Test Report: DDRH-120-48

120W High Reliable 250~1500Vdc Ultra Wide Input DIN Rail Type 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

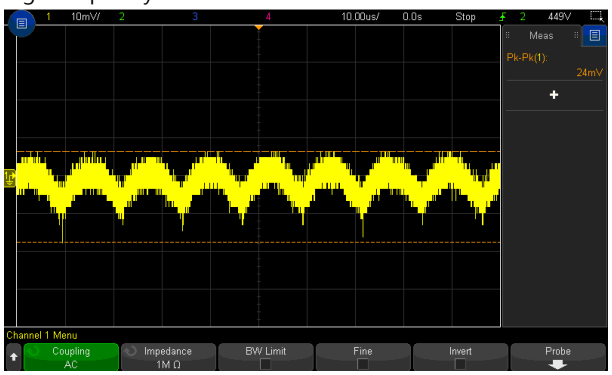
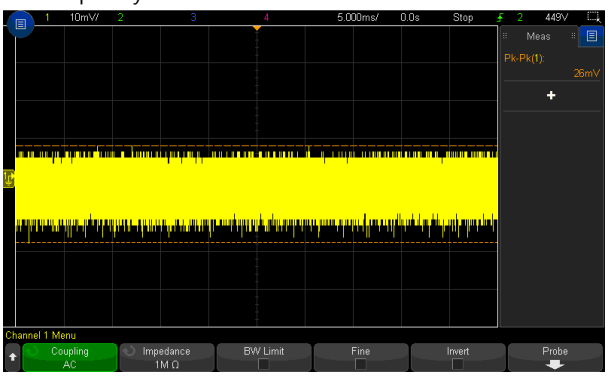
Safety Test
E.M.C. Test

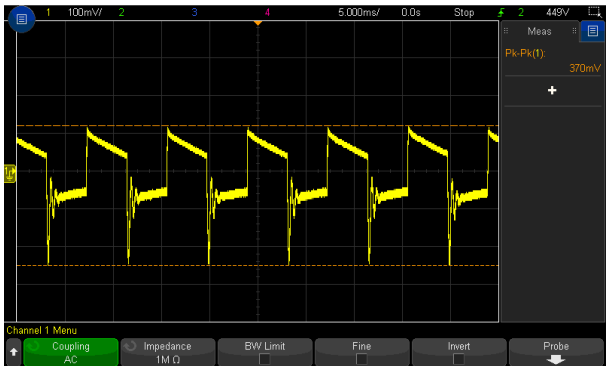
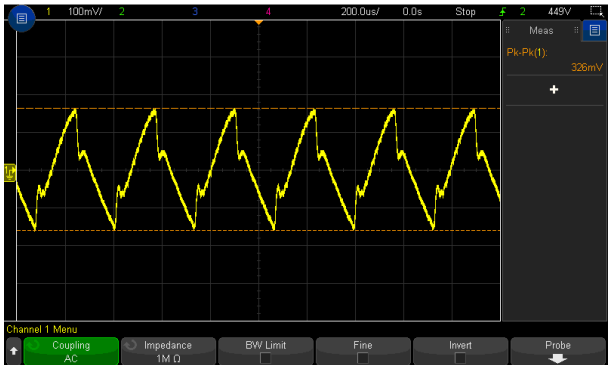
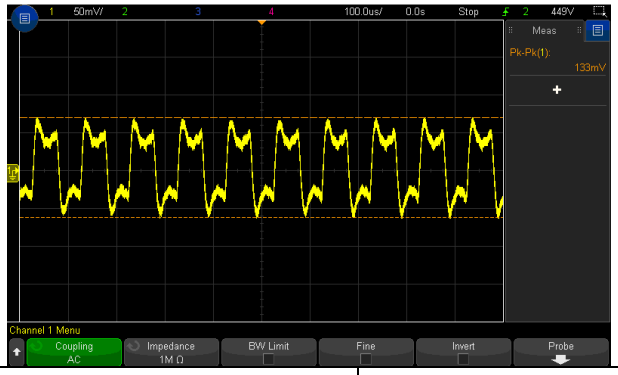
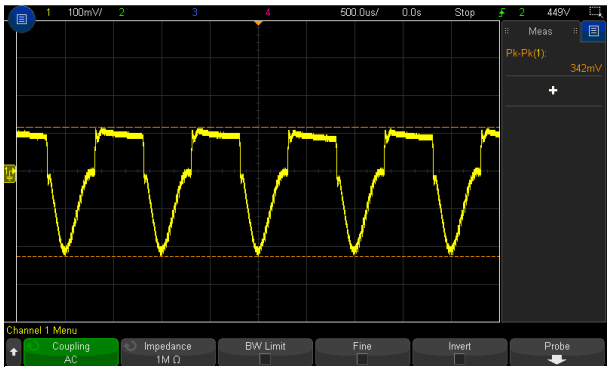
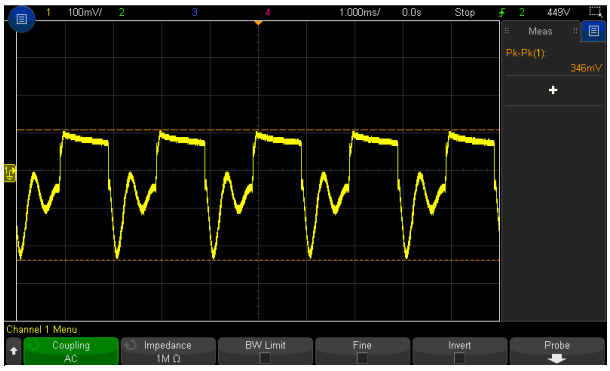
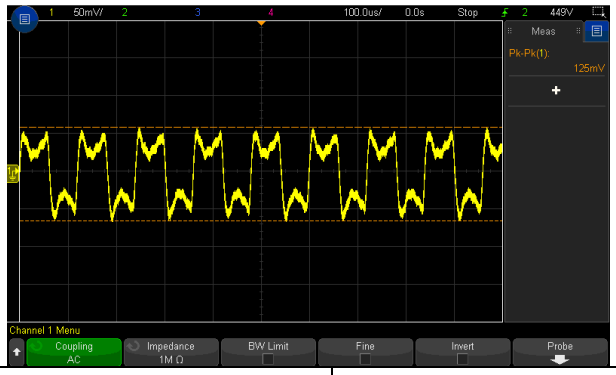
■ RELIABILITY TEST

