Test Report: RSD-30G-12

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

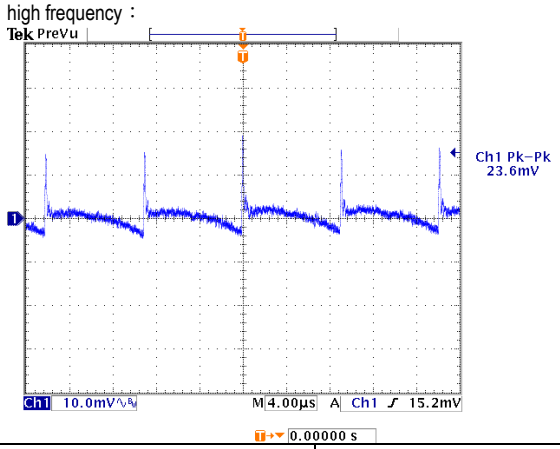
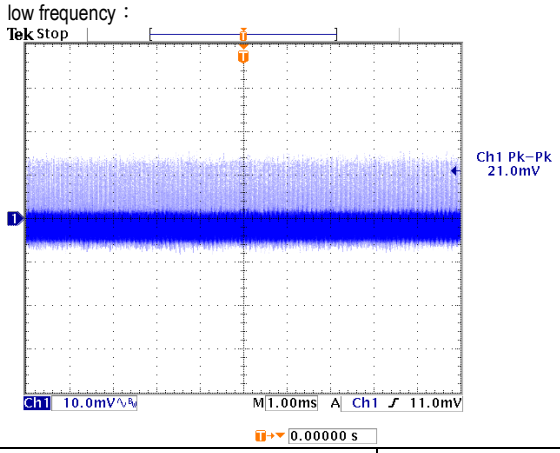
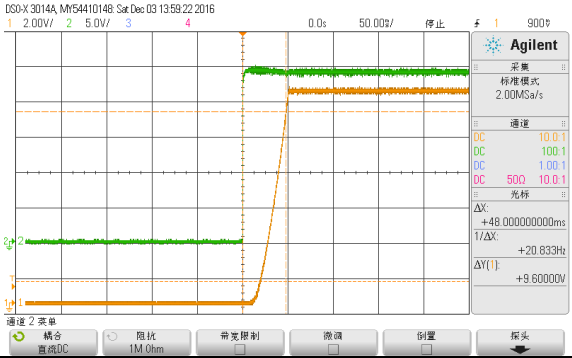
Safety Test
E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

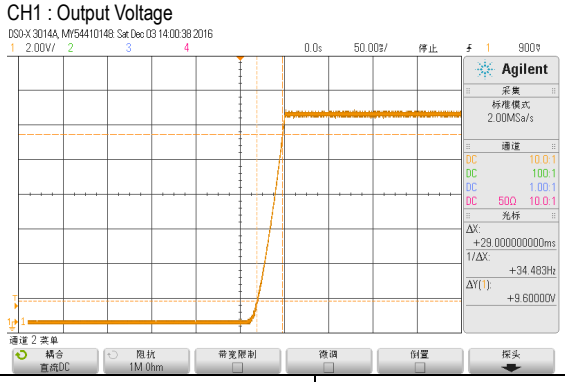
■ DESIGN VERIFY TEST

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℃	V1: 0.108%~ 0.233%
2	LINE REGULATION (Max)	V1: 0.3 %~ -0.3 %	I/P: 9 VDC / 36 VDC O/P:FULL LOAD Ta:25℃	V1: 0%~ 0%
3	LOAD REGULATION (Max)	V1: 0.3 %~ -0.3 %	I/P: 24VDC O/P:FULL ~MIN LOAD Ta:25℃	V1: 0%~ 0%
4	OVER/UNDERSHOOT TEST	< ±5%	I/P: 24 VDC O/P:FULL LOAD Ta:25℃	TEST:< 1.33%
5	RIPPLE & NOISE (Max)	V1: 60 mVp-p	I/P: 24 VDC O/P:FULL LOAD Ta:25℃	V1: 23.6mVp-p
	high frequency： 		low frequency： 	
6	SET UP TIME (Max)	24VDC/ 120 ms	I/P: 24VDC O/P:FULL LOAD Ta:25℃	24VDC/ 48 ms
	INPUT=24VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage 			
7	RISE TIME (Max)	24VDC/ 85 ms	I/P: 24 VDC O/P:FULL LOAD Ta:25℃	24VDC/ 29 ms

