Test Report: HRPG-1000N3-12

1000W 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

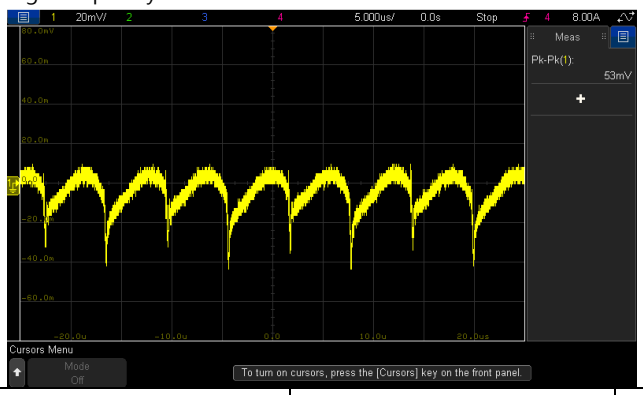
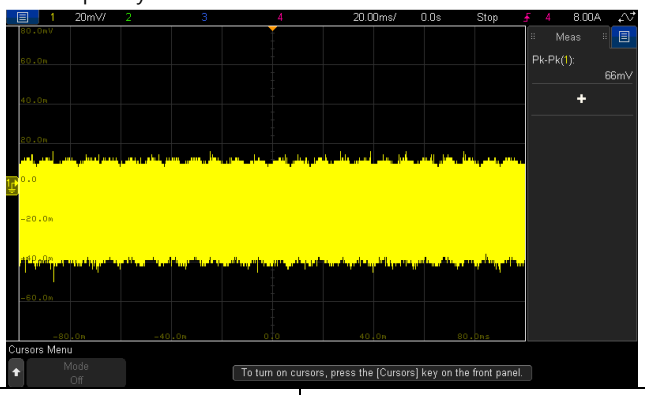
Safety Test
E.M.C. Test

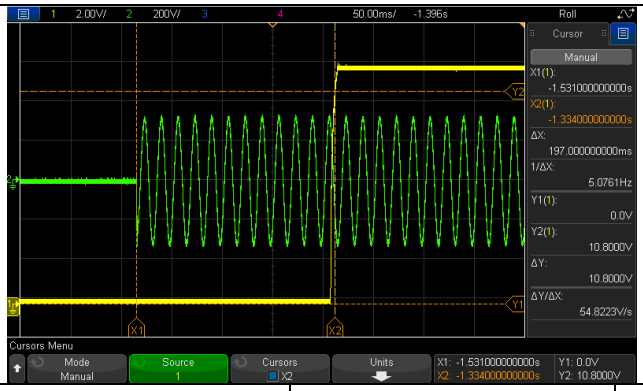
■ RELIABILITY TEST

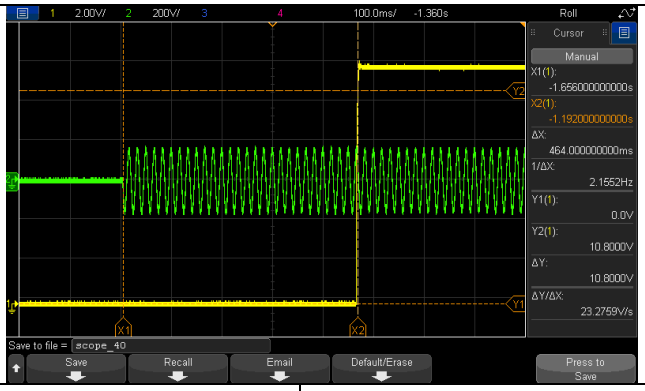
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

