



# Test Report: RSP-1600-24

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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

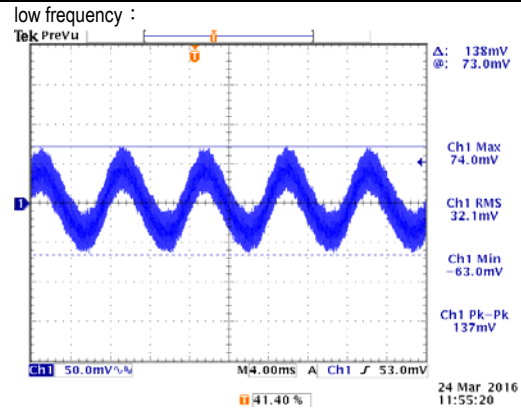
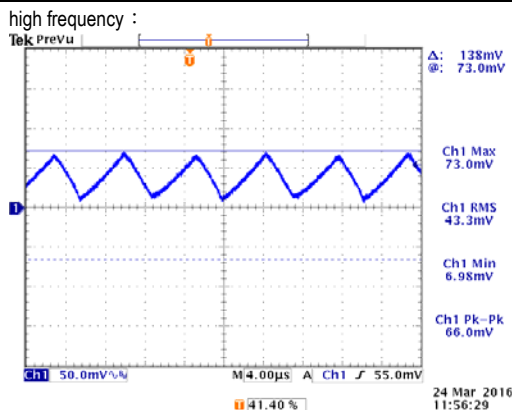
## ■ RELIABILITY TEST

ENVIRONMENT TEST

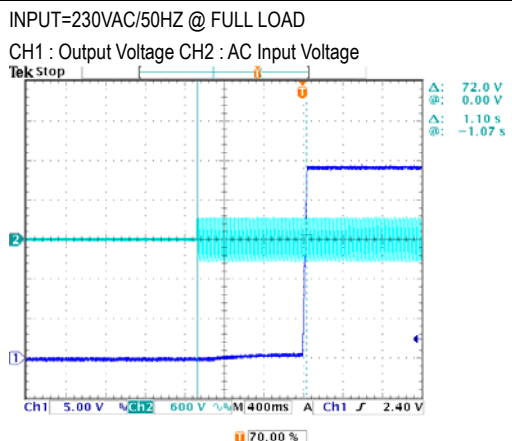
■ DESIGN VERIFY TEST

**OUTPUT FUNCTION TEST**

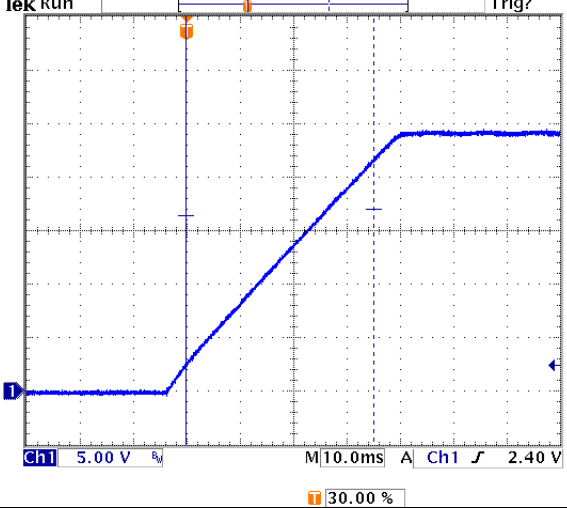
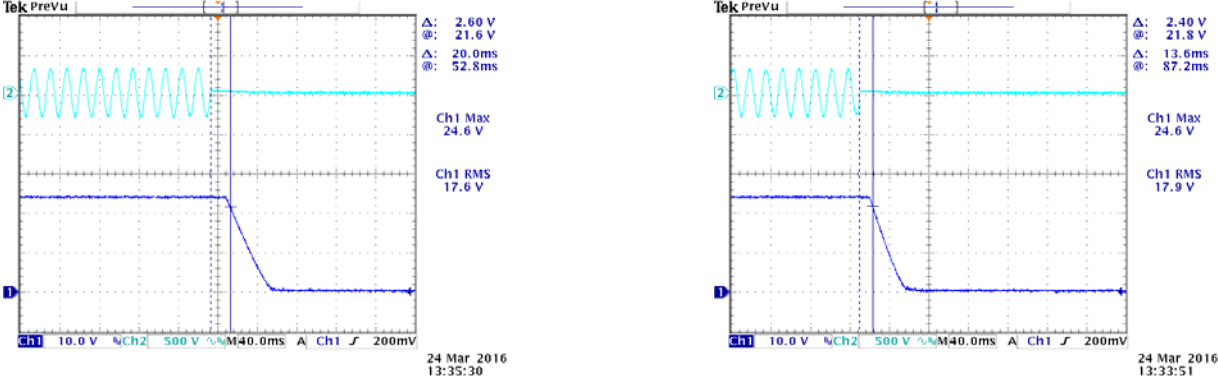
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 23.5 V~ 30V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	22.6V~30.72V/230VAC 22.6V~30.72V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1%~-1%	I/P: 180VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: 0.13%~-0.13%
3	LINE REGULATION (Max)	V1: 0.5%~-0.5%	I/P: 180VAC~264VAC O/P:FULL LOAD Ta:25°C	V1: 0.05%~-0.05%
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: 200 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 138 mVp-p

