



Test Report: HRP-150N3-48

150W 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

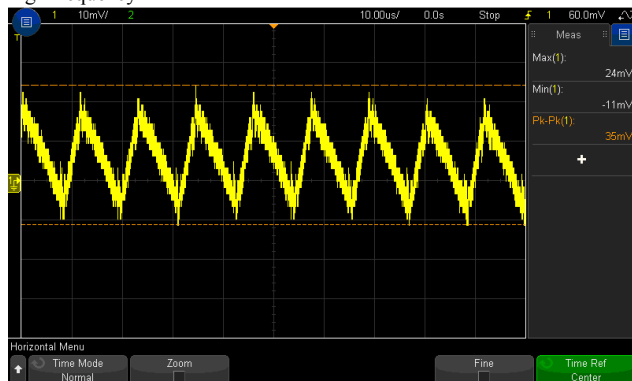
- ENVIRONMENT TEST

DESIGN VERIFY TEST

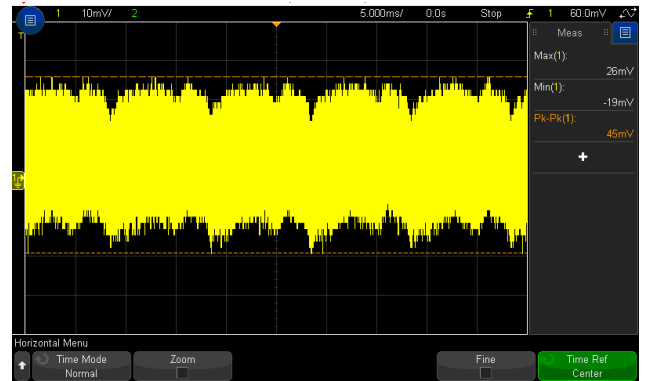
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 40.8 V~55.2 V	I/P : 230VAC I/P : 115VAC O/P : MIN LOAD Ta : 25°C	36.404V~ 57.56V/230VAC 36.404V~ 57.56V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.5 % ~ +1.5 %	I/P: 85VAC /264VAC O/P:FULL/MIN. LOAD Ta:25°C	V1: -0.0083% ~ 0.00415%
3	LINE REGULATION (Max)	V1: -0.2 % ~ +0.2 %	I/P: 85VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: -0.0083% ~ 0.00415%
4	LOAD REGULATION(Max)	V1: -0.5 % ~ +0.5 %	I/P: 230VAC O/P:FULL~MIN LOAD Ta:25°C	V1: -0.0021% ~ 0.00%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	1.30%
6	RIPPLE & NOISE(Max)	V1: 240mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 45mVp-p

high frequency :

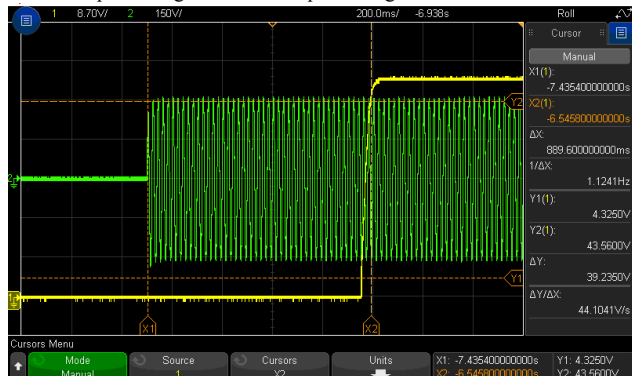


low frequency :

