Fuji Electric
Innovating Energy Technology

Confidential

0. PCN 002-14-FE Production expansion at SZF factory

1. Scope of PCN Improvement of production capacity and risk avoidance

2. Products to be affected EconoPIM™ , PC-Pack module (M711,M712,M633,M636)
Please refer to attached file in detail.
(Note:EconoPIM™ is registered trademark of Infineon Technologies AG,Germany)

3. Description of the products changing and its evaluation results

1). Key point

(1)Chemicals & Materials :

All of the chemicals & materials to be used for the IGBT module assembling in Fuji Electric Shen-zhen(in China)(hear in after SZF) are purchased with same spec as Fuji Electric Power Semiconductor Omachi Factory(hear in after Omachi factory).

(2) Equipments:

All of the equipments and the test equipments provided for the production & test process in SZF are the same design and performances as compared with Omachi factory.Please refer to page 4.

(3)Process & Conditions:

The process flow of the production is the same as Omachi factory and the same production method under the same process conditions with the control limits are provided as Omachi factory.Please refer to page 4.

2). Intension of the change

In order to respond the customer demand stably. At present Fuji has been setting up the assembling production line in SZF,in terms of the delivery flexibility and also avoiding risks such an earthquake and so on.We already announced to start production for dual pack module in June 2013.
This time, the production for EconoPIM™ , PC-Pack module is ready to start.

3). Qualification test result

(1)Electrical characteristic

As a comparison result of VGE(th) and VCE(sat),VF between SZF products and the Omachi products, no obvious difference was conformed. Please refer to page 5.

(2)Solder joint analysis

The solder joint layer between the DCB substrate and the chips was observed by using scanning acoustic tomography. As a result, no obvious difference was confirmed. Please refer to photo(2),(3) on page 6.

(3)Al bond joint analysis

The Al bond joint layer was observed after sheering off the Al wire. As a result, no obvious difference was confirmed shown as photo(4) on page 7.

(4)Reliability test result

The 7 kinds of reliability test was selected and implemented as a study result of FMEA analysis. As a result, SZF products passed all the reliability test shown on page 8 ~ 16.

From these qualification test result, it was concluded that SZF products has same characteristics and reliability with Omachi products.

4.Products changing schedule

We would like to start this changing from Feb 2014.

In case of no reply was made within 30 days after submitted this PCN to the customer, We would like to deal with this PCN is agreed by the customer.

Confidential

5. Contact persons for PCN

Contact person in FEA	T.Takaku	e-mail	TTakaku@fecoa.fujielectric.com
Tel.	+1-972-733-1700	Fax.	+1-732-457-0042

Contact person in FEE	T.Heinzel	e-mail	theinzel@fujielectric.de
Tel.	+49 69 66 90 29-64	Fax.	+49 69 66 90 29-56

Contact person in FE	M.Kosaka	e-mail	kosaka-motohiro@fujielectric.co.jp
Tel.	+81-263-28-3194	Fax.	+81-263-26-6945

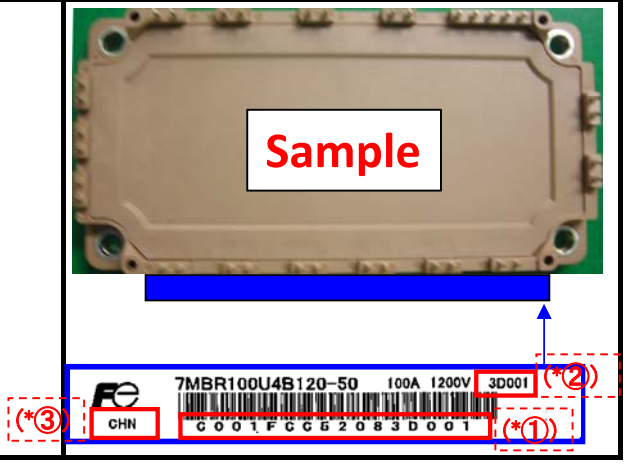
Contact person in FET	F.Kumazawa	e-mail	f.kumazawa@fet.fujielectric.com
Tel.	+886-2-2515-1850	Fax.	+886-2-2515-1860

Approval				
Document originator	H.Hamamoto	H. Hamamoto	**Date**	31th Jan. 2014
Document check	K.Ohshika	K. Ohshika	**Date**	31th Jan. 2014
Document approval	M.Kosaka	M. Kosaka	**Date**	31th Jan. 2014

Quality Assurance Section 2
Quality Assurance Dept.
Electronic Devices Business Headquarters
Fuji Electric Co.,Ltd

4-18-1 Tsukama Omachi Nagano Japan

Confidential

	New label
EconoPIM™, PC-Pack	

*1)

	1st digit	Next 3 digit	Next one digit	Next 6 digit	Next 5 digit
Omachi products	O	Serial number	F	Production code(*4)	Production lot
SZF products	C	Serial number	F	Production code(*4)	Production lot

*2)

	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

*3)

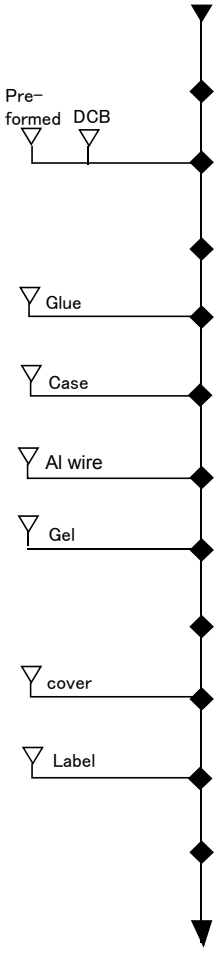
Omachi products : JAPAN O
SZF products : CHN

*4) Each production site has individual different number of production coc

Photo(1) Label description

Confidential

Table(1) Process copmarison between Omachi factory and SZF

Process flow	process name	Process condition & control limit etc	At present facilities
	Dicing	Same as Omachi Fuji	Purchased from same supplier with same design
	Transfer to the tray or reel	Same as Omachi Fuji	Purchased from same supplier with same design
	Chips,preformed solder mounting	Same as Omachi Fuji	Purchased from same supplier with same design
	H2 vacuum soldering	Same as Omachi Fuji	Purchased from same supplier with same design
	Glue dispensing	Same as Omachi Fuji	Purchased from same supplier with same design
	Case mount	Same as Omachi Fuji	Purchased from same supplier with same design
	Al wire bonding	Same as Omachi Fuji	Purchased from same supplier with same design
	Gel injection	Same as Omachi Fuji	Purchased from same supplier with same design
	Gel curing	Same as Omachi Fuji	Purchased from same supplier with same design
	Covering	Same as Omachi Fuji	Purchased from same supplier with same design
	Labeling	Same as Omachi Fuji	Purchased from same supplier with same design
	Outgoing test, Visual inspection	Same as Omachi Fuji	Purchased from same supplier with same design
	Packing, Shipment	Same as Omachi Fuji	Purchased from same supplier with same design

