Test Report: RCP-1600-12

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

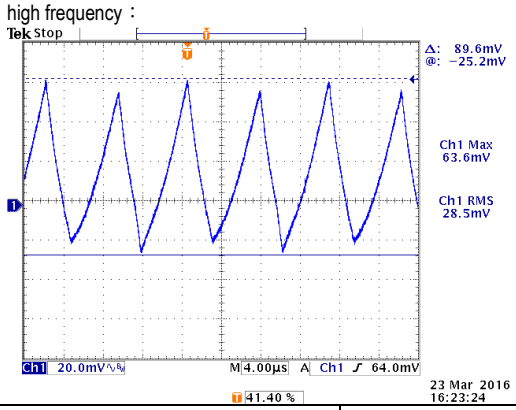
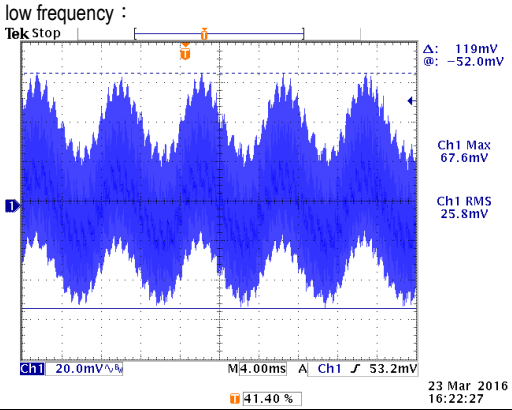
Safety Test
E.M.C. Test

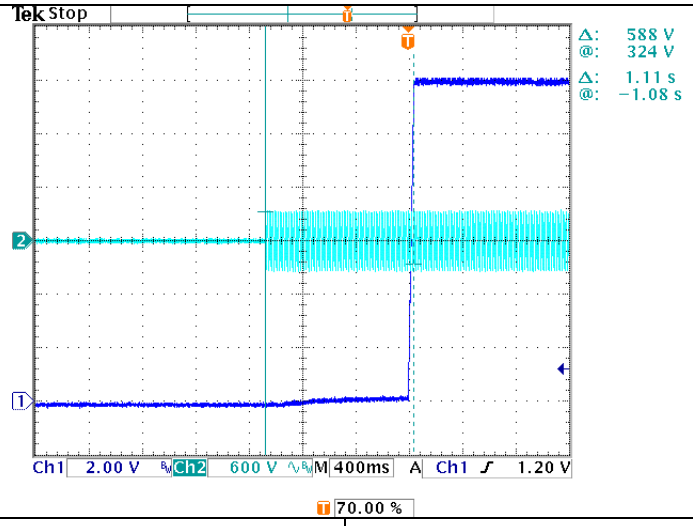
■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

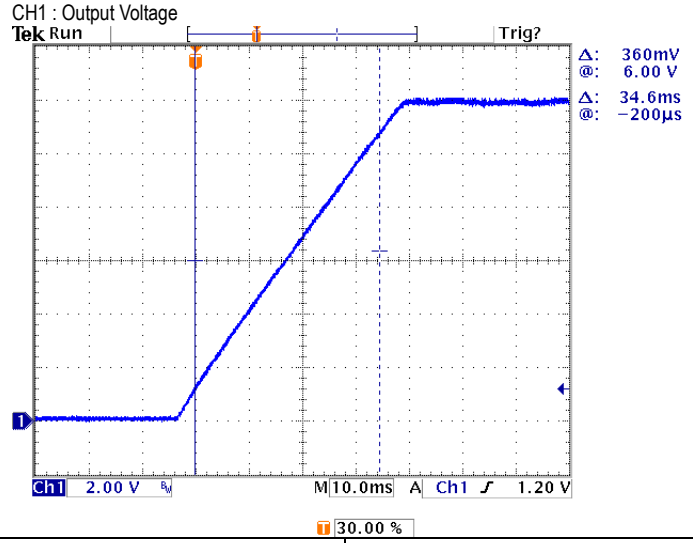
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 11.5 V~ 15V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	11.03V~15.26V/230VAC 11.03V~15.26V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1 %~ -1 %	I/P: 180VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: 0.25%~ -0.25 %
3	LINE REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 180VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1: 0 %~ 0 %
4	LOAD REGULATION(Max)	V1: 0.5 %~ -0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: 0.25%~ -0.25 %
5	OVER/UNDERSHOOT TEST	＜±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	<5 %
6	RIPPLE & NOISE(Max)	V1: 150 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 119 mVp-p
	high frequency： 		low frequency： 	
7	SET UP TIME(Max)	230VAC/1500ms	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 1100 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℃	230VAC/ 34.6 ms

