Test Report: MPM-45-24

45W AC-DC High Reliable PCB-Mount Green Medical Power Moudle

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Component Stress Test

■ SAFETY & E.M.C. TEST

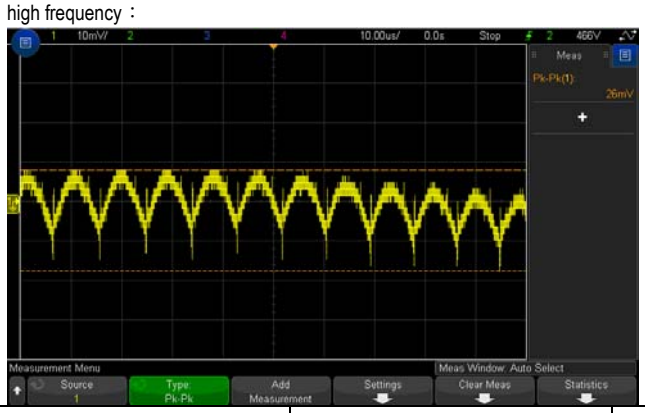
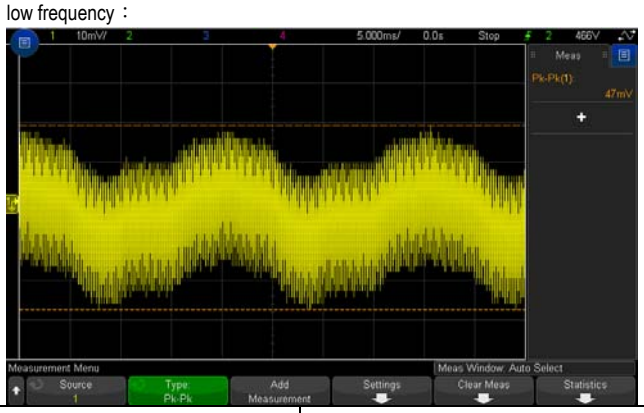
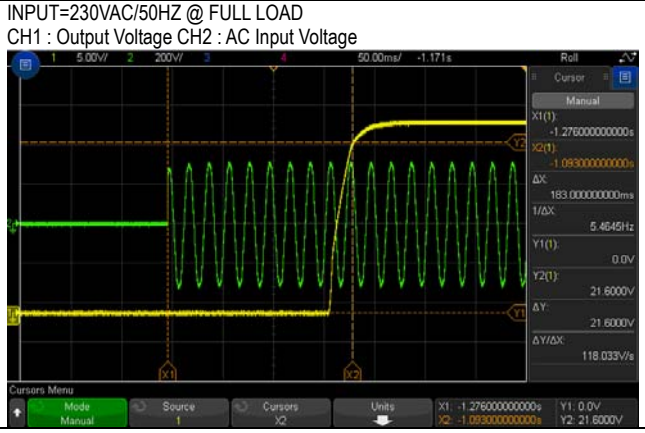
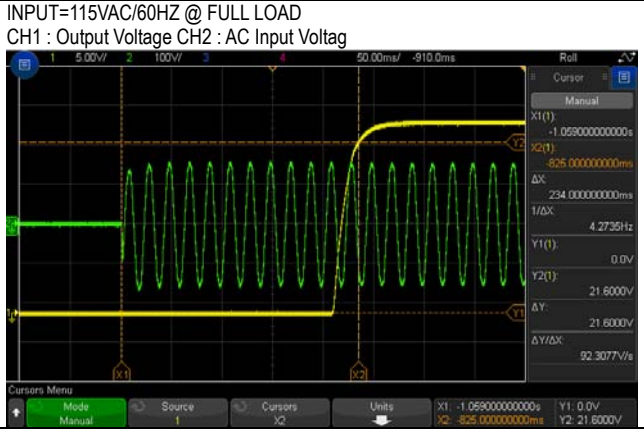
Safety Test
E.M.C. Test

