



TEST REPORT: MFM-15-3.3

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

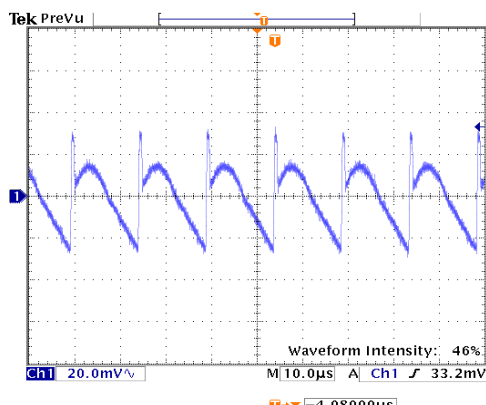
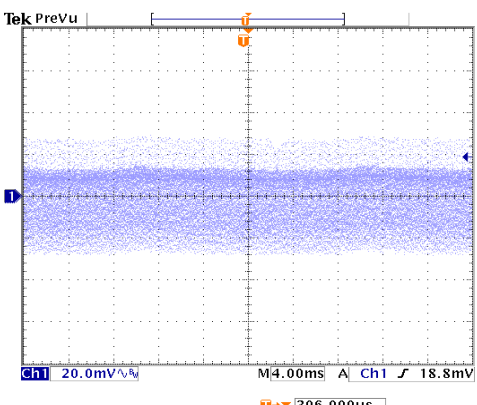
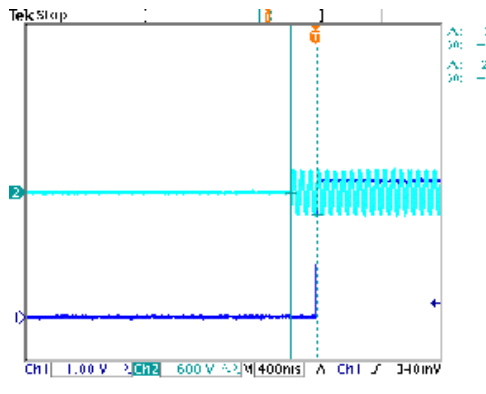
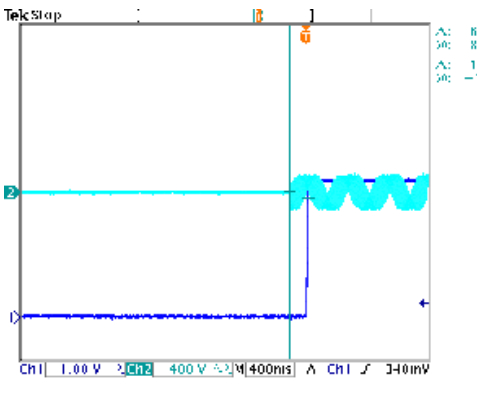
Safety Test

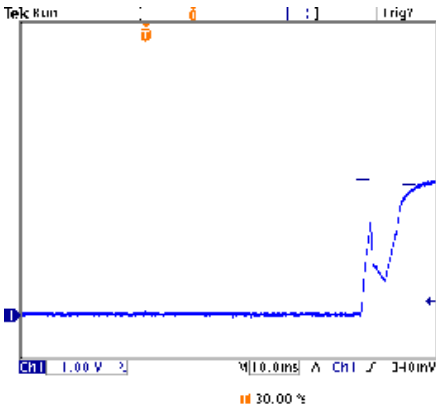
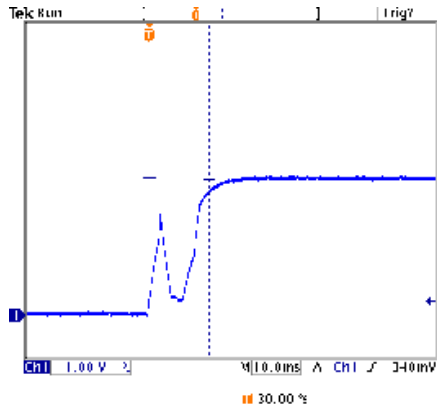
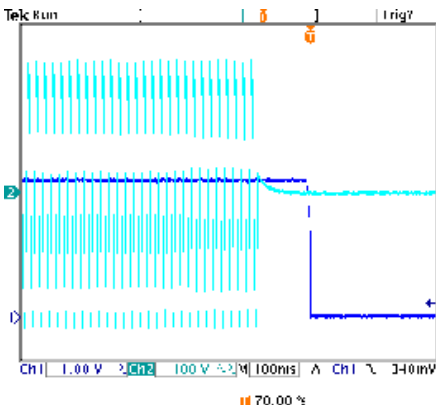
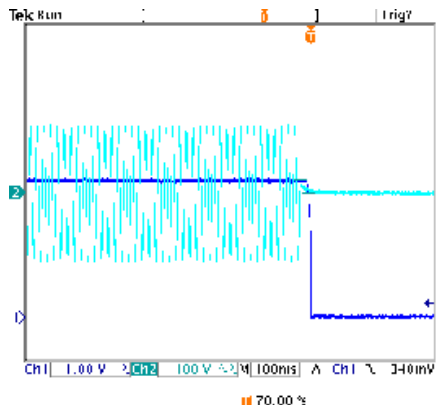
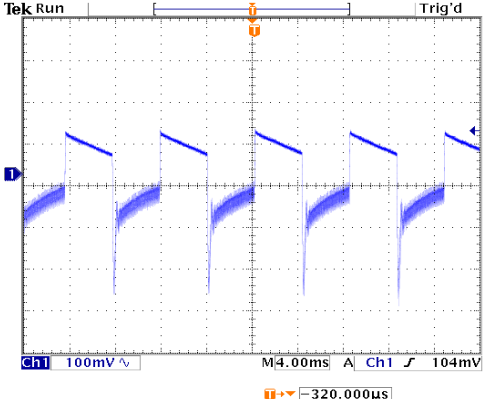
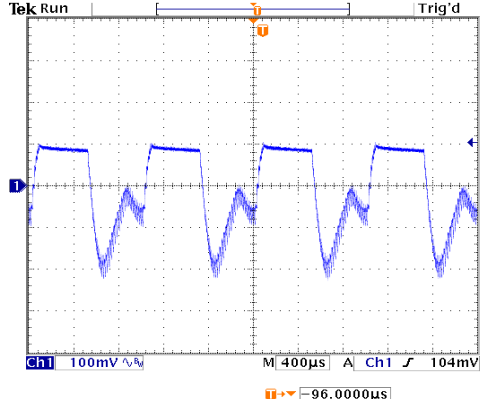
E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

