Test Report: DDRH-120-12

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

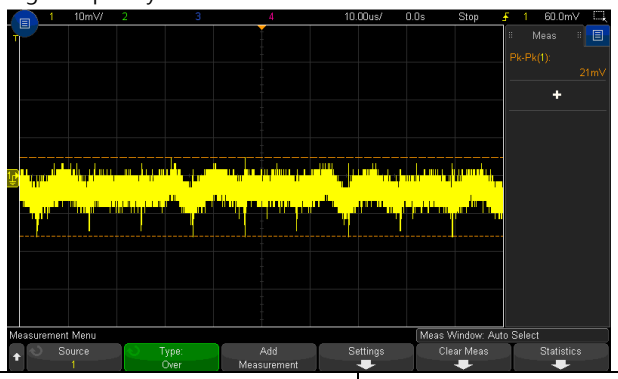
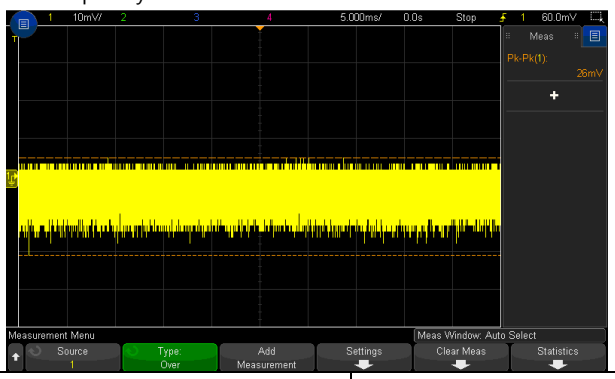
Safety Test
E.M.C. Test

