



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

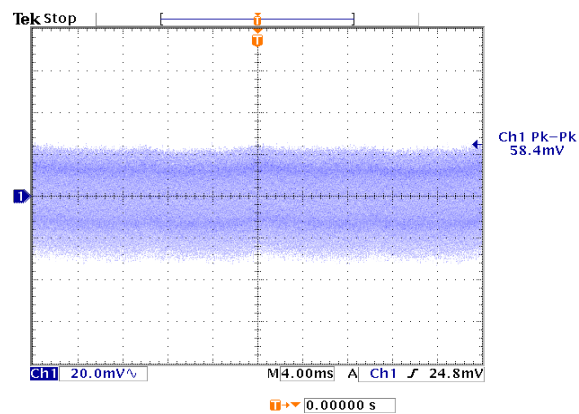
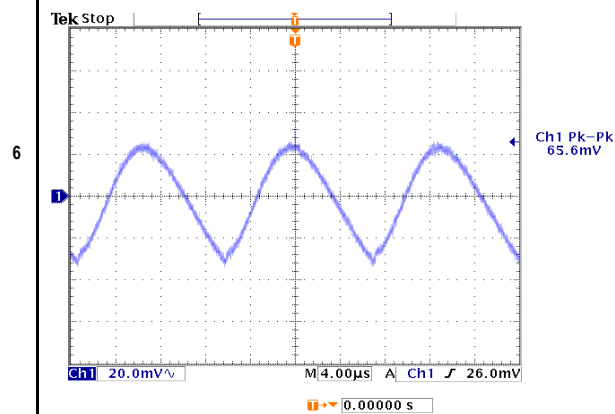
- ENVIRONMENT TEST

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:



SET UP TIME (MAX.)	230VAC	: 1500ms
	115VAC	: 1500ms

I/P :	230VAC	230VAC	: 176ms
I/P :	115VAC	115VAC	: 192ms
O/P:	FULL LOAD		
TA:	25°C		

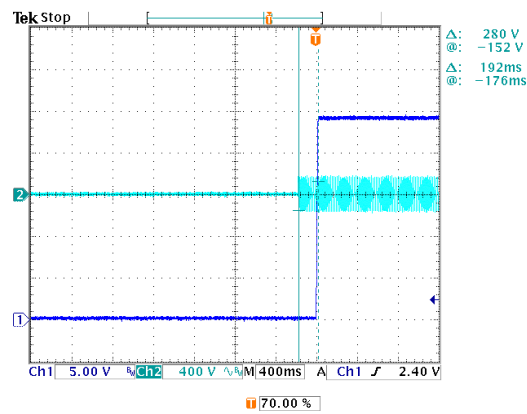
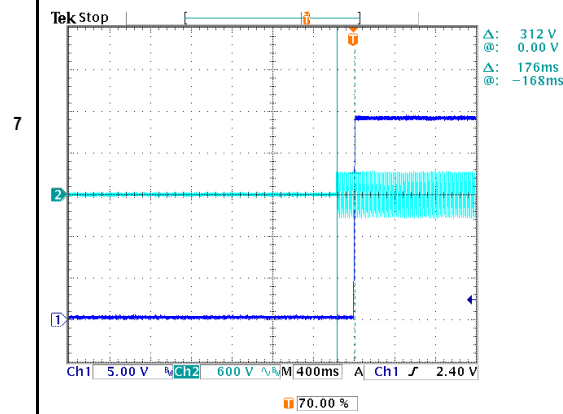
230VAC	: 176ms
115VAC	: 192ms

INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

INPUT=115VAC/60HZ @ FULL LOAD

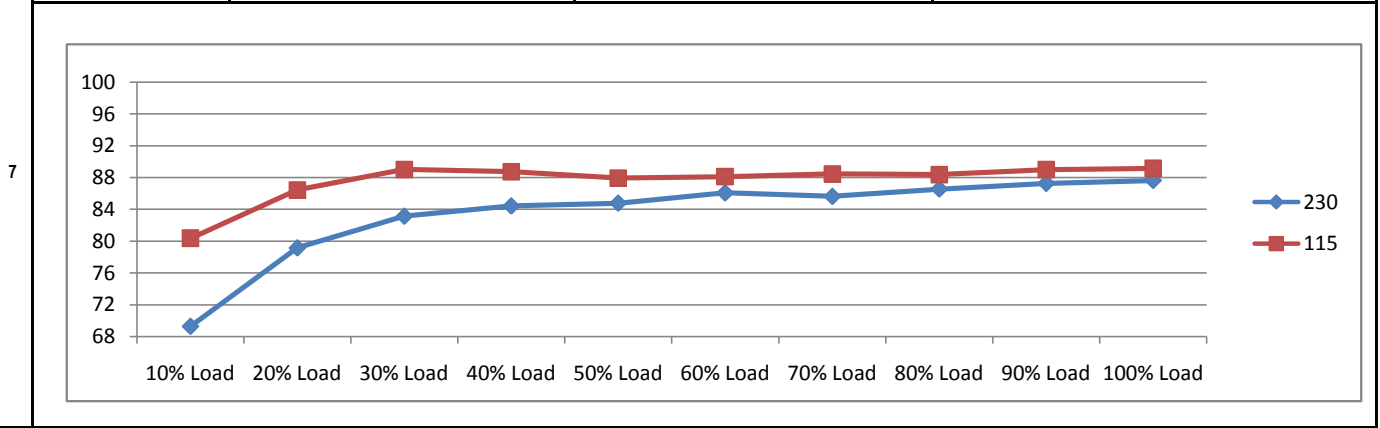
CH1 : Output Voltage CH2 : AC Input Voltage



