Test Report: DDRH-240-12

240W 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

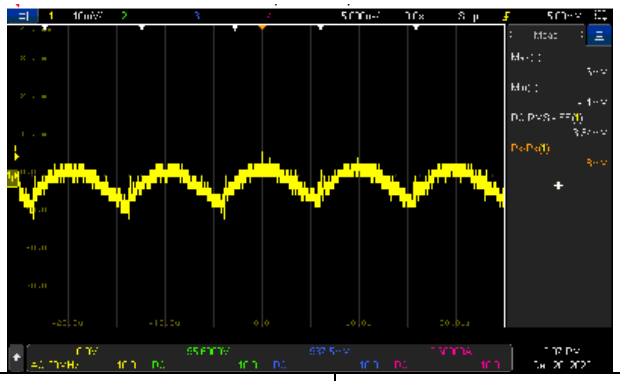
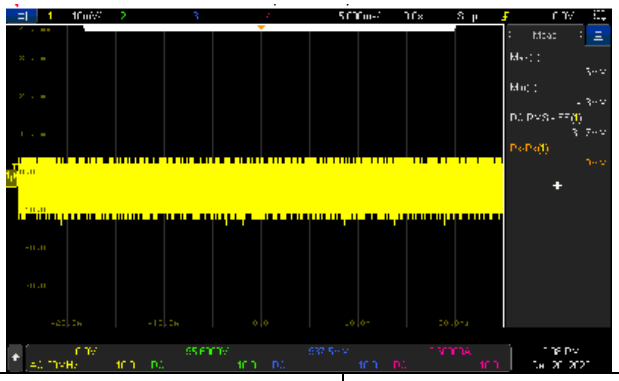
Safety Test
E.M.C. Test

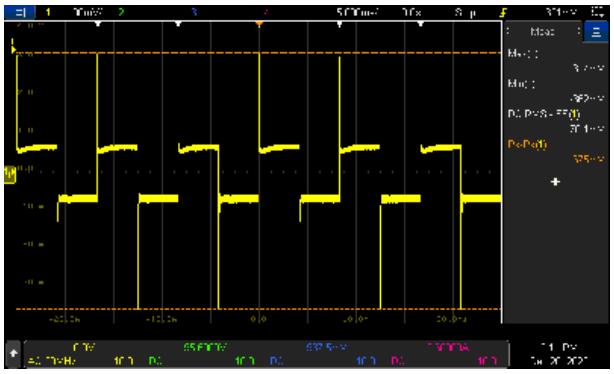
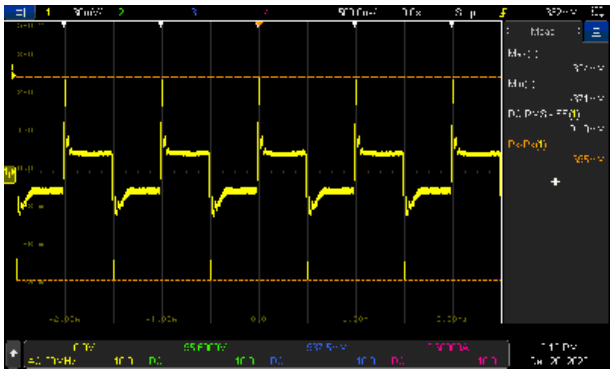
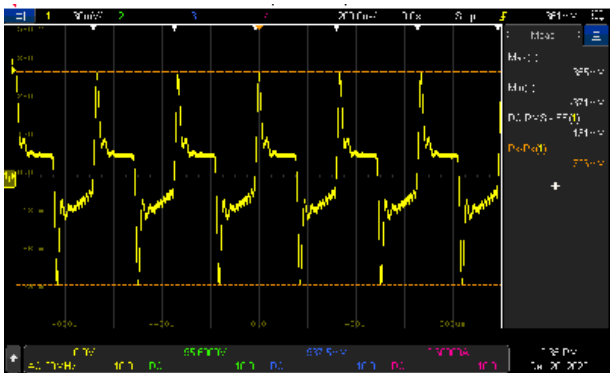
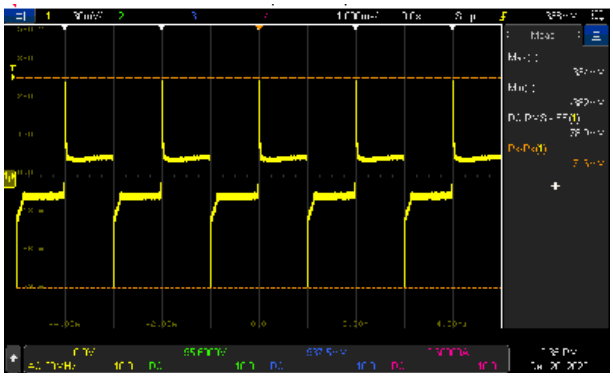
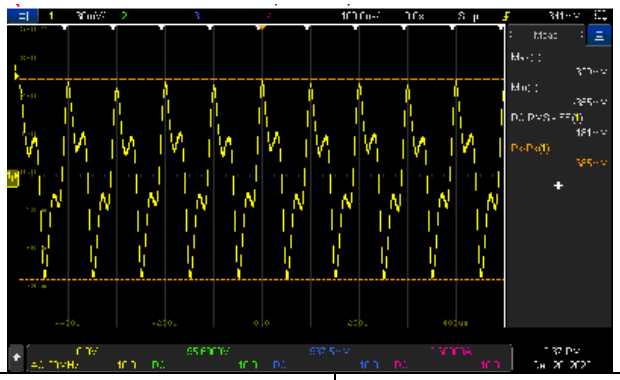
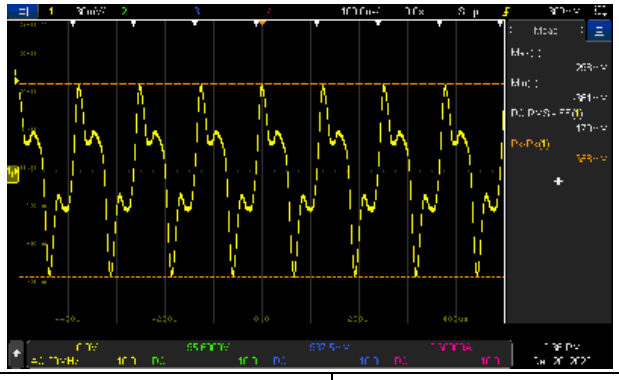
■ RELIABILITY TEST

