



Test Report: DDR-60G-5

60W 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

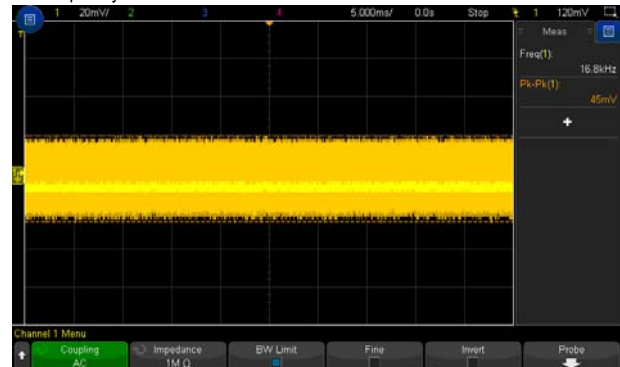
OUTPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|--------------------------------|-----------------|---|--------------------|
| 1 | OUTPUT VOLTAGE ADJUST RANGE | CH1:4.5 V~5.5 V | I/P : 24 VDC O/P : MIN LOAD Ta : 25°C | 4.41V~5.71V |
| 2 | OUTPUT VOLTAGE TOLERANCE (Max) | V1: -2%~ 2% | I/P:9 VDC / 36VDC O/P:FULL/ MIN. LOAD Ta:25°C | V1: -0.84%~ 0.82% |
| 3 | LINE REGULATION (Max) | V1:-0.5%~ 0.5% | I/P: 9VDC /36VDC O/P:FULL LOAD Ta:25°C | V1: -0.04 %~0.02 % |
| 4 | LOAD REGULATION (Max) | V1: -1.5%~ 1.5% | I/P: 24VDC O/P:FULL ~MIN LOAD Ta:25°C | V1: -0.84%~ 0.82% |
| 5 | OVER/UNDERSHOOT TEST | < ±10% | I/P:24VDC O/P:FULL LOAD Ta:25°C | TEST: 7.3% |
| 6 | RIPPLE & NOISE (Max) | V1: 60mVp-p | I/P: 24VDC O/P:FULL LOAD Ta:25°C | V1: 45mVp-p |

high frequency :



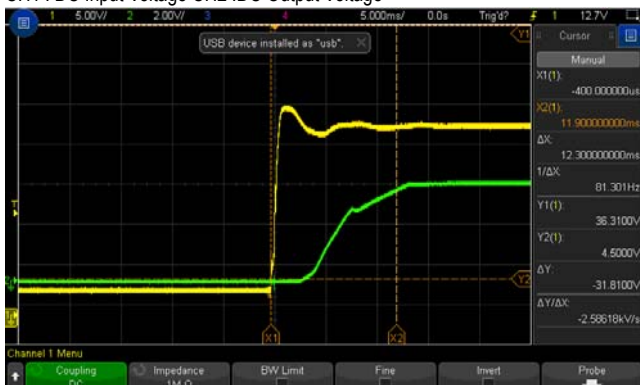
low frequency :



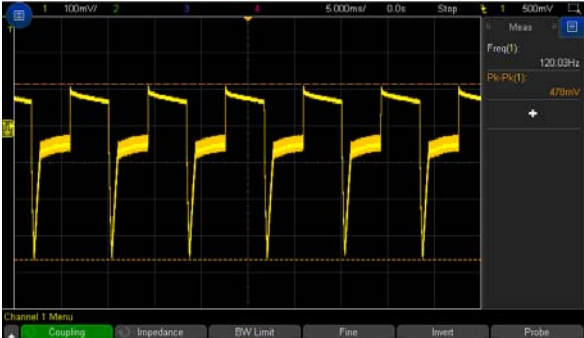
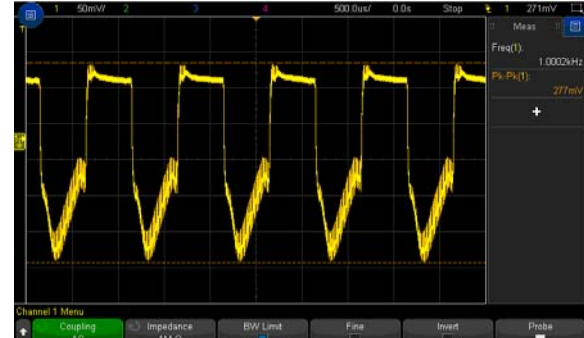