ENVIRONMENT TEST

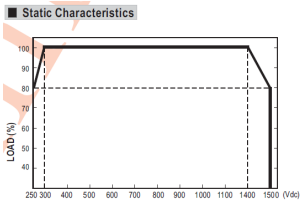
■ DESIGN VERIFY TEST

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℃	46.768V~60.09V/ 800 VDC
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -1.0%~ +1.0%	I/P: 1500VDC / 250 VDC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.1103%~ 0.0686%
3	LINE REGULATION (Max)	V1: -0.5%~+0.5 %	I/P: 1500VDC / 250 VDC O/P:FULL LOAD Ta:25℃	V1: 0.00%~ 0.0583%
4	LOAD REGULATION (Max)	V1: -1.0%~ +1.0 %	I/P: 800VDC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.1103%~ 0.0686%
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℃	26mVp-p
	high frequency :  		low frequency :  	
7	DYNAMIC LOAD	V: 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	(1) 370mVp-p (2) 342mVp-p (3) 346mVp-p (4) 326mVp-p (5) 125mVp-p (6) 133mVp-p

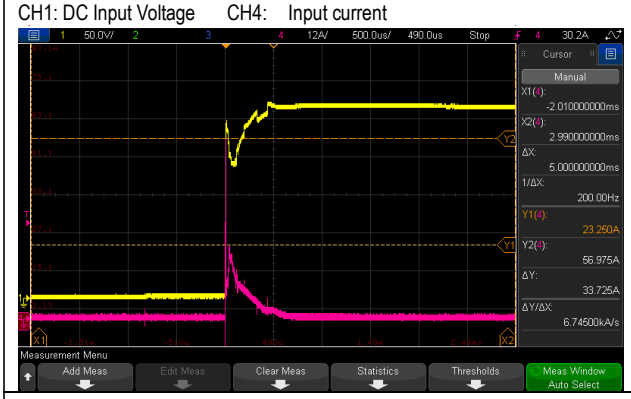
			(6)FULL /MIN LOAD 50%DUTY / 10KHZ Ta:25℃	
	FULL /50% LOAD 50%DUTY / 120HZ  FULL /50% LOAD 50%DUTY / 3KHZ  FULL /50% LOAD 50%DUTY / 10KHZ 		FULL /50% LOAD 50%DUTY / 1KHZ  FULL /50% LOAD 50%DUTY / 500HZ  FULL /50% LOAD 50%DUTY / 8KHZ 	
8	TRANSIENT RECOVERY TIME	V1:4800mVp-p	I/P: 800 VDC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	143mVp-p
9	EXERNAL CAPACITANCE LOAD(Max.)	1000uF	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℃	244.74V~ 1400V/FULL LOAD 244.74V~ 1500V/80% LOAD
			I/P: LOW-LINE-0.2V= 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℃	92.09%/300VDC 92.38%/800VDC 87.97%/1500VDC
3	INRUSH CURRENT(TYP)	70A/250VDC 200A/800VDC 300A/1500VDC COLD START	I/P: 250VDC (80% LOAD) I/P: 800VDC I/P: 1500VDC (80% LOAD) O/P:FULL LOAD Ta:25℃	I = 23.25A/ 250VDC I =73.075 A/ 800VDC I =138.75A/ 1500VDC