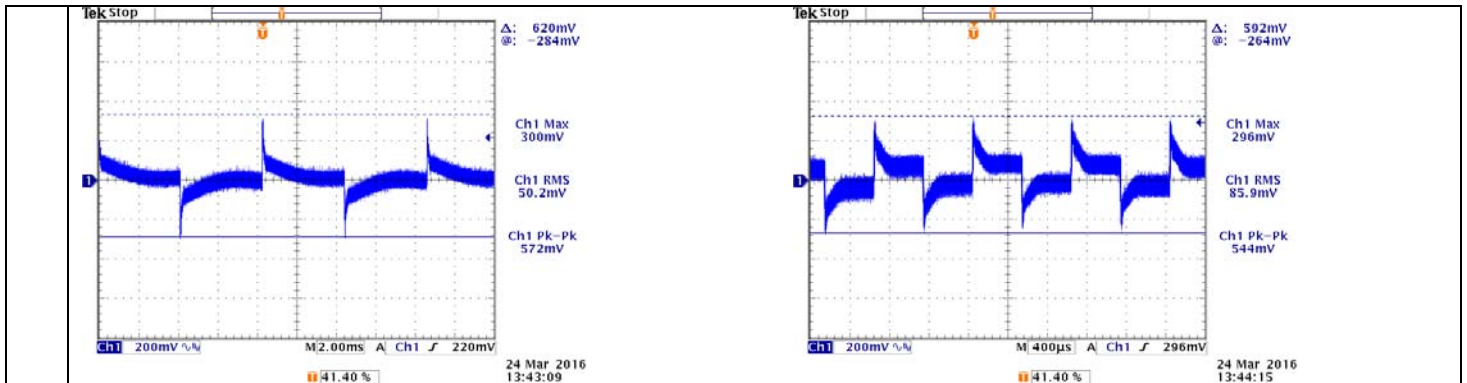


7	SET UP TIME(Max)	230VAC/1500ms	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 1100 ms
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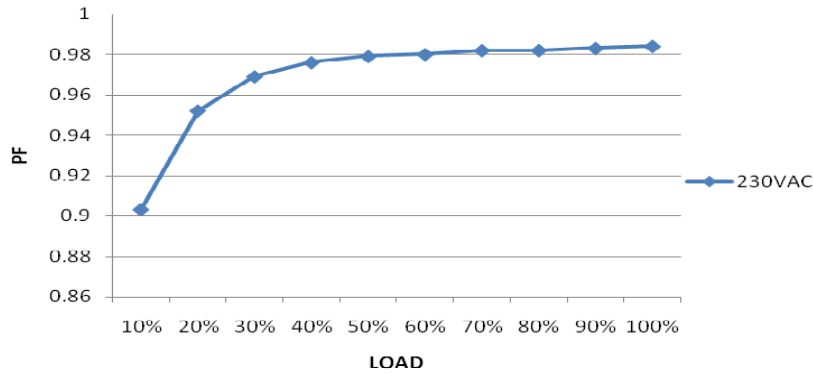


