



Test Report: RSD-60L-24

60W Reliable Railway DC-DC Converter

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

■ RELIABILITY TEST

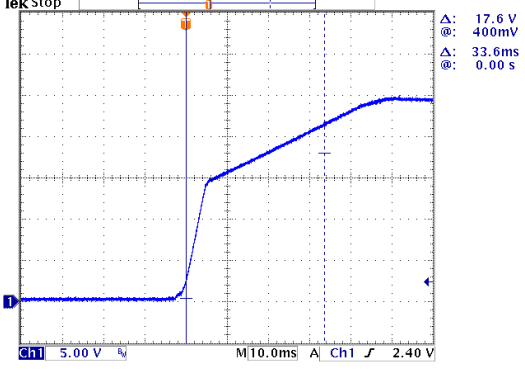
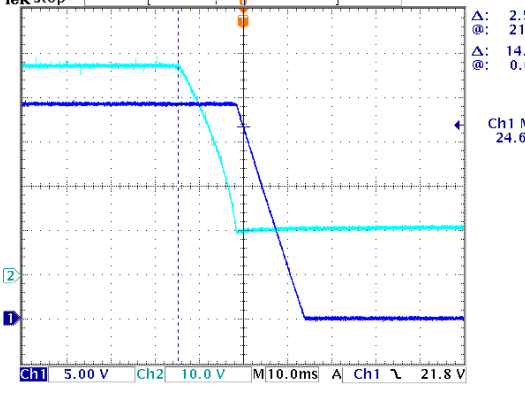
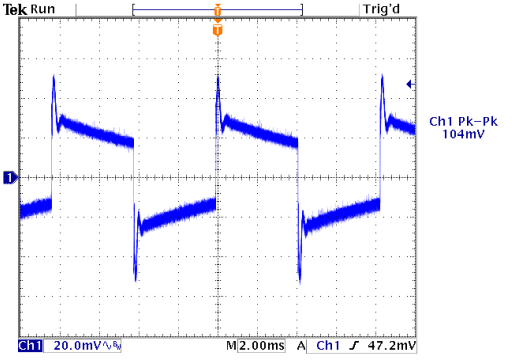
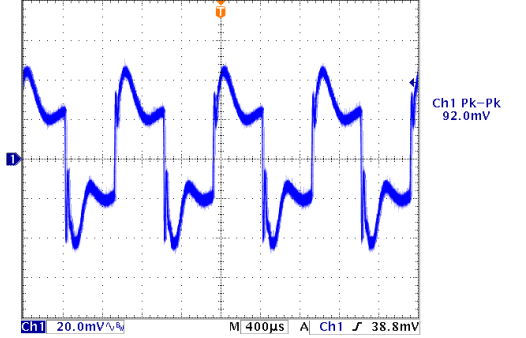
ENVIRONMENT TEST

DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|---|--------------------------------|-------------------|---|---------------------|
| 1 | OUTPUT VOLTAGE TOLERANCE (Max) | V1: 2 %~ -2 % | I/P: 18 VDC / 72 VDC O/P:FULL / MIN. LOAD Ta:25°C | V1: 0.908%~ 0.938 % |
| 2 | LINE REGULATION (Max) | V1: 0.2 %~ -0.2 % | I/P: 18 VDC / 72 VDC O/P:FULL LOAD Ta:25°C | V1: 0%~0 % |
| 3 | LOAD REGULATION (Max) | V1: 0.2 %~ -0.2 % | I/P: 48VDC O/P:FULL ~MIN LOAD Ta:25°C | V1: -0.01%~ 0.01% |
| 4 | OVER/UNDERSHOOT TEST | < ±5% | I/P: 48 VDC O/P:FULL LOAD Ta:25°C | TEST: 2.066% |
| 5 | RIPPLE & NOISE (Max) | V1: 50 mVp-p | I/P: 48 VDC O/P:FULL LOAD Ta:25°C | V1: 11.2mVp-p |
| <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>high frequency :</p> </div> <div style="text-align: center;"> <p>low frequency :</p> </div> </div> | | | | |
| 6 | SET UP TIME (Max) | 48VDC/ 100ms | I/P: 48VDC O/P:FULL LOAD Ta:25°C | 48VDC/ 60.8ms |
| <p>INPUT=48VDC @ FULL LOAD</p> <p>CH1 : Output Voltage CH2 : DC Input Voltage</p> | | | | |
| 7 | RISE TIME (Max) | 48VDC/ 60 ms | I/P: 48 VDC O/P:FULL LOAD Ta:25°C | 48VDC/33.6ms |



