



# TEST REPORT: MFM-05-12

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## 5W 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

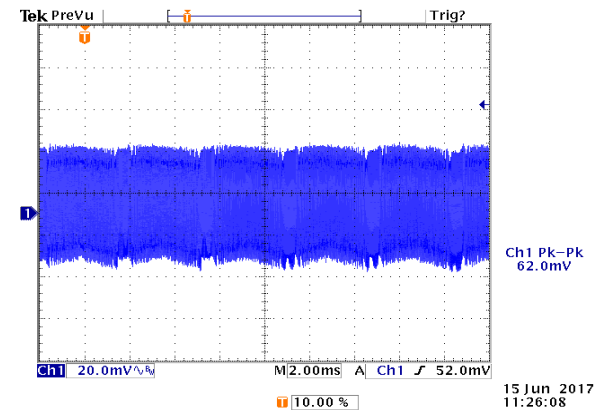
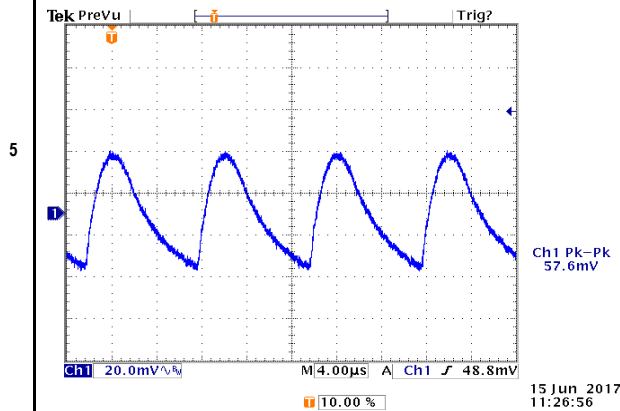


DESIGN VERIFY TEST  
OUTPUT FUNCTION

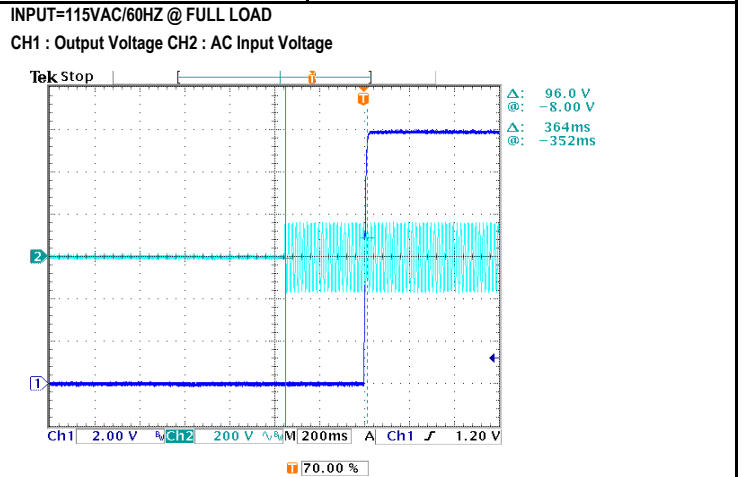
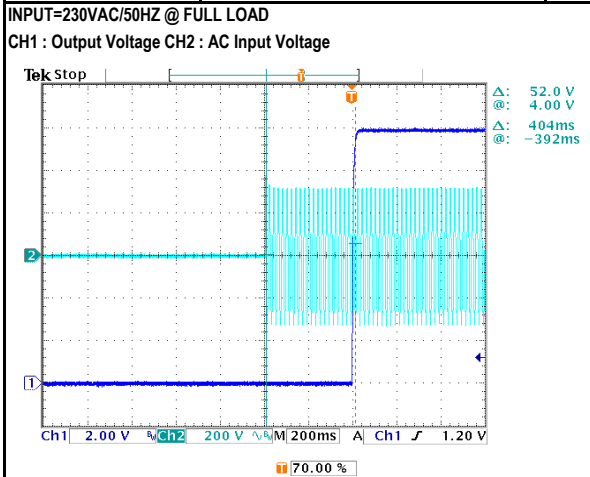
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 2.5% ~ -2.5%	I/P : 100VAC / 264VAC O/P: FULL / MINLOAD TA= 25°C	V1: -0.16% ~ 0.04%
2	LINE REGULATION (MAX.)	V1 : 0.3% ~ -0.3%	I/P : 100VAC / 264VAC O/P: FULL LOAD TA: 25°C	V1: -0.04% ~ 0.04%
3	LOAD REGULATION(MAX.)	V1 : 0.5% ~ -0.5%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA: 25°C	V1: -0.16% ~ 0.00%
4	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA: 25°C	TEST< 4.2 %
	RIPPLE & NOISE(Max)	V1 : 150 mVp-p	I/P : 230VAC O/P: FULL LOAD TA: 25°C	V1 : 62 mVp-p

high frequency:

low frequency:



SET UP TIME (MAX.)	230VAC : 1000ms	I/P : 230VAC	230VAC : 404ms
	115VAC : 1000ms	I/P : 115VAC	115VAC : 364ms
		O/P: FULL LOAD	
		TA: 25°C	



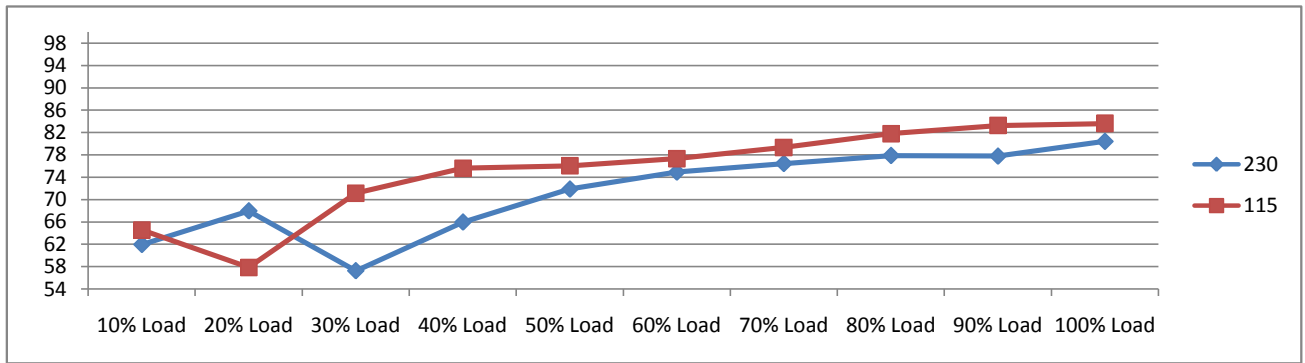


7	RISE TIME (MAX.)	230VAC : 30ms 115VAC : 30ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 10.0ms 115VAC : 10.6ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage	
8	HOLD UP TIME (TYP.)	230VAC : 40ms 115VAC : 12ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 126.0ms 115VAC : 28.0ms
	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 : 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	(1). 632mv (2). 580mv unit:mVp-p
	FULL /MIN LOAD 50%DUTY / 120HZ		FULL /MIN% LOAD 50%DUTY / 1KHZ	
15 Jun 2017 11:30:42		15 Jun 2017 11:28:44		

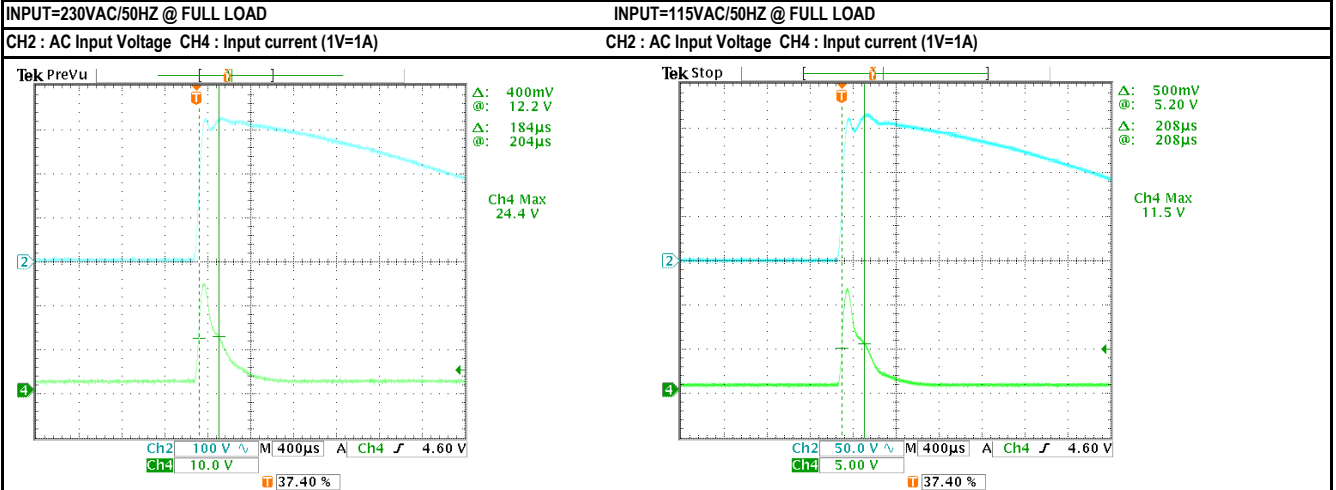


INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC ~ 264VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	50.0VAC ~ 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°C	TEST : OK
3	INPUT CURRENT (TYP.)	0.1A / 230VAC 0.2A / 115VAC	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 0.051A / 230VAC I= 0.084A / 115VAC
4	LEAKAGE CURRENT	< 0.08mA	I/P : 264VAC O/P : MIN LOAD TA : 25°C	0.0272 mA
5	NO LOAD POWER CONSUMPTION	< 0.075W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.051 W
	EFFICIENCY (TYP.)	80.0%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	80.42 %



