



Test Report: RCP-1600-48

1600W Rack Mountable Front End Rectifier

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Control Function Test
Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test
E.M.C. Test

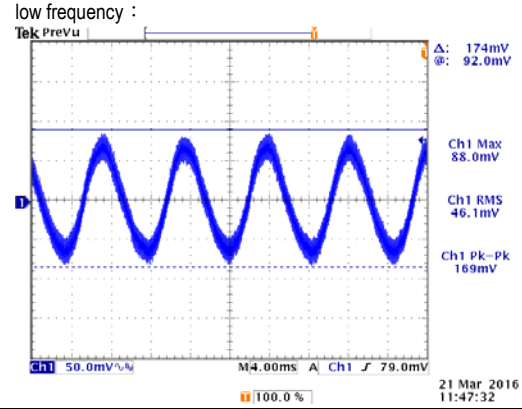
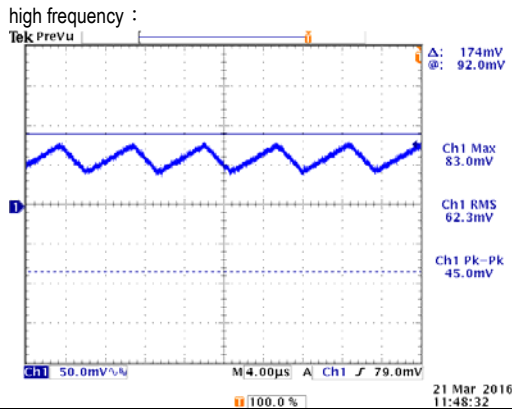
■ RELIABILITY TEST

ENVIRONMENT TEST

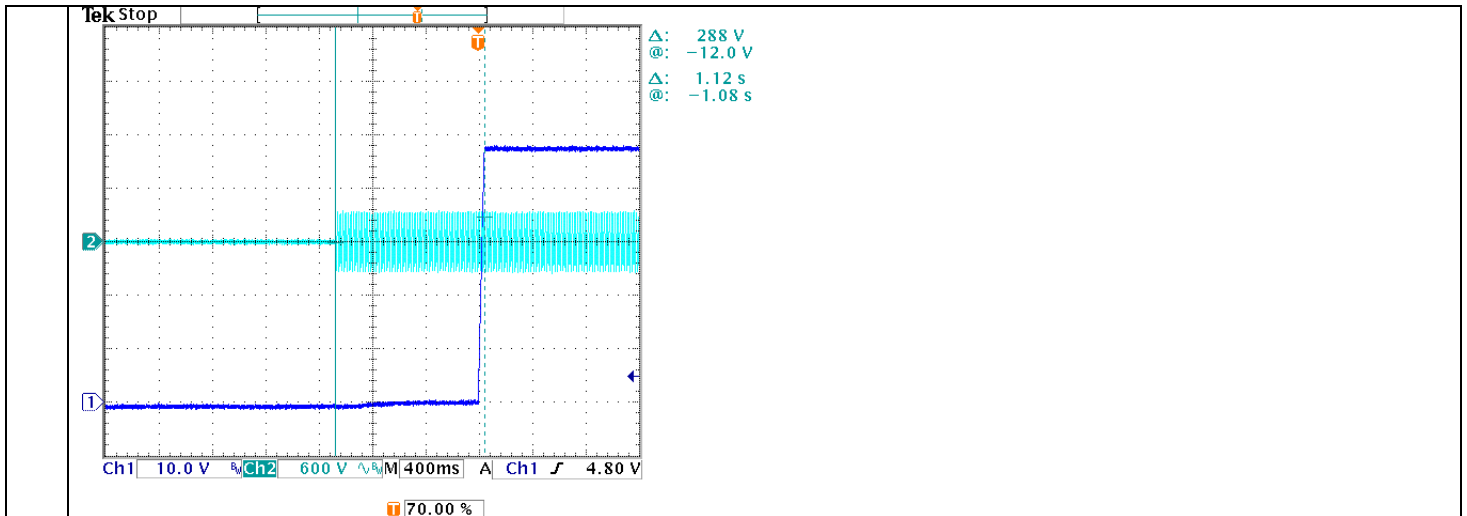
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

