



# Test Report: RSDH-150-12

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150W High Reliable 250~1500Vdc Ultra Wide Input  
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

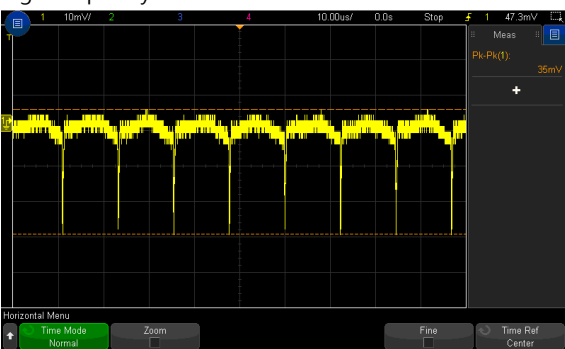
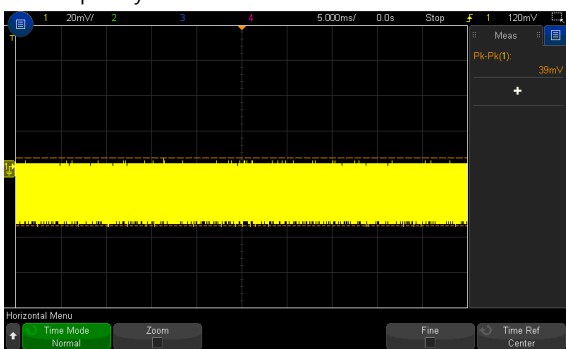
Safety Test  
E.M.C. Test

## ■ RELIABILITY TEST

ENVIRONMENT TEST

## DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 12V~ 15V	I/P : 800 VDC O/P : MIN LOAD Ta : 25°C	11.515V~ 15.494V/ 600 VDC
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -1.5%~ +1.5%	I/P: 1500VDC / 250 VDC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.2328%~0.2161%
3	LINE REGULATION (Max)	V1: -0.5%~+0.5 %	I/P: 1500VDC / 250 VDC O/P:FULL LOAD Ta:25°C	V1: -0.008%~0.008 %
4	LOAD REGULATION (Max)	V1: -1.5%~+1.5 %	I/P: 800VDC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.2328%~0.2161%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 800 VDC O/P:FULL LOAD Ta:25°C	TEST: 1.2%
6	RIPPLE & NOISE (Max)	V1: 120mVp-p	I/P: 800 VDC O/P:FULL LOAD Ta:25°C	V1: 39mVp-p
		high frequency :	low frequency :	
				
7	DYNAMIC LOAD	V1: 1200mVp-p	I/P: 800VDC O/P: (1)FULL /MIN LOAD 50%DUTY / 120HZ (2)FULL /MIN LOAD 50%DUTY / 1KHZ (3)FULL /MIN LOAD 50%DUTY / 500HZ (4)FULL /MIN LOAD 50%DUTY / 3KHZ (5)FULL /MIN LOAD 50%DUTY / 8KHZ (6)FULL /MIN LOAD 50%DUTY /	(1) 810mVp-p (2) 530mVp-p (3) 560mVp-p (4) 326mVp-p (5) 438mVp-p (6) 466mVp-p

				10KHZ Ta:25°C	
		FULL /50% LOAD 50%DUTY / 120HZ		FULL /50% LOAD 50%DUTY / 1KHZ	
		FULL /50% LOAD 50%DUTY / 3KHZ		FULL /50% LOAD 50%DUTY / 500HZ	
		FULL /50% LOAD 50%DUTY / 10KHZ		FULL /50% LOAD 50%DUTY / 8KHZ	
8	EXERNAL CAPACITANCE LOAD(Max.)	4000uF	I/P : 800VDC O/P : TESTING LOAD Ta : 25°C	TEST: <u>OK</u>	

