



Test Report: ERDN20-12

20A Enclosed 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

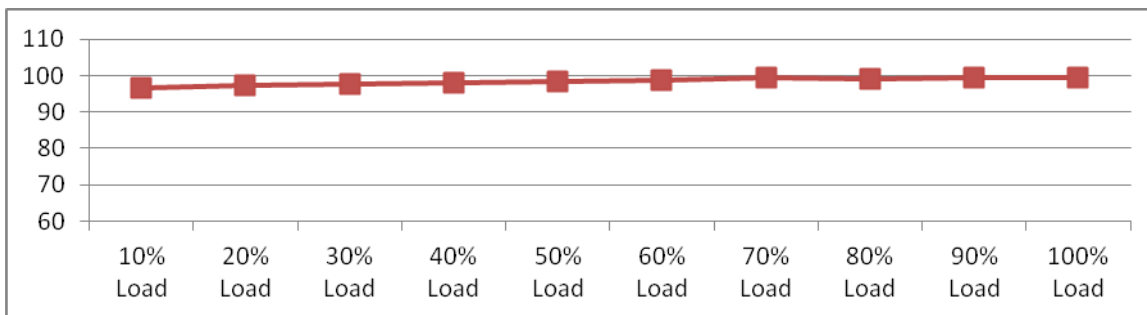
OUTPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|--------------------------------|-----------------------|---|--------|
| 1 | RATED CURRENT | 0~20A CONTINUOUS | I/P : 12VDC O/P : FULL LOAD Ta : 25°C | OK |
| 2 | PEAK CURRENT | 30A 5Sec NO DAMAGE | I/P: 12VDC O/P : 30A Ta:25°C | OK |
| 3 | CAPACITANCE | 320uF | I/P : 12VDC O/P : 320uF Ta : 25°C | OK |
| 4 | STANDBY POWER LOSSES (Typ.) | 1.5W | I/P : 12VDC O/P : NO LOAD Ta : 25°C | 0.25W |

INPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|-----------------------------------|--|---|---------------|
| 1 | INPUT VOLTAGE RANGE | 9VDC~14VDC | I/P:TESTING O/P:FULL LOAD Ta:25°C | 8.55VDC~14.64 |
| 2 | RATED CURRENT | 0~10Ax2 input, 0~20Ax1 input Continuous | I/P : 12VDC O/P: 20A Ta:25°C | OK |
| 3 | VOLTAGE DROP (Vin-Vout) (max.) | 0.2V | I/P : 12VDC O/P : FULL LOAD Ta : 25°C | 0.07V |
| 4 | PEAK CURRENT | 0~15Ax2 input, 0~30Ax1 5Sec NO DAMAGE | I/P: 12VDC O/P : 30A Ta:25°C | OK |
| 5 | INPUT REVERSE CURRENT (max.) | 1mA | I/P : 40VDC O/P : FULL LOAD Ta : 25°C | 2.78uA |
| 6 | INPUT REVERSE VOLTAGE (max.) | 40Vdc NO DAMAGE | I/P : 40VDC O/P : FULL LOAD Ta : 25°C | OK |
| 7 | EFFICIENCY(Typ.) | 98% | I/P:12VDC O/P:FULL LOAD Ta:25°C | 99.29 % |

EFFICIENCY vs LOAD



PROTECTION FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|----------------------|-------------------------------|---|-----------|
| 1 | OVER LOAD PROTECTION | <30A No damage 5 sec (max) | I/P:12VDC O/P:30A Ta:25°C | NO DAMAGE |
| 2 | SHORT PROTECTION | <30A No damage 5 sec (max) | I/P: 14VDC O/P: FULL LOAD Ta:25°C | NO DAMAGE |

CONTROL FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|---------------------------|--|---|-----------|
| 1 | RELAY | 30VDC/1A RESISTIVE LOAD | I/P:12VDC O/P:FULL LOAD Ta:25°C | TEST : OK |
| 2 | REDUNDANCY | For 1+1 redundancy,and support N+1 redundancy | I/P:12VDC O/P:FULL LOAD Ta:25°C | TEST :OK |
| 3 | BOTH INPUTS VOLTANG ALARM | <8.5V OR >14.7V (±5%) | I/P:TESTING O/P:FULL LOAD Ta:25°C | TEST :OK |
| 4 | LED STATUS DISPLAY | GREEN LED OK | I/P:12VDC O/P:FULL LOAD Ta:25°C | TEST :OK |

