Fuji Electric
Innovating Energy Technology

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To Customers

0. PCN 022-21-FE

Approval of additional factory for IPM production

1. Purpose of PCN

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

2. Products to be affected

Product type name : 7MBP50VFN060-50, 7MBP75VFN060-50, 7MBP50VFN120-50, 6MBP100VFN060-50 (PKG P636)

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).

- Label:
  The label which in product manufactured by SZF will be different from current label. Please refer to photo(1) on page 3.

- Lid:
  Addition of new supplier (China) for lid. Beside, for improvement of positioning adjustment for process in SZF, one pin shape is changed.
  But, appearance of lid is the same as current supplier. Please refer to photo(2) on page 4.

- 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(3) 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.

3-3 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 P636 products for other customers has been produced in SZF, 7MBP50VFN060-50, 7MBP75VFN060-50 and 7MBP50VFN120-50, 6MBP100VFN060-50 are ready for supplying.

REVISIONS

3-3 Qualification test results

(1) Electrical characteristics
As comparison results of VCE(sat), VF, Ioc, and 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 (7MBP50VFN120-50), it was concluded that SZF target products (7MBP50VFN060-50, 7MBP75VFN060-50, 6MBP100VFN060-50) have same characteristics and reliability with Omachi products.

4. Products changing schedule

We would like to start these changing from August 2021.
Please reply including the necessity of the sample within 30 days after received this PCN. We are going to proceed this PCN without any notice when there is any reply within 30 days after received this PCN.

Approval				
Document originator	T. Uematsu	T. Uematsu	Date	Jul. 30th, 2021
Document check	H. Sakamoto	H. Sakamoto	Date	Jul. 30th, 2021
Document approval	K. Nakada	K. Nakada	Date	Jul. 30th, 2021

Module Quality Assurance Section 2
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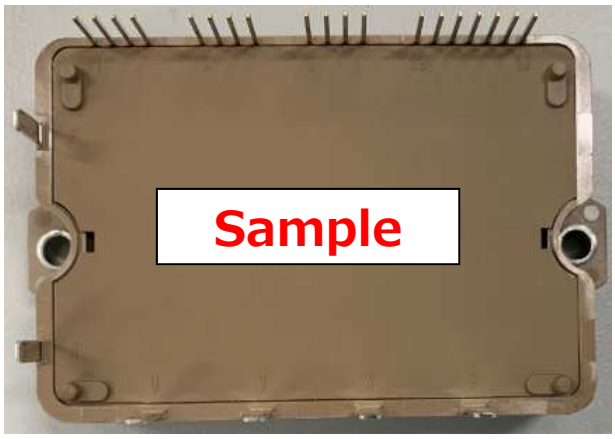
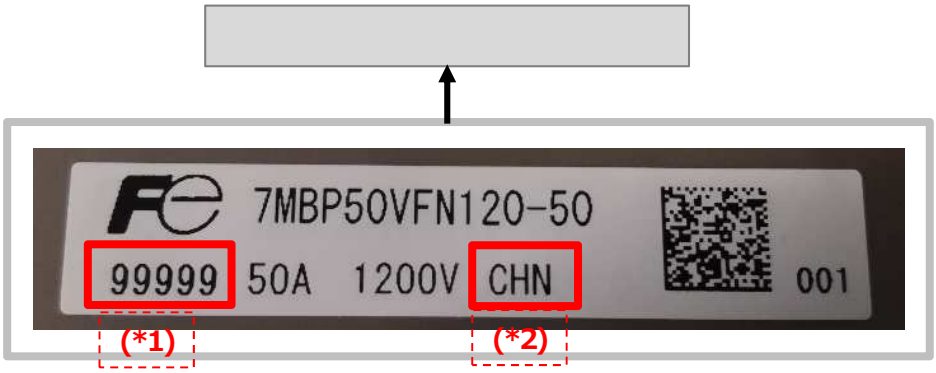
IPM	New label (P636)





(*1)

