Test Report: RSD-60H-3.3

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

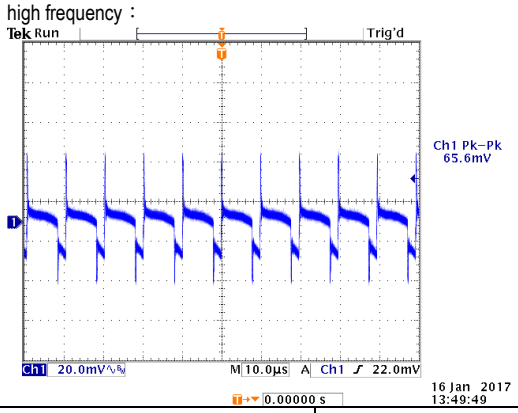
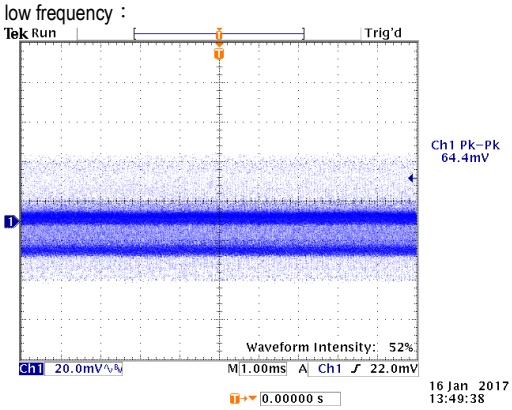
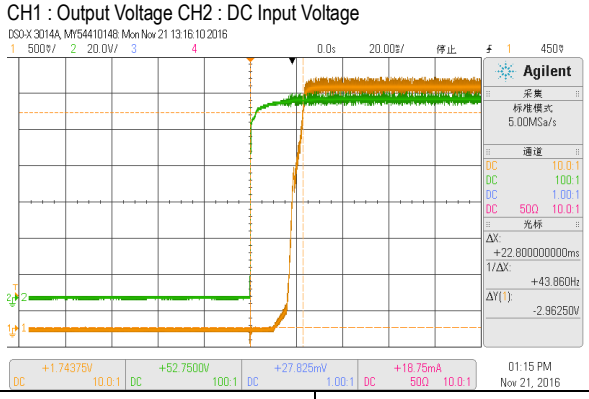
Safety Test
E.M.C. Test

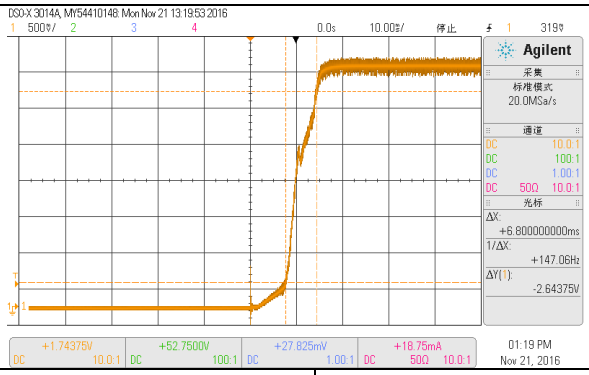
■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

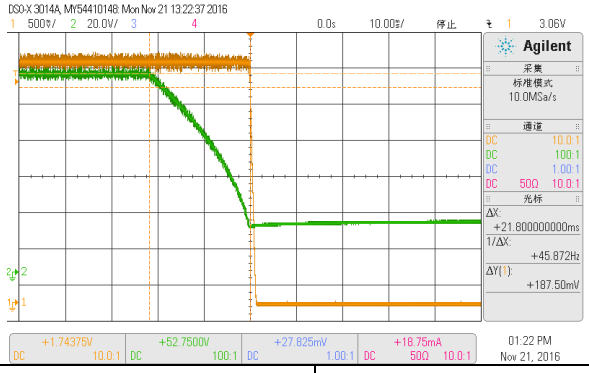
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE TOLERANCE (Max)	V1: 2 %~ -2 %	I/P: 40 VDC / 160 VDC O/P:FULL/ MIN. LOAD Ta:25℃	V1: 0.697%~ 1.118 %
2	LINE REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 40 VDC / 160 VDC O/P:FULL LOAD Ta:25℃	V1: 0%~ 0%
3	LOAD REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 110VDC O/P:FULL ~MIN LOAD Ta:25℃	V1: 0.207 % ~ -0.207 %
4	OVER/UNDERSHOOT TEST	＜±15%	I/P: 110VDC O/P:FULL LOAD Ta:25℃	TEST:3.636%
5	RIPPLE & NOISE (Max)	V1: 80mVp-p	I/P: 110VDC O/P:FULL LOAD Ta:25℃	V1: 65.6mVp-p
	high frequency：  low frequency： 			
6	SET UP TIME (Max)	110VDC/ 100ms	I/P: 110VDC O/P:FULL LOAD Ta:25℃	110VDC/22.8ms
	INPUT=110VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage 			
7	RISE TIME (Max)	110VDC/ 60 ms	I/P: 110VDC O/P:FULL LOAD Ta:25℃	110VDC/ 6.8ms
	INPUT=110VDC @ FULL LOAD CH1 : Output Voltage			