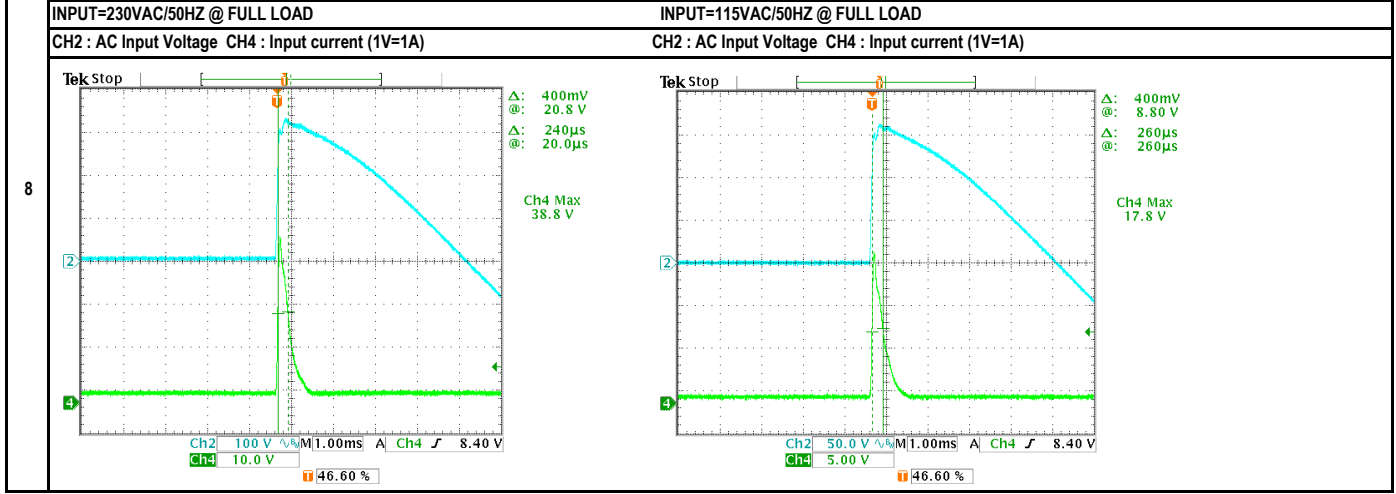
<p>RISE TIME (MAX.)</p>	<p>230VAC : 30ms 115VAC : 30ms</p>	<p>I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA: 25°C</p>	<p>230VAC : 11.4ms 115VAC : 14.4ms</p>
<p>8</p> <p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p> <p>Δ: 3.80 V @: 16.9 V Δ: 11.4ms @: 0.00 s</p> <p>Ch1 5.00 V M10.0ms A Ch1 2.40 V</p>	<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage</p> <p>Δ: 15.2 V @: 2.50 V Δ: 14.4ms @: 0.00 s</p> <p>Ch1 5.00 V M10.0ms A Ch1 2.40 V</p>		
<p>HOLD UP TIME (TYP.)</p>	<p>230VAC : 40ms 115VAC : 10ms</p>	<p>I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA: 25°C</p>	<p>230VAC : 100.0ms 115VAC : 22.0ms</p>
<p>9</p> <p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> <p>Δ: 366 V @: 252 V Δ: 100ms @: -108ms</p> <p>Ch1 5.00 V Ch2 100 V M100ms A Ch1 2.40 V</p>	<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> <p>Δ: 86.0 V @: -82.0 V Δ: 22.0ms @: -30.0ms</p> <p>Ch1 5.00 V Ch2 100 V M100ms A Ch1 2.40 V</p>		
<p>DYNAMIC LOAD</p>	<p>V1 : 2400 mVp-p</p>	<p>I/P : 230VAC O/P: (1)Full/Min load 50% duty/120HZ (2)Full/Min load 50% duty/1KHZ TA: 25°C</p>	<p>V1: (1). 512mv (2). 442mv unit:mVp-p</p>
<p>10</p> <p>FULL / MIN LOAD 50%DUTY / 120HZ</p> <p>Ch1 Pk-Pk 512mV</p> <p>Ch1 100mV M4.00ms A Ch1 182mV</p>	<p>FULL / MIN% LOAD 50%DUTY / 1KHZ</p> <p>Ch1 Pk-Pk 442mV</p> <p>Ch1 100mV M400μs A Ch1 160mV</p> <p>Waveform Intensity: 66%</p>		