Module type name :7MBR100U4B120-50

Confidential

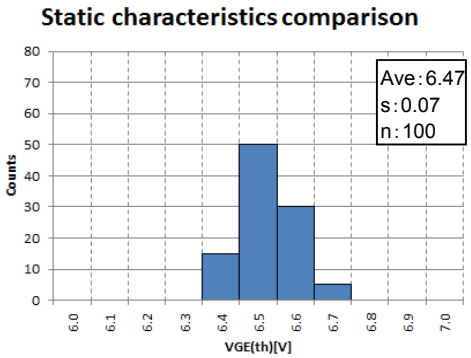
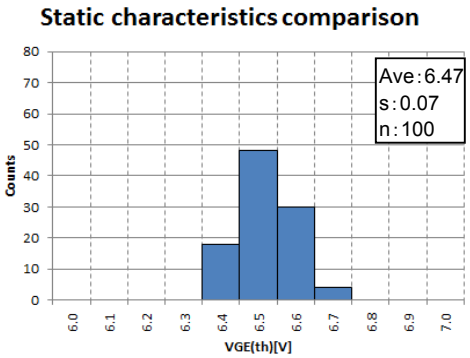
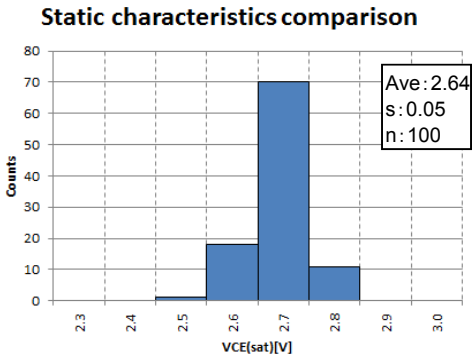
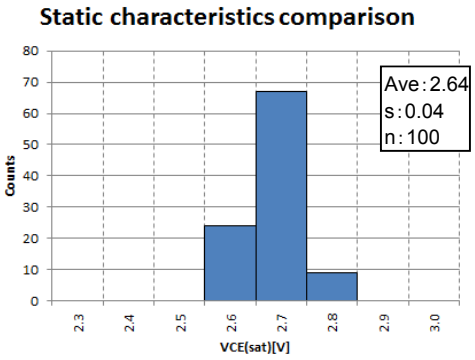
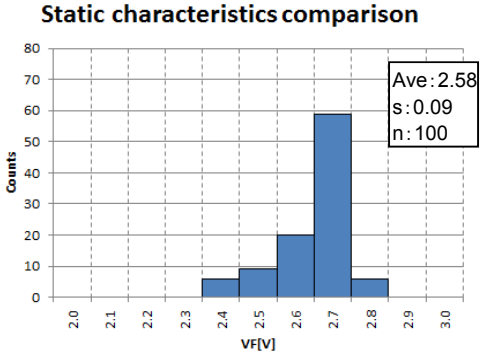
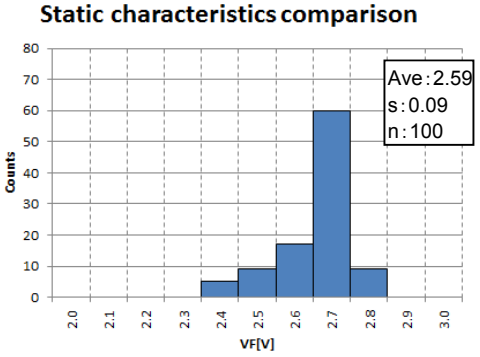
	Products made in Omachi	Products made in SZF
VGE(th)		
VCE(sat)		
VF		

Fig.(1) Comparison results of electrical characteristic

Confidential

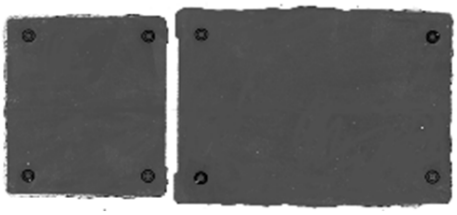
	Products made in Omachi	Products made in SZF
Solder joint analysis (Under the DCB)		

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

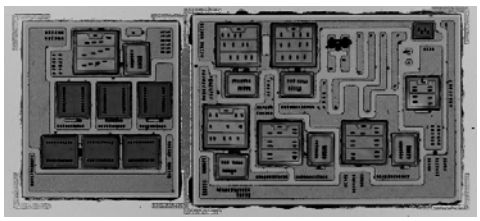
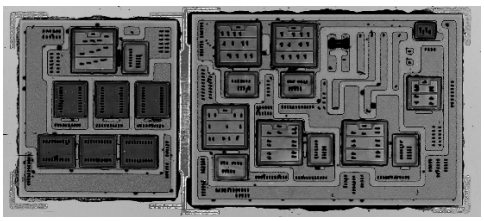
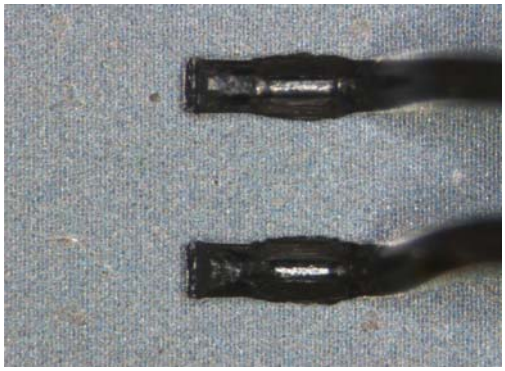
	Products made in Omachi	Products made in SZF
Solder joint analysis (Under the chip)		

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

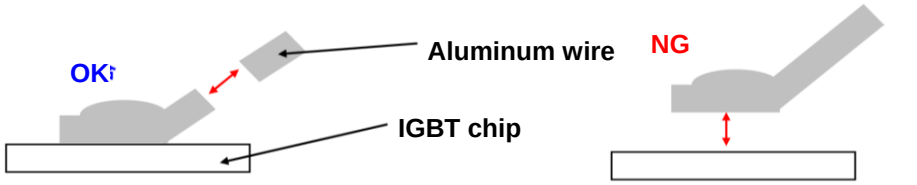
Confidential

	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	690	C	No1	710	C
	No2	710	C	No2	700	C
	No3	690	C	No3	700	C
	No4	710	C	No4	720	C
	No5	710	C	No5	700	C
	No6	700	C	No6	700	C
	No7	710	C	No7	680	C
	No8	690	C	No8	710	C
	No9	700	C	No9	700	C
	No10	700	C	No10	690	C
	Ave	701		Ave	701	
	σ	8.8		σ	11.0	

(Target:Pulling strength>=550gf)

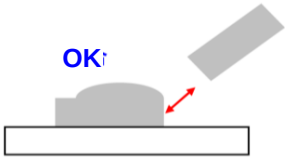
Photo.(4) Comparison results of withstand capability against the pulling force

Tensile strength and 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 result

Confidential

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 tests	1	High Temperature Storage	Storage temp. : 125+/-5 deg.C Test duration : 1000hrs.	Test Method 201	Passed	Passed
	2	Low Temperature Storage	Storage temp. : -40+/-5 deg.C Test duration : 1000hrs.	Test Method 202	Passed	Passed
	3	Temperature Humidity storage	Storage temp. : 85+/-2 deg.C Relative humidity : 85+/-5% RH Test duration : 1000hrs.	Test Method 103 Test Code C	Passed	Passed
	4	Unsaturated Pressurized vapor	Test temp. : 120 +/-2 deg.C Relative humidity : 85 +/- 5% Test duration : 96hrs.	Test Method 103 Test Code E	Passed	Passed
	5	Temperature Cycle	Test temp. : Low temp. -40 +/-5 deg.C High temp. 125 +/-5 deg.C RT 5~35 deg.C Dwell time : High ~ RT ~ Low ~ RT 1hrs. 0.5hrs. 1hrs. 0.5hrs. Number of cycles : 100 cycles	Test Method 105	Passed	Passed
	6	Thermal Shock	Test temp. : High temp. 100 +0 -5 deg.C Low temp. 0 +5 -0 deg.C Used liquid : Water with ice and boiling water Dipping time : 5 min. for each temp. Transfer time : 10 sec. Number of cycles : 10 cycles	Test Method 307 Method 1 Condition code A	Passed	Passed
Endurance test	7	Intermitted Operating Life (power cycle) (for IGBT)	On time : 2sec OFF time : 18sec Test temp. : ΔTj=100+/-5 deg.C Tj<=150 deg.C,Ta=25+/-5 deg.C Number of cycles : 15,000cycle	Test Method 106	Passed	Passed

Table.(3) Failure Criteria

Confidential

Item	Characteristic		Symbol	Failure criteria		Unit	Note
				Lower limit	Upper limit		
Electrical characteristic	Gate threshold voltag		VGE(th)	LSLX0.8	USLX1.2	V	
	Saturation voltage		VCE(sat)	-	USLX1.2	V	
	Forward voltage		VF	-	USLX1.2	V	
	Thermal resistance	IGBT	dVCE	-	USLX1.2	mV	
		FWD	dVF	-	USLX1.2	mV	
	Isolation voltage		Viso	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.

