



Test Report: LOP-400-24

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

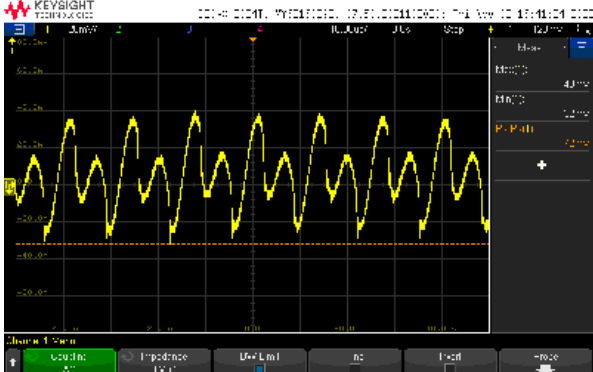
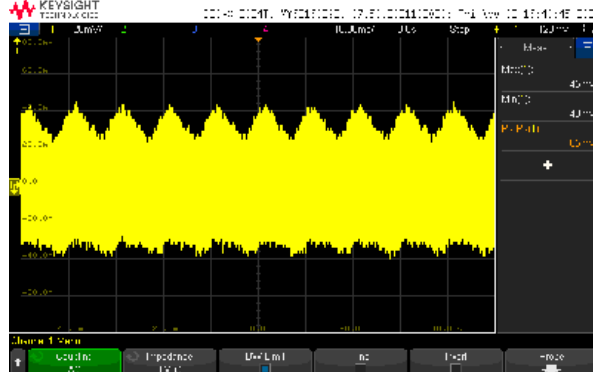
E.M.C. Test

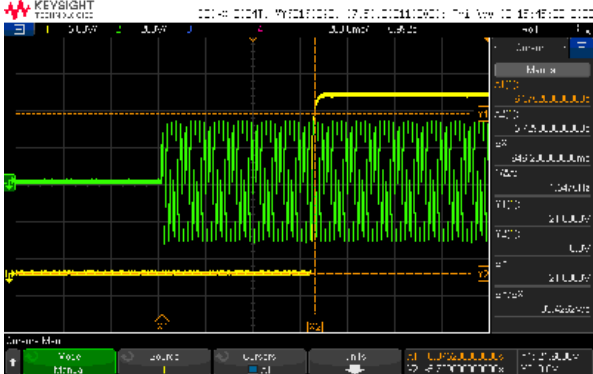
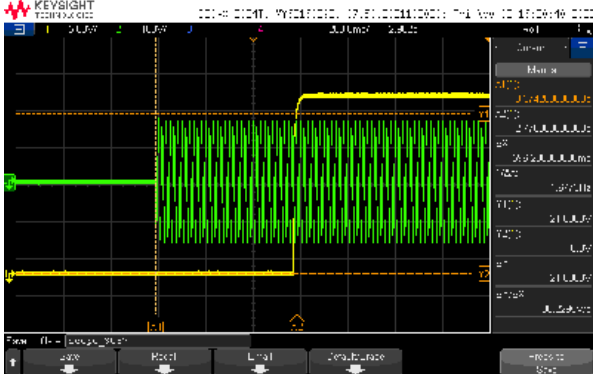
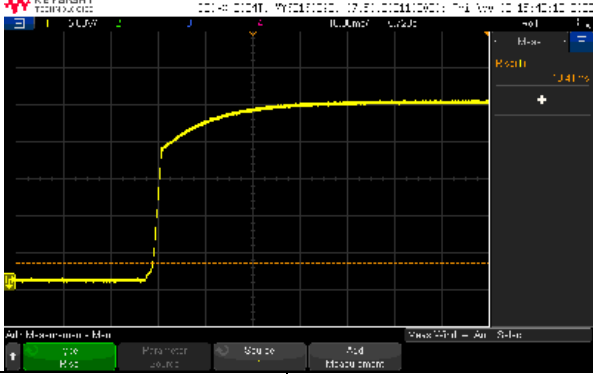
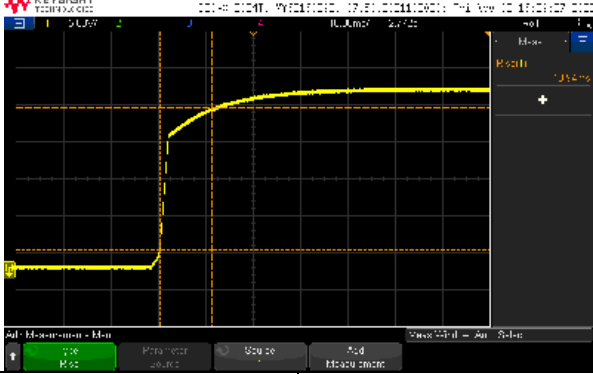
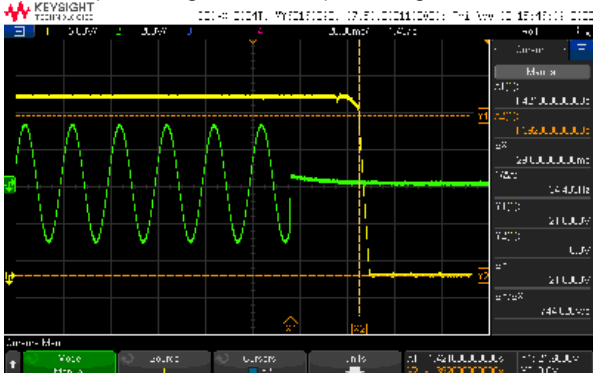
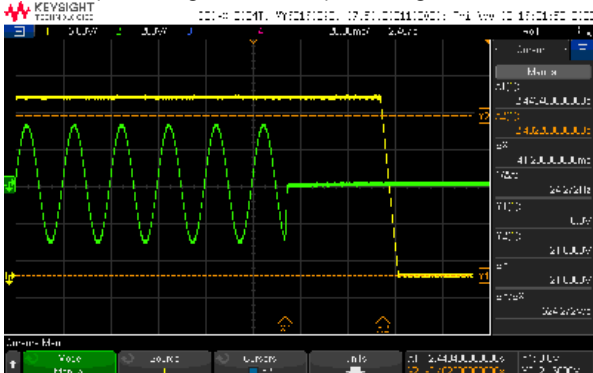
■ RELIABILITY TEST

