



Test Report: PSPA-1000-24

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

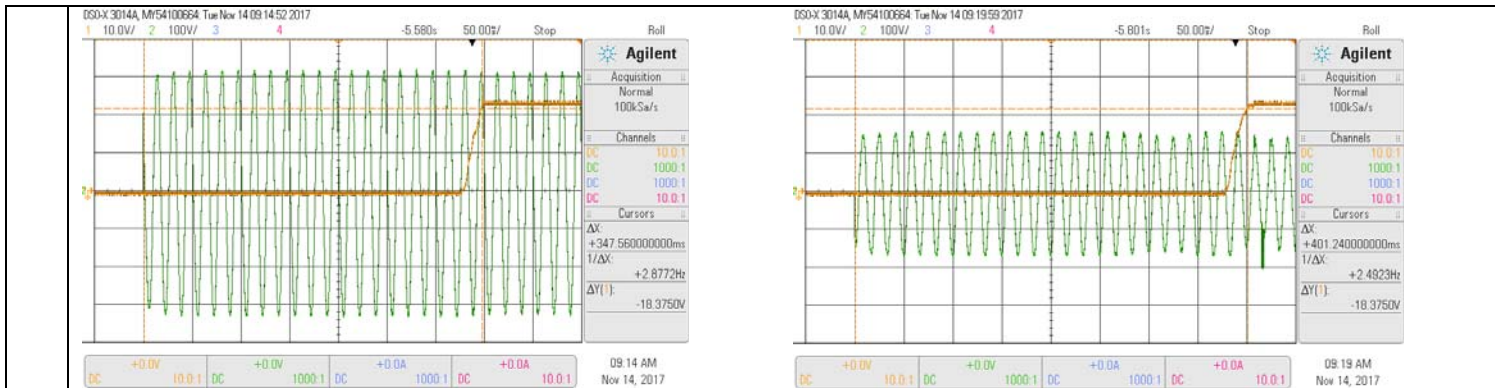
■ RELIABILITY TEST

- ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

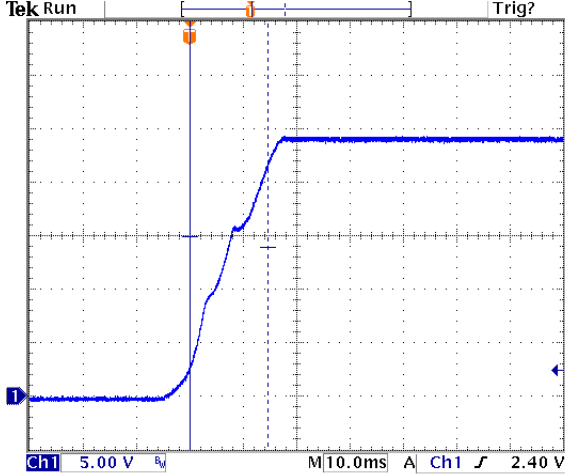
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 22V~ 28V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	21.07V~28.93V/230VAC 21.07V~28.93V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1.0%~ -1.0%	I/P: 90VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: 0.542%~-0.375%
3	LINE REGULATION (Max)	V1: 0.5%~ -0.5%	I/P: 90VAC~ 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: 0.041 %~-0.041%
5	OVER/UNDERSHOOT TEST	< ±15%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	<15 %
6	RIPPLE & NOISE(Max)	V1: 200mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 47mVp-p
<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p>high frequency :</p> </div> <div style="width: 45%;"> <p>low frequency :</p> </div> </div>				
7	SET UP TIME(Max)	230VAC/1000ms 115VAC/1000ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 347.56ms 115VAC/ 401.24ms
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	I/P : 230 VAC	230VAC/ 14.6ms
		115VAC/50ms	I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	115VAC/ 12.2ms