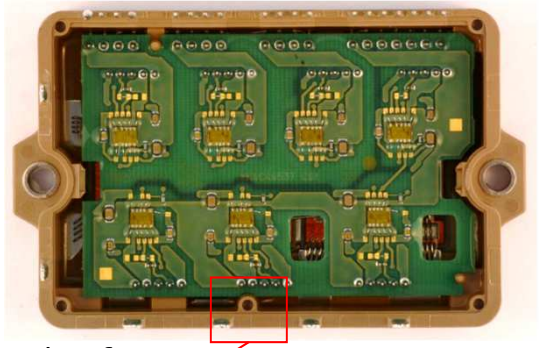
	1st one digit	Next 1 digit	Next 3 digit
Omachi products	Last one digit of product year	Product month	Sequential number
SZF products	Last one digit of product year	Product month	Sequential number

(*2)

Omachi products	: JAPAN O
SZF products	: CHN

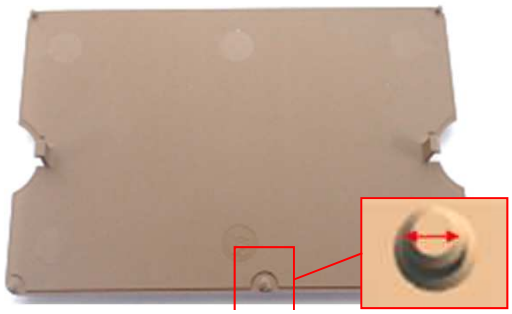
Photo(1) Label description

Inside of P636(No changing)

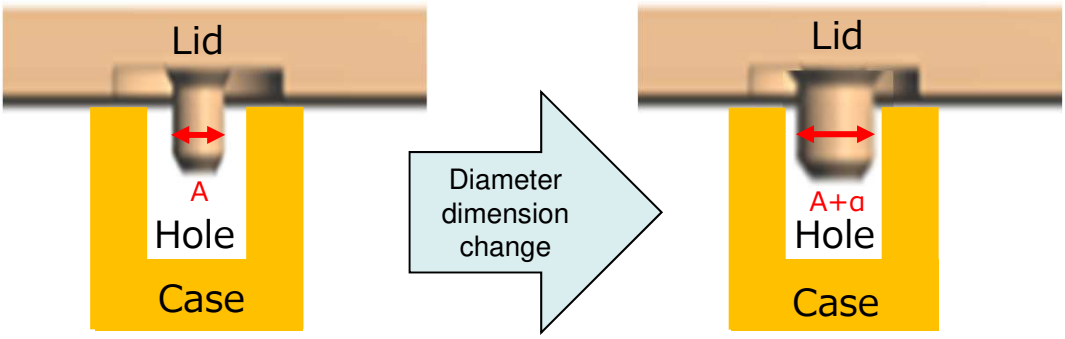


Hole of case

Reverse side of lid

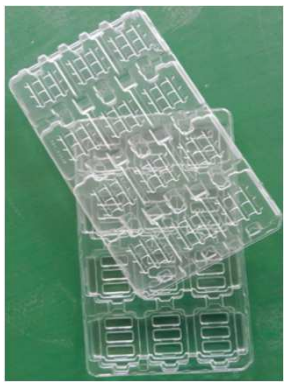


A: Pin diameter dimension change



Photo(2) shape change of lid

PKG : P636

	Existing	Addition
Tray	 	 
Packing		

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

Photo(3) Appearance of packing trays

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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 ▽Solderplate ▽Cu plate			
	Chip mounting and Soldering	Same as Omachi	Same design as Omachi
▽Printing cuicuit boad ▽Control IC			
	Chip mounting and Soldering	Same as Omachi	Same design as Omachi
	AL-wire bonding	Same as Omachi	Same design as Omachi
▽Terminal case ▽Silicone glue			
	Case gluing	Same as Omachi	Same design as Omachi
	AL-wire bonding	Same as Omachi	Same design as Omachi
▽Cream solder			
	PC board gluing	Same as Omachi	Same design as Omachi
▽Silicone gel			
	Silicone gel injection and gel curing	Same as Omachi	Same design as Omachi
▽Lid			
	Cover-lid assembly	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 7MBP50VFN120-50

