



Test Report: DDR-15L-5

15W DIN Rail type DC-DC Converter

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Control Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

■ RELIABILITY TEST

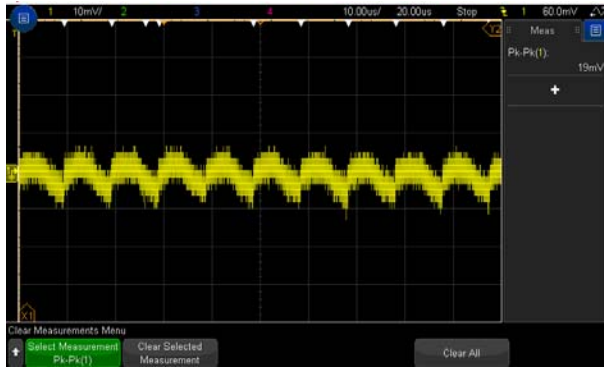
ENVIRONMENT TEST

DESIGN VERIFY TEST

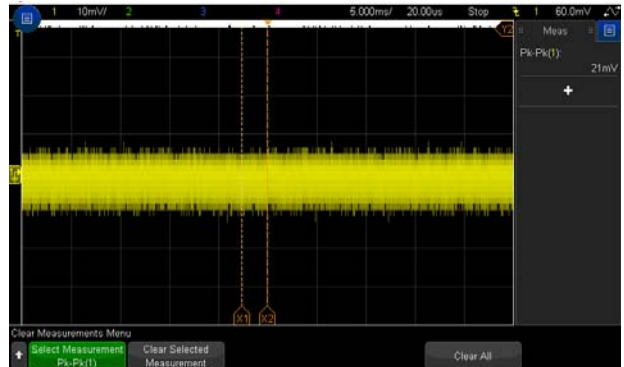
OUTPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|--------------------------------|-----------------|--|---------------------|
| 1 | OUTPUT VOLTAGE ADJUST RANGE | CH1:4.5 V~5.5 V | I/P : 48 VDC O/P : MIN LOAD Ta : 25°C | 4.40V~5.71V |
| 2 | OUTPUT VOLTAGE TOLERANCE (Max) | V1: -2%~ 2% | I/P:18 VDC / 75VDC O/P:FULL/ MIN. LOAD Ta:25°C | V1: -0.491 %~0.485% |
| 3 | LINE REGULATION (Max) | V1:-0.5%~ 0.5% | I/P: 18 VDC / 75VDC O/P:FULL LOAD Ta:25°C | V1: -0.006 %~ 0 % |
| 4 | LOAD REGULATION (Max) | V1: -1.0%~ 1.0% | I/P: 48VDC O/P:FULL ~MIN LOAD Ta:25°C | V1: -0.491 %~0.485% |
| 5 | OVER/UNDERSHOOT TEST | < ±10% | I/P:48VDC O/P:FULL LOAD Ta:25°C | TEST:1.2% |
| 6 | RIPPLE & NOISE (Max) | V1: 50 mVp-p | I/P: 48VDC O/P:FULL LOAD Ta:25°C | V1: 21 mVp-p |

high frequency :



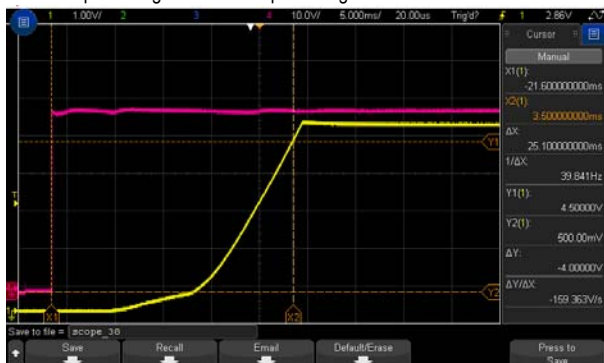
low frequency :