INPUT=230VAC/50HZ @ FULL LOAD

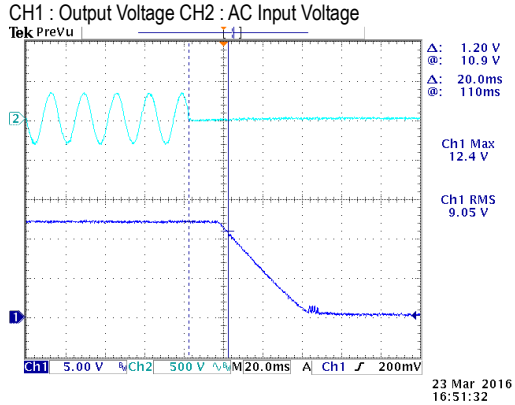
CH1 : Output Voltage



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℃	20ms (75% load) 12.8ms (100% load)

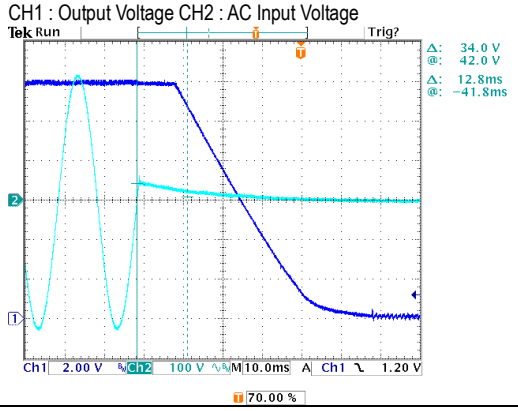
INPUT=230VAC/50HZ @75% LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



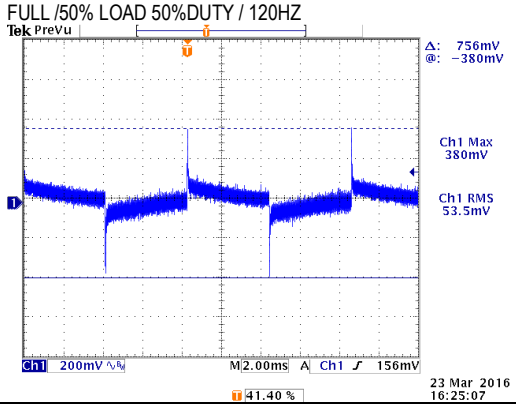
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

