TEST REPORT: MFM-10-15

10W High Green Reliable Medical On Board Type

■ DESIGN VERIFY TEST

- Output Function Test
- Input Function Test
- Protection Function Test
- Control Function Test
- Component Stress Test

■ SAFETY & E.M.C. TEST

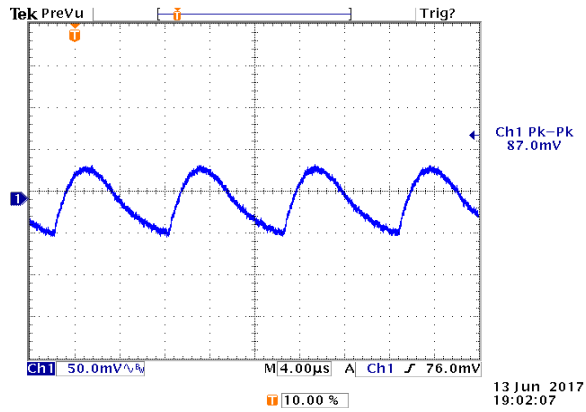
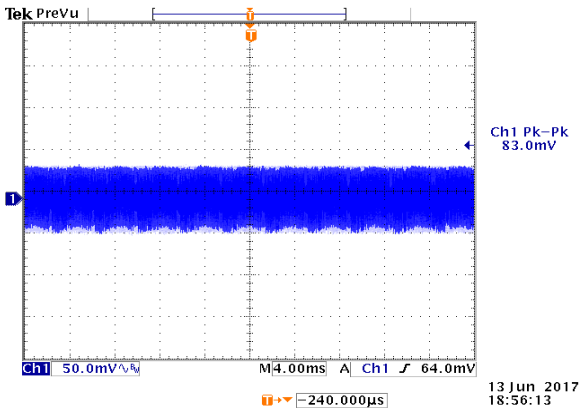
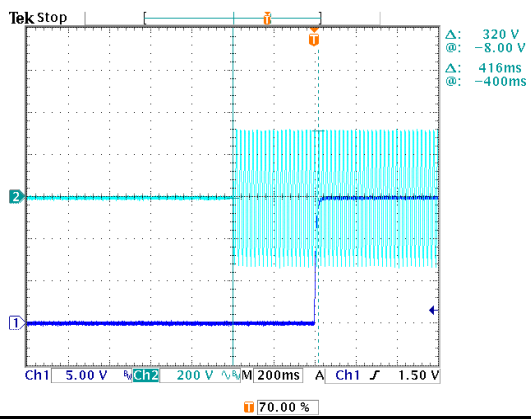
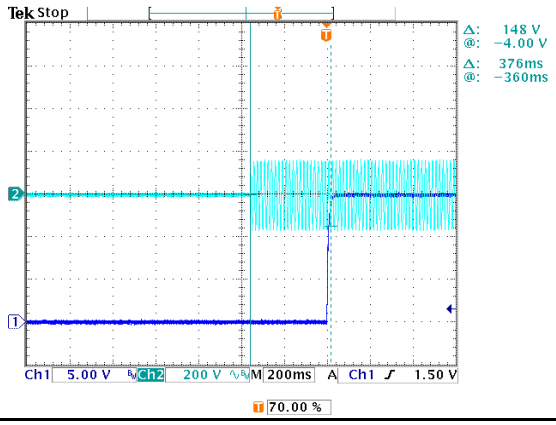
- Safety Test
- E.M.C. Test