VGE(th)
Ic=100mA,VCE=20V

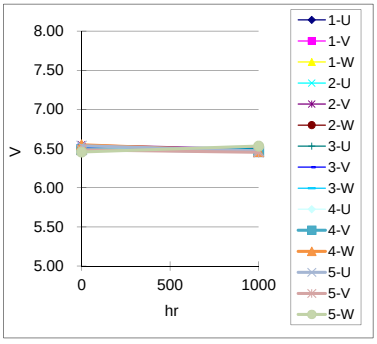
	0	1000
1-U	6.54	6.47
1-V	6.52	6.52
1-W	6.55	6.49
2-U	6.52	6.49
2-V	6.55	6.50
2-W	6.52	6.50
3-U	6.52	6.50
3-V	6.51	6.49
3-W	6.52	6.49
4-U	6.49	6.53
4-V	6.49	6.46
4-W	6.55	6.46
5-U	6.54	6.47
5-V	6.48	6.45
5-W	6.46	6.53

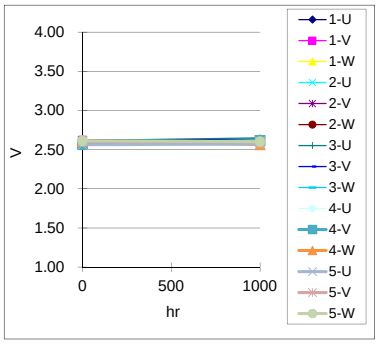
VCE(sat)
Ic=100A,VGE=15V

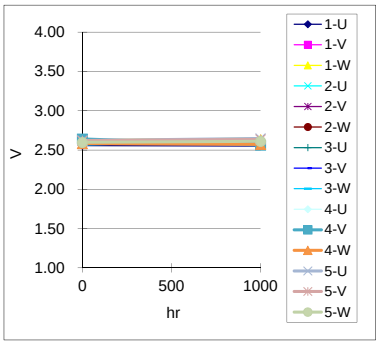
	0	1000
1-U	2.58	2.63
1-V	2.63	2.62
1-W	2.58	2.64
2-U	2.58	2.57
2-V	2.62	2.59
2-W	2.62	2.63
3-U	2.62	2.65
3-V	2.60	2.63
3-W	2.61	2.60
4-U	2.58	2.58
4-V	2.56	2.62
4-W	2.61	2.56
5-U	2.56	2.57
5-V	2.60	2.60
5-W	2.61	2.60

VF
IF=100A

	0	1000
1-U	2.56	2.55
1-V	2.60	2.57
1-W	2.63	2.65
2-U	2.62	2.61
2-V	2.57	2.64
2-W	2.62	2.59
3-U	2.59	2.58
3-V	2.62	2.61
3-W	2.56	2.62
4-U	2.61	2.57
4-V	2.64	2.56
4-W	2.58	2.57
5-U	2.62	2.65
5-V	2.62	2.63
5-W	2.60	2.61







Sample 7MBR100U4B120-50

Fig.(2) Static characteristic data in the high temperature storage test(Omachi)

VGE(th)
Ic=100mA,VCE=20V

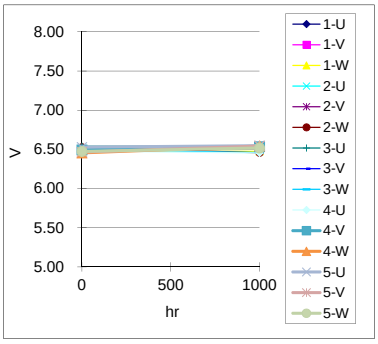
	0	1000
1-U	6.48	6.47
1-V	6.49	6.53
1-W	6.48	6.47
2-U	6.50	6.55
2-V	6.50	6.52
2-W	6.53	6.46
3-U	6.54	6.54
3-V	6.49	6.52
3-W	6.50	6.46
4-U	6.48	6.45
4-V	6.49	6.53
4-W	6.45	6.54
5-U	6.53	6.55
5-V	6.46	6.54
5-W	6.47	6.52

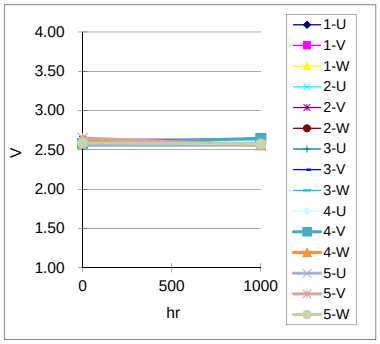
VCE(sat)
Ic=100A,VGE=15V

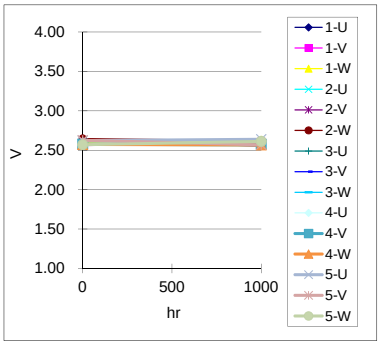
	0	1000
1-U	2.60	2.64
1-V	2.59	2.60
1-W	2.63	2.58
2-U	2.58	2.56
2-V	2.63	2.64
2-W	2.58	2.65
3-U	2.56	2.64
3-V	2.56	2.64
3-W	2.60	2.62
4-U	2.63	2.61
4-V	2.58	2.64
4-W	2.63	2.56
5-U	2.55	2.56
5-V	2.65	2.56
5-W	2.59	2.57

VF
IF=100A

	0	1000
1-U	2.57	2.61
1-V	2.56	2.61
1-W	2.60	2.63
2-U	2.63	2.58
2-V	2.62	2.55
2-W	2.65	2.62
3-U	2.62	2.63
3-V	2.57	2.61
3-W	2.56	2.56
4-U	2.61	2.60
4-V	2.58	2.58
4-W	2.57	2.56
5-U	2.62	2.64
5-V	2.63	2.57
5-W	2.57	2.61







Sample 7MBR100U4B120-50

Fig.(3) Static characteristic data in the high temperature storage test(SZF)

VGE(th)
Ic=100mA,VCE=20V

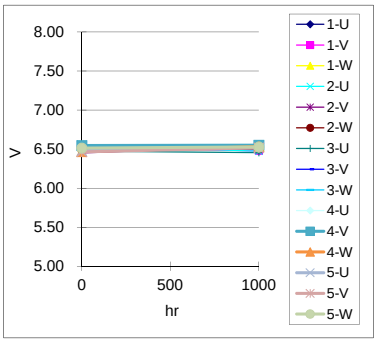
	0	1000
1-U	6.49	6.50
1-V	6.54	6.48
1-W	6.51	6.53
2-U	6.55	6.47
2-V	6.45	6.53
2-W	6.47	6.50
3-U	6.47	6.45
3-V	6.49	6.53
3-W	6.53	6.52
4-U	6.54	6.53
4-V	6.55	6.55
4-W	6.47	6.53
5-U	6.48	6.51
5-V	6.46	6.52
5-W	6.51	6.53

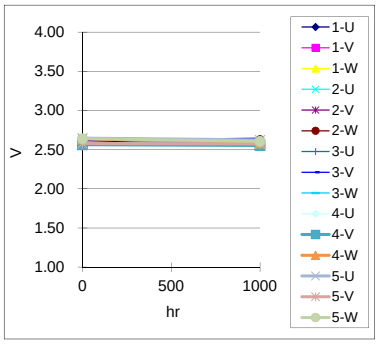
VCE(sat)
Ic=100A,VGE=15V

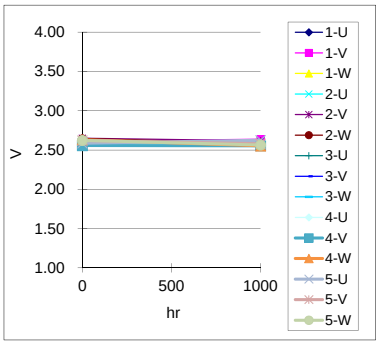
	0	1000
1-U	2.62	2.56
1-V	2.63	2.56
1-W	2.59	2.58
2-U	2.65	2.56
2-V	2.64	2.60
2-W	2.56	2.63
3-U	2.59	2.55
3-V	2.62	2.64
3-W	2.58	2.61
4-U	2.58	2.56
4-V	2.56	2.55
4-W	2.64	2.59
5-U	2.64	2.62
5-V	2.58	2.57
5-W	2.64	2.60

VF
IF=100A

	0	1000
1-U	2.55	2.63
1-V	2.61	2.64
1-W	2.60	2.57
2-U	2.56	2.62
2-V	2.65	2.62
2-W	2.65	2.58
3-U	2.60	2.59
3-V	2.57	2.56
3-W	2.61	2.59
4-U	2.56	2.59
4-V	2.56	2.55
4-W	2.63	2.55
5-U	2.58	2.62
5-V	2.62	2.58
5-W	2.62	2.56







Sample 7MBR100U4B120-50

Fig.(4) Static characteristic data in the low temperature storage test(Omachi)