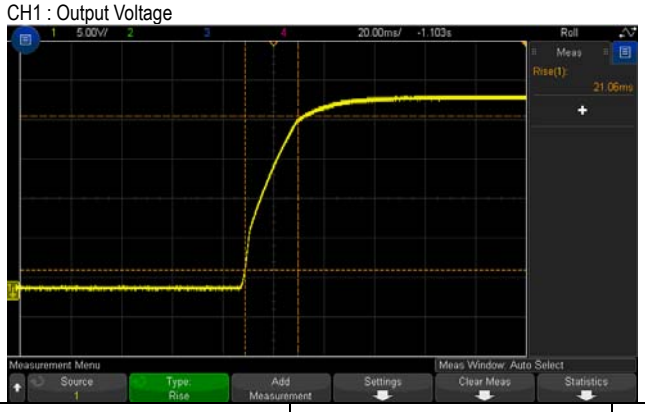
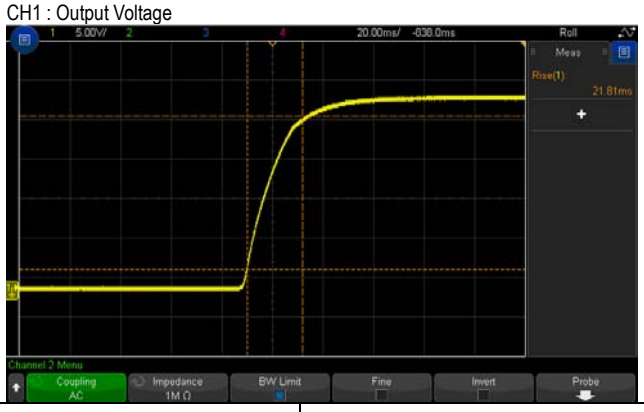
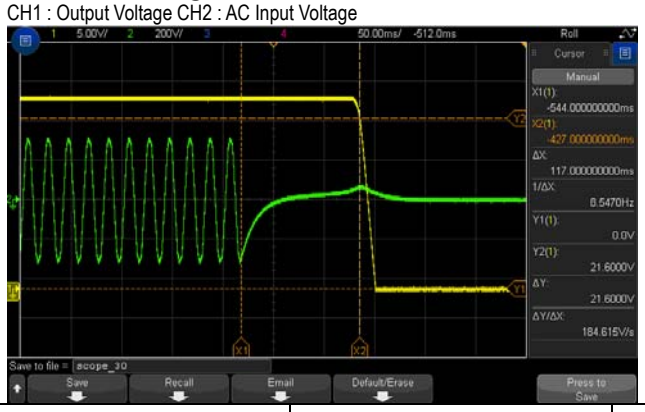
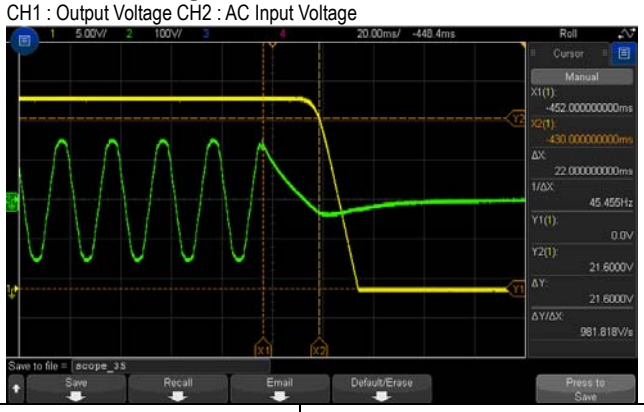
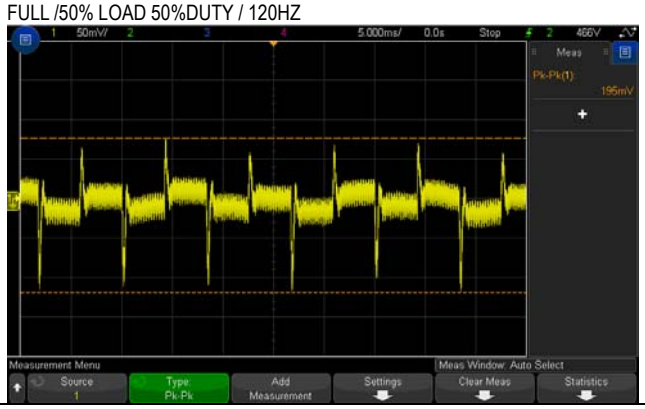
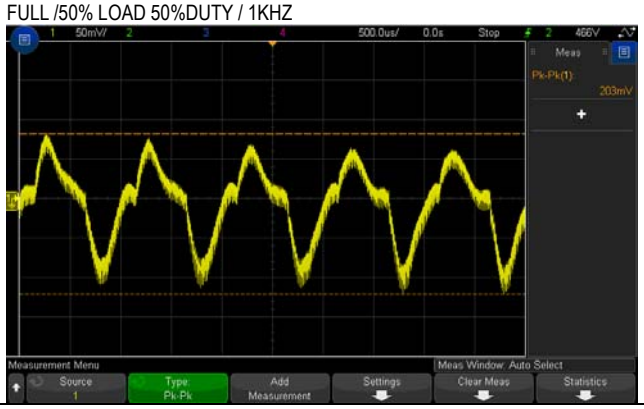
■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

