



# Test Report: DDR-240B-24

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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

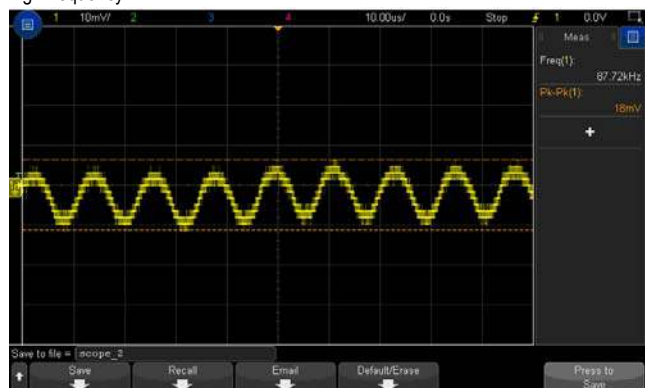
ENVIRONMENT TEST

## DESIGN VERIFY TEST

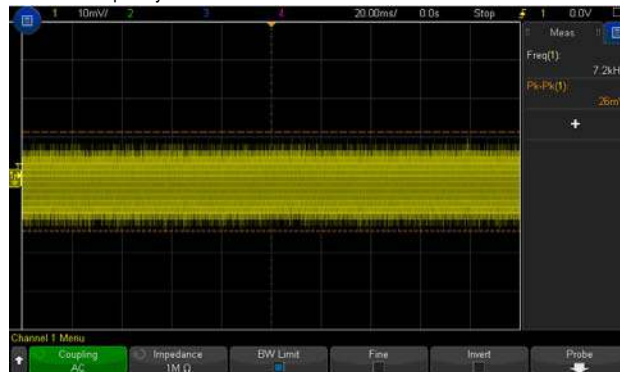
### OUTPUT FUNCTION TEST

| NO | TEST ITEM                      | SPECIFICATION    | TEST CONDITION                                            | RESULT                 |
|----|--------------------------------|------------------|-----------------------------------------------------------|------------------------|
| 1  | OUTPUT VOLTAGE ADJUST RANGE    | CH1: 24V~28 V    | I/P: NORMAL VOLTAGE<br>O/P: MIN LOAD<br>Ta: 25°C          | CH1: 22.726.V~ 28.913V |
| 2  | OUTPUT VOLTAGE TOLERANCE (Max) | V1: -1%~1 %      | I/P: 16.8VDC /33.6VDC<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: 16.8 VDC /33.6VDC<br>O/P: FULL LOAD<br>Ta: 25°C      | V1: -0.1%~ 0. 1%       |
| 4  | LOAD REGULATION (Max)          | V1: -1 %~ 1 %    | I/P: 24VDC<br>O/P: FULL ~MIN LOAD<br>Ta: 25°C             | V1: -0.2%~ 0.2%        |
| 5  | OVER/UNDERSHOOT TEST           | < ±5%            | I/P: 24 VDC<br>O/P: FULL LOAD<br>Ta: 25°C                 | TEST: 1.3%             |
| 6  | RIPPLE & NOISE (Max)           | V1: 80mVp-p      | I/P: 24VDC<br>O/P: FULL LOAD<br>Ta: 25°C                  | V1: 26 mVp-p           |

high frequency :



low frequency :