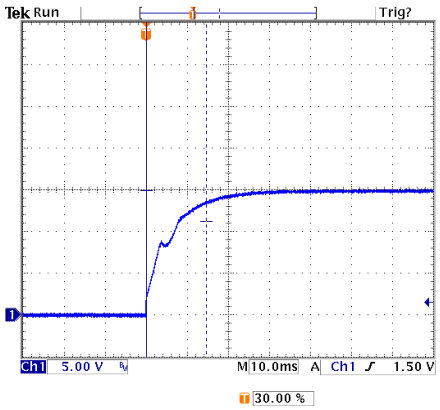
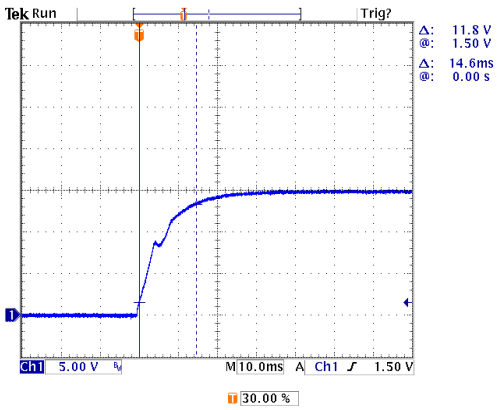
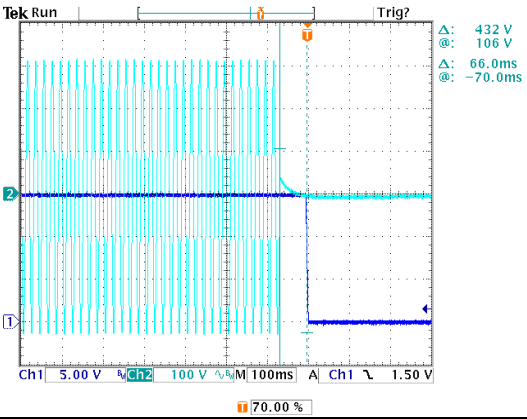
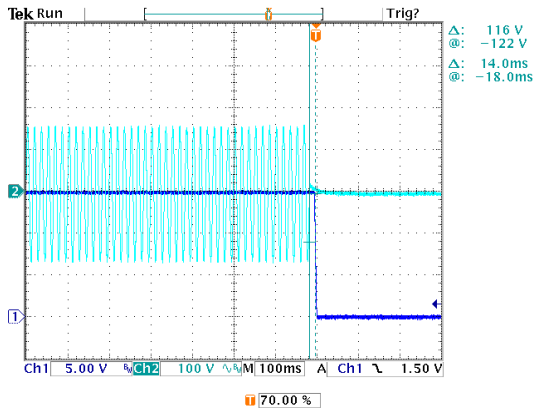
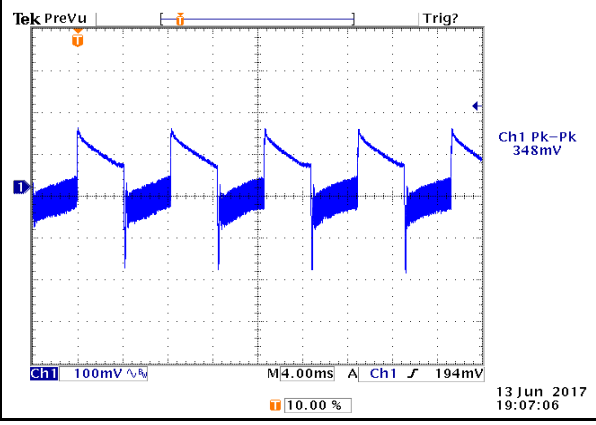
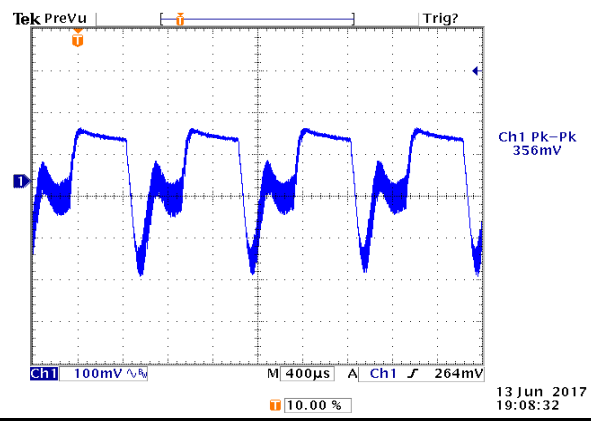
■ RELIABILITY TEST

