



# Test Report: DDR-240C-24

---

240W DIN Rail Type DC-DC Converter

## ■ 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

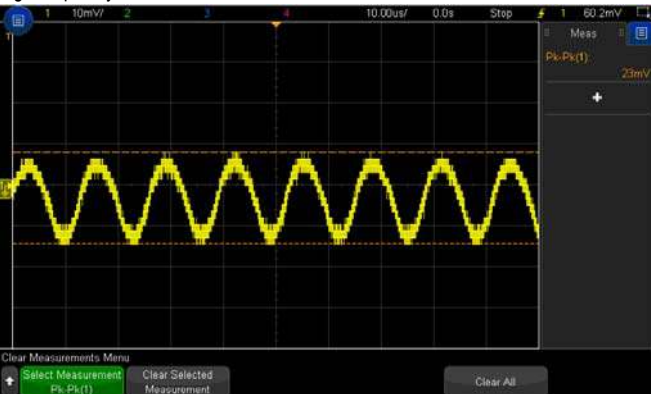
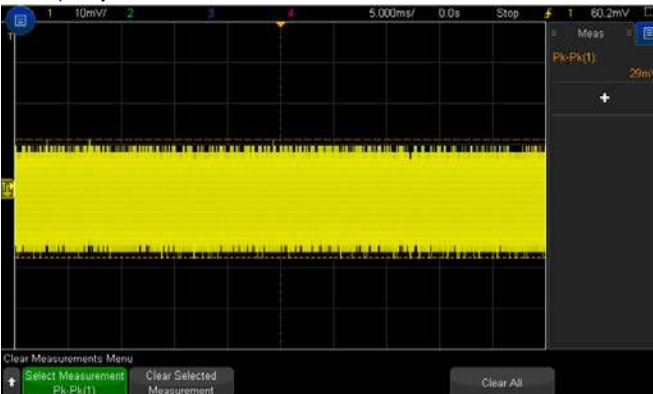
E.M.C. Test