ENVIRONMENT TEST

■ DESIGN VERIFY TEST

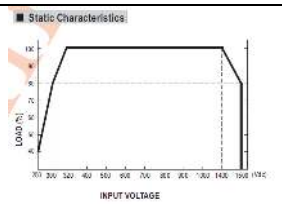
OUTPUT FUNCTION TEST

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℃	11.066V~ 15.34V/ 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: -0.5343%~ 0.5009%
3	LINE REGULATION (Max)	V1: -0.5%~+0.5 %	I/P: 1500VDC / 250 VDC O/P:FULL LOAD Ta:25℃	V1: -0.0168%~ 0.0252%
4	LOAD REGULATION (Max)	V1: -1%~ +1%	I/P: 800VDC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.5343%~ 0.5009%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 800 VDC O/P:FULL LOAD Ta:25℃	TEST: 0.94%
6	RIPPLE & NOISE (Max)	*V1:* 120mVp-p	I/P: 800 VDC O/P:FULL LOAD Ta:25℃	V1: 19mVp-p
	high frequency : 		low frequency : 	
7	DYNAMIC LOAD	V1: 1200 mVp-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 / 10KHZ	(1) 675mVp-p (2) 695mVp-p (3) 716mVp-p (4) 726mVp-p (5) 658mVp-p (6) 685mVp-p

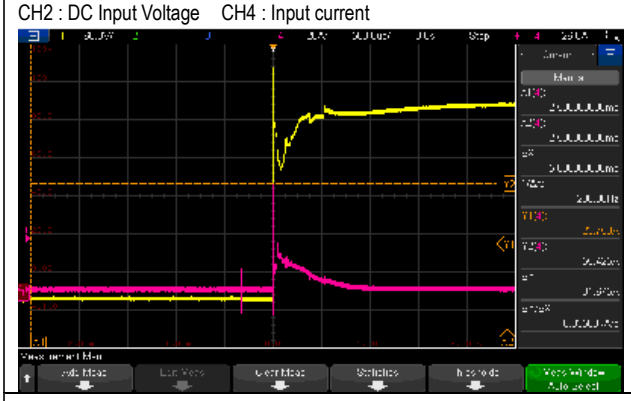
			Ta:25℃	
	FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 	
	FULL /50% LOAD 50%DUTY / 3KHZ 		FULL /50% LOAD 50%DUTY / 500HZ 	
	FULL /50% LOAD 50%DUTY / 10KHZ 		FULL /50% LOAD 50%DUTY / 8KHZ 	
8	EXERNAL CAPACITANCE LOAD(Max.)	8000uF	I/P：800VDC O/P：TESTING LOAD Ta：25℃	TEST: OK

