



# Test Report: HRP-600N3-24

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600W Ultra-High Peak Power Supply

## ■ 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

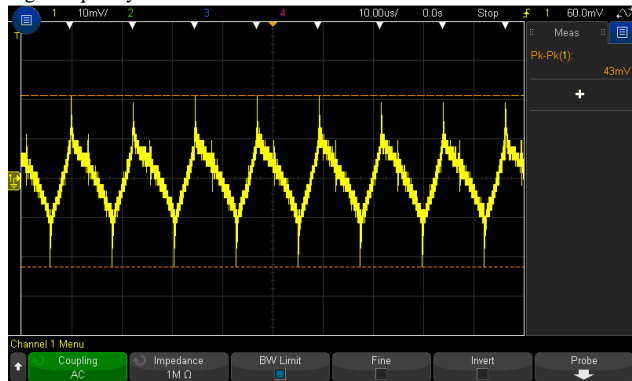
ENVIRONMENT TEST

### DESIGN VERIFY TEST

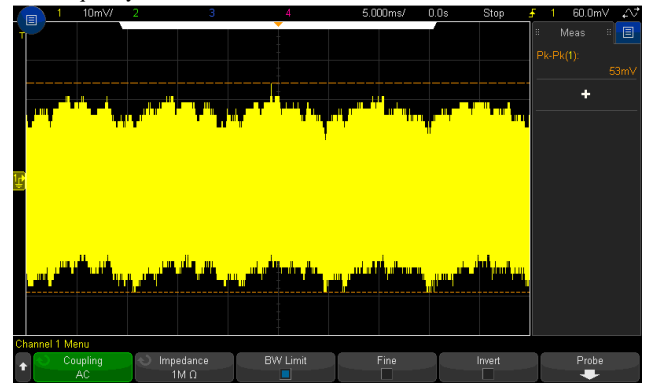
### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 21.6V~ 28.8 V	I/P : 230VAC I/P : 115VAC O/P : MIN LOAD Ta : 25°C	19.16V~29.56V/230VAC 19.16V~29.56V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.0 % ~ +1.0 %	I/P: 85VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.03 % ~ 0.03 %
3	LINE REGULATION (Max)	V1: -0.2 % ~ +0.2 %	I/P: 85VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0% ~ 0 %
4	LOAD REGULATION(Max)	V1: -0.5 % ~ +0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.03 % ~ 0.03 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	1.3%
6	RIPPLE & NOISE(Max )	V1: 150mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 53mVp-p

high frequency :

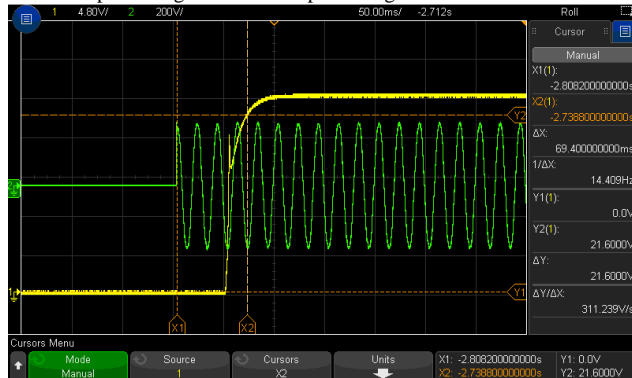


low frequency :

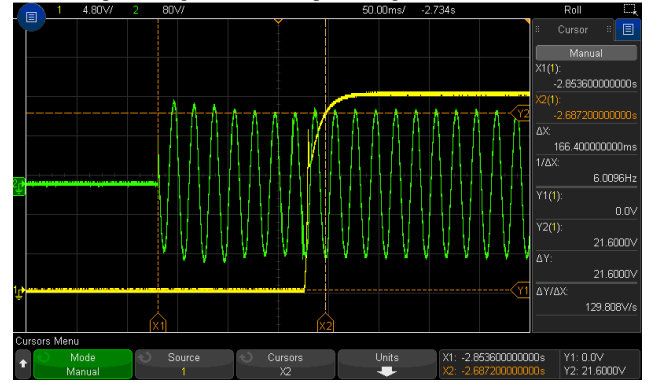


7	SET UP TIME(Max)	230VAC/1800ms 115VAC/3600ms	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 69.4 ms 115VAC/ 166.4 ms
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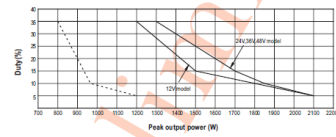
INPUT=230VAC/50HZ @ FULL LOAD  
CH1 : Output Voltage CH3 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD  
CH1 : Output Voltage CH3 : AC Input Voltage

