



Test Report: LOP-600-48

600W 5"×3" Low Profile Open Frame 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

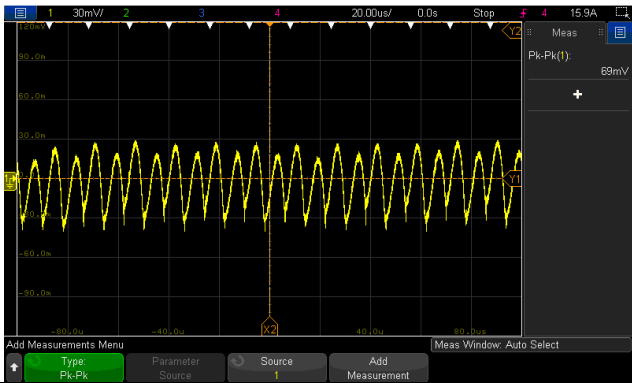
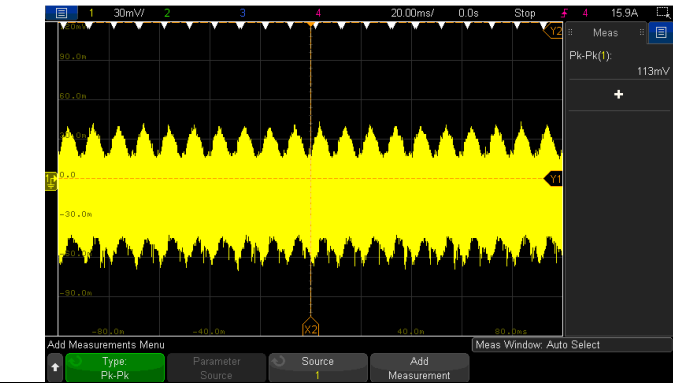
E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 45.6~50.4V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	44.132V~52.17V/230VAC 44.132V~52.17V/115VAC
2	OUTPUT VOLTAGE TOLERANCE	V1: -1% ~ +1%	I/P: 80VAC~ 264VAC O/P:FULL~ MIN. LOAD Ta:25°C	V1: -0.02% ~0.09%
3	LINE REGULATION	V1: -0.5% ~ +0.5%	I/P: 80VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0% ~0 %
4	LOAD REGULATION	V1: -1% ~ +1%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.02% ~0.09%
5	OVER/UNDERSHOOT TEST	<±5%	I/P: 230VAC O/P:FULL LOAD / NO LOAD Ta:25°C	0.84%
6	RIPPLE & NOISE (Max)	V1: 250mVp-p	I/P:230VAC O/P: FULL LOAD O/P:PEAK LOAD Ta:25°C	V1: 69mVp-p / high frequency 113mVp-p / low frequency
		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>high frequency :</p>  </div> <div style="text-align: center;"> <p>low frequency :</p>  </div> </div>		
7	SET UP TIME(Max)	230VAC/1000ms 115VAC/1500ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 806ms 115VAC/ 624ms
		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>INPUT=230VAC/50HZ @ FULL LOAD CH1: Output Voltage CH2: AC Input Voltage</p> </div> <div style="text-align: center;"> <p>INPUT=115VAC/60HZ @ FULL LOAD CH1: Output Voltage CH2: AC Input Voltage</p> </div> </div>		