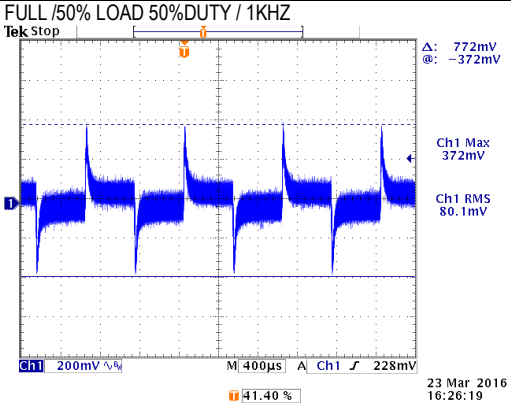


10	DYNAMIC LOAD	V1: 1200 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	756mVp-p 772mVp-p

FULL /50% LOAD 50%DUTY / 120HZ

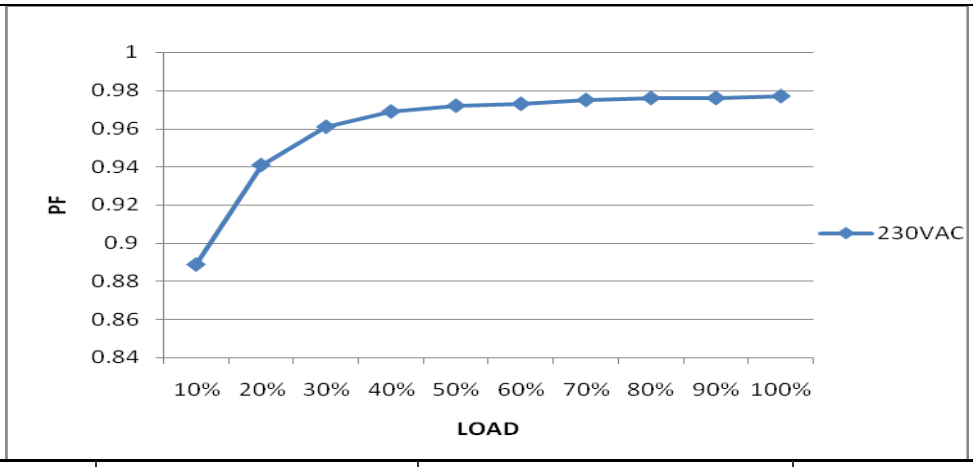


FULL /50% LOAD 50%DUTY / 1KHZ



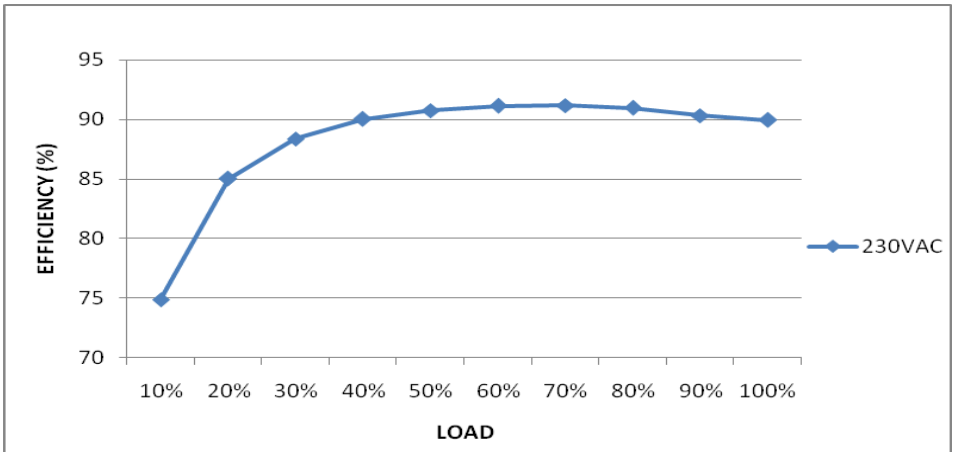
INPUT FUNCTION TEST

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℃	150 V~ 264 V 87V~264V
			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)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 8 A 115V/ 14 A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD (PLEASE CHECK DERATING CURVE) Ta：25℃	I =7.49A/ 230VAC I =12.41A/ 115VAC
4	LEAKAGE CURRENT	<1.5 mA / 230 VAC	I/P： 230 VAC O/P：Min LOAD Ta：25℃	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℃	PF=0.977/230VAC
	P.F vs LOAD			



6	EFFICIENCY(Typ.)	88.5%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	88.75 %

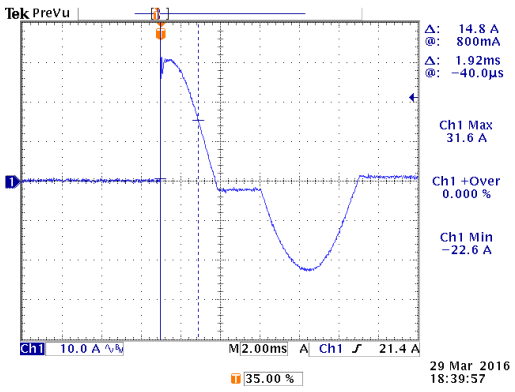
EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	230V/35 A COLD START	I/P ： 230 VAC O/P ：FULL LOAD Ta ：25℃	I =31.6A/ 230VAC T50= 1920 us/230V

INPUT=230VAC/50HZ @ FULL LOAD

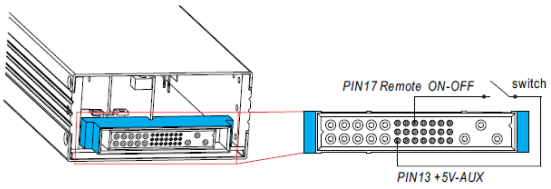
CH1 : Input current



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℃	109.2%/ 264VAC 109.2%/ 230VAC 109.2%/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	15.75 V~ 18.75 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℃	17.5V/ 264VAC 17.5V/ 230VAC 17.7V/ 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℃	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℃	4.74 V 0.3 A ；ripple: 24mVp-p 11.28V 0.8 A；ripple: 195 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.  Between Remote ON-OFF and +5V-AUX / Power Supply Status: Switch Short / ON; Switch Open / OFF I/P: 230 VAC O/P:FULL LOAD Ta:25℃ Test Result： Between Remote ON-OFF and +5V-AUX / OUTPUT: SW SHORT / ON; SW OPEN / OFF		
3	REMOTE SENSE	S+ / S- 0.3V~0.5V Compensate voltage drop on	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	0.3V~0.5V

