



# TEST REPORT: MFM-30-48

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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

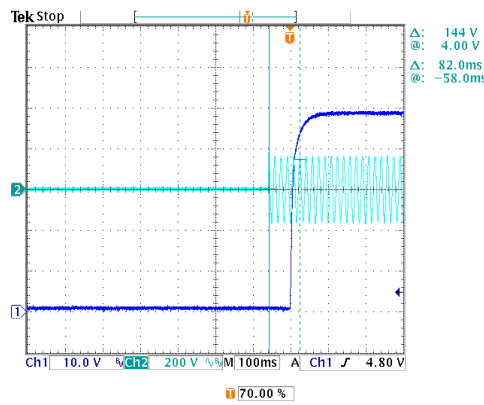
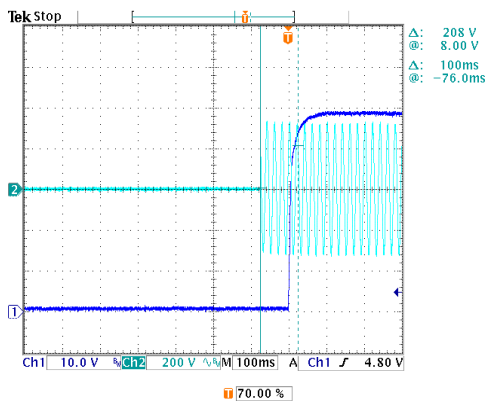
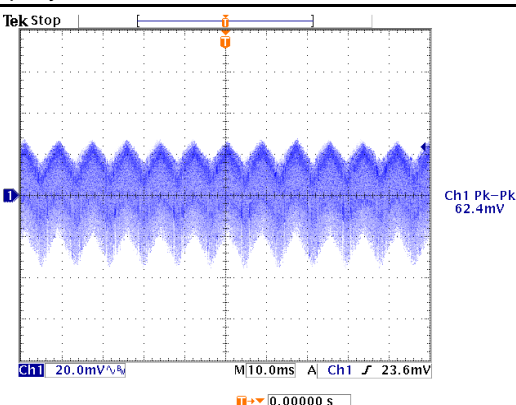
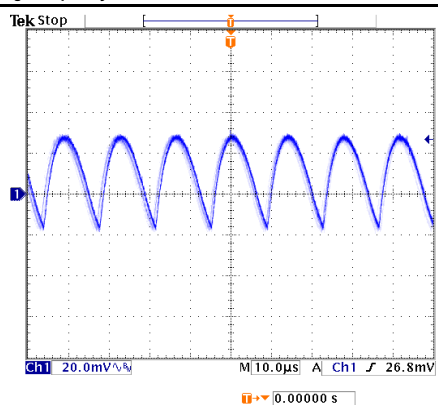
Safety Test  
E.M.C. Test

