



Test Report: MPM-90-12

90W 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

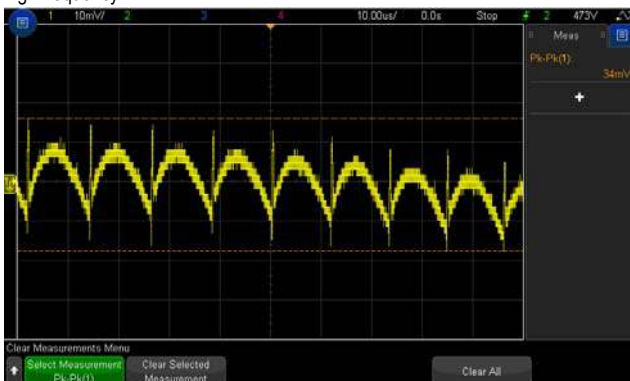
ENVIRONMENT TEST

DESIGN VERIFY TEST

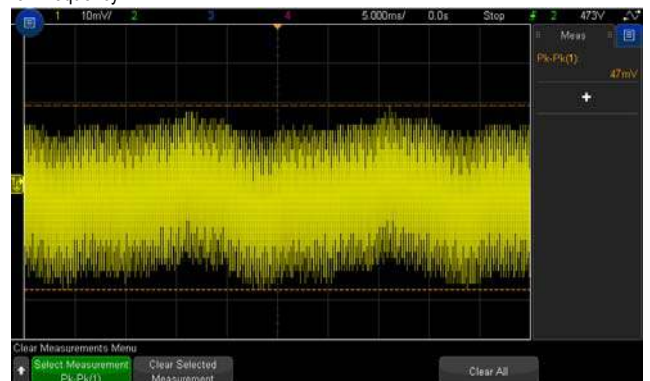
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -2.0%~ +2.0 %	I/P: 80VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.08 %~0.1%
2	LINE REGULATION (Max)	V1: -0.5%~ +0.5 %	I/P: 80VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1: -0.01%~ 0.1%
3	LOAD REGULATION(Max)	V1: -1.0%~ +1.0 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1:-0.08 %~0.1%
4	OVER/UNDERSHOOT TEST	< $\pm 5\%$	I/P: 230VAC O/P:FULL LOAD Ta:25℃	0.8%
5	PEAK LOAD TEST	≥ 10 Sec.	I/P: 230VAC O/P:PEAK LOAD Ta:25℃	OK
6	RIPPLE & NOISE(Max)	V1: 120mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 47mVp-p

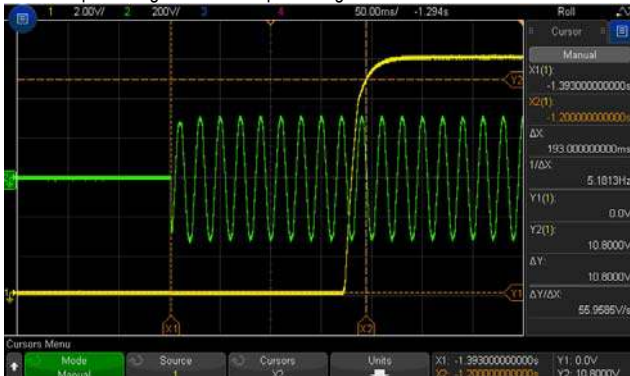
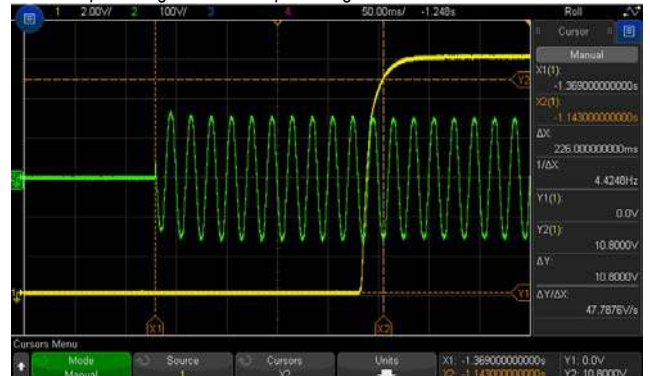
high frequency :

