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

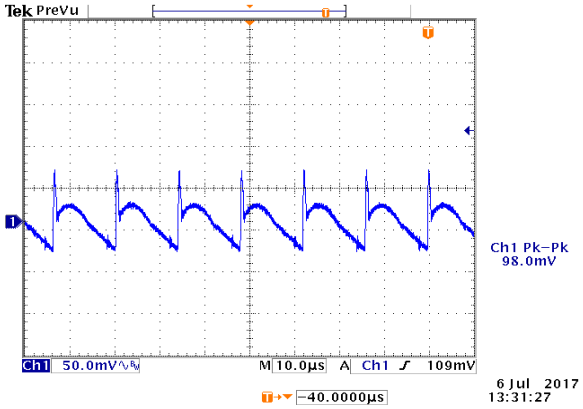
- Safety Test
- E.M.C. Test

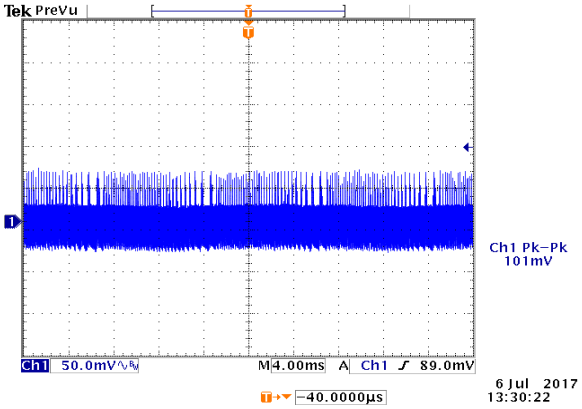
■ RELIABILITY TEST

- ENVIRONMENT TEST

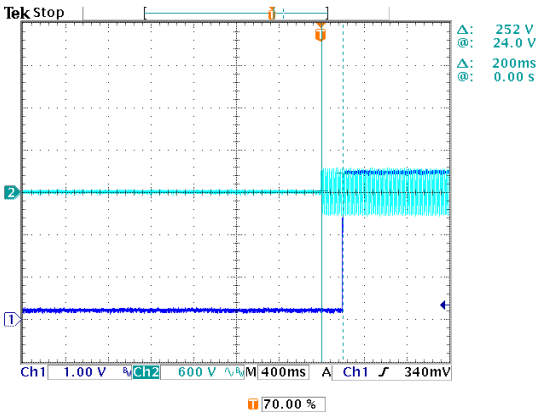
■ DESIGN VERIFY TEST
OUTPUT FUNCTION

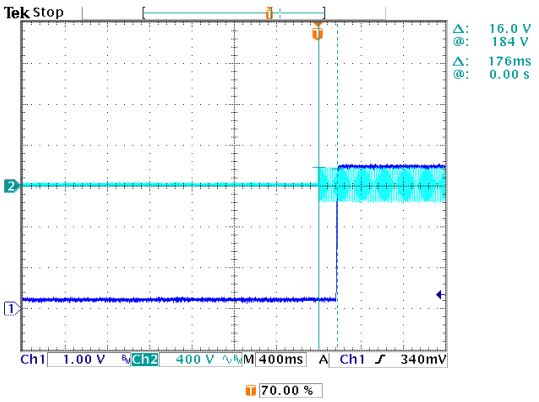
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 2.0% ~ -2.0%	I/P : 80VAC / 264VAC O/P: FULL / MINLOAD TA= 25℃	V1: 0.61% ~ -0.30%
2	LINE REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 80VAC / 264VAC O/P: FULL LOAD TA : 25℃	V1: 0.00% ~ 0.00%
3	LOAD REGULATION(MAX.)	V1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





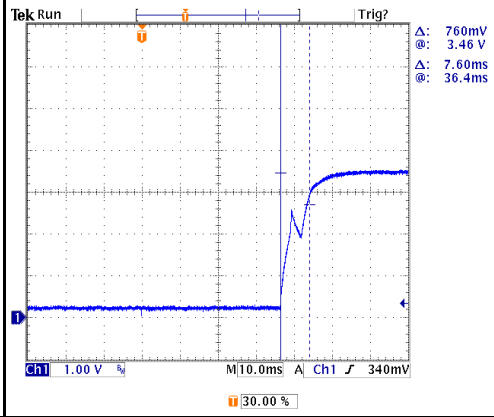
6	SET UP TIME (MAX.)	230VAC : 1500ms 115VAC : 1500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 200ms 115VAC : 176ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	



