



Test Report: UHP-2500-24

2500W Conduction Cooling with PFC Switching 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

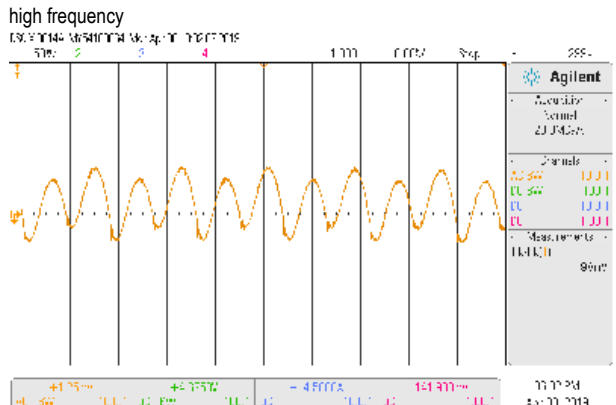
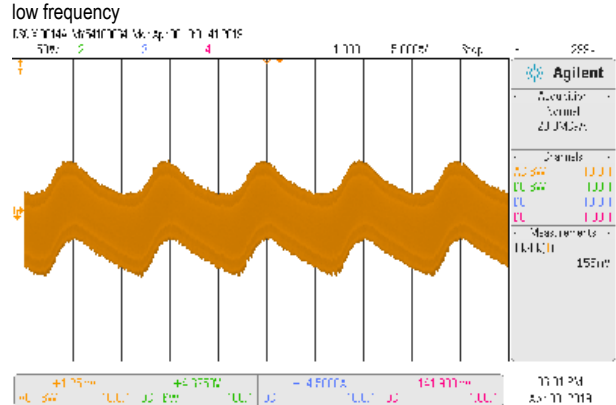
E.M.C. Test