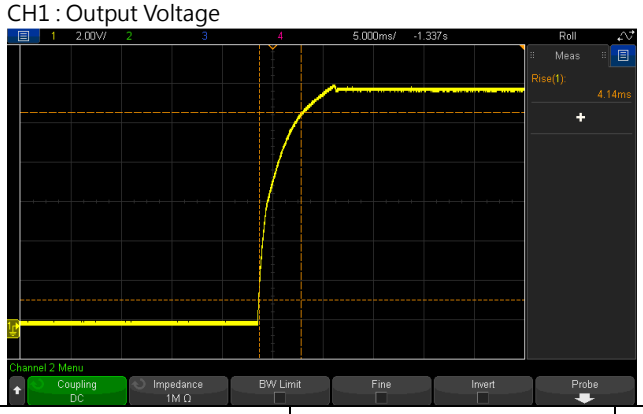
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 11 V~ 14 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25℃	10.61V~14.47V/230VAC 10.60V~14.47V/115VAC
2	OUTPUT VOLTAGE TOLERANCE	V1: -2.0%~ 2.0 %	I/P: 90VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.03 %~ 0.12 %
3	LINE REGULATION	V1: -0.5%~ 0.5 %	I/P: 90VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1: 0%~0.01 %
4	LOAD REGULATION	V1: -2.0%~ 2.0 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.03 %~ 0.12 %
5	OVER/UNDERSHOOT TEST	<± 5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	-4.1%
6	RIPPLE & NOISE (Max)	V1: 150mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 53mVp-p / high frequency 66mVp-p / low frequency
	high frequency :  low frequency : 			
7	SET UP TIME(Max)	230VAC/1000ms 115VAC/2000ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	230VAC/ 197 ms 115VAC/ 464 ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	



