



Test Report: HRP-600N3-48

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

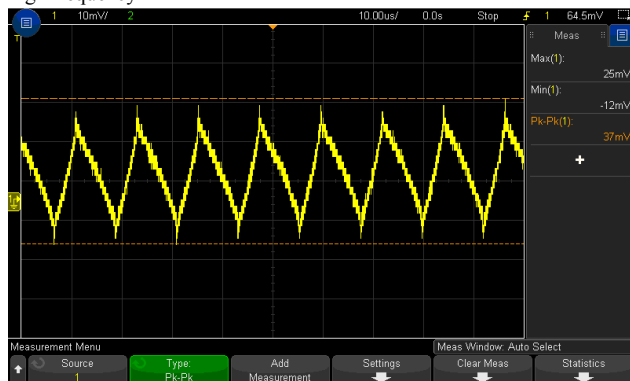
ENVIRONMENT TEST

DESIGN VERIFY TEST

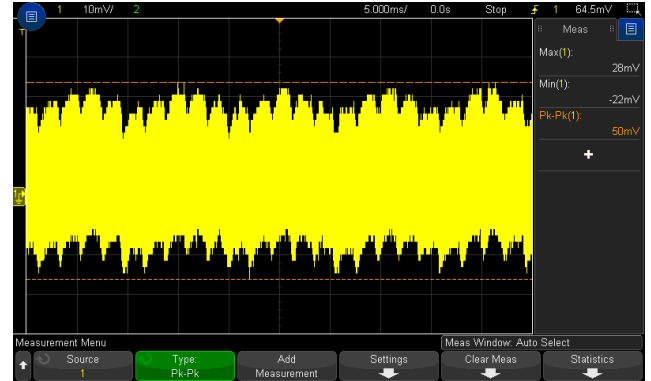
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 40.8V~ 55.2 V	I/P : 230VAC I/P : 115VAC O/P : MIN LOAD Ta : 25°C	39.349V~58.44V/230VAC 39.389V~58.43V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.0 % ~ +1.0 %	I/P: 85VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.0082% ~ 0.02698%
3	LINE REGULATION (Max)	V1: -0.2 % ~ +0.2 %	I/P: 85VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: -0.0000% ~ 0.0042%
4	LOAD REGULATION(Max)	V1: -0.5 % ~ +0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.0082 % ~ 0.02698 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	1.3%
6	RIPPLE & NOISE(Max)	V1: 240mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1:50 mVp-p

high frequency :

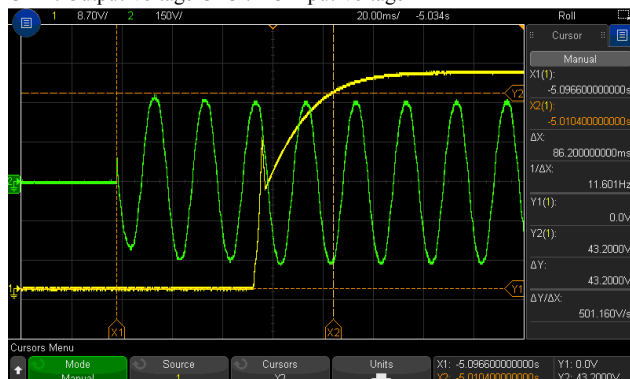


low frequency :