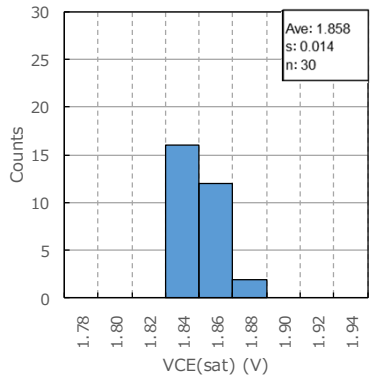
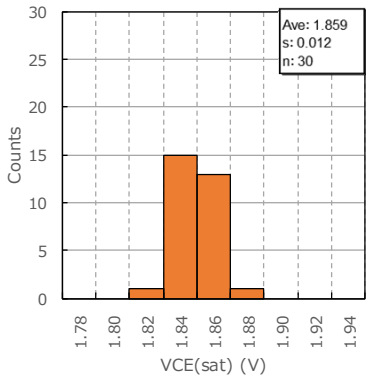
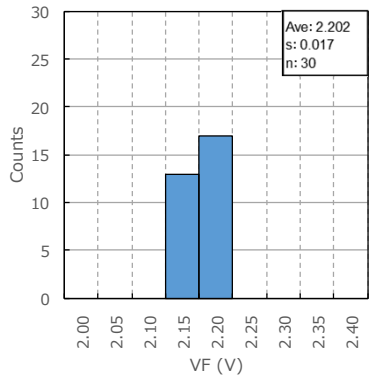
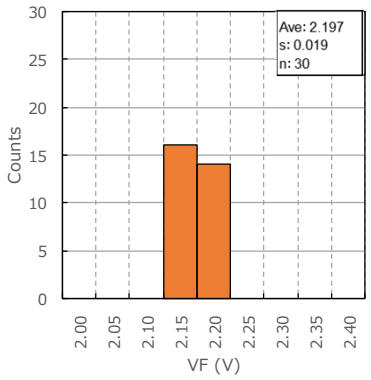
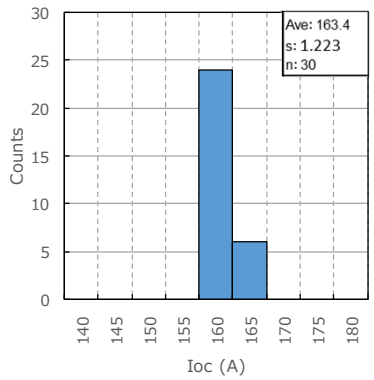
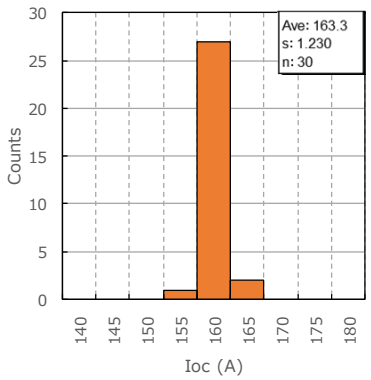
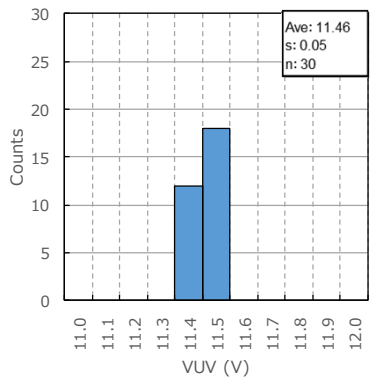
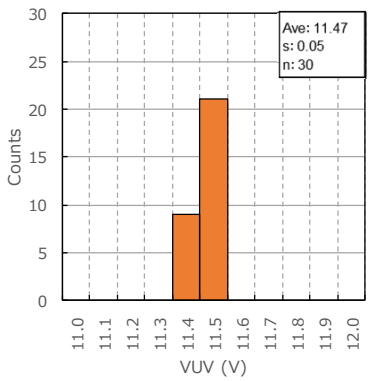
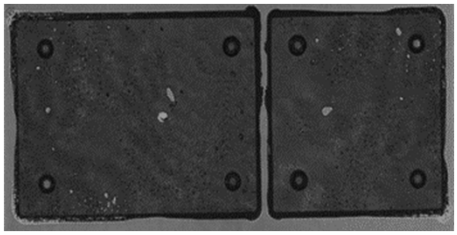
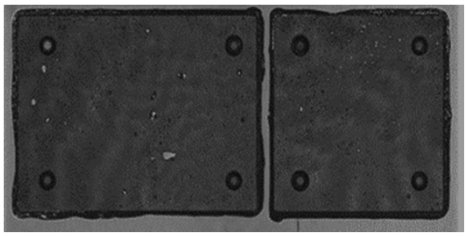
	Products made in Omachi	Products made in SZF
VCE(sat)		
VF		
Ioc		
Vuv		

