Test Report: LOP-400-48

400W 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

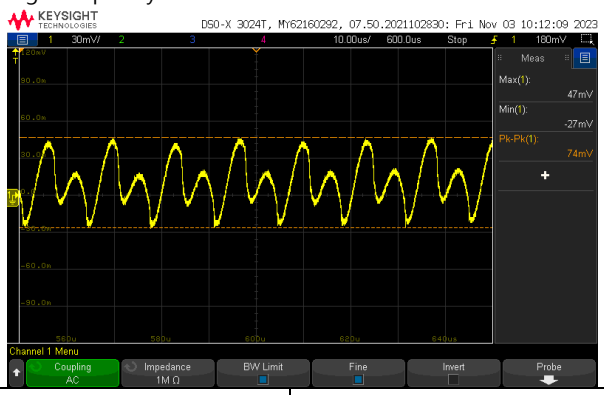
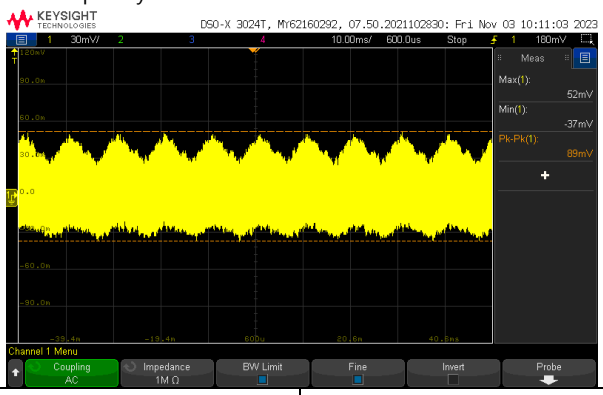
Safety Test
E.M.C. Test

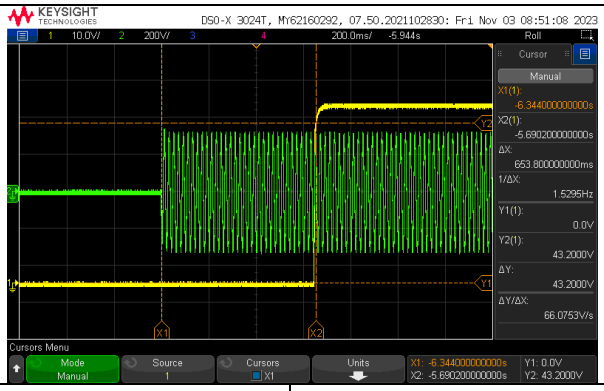
■ RELIABILITY TEST

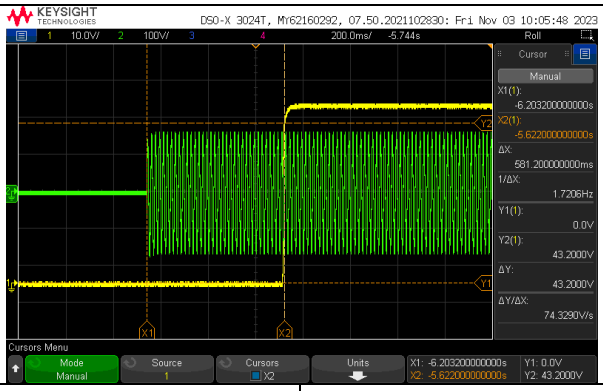
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