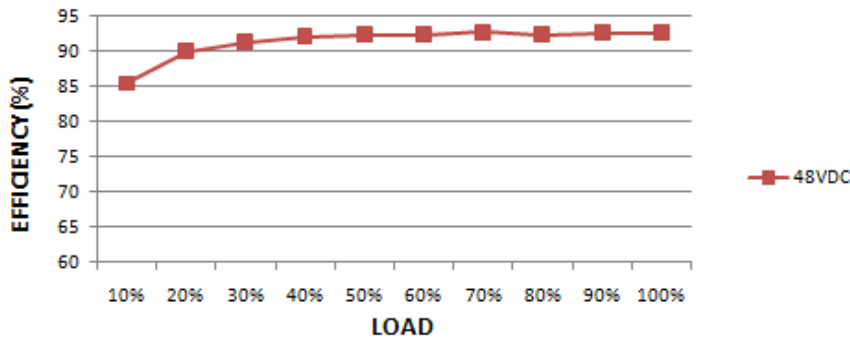
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|---|---|---------------|---|
| | <p>INPUT=48VDC @ FULL LOAD CH1 : Output Voltage</p>  | | |
| 8 | HOLD UP TIME (TYP) | 48VDC/ 10 ms | <p>I/P: 48 VDC O/P: FULL LOAD Ta:25°C</p> <p>14.8ms / full load</p> |
| | <p>INPUT=48VDC @ FULL LOAD CH1 : Output Voltage CH2 :DC Input Voltage</p>  | | |
| 9 | DYNAMIC LOAD | V1: 2400mVp-p | <p>I/P: 48VDC O/P: (1)FULL /MIN LOAD 50%DUTY / 120HZ (2)FULL /MIN LOAD 50%DUTY / 1KHZ Ta:25°C</p> <p>104mVp-p 92mVp-p</p> |
| | <div style="display: flex; justify-content: space-around;"> <div data-bbox="151 1467 678 1848"> <p>FULL /MIN LOAD 50%DUTY / 120HZ</p>  </div> <div data-bbox="837 1467 1364 1848"> <p>FULL /MIN LOAD 50%DUTY / 1KHZ</p>  </div> </div> | | |



INPUT FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|---------------------|-----------------|--|-----------------|
| 1 | INPUT VOLTAGE RANGE | 18 VDC / 72 VDC | I/P:TESTING O/P:FULL LOAD Ta:25°C | 12.3V~ 72 V |
| | | | I/P: LOW-LINE-0.2= 17.8 V HIGH-LINE+3V= 75 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec . OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE) | TEST : OK |
| 2 | DC CURRENT(TYP) | 48VDC/ 1.5A | I/P: 48VDC O/P:FULL LOAD Ta:25°C | I =1.358A/48VDC |
| 3 | EFFICIENCY(TYP) | 91.5% | I/P: 48VDC O/P:FULL LOAD Ta:25°C | 92.94% |

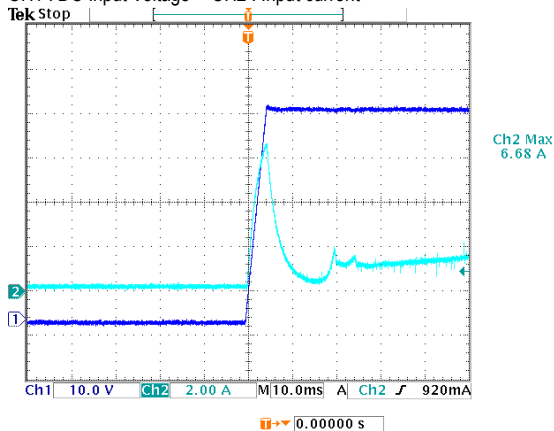
EFFICIENCY vs LOAD



| | | | | |
|---|---------------------|--------------------------|---------------------------------------|-----------------|
| 4 | INRUSH CURRENT(TYP) | 48VDC/ 20A COLD START | I/P:48VDC O/P:FULL LOAD Ta:25°C | I =6.68A/ 48VDC |
|---|---------------------|--------------------------|---------------------------------------|-----------------|