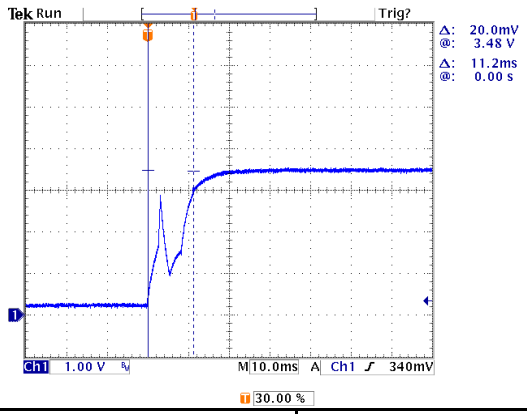


7	RISE TIME (MAX.)	230VAC : 30ms 115VAC : 30ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 7.6ms 115VAC : 11.2ms	

INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage

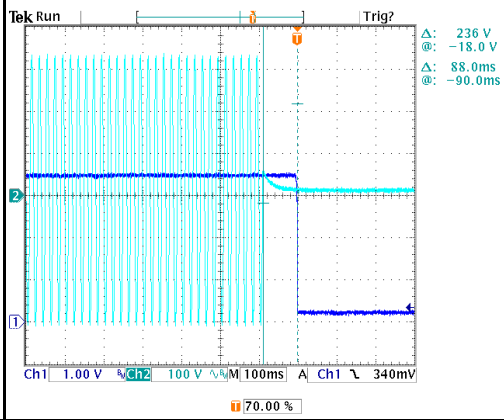


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage

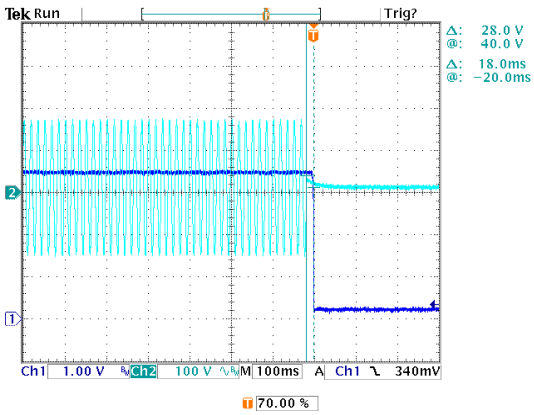


8	HOLD UP TIME (TYP.)	230VAC : 40ms 115VAC : 10ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 88.0ms 115VAC : 18.0ms	

INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

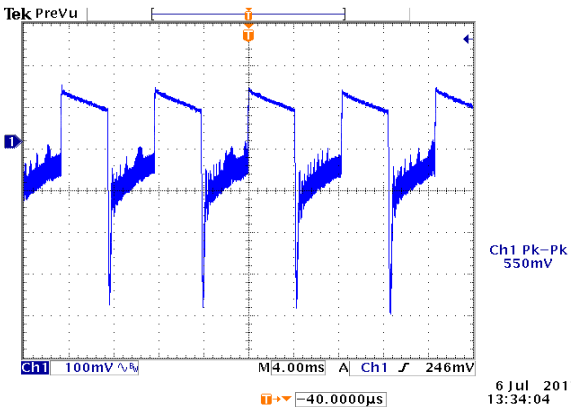


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

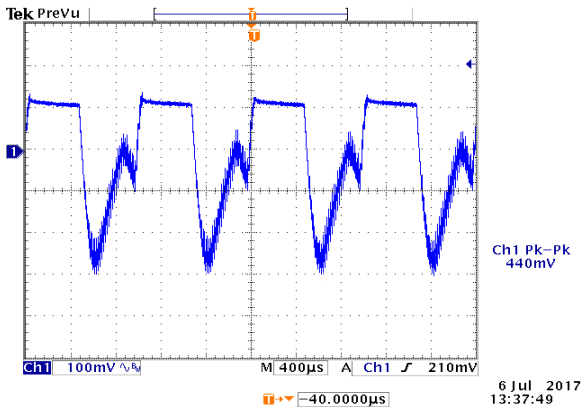


9	DYNAMIC LOAD	V1 : 990 mVp-p	I/P : 230VAC O/P: (1)Full/Min load 50%duty/120HZ (2)Full/Min load 50%duty/1KHZ TA : 25℃	(1). (2). unit:mVp-p V1: 550mv 440mv	