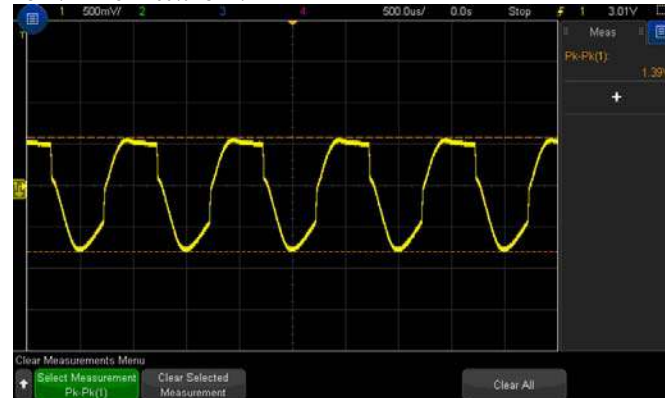
## ■ RELIABILITY TEST

ENVIRONMENT TEST

## DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

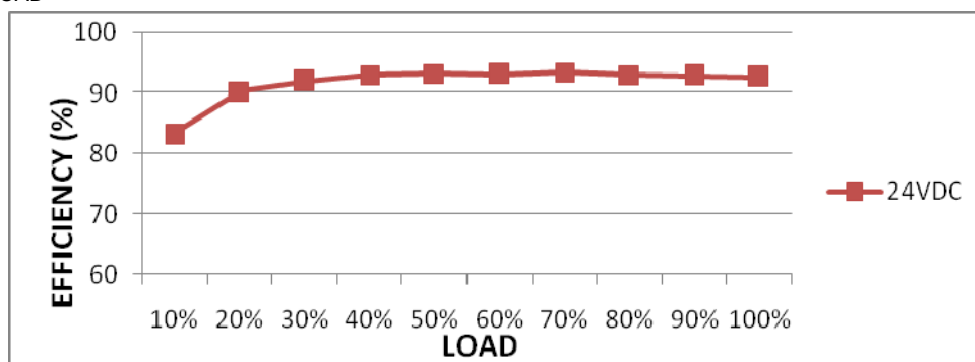
| NO                                                                                                                                                                                                                                                        | TEST ITEM                      | SPECIFICATION    | TEST CONDITION                                            | RESULT                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------|-----------------------------------------------------------|------------------------|
| 1                                                                                                                                                                                                                                                         | OUTPUT VOLTAGE ADJUST RANGE    | CH1: 24V~ 28V    | I/P: NORMAL VOLTAGE<br>O/P: MIN LOAD<br>Ta: 25°C          | CH1: 22.594 V~ 28.674V |
| 2                                                                                                                                                                                                                                                         | OUTPUT VOLTAGE TOLERANCE (Max) | V1: -1%~1 %      | I/P: 33.6VDC /67.2VDC<br>O/P: FULL/ MIN. LOAD<br>Ta: 25°C | V1: -0.2%~ 0.2%        |
| 3                                                                                                                                                                                                                                                         | LINE REGULATION (Max)          | V1: -0.5 %~ 0.5% | I/P: 33.6 VDC /67.2VDC<br>O/P: FULL LOAD<br>Ta: 25°C      | V1: 0%~ 0%             |
| 4                                                                                                                                                                                                                                                         | LOAD REGULATION (Max)          | V1: -1 %~ 1 %    | I/P: 48VDC<br>O/P: FULL ~MIN LOAD<br>Ta: 25°C             | V1: -0.2 %~ 0.2 %      |
| 5                                                                                                                                                                                                                                                         | OVER/UNDERSHOOT TEST           | < ±5%            | I/P: 48VDC<br>O/P: FULL LOAD<br>Ta: 25°C                  | TEST: 1.3%             |
| 6                                                                                                                                                                                                                                                         | RIPPLE & NOISE (Max)           | V1: 80 mVp-p     | I/P: 48VDC<br>O/P: FULL LOAD<br>Ta: 25°C                  | V1: 29mVp-p            |
| <div> <div>high frequency :</div>  </div> <div> <div>low frequency :</div>  </div> |                                |                  |                                                           |                        |
| 7                                                                                                                                                                                                                                                         | SET UP TIME (Max)              | 48VDC/ 500 ms    | I/P: 48VDC<br>O/P: FULL LOAD<br>Ta: 25°C                  | 48VDC/ 38.8 ms         |
| <div> <div>INPUT=24VDC @ FULL LOAD</div> <div>CH1 : Output Voltage CH2 : DC Input Voltage</div>  </div>                                                                |                                |                  |                                                           |                        |

|                                                                                                                                                              |                    |                                   |                                                                                                               |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 8                                                                                                                                                            | RISE TIME (Max)    | 48VDC/ 60ms                       | I/P: 48VDC<br>O/P: FULL LOAD<br>Ta: 25°C                                                                      | 48VDC/ 6.59ms                         |
| INPUT=24VDC @ FULL LOAD<br>                                                 |                    |                                   |                                                                                                               |                                       |
| 9                                                                                                                                                            | HOLD UP TIME (TYP) | 48VDC/ 8ms<br>48VDC/ 10ms@70%LOAD | I/P: 48VDC<br>O/P: FULL LOAD<br>Ta: 25°C                                                                      | 48VDC/ 9.4ms<br>48VDC/ 13.6ms@70%LOAD |
| INPUT=48VDC @ FULL LOAD<br>CH1 : Output Voltage CH2 : DC Input Voltage<br> |                    |                                   |                                                                                                               |                                       |
| INPUT=48VDC @ 70% LOAD<br>CH1 : Output Voltage CH2 : DC Input Voltage<br> |                    |                                   |                                                                                                               |                                       |
| 10                                                                                                                                                           | DYNAMIC LOAD       | V1: 2400mVp-p                     | I/P: 48VDC<br>O/P:<br>(1) FULL / MIN LOAD 50% DUTY / 120HZ<br>(2) FULL / MIN LOAD 50% DUTY / 1KHZ<br>Ta: 25°C | 1370mVp-p<br>1390mVp-p                |
| FULL / MIN LOAD 50% DUTY / 120HZ<br>                                      |                    |                                   |                                                                                                               |                                       |
| FULL / MIN LOAD 50% DUTY / 1KHZ<br>                                      |                    |                                   |                                                                                                               |                                       |