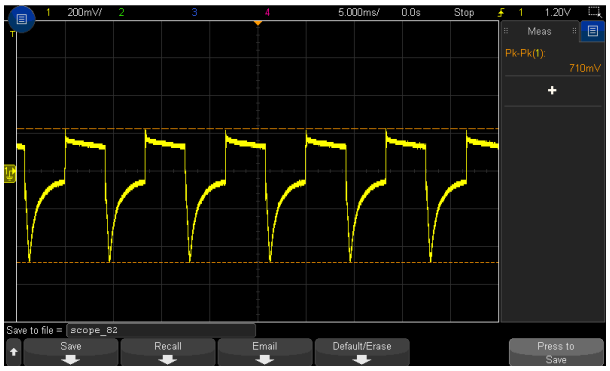
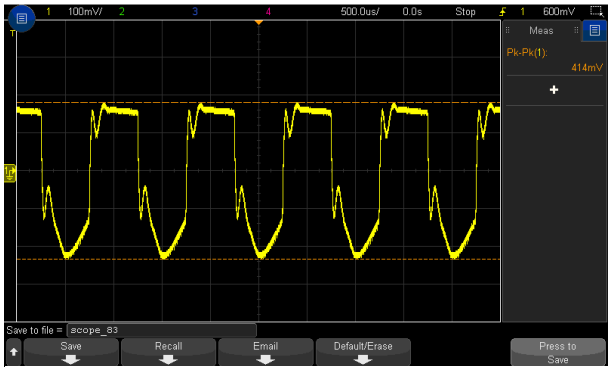
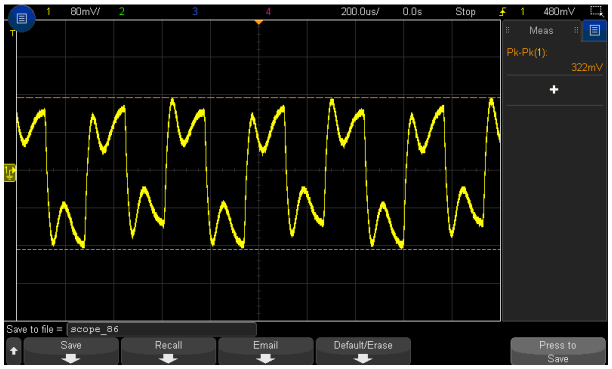
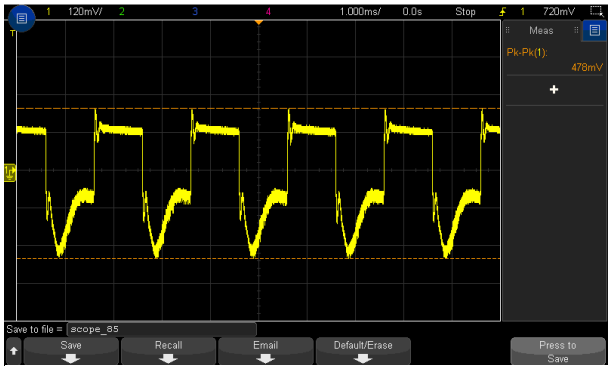
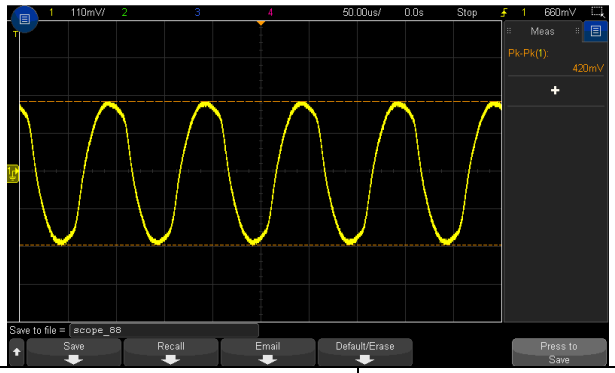
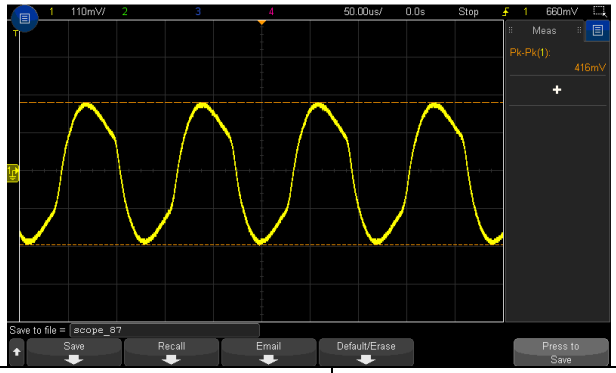
■ RELIABILITY TEST

ENVIRONMENT TEST

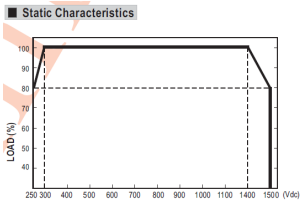
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 12V~ 15V	I/P : 800 VDC O/P : MIN LOAD Ta : 25℃	11.637V~15.511V/ 800 VDC
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -1.5%~ +1.5%	I/P: 1500VDC / 250 VDC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.3636%~ 0.3719%
3	LINE REGULATION (Max)	V1: -0.5%~+0.5 %	I/P: 1500VDC / 250 VDC O/P:FULL LOAD Ta:25℃	V1: 0.0249%~ 0 %
4	LOAD REGULATION (Max)	V1: -1.5%~ +1.5 %	I/P: 800VDC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.3636%~ 0.3719%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 800 VDC O/P:FULL LOAD Ta:25℃	TEST: 1.67%
6	RIPPLE & NOISE (Max)	V1: 120mVp-p	I/P: 800 VDC O/P:FULL LOAD Ta:25℃	26mVp-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) 710mVp-p (2) 414mVp-p (3) 478mVp-p (4) 322mVp-p (5) 416mVp-p (6) 420mVp-p

