



# Test Report: BIC-2200-24

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AC<->DC Bidirectional Power Supply with Energy Recycle Function

## ■ DESIGN VERIFY TEST

Output Function Test (AC to DC Direction)

Input Function Test(AC to DC Direction)

Output Function Test (DC to AC Direction)

Input Function Test(DC to AC Direction)

Protection Function Test

Control Function Test

Component Stress Test

## ■ SAFETY & E.M.C. TEST

Safety Test

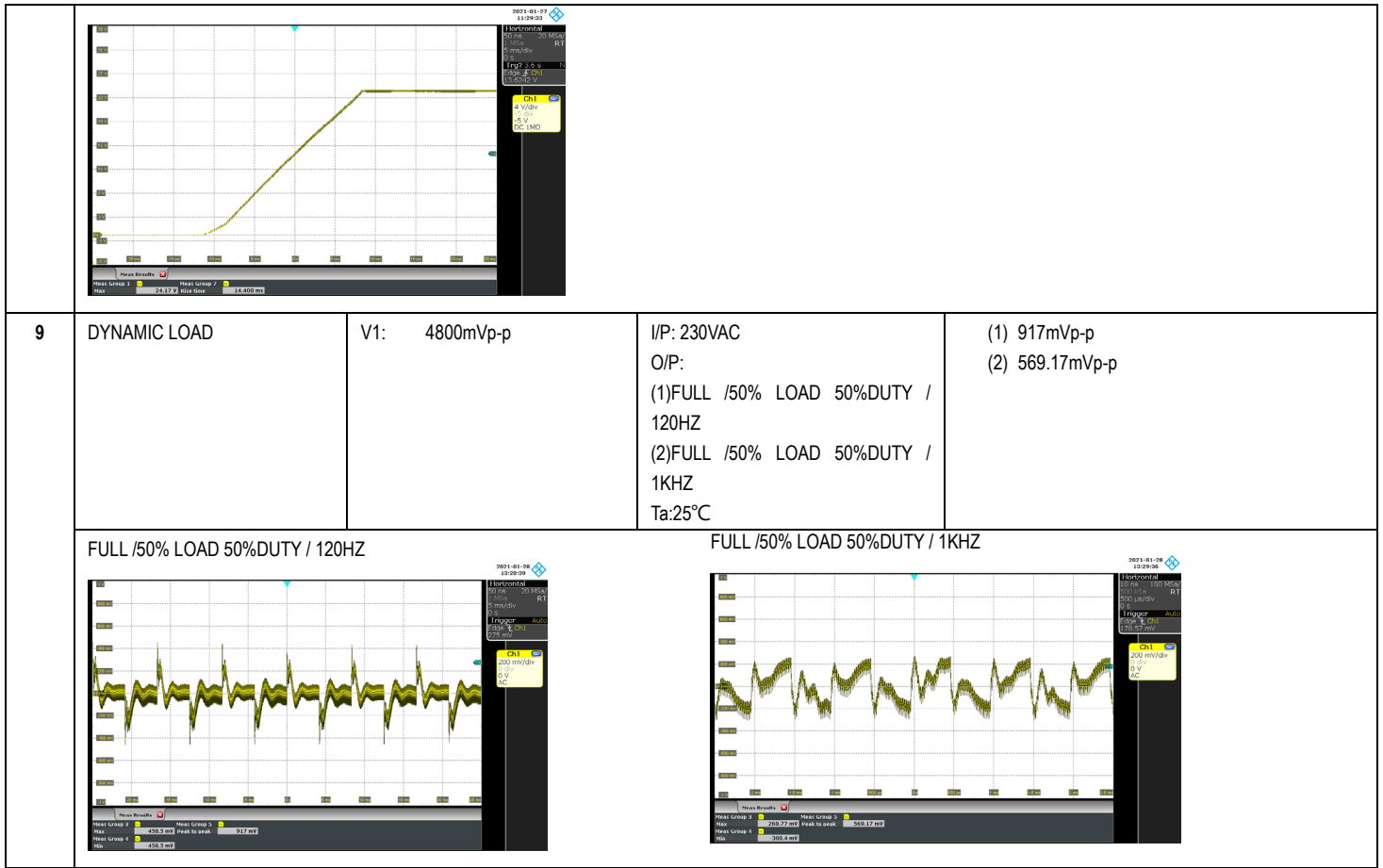
E.M.C. Test

## ■ RELIABILITY TEST

ENVIRONMENT TEST

■ **DESIGN VERIFY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 19V~ 28 V	I/P : 230 VAC O/P : MIN LOAD Ta : 25°C	18.4V~28.9V/230VAC
2	VOLTAGE TOLERANCE (Max)	V1: 1%~ -1 %	I/P: 180VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: 0.66%~ -0.59 %
3	LINE REGULATION (Max)	V1: 0.5%~ -0.5 %	I/P: 180VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0.06%~ -0.06 %
4	LOAD REGULATION(Max)	V1: 0.5%~ -0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.05%~ -0.03 %
5	OVER/UNDERSHOOT TEST	< ±10%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	<10%
6	RIPPLE & NOISE(Max)	V1: 260mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 199.6mVp-p
		high frequency :	low frequency :	
7	SET UP TIME(Max)	230VAC/1800ms	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 994ms
		INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 		
8	RISE TIME (Max)	230VAC/60ms	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/14.4ms
		INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		



