



TEST REPORT: MFM-15-12

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

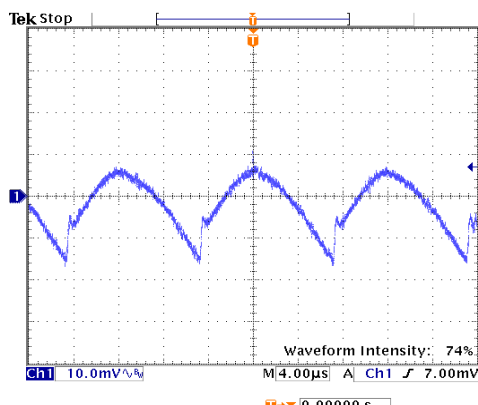
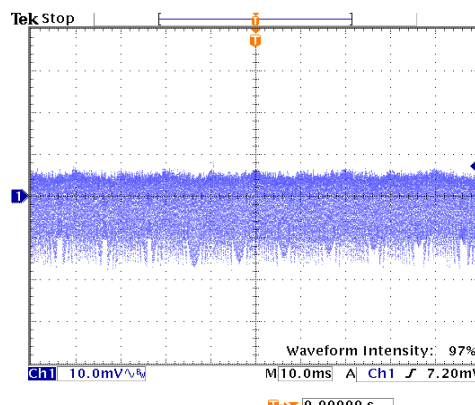
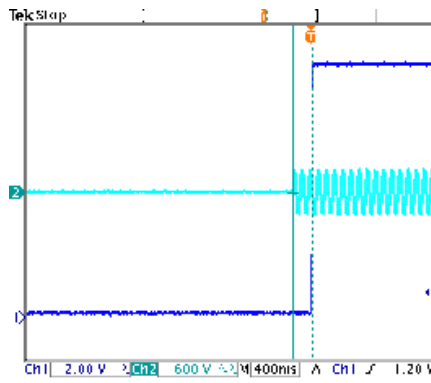
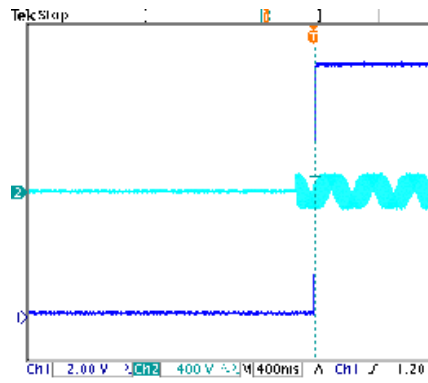
■ **SAFETY & E.M.C. TEST**

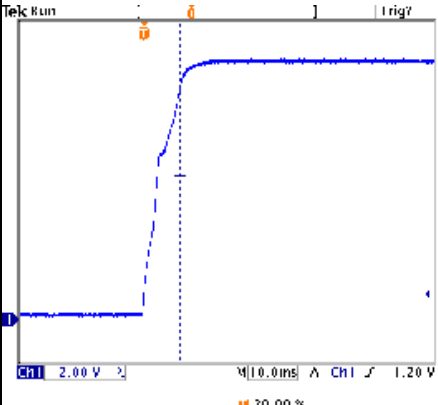
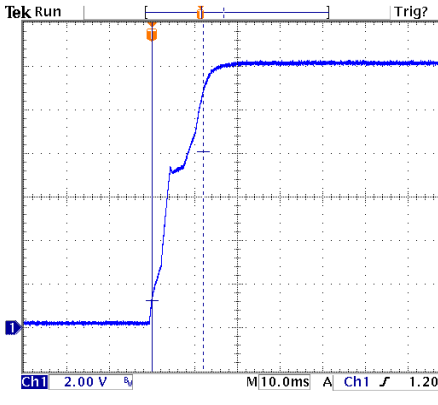
Safety Test
E.M.C. Test

■ **RELIABILITY TEST**

ENVIRONMENT TEST

DESIGN VERIFY TEST OUTPUT FUNCTION

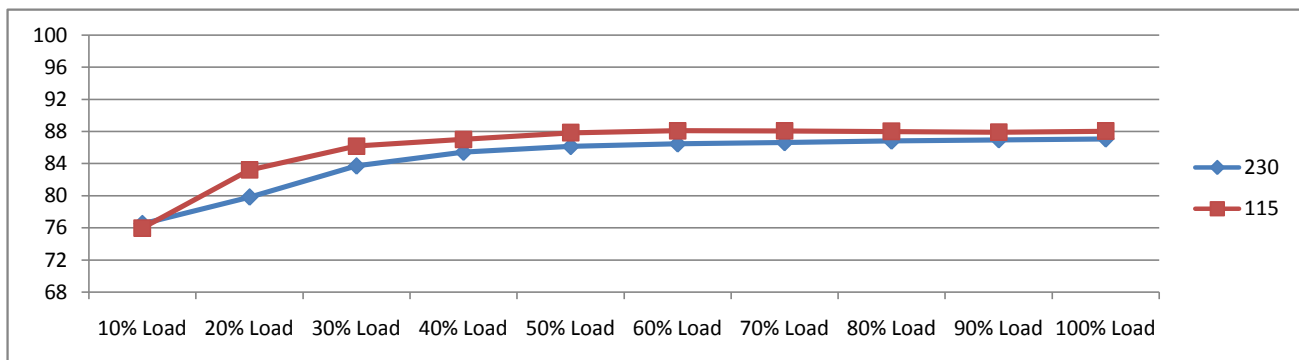
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 2.0% ~ -2.0%	I/P : 80VAC / 264VAC O/P: FULL / MINLOAD TA= 25°C	V1: 0.33% ~ 0.25%
3	LINE REGULATION (MAX.)	V1 : 0.3% ~ -0.3%	I/P : 80VAC / 264VAC O/P: FULL LOAD TA : 25°C	V1: 0.90% ~ 0.90%
4	LOAD REGULATION(MAX.)	V1 : 0.5% ~ -0.5%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25°C	V1: 0.00% ~ -0.08%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25°C	TEST< 3.3 %
6	RIPPLE & NOISE(Max)	V1 : 150 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25°C	V1 : 27.6 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 : 192ms 115VAC : 184ms
		INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage
				