- ENVIRONMENT TEST

■ DESIGN VERIFY TEST

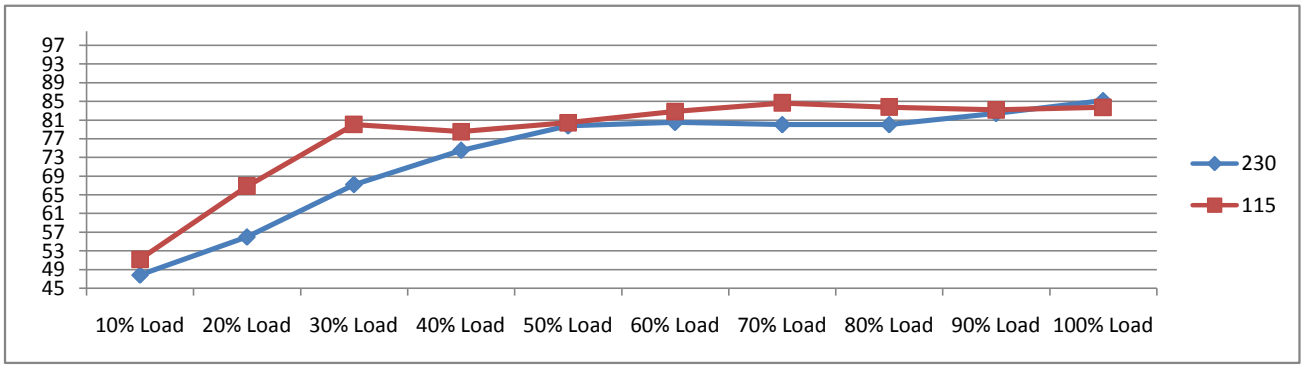
OUTPUT FUNCTION

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 2.5% ~ -2.5%	I/P : 100VAC / 264VAC O/P: FULL / MINLOAD TA= 25℃	V1: 0.20% ~ -0.20%
2	LINE REGULATION (MAX.)	V1 : 0.3% ~ -0.3%	I/P : 100VAC / 264VAC O/P: FULL LOAD TA : 25℃	V1: 0.00% ~ 0.00%
3	LOAD REGULATION(MAX.)	V1 : 0.5% ~ -0.5%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25℃	V1: 0.00% ~ 0.00%
4	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	TEST< 2.7 %
5	RIPPLE & NOISE(Max)	V1 : 180 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25℃	V1 : 87 mVp-p
	high frequency:		low frequency:	
				
6	SET UP TIME (MAX.)	230VAC : 1000ms 115VAC : 1000ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 416ms 115VAC : 376ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	
				

7	RISE TIME (MAX.)	230VAC : 30ms 115VAC : 30ms		I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 14.6ms 115VAC : 14.6ms	
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage			INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage		
						
8	HOLD UP TIME (TYP.)	230VAC : 40ms 115VAC : 8ms		I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 66.0ms 115VAC : 14.0ms	
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage			INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		
						
9	DYNAMIC LOAD	V1 : 1500 mVp-p		I/P : 230VAC O/P: (1)Full/Min load 50%duty/120HZ (2)Full/Min load 50%duty/1KHZ TA : 25℃	(1). (2). unit:mVp-p V1: 348mv 356mv	
	FULL /MIN LOAD 50%DUTY / 120HZ			FULL /MIN% LOAD 50%DUTY / 1KHZ		
						

INPUT FUNCTION TEST

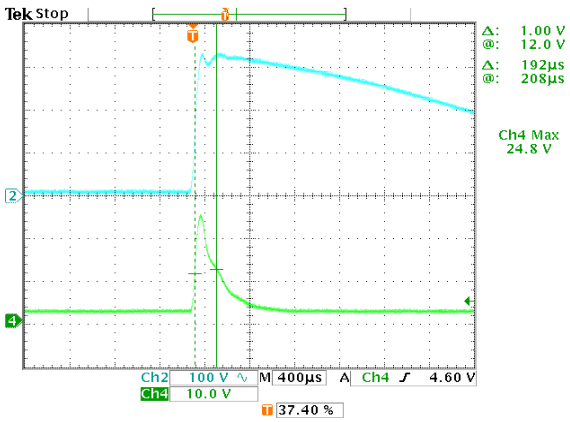
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC ~ 264VAC	I/P : TESTING O/P : FULL LOAD Ta : 25℃	64.0VAC ~ 264VAC
			I/P : LOW-LINE = 97VAC HIGH-LINE = 300VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~ 440HZ NO DAMAGE	I/P : 100VAC ~ 264VAC O/P : FULL~MIN LOAD Ta : 25℃	TEST : OK
3	INPUT CURRENT (TYP.)	0.2A / 230VAC 0.3A / 115VAC	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	I= 0.083A / 230VAC I= 0.147A / 115VAC
4	LEAKAGE CURRENT	< 0.08mA	I/P : 264VAC O/P: MIN LOAD TA : 25℃	0.0275 mA
5	NO LOAD POWER CONSUMPTION	< 0.075W	I/P : 230VAC O/P: MIN LOAD TA : 25℃	< 0.0521 W
6	EFFICIENCY (TYP.)	83.0%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	85.17 %



