



# TEST REPORT: HDR-60-24

## 60W Ultra Slim Step Shape DIN Rail

### ■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Component Stress Test

### ■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

### ■ RELIABILITY TEST

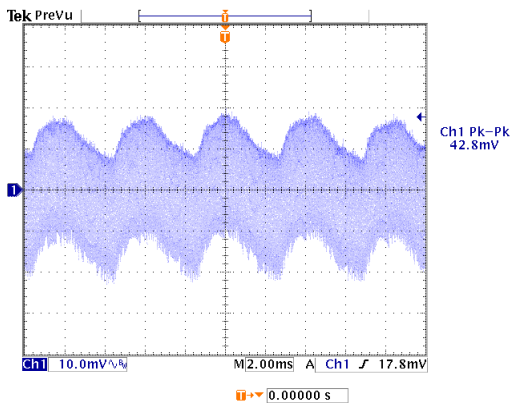
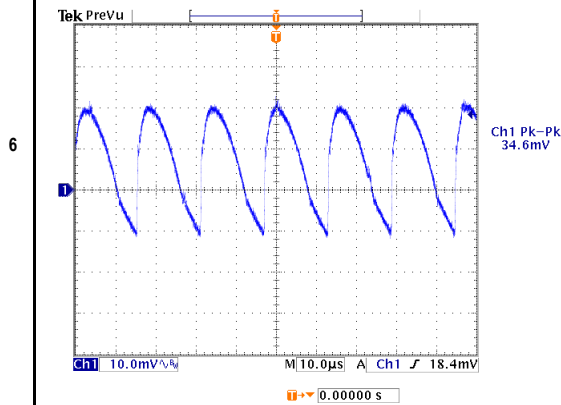
ENVIRONMENT TEST

DESIGN VERIFY TEST  
OUTPUT FUNCTION

| NO | TEST ITEM                      | SPECIFICATION        | TEST CONDITION   | RESULT               |
|----|--------------------------------|----------------------|--|----------------------|
| 1  | OUTPUT VOLTAGE ADJUST RANGE    | CH1: 21.60V ~ 29.00V | I/P : 230VAC<br>O/P: MIN LOAD<br>TA : 25°C               | CH1: 20.97V ~ 29.87V |
| 2  | OUTPUT VOLTAGE TOLERANCE (Max) | V1 : 1.0% ~ -1.0%    | I/P : 100VAC / 277VAC<br>O/P: FULL / MINLOAD<br>TA= 25°C | V1: 0.58% ~ 0.29%    |
| 3  | LINE REGULATION (MAX.)         | V1 : 1.0% ~ -1.0%    | I/P : 100VAC / 277VAC<br>O/P: FULL LOAD<br>TA : 25°C     | V1: 0.04% ~ -0.08%   |
| 4  | LOAD REGULATION (MAX.)         | V1 : 1.0% ~ -1.0%    | I/P : 230VAC<br>O/P: MIN LOAD ~ FULL LOAD<br>TA : 25°C   | V1: 0.08% ~ -0.12%   |
| 5  | OVER/UNDERSHOOT TEST           | < ±5%                | I/P : 230VAC<br>O/P: FULL LOAD<br>TA : 25°C              | TEST< 1.7 %          |
|    | RIPPLE & NOISE(Max)            | V1 : 150 mVp-p       | I/P : 230VAC<br>O/P: FULL LOAD<br>TA : 25°C              | V1 : 42.8 mVp-p      |

high frequency:

low frequency:



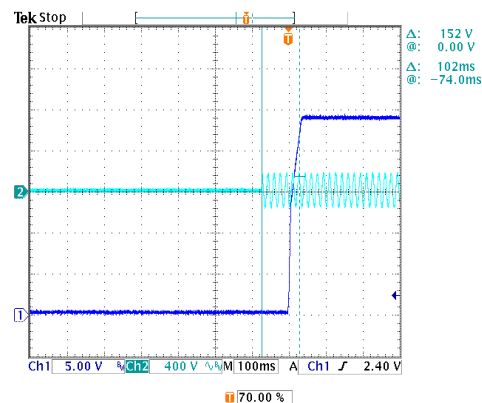
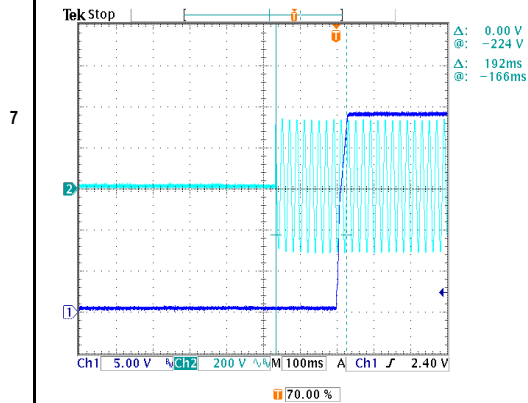
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|--------------------|----------------------------------|---|----------------------------------|
| SET UP TIME (MAX.) | 230VAC : 500ms<br>115VAC : 500ms | I/P : 230VAC<br>I/P : 115VAC<br>O/P: FULL LOAD<br>TA : 25°C | 230VAC : 192ms<br>115VAC : 102ms |
|--------------------|----------------------------------|---|----------------------------------|

INPUT=230VAC/50HZ @ FULL LOAD

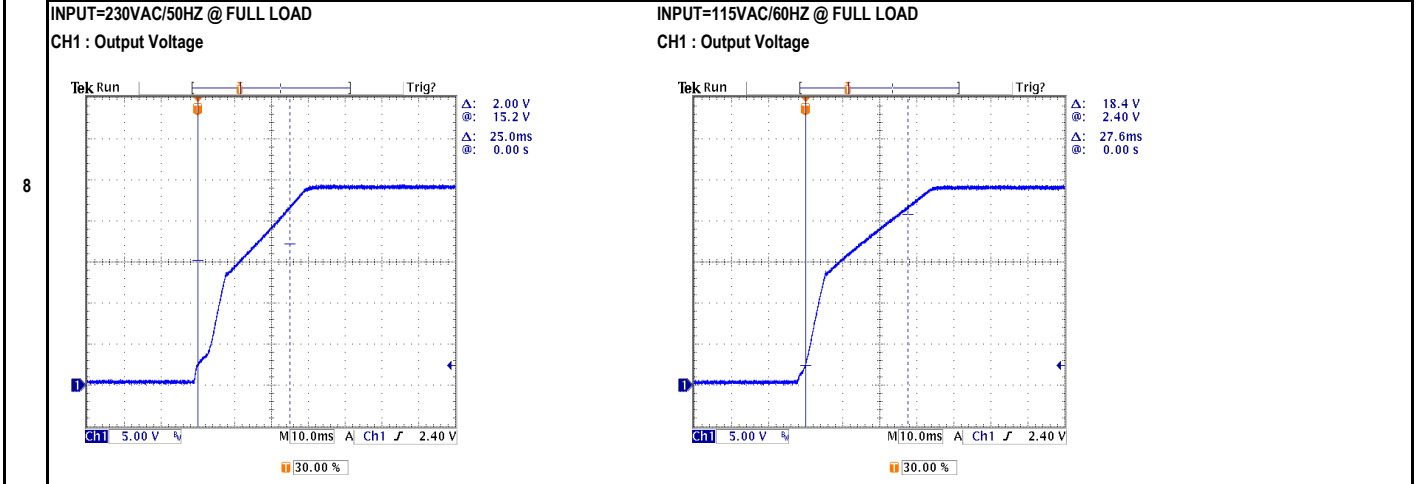
CH1 : Output Voltage CH2 : AC Input Voltage