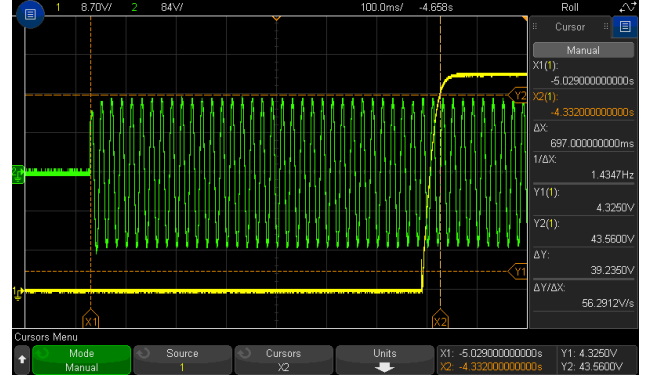


7	SET UP TIME(Max)	230VAC/ 3000ms 115VAC/3000ms	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD Ta : 25°C	230VAC/889.6ms 115VAC/697.0ms
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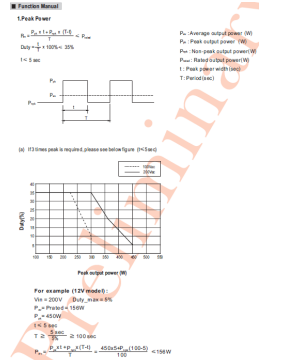
INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage CH3 : AC Input Voltage



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/27.38ms 115VAC/28.22ms
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/41.8ms 115VAC/42.4 ms
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: 4800mVp-p	I/P: 230VAC O/P: (1)FULL/50%LOAD 50%DUTY / 120HZ (2)FULL/50%LOAD 50%DUTY / 1KHZ Ta:25°C	249mVp-p 227mVp-p
FULL /50% LOAD 50%DUTY / 120HZ		FULL /50% LOAD 50%DUTY / 1KHZ		

11	TRANSIENT RECOVERY TIME	V1: 480mVp-p	I/P: 230VAC O/P:40%LOADCHANGE 50%DUTY/120HZ 1.25A/us	780mVp-p
12	PEAK POWER	1 HOUR NO DAMAGE  <p> $P_{avg} = I_{avg} \times V_{avg} = I_{avg} \times (V_{in} \times \eta)$ $P_{peak} = I_{peak} \times V_{peak}$ $P_{avg} = P_{peak} \times D$ $D = \frac{t_{on}}{t_{on} + t_{off}}$ $t_{on} = 100\mu s$ $t_{off} = 100\mu s$ $f = 1000 Hz$ $\eta = 0.8$ $V_{in} = 230V$ $I_{avg} = 1.25A$ $I_{peak} = 1.25A$ $V_{peak} = 230V$ $P_{avg} = 1.25A \times 230V \times 0.8 = 220W$ $P_{peak} = 1.25A \times 230V = 287.5W$ $D = \frac{100\mu s}{100\mu s + 100\mu s} = 0.5$ $P_{avg} = 287.5W \times 0.5 = 143.75W$ $P_{avg} = 143.75W < 220W$ OK </p>	I/P : 200VAC I/P : 100VAC O/P:TESTING Ta:25°C	TEST:OK

