TEST REPORT: MFM-30-12

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

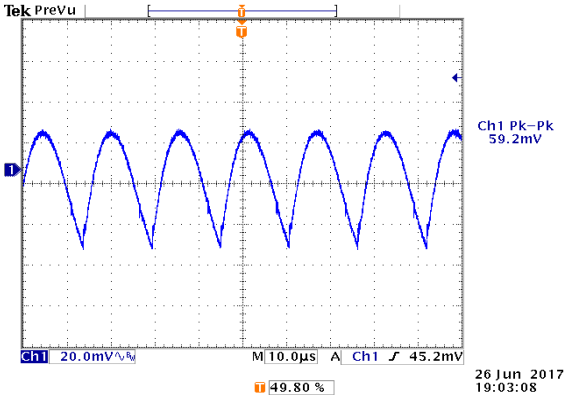
- Safety Test
- E.M.C. Test

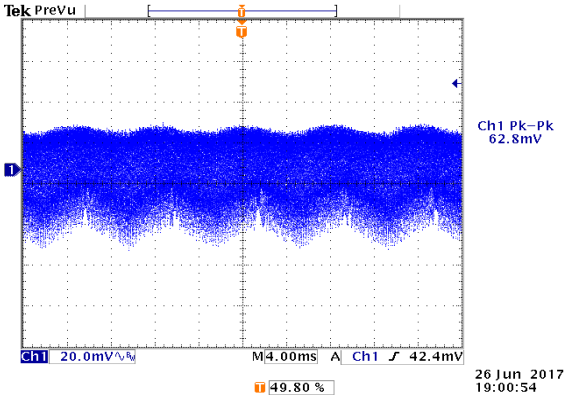
■ RELIABILITY TEST

- ENVIRONMENT TEST

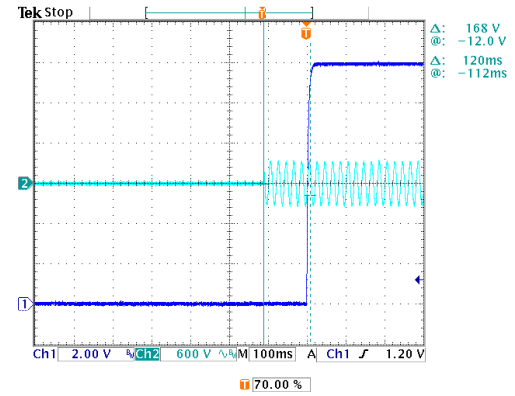
DESIGN VERIFY TEST
OUTPUT FUNCTION

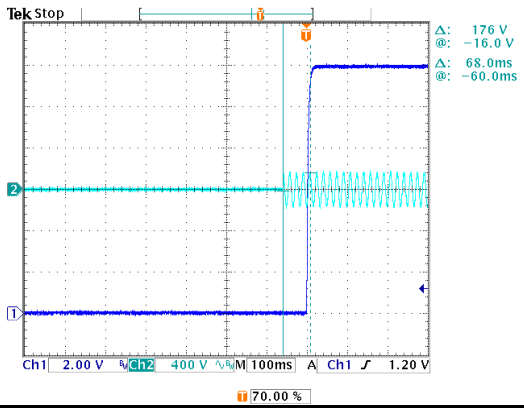
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 2.0% ~ -2.0%	I/P : 80VAC / 264VAC O/P: FULL / MINLOAD TA= 25℃	V1: -0.08% ~ -0.17%
2	LINE REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 80VAC / 264VAC O/P: FULL LOAD TA : 25℃	V1: 0.00% ~ 0.00%
3	LOAD REGULATION(MAX.)	V1 : 0.5% ~ -0.5%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25℃	V1: 0.08% ~ -0.08%
4	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	TEST< 4.3 %
5	RIPPLE & NOISE(Max)	V1 : 120 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25℃	V1 : 62.8 mVp-p
	high frequency:		low frequency:	