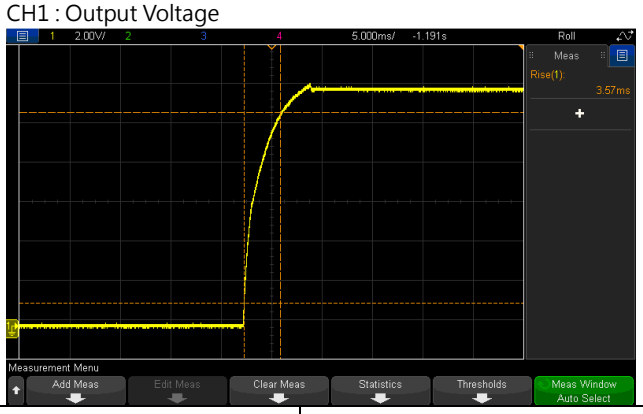


8	RISE TIME (Max)	230VAC/50ms 115VAC/50ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 4.14 ms 115VAC/ 3.57 ms

INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage

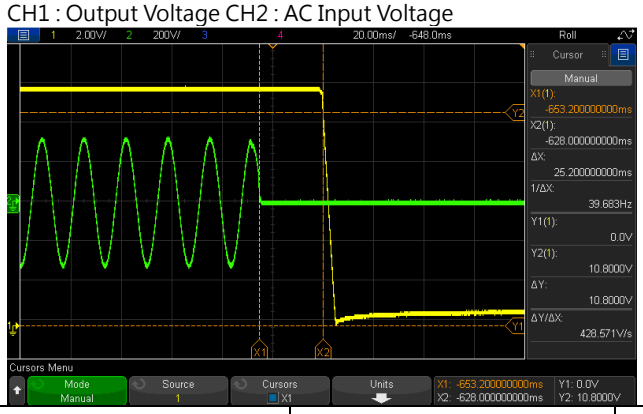


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage

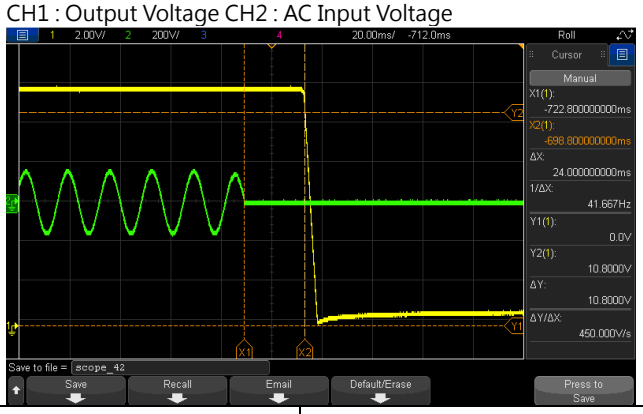


9	HOLD UP TIME (Typ.)	230VAC/16ms 115VAC/16ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 25.2ms 115VAC/ 24.0ms

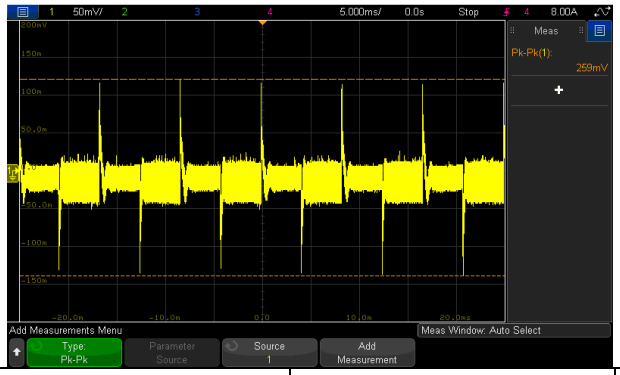
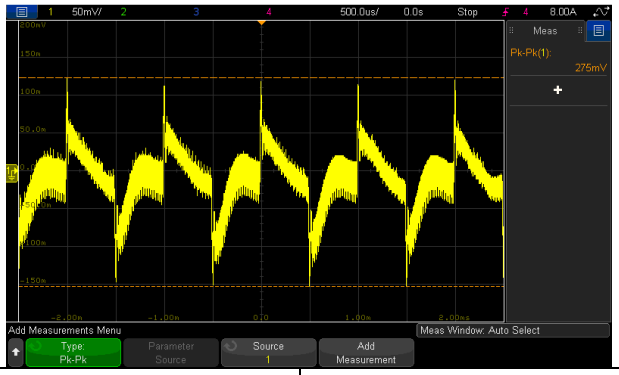
INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage



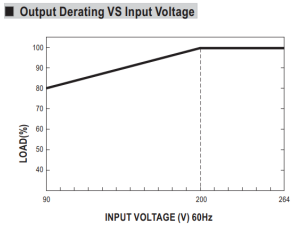
INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