DESIGN VERIFY TEST OUTPUT FUNCTION

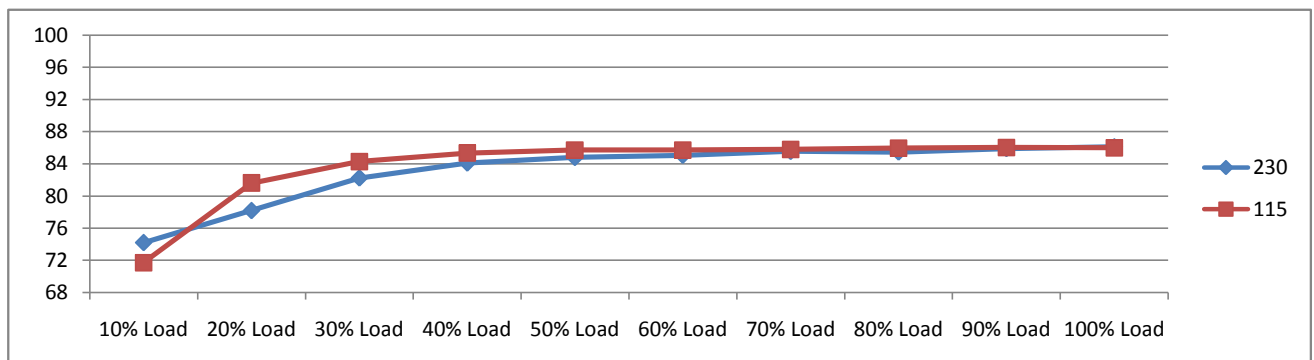
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 2.0% ~ -2.0%	I/P : 80VAC / 264VAC O/P: FULL / MINLOAD TA= 25°C	V1: 0.30% ~ -0.30%
2	LINE REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 80VAC / 264VAC O/P: FULL LOAD TA : 25°C	V1: 0.00% ~ 0.00%
3	LOAD REGULATION(MAX.)	V1 : 0.5% ~ -0.5%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25°C	V1: 0.30% ~ -0.30%
4	OVER/UNDERSHOOT TEST	< ±15%	I/P : 230VAC O/P: FULL LOAD TA : 25°C	TEST< 3.0 %
5	RIPPLE & NOISE(Max)	V1 : 150 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25°C	V1 : 62.4 mVp-p
		high frequency:		low frequency:
				
6	SET UP TIME (MAX.)	230VAC : 1500ms 115VAC : 1500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 256ms 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 : 11.2ms 115VAC : 14.6ms
7	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage 
	HOLD UP TIME (TYP.)		230VAC : 120.0ms 115VAC : 20.0ms
8	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 
	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 V1: (1). 404mv (2). 326mv unit:mVp-p
9	FULL /MIN LOAD 50%DUTY / 120HZ 		FULL /MIN% LOAD 50%DUTY / 1KHZ 
	320.000μs		96.0000μs

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 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)	75.0VAC ~ 264VAC 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= 0.1377 / 230VAC I= 0.2164 / 115VAC
4	LEAKAGE CURRENT	< 80.00μA	I/P : 264VAC O/P : MIN LOAD TA : 25°C	Touch current 49.5 μA
5	NO LOAD POWER CONSUMPTION	< 0.1W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.0612 W
	EFFICIENCY (TYP.)	83.5%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	86.12 %

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INRUSH CURRENT (TYP.)

