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Test Report: RSDH-300-48

300W 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

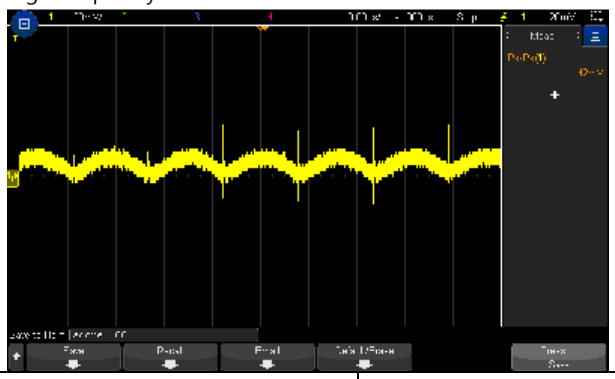
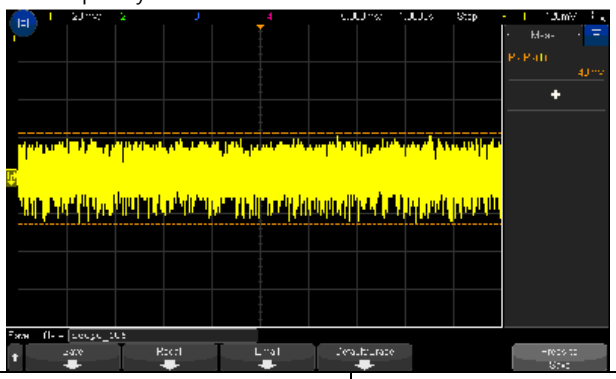
Safety Test
E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

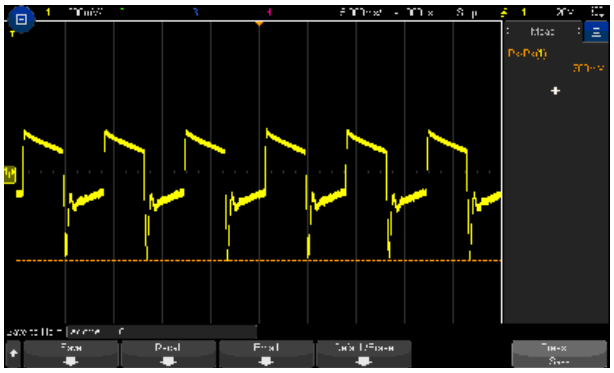
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

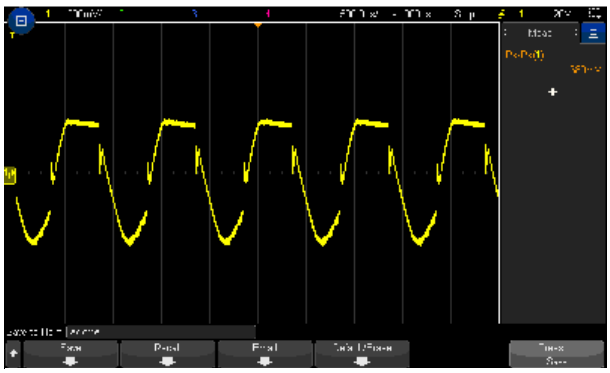
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 48V~ 58V	I/P : 800 VDC O/P : MIN LOAD Ta : 25℃	45.889V~60.26V/800VDC
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -1.0%~ +1.0%	I/P: 1500VDC / 250 VDC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.0333%~ 0.0354%
3	LINE REGULATION (Max)	V1: -0.5%~+0.5 %	I/P: 1500VDC / 250 VDC O/P:FULL LOAD Ta:25℃	V1: -0.0271%~ 0.0063%
4	LOAD REGULATION (Max)	V1: -1.0%~+1.0 %	I/P: 800VDC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.0333%~ 0.0354%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 800 VDC O/P: FULL LOAD Ta:25℃	TEST: 2.1%
6	RIPPLE & NOISE (Max)	*V1:* 300mVp-p	I/P: 800 VDC O/P: FULL LOAD Ta:25℃	48 mVp-p
	high frequency : 		low frequency : 	
7	DYNAMIC LOAD	V1: 4800mVp-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) 700mVp-p (2) 680mVp-p (3) 590mVp-p (4) 293mVp-p (5) 342mVp-p (6) 358mVp-p