VGE(th)
Ic=100mA,VCE=20V

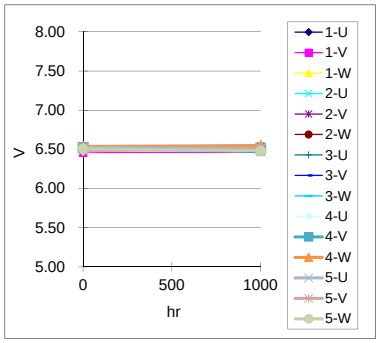
	0	1000
1-U	6.52	6.53
1-V	6.46	6.46
1-W	6.55	6.48
2-U	6.51	6.46
2-V	6.49	6.54
2-W	6.52	6.53
3-U	6.54	6.46
3-V	6.54	6.50
3-W	6.51	6.53
4-U	6.47	6.51
4-V	6.53	6.51
4-W	6.54	6.55
5-U	6.52	6.52
5-V	6.48	6.51
5-W	6.51	6.48

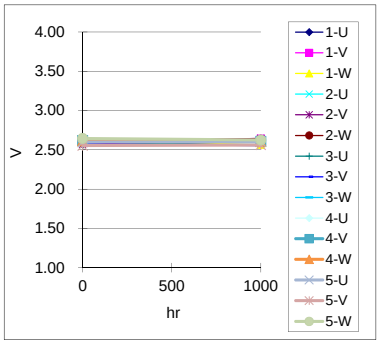
VCE(sat)
Ic=100A,VGE=15V

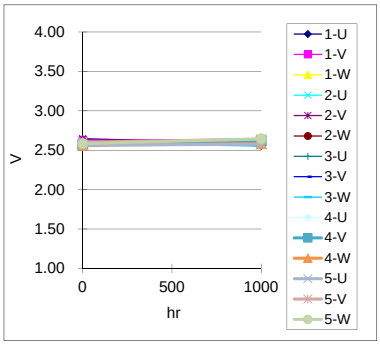
	0	1000
1-U	2.57	2.60
1-V	2.63	2.64
1-W	2.64	2.56
2-U	2.59	2.61
2-V	2.57	2.65
2-W	2.63	2.64
3-U	2.56	2.61
3-V	2.57	2.55
3-W	2.62	2.60
4-U	2.62	2.58
4-V	2.62	2.61
4-W	2.61	2.60
5-U	2.60	2.60
5-V	2.55	2.56
5-W	2.64	2.62

VF
IF=100A

	0	1000
1-U	2.63	2.56
1-V	2.63	2.64
1-W	2.57	2.59
2-U	2.62	2.57
2-V	2.65	2.58
2-W	2.59	2.61
3-U	2.58	2.60
3-V	2.55	2.60
3-W	2.59	2.55
4-U	2.59	2.65
4-V	2.57	2.62
4-W	2.56	2.58
5-U	2.57	2.57
5-V	2.60	2.64
5-W	2.58	2.64







Sample 7MBR100U4B120-50

図.(5) Static characteristic data in the low temperature storage test(SZF)

Confidential

VGE(th)
Ic=100mA,VCE=20V

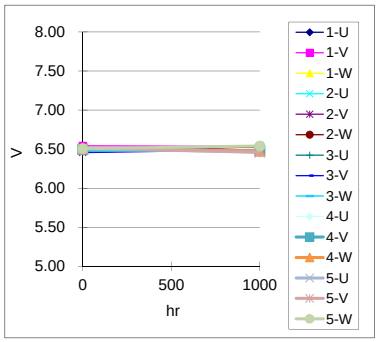
	0	1000
1-U	6.48	6.49
1-V	6.54	6.53
1-W	6.51	6.48
2-U	6.48	6.55
2-V	6.46	6.53
2-W	6.49	6.53
3-U	6.48	6.54
3-V	6.46	6.49
3-W	6.47	6.48
4-U	6.51	6.49
4-V	6.49	6.48
4-W	6.51	6.48
5-U	6.50	6.46
5-V	6.51	6.46
5-W	6.50	6.54

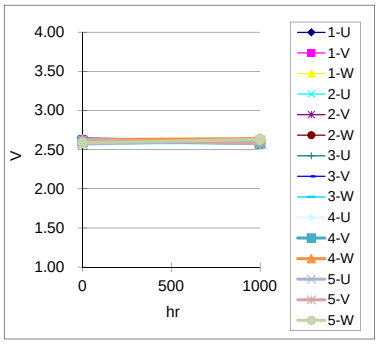
VCE(sat)
Ic=100A,VGE=15V

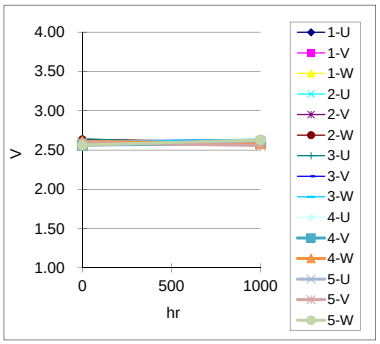
	0	1000
1-U	2.65	2.61
1-V	2.63	2.61
1-W	2.63	2.61
2-U	2.57	2.63
2-V	2.64	2.61
2-W	2.58	2.65
3-U	2.57	2.60
3-V	2.58	2.58
3-W	2.64	2.58
4-U	2.57	2.56
4-V	2.61	2.58
4-W	2.63	2.64
5-U	2.57	2.61
5-V	2.63	2.58
5-W	2.59	2.63

VF
IF=100A

	0	1000
1-U	2.59	2.56
1-V	2.56	2.61
1-W	2.60	2.58
2-U	2.60	2.61
2-V	2.59	2.60
2-W	2.64	2.60
3-U	2.64	2.57
3-V	2.61	2.63
3-W	2.61	2.64
4-U	2.62	2.60
4-V	2.56	2.58
4-W	2.61	2.58
5-U	2.56	2.62
5-V	2.59	2.56
5-W	2.56	2.63







Sample 7MBR100U4B120-50

Fig.(6) Static characteristic data in the high temperature humidity storage test(Omachi)

VGE(th)
Ic=100mA,VCE=20V

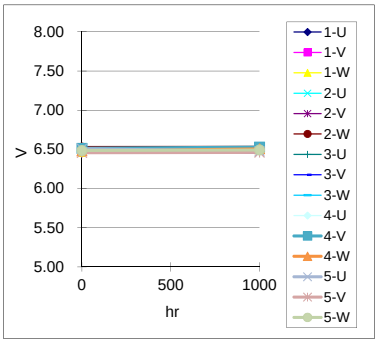
	0	1000
1-U	6.52	6.49
1-V	6.49	6.53
1-W	6.45	6.51
2-U	6.49	6.48
2-V	6.50	6.52
2-W	6.54	6.54
3-U	6.52	6.47
3-V	6.52	6.45
3-W	6.46	6.46
4-U	6.51	6.52
4-V	6.51	6.53
4-W	6.48	6.51
5-U	6.51	6.47
5-V	6.46	6.46
5-W	6.48	6.49

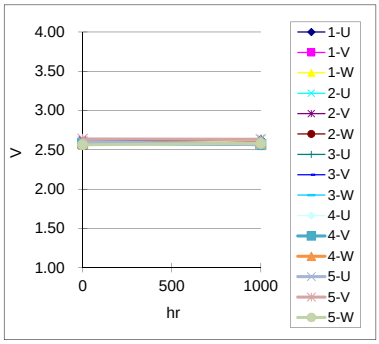
VCE(sat)
Ic=100A,VGE=15V

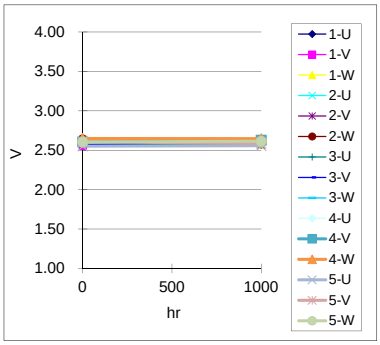
	0	1000
1-U	2.61	2.64
1-V	2.61	2.56
1-W	2.60	2.62
2-U	2.64	2.64
2-V	2.63	2.60
2-W	2.60	2.58
3-U	2.59	2.59
3-V	2.58	2.57
3-W	2.63	2.63
4-U	2.57	2.62
4-V	2.58	2.56
4-W	2.58	2.58
5-U	2.60	2.56
5-V	2.64	2.63
5-W	2.56	2.58