8	RISE TIME (Max)	230VAC/60ms	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 35.2 ms
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p>  <p>Δ: 600mV @: 16.4 V Δ: 35.2ms @: -200µs</p> <p>Ch1 5.00 V M 10.0ms A Ch1 2.40 V</p> <p>30.00 %</p>				
9	HOLD UP TIME (Typ.)	230VAC 75%/ 16ms 230VAC 100%/10ms	I/P : 230 VAC O/P : 75% LOAD O/P : 100% LOAD Ta : 25°C	20ms (75% load) 13.6ms (100% load)
<p>INPUT=230VAC/50HZ @ 75% LOAD INPUT=230VAC/50HZ @ FULL LOAD</p> <p>CH1 : Output Voltage CH2 : AC Input Voltage CH1 : Output Voltage CH2 : AC Input Voltage</p>  <p>Δ: 2.60 V @: 21.6 V Δ: 20.0ms @: 52.8ms Ch1 Max 24.6 V Ch1 RMS 17.6 V</p> <p>Δ: 2.40 V @: 21.8 V Δ: 13.6ms @: 87.2ms Ch1 Max 24.6 V Ch1 RMS 17.9 V</p> <p>Ch1 10.0 V Ch2 500 V M 40.0ms A Ch1 200mV</p> <p>24 Mar 2016 13:35:30 24 Mar 2016 13:33:51</p>				
10	DYNAMIC LOAD	V1: 2400 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	620mVp-p 592mVp-p
FULL /50% LOAD 50%DUTY / 120HZ		FULL /50% LOAD 50%DUTY / 1KHZ		



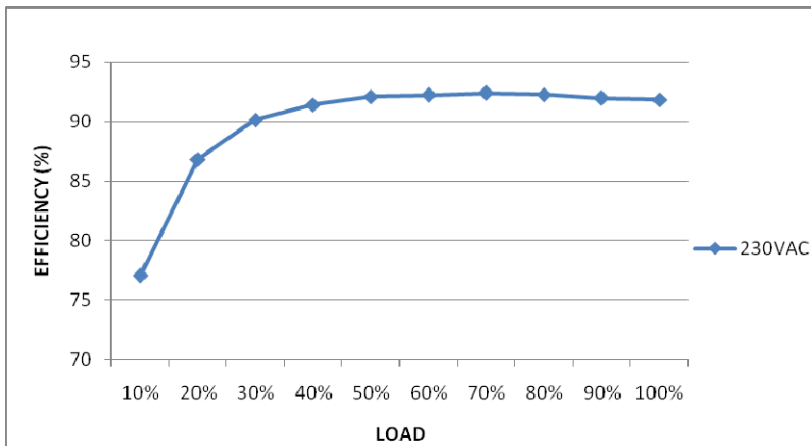
**INPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC	I/P:TESTING O/P:FULL LOAD Ta:25°C	149V~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°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 =7.83A/ 230VAC I =12.77A/ 115VAC
4	LEAKAGE CURRENT	<2 mA / 230 VAC	I/P : 230 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.6 mA N-FG : 0.6 mA
5	POWER FACTOR (Typ.)	0.97 / 230VAC	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	PF=0.98/230VAC
	P.F vs LOAD			



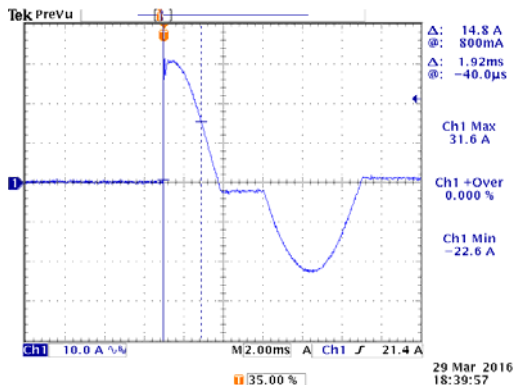
6	EFFICIENCY(Typ.)	91.5%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	92.15 %
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EFFICIENCY vs LOAD