■ RELIABILITY TEST

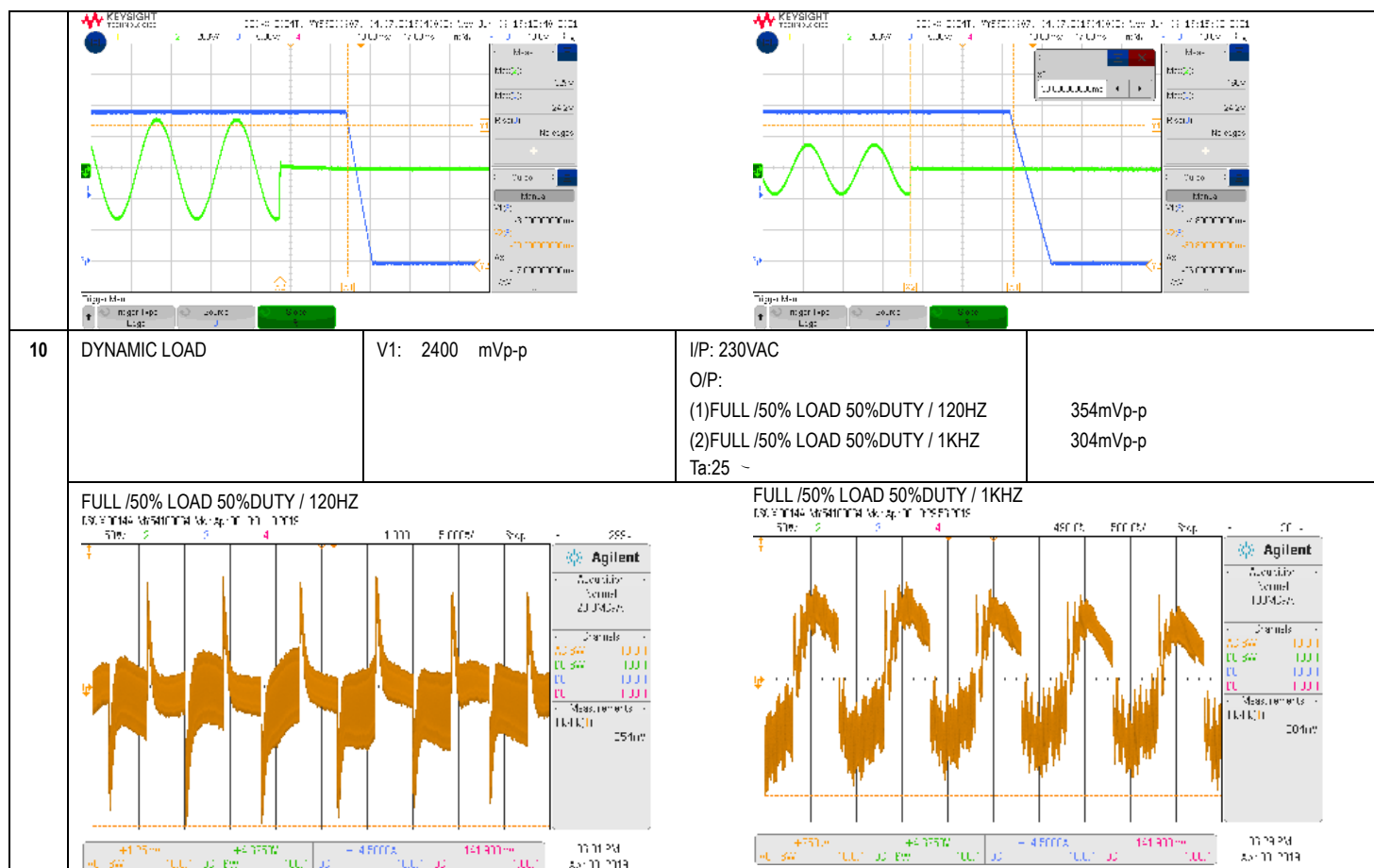
ENVIRONMENT TEST

DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 24V~ 28.8 V	I/P 230 VAC I/P 115 VAC O/P MIN LOAD Ta 25 ~	23.37V~ 29.63V/230VAC 23.37V~ 29.63V /115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1%~ -1 %	I/P: 180VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25 ~	V1: 0.2 %~ -0.2 %
3	LINE REGULATION (Max)	V1: 0.5%~-0.5 %	I/P: 180VAC~ 264VAC O/P:FULL LOAD Ta:25 ~	V1: 0.05%~-0.05 %
4	LOAD REGULATION(Max)	V1: 1%~ -1%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25 ~	V1: 0.2 %~ -0.2 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25 ~	< 5 %
6	RIPPLE & NOISE(Max)	V1: 300mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25 ~	V1: 155 mVp-p
high frequency  low frequency 				
7	SET UP TIME(Max)	230VAC/1500ms 115VAC/1500ms Derating may be needed under low input voltages. Please check the derating curve and Static characteristics for more details	I/P 230 VAC O/P FULL LOAD I/P 115 VAC O/P 63.8% LOAD Ta 25 ~	230VAC/ 698ms 115VAC/ 944 ms
INPUT=230VAC/50HZ @ FULL LOAD CH3: Output Voltage CH2 : AC Input Voltage			INPUT=115VAC/60HZ @ 63.8% LOAD CH3 : Output Voltage CH2 : AC Input Voltage	

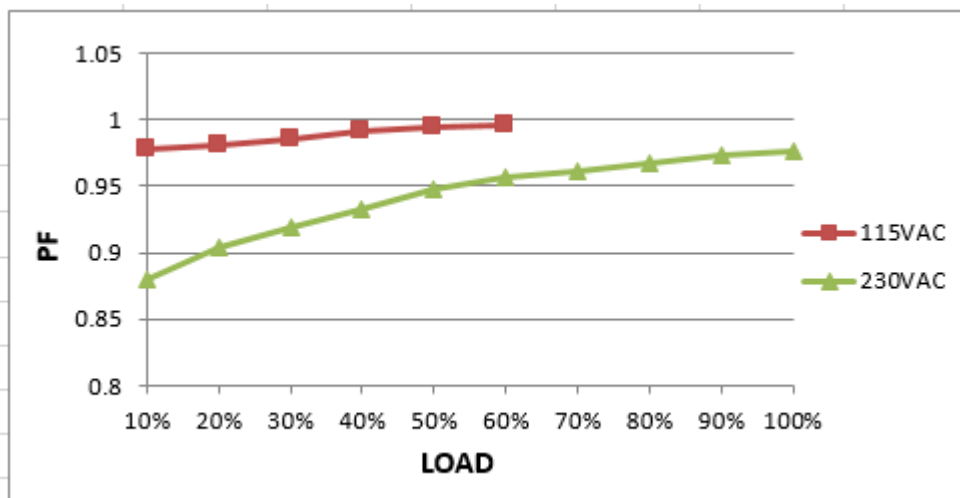
8	RISE TIME (Max) 230VAC/50ms 115VAC/60ms Derating may be needed under low input voltages. Please check the derating curve and Static characteristics for more details	I/P 230 VAC O/P FULL LOAD I/P 115 VAC O/P 63.8% LOAD Ta 25 ~	230VAC/ 7.57 ms 115VAC/ 7.21 ms
INPUT=230VAC/50HZ @ FULL LOAD CH3 : Output Voltage 		INPUT=115VAC/60HZ @ 63.8% LOAD CH3 : Output Voltage 	
9	HOLD UP TIME (Typ.) 230 ~ 115VAC/10ms at full load 230 ~ 115VAC/16ms at 75% load Derating may be needed under low input voltages. Please check the derating curve and Static characteristics for more details	I/P 230 VAC O/P FULL LOAD/75% LOAD I/P 115 VAC O/P 63.8% LOAD/47.85% LOAD Ta 25 ~	230VAC/ 13.2 ms at full load 230VAC/ 17 ms at 75% load 115VAC/ 19.4 ms at 63.8% load 115VAC/ 26 ms at 47.85% load
INPUT=230VAC/50HZ @ FULL LOAD CH3 : Output Voltage CH2 : AC Input Voltage 		INPUT=115VAC/60HZ @ 63.8% LOAD CH3 : Output Voltage CH2 : AC Input Voltage 	
INPUT=230VAC/50HZ@75% LOAD		INPUT=115VAC/60HZ@47.85% load	