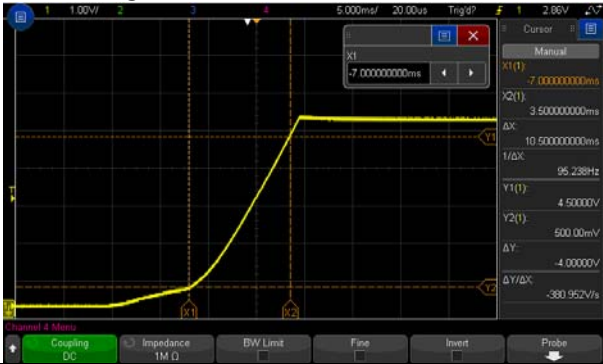
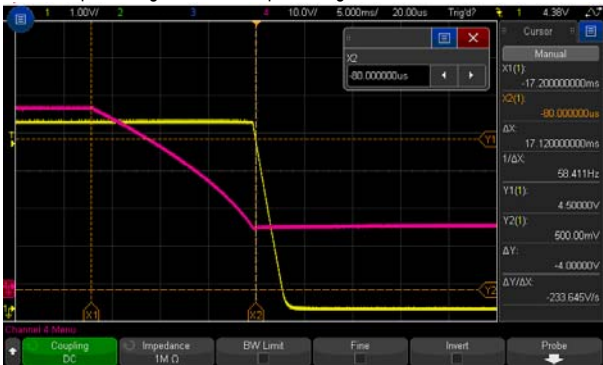
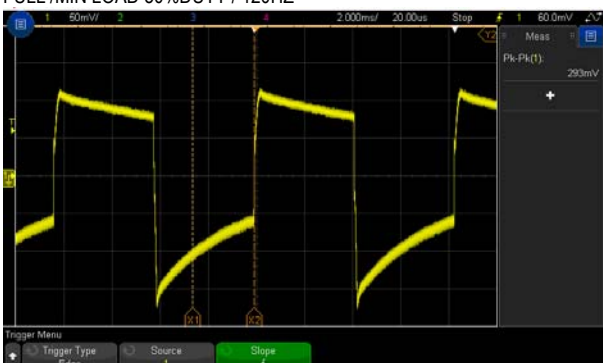



| | | | | |
|---|-------------------|--------------|--|----------------|
| 7 | SET UP TIME (Max) | 48VDC/120 ms | I/P:48 VDC O/P:FULL LOAD Ta:25°C | 48VDC/ 25.1 ms |
|---|-------------------|--------------|--|----------------|

INPUT=48VDC @ FULL LOAD

CH1 : Output Voltage CH4 : DC Input Voltage



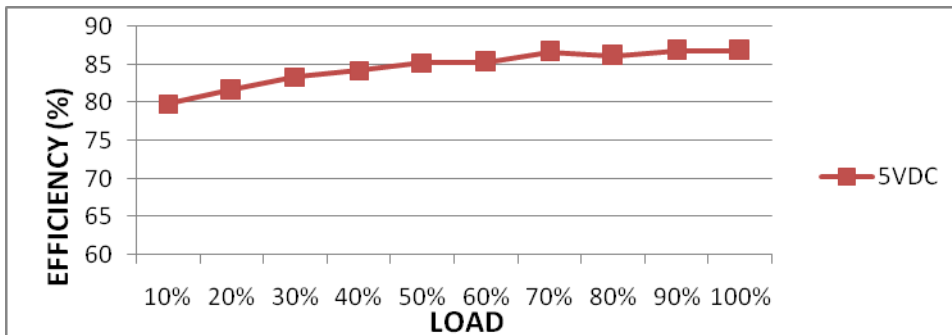
| | | | | |
|---|--------------------|----------------|--|----------------------|
| 8 | RISE TIME (Max) | 48VDC/ 85 ms | I/P: 48 VDC O/P:FULL LOAD Ta:25°C | 48VDC/ 10.5 ms |
| <p>INPUT=48VDC@ FULL LOAD</p>  | | | | |
| 9 | HOLD UP TIME (TYP) | 48VDC/16ms | I/P: 48VDC O/P:F ULL LOAD Ta:25°C | 48VDC/ 17.12 ms |
| <p>INPUT=48VDC @ FULL LOAD CH1 : Output Voltage CH4 : DC Input Voltage</p>  | | | | |
| 10 | DYNAMIC LOAD | V1: 1000 mVp-p | I/P: 48VDC O/P: (1)FULL /MIN LOAD 50%DUTY / 120HZ (2)FULL /MIN LOAD 50%DUTY / 1KHZ Ta:25°C | 293mVp-p 199mVp-p |
| <p>FULL /MIN LOAD 50%DUTY / 120HZ</p>  <p>FULL /MIN LOAD 50%DUTY / 1KHZ</p>  | | | | |

INPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|---------------------|---------------|---|--------------|
| 1 | INPUT VOLTAGE RANGE | 18VDC~ 75 VDC | I/P:TESTING O/P:FULL LOAD Ta:25°C | 17.539V~ 75V |

| | | | | |
|---|--------------------|-------------|--|-----------------|
| | | | I/P: LOW-LINE-0.2=17.8V HIGH-LINE+3V=78V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec . OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE) | TEST:OK |
| 2 | INPUT CURRENT(TYP) | 48VDC/0.4 A | I/P: 48VDC O/P:FULL LOAD Ta:25°C | I =0.355A/48VDC |
| 3 | EFFICIENCY(TYP) | 85 % | I/P: 48VDC O/P:FULL LOAD Ta:25°C | 86.85% |

EFFICIENCY vs LOAD



| | | | | |
|---|---------------------|---------------------------|--|-----------------|
| 4 | INRUSH CURRENT(TYP) | 48VDC/ 15 A COLD START | I/P: 48VDC O/P:FULL LOAD Ta:25°C | I =4.49A/ 48VDC |
|---|---------------------|---------------------------|--|-----------------|

INPUT=48VDC @ FULL LOAD



PROTECTION FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|-------------------------|-----------------------------|---|--|
| 1 | OVER LOAD PROTECTION | 110%~150%RATED OUTPUT POWER | I/P: 75VDC I/P: 48 VDC I/P: 18 VDC O/P:TESTING Ta:25°C | 139.1%/ 75VDC 132.3%/ 48VDC 135%/ 18VDC PROTECTION TYPE : Hiccup mode ,recovers automatically after fault condition is removed |
| 2 | OVER VOLTAGE PROTECTION | CH: 5.75 V~ 7V | I/P: 75VDC I/P: 48 VDC I/P: 18 VDC O/P:MIN LOAD Ta:25°C | 6.2V/75VDC 6.2V/ 48VDC 6.2V/ 18VDC PROTECTION TYPE : Shut down O/P voltage,re-power on to recover |



| | | | | |
|---|------------------|--|--|---|
| 3 | SHORT PROTECTION | SHORT EVERY OUTPUT 1 HOUR NO DAMAGE | I/P: 75 VDC O/P: FULL LOAD Ta:25°C | NO DAMAGE PROTECTION TYPE : Hiccup mode ,recovers automatically after fault condition is removed |
| 4 | INPUT REVERSE | POWER OK | I/P: 75VDC O/P: FULL LOAD Ta:25°C | NO DAMAGE |

COMPONENT STRESS TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|--|---|--|---|
| 1 | PWM Transistor (D to S) or (C to E) Peak Voltage | Q 3 Rated : 150 V | I/P:High-Line +3V =78V DC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3)full load continue Ta:25°C | VDS: (1)127.2V (2)116.7V (3)124.8V |
| 2 | Diode Peak Voltage | Q100 Rated : 60V | I/P:High-Line +3V =78 V DC ON/OFF O/P: (1)Full Load (2)Output Short (3)full load continue Ta:25°C | Q100: VDS: (1)33.2V (2)25V (3)29.2V |
| 3 | Input Capacitor Voltage | C4 Rated: : 100 μ / 80V | I/P:High-Line +3V =78 V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue Ta:25°C | C4: (1)79.5V (2)79.5V (3)79.1V (4)79.1V |
| 4 | Control IC Voltage Test | PWM IC U1 Rated -0.3V~30V U100 Rated -0.3V~38V | I/P:High-Line +3V =78 V DC ON/OFF O/P:(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25°C | U1: (1) 19.7V (2) 10.5V (3) 21V (4) 18.7V U100 (1)27.8V (2)22V (3)27.8V (4)28.6V |
| 5 | Clamp Diode Peak Voltage | D3 Rated : 400V | I/P : High-Line +3V = 78 V DC ON/OFF O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C | D3: (1)103.1V (2)100.7V |