INPUT=115VAC/60HZ @ FULL LOAD

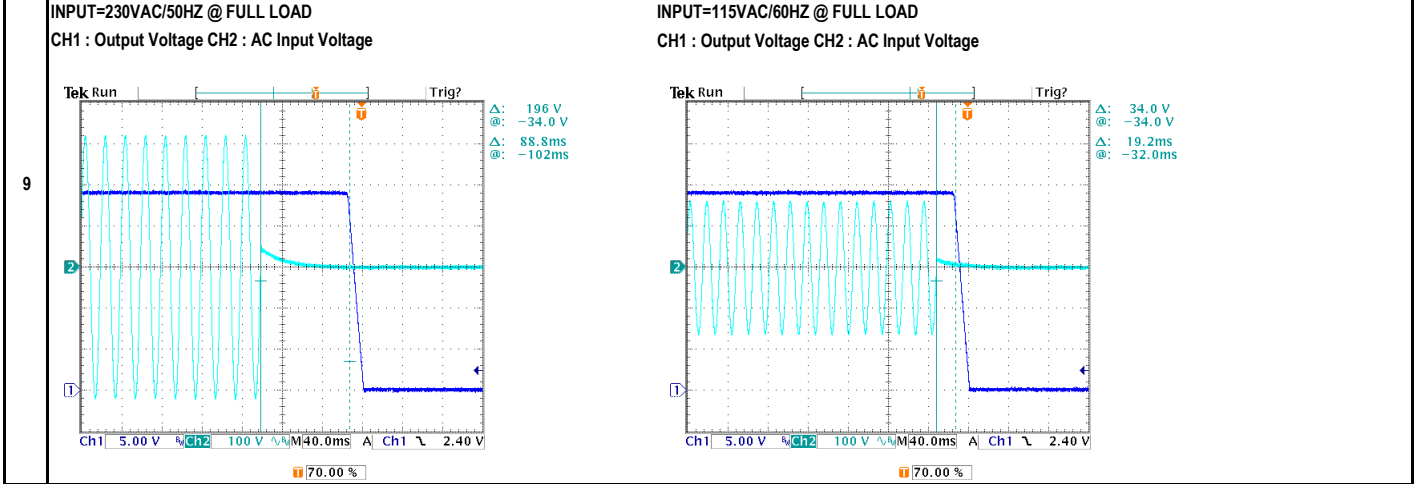
CH1 : Output Voltage CH2 : AC Input Voltage



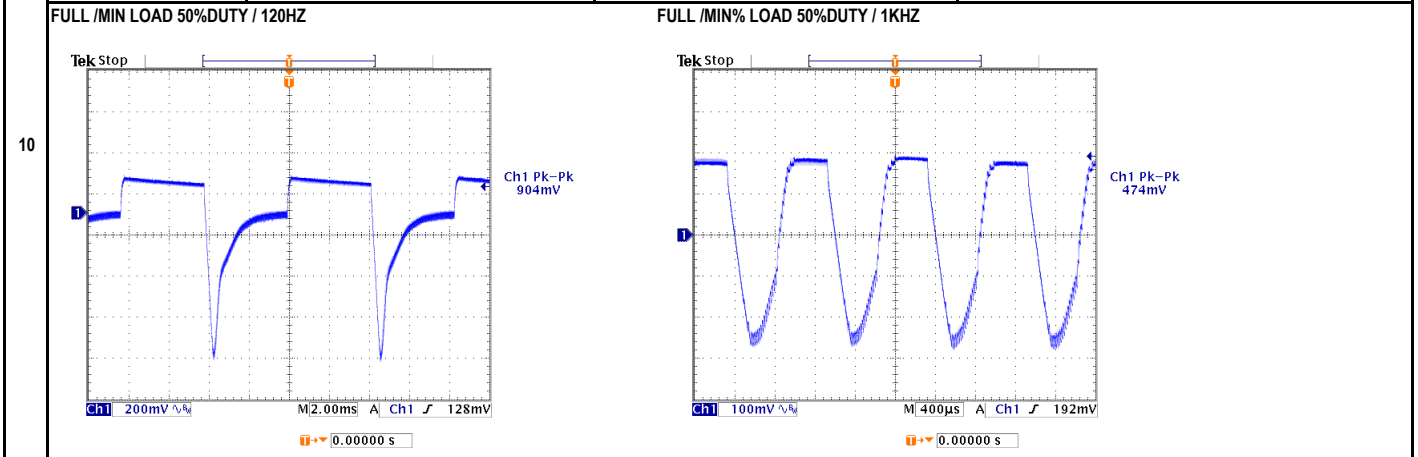
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|------------------|--------|--------|-------|-----------|--------|----------|
| RISE TIME (MAX.) | 230VAC | : 50ms | I/P : | 230VAC    | 230VAC | : 25.0ms |
|                  | 115VAC | : 50ms | I/P : | 115VAC    | 115VAC | : 27.6ms |
|                  |        |        | O/P : | FULL LOAD |        |          |
|                  |        |        | TA :  | 25°C      |        |          |