VF
IF=100A

	0	1000
1-U	2.55	2.63
1-V	2.55	2.60
1-W	2.63	2.57
2-U	2.60	2.57
2-V	2.64	2.56
2-W	2.65	2.63
3-U	2.57	2.57
3-V	2.57	2.60
3-W	2.60	2.59
4-U	2.60	2.65
4-V	2.60	2.63
4-W	2.65	2.65
5-U	2.55	2.56
5-V	2.61	2.58
5-W	2.60	2.61







Sample 7MBR100U4B120-50

Fig.(7) Static characteristic data in the high temperature humidity storage test(SZF)

Confidential

VGE(th)
Ic=100mA,VCE=20V

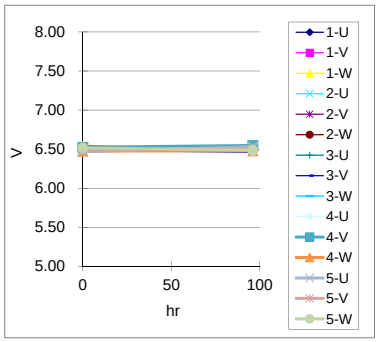
	0	96
1-U	6.50	6.50
1-V	6.51	6.54
1-W	6.55	6.48
2-U	6.46	6.51
2-V	6.54	6.50
2-W	6.46	6.53
3-U	6.54	6.47
3-V	6.49	6.46
3-W	6.53	6.51
4-U	6.53	6.48
4-V	6.52	6.54
4-W	6.47	6.48
5-U	6.47	6.53
5-V	6.48	6.51
5-W	6.51	6.49

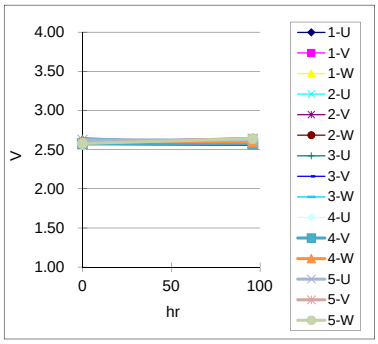
VCE(sat)
Ic=100A,VGE=15V

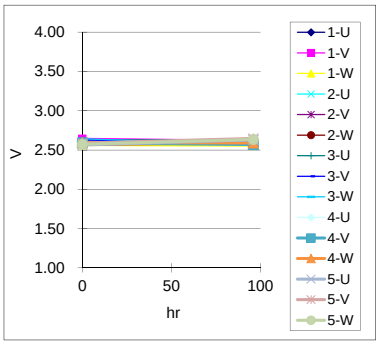
	0	96
1-U	2.62	2.56
1-V	2.59	2.63
1-W	2.55	2.64
2-U	2.60	2.57
2-V	2.60	2.65
2-W	2.58	2.59
3-U	2.65	2.57
3-V	2.57	2.55
3-W	2.63	2.60
4-U	2.59	2.62
4-V	2.58	2.57
4-W	2.60	2.60
5-U	2.62	2.62
5-V	2.58	2.64
5-W	2.58	2.64

VF
IF=100A

	0	96
1-U	2.56	2.57
1-V	2.65	2.62
1-W	2.56	2.55
2-U	2.59	2.57
2-V	2.56	2.58
2-W	2.56	2.64
3-U	2.62	2.64
3-V	2.63	2.60
3-W	2.64	2.56
4-U	2.57	2.64
4-V	2.59	2.57
4-W	2.59	2.59
5-U	2.56	2.63
5-V	2.59	2.65
5-W	2.57	2.63







Sample 7MBR100U4B120-50

Fig.(8) Static characteristic data in the Unsaturated pressurized vapor test(Omachi)

VGE(th)
Ic=100mA,VCE=20V

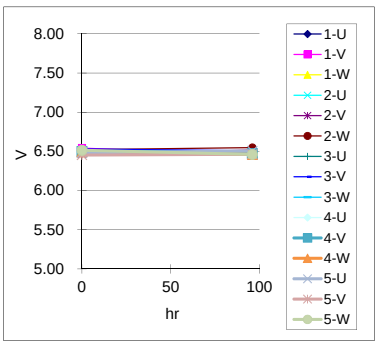
	0	96
1-U	6.50	6.48
1-V	6.54	6.46
1-W	6.48	6.50
2-U	6.52	6.50
2-V	6.46	6.52
2-W	6.52	6.55
3-U	6.50	6.48
3-V	6.53	6.51
3-W	6.48	6.49
4-U	6.51	6.48
4-V	6.50	6.47
4-W	6.49	6.46
5-U	6.48	6.51
5-V	6.45	6.46
5-W	6.51	6.46

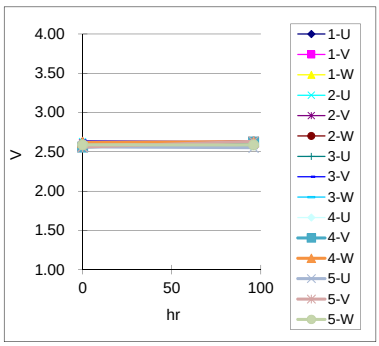
VCE(sat)
Ic=100A,VGE=15V

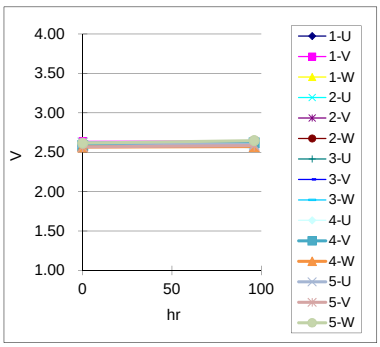
	0	96
1-U	2.63	2.57
1-V	2.59	2.58
1-W	2.56	2.60
2-U	2.63	2.58
2-V	2.61	2.64
2-W	2.58	2.64
3-U	2.60	2.63
3-V	2.64	2.63
3-W	2.61	2.58
4-U	2.60	2.61
4-V	2.56	2.62
4-W	2.62	2.63
5-U	2.56	2.55
5-V	2.56	2.63
5-W	2.59	2.59

VF
IF=100A

	0	96
1-U	2.63	2.63
1-V	2.64	2.64
1-W	2.57	2.64
2-U	2.61	2.56
2-V	2.60	2.60
2-W	2.62	2.57
3-U	2.57	2.64
3-V	2.60	2.58
3-W	2.63	2.61
4-U	2.58	2.64
4-V	2.58	2.62
4-W	2.57	2.57
5-U	2.62	2.60
5-V	2.57	2.58
5-W	2.61	2.65







Sample 7MBR100U4B120-50

Fig.(9) Static characteristic data in the Unsaturated pressurized vapor test(SZF)

VGE(th)
Ic=100mA,VCE=20V

	0	100
1-U	6.51	6.45
1-V	6.54	6.48
1-W	6.48	6.51
1-X	6.52	6.52
1-Y	6.53	6.51
1-Z	6.48	6.55
2-U	6.46	6.45
2-V	6.52	6.48
2-W	6.52	6.45
2-X	6.54	6.52
2-Y	6.48	6.52
2-Z	6.47	6.52
3-U	6.53	6.47
3-V	6.47	6.46
3-W	6.49	6.55
3-X	6.50	6.47
3-Y	6.49	6.48
3-Z	6.45	6.54
4-U	6.54	6.49
4-V	6.53	6.48
4-W	6.46	6.53
4-X	6.49	6.54
4-Y	6.54	6.47
4-Z	6.48	6.48
5-U	6.51	6.52
5-V	6.46	6.45
5-W	6.46	6.54
5-X	6.47	6.50
5-Y	6.49	6.49
5-Z	6.49	6.47

VCE(sat)
Ic=100A,VGE=15V

	0	100
1-U	2.65	2.64
1-V	2.61	2.61
1-W	2.64	2.57
1-X	2.61	2.65
1-Y	2.61	2.56
1-Z	2.60	2.58
2-U	2.56	2.61
2-V	2.56	2.65
2-W	2.58	2.63
2-X	2.59	2.60
2-Y	2.55	2.64
2-Z	2.59	2.57
3-U	2.57	2.63
3-V	2.57	2.64
3-W	2.61	2.60
3-X	2.62	2.63
3-Y	2.62	2.58
3-Z	2.62	2.65
4-U	2.60	2.57
4-V	2.61	2.56
4-W	2.61	2.56
4-X	2.64	2.61
4-Y	2.62	2.56
4-Z	2.60	2.57
5-U	2.62	2.55
5-V	2.63	2.65
5-W	2.64	2.55
5-X	2.56	2.61
5-Y	2.61	2.58
5-Z	2.59	2.60

