TEST REPORT: MFM-30-15

30W 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

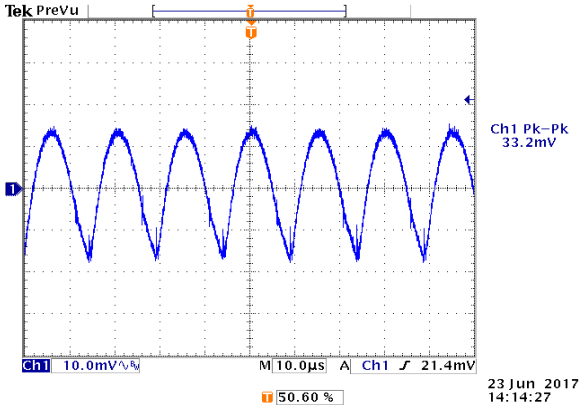
■ RELIABILITY TEST

- ENVIRONMENT TEST

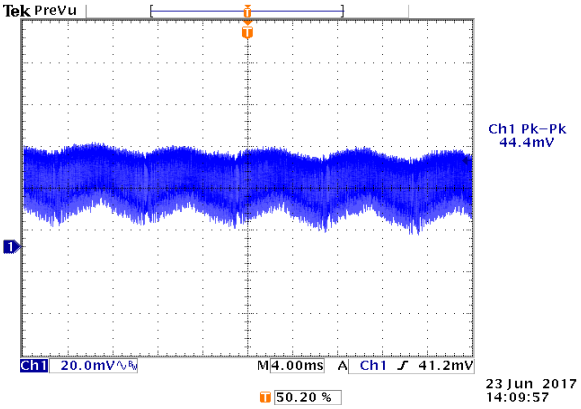
DESIGN VERIFY TEST
OUTPUT FUNCTION

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: -0.13% ~ -0.20%
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: 0.07% ~ -0.07%
4	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	TEST< 2.7 %
5	RIPPLE & NOISE(Max)	V1 : 120 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25℃	V1 : 44.4 mVp-p

high frequency:

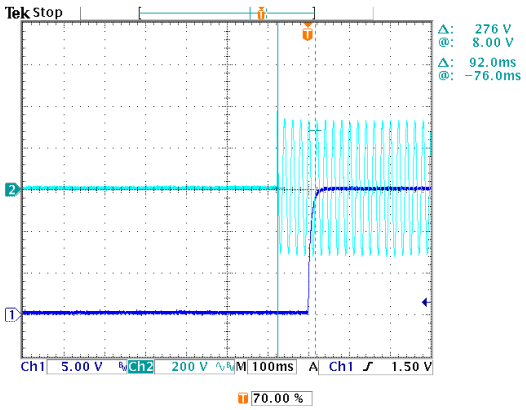


low frequency:

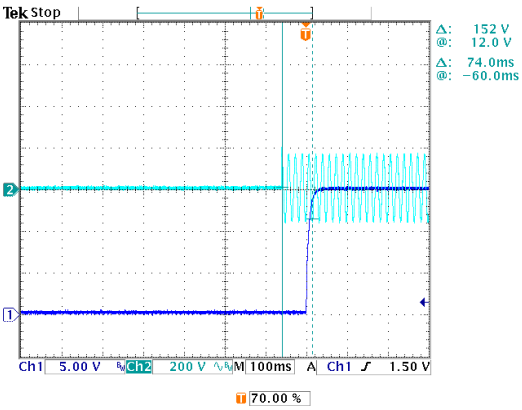


NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
6	SET UP TIME (MAX.)	230VAC : 500ms 115VAC : 500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 92ms 115VAC : 74ms