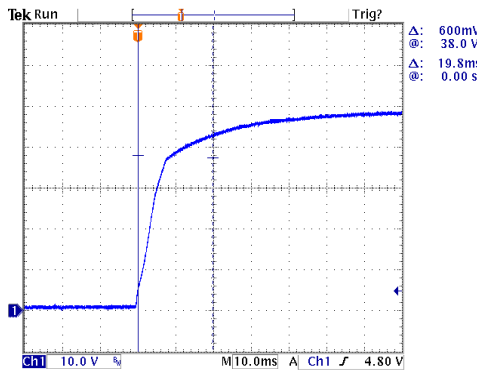
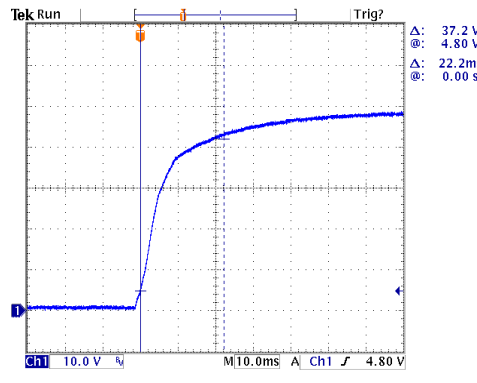
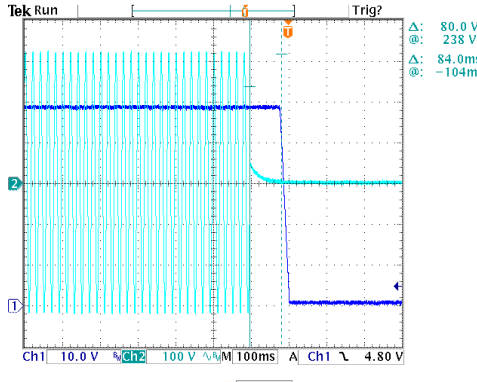
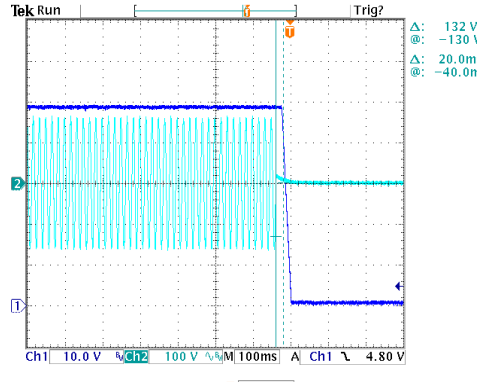
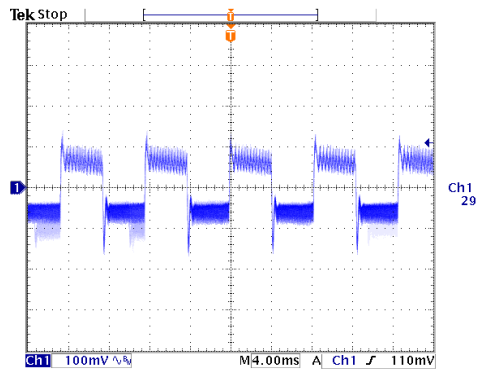
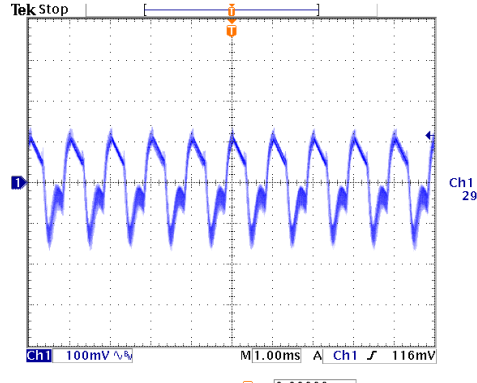
### ■ RELIABILITY TEST

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<br>O/P: FULL / MINLOAD<br>TA= 25°C                      | V1: 0.44% ~ 0.40%               |
| 2  | LINE REGULATION (MAX.)         | V1 : 0.5% ~ -0.5%                                                            | I/P : 80VAC / 264VAC<br>O/P: FULL LOAD<br>TA: 25°C                           | V1: 0.00% ~ -0.02%              |
| 3  | LOAD REGULATION(MAX.)          | V1 : 0.5% ~ -0.5%                                                            | I/P : 230VAC<br>O/P: MIN LOAD ~ FULL LOAD<br>TA: 25°C                        | V1: 0.02% ~ -0.02%              |
| 4  | OVER/UNDERSHOOT TEST           | < ±5%                                                                        | I/P : 230VAC<br>O/P: FULL LOAD<br>TA: 25°C                                   | TEST< 2.1 %                     |
| 5  | RIPPLE & NOISE(Max)            | V1 : 200 mVp-p                                                               | I/P : 230VAC<br>O/P: FULL LOAD<br>TA: 25°C                                   | V1 : 62.4 mVp-p                 |
|    |                                |                                                                              | high frequency:                                                              | low frequency:                  |
| 6  | SET UP TIME (MAX.)             | 230VAC : 500ms<br>115VAC : 500ms                                             | I/P : 230VAC<br>I/P : 115VAC<br>O/P: FULL LOAD<br>TA: 25°C                   | 230VAC : 100ms<br>115VAC : 82ms |
|    |                                | INPUT=230VAC/50HZ @ FULL LOAD<br>CH1 : Output Voltage CH2 : AC Input Voltage | INPUT=115VAC/60HZ @ FULL LOAD<br>CH1 : Output Voltage CH2 : AC Input Voltage |                                 |