### INPUT FUNCTION TEST

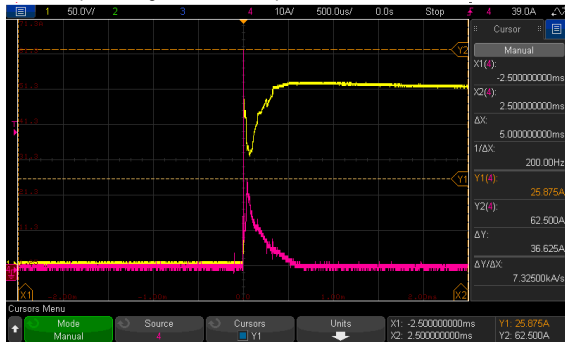
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	250VDC~ 1500 VDC	I/P: TESTING O/P:FULL LOAD Ta:25°C	233.91V~ 1400 V/FULL LOAD 233.44V~ 1500 V/80% LOAD 233.31V~ 1500 V/40% LOAD



			<p>I/P: LOW-LINE-0.2= 249.8V HIGH-LINE+3V= 1503V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec . OFF: 30 Sec 10MIN ( POWER ON/OFF NO DAMAGE )</p>	<p>TEST: <u>OK</u></p>
2	EFFICIENCY(TYP)	<p>88%/300VDC 88%/800VDC 85%/1500VDC</p>	<p>I/P: 300VDC ( 80% LOAD ) I/P: 800VDC I/P: 1500VDC ( 80% LOAD ) O/P:FULL LOAD Ta:25°C</p>	<p>88.89%/300VDC 89.25%/800VDC 85.54%/1500VDC</p>
3	INRUSH CURRENT(TYP)	<p>70A/250VDC 200A/800VDC 300A/1500VDC COLD START</p>	<p>I/P: 250VDC ( 40% LOAD ) I/P: 800VDC I/P: 1500VDC ( 80% LOAD ) O/P:FULL LOAD Ta:25°C</p>	<p>I = 25.875A/ 250VDC I = 86.5A/ 800VDC I = 162A/ 1500VDC</p>

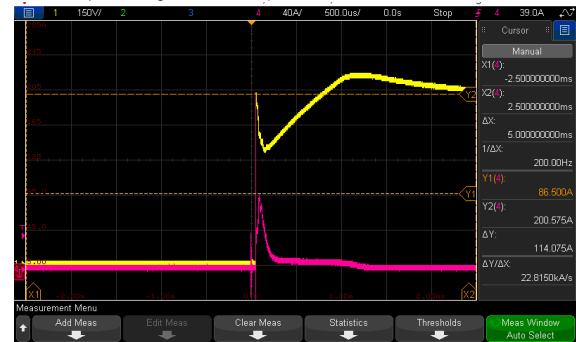
INPUT=250VDC @ TEST LOAD

CH1: DC Input Voltage CH4: Input current



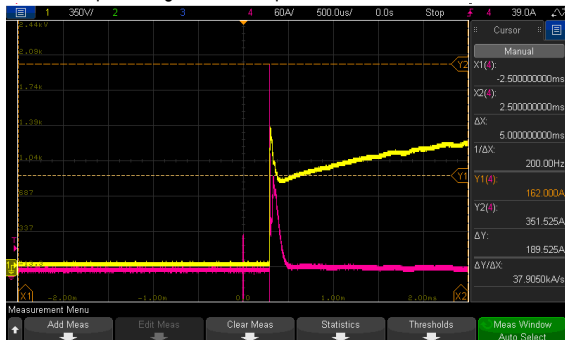
INPUT=800VDC @ FULL LOAD

CH1: DC Input Voltage CH4: Input current



INPUT=1500VDC @ TEST LOAD

CH1: DC Input Voltage CH4: Input current



### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~135% RATED OUTPUT POWER	I/P: 1400 VDC I/P: 800 VDC	119.56%/1400VDC 118.75%/ 800 VDC