INPUT=48VDC @ FULL LOAD

CH1 : DC Input Voltage CH2 : Input current



PROTECTION FUNCTION TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|-------------------------|---|--|---|
| 1 | OVER LOAD PROTECTION | 105%~135 %RATED OUTPUT POWER PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed | I/P: 72VDC I/P: 48VDC I/P: 18VDC O/P: TESTING Ta:25°C | 119.2% 119.2% 119.2% PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed |
| 2 | OVER VOLTAGE PROTECTION | CH: 27.6V~ 32.4 V PROTECTION TYPE : Shut down o/p voltage, re-power on to recover | I/P: 72VDC I/P: 48VDC I/P: 18VDC O/P : NO LOAD Ta:25°C | 29.55V 29.48V 29.44V PROTECTION TYPE : Shut down o/p voltage, re-power on to recover |
| 3 | SHORT PROTECTION | SHORT EVERY OUTPUT 1 HOUR NO DAMAGE | I/P: 72VDC 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: 72 VDC 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 | Q3 Rated :33 A/ 150V | I/P:High-Line +3V =75V AC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25°C | VDS: (1) 148V (2) 125V (3) 137V |
| 2 | Diode Peak Voltage | Q100 Rated : 10A/ 150 V | I/P:High-Line +3V =75V AC ON/OFF O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25°C | Q100: VDS: (1) 132V (2) 116V (3) 106V |
| 3 | Input Capacitor Voltage | C5 Rated: :120 μ /80 V 105°C | I/P:High-Line +3V =75V 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) 76.0V (2) 75.8V (3) 74.0V (4) 74.0V |
| 4 | Control IC Voltage Test | PWM IC U1 Rated : 40 V V(MIN.) -0.3V | I/P:High-Line +3V =75V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25°C | (1) 21.2V (2) 10.6V (3) 10.8V (4) 24.1V |



| | | | | |
|---|--------------------------|-------------------------|--|------------------------|
| 5 | Clamp Diode Peak Voltage | D4 Rated : 600 V 3 A | I/P : High-Line +3V = 75V AC ON/OFF O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C | (1) 96.0V (2) 92.4V |
|---|--------------------------|-------------------------|--|------------------------|

SAFETY TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|----------------------|---|---|--|
| 1 | WITHSTAND VOLTAGE | EN 60950-1 I/P-O/P:4KVDC/min I/P-FG:2.5KVDC/min O/P-FG:2.5KVDC/min | I/P-O/P: 4.4KVDC/min I/P-FG: 3 KVDC/min O/P-FG:3KVDC/min Ta:25°C | I/P-O/P: 1.65mA I/P-FG: 2.23mA O/P-FG: 1.16mA NO DAMAGE |
| 2 | ISOLATION RESISTANCE | I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ | I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C | I/P-O/P:9999MΩ I/P-FG: 9999MΩ O/P-FG:9999 MΩ NO DAMAGE |
| 3 | GROUNDING CONTINUITY | EN 60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ | 40A / 2min Ta:25°C | 20mΩ |

E.M.C TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT |
|----|---|---|---|-------------------------------|
| 1 | RADIATION | BS EN/EN55032 CLASS B | I/P: 48 VDC O/P:FULL LOAD Ta:25°C | PASS Test by certified Lab |
| 2 | CONDUCTION | BS EN/EN55032 CLASS B | I/P: 48 VDC O/P:FULL LOAD Ta:25°C | PASS Test by certified Lab |
| 3 | E.S.D | BS EN/EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:6KV | I/P: 48 VDC O/P:FULL LOAD Ta:25°C | CRITERIA A |
| 4 | E.F.T | BS EN/EN61000-4-4 LIGHT INDUSTRY INPUT: 2KV | I/P: 48 VDC O/P:FULL LOAD Ta:25°C | CRITERIA A |
| 5 | SURGE | BS EN/EN61000-4-5 LIGHT INDUSTRY L-N :1KV L,N-PE:2KV | I/P:48 VDC O/P:FULL LOAD Ta:25°C | CRITERIA A |
| 6 | Test by certified Lab & Test Report Prepare | | | |

