



# Test Report: RSD-30L-3.3

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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: 18 VDC / 72 VDC O/P:FULL / MIN. LOAD Ta:25°C	V1: -0.15%~ -0.212 %
2	LINE REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 18 VDC / 72 VDC O/P:FULL LOAD Ta:25°C	V1: 0 %~0 %
3	LOAD REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 48VDC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0 %~0 %
4	OVER/UNDERSHOOT TEST	< ±15%	I/P: 48 VDC O/P:FULL LOAD Ta:25°C	TEST: <4.938%
5	RIPPLE & NOISE (Max)	V1: 70 mVp-p	I/P: 48 VDC O/P:FULL LOAD Ta:25°C	V1: 29.4mVp-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/ 120 ms	I/P: 48VDC O/P:FULL LOAD Ta:25°C	48VDC/31.8 ms
<p>INPUT=48VDC @ FULL LOAD</p> <p>CH1 : Output Voltage CH2 : DC Input Voltage</p>				
7	RISE TIME (Max)	48VDC/ 85 ms	I/P: 48 VDC O/P:FULL LOAD Ta:25°C	48VDC/10.6ms

<p>INPUT=48VDC @ FULL LOAD</p> <p>CH1 : Output Voltage</p>			
<p>8 HOLD UP TIME (TYP)</p>	<p>48VDC / 10 ms</p>	<p>I/P: 48 VDC O/P: FULL LOAD Ta:25°C</p>	<p>24ms / full load</p>
<p>INPUT=48VDC @ FULL LOAD</p> <p>CH1 : Output Voltage CH2 DC Input Voltage</p>			
<p>9 DYNAMIC LOAD</p>	<p>V1: 990mVp-p</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>692mVp-p 598mVp-p</p>
<p>FULL /MIN LOAD 50%DUTY / 120HZ</p> <p>Ch1 Pk-Pk 692mV</p>		<p>FULL /MIN LOAD 50%DUTY / 1KHZ</p> <p>Ch1 Pk-Pk 598mV</p>	

## 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	17.29V ~ 36 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/ 0.52A	I/P: 48VDC O/P: FULL LOAD Ta: 25°C	I=0.4356A/48VDC																						
3	EFFICIENCY(TYP)	84%	I/P: 48VDC O/P: FULL LOAD Ta: 25°C	88.3%																						
<p><b>EFFICIENCY vs LOAD</b></p> <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>EFFICIENCY (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>82.0</td></tr> <tr><td>20%</td><td>85.0</td></tr> <tr><td>30%</td><td>86.5</td></tr> <tr><td>40%</td><td>87.0</td></tr> <tr><td>50%</td><td>87.5</td></tr> <tr><td>60%</td><td>87.8</td></tr> <tr><td>70%</td><td>88.0</td></tr> <tr><td>80%</td><td>88.1</td></tr> <tr><td>90%</td><td>88.2</td></tr> <tr><td>100%</td><td>88.3</td></tr> </tbody> </table>					LOAD (%)	EFFICIENCY (%)	10%	82.0	20%	85.0	30%	86.5	40%	87.0	50%	87.5	60%	87.8	70%	88.0	80%	88.1	90%	88.2	100%	88.3
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4	INRUSH CURRENT(TYP)	48VDC/ 20A COLD START	I/P: 48VDC O/P: FULL LOAD Ta: 25°C	I=4.54A/ 48VDC																						
<p>INPUT=48VDC @ FULL LOAD CH2 : DC Input Voltage CH4 : Input current (1V=1A)</p> <p>Agilent Oscilloscope Settings:          - Scale: 10.0V (CH2), 2.00A (CH4)          - Timebase: 10.00µs          - Trigger: 0.0s          - Max Inrush Current: 4.54A</p>																										

## 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	118.33% 118.16% 118.33% PROTECTION TYPE : Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH: 3.8V~ 4.5 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	4.15V 4.14V 4.15V 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,
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 150V /28A	I/P:High-Line +3V =75V DC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25°C	VDS: (1) 140V (2) 118V (3) 128V
2	Diode Peak Voltage	Q100 Rated : 120 A/ 40 V	I/P:High-Line +3V =75V DC ON/OFF O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25°C	Q100: VDS: (1) 30.2V (2) 26.4V (3) 28.1V
3	Input Capacitor Voltage	C5 Rated: : 120 $\mu$ / 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) 76.4V (2) 76.8V (3) 76.4V (4) 76.4V
4	Control IC Voltage Test	PWM IC U1 Rated : 35 V  3.9V(MIN.)	I/P:High-Line +3V =75V DC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25°C	(1) 13.9V (2) 10.3V (3) 10.3V (4) 12.3V

5	Clamp Diode Peak Voltage	D4 Rated : 3A/100V	I/P : High-Line +3V = 75V DC ON/OFF O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C	(1) 75.6V (2) 59.6V
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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: 1.03mA I/P-FG: 1.47mA O/P-FG: 0.78mA 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:9999 MΩ 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>20mΩ</b>

### 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 A	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-30L-12 1. ROOM AMBIENT BURN-IN : 1HRS I/P : 48VDC O/P : FULL LOAD Ta= 19.0℃ 2. HIGH AMBIENT BURN-IN : 1HRS I/P : 48VDC O/P : FULL LOAD Ta= 54.1℃																																																										
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3	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 48VDC O/P : 114.6 % 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 °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 : 75VDC O/P : FULL LOAD Ta= 55 °C HUMIDITY= 95 %R.H	TEST: OK																																																								
6	TEMPERATURE COEFFICIENT	±0.03 %(0~50℃)	I/P : 48VDC O/P : FULL LOAD	±0.0071 %(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																																																								
8.	THERMAL SHOCK TEST	1. Thermal shock Temperature : -45℃~ +60℃ 2. Temperature change rate : 25℃ / 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) 818531HRS (2) 129467HRS (3) 175061HRS (4) 225798HRS
11	MTBF	3093.5K hrs min. Telcordia SR-332 (Bellcore) ; 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

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