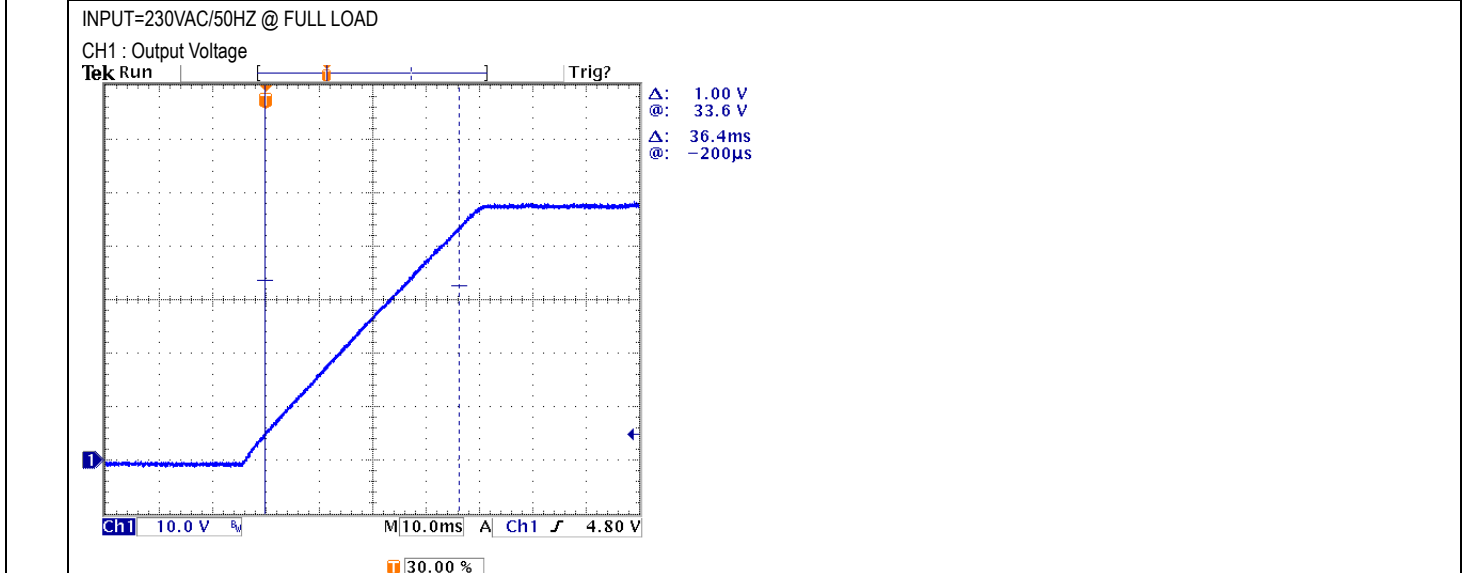
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 47.5 V~ 58.8V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	45.62V~60.1V/230VAC 45.62V~60.1V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1%~ -1%	I/P: 180VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: 0.2%~ -0.2%
3	LINE REGULATION (Max)	V1: 0.5%~ -0.5%	I/P: 180VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0.07%~ -0.07%
4	LOAD REGULATION(Max)	V1: 0.5%~ -0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.05%~ -0.05%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	<5%
6	RIPPLE & NOISE(Max)	V1: 300 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 169 mVp-p