**INPUT FUNCTION TEST(AC to DC Direction)**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC~264VAC	I/P: TESTING O/P: FULL LOAD Ta: 25°C	(1) 165V~264V
			I/P: LOW-LINE-3V=177 V HIGH-LINE+15%=300 V O/P: FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST: OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 180VAC ~264 VAC O/P: FULL ~MIN LOAD Ta: 25°C	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 11A	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I =10.34A/ 230VAC
4	LEAKAGE CURRENT	< 2mA / 230 VAC	I/P : 230 VAC O/P : Min LOAD Ta : 25°C	L-FG : 1.2 mA N-FG : 1.2 mA
5	POWER FACTOR (Typ.)	0.98/ 230VAC	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	PF=0.9965/230VAC

	<p>P.F vs LOAD</p> <table border="1"> <caption>PF vs LOAD Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>180VAC PF</th> <th>230VAC PF</th> </tr> </thead> <tbody> <tr><td>10%</td><td>0.88</td><td>0.83</td></tr> <tr><td>20%</td><td>0.96</td><td>0.94</td></tr> <tr><td>30%</td><td>0.98</td><td>0.97</td></tr> <tr><td>40%</td><td>0.99</td><td>0.98</td></tr> <tr><td>50%</td><td>0.995</td><td>0.99</td></tr> <tr><td>60%</td><td>1.00</td><td>0.995</td></tr> <tr><td>70%</td><td>1.00</td><td>0.995</td></tr> <tr><td>80%</td><td>1.00</td><td>0.995</td></tr> <tr><td>90%</td><td>1.00</td><td>0.995</td></tr> <tr><td>100%</td><td>1.00</td><td>0.995</td></tr> </tbody> </table>			LOAD (%)	180VAC PF	230VAC PF	10%	0.88	0.83	20%	0.96	0.94	30%	0.98	0.97	40%	0.99	0.98	50%	0.995	0.99	60%	1.00	0.995	70%	1.00	0.995	80%	1.00	0.995	90%	1.00	0.995	100%	1.00	0.995	
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6	<p>EFFICIENCY(Typ.)</p>	<p>93%</p>	<p>I/P:230 VAC O/P: 75% LOAD Ta:25°C</p>	<p>93.02%</p>																																	
	<p>EFFICIENCY vs LOAD</p> <table border="1"> <caption>Efficiency vs LOAD Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>180VAC Efficiency (%)</th> <th>230VAC Efficiency (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>84.5</td><td>84.5</td></tr> <tr><td>20%</td><td>91.5</td><td>92.0</td></tr> <tr><td>30%</td><td>94.0</td><td>94.5</td></tr> <tr><td>40%</td><td>94.5</td><td>95.0</td></tr> <tr><td>50%</td><td>94.5</td><td>95.0</td></tr> <tr><td>60%</td><td>94.0</td><td>94.5</td></tr> <tr><td>70%</td><td>93.5</td><td>94.0</td></tr> <tr><td>80%</td><td>93.0</td><td>93.5</td></tr> <tr><td>90%</td><td>92.5</td><td>93.0</td></tr> <tr><td>100%</td><td>92.0</td><td>92.5</td></tr> </tbody> </table>			LOAD (%)	180VAC Efficiency (%)	230VAC Efficiency (%)	10%	84.5	84.5	20%	91.5	92.0	30%	94.0	94.5	40%	94.5	95.0	50%	94.5	95.0	60%	94.0	94.5	70%	93.5	94.0	80%	93.0	93.5	90%	92.5	93.0	100%	92.0	92.5	
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7	<p>INRUSH CURRENT(Typ.)</p>	<p>230V/35A COLD START</p>	<p>I/P : 230 VAC O/P : FULL LOAD Ta : 25°C</p>	<p>I=32.8A/ 230VAC T50=1900us/230V</p>																																	
	<p>INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current</p>																																				
8	<p>TOTAL HARMONIC DISTORTION</p>	<p>&lt;3%</p>	<p>I/P : 230VAC O/P : FULL LOAD Ta : 25°C</p>	<p>THD = 1.9%</p>																																	

**OUTPUT FUNCTION TEST(DC to AC Direction)**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RATED OUTPUT POWER (Typ.) (@230V, 50Hz)	1725VA	I/P:12VDC O/P: FULL LOAD Ta:25°C	1707.5VA
2	VOLTAGE RANGE	180VAC~264VAC	I/P:24VDC O/P: TESTING Ta:25°C	(1) 170 VAC~270VAC
3	FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:24VDC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK
4	AC CURRENT (Typ.)	230VAC/ 7.5 A	I/P : 24VDC O/P : FULL LOAD Ta : 25°C	I =7.3A/ 230VAC
5	POWER FACTOR (Typ.)	0.99/ 230VAC	I/P : 24VDC O/P : FULL LOAD Ta : 25°C	PF=0.994/230VAC
6	EFFICIENCY(Typ.)	93%	I/P: 24VDC O/P:75%LOAD Ta:25°C	93.3%
7	TOTAL HARMONIC DISTORTION	<3%	I/P : 24VDC O/P : FULL LOAD Ta : 25°C	THD = 2.7 %