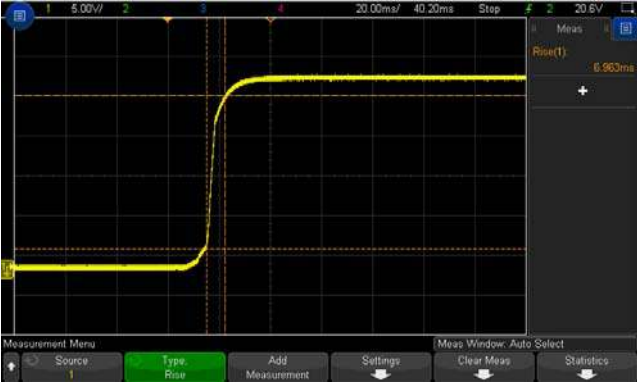
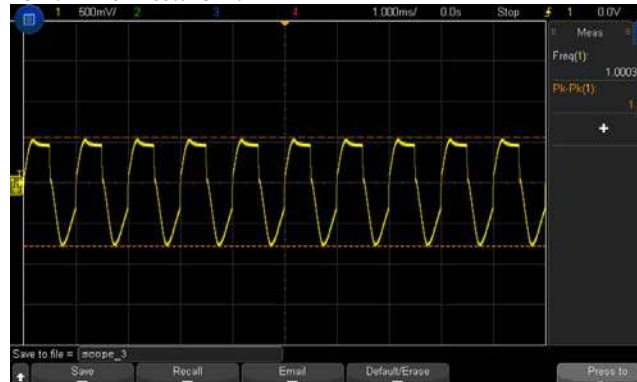


|   |                   |               |                                          |               |
|---|-------------------|---------------|------------------------------------------|---------------|
| 7 | SET UP TIME (Max) | 24VDC/ 500 ms | I/P: 24VDC<br>O/P: FULL LOAD<br>Ta: 25°C | 24VDC/ 23.6ms |
|---|-------------------|---------------|------------------------------------------|---------------|

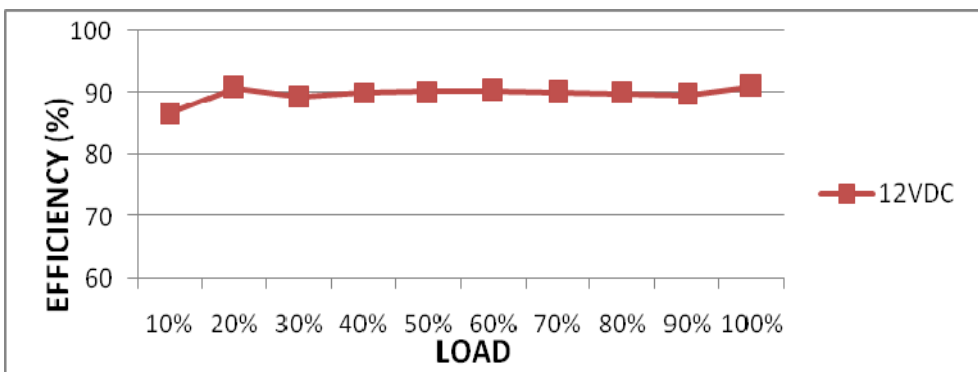
INPUT=24VDC @ FULL LOAD

CH1 : Output Voltage CH2 : DC Input Voltage



|                                                                                                                                                              |                    |                                           |                                                                                                             |                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| 8                                                                                                                                                            | RISE TIME (Max)    | 24VDC/ 60ms                               | I/P: 24 VDC<br>O/P: FULL LOAD<br>Ta: 25°C                                                                   | 24VDC/ 6.96ms                                   |
| INPUT=24VDC @ FULL LOAD<br>                                                 |                    |                                           |                                                                                                             |                                                 |
| 9                                                                                                                                                            | HOLD UP TIME (TYP) | 24VDC/6ms@FULL LOAD<br>24VDC/10ms@70%LOAD | I/P: 24 VDC<br>O/P: FULL LOAD<br>Ta: 25°C                                                                   | 24VDC/ 7.2ms@FULL LOAD<br>24VDC/ 10.4ms@70%LOAD |
| INPUT=24VDC @ FULL LOAD<br>CH1 : Output Voltage CH2 : DC Input Voltage<br> |                    |                                           |                                                                                                             |                                                 |
| INPUT=24VDC @ 70% LOAD<br>CH1 : Output Voltage CH2 : DC Input Voltage<br> |                    |                                           |                                                                                                             |                                                 |
| 10                                                                                                                                                           | DYNAMIC LOAD       | V1: 2400mVp-p                             | I/P: 24VDC<br>O/P:<br>(1) FULL / MIN LOAD 50%DUTY / 120HZ<br>(2) FULL / MIN LOAD 50%DUTY / 1KHZ<br>Ta: 25°C | 1290mVp-p<br>1350mVp-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 | 16.8VDC~ 33.6VDC         | I/P:TESTING<br>O/P:FULL LOAD<br>Ta:25℃                                                                                                                                 | 16.1V~ 33.6VV   |
|                                                                                                |                     |                          | I/P:<br>LOW-LINE-0.2=16.6V<br>HIGH-LINE+3V=36.6V<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)  | 24VDC/11.2 A             | I/P: 24VDC<br>O/P:FULL LOAD<br>Ta:25℃                                                                                                                                  | I =10.96A/24VDC |
| 3                                                                                              | EFFICIENCY(TYP)     | 90%                      | I/P: 24VDC<br>O/P:FULL LOAD<br>Ta:25℃                                                                                                                                  | 90.46%          |
| EFFICIENCY vs LOAD                                                                             |                     |                          |                                                                                                                                                                        |                 |
| <div></div> |                     |                          |                                                                                                                                                                        |                 |
| 4                                                                                              | INRUSH CURRENT(TYP) | 24VDC/30 A<br>COLD START | I/P:24 VDC<br>O/P:FULL LOAD<br>Ta:25℃                                                                                                                                  | I =23.5A/ 24VDC |
| INPUT=24VDC @ FULL LOAD                                                                        |                     |                          |                                                                                                                                                                        |                 |
| <div></div> |                     |                          |                                                                                                                                                                        |                 |