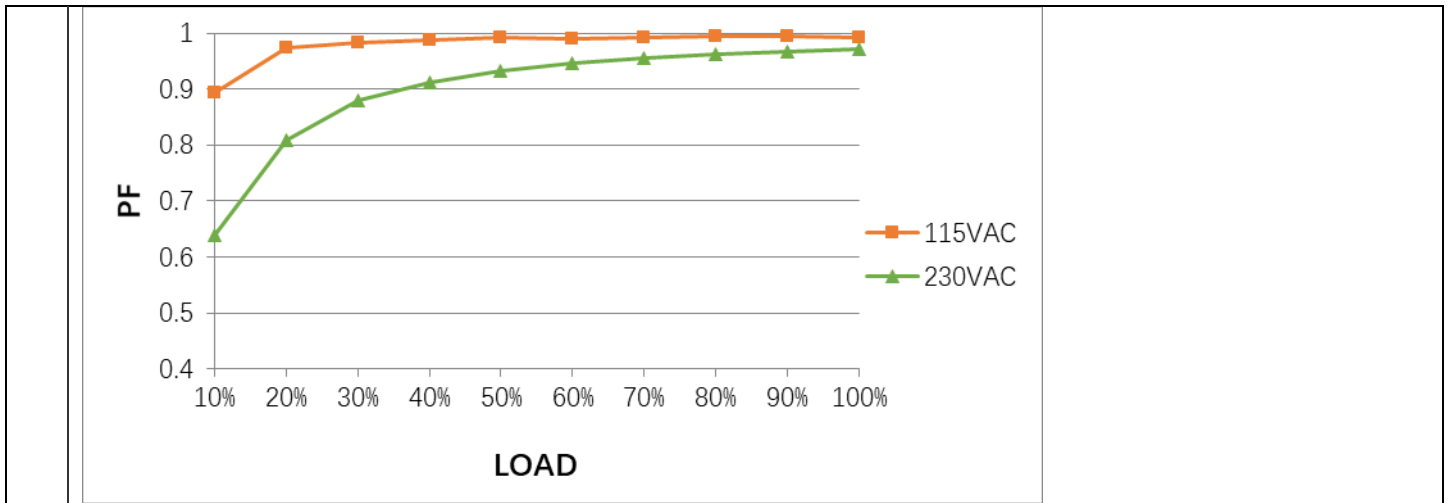
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC~264VAC 120VDC~ 370VDC	(1) I/P: TESTING O/P: FULL LOAD	(1) 76.5V~264V
			(2) I/P: DC TESTING (L :+ N:-) O/P: FULL / 50% LOAD	(2) 101.8Vdc~370Vdc/FULL LOAD 101.6Vdc~370Vdc/50% LOAD
1	INPUT VOLTAGE RANGE	85VAC~264VAC 120VDC~ 370VDC	(3) I/P: DC TESTING (L:- N:+) O/P: FULL / 50% LOAD Ta:25°C	(3) 101.6Vdc~370Vdc/FULL LOAD 101.6Vdc~370Vdc/50% LOAD
			I/P: LOW-LINE-3V=82 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)	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/ 0.9 A 115V/ 1.7A	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD Ta : 25°C	I = 0.791A/ 230VAC I = 1.590A/ 115VAC
4	LEAKAGE CURRENT	< 1mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	0.870mA
5	POWER FACTOR (Typ.)	0.95/ 230VAC 0.98/115VAC	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF=0.9732 /230VAC PF=0.9922 /115VAC
			P.F vs LOAD	

