Test Report: MPM-65-24

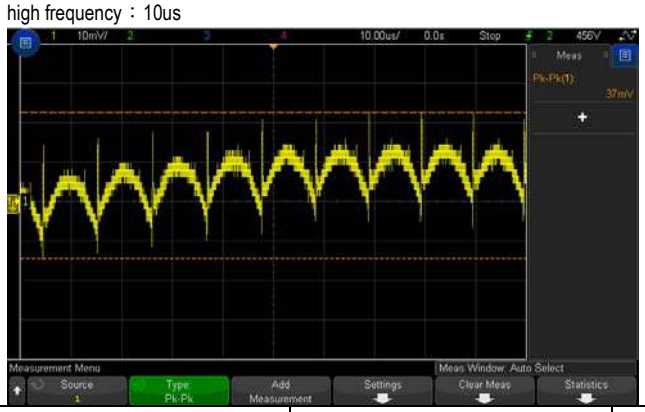
65W AC-DC High Reliable PCB-Mount Green Medical Power Moudle

■ DESIGN VERIFY TEST

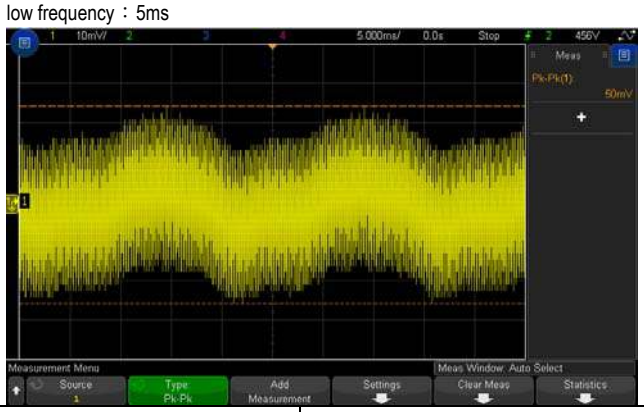
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -2.0%~ +2.0 %	I/P: 80VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.05%~0.09%
2	LINE REGULATION (Max)	V1: -0.5%~ +0.5 %	I/P: 80VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1: -0.04%~0.09%
3	LOAD REGULATION(Max)	V1:-0.5%~ +0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.05%~0.09%
4	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	1.3%
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: 50mVp-p