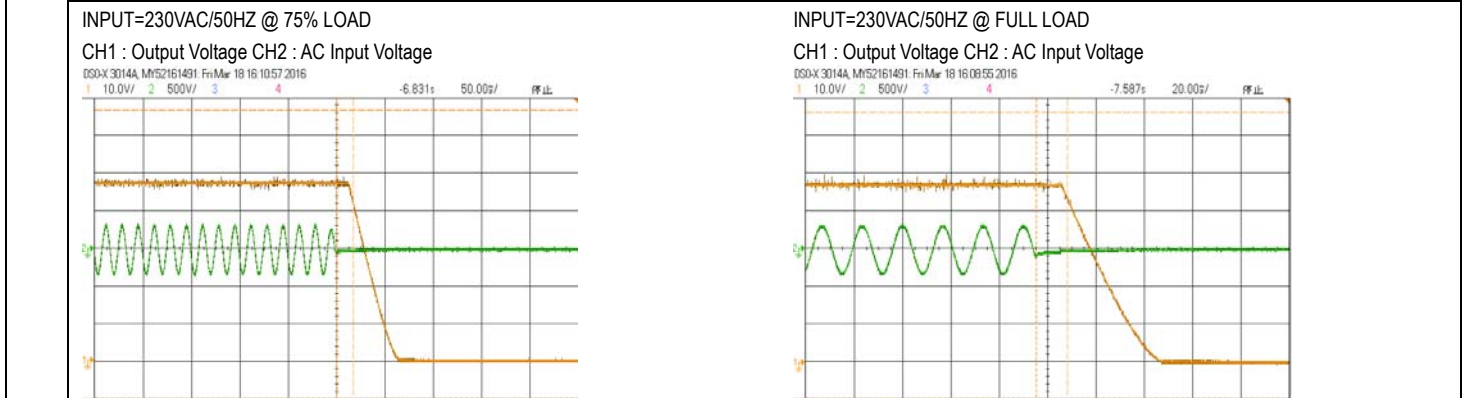
7	SET UP TIME(Max)	230VAC/1500ms	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 1120 ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage				

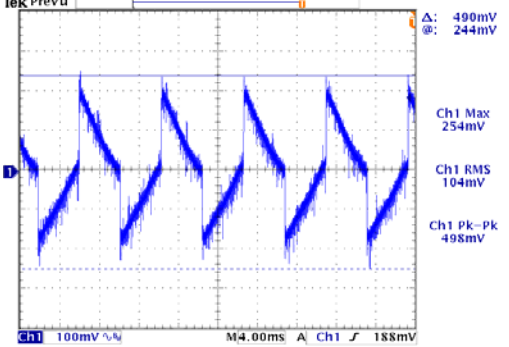
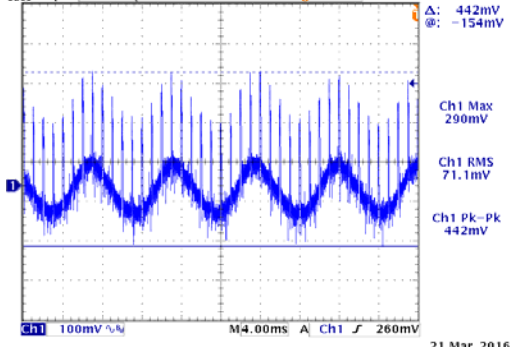


8	RISE TIME (Max)	230VAC/60ms	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 36.4 ms
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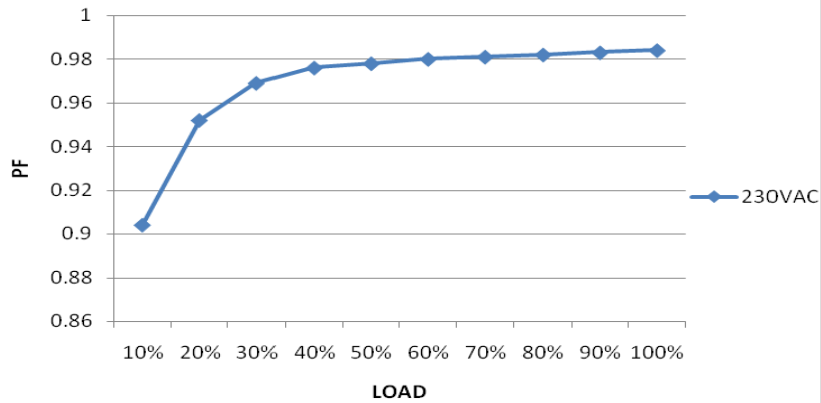
9	HOLD UP TIME (Typ.)	230VAC 75%/ 16ms 230VAC 100%/10ms	I/P : 230 VAC O/P : 75% LOAD O/P : 100% LOAD Ta : 25°C	17 ms (75% load) 12.8ms (100% load)
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10	DYNAMIC LOAD	V1: 4800 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	498mVp-p 442mVp-p
FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 		