COMPONENT STRESS TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|----------------------------|--|--|----------------------------------|
| 1 | Transistor Peak Voltage | Q1 VGS Rated : ± 20V Q3 VGS Rated : ± 20V | I/P:14VDC DC ON/OFF O/P:FULL LOAD Ta:25°C | Q1 VGS:14.0V Q3 VGS:13.8V |

SAFETY TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|----------------------|--|--|---|
| 1 | WITHSTAND VOLTAGE | I/P/O/P-FG: 0.5KVAC/min I/P/FG-RELAY :0.5KVAC/min FG-RELAY:0.5KVAC/min | I/P/O/P-FG: 0.6 KVAC/min I/P/FG-RELAY: 0.6 KVAC/min O/P-FG:0.6 KVAC/min Ta:25°C | I/P/O/P-FG:7.64mA I/P/FG-RELAY:0.142mA FG-RELAY:0.139m A NO DAMAGE |
| 2 | ISOLATION RESISTANCE | I/P/O/P-FG:500VDC>100MΩ I/P/FG-RELAY: 500VDC>100MΩ FG-RELAY:500VDC>100MΩ | I/P/O/P-FG: 500 VDC I/P/FG-RELAY: 500 VDC FG-RELAY: 500 VDC Ta:25°C | I/P/O/P-FG: 9999MΩ I/P/FG-RELAY: 9999MΩ FG-RELAY:9999MΩ NO DAMAGE |
| 3 | GROUNDING CONTINUITY | FG(PE) TO CHASSIS OR TRACE < 100 mΩ | 40A / 2min Ta:25°C | 5 mΩ |

E.M.C TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|---|---|---|---|
| 1 | CONDUCTION | <input checked="" type="checkbox"/> EN55032 CLASS B | I/P : 12VDC O/P : FULL/50% LOAD Ta : 25°C | PASS Test by certified Lab |
| 2 | RADIATION | <input checked="" type="checkbox"/> EN55032 CLASS B | I/P : 12VDC O/P : FULL LOAD Ta : 25°C | PASS Test by certified Lab |
| 3 | E.S.D | EN61000-4-2 AIR: 15KV / Contact: 8KV | I/P : 12VDC O/P : FULL LOAD Ta : 25°C | <input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B |
| 4 | E.F.T | EN61000-4-4 <input checked="" type="checkbox"/> INDUSTRY INPUT : 2KV | I/P : 12VDC O/P : FULL LOAD Ta : 25°C | <input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B |
| 5 | SURGE | IEC61000-4-5 <input checked="" type="checkbox"/> LIGHT INDUSTRY L-N : 1KV L,N-PE : 2KV | I/P : 12VDC O/P : FULL LOAD Ta : 25°C | <input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B |
| 6 | Test by certified Lab & Test Report Prepare 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----|---------------------------------|--|--|--|----|----------|--------------------------|--------------------------|---|------|--------|--------|---|-----|--------|--------|---|-----|--------|--------|---|-----|--------|--------|---|-----|--------|--------|---|-----|--------|--------|---|----|--------|--------|---|----|--------|--------|---|----|--------|--------|----|-----|--------|--------|----|-----|--------|--------|----|-----|--------|--------|----|-----|--------|--------|
| 1 | TEMPERATURE RISE TEST | MODEL : ERDN20-5 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 5VDC O/P : FULL LOAD Ta= 24.9 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 5VDC O/P : FULL LOAD Ta= 60.2 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | <table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 24.9 °C</th> <th>HIGH AMBIENT Ta= 60.2 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>ZNR1</td><td>44.4°C</td><td>81.0°C</td></tr> <tr><td>2</td><td>C17</td><td>41.8°C</td><td>78.2°C</td></tr> <tr><td>3</td><td>C15</td><td>37.3°C</td><td>73.2°C</td></tr> <tr><td>4</td><td>C16</td><td>41.3°C</td><td>77.2°C</td></tr> <tr><td>5</td><td>RY1</td><td>39.9°C</td><td>72.0°C</td></tr> <tr><td>6</td><td>RY2</td><td>44.3°C</td><td>77.2°C</td></tr> <tr><td>7</td><td>U4</td><td>34.6°C</td><td>70.3°C</td></tr> <tr><td>8</td><td>Q1</td><td>42.6°C</td><td>79.5°C</td></tr> <tr><td>9</td><td>Q2</td><td>54.6°C</td><td>93.7°C</td></tr> <tr><td>10</td><td>Q21</td><td>36.3°C</td><td>71.9°C</td></tr> <tr><td>11</td><td>Q22</td><td>38.0°C</td><td>68.9°C</td></tr> <tr><td>12</td><td>R54</td><td>42.5°C</td><td>80.5°C</td></tr> <tr><td>13</td><td>PCB</td><td>52.3°C</td><td>90.7°C</td></tr> </tbody> </table> | NO | Position | ROOM AMBIENT Ta= 24.9 °C | HIGH AMBIENT Ta= 60.2 °C | 1 | ZNR1 | 44.4°C | 81.0°C | 2 | C17 | 41.8°C | 78.2°C | 3 | C15 | 37.3°C | 73.2°C | 4 | C16 | 41.3°C | 77.2°C | 5 | RY1 | 39.9°C | 72.0°C | 6 | RY2 | 44.3°C | 77.2°C | 7 | U4 | 34.6°C | 70.3°C | 8 | Q1 | 42.6°C | 79.5°C | 9 | Q2 | 54.6°C | 93.7°C | 10 | Q21 | 36.3°C | 71.9°C | 11 | Q22 | 38.0°C | 68.9°C | 12 | R54 | 42.5°C | 80.5°C | 13 | PCB | 52.3°C | 90.7°C |
| NO | Position | ROOM AMBIENT Ta= 24.9 °C | HIGH AMBIENT Ta= 60.2 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | ZNR1 | 44.4°C | 81.0°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | C17 | 41.8°C | 78.2°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | C15 | 37.3°C | 73.2°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | C16 | 41.3°C | 77.2°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | RY1 | 39.9°C | 72.0°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | RY2 | 44.3°C | 77.2°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | U4 | 34.6°C | 70.3°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Q1 | 42.6°C | 79.5°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Q2 | 54.6°C | 93.7°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | Q21 | 36.3°C | 71.9°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Q22 | 38.0°C | 68.9°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | R54 | 42.5°C | 80.5°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | PCB | 52.3°C | 90.7°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | OVER LOAD BURN-IN TEST | NO DAMAGE 1 HOUR (MIN) | I/P : 5 VDC O/P : 115% LOAD Ta : 25°C | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | LOW TEMPERATURE TURN ON TEST | TURN ON AFTER 2 HOUR | I/P : 4.5VDC/6VDC O/P : 100 % LOAD Ta= -45°C | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