### INPUT FUNCTION TEST

| NO | TEST ITEM           | SPECIFICATION    | TEST CONDITION                                                                                                                                                          | RESULT          |
|----|---------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1  | INPUT VOLTAGE RANGE | 33.6VDC~ 67.2VDC | I/P: TESTING<br>O/P: FULL LOAD<br>Ta: 25°C                                                                                                                              | 32.25V~67.2V    |
|    |                     |                  | I/P:<br>LOW-LINE-0.2=33.4V<br>HIGH-LINE+3V=70.2V<br>O/P: FULL/MIN LOAD<br>(PLEASE CHECK DERATING CURVE)<br>ON: 30 Sec . OFF: 30 Sec 10MIN<br>( POWER ON/OFF NO DAMAGE ) | TEST: OK        |
| 2  | INPUT CURRENT(TYP)  | 48VDC/5.6A       | I/P: 48VDC<br>O/P: FULL LOAD<br>Ta: 25°C                                                                                                                                | I = 5.41A/48VDC |
| 3  | EFFICIENCY(TYP)     | 91%              | I/P: 48VDC<br>O/P: FULL LOAD<br>Ta: 25°C                                                                                                                                | 91.2%           |

EFFICIENCY vs LOAD



|   |                     |                          |                                           |                  |
|---|---------------------|--------------------------|-------------------------------------------|------------------|
| 4 | INRUSH CURRENT(TYP) | 48VDC/30 A<br>COLD START | I/P: 48 VDC<br>O/P: FULL LOAD<br>Ta: 25°C | I = 20.6A/ 48VDC |
|---|---------------------|--------------------------|-------------------------------------------|------------------|

INPUT=24VDC @ FULL LOAD



## PROTECTION FUNCTION TEST

| NO | TEST ITEM               | SPECIFICATION                          | TEST CONDITION                                                        | RESULT                                                                                                                                                                                                                                  |
|----|-------------------------|----------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | OVER LOAD PROTECTION    | 105 %~135 %RATED OUTPUT POWER          | I/P: 67.2VDC<br>I/P: 48VDC<br>I/P: 33.6VDC<br>O/P: TESTING<br>Ta:25°C | 122.12%/ 67.2VDC<br>121.98%/ 48VDC<br>122.1%/ 33.6VDC<br>PROTECTION TYPE :<br>Normally works within 150% rated output power for more than 3 seconds and then constant current protection 105~135% rated output power with auto-recovery |
| 2  | OVER VOLTAGE PROTECTION | CH: 28.8V~ 33.6V                       | I/P:67.2VDC<br>I/P: 48VDC<br>I/P: 33.6VDC<br>O/P: MIN LOAD<br>Ta:25°C | 32.0V/67.2VDC<br>32.0V/ 48VDC<br>32.1V/ 33.6VDC<br>PROTECTION TYPE :<br>Shut down O/P voltage, re-power on to recover                                                                                                                   |
| 3  | SHORT PROTECTION        | SHORT EVERY OUTPUT<br>1 HOUR NO DAMAGE | I/P:67.2VDC<br>O/P: FULL LOAD<br>Ta:25°C                              | NO DAMAGE<br>PROTECTION TYPE :<br>constant current protection 105~135% rated output power with auto-recovery                                                                                                                            |
| 4  | INPUT REVERSE           | POWER OK                               | I/P: 67.2VDC<br>O/P: NO LOAD<br>Ta:25°C                               | NO DAMAGE                                                                                                                                                                                                                               |