7	INRUSH CURRENT (TYP.)	45A / 230VAC 25A / 115VAC twidth= 555 us measured at 50% Ipeak COLD START	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	I= 24.8A / 230VAC I= 11.6A / 115VAC T50= 192.0us / 230VAC

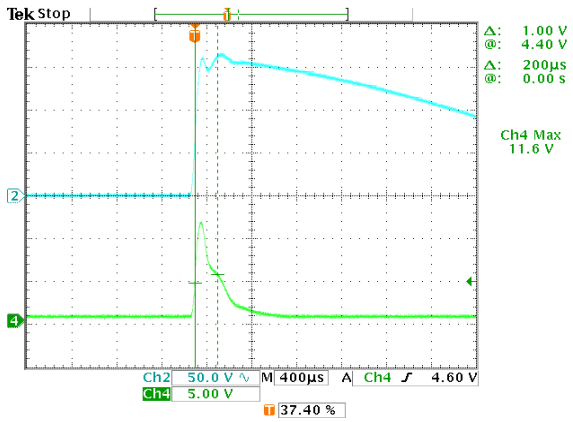
INPUT=230VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current (1V=1A)



INPUT=115VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current (1V=1A)



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	110% ~ 180%	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING TA : 25℃	159.00% 264VAC 154.40% 230VAC 143.00% 100VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	17.30V ~ 20.30V	TA : 25℃	18.30V Shut off o/p voltage,damping by zener diode
3	OVER TEMPERATURE PROTECTION	Shut down Re- power ON	I/P: 264VAC I/P: 80VAC O/P: FULL LOAD	O.T.P. Active Shut down Re- power ON
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 80VAC O/P: FULL LOAD Ta: 25℃	NO DAMAGE Hiccup Mode

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Power Transistor	U1 Rated : 800V 2.0A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Fulll load continue Ta : 25℃	VIN: 267VAC VDS: (1). 496.00V (2). 490.00V (3). 498.00V
2	O/P Diode	D100 Rated : 120V 10.0A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Fulll load continue	D100 VDS : (1). 102.00V (2). 92.40V (3). 103.00V
3	Input Capacitor	C5 Rated : 10uf 400V	I/P : 267VAC O/P : (1)Full Load Turn on /Off (2)Min load Turn on /Off (3)Full Load /Min load Change (4)Full Load Continue Ta : 25℃	(1). 388.00V (2). 388.00V (3). 388.00V (4). 386.00V
4	Control IC	U1 Rated : 27V (max) -0.3V (min)	I/P : 267VAC O/P : (1)Full Load (2)Output Short (3)O.L.P (4)Low Line No Load Vo(min) Ta : 25℃	U1 (1). 17.70V (2). 17.10V (3). 18.20V (4). 19.00V
5	Clamp Diode	D2 Rated : 1000V 1.0A	I/P : 267VAC O/P : (1)Dynamic Load Full/Min Load (2)Fulll load continue Ta : 25℃	(1). 464.00V (2). 466.00V

■SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P : 4.000KVAC /min	I/P-O/P: 4.250KVAC /min Ta : 25℃	I/P-O/P: 0.60mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ	I/P-O/P: 500VDC Ta : 25℃/70%RH	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 : 230VAC /50HZ O/P : FULL LOAD / 50% LOAD Ta : 25℃	PASS Test by certified Lab
3	RADIATION	EN55015 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 AIR：15KV / Contact：8KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INPUT：2KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
6	SURGE	IEC61000-4-5 L-N:1KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A

