



# Test Report: RSD-30G-5

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30W 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

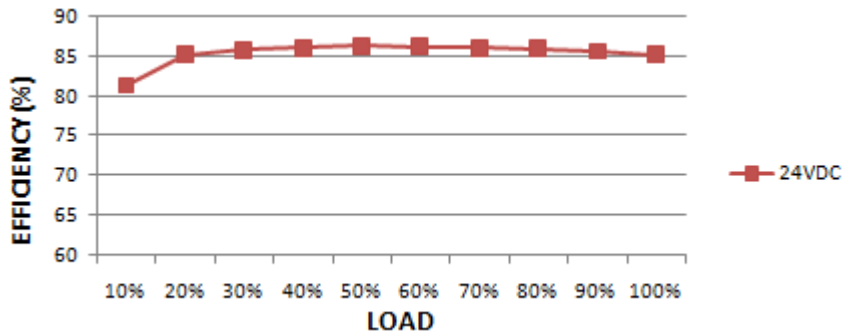
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE TOLERANCE (Max)	V1: 2 %~ -2 %	I/P: 9 VDC / 36 VDC O/P:FULL/ MIN. LOAD Ta:25°C	V1: 0.174%~0.246%
2	LINE REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 9 VDC / 36 VDC O/P:FULL LOAD Ta:25°C	V1: 0%~ 0%
3	LOAD REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 24VDC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0%~ -0%
4	OVER/UNDERSHOOT TEST	< ±10%	I/P: 24 VDC O/P:FULL LOAD Ta:25°C	TEST:<4%
5	RIPPLE & NOISE (Max)	V1: 70 mVp-p	I/P: 24 VDC O/P:FULL LOAD Ta:25°C	V1: 13.8mVp-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)	24VDC/120 ms	I/P: 24VDC O/P:FULL LOAD Ta:25°C	24VDC/31.4ms
<p>INPUT=24VDC @ FULL LOAD</p> <p>CH1 : Output Voltage CH2 : DC Input Voltage</p>				
7	RISE TIME (Max)	24VDC/ 85 ms	I/P: 24 VDC O/P:FULL LOAD Ta:25°C	24VDC/16.264 ms

<p>INPUT=24VDC @ FULL LOAD</p> <p>CH1 : Output Voltage</p>			
8	<p>HOLD UP TIME (TYP)</p> <p>24VDC / 3 ms 24VDC / 10 ms</p>	<p>I/P: 24 VDC</p> <p>O/P: FULL LOAD / 80% LOAD</p> <p>Ta:25°C</p>	<p>6.8ms / full load 13.8ms / 80% load</p>
<p>INPUT=24VDC @ FULL LOAD</p> <p>CH1 : Output Voltage CH2 : DCInput Voltage</p>		<p>INPUT=24VDC @ 50% LOAD</p> <p>CH1 : Output Voltage CH2 : DCInput Voltage</p>	
9	<p>DYNAMIC LOAD</p> <p>V1: 1000mVp-p</p>	<p>I/P: 24VDC</p> <p>O/P:</p> <p>(1)FULL /MIN LOAD 50%DUTY / 120HZ</p> <p>(2)FULL /MIN LOAD 50%DUTY / 1KHZ</p> <p>Ta:25°C</p>	<p>612mVp-p 295mVp-p</p>
<p>FULL /MIN LOAD 50%DUTY / 120HZ</p> <p>Ch1 Pk-Pk 612mV</p>		<p>FULL /MIN LOAD 50%DUTY / 1KHZ</p> <p>Ch1 Pk-Pk 295mV</p>	

## INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	9VDC~ 36 VDC	I/P:TESTING O/P:FULL LOAD Ta:25°C	7.57V~ 36V
			I/P: LOW-LINE-0.2= 8.8 V HIGH-LINE+3V= 39 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)	24VDC/ 1.5A	I/P: 24VDC O/P:FULL LOAD Ta:25°C	I=1.461A/24VDC
3	EFFICIENCY(TYP)	85%	I/P: 24VDC O/P:FULL LOAD Ta:25°C	85.3 %

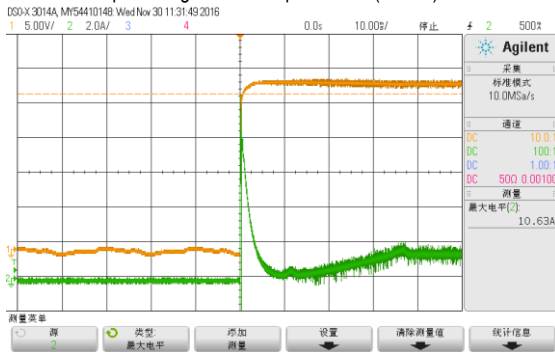
EFFICIENCY vs LOAD



4	INRUSH CURRENT(TYP)	24VDC/ 15A COLD START	I/P:24VDC O/P:FULL LOAD Ta:25°C	I=10.63A/ 24VDC
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INPUT=24VDC @ FULL LOAD

SCH2 : DC Input Voltage CH4 : Input current (1V=1A)