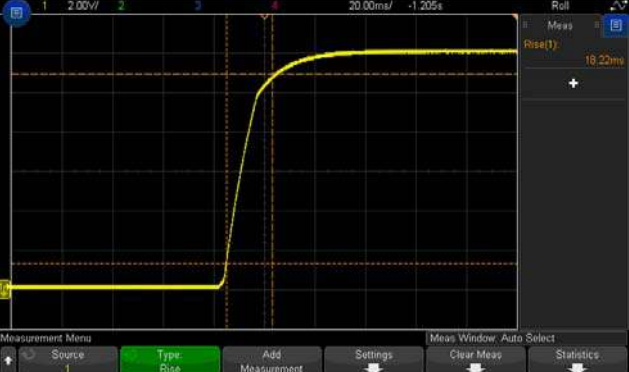
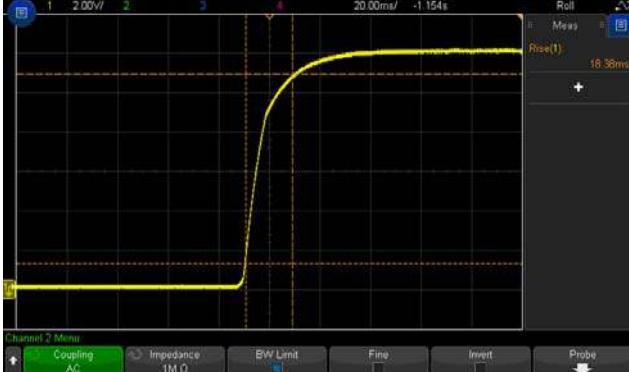
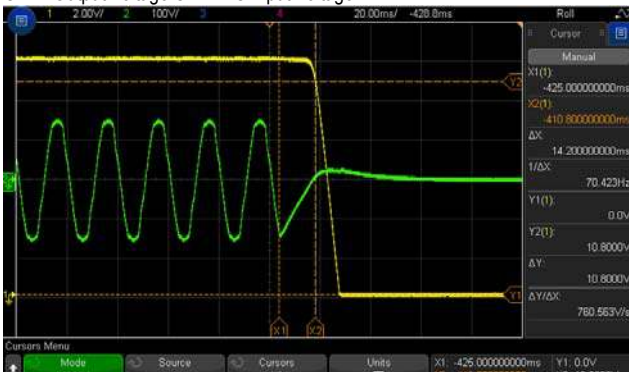
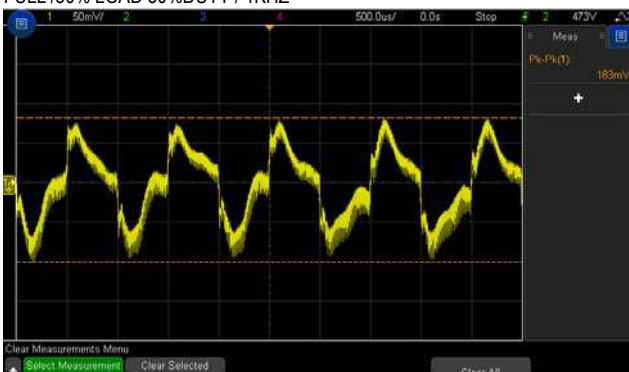


low frequency :



7	SET UP TIME(Max)	230VAC/1000ms 115VAC/1000ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	230VAC/ 193 ms 115VAC/ 226 ms
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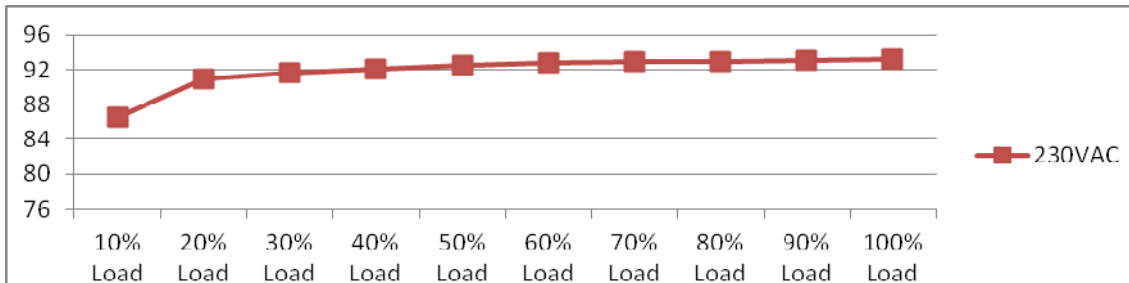
INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

