Test Report: RSP-1600-12

1600W Power Supply with Single Output

■ DESIGN VERIFY TEST

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

■ SAFETY & E.M.C. TEST

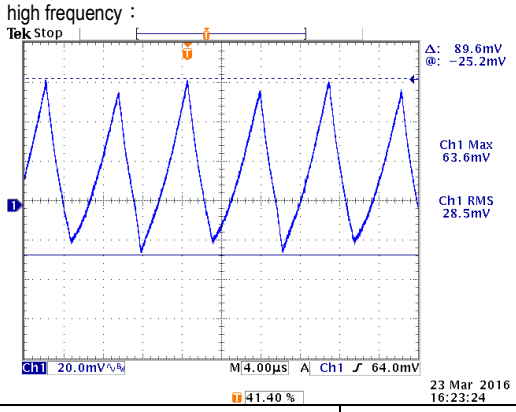
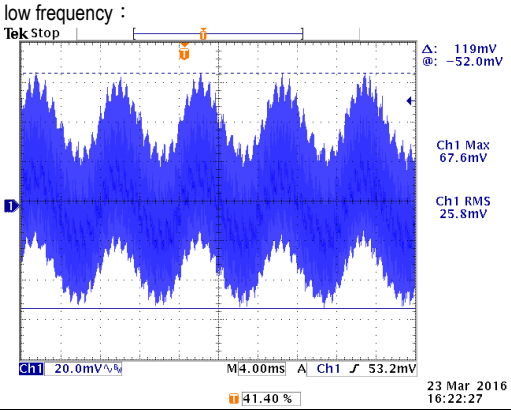
Safety Test
E.M.C. Test

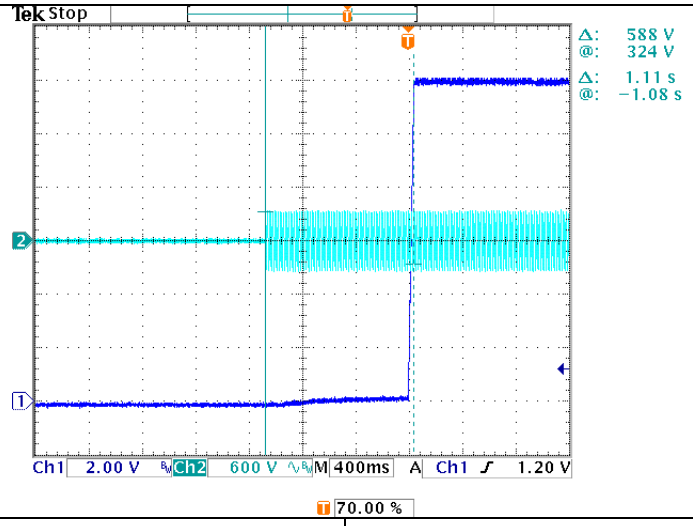
■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

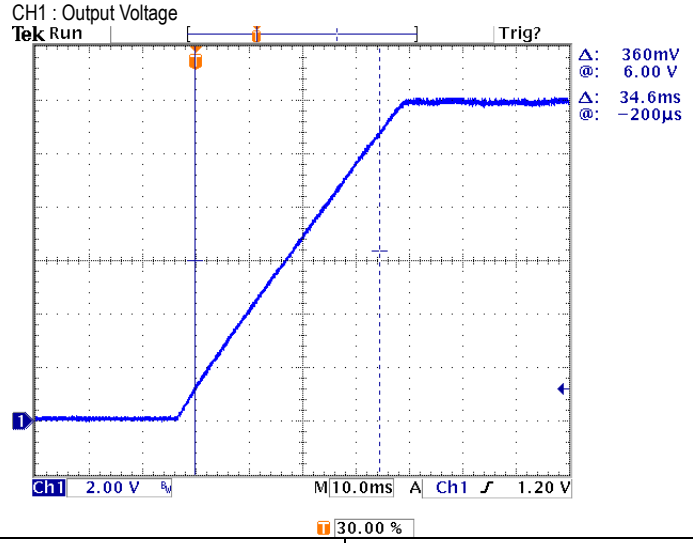
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 11.5 V~ 15V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	11.03V~15.26V/230VAC 11.03V~15.26V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1 %~ -1 %	I/P: 180VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: 0.25%~ -0.25 %
3	LINE 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

