



TEST REPORT: MFM-15-24

15W High Reliable Green 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

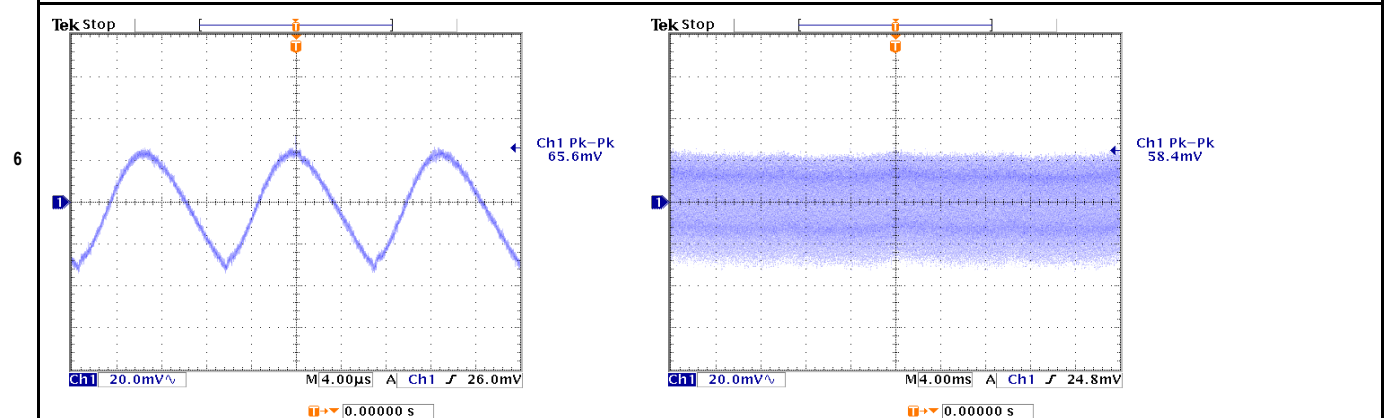
ENVIRONMENT TEST

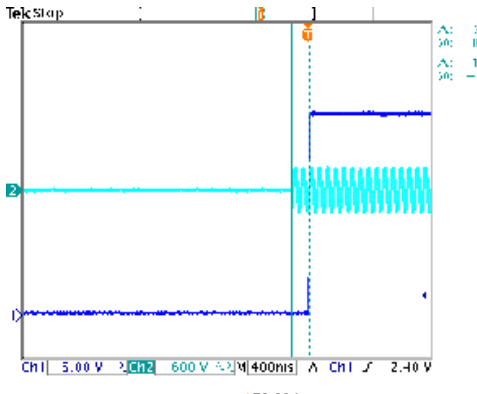
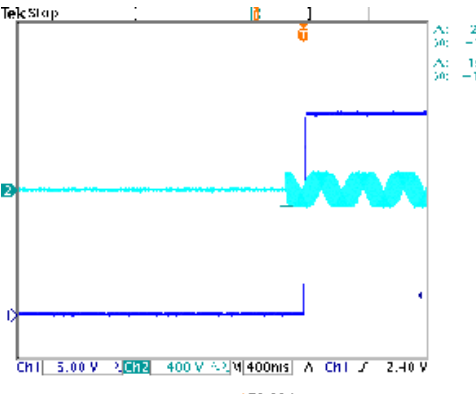
DESIGN VERIFY TEST OUTPUT FUNCTION

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 2.0% ~ -2.0%	I/P : 80VAC / 264VAC O/P: FULL / MINLOAD TA= 25°C	V1: 0.62% ~ -0.50%
3	LINE REGULATION (MAX.)	V1 : 0.3% ~ -0.3%	I/P : 80VAC / 264VAC O/P: FULL LOAD TA : 25°C	V1: 0.04% ~ -0.04%
4	LOAD REGULATION(MAX.)	V1 : 0.5% ~ -0.5%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25°C	V1: 0.04% ~ -0.04%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25°C	TEST< 2.1 %
	RIPPLE & NOISE(Max)	V1 : 180 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25°C	V1 : 65.6 mVp-p

high frequency:

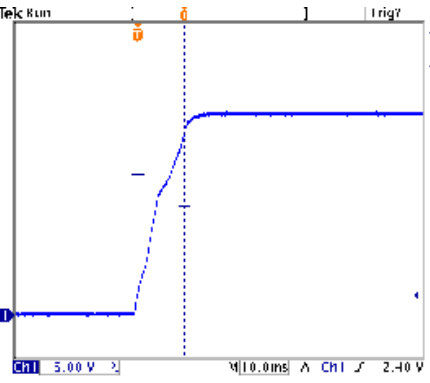
low frequency:



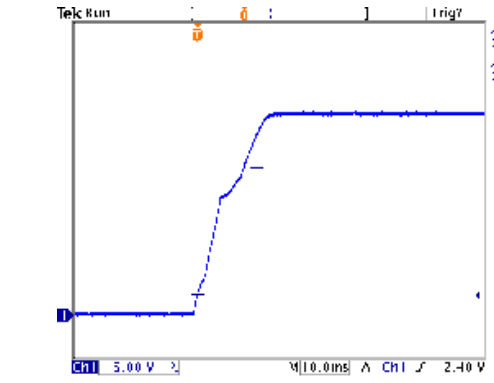
7	SET UP TIME (MAX.)	230VAC : 1500ms 115VAC : 1500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 176ms 115VAC : 192ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	
	 Ch1 5.00 V Ch2 600 V 400ms		 Ch1 5.00 V Ch2 400 V 400ms	

8	RISE TIME (MAX.)	230VAC : 30ms 115VAC : 30ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA: 25°C	230VAC : 11.4ms 115VAC : 14.4ms
9	HOLD UP TIME (TYP.)	230VAC : 40ms 115VAC : 10ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA: 25°C	230VAC : 100.0ms 115VAC : 22.0ms
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°C	V1: (1). 512mv (2). 442mv unit:mVp-p

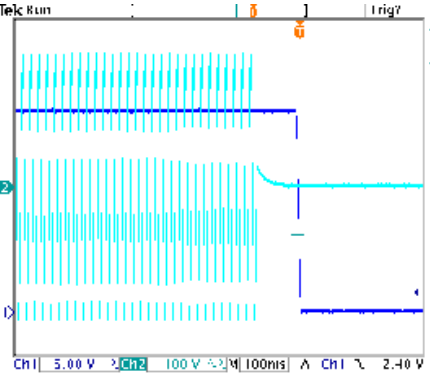
INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage



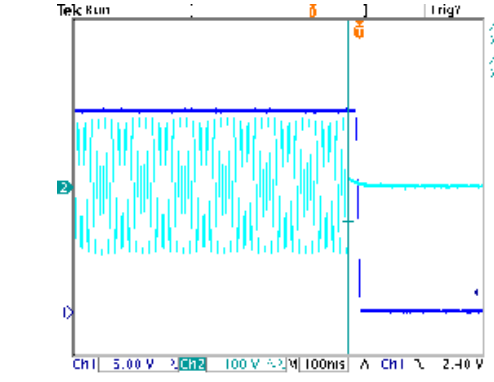
INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage



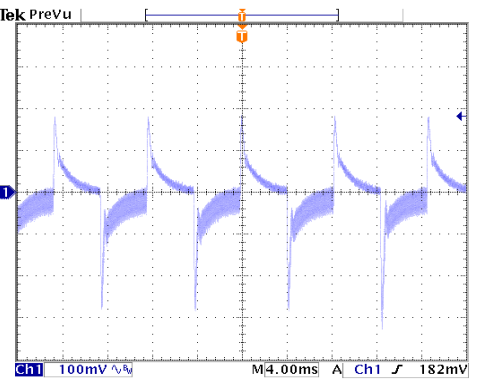
INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage



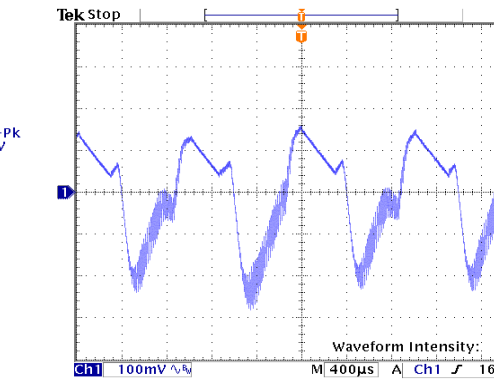
INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage



FULL /MIN LOAD 50%DUTY / 120HZ

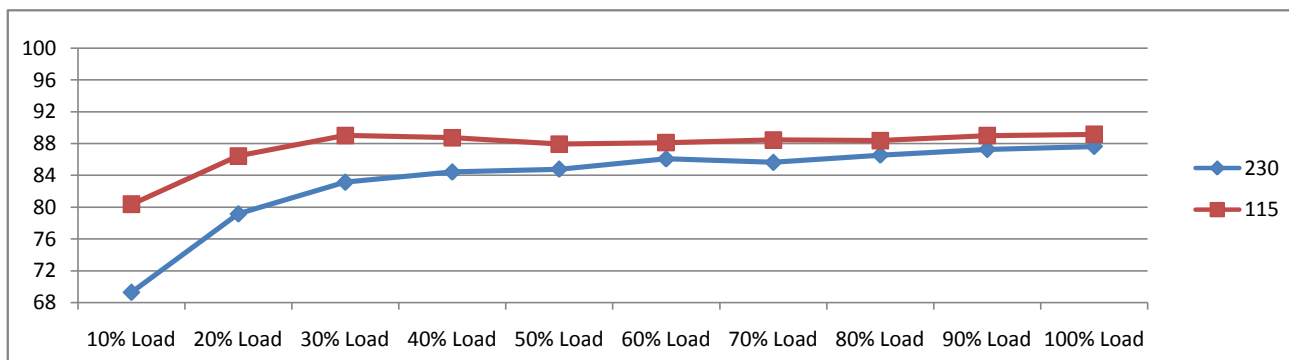


FULL /MIN% LOAD 50%DUTY / 1KHZ



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°C	74.0VAC ~ 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 : 80VAC ~ 264VAC O/P : FULL-MIN LOAD Ta : 25°C	TEST : OK
3	INPUT CURRENT (TYP.)	0.3 / 230VAC 0.6 / 115VAC	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 0.1712 / 230VAC I= 0.2671 / 115VAC
4	LEAKAGE CURRENT	< 80.00μA	I/P : 264VAC O/P : MIN LOAD TA : 25°C	Touch current 48 μA
5	NO LOAD POWER CONSUMPTION	< 0.1W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.0568 W
7	EFFICIENCY (TYP.)	86.5%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	87.63 %



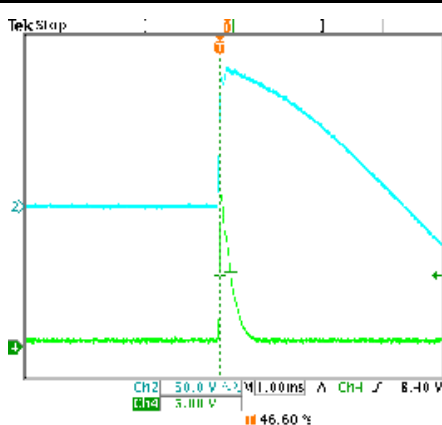
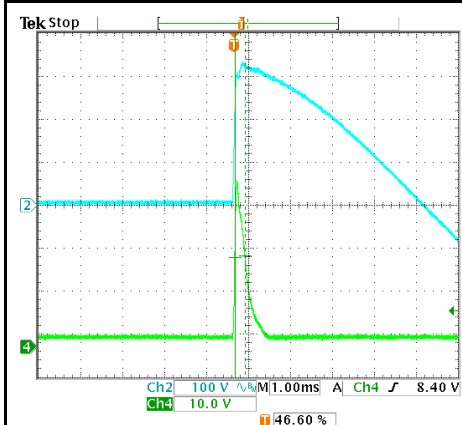
8	INRUSH CURRENT (TYP.)	45A / 230VAC 20A / 115VAC twidth= 555 us measured at 50% Ipeak COLD START	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 38.8A / 230VAC I= 17.8A / 115VAC T50= 240.0us / 230VAC
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INPUT=230VAC/50HZ @ FULL LOAD

INPUT=115VAC/50HZ @ FULL LOAD

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

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PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	110% ~ 150%	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta: 25°C	139.73% 264VAC 134.02% 230VAC 125.81% 100VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	27.60V ~ 32.40V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD Ta: 25°C	29.00V 264VAC 29.00V 230VAC 29.00V 80VAC Shut off o/p voltage, clamping by zener diode
3	OVER TEMPERATURE PROTECTION	Shut down o/p voltage, recovers automatically after fault condition is removed	I/P: 264VAC I/P: 80VAC O/P: FULL LOAD	O.T.P. Active Shut down o/p voltage, recovers automatically after fault condition is removed
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 80VAC O/P: FULL LOAD Ta: 25°C	NO DAMAGE Hiccup Mode

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Power Transistor	U1 Rated : 800V 11.5A	I/P : 267VAC VDS : O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	VIN: 267VAC VDS: (1). 510.00V (2). 434.00V (3). 508.00V
2	O/P MOSFET	Q100 Rated : 200V 5.0A	I/P : 267VAC VDS : O/P : (1) Full Load Turn on (2) Output Short (3) Full load continue Ta : 25°C	Q100 VDS : (1). 122.00V (2). 117.00V (3). 122.00V
3	Input Capacitor	C5 Rated : 33uf 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°C	(1). 374.00V (2). 374.00V (3). 374.00V (4). 372.00V
4	Control IC	U1 Rated : 27V (max) -0.3 (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°C	U1 (1). 17.50V (2). 16.00V (3). 16.50V (4). 16.30V
9	Clamp Diode	D1 Rated : 1000V 1.0A	I/P : 267VAC O/P : (1) Dynamic Load Full/Min Load (2) Full load continue Ta : 25°C	(1). 464.00V (2). 464.00V

