



# Test Report: DRDN40-48

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40A DIN Rail Type Redundancy Module

## ■ 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

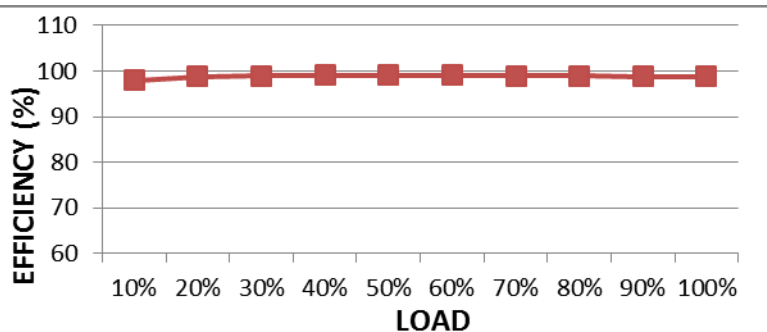
### OUTPUT FUNCTION TEST

| NO | TEST ITEM                      | SPECIFICATION         | TEST CONDITION                              | RESULT |
|----|--------------------------------|-----------------------|---------------------------------------------|--------|
| 1  | RATED CURRENT                  | 0~40A<br>CONTINUOUS   | I/P : 48VDC<br>O/P : FULL LOAD<br>Ta : 25°C | OK     |
| 2  | PEAK CURRENT                   | 60A 5Sec<br>NO DAMAGE | I/P: 48VDC<br>O/P : 60A<br>Ta:25°C          | OK     |
| 3  | CAPACITANCE                    | 320uF                 | I/P : 48VDC<br>O/P : 320uF<br>Ta : 25°C     | OK     |
| 4  | STANDBY POWER LOSSES<br>(Typ.) | 1.5W                  | I/P : 48VDC<br>O/P : NO LOAD<br>Ta : 25°C   | 0.89W  |

### INPUT FUNCTION TEST

| NO | TEST ITEM                         | SPECIFICATION                              | TEST CONDITION                                         | RESULT            |
|----|-----------------------------------|--------------------------------------------|--------------------------------------------------------|-------------------|
| 1  | INPUT VOLTAGE RANGE               | 36VDC~60VDC                                | I/P: TESTING<br>O/P: FULL LOAD<br>Ta: 25°C             | 34.14VDC~62.08VDC |
| 2  | RATED CURRENT                     | 0~20Ax2 input, 0~40Ax1 input<br>Continuous | I/P : 48VDC<br>O/P: 0~20Ax2 input, 0~40Ax1<br>Ta: 25°C | OK                |
| 3  | VOLTAGE DROP (Vin-Vout)<br>(max.) | 0.3V                                       | I/P : 48VDC<br>O/P : FULL LOAD<br>Ta : 25°C            | 0.24V             |
| 4  | PEAK CURRENT                      | 0~30Ax2 input, 0~60Ax1 5Sec<br>NO DAMAGE   | I/P: 48VDC<br>O/P : 60A<br>Ta: 25°C                    | OK                |
| 5  | INPUT REVERSE CURRENT<br>(max.)   | 1mA                                        | I/P : 48VDC<br>O/P : FULL LOAD<br>Ta : 25°C            | 2.87uA            |
| 6  | INPUT REVERSE VOLTAGE<br>(max.)   | 65Vdc<br>NO DAMAGE                         | I/P : 65VDC<br>O/P : FULL LOAD<br>Ta : 25°C            | OK                |
| 7  | EFFICIENCY(Typ.)                  | 98%                                        | I/P: 48VDC<br>O/P: FULL LOAD<br>Ta: 25°C               | 99.66%            |

EFFICIENCY vs LOAD



### PROTECTION FUNCTION TEST

| NO | TEST ITEM            | SPECIFICATION                 | TEST CONDITION                         | RESULT    |
|----|----------------------|-------------------------------|----------------------------------------|-----------|
| 1  | OVER LOAD PROTECTION | <60A No damage<br>5 sec (max) | I/P:48VDC<br>O/P:TESTING<br>Ta:25℃     | NO DAMAGE |
| 2  | SHORT PROTECTION     | <60A No damage<br>5 sec (max) | I/P: 60VDC<br>O/P: FULL LOAD<br>Ta:25℃ | NO DAMAGE |