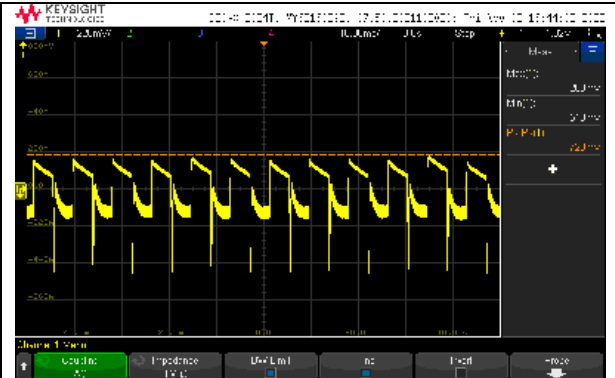
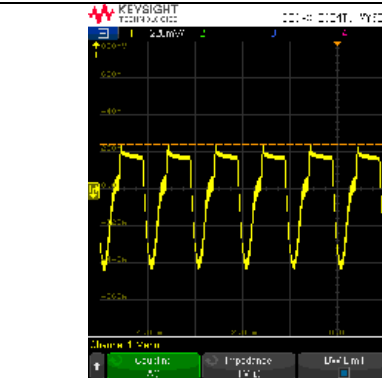
ENVIRONMENT TEST