|                     |        |        |       |           |        |          |
|---------------------|--------|--------|-------|-----------|--------|----------|
| HOLD UP TIME (TYP.) | 230VAC | : 30ms | I/P : | 230VAC    | 230VAC | : 88.8ms |
|                     | 115VAC | : 12ms | I/P : | 115VAC    | 115VAC | : 19.2ms |
|                     |        |        | O/P : | FULL LOAD |        |          |
|                     |        |        | TA :  | 25°C      |        |          |



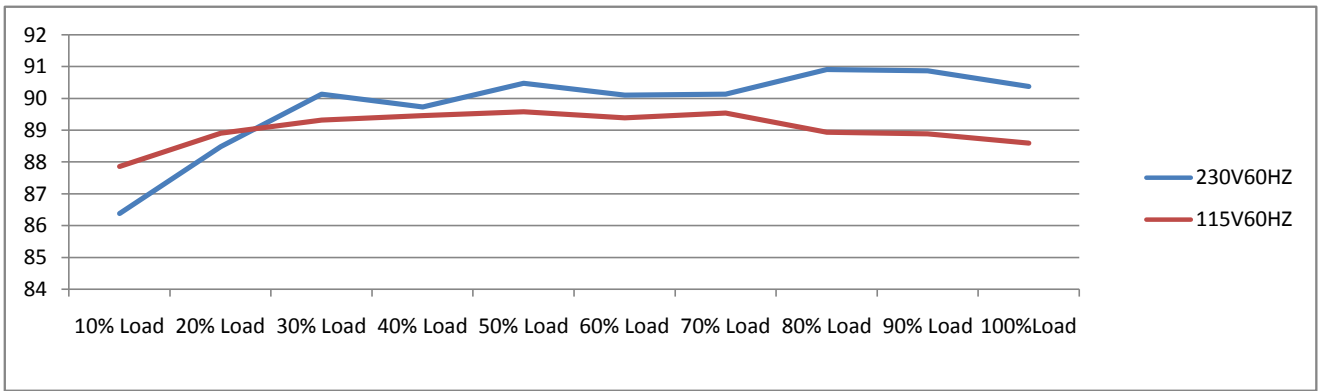
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|--------------|------|------|--------------------------------|-------|--------|-------|-------|------------|
| DYNAMIC LOAD | V1 : | 2400 | mVp-p                          | I/P : | 230VAC | (1).  | (2).  | unit:mVp-p |
|              |      |      |                                | O/P : |        | 904mv | 474mv |            |
|              |      |      | (1)Full/Min load 50%duty/120HZ |       |        |       |       |            |
|              |      |      | (2)Full/Min load 50%duty/1KHZ  |       |        |       |       |            |
|              |      |      | TA :                           | 25°C  |        |       |       |            |



INPUT FUNCTION TEST

| NO | TEST ITEM                 | SPECIFICATION                    | TEST CONDITION   | RESULT                                 |
|----|---------------------------|----------------------------------|--|--|
| 1  | INPUT VOLTAGE RANGE       | 85VAC ~ 277VAC                   | I/P : TESTING<br>O/P : FULL LOAD<br>Ta : 25°C  | 68.0VAC ~ 277VAC                       |
|    |                           |                                  | 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 : 100VAC ~ 277VAC<br>O/P : FULL-MIN LOAD<br>Ta : 25°C  | TEST : OK                              |
| 3  | INPUT CURRENT (TYP.)      | 0.80A / 230VAC<br>1.20A / 115VAC | I/P : 230VAC<br>I/P : 115VAC<br>O/P : FULL LOAD<br>TA : 25°C   | I= 0.52A / 230VAC<br>I= 0.92A / 115VAC |
| 4  | NO LOAD POWER CONSUMPTION | < 0.30W                          | I/P : 230VAC<br>O/P : MIN LOAD<br>TA : 25°C  | < 0.1125 W                             |
|    | EFFICIENCY (TYP.)         | 90.0%                            | I/P : 230VAC<br>O/P : FULL LOAD<br>TA : 25°C   | 90.374 %                               |