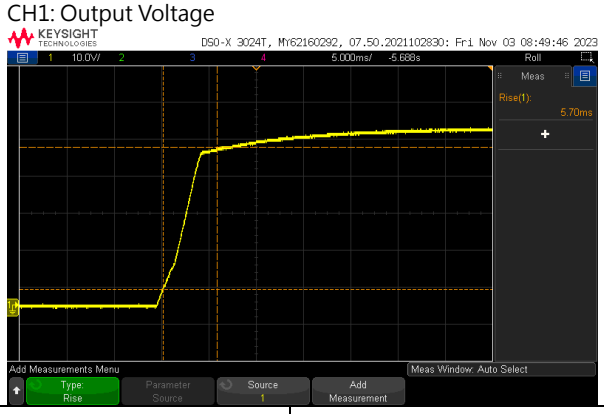
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 45.6V~50.4V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25℃	43.741V~51.75V/230VAC 43.739V~51.74V/115VAC
2	OUTPUT VOLTAGE TOLERANCE	V1: -1% ~ +1%	I/P: 80VAC~ 264VAC O/P:FULL~ MIN. LOAD Ta:25℃	V1: -0.0042% ~0.0792%
3	LINE REGULATION	V1: -0.5% ~ +0.5%	I/P: 80VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1: 0% ~0.0084%
4	LOAD REGULATION	V1: -1% ~ +1%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.0042% ~0.0792%
5	OVER/UNDERSHOOT TEST	<±5%	I/P: 230VAC O/P:FULL LOAD / NO LOAD Ta:25℃	2.1%
6	RIPPLE & NOISE (Max)	V1: 250mVp-p	I/P:230VAC O/P: FULL LOAD Ta:25℃	V1: 74mVp-p / high frequency 89mVp-p / low frequency
	high frequency : 		low frequency : 	
7	SET UP TIME(Max)	230VAC/1000ms 115VAC/1500ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	230VAC/ 653.8ms 115VAC/ 581.2ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1: Output Voltage CH2: AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1: Output Voltage CH2: AC Input Voltage	



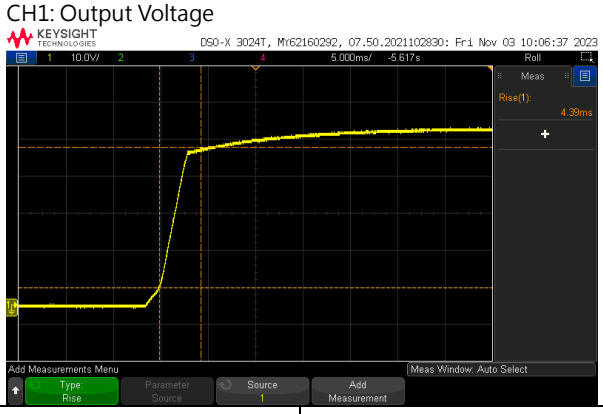


8	RISE TIME (Max)	230VAC/30ms 115VAC/30ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 5.70ms 115VAC/ 4.39ms

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

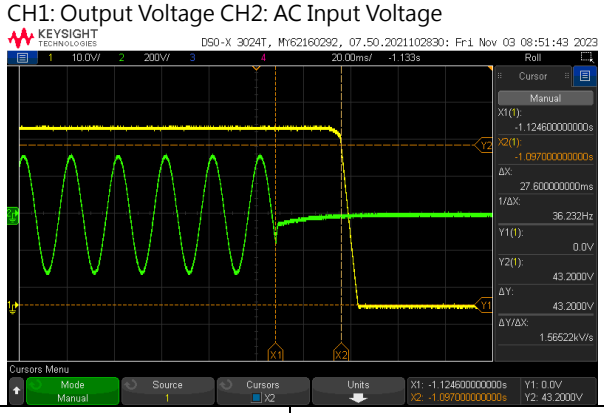


INPUT=115VAC/60HZ @ FULL LOAD
CH1: Output Voltage

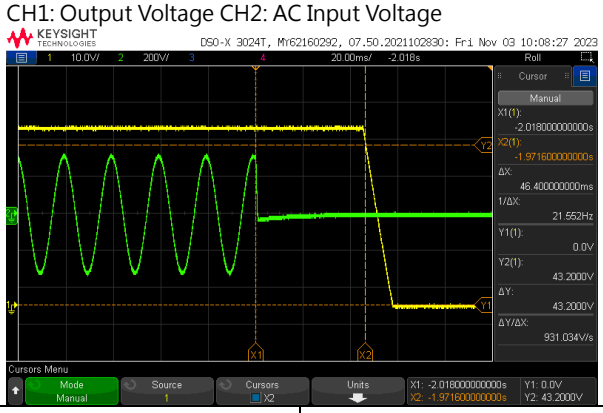


9	HOLD UP TIME (Typ.)	16ms /400W load 30ms /250W load	I/P： 230 VAC O/P：TESTING Ta：25℃	27.6ms /400W load 46.4ms /250W load