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

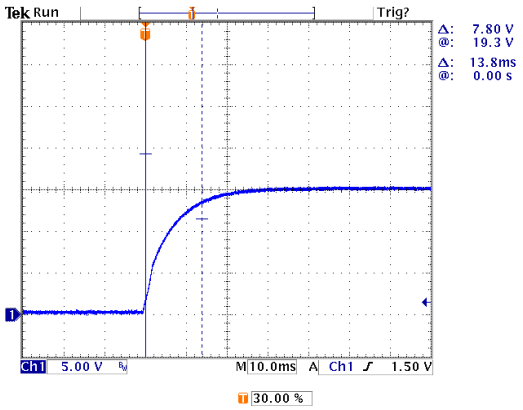


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

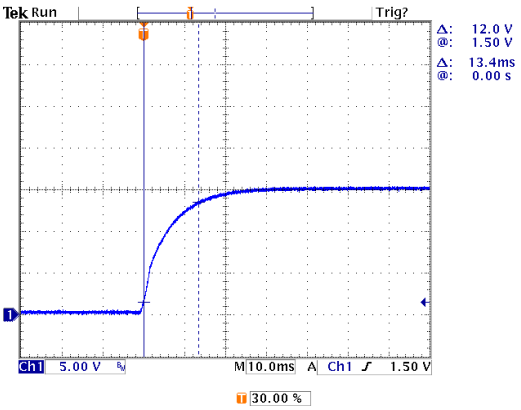


7	RISE TIME (MAX.)	230VAC : 30ms 115VAC : 30ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 13.8ms 115VAC : 13.4ms

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

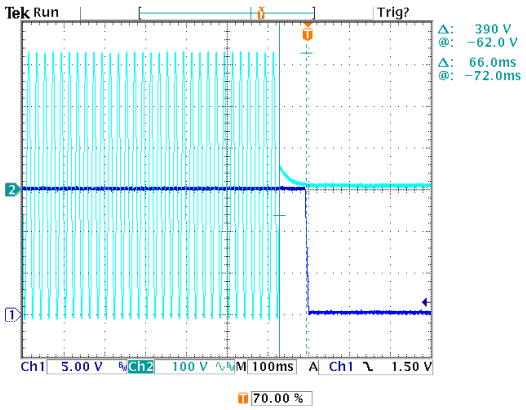


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage

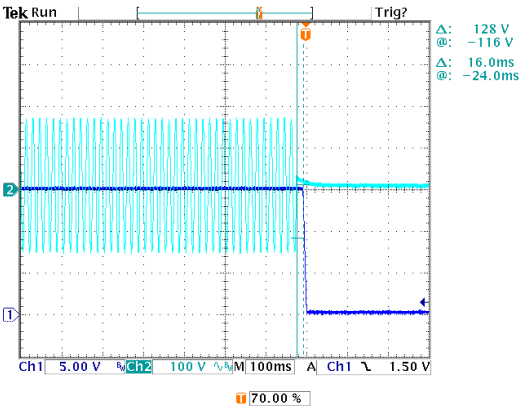


8	HOLD UP TIME (TYP.)	230VAC : 40ms 115VAC : 12ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 66.0ms 115VAC : 16.0ms

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

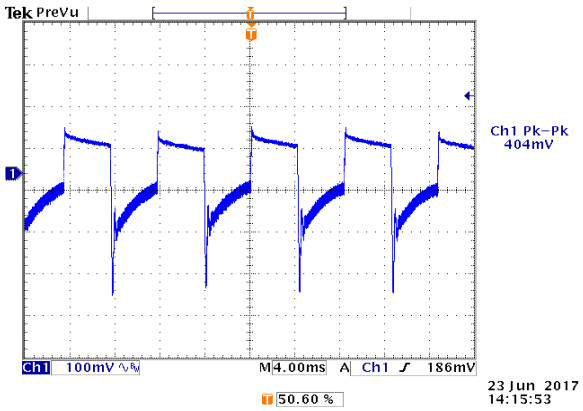


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

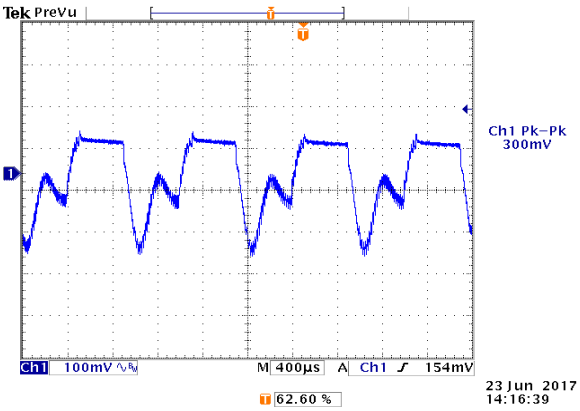


9	DYNAMIC LOAD	V1 : 1500 mVp-p	I/P : 230VAC O/P: (1)Full/Min load 50%duty/120HZ (2)Full/Min load 50%duty/1KHZ TA : 25℃	(1). (2). unit:mVp-p V1: 404mv 300mv