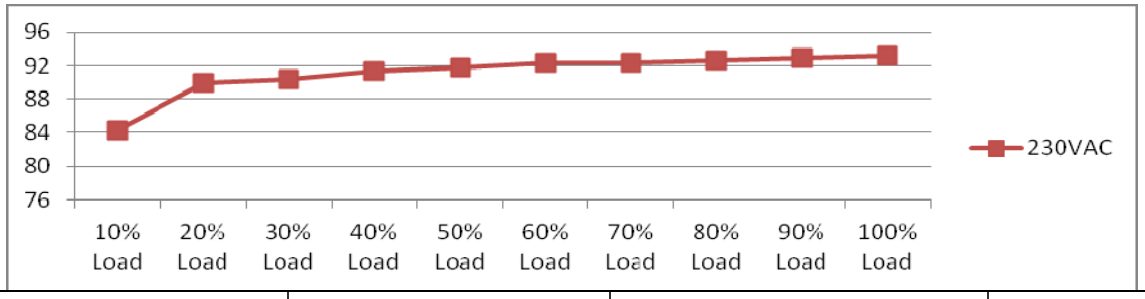
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -2%~ +2 %	I/P: 80VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.08%~0.13%
2	LINE REGULATION (Max)	V1: -0.5%~ +0.5 %	I/P: 80VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1:-0.03%~0.13%
3	LOAD REGULATION(Max)	V1: -0.5%~ +0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1:-0.08%~0.10%
4	OVER/UNDERSHOOT TEST	< ± 5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	0.4%
5	PEAK LOAD TEST	≥10 Sec.	I/P: 230VAC O/P:PEAK LOAD Ta:25℃	OK
6	RIPPLE & NOISE(Max)	V1: 200mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 47mVp-p
	high frequency： 		low frequency： 	
7	SET UP TIME(Max)	230VAC/1000ms 115VAC/1000ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 183ms 115VAC/ 234ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltag 	

8	RISE TIME (Max)	230VAC/30ms 115VAC/30ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 21.06ms 115VAC/ 21.81ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
9	HOLD UP TIME (Typ.)	230VAC/50ms 115VAC/12ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 117ms 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: 2400 mVp-p	I/P: 230VAC O/P: (1)FULL /MIN LOAD 50%DUTY / 120HZ (2)FULL /MIN LOAD 50%DUTY / 1KHZ Ta:25℃	 195mVp-p 203mVp-p
	FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 	