**INPUT FUNCTION TEST(DC to AC Direction)**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RATED INPUT POWER	1800W	I/P : 24VDC O/P : FULL LOAD Ta : 25°C	1828W
2	DC VOLTAGE RANGE	19VDC ~28VDC	I/P : 24VDC O/P : FULL LOAD Ta : 25°C	19VDC/76.14A 24VDC/75.06A 28VDC/64.68A/ AUTO DERATING
3	MAX INPUT CURRENT	75A	I/P : 24VDC O/P : FULL LOAD Ta : 25°C	75.06A

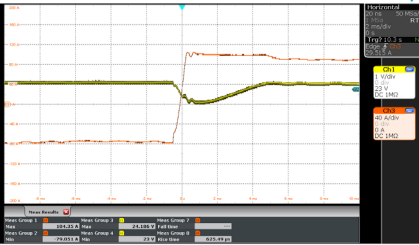
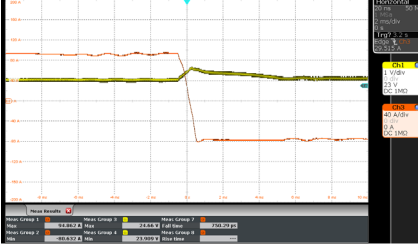
**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~ 115 % <b>AC to DC Direction:</b> Constant current limiting, shut down DC O/P voltage 5 sec. after DC O/P voltage is down low, re-power on to recover  <b>DC to AC Direction:</b> Not accurable with constant power design	<b>AC to DC Direction</b> I/P: 264VAC I/P: 230VAC I/P: 180VAC  <b>DC to AC Direction</b> I/P: 19VDC I/P: 24VDC I/P: 28VDC O/P:FULL LOAD Ta:25°C	<b>AC to DC Direction</b> 112.2%/ 264VAC 112.2%/ 230VAC 112.2%/180VAC PROTECTION TYPE : Constant current limiting, shut down DC O/P voltage 5 sec. after DC O/P voltage is down low, re-power on to recover <b>DC to AC Direction:</b> 19VDC/76.14A 24VDC/75.06A 28VDC/64.68A/ AUTO DERATING

				PROTECTION TYPE : Not accurable with constant power design
2	OVER VOLTAGE PROTECTION	33.6V~39.2V Protection type :Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 180VAC O/P:MIN LOAD Ta:25°C	<b>AC to DC Direction</b> 35.17V/ 264VAC 35.17V/ 230VAC 35.17V/ 180VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	Protection type : Shut down o/p voltage, recovers automatically after temperature goes down	<b>AC to DC Direction</b> I/P: 264VAC I/P: 180VAC  <b>DC to AC Direction</b> I/P: 19VDC I/P: 28VDC  O/P:FULL LOAD	<b>AC to DC Direction</b> O.T.P. Active Protection type : Shut down o/p voltage, recovers automatically after temperature goes down <b>DC to AC Direction</b> O.T.P. Active Protection type : Shut down o/p voltage, recovers automatically after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 180VAC  I/P: 19VDC I/P: 28VDC  O/P: FULL LOAD Ta:25°C	<b>AC to DC Direction</b> NO DAMAGE PROTECTION TYPE : Shut down o/p current, re-power on to recover  <b>DC to AC Direction</b> NO DAMAGE PROTECTION TYPE : shut down O/P voltage. re-power on to recover
5	ISLANDING PROTECTION	NO DAMAGE PROTECTION TYPE : Shut down o/p voltage, re-power on to recover	IEC62116 I/P: 27.1VDC O/P: FULL LOAD  I/P: 23.5VDC O/P: 50% LOAD  I/P: 19.9VDC O/P: 10% LOAD  Ta:25°C	<b>DC to AC Direction</b> NO DAMAGE PROTECTION TYPE : Shut down o/p voltage, re-power on to recover

