Test Report: PSPA-1000-15

1000W with PFC and Parallel Function

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Control Function Test
Component Stress Test

■ SAFETY & E.M.C. TEST

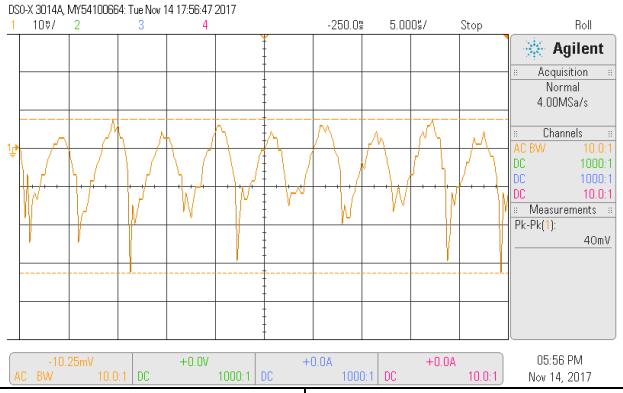
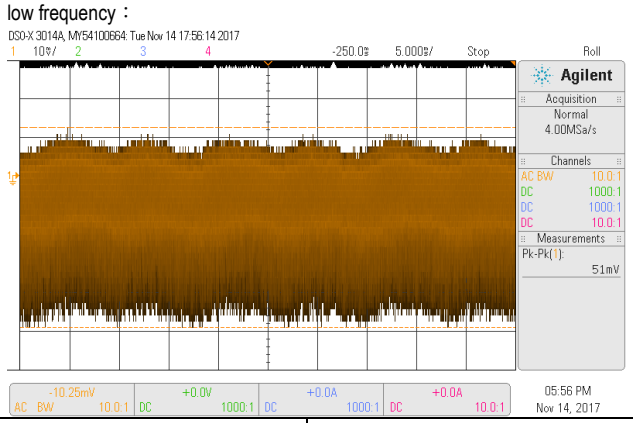
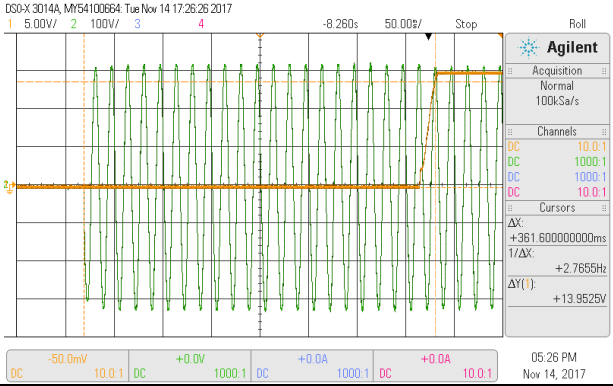
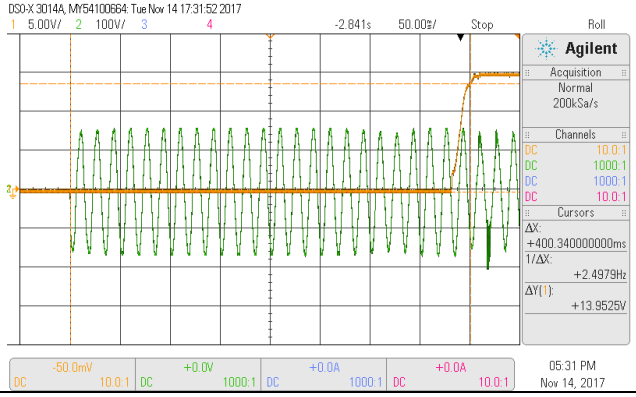
Safety Test
E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