## COMPONENT STRESS TEST

| NO | TEST ITEM                                            | SPECIFICATION                                              | TEST CONDITION                                                                                                                                                    | RESULT                                                                                             |
|----|------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 1  | PWM Transistor<br>( D to S) or (C to E) Peak Voltage | Q11 Rated<br>: 200V                                        | I/P: High-Line +3V =70.2V<br>DC ON/OFF<br>VDS:<br>O/P: (1) Full Load<br>(2) Output Short<br>(3) Full Load continue<br>Ta:25°C                                     | VDS:<br>(1) 120.9V<br>(2) 98.4V<br>(3) 102.4V                                                      |
| 2  | Clamp MOSFET<br>( D to S) or (C to E) Peak Voltage   | Q 6 Rated<br>: 200V                                        | I/P: High-Line +3V =70.2V<br>DC ON/OFF<br>O/P: (1) Full Load<br>(2) Output Short<br>(3) Full Load continue<br>Ta:25°C                                             | VDS:<br>(1) 124.1V<br>(2) 76.7V<br>(3) 96.8V                                                       |
| 3  | Diode Peak Voltage                                   | D100 Rated<br>: 20A/ 200V<br><br>D102 Rated<br>: 20 A/200V | I/P: High-Line +3V =70.2V<br>DC ON/OFF<br>O/P: (1) Full Load<br>(2) Output Short<br>(3) Full Load continue<br>Ta:25°C                                             | D100 VDS:<br>(1) 138.6V<br>(2) 37.3V<br>(3) 40.5V<br>D102 VDS:<br>(1) 178V<br>(2) 186V<br>(3) 164V |
| 4  | Input Capacitor Voltage                              | C7 Rated<br>: 680 $\mu$ / 80V                              | I/P: High-Line +3V =70.2V<br>O/P: (1) Full Load input on/off<br>(2) Min load input on /Off<br>(3) Full Load /Min load Change<br>(4) Full load continue<br>Ta:25°C | (1) 71.0V<br>(2) 71.0V<br>(3) 71.0V<br>(4) 70.2V                                                   |

|   |                         |                              |                                                                                                                                               |                                                                |
|---|-------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| 5 | Control IC Voltage Test | PWM IC U1 Rated<br>-0.3V~16V | I/P:High-Line +3V =70.2 V<br>DC ON/OFF<br>O/P(1)FULL LOAD<br>(2) Output Short<br>(3)O.L.P<br>(4)O.V.P.<br>(5)NO LOAD VR 下限.LOW LINE<br>Ta:25℃ | (1) 13.9V<br>(2) 13.8V<br>(3) 13.9V<br>(4) 13.55V<br>(5) 9.29V |
|---|-------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|

## SAFETY TEST& E.M.C.

### SAFETY TEST

| NO | TEST ITEM            | SPECIFICATION                                                                 | TEST CONDITION                                                              | RESULT                                                        |
|----|----------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------|
| 1  | WITHSTAND VOLTAGE    | EN 60950-1<br>I/P-O/P:4KVDC/min<br>I/P-FG:2.5 KVDC/min<br>O/P-FG:0.71KVDC/min | I/P-O/P: 4.4KVDC/min<br>I/P-FG: 3 KVDC/min<br>O/P-FG:0.85KVDC/min<br>Ta:25℃ | I/P-O/P: 0 mA<br>I/P-FG: 0mA<br>O/P-FG: 0 mA<br>NO DAMAGE     |
| 2  | ISOLATION RESISTANCE | I/P-O/P:500VDC>100MΩ<br>I/P-FG: 500VDC>100MΩ<br>O/P-FG:500VDC>100MΩ           | I/P-O/P: 500 VDC<br>I/P-FG: 500 VDC<br>O/P-FG: 500 VDC<br>Ta:25℃            | I/P-O/P:9999MΩ<br>I/P-FG:9999MΩ<br>O/P-FG:9999MΩ<br>NO DAMAGE |
| 3  | GROUNDING CONTINUITY | EN 60950-1<br>FG(PE) TO CHASSIS<br>OR TRACE < 100 mΩ                          | 40A / 2min<br>Ta:25℃                                                        | 10mΩ                                                          |

