



Test Report: RSD-500C-48

500W Enclosed Type Reliable Railway DC-DC Converter

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Control Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

■ RELIABILITY TEST

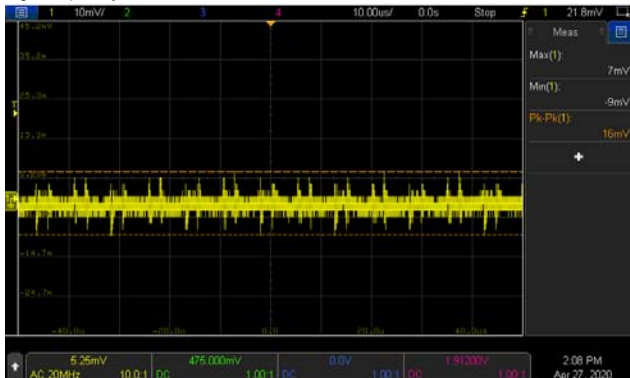
ENVIRONMENT TEST

DESIGN VERIFY TEST

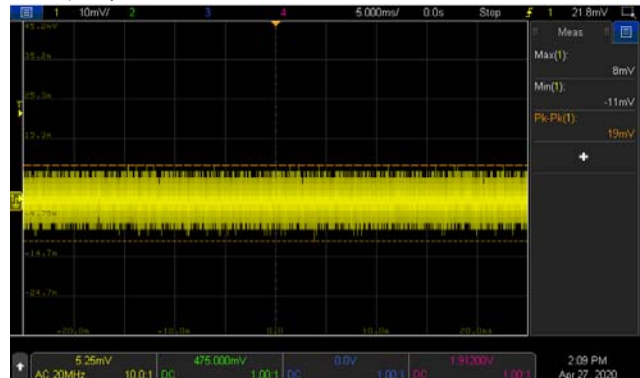
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1:48V ~ 56V	I/P: 48VDC O/P : MIN LOAD Ta : 25°C	45.76V~57.69V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1:-1%~+1 %	I/P:33.6 VDC /67.2 VDC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.06 %~ 0.03 %
3	LINE REGULATION (Max)	V1:-0.5%~+0.5 %	I/P:33.6 VDC /67.2 VDC O/P:FULL LOAD Ta:25°C	V1: -0.02 %~ 0.02 %
4	LOAD REGULATION (Max)	V1:-1%~ +1 %	I/P: 48VDC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.06 %~ 0.03 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 48VDC O/P:FULL LOAD Ta:25°C	TEST:2.1%
6	RIPPLE & NOISE (Max)	V1:150 mVp-p	I/P: 48VDC O/P:FULL LOAD Ta:25°C	V1:19mVp-p

high frequency :



low frequency :

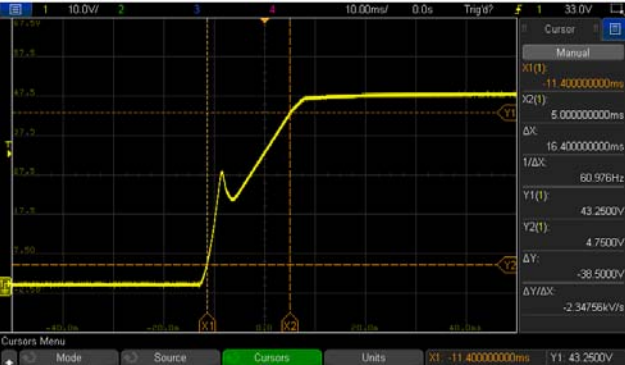


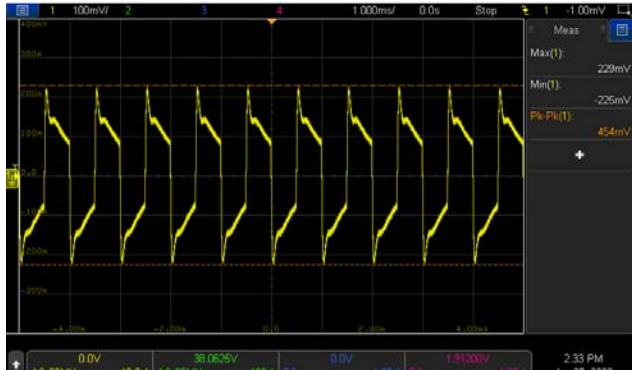


7	SET UP TIME (Max)	48VDC / 500ms	I/P: 48VDC O/P:FULL LOAD Ta:25°C	83.8 ms
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INPUT=48 VDC @ FULL LOAD