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	I/P : 230VAC	I= 0.1712 / 230VAC
		0.6 / 115VAC	I/P : 115VAC O/P : FULL LOAD TA : 25°C	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
	EFFICIENCY (TYP.)	86.5%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	87.63 %



8	INRUSH CURRENT (TYP.)	45A / 230VAC 20A / 115VAC COLD START twidh= 555 us measured at 50% Ipeak	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
		INPUT=230VAC/50HZ @ FULL LOAD	INPUT=115VAC/50HZ @ FULL LOAD	





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°C 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 45.8°C	<table border="1"> <thead> <tr> <th>NO.</th> <th>Positio</th> <th>ROOM AMBIENT 24.5°C</th> <th>HIGH AMBIENT Ta: 45.8°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>50.8°C</td><td>71.7°C</td></tr> <tr><td>2</td><td>C6</td><td>53.2°C</td><td>75.1°C</td></tr> <tr><td>3</td><td>C5</td><td>55.5°C</td><td>76.4°C</td></tr> <tr><td>4</td><td>U1</td><td>71.6°C</td><td>88.2°C</td></tr> <tr><td>5</td><td>T1</td><td>64.9°C</td><td>78.0°C</td></tr> <tr><td>6</td><td>C105</td><td>43.7°C</td><td>65.4°C</td></tr> <tr><td>7</td><td>Q100</td><td>74.7°C</td><td>92.3°C</td></tr> <tr><td>8</td><td>BD1</td><td>54.8°C</td><td>76.7°C</td></tr> <tr><td>9</td><td>C1</td><td>43.8°C</td><td>64.5°C</td></tr> <tr><td>10</td><td>L100</td><td>56.9°C</td><td>77.8°C</td></tr> <tr><td>60</td><td>TA</td><td>24.5°C</td><td>45.8°C</td></tr> </tbody> </table>	NO.	Positio	ROOM AMBIENT 24.5°C	HIGH AMBIENT Ta: 45.8°C	1	LF1	50.8°C	71.7°C	2	C6	53.2°C	75.1°C	3	C5	55.5°C	76.4°C	4	U1	71.6°C	88.2°C	5	T1	64.9°C	78.0°C	6	C105	43.7°C	65.4°C	7	Q100	74.7°C	92.3°C	8	BD1	54.8°C	76.7°C	9	C1	43.8°C	64.5°C	10	L100	56.9°C	77.8°C	60	TA	24.5°C	45.8°C	
NO.	Positio	ROOM AMBIENT 24.5°C	HIGH AMBIENT Ta: 45.8°C																																																	
1	LF1	50.8°C	71.7°C																																																	
2	C6	53.2°C	75.1°C																																																	
3	C5	55.5°C	76.4°C																																																	
4	U1	71.6°C	88.2°C																																																	
5	T1	64.9°C	78.0°C																																																	
6	C105	43.7°C	65.4°C																																																	
7	Q100	74.7°C	92.3°C																																																	
8	BD1	54.8°C	76.7°C																																																	
9	C1	43.8°C	64.5°C																																																	
10	L100	56.9°C	77.8°C																																																	
60	TA	24.5°C	45.8°C																																																	
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230VAC O/P : 131.00% LOAD Ta : 25°C	TEST : OK																																																
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 264VAC / 100VAC O/P : FULL LOAD Ta : -35.0°C	TEST : OK																																																
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 55°C NO DAMAGE	I/P : 272VAC O/P : FULL LOAD Ta : 55°C HUMIDITY= 95.0% RH	TEST : OK																																																
5	TEMPERATURE COEFFICIENT	±0.03% /(0°C~55°C)	I/P : 230VAC O/P : FULL LOAD	±0.0078% /(0°C~55°C)																																																
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -40°C ~ +95°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : STATIC		TEST : OK																																																
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -40°C ~ +60°C 2. Temperature change rate : 25°C / 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		TEST : OK																																																



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