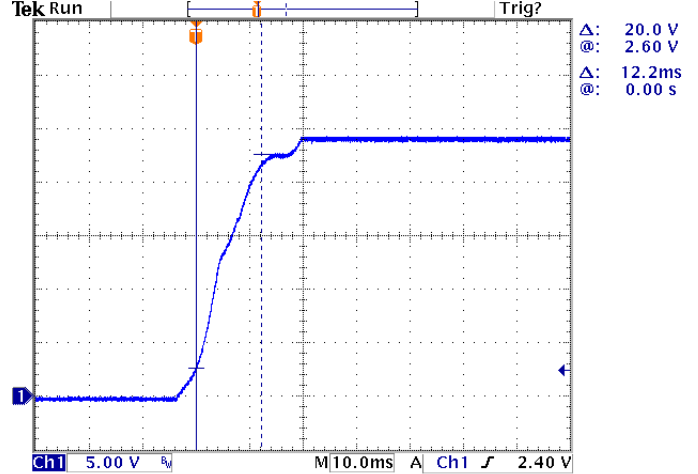
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage



INPUT=115VAC/60HZ @ FULL LOAD

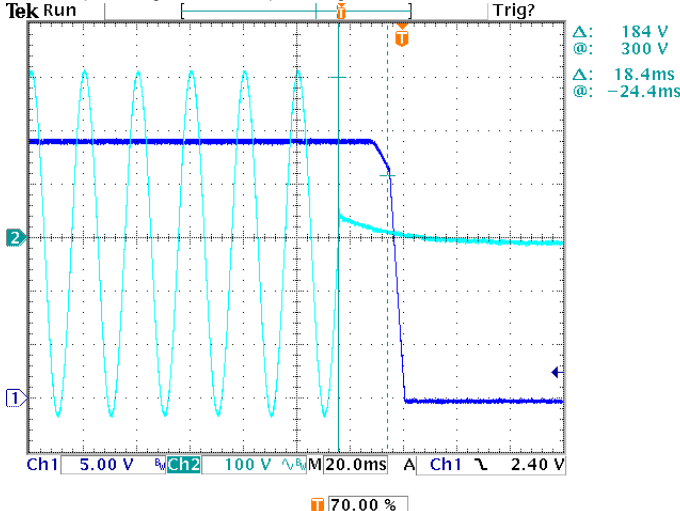
CH1 : Output Voltage



9	HOLD UP TIME (Typ.)	230VAC/16ms	I/P : 230 VAC	230VAC/ 18.4ms
		115VAC/20ms	I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	115VAC/ 22ms

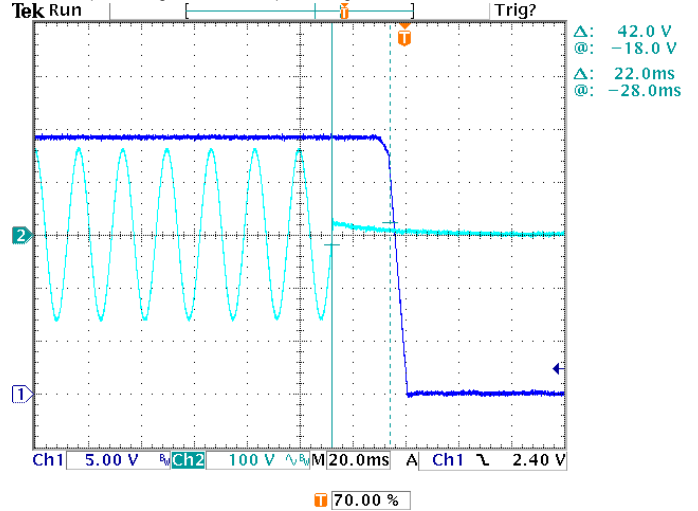
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

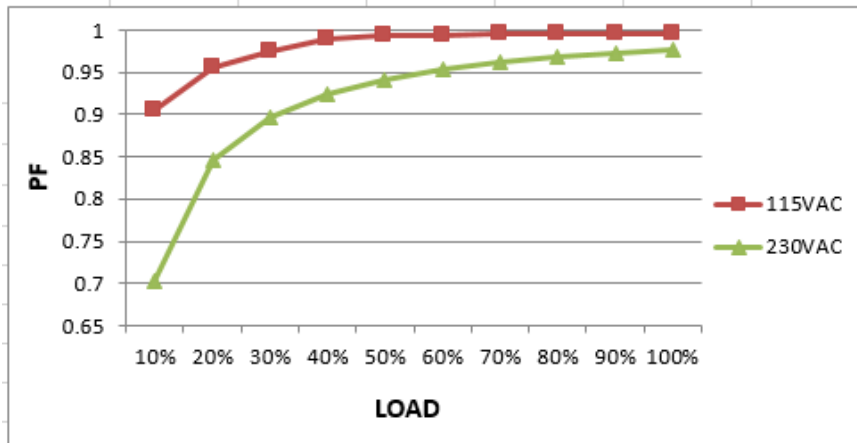
CH1 : Output Voltage CH2 : AC Input Voltage