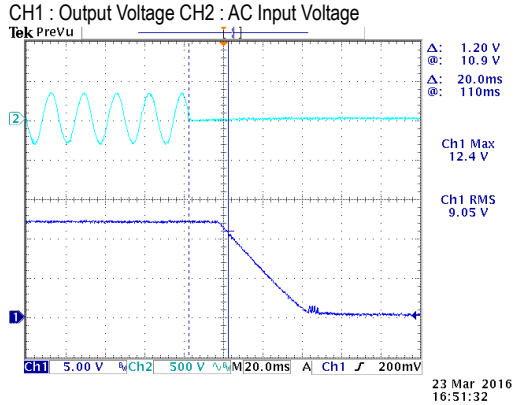
CH1 : Output Voltage



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)

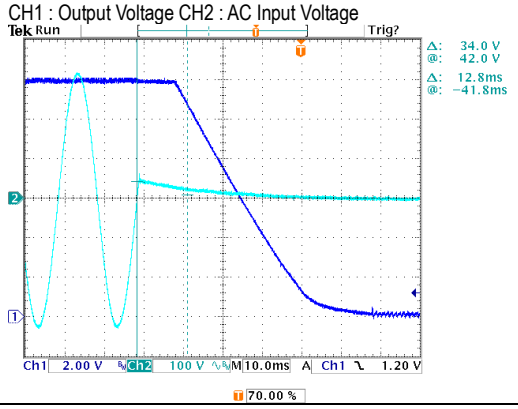
INPUT=230VAC/50HZ @ 75% LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



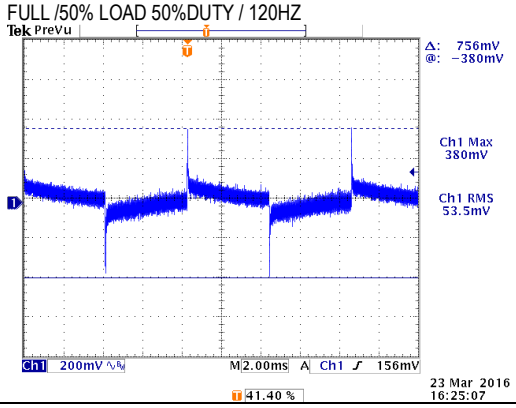
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