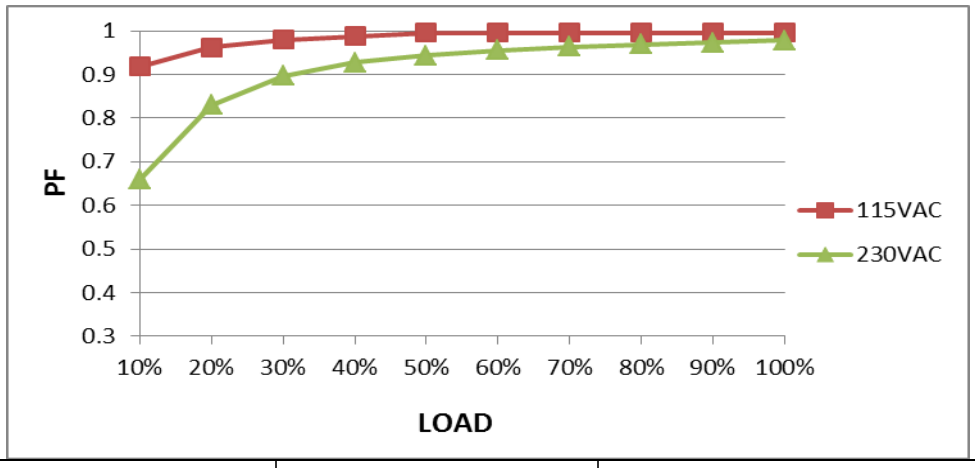
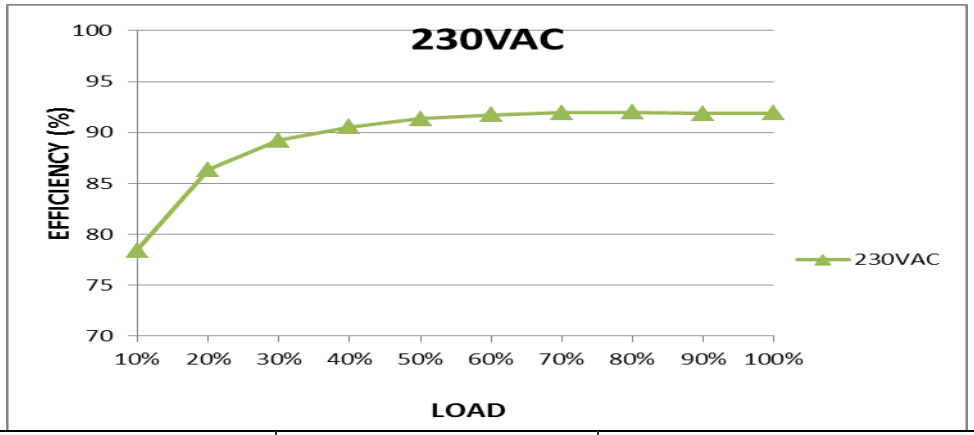
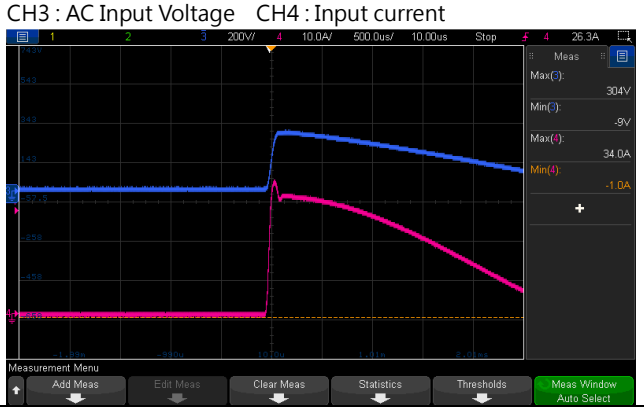
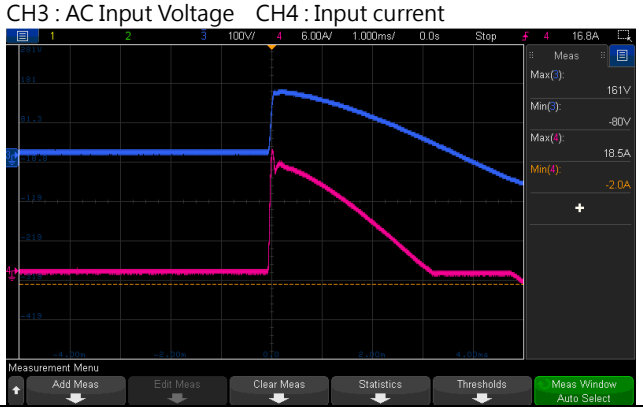


10	DYNAMIC LOAD	V1: 1200mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	259mVp-p 275mVp-p

	FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 	
11	TRANSIENT RECOVERY TIME	V1: 1200mVp-p <500us	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	221mVp-p
12	PEAK LOAD	PEAK LOAD@5S	I/P: 264VAC I/P: 200VAC I/P: 100VAC O/P: PEAK LOAD	TEST： I/P: 264VAC OK I/P: 200VAC OK I/P: 100VAC OK