INPUT=230VAC/50HZ @ 400W load
CH1: Output Voltage CH2: AC Input Voltage



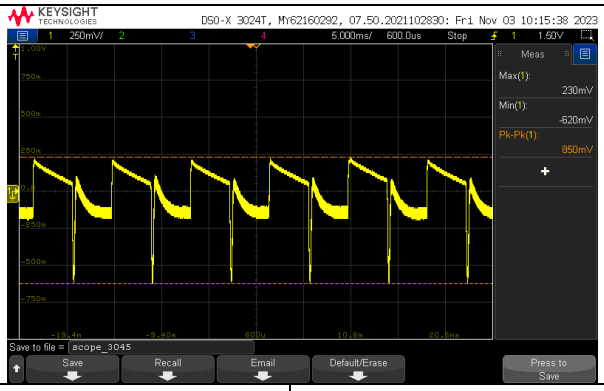
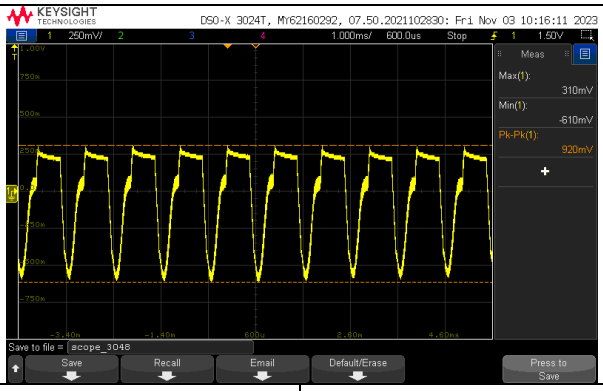
INPUT=230VAC/50HZ @ 250W load
CH1: Output Voltage CH2: AC Input Voltage



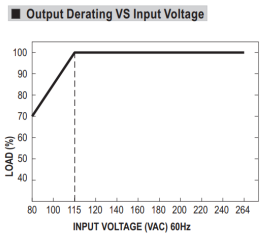
10	DYNAMIC LOAD	V1: 4800mVp-p	I/P: 230VAC O/P: (1) FULL/0% LOAD 50%DUTY / 120HZ (2) FULL/0% LOAD 50%DUTY / 1KHZ Ta:25℃	850mVp-p 920mVp-p

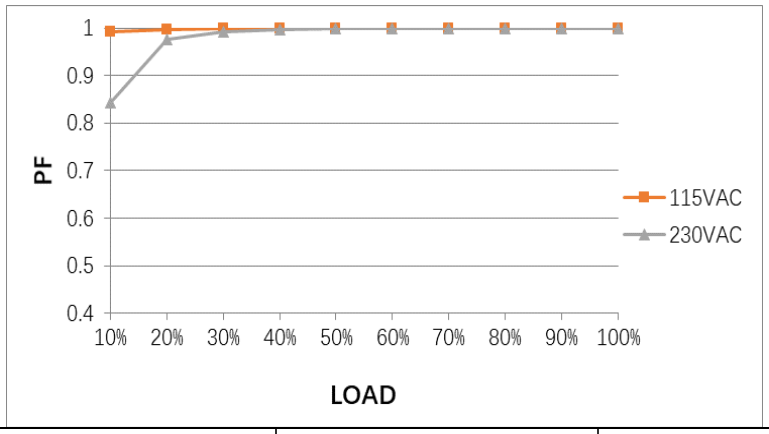
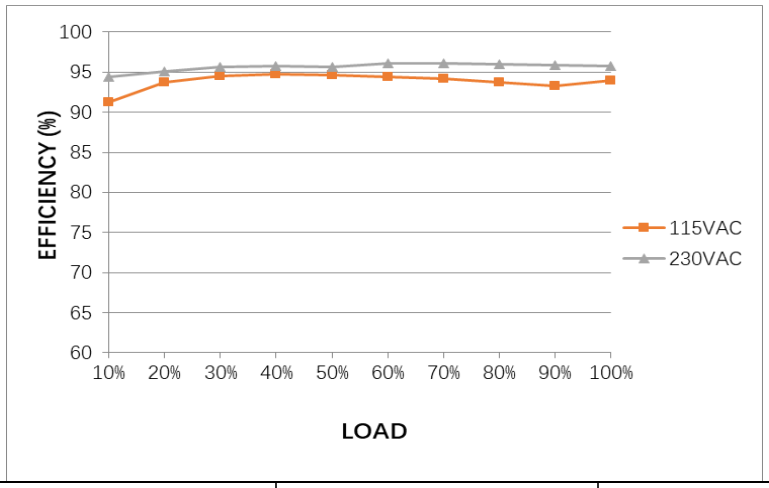
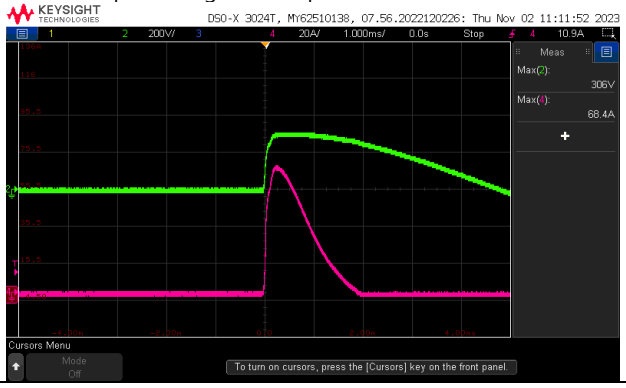
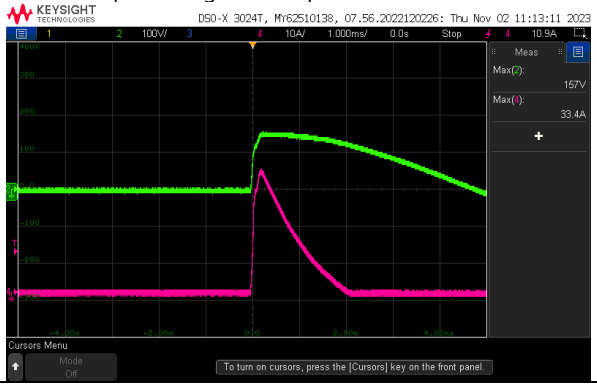
FULL /0% LOAD 50%DUTY / 120HZ