10	DYNAMIC LOAD	V1: 2400mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	105mVp-p 108mVp-p

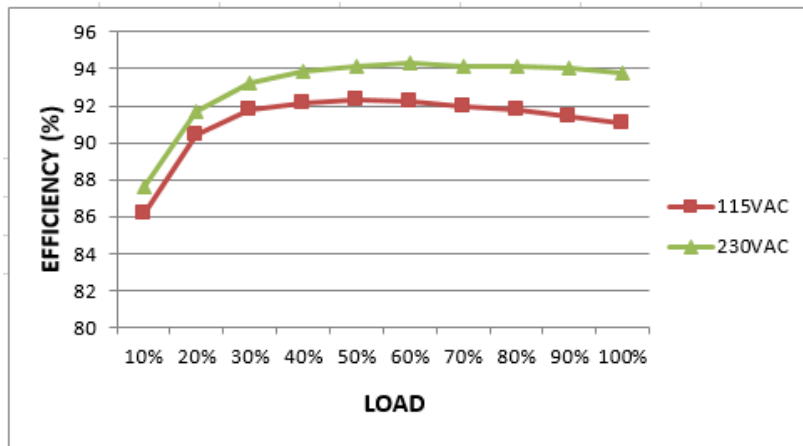
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC	I/P:TESTING O/P:FULL LOAD Ta:25°C	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:90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	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°C	I =4.82A/ 230VAC I =8.215/ 115VAC
4	LEAKAGE CURRENT	< 0.5mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.36mA N-FG : 0.38mA
5	POWER FACTOR (Typ.)	0.95/ 230VAC 0.99/115VAC	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF=0.975/230VAC PF=0.997/115VAC
	P.F vs LOAD			



6	EFFICIENCY(Typ.)	93.5%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	93.55 %
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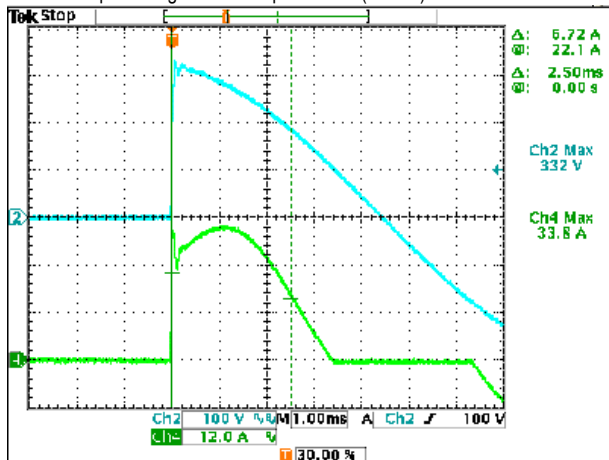
EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	230V/40A 115V/20A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I=33.8A/ 230VAC I=16.2A/ 115VAC T50= 2500us/230V
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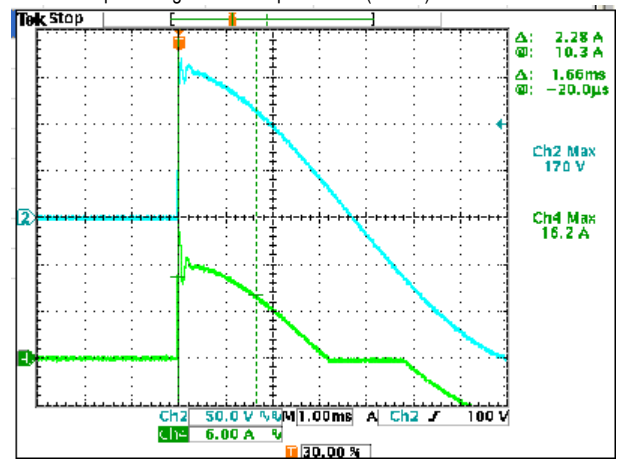
INPUT=230VAC/50HZ @ FULL LOAD