VF
IF=100A

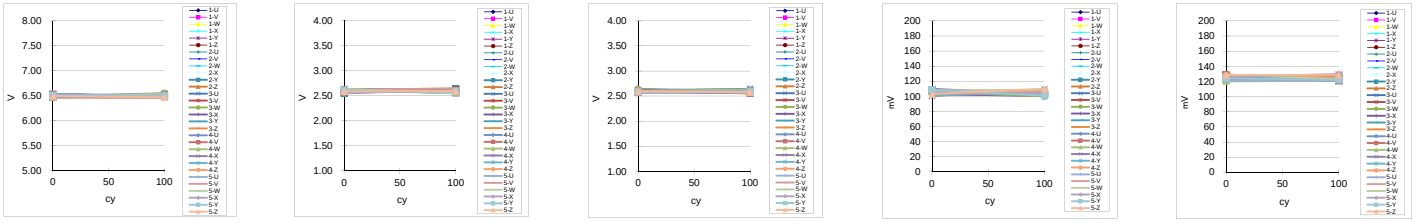
	0	100
1-U	2.57	2.56
1-V	2.57	2.58
1-W	2.62	2.58
1-X	2.64	2.61
1-Y	2.61	2.59
1-Z	2.59	2.56
2-U	2.64	2.62
2-V	2.60	2.64
2-W	2.60	2.63
2-X	2.62	2.59
2-Y	2.58	2.59
2-Z	2.64	2.57
3-U	2.60	2.65
3-V	2.58	2.62
3-W	2.64	2.56
3-X	2.60	2.61
3-Y	2.63	2.58
3-Z	2.63	2.60
4-U	2.62	2.64
4-V	2.60	2.56
4-W	2.60	2.63
4-X	2.58	2.56
4-Y	2.59	2.57
4-Z	2.60	2.57
5-U	2.58	2.60
5-V	2.60	2.58
5-W	2.57	2.61
5-X	2.56	2.60
5-Y	2.58	2.59
5-Z	2.60	2.58

dVCE
Ic=100A,VGE=15V,Pw=500ms

	0	100
1-U	101	107
1-V	107	104
1-W	107	103
1-X	107	101
1-Y	102	100
1-Z	104	109
2-U	102	103
2-V	106	104
2-W	108	104
2-X	102	109
2-Y	109	104
2-Z	107	105
3-U	109	103
3-V	108	101
3-W	105	100
3-X	110	104
3-Y	104	103
3-Z	105	102
4-U	109	105
4-V	109	103
4-W	107	103
4-X	100	110
4-Y	102	104
4-Z	108	107
5-U	107	109
5-V	104	105
5-W	108	109
5-X	105	105
5-Y	109	101
5-Z	103	110

dVF
Ic=100A,Pw=100ms

	0	100
1-U	124	121
1-V	129	126
1-W	127	124
1-X	128	128
1-Y	127	129
1-Z	126	122
2-U	129	120
2-V	122	123
2-W	127	124
2-X	123	120
2-Y	128	126
2-Z	123	122
3-U	127	121
3-V	122	129
3-W	124	129
3-X	128	127
3-Y	123	128
3-Z	129	120
4-U	122	121
4-V	129	121
4-W	121	124
4-X	125	128
4-Y	125	124
4-Z	128	126
5-U	120	121
5-V	124	122
5-W	129	123
5-X	126	130
5-Y	124	122
5-Z	129	129



Sample 7MBR100U4B120-50

Fig.(10) Static characteristic data in the temperature cycling test(Omachi)

VGE(th)
Ic=100mA,VCE=20V

	0	100
1-U	6.55	6.46
1-V	6.52	6.49
1-W	6.53	6.51
1-X	6.53	6.50
1-Y	6.49	6.46
1-Z	6.51	6.51
2-U	6.48	6.55
2-V	6.53	6.52
2-W	6.49	6.51
2-X	6.51	6.50
2-Y	6.50	6.55
2-Z	6.52	6.47
3-U	6.46	6.53
3-V	6.53	6.45
3-W	6.49	6.48
3-X	6.46	6.51
3-Y	6.49	6.48
3-Z	6.53	6.53
4-U	6.51	6.47
4-V	6.47	6.54
4-W	6.49	6.52
4-X	6.47	6.54
4-Y	6.50	6.51
4-Z	6.51	6.52
5-U	6.49	6.46
5-V	6.45	6.49
5-W	6.48	6.52
5-X	6.52	6.46
5-Y	6.45	6.54
5-Z	6.51	6.49

VCE(sat)
Ic=100A,VGE=15V

	0	100
1-U	2.56	2.63
1-V	2.64	2.56
1-W	2.55	2.63
1-X	2.56	2.63
1-Y	2.62	2.58
1-Z	2.61	2.63
2-U	2.61	2.60
2-V	2.63	2.57
2-W	2.64	2.62
2-X	2.62	2.62
2-Y	2.58	2.62
2-Z	2.64	2.60
3-U	2.58	2.60
3-V	2.62	2.58
3-W	2.65	2.64
3-X	2.56	2.61
3-Y	2.57	2.58
3-Z	2.55	2.59
4-U	2.62	2.59
4-V	2.59	2.60
4-W	2.56	2.62
4-X	2.56	2.59
4-Y	2.63	2.61
4-Z	2.62	2.59
5-U	2.64	2.58
5-V	2.61	2.60
5-W	2.64	2.57
5-X	2.65	2.64
5-Y	2.55	2.58
5-Z	2.56	2.64

VF
IF=100A

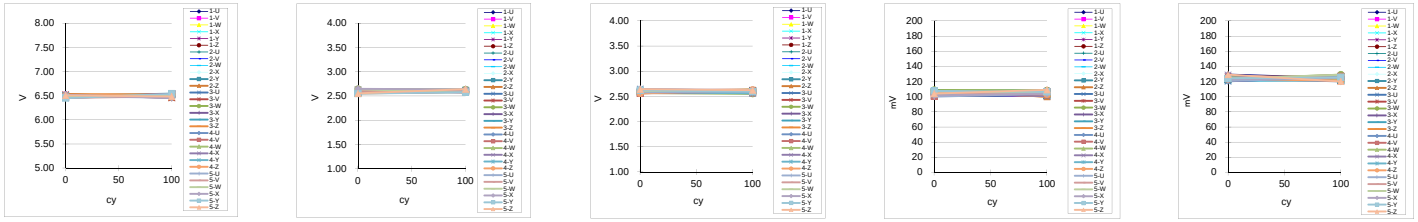
	0	100
1-U	2.59	2.64
1-V	2.57	2.59
1-W	2.56	2.65
1-X	2.57	2.62
1-Y	2.62	2.55
1-Z	2.61	2.57
2-U	2.65	2.61
2-V	2.58	2.64
2-W	2.63	2.57
2-X	2.59	2.61
2-Y	2.59	2.62
2-Z	2.56	2.62
3-U	2.65	2.61
3-V	2.58	2.62
3-W	2.57	2.55
3-X	2.58	2.61
3-Y	2.61	2.59
3-Z	2.61	2.64
4-U	2.57	2.63
4-V	2.57	2.57
4-W	2.61	2.61
4-X	2.62	2.56
4-Y	2.58	2.56
4-Z	2.56	2.63
5-U	2.58	2.60
5-V	2.62	2.64
5-W	2.61	2.64
5-X	2.65	2.63
5-Y	2.62	2.60
5-Z	2.64	2.63

dVCE
Ic=100A,VGE=15V,Pw=500ms

	0	100
1-U	100	101
1-V	103	100
1-W	108	104
1-X	105	104
1-Y	100	109
1-Z	100	103
2-U	109	109
2-V	107	103
2-W	109	104
2-X	107	101
2-Y	107	102
2-Z	108	100
3-U	101	102
3-V	101	107
3-W	109	108
3-X	103	102
3-Y	108	103
3-Z	107	100
4-U	102	102
4-V	101	107
4-W	108	106
4-X	106	101
4-Y	103	107
4-Z	106	103
5-U	100	104
5-V	104	104
5-W	107	105
5-X	102	104
5-Y	108	107
5-Z	104	109

dVF
Ic=100A,Pw=100ms

	0	100
1-U	130	125
1-V	125	128
1-W	125	128
1-X	123	123
1-Y	128	123
1-Z	122	123
2-U	122	124
2-V	120	129
2-W	120	121
2-X	128	124
2-Y	122	121
2-Z	125	127
3-U	120	127
3-V	126	127
3-W	123	129
3-X	121	126
3-Y	122	126
3-Z	127	126
4-U	125	120
4-V	124	127
4-W	127	123
4-X	129	120
4-Y	123	126
4-Z	123	121
5-U	121	126
5-V	123	129
5-W	124	129
5-X	123	125
5-Y	124	125
5-Z	129	120