## PROTECTION FUNCTION TEST

| NO | TEST ITEM               | SPECIFICATION                          | TEST CONDITION                                                           | RESULT                                                                                                                                                                                                                                   |
|----|-------------------------|----------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | OVER LOAD PROTECTION    | 105 %~135 %RATED OUTPUT POWER          | I/P: 33.6VDC<br>I/P: 24 VDC<br>I/P: 16.8 VDC<br>O/P: TESTING<br>Ta:25°C  | 125.2%/ 33.6 VDC<br>125.2%/ 24 VDC<br>125.2%/ 16.8 VDC<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~ 35V                         | I/P: 33.6 VDC<br>I/P: 24VDC<br>I/P: 16.8 VDC<br>O/P: MIN LOAD<br>Ta:25°C | 31.6V/ 33.6 VDC<br>31.6V/ 24 VDC<br>31.6V/ 16.8 VDC<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: 33.6VDC<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: 33.6VDC<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>: 100 V                             | I/P: High-Line +3V =36.6V<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) 64.8V<br>(2) 55.1V<br>(3) 55.1V                                  |
| 2  | Clamp MOSFET<br>(D to S) or (C to E) Peak Voltage   | Q 6 Rated<br>: 100V                              | I/P: High-Line +3V =36.6V<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) 60.0V<br>(2) 42.3V<br>(3) 52.7V                                  |
| 3  | Diode Peak Voltage                                  | D100 Rated<br>: 200V<br><br>D102 Rated<br>: 200V | I/P: High-Line +3V =36.6V<br>DC ON/OFF<br>O/P: (1) Full Load<br>(2) Output Short<br>(3) Full Load Continue<br>Ta:25°C                                             | D100: D102:<br>(1) 140V (1) 176V<br>(2) 41.5V (2) 182V<br>(3) 43.1V (3) 174V |
| 4  | Input Capacitor Voltage                             | C7 Rated<br>: 2200 $\mu$ / 35V                   | I/P: High-Line +3V =36.6V<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) 34.6V<br>(2) 34.2V<br>(3) 34.6V<br>(4) 34.6V                             |

|   |                         |                              |                                                                                                                                              |                                                              |
|---|-------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| 5 | Control IC Voltage Test | PWM IC U1 Rated<br>-0.3V~16V | I/P:High-Line +3V =36.6V<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) 14.4V<br>(2) 14.0V<br>(3) 14.8V<br>(4) 13.8V<br>(5) 9.6V |
|---|-------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|