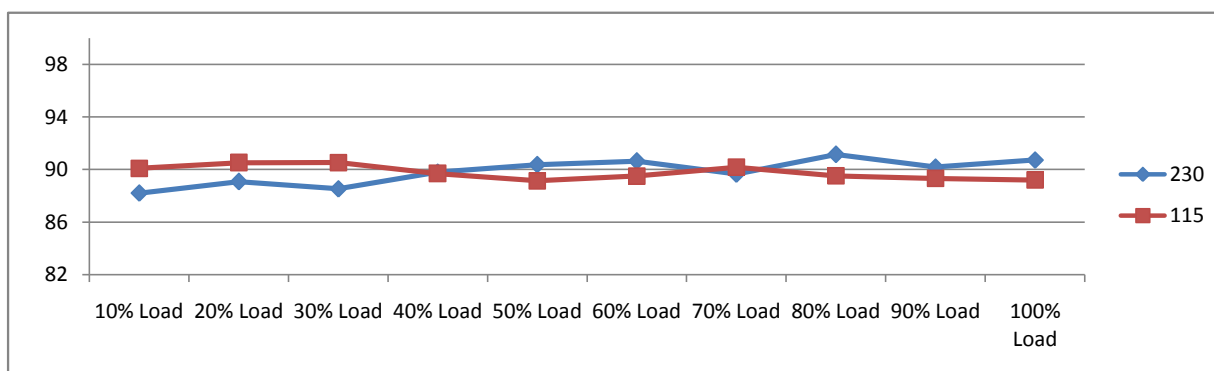


|   |                                                                                                                                                                                                                                                                                                                                                                                                  |                                |                                                                                                      |                                      |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------|
| 7 | RISE TIME (MAX.)                                                                                                                                                                                                                                                                                                                                                                                 | 230VAC : 30ms<br>115VAC : 30ms | I/P : 230VAC<br>I/P : 115VAC<br>O/P: FULL LOAD<br>TA : 25°C                                          | 230VAC : 19.8ms<br>115VAC : 22.2ms   |
|   | <div> <div>INPUT=230VAC/50HZ @ FULL LOAD</div> <div>CH1 : Output Voltage</div>  </div> <div> <div>INPUT=115VAC/60HZ @ FULL LOAD</div> <div>CH1 : Output Voltage</div>  </div>                                                 |                                |                                                                                                      |                                      |
| 8 | HOLD UP TIME (TYP.)                                                                                                                                                                                                                                                                                                                                                                              | 230VAC : 40ms<br>115VAC : 12ms | I/P : 230VAC<br>I/P : 115VAC<br>O/P: FULL LOAD<br>TA : 25°C                                          | 230VAC : 84.0ms<br>115VAC : 20.0ms   |
|   | <div> <div>INPUT=230VAC/50HZ @ FULL LOAD</div> <div>CH1 : Output Voltage CH2 : AC Input Voltage</div>  </div> <div> <div>INPUT=115VAC/60HZ @ FULL LOAD</div> <div>CH1 : Output Voltage CH2 : AC Input Voltage</div>  </div> |                                |                                                                                                      |                                      |
| 9 | DYNAMIC LOAD                                                                                                                                                                                                                                                                                                                                                                                     | V1 : 4800 mVp-p                | I/P : 230VAC<br>O/P:<br>(1)Full/Min load 50%duty/120HZ<br>(2)Full/Min load 50%duty/1KHZ<br>TA : 25°C | V1: (1). 298mv (2). 296mv unit:mVp-p |
|   | <div> <div>FULL /MIN LOAD 50%DUTY / 120HZ</div>  </div> <div> <div>FULL /MIN% LOAD 50%DUTY / 1KHZ</div>  </div>                                                                                                           |                                |                                                                                                      |                                      |