■RELIABILITY TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td>MODEL : MFM-10-15
1. ROOM AMBIENT BURN-IN : 1.0hrs
IP: 230VAC O/P: 100% LOAD TA= 21.1℃
2. HIGH AMBIENT BURN-IN : 1.0hrs
IP: 230VAC O/P: 100% LOAD TA= 56.3℃
<table>
<tr><th>NO.</th><th>Position</th><th>ROOM AMBIENT 21.1℃</th><th>HIGH AMBIENT Ta： 56.3℃</th></tr>
<tr><td>1</td><td>C4</td><td>45.4℃</td><td>76.9℃</td></tr>
<tr><td>2</td><td>C5</td><td>50.0℃</td><td>80.8℃</td></tr>
<tr><td>3</td><td>C37</td><td>47.5℃</td><td>73.8℃</td></tr>
<tr><td>4</td><td>R1</td><td>51.5℃</td><td>80.8℃</td></tr>
<tr><td>5</td><td>U1</td><td>76.4℃</td><td>101.1℃</td></tr>
<tr><td>6</td><td>T1</td><td>60.8℃</td><td>90.5℃</td></tr>
<tr><td>7</td><td>C101</td><td>43.1℃</td><td>71.4℃</td></tr>
<tr><td>8</td><td>D100</td><td>54.7℃</td><td>86.3℃</td></tr>
<tr><td>9</td><td>BD1</td><td>44.7℃</td><td>76.8℃</td></tr>
<tr><td>60</td><td>TA</td><td>21.1℃</td><td>56.3℃</td></tr>
</table></td><td></td></tr>
<tr><td>2</td><td>OVER LOAD BURN-IN TEST</td><td>NO DAMAGE
1 HOUR (MIN)</td><td>I/P : 230VAC
O/P : 133.00% LOAD
Ta : 25℃</td><td>TEST：OK</td></tr>
<tr><td>3</td><td>LOW TEMPERATURE TURN ON TEST</td><td>NO DAMAGE
1 HOUR (MIN)</td><td>I/P : 264VAC / 100VAC
O/P : FULL LOAD
Ta : -35.0℃</td><td>TEST：OK</td></tr>
<tr><td>4</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 50℃
NO DAMAGE</td><td>I/P : 272VAC
O/P : FULL LOAD
Ta : 50℃
HUMIDITY= 95.0% RH</td><td>TEST：OK</td></tr>
<tr><td>5</td><td>TEMPERATURE COEFFICIENT</td><td>±0.03% /(0℃~50℃)</td><td>I/P : 230VAC
O/P : FULL LOAD</td><td>±0.0032% /(0℃~50℃)</td></tr>
<tr><td>6</td><td>STORAGE TEMPERATURE TEST</td><td>1. Thermal shock Temperature : -45℃ ~ +100℃
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</td><td></td><td>TEST：OK</td></tr>
<tr><td>7</td><td>THERMAL SHOCK TEST</td><td>1. Thermal shock Temperature : -35℃ ~ +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 :
230VAC Full Load AC ON/OFF test turn on 3sec ; turn off 1sec @ 15CYCLE
230VAC Full Load AC ON turn on continue @ 1CYCLE</td><td></td><td>TEST：OK</td></tr>
<tr><td>8</td><td>VIBRATION TEST</td><td>1 Carton & 1 Set
(1) Waveform : Sine Wave
(2) Frequency : 10~500Hz
(4) Acceleration : 5G
(5) Test Time : 60 min in each axis (X.Y.Z)
(6) Ta : 25℃</td><td></td><td>TEST：OK</td></tr>
</table>

9	CAPACITOR LIFE CYCLE	:SUPPOSE C101 IS THE MOST CRITICAL COMPONENT								
		(1) I/P：	230VAC	O/P：FULL LOAD	Ta=	25.0℃	LIFE TIME	(1).	484095.4	HRS
		(2) I/P：	230VAC	O/P：FULL LOAD	Ta=	50.0℃	LIFE TIME	(2).	138052.3	HRS
		(3) I/P：	230VAC	O/P：75% LOAD	Ta=	50.0℃	LIFE TIME	(3).	105759.4	HRS
		(4) I/P：	230VAC	O/P：50% LOAD	Ta=	50.0℃	LIFE TIME	(4).	161622	HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 9314.1K hrs min. Telcordia SR-332 (Bellcore) ; 1756.2K hrs min. MIL-HDBK-217F (25℃)								
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): Above 30000HRS @ TA 50℃								

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