			10KHZ Ta:25℃	

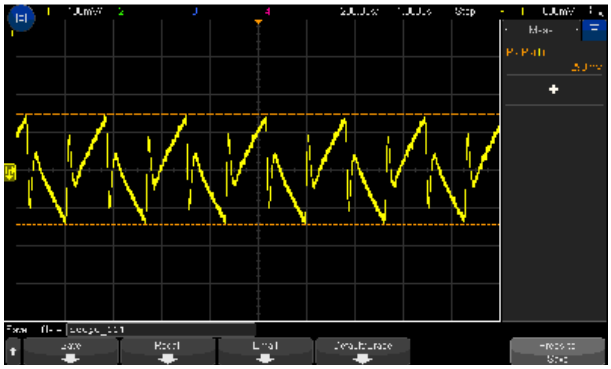
FULL /50% LOAD 50%DUTY / 120HZ



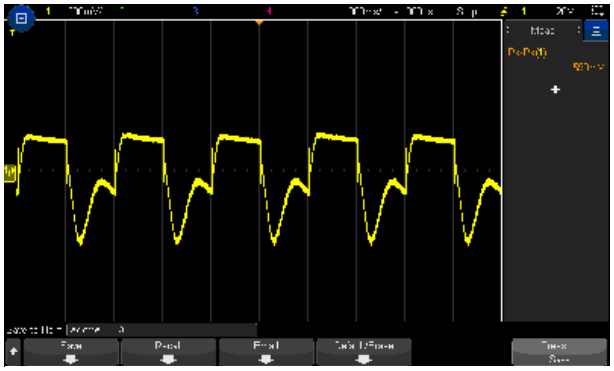
FULL /50% LOAD 50%DUTY / 1KHZ



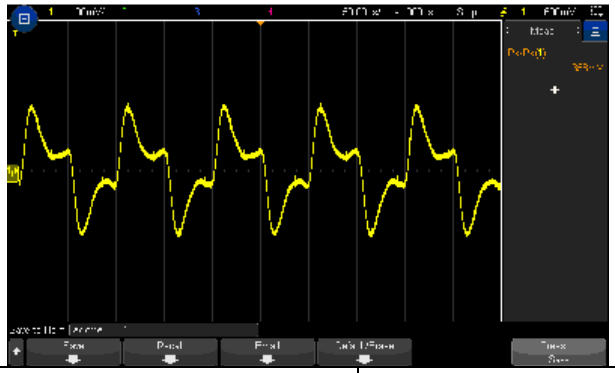
FULL /50% LOAD 50%DUTY / 3KHZ



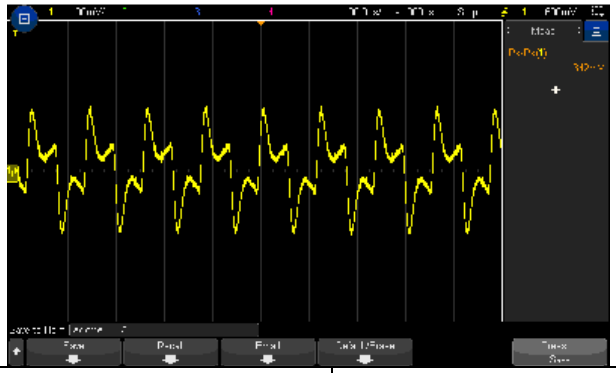
FULL /50% LOAD 50%DUTY / 500HZ



FULL /50% LOAD 50%DUTY / 10KHZ

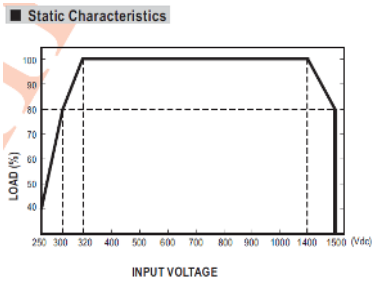


FULL /50% LOAD 50%DUTY / 8KHZ

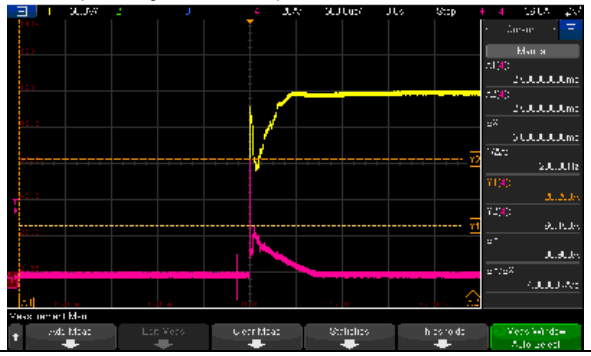


8	EXERNAL CAPACITANCE LOAD(Max.)	2000uF	I/P：800VDC O/P：TESTING LOAD Ta：25℃	TEST: OK

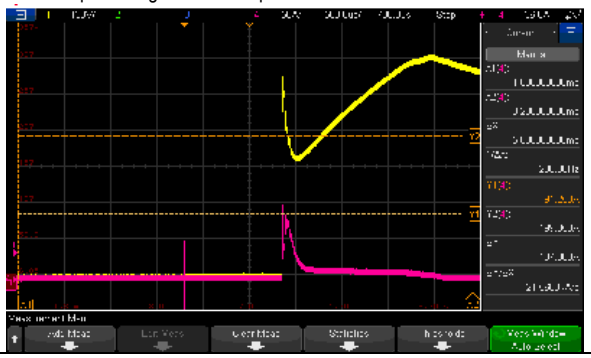
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	250VDC~ 1500 VDC 	I/P: TESTING O/P:FULL LOAD Ta:25℃	232.73V~ 1400 /FULL LOAD 232.15V~ 1500 V/80% LOAD 230.46V~ 1500 V/40% LOAD
			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)	TEST: OK
2	EFFICIENCY(TYP)	91%/300VDC 91%/800VDC 87%/1500VDC	I/P: 300VDC（80% LOAD） I/P: 800VDC I/P: 1500VDC（80% LOAD） O/P:FULL LOAD Ta:25℃	92.42%/300VDC 92.48%/800VDC 87.31%/1500VDC