DESIGN VERIFY TEST

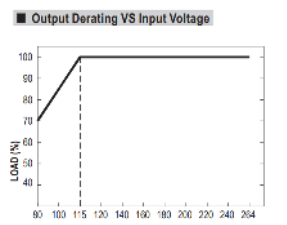
OUTPUT FUNCTION TEST

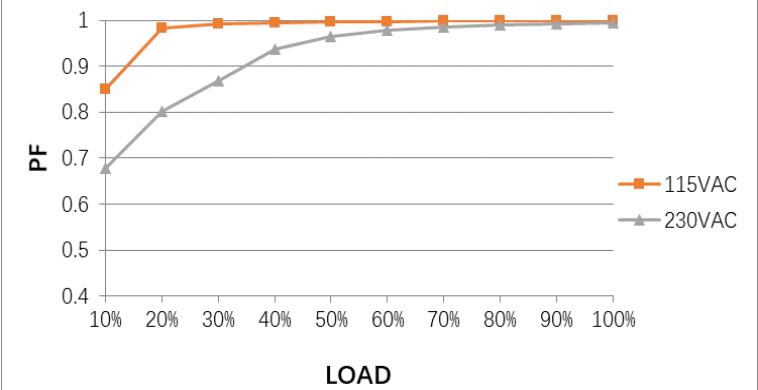
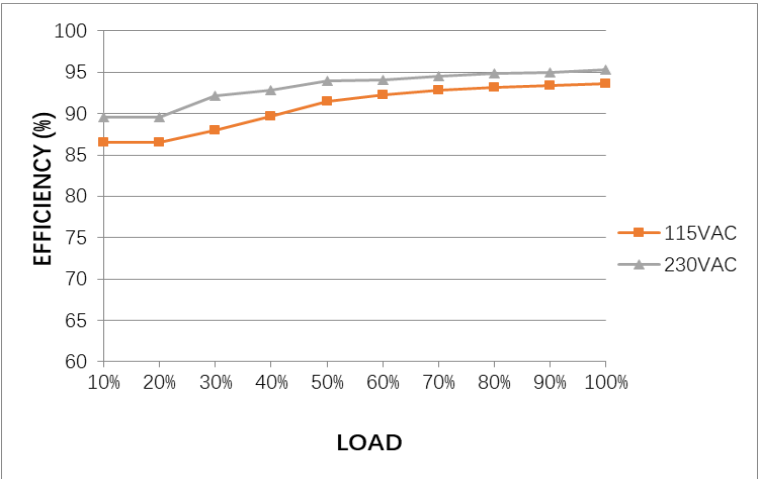
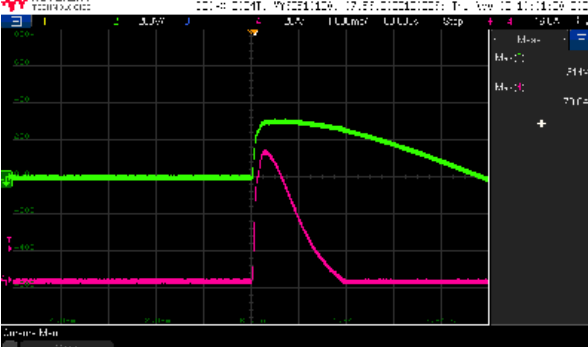
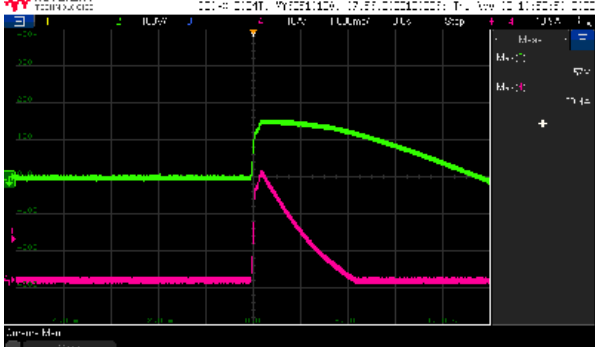
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 22.8V~25.2V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	22.081V~26.047V/230VAC 22.081V~26.047V/115VAC
2	OUTPUT VOLTAGE TOLERANCE	V1: -2% ~ +2%	I/P: 80VAC~ 264VAC O/P:FULL~ MIN. LOAD Ta:25°C	V1: -0.025% ~0.067%
3	LINE REGULATION	V1: -0.5% ~ +0.5%	I/P: 80VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0% ~0.017%
4	LOAD REGULATION	V1: -1% ~ +1%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.025% ~0.067%
5	OVER/UNDERSHOOT TEST	<±5%	I/P: 230VAC O/P:FULL LOAD / NO LOAD Ta:25°C	2.1%
6	RIPPLE & NOISE (Max)	V1: 200mVp-p	I/P:230VAC O/P: FULL LOAD Ta:25°C	V1: 72mVp-p / high frequency 85mVp-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°C	230VAC/ 646.2ms 115VAC/596.2ms
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°C	230VAC/ 10.41ms 115VAC/ 10.94ms
9	INPUT=230VAC/50HZ @ FULL LOAD CH1: Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1: Output Voltage 	
	HOLD UP TIME (Typ.)	16ms /400W load 30ms /250W load	I/P : 230 VAC O/P : TESTING Ta : 25°C	29.0ms /400W load 41.2ms /250W load
10	INPUT=230VAC/50HZ @ 400W load CH1: Output Voltage CH2: AC Input Voltage 		INPUT=230VAC/50HZ @ 250W load CH1: Output Voltage CH2: AC Input Voltage 	
	DYNAMIC LOAD	V1: 2400mVp-p	I/P: 230VAC O/P: (1) FULL/0% LOAD 50%DUTY / 120HZ (2) FULL/0% LOAD 50%DUTY / 1KHZ Ta:25°C	720mVp-p 760mVp-p
	FULL /0% LOAD 50%DUTY / 120HZ		FULL /0% LOAD 50%DUTY / 1KHZ	

				
11	TRANSIENT RECOVERY TIME	V1: 2400mVp-p < 500us	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	322mVp-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) 73.9V~264V/ FULL LOAD 73.8V~264V/ 70% LOAD (2) 107.2Vdc~370Vdc/FULL LOAD 107.2Vdc~370Vdc/70% LOAD (3) 107.2Vdc~370Vdc/FULL LOAD 107.2Vdc~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/ 2.1A 115V/ 4.2A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =1.8292A/ 230VAC I =3.7815A/ 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	Earth: 298uA / 264VAC Touch:37uA / 264VAC
5	NO LOAD CONSUMPTION	<0.5W	I/P : 240VAC O/P : NO LOAD Ta : 25°C	0.296W