		the load wiring up to 0.5V.		
4	ALARM SIGNAL	1. DC OK SIGNAL High (4.5 ~ 5.5V) : When the Vout≦ 80%±5%. Low (-0.1 ~ 0.5V) : When Vout≧ 80%±5%. The maximum sourcing current is 10mA and only for output. I/P: 230 VAC O/P:FULL LOAD Ta:25℃ Test Result：		
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.		

Vout	DC OK SIGNAL
Vout≦ 75%	5V
Vout≧ 85%	-0.09V

2. T-ALARM

P.S.U STATUS	Vo	T-ALARM
NORMAL	100%±2%	-0.1 ~0.5V
OTP OR FAN LOCK	0V	4.5~5.5V

I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：

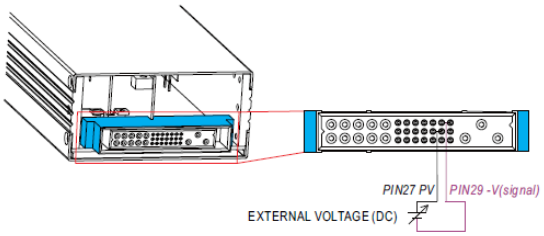
P.S.U STATUS	T-ALARM
NORMAL	-0.09V
OTP OR FAN LOCK	4.937V

3. AC- OK

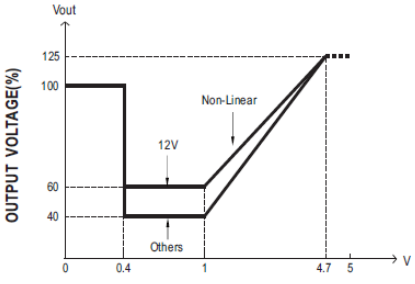
AC IN	Vo	AC OK
AC I/P≧87Vrms	100%±2%	4.5~5.5V
AC I/P≦75Vrms	0V	0~0.5V

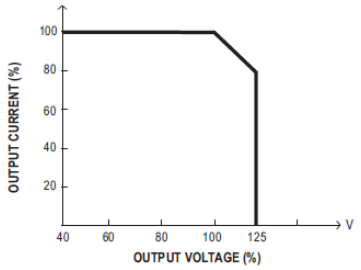
I/P: TEST
O/P:60%LOAD
Test Result：

AC IN	Vo	AC OK
AC I/P≧87V	100.69%	5.36V
AC I/P≦75V	0.00V	0.00V



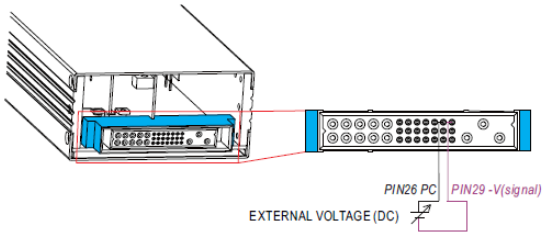
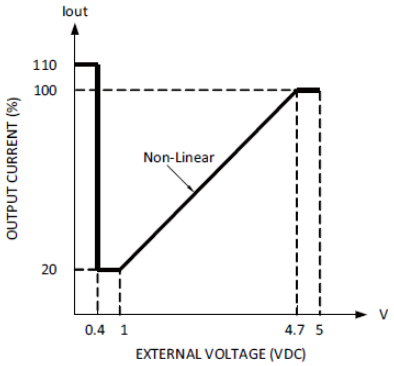
◎ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.





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

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

		PV / MODEL: <0.4V | 1V | 4.7V | 5V SPEC: 12V±5% | 7.2V±5% | 15V±5% | 15V±5% Vout: 12V | 7.27V | 15.01V | 15.19V
6	OUTPUT CURRENT PROGRAMMABLE (PC)	※ The constant current level can be trimmed to 20~100% of the rated current by applying EXTERNAL VOLTAGE.  ◎ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.  I/P: 230 VAC O/P:TESTING Ta:25℃ ADJ V: <0.4V | 1V | 4.7V | 5V SPEC: 110%±10% | 20%±10% | 100%±10% | 100%±10% Iout: 108.2% | 18.08% | 100.6% | 101.6%