8	<p>RISE TIME (Max)</p>	<p>230VAC/30ms 115VAC/30ms</p>	<p>I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C</p>	<p>230VAC/7.13 ms 115VAC/7.14ms</p>
	<p>INPUT=230VAC/50HZ @ FULL LOAD CH1: Output Voltage</p>			<p>INPUT=115VAC/60HZ @ FULL LOAD CH1: Output Voltage</p>
9	<p>HOLD UP TIME (Typ.)</p>	<p>8ms /600W load 12ms /400W load</p>	<p>I/P : 230 VAC O/P : TESTING Ta : 25°C</p>	<p>17.2ms /600W load 26.6ms /400W load</p>
	<p>INPUT=230VAC/50HZ @ 600W load CH1: Output Voltage CH2: AC Input Voltage</p>			<p>INPUT=230VAC/50HZ @ 400W load CH1: Output Voltage CH2: AC Input Voltage</p>
10	<p>DYNAMIC LOAD</p>	<p>V1: 4800mVp-p</p>	<p>I/P: 230VAC O/P: (1) FULL/0% LOAD 50%DUTY / 120HZ (2) FULL/0% LOAD 50%DUTY / 1KHZ Ta:25°C</p>	<p>736mVp-p 537mVp-p</p>
	<p>FULL /0% LOAD 50%DUTY / 120HZ</p>		<p>FULL /0% LOAD 50%DUTY / 1KHZ</p>	

11	TRANSIENT RECOVERY TIME	V1: 4800mVp-p < 500us	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	373mVp-p 0us
12	PEAK LOAD	150% PEAK LOAD@3S	I/P: 264VAC I/P: 115VAC O/P: PEAK LOAD	TEST : OK

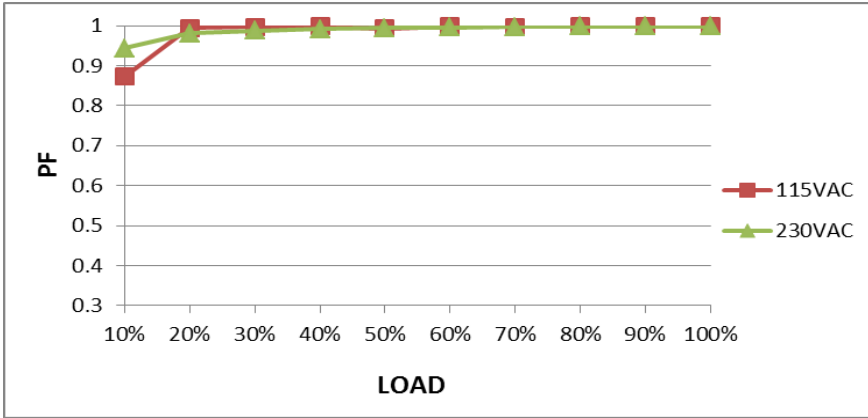
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC~264VAC 113VDC~ 370VDC 	(1) I/P: TESTING O/P: FULL / 70% LOAD (2) I/P: DC TESTING (L: + N: -) O/P: FULL / 70% LOAD (3) I/P: DC TESTING (L: - N: +) O/P: FULL / 70% LOAD Ta:25°C I/P: HIGH-LINE+15%=300V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	(1) 75V~264V/ FULL LOAD 75V~264V/ 70% LOAD (2) 95.26Vdc~370Vdc/FULL LOAD 96.42Vdc~370Vdc/70% LOAD (3) 95.26Vdc~370Vdc/FULL LOAD 96.42Vdc~370Vdc/70% LOAD TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:80 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST : OK
3	INPUT CURRENT (Typ.)	230V/ 3.2A 115V/ 6.4A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =2.76A/ 230VAC I =5.74A/ 115VAC
4	LEAKAGE CURRENT	Earth leakage current <500uA(rms) @ 264VAC touch current <70uA(rms) @ 264VAC	I/P : 264 VAC/60HZ O/P : Min LOAD Ta : 25°C	257.3 uA / 264 VAC@ For Earth 34.1uA / 264 VAC@For Touch
5	NO LOAD CONSUMPTION	<0.5W	I/P : 240VAC O/P : NO LOAD Ta : 25°C	0.3725W