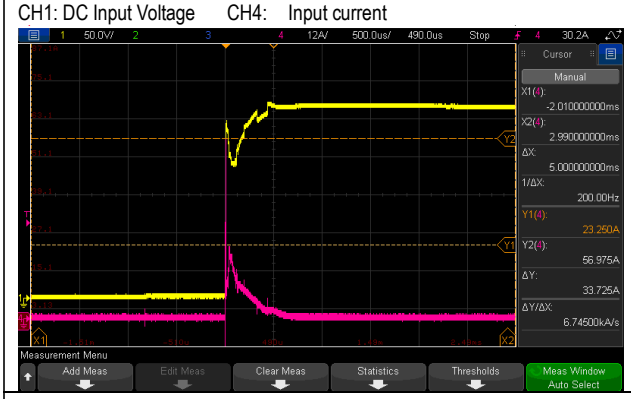
			10KHZ Ta:25℃	
	FULL /50% LOAD 50%DUTY / 120HZ  FULL /50% LOAD 50%DUTY / 1KHZ  FULL / MIN LOAD 50%DUTY / 3KHZ  FULL / MIN LOAD 50%DUTY / 500HZ  FULL / MIN LOAD 50%DUTY / 10KHZ  FULL / MIN LOAD 50%DUTY / 8KHZ 			
8	TRANSIENT RECOVERY TIME	V1:1200mVp-p	I/P: 800 VDC O/P: 40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	199mVp-p
9	EXERNAL CAPACITANCE LOAD(Max.)	4000uF	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℃	241.65V~ 1400V/FULL LOAD 241.42V~ 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)	88%/300VDC 87%/800VDC 84%/1500VDC	I/P: 300VDC (80% LOAD) I/P: 800VDC I/P: 1500VDC (80% LOAD) O/P:FULL LOAD Ta:25℃	88.57%/300VDC 87.65%/800VDC 85.07%/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

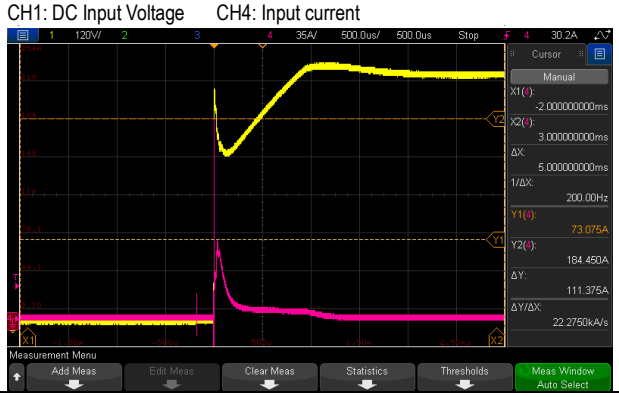
INPUT=250VDC @ TEST LOAD

CH1: DC Input Voltage CH4: Input current



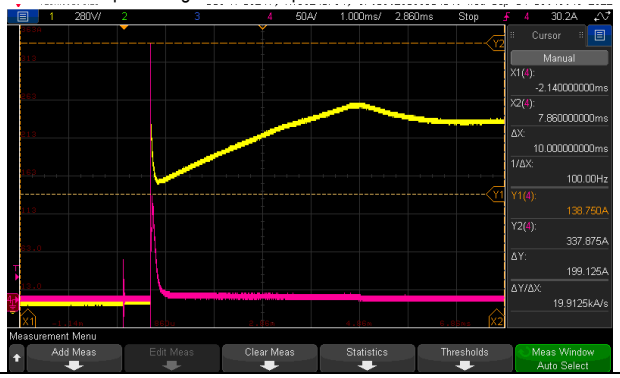
INPUT=800VDC @ FULL LOAD

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℃	119.41%/1400VDC 119.79%/800VDC 119.77%/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: 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℃	18.5V/ 1500 VDC 18.5V/ 800 VDC 18.5V/ 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 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: 225.24 Vdc , Under voltage release range TEST: 241.35 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 Q2 VDS: VDS: (1) 539V (1) 539V (2) 547V (2) 539V (3) 555V (3) 547V (4) 543V (4) 543V (5) 539V (5) 543V (6) 555V (6) 553V (7) 547V (7) 547V Q3 Q4 VDS: VDS: (1) 547V (1) 555V (2) 555V (2) 555V (3) 563V (3) 575V (4) 551V (4) 563V (5) 551V (5) 563V (6) 567V (6) 575V (7) 559V (7) 575V
2	Diode Peak Voltage	Q101/Q102 Rated: 24 A/200V	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) 126V (2) 126V (3) 126V (4) 126V (5) 126V (6) 126V (7) 126V (8) 126V Vo=Vnormal (1) 147V

