



# Test Report: RSDH-150-24

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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

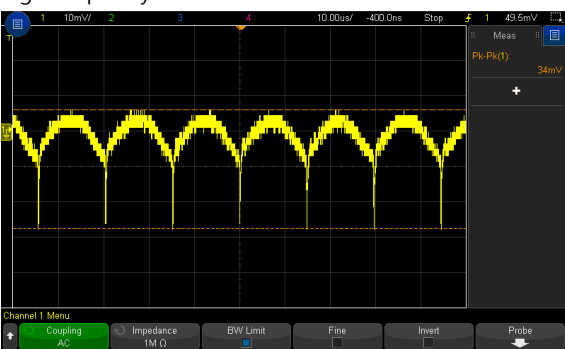
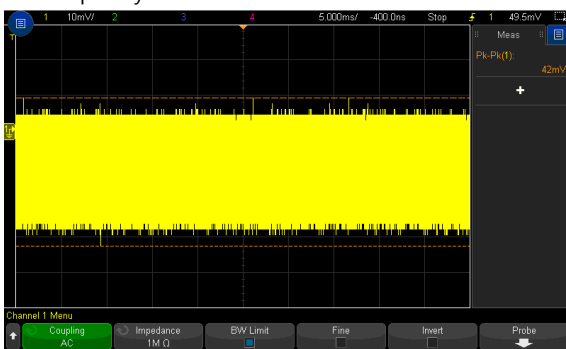
E.M.C. Test

## ■ RELIABILITY TEST

ENVIRONMENT TEST

## DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 24V~ 29V	I/P : 800 VDC O/P : MIN LOAD Ta : 25°C	23.116V~ 29.989V/ 800 VDC
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -1.0%~ +1.0%	I/P: 1500VDC / 250 VDC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.133%~0.079%
3	LINE REGULATION (Max)	V1: -0.5%~+0.5 %	I/P: 1500VDC / 250 VDC O/P:FULL LOAD Ta:25°C	V1: 0.0%~ 0.071%
4	LOAD REGULATION (Max)	V1: -1.5%~ +1.5%	I/P: 800VDC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.133%~0.079%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 800 VDC O/P:FULL LOAD Ta:25°C	TEST: 1.8%
6	RIPPLE & NOISE (Max)	V1: 240mVp-p	I/P: 800 VDC O/P:FULL LOAD Ta:25°C	V1: 42mVp-p
		high frequency :	low frequency :	
				
7	DYNAMIC LOAD	V1: 2400mVp-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) 710mVp-p (2) 454mVp-p (3) 460mVp-p (4) 304mVp-p (5) 328mVp-p (6) 352mVp-p

		10KHZ Ta:25°C	
		<p>FULL /50% LOAD 50%DUTY / 120KHZ</p>	<p>FULL /50% LOAD 50%DUTY / 1KHZ</p>
		<p>FULL /50% LOAD 50%DUTY / 3KHZ</p>	<p>FULL /50% LOAD 50%DUTY / 500HZ</p>
		<p>FULL /50% LOAD 50%DUTY / 10KHZ</p>	<p>FULL /50% LOAD 50%DUTY / 8KHZ</p>
8	EXERNAL CAPACITANCE LOAD(Max.) 2500uF	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	237.12V~ 1400 V/FULL LOAD 234.97V~ 1500 V/80% LOAD 233.71V~ 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 90%/800VDC 86%/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>90.28%/300VDC 91.28%/800VDC 88.52%/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 = 24.0A/ 250VDC I = 80A/ 800VDC I = 155.2A/ 1500VDC</p>

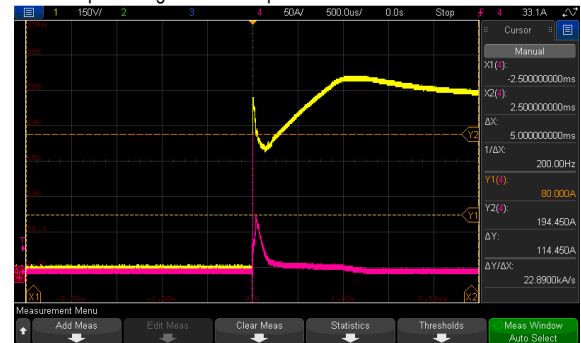
INPUT=250VDC @ TEST LOAD

CH1: DC Input Voltage CH4: Input current



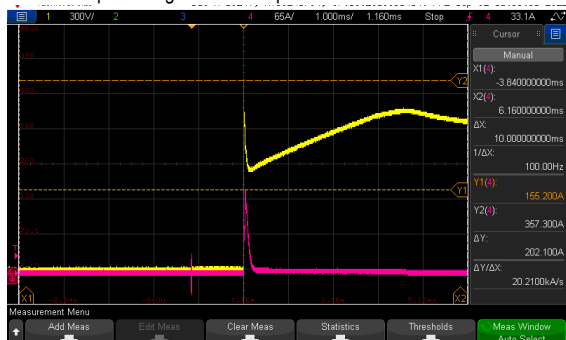
INPUT=800VDC @ FULL LOAD

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	120.45%/ 1400 VDC 119.75%/ 800 VDC