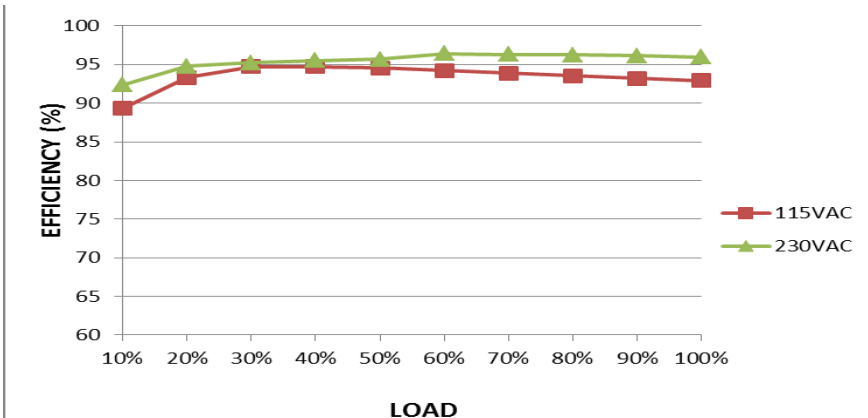
6	POWER FACTOR (Typ.)	0.94/ 230VAC 0.98/115VAC	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF=0.9935/230VAC PF=0.9975/115VAC
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P.F vs LOAD



7	EFFICIENCY(Typ.)	95%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	95.34%
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EFFICIENCY vs LOAD



8	INRUSH CURRENT(Typ.)	230V/80A 115V/40A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =66.1A/ 230VAC I =31.4A/ 115VAC T50=1080us/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	105%~ 150% PROTECTION TYPE : Hiccup after 3 sec, recovers automatically after fault condition is removed	I/P: 264VAC I/P: 230VAC I/P: 115VAC O/P:TESTING Ta:25°C	138.4%/ 264VAC 138.4%/ 230VAC 137.6%/ 115VAC PROTECTION TYPE : Hiccup after 3 sec, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	52.8V~62.4V Protection type: Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 80VAC O/P:MIN LOAD Ta:25°C	56.3V/ 264VAC 56.3V/ 80VAC 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 (Vin=115Vac); Shut down o/p voltage, re-power on to recover (Vin=230Vac or FAN LOCK)	I/P: 264VAC I/P: 80VAC O/P:FULL LOAD	O.T.P Active OK Protection type : Shut down o/p voltage, recovers automatically after temperature goes down (Vin=115Vac); Shut down o/p voltage, re-power on to recover (Vin=230Vac or FAN LOCK)
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE Protection type: Hiccup mode, recovers automatically after fault condition is removed	I/P: 264VAC I/P: 80VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : OK Hiccup mode, recovers automatically after fault condition is removed

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	EXTERNAL FAN SUPPLY	12V@0.5A for driving a fan ; tolerance -15% ~ +15% at main output 20% rated current (23CFM)	I/P: 230 VAC O/P: TESTING Ta:25°C	TEST : <u>-0.25 % ~ 0.17 %</u>
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°C	TEST : <u>OK</u>

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q2/ Q3 Rated: 26A/ 600V	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/	Q2: Q3: VDS: VDS: (1) 429V (1) 429V (2) 433V (2) 425V (3) 429V (3) 421V (4) 425V (4) 421V (5) 429V (5) 413V (6) 433V (6) 417V



			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°C	(7) 441V (8) 429V	(7) 425V (8) 421V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated: 52A/600V	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 (8) Peak Load Ta:25°C	VDS: (1) 437V (2) 425V (3) 433V (4) 429V (5) 429V (6) 449V (7) 453V (8) 449V	
3	P.F.C DIODE	D2 Rated: 6A/ 650V	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 (5) Peak Load Ta:25°C	(1) 408V (2) 396V (3) 416V (4) 416V (5) 416V	
4	Diode Peak Voltage	Q101/Q103 Rated: 100A/ 150V	AC ON/OFF I/P: High-Line +3V =267 V <u>Vo=Vmax</u> 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	<u>Q101:</u> <u>Vo=Vmax</u> VDS: (1) 122.1V (2) 124.4V (3) 122.1V (4) 125.0V (5) 124.0V (6) 124.5V (7) 119.7V (8) 117.6V (9) 121.5V (10) 125.0V <u>Vo=Vnormal</u> (1) 119.2V	<u>Q103:</u> <u>Vo=Vmax</u> VDS: (1) 124.5V (2) 123.7V (3) 123.7V (4) 124.7V (5) 123.7V (6) 124.5V (7) 118.1V (8) 118.6V (9) 129.2V (10) 126.9V <u>Vo=Vnormal</u> (1) 119.9V