high frequency：10us

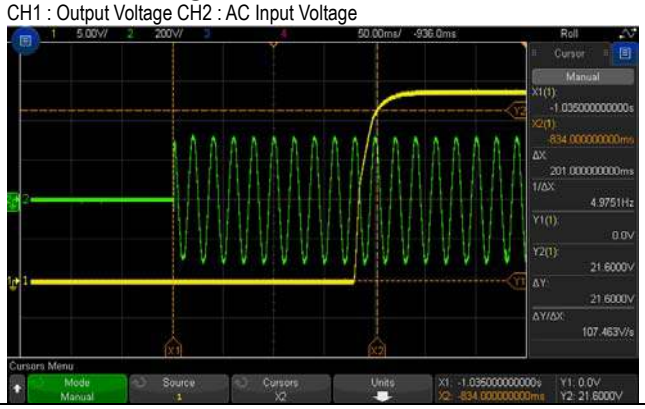


low frequency：5ms

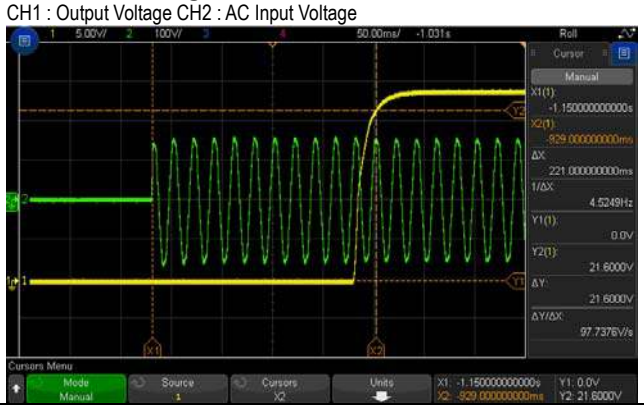


7	SET UP TIME(Max)	230VAC/1000ms 115VAC/1000ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/201 ms 115VAC/221 ms

INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

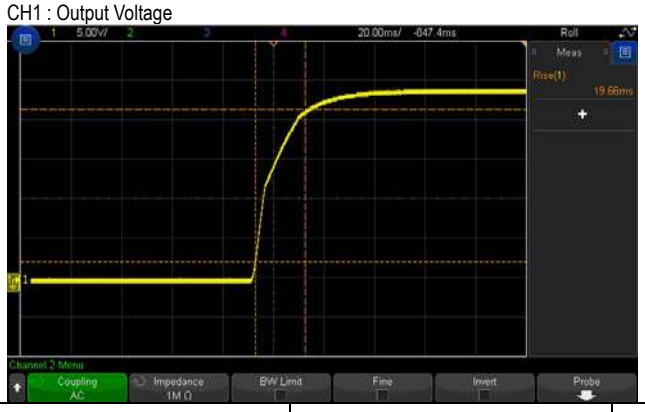


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

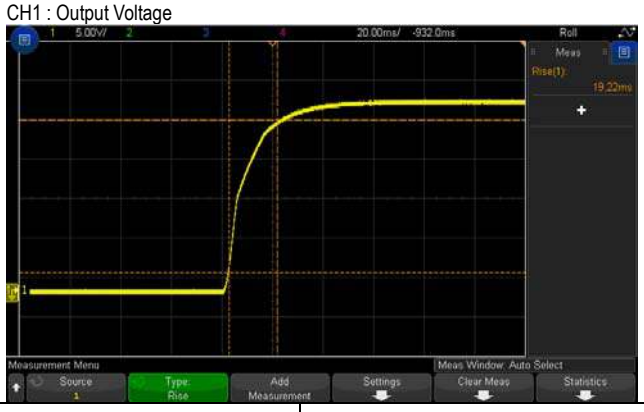


8	RISE TIME (Max)	230VAC/30ms 115VAC/30ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 19.66 ms 115VAC/ 19.22 ms

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

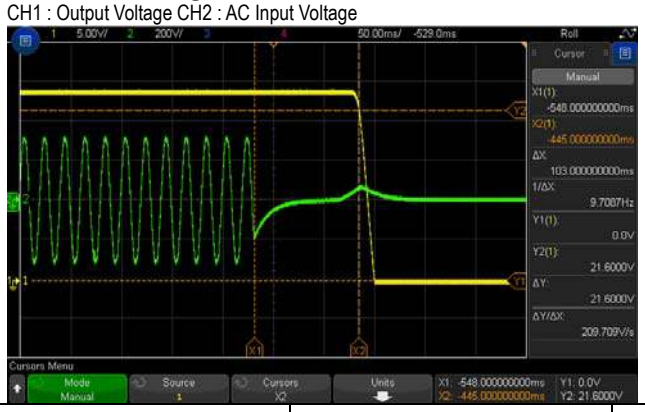


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage

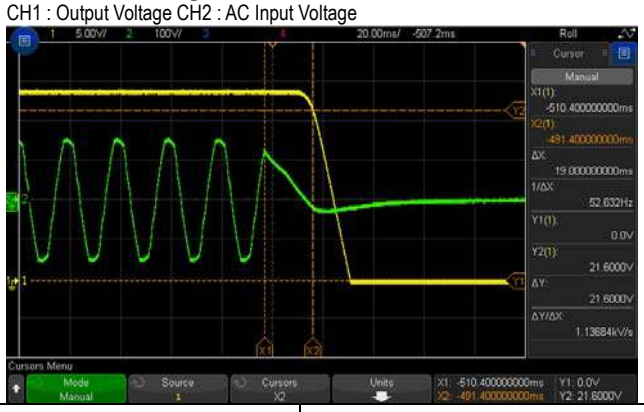


9	HOLD UP TIME (Typ.)	230VAC/50ms 115VAC/12ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 103 ms 115VAC/ 19 ms

INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

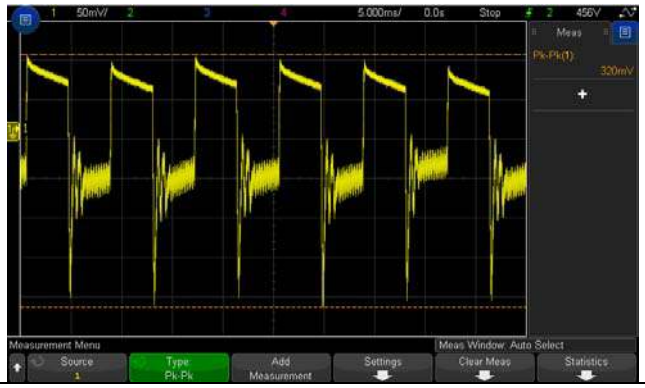


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