### CONTROL FUNCTION TEST

| NO | TEST ITEM                 | SPECIFICATION                                    | TEST CONDITION                       | RESULT    |
|----|---------------------------|--------------------------------------------------|--------------------------------------|-----------|
| 1  | RELAY                     | 30VDC/1A<br>RESISTIVE LOAD                       | I/P:48VDC<br>O/P:FULL LOAD<br>Ta:25℃ | TEST : OK |
| 2  | REDUNDANCY                | For 1+1 redundancy,and support<br>N+1 redundancy | I/P:48VDC<br>O/P:FULL LOAD<br>Ta:25℃ | TEST :OK  |
| 3  | BOTH INPUTS VOLTAGE ALARM | <34.2V OR> 63V ( ±5% )                           | I/P:48VDC<br>O/P:FULL LOAD<br>Ta:25℃ | TEST :OK  |
| 4  | LED STATUS DISPLAY        | GREEN LED OK                                     | I/P:48VDC<br>O/P:FULL LOAD<br>Ta:25℃ | TEST :OK  |

### COMPONENT STRESS TEST

| NO | TEST ITEM                  | SPECIFICATION                                        | TEST CONDITION                                    | RESULT                           |
|----|----------------------------|------------------------------------------------------|---------------------------------------------------|----------------------------------|
| 1  | Transistor<br>Peak Voltage | Q1 VGS Rated<br>: ±20V<br><br>Q3 VGS Rated<br>: ±20V | I/P:60VDC<br>DC ON/OFF<br>O/P:FULL LOAD<br>Ta:25℃ | Q1 VGS:12.4V<br><br>Q3 VGS:12.2V |

### SAFETY TEST

| NO | TEST ITEM            | SPECIFICATION                                                                  | TEST CONDITION                                                                          | RESULT                                                                     |
|----|----------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| 1  | WITHSTAND VOLTAGE    | I/P/O/P-FG: 0.5KVAC/min<br>I/P/FG-RELAY :0.5KVAC/min<br>FG-RELAY:0.5KVAC/min   | I/P/O/P-FG: 0.6 KVAC/min<br>I/P/FG-RELAY: 0.6 KVAC/min<br>O/P-FG:0.6 KVAC/min<br>Ta:25℃ | I/P/O/P-FG:7.68mA<br>I/P/FG-RELAY:0.275mA<br>FG-RELAY:0.264mA<br>NO DAMAGE |
| 2  | ISOLATION RESISTANCE | I/P/O/P-FG:500VDC>100MΩ<br>I/P/FG-RELAY: 500VDC>100MΩ<br>FG-RELAY:500VDC>100MΩ | I/P/O/P-FG: 500 VDC<br>I/P/FG-RELAY: 500 VDC<br>FG-RELAY: 500 VDC<br>Ta:25℃             | I/P/O/P-FG: 9999MΩ<br>I/P/FG-RELAY: 9999MΩ<br>FG-RELAY:9999MΩ<br>NO DAMAGE |
| 3  | GROUNDING CONTINUITY | FG(PE) TO CHASSIS<br>OR TRACE < 100 mΩ                                         | 40A / 2min<br>Ta:25℃                                                                    | 4 mΩ                                                                       |

### E.M.C TEST

| NO | TEST ITEM  | SPECIFICATION       | TEST CONDITION                                 | RESULT                        |
|----|------------|---------------------|------------------------------------------------|-------------------------------|
| 1  | CONDUCTION | ☑EN55032<br>CLASS B | I/P : 48VDC<br>O/P : FULL/50% LOAD<br>Ta : 25℃ | PASS<br>Test by certified Lab |

|   |                                                                                                                                   |                                                                                                 |                                             |                                                                                       |
|---|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------------|
| 2 | RADIATION                                                                                                                         | <input checked="" type="checkbox"/> EN55032<br>CLASS B                                          | I/P : 48VDC<br>O/P : FULL LOAD<br>Ta : 25°C | PASS<br>Test by certified Lab                                                         |
| 3 | E.S.D                                                                                                                             | EN61000-4-2<br><input checked="" type="checkbox"/> Din rail Model :<br>AIR: 15KV / Contact: 8KV | I/P : 48VDC<br>O/P : FULL LOAD<br>Ta : 25°C | <input checked="" type="checkbox"/> CRITERIA A<br><input type="checkbox"/> CRITERIA B |
| 4 | E.F.T                                                                                                                             | EN61000-4-4<br><input checked="" type="checkbox"/> INDUSTRY<br>INPUT : 2KV                      | I/P : 48VDC<br>O/P : FULL LOAD<br>Ta : 25°C | <input checked="" type="checkbox"/> CRITERIA A<br><input type="checkbox"/> CRITERIA B |
| 5 | SURGE                                                                                                                             | IEC61000-4-5<br><input checked="" type="checkbox"/> LIGHT INDUSTRY<br>L-N : 1KV<br>L,N-PE : 2KV | I/P : 48VDC<br>O/P : FULL LOAD<br>Ta : 25°C | <input checked="" type="checkbox"/> CRITERIA A<br><input type="checkbox"/> CRITERIA B |
| 6 | Test by certified Lab & Test Report Prepare<br>Any contradictions of the test results, please refer to the latest EMC test report |                                                                                                 |                                             |                                                                                       |