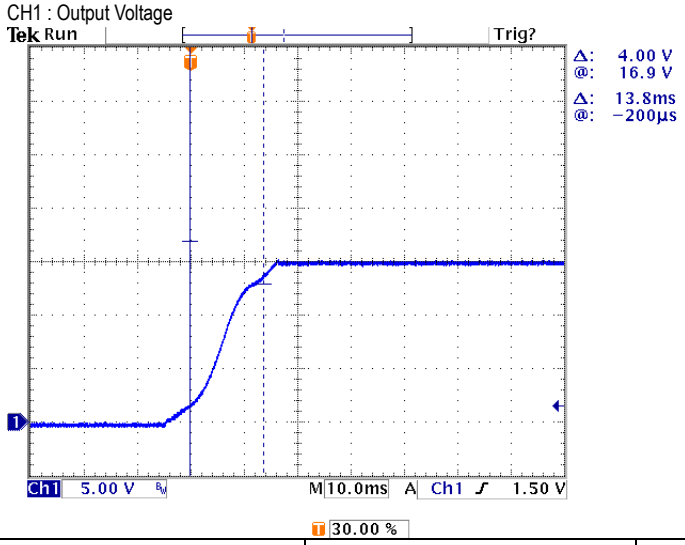
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 14V~ 17V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	13.436V~17.579V/230VAC 13.438V~17.579V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1.5%~ -1.5%	I/P:90VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: 0.6 %~ -0.33%
3	LINE REGULATION (Max)	V1: 0.5%~ -0.5%	I/P:90VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1: 0.4%~ 0%
4	LOAD REGULATION(Max)	V1: 1.5%~ -1.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1:0.133 %~ -0.066%
5	OVER/UNDERSHOOT TEST	< ±15%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	< 15%
6	RIPPLE & NOISE(Max)	V1: 150mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 51mVp-p
	high frequency： 		low frequency： 	
7	SET UP TIME(Max)	230VAC/1000ms 115VAC/1000ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/361.6ms 115VAC/400.34ms
	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/13.8ms 115VAC/14.6ms

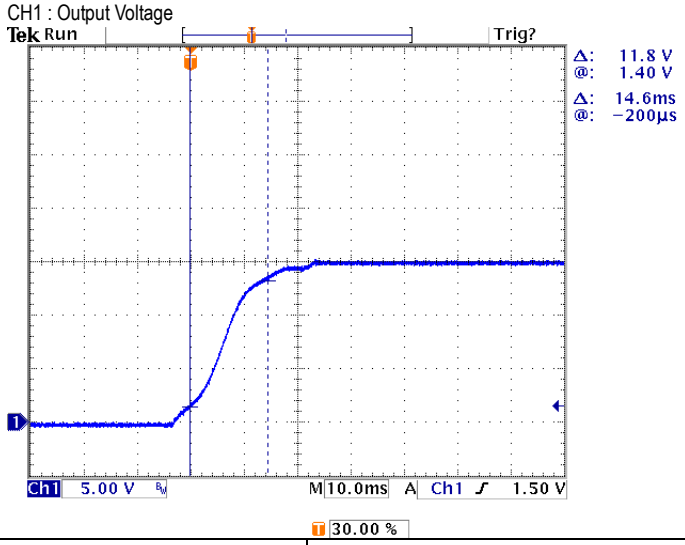
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage



INPUT=115VAC/60HZ @ FULL LOAD

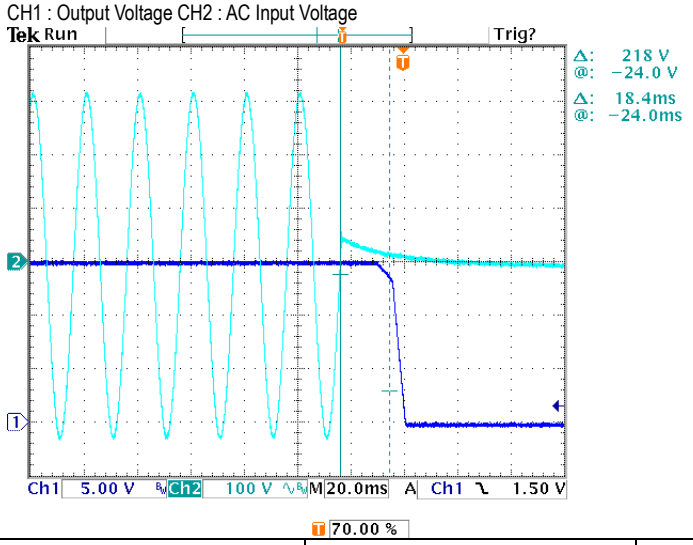
CH1 : Output Voltage



9	HOLD UP TIME (Typ.)	230VAC/16ms 115VAC/20ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 18.4 ms 115VAC/ 22.8ms

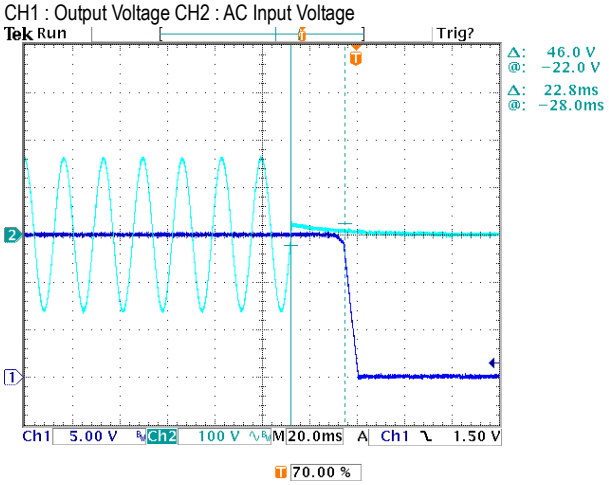
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

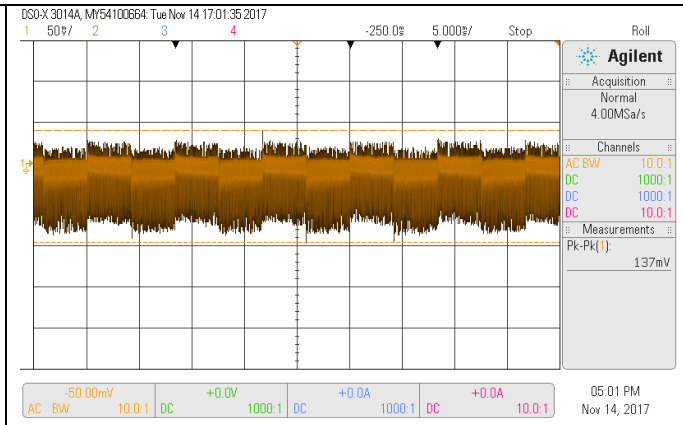
CH1 : Output Voltage CH2 : AC Input Voltage