**CONTROL FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
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1	AUXILIARY POWER (AUX)	<p>Auxiliary voltage output, 11.4~12.6V, referenced to GND-AUX (pin 2,4). The maximum output current is 0.5A. This output is not controlled by the Remote ON/OFF control.</p> <p>I/P: 230 VAC /12VDC O/P:FULL LOAD Ta:25°C</p> <p>Test Result :</p> <table border="1" data-bbox="507 477 1131 647"> <thead> <tr> <th></th> <th>TOLERANCE</th> <th>RIPPLE</th> </tr> </thead> <tbody> <tr> <td>SPEC</td> <td>11.4~12.6 V</td> <td>150mVp-p</td> </tr> <tr> <td>TEST RESULT</td> <td>11.74V</td> <td>50mV</td> </tr> </tbody> </table>		TOLERANCE	RIPPLE	SPEC	11.4~12.6 V	150mVp-p	TEST RESULT	11.74V	50mV				
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2	REMOTE ON/OFF CONTROL	<p>I/P: 230 VAC /12VDC O/P:FULL LOAD Ta:25°C</p> <p>Test Result :</p> <table border="1" data-bbox="507 797 1329 1030"> <thead> <tr> <th>MODE</th> <th>electrical signal or dry contact between Remote ON/OFF and +12V-AUX</th> <th>Power Supply Status</th> </tr> </thead> <tbody> <tr> <td rowspan="2">AC to DC Direction</td> <td>SW SHORT</td> <td>ON</td> </tr> <tr> <td>SW OPEN</td> <td>OFF</td> </tr> <tr> <td rowspan="2">DC to AC Direction</td> <td>SW SHORT</td> <td>ON</td> </tr> <tr> <td>SW OPEN</td> <td>OFF</td> </tr> </tbody> </table>	MODE	electrical signal or dry contact between Remote ON/OFF and +12V-AUX	Power Supply Status	AC to DC Direction	SW SHORT	ON	SW OPEN	OFF	DC to AC Direction	SW SHORT	ON	SW OPEN	OFF
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3	BIDIRECTION SWITCH TIME(DEFAULT)	<p>I/P: 230 VAC /24VDC O/P:FULL LOAD Ta:25°C</p> <p>Test Result :</p> <table border="1" data-bbox="507 1176 1329 1290"> <thead> <tr> <th>MODE</th> <th>BIDIRECTION SWITCH TIME</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>AC to DC Direction</td> <td>1ms</td> <td>626 us</td> </tr> <tr> <td>DC to AC Direction</td> <td>1ms</td> <td>750 us</td> </tr> </tbody> </table> <div style="display: flex; justify-content: space-around; margin-top: 10px;">   </div>	MODE	BIDIRECTION SWITCH TIME	Result	AC to DC Direction	1ms	626 us	DC to AC Direction	1ms	750 us				
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4	ALARM SIGNAL	<p>1. DC OK SIGNAL High (4.5 ~ 5.5V) : When the <math>V_{out} \leq 80\% \pm 5\%</math>. Low (-0.5 ~ 0.5V) : When the <math>V_{out} \geq 80\% \pm 5\%</math>. The maximum sourcing current is 4mA and only for output.</p> <p>I/P: 230 VAC/12VDC O/P:FULL LOAD Ta:25°C</p> <p>Test Result :</p> <table border="1" data-bbox="627 1816 1342 1904"> <thead> <tr> <th>MODE</th> <th>Vout</th> <th>DC OK SIGNAL</th> </tr> </thead> <tbody> <tr> <td rowspan="2">AC to DC Direction</td> <td><math>V_{out} \leq 75\%</math></td> <td>4.994V</td> </tr> <tr> <td><math>V_{out} \geq 85\%</math></td> <td>-0.038V</td> </tr> </tbody> </table>	MODE	Vout	DC OK SIGNAL	AC to DC Direction	$V_{out} \leq 75\%$	4.994V	$V_{out} \geq 85\%$	-0.038V					
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		<p>2. T-ALARM High (4.5 ~ 5.5V) : When the internal temperature exceeds the limit of temperature alarm, or when fan fails. Low (-0.5 ~ 0.5V) : When the internal temperature is normal, and when fan works normally. The maximum sourcing current is 4mA and only for output.</p> <p>I/P: 230 VAC/12VDC O/P:FULL LOAD Ta:25°C Test Result :</p> <table border="1" data-bbox="563 510 1513 622"> <thead> <tr> <th>MODE</th> <th>P.SU STATUS</th> <th>Vo</th> <th>T-ALARM SPEC</th> <th>T-ALARM TEST</th> </tr> </thead> <tbody> <tr> <td rowspan="3">AC to DC Direction</td> <td>NORMAL</td> <td>100%±2%</td> <td>-0.5 ~0.5V</td> <td>-0.038V</td> </tr> <tr> <td>OTP</td> <td>0V</td> <td>4.5~5.5V</td> <td>4.94V</td> </tr> <tr> <td>FAN LOCK</td> <td>0V</td> <td>4.5~5.5V</td> <td>4.94V</td> </tr> </tbody> </table>	MODE	P.SU STATUS	Vo	T-ALARM SPEC	T-ALARM TEST	AC to DC Direction	NORMAL	100%±2%	-0.5 ~0.5V	-0.038V	OTP	0V	4.5~5.5V	4.94V	FAN LOCK	0V	4.5~5.5V	4.94V		<p>3. FAULT High (4.5 ~ 5.5V) : When the input voltage is <math>\geq 175Vrms</math> · OLP, SCP,OTP,OVP,AC Fail,fan lock,islanding protection Low (-0.5 ~ 0.5V) : When the input voltage is <math>\leq 165Vrms</math>. The maximum sourcing current is 4mA and only for output.</p> <table border="1" data-bbox="627 741 1249 831"> <thead> <tr> <th>MODE</th> <th>Vout</th> <th>FAULT SIGNAL</th> </tr> </thead> <tbody> <tr> <td rowspan="2">AC to DC Direction</td> <td><math>VAC \geq 175Vrms</math></td> <td>5.027v</td> </tr> <tr> <td><math>VAC \leq 165Vrms</math>.</td> <td>-0.004V</td> </tr> </tbody> </table>	MODE	Vout	FAULT SIGNAL	AC to DC Direction	$VAC \geq 175Vrms$	5.027v	$VAC \leq 165Vrms$ .	-0.004V
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5	CURRENT SHARING	CURRENT SHARING TOLERANCE $\pm 10\%$	I/P : 230 VAC O/P : 95/50% LOAD Ta : 25°C	<table border="1"> <thead> <tr> <th>AC to DC Direction</th> <th>DC to AC Direction</th> </tr> </thead> <tbody> <tr> <td>O/P : 95%</td> <td>O/P : 100%</td> </tr> <tr> <td>PSU1 : 86.35A</td> <td>PSU1 : 74.57A</td> </tr> <tr> <td>PSU2 : 86.55A</td> <td>PSU2 : 74.63A</td> </tr> <tr> <td>PSU3 : 83.82A</td> <td>PSU3 : 74.2A</td> </tr> <tr> <td>PSU4 : 83.29A</td> <td>PSU4 : 74.2A</td> </tr> <tr> <td>PSU5 : 86A</td> <td>PSU5 : 74.2A</td> </tr> <tr> <td>O/P : 50%</td> <td>O/P : 50%</td> </tr> <tr> <td>PSU1 : 45.62 A</td> <td>PSU1 : 36.75 A</td> </tr> <tr> <td>PSU2 : 45.8A</td> <td>PSU2 : 36.82A</td> </tr> <tr> <td>PSU3 : 44.07A</td> <td>PSU3 : 36.74A</td> </tr> <tr> <td>PSU4 : 43.76A</td> <td>PSU4 : 36.04 A</td> </tr> <tr> <td>PSU5 : 45.6A</td> <td>PSU5 : 37.01A</td> </tr> </tbody> </table>	AC to DC Direction	DC to AC Direction	O/P : 95%	O/P : 100%	PSU1 : 86.35A	PSU1 : 74.57A	PSU2 : 86.55A	PSU2 : 74.63A	PSU3 : 83.82A	PSU3 : 74.2A	PSU4 : 83.29A	PSU4 : 74.2A	PSU5 : 86A	PSU5 : 74.2A	O/P : 50%	O/P : 50%	PSU1 : 45.62 A	PSU1 : 36.75 A	PSU2 : 45.8A	PSU2 : 36.82A	PSU3 : 44.07A	PSU3 : 36.74A	PSU4 : 43.76A	PSU4 : 36.04 A	PSU5 : 45.6A	PSU5 : 37.01A
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6	BATTERY MODE RATED CURRENT( CAN BUS model only)	AC to DC Direction:80A DC to AC Direction:64A Can be adjusted by communication	AC to DC Direction I/P: 230VAC DC to AC Direction I/P: 24VDC O/P:FULL LOAD Ta:25°C	AC to DC Direction: 80.22A/230VAC  DC to AC Direction 63.8A/24VDC																										