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: 4.400KVAC /min Ta : 25°C	I/P-O/P: 0.84mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC > 100MΩ	I/P-O/P: 500VDC Ta : 25°C / 70%RH	I/P-O/P: 9999.0MΩ 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 : 230VAC /50HZ O/P : FULL LOAD / 50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN55011 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 MEDICAL AIR: 15KV / Contact: 8KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 MEDICAL INPUT: 2KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	EN61000-4-5 MEDICAL L-N:1KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A

RELIABILITY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																	
1	TEMPERATURE RISE TEST	MODEL : MFM-15-24																																																			
		1. ROOM AMBIENT BURN-IN : 1.0hrs																																																			
		IP: 230VAC O/P: 100% LOAD TA= 24.5℃																																																			
		2. HIGH AMBIENT BURN-IN : 1.0hrs																																																			
		IP: 230VAC O/P: 100% LOAD TA= 45.8℃																																																			
		<table><tr><th>NO.</th><th>Positio</th><th>ROOM AMBIENT 24.5℃</th><th>HIGH AMBIENT Ta: 45.8℃</th></tr><tr><td>1</td><td>LF1</td><td>50.8℃</td><td>71.7℃</td></tr><tr><td>2</td><td>C6</td><td>53.2℃</td><td>75.1℃</td></tr><tr><td>3</td><td>C5</td><td>55.5℃</td><td>76.4℃</td></tr><tr><td>4</td><td>U1</td><td>71.6℃</td><td>88.2℃</td></tr><tr><td>5</td><td>T1</td><td>64.9℃</td><td>78.0℃</td></tr><tr><td>6</td><td>C105</td><td>43.7℃</td><td>65.4℃</td></tr><tr><td>7</td><td>Q100</td><td>74.7℃</td><td>92.3℃</td></tr><tr><td>8</td><td>BD1</td><td>54.8℃</td><td>76.7℃</td></tr><tr><td>9</td><td>C1</td><td>43.8℃</td><td>64.5℃</td></tr><tr><td>10</td><td>L100</td><td>56.9℃</td><td>77.8℃</td></tr><tr><td>60</td><td>TA</td><td>24.5℃</td><td>45.8℃</td></tr></table>			NO.	Positio	ROOM AMBIENT 24.5℃	HIGH AMBIENT Ta: 45.8℃	1	LF1	50.8℃	71.7℃	2	C6	53.2℃	75.1℃	3	C5	55.5℃	76.4℃	4	U1	71.6℃	88.2℃	5	T1	64.9℃	78.0℃	6	C105	43.7℃	65.4℃	7	Q100	74.7℃	92.3℃	8	BD1	54.8℃	76.7℃	9	C1	43.8℃	64.5℃	10	L100	56.9℃	77.8℃	60	TA	24.5℃	45.8℃	
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2	OVER LOAD BURN-IN TEST	NO DAMAGE	I/P : 230VAC	TEST : OK																																																	
		1 HOUR (MIN)	O/P : 131.00% LOAD																																																		
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE	Ta : 25℃	TEST : OK																																																	
		1 HOUR (MIN)	I/P : 264VAC / 100VAC																																																		
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	NO DAMAGE	O/P : FULL LOAD	TEST : OK																																																	
		IN CHAMBER ON	Ta : -35.0℃																																																		
5	TEMPERATURE COEFFICIENT	55℃	Ta : 55℃	TEST : OK																																																	
		NO DAMAGE	HUMIDITY= 95.0% RH																																																		
6	STORAGE TEMPERATURE TEST	±0.03% /(0℃~55℃)	I/P : 230VAC	±0.0078% /(0℃~55℃)																																																	
			O/P : FULL LOAD																																																		
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -40℃ ~ +95℃	TEST : OK																																																		
		2. Temperature change rate : 25℃ / MIN																																																			
8		3. Dwell time low and high temperature : 30 MIN/EACH																																																			
		4. Total test cycle : 10 CYCLE																																																			
9		5. Input/Output condition : STATIC																																																			
10		1. Thermal shock Temperature : -40℃ ~ +60℃	TEST : OK																																																		
		2. Temperature change rate : 25℃ / MIN																																																			
11		3. Dwell time low and high temperature : 30 MIN/EACH																																																			
		4. Total test cycle : 16 CYCLE																																																			
12		5. Input/Output condition :																																																			
13		230VAC Full Load AC ON/OFF test turn on 3sec ; turn off 1sec @ 15CYCLE																																																			
		230VAC Full Load AC ON turn on continue @ 1CYCLE																																																			



8	VIBRATION TEST	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°C	TEST : OK
9	CAPACITOR LIFE CYCLE	:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25.0°C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 55.0°C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 55.0°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 55.0°C LIFE TIME	(1). 568260 HRS (2). 69048 HRS (3). 65699.6 HRS (4). 86522.4 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1210K hrs min. MIL-HDBK-217F (25°C)	
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): Above 30000HRS @ TA 55°C	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