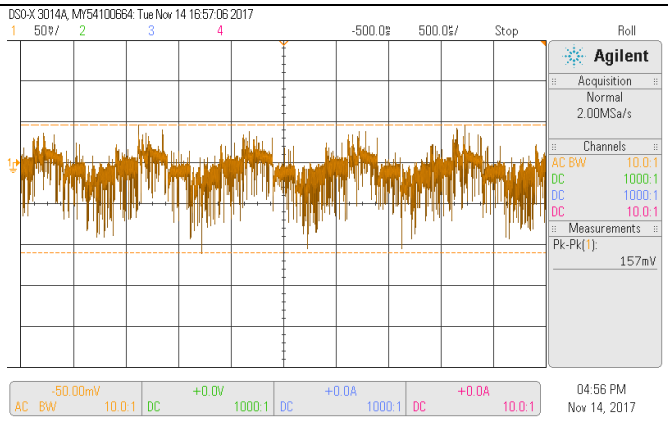


10	DYNAMIC LOAD	V1: 1500mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	 137mVp-p 157mVp-p

FULL /50% LOAD 50%DUTY / 120HZ

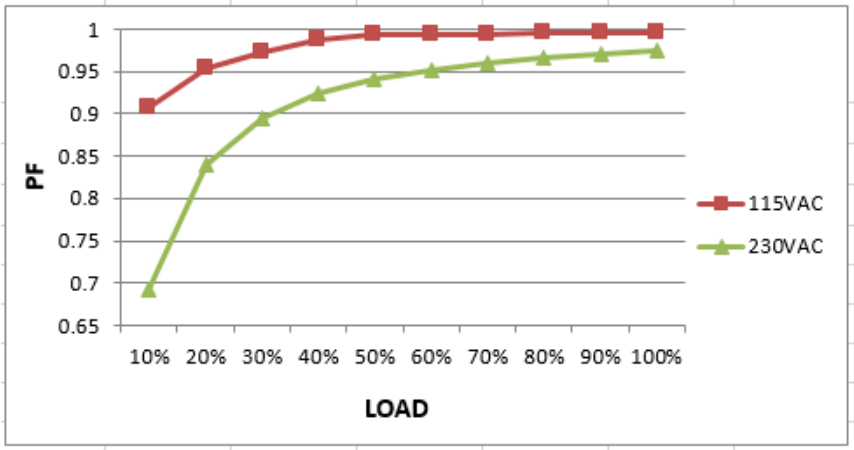
FULL /50% LOAD 50%DUTY / 1KHZ





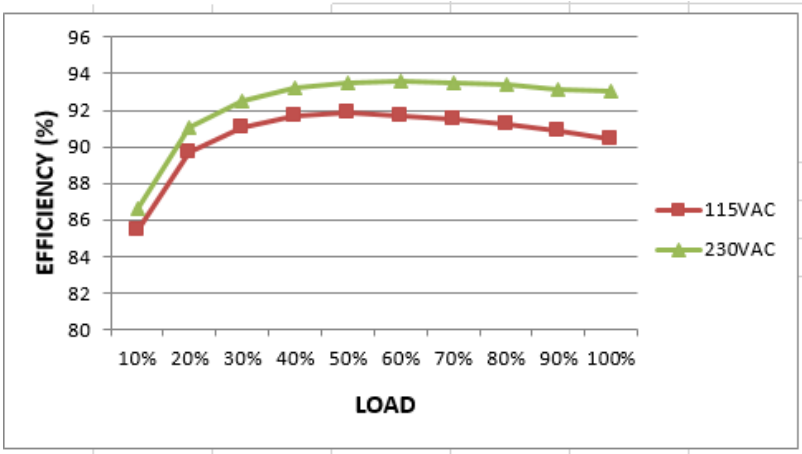
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	70V~264V
			I/P: 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 (POWER ON/OFF NO DAMAGE)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 90VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 5A 115V/ 8.5A	I/P ： 230 VAC I/P ： 115 VAC O/P ：FULL LOAD Ta ：25℃	I =4.61A/ 230VAC I =7.88A /115VAC
4	LEAKAGE CURRENT	< 0.5mA / 240 VAC	I/P ： 240 VAC O/P ：Min LOAD Ta ：25℃	L-FG ：0.4 mA N-FG ：0.42 mA
5	POWER FACTOR (Typ.)	0.95/ 230VAC 0.99/115VAC	I/P ： 230 VAC I/P ： 115 VAC O/P ：FULL LOAD Ta ：25℃	PF=0.976/230VAC PF=0.996/115VAC
	P.F vs LOAD			