| | | | | |
|---|-------------------|--------------|--|----------------|
| 7 | SET UP TIME (Max) | 24VDC/120 ms | I/P:24 VDC O/P:FULL LOAD Ta:25°C | 24VDC/ 12.3 ms |
|---|-------------------|--------------|--|----------------|

INPUT=24 @ FULL LOAD

CH1 : DC Input Voltage CH2 :DC Output Voltage



| | | | | |
|---|--------------------|---------------|--|----------------------|
| 8 | RISE TIME (Max) | 24VDC/ 85 ms | I/P: 24VDC O/P:FULL LOAD Ta:25°C | 24VDC/ 6.659 ms |
| <p>INPUT=24VDC@ FULL LOAD</p>  | | | | |
| 9 | HOLD UP TIME (TYP) | 24VDC/5ms | I/P: 24VDC O/P:FULL LOAD Ta:25°C | 24VDC/ 5.34 ms |
| <p>INPUT=24VDC @ FULL LOAD CH1 : DC Input Voltage CH2 :DC Output Voltage</p>  | | | | |
| 10 | DYNAMIC LOAD | V1: 1000mVp-p | I/P: 24VDC O/P: (1)FULL /MIN LOAD 50%DUTY / 120HZ (2)FULL /MIN LOAD 50%DUTY / 1KHZ Ta:25°C | 478mVp-p 277mVp-p |
| <div style="display: flex; justify-content: space-around;"> <div data-bbox="151 1496 737 1863"> <p>FULL /MIN LOAD 50%DUTY / 120HZ</p>  </div> <div data-bbox="857 1496 1442 1863"> <p>FULL /MIN LOAD 50%DUTY / 1KHZ</p>  </div> </div> | | | | |

INPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|---------------------|---------------|---|-----------|
| 1 | INPUT VOLTAGE RANGE | 9VDC~ 36VDC | I/P:TESTING O/P:FULL LOAD Ta:25°C | 7.8V~ 36V |

| | | | I/P: LOW-LINE-0.2=8.8V HIGH-LINE+3V=39V 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) | 24VDC/3A | I/P: 24VDC O/P:FULL LOAD Ta:25°C | I=A/24VDC | | | | | | | | | | | | | | | | | | | | | | |
| 3 | EFFICIENCY(TYP) | 87.5% | I/P: 24VDC O/P:FULL LOAD Ta:25°C | 88.35 % | | | | | | | | | | | | | | | | | | | | | | |
| <p>EFFICIENCY vs LOAD</p> <table border="1"> <caption>Efficiency vs Load Data (5VDC)</caption> <thead> <tr> <th>LOAD (%)</th> <th>EFFICIENCY (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>78</td></tr> <tr><td>20%</td><td>85</td></tr> <tr><td>30%</td><td>87</td></tr> <tr><td>40%</td><td>87.5</td></tr> <tr><td>50%</td><td>88</td></tr> <tr><td>60%</td><td>88.5</td></tr> <tr><td>70%</td><td>88.5</td></tr> <tr><td>80%</td><td>88.5</td></tr> <tr><td>90%</td><td>88.5</td></tr> <tr><td>100%</td><td>88.35</td></tr> </tbody> </table> | | | | | LOAD (%) | EFFICIENCY (%) | 10% | 78 | 20% | 85 | 30% | 87 | 40% | 87.5 | 50% | 88 | 60% | 88.5 | 70% | 88.5 | 80% | 88.5 | 90% | 88.5 | 100% | 88.35 |
| LOAD (%) | EFFICIENCY (%) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10% | 78 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20% | 85 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30% | 87 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40% | 87.5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 50% | 88 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60% | 88.5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 70% | 88.5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 80% | 88.5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 90% | 88.5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100% | 88.35 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | INRUSH CURRENT(TYP) | 24VDC/20A COLD START | I/P: 24VDC O/P:FULL LOAD Ta:25°C | 8.4A/ 24VDC | | | | | | | | | | | | | | | | | | | | | | |
| <p>INPUT=24VDC @ FULL LOAD</p> | | | | | | | | | | | | | | | | | | | | | | | | | | |