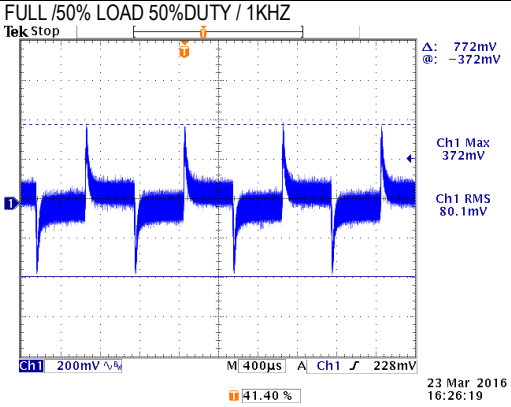


10	DYNAMIC LOAD	V1: 1200 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	756mVp-p 772mVp-p

FULL /50% LOAD 50%DUTY / 120HZ

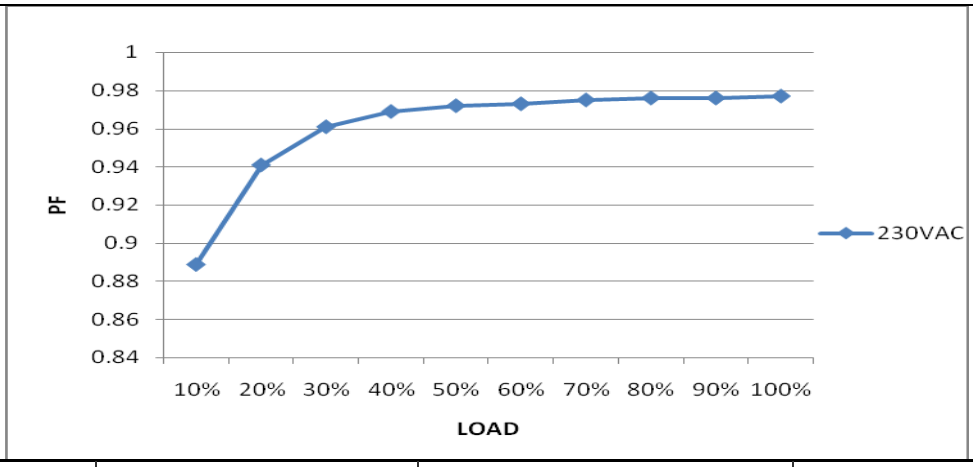


FULL /50% LOAD 50%DUTY / 1KHZ



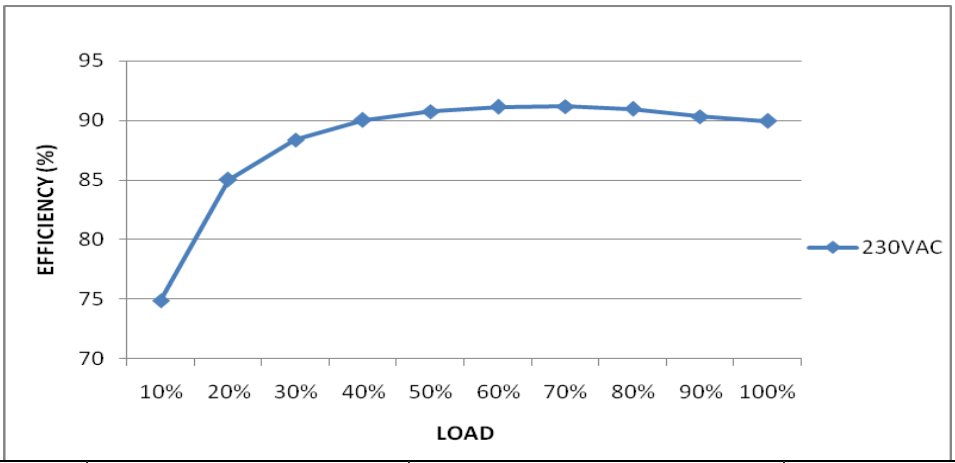
INPUT FUNCTION TEST

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	<2 mA / 230 VAC	I/P ： 230 VAC O/P ：Min LOAD Ta ：25℃	L-FG ：0.56 mA N-FG ：0.56 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.)	89%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	89.69 %

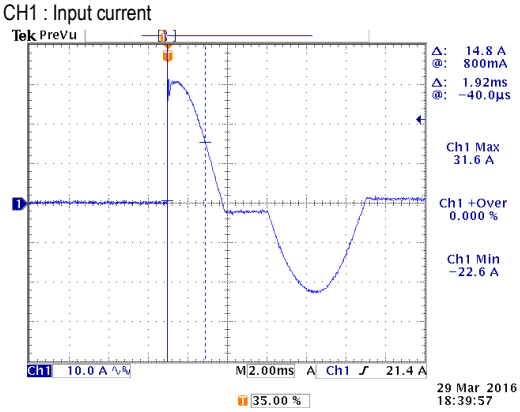
EFFICIENCY vs LOAD



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

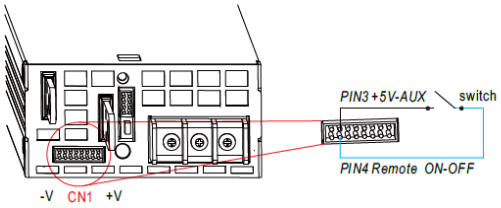
CH1 : Input current



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 17.5V/ 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

<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>AUXILIARY POWER (AUX)</td><td>1. 5V±10%@0.3A
ripple:150mVp-p
2. 12V±10%@0.8A
ripple:250mVp-p</td><td>I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃</td><td>4.74 V 0.3 A ；ripple: 24mVp-p
11.28V 0.8 A；ripple: 195 mVp-p</td></tr>
<tr><td>2</td><td>REMOTE ON/OFF CONTROL</td><td colspan="3">※ The power supply can be turned ON/OFF individually or along with other units by using the "Remote ON-OFF" function.
 

<table>
<tr><th>Between Remote ON-OFF and +5V-AUX</th><th>Power Supply Status</th></tr>
<tr><td>Switch Short</td><td>ON</td></tr>
<tr><td>Switch Open</td><td>OFF</td></tr>
</table>
I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：
<table>
<tr><th>Between Remote ON-OFF and +5V-AUX</th><th>Power Supply Status</th></tr>
<tr><td>SW SHORT</td><td>ON</td></tr>
<tr><td>SW OPEN</td><td>OFF</td></tr>
</table></td></tr>
<tr><td>3</td><td>REMOTE SENSE</td><td>S+ / S-
0.3V~0.5V
Compensate voltage drop on the load wiring up to 0.5V.</td><td>I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃</td><td>0.3V~0.5V</td></tr>
</table>