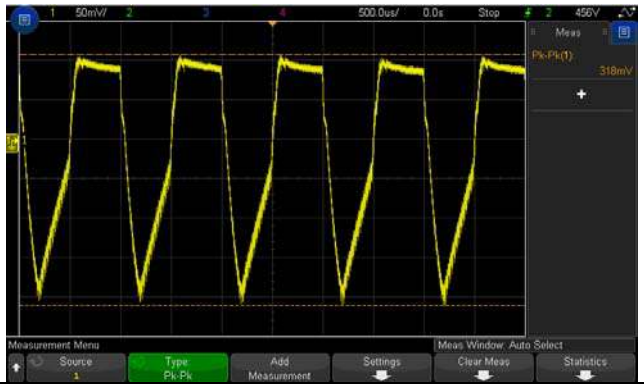


10	DYNAMIC LOAD	V1: 2400 mVp-p	I/P: 230VAC O/P: (1)FULL /HALF LOAD 50%DUTY / 120HZ (2)FULL /HALF LOAD 50%DUTY / 1KHZ Ta:25℃	 320 mVp-p 318 mVp-p

FULL /50% LOAD 50%DUTY / 120HZ



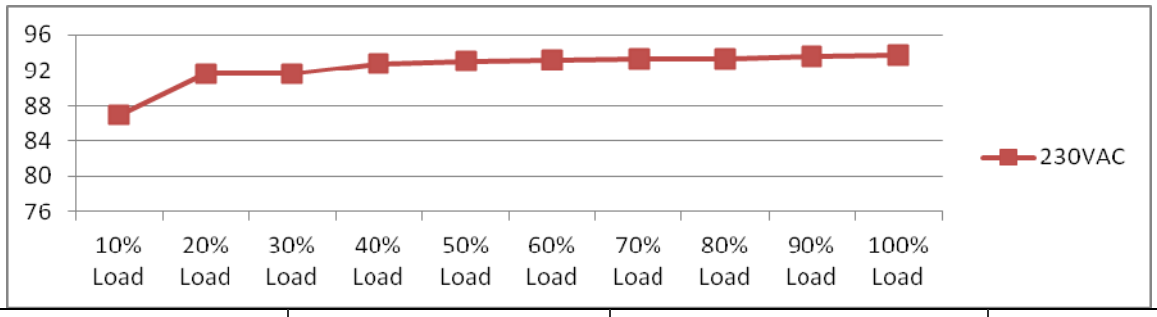
FULL /50% LOAD 50%DUTY / 1KHZ



INPUT FUNCTION TEST

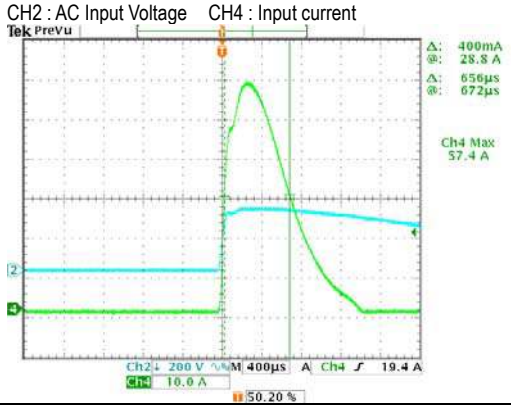
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC~264VAC 113VDC~370VDC	I/P:TESTING O/P:FULL LOAD Ta:25℃	73V~264V 102VDC~370VDC
			I/P: LOW-LINE-3V=77 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST: OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:80 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 1A 115V/ 1.5 A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =0.51A/ 230VAC I =0.88A/ 115VAC
4	LEAKAGE CURRENT	< 100uA / 264VAC	I/P： 264VAC O/P：Min LOAD Ta：25℃	Touch current：81.9uA
5	NO LOAD CONSUMPTION	<0.1 W	I/P：115VAC/230VAC O/P：NO LOAD Ta：25℃	0.032W/115VAC 0.076W/230VAC
7	EFFICIENCY(Typ.)	93%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	93.7%