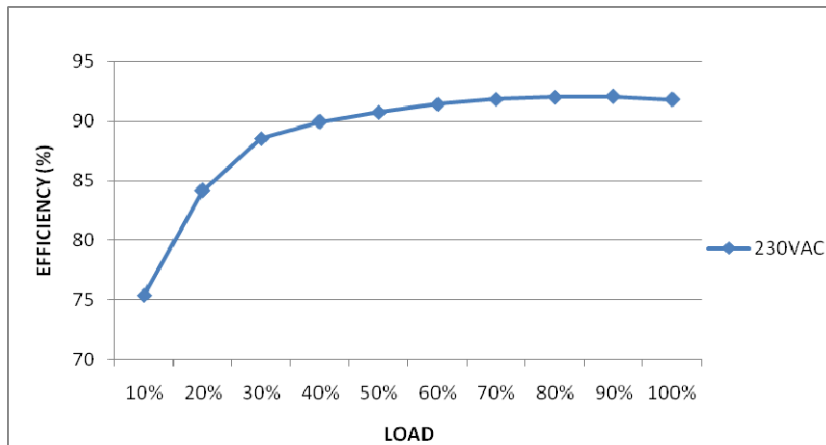
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC	I/P:TESTING O/P: FULL LOAD O/P:60% LOAD Ta:25°C I/P: (1)LOW-LINE-3V=87 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (2)230Vac ON: 0.5 Sec OFF: 0.5 Sec 20MIN (3)230Vac ON:3Sec OFF:3Sec 12HOURS (POWER ON/OFF NO DAMAGE)	150 V~ 264 V 87V~264V TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 8.5 A 115V/ 15 A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD (PLEASE CHECK DERATING CURVE) Ta : 25°C	I=7.72A/ 230VAC I=12.7A/ 115VAC
4	LEAKAGE CURRENT	<1.5mA / 230 VAC	I/P : 230 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.84 mA N-FG : 0.84 mA
5	POWER FACTOR (Typ.)	0.97 / 230VAC	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	PF=0.978/230VAC
P.F vs LOAD				



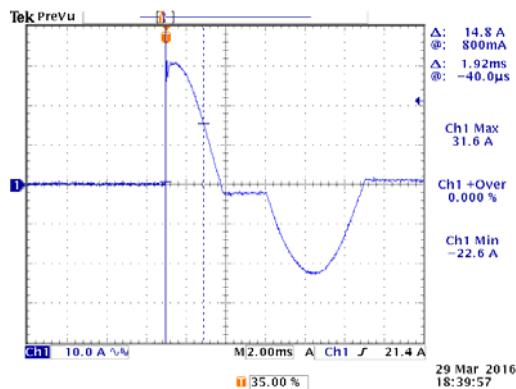
6	EFFICIENCY(Typ.)	93%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	93.15%
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EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	230V/35 A COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I=31.6A/ 230VAC T50= 1920 us/230V
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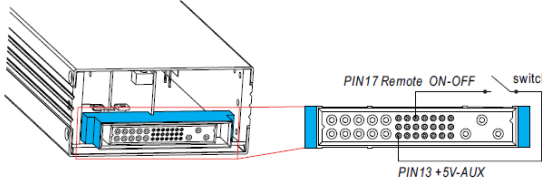
INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Input current



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~ 115 % PROTECTION TYPE : Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 180VAC O/P: TESTING Ta:25°C	107.76%/ 264VAC 107.76%/ 230VAC 107.76%/180VAC PROTECTION TYPE : Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power on to recover
2	OVER VOLTAGE PROTECTION	63 V~ 75 V PROTECTION TYPE : Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 90VAC O/P: MIN LOAD Ta:25°C	69V/ 264VAC 69V/ 230VAC 69V/ 90VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE PROTECTION TYPE : Shut down o/p voltage, recovers automatically after temperature goes down	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD	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 PROTECTION TYPE : Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power on to recover	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power on to recover

