



TEST REPORT: MFM-20-3.3

20W 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

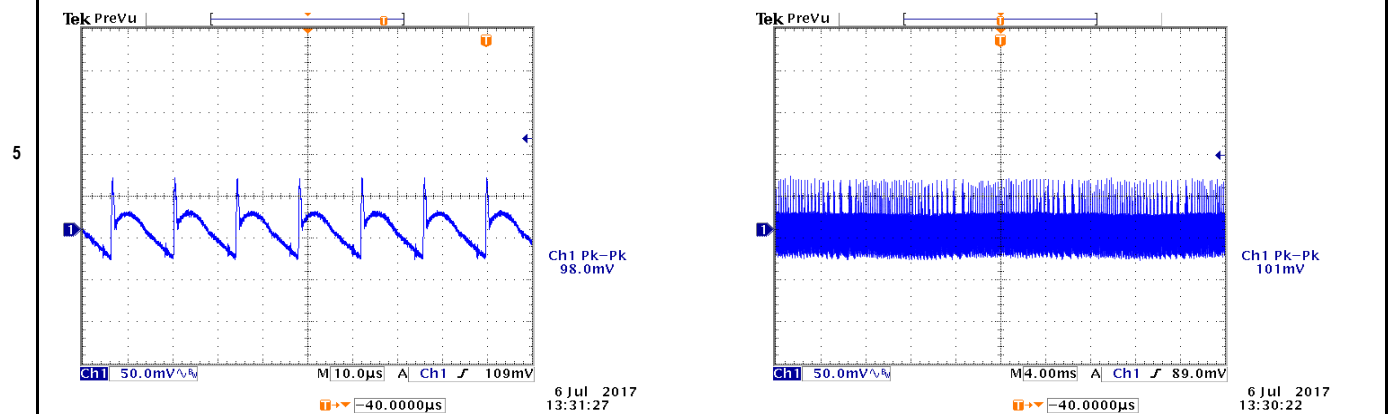
ENVIRONMENT TEST

DESIGN VERIFY TEST OUTPUT FUNCTION

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 2.0% ~ -2.0%	I/P : 80VAC / 264VAC O/P: FULL / MINLOAD TA= 25°C	V1: 0.61% ~ -0.30%
2	LINE REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 80VAC / 264VAC O/P: FULL LOAD TA : 25°C	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°C	V1: 0.00% ~ -0.30%
4	OVER/UNDERSHOOT TEST	< ±15%	I/P : 230VAC O/P: FULL LOAD TA : 25°C	TEST< 7.4 %
	RIPPLE & NOISE(Max)	V1 : 150 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25°C	V1 : 101 mVp-p

high frequency:

low frequency:



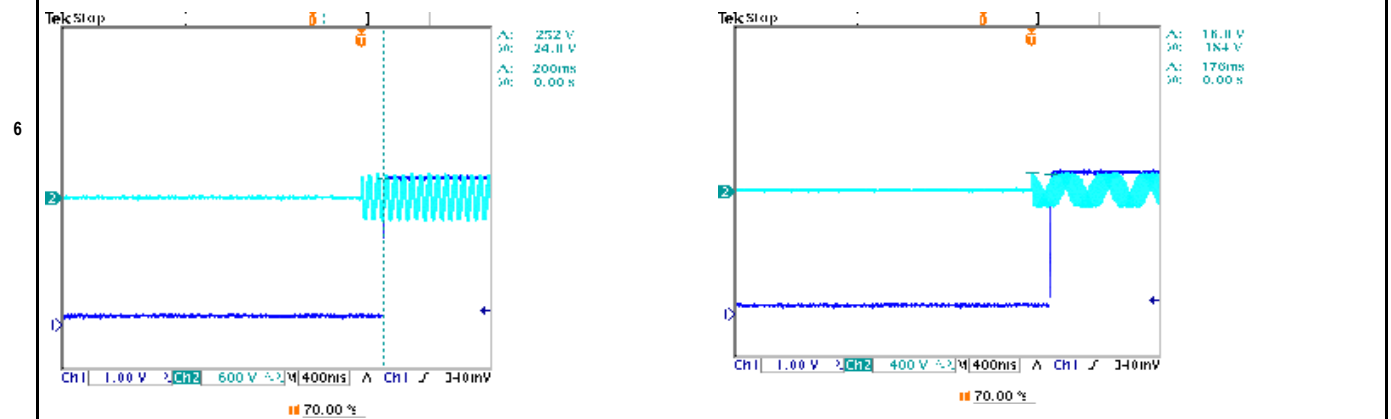
SET UP TIME (MAX.)	230VAC : 1500ms 115VAC : 1500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 200ms 115VAC : 176ms
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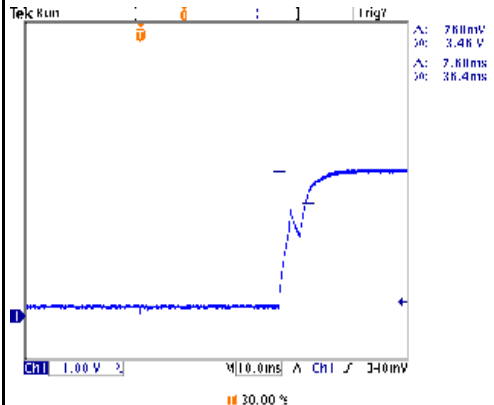
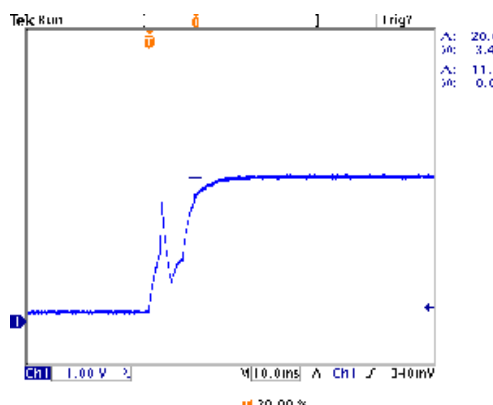
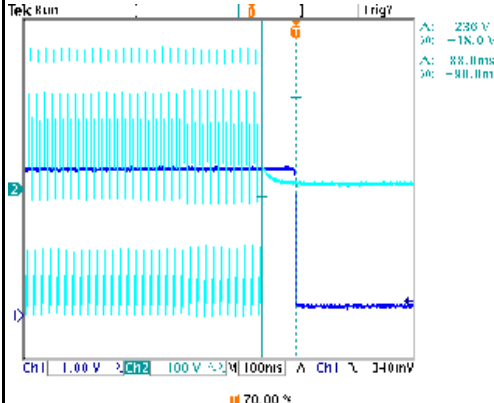
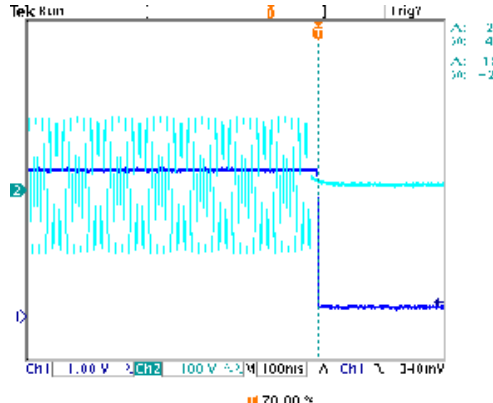
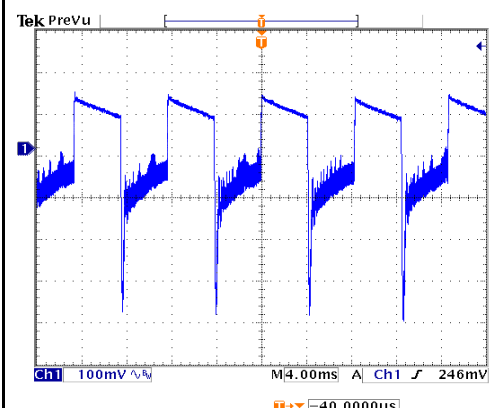
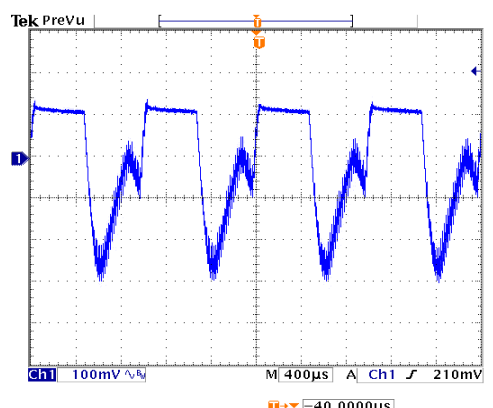
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