Sample 7MBR100U4B120-50

Fig.(11) Static characteristic data in the temperature cycling test(SZF)

Confidential

VGE(th)
Ic=100mA,VCE=20V

	0	10
1-U	6.45	6.47
1-V	6.51	6.53
1-W	6.49	6.51
1-X	6.49	6.48
1-Y	6.50	6.48
1-Z	6.46	6.49
2-U	6.53	6.48
2-V	6.45	6.49
2-W	6.53	6.45
2-X	6.46	6.50
2-Y	6.54	6.54
2-Z	6.50	6.48
3-U	6.46	6.51
3-V	6.49	6.54
3-W	6.52	6.45
3-X	6.54	6.50
3-Y	6.53	6.52
3-Z	6.47	6.51
4-U	6.55	6.55
4-V	6.49	6.50
4-W	6.53	6.53
4-X	6.55	6.52
4-Y	6.48	6.46
4-Z	6.47	6.49
5-U	6.48	6.51
5-V	6.52	6.49
5-W	6.47	6.49
5-X	6.46	6.48
5-Y	6.51	6.46
5-Z	6.51	6.48

VCE(sat)
Ic=100A,VGE=15V

	0	10
1-U	2.65	2.56
1-V	2.58	2.56
1-W	2.63	2.60
1-X	2.62	2.63
1-Y	2.64	2.58
1-Z	2.60	2.55
2-U	2.60	2.64
2-V	2.58	2.57
2-W	2.65	2.56
2-X	2.60	2.60
2-Y	2.60	2.59
2-Z	2.65	2.59
3-U	2.63	2.56
3-V	2.63	2.63
3-W	2.57	2.62
3-X	2.64	2.57
3-Y	2.58	2.62
3-Z	2.56	2.60
4-U	2.65	2.55
4-V	2.62	2.58
4-W	2.61	2.58
4-X	2.65	2.61
4-Y	2.57	2.56
4-Z	2.62	2.59
5-U	2.60	2.57
5-V	2.59	2.55
5-W	2.63	2.64
5-X	2.62	2.59
5-Y	2.56	2.56
5-Z	2.63	2.61

VF
IF=100A

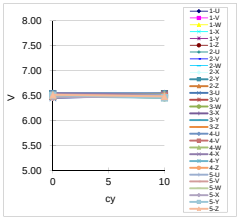
	0	10
1-U	2.56	2.61
1-V	2.61	2.56
1-W	2.58	2.57
1-X	2.58	2.57
1-Y	2.60	2.61
1-Z	2.55	2.57
2-U	2.56	2.59
2-V	2.62	2.56
2-W	2.59	2.59
2-X	2.60	2.65
2-Y	2.60	2.58
2-Z	2.62	2.64
3-U	2.58	2.58
3-V	2.61	2.59
3-W	2.62	2.61
3-X	2.59	2.58
3-Y	2.57	2.63
3-Z	2.59	2.57
4-U	2.63	2.61
4-V	2.61	2.58
4-W	2.63	2.61
4-X	2.62	2.59
4-Y	2.58	2.56
4-Z	2.62	2.64
5-U	2.62	2.60
5-V	2.62	2.58
5-W	2.59	2.62
5-X	2.55	2.62
5-Y	2.57	2.61
5-Z	2.62	2.56

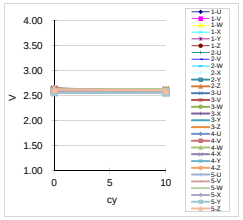
dVCE
Ic=100A,VGE=15V,Pw=500ms

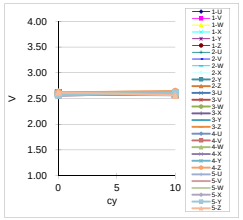
	0	10
1-U	105	108
1-V	103	100
1-W	106	108
1-X	106	102
1-Y	103	101
1-Z	110	103
2-U	103	103
2-V	105	110
2-W	107	108
2-X	108	103
2-Y	103	105
2-Z	109	103
3-U	100	105
3-V	100	106
3-W	110	110
3-X	105	104
3-Y	105	104
3-Z	106	106
4-U	104	110
4-V	102	103
4-W	103	110
4-X	107	101
4-Y	103	106
4-Z	104	109
5-U	103	101
5-V	109	100
5-W	108	101
5-X	106	101
5-Y	103	100
5-Z	106	107

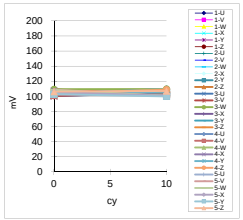
dVF
Ic=100A,Pw=100ms

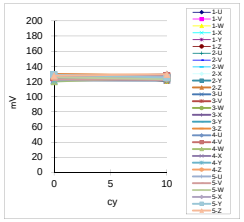
	0	10
1-U	122	130
1-V	123	127
1-W	127	120
1-X	121	122
1-Y	129	120
1-Z	129	122
2-U	127	121
2-V	125	122
2-W	129	125
2-X	121	129
2-Y	125	125
2-Z	130	127
3-U	122	122
3-V	127	124
3-W	125	122
3-X	123	129
3-Y	122	124
3-Z	129	129
4-U	124	130
4-V	125	127
4-W	120	126
4-X	127	123
4-Y	121	125
4-Z	126	125
5-U	126	123
5-V	122	122
5-W	125	123
5-X	128	127
5-Y	129	125
5-Z	128	130











Sample 7MBR100U4B120-50

Fig.(12) Static characteristic data in the temperature shock test(Omachi)

VGE(th)
Ic=100mA,VCE=20V

	0	10
1-U	6.47	6.45
1-V	6.53	6.48
1-W	6.50	6.49
1-X	6.52	6.51
1-Y	6.53	6.54
1-Z	6.48	6.54
2-U	6.47	6.49
2-V	6.47	6.48
2-W	6.51	6.47
2-X	6.52	6.48
2-Y	6.52	6.55
2-Z	6.55	6.50
3-U	6.49	6.52
3-V	6.52	6.49
3-W	6.49	6.45
3-X	6.53	6.47
3-Y	6.50	6.48
3-Z	6.47	6.48
4-U	6.51	6.48
4-V	6.51	6.47
4-W	6.45	6.46
4-X	6.47	6.49
4-Y	6.51	6.48
4-Z	6.53	6.50
5-U	6.48	6.51
5-V	6.54	6.52
5-W	6.54	6.53
5-X	6.47	6.48
5-Y	6.51	6.54
5-Z	6.46	6.52

VCE(sat)
Ic=100A,VGE=15V

	0	10
1-U	2.60	2.57
1-V	2.58	2.62
1-W	2.60	2.56
1-X	2.60	2.56
1-Y	2.57	2.58
1-Z	2.63	2.64
2-U	2.62	2.64
2-V	2.57	2.60
2-W	2.64	2.60
2-X	2.60	2.57
2-Y	2.61	2.61
2-Z	2.56	2.62
3-U	2.61	2.62
3-V	2.65	2.58
3-W	2.56	2.56
3-X	2.60	2.59
3-Y	2.55	2.56
3-Z	2.63	2.58
4-U	2.65	2.59
4-V	2.64	2.62
4-W	2.63	2.64
4-X	2.59	2.56
4-Y	2.65	2.60
4-Z	2.56	2.62
5-U	2.64	2.56
5-V	2.59	2.57
5-W	2.60	2.63
5-X	2.59	2.56
5-Y	2.58	2.63
5-Z	2.62	2.64