## INPUT FUNCTION TEST

| NO | TEST ITEM                 | SPECIFICATION                    | TEST CONDITION                                                                                                                       | RESULT                                 |
|----|---------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 1  | INPUT VOLTAGE RANGE       | 80VAC ~ 264VAC                   | I/P : TESTING<br>O/P : FULL LOAD<br>Ta : 25°C                                                                                        | 72.0VAC ~ 264VAC                       |
|    |                           |                                  | I/P :<br>LOW-LINE = 97VAC<br>HIGH-LINE = 300VAC<br>O/P : FULL/MIN LOAD<br>ON:30 Sec ; OFF:30 Sec 10MIN<br>( POWER ON/OFF NO DAMAGE ) | TEST : OK                              |
| 2  | INPUT FREQUENCY RANGE     | 47HZ ~ 63HZ<br>NO DAMAGE         | I/P : 80VAC ~ 264VAC<br>O/P : FULL~MIN LOAD<br>Ta : 25°C                                                                             | TEST : OK                              |
| 3  | INPUT CURRENT (TYP.)      | 0.50A / 230VAC<br>0.75A / 115VAC | I/P : 230VAC<br>I/P : 115VAC<br>O/P : FULL LOAD<br>TA : 25°C                                                                         | I= 0.32A / 230VAC<br>I= 0.52A / 115VAC |
| 4  | LEAKAGE CURRENT           | < 80.00μA                        | I/P : 264VAC<br>O/P : MIN LOAD<br>TA : 25°C                                                                                          | 46 μA                                  |
| 5  | NO LOAD POWER CONSUMPTION | < 0.075W                         | I/P : 230VAC<br>O/P : MIN LOAD<br>TA : 25°C                                                                                          | < 0.0699 W                             |
|    | EFFICIENCY (TYP.)         | 91.0%                            | I/P : 230VAC<br>O/P : FULL LOAD<br>TA : 25°C                                                                                         | 90.73 %                                |

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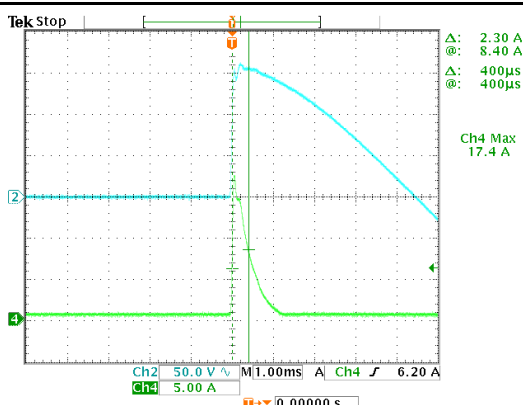
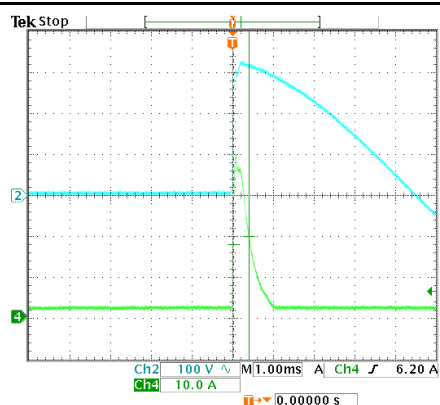
|                       |                                      |                 |                       |
|-----------------------|--------------------------------------|-----------------|-----------------------|
| INRUSH CURRENT (TYP.) | 45A / 230VAC                         | I/P : 230VAC    | I= 39.4A / 230VAC     |
|                       | 25A / 115VAC                         | I/P : 115VAC    | I= 17.4A / 115VAC     |
|                       | twidth= 555 us measured at 50% Ipeak | O/P : FULL LOAD | T50= 380.0us / 230VAC |
|                       | COLD START                           | TA : 25°C       |                       |

INPUT=230VAC/50HZ @ FULL LOAD

INPUT=115VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current

CH2 : AC Input Voltage CH4 : Input current





# 30W High Reliable Green Medical On Board Type MFM-30 series

## PROTECTION FUNCTION TEST

| NO | TEST ITEM               | SPECIFICATION                          | TEST CONDITION                                                        | RESULT                                                                   |
|----|-------------------------|----------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------|
| 1  | OVER LOAD PROTECTION    | 115% ~ 165%                            | I/P: 264VAC<br>I/P: 230VAC<br>I/P: 100VAC<br>O/P: TESTING<br>Ta: 25°C | 154.46% 264VAC<br>155.51% 230VAC<br>153.38% 100VAC<br>Hiccup Mode        |
| 2  | OVER VOLTAGE PROTECTION | 50.40V ~ 64.00V                        | I/P: 264VAC<br>I/P: 230VAC<br>I/P: 80VAC<br>O/P: MIN LOAD<br>Ta: 25°C | 56.60V 264VAC<br>56.60V 230VAC<br>57.00V 80VAC<br>Shut down Re- power ON |
| 3  | SHORT PROTECTION        | SHORT EVERY OUTPUT<br>1 HOUR NO DAMAGE | I/P: 264VAC<br>I/P: 80VAC<br>O/P: FULL LOAD<br>Ta: 25°C               | NO DAMAGE<br>Hiccup Mode                                                 |