INPUT=24VDC @ FULL LOAD

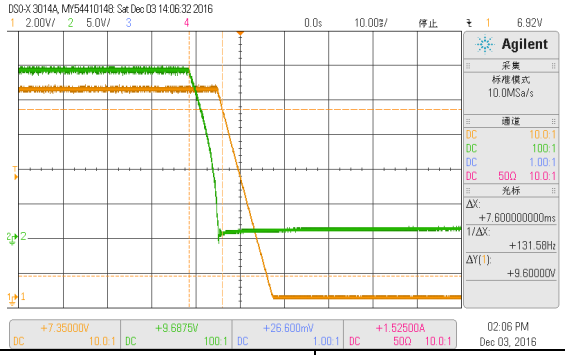
CH1 : Output Voltage



8	HOLD UP TIME (TYP)	24VDC/ 3 ms 24VDC/ 10 ms	I/P: 24 VDC O/P:F ULL LOAD / 80% LOAD Ta:25℃	7.6ms / full load 15.6ms / 80% load

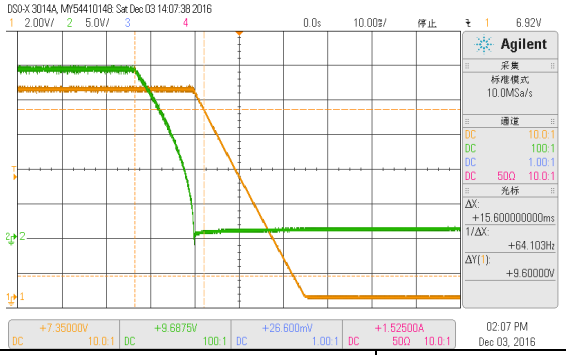
INPUT=24VDC @ FULL LOAD

CH1 : Output Voltage CH2 : DCInput Voltage



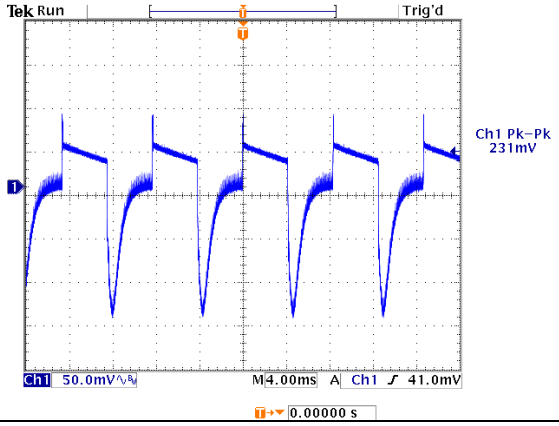
INPUT=24VDC @ 80% LOAD

CH1 : Output Voltage CH2 : DCInput Voltage

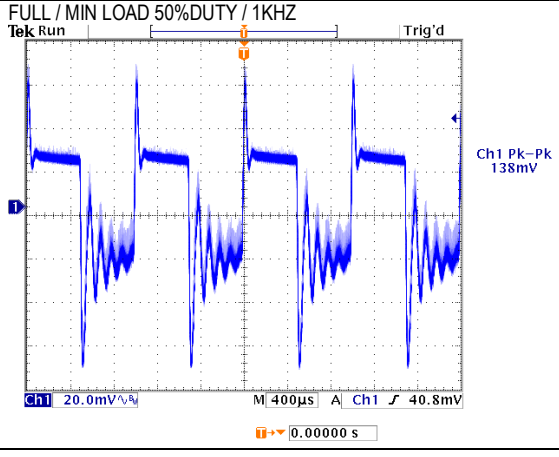


9	DYNAMIC LOAD	V1: 1200mVp-p	I/P: 24VDC O/P: (1)FULL /MIN LOAD 50%DUTY / 120HZ (2)FULL / MIN LOAD 50%DUTY / 1KHZ Ta:25℃	 231mVp-p 138mVp-p

