Fuji Electric
Innovating Energy Technology

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To Customers

0. PCN 001-21-FE

Approval of additional factory for IPM production

1. Scope of PCN

Improvement of production capacity and risk avoidance.
Addition Shenzhen Factory in China to current Omachi Factory in Japan.

2. Products to be affected

Product type name : 6MBP30VAA060-50, 6MBP50VAA060-50, 6MBP25VAA120-50
(PKG P629)

3. Description of the products changing and its evaluation results

3-1 Key points

(1) Chemicals & Materials :

The chemicals & materials (except for packing trays) to be used for the IPM assembling in Fuji Electric Shenzhen Factory in China (hereinafter SZF) are purchased with same spec as Fuji Electric Power Semiconductor Omachi Factory(hereinafter Omachi factory).

- Packing tray :
  Adding the second supplier. The specification of characteristics and size are not changed although color of them is slightly changed. Please refer to photo(2) on page 4.

(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) on page 5.

(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) on page 5.

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. One of P629 products for other customers has been produced in SZF, 6MBP30VAA060-50, 6MBP50VAA060-50 and 6MBP25VAA120-50 are on ready for supplying.

REVISIONS

3-3 Qualification test results

(1) Electrical characteristics

As comparison results of VCE(sat) and VF, Ioc, VUV between SZF products and the Omachi products, no obvious difference was conformed. Please refer to fig.(1) on page 6.

(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(4),(5) on page 7.

(3) AL-wire bonding characteristics

As comparison results of AL-wire shape and pull force test, no obvious difference was confirmed shown as photo(6) on page 8.

(4) Reliability test results

The following four reliability tests were selected and implemented as a study result of FMEA analysis.

(a) Environment test: Please refer to table(2) on page 9.
(b) Endurance test : Please refer to table(2) on page 9.

From investigation results of (a),(b), SZF products passed reliability tests.

(c) Vibration test for the box with condition of a=0.59G, f=3 ~ 200Hz, 90min.
(d) Drop test with the condition of 60cm higher position from the ground.

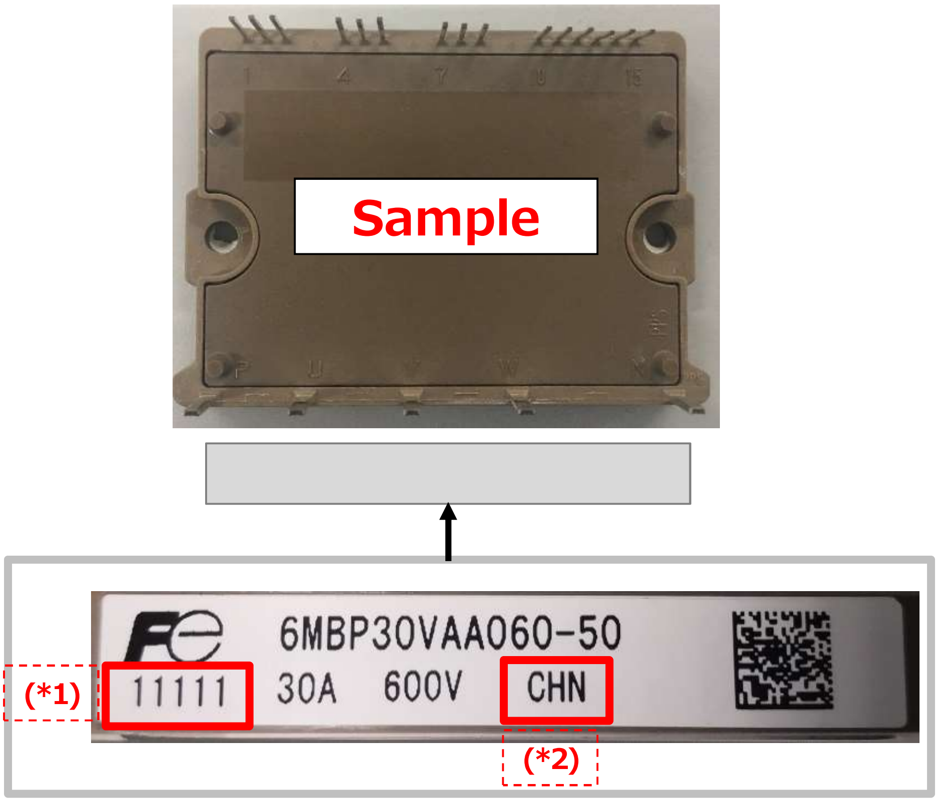
From investigation results of (c),(d), no electrical and physical damage was confirmed. We are confident that the additional packing tray has no negative impact for the quality and reliability.