## ■ RELIABILITY TEST

### ENVIRONMENT TEST

| NO | TEST ITEM              | SPECIFICATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | TEST CONDITION                               | RESULT    |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
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| 1  | TEMPERATURE RISE TEST  | <div>MODEL : DRDN40-48</div> <div>1. ROOM AMBIENT BURN-IN : 2 HRS</div> <div>I/P : 48VDC O/P : FULL LOAD Ta= 28.4 °C</div> <div>2. HIGH AMBIENT BURN-IN : 2 HRS</div> <div>I/P : 48VDC O/P : FULL LOAD Ta= 63.6 °C</div> <table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 28.4 °C</th><th>HIGH AMBIENT Ta= 63.6 °C</th></tr><tr><td>1</td><td>ZNR1</td><td>64.1°C</td><td>102.1°C</td></tr><tr><td>2</td><td>Q1</td><td>67.9°C</td><td>106.6°C</td></tr><tr><td>3</td><td>Q2</td><td>68.5°C</td><td>107.8°C</td></tr><tr><td>4</td><td>C17</td><td>71.4°C</td><td>109.9°C</td></tr><tr><td>5</td><td>C15</td><td>49.3°C</td><td>86.3°C</td></tr><tr><td>6</td><td>C16</td><td>47.2°C</td><td>83.5°C</td></tr><tr><td>7</td><td>RY1</td><td>55.0°C</td><td>93.5°C</td></tr><tr><td>8</td><td>RY2</td><td>55.0°C</td><td>92.8°C</td></tr><tr><td>9</td><td>PCB</td><td>77.8°C</td><td>117.6°C</td></tr><tr><td>10</td><td>U4</td><td>55.0°C</td><td>91.5°C</td></tr><tr><td>11</td><td>U1</td><td>54.0°C</td><td>90.8°C</td></tr><tr><td>12</td><td>U2</td><td>53.8°C</td><td>90.4°C</td></tr><tr><td>13</td><td>C4</td><td>67.8°C</td><td>104.6°C</td></tr><tr><td>14</td><td>Q3</td><td>77.3°C</td><td>118.3°C</td></tr><tr><td>15</td><td>Q4</td><td>70.7°C</td><td>110.5°C</td></tr><tr><td>16</td><td>D3</td><td>56.1°C</td><td>92.0°C</td></tr><tr><td>17</td><td>R54</td><td>60.1°C</td><td>95.6°C</td></tr><tr><td>18</td><td>R56</td><td>63.0°C</td><td>98.9°C</td></tr><tr><td>19</td><td>Q13</td><td>63.1°C</td><td>97.5°C</td></tr><tr><td>20</td><td>Q14</td><td>71.1°C</td><td>107.4°C</td></tr><tr><td>21</td><td>R48</td><td>63.5°C</td><td>99.4°C</td></tr><tr><td>22</td><td>Q21</td><td>45.4°C</td><td>82.3°C</td></tr></table> |                                              |           | NO | Position | ROOM AMBIENT Ta= 28.4 °C | HIGH AMBIENT Ta= 63.6 °C | 1 | ZNR1 | 64.1°C | 102.1°C | 2 | Q1 | 67.9°C | 106.6°C | 3 | Q2 | 68.5°C | 107.8°C | 4 | C17 | 71.4°C | 109.9°C | 5 | C15 | 49.3°C | 86.3°C | 6 | C16 | 47.2°C | 83.5°C | 7 | RY1 | 55.0°C | 93.5°C | 8 | RY2 | 55.0°C | 92.8°C | 9 | PCB | 77.8°C | 117.6°C | 10 | U4 | 55.0°C | 91.5°C | 11 | U1 | 54.0°C | 90.8°C | 12 | U2 | 53.8°C | 90.4°C | 13 | C4 | 67.8°C | 104.6°C | 14 | Q3 | 77.3°C | 118.3°C | 15 | Q4 | 70.7°C | 110.5°C | 16 | D3 | 56.1°C | 92.0°C | 17 | R54 | 60.1°C | 95.6°C | 18 | R56 | 63.0°C | 98.9°C | 19 | Q13 | 63.1°C | 97.5°C | 20 | Q14 | 71.1°C | 107.4°C | 21 | R48 | 63.5°C | 99.4°C | 22 | Q21 | 45.4°C | 82.3°C |
| NO | Position               | ROOM AMBIENT Ta= 28.4 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | HIGH AMBIENT Ta= 63.6 °C                     |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 1  | ZNR1                   | 64.1°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 102.1°C                                      |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 2  | Q1                     | 67.9°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 106.6°C                                      |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 3  | Q2                     | 68.5°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 107.8°C                                      |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 4  | C17                    | 71.4°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 109.9°C                                      |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 5  | C15                    | 49.3°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 86.3°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 6  | C16                    | 47.2°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 83.5°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 7  | RY1                    | 55.0°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 93.5°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 8  | RY2                    | 55.0°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 92.8°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 9  | PCB                    | 77.8°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 117.6°C                                      |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 10 | U4                     | 55.0°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 91.5°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 11 | U1                     | 54.0°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 90.8°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 12 | U2                     | 53.8°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 90.4°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 13 | C4                     | 67.8°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 104.6°C                                      |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 14 | Q3                     | 77.3°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 118.3°C                                      |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 15 | Q4                     | 70.7°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 110.5°C                                      |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 16 | D3                     | 56.1°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 92.0°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 17 | R54                    | 60.1°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 95.6°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 18 | R56                    | 63.0°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 98.9°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 19 | Q13                    | 63.1°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 97.5°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 20 | Q14                    | 71.1°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 107.4°C                                      |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 21 | R48                    | 63.5°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 99.4°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 22 | Q21                    | 45.4°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 82.3°C                                       |           |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |
| 2  | OVER LOAD BURN-IN TEST | NO DAMAGE<br>1 HOUR ( MIN )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | I/P : 48 VDC<br>O/P : 115% LOAD<br>Ta : 25°C | TEST : OK |    |          |                          |                          |   |      |        |         |   |    |        |         |   |    |        |         |   |     |        |         |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |        |   |     |        |         |    |    |        |        |    |    |        |        |    |    |        |        |    |    |        |         |    |    |        |         |    |    |        |         |    |    |        |        |    |     |        |        |    |     |        |        |    |     |        |        |    |     |        |         |    |     |        |        |    |     |        |        |