**COMPONENT STRESS TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor ( D to S) or (C to E) Peak Voltage	<b>AC to DC Direction &amp; DC to AC Direction</b>  Q903 Rated: 36A/ 600V VGS :± 20V	AC ON/OFF  <b>AC to DC Direction</b> I/P:High-Line +3V =267V VDS: O/P: (1)Full Load (2)Output Short (3)0%→400% Load.  I/P:Low-Line -3V = 177V O/P: (1)Full Load (2)Output Short (3)0%→400% Load.	<b>AC to DC Direction</b> I/P:High-Line +3V =267V VDS: (1) 419V/20.38A (2) 408V/ 15.21A (3) 403V/16.05 A  I/P:Low-Line -3V = 177V VDS: (1) 406V/ 19.98A (2) 398V/ 14.85A (3) 402V/ 16.03A



			<p><b>DC to AC Direction</b>  I/P: 28VDC  VDS:  O/P: (1)Full Load  (2)+100%Io/1S~-100%Io/1S  (3)-100%Io AC Off  I/P: 19VDC  O/P: (1)Full Load  (2)+100%Io~-100%Io  (3)-100%Io AC Off  Ta:25°C</p>	<p><b>DC to AC Direction</b>  I/P: 28VDC  VDS:  (1) 423 V/5.32A  (2) 431 V/6.91A  (3) 510 V/6.29A  I/P: 19VDC  VDS:  (1) 424V/ 5.34A  (2) 435V/6.57A  (3) 510V/6.37A</p>	
2	P.F.C Transistor ( D to S) or (C to E) Peak Voltage	<p><b>AC to DC Direction</b>  Q2 Rated : 53A/ 650V  VGS :-8~19V   Q4 Rated : 52A/ 600V  VGS :± 25V</p>	<p>I/P:High-Line +3V =267 V  AC ON/OFF  (1)Full Load  (2)Output Short  (3)0%→400% Load.   I/P:Low-Line -3V = 177V  AC ON/OFF  O/P:(1)Full Load  (2)Output Short  (3)0%→400% Load.   Ta:25°C</p>	<p>I/P:High-Line +3V =267V  Q2 VDS:  (1) 469V/21.8A  (2) 423V/10.9A  (3) 418V/9.56A   Q4 VDS:  (1) 411V/18.5A  (2) 412V/10.29A  (3) 412V/11.28A   I/P:Low-Line -3V = 177V  Q2 VDS:  (1) 429V/13.61A  (2) 413V/9.5A  (3) 417V/15.58A   Q4 VDS:  (1) 441V/15.65A  (2) 441V/13.98A  (3) 417V/13.81A</p>	
3	Diode Peak Voltage	<p><b>AC to DC Direction &amp; DC to AC Direction</b>  Q950 Rated: 24A/250V  VGS :±20V   Q951 Rated: 24A/250V  VGS :±20V   Q958 Rated: 225A/ 60V  VGS :±20V   Q959 Rated: 24A/250V  VGS :±20V   AC to DC Direction only  Q74 Rated:24A/250V  VGS :±20V</p>	<p><b>AC to DC Direction</b>  AC ON/OFF  I/P:High-Line +3V =267 V  <u>VO=SPEC VR MAX</u>  O/P: (1)Full Load  (2)Output Short  (3)0%→400% Load.   <u>VO=RATED VOLTAGE</u>  O/P: (1)Full Load   <b>DC to AC Direction</b>  I/P:28VDC  <u>VO=SPEC VR MAX</u>  O/P: (1)Full Load  (2)+100%Io/1S~-100%Io/1S  (3)-100%Io AC Off   <u>VO=RATED VOLTAGE</u>  O/P: (1)Full Load   Ta:25°C</p>	<p><b>AC to DC Direction</b>  Q950:  <u>VO=SPEC VR MAX</u>  VDS:  (1) 46.1V  (2) 43.3V  (3) 54.1V   <u>VO=RATED VOLTAGE</u>  (1) 45.7V   Q951:  <u>VO=SPEC VR MAX</u>  VDS:  (1) 44.1V  (2) 42.1V  (3) 44.1V  <u>VO=RATED VOLTAGE</u>  (1) 45.7V   Q958:  <u>VO=SPEC VR MAX</u>  VDS:  (1) 46.5V  (2) 41.7V</p>	<p><b>DC to AC Direction</b>  Q950:  <u>VO=SPEC VR MAX</u>  VDS:  (1) 50.1V 542  (2) 52.1V 543  (3) 58.9V 544   <u>VO=RATED VOLTAGE</u>  (1) 49.3V 538   Q951:  <u>VO=SPEC VR MAX</u>  VDS:  (1) 49.7V  (2) 50.1V  (3) 57.3V  <u>VO=RATED VOLTAGE</u>  (1) 48.9V   Q958:  <u>VO=SPEC VR MAX</u>  VDS:  (1) 48.5V  (2) 48.9V</p>