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC~264VAC 113VDC~370VDC	I/P:TESTING O/P:FULL LOAD Ta:25℃	68V~264V 96VDC~370VDC
			I/P: LOW-LINE-3V=77 V HIGH-LINE+10V=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:80 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 0.6 A 115V/ 1.2 A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =0.39A/ 230VAC I =0.62A/ 115VAC
4	LEAKAGE CURRENT	< 100uA / 264VAC	I/P： 264VAC O/P：Min LOAD Ta：25℃	Touch current： 80.7 uA
5	NO LOAD CONSUMPTION	<0.1 W	I/P：115VAC/230VAC O/P：NO LOAD Ta：25℃	0.051W/115VAC 0.077W/230VAC
7	EFFICIENCY(Typ.)	92.5%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	93.2%

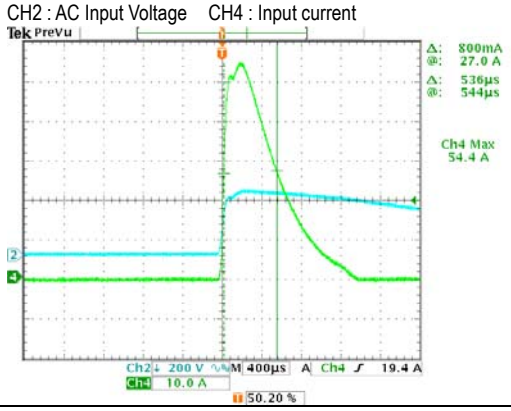
EFFICIENCY vs LOAD



8	INRUSH CURRENT(Typ.)	230V/60A 115V/30A COLD START	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =54.4A/ 230VAC I =22.8A/ 115VAC

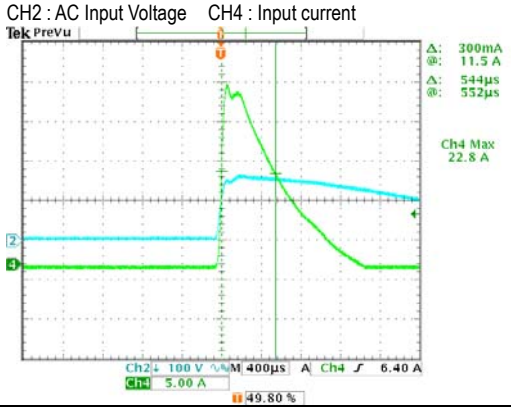
INPUT=230VAC/50HZ @ FULL LOAD

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	115%~ 135 %	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P:TESTING Ta:25℃	124.4% 264VAC 130.8%/ 230VAC 122.3%100VAC PROTECTION TYPE： Hiccup mode ,recovers automatically after fault condition is removerd。
2	OVER VOLTAGE PROTECTION	25.2V~32.4V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P:MIN LOAD Ta:25℃	27.4VAC 27.4VAC 27.4VAC 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: 80VAC 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: 80VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE PROTECTION TYPE： Hiccup mode ,recovers automatically after fault condition is removerd。

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated: 7A/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. Ta:25℃	VDS: (1) 535V (2) 434V (3) 535V (4) 535V (5) 535V (6) 535V (7) 535V
4	Diode Peak Voltage	Q100 Rated: 27.4A/150V	AC ON/OFF I/P:High-Line +3V =267 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 Ta:25℃	Q100: VDS: (1) 122.7V (2) 129.1V (3) 122.7V (4) 128.3V (5) 122.7V (6) 124.3V (7) 132.0V (8) 124.3V