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：

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

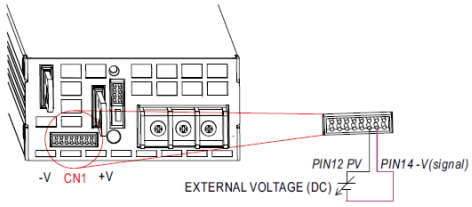
Ta:25℃

Test Result：

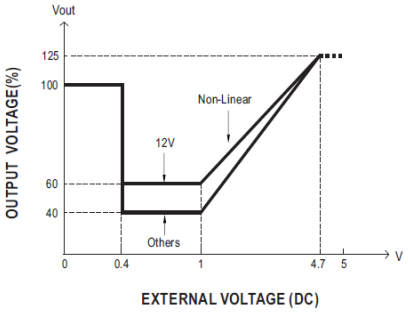
P.SU STATUS	T-ALARM
NORMAL	-0.09V
OTP OR FAN LOCK	4.937V

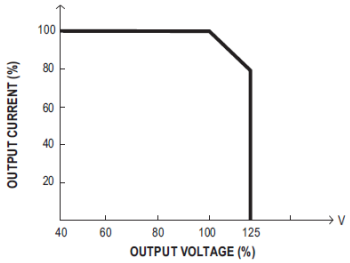
5 OUTPUT VOLTAGE PROGRAMMABLE(PV)

※ In addition to the adjustment via the built-in potentiometer, the output voltage can be trimmed 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.

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

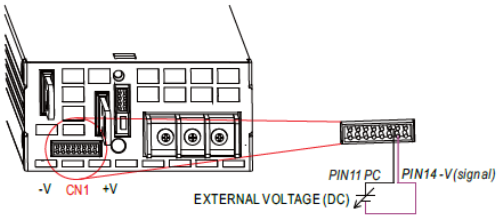
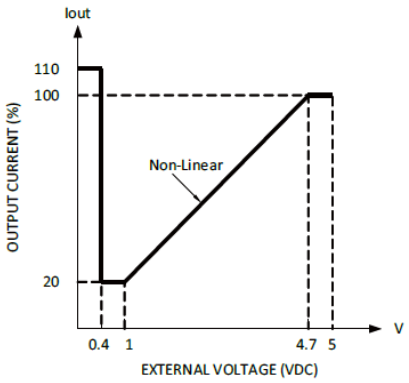
I/P: 230 VAC

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)	 ◎ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.  I/P: 230 VAC O/P:TESTING Ta:25℃ Test Result： 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%
7	CURRENT SHARING	< ±5% I/P： 230 VAC O/P：FULL/50% LOAD Ta：25℃ O/P：100% PSU1：126.8 A PSU2：125.5 A PSU3：124.3 A PSU4：126.3 A PSU5：125.3 A PSU6：125.3 A O/P：50% PSU1：62.3 A PSU2：63.4 A PSU3：63.1 A PSU4：62.1 A PSU5：63.5 A PSU6：63.5 A

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)395V
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

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℃	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
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	17mΩ

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： RSP-1600-24
1. ROOM AMBIENT BURN-IN：1 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 28.3 ℃
2. HIGH AMBIENT BURN-IN： 3 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 52.5 ℃</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：105% 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	63.0℃	93.0℃
2	Q904	60.8℃	89.5℃
3	Q52	63.1℃	89.3℃
4	D50	70.3℃	97.8℃
5	BD1	44.2℃	69.2℃
6	L900	54.9℃	80.5℃
7	T3	53.4℃	80.3℃
8	RG301	71.8℃	98.9℃
9	RG302	66.6℃	92.5℃
10	T1	60.5℃	88.0℃
11	Q101	63.9℃	94.7℃
12	Q104	61.3℃	90.9℃
13	U921	43.7℃	68.2℃
14	C5	38.5℃	62.4℃
15	L100	71.9℃	96.4℃
16	ZNR1	29.2℃	53.3℃
17	L2	47.4℃	71.9℃
18	RY1	33.3℃	58.0℃
19	C101	31.3℃	55.1℃
20	T52	41.7℃	66.6℃
21	RTH21	55.7℃	82.7℃
22	RTH9	44.4℃	68.5℃
23	U671	31.3℃	55.2℃
24	U82	59.7℃	86.3℃
25	Q151	40.9℃	65.0℃

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) 2451612HRS (2) 445544HRS (3) 480914HRS (4) 490935HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 478.8K hrs min. Telcordia SR-332 (Bellcore) ; 42.1K 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