CH1 : Output Voltage CH2 : DC Input Voltage

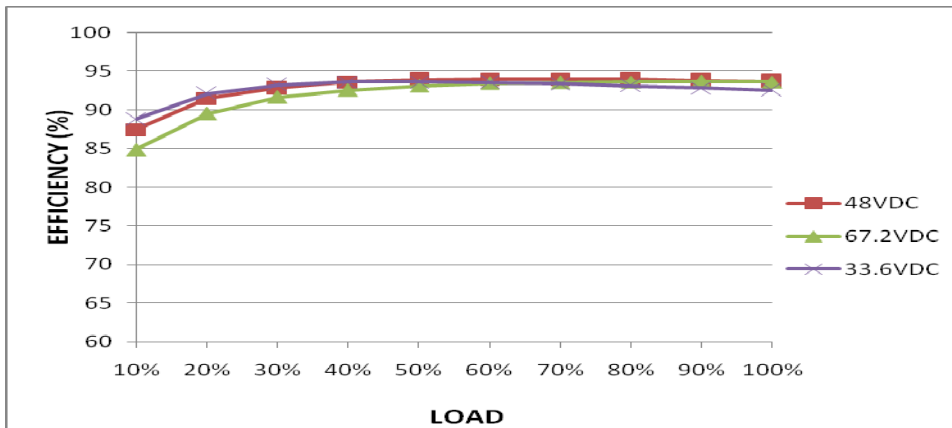


8	RISE TIME (Max)	48VDC/60ms	I/P: 48VDC O/P: FULL LOAD Ta: 25°C	16.4 ms
<p>INPUT= 48VDC @ FULL LOAD CH1 : Output Voltage</p> 				
9	HOLD UP TIME (TYP)	48VDC/3 ms	I/P: 48VDC O/P: FULL LOAD Ta: 25°C	8.78 ms
<p>INPUT= 48VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage</p> 				
10	TRANSIENT RECOVERY TIME	V1: 4800mVp-p	I/P: 48VDC O/P: 40% LOAD CHANGE 50%DUTY/120HZ	370mVp-p
11	DYNAMIC LOAD	V1: 4800mVp-p	I/P: 48VDC O/P: (1) FULL /50% LOAD 50%DUTY / 120HZ (2) FULL /50% LOAD 50%DUTY / 1KHZ Ta: 25°C	535mVp-p 454mVp-p
<p>FULL /50% LOAD 50%DUTY / 120HZ</p>  <p>FULL /50% LOAD 50%DUTY / 1KHZ</p> 				

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	33.6VDC~67.2VDC 28.8VDC~33.6VDC/1s	I/P: TESTING O/P: FULL LOAD Ta: 25°C	(1) 28.43V~ 67.2 V (2) TEST: OK
			I/P: LOW-LINE-0.2=33.4V HIGH-LINE+3V=70.2V O/P: FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec . OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST: OK
2	INPUT CURRENT(TYP)	48VDC / 11 A	I/P: 48VDC O/P: FULL LOAD Ta: 25°C	I=10.24A
3	EFFICIENCY(TYP)	93%	I/P: 48VDC O/P: FULL LOAD Ta: 25°C	93.65%

EFFICIENCY vs LOAD



4	INRUSH CURRENT(TYP)	30A COLD START	I/P: 48VDC O/P: FULL LOAD Ta: 25°C	I=18.6A
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INPUT= VDC @ FULL LOAD