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC (300VAC for 5 sec.) 127VDC~ 370VDC 	(1) I/P:TESTING O/P:FULL LOAD (2) I/P:DC TESTING(L:+ N:-) O/P: FULL / 80% LOAD (3) I/P:DC TESTING(L:- N:+) O/P: FULL / 80% LOAD Ta:25℃	(1) 83.5V~264V/ FULL LOAD 75.2V~264V/ 80% LOAD (2) 118.5Vdc~370Vdc/FULL LOAD 117.7Vdc~370Vdc/80% LOAD (3) 118.0Vdc~370Vdc/FULL LOAD 117.7Vdc~370Vdc/80% LOAD
			I/P: 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:90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 5 A 115V/ 8.5 A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =4.74A/ 230VAC I =8.11A/ 115VAC
4	LEAKAGE CURRENT	< 1.2mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	0.703mA
5	NO LOAD CONSUMPTION	<0.85W @ RC OFF	I/P：230VAC O/P：NO LOAD Ta：25℃	0.651W/ 230VAC

6	POWER FACTOR (Typ.)	0.95/ 230VAC 0.99/115VAC	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	PF=0.975/230VAC PF=0.997/115VAC
	P.F vs LOAD 			
7	EFFICIENCY(Typ.)	91.5%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	91.9%
	EFFICIENCY vs LOAD 			
8	INRUSH CURRENT(Typ.)	230V/40A 115V/25A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	I =34.0A/ 230VAC I =18.5A/ 115VAC T50= 1680us/230V
	INPUT=230VAC/50HZ @ FULL LOAD CH3 : AC Input Voltage CH4 : Input current 		INPUT=115VAC/ 60HZ @ FULL LOAD CH3 : 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 ; output power >320% rated then shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 200VAC O/P:TESTING Ta:25℃	>105%: 115%/ 264VAC 114.88%/ 230VAC 114.88%/200VAC >320% : 310%/ 264VAC 310%/ 230VAC 310%/200VAC PROTECTION TYPE : Output power >105% rated for more than 5 seconds then shut down o/p voltage, re-power on to recover ; output power >320% rated then shut down o/p voltage, re-power on to recover
2	OVER VOLTAGE PROTECTION	14.5V~16.5V Protection type : Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 90VAC O/P:MIN LOAD Ta:25℃	15.54V/ 264VAC 15.54V/ 90VAC PROTECTION TYPE : 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: 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	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE PROTECTION TYPE : Shut down o/p voltage, re-power on to recover

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	REMOTE ON/OFF CONTROL	Power ON : short; Power OFF : open.	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	TEST: OK
2	REMOTE SENSE	S+ / S- The remote sensing compensates voltage drop on the load wiring up to 0.5V	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	TEST: OK
3	DC-OK SIGNAL	The TTL signal out, PSU turn on = 3.3 ~ 5.6V ; PSU turn off = 0 ~ 1V	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	PSU turn on = 4.77 V ; PSU turn off = 0.09 V
4	5V STANDBY	5VSB : 5V@0.3A ; tolerance ±5%, ripple : 50mVp-p(max.)	I/P: 230 VAC O/P:TESTING Ta:25℃	TOLERANCE: -0.75%~0.13 % RIPPLE: 11mVp-p
5	FAN ON/OFF CONTROL	Fan on/off by NTC(RT50) or 30% load min	I/P: 230 VAC O/P:TESTING	FAN ON: By NTC: OK; LOAD（%）: 22.5%
6	CURRENT SHARING	Up to 4000W or (3+1) units.	I/P: 230 VAC O/P: (The rated current per unit) x (Number of unit) x 0.9 Ta:25℃	TEST: OK

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q910 / Q911 Rated : 66 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	Q910 VDS: (1) 464V (2) 468V (3) 468V (4) 468V (5) 464V (6) 468V (7) 464V (8) 460V	Q911 VDS: (1) 472V (2) 464V (3) 476V (4) 476V (5) 472V (6) 472V (7) 468V (8) 464V