INPUT FUNCTION TEST

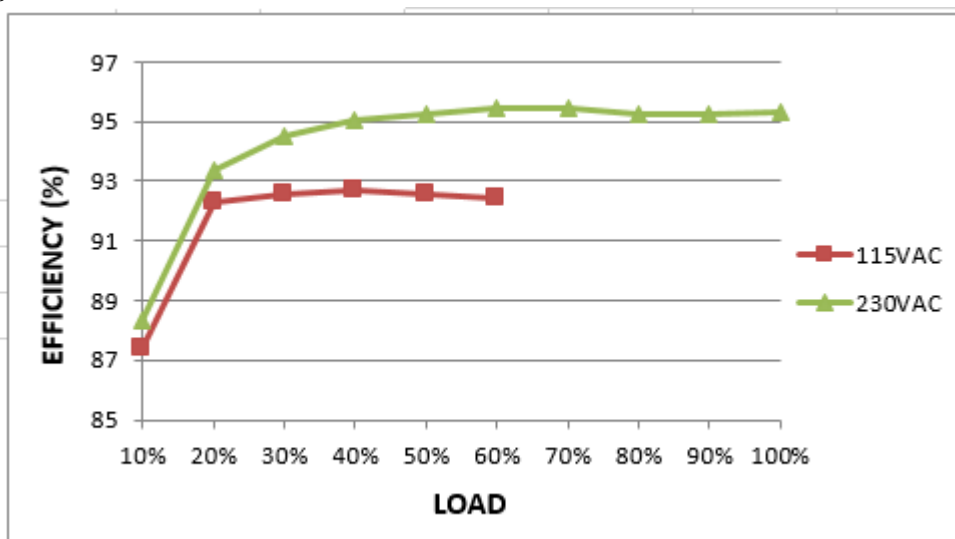
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC	I/P:TESTING O/P:FULL LOAD/ Derating Load Ta:25 ~	167V~264V (100%) 83V~264V (50%)
			I/P: LOW-LINE-3V=177 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF 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 ~	TEST:OK
3	INPUT CURRENT (Typ.)	230V/ 14.3 A	I/P 230 VAC O/P FULL LOAD Ta 25 ~	I=11.95 A/ 230VAC
4	LEAKAGE CURRENT	< 0.75mA / 240 VAC	I/P 240 VAC O/P Min LOAD Ta 25 ~	L-FG 0.54mA N-FG 0.54 mA
5	POWER FACTOR (Typ.)	0.95/ 230VAC	I/P 230 VAC O/P FULL LOAD Ta 25 ~	PF= 0.978/230VAC