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



INPUT=115VAC/ 60HZ @ FULL LOAD

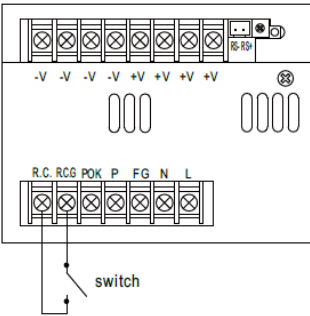
CH2 : AC Input Voltage CH4 : Input current (1V=1A)



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: 115VAC O/P: TESTING Ta:25°C	119.97%/ 264VAC 119.85%/ 230VAC 119.69%/115VAC PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	29V~33V 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°C	30.58V/ 264VAC 30.64V/ 230VAC 30.46V/ 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°C	NO DAMAGE 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°C	O/P : 100% PSU1 : 39.24 A PSU2 : 38.43 A PSU3 : 38.25A PSU4 : 38.52A O/P : 50% PSU1 : 21.8 A PSU2 : 21.5 A PSU3 : 21.2A PSU4 : 21.3A					
2	REMOTE SENSE	S+ / S- >0.5V	I/P: 230 VAC O/P: FULL LOAD Ta:25°C	> 0.5 V					
3	REMOTE ON/OFF CONTROL	<p>※ The power supply can be turned ON-OFF individually or along with other units by using the "Remote ON-OFF" function.</p>  <p>I/P: 230 VAC O/P: NO LOAD</p>	<table border="1"> <thead> <tr> <th>Between R.C. and R.C.G</th> <th>Power Supply Status</th> </tr> </thead> <tbody> <tr> <td>Switch Short</td> <td>ON</td> </tr> <tr> <td>Switch Open</td> <td>OFF</td> </tr> </tbody> </table>	Between R.C. and R.C.G	Power Supply Status	Switch Short	ON	Switch Open	OFF
Between R.C. and R.C.G	Power Supply Status								
Switch Short	ON								
Switch Open	OFF								

		Ta:25°C TEST RESULT : OK						
4	POK SIGNAL	<p>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.</p> <p>I/P: 230 VAC O/P: FULL LOAD Ta:25°C TEST RESULT :</p> <table border="1"> <tr> <td></td> <td>PSU TURN ON</td> <td>PSU TURN OFF</td> </tr> <tr> <td>P OK</td> <td>4.34V</td> <td>0.04V</td> </tr> </table>		PSU TURN ON	PSU TURN OFF	P OK	4.34V	0.04V
	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°C	303V 197V VDS: VDS: (1) 480V (1) 474V (2) 476V (2) 472V (3) 480V (3) 472V (4) 476V (4) 478V (5) 480V (5) 478V (6) 480V (6) 482V (7) 468V (7) 438V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated: 30.8A / 600V	I/P:High-Line +3V =303V 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°C	303V 197V VDS: VDS: (1) 440V (1) 418V (2) 436V (2) 414V (3) 436V (3) 418V (4) 434V (4) 416V (5) 430V (5) 420V (6) 436V (6) 416V (7) 432V (7) 414V

3	P.F.C DIODE	D6 Rated: 6A / 600V	I/P:High-Line +3V =303V 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/5KHz (4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25°C	303V (1) 392V (2) 388V (3) 384V (4) 390V	197V (1) 396V (2) 394V (3) 398V (4)396V	
4	SR MOSFET Peak Voltage	Q503 Rated: 100A / 80V Q507 Rated: 100A / 80V	I/P:High-Line +3V =303V 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	Q503: VDS: (1)67.2V (2)17.5V (3)66.8V (4)66.8V (5)67.6V (6)66.8V (7)69.2V (8)64.8V	Q507: VDS: (1)71.2V (2)19.4V (3)71.2V (4)71.6V (5)72.0V (6)70.8V (7)76.8V (8)68.4V	
5	Bulk Capacitor Voltage	C5 Rated: 150μ/400 V 105 °C 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°C	(1) 428V (2) 428V (3) 428V (4) 428V		
6	Control IC Voltage	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°C	U900 (1) 14.7V (2) 14.5V (3) 14.2V (4) 14.2V (5) 12.6V	U1 (1) 15.5V (2) 16.0V (3) 15.9V (4) 15.5V (5)14.0V	U502 (1)12.4V (2)12.8V (3)12.6V (4)10.7V (5)9.08V
7	STAND BY POWER	U971 Rated : 1.8 A / 700V	I/P:High-Line +3V =303 V AC ON/OFF O/P: (1)Full Load (2)Remote On/Off I/P:Low-Line -3V =197 V AC ON/OFF O/P: (1)Full Load (2)Remote On/Off	303V (1) 518V (2) 536V	197V (1) 482V (2) 492V	