3	INRUSH CURRENT(TYP)	120A/300VDC 300A/800VDC 500A/1500VDC COLD START	I/P: 300VDC（80% LOAD） I/P: 800VDC I/P: 1500VDC（80% LOAD） O/P:FULL LOAD Ta:25℃	I = 28.25A/ 300VDC I = 91.25A/ 800VDC I = 175.325A/ 1500VDC

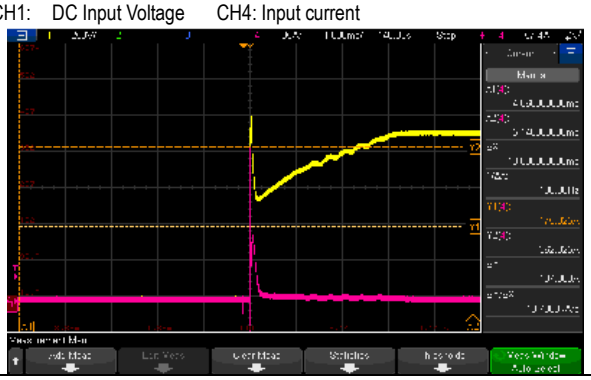
INPUT=250VDC @ TEST LOAD
CH1: DC Input Voltage CH4: Input current



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 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: 1400 VDC I/P: 800 VDC I/P: 320 VDC O/P:TESTING Ta:25℃	120.69%/1400VDC 121.11%/800VDC 120.68%320VDC 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: 62V~70V 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℃	63.40V/ 1500 VDC 63.40V/ 800 VDC 63.40V/ 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 OK 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℃	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℃	NO DAMAGE Under voltage protection range TEST: 214.80 Vdc , Under voltage release range TEST: 232.60 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℃	TEST: OK NO DAMAGE, recovers automatically after fault condition is removed