From these qualification test results of the representative product(6MBP30VAA060-50), it was concluded that SZF target products(6MBP30VAA060-50, 6MBP50VAA060-50, 6MBP25VAA120-50) have same characteristics and reliability with Omachi products.

4. Products changing schedule

We would like to start these changing from March 2021.

Approval				
Document originator	T. Mori	T. Mori	Date	Jan. 27th, 2021
Document check	H. Sakamoto	H. Sakamoto	Date	Jan. 27th, 2021
Document approval	K. Nakada	K. Nakada	Date	Jan. 27th, 2021

	New label (P629)
IPM	

(*1)

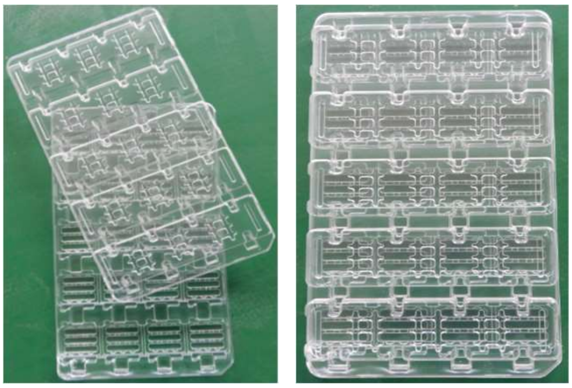
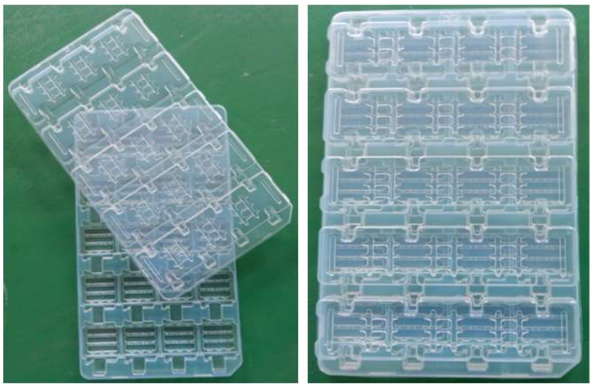
	1st one digit	Next 1 digit	Next 3 digit
Omachi products	Last one digit of product year	Product month	Sequential number
SZF products	Last one digit of product year	Product month	Sequential number

(*2)

Omachi products : JAPAN O
SZF products : CHN

Photo(1) Label description

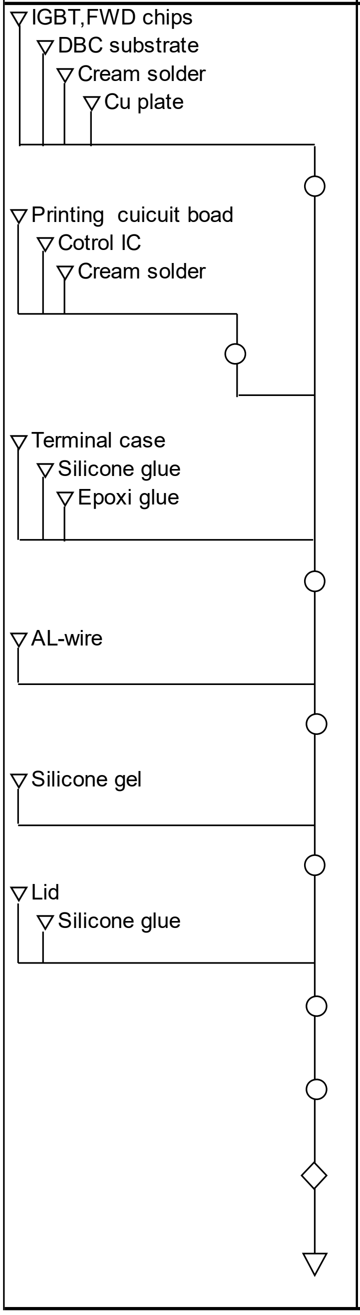
PKG : P629

	Existing	Addition
Tray		
Packing		

- Additional trays have same specification of characteristics and size with existing.
- Color of PCB surface is slightly changed.