## ■ SAFETY & E.M.C. TEST

### 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: 0mA<br>I/P-FG: 0 mA<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:24VDC<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:24VDC<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:24VDC<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: 24VDC<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: 24VDC<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-240B-24</div> <div>1. ROOM AMBIENT BURN-IN : 2 HRS</div> <div>I/P : 24VDC O/P : FULL LOAD Ta= 24.2 ℃</div> <div>2. HIGH AMBIENT BURN-IN : 2 HRS</div> <div>I/P : 24VDC O/P : FULL LOAD Ta= 50.8 ℃</div> <table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 24.2 ℃</th><th>HIGH AMBIENT Ta= 50.8 ℃</th></tr><tr><td>1</td><td>LF1</td><td>74.0℃</td><td>105.3℃</td></tr><tr><td>2</td><td>Q3</td><td>63.0℃</td><td>92.2℃</td></tr><tr><td>3</td><td>LF100</td><td>77.8℃</td><td>107.8℃</td></tr><tr><td>4</td><td>LF2</td><td>71.7℃</td><td>103.8℃</td></tr><tr><td>5</td><td>T1</td><td>72.3℃</td><td>102.7℃</td></tr><tr><td>6</td><td>T2</td><td>75.9℃</td><td>106.8℃</td></tr><tr><td>7</td><td>L100</td><td>77.6℃</td><td>108.8℃</td></tr><tr><td>8</td><td>C3</td><td>66.5℃</td><td>98.8℃</td></tr><tr><td>9</td><td>D100</td><td>90.0℃</td><td>120.0℃</td></tr><tr><td>10</td><td>D105</td><td>83.2℃</td><td>116.2℃</td></tr><tr><td>11</td><td>C103</td><td>75.4℃</td><td>106.7℃</td></tr><tr><td>12</td><td>C104</td><td>72.9℃</td><td>103.8℃</td></tr><tr><td>13</td><td>Q6</td><td>67.8℃</td><td>98.8℃</td></tr><tr><td>14</td><td>Q12</td><td>71.1℃</td><td>102.1℃</td></tr><tr><td>15</td><td>C21</td><td>68.0℃</td><td>99.0℃</td></tr><tr><td>16</td><td>R43</td><td>61.9℃</td><td>90.8℃</td></tr><tr><td>17</td><td>U1</td><td>72.7℃</td><td>102.8℃</td></tr><tr><td>18</td><td>C109</td><td>68.2℃</td><td>97.9℃</td></tr><tr><td>19</td><td>TSW1</td><td>79.8℃</td><td>108.0℃</td></tr></table> |                                                                    |                 | NO | Position | ROOM AMBIENT Ta= 24.2 ℃ | HIGH AMBIENT Ta= 50.8 ℃ | 1 | LF1 | 74.0℃ | 105.3℃ | 2 | Q3 | 63.0℃ | 92.2℃ | 3 | LF100 | 77.8℃ | 107.8℃ | 4 | LF2 | 71.7℃ | 103.8℃ | 5 | T1 | 72.3℃ | 102.7℃ | 6 | T2 | 75.9℃ | 106.8℃ | 7 | L100 | 77.6℃ | 108.8℃ | 8 | C3 | 66.5℃ | 98.8℃ | 9 | D100 | 90.0℃ | 120.0℃ | 10 | D105 | 83.2℃ | 116.2℃ | 11 | C103 | 75.4℃ | 106.7℃ | 12 | C104 | 72.9℃ | 103.8℃ | 13 | Q6 | 67.8℃ | 98.8℃ | 14 | Q12 | 71.1℃ | 102.1℃ | 15 | C21 | 68.0℃ | 99.0℃ | 16 | R43 | 61.9℃ | 90.8℃ | 17 | U1 | 72.7℃ | 102.8℃ | 18 | C109 | 68.2℃ | 97.9℃ | 19 | TSW1 | 79.8℃ | 108.0℃ |
| NO | Position                                                          | ROOM AMBIENT Ta= 24.2 ℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | HIGH AMBIENT Ta= 50.8 ℃                                            |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 1  | LF1                                                               | 74.0℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 105.3℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 2  | Q3                                                                | 63.0℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 92.2℃                                                              |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 3  | LF100                                                             | 77.8℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 107.8℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 4  | LF2                                                               | 71.7℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 103.8℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 5  | T1                                                                | 72.3℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 102.7℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 6  | T2                                                                | 75.9℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 106.8℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 7  | L100                                                              | 77.6℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 108.8℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 8  | C3                                                                | 66.5℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 98.8℃                                                              |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 9  | D100                                                              | 90.0℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 120.0℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 10 | D105                                                              | 83.2℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 116.2℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 11 | C103                                                              | 75.4℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 106.7℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 12 | C104                                                              | 72.9℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 103.8℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 13 | Q6                                                                | 67.8℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 98.8℃                                                              |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 14 | Q12                                                               | 71.1℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 102.1℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 15 | C21                                                               | 68.0℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 99.0℃                                                              |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 16 | R43                                                               | 61.9℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 90.8℃                                                              |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 17 | U1                                                                | 72.7℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 102.8℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 18 | C109                                                              | 68.2℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 97.9℃                                                              |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 19 | TSW1                                                              | 79.8℃                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 108.0℃                                                             |                 |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 2  | OVER LOAD BURN-IN TEST                                            | NO DAMAGE<br>1 HOUR ( MIN )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I/P : 24 VDC<br>O/P : 125 % LOAD<br>Ta : 25℃                       | TEST : OK       |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 3  | LOW TEMPERATURE<br>TURN ON TEST                                   | TURN ON AFTER 2 HOUR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | I/P : 21.6 VDC/ 33.6 VDC<br>O/P : 100 % LOAD<br>Ta= -40 ℃          | 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 ℃<br>NO DAMAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | I/P : 36.6 VDC<br>O/P : FULL LOAD<br>Ta= 50 ℃<br>HUMIDITY= 95 %R.H | TEST : OK       |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 5  | TEMPERATURE<br>COEFFICIENT                                        | ± 0.03 %(0~55℃)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I/P : 24 VDC<br>O/P : FULL LOAD                                    | ±0.0079%(0~50℃) |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |
| 6  | STORAGE TEMPERATURE TEST                                          | 1. Thermal shock Temperature : -45℃~ +90℃<br>2. Temperature change rate : 25℃ / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 10 CYCLE<br>5. Input/Output condition : STATIC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                    | TEST : OK       |    |          |                         |                         |   |     |       |        |   |    |       |       |   |       |       |        |   |     |       |        |   |    |       |        |   |    |       |        |   |      |       |        |   |    |       |       |   |      |       |        |    |      |       |        |    |      |       |        |    |      |       |        |    |    |       |       |    |     |       |        |    |     |       |       |    |     |       |       |    |    |       |        |    |      |       |       |    |      |       |        |