			Ta:25℃	
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : 73 A/ 600 V	AC ON/OFF I/P:High-Line =267V 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 Ta:25℃	Q1 VDS: (1) 480V (2) 460V (3) 476V (4) 480V (5) 476V (6) 476V (7) 464V (8) 480V
3	P.F.C DIODE	D6 Rated : 20 A/ 650 V	I/P:High-Line =300 V 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 Ta:25℃	(1) 408V (2) 388V (3) 408V (4) 408V (5) 408V
4	AUX MOS	U971 Rated : 1.8 A/700V	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 Ta:25℃	VDS: (1) 551V (2) 543V (3) 551V (4) 551V (5) 555V (6) 551V (7) 547V (8) 547V
5	Diode Peak Voltage	Q501/Q505 Rated : 130A/ 60 V Q503/Q507	AC ON/OFF I/P:High-Line =300 V Vo=Vmax O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/	Q501: Vo=Vmax VDS: (1) 46.4V (2) 51.4V (3) 46.9V Q503: Vo=Vmax VDS: (1) 48.5V (2) 55.7V (3) 50.9V

		Rated : 215A/ 60 V	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) burst Mode (10) Peak Load Vo=Vnormal O/P: (1)Full Load Ta:25℃	(4) 46.5V (5) 46.5V (6) 48.5V (7) 52.9V (8) 38.9V (9) 41.7V (10) 53.4V Vo=Vnormal (1) 43.2V Q505: Vo=Vmax VDS: (1) 49.9V (2) 51.3V (3) 44.9V (4) 44.9V (5) 44.9V (6) 47.3V (7) 53.8V (8) 38.1V (9) 39.7V (10) 53.4V Vo=Vnormal (1) 42.1V	(4) 50.5V (5) 50.9V (6) 53.1V (7) 56.2V (8) 39.7V (9) 45.7V (10) 49.9V Vo=Vnormal (1) 36.2V Q507: Vo=Vmax VDS: (1) 47.3V (2) 55.1V (3) 46.5V (4) 46.1V (5) 46.1V (6) 51.5V (7) 55.1V (8) 37.7V (9) 42.5V (10) 53.1V Vo=Vnormal (1) 44.1V
6	Input Capacitor Voltage	C5 Rated: 270 μ / 420 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℃	(1)382V (2)390V (3)394V (4)386V (5)406V (6)398V	
7	Control IC Voltage Test	PFC IC U1 Rated 12V~ 25 V PWM IC U900 Rated 8.9 V~ 15.5 V AUX PWM IC U971 Rated 15V~ 32 V	AC ON/OFF I/P:High-Line =300 V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD Ta:25℃	U1 (1) 18.5V (2) 18.7V (3) 18.7V (4) 18.5V (5) 14.3V U900 (1) 14.5V (2) 14.5V (3) 14.3V (4) 14.3V (5) 13.3V	U971 (1) 19.1V (2) 19.1V (3) 19.1V (4) 19.1V (5) 17.7V

■ 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℃	I/P-O/P:5.5mA I/P-FG:4.67mA O/P-FG:2.81m 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: 600 VDC I/P-FG: 600 VDC O/P-FG: 600 VDC Ta:25℃	I/P-O/P: 50GΩ I/P-FG: 32911MΩ O/P-FG: 50GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	12 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	BS EN/ EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	PASS
2	CONDUCTION	BS EN/ EN55032 (CISPR32) CLASS B	I/P： 230 VAC (50HZ) O/P：FULL/50% LOAD Ta：25℃	PASS Test by certified Lab
3	RADIATION	BS EN/ EN55032 (CISPR32) CLASS B	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	PASS Test by certified Lab
4	E.S.D	BS EN/ EN61000-4-2 AIR：8KV / Contact：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
5	E.F.T	BS EN/ EN61000-4-4 INDUSTRY INPUT： 2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
6	SURGE	BS EN/ EN61000-4-5 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 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 : HRPG-1000N3-12 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 28.3 ℃ 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 53.9 ℃		