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:6.15mA I/P-FG: 5.07mA O/P-FG: 4.74mA 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 Ta:25°C	I/P-O/P: 5.2GΩ I/P-FG:5.72 GΩ O/P-FG: 14.3GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	15mΩ

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 <u>INDUSTRY</u> 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 <u>INDUSTRY</u> INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 <u>INDUSTRY</u> 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			

■ **RELIABILITY TEST**

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL : PSPA-1000-24 1. ROOM AMBIENT BURN-IN : 2HRS I/P : 230VAC O/P : FULL LOAD 2. HIGH AMBIENT BURN-IN : 3HRS I/P : 230VAC O/P : FULL LOAD		

		NO	Position	ROOM AMBIENT Ta= 25°C	HIGH AMBIENT Ta= 50°C
		1	BD1	48.4°C	85.8°C
		2	R5	41.2°C	77.0°C
		3	Q1	41.9°C	78.4°C
		4	D6	57.4°C	93.6°C
		5	C5	36.3°C	70.6°C
		6	U971	46.9°C	83.0°C
		7	RY1	35.1°C	71.7°C
		8	Q405	36.4°C	70.7°C
		9	C406	28.2°C	63.0°C
		10	TSW4	36.2°C	71.9°C
		11	ZNR2	32.4°C	68.7°C
		12	RTH3	33.8°C	70.7°C
		13	L1	45.3°C	80.6°C
		14	T951	32.7°C	67.2°C
		15	C1	29.6°C	65.8°C
		16	LF2	32.3°C	68.2°C
		17	C2	31.4°C	67.4°C
		18	LF3	35.5°C	72.1°C
		19	T1-1	66.5°C	102.2°C
		20	T1-2	71.6°C	106.2°C
		21	T2-1	64.5°C	99.9°C
		22	T2-2	71.5°C	107.7°C
		23	L900	63.1°C	97.2°C
		24	C910	38.8°C	75.1°C
		25	C933	45.4°C	82.2°C
		26	C935	52.6°C	89.8°C
		27	Q911	56.4°C	100.7°C
		28	Q910	52.7°C	96.3°C
		29	C106	36.7°C	73.2°C
		30	C116	29.8°C	65.5°C
		31	C112	36.2°C	71.4°C
		32	C906	33.9°C	69.9°C
		33	U551	35.0°C	70.4°C
		34	Q503	60.5°C	100.7°C
		35	Q505	75.7°C	116.4°C
		36	Q501	58.8°C	97.7°C
		37	Q507	59.0°C	97.2°C
		38	U501	56.4°C	93.2°C
		39	U503	58.7°C	95.0°C
		40	U1	39.0°C	74.6°C
		41	C11	33.0°C	69.5°C
		42	D981	48.1°C	82.5°C
			U900	41.6°C	78.6°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)		I/P : 230 VAC O/P : 118 % LOAD Ta : 25°C	TEST : OK



3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/200VAC O/P : 100 % LOAD Ta= -25 °C	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50°C 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	± 0.001 %/°C(0~50°C)
6	STORAGE TEMPERATURE TEST	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		OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -25°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		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°C		TEST : OK
9	CAPACITOR LIFE CYCLE	PSPA-1000-24 SUPPOSE C106 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= °C LIFE TIME		(1) 1157040HRS (2) 92140HRS (3) 166941HRS (4) 235390HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 94.4K hrs min. MIL-HDBK-217F (25°C)		
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 50,000 hours @ TA 50°C		

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

12.10.30 A50-F031