Photo(2) Visual inspection result of packing trays

Table(1) Process comparison on between Omachi factory and SZF



Process flow	process name	Process condition & control limit etc	At present facilities
IGBT,FWD chips DBC substrate Cream solder Cu plate	Chip mounting and Soldering	Same as Omachi	Same design as Omachi
Printing cuicuit boad Cotrol IC Cream solder	Chip mounting and Soldering	Same as Omachi	Same design as Omachi
Terminal case Silicone glue Epoxi glue	Case gluing and PC board gluing	Same as Omachi	Same design as Omachi
AL-wire	AL-wire bonding	Same as Omachi	Same design as Omachi
Silicone gel	Silicone gel injection and gel curing	Same as Omachi	Same design as Omachi
Lid Silicone glue	Cover-lid assembly (with glue curing)	Same as Omachi	Same design as Omachi
	Labeling	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

Sample 6MBP30VAA060-50

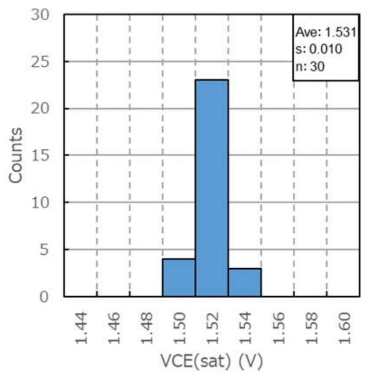
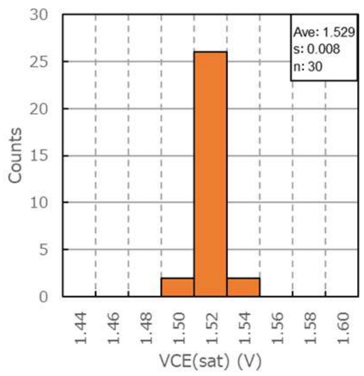
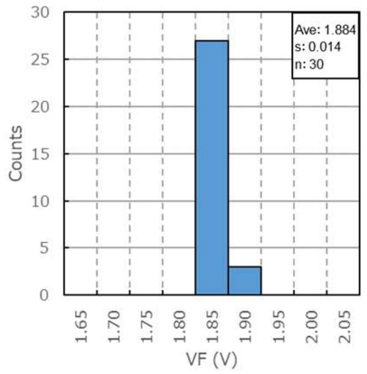
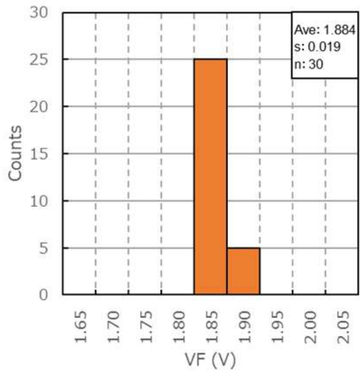
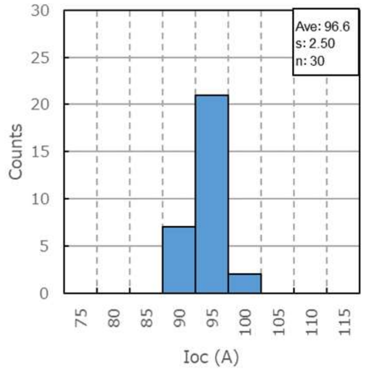
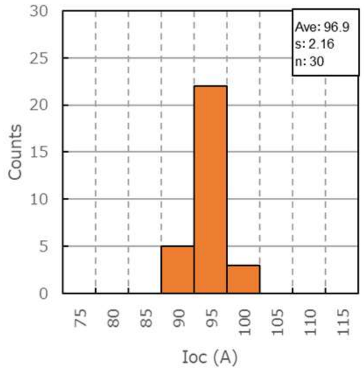
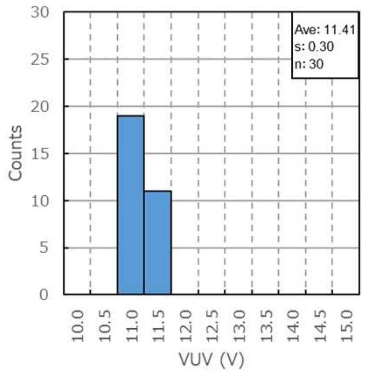
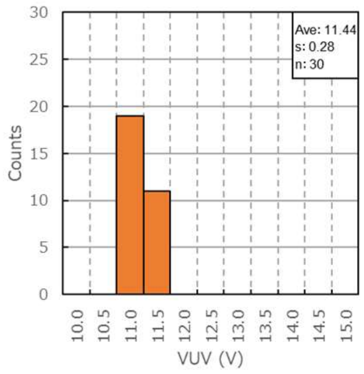
	Products made in Omachi	Products made in SZF
VCE(sat)		
VF		
Ioc		
VUV		