45A / 230VAC
20A / 115VAC
width= 555 us measured at 50% Ipeak
COLD START

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

I= 39.2A / 230VAC
I= 18.0A / 115VAC
T50= 260.0us / 230VAC

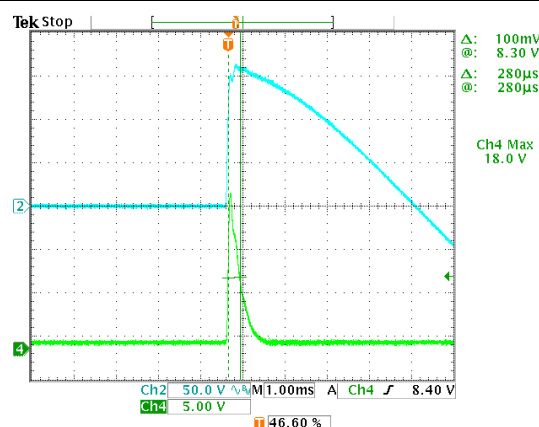
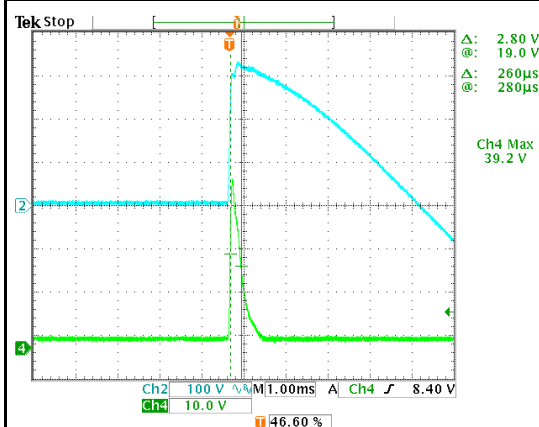
INPUT=230VAC/50HZ @ FULL LOAD

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	133.49% 264VAC 129.03% 230VAC 122.09% 100VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	3.80V ~ 5.00V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD Ta : 25°C	4.40V 264VAC 4.40V 230VAC 4.40V 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 0.0A	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). 520.00V (2). 490.00V (3). 518.00V
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). 28.40V (2). 25.60V (3). 28.40V
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). 384.00V (2). 382.00V (3). 382.00V (4). 380.00V
4	Control IC	U1 Rated : 24V (max) 10.5 (min) U100 Rated : 27 -0.3	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 U100 (1). 21.20V 9.92V (2). 16.10V 3.84V (3). 19.90V 10.00V (4). 17.20V 6.52V
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). 432.00V (2). 432.00V

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

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-15-5			
		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			
		NO.	Position	ROOM AMBIENT 24.5°C	HIGH AMBIENT Ta: 45.8°C
		1	LF1	56.5°C	74.2°C
		2	C6	67.8°C	86.0°C
		3	C5	69.1°C	88.1°C
		4	U1	97.7°C	116.1°C
		5	T1	77.8°C	95.5°C
		6	C105	56.8°C	76.3°C
		7	Q100	74.9°C	93.8°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE		TEST : OK	
		1 HOUR (MIN)			
		I/P : 230VAC			
		O/P : 130.00% LOAD			
		Ta : 25°C			
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE		TEST : OK	
		1 HOUR (MIN)			
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	I/P : 264VAC / 100VAC		TEST : OK	
		O/P : FULL LOAD			
5	TEMPERATURE COEFFICIENT	I/P : 230VAC		±0.0094% /(0°C~55°C)	
		O/P : FULL LOAD			
6	STORAGE TEMPERATURE TEST	I/P : 272VAC		TEST : OK	
		O/P : FULL LOAD			
7	THERMAL SHOCK TEST	Ta : 50°C		TEST : OK	
		HUMIDITY= 95.0% RH			
8		±0.03% /(0°C~55°C)			
9		I/P : 230VAC			
		O/P : FULL LOAD			
10		1. Thermal shock Temperature : -40°C ~ +95°C		TEST : OK	
		2. Temperature change rate : 25°C / MIN			
11		3. Dwell time low and high temperature : 30 MIN/EACH			
		4. Total test cycle : 10 CYCLE			
12		5. Input/Output condition : STATIC			
13		1. Thermal shock Temperature : -40°C ~ +55°C		TEST : OK	
		2. Temperature change rate : 25°C / MIN			
14		3. Dwell time low and high temperature : 30 MIN/EACH			
		4. Total test cycle : 16 CYCLE			
15		5. Input/Output condition :			
		230VAC Full Load AC ON/OFF test turn on 3sec ; turn off 1sec @ 15CYCLE			
16		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= 50.0°C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50.0°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 50.0°C LIFE TIME	(1). 311646.7 HRS (2). 62375 HRS (3). 122749.4 HRS (4). 158279.6 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 50°C	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