## COMPONENT STRESS TEST

| NO | TEST ITEM            | SPECIFICATION                          | TEST CONDITION                                                                                                                                     | RESULT                                                                        |
|----|----------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| 1  | PWM Power Transistor | Q1 Rated : 600V 7.5A                   | I/P : 267VAC<br>VDS :<br>O/P : (1)Full Load Turn on<br>(2) Output Short<br>(3)Full load continue<br>Ta : 25°C                                      | VIN: 267VAC<br>VDS:<br>(1). 470.00V<br>(2). 536.00V<br>(3). 470.00V           |
| 2  | O/P MOSFET           | Q100 Rated : 400V 10.0A<br><br>Rated : | I/P : 267VAC<br>VDS :<br>O/P : (1)Full Load Turn on<br>(2) Output Short<br>(3)Full load continue<br>Ta : 25°C                                      | Q100<br>VDS :<br>(1). 326.00V<br>(2). 336.00V<br>(3). 326.00V                 |
| 3  | Input Capacitor      | C5 Rated : 56uf 400V                   | I/P : 267VAC<br>O/P : (1)Full Load Turn on /Off<br>(2)Min load Turn on /Off<br>(3)Full Load /Min load Change<br>(4)Full Load Continue<br>Ta : 25°C | (1). 368.00V<br>(2). 370.00V<br>(3). 370.00V<br>(4). 368.00V                  |
| 4  | Control IC           | U1 Rated : 28V (max)<br>-0.3 (min)     | I/P : 267VAC<br>O/P : (1)Full Load<br>(2)Output Short<br>(3)O.L.P<br>(4)O.V.P<br>(5)Low Line No Load Vo(min)<br>Ta : 25°C                          | U1<br>(1). 21.60V<br>(2). 12.10V<br>(3). 21.40V<br>(4). 24.50V<br>(5). 20.80V |
| 5  | Clamp Diode          | D5 Rated : 1000V 1.0A                  | I/P : 267VAC<br>O/P : (1)Dynamic Load Full/Min Load<br>(2)Full load continue<br>Ta : 25°C                                                          | (1). 468.00V<br>(2). 464.00V                                                  |

## 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<br>Ta : 25°C | I/P-O/P: 0.95mA<br>NO DAMAGE   |
| 2  | ISOLATION RESISTANCE | I/P-O/P : 500VDC>100MΩ   | I/P-O/P: 500VDC<br>Ta : 25°C/70%RH   | I/P-O/P: 9999.0MΩ<br>NO DAMAGE |

### E.M.C. TEST

| NO | TEST ITEM | SPECIFICATION          | TEST CONDITION                                     | RESULT |
|----|-----------|------------------------|----------------------------------------------------|--------|
| 1  | HARMONIC  | EN61000-3-2<br>CLASS A | I/P : 230VAC /50HZ<br>O/P : FULL LOAD<br>Ta : 25°C | PASS   |



