



# TEST REPORT: MFM-30-24

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## 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

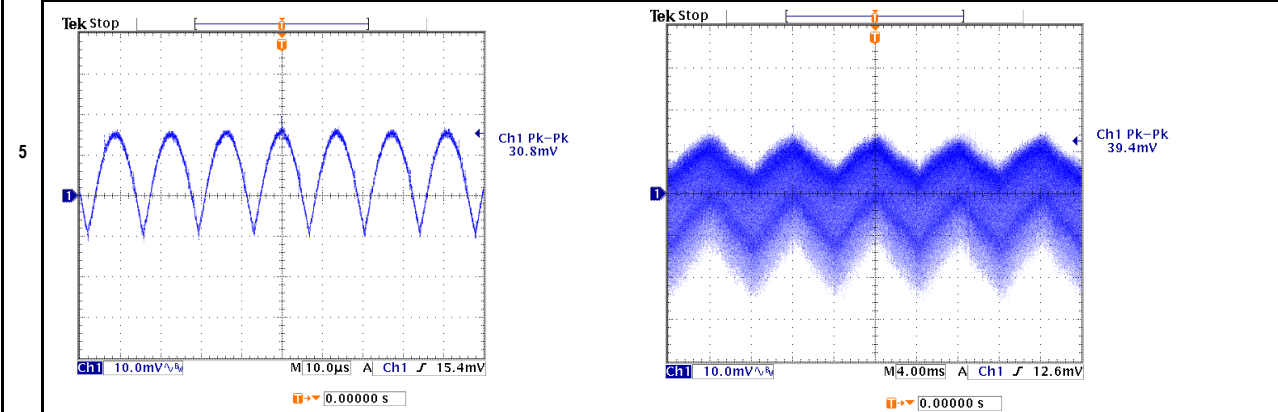


DESIGN VERIFY TEST  
OUTPUT FUNCTION

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°C	V1: 0.58% ~ 0.54%
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: 0.04% ~ -0.04%
4	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA: 25°C	TEST< 1.7 %
	RIPPLE & NOISE(Max)	V1 : 200 mVp-p	I/P : 230VAC O/P: FULL LOAD TA: 25°C	V1 : 39.4 mVp-p

high frequency:

low frequency:



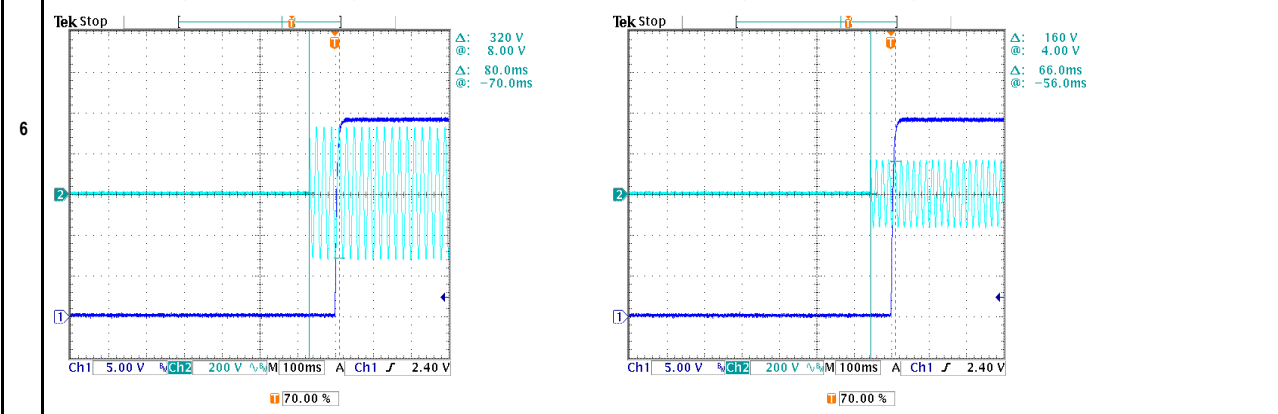
SET UP TIME (MAX.)	230VAC : 500ms 115VAC : 500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA: 25°C	230VAC : 80ms 115VAC : 66ms
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INPUT=230VAC/50HZ @ FULL LOAD