		Protection type : Hiccup mode when output voltage<55%, recovers automatically after condition is removed; Constant current limiting, recovers automatically after fault condition is removed within 55% ~ 100% rated output voltage	I/P: 320 VDC O/P:TESTING Ta:25°C	119.04/ 320 VDC PROTECTION TYPE : Hiccup mode when output voltage<55%, recovers automatically after condition is removed; Constant current limiting, recovers automatically after fault condition is removed within 55% ~ 100% rated output voltage
2	OVER VOLTAGE PROTECTION	CH: 16.5V~21V Protection type : Hiccup mode, recovers automatically after fault condition is removed	I/P: 1500VDC I/P: 800VDC I/P: 250VDC O/P:MIN LOAD Ta:25°C	18.40V/ 1500 VDC 18.40V/ 800 VDC 18.40V/ 250 VDC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
3	OVER TEMPERATURE PROTECTION	SPEC: NO DAMAGE Protection type : Hiccup mode, recovers automatically after fault condition is removed	I/P: 250VDC I/P: 1500VDC O/P:FULL LOAD	O.T.P. Active PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE Hiccup mode , recovers automatically after fault condition is removed	I/P: 250VDC I/P: 1500VDC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Hiccup mode , recovers automatically after fault condition is removed
5	DC INPUT UNDER VOLTAGE LOCKOUT	Under voltage protection range: 200 ~ 225Vdc , Under voltage release range:225 ~ 246.5Vdc	I/P:TESTING O/P: TEST LOAD Ta:25°C	NO DAMAGE Under voltage protection range TEST: <u>215.82</u> Vdc , Under voltage release range TEST: <u>235.53</u> Vdc ,
6.	DC INPUT REVERSE POLARITY	By internal Bridge Diode, no damage, recovers automatically after fault condition removed	I/P: 1500 VDC O/P: FULL LOAD Ta:25°C	TEST: <u>OK</u> NO DAMAGE, recovers automatically after fault condition is removed

### COMPONENT STRESS TEST

N	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor ( D to S) or (C to E) Peak Voltage	Q1/Q2/Q3/Q4  Rated: 17 A/ 650 V	DC ON/OFF I/P:High-Line +3V = 1503V VDS: O/P: (1)Full Load	Q1                      Q3 VDS:                    VDS: (1) 577V                (1) 601V (2) 541V                (2) 565V



			<p>(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>(3) 585V (4) 585V (5) 585V (6) 593V (7) 569V  Q2 VDS: (1) 585V (2) 561V (3) 584V (4) 584V (5) 581V (6) 593V (7) 565V</p>	<p>(3) 593V (4) 605V (5) 609V (6) 617V (7) 572V  Q4 VDS: (1) 583V (2) 609V (3) 587V (4) 575V (5) 617V (6) 599V (7) 579V</p>
2	Diode Peak Voltage	Q100 Rated: 40 A/ 200V	<p>DC ON/OFF I/P:High-Line +3V =1503 V Vo=Vmax 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=Vnormal O/P: (1)Full Load Ta:25°C</p>	<p>Q100: VDS: Vo=Vmax (1) 131V (2) 160V (3) 133V (4) 131V (5) 131V (6) 134V (7) 162V (8) 129V  Vo=Vnormal (1) 131V</p>	
3	Input Capacitor Voltage	C5/C7/C9/C18 Rated: 68μ / 400 V	<p>I/P:High-Line +3V =1503V 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)396V (2)394V (3)382V (4)382V  C9 (1)395V (2)394V (3)382V (4)382V</p>	<p>C7 (1)395V (2)393V (3)382V (4)382V  C18 (1)395V (2)394V (3)382V (4)382V</p>
4	Control IC Voltage Test	PWM IC U1 Rated 8.3V~ 28 V I/P IC U4 Rated 6.5V~ 30 V IC U200 Rated	<p>DC ON/OFF I/P:High-Line +3V =1503 V O/P(1)FULL LOAD (2) Output Short (3)O.L.P</p>	<p>U1/U4: (1) 17.2V (2) 17.2V (3) 17.2V (4) 17.2V</p>	<p>U200 : (1) 10.9V (2) 10.9V (3) 10.9V (4) 17.2V</p>



		3.5V~ 36V IC U100 Rated 8V~ 24V	(4)O.V.P. (5)NO LOAD VRmin(Low LINE) Ta:25°C	(5) 17.2V  U100: (1) 13.9V (2) 13.9V (3) 10.9V (4) 19.8V (5) 12.2V
5	Clamp Diode Peak Voltage	D1 / D2 / D3/ D4 Rated : 1000V /1 A	I/P : High-Line +3V =1503V DC ON/OFF O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C	D1: (1) 507V (2) 507V  D3: (1) 515V (2) 511V  D2: (1) 513V (2) 511V  D4: (1) 524V (2) 528V