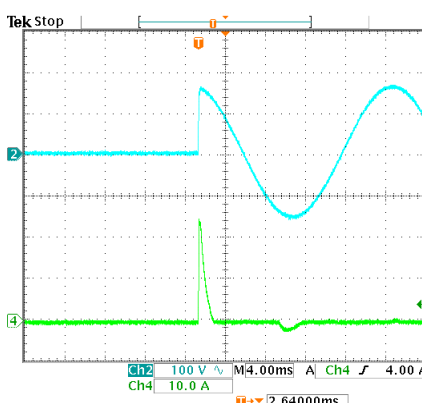
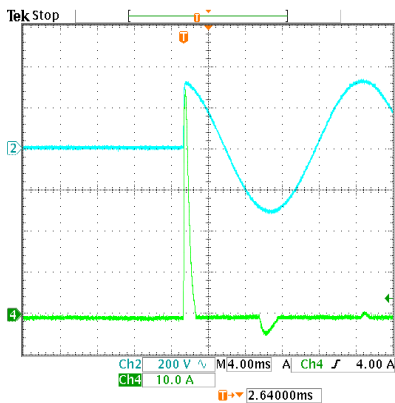
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|                       |  |  |  |
|-----------------------|--|--|--|
| INRUSH CURRENT (TYP.) | 60A / 230VAC<br>30A / 115VAC<br>twidth= 555 us measured at 50% Ipeak<br>COLD START | I/P : 230VAC<br>I/P : 115VAC<br>O/P : FULL LOAD<br>TA : 25°C | I= 54.8A / 230VAC<br>I= 24.8A / 115VAC |
|                       | INPUT=230VAC/50HZ @ FULL LOAD  | INPUT=115VAC/50HZ @ FULL LOAD                                |  |

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



**PROTECTION FUNCTION TEST**

| NO | TEST ITEM               | SPECIFICATION                          | TEST CONDITION   | RESULT  |
|----|-------------------------|--|--|---|
| 1  | OVER LOAD PROTECTION    | 105% ~ 160%                            | I/P: 277VAC<br>I/P: 230VAC<br>I/P: 100VAC<br>O/P: TESTING<br>TA : 25°C | 132.40% 277VAC<br>132.40% 230VAC<br>132.40% 100VAC<br>Constant Current Limiting |
| 2  | OVER VOLTAGE PROTECTION | 30.00V ~ 36.00V                        | I/P: 277VAC<br>I/P: 230VAC<br>I/P: 85VAC<br>O/P: MIN LOAD<br>TA : 25°C | 33.10V 277VAC<br>33.10V 230VAC<br>33.10V 85VAC<br>Shut down Re- power ON        |
| 3  | SHORT PROTECTION        | SHORT EVERY OUTPUT<br>1 HOUR NO DAMAGE | I/P: 277VAC<br>I/P: 85VAC<br>O/P: FULL LOAD<br>Ta: 25°C                | NO DAMAGE<br>Constant Current Limiting  |