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q1/Q2/Q3/Q4 Rated: 28 A/ 650 V	DC ON/OFF I/P: High-Line +3V = 1503V 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℃	Q1 VDS: (1) 476V (2) 540V (3) 476V (4) 476V (5) 476V (6) 476V (7) 467V Q2 VDS: (1) 488V (2) 536V (3) 496V (4) 492V (5) 488V (6) 496V (7) 492V Q3 VDS: (1) 467V (2) 512V (3) 467V (4) 467V (5) 467V (6) 467V (7) 463V Q4 VDS: (1) 484V (2) 516V (3) 488V (4) 484V (5) 484V (6) 492V (7) 492V
2	Diode Peak Voltage	Q100 /Q103 Rated: 20 A/600 V	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℃	Q100: VDS: Vo=Vmax (1) 519V (2) 510V (3) 518V (4) 514V (5) 510V (6) 554V (7) 519V (8) 515V Vo=Vnormal (1) 503V Q103: VDS: Vo=Vmax (1) 559V (2) 523V (3) 543V (4) 519V (5) 523V (6) 531V (7) 555V (8) 555V Vo=Vnormal (1) 553V
3	Input Capacitor Voltage	C5/C6/C7/C8 Rated: 120μ /420 V	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	C5 (1) 391V (2) 391V (3) 383V (4) 383V C6 (1) 383V (2) 383V (3) 383V (4) 383V

			Ta:25℃	C7 (1) 383V (2) 383V (3) 375V (4) 375V	C8 (1) 387V (2) 387V (3) 379V (4) 375V
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:3.5V~ 36V	DC ON/OFF I/P: High-Line +3V =1503 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℃	U1/U4: (1) 17.0V (2) 17.2V (3) 17.3V (4) 17.2V (5) 17.0V U200: (1) 20.5V (2) 20.5V (3) 20.5V (4) 35.9V (5) 20.5V	
7	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℃	D1: (1) 429V (2) 429V D3: (1) 424V (2) 421V	D2: (1) 429V (2) 429V D4: (1) 421V (2) 421V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P:4KVAC/min I/P-FG: 2 KVAC/min O/P-FG: 2KVAC/min	I/P-O/P: 4.4 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG: 2.4 KVAC/min Ta:25℃	I/P-O/P: 8.9 mA I/P-FG: 7.32 mA O/P-FG: 7.9 mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ	I/P-O/P: 600 VDC Ta:25℃	I/P-O/P: 9999 MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	2mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	BS EN/EN55032(CISPR32) CLASS A	I/P: 400VDC/800 VDC O/P:FULL LOAD Ta:25℃	PASS Test by certified Lab
2	CONDUCTION	BS EN/EN55032(CISPR32) CLASS A	I/P: 400VDC/800 VDC O/P:FULL LOAD	PASS Test by certified Lab

			Ta:25℃	
3	E.S.D	BS EN/EN61000-4-2 Level 3, 8KV air Level 2, 4KV contact	I/P: 400VDC/800 VDC O/P:FULL LOAD Ta:25℃	■ CRITERIA A □ CRITERIA B
4	E.F.T	BS EN/EN61000-4-4 INPUT: 2KV	I/P: 400VDC/800 VDC O/P:FULL LOAD Ta:25℃	■ CRITERIA A □ CRITERIA B
5	SURGE	BS EN/EN61000-4-5 Level 4, 2KV/Vin+ ~ Vin-, 4KV Vin~FG	I/P: 400VDC/800 VDC O/P:FULL LOAD Ta:25℃	■ CRITERIA A □ 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：RSDH-300-48 1. ROOM AMBIENT BURN-IN：2 HRS I/P：800 VDC O/P： FULL LOAD Ta= 25 ℃ 2. HIGH AMBIENT BURN-IN： 2 HRS I/P：800 VDC O/P： FULL LOAD Ta= 55 ℃		