P.F vs LOAD



6	EFFICIENCY(Typ.)	95%	I/P:230 VAC O/P:FULL LOAD Ta:25 ~	95.3%
---	------------------	-----	---	-------

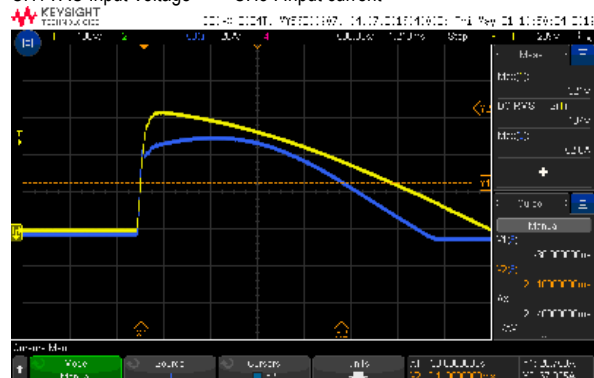
EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	230V/60A 115V/30A COLD START	I/P 230 VAC I/P 115 VAC O/P FULL LOAD Ta 25 ~	I=52.6A / 230VAC T50= 2140 us I=28.2A / 115VAC
---	----------------------	------------------------------------	--	--

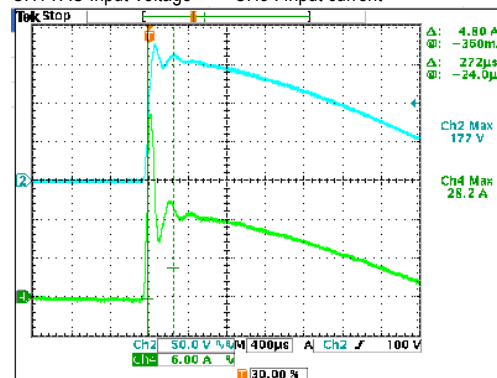
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : AC Input Voltage CH3 : Input current



INPUT=115VAC/60HZ @ FULL LOAD

CH1 : AC Input Voltage CH3 : Input current



8	NO LOAD CONSUMPTION	---	I/P : 115VAC I/P : 230VAC O/P : NO LOAD Ta : 25°C	10.65 W/115VAC 8.13 W/230VAC
---	---------------------	-----	--	---------------------------------

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~ 115 %(180VAC~264VAC) 52.5%~57.5% (90VAC) Protection type : Constant current limiting, shut down O/P voltage 5 sec. after O/P voltage is down low, re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 180VAC I/P: 90VAC O/P:TESTING Ta:25 ~	109.9%/ 264VAC 109.9%/ 230VAC 109.9%/180VAC 55.8%/90VAC PROTECTION TYPE Constant current limiting, shut down O/P voltage 5 sec. after O/P voltage is down low, re-power on to recover
2	OVER VOLTAGE PROTECTION	30V~35V 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 ~	32.4V/ 264VAC 32.4V/ 230VAC 32.35V/ 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 Protection type : Constant current limiting, shut down O/P voltage 5 sec. after O/P voltage is down low, re-power on to recover	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD Ta:25 ~	NO DAMAGE PROTECTION TYPE Constant current limiting, shut down O/P voltage 5 sec. after O/P voltage is down low, re-power on to recover

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT								
1	AUXILIARY POWER (AUX)	I/P: 230 VAC O/P:FULL LOAD Ta:25°C Test Result<table><tr><td>AUX</td><td>TOLERANCE</td><td>RIPPLE</td><td>TEST RESULT</td></tr><tr><td>12V / 0.4A</td><td>10.8~13.2 V</td><td>150mVp-p</td><td>11.6V /102mv</td></tr></table>			AUX	TOLERANCE	RIPPLE	TEST RESULT	12V / 0.4A	10.8~13.2 V	150mVp-p	11.6V /102mv
AUX	TOLERANCE	RIPPLE	TEST RESULT									
12V / 0.4A	10.8~13.2 V	150mVp-p	11.6V /102mv									

2

REMOTE ON/OFF CONTROL

<

4	OUTPUT CURRENT PROGRAMMABLE (PC)
---	----------------------------------

※ The output current can be trimmed to 20~100% of the rated current by applying EXTERNAL VOLTAGE.

PIN2 PC

EXTERNAL VOLTAGE (DC)

PIN3 & 4 -GND-signal

OUTPUT CURRENT (%)

EXTERNAL VOLTAGE (DC)

Non-Linear

I/P: 230 VAC

O/P: TESTING

Ta:25°C

ADJ V	<0.4V	1V	4.7V	5V
SPEC	110%±10%	20%±10%	100%±10%	100%±10%
iout	113.94A/109.34%	23.44A/22.49%	104.4A/100.2%	106.7A/102.4%

5	DC OK CONTACT RATINGS
---	-----------------------

DC-OK signal is a TTL level signal. The maximum sourcing current is 10mA.