		Protection type : Hiccup up 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	118.75%/ 320 VDC PROTECTION TYPE : Hiccup up 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: 33V~42V Protection type : Hiccup up mode, recovers automatically after fault condition is removed	I/P: 1500VDC I/P: 800VDC I/P: 250VDC O/P:MIN LOAD Ta:25°C	34.80V/ 1500 VDC 34.80V/ 800 VDC 34.80V/ 250 VDC PROTECTION TYPE : Hiccup up 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>217.37</u> Vdc , Under voltage release range TEST: <u>236.56</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) 533V                      (1) 561V (2) 545V                      (2) 549V



			<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) 541V (4) 533V (5) 533V (6) 541V (7) 541V</p> <p>Q2 VDS: (1) 529V (2) 543V (3) 537V (4) 529V (5) 529V (6) 533V (7) 537V</p>	<p>(3) 545V (4) 537V (5) 537V (6) 545V (7) 549V</p> <p>Q4 VDS: (1) 577V (2) 553V (3) 565V (4) 557V (5) 581V (6) 573V (7) 549V</p>
2	Diode Peak Voltage	<p>Q100  Rated: 20 A/ 600V</p>	<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: Vo=Vmax VDS: (1) 252V (2) 250V (3) 254V (4) 256V (5) 254V (6) 252V (7) 250V (8) 252V</p> <p>Vo=Vnormal (1) 246V</p>	
3	Input Capacitor Voltage	<p>C5/C7/C9/C18 Rated: 68μ / 400 V</p>	<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)384V (2)384V (3)384V (4)376V</p> <p>C7 (1)384V (2)384V (3)384V (4)376V</p> <p>C9 (1)388V (2)384V (3)376V (4)376V</p> <p>C18 (1)388V (2)388V (3)380V (4)380V</p>	
4	Control IC Voltage Test	<p>PWM IC U1 Rated 8.3V~ 28 V I/P IC U4 Rated 6.5V~ 30 V IC U200 Rated</p>	<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) 17.3V (2) 17.3V (3) 17.3V (4) 17.3V</p>	



		3.5V~ 36V	(4)O.V.P. (5)NO LOAD VRmin(LOW LINE) Ta:25°C	(5) 17.3V  U200: (1) 24.0V (2) 24.0V (3) 24.0V (4) 34.4V (5) 23.8V
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: D2: (1) 467V (1) 463V (2) 463V (2) 463V  D3: D4: (1) 467V (1) 471V (2) 471V (2) 467V

**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:7.74 mA I/P-FG: 5.63 mA O/P-FG: 5.36mA 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	3mΩ