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 55 ℃
1	C1	53.9℃	78.4℃
2	RTH1	65.3℃	86.0℃
3	R84	62.0℃	85.6℃
4	LF2	62.4℃	85.9℃
5	C11	60.3℃	83.8℃
6	BD1	64.8℃	87.9℃
7	C12	55.7℃	80.4℃
8	BD2	64.3℃	88.1℃
9	RA50	66.3℃	90.8℃
10	C8	63.1℃	87.3℃
11	C56	61.9℃	86.4℃
12	R54	65.2℃	89.6℃
13	D4	66.6℃	91.5℃
14	R46	66.7℃	91.1℃
15	D2	68.4℃	93.2℃
16	C6	64.6℃	89.0℃
17	ZNR4	59.3℃	83.7℃

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 55 ℃
18	Q9	64.6℃	89.3℃
19	Q10	54.2℃	79.5℃
20	U4	56.6℃	82.5℃
21	T3	66.1℃	90.2℃
22	U1	67.1℃	92.0℃
23	C78	67.6℃	91.8℃
24	TSW1	68.2℃	93.6℃
25	T2 coil	74.4℃	100.9℃
26	T2 core	72.9℃	98.6℃
27	C202	62.8℃	87.8℃
28	R101	56.8℃	88.4℃
29	T1 coil	75.9℃	99.6℃
30	T1 core	72.6℃	96.1℃
31	C106	62.6℃	87.1℃
32	D200	66.9℃	90.7℃
33	C108	62.0℃	86.8℃
34	C117	60.0℃	85.6℃
35	LF100	63.0℃	87.4℃
36	R232	61.2℃	86.9℃
37	U200	60.5℃	85.8℃
38	Q105	65.9℃	91.1℃
39	Q104	68.1℃	93.1℃
40	Q103	66.1℃	90.8℃
41	Q100	66.9℃	90.6℃
42	Q101	68.9℃	92.1℃
43	Q102	66.7℃	90.5℃
44	Q1	68.3℃	93.8℃
45	Q2	67.3℃	92.4℃
46	Q3	66.1℃	91.4℃
47	Q4	66.4℃	91.7℃
48	D10	60.8℃	85.6℃
49	Q200	66.3℃	89.7℃
50	U2	64.0℃	89.0℃

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P：800 VDC O/P： 125.61 %LOAD Ta：25℃	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 ℃ O/P： 50% LOAD Ta= -45 ℃	TEST：OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 55 ℃/95 %R.H NO DAMAGE	I/P：1503 VDC O/P：FULL LOAD Ta= 55 ℃ HUMIDITY= 95 %R.H	TEST：OK

5	TEMPERATURE COEFFICIENT	±0.03%/℃(0 ~ 55℃)	I/P：800 VDC O/P：FULL LOAD	± 0.008%/℃(0~55℃)
6	STORAGE TEMPERATURE TEST	-40~80℃	1. Thermal shock Temperature： -45℃~ +90℃ 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： STATIC	
7	THERMAL SHOCK TEST	-40~55℃	1. Thermal shock Temperature： -45℃~ +55℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：16 CYCLE 5. Input/Output condition： 15cycle: 800 VDC / 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℃	
9	CAPACITOR LIFE CYCLE	SUPPOSE C106 IS THE MOST CRITICAL COMPONENT (1) I/P： 800VDC O/P：FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P： 800VDC O/P：FULL LOAD Ta= 55 ℃ LIFE TIME (3) I/P： 800VDC O/P：75% LOAD Ta= 55 ℃ LIFE TIME (4) I/P： 800VDC O/P：50% LOAD Ta= 55 ℃ LIFE TIME		(1) 251038.2HRS (2) 45942.7HRS (3) 65273.1HRS (4) 111543.9HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 277.9K hrs min. Telcordia SR-332 (Bellcore) ; 99.1K hrs min. MIL-HDBK-217F (25℃)		
11	Ongoing Reliability Test	I/P：800VDC O/P：FULL LOAD TA=50℃ Demonstration Mean Time Between Failure : 30000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Yuwei	Liutt	Wangdz

2020.10.1 TAG-QA-009