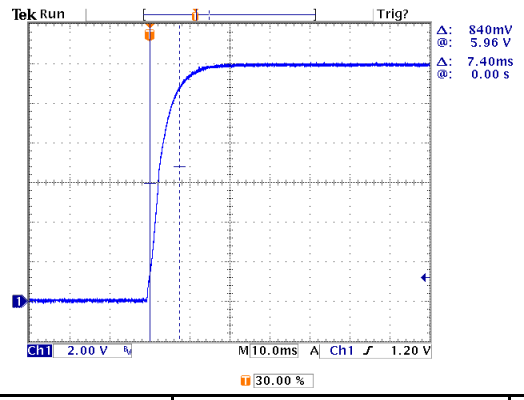
6	SET UP TIME (MAX.)	230VAC : 500ms 115VAC : 500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 120ms 115VAC : 68ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	



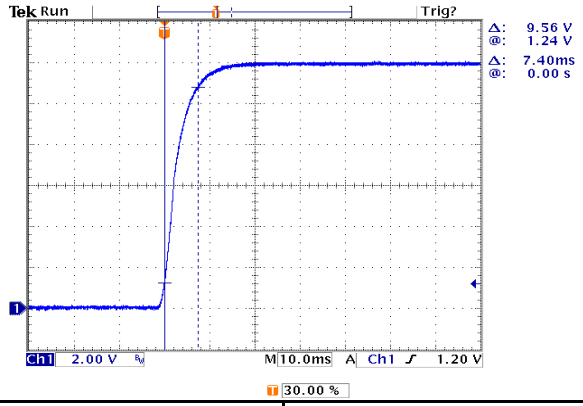


7	RISE TIME (MAX.)	230VAC : 30ms 115VAC : 30ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 7.4ms 115VAC : 7.4ms

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

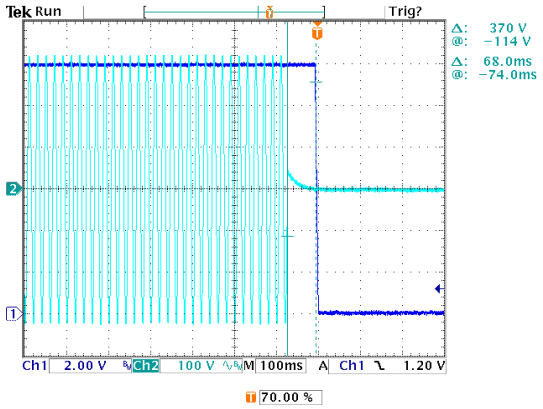


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage

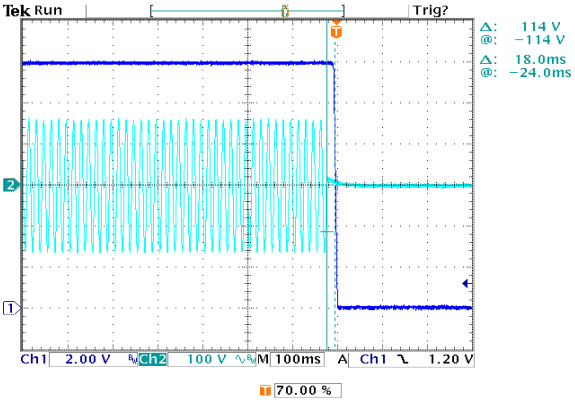


8	HOLD UP TIME (TYP.)	230VAC : 40ms 115VAC : 12ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 68.0ms 115VAC : 18.0ms