**COMPONENT STRESS TEST**

| NO | TEST ITEM            | SPECIFICATION  | TEST CONDITION  | RESULT  |
|----|----------------------|--|---|---|
| 1  | PWM Power Transistor | Q1 Rated : 600V 13.0A  | I/P : 280VAC<br>VDS :<br>O/P : (1)Full Load Turn on<br>(2) Output Short<br>(3)Full load continue<br>Ta : 25°C             | VIN: 280VAC<br>VDS:<br>(1). 560.00V<br>(2). 502.00V<br>(3). 558.00V   |
| 2  | O/P MOSFET           | Q100 Rated : 200V 20.0A  | I/P : 280VAC<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). 105.00V<br>(2). 78.40V<br>(3). 105.00V  |
| 3  | Input Capacitor      | C5 Rated : 120uf 400V  | I/P : 280VAC<br>O/P : (1)Full Load Turn on /Off<br>(2)Min load Turn on /Off<br>(3)Full Load /Min load Change<br>Ta : 25°C | (1). 374.00V<br>(2). 398.00V<br>(3). 376.00V  |
| 4  | Control IC           | U101 Rated : 38V (max)<br>0V (min)<br>U1 Rated : 35V (max)<br>0V (min) | I/P : 280VAC<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 | U101 U1<br>(1). 24.40V 22.20V<br>(2). 0.62V 11.40V<br>(3). 3.24V 11.40V<br>(4). 33.10V 29.80V<br>(5). 21.20V 18.20V |
| 5  | Clamp Diode          | D42 Rated : 1000V 2.0A   | I/P : 280VAC<br>O/P : (1)Dynamic Load Full/Min Load 90%Duty/1KHz<br>(2)Full load continue<br>Ta : 25°C                    | (1). 492.00V<br>(2). 288.00V  |

**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<br>Ta : 25°C | I/P-O/P: 1.64mA<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: 180MΩ<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                          |
| 2  | CONDUCTION | EN55022<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  | EN55022<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>INDUSTRY AIR: 8KV / Contact: 4KV | I/P : 230VAC /50HZ<br>O/P : FULL LOAD<br>Ta : 25°C            | CRITERIA A                    |
| 5  | E.F.T      | EN61000-4-4<br>INDUSTRY INPUT: 2KV              | I/P : 230VAC /50HZ<br>O/P : FULL LOAD<br>Ta : 25°C            | CRITERIA A                    |
| 6  | SURGE      | IEC61000-4-5<br>INDUSTRY L-N: 2KV;L/N-PE: 4KV   | 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 : HDR-60-24<br>1. ROOM AMBIENT BURN-IN : 1.0hrs<br>IP: 230VAC O/P: 100% LOAD TA= 21.2°C<br>2. HIGH AMBIENT BURN-IN : 1.0hrs<br>IP: 230VAC O/P: 100% LOAD TA= 49.8°C   | <table border="1"> <thead> <tr> <th>NO.</th> <th>Position</th> <th>ROOM AMBIENT 21.2°C</th> <th>HIGH AMBIENT Ta: 49.8°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>48.5°C</td><td>72.5°C</td></tr> <tr><td>2</td><td>BD1</td><td>52.9°C</td><td>76.3°C</td></tr> <tr><td>3</td><td>C5</td><td>54.6°C</td><td>79.6°C</td></tr> <tr><td>4</td><td>Q1</td><td>66.3°C</td><td>88.6°C</td></tr> <tr><td>5</td><td>D42</td><td>71.5°C</td><td>94.9°C</td></tr> <tr><td>6</td><td>T1</td><td>84.6°C</td><td>105.7°C</td></tr> <tr><td>7</td><td>C105</td><td>65.4°C</td><td>87.3°C</td></tr> <tr><td>8</td><td>Q100</td><td>76.4°C</td><td>98.7°C</td></tr> <tr><td>9</td><td>LF101</td><td>63.9°C</td><td>86.3°C</td></tr> <tr><td>10</td><td>U1</td><td>58.2°C</td><td>81.4°C</td></tr> </tbody> </table> | NO.                  | Position | ROOM AMBIENT 21.2°C | HIGH AMBIENT Ta: 49.8°C | 1 | LF1 | 48.5°C | 72.5°C | 2 | BD1 | 52.9°C | 76.3°C | 3 | C5 | 54.6°C | 79.6°C | 4 | Q1 | 66.3°C | 88.6°C | 5 | D42 | 71.5°C | 94.9°C | 6 | T1 | 84.6°C | 105.7°C | 7 | C105 | 65.4°C | 87.3°C | 8 | Q100 | 76.4°C | 98.7°C | 9 | LF101 | 63.9°C | 86.3°C | 10 | U1 | 58.2°C | 81.4°C |  |
| NO. | Position   | ROOM AMBIENT 21.2°C   | HIGH AMBIENT Ta: 49.8°C   |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 1   | LF1  | 48.5°C  | 72.5°C  |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 2   | BD1  | 52.9°C  | 76.3°C  |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 3   | C5   | 54.6°C  | 79.6°C  |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 4   | Q1   | 66.3°C  | 88.6°C  |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 5   | D42  | 71.5°C  | 94.9°C  |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 6   | T1   | 84.6°C  | 105.7°C   |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 7   | C105   | 65.4°C  | 87.3°C  |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 8   | Q100   | 76.4°C  | 98.7°C  |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 9   | LF101  | 63.9°C  | 86.3°C  |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 10  | U1   | 58.2°C  | 81.4°C  |                      |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 2   | OVER LOAD BURN-IN TEST                                 | NO DAMAGE<br>1 HOUR ( MIN )   | I/P : 230VAC<br>O/P : 123.10% LOAD<br>Ta : 25°C   | 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 : -30.0°C  | TEST : OK            |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 4   | HIGH HUMIDITY<br>HIGH TEMPERATURE<br>HIGH VOLTAGE TEST | AFTER 12 HOURS<br>IN CHAMBER ON<br>CONTROL 45°C<br>NO DAMAGE  | I/P : 272VAC<br>O/P : FULL LOAD<br>Ta : 45°C<br>HUMIDITY= 95.0% RH  | TEST : OK            |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 5   | TEMPERATURE COEFFICIENT                                | ±0.03% /(0°C~50°C)  | I/P : 230VAC<br>O/P : FULL LOAD   | ±0.0072% /(0°C~50°C) |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 6   | STORAGE TEMPERATURE TEST                               | 1. Thermal shock Temperature : -40°C ~ +85°C<br>2. Temperature change rate : 25°C / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 5 CYCLE<br>5. Input/Output condition : STATIC  |   | TEST : OK            |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |
| 7   | THERMAL SHOCK TEST                                     | 1. Thermal shock Temperature : -35°C ~ +50°C<br>2. Temperature change rate : 25°C / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 10 CYCLE<br>5. Input/Output condition :<br>230VAC Full Load AC ON/OFF test turn on 58sec ; turn off 2sec |   | TEST : OK            |          |                     |                         |   |     |        |        |   |     |        |        |   |    |        |        |   |    |        |        |   |     |        |        |   |    |        |         |   |      |        |        |   |      |        |        |   |       |        |        |    |    |        |        |  |