				<p>(3) 54.9V <u>VO=RATED VOLTAGE</u> (1) 45.7V</p> <p>Q959: <u>VO=SPEC VR MAX</u> VDS: (1) 44.1V (2) 45.7V (3) 43.7V <u>VO=RATED VOLTAGE</u> (1) 43.7V</p> <p>Q74 <u>VO=SPEC VR MAX</u> VDS: (1) 48.1V (2) 48.1V (3) 47.7V <u>VO=RATED VOLTAGE</u> (1) 48.5V</p>	<p>(3) 57.3V <u>VO=RATED VOLTAGE</u> (1) 49.3V</p> <p>Q959: <u>VO=SPEC VR MAX</u> VDS: (1) 49.3V (2) 50.9V (3) 58.5V <u>VO=RATED VOLTAGE</u> (1) 49.3V</p>
4	Input Voltage	Capacitor C6 Rated: 470μ/ 450V	<p>I/P:High-Line +3V =267V</p> <p><b>AC to DC Direction</b> O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue</p> <p><b>DC to AC Direction</b> (1)+100%Io~100%Io (2)-100%Io AC Off Ta:25°C</p>	<p><b>AC to DC Direction</b> (1) 414.3V (2) 410.1V (3) 429.9V (4) 412.1V</p> <p><b>.DC to AC Direction</b> (1)429.84V (2)448V</p>	
5	Control IC Voltage Test	<p>PWM IC U57 Rated -0.3V~ 20V</p> <p>PFC IC U551 Rated -0.3V~ 20V</p> <p>O/P IC U308 Rated -0.3V~ 20V</p> <p>MCU IC U201 Rated 1.71V~3.6V</p> <p>AUX IC U701 Rated -0.3V~35V</p>	<p>AC ON/OFF</p> <p><b>AC to DC Direction</b></p> <p>I/P:High-Line +3V =267 V</p> <p>O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(LOW LINE) Ta:25°C</p>	<p>U57: (1) 11.39V (2) 11.39V (3) 11.39V (4) 11.4V (5) 11.4V</p> <p>U551: (1) 11.95V (2) 11.95V (3) 11.94V (4) 11.95V (5) 11.95V</p> <p>U308: (1) 12.46V (2) 12.45V (3) 12.46V (4) 12.44V (5)12.43V</p> <p>U201: (1) 3.304V (2) 3.302V (3) 3.301V (4) 3.302V (5) 3.303V</p> <p>U701: (1) 13.69V (2) 13.76V (3) 13.57V (4) 13.76V (5)13.96V</p>	
6	STAND BY POWER	Q700 Rated: 4.5A/ 800V	<p>AC ON/OFF</p> <p><b>AC to DC Direction</b></p> <p>I/P:High-Line +3V =267 V</p> <p>O/P: (1)Full Load (2)Remote On/Off</p> <p>I/P:Low-Line -3V =177V</p>	<p>I/P:High-Line +3V =267 V</p> <p>(1) 557V/1.976 A (2) 561V/ 2.052A</p> <p>I/P:Low-Line -3V =177V</p>	

			O/P: (1)Full Load (2)Remote On/Off Ta:25°C	(1) 557V/ 1.846A (2) 565V/1.862 A
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■ **SAFETY& E.M.C. TEST**

**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:0.5KVAC/min	I/P-O/P: 3.6KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:0.6KVAC/min Ta:25°C	I/P-O/P: 16.5mA I/P-FG: 15.59mA O/P-FG:10.3 mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P: 30GΩ I/P-FG: 26.2GΩ O/P-FG: 27.7GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	13mΩ