### E.M.C TEST

| NO | TEST ITEM                                   | SPECIFICATION                                                                                                                                                   | TEST CONDITION                        | RESULT                                                                                             |
|----|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------------------------|
| 1  | RADIATION                                   | <input checked="" type="checkbox"/> EN55032 <input type="checkbox"/> EN55011<br><input type="checkbox"/> CLASS A<br><input checked="" type="checkbox"/> CLASS B | I/P:48VDC<br>O/P:FULL LOAD<br>Ta:25℃  | <input checked="" type="checkbox"/> PASS<br><input type="checkbox"/> FAIL<br>Test by certified Lab |
| 2  | CONDUCTION                                  | <input checked="" type="checkbox"/> EN55032 <input type="checkbox"/> EN55011<br><input type="checkbox"/> CLASS A<br><input checked="" type="checkbox"/> CLASS B | I/P:48VDC<br>O/P:FULL LOAD<br>Ta:25℃  | <input checked="" type="checkbox"/> PASS<br><input type="checkbox"/> FAIL<br>Test by certified Lab |
| 3  | E.S.D                                       | EN61000-4-2<br><input type="checkbox"/> Din rail Model :<br>AIR: 8KV / Contact: 6KV                                                                             | I/P:48VDC<br>O/P:FULL LOAD<br>Ta:25℃  | <input checked="" type="checkbox"/> CRITERIA A<br><input type="checkbox"/> CRITERIA B              |
| 4  | E.F.T                                       | EN61000-4-4<br><input type="checkbox"/> INDUSTRY<br>INPUT: 2KV                                                                                                  | I/P: 48VDC<br>O/P:FULL LOAD<br>Ta:25℃ | <input checked="" type="checkbox"/> CRITERIA A<br><input type="checkbox"/> CRITERIA B              |
| 5  | SURGE                                       | IEC61000-4-5<br><input type="checkbox"/> INDUSTRY<br>L-N :1KV<br>L,N-FG:2KV                                                                                     | I/P: 48VDC<br>O/P:FULL LOAD<br>Ta:25℃ | <input checked="" type="checkbox"/> CRITERIA A<br><input type="checkbox"/> CRITERIA B              |
| 6  | Test by certified Lab & Test Report Prepare |                                                                                                                                                                 |                                       |                                                                                                    |

