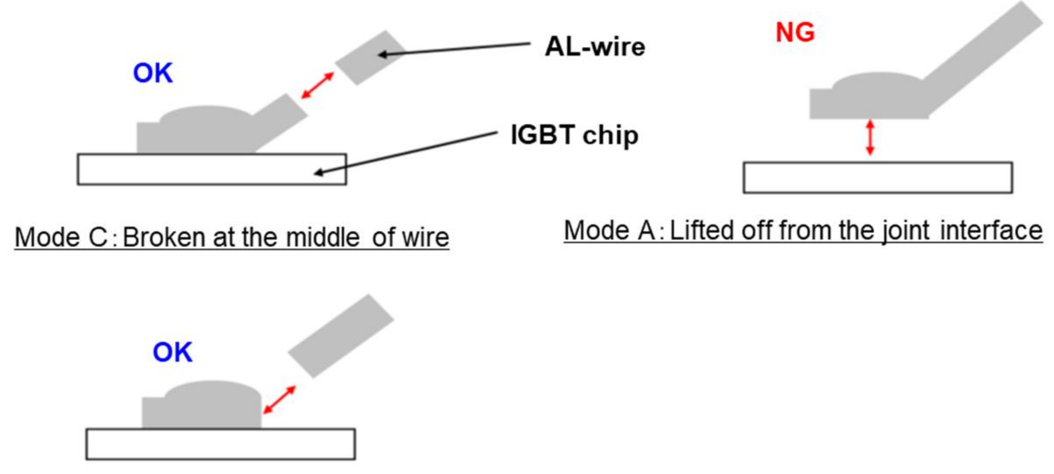
Sample 2MBI600XHA120-50

	Products made in Omachi			Products made in SZF		
Aluminum wire junction form comparison						
Tensile strength (gf)	Sample No	Pulling strength(gf)	Failure mode	Sample No	Pulling strength(gf)	Failure mode
	No1	1034	C	No1	1036	C
	No2	1038	C	No2	1051	C
	No3	1060	C	No3	1032	C
	No4	1059	C	No4	1023	C
	No5	1031	C	No5	1030	C
	No6	1068	C	No6	1049	C
	No7	1063	C	No7	1038	C
	No8	1056	C	No8	1037	C
	No9	1027	C	No9	1021	C
	No10	1028	C	No10	1027	C
	Ave	1046		Ave	1034.4	
	σ	16.2		σ	10.0	

（Target:Pulling strength>=800gf）

Photo(4) Comparison results of AL-wire bonding characteristics

Failure mode



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Table(2) Reliability test results

Test categories		Test items	Test methods and conditions	Reference norms JEITA ED-4701	Test result Number of Sample	Test result Number of failure
Environment tests	1	Temperature Cycle	Test temp. : Low temp. -40 +0/-10 deg.C / High temp. 125 +15/-0 deg.C Dwell time : High ~ Low 70min. 70min. Number of cycles : 100 cycles	Test Method 105A	5	0
	2	Temperature Humidity Bias (IGBT/FWD)	Test temp. : 85+/-2 deg.C Relative humidity : 85+/-5% Bias voltage : VCE = 0.8×VCES Bias method : Applied DC voltage to C-E VGE = 0V Test duration : 1000hrs.	Test Method 102A Condition code C	5	0

Table(3) Failure Criteria

Item	Characteristic		Symbol	Failure criteria Lower limit	Failure criteria Upper limit	Unit	Note
Electrical characteristic	Leakage current		*I* CES	-	USL×2	uA	
	Gate leakage current		±*I* GES	-	USL×2	nA	
	Gate threshold voltage		*V* GE(th)	LSLX0.8	USLX1.2	V	
	Saturation voltage		*V* CE(sat)	-	USLX1.2	V	
	Forward voltage		*V* F	-	USLX1.2	V	
	Thermal resistance	IGBT	Δ*V* CE	-	USLX1.2	mV	
		FWD	Δ*V* F	-	USLX1.2	mV	
	Isolation voltage		*V* iso	Broken insulation		-	
Visual inspection	Visual inspection Peeling Plating and the others		-	The visual sample		-	

LSL : Lower specified limit.

USL : Upper specified limit.

Note : Each parameter measurement read-outs shall be made after stabilizing the components at room ambient for 2 hours minimum, 24 hours maximum after removal from the tests. And in case of the wetting tests, for example, moisture resistance tests, each component shall be made wipe or dry completely before the measurement.