6	EFFICIENCY(Typ.)	93%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	93.19%

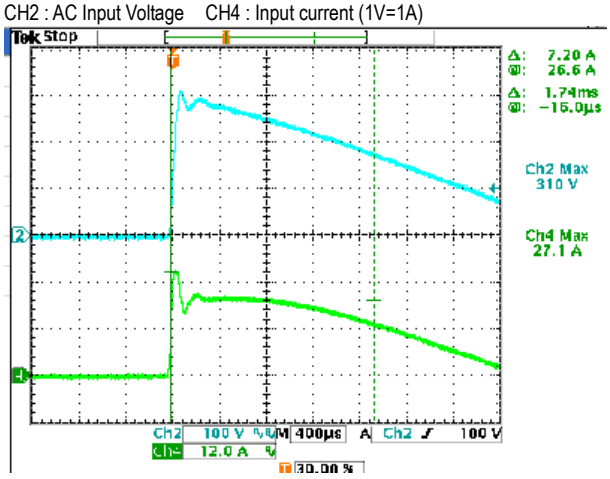
EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	230V/40A 115V/20A COLD START	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =27.1A/ 230VAC I =16.2A/ 115VAC T50:1740us/230V

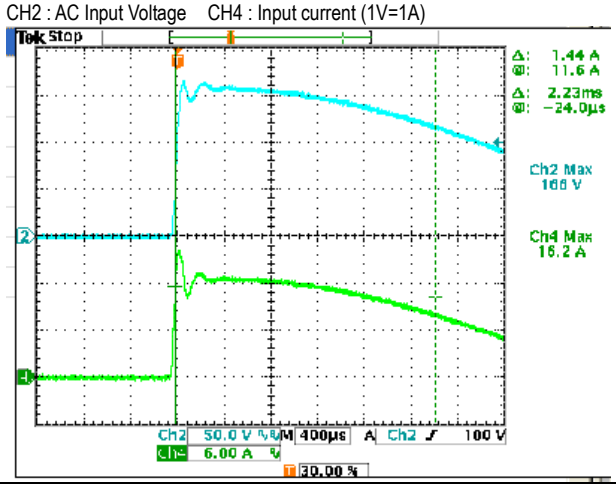
INPUT=230VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current (1V=1A)



INPUT=115VAC/ 60HZ @ FULL LOAD

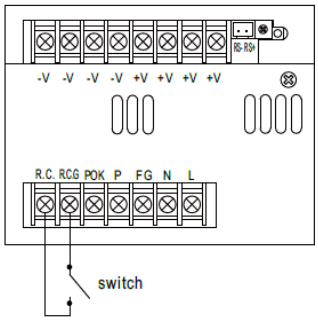
CH2 : AC Input Voltage CH4 : Input current (1V=1A)



PROTECTION FUNCTION TEST

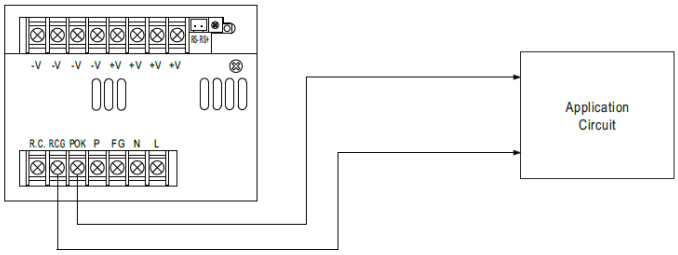
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~ 135% Protection type : Constant current limiting, recovers automatically after fault condition is removed	I/P: 264VAC I/P: 230VAC I/P: 200VAC O/P:TESTING Ta:25℃	117.07%/ 264VAC 117.03%/ 230VAC 117.03%/200VAC PROTECTION TYPE：Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	18.2V~20.6V 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℃	19.32V/ 264VAC 19.24V/ 230VAC 19.33V/ 90VAC PROTECTION TYPE：Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	Protection type : Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 90VAC O/P:FULL LOAD	O.T.P. Active Protection type : Shut down o/p voltage, re-power on to recover
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE I/P: 264VAC PROTECTION TYPE：Constant current limiting, recovers automatically after fault condition is removed