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°C	I= 24.4A / 230VAC I= 11.5A / 115VAC T50= 204.0us / 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% ~ 180%	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta: 25°C	148.70% 264VAC 144.70% 230VAC 140.40% 100VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	13.80V ~ 16.20V	Ta: 25°C	15.20V 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°C	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)Full load continue Ta : 25°C	VIN: 267VAC VDS: (1). 486.00V (2). 448.00V (3). 486.00V
2	O/P Diode	D100 Rated : 100V 10.0A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue	D100 VDS : (1). 80.40V (2). 68.00V (3). 82.00V
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°C	(1). 400.00V (2). 400.00V (3). 400.00V (4). 398.00V
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°C	U1 (1). 17.10V (2). 17.10V (3). 17.10V (4). 16.80V
5	Clamp Diode	D2 Rated : 1000V 1.0A	I/P : 267VAC O/P : (1)Dynamic Load Full/Min Load (2)Full load continue Ta : 25°C	(1). 462.00V (2). 460.00V

**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°C	I/P-O/P: 0.06mA 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: 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°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	EN55015 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 AIR: 15KV / Contact: 8KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INPUT: 2KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 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-05-12 1. ROOM AMBIENT BURN-IN : 1.0hrs IP: 230VAC      O/P: 100% LOAD      TA= 20.7°C 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC      O/P: 100% LOAD      TA= 60.0°C	<table border="1"> <thead> <tr> <th>NO.</th> <th>Position</th> <th>ROOM AMBIENT 20.7°C</th> <th>HIGH AMBIENT Ta: 60.0°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>C4</td><td>39.0°C</td><td>79.0°C</td></tr> <tr><td>2</td><td>C5</td><td>43.6°C</td><td>81.0°C</td></tr> <tr><td>3</td><td>C37</td><td>38.8°C</td><td>80.4°C</td></tr> <tr><td>4</td><td>R1</td><td>40.0°C</td><td>80.2°C</td></tr> <tr><td>5</td><td>U1</td><td>63.1°C</td><td>90.8°C</td></tr> <tr><td>6</td><td>T1</td><td>48.9°C</td><td>85.1°C</td></tr> <tr><td>7</td><td>C101</td><td>33.0°C</td><td>73.8°C</td></tr> <tr><td>8</td><td>D100</td><td>41.3°C</td><td>78.8°C</td></tr> <tr><td>9</td><td>BD1</td><td>36.9°C</td><td>76.4°C</td></tr> <tr><td>10</td><td>D2</td><td>54.6°C</td><td>90.2°C</td></tr> <tr><td>60</td><td>TA</td><td>20.7°C</td><td>60.0°C</td></tr> </tbody> </table>	NO.	Position	ROOM AMBIENT 20.7°C	HIGH AMBIENT Ta: 60.0°C	1	C4	39.0°C	79.0°C	2	C5	43.6°C	81.0°C	3	C37	38.8°C	80.4°C	4	R1	40.0°C	80.2°C	5	U1	63.1°C	90.8°C	6	T1	48.9°C	85.1°C	7	C101	33.0°C	73.8°C	8	D100	41.3°C	78.8°C	9	BD1	36.9°C	76.4°C	10	D2	54.6°C	90.2°C	60	TA	20.7°C	60.0°C	
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230VAC O/P : 130.00% 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 : -45.0°C	TEST : OK																																																
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60°C NO DAMAGE	I/P : 272VAC O/P : FULL LOAD Ta : 60°C HUMIDITY= 95.0% RH	TEST : OK																																																
5	TEMPERATURE COEFFICIENT	±0.03% / (0°C~60°C)	I/P : 230VAC O/P : FULL LOAD	±0.0013% / (0°C~60°C)																																																
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -45°C ~ +90°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 : -45°C ~ +65°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																																																



5W High Reliable Green Medical On Board Type MFM-05 series

9	CAPACITOR LIFE CYCLE	:SUPPOSE C101 IS THE MOST CRITICAL COMPONENT					
		(1) I/P : 230VAC	O/P : FULL LOAD	Ta= 25.0°C	LIFE TIME	(1).	942969.6 HRS
		(2) I/P : 230VAC	O/P : FULL LOAD	Ta= 60.0°C	LIFE TIME	(2).	75081.6 HRS
		(3) I/P : 230VAC	O/P : 75% LOAD	Ta= 60.0°C	LIFE TIME	(3).	81643.2 HRS
		(4) I/P : 230VAC	O/P : 50% LOAD	Ta= 60.0°C	LIFE TIME	(4).	138585.5 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 9337.3K hrs min. Telcordia SR-332 (Bellcore) ; 1799.5K hrs min. MIL-HDBK-217F (25°C)					
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): Above 30000HRS @ TA				60°C	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