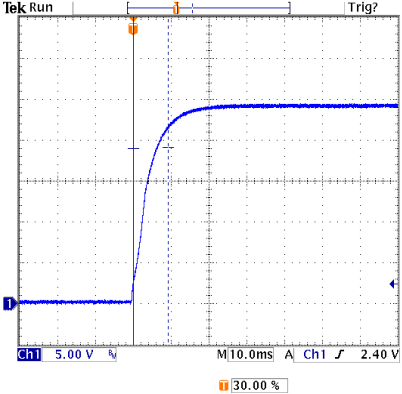
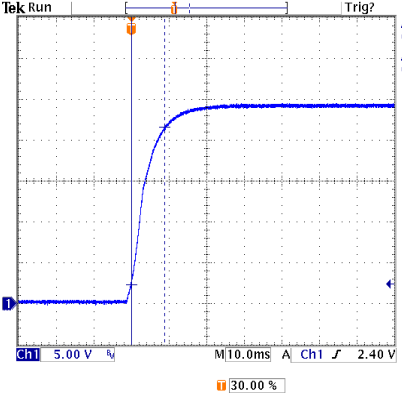
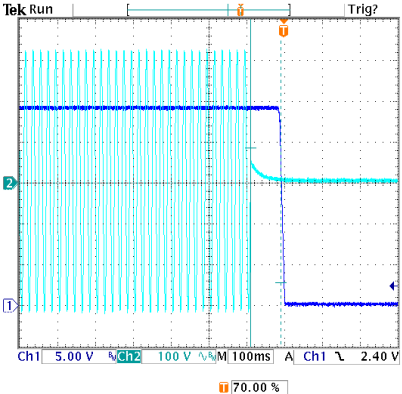
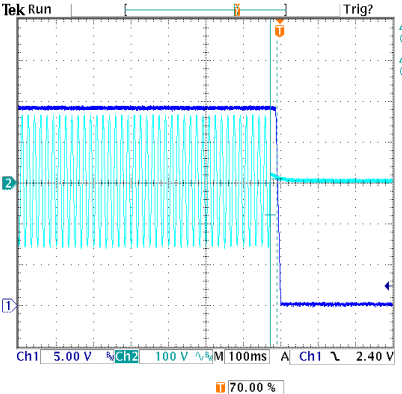
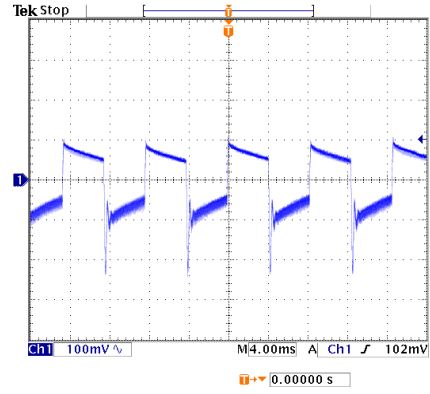
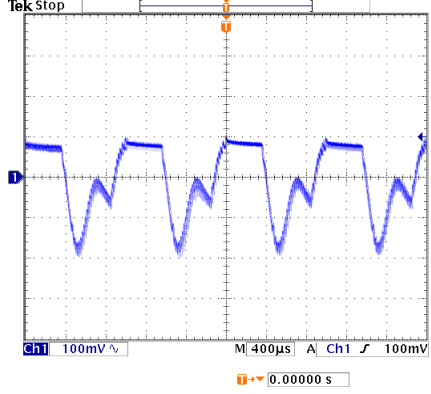
CH1 : Output Voltage CH2 : AC Input Voltage

INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



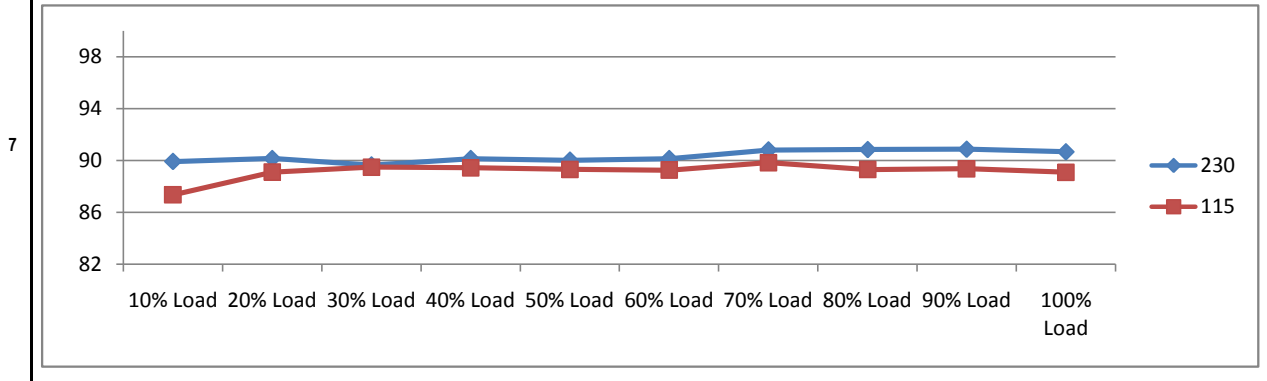


7	<b>RISE TIME (MAX.)</b>	230VAC : 30ms 115VAC : 30ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA: 25°C	230VAC : 9.2ms 115VAC : 8.8ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
8	<b>HOLD UP TIME (TYP.)</b>	230VAC : 40ms 115VAC : 12ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA: 25°C	230VAC : 80.0ms 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	<b>DYNAMIC LOAD</b>	V1 : 2400 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). 350mv (2). 298mv unit:mVp-p
	FULL /MIN LOAD 50%DUTY / 120HZ 		FULL /MIN% LOAD 50%DUTY / 1KHZ 	

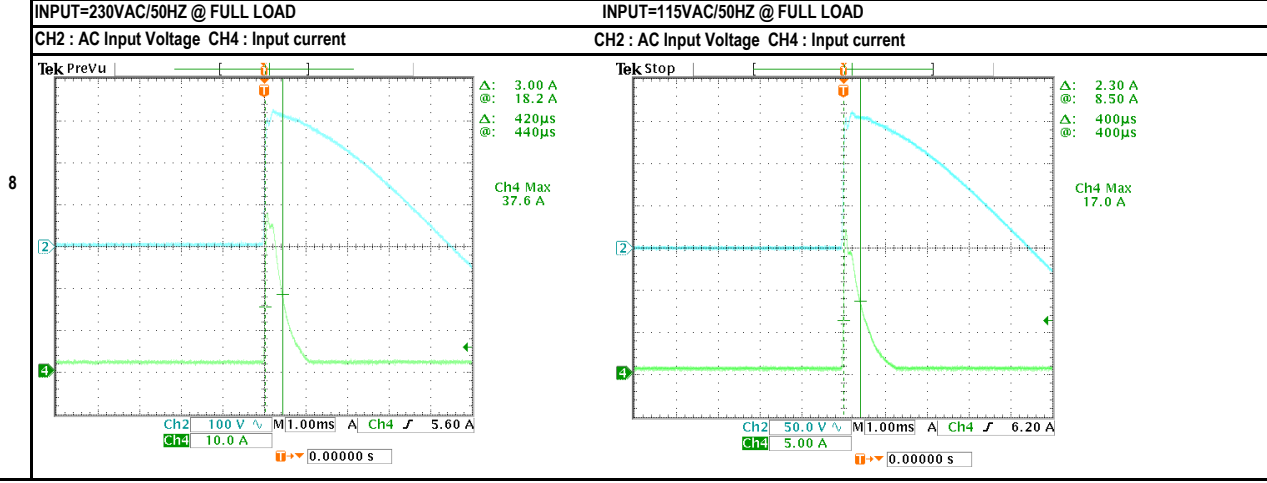


INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC ~ 264VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	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°C	TEST : OK
3	INPUT CURRENT (TYP.)	0.50A / 230VAC 0.75A / 115VAC	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 0.33A / 230VAC I= 0.53A / 115VAC
4	LEAKAGE CURRENT	< 80.00µA	I/P : 264VAC O/P : MIN LOAD TA : 25°C	48.2 µA
5	NO LOAD POWER CONSUMPTION	< 0.075W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.0545 W
	EFFICIENCY (TYP.)	90.0%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	90.68 %



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°C	I= 37.6A / 230VAC I= 17.0A / 115VAC T50= 420.0us / 230VAC
		INPUT=230VAC/50HZ @ FULL LOAD	INPUT=115VAC/50HZ @ FULL LOAD	





**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°C	148.25% 264VAC 149.49% 230VAC 147.00% 100VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	25.20V ~ 32.40V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD TA: 25°C	29.70V 264VAC 29.70V 230VAC 30.00V 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°C	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)Full load continue Ta : 25°C	VIN: 267VAC VDS: (1). 510.00V (2). 523.00V (3). 496.00V
2	O/P MOSFET	Q100 Rated : 200V 20.0A  Rated : 200V	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	Q100 VDS : (1). 176.00V (2). 177.00V (3). 179.00V
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°C	(1). 368.00V (2). 372.00V (3). 372.00V (4). 368.00V
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°C	U1 (1). 19.20V (2). 12.60V (3). 19.30V (4). 22.50V (5). 17.70V
5	Clamp Diode	D5 Rated : 1000V 1.0A	I/P : 267VAC O/P : (1)Dynamic Load Full/Min Load (2)Full load continue Ta : 25°C	(1). 474.00V (2). 472.00V