RISE TIME (MAX.)	230VAC : 30ms 115VAC : 30ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA: 25°C	230VAC : 8.6ms 115VAC : 12.0ms
8 INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage	
9 HOLD UP TIME (TYP.)	230VAC : 40ms 115VAC : 10ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA: 25°C	230VAC : 96.0ms 115VAC : 20.0ms
10 DYNAMIC LOAD	V1 : 1200 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). 422mv (2). 284mv unit:mVp-p
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	73.0VAC ~ 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= 0.1686 / 230VAC I= 0.2654 / 115VAC
4	LEAKAGE CURRENT	< 80.00μA	I/P : 264VAC O/P : MIN LOAD TA : 25°C	Touch current 50.6 μA
5	NO LOAD POWER CONSUMPTION	< 0.1W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.0431 W
	EFFICIENCY (TYP.)	86.5%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	87.06 %

7



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= 39.0A / 230VAC
I= 17.7A / 115VAC
T50= 260.0us / 230VAC

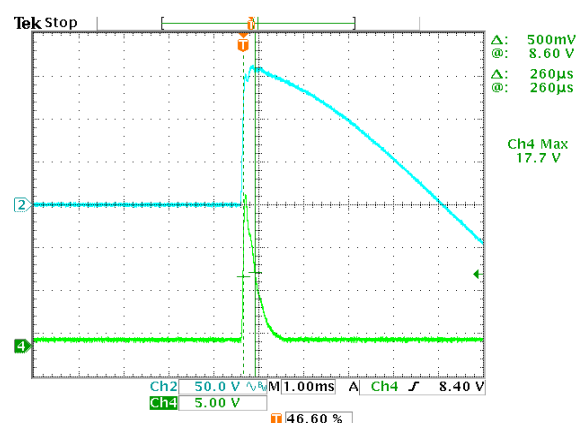
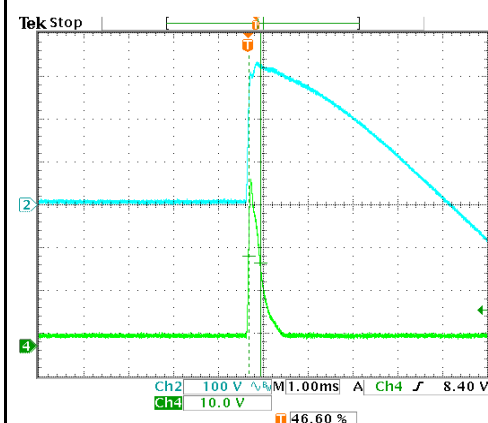
INPUT=230VAC/50HZ @ FULL LOAD

INPUT=115VAC/50HZ @ FULL LOAD

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

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

8





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	143.10% 264VAC 137.09% 230VAC 120.90% 100VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	13.80V ~ 16.20V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD Ta: 25°C	14.60V 264VAC 14.60V 230VAC 14.60V 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). 524.00V (2). 452.00V (3). 520.00V
2	O/P MOSFET	Q100 Rated : 100V 10.0A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	Q100 VDS : (1). 59.20V (2). 51.60V (3). 59.20V
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). 372.00V (2). 372.00V (3). 374.00V (4). 372.00V
4	Control IC	U1 Rated : 24V (max) 10.5 (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). 17.60V (2). 16.10V (3). 17.80V (4). 16.50V
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). 458.00V (2). 454.00V

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: 0.86mA 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℃					
		NO. Position ROOM AMBIENT 24.5℃ HIGH AMBIENT Ta: 60.1℃					
		1 LF1 45.9℃ 84.5℃					
		2 C6 48.0℃ 86.8℃					
		3 C5 52.7℃ 91.6℃					
		4 U1 54.5℃ 94.0℃					
		5 T1 53.4℃ 90.9℃					
		6 C105 44.1℃ 83.1℃					
		7 Q100 60.7℃ 97.6℃					
2	OVER LOAD BURN-IN TEST	NO DAMAGE	I/P : 230VAC	TEST : OK			
		1 HOUR (MIN)	O/P : 131.00% LOAD				
			Ta : 25℃				
		3	LOW TEMPERATURE TURN ON TEST		NO DAMAGE	I/P : 264VAC / 100VAC	TEST : OK
					1 HOUR (MIN)	O/P : FULL LOAD	
						Ta : -35.0℃	
					4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	
IN CHAMBER ON	O/P : FULL LOAD						
CONTROL 55℃	Ta : 55℃						
	NO DAMAGE	HUMIDITY= 95.0% RH					
5	TEMPERATURE COEFFICIENT	±0.03% /(0℃~55℃)	I/P : 230VAC	±0.0078% /(0℃~55℃)			
			O/P : FULL LOAD				
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -40℃ ~ +95℃	TEST : OK				
		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	1. Thermal shock Temperature : -40℃ ~ +60℃	TEST : OK				
		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					



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 1210 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