RELIABILITY TEST

ENVIRONMENT TEST

| NO | TEST ITEM | SPECIFICATION | TEST CONDITION | RESULT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----|---|--|---|--|----|----------|-------------------------|-------------------------|---|-----|-------|-------|---|-----|-------|-------|---|----|-------|-------|---|----|-------|-------|---|-----|-------|-------|---|----|-------|-------|---|----|-------|-------|---|------|-------|-------|---|------|-------|-------|----|------|-------|-------|----|------|-------|-------|----|----|-------|-------|----|----|-------|-------|----|----|-------|-------|----|----|-------|-------|----|----|-------|-------|----|------|-------|-------|----|------|-------|-------|----|----|-------|-------|
| 2 | TEMPERATURE RISE TEST | MODEL : RSD-60L-12 1. ROOM AMBIENT BURN-IN : 1HRS I/P : 48VDC O/P : FULL LOAD Ta= 23.4℃ 2. HIGH AMBIENT BURN-IN : 1HRS I/P : 48VDC O/P : FULL LOAD Ta= 53.2℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | <table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 23.4 ℃</th> <th>HIGH AMBIENT Ta= 53.2 ℃</th> </tr> </thead> <tbody> <tr><td>1</td><td>C12</td><td>36.3℃</td><td>65.6℃</td></tr> <tr><td>2</td><td>LF1</td><td>37.6℃</td><td>67.1℃</td></tr> <tr><td>3</td><td>C5</td><td>37.1℃</td><td>66.3℃</td></tr> <tr><td>4</td><td>C6</td><td>37.6℃</td><td>66.9℃</td></tr> <tr><td>5</td><td>C40</td><td>39.8℃</td><td>68.9℃</td></tr> <tr><td>6</td><td>T2</td><td>42.0℃</td><td>71.5℃</td></tr> <tr><td>7</td><td>T1</td><td>49.6℃</td><td>70.1℃</td></tr> <tr><td>8</td><td>C110</td><td>41.1℃</td><td>70.1℃</td></tr> <tr><td>9</td><td>C105</td><td>42.4℃</td><td>71.5℃</td></tr> <tr><td>10</td><td>L100</td><td>41.0℃</td><td>70.2℃</td></tr> <tr><td>11</td><td>C108</td><td>36.4℃</td><td>65.4℃</td></tr> <tr><td>12</td><td>Q1</td><td>37.4℃</td><td>66.9℃</td></tr> <tr><td>13</td><td>Q2</td><td>37.9℃</td><td>67.3℃</td></tr> <tr><td>14</td><td>Q3</td><td>45.5℃</td><td>75.4℃</td></tr> <tr><td>15</td><td>U1</td><td>40.9℃</td><td>70.4℃</td></tr> <tr><td>16</td><td>D4</td><td>45.7℃</td><td>75.4℃</td></tr> <tr><td>17</td><td>Q100</td><td>44.8℃</td><td>74.3℃</td></tr> <tr><td>18</td><td>U100</td><td>38.3℃</td><td>67.4℃</td></tr> <tr><td>19</td><td>D1</td><td>36.7℃</td><td>66.1℃</td></tr> </tbody> </table> | NO | Position | ROOM AMBIENT Ta= 23.4 ℃ | HIGH AMBIENT Ta= 53.2 ℃ | 1 | C12 | 36.3℃ | 65.6℃ | 2 | LF1 | 37.6℃ | 67.1℃ | 3 | C5 | 37.1℃ | 66.3℃ | 4 | C6 | 37.6℃ | 66.9℃ | 5 | C40 | 39.8℃ | 68.9℃ | 6 | T2 | 42.0℃ | 71.5℃ | 7 | T1 | 49.6℃ | 70.1℃ | 8 | C110 | 41.1℃ | 70.1℃ | 9 | C105 | 42.4℃ | 71.5℃ | 10 | L100 | 41.0℃ | 70.2℃ | 11 | C108 | 36.4℃ | 65.4℃ | 12 | Q1 | 37.4℃ | 66.9℃ | 13 | Q2 | 37.9℃ | 67.3℃ | 14 | Q3 | 45.5℃ | 75.4℃ | 15 | U1 | 40.9℃ | 70.4℃ | 16 | D4 | 45.7℃ | 75.4℃ | 17 | Q100 | 44.8℃ | 74.3℃ | 18 | U100 | 38.3℃ | 67.4℃ | 19 | D1 | 36.7℃ | 66.1℃ |