## RELIABILITY TEST

### ENVIRONMENT TEST

| NO | TEST ITEM                                                         | SPECIFICATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | TEST CONDITION                                                      | RESULT             |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
|----|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------|----|----------|--------------------------|--------------------------|---|-----|--------|--------|---|----|--------|--------|---|-------|--------|---------|---|-----|--------|--------|---|----|--------|--------|---|----|--------|--------|---|------|--------|---------|---|----|--------|--------|---|------|--------|---------|----|------|--------|---------|----|------|--------|---------|----|------|--------|--------|----|----|--------|--------|----|-----|--------|--------|----|-----|--------|--------|----|-----|--------|--------|----|----|--------|--------|----|------|--------|--------|----|------|--------|---------|
| 1  | TEMPERATURE RISE TEST                                             | <div>MODEL : DDR-240C-24</div> <div>1. ROOM AMBIENT BURN-IN : 1.5 HRS</div> <div>I/P : 48VDC O/P : FULL LOAD Ta= 24.2 °C</div> <div>2. HIGH AMBIENT BURN-IN : 1 HRS</div> <div>I/P : 48VDC O/P : FULL LOAD Ta= 50.8 °C</div> <table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 24.2 °C</th><th>HIGH AMBIENT Ta= 50.8 °C</th></tr><tr><td>1</td><td>LF1</td><td>61.8°C</td><td>92.9°C</td></tr><tr><td>2</td><td>Q3</td><td>64.9°C</td><td>97.2°C</td></tr><tr><td>3</td><td>LF100</td><td>74.2°C</td><td>104.9°C</td></tr><tr><td>4</td><td>LF2</td><td>61.6°C</td><td>92.6°C</td></tr><tr><td>5</td><td>T1</td><td>67.5°C</td><td>98.5°C</td></tr><tr><td>6</td><td>T2</td><td>63.3°C</td><td>93.5°C</td></tr><tr><td>7</td><td>L100</td><td>72.8°C</td><td>104.0°C</td></tr><tr><td>8</td><td>C3</td><td>58.1°C</td><td>89.4°C</td></tr><tr><td>9</td><td>D100</td><td>86.4°C</td><td>115.5°C</td></tr><tr><td>10</td><td>D105</td><td>80.6°C</td><td>109.3°C</td></tr><tr><td>11</td><td>C103</td><td>71.5°C</td><td>101.4°C</td></tr><tr><td>12</td><td>C104</td><td>64.9°C</td><td>96.0°C</td></tr><tr><td>13</td><td>Q6</td><td>60.1°C</td><td>90.5°C</td></tr><tr><td>14</td><td>Q12</td><td>62.3°C</td><td>93.8°C</td></tr><tr><td>15</td><td>C21</td><td>60.7°C</td><td>90.9°C</td></tr><tr><td>16</td><td>R43</td><td>45.5°C</td><td>74.6°C</td></tr><tr><td>17</td><td>U1</td><td>62.6°C</td><td>92.1°C</td></tr><tr><td>18</td><td>C109</td><td>62.6°C</td><td>93.8°C</td></tr><tr><td>19</td><td>TSW1</td><td>72.9°C</td><td>102.8°C</td></tr></table> |                                                                     |                    | NO | Position | ROOM AMBIENT Ta= 24.2 °C | HIGH AMBIENT Ta= 50.8 °C | 1 | LF1 | 61.8°C | 92.9°C | 2 | Q3 | 64.9°C | 97.2°C | 3 | LF100 | 74.2°C | 104.9°C | 4 | LF2 | 61.6°C | 92.6°C | 5 | T1 | 67.5°C | 98.5°C | 6 | T2 | 63.3°C | 93.5°C | 7 | L100 | 72.8°C | 104.0°C | 8 | C3 | 58.1°C | 89.4°C | 9 | D100 | 86.4°C | 115.5°C | 10 | D105 | 80.6°C | 109.3°C | 11 | C103 | 71.5°C | 101.4°C | 12 | C104 | 64.9°C | 96.0°C | 13 | Q6 | 60.1°C | 90.5°C | 14 | Q12 | 62.3°C | 93.8°C | 15 | C21 | 60.7°C | 90.9°C | 16 | R43 | 45.5°C | 74.6°C | 17 | U1 | 62.6°C | 92.1°C | 18 | C109 | 62.6°C | 93.8°C | 19 | TSW1 | 72.9°C | 102.8°C |
| NO | Position                                                          | ROOM AMBIENT Ta= 24.2 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | HIGH AMBIENT Ta= 50.8 °C                                            |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 1  | LF1                                                               | 61.8°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 92.9°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 2  | Q3                                                                | 64.9°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 97.2°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 3  | LF100                                                             | 74.2°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 104.9°C                                                             |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 4  | LF2                                                               | 61.6°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 92.6°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 5  | T1                                                                | 67.5°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 98.5°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 6  | T2                                                                | 63.3°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 93.5°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 7  | L100                                                              | 72.8°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 104.0°C                                                             |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 8  | C3                                                                | 58.1°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 89.4°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 9  | D100                                                              | 86.4°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 115.5°C                                                             |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 10 | D105                                                              | 80.6°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 109.3°C                                                             |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 11 | C103                                                              | 71.5°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 101.4°C                                                             |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 12 | C104                                                              | 64.9°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 96.0°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 13 | Q6                                                                | 60.1°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 90.5°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 14 | Q12                                                               | 62.3°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 93.8°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 15 | C21                                                               | 60.7°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 90.9°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 16 | R43                                                               | 45.5°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 74.6°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 17 | U1                                                                | 62.6°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 92.1°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 18 | C109                                                              | 62.6°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 93.8°C                                                              |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 19 | TSW1                                                              | 72.9°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 102.8°C                                                             |                    |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 2  | OVER LOAD BURN-IN TEST                                            | NO DAMAGE<br>1 HOUR ( MIN )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | I/P : 48 VDC<br>O/P : 123 % LOAD<br>Ta : 25°C                       | TEST : OK          |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 3  | LOW TEMPERATURE<br>TURN ON TEST                                   | TURN ON AFTER 2 HOUR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I/P : 43.2 VDC/ 67.2 VDC<br>O/P : 100 % LOAD<br>Ta= -40 °C          | TEST : OK          |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 4  | HIGH HUMIDITY<br>HIGH TEMPERATURE<br>HIGH VOLTAGE<br>TURN ON TEST | AFTER 12 HOURS<br>IN CHAMBER ON<br>CONTROL 55 °C<br>NO DAMAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | I/P : 70.2 VDC<br>O/P : FULL LOAD<br>Ta= 50 °C<br>HUMIDITY= 95 %R.H | TEST : OK          |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 5  | TEMPERATURE<br>COEFFICIENT                                        | ± 0.03 %(0~55°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I/P : 48VDC<br>O/P : FULL LOAD                                      | ± 0.0063 %(0~50°C) |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |
| 6  | STORAGE TEMPERATURE TEST                                          | 1. Thermal shock Temperature : -45°C~ +90°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 : STATIC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                     | TEST : OK          |    |          |                          |                          |   |     |        |        |   |    |        |        |   |       |        |         |   |     |        |        |   |    |        |        |   |    |        |        |   |      |        |         |   |    |        |        |   |      |        |         |    |      |        |         |    |      |        |         |    |      |        |        |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |    |        |        |    |      |        |        |    |      |        |         |