FULL /0% LOAD 50%DUTY / 1KHZ

				
11	TRANSIENT RECOVERY TIME	V1: 4800mVp-p < 500us	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	380mVp-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℃	(1) 74.3V~264V/ FULL LOAD 74.3V~264V/ 70% LOAD (2) 105.2Vdc~370Vdc/FULL LOAD 105.2Vdc~370Vdc/70% LOAD (3) 105.2Vdc~370Vdc/FULL LOAD 105.2Vdc~370Vdc/70% LOAD
			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)	TEST：OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:80 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST：OK
3	INPUT CURRENT (Typ.)	230V/ 2.1A 115V/ 4.2A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =1.8230A/ 230VAC I =3.8169A/ 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℃	Earth: 335uA / 264VAC Touch:37uA / 264VAC
5	NO LOAD CONSUMPTION	<0.5W	I/P：240VAC O/P：NO LOAD Ta：25℃	0.348W

6	POWER FACTOR (Typ.)	0.95/ 230VAC 0.98/115VAC	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	PF=0.9994/230VAC PF=0.9980/115VAC
	P.F vs LOAD 			
7	EFFICIENCY(Typ.)	95%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	95.32%
	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℃	I =68.4A/ 230VAC I =33.4A/ 115VAC T50= 900us/230V
	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% rated output power 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℃	125.72%/ 264VAC 125.76%/ 230VAC 125.67%/ 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℃	56.7V/ 264VAC 56.9V/ 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 or re-power on to recover	I/P: 264VAC I/P: 80VAC O/P:FULL LOAD	O.T.P. Active Protection type : Shut down o/p voltage, recovers automatically after temperature goes down or re-power on to recover
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℃	NO DAMAGE PROTECTION TYPE : 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℃	TEST : -0.2895% ~ 0.075%
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

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: 18A/ 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℃	Q2: VDS: (1) 466V (2) 478V (3) 466V (4) 466V (5) 466V (6) 462V (7) 494V (8) 466V Q3: VDS: (1) 458V (2) 478V (3) 454V (4) 454V (5) 462V (6) 458V (7) 490V (8) 462V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 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/ 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) 482V (2) 478V (3) 486V (4) 482V (5) 486V (6) 482V (7) 506V (8) 502V
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℃	(1) 434V (2) 426V (3) 422V (4) 418V (5) 434V
4	Diode Peak Voltage	Q101/Q103 Rated:	AC ON/OFF I/P: High-Line +3V =267 V	Q101: Vo=Vmax Q103: Vo=Vmax