SAFETY TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|----------------------|---------------------------------|---------------------------------|-------------------------------|
| 1 | WITHSTAND VOLTAGE | EN 60950-1 I/P-O/P:4KVDC/min | I/P-O/P: 4.4KVDC/min Ta:25°C | I/P-O/P: 0 mA NO DAMAGE |
| 2 | ISOLATION RESISTANCE | I/P-O/P:500VDC>100MΩ | I/P-O/P: 500 VDC Ta:25°C | I/P-O/P: 9999 MΩ NO DAMAGE |



E.M.C TEST

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

■ RELIABILITY TEST

ENVIRONMENT TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----|------------------------|---|---|---|----|----------|--------------------------|--------------------------|---|-------|--------|--------|---|----|--------|--------|---|-----|--------|--------|---|----|--------|--------|---|----|--------|--------|---|------|--------|--------|---|----|--------|--------|---|----|--------|--------|---|----|--------|--------|----|----|--------|--------|----|----|--------|--------|----|----|--------|--------|----|------|--------|--------|----|------|--------|--------|
| 1 | TEMPERATURE RISE TEST | MODEL : DDR-15L-5 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 48VDC O/P : FULL LOAD Ta= 20.6 °C 2. HIGH AMBIENT BURN-IN : HRS I/P : 48VDC O/P : FULL LOAD Ta= 60.5 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | <table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 20.6 °C</th> <th>HIGH AMBIENT Ta= 60.5 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF100</td><td>57.0°C</td><td>93.4°C</td></tr> <tr><td>2</td><td>T1</td><td>58.0°C</td><td>93.4°C</td></tr> <tr><td>3</td><td>LF1</td><td>41.1°C</td><td>79.9°C</td></tr> <tr><td>4</td><td>Q2</td><td>33.4°C</td><td>71.1°C</td></tr> <tr><td>5</td><td>Q3</td><td>60.0°C</td><td>90.4°C</td></tr> <tr><td>6</td><td>Q100</td><td>59.6°C</td><td>95.1°C</td></tr> <tr><td>7</td><td>U1</td><td>45.1°C</td><td>81.6°C</td></tr> <tr><td>8</td><td>D3</td><td>57.0°C</td><td>92.8°C</td></tr> <tr><td>9</td><td>C5</td><td>55.3°C</td><td>90.8°C</td></tr> <tr><td>10</td><td>C2</td><td>40.6°C</td><td>79.4°C</td></tr> <tr><td>11</td><td>C3</td><td>50.7°C</td><td>88.1°C</td></tr> <tr><td>12</td><td>C7</td><td>47.7°C</td><td>84.4°C</td></tr> <tr><td>13</td><td>C101</td><td>56.3°C</td><td>92.4°C</td></tr> <tr><td>14</td><td>C104</td><td>42.3°C</td><td>79.8°C</td></tr> </tbody> </table> | NO | Position | ROOM AMBIENT Ta= 20.6 °C | HIGH AMBIENT Ta= 60.5 °C | 1 | LF100 | 57.0°C | 93.4°C | 2 | T1 | 58.0°C | 93.4°C | 3 | LF1 | 41.1°C | 79.9°C | 4 | Q2 | 33.4°C | 71.1°C | 5 | Q3 | 60.0°C | 90.4°C | 6 | Q100 | 59.6°C | 95.1°C | 7 | U1 | 45.1°C | 81.6°C | 8 | D3 | 57.0°C | 92.8°C | 9 | C5 | 55.3°C | 90.8°C | 10 | C2 | 40.6°C | 79.4°C | 11 | C3 | 50.7°C | 88.1°C | 12 | C7 | 47.7°C | 84.4°C | 13 | C101 | 56.3°C | 92.4°C | 14 | C104 | 42.3°C | 79.8°C |
| NO | Position | ROOM AMBIENT Ta= 20.6 °C | HIGH AMBIENT Ta= 60.5 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | LF100 | 57.0°C | 93.4°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | T1 | 58.0°C | 93.4°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | LF1 | 41.1°C | 79.9°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Q2 | 33.4°C | 71.1°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | Q3 | 60.0°C | 90.4°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Q100 | 59.6°C | 95.1°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | U1 | 45.1°C | 81.6°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | D3 | 57.0°C | 92.8°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | C5 | 55.3°C | 90.8°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | C2 | 40.6°C | 79.4°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | C3 | 50.7°C | 88.1°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | C7 | 47.7°C | 84.4°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | C101 | 56.3°C | 92.4°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | C104 | 42.3°C | 79.8°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | OVER LOAD BURN-IN TEST | NO DAMAGE 1 HOUR (MIN) | I/P : 48 VDC O/P : 140 % LOAD Ta : 25°C | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