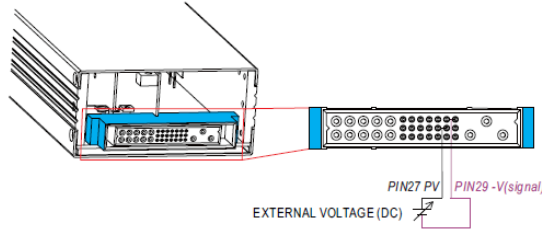
CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT											
1	AUXILIARY POWER (AUX)	1. 5V±10%@0.3A ripple:150mVp-p 2. 12V±10%@0.8A ripple:250mVp-p	I/P: 230 VAC O/P: FULL LOAD Ta:25°C	4.78 V 0.3A ; ripple: 15.9mVp-p 11.16V 0.8 A ; ripple: 100 mVp-p											
2	REMOTE ON/OFF CONTROL	The power supply can be turned ON/OFF individually or along with other units by using the "Remote ON-OFF" function.  I/P: 230 VAC O/P: FULL LOAD Ta:25°C Test Result : <table border="1" data-bbox="470 1758 1093 1870"> <tr> <td>Between ON/OFF and +5V-AUX</td> <td>OUTPUT</td> </tr> <tr> <td>SW SHORT</td> <td>ON</td> </tr> <tr> <td>SW OPEN</td> <td>OFF</td> </tr> </table>	Between ON/OFF and +5V-AUX	OUTPUT	SW SHORT	ON	SW OPEN	OFF	<table border="1" data-bbox="1069 1512 1492 1601"> <thead> <tr> <th>Between Remote ON-OFF and +5V-AUX</th> <th>Power Supply Status</th> </tr> </thead> <tbody> <tr> <td>Switch Short</td> <td>ON</td> </tr> <tr> <td>Switch Open</td> <td>OFF</td> </tr> </tbody> </table>	Between Remote ON-OFF and +5V-AUX	Power Supply Status	Switch Short	ON	Switch Open	OFF
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3	REMOTE SENSE	S+ / S- >0.5V Compensate voltage drop on the load wiring up to 0.5V.	I/P: 230 VAC O/P: FULL LOAD Ta:25°C	> 0.5 V											