		19A/ 200V	O/P: (1)Full Load (2)Output Short Vo=Vmax (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 (10) Peak Load Vo=Vnormal O/P: (1) Full Load Ta:25℃	VDS: (1) 149V (2) 148V (3) 150V (4) 149V (5) 149V (6) 151V (7) 153V (8) 131V (9) 137V (10) 154V Vo=Vnormal (1) 144V	VDS: (1) 168V (2) 167V (3) 168V (4) 167V (5) 167V (6) 167V (7) 177V (8) 141V (9) 148V (10) 174V Vo=Vnormal (1) 161V
5	Input Capacitor Voltage	C5 Rated: 270μ / 420V	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) 402V (2) 400V (3) 410V (4) 396V	
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℃	U1 (1) 19.1V (2) 19.1V (3) 19.1V (4) 19.1V (5) 19.1V	U101 (1) 11.8V (2) 11.5V (3) 11.8V (4) 11.9V (5) 10.9V

■ 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℃	I/P-O/P: 2.45mA I/P-FG: 3.17mA O/P-FG: 1.506mA 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: 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℃	PASS
2	CONDUCTION	BS EN/EN55032(CISPR32) BS EN/EN55011(CISPR11) 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℃	PASS Test by certified Lab
3	RADIATION	BS EN/EN55032(CISPR32) BS EN/EN55011(CISPR11) Class Ⅰ: Class B , Class Ⅱ: Class A BS EN/EN55014(CISPR32) Class Ⅰ: 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 ■ MEDICAL AIR：15KV / Contact：8KV	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 ■ 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：LOP-400-48 1. ROOM AMBIENT BURN-IN： 2HRS I/P： 230VAC O/P： FULL LOAD Ta= 26.0 ℃ 2. HIGH AMBIENT BURN-IN： 2HRS I/P： 230VAC O/P： FULL LOAD Ta= 50.0 ℃		

NO	Position	ROOM AMBIENT Ta= 26.0℃	HIGH AMBIENT Ta= 50.0℃
1	ZNR1	27.7℃	51.7℃
2	C1	27.4℃	51.3℃
3	LF2	31.9℃	55.9℃
4	LF1	27.6℃	51.9℃
5	C2	28.0℃	52.0℃
6	RTH1	32.3℃	56.3℃
7	BD1	45.8℃	69.1℃
8	RY1	43.1℃	66.9℃
9	C8	36.2℃	59.3℃
10	L1	42.5℃	66.4℃
11	Q1	44.5℃	70.7℃
12	D2	48.9℃	73.9℃
13	Q3	48.3℃	74.2℃
14	Q2	48.4℃	73.5℃
15	C54	39.8℃	63.6℃
16	C60	26.9℃	51.2℃
17	T1 coil	52.4℃	77.4℃
18	T1 core	37.3℃	62.5℃
19	C5	35.7℃	59.2℃
20	RTH3	39.1℃	61.6℃
21	U1	41.2℃	63.8℃
22	D103	35.0℃	58.7℃
23	C125	35.9℃	58.7℃
24	Q102	35.0℃	60.0℃
25	Q103	36.3℃	61.5℃
26	C103	31.4℃	55.8℃
27	C104	33.0℃	56.9℃
28	L100	33.3℃	57.0℃
29	U101	32.5℃	57.6℃
30	RG100	47.0℃	67.2℃
31	R100	31.7℃	55.8℃
32	R122	42.1℃	61.0℃
33	D105	41.8℃	61.2℃
34	U4	35.0℃	55.2℃
35	D1	33.4℃	57.2℃
36	R3	39.2℃	62.3℃
37	D20	29.5℃	53.4℃
38	C112	31.6℃	54.9℃
39	R105	33.9℃	58.7℃

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 139.16% LOAD Ta : 25℃	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC 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= 50 ℃ HUMIDITY= 95 %R.H	TEST：OK
5	TEMPERATURE COEFFICIENT	± 0.03 %/℃(0~50℃)	I/P： 230 VAC O/P：FULL LOAD	± 0.008 %/℃(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, 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℃	
9	CAPACITOR LIFE CYCLE	SUPPOSE C104 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) 2112136.4 HRS (2) 375973.5 HRS (3) 468129.5 HRS (4) 540002.5 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1696.4K hrs min. Telcordia SR-332 (Bellcore) ; 231.2K hrs min. MIL-HDBK-217F (25℃)		
11	Ongoing Reliability Test	I/P：230VAC O/P：FULL LOAD TA=50℃ Demonstration Mean Time Between Failure : 30,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Yuwei	Liutt	Wangdz

2020.10.1 TAG-QA-009