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CURRENT SHARING	< 10%	I/P： 230 VAC O/P：FULL/50% LOAD Ta：25℃	O/P：100% PSU1： 58.23A PSU2： 57.4 A PSU3： 57.64A PSU4： 57.61A O/P：50% PSU1： 33.3 A PSU2： 30.9 A PSU3： 32.22A PSU4： 33.14A
2	REMOTE SENSE	S+ / S- >0.5V	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	>0.5
3	REMOTE ON-OFF CONTROL	※ The power supply can be turned ON-OFF individually or along with other units by using the "Remote ON-OFF" function.  I/P: 230 VAC O/P:NO LOAD Ta:25℃ TEST RESULT :OK		

Between R.C. and R.C.G	Power Supply Status
Switch Short	ON
Switch Open	OFF

4	POK SIGNAL	The TTL signal out, PSU turn on = 2.4 ~ 5V ; PSU turn off = 0 ~ 0.4V. Please refer to the Function Manual. ※ POK signal indicates the output status of the power supply. It can operate in two ways : One is sinking current from external TTL signal ; the other is sending out a TTL voltage signal. ◎ **Sinking current from external TTL signal:** The maximum sink current is 10mA and the maximum external voltage is 5.6V.



I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
TEST RESULT :

	PSU TURN ON	PSU TURN OFF
P OK	4.34V	0.04V

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q911 Rated: 26A / 600V	I/P:High-Line +3V =303V I/P:Low-Line -3V = 197V 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℃	303V VDS: (1)428V (2)434V (3)430V (4)436V (5)432V (6)432V (7)430V	197V VDS: (1)450V (2)412V (3)446V (4)448V (5)448V (6)444V (7)418V
2	P.F.C Transistor (D to S) or (C to E) **Peak Voltage**	Q1 Rated: 34A / 650V	I/P:High-Line +3V =303 V I/P:Low-Line -3V = 197V 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℃	303V VDS: (1)436V (2)430V (3) 432V (4) 434V (5) 430V (6) 432V (7)426V	197V VDS: (1)452V (2)416V (3) 452V (4) 444V (5) 446V (6) 442V (7)416V
3	P.F.C DIODE	D6 Rated: 6A / 600V	I/P:High-Line +3V =303 V I/P:Low-Line -3V = 197V	303V	197V

			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 Ta:25℃	(1) 386V (2) 384V (3) 384V (4) 386V		(1) 396V (2) 390V (3) 394V (4) 390V
4	Diode Peak **Voltage**	Q503 Rated : 100A / 60V Q507 Rated : 100A / 60V	I/P:High-Line +3V =303 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℃	Q503: VDS: (1)42.8V (2)22.8V (3)42.8V (4)43.0V (5)43.8V (6)45.4V (7)44.2V (8)40.4V		Q507: VDS: (1)46.4V (2)12.4V (3)46.6V (4) 47.2V (5)48.0V (6)51.0V (7) 50.8V (8) 41.6V
5	**Input Capacitor Voltage**	C5 Rated: 150μ/400 V 105 ℃ PEAK VOLTAGE: 460V@30S	I/P:High-Line +3V =303V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue Ta:25℃	(1)427V (2)432V (3)430V (4) 428V		
6	**Control IC Voltage Test**	PWM IC U900 8.85 V ~ 16 V PFC IC U1 : 12.9 V ~ 25 V O/P SR U502 Rated: 8V~ 24V	I/P:High-Line +3V =303 V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRMIN (LOW LINE) Ta:25℃	(1) 14.1V (2) 14.2V (3) 14.1V (4) 14.3V (5) 12.6V	(1)15.6V (2)15.6V (3)15.7V (4)15.6V (5)14.4V	(1) 20.229V (2) 21.019V (3) 19.076V (4) 20.071V (5) 22.442V
7	TOP SWITCHING STAND BY POWER	U971 Rated: 1.8 A / 700V	I/P:High-Line +3V =303 V I/P:Low-Line -3V =197 V AC ON/OFF O/P: (1)Full Load (2)Remote On/Off Ta:25℃	303V (1) 506.56V (2) 506.72V	197V (1)467.19V (2)486.96V	