PIN6 DC OK

PIN9 & 10 GND-AUX

DC-OK signal	Power Supply Status
"High" >4.5~5.5V	ON
"Low" <-0.5~0.5V	OFF

I/P: 230 VAC

O/P: TESTING

Ta:25°C

DC-OK signal	Power Supply Status
"High" >4.5~5.5V	ON(5.06v)
"Low" <-0.5~0.5V	OFF(-0.09V)

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q903 Rated : 48 A/ 600 V	AC ON/OFF I/P: High-Line +3V = 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. I/P: Low-Line -3V = 177V O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/	VDS: (1) 519V (2) 523V (3) 507v (4) 507v (5) 502V (6) 438V (7) 478V VDS: (1) 462V (2) 470V (3) 454V

			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% _i 400% Load. Ta:25 ~	(4) 458V (5)462V (6)442V (7)470V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q 65 Rated 33A/ 600 V VGS : 20 V	I/P:High-Line +3V =267 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% _i 400% Load. I/P:Low-Line -3V = 177V 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% _i 400% Load. Ta:25 ~	VDS: (1) 474V (2) 426V (3) 474V (4) 470V (5) 470V (6) 466V (7) 426V VDS: (1) 478V (2) 410V (3) 478V (4) 478V (5) 478V (6) 458V (7) 434V
3	P.F.C DIODE	D 14 Rated 10 A/650 V	I/P:High-Line +3V =267 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 I/P:Low-Line -3V = 177V 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) 450V (2) 410V (3) 426V (4) 422V (1) 426V (2) 402V (3) 442V (4) 430V
4	Diode Peak Voltage	Q109 Rated 100 A/100 V	AC ON/OFF I/P:High-Line +3V =267 V	Q109: Q113: VDS: VDS:

		Q113 Rated 100 A/100 V	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) burst Mode Ta:25 ~	(1)79.6V (2)28.1V (3)78.8V (4)79.6V (5)80.4V (6)78.8V (7)65.9V (8)69.9V (9)65.1	(1)81.2V (2)20.1V (3)81.2V (4) 81.2V (5) 82.8V (6) 81.2V (7)69.1V (8)66.7V (9)69V
5	Input Capacitor Voltage	C5 Rated: : 180μ/450 V Surge Voltage :495V	I/P:High-Line +3V =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 Ta:25 ~	(1)400V (2)396V (3)420V (4) 382V	
6	Control IC Voltage Test	PWM IC U800 Rated 8.85 V~ 16V PFC IC U401 Rated 10.6V~ 21 V O/P IC U153Rated 8V~ 24V	AC ON/OFF I/P:High-Line +3V =267 V O/P:(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(LOW LINE) Ta:25 ~	U800: (1) 14.8V(100M) (2) 15.5V (3) 14.6V(100M) (4) 13.7V (5) 14.8V(100M) U401: (1) 15.3V (2) 14.3V (3) 15.5V (4) 14.7V (5) 15V	U153: (1) 12.3V (2) 10.7V (3) 10.7V (4) 7.6V (5) 12V
8	TOP SWITCHING STAND BY POWER	U601 Rated 3.5A/800 V	AC ON/OFF I/P:High-Line +3V =267 V O/P: (1)Full Load (2)Remote On/Off I/P:Low-Line -3V =87 V O/P: (1)Full Load (2)Remote On/Off Ta:25 ~	U601 (1) 569V (2) 545V (1) 545 V (2) 548V	

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3.75KVAC/min I/P-FG: 2KVAC/min O/P-FG:1.25KVAC/min	I/P-O/P: 4.125 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.5KVAC/min Ta:25 ~	I/P-O/P:9.07mA I/P-FG:8.66mA O/P-FG:5.9mA 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 ~	I/P-O/P: 23.9GΩ I/P-FG: 19.8GΩ O/P-FG:22.4GΩ NO DAMAGE

3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25 ~	23 mΩ
---	----------------------	--	-----------------------	-------