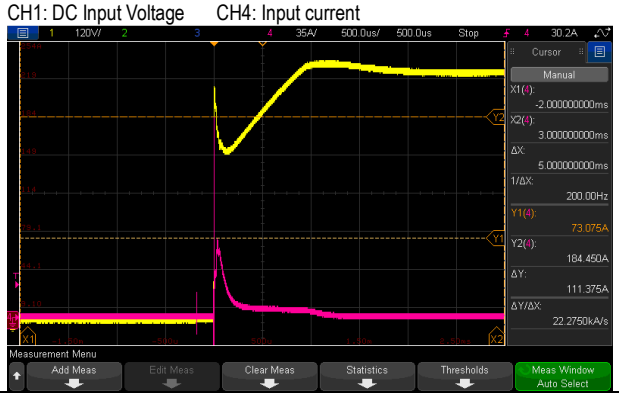
INPUT=250VDC @ TEST LOAD

CH1: DC Input Voltage CH4: Input current



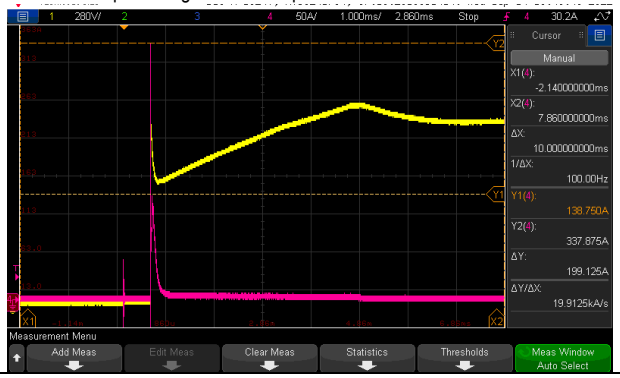
INPUT=800VDC @ FULL LOAD

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℃	126.272%/ 1400 VDC 124.424%/ 800 VDC 121.424%/ 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: 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℃	62.6V/250VDC 63.0V/800VDC 62.6V/1500VDC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
3	OVER TEMPERATURE PROTECTION	SPEC:NO DAMAGE Protection type : Hiccup up 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 up 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 OK PROTECTION TYPE : Hiccup mode , recovers automatically after fault condition is removed
5	DC INPUT UNDER VOLTAGE LOCKOUT	Under voltage protection range: 200 ~ 230Vdc , Under voltage release range:230 ~ 245Vdc	I/P:TESTING O/P: TEST LOAD Ta:25℃	NO DAMAGE Under voltage protection range TEST: 227.38 Vdc , Under voltage release range TEST: 244.57 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

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	DC OK CONTACT RATINGS	30VDC/1A RESISTIVE LOAD	I/P:800VDC O/P:FULL LOAD Ta:25℃	TEST : OK

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: 17 A/ 680 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) 481V (2) 497V (3) 485V (4) 489V (5) 477V (6) 485V (7) 477V Q2 VDS: (1) 489V (2) 501V (3) 485V (4) 485V (5) 481V (6) 485V (7) 481V Q3 VDS: (1) 477V (2) 525V (3) 485V (4) 489V (5) 485V (6) 485V (7) 493V Q4 VDS: (1) 497V (2) 577V (3) 501V (4) 501V (5) 497V (6) 501V (7) 505V
2	Diode Peak Voltage	Q101/Q102 Rated: 20 A/ 600V	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	Q101 / Q102: VDS: Vo=Vmax (1) 485V (2) 581V (3) 485V (4) 485V (5) 485V (6) 485V (7) 485V (8) 485V Vo=Vnormal (1) 473V