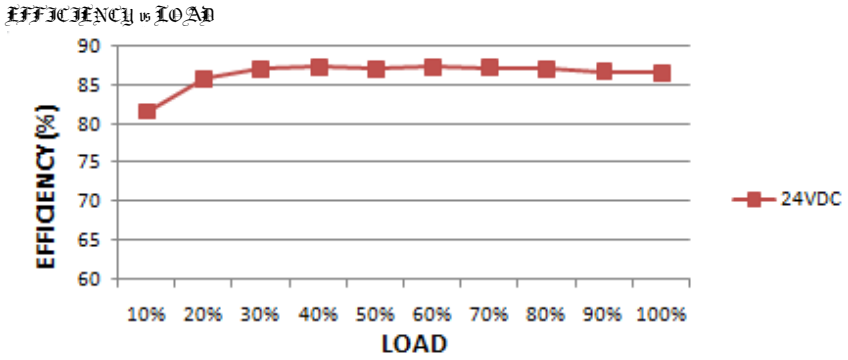
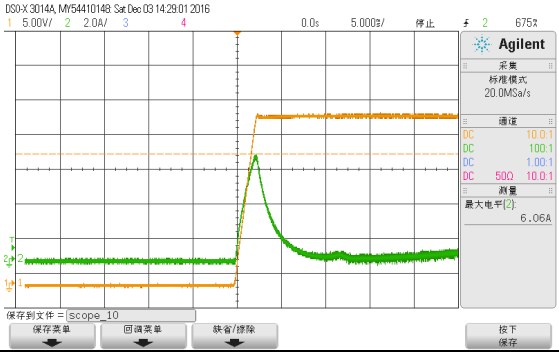
FULL / MIN LOAD 50%DUTY / 120HZ



FULL / MIN LOAD 50%DUTY / 1KHZ



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℃	7.4V~ 36 V
			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℃	I =1.4274A/24VDC
3	EFFICIENCY(TYP)	86.5%	I/P: 24VDC O/P:FULL LOAD Ta:25℃	86.8%
				
4	INRUSH CURRENT(TYP)	24VDC/ 20A COLD START	I/P:24VDC O/P:FULL LOAD Ta:25℃	I =6.06A/24VDC
	INPUT=24VDC @ FULL LOAD CH2 : 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℃	120% 120% 120.4% PROTECTION TYPE： Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH: 13.8V~ 16.2 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℃	14.94V 14.88V 14.94V 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℃	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℃	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℃	 VDS: (1) 88.0V (2) 85.6V (3) 85.6V
2	Diode Peak **Voltage**	Q100 Rated 20A/100V	I/P:High-Line +3V =39V DC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25℃	 VDS: (1) 52.8V (2) 39.6V (3) 52.8V
3	**Input Capacitor Voltage**	C5 Rated: 220u/50V 105℃	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℃	(1) 39.8V (2) 39.2V (3) 39.8V (4) 39.8V
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℃	(1) 17.1V (2) 10.5V (3) 10.5V (4) 18.0V

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℃	(1) 44.4V (2) 43.2V

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℃	I/P-O/P: 1.02 mA I/P-FG: 1.47 mA 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℃	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℃	**20mΩ**

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	BS EN/EN55032 CLASS B	I/P: 24 VDC O/P:FULL LOAD Ta:25℃	PASS Test by certified Lab
2	CONDUCTION	BS EN/EN55032 CLASS A	I/P: 24 VDC O/P:FULL LOAD Ta:25℃	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℃	CRITERIA A
4	E.F.T	BS EN/EN61000-4-2 LIGHT INDUSTRY INPUT: 2KV	I/P: 24 VDC O/P:FULL LOAD Ta:25℃	CRITERIA A
5	SURGE	BS EN/EN61000-4-5 LIGHT INDUSTRY L-N :1KV L,N-PE:2KV	I/P: 24 VDC O/P:FULL LOAD Ta:25℃	CRITERIA A
6	Test by certified Lab & Test Report Prepare			