15W DIN Rail type DC-DC Converter

DDR-15L series

| 3 | LOW TEMPERATURE TURN ON TEST | TURN ON AFTER 2 HOUR | I/P : 24 VDC/ 75 VDC 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 NO DAMAGE | I/P : 78 VDC O/P : FULL LOAD Ta= 60 °C HUMIDITY= 95 %R.H | TEST : OK | | | | | | | | | | | | |
| 5 | TEMPERATURE COEFFICIENT | ± 0.03 %(0~60°C) | I/P : 48 VDC O/P : FULL LOAD | ±0.01 %(0~60°C) | | | | | | | | | | | | |
| 6 | STORAGE TEMPERATURE TEST | 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 | | TEST : OK | | | | | | | | | | | | |
| 7. | THERMAL SHOCK TEST | 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 : 48VDC/Full Load DC ON/OFF TEST turn on 3sec ; turn off 1sec@15cycle\ 48VDC/Full Load DC ON@1cycle | | TEST : OK | | | | | | | | | | | | |
| 8 | VIBRATION TEST | 1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 3G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C 2 Din Rail <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Displacement</th> <th>Acceleration</th> </tr> </thead> <tbody> <tr> <td>2 (+3/-0) Hz up to 15Hz</td> <td>± 2.5mm</td> <td>-----</td> </tr> <tr> <td>15Hz up to 50Hz</td> <td>-----</td> <td>2.3g</td> </tr> <tr> <td>Sweep rate</td> <td colspan="2">Max 1 Octave/minute</td> </tr> </tbody> </table> | | | Displacement | Acceleration | 2 (+3/-0) Hz up to 15Hz | ± 2.5mm | ----- | 15Hz up to 50Hz | ----- | 2.3g | Sweep rate | Max 1 Octave/minute | | TEST : OK |
| | Displacement | Acceleration | | | | | | | | | | | | | | |
| 2 (+3/-0) Hz up to 15Hz | ± 2.5mm | ----- | | | | | | | | | | | | | | |
| 15Hz up to 50Hz | ----- | 2.3g | | | | | | | | | | | | | | |
| Sweep rate | Max 1 Octave/minute | | | | | | | | | | | | | | | |
| 9 | CAPACITOR LIFE CYCLE | SUPPOSE C101 IS THE MOST CRITICAL COMPONENT (1) I/P : 48VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 48VDC O/P : FULL LOAD Ta= 60 °C LIFE TIME (3) I/P : 48VDC O/P : 75% LOAD Ta= 60 °C LIFE TIME (4) I/P : 48VDC O/P : 50% LOAD Ta= 60 °C LIFE TIME | | (1) 632472.0 HRS (2) 89352.0 HRS (3) 158906.4 HRS (4) 251762.4 HRS | | | | | | | | | | | | |
| 10 | MTBF | Conducted by Parts Stress Analysis Prediction 907K hrs min. MIL-HDBK-217F (25°C) | | | | | | | | | | | | | | |
| 11 | DMTBF/Accelerated Life Test | Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 60°C | | | | | | | | | | | | | | |

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

12.10.30 A50-F031