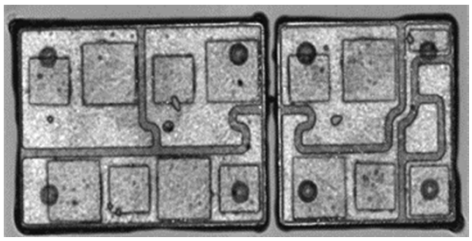
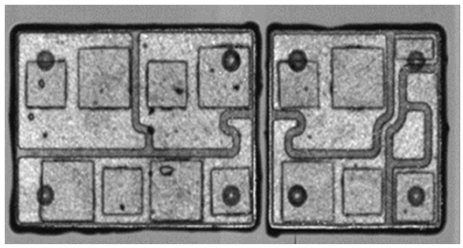
Fig.(1) Comparison results of electrical characteristics

Sample 7MBP50VFN120-50

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

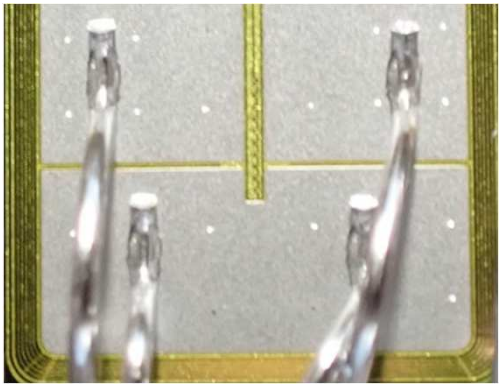
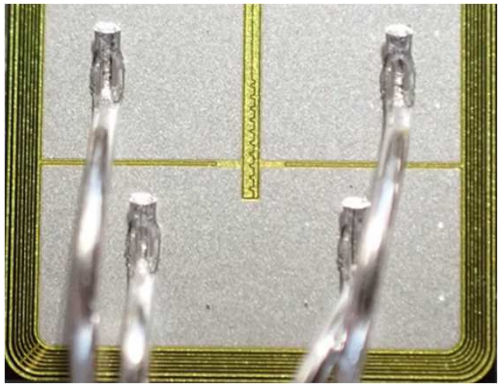
Photo(4) Comparison results of solder joint analysis (Under the DCB)

Sample 7MBP50VFN120-50

	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)

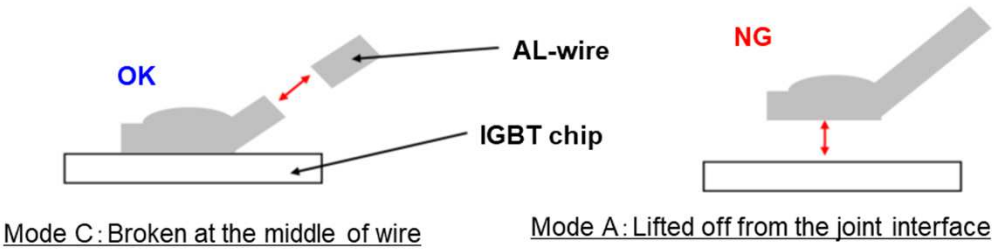
Sample 7MBP50VFN120-50

	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	740	C	No1	700	C
	No2	710	C	No2	710	C
	No3	710	C	No3	700	C
	No4	730	C	No4	720	C
	No5	730	C	No5	720	C
	No6	690	C	No6	740	C
	No7	700	C	No7	720	C
	No8	720	C	No8	710	C
	No9	720	C	No9	700	C
	No10	720	C	No10	710	C
	Ave	717		Ave	713	
	σ	14.9		σ	12.5	

(Target:Pulling strength>=570gf)

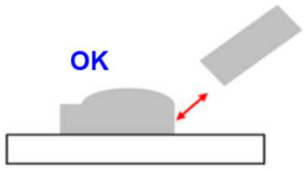
Photo(6) Comparison results of AL-wire bonding characteristics

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

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Table(2) Reliability test results

Test categories	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 test	Temperature Cycle	Test temp. : Low temp. -40 +/-5 ℃ High temp. 125 +/-5 ℃ RT 5~35 ℃ Dwell time : High ~ RT ~ Low ~ RT 1hr 0.5hr 1hr 0.5hr 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 : VCE=0.8 x VCES Bias Method : Applied DC voltage to C-E Vcc=15V Test duration : 1000 hr	Test Method 101	Passed	Passed