**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P:4KVAC/min I/P-FG: 3.75 KVAC/min O/P-FG: 2KVAC/min	I/P-O/P: 4.4 KVAC/min I/P-FG: 4.125 KVAC/min O/P-FG: 2.4 KVAC/min Ta:25°C	I/P-O/P:4.7 mA I/P-FG: 6.87 mA O/P-FG: 5.42mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ	I/P-O/P: 600 VDC Ta:25°C	I/P-O/P:9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	<b>2mΩ</b>

**E.M.C TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	EN55032 CLASS A	I/P: 400 VDC/800VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
2	CONDUCTION	EN55032 CLASS A	I/P: 400 VDC/800VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 Level 3 8KV air Level 2 4KV contact ,	I/P: 400 VDC/800VDC O/P:FULL LOAD Ta:25°C	CRITERIA A
4	E.F.T	EN61000-4-4 INPUT: 2KV	I/P: 400 VDC/800VDC O/P:FULL LOAD Ta:25°C	CRITERIA A
5	SURGE	IEC61000-4-5 Vin+~Vin- :2KV Vin~FG:4KV	I/P: 400 VDC/800VDC O/P:FULL LOAD Ta:25°C	CRITERIA A

6	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report
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## ■ RELIABILITY TEST

### ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																																				
1	TEMPERATURE RISE TEST	MODEL : RSDH-150-12 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 800 VDC O/P : FULL LOAD Ta=25 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 800 VDC O/P : FULL LOAD Ta=55 °C																																																																																																																						
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 25 °C</th> <th>HIGH AMBIENT Ta= 55 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>C1</td><td>50.9°C</td><td>83.2°C</td></tr> <tr><td>2</td><td>RTH1</td><td>52.2°C</td><td>84.5°C</td></tr> <tr><td>3</td><td>C10</td><td>52.5°C</td><td>85.0°C</td></tr> <tr><td>4</td><td>R85</td><td>54.6°C</td><td>85.3°C</td></tr> <tr><td>5</td><td>LF2</td><td>55.1°C</td><td>88.1°C</td></tr> <tr><td>6</td><td>BD1</td><td>55.9°C</td><td>88.8°C</td></tr> <tr><td>7</td><td>BD2</td><td>58.1°C</td><td>91.3°C</td></tr> <tr><td>8</td><td>R50</td><td>63.4°C</td><td>98.3°C</td></tr> <tr><td>9</td><td>C18</td><td>59.2°C</td><td>92.8°C</td></tr> <tr><td>10</td><td>U1</td><td>66.0°C</td><td>85.2°C</td></tr> <tr><td>11</td><td>C12</td><td>54.7°C</td><td>88.1°C</td></tr> <tr><td>12</td><td>C7</td><td>60.3°C</td><td>94.3°C</td></tr> <tr><td>13</td><td>ZNR3</td><td>58.6°C</td><td>92.3°C</td></tr> <tr><td>14</td><td>Q10</td><td>58.0°C</td><td>91.4°C</td></tr> <tr><td>15</td><td>D1</td><td>64.9°C</td><td>100.5°C</td></tr> <tr><td>16</td><td>C78</td><td>64.8°C</td><td>98.7°C</td></tr> <tr><td>17</td><td>T3</td><td>61.3°C</td><td>95.3°C</td></tr> <tr><td>18</td><td>U4</td><td>61.1°C</td><td>95.1°C</td></tr> <tr><td>19</td><td>D14</td><td>64.2°C</td><td>98.3°C</td></tr> <tr><td>20</td><td>Q9</td><td>60.7°C</td><td>94.1°C</td></tr> <tr><td>21</td><td>U2</td><td>59.3°C</td><td>93.0°C</td></tr> <tr><td>22</td><td>TSW1</td><td>66.9°C</td><td>101.1°C</td></tr> <tr><td>23</td><td>T1coil</td><td>70.6°C</td><td>105.4°C</td></tr> <tr><td>24</td><td>T1core</td><td>68.8°C</td><td>103.4°C</td></tr> <tr><td>25</td><td>C106</td><td>64.8°C</td><td>99.3°C</td></tr> <tr><td>26</td><td>C108</td><td>64.9°C</td><td>99.5°C</td></tr> <tr><td>27</td><td>C114</td><td>63.4°C</td><td>97.6°C</td></tr> <tr><td>28</td><td>U100</td><td>86.0°C</td><td>112.9°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 55 °C	1	C1	50.9°C	83.2°C	2	RTH1	52.2°C	84.5°C	3	C10	52.5°C	85.0°C	4	R85	54.6°C	85.3°C	5	LF2	55.1°C	88.1°C	6	BD1	55.9°C	88.8°C	7	BD2	58.1°C	91.3°C	8	R50	63.4°C	98.3°C	9	C18	59.2°C	92.8°C	10	U1	66.0°C	85.2°C	11	C12	54.7°C	88.1°C	12	C7	60.3°C	94.3°C	13	ZNR3	58.6°C	92.3°C	14	Q10	58.0°C	91.4°C	15	D1	64.9°C	100.5°C	16	C78	64.8°C	98.7°C	17	T3	61.3°C	95.3°C	18	U4	61.1°C	95.1°C	19	D14	64.2°C	98.3°C	20	Q9	60.7°C	94.1°C	21	U2	59.3°C	93.0°C	22	TSW1	66.9°C	101.1°C	23	T1coil	70.6°C	105.4°C	24	T1core	68.8°C	103.4°C	25	C106	64.8°C	99.3°C	26	C108	64.9°C	99.5°C	27	C114	63.4°C	97.6°C	28	U100	86.0°C	112.9°C
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22	TSW1	66.9°C	101.1°C																																																																																																																					
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24	T1core	68.8°C	103.4°C																																																																																																																					
25	C106	64.8°C	99.3°C																																																																																																																					
26	C108	64.9°C	99.5°C																																																																																																																					
27	C114	63.4°C	97.6°C																																																																																																																					
28	U100	86.0°C	112.9°C																																																																																																																					