## 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: 36VDC I/P: 24VDC I/P: 9VDC O/P: TESTING Ta:25°C	118.5% 118.5% 120.2% PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH: 5.75V~ 7 V PROTECTION TYPE : Shut down o/p voltage, re-power on to recover	I/P: 36 VDC I/P: 24VDC I/P: 9VDC O/P : NO LOAD Ta:25°C	6.10V 6.10V 6.11V 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: 36 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 70A/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) 80.4V (2) 79.2V (3) 80.0V
2	Diode Peak Voltage	Q100 Rated 120A/40V	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) 25.2V (2) 24.8V (3) 25.0V
3	Input Capacitor Voltage	C5 Rated: 220u/50V 105°C	I/P: High-Line +3V =39V 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) 39.4V (2) 39.0V (3) 39.4V (4) 39.4V
4	Control IC Voltage Test	PWM IC U1 Rated 35V 3.9V(MIN.)	I/P: High-Line +3V =39V DC ON/OFF O/P(1) FULL LOAD (2) Output Short (3) O.L.P (4) O.V.P. Ta:25°C	(1) 12.2V (2) 10.3V (3) 10.3V (4) 10.4V

5	Clamp Diode Peak Voltage	D4 Rated 3A/100V	I/P : High-Line +3V = 39V DC ON/OFF O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C	(1) 42.4V (2) 40.8V
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### 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: 1.10mA I/P-FG: 1.54mA O/P-FG: 1.23mA 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: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	EN 60950-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	<b>18mΩ</b>

### E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	EN55032 CLASS B	I/P: 24 VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
2	CONDUCTION	EN55032 CLASS A	I/P: 24 VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:6KV	I/P: 24 VDC O/P:FULL LOAD Ta:25°C	CRITERIA A
4	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 2KV	I/P: 24 VDC O/P:FULL LOAD Ta:25°C	CRITERIA A
5	SURGE	IEC61000-4-5 LIGHT INDUSTRY L-N :1KV L,N-PE:2KV	I/P: 24 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-30G-5 1. ROOM AMBIENT BURN-IN : 1HRS I/P : 36VDC O/P : FULL LOAD Ta= 19.0°C 2. HIGH AMBIENT BURN-IN : 1HRS I/P : 36VDC O/P : FULL LOAD Ta= 54.1°C																																																																		
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 19.0 °C</th> <th>HIGH AMBIENT Ta= 54.1 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>37.5°C</td><td>70.3°C</td></tr> <tr><td>2</td><td>C5</td><td>40.2°C</td><td>73.0°C</td></tr> <tr><td>3</td><td>C12</td><td>35.3°C</td><td>68.0°C</td></tr> <tr><td>4</td><td>D4</td><td>45.9°C</td><td>79.4°C</td></tr> <tr><td>5</td><td>T1</td><td>45.5°C</td><td>77.8°C</td></tr> <tr><td>6</td><td>C40</td><td>41.5°C</td><td>73.8°C</td></tr> <tr><td>7</td><td>C112</td><td>41.1°C</td><td>73.7°C</td></tr> <tr><td>8</td><td>C105</td><td>41.4°C</td><td>74.3°C</td></tr> <tr><td>9</td><td>L100</td><td>39.8°C</td><td>73.2°C</td></tr> <tr><td>10</td><td>Q100</td><td>42.4°C</td><td>75.5°C</td></tr> <tr><td>11</td><td>U101</td><td>36.6°C</td><td>69.5°C</td></tr> <tr><td>12</td><td>Q3</td><td>46.5°C</td><td>80.8°C</td></tr> <tr><td>13</td><td>Q2</td><td>36.8°C</td><td>69.6°C</td></tr> <tr><td>14</td><td>Q1</td><td>35.6°C</td><td>69.0°C</td></tr> <tr><td>15</td><td>U1</td><td>36.2°C</td><td>69.1°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 19.0 °C	HIGH AMBIENT Ta= 54.1 °C	1	LF1	37.5°C	70.3°C	2	C5	40.2°C	73.0°C	3	C12	35.3°C	68.0°C	4	D4	45.9°C	79.4°C	5	T1	45.5°C	77.8°C	6	C40	41.5°C	73.8°C	7	C112	41.1°C	73.7°C	8	C105	41.4°C	74.3°C	9	L100	39.8°C	73.2°C	10	Q100	42.4°C	75.5°C	11	U101	36.6°C	69.5°C	12	Q3	46.5°C	80.8°C	13	Q2	36.8°C	69.6°C	14	Q1	35.6°C	69.0°C	15	U1	36.2°C	69.1°C
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3	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 24VDC O/P : 114 % LOAD Ta : 25°C	TEST : OK																																																																
4	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 36VDC/ 9VDC O/P : 100 % LOAD Ta= -40 °C	TEST : OK																																																																
5	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 55 °C NO DAMAGE	I/P : 39VDC O/P : FULL LOAD Ta= 55 °C HUMIDITY= 95 %R.H	TEST: OK																																																																
6	TEMPERATURE COEFFICIENT	± 0.03 %(0~50°C)	I/P : 24VDC O/P : FULL LOAD	± 0.0057 %(0~50°C)																																																																
7	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -40°C~ +85°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 5 CYCLE 5. Input/Output condition : STATIC		TEST : OK																																																																
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 : 36VDC/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 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 55°C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 55°C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 55°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 55°C LIFE TIME	(1) 158118HRS (2) 158118HRS (3) 158118HRS (4) 158118HRS
11	MTBF	Conducted by Parts Stress Analysis Prediction 396.9K 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

2007/3/20 A50-S014