VF
IF=100A

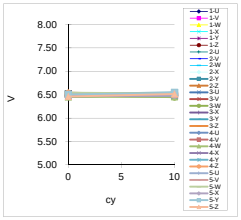
	0	10
1-U	2.64	2.59
1-V	2.63	2.63
1-W	2.63	2.59
1-X	2.56	2.58
1-Y	2.56	2.65
1-Z	2.61	2.62
2-U	2.59	2.59
2-V	2.64	2.65
2-W	2.62	2.62
2-X	2.57	2.63
2-Y	2.56	2.64
2-Z	2.56	2.57
3-U	2.60	2.64
3-V	2.57	2.62
3-W	2.64	2.61
3-X	2.63	2.60
3-Y	2.61	2.60
3-Z	2.65	2.61
4-U	2.61	2.56
4-V	2.63	2.59
4-W	2.61	2.61
4-X	2.55	2.56
4-Y	2.59	2.62
4-Z	2.61	2.59
5-U	2.60	2.60
5-V	2.64	2.58
5-W	2.58	2.65
5-X	2.64	2.57
5-Y	2.63	2.57
5-Z	2.63	2.64

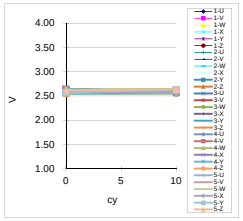
dVCE
Ic=100A,VGE=15V,Pw=500ms

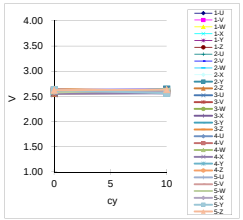
	0	10
1-U	106	100
1-V	106	105
1-W	101	102
1-X	107	102
1-Y	104	108
1-Z	100	101
2-U	104	110
2-V	107	107
2-W	107	109
2-X	105	109
2-Y	109	105
2-Z	107	104
3-U	102	102
3-V	104	104
3-W	102	104
3-X	107	107
3-Y	108	104
3-Z	101	100
4-U	106	103
4-V	105	101
4-W	102	108
4-X	106	102
4-Y	100	101
4-Z	107	104
5-U	106	107
5-V	101	108
5-W	109	109
5-X	106	105
5-Y	102	104
5-Z	108	107

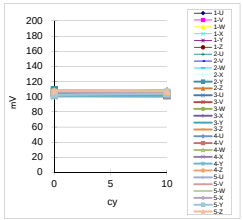
dVF
Ic=100A,Pw=100ms

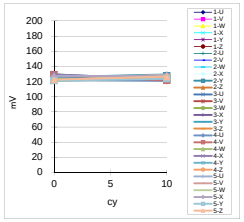
	0	10
1-U	127	126
1-V	127	122
1-W	122	127
1-X	122	127
1-Y	125	121
1-Z	127	123
2-U	128	127
2-V	126	125
2-W	128	126
2-X	126	124
2-Y	127	128
2-Z	126	125
3-U	129	123
3-V	123	124
3-W	127	122
3-X	125	129
3-Y	126	129
3-Z	123	122
4-U	123	121
4-V	129	121
4-W	123	126
4-X	129	123
4-Y	121	124
4-Z	122	125
5-U	128	127
5-V	122	129
5-W	121	129
5-X	127	128
5-Y	121	124
5-Z	122	127









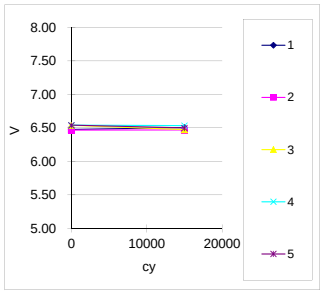


Sample 7MBR100U4B120-50

Fig.(13) Static characteristic data in the temperature shock test(SZF)

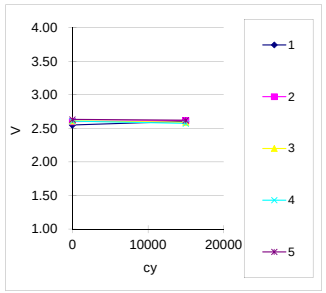
VGE(th)
Ic=100mA,VCE=20V

	0	15000
1	6.48	6.51
2	6.47	6.47
3	6.54	6.47
4	6.54	6.54
5	6.54	6.50



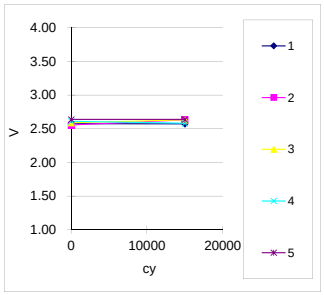
VCE(sat)
Ic=100A,VGE=15V

	0	15000
1	2.55	2.60
2	2.60	2.62
3	2.61	2.59
4	2.61	2.57
5	2.63	2.62



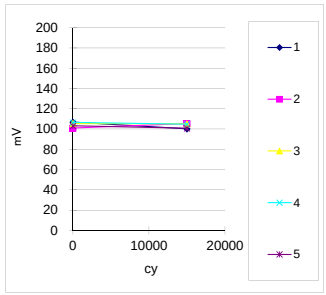
VF
IF=100A

	0	15000
1	2.58	2.57
2	2.56	2.63
3	2.59	2.63
4	2.61	2.58
5	2.64	2.64



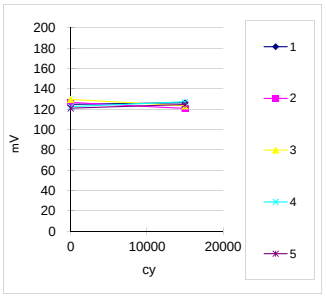
dVCE
Ic=100A,VGE=15V,Pw=500ms

	0	15000
1	107	100
2	101	105
3	106	105
4	107	105
5	103	101



dVF
Ic=100A,Pw=100ms

	0	15000
1	125	126
2	127	121
3	130	123
4	123	127
5	121	125

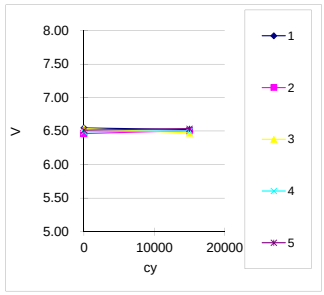


Sample 7MBR100U4B120-50

Fig.(14) Static characteristic data in the power cycling test(Omachi)

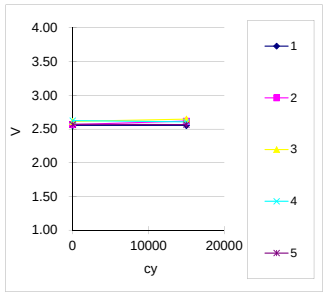
VGE(th)
Ic=100mA,VCE=20V

	0	15000
1	6.55	6.52
2	6.46	6.50
3	6.54	6.47
4	6.49	6.50
5	6.51	6.54



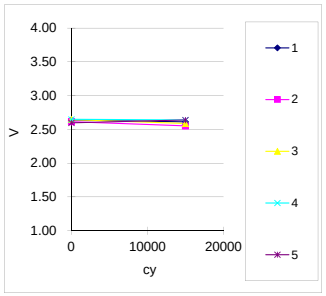
VCE(sat)
Ic=100A,VGE=15V

	0	15000
1	2.55	2.55
2	2.57	2.62
3	2.61	2.65
4	2.63	2.61
5	2.57	2.57



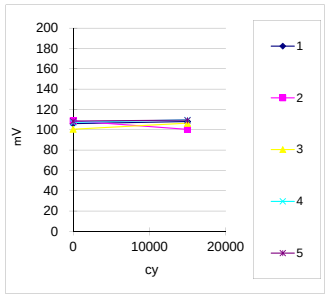
VF
IF=100A

	0	15000
1	2.64	2.61
2	2.61	2.55
3	2.64	2.59
4	2.65	2.64
5	2.60	2.64



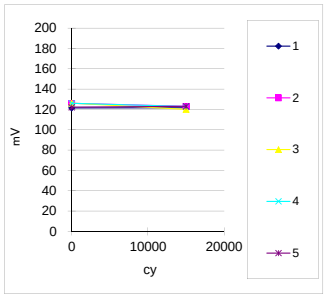
dVCE
Ic=100A,VGE=15V,Pw=500ms

	0	15000
1	106	108
2	109	100
3	101	106
4	107	110
5	108	109



dVF
Ic=100A,Pw=100ms

	0	15000
1	122	122
2	126	123
3	126	120
4	126	123
5	122	123



Sample 7MBR100U4B120-50

Fig.(15) Static characteristic data in the power cycling test(SZF)