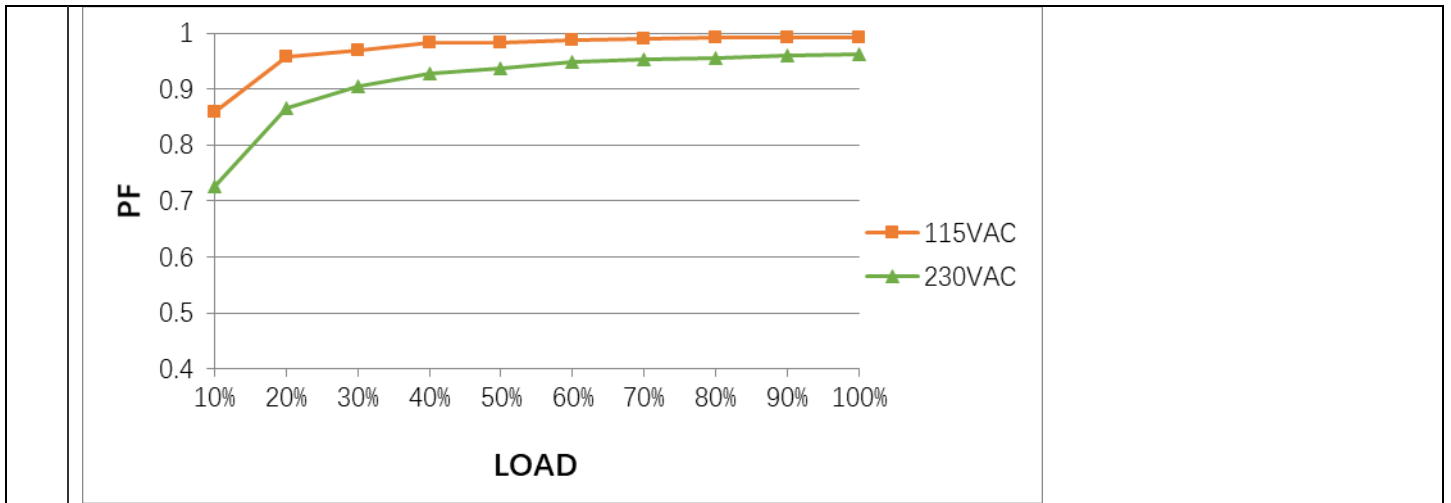


8	RISE TIME (Max)	230VAC/50ms 115VAC/50ms	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 18.58ms 115VAC/ 18.42ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage		
9	HOLD UP TIME (Typ.)	230VAC/16ms 115VAC/16ms	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 38.6 ms 115VAC/ 37.4ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH3 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH3 : AC Input Voltage		
10	DYNAMIC LOAD	V1: 2400 mVp-p	I/P: 230VAC O/P: (1)FULL/0% LOAD 50%DUTY / 120HZ (2)FULL/0% LOAD 50%DUTY / 1KHZ Ta:25°C	1120mVp-p 593mVp-p
FULL /50% LOAD 50%DUTY / 120HZ		FULL /50% LOAD 50%DUTY / 1KHZ		