|                         |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                           |              |              |                         |         |       |                 |       |      |            |                     |  |           |
|-------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------|--------------|-------------------------|---------|-------|-----------------|-------|------|------------|---------------------|--|-----------|
| 7                       | THERMAL SHOCK TEST          | 1. Thermal shock Temperature : -45℃~ +55℃<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 : 48VDC/Full Load DC ON/OFF TEST<br>turn on 3sec ; turn off 1sec@15cycle\ 48VDC/Full Load DC ON@1cycle                                                                                                                                                                                          | TEST : OK                                                                 |              |              |                         |         |       |                 |       |      |            |                     |  |           |
| 8                       | VIBRATION TEST              | 1 Carton & 1 Set<br>(1) Waveform : Sine Wave<br>(2) Frequency : 10~500Hz<br>(3) Sweep Time : 10min/sweep cycle<br>(4) Acceleration : 5G<br>(5) Test Time : 60min in each axis (X.Y.Z)<br>(6) Ta : 25℃<br><br>2 Din Rail <table><tr><td></td><td>Displacement</td><td>Acceleration</td></tr><tr><td>2 (+3/-0) Hz up to 15Hz</td><td>± 2.5mm</td><td>-----</td></tr><tr><td>15Hz up to 50Hz</td><td>-----</td><td>2.3g</td></tr><tr><td>Sweep rate</td><td colspan="2">Max 1 Octave/minute</td></tr></table> |                                                                           | Displacement | Acceleration | 2 (+3/-0) Hz up to 15Hz | ± 2.5mm | ----- | 15Hz up to 50Hz | ----- | 2.3g | Sweep rate | Max 1 Octave/minute |  | TEST : OK |
|                         | Displacement                | Acceleration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                           |              |              |                         |         |       |                 |       |      |            |                     |  |           |
| 2 (+3/-0) Hz up to 15Hz | ± 2.5mm                     | -----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                           |              |              |                         |         |       |                 |       |      |            |                     |  |           |
| 15Hz up to 50Hz         | -----                       | 2.3g                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                           |              |              |                         |         |       |                 |       |      |            |                     |  |           |
| Sweep rate              | Max 1 Octave/minute         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                           |              |              |                         |         |       |                 |       |      |            |                     |  |           |
| 9                       | CAPACITOR LIFE CYCLE        | SUPPOSE C103 IS THE MOST CRITICAL COMPONENT<br>(1) I/P : 48VDC O/P : FULL LOAD Ta= 25 °℃ LIFE TIME<br>(2) I/P : 48VDC O/P : FULL LOAD Ta= 50 °℃ LIFE TIME<br>(3) I/P : 48VDC O/P : 75% LOAD Ta= 50 °℃ LIFE TIME<br>(4) I/P : 48VDC O/P : 50% LOAD Ta= 50 °℃ LIFE TIME                                                                                                                                                                                                                                      | (1) 388811.3 HRS<br>(2) 54648.8 HRS<br>(3) 136176.4 HRS<br>(4) 295617 HRS |              |              |                         |         |       |                 |       |      |            |                     |  |           |
| 10                      | MTBF                        | Conducted by Parts Stress Analysis Prediction<br>484.9K hrs min. Telcordia SR-332 (Bellcore) ; 189.9K hrs min. MIL-HDBK-217F (25℃)                                                                                                                                                                                                                                                                                                                                                                         |                                                                           |              |              |                         |         |       |                 |       |      |            |                     |  |           |
| 11                      | DMTBF/Accelerated Life Test | Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50℃                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                           |              |              |                         |         |       |                 |       |      |            |                     |  |           |

| TEST RESULT | TESTER | REVIEW | APPROVAL |
|-------------|--------|--------|----------|
| PASS        | LIUTT  |        | WANGDZ   |

2018.4.30 GP-A50-F010