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/ 18.22 ms 115VAC/ 18.38 ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage				
INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage				
9	HOLD UP TIME (Typ.)	230VAC/30ms 115VAC/10ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 85 ms 115VAC/ 14.2 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: 1200 mVp-p	I/P: 230VAC O/P: (1)FULL /HALF LOAD 50%DUTY / 120HZ (2)FULL /HALF LOAD 50%DUTY / 1KHZ Ta:25°C	197 mVp-p 183 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 113 VDC ~370VDC	I/P:TESTING O/P:FULL LOAD Ta:25°C	69VAC~264VAC 99VDC~370 VDC
			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°C	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 1.1A 115V/ 1.9 A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I=0.62A/ 230VAC I=1.13A/ 115VAC
4	LEAKAGE CURRENT	< 100uA / 264VAC	I/P : 264VAC O/P : Min LOAD Ta : 25°C	Touch current : 81.8 uA
5	NO LOAD CONSUMPTION	<0.1 W	I/P : 115VAC/230VAC O/P : NO LOAD Ta : 25°C	0.062W/115VAC 0.088W/230VAC
7	EFFICIENCY(Typ.)	92%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	93.16%

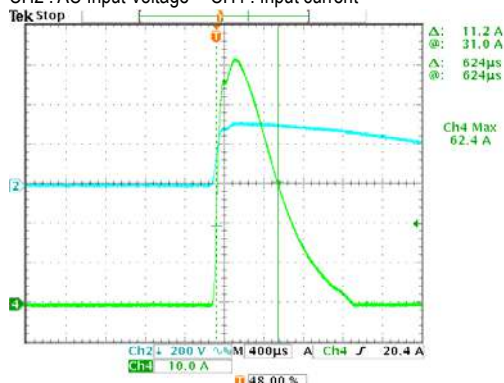
EFFICIENCY vs LOAD



8	INRUSH CURRENT(Typ.)	230V/65A 115V/30A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I=62.4A/ 230VAC I=26.9A/ 115VAC
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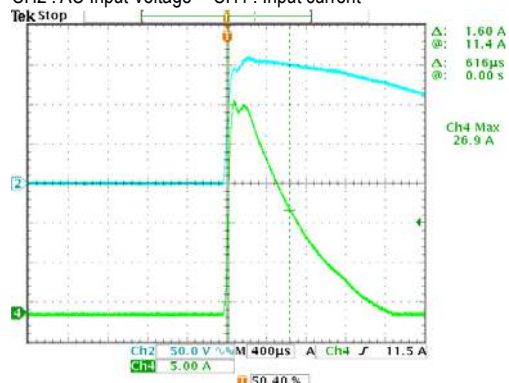
INPUT=230VAC/50HZ @ FULL LOAD

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	115%~ 160 %	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta:25℃	128.8%/ 264VAC 134.6%/ 230VAC 126.1%/100VAC PROTECTION TYPE : Hiccup mode ,recovers automatically after fault condition is removed.
2	OVER VOLTAGE PROTECTION	12.6V~16.2V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD Ta:25℃	14.2V/ 264VAC 14.2V/ 230VAC 14.2V/ 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 removed.

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated: 17A/ 680V	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) 558V (2) 558V (3) 558V (4) 554V (5) 550V (6) 558V (7) 558V
4	Diode Peak Voltage	Q100 Rated: 140A/ 85V	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) 60.9V (2) 60.9V (3) 60.9V (4) 60.9V (5) 60.9V (6) 60.9V (7) 60.9V (8) 60.9V

5	Input Capacitor Voltage	C5 Rated: 150 μ / 450 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°C	(1) 369V (2) 373V (3) 373V (4) 369V
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 =267 V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD (LOW LINE) Ta:25°C	U2 (1)17.2V (2)17.2V (3)17.2V (4)17.2V (5)17.2V U100 (1)12.4V (2)12.2V (3)12.2V (4)14.2V (5)12.2V
9	Clamp Diode Peak Voltage	D1 Rated : 650 V/ 1 A	AC ON/OFF I/P : High-Line +3V =267 V O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C	(1) 461V (2) 457V