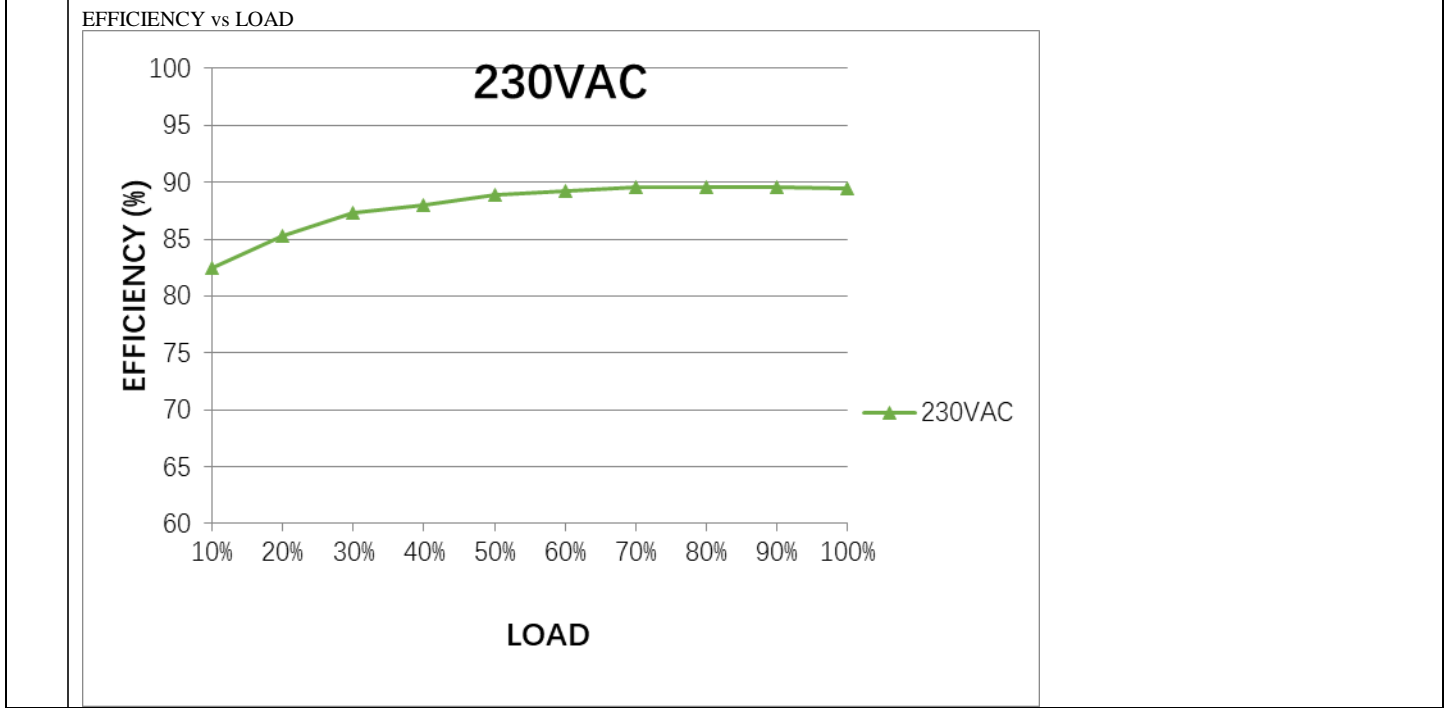
11	TRANSIENT RECOVERY TIME	V1: 2400 mVp-p	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	300mVp-p
12	PEAK POWER	<p>1 HOUR NO DAMAGE</p> <p><b>1 Peak Power</b></p> $P_{out} = \frac{P_{avg} \times T + P_{pk} \times t}{T} < P_{max}$ $Duty = \frac{t}{T} \times 100\% < 35\%$ <p> <math>P_{avg}</math>: Average output power (W)  <math>P_{pk}</math>: Peak output power (W)  <math>P_{non}</math>: Non-peak output power (W)  <math>P_{rated}</math>: Rated output power (W)  <math>t</math>: Peak power width (sec)  <math>T</math>: Period (sec)         </p> <p>(If 3.5 times peak is required, please see below figure (20Sec))</p>  <p>For example (24V model):  <math>V_{in} = 200V</math>   <math>Duty_{max} = 25\%</math>  <math>P_{in} = P_{rated} = 648W</math>  <math>P_{out} = 150W</math>  <math>t &lt; 0.5sec</math>  <math>T = \frac{0.5sec}{25\%} = 2sec</math>  <math>P_{pk} = \frac{P_{in} \times T + P_{out} \times t}{T} = \frac{648W \times 2 + 150W \times 0.5}{2} = 648.75W</math>  <math>P_{pk} &lt; 300W</math> </p>	I/P : 200VAC I/P : 100VAC O/P:TESTING Ta:25°C	TEST: OK

### INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC~264VAC 120VDC~ 370VDC	(1) I/P:TESTING O/P:FULL LOAD  (2) I/P:DC TESTING(L:+ N:-) O/P: FULL / 50% LOAD  (3) I/P:DC TESTING(L:- N:+) O/P: FULL / 50% LOAD  Ta:25°C  I/P: LOW-LINE-3V=97 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)	(1) 79.4V~264V (2) 107.2Vdc~370Vdc/FULL LOAD 107.2Vdc~370Vdc/50% LOAD (3) 107.2Vdc~370Vdc/FULL LOAD 107.2Vdc~370Vdc/50% LOAD  TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:85 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 3.6 A 115V/ 7.6A	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD Ta : 25°C	I = 3.31 A/ 230VAC I = 6.69 A/ 115VAC
4	LEAKAGE CURRENT	<2 mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	1.78 mA
5	POWER FACTOR (Typ.)	0.94/ 230VAC 0.98/115VAC	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.963 /230VAC PF= 0.993 /115VAC
P.F vs LOAD				

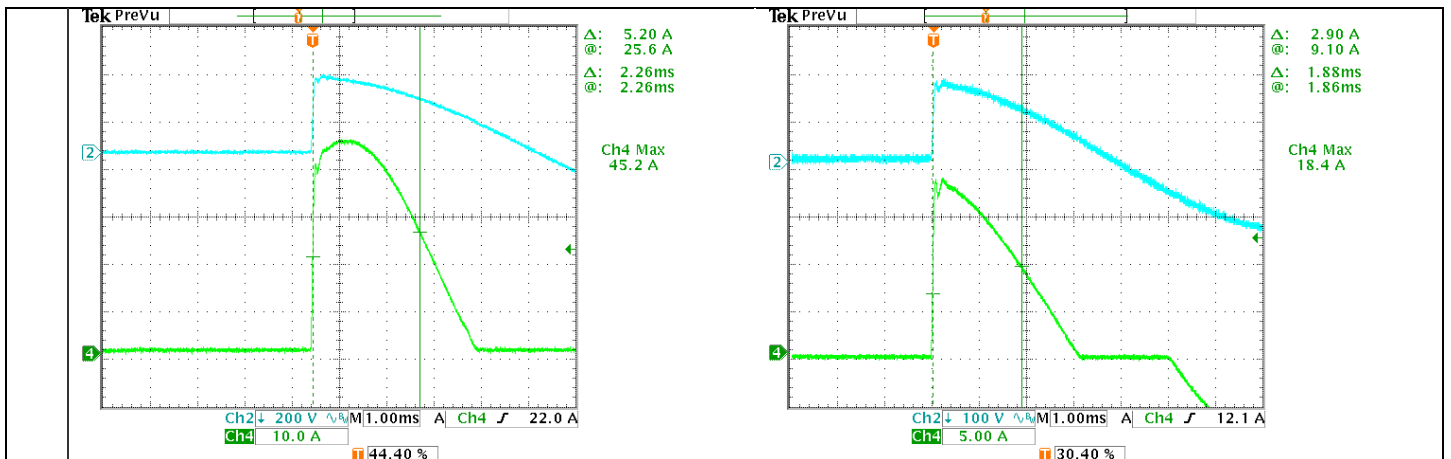


6	EFFICIENCY(Typ.)	88%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	89.3 %
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7	INRUSH CURRENT(Typ.)	230V/70A 115V/35A COLD START	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD Ta : 25°C	I = 45.2 A/ 230VAC I = 18.4 A/ 115VAC T50= 2260 us/230V
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INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current	INPUT=115VAC/ 60HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current
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### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	Output power >105% rated for more than 5 seconds then shut down o/p voltage, re-power on to recover  Constant current limiting for output power >380% rated for more than 5 seconds and then shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta: 25°C	114%/ 264VAC 114%/ 230VAC 114%/100VAC 5S TEST: OK PROTECTION TYPE : Output power >105% rated for more than 5 seconds then shut down o/p voltage, re-power on to recover Constant current limiting for output power >380% rated for more than 5 seconds and then shut down o/p voltage, re-power on to recover
2	OVER VOLTAGE PROTECTION	30V~34.8V Protection type : Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD Ta: 25°C	32.9V/ 264VAC 32.9V/ 230VAC 32.9V/ 85VAC PROTECTION TYPE : OK 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	I/P: 264VAC I/P: 85VAC O/P: FULL LOAD	O.T.P. Active PROTECTION TYPE : OK 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: 85VAC O/P: FULL LOAD Ta: 25°C	NO DAMAGE PROTECTION TYPE : OK Constant current limiting, and shut down after 5 seconds , re-power on to recover .

### CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	REMOTE SENSE	S+ / S- >0.3V Compensate voltage drop on the load wiring up to 0.5V.	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	0.84V



2	DC OK SIGNAL	High (3.3 ~ 5.6V) :PSU turn on Low (0 ~ 1V) : PSU turn off. I/P: 230 VAC O/P:FULL LOAD Ta:25°C Test Result :				
		Vout	DC OK SIGNAL			
		PSU turn on	5.183V			
		PSU turn off	0.003V			
3	FAN ON/OFF CONTROL	Load 35±15% or RTH2≥50°C FAN ON	I/P: 230VAC O/P:TESTING			
					RTH(°C)	LOAD(%)
				FAN ON	OK	40%

**COMPONENT STRESS TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor ( D to S) or (C to E) Peak Voltage	Q 3/Q4 Rated :32 A/ 650 V	AC ON/OFF I/P: High-Line =300V 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. (8)Peak Load (350%) Ta:25°C	Q3 Q4 VDS: (1) 519V (1) 508V (2) 579V (2) 623V (3) 519V (3) 508V (4) 519V (4) 508V (5) 523V (5) 514V (6) 543V (6) 514V (7) 583V (7) 641V (8) 567V (8) 641V
2	P.F.C Transistor ( D to S) or (C to E) Peak Voltage	Q1 Rated :34 A/ 600 V	I/P: High-Line =267V 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)Peak Load (350%) Ta:25°C	Q1 VDS: (1) 490V (2) 482V (3) 494V (4) 494V (5) 494V (6) 515V (7) 470V (8) 494V
3	P.F.C DIODE	D1 Rated :10A/ 650 V	I/P: High-Line =267V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (5)Peak Load (350%) Ta:25°C	(1) 461V (2) 473V (3) 461V (4) 457V (5) 469V

4	Diode Peak Voltage	<p>Q101 Rated :20 A/ 200 V</p> <p>Q103 Rated :20 A/200 V</p>	<p>AC ON/OFF</p> <p>I/P: High-Line =300V</p> <p>Vomax</p> <p>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 (9)Peak Load (350%)</p> <p>Vo</p> <p>O/P: (1)Full Load Ta:25°C</p>	<p>Q101: Vomax VDS: (1) 152V (2) 145V (3) 152V (4) 150V (5) 150V (6) 147V (7) 150V (8) 144V (9) 146V Vo (1) 145V</p> <p>Q103: Vomax VDS: (1) 146V (2) 173V (3) 152V (4) 152V (5) 155V (6) 154V (7) 154V (8) 143V (9) 160V Vo (1) 151V</p>
5	Input Capacitor Voltage	C5 Rated: : 680 $\mu$ /450V	<p>I/P High-Line =267V</p> <p>O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue (5)Peak Load on/off (350%) (6)Peak Load continue (350%) Ta:25°C</p>	<p>(1)428V (2)424V (3)428V (4)428V (5)448V (6)448V</p>
6	Control IC Voltage Test	<p>PWM IC U1 Rated 11V~ 30 V</p> <p>O/P IC U202/ U203 Rated 3 V~ 30 V</p>	<p>AC ON/OFF</p> <p>I/P: High-Line =300V</p> <p>O/P: (1) FULL LOAD (2) Output Short (3) O.L.P (4) O.V.P. (5) NO LOAD <math>V_{Rmin}</math> (LOW LINE) Ta:25°C</p>	<p>U1 U202/U203</p> <p>(1) 16.6V (1) 12.5V (2) 17.4V (2) 11.7V (3) 16.8V (3) 12.5V (4) 16.6V (4) 20.4V (5) 13.8V (5) 12.2V</p>

### ■ SAFETY& E.M.C. TEST

#### SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	<p>I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:0.5KVAC/min</p>	<p>I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:0.6 KVAC/min Ta:25°C</p>	<p>I/P-O/P: 7.97mA I/P-FG: 8.11mA O/P-FG: 3.476mA NO DAMAGE</p>
2	ISOLATION RESISTANCE	<p>I/P-O/P:500VDC&gt;100M<math>\Omega</math> I/P-FG: 500VDC&gt;100M<math>\Omega</math> O/P-FG:500VDC&gt;100M<math>\Omega</math></p>	<p>I/P-O/P: 600 VDC I/P-FG: 600 VDC O/P-FG: 600 VDC Ta:25°C</p>	<p>I/P-O/P: 9999M<math>\Omega</math> I/P-FG: 9999M<math>\Omega</math> O/P-FG: 9999M<math>\Omega</math> NO DAMAGE</p>
3	GROUNDING CONTINUITY	<p>FG(PE) TO CHASSIS OR TRACE &lt; 100m<math>\Omega</math></p>	<p>40A / 2min Ta:25°C</p>	<p>5m<math>\Omega</math></p>