## 30W High Reliable Green Medical On Board Type MFM-30 series

|   |            |                                         |                                                               |                               |
|---|------------|-----------------------------------------|---------------------------------------------------------------|-------------------------------|
| 2 | CONDUCTION | EN55011<br>CLASS B                      | I/P : 230VAC /50HZ<br>O/P : FULL LOAD / 50% LOAD<br>Ta : 25°C | PASS<br>Test by certified Lab |
| 3 | RADIATION  | EN55011<br>CLASS B                      | I/P : 230VAC /50HZ<br>O/P : FULL LOAD<br>Ta : 25°C            | PASS<br>Test by certified Lab |
| 4 | E.S.D      | EN61000-4-2<br>AIR: 15KV / Contact: 8KV | I/P : 230VAC /50HZ<br>O/P : FULL LOAD<br>Ta : 25°C            | CRITERIA A                    |
| 5 | E.F.T      | EN61000-4-4<br>MEDICAL INPUT: 2KV       | I/P : 230VAC /50HZ<br>O/P : FULL LOAD<br>Ta : 25°C            | CRITERIA A                    |
| 6 | SURGE      | EN61000-4-5<br>MEDICAL LINE-LINE:1KV    | I/P : 230VAC /50HZ<br>O/P : FULL LOAD<br>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℃                                                                                                                                                                                                                                                                                                        |                                                                   |                    |                        |
|    |                                                        | 2. HIGH AMBIENT BURN-IN : 1.0hrs                                                                                                                                                                                                                                                                                                           |                                                                   |                    |                        |
|    |                                                        | IP: 230VAC O/P: 100% LOAD TA= 61.2℃                                                                                                                                                                                                                                                                                                        |                                                                   |                    |                        |
|    |                                                        | NO.                                                                                                                                                                                                                                                                                                                                        | Positid                                                           | 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 COI                                                            | 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℃                                                             |                    |                        |
| 2  | OVER LOAD BURN-IN TEST                                 | NO DAMAGE<br>1 HOUR ( MIN )                                                                                                                                                                                                                                                                                                                | I/P : 230VAC<br>O/P : 162.0% LOAD<br>Ta : 25℃                     | TEST : OK          |                        |
| 3  | LOW TEMPERATURE TURN ON TEST                           | NO DAMAGE<br>1 HOUR ( MIN )                                                                                                                                                                                                                                                                                                                | I/P : 264VAC / 100VAC<br>O/P : FULL LOAD<br>Ta : -40.0℃           | TEST : OK          |                        |
| 4  | HIGH HUMIDITY<br>HIGH TEMPERATURE<br>HIGH VOLTAGE TEST | AFTER 12 HOURS<br>IN CHAMBER ON<br>CONTROL 60℃<br>NO DAMAGE                                                                                                                                                                                                                                                                                | I/P : 272VAC<br>O/P : FULL LOAD<br>Ta : 60℃<br>HUMIDITY= 95.0% RH | TEST : OK          |                        |
| 5  | TEMPERATURE COEFFICIENT                                | ±0.03% /℃(0~60℃)                                                                                                                                                                                                                                                                                                                           | I/P : 230VAC<br>O/P : FULL LOAD                                   | ±0.0023% /℃(0~60℃) |                        |
| 6  | STORAGE TEMPERATURE TEST                               | 1. Thermal shock Temperature : -45℃ ~ +90℃<br>2. Temperature change rate : 25℃ / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 10 CYCLE<br>5. Input/Output condition : STATIC                                                                                                                       |                                                                   | TEST : OK          |                        |
| 7  | THERMAL SHOCK TEST                                     | 1. Thermal shock Temperature : -45℃ ~ 65℃<br>2. Temperature change rate : 25℃ / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 16 CYCLE<br>5. Input/Output condition :<br>230VAC Full Load AC ON/OFF test turn on 3sec ; turn off 1sec @ 15CYCLE<br>230VAC Full Load AC ON turn on continue @ 1CYCLE |                                                                   | TEST : OK          |                        |
| 8  | VIBRATION TEST                                         | 1 Carton & 1 Set<br>(1) Waveform : Sine Wave<br>(2) Frequency : 10~500Hz<br>(4) Acceleration : 3G<br>(5) Test Time : 60min in each axis (X.Y.Z)<br>(6) Ta : 25℃                                                                                                                                                                            |                                                                   | TEST : OK          |                        |



# 30W High Reliable Green Medical On Board Type MFM-30 series

|    |                              |                                                                                                                                                                                                                                                                                                                                               |
|----|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9  | CAPACITOR LIFE CYCLE         | :SUPPOSE C105 IS THE MOST CRITICAL COMPONENT<br>(1) I/P : 230VAC O/P : FULL LOAD Ta= 25°C LIFE TIME (1). 496583.6 HRS<br>(2) I/P : 230VAC O/P : FULL LOAD Ta= 60°C LIFE TIME (2). 82527.6 HRS<br>(3) I/P : 230VAC O/P : 75% LOAD Ta= 60°C LIFE TIME (3). 129361.8 HRS<br>(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<br>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   |