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:6.4mA I/P-FG:5.3mA O/P-FG:5.1:m 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	I/P-O/P:6.43 GΩ I/P-FG:6.01 GΩ O/P-FG: 15.3GΩ

			Ta:25℃	NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	11mΩ

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℃	PASS
2	CONDUCTION	EN55032 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL/50% LOAD Ta：25℃	PASS Test by certified Lab
3	RADIATION	EN55032 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	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℃	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT： 2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	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℃	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： PSPA-1000-12 1. ROOM AMBIENT BURN-IN： 14HRS I/P： 230VAC O/P： FULL LOAD 2. HIGH AMBIENT BURN-IN： 2HRS I/P： 230VAC O/P： FULL LOAD		

NO	Position	ROOM AMBIENT Ta= 25℃	HIGH AMBIENT Ta= 50℃
1	BD1	64.3℃	88.6℃
2	R5	43.7℃	67.7℃
3	Q1	46.4℃	72.9℃
4	D6	61.3℃	86.1℃
5	C5	41.1℃	64.3℃
6	U971	46.1℃	72.1℃
7	RY1	46.3℃	70.8℃
8	Q405	39.7℃	64.7℃
9	C406	28.3℃	54.1℃
10	TSW4	38.3℃	63.6℃
11	RTH3	38.8℃	63.9℃
12	L1	51.0℃	73.1℃
13	T951	39.4℃	64.5℃
14	C1	33.3℃	59.5℃
15	LF2	37.7℃	63.9℃
16	C2	33.3℃	58.5℃
17	LF3	39.5℃	64.0℃
18	T1-1	73.7℃	100.4℃
19	T1-2	71.2℃	99.0℃
20	T2-1	61.6℃	88.6℃
21	T2-2	63.4℃	91.6℃
22	L900	59.8℃	83.1℃
23	Q910	51.6℃	78.9℃
24	C933	48.1℃	72.4℃
25	C935	46.2℃	70.4℃
26	Q911	59.5℃	88.5℃
27	C910	40.7℃	65.7℃
28	C106	46.4℃	72.2℃
29	C116	39.9℃	65.3℃
30	C906	39.0℃	62.8℃
31	C112	50.3℃	76.3℃
32	U551	54.7℃	79.9℃
33	U501	75.0℃	103.2℃
34	Q505	83.7℃	114.5℃
35	Q501	66.1℃	92.8℃
36	U503	60.4℃	108.9℃
37	Q503	72.7℃	100.9℃
38	Q507	84.5℃	114.1℃
39	U1	40.6℃	66.0℃
40	C11	40.2℃	64.8℃
41	D981	47.4℃	72.7℃
42	U900	43.5℃	69.0℃

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P： 230 VAC O/P： 121 % 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= -25℃	TEST：OK

4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50℃ NO DAMAGE	I/P： 272 VAC O/P：FULL LOAD Ta= 50 ℃ HUMIDITY= 95 %R.H	TEST：OK
5	TEMPERATURE COEFFICIENT	± 0.03 %/℃(0~50℃)	I/P： 230 VAC O/P：FULL LOAD	± 0 %/℃(0~50℃)
6	STORAGE TEMPERATURE TEST	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		OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature： -25℃~ +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		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℃		TEST：OK
9	CAPACITOR LIFE CYCLE	PSPA-1000-12 SUPPOSE C106 IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P：FULL LOAD Ta= ℃ LIFE TIME (2) I/P： 230VAC O/P：FULL LOAD Ta= ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= ℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= ℃ LIFE TIME		(1) 350803HRS (2) 58648HRS (3) 182594HRS (4) 471820HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 807.1K hrs min. Telcordia SR-332 (Bellcore) ; 94.9K hrs min. MIL-HDBK-217F (25)		
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 50,000 hours @ TA 50℃		

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

12.10.30 A50-F031