|    |                                                                   |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                |                                                                   |
|----|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 3  | LOW TEMPERATURE<br>TURN ON TEST                                   | TURN ON AFTER 2 HOUR                                                                                                                                                                                                                                                 | I/P : 36VDC/60VDC<br>O/P : 100 % LOAD<br>Ta= -45°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 60 °C /95 %R.H<br>NO DAMAGE                                                                                                                                                                                               | I/P : 60 VDC<br>O/P : FULL LOAD<br>Ta= 60 °C<br>HUMIDITY= 95 %R.H                                                                                                                                                                                                                                              | TEST : OK                                                         |
| 5  | TEMPERATURE<br>COEFFICIENT                                        | ± 0.03%/°C (0~60°C)                                                                                                                                                                                                                                                  | I/P : 48 VDC<br>O/P : FULL LOAD                                                                                                                                                                                                                                                                                | ± 0.016%/°C (0~60°C)                                              |
| 6  | STORAGE TEMPERATURE TEST                                          | -40~85°C                                                                                                                                                                                                                                                             | 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                                                                                          |                                                                   |
| 7  | THERMAL SHOCK TEST                                                | -40~60°C                                                                                                                                                                                                                                                             | 1. Thermal shock Temperature : -45°C~+65°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 :<br>15cycle:48VDC/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST<br>1cycle:48VDC/ FULL LOAD Burn In Test |                                                                   |
| 8  | VIBRATION TEST                                                    | 10 ~ 500Hz, 5G 10min./1cycle,<br>60min. each along X, Y, Z axes                                                                                                                                                                                                      | 1 Carton & 1 Set<br>(1) Waveform : Sine Wave<br>(2) Frequency : 10~500Hz<br>(3) Sweep Time : 12min/sweep cycle<br>(4) Acceleration : 6G<br>(5) Test Time : 180min in each axis (X.Y.Z)<br>(6) Ta : 25°C                                                                                                        |                                                                   |
| 9  | CAPACITOR<br>LIFE CYCLE                                           | SUPPOSE C15 IS THE MOST CRITICAL COMPONENT<br>(1) I/P : 48VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME<br>(2) I/P : 48VDC O/P : FULL LOAD Ta= 60 °C LIFE TIME<br>(3) I/P : 48VDC O/P : 75% LOAD Ta= 60 °C LIFE TIME<br>(4) I/P : 48VDC O/P : 50% LOAD Ta= 60 °C LIFE TIME |                                                                                                                                                                                                                                                                                                                | (1) 420906 HRS<br>(2) 32839 HRS<br>(3) 53719 HRS<br>(4) 81989 HRS |
| 10 | MTBF                                                              | Conducted by Parts Stress Analysis Prediction<br>557.52K hrs min. Telcordia SR-332 (Bellcore) ; 277.24K hrs min. MIL-HDBK-217F (25°C)                                                                                                                                |                                                                                                                                                                                                                                                                                                                |                                                                   |
| 11 | Ongoing Reliability Test                                          | I/P : 48VDC O/P : FULL LOAD TA=50°C<br>Demonstration Mean Time Between Failure : 30000 hours                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                |                                                                   |

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

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