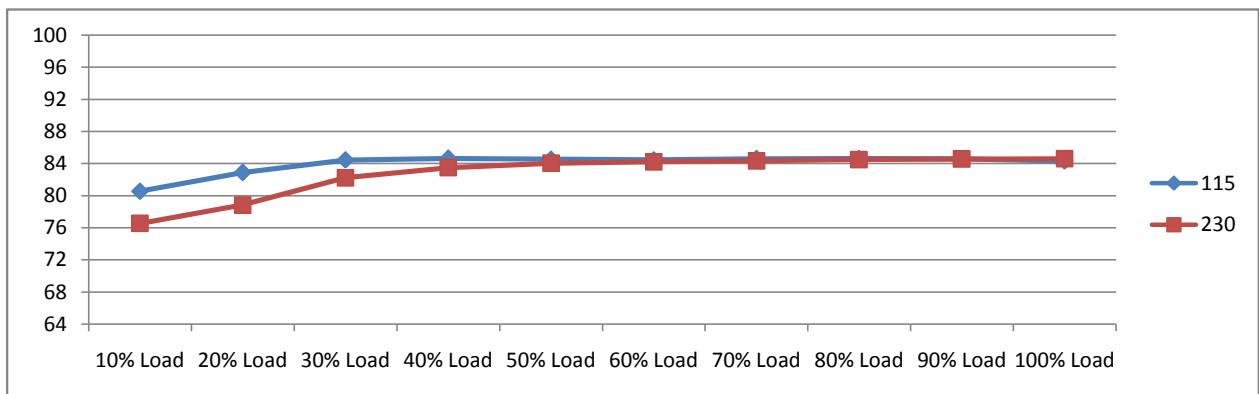


7	RISE TIME (MAX.)	230VAC : 30ms 115VAC : 30ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 7.6ms 115VAC : 11.2ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage	
				
8	HOLD UP TIME (TYP.)	230VAC : 40ms 115VAC : 10ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 88.0ms 115VAC : 18.0ms
	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 : 990 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). 550mv (2). 440mv unit:mVp-p
	FULL /MIN LOAD 50%DUTY / 120HZ		FULL /MIN% LOAD 50%DUTY / 1KHZ	
				
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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	75.0VAC ~ 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.)	0.5 / 230VAC 0.75 / 115VAC	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 0.147 / 230VAC I= 0.239 / 115VAC
4	LEAKAGE CURRENT	< 80.00μA	I/P : 264VAC O/P : MIN LOAD TA : 25°C	Touch current 50.4 μA
5	NO LOAD POWER CONSUMPTION	< 0.1W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.067 W
	EFFICIENCY (TYP.)	81.0%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	83.13 %

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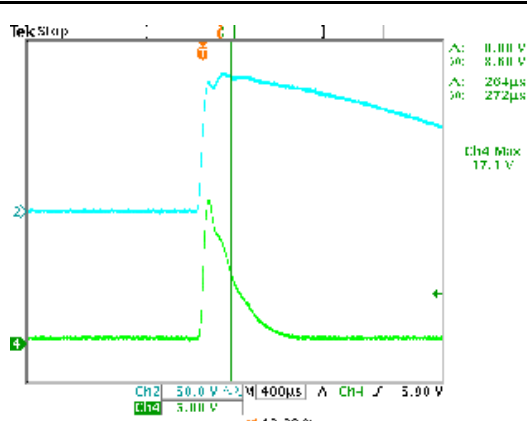
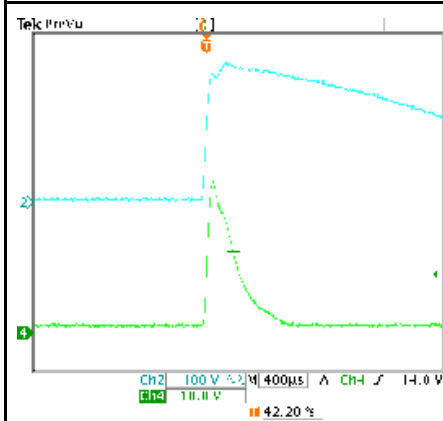