| | | | | |
|----|---|--|---|--|
| 4 | HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST | AFTER 12 HOURS IN CHAMBER ON CONTROL 60 °C /95 %R.H NO DAMAGE | I/P : 6 VDC O/P : FULL LOAD Ta= 60 °C HUMIDITY= 95 %R.H | TEST : OK |
| 5 | TEMPERATURE COEFFICIENT | ± 0.03%/°C (0~60°C) | I/P : 5 VDC O/P : FULL LOAD | ± 0.021%/°C (0~60°C) |
| 6 | STORAGE TEMPERATURE TEST | -40~85°C | 1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : STATIC | |
| 7 | THERMAL SHOCK TEST | -40~60°C | 1. Thermal shock Temperature : -45°C~ +65°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 16 CYCLE 5. Input/Output condition : 15cycle:5VDC/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:5VDC/ FULL LOAD Burn In Test | |
| 8 | VIBRATION TEST | 10 ~ 500Hz, 5G 10min./1cycle, 60min. each along X, Y, Z axes | 1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C | |
| 9 | CAPACITOR LIFE CYCLE | SUPPOSE C17 IS THE MOST CRITICAL COMPONENT (1) I/P : 5VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 5VDC O/P : FULL LOAD Ta= 60 °C LIFE TIME (3) I/P : 5VDC O/P : 75% LOAD Ta= 60 °C LIFE TIME (4) I/P : 5VDC O/P : 50% LOAD Ta= 60 °C LIFE TIME | | (1) 555389 HRS (2) 45486HRS (3) 72372 HRS (4) 96159 HRS |
| 10 | MTBF | Conducted by Parts Stress Analysis Prediction 1853.5K hrs min. Telcordia SR-332 (Bellcore) ; 378.7K hrs min. MIL-HDBK-217F (25°C) | | |
| 11 | Ongoing Reliability Test | I/P : 5VDC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30000 hours | | |

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

2018.4.30 GP-A50-F010