8	HOLD UP TIME (TYP)	110VDC/ 10 ms	I/P: 110VDC O/P:F ULL LOAD Ta:25℃	21.8ms / full load

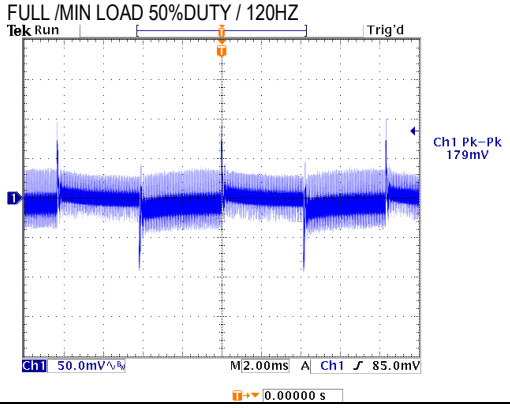
INPUT=110VDC @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

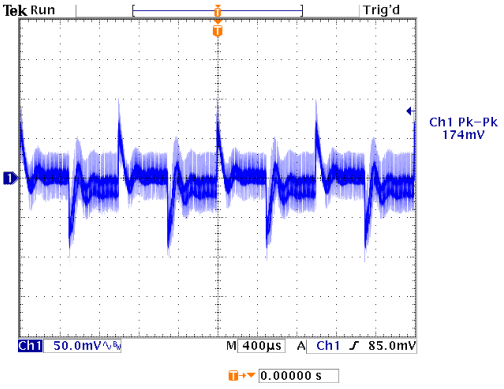


9	DYNAMIC LOAD	V1: 990mVp-p	I/P: 110VDC O/P: (1)FULL /MIN LOAD 50%DUTY / 120HZ (2)FULL /MIN LOAD 50%DUTY / 1KHZ Ta:25℃	 179mVp-p 174mVp-p

FULL /MIN LOAD 50%DUTY / 120HZ

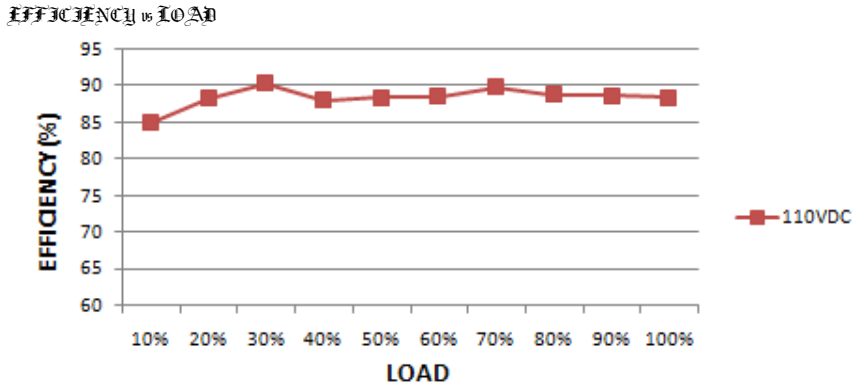
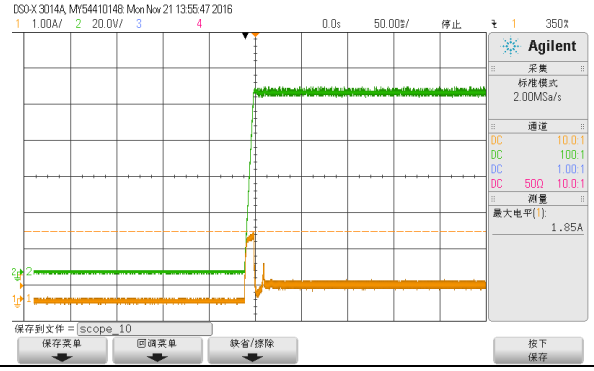


FULL /MIN LOAD 50%DUTY / 1KHZ



INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT

1	INPUT VOLTAGE RANGE	40 VDC / 160 VDC	I/P:TESTING O/P:FULL LOAD Ta:25℃	37.4V~160 V
			I/P: LOW-LINE-0.2= 39.8 V HIGH-LINE+3V= 163 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)	110VDC/ 0.415A	I/P: 110VDC O/P:FULL LOAD Ta:25℃	I =0.403A/110VDC
3	EFFICIENCY(TYP)	87.5%	I/P: 110VDC O/P:FULL LOAD Ta:25℃	88.33%
				