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INRUSH CURRENT (TYP.)	45A / 230VAC 20A / 115VAC twidth= 555 us measured at 50% Ipeak COLD START	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 36.2A / 230VAC I= 17.1A / 115VAC T50= 256.0us / 230VAC
	INPUT=230VAC/50HZ @ FULL LOAD	INPUT=115VAC/50HZ @ 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	129.55% 264VAC 124.44% 230VAC 118.80% 100VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	3.80V ~ 5.00V	I/P: 80VAC/230VAC/264VAC O/P: MIN LOAD Ta: 25°C	4.40V 264VAC 4.40V 230VAC 4.40V 80VAC Shut off o/p voltage
3	OVER TEMPERATURE PROTECTION	Shut down o/p voltage, recovers automatically after temperature goes down	I/P: 264VAC I/P: 80VAC O/P: FULL LOAD	O.T.P. Active Shut down o/p voltage, recovers automatically after temperature goes down
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 OK 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). 470.00V (2). 450.00V (3). 46.00V
2	O/P MOSFET	Q100 Rated : 60V 84.0A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	Q100 VDS : (1). 24.20V (2). 23.20V (3). 25.00V
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). 352.00V (2). 356.00V (3). 352.00V (4). 346.00V
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). 22.60V 12.10V (2). 15.80V 5.90V (3). 22.80V 12.60V (4). 16.00V 7.70V
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). 408.00V (2). 414.00V

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: 0.89mA 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



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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-20-5						
			1. ROOM AMBIENT BURN-IN : 1.0hrs						
			IP: 230VAC O/P: 100% LOAD TA= 23.1°C						
			2. HIGH AMBIENT BURN-IN : 1.0hrs						
			IP: 230VAC O/P: 100% LOAD TA= 50.6°C						
			NO.	Positio	ROOM AMBIENT 23.1°C	HIGH AMBIENT Ta: 50.6°C			
			1	LF1	54.1°C	80.4°C			
			2	C6	65.5°C	81.8°C			
			3	C5	62.8°C	85.5°C			
			4	U1	99.5°C	120.6°C			
			5	T1	77.8°C	102.2°C			
			6	C105	55.9°C	79.5°C			
			7	Q100	75.0°C	107.2°C			
2	OVER LOAD BURN-IN TEST		NO DAMAGE	I/P : 230VAC	TEST : OK				
			1 HOUR (MIN)	O/P : 130.00% LOAD					
				Ta : 25°C					
			3	LOW TEMPERATURE TURN ON TEST			NO DAMAGE	I/P : 264VAC / 100VAC	TEST : OK
							1 HOUR (MIN)	O/P : FULL LOAD	
								Ta : -35.0°C	
							4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	
O/P : FULL LOAD									
Ta : 45°C									
HUMIDITY= 95.0% RH									
5	TEMPERATURE COEFFICIENT		±0.03% /(0°C~50°C)	I/P : 230VAC	±0.0072% /(0°C~50°C)				
				O/P : FULL LOAD					
6	STORAGE TEMPERATURE TEST		1. Thermal shock Temperature : -45°C ~ +90°C		TEST : OK				
			2. Temperature change rate : 25°C / MIN						
7	THERMAL SHOCK TEST		3. Dwell time low and high temperature : 30 MIN/EACH		TEST : OK				
			4. Total test cycle : 10 CYCLE						
8	VIBRATION TEST		5. Input/Output condition : STATIC		TEST : OK				
			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						



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9	CAPACITOR LIFE CYCLE	MFM-20-5 :SUPPOSE C105 IS THE MOST CRITICAL COMPONENT						
		(1) I/P : 230VAC	O/P : FULL LOAD	Ta= 25.0℃	LIFE TIME	(1).	295541.6	HRS
		(2) I/P : 230VAC	O/P : FULL LOAD	Ta= 45.0℃	LIFE TIME	(2).	96794.1	HRS
		(3) I/P : 230VAC	O/P : 75% LOAD	Ta= 45.0℃	LIFE TIME	(3).	171874.2	HRS
		(4) I/P : 230VAC	O/P : 50% LOAD	Ta= 45.0℃	LIFE TIME	(4).	268856.8	HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1210K hrs min. MIL-HDBK-217F (25℃)						
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): Above 30000HRS @ TA 45℃						

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