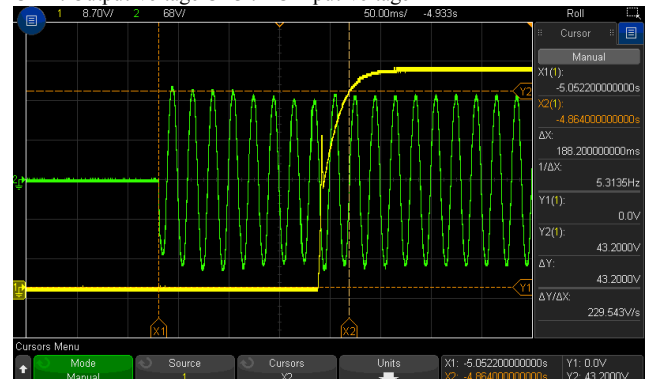


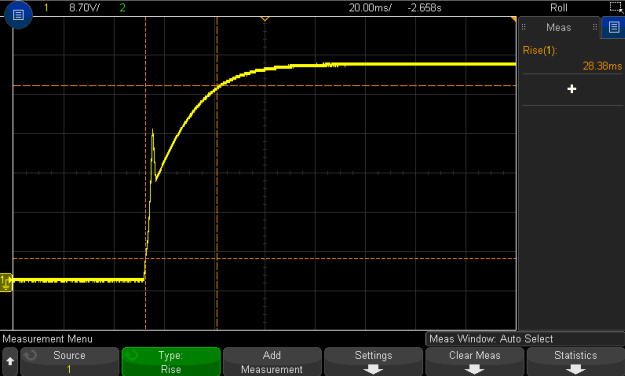
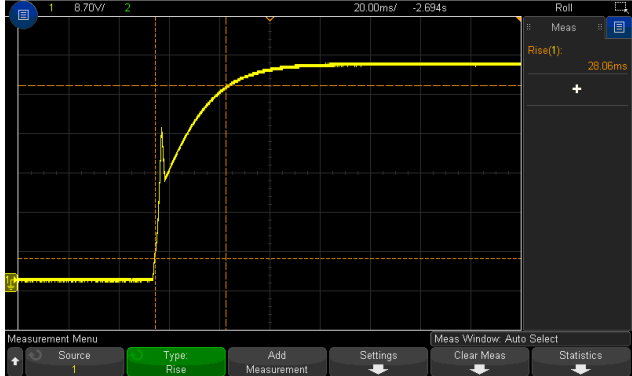
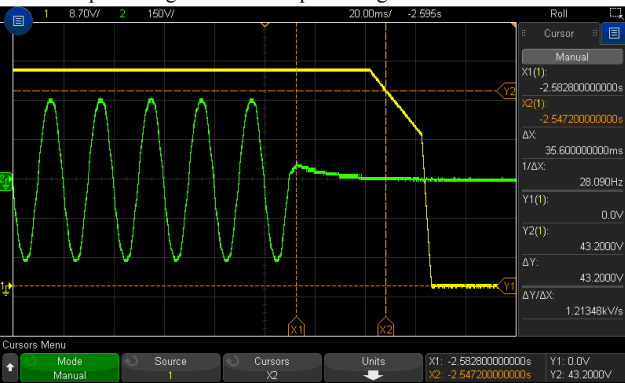
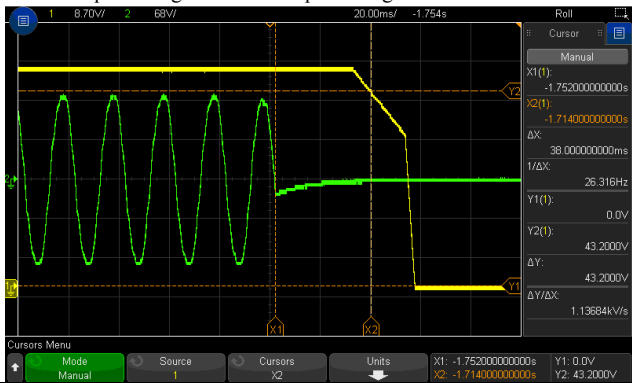


7	SET UP TIME(Max)	230VAC/ 1800ms 115VAC/3600ms	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 86.2 ms 115VAC/ 188.2 ms
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INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage CH3 : AC Input Voltage



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 / 28.38ms 115VAC / 28.06 ms
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 / 35.6ms 115VAC / 38.0ms
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: 4800 mVp-p	I/P: 230VAC O/P: (1)FULL/50% LOAD 50%DUTY / 120HZ (2)FULL/50% LOAD 50%DUTY / 1KHZ Ta:25°C	519mVp-p 416mVp-p
FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 	

11	TRANSIENT RECOVERY TIME	V1: 4800 mVp-p	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	420mVp-p
12	PEAK POWER	<p>1 HOUR NO DAMAGE</p> <p>1 Peak Power</p> $P_{avg} = \frac{P_{pk} \times T + P_{pk} \times (T-t)}{T} < P_{max}$ $Duty = \frac{t}{T} \times 100\% < 35\%$ <p>(*) If 3.5sec peak is required, please see below figure (DC5sec)</p> <p>For example (24V model): $V_{in} = 200V$ / $Duty_{max} = 25\%$ $P_{pk} = P_{rated} \times 1.489V$ $P_{pk} = 1500W$ $T = 0.5sec$ $t = 25\% \times 0.5 = 0.125sec$ $P_{pk} = \frac{P_{avg} \times T + P_{pk} \times (T-t)}{T} = \frac{1500 \times 0.5 + P_{pk} \times (0.5 - 0.125)}{0.5} < 648W$ $P_{pk} < 364W$</p>	I/P : 200VAC I/P : 100VAC O/P: TESTING Ta:25°C	TEST: OK