6	POWER FACTOR (Typ.)	0.95/ 230VAC 0.98/115VAC	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF=0.9994/230VAC PF=0.9982/115VAC
	P.F vs LOAD 			
7	EFFICIENCY(Typ.)	94.5%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	95.46%
	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 =70.0A/ 230VAC I =29.4A/ 115VAC T50= 880us/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°C	122.40%/ 264VAC 122.32%/ 230VAC 122.20%/ 115VAC PROTECTION TYPE : Hiccup after 3 sec, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	26.4V~31.2V 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	28.50V/ 264VAC 28.50V/ 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°C	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°C	TEST : <u>-0.484% ~ 0.284%</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 : 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°C	Q2: VDS: (1) 465V (2) 481V (3) 469V (4) 469V (5) 465V (6) 465V (7) 489V (8) 465V Q3: VDS: (1) 469V (2) 485V (3) 469V (4) 469V (5) 473V (6) 465V (7) 501V (8) 477V
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°C	VDS: (1) 513V (2) 461V (3) 477V (4) 489V (5) 485V (6) 517V (7) 513V (8) 501V
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) 432V (2) 420V (3) 420V (4) 416V (5) 420V
4	Diode Peak Voltage	Q101/Q103 Rated:	AC ON/OFF I/P: High-Line +3V =267 V	Q101: Vo=Vmax Q103: Vo=Vmax

		120A/ 80V	Vo=Vmax 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 (10) Peak Load Vo=Vmax O/P: (1) Full Load Ta:25°C	VDS: (1) 70.9V (2) 70.9V (3) 70.9V (4) 70.9V (5) 70.4V (6) 70.8V (7) 70.3V (8) 65.6V (9) 65.6V (10) 70.8V Vo=Vmax (1) 69.9V	VDS: (1) 71.3V (2) 71.3V (3) 71.3V (4) 71.9V (5) 71.9V (6) 71.3V (7) 71.2V (8) 61.7V (9) 65.6V (10) 71.7V Vo=Vmax (1) 71.4V
	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°C	(1) 405V (2) 404V (3) 408V (4) 408V	
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 (1) 19.2V (2) 19.2V (3) 19.2V (4) 19.2V (5) 19.1V	U101 (1) 11.60V (2) 11.20V (3) 11.30V (4) 11.80V (5) 10.6V

■ 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: 2.73mA I/P-FG: 3.22mA O/P-FG: 1.514mA 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) 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°C	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°C	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°C	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°C	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°C	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-400-24 1. ROOM AMBIENT BURN-IN : 2HRS I/P : 230VAC O/P : FULL LOAD Ta=26.6 °C 2. HIGH AMBIENT BURN-IN : 2HRS I/P : 230VAC O/P : FULL LOAD Ta= 51.7 °C		

			NO	Position	ROOM AMBIENT Ta= 26.6°C	HIGH AMBIENT Ta=51.7°C
			1	ZNR1	29.0°C	54.5°C
			2	LF2	37.1°C	62.7°C
			3	BD1	42.6°C	67.6°C
			4	LF1	30.6°C	56.3°C
			5	C2	31.8°C	57.5°C
			6	RTH1	32.8°C	59.1°C
			7	RY1	37.3°C	64.1°C
			8	RTH3	40.7°C	67.8°C
			9	C8	35.3°C	60.9°C
			10	L1	41.6°C	67.3°C
			11	C60	28.1°C	53.8°C
			12	T1 coil	36.6°C	62.9°C
			13	T1 core	36.0°C	62.0°C
			14	C5	35.1°C	60.5°C
			15	Q1	52.1°C	78.9°C
			16	Q3	50.1°C	77.0°C
			17	Q2	51.5°C	78.5°C
			18	U1	40.5°C	65.9°C
			19	D2	50.3°C	77.1°C
			20	C55	41.3°C	68.5°C
			21	D103	40.7°C	68.1°C
			22	C120	39.1°C	65.4°C
			23	C104	37.3°C	63.6°C
			24	Q101	45.7°C	74.0°C
			25	Q103	45.7°C	73.8°C
			26	C103	33.4°C	59.6°C
			27	C102	33.7°C	59.8°C
			28	L100	35.1°C	61.2°C
			29	R122	40.0°C	65.4°C
			30	D1	34.0°C	59.6°C
			31	U103	33.7°C	59.6°C
			32	U101	33.2°C	59.4°C
			33	RG100	40.5°C	66.0°C
			34	U3	34.6°C	60.3°C
			35	D105	37.9°C	63.1°C
			36	D20	28.7°C	54.6°C
			37	R100	37.8°C	64.8°C
			38	R3	39.7°C	65.7°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 131.85% LOAD Ta : 25°C		TEST : OK	
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC 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	± 0.009 %/°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 C104 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) 982687.1 HRS (2) 159851.5 HRS (3) 284107.5 HRS (4) 402726.2 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°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