FULL /MIN LOAD 50%DUTY / 120HZ

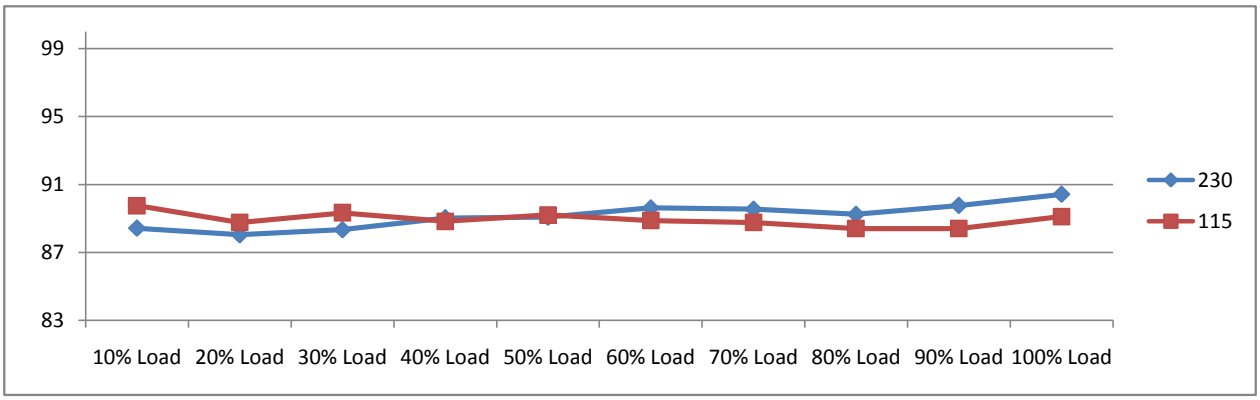


FULL /MIN% LOAD 50%DUTY / 1KHZ



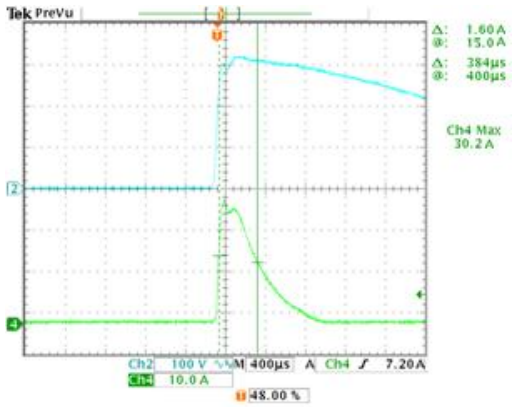
INPUT FUNCTION TEST

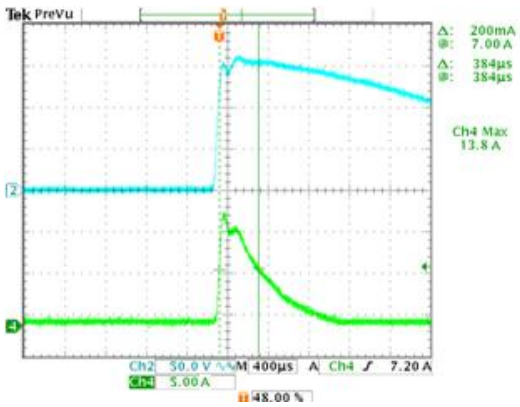
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC ~ 264VAC	I/P : TESTING O/P : FULL LOAD Ta : 25℃	72.0VAC ~ 264VAC
			I/P : LOW-LINE = 97VAC HIGH-LINE = 300VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~ 63HZ NO DAMAGE	I/P : 80VAC ~ 264VAC O/P : FULL~MIN LOAD Ta : 25℃	TEST : OK
3	INPUT CURRENT (TYP.)	0.50A / 230VAC 0.75A / 115VAC	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	I= 0.24A / 230VAC I= 0.46A / 115VAC
4	LEAKAGE CURRENT	< 80.00μA	I/P : 264VAC O/P: MIN LOAD TA : 25℃	53.2 μA
5	NO LOAD POWER CONSUMPTION	< 0.075W	I/P : 230VAC O/P: MIN LOAD TA : 25℃	< 0.0439 W
7	EFFICIENCY (TYP.)	89.0%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	90.43 %