**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°C	I/P-O/P: 1.03mA 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 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 LINE-LINE: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-30-24 1. ROOM AMBIENT BURN-IN : 1.0hrs IP: 230VAC      O/P: 100% LOAD      TA= 25.2°C 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC      O/P: 100% LOAD      TA= 61.2°C	<table border="1"> <thead> <tr> <th>NO.</th> <th>Positic</th> <th>ROOM AMBIENT 25.2°C</th> <th>HIGH AMBIENT Ta: 61.2°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>41.9°C</td><td>77.1°C</td></tr> <tr><td>2</td><td>LF2</td><td>48.1°C</td><td>80.3°C</td></tr> <tr><td>3</td><td>C5</td><td>46.8°C</td><td>81.7°C</td></tr> <tr><td>4</td><td>C40</td><td>50.2°C</td><td>87.4°C</td></tr> <tr><td>5</td><td>BD1</td><td>59.8°C</td><td>91.2°C</td></tr> <tr><td>6</td><td>R7</td><td>65.8°C</td><td>101.5°C</td></tr> <tr><td>7</td><td>T1 COI</td><td>75.0°C</td><td>107.7°C</td></tr> <tr><td>8</td><td>Q100</td><td>67.5°C</td><td>101.5°C</td></tr> <tr><td>9</td><td>C105</td><td>53.9°C</td><td>90.8°C</td></tr> <tr><td>10</td><td>L100</td><td>41.0°C</td><td>78.3°C</td></tr> <tr><td>11</td><td>Q1</td><td>60.6°C</td><td>95.3°C</td></tr> <tr><td>12</td><td>U1</td><td>55.7°C</td><td>91.1°C</td></tr> <tr><td>13</td><td>D5</td><td>62.5°C</td><td>100.0°C</td></tr> <tr><td>14</td><td>R40</td><td>60.6°C</td><td>93.1°C</td></tr> <tr><td>60</td><td>TA</td><td>25.2°C</td><td>61.2°C</td></tr> </tbody> </table>	NO.	Positic	ROOM AMBIENT 25.2°C	HIGH AMBIENT Ta: 61.2°C	1	LF1	41.9°C	77.1°C	2	LF2	48.1°C	80.3°C	3	C5	46.8°C	81.7°C	4	C40	50.2°C	87.4°C	5	BD1	59.8°C	91.2°C	6	R7	65.8°C	101.5°C	7	T1 COI	75.0°C	107.7°C	8	Q100	67.5°C	101.5°C	9	C105	53.9°C	90.8°C	10	L100	41.0°C	78.3°C	11	Q1	60.6°C	95.3°C	12	U1	55.7°C	91.1°C	13	D5	62.5°C	100.0°C	14	R40	60.6°C	93.1°C	60	TA	25.2°C	61.2°C	
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230VAC O/P : 162.0% LOAD Ta : 25°C	TEST : OK																																																																
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 264VAC / 100VAC O/P : FULL LOAD Ta : -40.0°C	TEST : OK																																																																
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60°C NO DAMAGE	I/P : 272VAC O/P : FULL LOAD Ta : 60°C HUMIDITY= 95.0% RH	TEST : OK																																																																
5	TEMPERATURE COEFFICIENT	±0.03% /°C(0~60°C)	I/P : 230VAC O/P : FULL LOAD	±0.0023% /°C(0~60°C)																																																																
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -45°C ~ +90°C 2. Temperature change rate : 25°C / 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°C ~ 65°C 2. Temperature change rate : 25°C / 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°C		TEST : OK																																																																



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9	CAPACITOR LIFE CYCLE	:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT					
		(1) I/P : 230VAC	O/P : FULL LOAD	Ta= 25°C	LIFE TIME	(1).	496583.6 HRS
		(2) I/P : 230VAC	O/P : FULL LOAD	Ta= 60°C	LIFE TIME	(2).	82527.6 HRS
		(3) I/P : 230VAC	O/P : 75% LOAD	Ta= 60°C	LIFE TIME	(3).	129361.8 HRS
		(4) I/P : 230VAC	O/P : 50% LOAD	Ta= 60°C	LIFE TIME	(4).	185681.6 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 779Khrs min. MIL-HDBK-217F (25°C)					
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): 30000HRS @ TA 60°C					

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