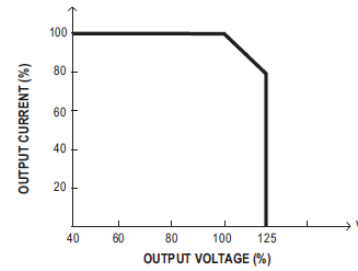
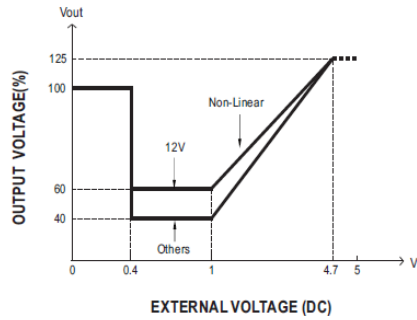
4	ALARM SIGNAL	<p>1. DC OK SIGNAL High (4.5 ~ 5.5V) : When the $V_{out} \leq 80\% \pm 5\%$. Low (-0.1 ~ 0.5V) : When $V_{out} \geq 80\% \pm 5\%$. The maximum sourcing current is 10mA and only for output. I/P: 230 VAC O/P: FULL LOAD Ta: 25°C Test Result :</p> <table border="1" data-bbox="544 472 1075 551"> <thead> <tr> <th>Vout</th> <th>DC OK SIGNAL</th> </tr> </thead> <tbody> <tr> <td>$V_{out} \leq 75\%$</td> <td>5.037 V</td> </tr> <tr> <td>$V_{out} \geq 85\%$</td> <td>-0.09V</td> </tr> </tbody> </table> <p>2. T-ALARM</p> <table border="1" data-bbox="536 658 1126 736"> <thead> <tr> <th>P.S.U STATUS</th> <th>Vo</th> <th>T-ALARM</th> </tr> </thead> <tbody> <tr> <td>NORMAL</td> <td>100%±2%</td> <td>-0.1 ~0.5V</td> </tr> <tr> <td>OTP OR FAN LOCK</td> <td>0V</td> <td>4.5~5.5V</td> </tr> </tbody> </table> <p>I/P: 230 VAC O/P: FULL LOAD Ta: 25°C Test Result :</p> <table border="1" data-bbox="536 842 1126 943"> <thead> <tr> <th>P.S.U STATUS</th> <th>T-ALARM</th> </tr> </thead> <tbody> <tr> <td>NORMAL</td> <td>-0.09V</td> </tr> <tr> <td>OTP OR FAN LOCK</td> <td>4.998V</td> </tr> </tbody> </table> <p>3. AC- OK</p> <table border="1" data-bbox="544 969 1134 1048"> <thead> <tr> <th>AC IN</th> <th>Vo</th> <th>AC OK</th> </tr> </thead> <tbody> <tr> <td>$AC I/P \geq 87V_{rms}$</td> <td>100%±2%</td> <td>4.5~5.5V</td> </tr> <tr> <td>$AC I/P \leq 75V_{rms}$</td> <td>0V</td> <td>0~0.5V</td> </tr> </tbody> </table> <p>I/P: TEST O/P: 60%LOAD Test Result :</p> <table border="1" data-bbox="552 1160 1139 1256"> <thead> <tr> <th>AC IN</th> <th>Vo</th> <th>AC OK</th> </tr> </thead> <tbody> <tr> <td>$AC I/P \geq 87V$</td> <td>100.4%</td> <td>5.39V</td> </tr> <tr> <td>$AC I/P \leq 75V$</td> <td>0.002V</td> <td>0.002</td> </tr> </tbody> </table>	Vout	DC OK SIGNAL	$V_{out} \leq 75\%$	5.037 V	$V_{out} \geq 85\%$	-0.09V	P.S.U STATUS	Vo	T-ALARM	NORMAL	100%±2%	-0.1 ~0.5V	OTP OR FAN LOCK	0V	4.5~5.5V	P.S.U STATUS	T-ALARM	NORMAL	-0.09V	OTP OR FAN LOCK	4.998V	AC IN	Vo	AC OK	$AC I/P \geq 87V_{rms}$	100%±2%	4.5~5.5V	$AC I/P \leq 75V_{rms}$	0V	0~0.5V	AC IN	Vo	AC OK	$AC I/P \geq 87V$	100.4%	5.39V	$AC I/P \leq 75V$	0.002V	0.002
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5 OUTPUT VOLTAGE PROGRAMMABLE(PV)

※ In addition to the adjustment via the built-in potentiometer, the output voltage can be trimmed to 40~125% of the nominal voltage by applying EXTERNAL VOLTAGE.



◎ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.



• The rated current should change with the Output Voltage Programming accordingly.

I/P: 230 VAC
 O/P: FULL LOAD
 Ta: 25°C
 TEST RESULT :

MODEL \ PV	<0.4V	1V	4.7V	5V
SPEC	48V±5%	19.2V±5%	60V±5%	60V±5%
Vout	48.1V	19.21V	59.7V	61.01V

6 OUTPUT CURRENT PROGRAMMABLE (PC)

※ The constant current level can be trimmed to 20~100% of the rated current by applying EXTERNAL VOLTAGE.

EXTERNAL VOLTAGE (DC) $\frac{1}{\mu}$

○ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.

I/P: 230 VAC
O/P: TESTING
Ta: 25°C
TEST RESULT :

ADJ V	<0.4V	1V	4.7V	5V
SPEC	110%±10%	20%±10%	100%±10%	100%±10%
lout	107.6%	15.8%	100%	100.59%

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q901 Rated 37A/600V	I/P: High-Line +3V = 267V AC ON/OFF VDS: O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90% Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90% Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90% Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50% Duty/120Hz (7) 0% → 400% Load. Ta: 25°C	VDS: (1) 566V (2) 546V (3) 512V (4) 568V (5) 568V (6) 488V (7) 550V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q52 Rated 33A/600V	I/P: High-Line +3V = 267 V AC ON/OFF O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/	VDS: (1) 480V (2) 472V (3) 464V