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

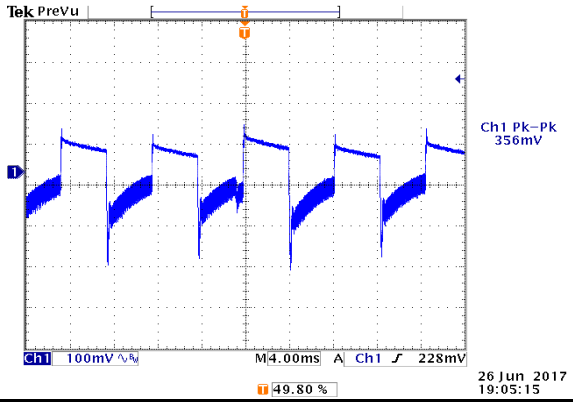


INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage

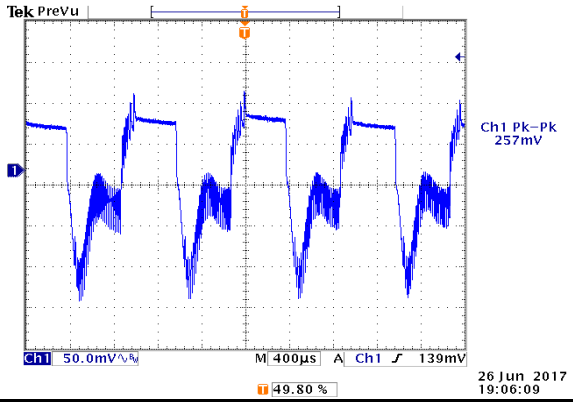


9	DYNAMIC LOAD	V1 : 1200 mVp-p	I/P : 230VAC O/P: (1)Full/Min load 50%duty/120HZ (2)Full/Min load 50%duty/1KHZ TA : 25℃	(1). (2). unit:mVp-p V1: 356mv 257mv

FULL /MIN LOAD 50%DUTY / 120HZ

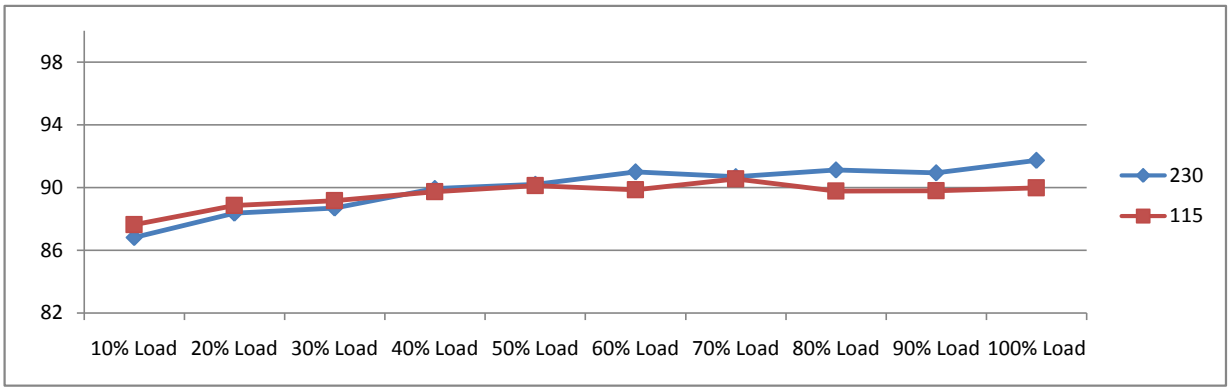


FULL /MIN% LOAD 50%DUTY / 1KHZ



INPUT FUNCTION TEST

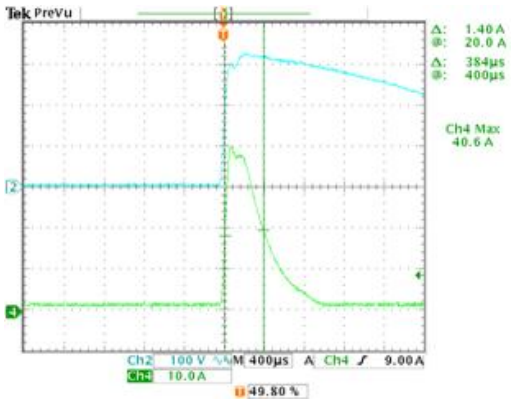
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC ~ 264VAC	I/P : TESTING O/P : FULL LOAD Ta : 25℃	72.0VAC ~ 264VAC
			I/P : LOW-LINE = 97VAC HIGH-LINE = 300VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~ 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= 0.44A / 115VAC
4	LEAKAGE CURRENT	< 80.00μA	I/P : 264VAC O/P: MIN LOAD TA : 25℃	Touch current 49.7 μA
5	NO LOAD POWER CONSUMPTION	< 0.075W	I/P : 230VAC O/P: MIN LOAD TA : 25℃	< 0.0741 W
7	EFFICIENCY (TYP.)	90.0%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	92.5 %



NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
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= 40.6A / 230VAC I= 21.8A / 115VAC T50= 384.0us / 230VAC

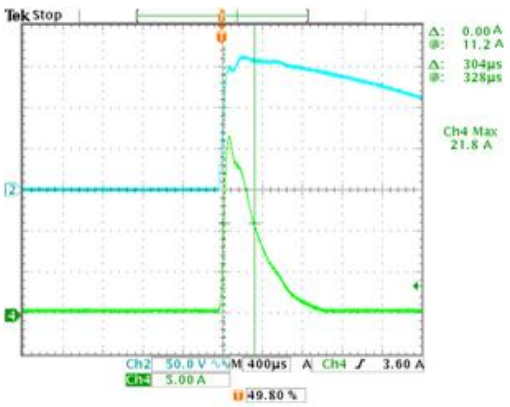
INPUT=230VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current



INPUT=115VAC/50HZ @ FULL LOAD

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℃	160.00% 264VAC 156.00% 230VAC 154.00% 100VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	12.60V ~ 16.20V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD TA : 25℃	14.50V 264VAC 14.50V 230VAC 14.40V 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 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). 442.00V (2). 448.00V (3). 438.00V
2	O/P MOSFET	Q100 Rated : 100V 80.0A Rated :	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Fulll load continue Ta : 25℃	Q100 VDS : (1). 89.00V (2). 84.00V (3). 86.00V
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). 360.00V (2). 360.00V (3). 356.00V (4). 344.00V
4	Control IC	U1 Rated : 28V (max) -0.3 (min) U100 Rated : 38V (max) -0.3V (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 U100 (1). 19.60V 12.1 (2). 12.10V 0.9 (3). 19.80V 12.1 (4). 22.50V 14.4 (5). 19.00V 12.2
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). 418.00V (2). 420.00V

■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: 1.18mA 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 : 144.0% 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	±0.0055% /℃(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
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

NO.	Position	ROOM AMBIENT 25.2℃	HIGH AMBIENT Ta: 61.2℃
1	LF1	40.6℃	72.6℃
2	LF2	46.3℃	75.2℃
3	C5	49.7℃	78.6℃
4	C40	61.6℃	84.0℃
5	BD1	63.9℃	89.7℃
6	R7	67.9℃	84.9℃
7	T1 COIL	83.4℃	97.1℃
8	Q100	86.0℃	92.7℃
9	C105	80.2℃	92.1℃
10	L100	57.3℃	78.8℃
11	Q1	68.0℃	91.8℃
12	U1	62.3℃	83.5℃
13	D5	77.4℃	89.1℃
14	R40	60.7℃	90.6℃
60	TA	25.2℃	61.2℃

9	CAPACITOR LIFE CYCLE	:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT								
		(1) I/P：	230VAC	O/P：FULL LOAD	Ta=	25℃	LIFE TIME	(1).	56962.2	HRS
		(2) I/P：	230VAC	O/P：FULL LOAD	Ta=	60℃	LIFE TIME	(2).	32909.3	HRS
		(3) I/P：	230VAC	O/P：75% LOAD	Ta=	60℃	LIFE TIME	(3).	42198.7	HRS
		(4) I/P：	230VAC	O/P：50% LOAD	Ta=	60℃	LIFE TIME	(4).	69229.4	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