PROTECTION FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|-------------------------|-----------------------------------|--|---|
| 1 | OVER LOAD PROTECTION | 105%~135%RATED OUTPUT POWER OK | I/P: 36VDC I/P: 24 VDC I/P: 9 VDC O/P:TESTING Ta:25°C | 115.0%/ 36VDC 115.2%/ 24VDC 114.7%/ 9VDC PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed |
| 2 | OVER VOLTAGE PROTECTION | CH: 5.75V~7 V | I/P: 36VDC I/P: 24 VDC I/P: 9 VDC O/P:MIN LOAD Ta:25°C | 6.4V/36VDC 6.4V/ 24VDC 6.4V/ 9VDC PROTECTION TYPE : Shut down O/P voltage,re-power on to recover |

| | | | | |
|---|------------------|--|---|--|
| 3 | SHORT PROTECTION | SHORT EVERY OUTPUT 1 HOUR NO DAMAGE | I/P: 36VDC O/P: FULL LOAD Ta:25°C | NO DAMAGE PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed |
| 4 | INPUT REVERSE | POWER OK | I/P:36VDC O/P: NO 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 : 100 V | I/P:High-Line +3V =39V DC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3)full load continue Ta:25°C | VDS: (1) 72.3V (2)68.3V (3) 72.3V |
| 2 | Diode Peak Voltage | Q100 Rated : 60V | I/P:High-Line +3V =39 V DC ON/OFF O/P: (1)Full Load (2)Output Short (3)full load continue Ta:25°C | VDS: (1)37.5V (2)34.7V (3)37.5V |
| 3 | Input Capacitor Voltage | C5 Rated: : 1200 μ / 50V | I/P:High-Line +3V =39 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 | (1)41.9V (2)42.7V (3)42.3V (4)41.9V |
| 4 | Control IC Voltage Test | PWM IC U1 Rated -0.3V~30V U100 Rated -0.3V~38V | I/P:High-Line +3V =39 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) 11.30V (2) 11.62V (3) 11.62V (4) 11.72V U100 (1)9.93V (2)4.93V (3)10.17V (4)8.81V |
| 5 | Clamp Diode Peak Voltage | D4 Rated : 100 V D7 Rated : 100 V | I/P : High-Line +3V =39 V DC ON/OFF O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C | D4 (1) 72.7V (2) 71.1V D7 (1)71.3V (2)64.9V |



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: 0μA NO DAMAGE |
| 2 | ISOLATION RESISTANCE | I/P-O/P:500VDC>100MΩ | I/P-O/P: 500 VDC Ta:25°C | I/P-O/P: 9999MΩ 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 checked="" type="checkbox"/> CLASS A <input type="checkbox"/> CLASS B | I/P: 24 VDC 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 checked="" type="checkbox"/> CLASS A <input type="checkbox"/> CLASS B | I/P: 24 VDC 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: 24 VDC 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: 24 VDC 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: 24 VDC 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 |
|----|-----------------------|---|----------------|--------|
| 2 | TEMPERATURE RISE TEST | MODEL : DDR-60G-5 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 24VDC O/P : FULL LOAD Ta= 27.3 °C 2. HIGH AMBIENT BURN-IN : 1 HRS I/P : 24VDC O/P : FULL LOAD Ta= 50.8 °C | | |