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 A	I/P 230 VAC (50HZ) O/P FULL LOAD Ta 25°C	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	IEC61000-6-2 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 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 UHP-2500-24 (AMBIENT TEMPERATURE WITH FORCED AIR COOLING) 1. ROOM AMBIENT BURN-IN 2 HRS I/P 230VAC O/P FULL LOAD Ta=25 ~ 2. HIGH AMBIENT BURN-IN 2 HRS I/P 230VAC O/P FULL LOAD Ta= 50 ~		

NO	Position	ROOM AMBIENT Ta= 25 ~	HIGH AMBIENT Ta= 50 ~
1	BD1	78.7 ~	99.4 ~
2	BD2	64.6 ~	86.5 ~
3	ZNR3	60.5 ~	79.7 ~
4	C14	62.3 ~	82.5 ~
5	L1	63.2 ~	86.4 ~
6	L2	60.3 ~	83.7 ~
7	L3	71.7 ~	91.1 ~
8	D10	43.0 ~	67.8 ~
9	Q52	66.1 ~	87.4 ~
10	Q66	66.6 ~	88.5 ~
11	C417	63.6 ~	77.1 ~
12	Q901	68.6 ~	90.8 ~
13	Q902	65.2 ~	87.4 ~
14	Q903	61.1 ~	83.3 ~
15	LF1	71.1 ~	81.4 ~
16	LF3	61.1 ~	83.3 ~
17	T1 WIRE	72.5 ~	96.4 ~
18	T1 CORE	59.5 ~	82.8 ~
19	T2 WIRE	69.9 ~	92.5 ~
20	T2 CORE	59.7 ~	80.9 ~
21	RT21	70.9 ~	92.2 ~
22	C10	62.8 ~	79.7 ~
23	T51	67.3 ~	83.1 ~
24	T52	67.9 ~	82.6 ~
25	C968	61.2 ~	77.6 ~
26	C962	63.4 ~	79.6 ~
27	D14	84.5 ~	107.8 ~
28	Q907	63.6 ~	81.8 ~
29	Q916	61.2 ~	76.2 ~
30	D985	55.9 ~	72.0 ~
31	Q105	62.9 ~	86.2 ~
32	Q101	62.1 ~	85.2 ~
33	Q113	62.0 ~	85.3 ~
34	Q109	58.7 ~	82.3 ~
35	U151	62.3 ~	82.9 ~
36	U153	65.9 ~	89.1 ~
37	U401	68.8 ~	85.4 ~
38	T601	60.3 ~	81.8 ~
39	RG61	53.3 ~	76.4 ~
40	C652	59.2 ~	81.1 ~
41	C632	47.9 ~	72.9 ~
41	RG65	64.2 ~	85.8 ~
42	U701	40.1 ~	65.2 ~
43	U601	61.1 ~	82.8 ~
44	RG52	71.3 ~	94.1 ~
45	C116	52.4 ~	71.5 ~
46	C117	52.7 ~	75.5 ~
47	C112	55.3 ~	77.8 ~
48	C120	55.1 ~	73.5 ~
49	RY1	61.3 ~	75.2 ~

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P 230 VAC O/P 110 LOAD Ta 25 ~	TEST OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P 264VAC/180VAC O/P 100 LOAD Ta= -35 ~/-30 ~	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= 50 ~ HUMIDITY= 95 %R.H	TEST OK
5	TEMPERATURE COEFFICIENT	± 0.03 %/ ~(0~50 ~)	I/P 230 VAC O/P FULL LOAD	± 0.011 %/ ~(0~50 ~)
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	-30~50°C	1. Thermal shock Temperature : -35°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	
8	VIBRATION TEST	10 ~ 500Hz, 2G 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 3G (5) Test Time 180min in each axis (X.Y.Z) (6) Ta 25°C	
9	CAPACITOR LIFE CYCLE	SUPPOSE C116 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= 45 ~ LIFE TIME (3) I/P 230VAC O/P 75% LOAD Ta= 45 ~ LIFE TIME (4) I/P 230VAC O/P 50% LOAD Ta= 45 ~ LIFE TIME		(1) 294503HRS (2) 82261HRS (3) 127692HRS (4) 185079HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 166.12K hrs min. Telcordia SR-332 (Bellcore) ; 48.91K hrs min. MIL-HDBK-217F (25 ~)		
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	DANIEL GAO	SANFORD SU	VINCENT TSENG

2018.4.30 GP-A50-F010