### 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 B	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 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 : HRP-600N3-24 1. ROOM AMBIENT BURN-IN : 2HRS I/P : 230VAC O/P : FULL LOAD Ta= 22.5 °C 2. HIGH AMBIENT BURN-IN : 2HRS I/P : 230VAC O/P : FULL LOAD Ta= 51.2 °C																																																						
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 22.5 °C</th> <th>HIGH AMBIENT Ta= 51.2 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>ZNR1</td><td>24.5°C</td><td>53.3°C</td></tr> <tr><td>2</td><td>LF1</td><td>24.9°C</td><td>53.8°C</td></tr> <tr><td>3</td><td>C61</td><td>24.3°C</td><td>53.2°C</td></tr> <tr><td>4</td><td>U1</td><td>25.6°C</td><td>54.5°C</td></tr> <tr><td>5</td><td>C5</td><td>26.2°C</td><td>55.0°C</td></tr> <tr><td>6</td><td>RTH1</td><td>23.9°C</td><td>52.6°C</td></tr> <tr><td>7</td><td>RY1</td><td>29.0°C</td><td>57.9°C</td></tr> <tr><td>8</td><td>C10</td><td>27.5°C</td><td>56.5°C</td></tr> <tr><td>9</td><td>BD1</td><td>31.5°C</td><td>60.1°C</td></tr> <tr><td>10</td><td>Q1</td><td>31.6°C</td><td>61.0°C</td></tr> <tr><td>11</td><td>TSW1</td><td>30.9°C</td><td>60.3°C</td></tr> <tr><td>12</td><td>L3</td><td>29.2°C</td><td>58.7°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 22.5 °C	HIGH AMBIENT Ta= 51.2 °C	1	ZNR1	24.5°C	53.3°C	2	LF1	24.9°C	53.8°C	3	C61	24.3°C	53.2°C	4	U1	25.6°C	54.5°C	5	C5	26.2°C	55.0°C	6	RTH1	23.9°C	52.6°C	7	RY1	29.0°C	57.9°C	8	C10	27.5°C	56.5°C	9	BD1	31.5°C	60.1°C	10	Q1	31.6°C	61.0°C	11	TSW1	30.9°C	60.3°C	12	L3	29.2°C	58.7°C
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		NO	Position	ROOM AMBIENT Ta= 22.5 °C	HIGH AMBIENT Ta= 51.2 °C
		13	D1	41.9°C	71.2°C
		14	T1 Core	50.8°C	80.3°C
		15	T1 Coil	23.3°C	54.2°C
		16	Q103	50.3°C	78.8°C
		17	Q100	43.3°C	72.3°C
		18	Q102	51.5°C	81.2°C
		19	Q105	53.0°C	81.2°C
		20	T2	26.9°C	55.8°C
		21	Q4	34.9°C	65.2°C
		22	D22	35.8°C	65.8°C
		23	RTH2	30.8°C	60.9°C
		24	RG1	39.1°C	69.1°C
		25	C106	33.2°C	63.0°C
		26	C108	32.9°C	62.6°C
		27	L100	49.1°C	80.8°C
		28	J115	45.7°C	75.8°C
		29	R106	45.2°C	74.9°C
		30	R100	52.5°C	84.5°C
		31	D30	30.7°C	60.1°C
		32	Q19	28.0°C	56.4°C
		33	TSW2	37.7°C	66.8°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )		I/P : 230 VAC O/P : 114% 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= -45 °C	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C/95 %R.H 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	± 0.009 %/°C (0~50°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	-40~50°C		1. Thermal shock Temperature : -45°C ~ +55°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, 5G 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 : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C106 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) 1750433.5HRS (2) 286719.6HRS (3) 368436.6HRS (4) 442852.8HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 452.04K hrs min. Telcordia SR-332 (Bellcore) ; 191.26K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 50,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Liutt		Wangdz

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