| | | NO | Position | ROOM AMBIENT Ta= 27.3 °C | HIGH AMBIENT Ta= 50.8 °C | | | | | | | | | | | | |
|-------------------------|---|--|----------|---|--------------------------|--------------|--------------|-------------------------|---------|-------|-----------------|-------|------|------------|---------------------|--|-----------|
| | | 1 | LF1 | 60.5°C | 75.5°C | | | | | | | | | | | | |
| | | 2 | C5 | 66.5°C | 85.7°C | | | | | | | | | | | | |
| | | 3 | T1 | 78.0°C | 99.6°C | | | | | | | | | | | | |
| | | 4 | Q3 | 66.6°C | 81.9°C | | | | | | | | | | | | |
| | | 5 | D4 | 107.1°C | 95.8°C | | | | | | | | | | | | |
| | | 6 | D7 | 89.6°C | 87.4°C | | | | | | | | | | | | |
| | | 7 | R9 | 104.5°C | 109.6°C | | | | | | | | | | | | |
| | | 8 | Q100 | 77.4°C | 99.0°C | | | | | | | | | | | | |
| | | 9 | C105 | 79.7°C | 97.8°C | | | | | | | | | | | | |
| | | 10 | C107 | 68.3°C | 90.6°C | | | | | | | | | | | | |
| | | 11 | U1 | 69.6°C | 92.0°C | | | | | | | | | | | | |
| | | 12 | ZNR1 | 52.8°C | 72.8°C | | | | | | | | | | | | |
| | | 13 | Q1 | 55.0°C | 75.1°C | | | | | | | | | | | | |
| | | 14 | L1 | 97.3°C | 93.4°C | | | | | | | | | | | | |
| | | 15 | RTH1 | 61.7°C | 77.6°C | | | | | | | | | | | | |
| | | 16 | L100 | 86.5°C | 109.4°C | | | | | | | | | | | | |
| | | 17 | C110 | 75.8°C | 97.1°C | | | | | | | | | | | | |
| | | 18 | C40 | 70.8°C | 90.1°C | | | | | | | | | | | | |
| 3 | OVER LOAD BURN-IN TEST | NO DAMAGE 1 HOUR (MIN) | | I/P : 24 VDC O/P : 117 % LOAD Ta : 25°C | TEST : OK | | | | | | | | | | | | |
| 4 | LOW TEMPERATURE TURN ON TEST | TURN ON AFTER 2 HOUR | | I/P : 36 VDC/ 18 VDC O/P : 100 % LOAD Ta= -45 °C | TEST : OK | | | | | | | | | | | | |
| 5 | HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST | AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE | | I/P : 39 VDC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H | TEST : OK | | | | | | | | | | | | |
| 6 | TEMPERATURE COEFFICIENT | ± 0.03 %(0~50°C) | | I/P : 24 VDC O/P : FULL LOAD | ±0.0054 %(0~50°C) | | | | | | | | | | | | |
| 7 | 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 | | | | | | | | | | | | |
| 8. | THERMAL SHOCK TEST | 1. Thermal shock Temperature : -45°C~ +55°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 : 24VDC/Full Load DC ON/OFF TEST turn on 3sec ; turn off 1sec@15cycle\ 24VDC/Full Load DC ON@1cycle | | | TEST : OK | | | | | | | | | | | | |
| 9 | 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 | | | | | | | | | | | | | | | | |



60W DIN Rail Type DC-DC Converter

DDR-60G series

| | | | |
|----|-----------------------------|---|---|
| 10 | CAPACITOR LIFE CYCLE | SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 24VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 24VDC O/P : FULL LOAD Ta= 50 °C LIFE TIME (3) I/P : 24VDC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 24VDC O/P : 50% LOAD Ta= 50 °C LIFE TIME | (1) 502386.0 HRS (2) 50194.8 HRS (3) 199990.8 HRS (4) 632472.0 HRS |
| 11 | MTBF | Conducted by Parts Stress Analysis Prediction 611K hrs min. MIL-HDBK-217F (25°C) | |
| 12 | DMTBF/Accelerated Life Test | Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50°C | |

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

12.10.30 A50-F031