150W High Reliable 250~1500Vdc Ultra Wide  
Input DC-DC Converter

RSDH-150 series

			NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 55 °C
			29	Q1	64.8°C	101.6°C
30	Q2	64.9°C	100.5°C			
31	Q3	65.4°C	101.8°C			
32	Q4	65.7°C	103.0°C			
33	R46	70.5°C	105.5°C			
34	R231	70.7°C	103.7°C			
35	R101	62.6°C	96.9°C			
36	Q100	71.4°C	107.7°C			
37	Q101	67.6°C	103.0°C			
38	D10	67.0°C	99.4°C			
39	R54	70.0°C	103.7°C			
40	U200	59.2°C	92.9°C			
41	C56	63.4°C	97.0°C			
42	LF100	57.8°C	91.2°C			
43	Q70	66.7°C	99.3°C			

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 800 VDC O/P : 113.56%LOAD Ta : 25°C	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 300 VDC / 1500 VDC O/P : 100%LOAD Ta= -5 °C O/P : 50%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 : 1503 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 : 800 VDC O/P : FULL LOAD	± 0.009 %/°C(0~55°C)
6	STORAGE TEMPERATURE TEST	-40~80°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~ +55°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: 800VDC / FULL LOAD DC ON 3sec/DC OFF 1sec TEST 1cycle: 800 VDC / FULL LOAD Burn In Test	
8	VIBRATION TEST	10 ~ 500Hz, 3G 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 : 4G (5) Test Time : 180min in each axis (X.Y.Z)	



		(6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	<p>SUPPOSE C108 IS THE MOST CRITICAL COMPONENT</p> <p>(1) I/P : 800VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (1) 183663.7HRS</p> <p>(2) I/P : 800VDC O/P : FULL LOAD Ta= 55 °C LIFE TIME (2) 19439.5HRS</p> <p>(3) I/P : 800VDC O/P : 75% LOAD Ta= 55 °C LIFE TIME (3) 46883.6HRS</p> <p>(4) I/P : 800VDC O/P : 50% LOAD Ta= 55 °C LIFE TIME (4) 79873.5HRS</p>
10	MTBF	<p>Conducted by Parts Stress Analysis Prediction</p> <p>1924.7K hrs min. Telcordia SR-332 (Bellcore) ; 285.9K hrs min. MIL-HDBK-217F (25°C)</p>
11	Ongoing Reliability Test	<p>I/P : 800VDC O/P : FULL LOAD TA=50°C</p> <p>Demonstration Mean Time Between Failure : 30000 hours</p>

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Yuwei	Liutt	Wangdz

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