|                         |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                           |              |              |                         |         |       |                 |       |      |            |                     |  |           |
|-------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------|--------------|-------------------------|---------|-------|-----------------|-------|------|------------|---------------------|--|-----------|
| 7.                      | THERMAL SHOCK TEST          | 1. Thermal shock Temperature : -45°C~ +55°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 : 16 CYCLE<br>5. Input/Output condition : 24VDC/Full Load DC ON/OFF TEST<br>turn on 3sec ; turn off 1sec@15cycle\ 24VDC/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°C<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 : 24VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME<br>(2) I/P : 24VDC O/P : FULL LOAD Ta= 50 °C LIFE TIME<br>(3) I/P : 24VDC O/P : 75% LOAD Ta= 50 °C LIFE TIME<br>(4) I/P : 24VDC O/P : 50% LOAD Ta= 50 °C LIFE TIME                                                                                                                                                                                                                                       | (1) 296685 HRS<br>(2) 37833.8 HRS<br>(3) 106068.1 HRS<br>(4) 246886.5 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°C)                                                                                                                                                                                                                                                                                                                                                                         |                                                                           |              |              |                         |         |       |                 |       |      |            |                     |  |           |
| 11                      | DMTBF/Accelerated Life Test | Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50°C                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                           |              |              |                         |         |       |                 |       |      |            |                     |  |           |

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

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