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q901 Rated 29A/600 V	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℃	VDS: (1)494V (2)470V (3)478V (4)482V (5)486V (6)475V (7)482V

2	P.F.C Transistor (D to S) or (C to E) **Peak Voltage**	Q52 Rated 52 A/600 V	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. Ta:25℃	VDS: (1)439V (2)455V (3)455V (4)451V (5)459V (6)435V (7)419V
3	Diode Peak **Voltage**	Q101 Rated 210 A/75 V Q104 Rated 210 A/75 V	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℃	Q101: VDS: (1)50.6V (2)51.4V (3)59.8V (4)52.2V (5)51.8V (6)61V (7)58.6V (8)60.9V Q104: VDS: (1)60.1V (2)54.5V (3)65.7V (4)53.7V (5)52.1V (6)66.5V (7)51.3V (8)64.1V
4	Input Capacitor Voltage	C5 Rated: 680μ/400V SURGE VOLTAGE:450V	I/P:High-Line +3V =267 V O/P: (1)Full Load Ta:25℃	(1)398V
5	Control IC Voltage Test	PWM IC U901 Rated 6.5 V~24 V PFC IC U51 Rated 4.5V~15V O/P IC U142 Rated 4.5V~ 15V	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℃	U901 U51 U142 (1) 13.4 V 12.93V 12.5 V (2) 13.25 V 12.93V 12.5 V (3) 13.25 V 12.9 V 12.5 V (4) 13.2 V 12.9V 12.5 V
6	Transistor	Q154 Rated： 100A/40V	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	(1)400mV (2)600mV (3)600mV
7	Transistor	Q163 Rated： 2.4A/100V	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	(1)600mV (2)9.3V (3)600mV

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: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:0.6 KVAC/min Ta:25℃	I/P-O/P:6.23mA I/P-FG:5.77mA O/P-FG:6.08m 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℃	I/P-O/P: 7.28GΩ I/P-FG: 5.7GΩ O/P-FG: 9.2GΩ NO DAMAGE

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℃	PASS
2	CONDUCTION	EN55022 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL/50% LOAD Ta：25℃	PASS Test by certified Lab
3	RADIATION	EN55022 CLASS A	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	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℃	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT： 2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	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℃	CRITERIA A
7	Test by certified Lab & Test Report Prepare			

■ RELIABILITY TEST

ENVIRONMENT TEST

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

NO	Position	ROOM AMBIENT Ta= 28.3 ℃	HIGH AMBIENT Ta= 52.5 ℃
1	Q901	81.1℃	96.7℃
2	Q904	78.0℃	92.1℃
3	Q52	73.9℃	85.7℃
4	D50	72.7℃	84.9℃
5	BD1	61.5℃	72.6℃
6	L900	60.7℃	70.7℃
7	T3	47.6℃	58.8℃
8	RG301	51.2℃	62.3℃
9	RG302	45.8℃	57.8℃
10	T1	62.0℃	73.6℃
11	Q101	62.6℃	76.0℃
12	Q104	71.6℃	85.9℃
13	U921	54.2℃	65.4℃
14	C5	54.9℃	67.1℃
15	L100	98.3℃	110.8℃
16	ZNR1	62.1℃	73.5℃
17	L2	65.1℃	75.6℃
18	RY1	58.7℃	69.7℃
19	C101	62.8℃	75.2℃
20	T52	56.7℃	68.0℃
21	RTH21	61.6℃	73.4℃
22	RTH9	64.1℃	76.8℃
23	U671	59.8℃	71.4℃
24	U82	47.3℃	63.0℃
25	Q151	67.2℃	79.2℃

6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature： -45℃~ +90℃ 2. Temperature change rate ：25℃ / 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	1. Thermal shock Temperature： -35℃~ +55℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：10 CYCLE 5. Input/Output condition： 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST(13500 TIMES) 1cycle:230V/ FULL LOAD Burn In Test	OK
8	VIBRATION TEST	1 Carton & 1 Set (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℃	TEST：OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C101 IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P：FULL LOAD Ta= 25℃ LIFE TIME (2) I/P： 230VAC O/P：FULL LOAD Ta= 50℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 50℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 50℃ LIFE TIME	(1) 522532HRS (2) 104695HRS (3) 131576HRS (4) 209272HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 483.3K hrs min. Telcordia SR-332 (Bellcore) ; 39.4K hrs min. MIL-HDBK-217F (25℃)	
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 50,000 hours @ TA 50℃	

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

12.10.30 A50-F031