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

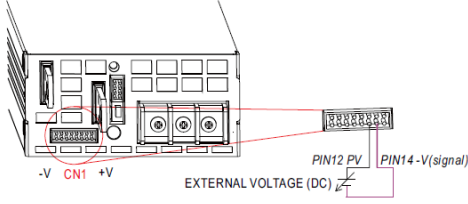


## PROTECTION FUNCTION TEST

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	108%/ 264VAC 108.2%/ 230VAC 107.9%/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	31.5 V~ 37.5 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	34.5V/ 264VAC 34.5V/ 230VAC 34.5V/ 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°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	4.741V/0.3A ; ripple:14mVp-p 11.36V/0.8A ; ripple: 156 mVp-p						
2	REMOTE ON/OFF CONTROL	<p>※ The power supply can be turned ON/OFF individually or along with other units by using the "Remote ON-OFF" function.</p> <p>I/P: 230 VAC O/P: FULL LOAD Ta:25°C Test Result :</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Between Remote ON-OFF and +5V-AUX</th> <th>Power Supply Status</th> </tr> </thead> <tbody> <tr> <td>SW SHORT</td> <td>ON</td> </tr> <tr> <td>SW OPEN</td> <td>OFF</td> </tr> </tbody> </table>	Between Remote ON-OFF and +5V-AUX	Power Supply Status	SW SHORT	ON	SW OPEN	OFF		
Between Remote ON-OFF and +5V-AUX	Power Supply Status									
SW SHORT	ON									
SW OPEN	OFF									
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						

<p>4 ALARM SIGNAL</p>	<p>1. DC OK SIGNAL          High (4.5 ~ 5.5V) : When the <math>V_{out} \leq 80\% \pm 5\%</math>.          Low (-0.1 ~ 0.5V) : When <math>V_{out} \geq 80\% \pm 5\%</math>.          The maximum sourcing current is 10mA and only for output.          I/P: 230 VAC          O/P: FULL LOAD          Ta: 25°C</p> <table border="1" data-bbox="539 452 1088 555"> <thead> <tr> <th>Vout</th> <th>DC OK SIGNAL</th> </tr> </thead> <tbody> <tr> <td><math>V_{out} \leq 75\%</math></td> <td>4.985V</td> </tr> <tr> <td><math>V_{out} \geq 85\%</math></td> <td>-0.09V</td> </tr> </tbody> </table> <p>2. T-ALARM</p> <table border="1" data-bbox="539 631 1129 712"> <thead> <tr> <th>PSU 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="545 837 1114 936"> <thead> <tr> <th>P.S.U STATUS</th> <th>T-ALARM</th> </tr> </thead> <tbody> <tr> <td>NORMAL</td> <td>-0.09 V</td> </tr> <tr> <td>OTP OR FAN LOCK</td> <td>4.936V</td> </tr> </tbody> </table>	Vout	DC OK SIGNAL	$V_{out} \leq 75\%$	4.985V	$V_{out} \geq 85\%$	-0.09V	PSU 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	-0.09 V	OTP OR FAN LOCK	4.936V
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OTP OR FAN LOCK	4.936V																					
<p>5 OUTPUT VOLTAGE PROGRAMMABLE(PV)</p>	<p>※ In addition to the adjustment via the built-in potentiometer, the output voltage can be trimmed by applying EXTERNAL VOLTAGE.</p>  <p>◎ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="497 1290 906 1599"> </div> <div data-bbox="995 1303 1343 1563"> </div> </div> <p>◎ The rated current should change with the Output Voltage Programming accordingly.          ◎ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.</p> <p>I/P: 230 VAC          O/P: FULL LOAD          Ta: 25°C          Test Result :</p> <table border="1" data-bbox="472 1742 1155 1944"> <thead> <tr> <th>MODEL \ PV</th> <th>&lt;0.4V</th> <th>1V</th> <th>4.7V</th> <th>5V</th> </tr> </thead> <tbody> <tr> <td>SPEC</td> <td>24V±5%</td> <td>9.6V±5%</td> <td>30V±5%</td> <td>30V±5%</td> </tr> <tr> <td>Vout</td> <td>24.11V</td> <td>9.47V</td> <td>30.01V</td> <td>30.52V</td> </tr> </tbody> </table>	MODEL \ PV	<0.4V	1V	4.7V	5V	SPEC	24V±5%	9.6V±5%	30V±5%	30V±5%	Vout	24.11V	9.47V	30.01V	30.52V						
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Vout	24.11V	9.47V	30.01V	30.52V																		