■ RELIABILITY TEST

ENVIRONMENT TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th></tr>
<tr><td>2</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL： RSD-30G-5
1. ROOM AMBIENT BURN-IN： 1HRS
I/P： 24VDC O/P： FULL LOAD Ta= 19.0℃
2. HIGH AMBIENT BURN-IN： 1HRS
I/P： 24VDC O/P： FULL LOAD Ta= 54.1℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 19.0 ℃</th><th>HIGH AMBIENT Ta= 54.1 ℃</th></tr>
<tr><td>1</td><td>LF1</td><td>37.5℃</td><td>70.3℃</td></tr>
<tr><td>2</td><td>C5</td><td>40.2℃</td><td>73.0℃</td></tr>
<tr><td>3</td><td>C12</td><td>35.3℃</td><td>68.0℃</td></tr>
<tr><td>4</td><td>D4</td><td>45.9℃</td><td>79.4℃</td></tr>
<tr><td>5</td><td>T1</td><td>45.5℃</td><td>77.8℃</td></tr>
<tr><td>6</td><td>C40</td><td>41.5℃</td><td>73.8℃</td></tr>
<tr><td>7</td><td>C112</td><td>41.1℃</td><td>73.7℃</td></tr>
<tr><td>8</td><td>C105</td><td>41.4℃</td><td>74.3℃</td></tr>
<tr><td>9</td><td>L100</td><td>39.8℃</td><td>73.2℃</td></tr>
<tr><td>10</td><td>Q100</td><td>42.4℃</td><td>75.5℃</td></tr>
<tr><td>11</td><td>U101</td><td>36.6℃</td><td>69.5℃</td></tr>
<tr><td>12</td><td>Q3</td><td>46.5℃</td><td>80.8℃</td></tr>
<tr><td>13</td><td>Q2</td><td>36.8℃</td><td>69.6℃</td></tr>
<tr><td>14</td><td>Q1</td><td>35.6℃</td><td>69.0℃</td></tr>
<tr><td>15</td><td>U1</td><td>36.2℃</td><td>69.1℃</td></tr>
</table></td></tr>
<tr><td>3</td><td>OVER LOAD BURN-IN TEST</td><td>NO DAMAGE
1 HOUR (MIN)</td><td>I/P： 24VDC
O/P：114 % LOAD
Ta：25℃</td><td>TEST：OK</td></tr>
<tr><td>4</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2 HOUR</td><td>I/P： 36VDC/ 9VDC
O/P： 100 % LOAD
Ta= -40 ℃</td><td>TEST：OK</td></tr>
<tr><td>5</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 55 ℃
NO DAMAGE</td><td>I/P： 39VDC
O/P：FULL LOAD
Ta= 55 ℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td></tr>
<tr><td>6</td><td>TEMPERATURE
COEFFICIENT</td><td>± 0.03 %(0~50℃)</td><td>I/P： 24VDC
O/P：FULL LOAD</td><td>± 0.0057 %(0~50℃)</td></tr>
<tr><td>7</td><td>STORAGE TEMPERATURE TEST</td><td colspan="2">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</td><td>TEST：OK</td></tr>
<tr><td>8.</td><td>THERMAL SHOCK TEST</td><td colspan="2">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： 36VDC/Full Load DC ON/OFF TEST
turn on 58sec；turn off 2sec</td><td>TEST：OK</td></tr>
</table>

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℃	TEST：OK
10	CAPACITOR LIFE CYCLE	SUPPOSE C 105 IS THE MOST CRITICAL COMPONENT (1) I/P： 24VDC O/P：FULL LOAD Ta= 25℃ LIFE TIME (2) I/P： 24VDC O/P：FULL LOAD Ta= 55℃ LIFE TIME (3) I/P： 24VDC O/P：75% LOAD Ta= 55℃ LIFE TIME (4) I/P： 24VDC O/P：50% LOAD Ta= 55℃ LIFE TIME	(1) 455629.5HRS (2) 66339.1HRS (3) 112533.2HRS (4) 159487.7HRS
11	MTBF	3093.5K hrs min. Telcordia SR-332 (Bellcore) ; 396.9K hrs min. MIL-HDBK-217F (25℃)	
12	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 55℃	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Frank	Gesg	Wangdz

2007/3/20 A50-S014