			<p>Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. Ta:25°C</p>	<p>(4)472V (5)456V (6)440V (7)423V</p>
3	Diode Peak Voltage	<p>Q101 Rated 65A/200 V</p> <p>Q104 Rated 65A/200 V</p>	<p>I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8).NO LOAD Ta:25°C</p>	<p>Q101: Q104: VDS: VDS: (1)187V (1)189V (2)181V (2)195V (3)185V (3)195V (4)185V (4)197V (5)183V (5)195V (6)183V (6)197V (7)187V (7)189V (8)177V (8)177V</p>
4	Input Capacitor Voltage	<p>C5 Rated: 680μ/400V SURGE VOLTAGE:450V</p>	<p>I/P:High-Line +3V =267 V O/P: (1)Full Load Ta:25°C</p>	<p>(1)397V</p>
5	Control IC Voltage Test	<p>PFC IC U51 Rated 4.5V~ 15V</p> <p>PWM IC U901 Rated 6.5V~ 24V</p>	<p>I/P:High-Line +3V =267 V AC ON/OFF O/P:(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25°C</p>	<p>U51 (1) 11.68V (2) 11.68V (3) 11.68V (4) 11.68V</p> <p>U901 (1)12.56V (2)12.56V (3)12.56V (4)12.56V</p>
6	Transistor	<p>Q154 Rated : 100A/40V</p>	<p>I/P:High-Line +3V =267 V (HOT SWAP TEST) O/P: (1)Full Load (2)NO LOAD (3)Dynamic Load Full Load/ Min. Load 50%Duty/120Hz</p>	<p>(1)400mV (2)600mV (3)600mV</p>
7	Transistor	<p>Q163 Rated : 2.4A/100V</p>	<p>I/P:High-Line +3V =267 V (HOT SWAP TEST) O/P: (1)Full Load (2)NO LOAD (3)Dynamic Load Full Load/ Min. Load 50%Duty/120Hz</p>	<p>(1)600mV (2)9.3V (3)600mV</p>

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:1.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.8 KVAC/min Ta:25°C	I/P-O/P:6.9mA I/P-FG:8.04mA O/P-FG:6.28m A 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: 8.16GΩ I/P-FG: 9.35GΩ O/P-FG: 9.4GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	17 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:100% LOAD Ta:25°C	PASS
2	CONDUCTION	EN55022 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN55022 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 INDUSTRY 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 INDUSTRY 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			

■ **RELIABILITY TEST**

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																								
1	TEMPERATURE RISE TEST	MODEL : RCP-1600-24 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 37.5 °C 2. HIGH AMBIENT BURN-IN : 3 HRS I/P : 230VAC O/P : FULL LOAD Ta= 51.7 °C																																																																																																										
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 107% LOAD Ta : 25°C	TEST : OK																																																																																																								
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 230VAC/180VAC O/P : 100 % LOAD Ta= -35°C / -30°C	TEST : OK																																																																																																								
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK																																																																																																								
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C (0-50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.002 %/°C (0-50°C)																																																																																																								



6	STORAGE TEMPERATURE TEST	<ol style="list-style-type: none"> 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 : 5 CYCLE 5. Input/Output condition : STATIC 	OK
7	THERMAL SHOCK TEST	<ol style="list-style-type: none"> 1. Thermal shock Temperature : -35°C~ +55°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 : <p>15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST(13500 TIMES)</p> <p>1cycle:230V/ FULL LOAD Burn In Test</p>	OK
8	VIBRATION TEST	<p>1 Carton & 1 Set</p> <ol style="list-style-type: none"> (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 2G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C 	TEST : OK
9	CAPACITOR LIFE CYCLE	<p>SUPPOSE C101 IS THE MOST CRITICAL COMPONENT</p> <ol style="list-style-type: none"> (1) I/P : 230VAC O/P : FULL LOAD Ta= 25°C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 50°C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 50°C LIFE TIME 	<ol style="list-style-type: none"> (1) 522532HRS (2) 104695HRS (3) 131576HRS (4) 209272HRS
10	MTBF	<p>Conducted by Parts Stress Analysis Prediction</p> <p>162.2K hrs min. Telcordia SR-332 (Bellcore) ; 39.3K hrs min. MIL-HDBK-217F (25°C)</p>	
11	DMTBF/Accelerated Life Test	<p>Demonstration Mean Time Between Failure (Expected Life): Above 50,000 hours @ TA 50°C</p>	

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

12.10.30 A50-F031