**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-150-24 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 800VDC O/P : FULL LOAD Ta= 25 °C 2. HIGH AMBIENT BURN-IN : 2HRS I/P : 800VDC 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>52.1°C</td><td>80.6°C</td></tr> <tr><td>2</td><td>RTH1</td><td>53.6°C</td><td>82.0°C</td></tr> <tr><td>3</td><td>C10</td><td>53.2°C</td><td>81.8°C</td></tr> <tr><td>4</td><td>R84</td><td>59.3°C</td><td>88.1°C</td></tr> <tr><td>5</td><td>LF2</td><td>55.6°C</td><td>84.5°C</td></tr> <tr><td>6</td><td>BD1</td><td>57.6°C</td><td>86.2°C</td></tr> <tr><td>7</td><td>BD2</td><td>59.4°C</td><td>88.2°C</td></tr> <tr><td>8</td><td>R50</td><td>62.4°C</td><td>91.9°C</td></tr> <tr><td>9</td><td>C18</td><td>59.9°C</td><td>88.9°C</td></tr> <tr><td>10</td><td>U1</td><td>65.3°C</td><td>95.0°C</td></tr> <tr><td>11</td><td>C12</td><td>56.0°C</td><td>85.2°C</td></tr> <tr><td>12</td><td>C7</td><td>60.4°C</td><td>89.6°C</td></tr> <tr><td>13</td><td>ZNR3</td><td>59.3°C</td><td>88.5°C</td></tr> <tr><td>14</td><td>Q10</td><td>57.8°C</td><td>86.8°C</td></tr> <tr><td>15</td><td>D1</td><td>62.8°C</td><td>92.1°C</td></tr> <tr><td>16</td><td>C78</td><td>63.2°C</td><td>92.8°C</td></tr> <tr><td>17</td><td>T3</td><td>62.7°C</td><td>92.1°C</td></tr> <tr><td>18</td><td>U4</td><td>61.3°C</td><td>90.6°C</td></tr> <tr><td>19</td><td>Q9</td><td>61.4°C</td><td>90.4°C</td></tr> <tr><td>20</td><td>D14</td><td>63.1°C</td><td>93.1°C</td></tr> <tr><td>21</td><td>U2</td><td>55.4°C</td><td>86.3°C</td></tr> <tr><td>22</td><td>TSW1</td><td>70.5°C</td><td>101.1°C</td></tr> <tr><td>23</td><td>T1coil</td><td>84.1°C</td><td>113.8°C</td></tr> <tr><td>24</td><td>T1core</td><td>76.9°C</td><td>107.1°C</td></tr> <tr><td>25</td><td>C106</td><td>62.8°C</td><td>92.8°C</td></tr> <tr><td>26</td><td>C108</td><td>62.2°C</td><td>92.1°C</td></tr> <tr><td>27</td><td>C114</td><td>59.4°C</td><td>89.6°C</td></tr> <tr><td>28</td><td>R46</td><td>67.1°C</td><td>96.8°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 55 °C	1	C1	52.1°C	80.6°C	2	RTH1	53.6°C	82.0°C	3	C10	53.2°C	81.8°C	4	R84	59.3°C	88.1°C	5	LF2	55.6°C	84.5°C	6	BD1	57.6°C	86.2°C	7	BD2	59.4°C	88.2°C	8	R50	62.4°C	91.9°C	9	C18	59.9°C	88.9°C	10	U1	65.3°C	95.0°C	11	C12	56.0°C	85.2°C	12	C7	60.4°C	89.6°C	13	ZNR3	59.3°C	88.5°C	14	Q10	57.8°C	86.8°C	15	D1	62.8°C	92.1°C	16	C78	63.2°C	92.8°C	17	T3	62.7°C	92.1°C	18	U4	61.3°C	90.6°C	19	Q9	61.4°C	90.4°C	20	D14	63.1°C	93.1°C	21	U2	55.4°C	86.3°C	22	TSW1	70.5°C	101.1°C	23	T1coil	84.1°C	113.8°C	24	T1core	76.9°C	107.1°C	25	C106	62.8°C	92.8°C	26	C108	62.2°C	92.1°C	27	C114	59.4°C	89.6°C	28	R46	67.1°C	96.8°C
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17	T3	62.7°C	92.1°C																																																																																																																					
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25	C106	62.8°C	92.8°C																																																																																																																					
26	C108	62.2°C	92.1°C																																																																																																																					
27	C114	59.4°C	89.6°C																																																																																																																					
28	R46	67.1°C	96.8°C																																																																																																																					





			NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 55 °C
			29	Q1	64.6°C	94.6°C
30	Q2	64.3°C	94.5°C			
31	Q3	64.5°C	95.0°C			
32	Q4	63.5°C	93.7°C			
33	R231	65.2°C	95.0°C			
34	R54	64.3°C	94.3°C			
35	R101	64.6°C	94.3°C			
36	Q100	80.5°C	111.6°C			
37	Q101	78.4°C	107.5°C			
38	C56	61.8°C	91.8°C			
39	U200	58.8°C	88.9°C			
40	LF100	55.6°C	85.9°C			
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 800 VDC O/P : 116%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 : 1503VDC O/P : FULL LOAD Ta= 55 °C HUMIDITY= 95 %R.H	TEST : OK		
5	TEMPERATURE COEFFICIENT	$\pm 0.03 \text{ } ^\circ\text{C}/^\circ\text{C}(0\sim 55^\circ\text{C})$	I/P : 800 VDC O/P : FULL LOAD	$\pm 0.008 \text{ } \%/^\circ\text{C}(0\sim 55^\circ\text{C})$		
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: 800VDC / 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	SUPPOSE C106 IS THE MOST CRITICAL COMPONENT (1) I/P : 800VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 800VDC O/P : FULL LOAD Ta= 55 °C LIFE TIME (3) I/P : 800VDC O/P : 75% LOAD Ta= 55 °C LIFE TIME (4) I/P : 800VDC O/P : 50% LOAD Ta= 55 °C LIFE TIME	(1) 232191HRS (2) 30678HRS (3) 48015HRS (4) 75142HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1924.7K hrs min. Telcordia SR-332 (Bellcore) ; 285.9K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 800VDC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Yuwei	Liutt	Wangdz

2020.10.1 TAG-QA-009