			(9) burst Mode (10) Peak Load $V_o = V_{normal}$ O/P: (1) Full Load Ta:25°C	
5	Input Capacitor Voltage	C5 Rated: 330μ / 400V	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°C	(1) 393V (2)385 V (3)395 V (4)393 V
6	Control IC Voltage Test	PFC /PWM IC U1: Rated : 10.4V~28.7 V O/P IC U101 Rated : 4.75V~38V	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°C	U1 U101 (1) 18.9V (1) 10.85V (2) 18.9V (2) 10.69V (3) 18.9V (3) 10.69V (4) 18.9V (4) 11.33V (5) 18.9V (5) 8.60V

■ SAFETY& E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 4KVAC/min I/P-FG :2KVAC/min O/P-FG:1.5KVAC/min	I/P-O/P: 4.4 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.8 KVAC/min Ta:25°C	I/P-O/P: 1.679mA I/P-FG: 2.41mA O/P-FG:0.812mA 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°C	I/P-O/P:50GΩ I/P-FG:50GΩ O/P-FG:50GΩ NO DAMAGE

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°C	PASS
2	CONDUCTION	BS EN/EN55032(CISPR32) Class I: Class B , Class II: Class A BS EN/EN55014(CISPR32) Class I: Class B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab



		NO	Position	ROOM AMBIENT Ta= 28.3 °C	HIGH AMBIENT Ta= 50.7°C
		13	Q3	50.4°C	74.1°C
		14	Q4	49.7°C	73.3°C
		15	C5	44.4°C	66.7°C
		16	T1coil	70.2°C	93.9°C
		17	T1core	41.7°C	65.1°C
		18	TSW1	38.1°C	62.3°C
		19	Q102	46.5°C	71.2°C
		20	Q103	47.7°C	72.7°C
		21	C103	34.8°C	58.8°C
		22	C104	38.7°C	62.4°C
		23	C102	37.4°C	61.2°C
		24	C120	39.6°C	63.1°C
		25	L100	37.0°C	60.7°C
		26	C125	39.9°C	63.7°C
		27	D103	40.5°C	64.6°C
		28	C37	43.2°C	66.6°C
		29	U1	43.0°C	65.9°C
		30	Q8	29.3°C	52.0°C
		31	U103	35.9°C	58.6°C
		32	RG100	41.9°C	65.4°C
		33	U4	35.9°C	59.3°C
		34	R122	39.9°C	62.9°C
		35	D105	37.3°C	59.9°C
		36	R3	41.9°C	65.0°C
		37	D1	35.9°C	58.3°C
		38	Q108	34.7°C	58.1°C
		39	U101	34.5°C	57.4°C
		40	R101	40.2°C	65.3°C
		41	R105	39.4°C	63.6°C
		42	D20	31.8°C	55.7°C
		43	Q7	31.6°C	54.5°C
		44	C60	29.5°C	52.2°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)		I/P : 230 VAC O/P : 129.4%LOAD Ta : 25°C	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR		I/P : 264VAC/115VAC 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	±0.006%/°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
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 : 12min/sweep cycle (4) Acceleration : 3G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C102 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) 1550753.7HRS (2) 250515.1HRS (3) 360491.8HRS (4) 452657.3HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1963.2K hrs min. Telcordia SR-332 (Bellcore); 310.9K 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 : 30,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Yuwei	Liutt	Wangdz

2020.10.1 TAG-QA-009