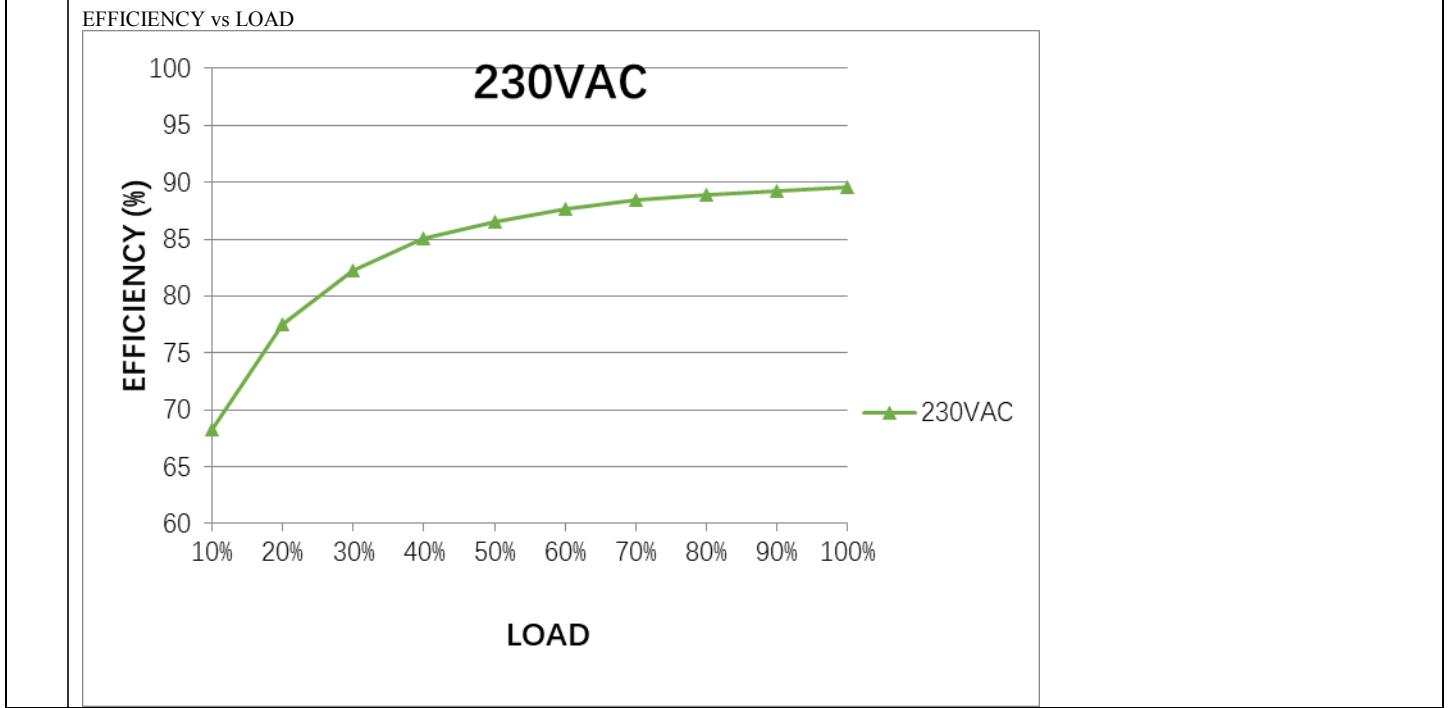


150W Ultra-High Peak Power Supply

HRP-150N3 series

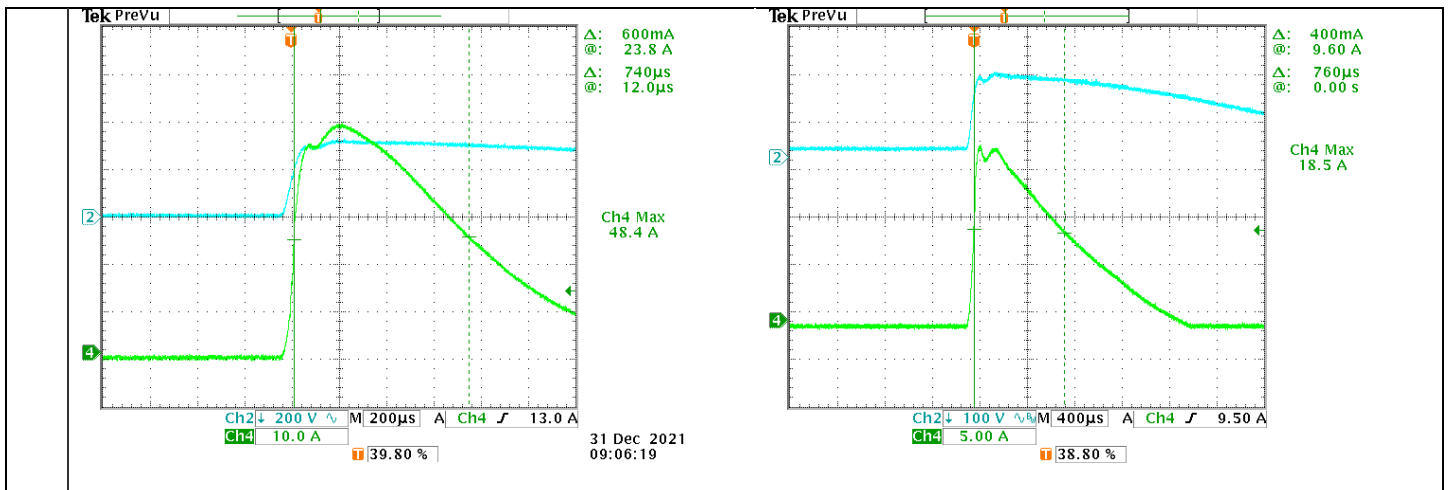


6	EFFICIENCY(Typ.)	89%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	89.37%
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7	INRUSH CURRENT(Typ.)	230V/70A 115V/35A COLD START	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD Ta : 25°C	I=48.4A/230VAC I=18.5A/115VAC T50=740us/230V
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INPUT=230VAC/50HZ @ 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 >330% 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	109.39%/ 264VAC 108.09%/ 230VAC 109.55%/ 100VAC 5S TEST: OK PROTECTION TYPE : OK 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 >330% rated for more than 5 seconds and then shut down o/p voltage, re-power on to recover
2	OVER VOLTAGE PROTECTION	57.6V~67.2V 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	61.6V/ 264VAC 61.6V/ 230VAC 61.6V/ 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 0.3V.	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	0.4V