Fig.(1) Comparison results of electrical characteristics

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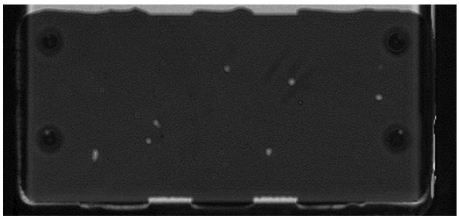
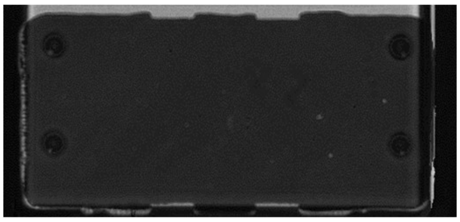
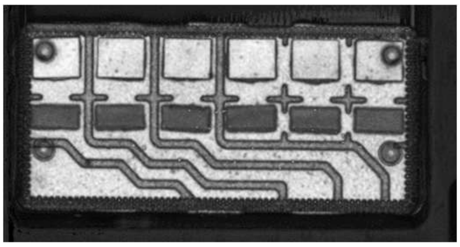
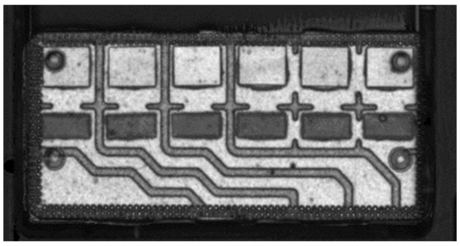
Sample 6MBP30VAA060-50

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

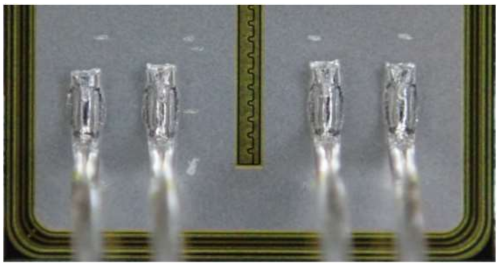
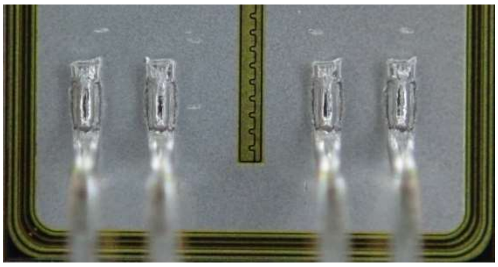
Photo(4) Comparison results of solder joint analysis(Under the DCB)

Sample 6MBP30VAA060-50

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

Photo(5) Comparison results of solder joint analysis(Under the chips)

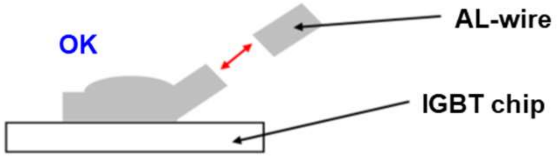
Sample 6MBP30VAA060-50

	Products made in Omachi			**Products made in SZF**		
AL-wire shape						
Pull force test	Sample No	Pull strength(gf)	Failure mode	Sample No	Pull strength(gf)	Failure mode
	No1	430	C	No1	420	C
	No2	430	C	No2	420	C
	No3	430	C	No3	420	C
	No4	420	C	No4	430	C
	No5	440	C	No5	430	C
	No6	430	C	No6	430	C
	No7	420	C	No7	430	C
	No8	430	C	No8	430	C
	No9	440	C	No9	440	C
	No10	430	C	No10	430	C
	Ave	430		Ave	428	
	σ	6.7		σ	6.3	

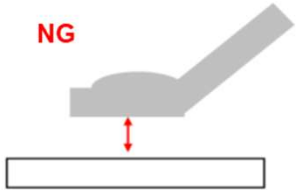
(Target:Pull strength>=300gf)

Photo(6) Comparison results of AL-wire bonding characteristics

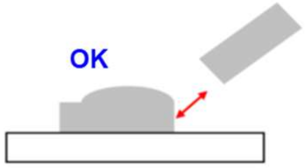
Failure mode



Mode C : Broken at the middle of wire



Mode A : Lifted off from the joint interface



Mode B : Broken at the neck of the bond joint

Table(2) Reliability test results

Test cate-gories	Test items	Test methods and conditions	Reference norms EIAJ ED-4071	Test result (each 5 pcs.)	
				Products made in Omachi	Products made in SZF
Environment tests	Temperature Cycle	Test temp. : Low temp. -40 +/-5 ℃ High temp. 125 +/-5 ℃ RT 5~35 ℃ Dwell time : High ~ RT ~ Low ~ RT 1hrs. 0.5hrs. 1hrs. 0.5hrs. Number of cycles : 100 cycles	Test Method 105	Passed	Passed
Endurance test	High Temperature reverse bias	Test temp. : Ta= 125 +/-5 ℃ (Tj≦ 150℃) Bias Voltage : VC=0.8 x VCES Bias Method : Applied DC voltage to C-E Vcc=15V test duration : 1000 hr.	Test Method 101	Passed	Passed