CH2 : DC Input Voltage CH3 : Input current



5	INTERRUPTION OF VOLTAGE SUPPLY	B/C- type comply with S2 level (10ms)@ 70% load ;	I/P: 48VDC SHORT O/P: TESTING Ta: 25°C	12.52ms /70% load
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PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~135%RATED OUTPUT POWER	I/P: 33.6 VDC I/P: 48 VDC I/P: 67.2 VDC O/P: TESTING Ta:25°C	119.58%/ 33.6 VDC 120.51%/ 48 VDC 120.21%/ 67.2 VDC PROTECTION TYPE : Constant current limiting 105%~135% rated output power with auto-recovery .
2	OVER VOLTAGE PROTECTION	CH: 57.6 V~ 65 V	I/P: 33.6 VDC I/P: 48 VDC I/P: 67.2 VDC O/P: MIN LOAD Ta:25°C	62.0V/ 33.6 VDC 62.0V/ 48 VDC 62.0V/ 67.2 VDC PROTECTION TYPE : Shut down O/P voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	SPEC: NO DAMAGE	I/P: 67.2/33.6 VDC O/P: FULL LOAD	O.T.P. Active OK PROTECTION TYPE : Shut down O/P voltage, re-power on to recover
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 67.2/33.6 VDC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting with auto-recovery recovers automatically after fault condition is removed.
5	INPUT REVERSE	POWER OK	I/P: 67.2/33.6 VDC O/P: FULL LOAD Ta:25°C	NO DAMAGE
6	INPUT UNDER VOLTAGE PROTECTION	48 VIN (C-TYPE) : POWER ON >=33.6V POWER OFF <=33V	I/P: TESTING O/P: FULL LOAD Ta:25°C	TEST : POWER ON >= 28.43 V POWER OFF <= 26.06 V

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q 10/Q12/ Q21/Q23 Rated : 65A/ 200 V	DC ON/OFF I/P: High-Line +3V =70.2V VDS: O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0%→400% Load. Ta:25°C	Q10 VDS: (1) 103.9V (2) 139V (3) 148V (4) 139V (5) 135V (6) 145V (7) 150V Q21 VDS: (1) 106.7V (2) 121.2V (3) 148V (4) 133V (5) 127V (6) 144V (7) 142V Q12 VDS: (1) 104.9V (2) 131.3V (3) 147V (4) 141V (5) 137V (6) 143V (7) 165V Q23 VDS: (1) 103.7V (2) 125V (3) 145V (4) 131V (5) 131V (6) 147V (7) 110.7V
2	Clamp MOSFET (D to S) or (C to E) Peak Voltage	Q8/Q19 Rated : 34A/ 200 V	DC ON/OFF	Q8 VDS: Q19 VDS:

			<p>I/P:High-Line +3V =70.2V VDS: O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. Ta:25°C</p>	<p>(1) 87.5V (2) 115.7V (3) 148V (4) 136V (5) 134V (6) 142V (7) 136.4V</p>	<p>(1) 83.1V (2) 115.3V (3) 162V (4) 138V (5) 138V (6) 154V (7) 127.4V</p>
3	Diode Peak Voltage	<p>Q100/ Q200 Rated : 20 A/ 400 V Q102Q104 Rated : 20 A/ 400 V</p>	<p>DC ON/OFF I/P:High-Line +3V =70.2 V VOmax: O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8).NO LOAD VO: O/P: (1)Full Load Ta:25°C</p>	<p>Q100: VOmax: VDS: (1) 294V (2) 258V (3) 375V (4) 375V (5) 375V (6) 383V (7) 262V (8) 155V VO: (1) 284V Q102: VOmax: VDS: (1) 359V (2) 359V (3) 359V (4) 359V (5) 359V (6) 359V (7) 359V (8) 355V VO: (1) 351V</p>	<p>Q200: VOmax: VDS: (1) 254V (2) 238V (3) 363V (4) 379V (5) 379V (6) 375V (7) 280V (8) 157V VO: (1) 264V Q104: VOmax: VDS: (1) 359V (2) 359V (3) 363V (4) 363V (5) 363V (6) 363V (7) 359V (8) 355V VO: (1) 355V</p>
4	Input Capacitor Voltage	<p>C5/C35 Rated: : 820 μ / 80 V</p>	<p>I/P:High-Line +3V =70.2V 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</p>	<p>C5 (1)72.2V (2)71.8V (3)71.0V (4) 71.0V</p>	<p>C35 (1)72.6V (2)72.2V (3)71.4V (4) 71.0V</p>
5	Control IC Voltage Test	<p>PWM IC U1 Rated 7.5V~ 15 V O/P U201 Rated 0V~ 32 V</p>	<p>DC ON/OFF I/P:High-Line +3V =70.2 V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(LOW LINE) Ta:25°C</p>	<p>U4 (1) 13.82V (2) 13.98V (3) 13.9V (4) 12.77V (5) 12.34V</p>	<p>U201 (1) 13.63V (2) 13.63V (3) 13.47V (4) 26.6V (5) 11.86V</p>