			Ta:25℃		
3	Input Capacitor Voltage	C5/C7/C9/C18 Rated: 68μ / 400 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 Ta:25℃	C5 (1) 384V (2) 380V (3) 376V (4) 376V C7 (1)380V (2)380V (3)384V (4)376V	C9 (1) 384V (2) 384V (3) 376V (4) 376V C18 (1)384V (2)384V (3)376V (4)376V
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) 16.9V (2) 16.9V (3) 16.9V (4) 16.9V (5) 16.9V U200: (1) 16.4V (2) 16.4V (3) 16.4V (4) 30.4V (5) 15.8V	
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) 436V (2) 436V D3: (1) 436V (2) 432V	D2: (1) 436V (2) 436V D4: (1) 441V (2) 432V

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: 2 KVAC/min O/P-DC OK:0.5KVAC/min	I/P-O/P: 4.4 KVAC/min I/P-FG: 4.125 KVAC/min O/P-FG: 2.4 KVAC/min O/P-DC OK:0.6KVAC/min Ta:25℃	I/P-O/P:8.39 mA I/P-FG: 6.96 mA O/P-FG:5.55 mA O/P- DC OK: 0.01 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 Ta:25℃	PASS Test by certified Lab
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：DDRH-120-48 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= 50 ℃		

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 50 ℃
1	RTH1	42.7℃	64.9℃
2	R5	38.9℃	62.2℃
3	ZNR3	43.0℃	65.9℃
4	C10	39.9℃	63.1℃
5	BD1	50.6℃	72.5℃
6	LF2	45.1℃	68.4℃
7	LF3	46.3℃	69.0℃
8	C5	40.6℃	64.6℃
9	C18	52.5℃	74.2℃
10	C71	58.4℃	80.5℃

			NO	Position	ROOM AMBIENT Ta= 25 ℃ / HIGH AMBIENT Ta= 50 ℃
			11	C56	59.3℃ / 81.4℃
			12	T1 coil	62.3℃ / 83.9℃
			13	T1 core	63.1℃ / 85.1℃
			14	D10	64.4℃ / 85.4℃
			15	TSW1	64.5℃ / 86.6℃
			16	Q10	37.5℃ / 61.5℃
			17	T3	47.4℃ / 71.6℃
			18	U1	58.8℃ / 81.6℃
			19	U200	57.2℃ / 79.2℃
			20	C107	56.7℃ / 80.0℃
			21	C108	56.6℃ / 78.7℃
			22	LF100	56.7℃ / 79.1℃
			23	C114	52.4℃ / 75.2℃
			24	RY1	63.0℃ / 84.1℃
			25	U2	55.0℃ / 77.0℃
			26	R48	58.7℃ / 79.1℃
			27	R232	60.6℃ / 82.1℃
			28	Q1	55.8℃ / 74.0℃
			29	Q2	62.2℃ / 79.4℃
			30	Q3	55.1℃ / 75.7℃
			31	Q4	57.8℃ / 76.8℃
			32	Q11	61.5℃ / 82.5℃
			33	R46	66.7℃ / 87.2℃
			34	R54	60.5℃ / 80.2℃
			35	Q101	58.5℃ / 81.7℃
			36	Q102	59.0℃ / 81.6℃
			37	C15	61.6℃ / 82.5℃
			38	U4	38.5℃ / 62.8℃
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P：800 VDC O/P： 119 %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 50 ℃/95 %R.H NO DAMAGE	I/P：1500 VDC O/P：FULL LOAD Ta= 50 ℃ HUMIDITY= 95 %R.H	TEST：OK	
5	TEMPERATURE COEFFICIENT	± 0.03 %/℃(0~50℃)	I/P：800 VDC O/P：FULL LOAD	± 0.0011 %/℃(0~50℃)	

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	-40~50℃	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, 2G 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：3G (5) Test Time：180min in each axis (X.Y.Z) (6) Ta：25℃
9	CAPACITOR LIFE CYCLE	SUPPOSE C107 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= 50 ℃ LIFE TIME (3) I/P： 800VDC O/P：75% LOAD Ta= 50 ℃ LIFE TIME (4) I/P： 800VDC O/P：50% LOAD Ta= 50 ℃ LIFE TIME	(1) 442770.6HRS (2) 74049.4HRS (3) 92727.6HRS (4) 127379.4HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 257.2 hrs min. MIL-HDBK-217F (25℃); 1596.3 hrs min. Telcordia TR/SR-332 (Bellcore) (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