4	INRUSH CURRENT(TYP)	110VDC/ 20A COLD START	I/P:110VDC O/P:FULL LOAD Ta:25℃	I =1.85A/110 VDC
	INPUT=110VDC @ FULL LOAD CH2 : DC Input Voltage CH1 : 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: 160VDC I/P: 110VDC I/P: 40VDC O/P:TESTING Ta:25℃	116.7% 116.7% 116.7% PROTECTION TYPE： Constant current limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH: 4.3V~ 4.95 V PROTECTION TYPE： Shut down o/p voltage, re-power on to recover	I/P: 160VDC I/P: 110VDC I/P: 40VDC O/P：NO LOAD Ta:25℃	4.56V 4.66V 4.60V PROTECTION TYPE： Shut down o/p voltage, re-power on to recover
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 110VDC 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: 110 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 : 18 A/ 500 V	I/P:High-Line +3V =163V AC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25℃	VDS: (1) 285V (2) 285V (3) 272V
2	Diode Peak **Voltage**	Q100 Rated : 90A/ 40 V	I/P:High-Line +3V =163V AC ON/OFF O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25℃	Q100: VDS: (1) 35.0V (2) 35.4V (3) 33.5V
3	**Input Capacitor Voltage**	C5 Rated: : 27 μ / 200V 105 ℃	I/P:High-Line +3V =163V 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) 166V (2) 166V (3) 166V (4) 166V
4	**Control IC Voltage Test**	PWM IC U1 Rated : 40 V(MAX.) -0.3V(MIN.)	I/P:High-Line +3V =163V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25℃	(1) 22.5V (2) 16.1V (3) 14.1V (4) 16.7V
5	**Clamp Diode Peak Voltage**	D4 Rated ： 600V/3A	I/P ：High-Line +3V = 163V AC ON/OFF O/P ： (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta ：25℃	(1) 169V (2) 169V

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: 1.32mA I/P-FG:2.45mA O/P-FG:2.21 mA 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: 110 VDC O/P:FULL LOAD Ta:25℃	PASS Test by certified Lab
2	CONDUCTION	BS EN/EN55032 CLASS A	I/P: 110 VDC O/P:FULL LOAD Ta:25℃	PASS Test by certified Lab
3	E.S.D	BS EN/EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:6KV	I/P: 110 VDC O/P:FULL LOAD Ta:25℃	CRITERIA A
4	E.F.T	BS EN/EN61000-4-4 LIGHT INDUSTRY INPUT: 2KV	I/P: 110 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: 110 VDC O/P:FULL LOAD Ta:25℃	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-60H-24

1. ROOM AMBIENT BURN-IN： 1HRS
   I/P：110VDC O/P： FULL LOAD Ta= 22.2℃
2. HIGH AMBIENT BURN-IN： 1HRS
   I/P：110VDC O/P： FULL LOAD Ta= 52.3℃

NO	Position	ROOM AMBIENT Ta=22.2℃	HIGH AMBIENT Ta= 52.3 ℃
1	C12	38.1℃	67.6℃
2	LF1	39.6℃	68.9℃
3	C5	39.5℃	68.5℃
4	C6	40.0℃	69.1℃
5	C40	42.4℃	71.3℃
6	T2	43.6℃	73.0℃
7	T1	54.0℃	82.3℃
8	C110	44.2℃	73.1℃
9	C105	46.1℃	74.7℃
10	L100	44.0℃	72.8℃
11	C108	39.2℃	68.0℃
12	Q1	40.0℃	69.5℃
13	Q2	40.3℃	69.7℃
14	Q3	45.5℃	75.9℃
15	U1	43.8℃	73.2℃
16	D4	46.6℃	75.5℃
17	Q100	52.9℃	81.9℃
18	U101	42.6℃	71.6℃
19	D1	38.8℃	68.6℃

3	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P： 110VDC O/P：115.8 % LOAD Ta：25℃	TEST：OK
4	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P： 110VDC/ 40VDC 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： 163VDC O/P：FULL LOAD Ta= 55 ℃ HUMIDITY= 95 %R.H	TEST：OK
6	TEMPERATURE COEFFICIENT	± 0.03 %(0~50℃)	I/P： 110VDC O/P：FULL LOAD	± 0.0014 %(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：110VDC/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℃	TEST：OK
10	CAPACITOR LIFE CYCLE	SUPPOSE C 105 IS THE MOST CRITICAL COMPONENT (1) I/P：110VDC O/P：FULL LOAD Ta= 25℃ LIFE TIME (2) I/P：110VDC O/P：FULL LOAD Ta= 55℃ LIFE TIME (3) I/P：110VDC O/P：75% LOAD Ta= 55℃ LIFE TIME (4) I/P：110VDC O/P：50% LOAD Ta= 55℃ LIFE TIME	(1) 697923HRS (2) 96743HRS (3) 163429HRS (4) 196525HRS
11	MTBF	2738.8K hrs min. Telcordia SR-332 (Bellcore) ; 593.9K 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