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	EN 60950-1 I/P-O/P:4KVDC/min I/P-FG:2.5 KVDC/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: 0.2 uA I/P-FG: 0.5 uA O/P-FG: 0 uA 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: 600 VDC I/P-FG: 600 VDC O/P-FG: 600 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	2 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	EN55032 CLASS B	I/P: 48VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
2	CONDUCTION	EN55032 CLASS A	I/P:48VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 <input type="checkbox"/> MEDICAL AIR: 15KV / Contact: 8KV <input type="checkbox"/> LIGHT INDUSTRY AIR: 8KV / Contact: 4KV <input checked="" type="checkbox"/> INDUSTRY AIR: 8KV / Contact: 6KV	I/P: 48VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
4	E.F.T	EN61000-4-4 <input type="checkbox"/> LIGHT INDUSTRY INPUT: 0.5KV <input type="checkbox"/> MEDICAL <input checked="" type="checkbox"/> INDUSTRY INPUT: 2KV	I/P:48VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
5	SURGE	IEC61000-4-5 <input checked="" type="checkbox"/> INDUSTRY L-N :1KV L,N-PE:2KV	I/P:48VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
6	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL : RSD-500C-24 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 48 VDC O/P : FULL LOAD Ta= 25 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 48 VDC O/P : FULL LOAD Ta= 55 °C		

		NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 55 °C
		1	Q2	58.6°C	89.3°C
		2	ZNR1	52.5°C	83.2°C
		3	U1	69.4°C	101.4°C
		4	T3	65.3°C	95.6°C
		5	T4	64.8°C	95.1°C
		6	C17	62.6°C	93.1°C
		7	LF1	62.0°C	93.0°C
		8	D2	58.5°C	89.1°C
		9	C6	64.1°C	94.3°C
		10	Q19	62.3°C	93.0°C
		11	Q23	66.9°C	98.7°C
		12	R90	63.2°C	94.5°C
		13	Q10	69.7°C	101.1°C
		14	LF2	65.3°C	95.7°C
		15	T5	66.5°C	97.5°C
		16	U4	71.3°C	102.0°C
		17	C60	56.0°C	87.0°C
		18	T1	69.8°C	100.2°C
		19	T6	66.5°C	97.0°C
		20	T2	71.2°C	101.7°C
		21	Q100	71.2°C	102.1°C
		22	Q103	70.6°C	103.1°C
		23	Q105	67.5°C	101.0°C
		24	L101	79.0°C	110.4°C
		25	L100	76.7°C	108.0°C
		26	TSW1	66.6°C	97.3°C
		27	C103	68.0°C	99.1°C
		28	C102	65.8°C	97.1°C
		29	C114	66.2°C	97.3°C
		30	Q200	72.8°C	103.5°C
		31	D107	61.6°C	92.4°C
		32	D213	64.0°C	95.2°C
		33	D106	63.3°C	94.0°C
		34	Q204	66.8°C	97.5°C
		35	U5	64.4°C	94.9°C
		36	D204	66.2°C	96.9°C
		37	Q37	61.2°C	91.6°C
		38	U3	60.5°C	90.9°C
		39	Q17	70.2°C	101.2°C
		40	D23	65.6°C	96.6°C
		41	C54	62.3°C	93.0°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)		I/P : 48 VDC O/P : 120 % LOAD Ta : 25°C	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR		I/P : 33.6 VDC / 67.2 VDC O/P : 100 % LOAD Ta= -45 °C	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 55 °C /95 %R.H NO DAMAGE		I/P : 70.2 VDC O/P : FULL LOAD Ta= 55 °C HUMIDITY= 95 %R.H	TEST : OK



5	TEMPERATURE COEFFICIENT	±0.03%/°C(0~55°C)	I/P : 48 VDC O/P : FULL LOAD	± 0.0051%/°C(0~55°C)
6	STORAGE TEMPERATURE TEST	-40~85°C	1. Thermal shock Temperature : -45°C~ +90°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 : STATIC	
7	THERMAL SHOCK TEST	-40~55°C	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 : 16 CYCLE 5. Input/Output condition : 15cycle: 48 VDC / FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle: 48 VDC / FULL LOAD Burn In Test	
8	VIBRATION TEST	10 ~ 500Hz, 5G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C	
9	CAPACITOR LIFE CYCLE	SUPPOSE C103 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) 213709.1HRS (2) 24752.5HRS (3) 52832.2HRS (4) 104197.1HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 277.9K hrs min. Telcordia SR-332 (Bellcore) ; 99.1K hrs min. MIL-HDBK-217F (25°C)		
11	Ongoing Reliability Test	I/P : 48VDC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		Wangdz

2018.4.30 GP-A50-F010