<p>6</p>	<p>OUTPUT CURRENT PROGRAMMABLE (PC)</p>	<p>© For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.</p> <p>I/P: 230 VAC O/P: TESTING Ta: 25°C Test Result :</p> <table border="1"> <tr> <td>ADJ V</td> <td>&lt;0.4V</td> <td>1V</td> <td>4.7V</td> <td>5V</td> </tr> <tr> <td>SPEC</td> <td>110%±10%</td> <td>20%±10%</td> <td>100%±10%</td> <td>100%±10%</td> </tr> <tr> <td>lout</td> <td>107.9%</td> <td>19.46%</td> <td>100%</td> <td>101.2%</td> </tr> </table>	ADJ V	<0.4V	1V	4.7V	5V	SPEC	110%±10%	20%±10%	100%±10%	100%±10%	lout	107.9%	19.46%	100%	101.2%	
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<p>7</p>	<p>CURRENT SHARING</p>	<p>&lt; ±5%</p>	<p>I/P : 230 VAC O/P : FULL/50% LOAD Ta : 25°C</p>	<p>O/P : 100%</p> <p>PSU1 : 66.56 A PSU2 : 68.1 A PSU3 : 65.2 A PSU4 : 66.2 A PSU5 : 64.2 A PSU6 : 64.2 A</p> <p>O/P : 50%</p> <p>PSU1 : 33.32 A PSU2 : 32.81 A PSU3 : 32.76 A PSU4 : 33.21 A PSU5 : 32.08 A PSU6 : 32.08 A</p>														

## COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q901 Rated 29 A/650 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°C	VDS: (1) 469V (2) 441V (3) 425V (4) 469V (5) 469V (6) 461V (7) 453V



2	P.F.C Transistor (D to S) or (C to E) <b>Peak Voltage</b>	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°C	VDS: (1)464V (2)464V (3)464V (4) 468V (5) 468V (6) 436V (7)420V
3	Diode <b>Peak Voltage</b>	Q101 Rated 104 A/150 V  Q104 Rated 104 A/150 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°C	Q101: Q104: VDS: VDS: (1)101.2V (1)100.4V (2)98V (2)92.4V (3)114.9V (3)86.8V (4)99.6V (4)96.4V (5)99.6V (5)93.2V (6)114.9V (6)109.3V (7)98V (7)109.3 (8)95.6V (8)106.1V
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°C	(1)398V
5	Control IC Voltage Test	PWM IC U901 Rated 6.5 V~24V  PFC IC U51 Rated 4.5V~ 16V	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	(1) 13.8V (2) 13.7V (3) 13.7V (4) 13.2V  (1)12.8 V (2)12.3V (3)12.3V (4)12.2V

**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:6.77mA I/P-FG:7.63mA O/P-FG:5.84m 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: 30GΩ I/P-FG: 30GΩ O/P-FG: 30GΩ 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 : RSP-1600-24 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta= 28.3 °C 2. HIGH AMBIENT BURN-IN : 3 HRS I/P : 230VAC O/P : FULL LOAD Ta= 52.5 °C																																																																																																										
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 105% 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	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	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 :  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°C	TEST : OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C101 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= 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	(1) 2451612HRS (2) 445544HRS (3) 480914HRS (4) 490935HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 160.9K hrs min. Telcordia SR-332 (Bellcore) ; 42.1K hrs min. MIL-HDBK-217F (25°C)	
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 50,000 hours @ TA 50°C	

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

12.10.30 A50-F031