8	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℃	I= 30.2A / 230VAC I= 13.8A / 115VAC T50= 384.0us / 230VAC

INPUT=230VAC/50HZ @ FULL LOAD	INPUT=115VAC/50HZ @ FULL LOAD
CH2 : AC Input Voltage CH4 : Input current	CH2 : AC Input Voltage CH4 : Input current





PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	115% ~ 165%	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING TA : 25℃	158.00% 264VAC 152.00% 230VAC 143.50% 100VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	15.80V ~ 20.30V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD TA : 25℃	19.10V 264VAC 19.20V 230VAC 19.10V 80VAC Shut down Re- power ON
3	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	Q1 Rated : 600V 7.5A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Fulll load continue Ta : 25℃	VIN: 267VAC VDS: (1). 468.00V (2). 536.00V (3). 474.00V
2	O/P MOSFET	Q100 Rated : 120V 20.0A Rated :	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Fulll load continue Ta : 25℃	Q100 VDS : (1). 106.00V (2). 103.00V (3). 105.00V
3	Input Capacitor	C5 Rated : 56uf 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). 362.00V (2). 372.00V (3). 364.00V (4). 362.00V
4	Control IC	U1 Rated : 28V (max) -0.3 (min)	I/P : 267VAC O/P : (1)Full Load (2)Output Short (3)O.L.P (4)O.V.P (5)Low Line No Load Vo(min) Ta : 25℃	U1 (1). 19.30V (2). 12.50V (3). 19.80V (4). 23.00V (5). 18.60V
5	Clamp Diode	D5 Rated : 1000V 1.0A	I/P : 267VAC O/P : (1)Dynamic Load Full/Min Load (2)Fulll load continue Ta : 25℃	(1). 454.00V (2). 456.00V

■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℃	I/P-O/P: 1.08mA 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 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 LINE-LINE: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-30-24 1. ROOM AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 25.2℃ 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 61.2℃		
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230VAC O/P : 162.0% 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 : -40.0℃	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60℃ NO DAMAGE	I/P : 272VAC O/P : FULL LOAD Ta : 60℃ HUMIDITY= 95.0% RH	TEST : OK
5	TEMPERATURE COEFFICIENT	±0.03% /℃(0~60℃)	I/P : 230VAC O/P : FULL LOAD	±0.0023% /℃(0~60℃)
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 : -45℃ ~ 65℃ 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

NO.	Position	ROOM AMBIENT 25.2℃	HIGH AMBIENT Ta: 61.2℃
1	LF1	41.9℃	77.1℃
2	LF2	48.1℃	80.3℃
3	C5	46.8℃	81.7℃
4	C40	50.2℃	87.4℃
5	BD1	59.8℃	91.2℃
6	R7	65.8℃	101.5℃
7	T1 COIL	75.0℃	107.7℃
8	Q100	67.5℃	101.5℃
9	C105	53.9℃	90.8℃
10	L100	41.0℃	78.3℃
11	Q1	60.6℃	95.3℃
12	U1	55.7℃	91.1℃
13	D5	62.5℃	100.0℃
14	R40	60.6℃	93.1℃
60	TA	25.2℃	61.2℃

8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (4) Acceleration： 3G (5) Test Time：60min in each axis (X.Y.Z) (6) Ta：25℃	TEST：OK
9	CAPACITOR LIFE CYCLE	:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P：FULL LOAD Ta= 25℃ LIFE TIME (2) I/P： 230VAC O/P：FULL LOAD Ta= 60℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 60℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 60℃ LIFE TIME	(1). 496583.6 HRS (2). 82527.6 HRS (3). 129361.8 HRS (4). 185681.6 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 779Khrs min. MIL-HDBK-217F (25℃)	
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): 30000HRS @ TA 60℃	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