**E.M.C TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25°C	PASS
2	CONDUCTION	EN55032 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN55032 CLASS A	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2  AIR : 8KV / Contact : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4  INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N : 2KV L,N-PE : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

■ **RELIABILITY TEST**

**ENVIRONMENT TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																																																																											
1	TEMPERATURE RISE TEST	MODEL : BIC-2200-12 <b>AC to DC Direction:</b> 1. ROOM AMBIENT BURN-IN : 1.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 25 °C 2. HIGH AMBIENT BURN-IN : 1.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 40 °C  <b>DC to AC Direction:</b> 1. ROOM AMBIENT BURN-IN : 0.5 HRS I/P : 12VDC O/P : FULL LOAD Ta= 25 °C 2. HIGH AMBIENT BURN-IN : 1.5 HRS I/P : 12VDC O/P : FULL LOAD Ta= 40 °C																																																																																																																																																													
		<table border="1"> <thead> <tr> <th rowspan="2">NO</th> <th rowspan="2">Position</th> <th colspan="2">AC to DC Direction:</th> <th colspan="2">DC to AC Direction:</th> </tr> <tr> <th>ROOM AMBIENT Ta= 25°C</th> <th>HIGH AMBIENT Ta= 40 °C</th> <th>ROOM AMBIENT Ta= 25°C</th> <th>HIGH AMBIENT Ta= 40 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>Q1</td><td>67.4°C</td><td>84.0°C</td><td>49.5°C</td><td>68.9°C</td></tr> <tr><td>2</td><td>Q4</td><td>38.1°C</td><td>56.3°C</td><td>32.4°C</td><td>49.7°C</td></tr> <tr><td>3</td><td>Q906</td><td>51.5°C</td><td>74.5°C</td><td>38.9°C</td><td>55.6°C</td></tr> <tr><td>4</td><td>Q907</td><td>60.4°C</td><td>83.8°C</td><td>42.4°C</td><td>61.2°C</td></tr> <tr><td>5</td><td>T1 coil</td><td>81.9°C</td><td>103.9°C</td><td>56.6°C</td><td>75.5°C</td></tr> <tr><td>6</td><td>Q950</td><td>87.9°C</td><td>109.0°C</td><td>59.6°C</td><td>81.0°C</td></tr> <tr><td>7</td><td>Q957</td><td>79.3°C</td><td>99.6°C</td><td>55.7°C</td><td>76.8°C</td></tr> <tr><td>8</td><td>Q700</td><td>40.4°C</td><td>56.8°C</td><td>35.4°C</td><td>55.2°C</td></tr> <tr><td>9</td><td>T55</td><td>45.1°C</td><td>60.6°C</td><td>43.2°C</td><td>60.8°C</td></tr> <tr><td>10</td><td>Q3</td><td>37.5°C</td><td>57.1°C</td><td>32.2°C</td><td>49.2°C</td></tr> <tr><td>11</td><td>Q959</td><td>80.4°C</td><td>104.5°C</td><td>58.1°C</td><td>75.7°C</td></tr> <tr><td>12</td><td>Q964</td><td>97.1°C</td><td>110°C</td><td>66.0°C</td><td>84.4°C</td></tr> <tr><td>13</td><td>D972</td><td>99.3°C</td><td>111°C</td><td>66.9°C</td><td>85.7°C</td></tr> <tr><td>14</td><td>T1 core</td><td>50.2°C</td><td>70.0°C</td><td>39.0°C</td><td>58.2°C</td></tr> <tr><td>15</td><td>C722</td><td>38.1°C</td><td>53.3°C</td><td>35.8°C</td><td>53.7°C</td></tr> <tr><td>16</td><td>L700</td><td>35.7°C</td><td>48.5°C</td><td>33.2°C</td><td>52.0°C</td></tr> <tr><td>17</td><td>D707</td><td>36.1°C</td><td>51.7°C</td><td>33.6°C</td><td>52.0°C</td></tr> <tr><td>18</td><td>U701</td><td>40.5°C</td><td>57.8°C</td><td>37.3°C</td><td>54.5°C</td></tr> <tr><td>19</td><td>C711</td><td>39.2°C</td><td>57.2°C</td><td>36.8°C</td><td>53.6°C</td></tr> <tr><td>20</td><td>RG70</td><td>48.0°C</td><td>66.3°C</td><td>46.5°C</td><td>64.4°C</td></tr> <tr><td>21</td><td>D706</td><td>58.0°C</td><td>74.9°C</td><td>58.9°C</td><td>73.8°C</td></tr> <tr><td>22</td><td>D705</td><td>50.1°C</td><td>67.5°C</td><td>43.1°C</td><td>62.8°C</td></tr> <tr><td>23</td><td>U551</td><td>48.2°C</td><td>64.7°C</td><td>38.7°C</td><td>59.1°C</td></tr> <tr><td>24</td><td>U201</td><td>50.7°C</td><td>66.0°C</td><td>40.3°C</td><td>59.7°C</td></tr> </tbody> </table>				