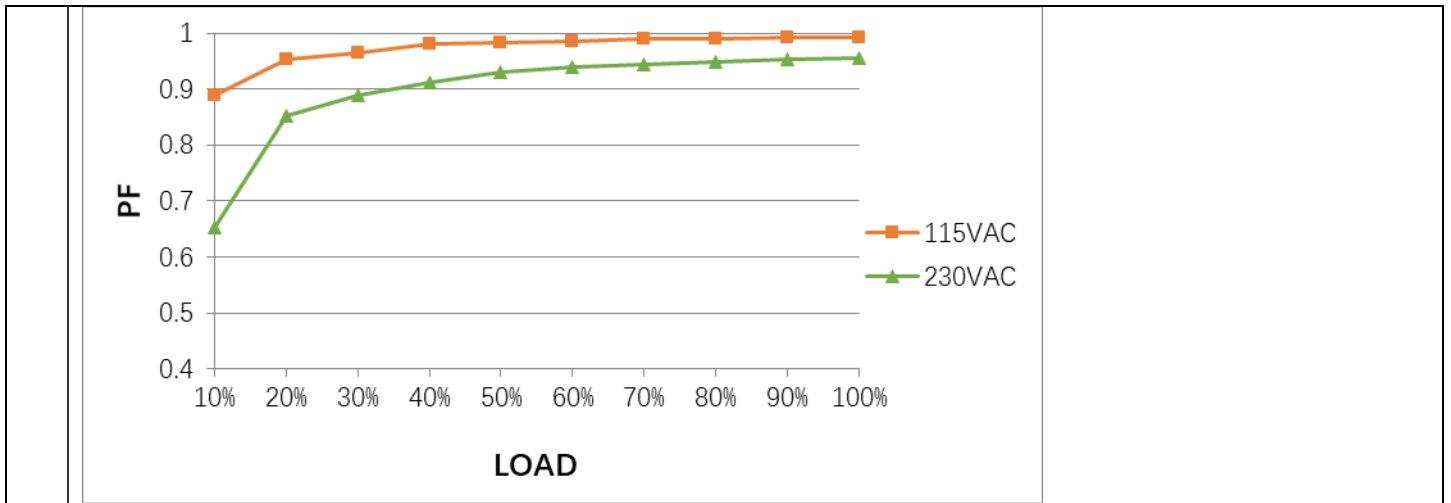
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC~264VAC 120VDC~ 370VDC	(1) I/P: TESTING O/P: FULL LOAD	(1) 80.19V~264V
			(2) I/P: DC TESTING(L: + N: -) O/P: FULL / 50% LOAD	(2) 107.2Vdc~370Vdc/FULL LOAD 107.2Vdc~370Vdc/50% LOAD
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	(3) I/P: DC TESTING(L: - N: +) O/P: FULL / 50% LOAD	(3) 107.2Vdc~370Vdc/FULL LOAD 107.2Vdc~370Vdc/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)	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 = 3.1573 A/ 230VAC I = 6.3522A/ 115VAC
4	LEAKAGE CURRENT	<2 mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	1.422 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= 0.9572 /230VAC PF= 0.9887 /115VAC
	P.F vs LOAD			