|    |                              |  |  |
|----|------------------------------|--|--|
| 8  | VIBRATION TEST               | 1 Carton & 1 Set<br>(1) Waveform : Sine Wave<br>(2) Frequency : 10~500Hz<br>(4) Acceleration : 2G<br>(5) Test Time : 60 min in each axis (X.Y.Z)<br>(6) Ta : 25°C  | TEST : OK  |
| 9  | CAPACITOR LIFE CYCLE         | :SUPPOSE C105 IS THE MOST CRITICAL COMPONENT<br>(1) I/P : 230VAC O/P : FULL LOAD Ta= 25.0°C LIFE TIME<br>(2) I/P : 230VAC O/P : FULL LOAD Ta= 45.0°C LIFE TIME<br>(3) I/P : 230VAC O/P : 75% LOAD Ta= 45.0°C LIFE TIME<br>(4) I/P : 230VAC O/P : 50% LOAD Ta= 45.0°C LIFE TIME | (1). 120198 HRS<br>(2). 47838 HRS<br>(3). 73808.8 HRS<br>(4). 153816 HRS |
| 10 | MTBF                         | Conducted by Parts Stress Analysis Prediction<br>927.6K hrs min. MIL-HDBK-217F (25°C)  |  |
| 11 | DMTBF /Accelerated Life test | Demonstration Mean Time Between Failure (Expected Life): Above 30000HRS @ TA 45°C  |  |

|             |        |        |          |
|-------------|--------|--------|----------|
| TEST RESULT | TESTER | REVIEW | APPROVAL |
| PASS        | FRANK  | GESG   | WANGDZ   |