FULL /MIN LOAD 50%DUTY / 120HZ

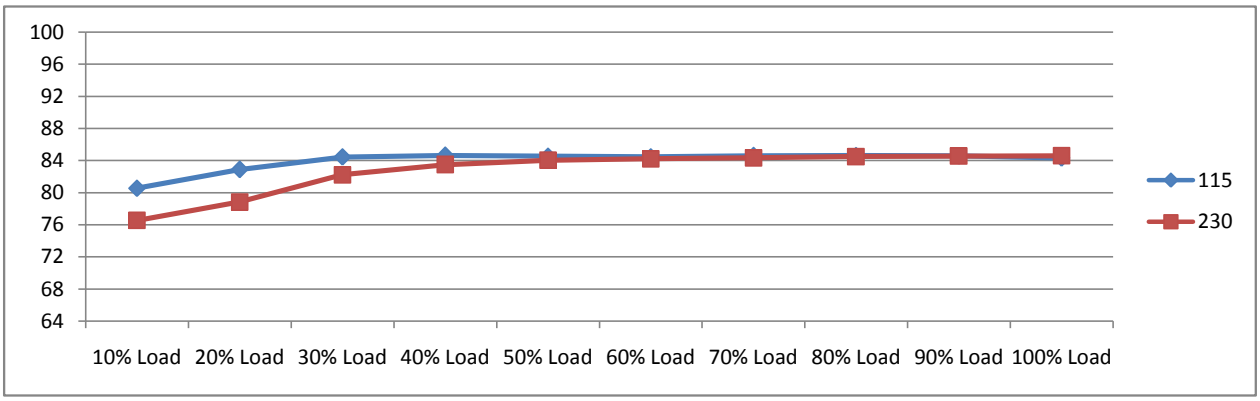


FULL /MIN% LOAD 50%DUTY / 1KHZ



INPUT FUNCTION TEST

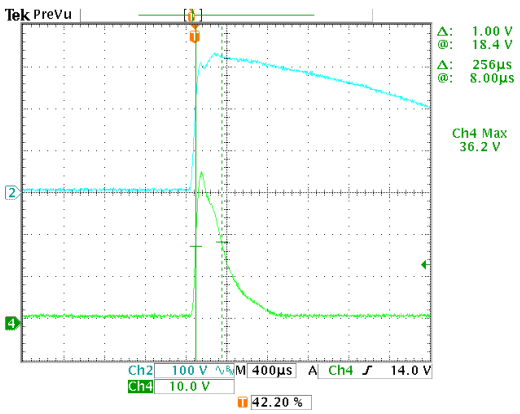
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC ~ 264VAC	I/P : TESTING O/P : FULL LOAD Ta : 25℃	75.0VAC ~ 264VAC
			I/P : LOW-LINE = 97VAC HIGH-LINE = 300VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~ 440HZ NO DAMAGE	I/P : 80VAC ~ 264VAC O/P : FULL~MIN LOAD Ta : 25℃	TEST : OK
3	INPUT CURRENT (TYP.)	0.5 / 230VAC 0.75 / 115VAC	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	I= 0.147 / 230VAC I= 0.239 / 115VAC
4	LEAKAGE CURRENT	< 80.00μA	I/P : 264VAC O/P: MIN LOAD TA : 25℃	Touch current 50.4 μA
5	NO LOAD POWER CONSUMPTION	< 0.1W	I/P : 230VAC O/P: MIN LOAD TA : 25℃	< 0.067 W
7	EFFICIENCY (TYP.)	81.0%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	83.13 %



8	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℃	I= 36.2A / 230VAC I= 17.1A / 115VAC T50= 256.0us / 230VAC

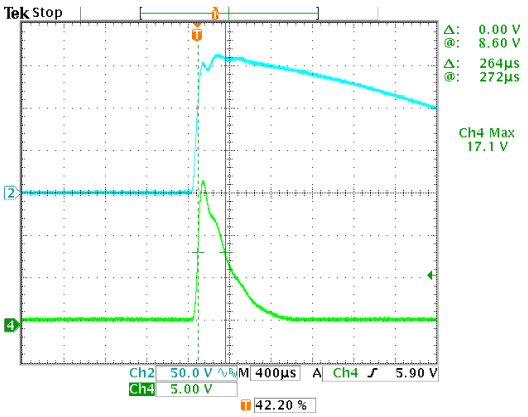
INPUT=230VAC/50HZ @ FULL LOAD

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



INPUT=115VAC/50HZ @ FULL LOAD

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



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℃	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℃	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℃	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)Fulll load continue Ta： 25℃	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)Fulll load continue Ta： 25℃	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℃	(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℃	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)Fulll load continue Ta： 25℃	(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℃	I/P-O/P: 0.89mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P： 500VDC>100MΩ	I/P-O/P: 500VDC Ta： 25℃/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℃	PASS

2	CONDUCTION	EN55011 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD / 50% LOAD Ta : 25℃	PASS Test by certified Lab
3	RADIATION	EN55011 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	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℃	CRITERIA A
5	E.F.T	EN61000-4-4 MEDICAL INPUT：2KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
6	SURGE	EN61000-4-5 MEDICAL L-N:1KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25℃	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℃ 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 50.6℃		
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230VAC O/P : 130.00% LOAD Ta : 25℃	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 264VAC / 100VAC O/P : FULL LOAD Ta : -35.0℃	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45℃ NO DAMAGE	I/P : 272VAC O/P : FULL LOAD Ta : 45℃ HUMIDITY= 95.0% RH	TEST : OK
5	TEMPERATURE COEFFICIENT	±0.03% /(0℃~50℃)	I/P : 230VAC O/P : FULL LOAD	±0.0072% /(0℃~50℃)
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -45℃~ +90℃ 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		TEST : OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -40℃ ~ +50℃ 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		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℃		TEST : OK

NO.	Position	ROOM AMBIENT 23.1℃	HIGH AMBIENT Ta: 50.6℃
1	LF1	54.1℃	80.4℃
2	C6	65.5℃	81.8℃
3	C5	62.8℃	85.5℃
4	U1	99.5℃	120.6℃
5	T1	77.8℃	102.2℃
6	C105	55.9℃	79.5℃
7	Q100	75.0℃	107.2℃
8	BD1	64.6℃	107.2℃
9	C1	51.7℃	77.0℃
10	L100	68.7℃	96.3℃
60	TA	23.1℃	50.6℃

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