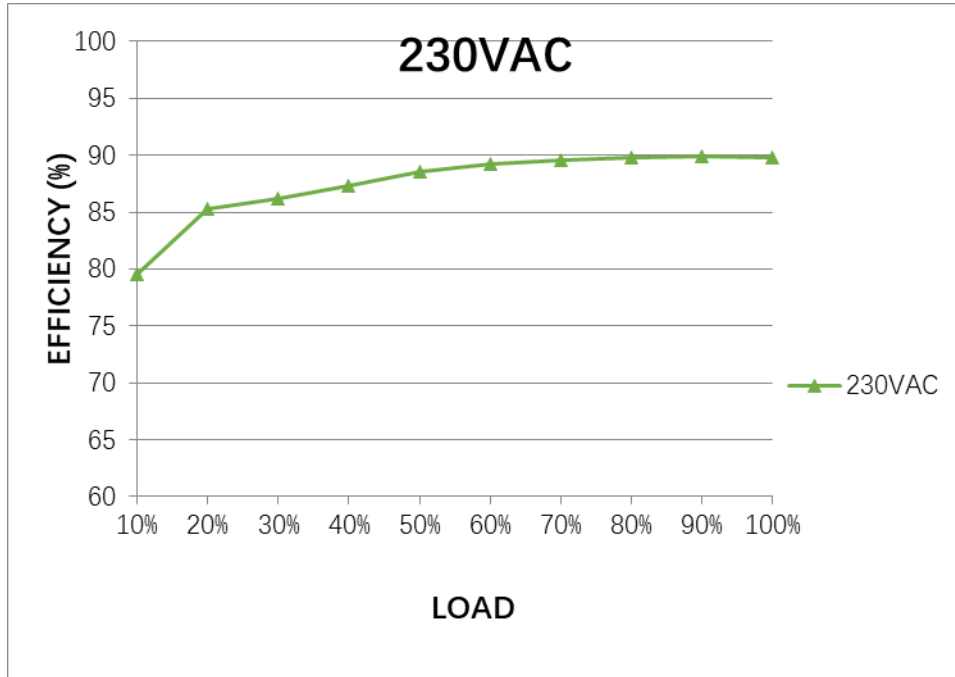
600W Ultra-High Peak Power Supply

HRP-600N3 series



6	EFFICIENCY(Typ.)	89%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	89.66%
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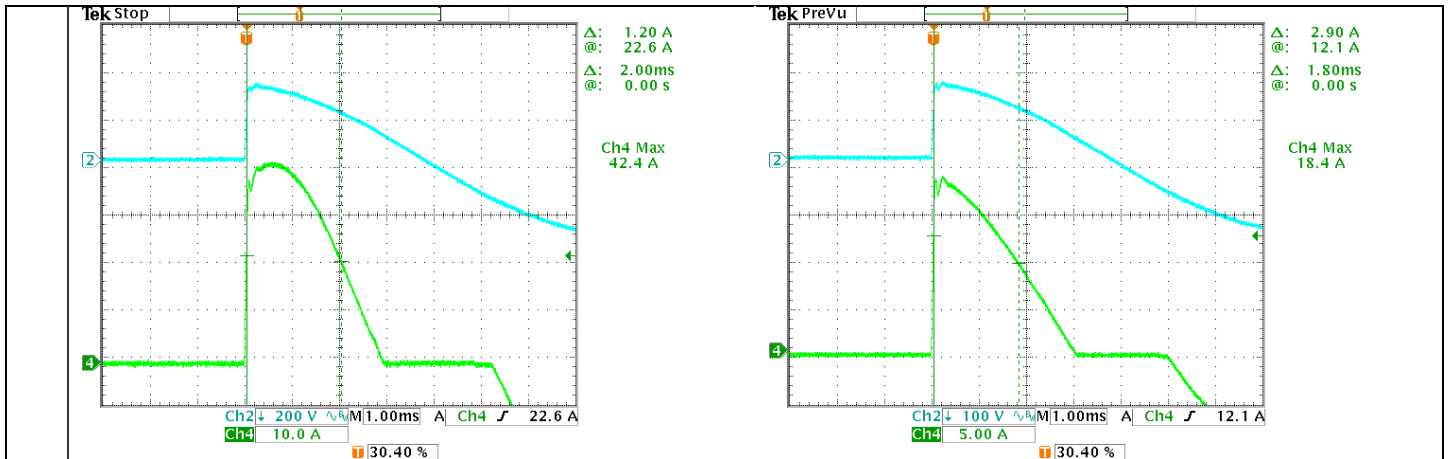
EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	230V/70A 115V/35A COLD START	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD Ta : 25°C	I = 42.4 A/ 230VAC I = 18.4 A/ 115VAC T50= 2000 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



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	113.23%/ 264VAC 113.23%/ 230VAC 113.27%/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	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	62.1V/ 264VAC 62.1V/ 230VAC 62.1V/ 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	0.34 V



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	5.217V			
		PSU turn off	0.002V			
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	32.97%

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) 503V (1) 523V (2) 571V (2) 546V (3) 499V (3) 515V (4) 503V (4) 519V (5) 511V (5) 519V (6) 511V (6) 531V (7) 579V (7) 550V (8) 579V (8) 562V
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) 487V (2) 511V (3) 487V (4) 487V (5) 507V (6) 491V (7) 495V (8) 507V
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 (1200W) Ta:25°C	(1) 434V (2) 434V (3) 434V (4) 434V (5) 462V

4	Diode Peak Voltage	<p>Q101 Rated : 20 A/ 400 V</p> <p>Q103 Rated : 20 A/ 400 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:</p> <p>Q103: Vomax VDS:</p> <p>(1) 138V (1) 301V (2) 158V (2) 349V (3) 155V (3) 316V (4) 145V (4) 301V (5) 138V (5) 303V (6) 184V (6) 253V (7) 183V (7) 305V (8) 185V (8) 305V (9) 183V (9) 291V</p> <p>Vo (1) 167V (1) 293V</p>
5	Input Capacitor Voltage	C5 Rated: : 680 μ / 450 V	<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%)</p> <p>Ta:25°C</p>	<p>(1) 409V (2) 401V (3) 393V (4) 389V (5) 421V (6) 417V</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 VRmin (LOW LINE)</p> <p>Ta:25°C</p>	<p>U1 U202/U203</p> <p>(1) 15.8V (1) 12.8V (2) 17.0V (2) 13.0V (3) 16.0V (3) 12.2V (4) 16.6V (4) 24.2V (5) 15.4V (5) 12.2V</p>

■ 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:8.81mA I/P-FG: 8.34mA O/P-FG:6.38mA 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	6m Ω

		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	



600W Ultra-High Peak Power Supply

HRP-600N3 series

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 1380.2K hrs min. Telcordia SR-332 (Bellcore) ; 191.8K 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

2020.10.01 TAG-QA-009