NO	Position	AC to DC Direction:		DC to AC Direction:		ROOM AMBIENT Ta= 25°C	HIGH AMBIENT Ta= 40 °C	ROOM AMBIENT Ta= 25°C	HIGH AMBIENT Ta= 40 °C	1	Q1	67.4°C	84.0°C	49.5°C	68.9°C	2	Q4	38.1°C	56.3°C	32.4°C	49.7°C	3	Q906	51.5°C	74.5°C	38.9°C	55.6°C	4	Q907	60.4°C	83.8°C	42.4°C	61.2°C	5	T1 coil	81.9°C	103.9°C	56.6°C	75.5°C	6	Q950	87.9°C	109.0°C	59.6°C	81.0°C	7	Q957	79.3°C	99.6°C	55.7°C	76.8°C	8	Q700	40.4°C	56.8°C	35.4°C	55.2°C	9	T55	45.1°C	60.6°C	43.2°C	60.8°C	10	Q3	37.5°C	57.1°C	32.2°C	49.2°C	11	Q959	80.4°C	104.5°C	58.1°C	75.7°C	12	Q964	97.1°C	110°C	66.0°C	84.4°C	13	D972	99.3°C	111°C	66.9°C	85.7°C	14	T1 core	50.2°C	70.0°C	39.0°C	58.2°C	15	C722	38.1°C	53.3°C	35.8°C	53.7°C	16	L700	35.7°C	48.5°C	33.2°C	52.0°C	17	D707	36.1°C	51.7°C	33.6°C	52.0°C	18	U701	40.5°C	57.8°C	37.3°C	54.5°C	19	C711	39.2°C	57.2°C	36.8°C	53.6°C	20	RG70	48.0°C	66.3°C	46.5°C	64.4°C	21	D706	58.0°C	74.9°C	58.9°C	73.8°C	22	D705	50.1°C	67.5°C	43.1°C	62.8°C	23	U551	48.2°C	64.7°C	38.7°C	59.1°C	24	U201	50.7°C	66.0°C	40.3°C	59.7°C
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		25	Q2	66.8°C	85.1°C	49.5°C	68.0°C
		26	T550	33.9°C	51.4°C	31.2°C	47.5°C
		27	L900	63.0°C	82.7°C	44.9°C	61.0°C
		28	T3	40.4°C	60.4°C	34.7°C	51.1°C
		29	RT51	47.0°C	66.8°C	39.4°C	56.5°C
		30	RT52	35.7°C	55.1°C	29.9°C	50.1°C
		31	L1	40.6°C	56.5°C	31.9°C	51.1°C
		32	BD1	28.3°C	43.0°C	23.0°C	42.8°C
		33	RY1	28.3°C	42.0°C	24.3°C	43.0°C
		34	Q902	57.0°C	77.4°C	38.4°C	55.4°C
		35	LF3	31.6°C	50.6°C	26.9°C	44.8°C
		36	C2	24.2°C	42.4°C	23.0°C	40.9°C
		37	C962	29.4°C	46.0°C	26.8°C	44.3°C
		38	C958	29.9°C	46.7°C	25.5°C	44.7°C
		39	L950	56.7°C	71.2°C	39.9°C	59.2°C
		40	RG61	37.4°C	56.2°C	30.9°C	50.5°C
		41	T92	49.4°C	68.5°C	38.0°C	56.1°C
		42	U405	36.0°C	55.1°C	34.0°C	50.2°C
		43	U51	33.6°C	55.6°C	31.5°C	47.3°C
		44	R143	44.6°C	68.5°C	41.1°C	57.4°C
		45	D906	38.3°C	60.6°C	37.9°C	55.7°C
		46	D905	38.6°C	59.5°C	38.3°C	57.3°C
		47	U120	42.6°C	60.8°C	35.1°C	52.9°C
		48	Q74	50.3°C	68.1°C	39.4°C	58.0°C
		49	RG50	30.9°C	47.2°C	27.9°C	45.7°C
		50	R938	38.2°C	50.4°C	29.8°C	49.4°C
		51	C6	48.2°C	67.1°C	39.3°C	56.1°C
		52	Q903	61.5°C	84.4°C	42.9°C	59.5°C
		53	Q952	80.1°C	101.0°C	58.0°C	77.0°C
		54	D982	72.8°C	92.5°C	53.5°C	74.4°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )			I/P : 230 VAC O/P : 110% LOAD Ta : 25°C		TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR			I/P : 264VAC/100VAC O/P : 100 %LOAD Ta= -35 °C		TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 40 °C/95 %R.H NO DAMAGE			I/P : 268 VAC O/P : FULL LOAD Ta= 40 °C HUMIDITY= 95 %R.H		TEST : OK
5	TEMPERATURE COEFFICIENT	± 0.03%/°C(0~45°C)			I/P : 230 VAC O/P : FULL LOAD		± 0.01%/°C(0~45°C)
6	STORAGE TEMPERATURE TEST	-40~85°C			1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : STATIC		

7	THERMAL SHOCK TEST	-30~45°C	1. Thermal shock Temperature : -35°C~ +50°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 16 CYCLE 5. Input/Output condition : 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test
8	VIBRATION TEST	10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 3G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C962 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 40 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 40°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 40 °C LIFE TIME	(1) 519622HRS (2) 164428HRS (3) 481868HRS (4) 784370HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 462.9K hrs min. Telcordia SR-332 (Bellcore) ; 46K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=40°C Demonstration Mean Time Between Failure : 50,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT TSENG

2020.10.1 TAG-QA-009