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 :13 A/ 600 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 (300%) Ta:25°C	Q3 Q4 VDS: (1) 544V (1) 556V (2) 520V (2) 520V (3) 545V (3) 556V (4) 544V (4) 552V (5) 536V (5) 548V (6) 528V (6) 524V (7) 524V (7) 516V (8) 528V (8) 532V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated :18 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 (300%) Ta:25°C	Q1 VDS: (1) 448V (2) 480V (3) 448V (4) 452V (5) 452V (6) 488V (7) 500V (8) 452V
3	P.F.C DIODE	D1 Rated :8A/ 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/5KHz (4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (5)Peak Load (300%) Ta:25°C	(1) 419V (2) 503V (3) 419V (4) 423V (5) 402V
4	Diode Peak Voltage	Q101 Rated :20 A/ 400 V V Q103 Rated :20 A/400 V	AC ON/OFF I/P: High-Line =300V 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.	Q101: Q103: Vomax Vomax VDS: VDS: (1) 272V (1) 355V (2) 284V (2) 371V (3) 278V (3) 363V (4) 258V (4) 359V (5) 256V (5) 363V (6) 246V (6) 367V (7) 238V (7) 375V (8) 212V (8) 327V



			(8).NO LOAD (9)Peak Load (300%) Vo: O/P: (1)Full Load Ta:25°C	(9) 246V Vo: (1) 278V	(9) 367V Vo: (1) 371V
5	Input Capacitor Voltage	C5 Rated: : 150 μ / 400 V	I/P High-Line =267V 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 (300%) (6)Peak Load continue (300%) Ta:25°C	(1) 389V (2) 389V (3) 397V (4) 381V (5) 393V (6) 397V	
6	Control IC Voltage Test	PWM IC U1 Rated 11V~ 30 V O/P IC U102/ U101 Rated 3 V~ 30 V	AC ON/OFF I/P: High-Line =300V O/P: (1) FULL LOAD (2) Output Short (3) O.L.P (4) O.V.P. (5) NO LOAD VRmin(LOW LINE) Ta:25°C	U1 (1) 15.9V (2) 16.1V (3) 16.1V (4) 16.1V (5) 16.1V	U101 (1) 7.10V (2) 6.94V (3) 7.17V (4) 7.02V (5) 7.02V

■ SAFETY& E.M.C. TEST

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°C	I/P-O/P: 2.58mA I/P-FG: 2.702mA O/P-FG:1.906m A NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M Ω I/P-FG: 500VDC>100M Ω O/P-FG:500VDC>100M Ω	I/P-O/P: 600 VDC I/P-FG: 600 VDC O/P-FG: 600 VDC Ta:25°C	I/P-O/P:9999M Ω I/P-FG: 9999M Ω O/P-FG: 9999M Ω NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100m Ω	40A / 2min Ta:25°C	3m Ω