5	Input Capacitor Voltage	C5 Rated: 120μ/ 400 V	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) 368V (2) 368V (3) 368V (4) 364V
6	Control IC Voltage Test	PWM IC U2 Rated: -0.3 V~ 30 V O/P IC U100 Rated: -0.3V~ 38 V	AC ON/OFF I/P:High-Line +3V =267V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD (LOW LINE) Ta:25℃	U2 U100 (1)17.3V (1)15.1V (2)17.3V (2)15.1V (3)17.3V (3)13.5V (4)14.7V (4)18.1V (5)17.3V (5)15.3V
9	Clamp Diode Peak Voltage	D1 Rated： 650 V/ 1 A	AC ON/OFF I/P：High-Line +3V = 267V O/P： (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta：25℃	(1) 465V (2) 461V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 4KVAC/min	I/P-O/P:4.4 KVAC/min Ta:25℃	I/P-O/P:2.249mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ	I/P-O/P: 600 VDC Ta:25℃	I/P-O/P: 9999MΩ NO DAMAGE

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℃	PASS
2	CONDUCTION	EN55011 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL/50% LOAD Ta：25℃	PASS Test by certified Lab
3	RADIATION	EN55011 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 MEDICAL AIR：15KV / Contact：8KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	☑CRITERIA A □CRITERIA B
5	E.F.T	EN61000-4-4 MEDICAL INPUT： 2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	☑CRITERIA A □CRITERIA B
6	SURGE	IEC61000-4-5 MEDICAL L-N ：1KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	☑CRITERIA A □CRITERIA B
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：MPM-45-48 1. ROOM AMBIENT BURN-IN：2 HRS I/P： 230VAC O/P： FULL LOAD Ta= 28 ℃ 2. HIGH AMBIENT BURN-IN： 2 HRS I/P： 230VAC O/P： FULL LOAD Ta= 60.6℃		
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P： 230 VAC O/P： 134 % 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= -35 ℃	TEST：OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60 ℃ / 95 %R.H NO DAMAGE	I/P： 272 VAC O/P：FULL LOAD Ta= 60 ℃ HUMIDITY= 95 %R.H	TEST：OK
5	TEMPERATURE COEFFICIENT	± 0.03 %/℃(0~50℃)	I/P： 230 VAC O/P：FULL LOAD	± 0.0116 %/℃(0~50℃)

NO	Position	ROOM AMBIENT Ta= 28 ℃	HIGH AMBIENT Ta=60.6 ℃
1	RTH1	51.2℃	76.8℃
2	LF1	50℃	77.8℃
3	LF2	51.4℃	79.8℃
4	C1	49.9℃	78℃
5	BD1	53℃	81.5℃
6	C5	51.9℃	80.7℃
7	Q1	55.8℃	84.8℃
8	C11	55.1℃	80.4℃
9	RTH2	52.4℃	81.6℃
10	T1 coil	54.9℃	83.9℃
11	T1 core	54.1℃	83.1℃
12	Q100	55.6℃	84.7℃
13	C105	52.7℃	82℃
14	C106	47.8℃	77.3℃
15	C107	47.6℃	73.8℃
16	L100	46℃	75.8℃
17	R22	54℃	82.6℃
18	D1	52.8℃	82.8℃
19	U2	53.8℃	83℃
20	U3	49.5℃	79.8℃
21	R5	56.2℃	85.6℃
22	C8	54.5℃	83.9℃
23	R21	53.6℃	82.8℃
24	D2	54.4℃	84.5℃
25	R11	53.2℃	82.7℃
26	Q2	51.3℃	81℃
27	PCB	51.1℃	80.7℃

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	-30~60℃	1. Thermal shock Temperature： -35℃~ +65℃ 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：10min/sweep cycle (4) Acceleration：3G (5) Test Time：180min in each axis (X.Y.Z) (6) Ta：25℃	
9	CAPACITOR LIFE CYCLE	SUPPOSE C105 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= 60 ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 60 ℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 60 ℃ LIFE TIME		(1) 463228 HRS (2) 51508 HRS (3) 68503 HRS (4) 94082 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 563.44K hrs min. MIL-HDBK-217F (25℃); 1530.14 K hrs min.Telcordia TR/SR-332（Bellcore）(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	LIUTT		Wangdz

2018.4.30 GP-A50-F010