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°C	I/P-O/P:1.786 mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M Ω	I/P-O/P: 600 VDC Ta:25°C	I/P-O/P:9999M Ω 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°C	PASS
2	CONDUCTION	EN55011 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN55011 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 <u>MEDICAL</u> AIR: 15KV / Contact : 8KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	☒ 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°C	☒ CRITERIA A ☐ CRITERIA B
6	SURGE	IEC61000-4-5 MEDICAL L-N : 1KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	☒ 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-90-12 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 26.2 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 51.9 °C <table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 26.2 °C</th><th>HIGH AMBIENT Ta= 51.9 °C</th></tr><tr><td>1</td><td>RTH1</td><td>67°C</td><td>87.8°C</td></tr><tr><td>2</td><td>LF1</td><td>63.1°C</td><td>85°C</td></tr><tr><td>3</td><td>LF2</td><td>63.3°C</td><td>86.2°C</td></tr><tr><td>4</td><td>C1</td><td>63.7°C</td><td>86.5°C</td></tr><tr><td>5</td><td>BD1</td><td>64.7°C</td><td>87.4°C</td></tr><tr><td>6</td><td>C5</td><td>65.2°C</td><td>88.3°C</td></tr><tr><td>7</td><td>R22</td><td>65.7°C</td><td>88.6°C</td></tr><tr><td>8</td><td>Q1</td><td>66.7°C</td><td>89.5°C</td></tr><tr><td>9</td><td>C11</td><td>62.8°C</td><td>85.7°C</td></tr><tr><td>10</td><td>RTH2</td><td>65.3°C</td><td>88.4°C</td></tr><tr><td>11</td><td>T1 coil</td><td>66.6°C</td><td>90.1°C</td></tr><tr><td>12</td><td>T1 core</td><td>65.2°C</td><td>88.4°C</td></tr><tr><td>13</td><td>Q100</td><td>68.4°C</td><td>91.9°C</td></tr><tr><td>14</td><td>L100</td><td>57.7°C</td><td>81.5°C</td></tr><tr><td>15</td><td>C107</td><td>55.7°C</td><td>79.3°C</td></tr><tr><td>16</td><td>C106</td><td>61.8°C</td><td>85.4°C</td></tr><tr><td>17</td><td>C105</td><td>67.6°C</td><td>91.1°C</td></tr><tr><td>18</td><td>D1</td><td>77.2°C</td><td>100.4°C</td></tr><tr><td>19</td><td>U2</td><td>64.8°C</td><td>87.5°C</td></tr><tr><td>20</td><td>U100</td><td>70.3°C</td><td>93.9°C</td></tr><tr><td>21</td><td>U3</td><td>63.5°C</td><td>86.7°C</td></tr><tr><td>22</td><td>U4</td><td>60.9°C</td><td>84.6°C</td></tr><tr><td>23</td><td>BC1</td><td>71.6°C</td><td>94.6°C</td></tr><tr><td>24</td><td>PCB</td><td>67.7°C</td><td>91.6°C</td></tr></table>			NO	Position	ROOM AMBIENT Ta= 26.2 °C	HIGH AMBIENT Ta= 51.9 °C	1	RTH1	67°C	87.8°C	2	LF1	63.1°C	85°C	3	LF2	63.3°C	86.2°C	4	C1	63.7°C	86.5°C	5	BD1	64.7°C	87.4°C	6	C5	65.2°C	88.3°C	7	R22	65.7°C	88.6°C	8	Q1	66.7°C	89.5°C	9	C11	62.8°C	85.7°C	10	RTH2	65.3°C	88.4°C	11	T1 coil	66.6°C	90.1°C	12	T1 core	65.2°C	88.4°C	13	Q100	68.4°C	91.9°C	14	L100	57.7°C	81.5°C	15	C107	55.7°C	79.3°C	16	C106	61.8°C	85.4°C	17	C105	67.6°C	91.1°C	18	D1	77.2°C	100.4°C	19	U2	64.8°C	87.5°C	20	U100	70.3°C	93.9°C	21	U3	63.5°C	86.7°C	22	U4	60.9°C	84.6°C	23	BC1	71.6°C	94.6°C	24	PCB	67.7°C	91.6°C
NO	Position	ROOM AMBIENT Ta= 26.2 °C	HIGH AMBIENT Ta= 51.9 °C																																																																																																					
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6	C5	65.2°C	88.3°C																																																																																																					
7	R22	65.7°C	88.6°C																																																																																																					
8	Q1	66.7°C	89.5°C																																																																																																					
9	C11	62.8°C	85.7°C																																																																																																					
10	RTH2	65.3°C	88.4°C																																																																																																					
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18	D1	77.2°C	100.4°C																																																																																																					
19	U2	64.8°C	87.5°C																																																																																																					
20	U100	70.3°C	93.9°C																																																																																																					
21	U3	63.5°C	86.7°C																																																																																																					
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24	PCB	67.7°C	91.6°C																																																																																																					
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 133 % 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= -35 °C	TEST : OK																																																																																																				
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 55 °C /95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 55 °C HUMIDITY= 95 %R.H	TEST : OK																																																																																																				
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C (0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.0224 %/°C (0~50°C)																																																																																																				

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 C106 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) 281108 HRS (2) 40646 HRS (3) 71744 HRS (4) 116595 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 570.5K hrs min. MIL-HDBK-217F (25℃); 1514.81 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