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 _s 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-600N3-48 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 26.6 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 41.6 °C																																																																																																														
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 26.6 °C</th> <th>HIGH AMBIENT Ta= 41.6 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>47.9°C</td><td>62.6°C</td></tr> <tr><td>2</td><td>ZNR1</td><td>47.4°C</td><td>61.3°C</td></tr> <tr><td>3</td><td>LF2</td><td>52.3°C</td><td>66.7°C</td></tr> <tr><td>4</td><td>RY1</td><td>74.6°C</td><td>88.1°C</td></tr> <tr><td>5</td><td>RTH1</td><td>49.7°C</td><td>61.8°C</td></tr> <tr><td>6</td><td>BD1</td><td>65.3°C</td><td>78.8°C</td></tr> <tr><td>7</td><td>L3</td><td>70.7°C</td><td>87.3°C</td></tr> <tr><td>8</td><td>TSW1</td><td>58.2°C</td><td>71.3°C</td></tr> <tr><td>9</td><td>Q1</td><td>70.2°C</td><td>83.2°C</td></tr> <tr><td>10</td><td>D1</td><td>68.8°C</td><td>83.6°C</td></tr> <tr><td>11</td><td>C5</td><td>68.6°C</td><td>84.1°C</td></tr> <tr><td>12</td><td>Q3</td><td>85.5°C</td><td>99.2°C</td></tr> <tr><td>13</td><td>T2</td><td>68.5°C</td><td>83.4°C</td></tr> <tr><td>14</td><td>Q4</td><td>87.0°C</td><td>101.6°C</td></tr> <tr><td>15</td><td>U1</td><td>66.8°C</td><td>79.9°C</td></tr> <tr><td>16</td><td>T1 Core</td><td>86.8°C</td><td>102.6°C</td></tr> <tr><td>17</td><td>T1 Coil</td><td>75.8°C</td><td>91.8°C</td></tr> <tr><td>18</td><td>RTH2</td><td>65.3°C</td><td>79.5°C</td></tr> <tr><td>19</td><td>Q101</td><td>75.2°C</td><td>89.0°C</td></tr> <tr><td>20</td><td>L100</td><td>85.8°C</td><td>100.4°C</td></tr> <tr><td>21</td><td>C105</td><td>71.5°C</td><td>85.2°C</td></tr> <tr><td>22</td><td>C238</td><td>64.9°C</td><td>79.9°C</td></tr> <tr><td>23</td><td>U101</td><td>59.0°C</td><td>73.4°C</td></tr> <tr><td>24</td><td>U2</td><td>57.0°C</td><td>79.1°C</td></tr> <tr><td>25</td><td>J111</td><td>64.9°C</td><td>65.4°C</td></tr> <tr><td>26</td><td>R111</td><td>66.0°C</td><td>78.0°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 26.6 °C	HIGH AMBIENT Ta= 41.6 °C	1	LF1	47.9°C	62.6°C	2	ZNR1	47.4°C	61.3°C	3	LF2	52.3°C	66.7°C	4	RY1	74.6°C	88.1°C	5	RTH1	49.7°C	61.8°C	6	BD1	65.3°C	78.8°C	7	L3	70.7°C	87.3°C	8	TSW1	58.2°C	71.3°C	9	Q1	70.2°C	83.2°C	10	D1	68.8°C	83.6°C	11	C5	68.6°C	84.1°C	12	Q3	85.5°C	99.2°C	13	T2	68.5°C	83.4°C	14	Q4	87.0°C	101.6°C	15	U1	66.8°C	79.9°C	16	T1 Core	86.8°C	102.6°C	17	T1 Coil	75.8°C	91.8°C	18	RTH2	65.3°C	79.5°C	19	Q101	75.2°C	89.0°C	20	L100	85.8°C	100.4°C	21	C105	71.5°C	85.2°C	22	C238	64.9°C	79.9°C	23	U101	59.0°C	73.4°C	24	U2	57.0°C	79.1°C	25	J111	64.9°C	65.4°C	26	R111	66.0°C	78.0°C
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19	Q101	75.2°C	89.0°C																																																																																																													
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22	C238	64.9°C	79.9°C																																																																																																													
23	U101	59.0°C	73.4°C																																																																																																													
24	U2	57.0°C	79.1°C																																																																																																													
25	J111	64.9°C	65.4°C																																																																																																													
26	R111	66.0°C	78.0°C																																																																																																													



150W Ultra-High Peak Power Supply

HRP-150N3 series

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 108.09% 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 40°C/95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 40 °C HUMIDITY= 95%R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	± 0.04 %/°C(0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.0068%/°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	-40~40°C	1. Thermal shock Temperature : -45°C~+45°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 C105 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= 40 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 40 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 40 °C LIFE TIME		(1) 168963HRS (2) 65370.3HRS (3) 128141.9HRS (4) 148296.2HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1706.0K hrs min. Telcordia SR-332 (Bellcore) ; 222.8K hrs min. MIL-HDBK-217F (25°C)		
11	Ongoing Reliability Test	I/P : 230VAC O/P : 80% LOAD TA=50°C Demonstration Mean Time Between Failure : 50000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Liutt		Wangdz

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