			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 C9 (1) 384V (1) 384V (2) 380V (2) 384V (3) 376V (3) 376V (4) 376V (4) 376V C7 C18 (1) 384V (1) 384V (2) 384V (2) 384V (3) 376V (3) 376V (4) 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 O/P IC U100 Rated: 8V~ 24V	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: U100 (1) 17.2V (1) 12.27V (2) 17.2V (2) 12.19V (3) 17.2V (3) 12.19V (4) 17.2V (4) 20.80V (5) 17.2V (5) 11.15V U200: (1) 11.79V (2) 11.79V (3) 11.79V (4) 20.40V (5) 11.39V
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℃	D1: D2: (1) 488V (1) 488V (2) 488V (2) 488V D3: D4: (1) 496V (1) 496V (2) 496V (2) 496V

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: 2 KVAC/min O/P-DC OK:0.5KVAC/min	I/P-O/P: 4.4 KVAC/min I/P-FG: 2.4 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: 6.92 mA O/P-FG:5.55 mA O/P- DC OK: 0.009 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℃	3mΩ

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-120-12 1. ROOM AMBIENT BURN-IN： 2HRS I/P： 800VDC O/P： FULL LOAD Ta= 25 ℃ 2. HIGH AMBIENT BURN-IN： 2 HRS I/P： 800VDC O/P： FULL LOAD Ta= 50 ℃		

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 50 ℃
1	C1	33.5℃	56.9℃
2	RTH1	39.0℃	62.1℃
3	R5	38.6℃	61.9℃
4	ZNR3	40.6℃	64.5℃
5	C10	38.6℃	62.4℃
6	BD1	41.8℃	65.3℃
7	LF2	40.3℃	64.5℃
8	LF3	42.6℃	67.2℃
9	C5	39.7℃	63.3℃
10	C18	46.6℃	71.8℃
11	C100	66.7℃	90.8℃

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 50 ℃
12	R102	57.6℃	35.9℃
13	D212	67.7℃	91.5℃
14	D213	69.7℃	93.8℃
15	C71	59.7℃	84.0℃
16	C56	61.9℃	86.1℃
17	T1 coil	67.6℃	89.4℃
18	T1 core	72.8℃	96.0℃
19	D10	74.3℃	98.2℃
20	TSW1	67.1℃	89.8℃
21	Q10	34.9℃	58.3℃
22	T3	50.9℃	76.2℃
23	U1	53.3℃	79.5℃
24	U2	54.3℃	79.5℃
25	C107	68.1℃	91.6℃
26	C108	65.2℃	87.4℃
27	L100	73.5℃	96.8℃
28	C114	65.8℃	89.2℃
29	U200	62.7℃	85.6℃
30	R48	55.2℃	81.8℃
31	R231	73.4℃	95.5℃
32	U100	69.9℃	92.9℃
33	Q1	52.4℃	80.4℃
34	Q2	53.0℃	80.1℃
35	Q3	49.9℃	76.8℃
36	Q4	54.1℃	83.1℃
37	Q11	66.7℃	90.0℃
38	R46	64.7℃	87.5℃
39	R54	73.9℃	107.9℃
40	C35	64.2℃	92.5℃

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P：800 VDC O/P： 120 %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: 800VDC / 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) 159147.7HRS (2) 25006.3HRS (3) 54978.4HRS (4) 98818.7HRS
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