| NO | Position | ROOM AMBIENT Ta= 23.4 ℃ | HIGH AMBIENT Ta= 53.2 ℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | C12 | 36.3℃ | 65.6℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | LF1 | 37.6℃ | 67.1℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | C5 | 37.1℃ | 66.3℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | C6 | 37.6℃ | 66.9℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | C40 | 39.8℃ | 68.9℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | T2 | 42.0℃ | 71.5℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | T1 | 49.6℃ | 70.1℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | C110 | 41.1℃ | 70.1℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | C105 | 42.4℃ | 71.5℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | L100 | 41.0℃ | 70.2℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | C108 | 36.4℃ | 65.4℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | Q1 | 37.4℃ | 66.9℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | Q2 | 37.9℃ | 67.3℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | Q3 | 45.5℃ | 75.4℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | U1 | 40.9℃ | 70.4℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | D4 | 45.7℃ | 75.4℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | Q100 | 44.8℃ | 74.3℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | U100 | 38.3℃ | 67.4℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | D1 | 36.7℃ | 66.1℃ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | OVER LOAD BURN-IN TEST | NO DAMAGE 1 HOUR (MIN) | I/P : 48VDC O/P : 116.8 % LOAD Ta : 25℃ | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | LOW TEMPERATURE TURN ON TEST | TURN ON AFTER 2 HOUR | I/P : 72VDC/ 18VDC O/P : 100 % LOAD Ta= -40 ℃ | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST | AFTER 12 HOURS IN CHAMBER ON CONTROL 55 ℃ NO DAMAGE | I/P : 75VDC O/P : FULL LOAD Ta= 55 ℃ HUMIDITY= 95 %R.H | TEST: OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | TEMPERATURE COEFFICIENT | ± 0.03 %(0~50℃) | I/P : 48VDC O/P : FULL LOAD | ± 0.0028 %(0~50℃) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | STORAGE TEMPERATURE TEST | 1. Thermal shock Temperature : -40℃~ +85℃ 2. Temperature change rate : 25℃ / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 5 CYCLE 5. Input/Output condition : STATIC | | TEST : OK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



60W Reliable Railway DC-DC Converter

RSD-60L series

| | | | |
|----|-----------------------------|---|--|
| 8. | THERMAL SHOCK TEST | 1. Thermal shock Temperature : -45°C~ +60°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 : 48VDC/Full Load DC ON/OFF TEST turn on 58sec ; turn off 2sec | TEST : OK |
| 9 | VIBRATION TEST | 1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 5G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C | TEST : OK |
| 10 | CAPACITOR LIFE CYCLE | SUPPOSE C 105 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= 55°C LIFE TIME (3) I/P : 48VDC O/P : 75% LOAD Ta= 55°C LIFE TIME (4) I/P : 48VDC O/P : 50% LOAD Ta= 55°C LIFE TIME | (1) 866977HRS (2) 113760HRS (3) 175576HRS (4) 251932HRS |
| 11 | MTBF | 2738.8K hrs min. Telcordia SR-332 (Bellcore) ; 593.9K hrs min. MIL-HDBK-217F (25°C) | |
| 12 | DMTBF/Accelerated Life Test | Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 55°C | |

| TEST RESULT | TESTER | REVIEW | APPROVAL |
|-------------|--------|--------|----------|
| PASS | Frank | Gesg | Wangdz |

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