NO	Position	ROOM AMBIENT Ta= 28.3 ℃	HIGH AMBIENT Ta= 53.9 ℃
1	ZNR1	35.1℃	61℃
2	C1	42.1℃	69.2℃
3	LF1	43.6℃	71.2℃
4	LF2	45.4℃	71.9℃
5	RTH3	44.2℃	69.8℃
6	C11	48.3℃	74℃
7	BD1	52℃	77.1℃
8	TSW4	39.8℃	65.5℃
9	L1	65.2℃	90.1℃
10	L900	59.7℃	85.6℃
11	Q910	65.7℃	94.4℃
12	Q911	62.7℃	90.8℃
13	C946	43.7℃	69.3℃
14	D935	40.9℃	66.6℃
15	C6	46.4℃	71.4℃
16	Q1	48.8℃	74.2℃
17	Q2	41.5℃	67.1℃
18	D6	46.9℃	72.5℃
19	T2coil	71.7℃	98.1℃
20	T2core	50.1℃	76.4℃
21	T1coil	73.2℃	99.7℃
22	T1core	51.6℃	78℃
23	Q508	49.6℃	75℃
24	Q516	64.4℃	90.1℃
25	Q504	53.6℃	78.6℃
26	Q514	58.5℃	85℃
27	R567	61.6℃	87.2℃
28	RT50	49.1℃	74.8℃
29	U503	53.7℃	78.8℃
30	U501	54.5℃	81.3℃
31	TSW3	39.9℃	65.6℃
32	C109	42.1℃	67.6℃

		33 C107 45.3℃ 70.7℃ 34 C106 45℃ 70.4℃ 35 C115 38.1℃ 63.3℃ 36 U202 30.7℃ 56℃ 37 RG2 41.3℃ 68℃ 38 U900 36.4℃ 61.7℃ 39 U971 49.3℃ 74.8℃ 40 U903 31.9℃ 56.9℃ 41 T951 52℃ 77.2℃ 42 R977 67.6℃ 94.6℃ 43 D431 46.2℃ 71.4℃ 44 D8 48℃ 73.3℃ 45 Q914 51.7℃ 77.7℃ 46 J101 48.2℃ 74.2℃ 47 D230 52.9℃ 78.8℃ 48 U1 52.8℃ 77.1℃ 49 R6 53℃ 79.6℃		
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P： 230 VAC O/P：108%LOAD Ta：25℃	TEST：OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P： 264VAC/200VAC O/P： 100 %LOAD Ta= -45℃	TEST：OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 ℃/95 %R.H NO DAMAGE	I/P： 272 VAC O/P：FULL LOAD Ta= 49.2 ℃ HUMIDITY= 95 %R.H	TEST：OK
5	TEMPERATURE COEFFICIENT	± 0.03%/℃(0~50℃)	I/P： 230 VAC O/P：FULL LOAD	0.002%/℃(0~50℃)
6	STORAGE TEMPERATURE TEST	-40~85℃	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：10 CYCLE 5. Input/Output condition： STATIC	
7	THERMAL SHOCK TEST	-40~50℃	1. Thermal shock Temperature： -45℃~ +55℃ 2. Temperature change rate ：25℃ / 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：12min/sweep cycle (4) Acceleration：6G (5) Test Time：180min in each axis (X.Y.Z) (6) Ta：25℃
9	CAPACITOR LIFE CYCLE	SUPPOSE C107 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) 860315HRS (2) 154206.7HRS (3) 275257.5HRS (4) 399046.9HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 989.2K hrs min. Telcordia SR-332 (Bellcore) ; 130.6K hrs min. MIL-HDBK-217F (25℃	
11	Ongoing Reliability Test	I/P：230VAC O/P：FULL LOAD TA=50℃ Demonstration Mean Time Between Failure : 50000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Yuwei	Liutt	Wangdz

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