EFFICIENCY vs LOAD

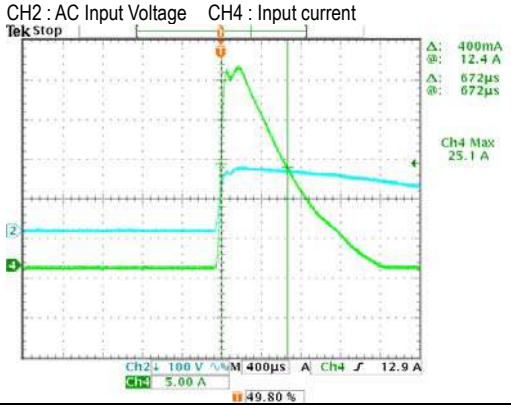


8	INRUSH CURRENT(Typ.)	230V/65A 115V/30A COLD START	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =57.4A/ 230VAC I =25.1A/ 115VAC

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℃	124.3%/ 264VAC 129.5%/ 230VAC 120.0%/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℃	28.0V/ 264VAC 28.0V/ 230VAC 28.0V/ 80VAC 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/ 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. Ta:25℃	VDS: (1) 541V (2) 444V (3) 541V (4) 545V (5) 545V (6) 545V (7) 541V
4	Diode Peak Voltage	Q100 Rated: 27.4A/ 150 V	AC ON/OFF I/P:High-Line +3V =267V 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℃	Q101: VDS: (1) 126V (2) 128V (3) 125.2V (4) 123.6V (5) 123.6V (6) 126V (7) 125.2V (8) 126V

5	Input Capacitor Voltage	C5 Rated: 150 μ / 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)372V (2) 372V (3) 372V (4) 368V
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)17.2V (1)15.2V (2)17.2V (2)15.2V (3)17.2V (3)14.4V (4)18.8V (4)18.8V (5)17.2V (5)15.2V
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)480 V (2)480 V

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:2.481mA 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-65-48 1. ROOM AMBIENT BURN-IN：2 HRS I/P： 230VAC O/P： FULL LOAD Ta= 26 ℃ 2. HIGH AMBIENT BURN-IN：2 HRS I/P： 230VAC O/P： FULL LOAD Ta= 56 ℃		
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 55 ℃ / 95 %R.H NO DAMAGE	I/P： 272 VAC O/P：FULL LOAD Ta= 55 ℃ HUMIDITY= 95 %R.H	TEST：OK
5	TEMPERATURE COEFFICIENT	± 0.03 %/℃(0~50℃)	I/P： 230 VAC O/P：FULL LOAD	± 0.0089 %/℃(0~50℃)

NO	Position	ROOM AMBIENT Ta=26 ℃	HIGH AMBIENT Ta=56 ℃
1	RTH1	56.6℃	79.6℃
2	LF1	53.9℃	79.6℃
3	LF2	55.5℃	82.4℃
4	C1	50.8℃	75.1℃
5	BD1	57.5℃	84.5℃
6	C5	55.5℃	82.3℃
7	Q1	60.6℃	87.8℃
8	C11	54.1℃	81.4℃
9	RTH2	55.9℃	83.3℃
10	T1 coil	60.2℃	87.7℃
11	T1 core	58.6℃	86℃
12	Q100	63.5℃	90.2℃
13	C105	59.4℃	86.1℃
14	L100	47.7℃	75.4℃
15	D1	59.9℃	86.9℃
16	U2	58.1℃	85.8℃
17	R5	57.3℃	87.2℃
18	C8	57.5℃	85.7℃
19	R22	58.8℃	85.9℃
20	R21	57.4℃	85.1℃
21	U3	53.9℃	82.2℃
22	D2	55.4℃	84.2℃
23	R11	54.5℃	83.1℃
24	Q2	53.9℃	82.1℃
25	PCB	58.5℃	85.6℃

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	-30~55℃	1. Thermal shock Temperature： -35℃~ +60℃ 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=55 ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta=55 ℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta=55 ℃ LIFE TIME	(1) 237571 HRS (2) 37317 HRS (3) 56764 HRS (4) 95221 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