INPUT FUNCTION TEST

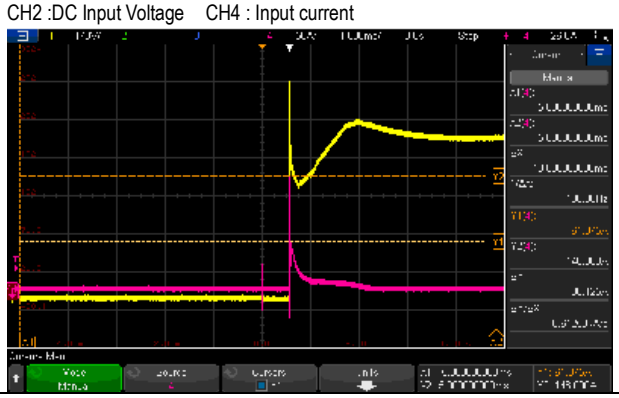
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	250VDC~ 1500 VDC	I/P: TESTING O/P:FULL LOAD Ta:25℃	237V~ 1400 V/FULL LOAD 235V~ 1500 V/80% LOAD 235V~ 1500 V/40% LOAD

			I/P: LOW-LINE-0.2= 249.8 V HIGH-LINE+3V= 1503 V 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)	85%/300VDC 88%/800VDC 85%/1500VDC	I/P: 300VDC (80% LOAD) I/P: 800VDC I/P: 1500VDC (80% LOAD) O/P:FULL LOAD Ta:25℃	90.15%/300VDC 90.89%/800VDC 86.53%/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 = 23.75A/ 300VDC I = 61.9A/ 800VDC I = 121A/ 1500VDC

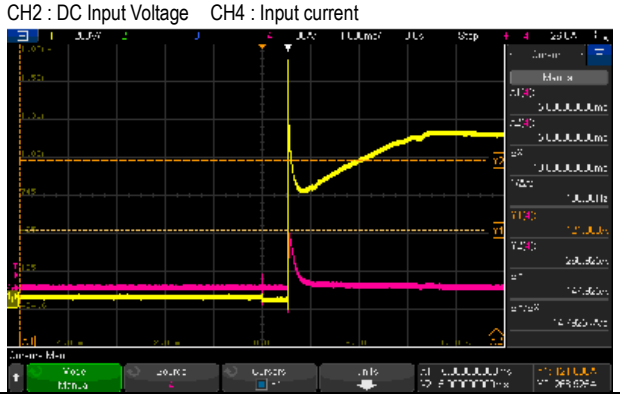
INPUT=300VDC @ TEST LOAD
CH2 : DC Input Voltage CH4 : Input current



INPUT=800VDC @ FULL LOAD
CH2 :DC Input Voltage CH4 : Input current



INPUT=1500VDC @ TEST LOAD
CH2 : 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<35%, recovers automatically after	I/P: 1400 VDC I/P: 800 VDC I/P: 320 VDC O/P:TESTING Ta:25℃	117.96%/ 1400 VDC 118.56%/ 800 VDC 118. 56%/ 320 VDC PROTECTION TYPE : Hiccup mode when output voltage<35%, recovers

		condition is removed; Constant current limiting, recovers automatically after fault condition is removed within 35% ~ 100% rated output voltage		automatically after condition is removed; Constant current limiting, recovers automatically after fault condition is removed within 35% ~ 100% rated output voltage
2	OVER VOLTAGE PROTECTION	CH: 16.5 V~ 21 V Protection type : Shut down o/p voltage, re-power on to recover	I/P: 1500VDC I/P: 800VDC I/P: 250VDC O/P:MIN LOAD Ta:25℃	18.8V/ 1500 VDC 18.2V/ 800 VDC 18.3V/ 250 VDC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
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	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: 217 Vdc , Under voltage release range TEST: 238 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 Contact Close：DC OK Contact Open：DC Fail	I/P:800VDC O/P:FULL LOAD Ta:25℃	TEST: OK
2	CURRENT SHARING	Up to 960W(3+1 units)	I/P:800VDC O/P: (The rated current per unit) x (Number of unit) x 0.9 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: 19 A/ 650V	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) 579V (1) 571V (2) 583V (2) 575V (3) 579V (3) 571V (4) 575V (4) 571V (5) 579V (5) 571V (6) 575V (6) 571V (7) 583V (7) 583V Q3 Q4 VDS: VDS: (1) 555V (1) 551V (2) 555V (2) 559V (3) 551V (3) 555V (4) 551V (4) 555V (5) 555V (5) 559V (6) 551V (6) 551V (7) 563V (7) 563V
2	Diode Peak Voltage	Q100 Rated: 25A/ 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 Ta:25℃	VDS: Vo=Vmax (1) 123V (2) 179V (3) 116V (4) 127V (5) 116V (6) 118V (7) 109V (8) 129V Vo=Vnormal (1) 109V
3	Input Capacitor Voltage	C5/C6/C7/C8 Rated: 100 μ / 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 Ta:25℃	C5 C6 (1) 390V (1) 390V (2) 390V (2) 390V (3) 382V (3) 385V (4) 382V (4) 385V C7 C8

				(1) 390V (2) 390V (3) 382V (4) 382V	(1) 390V (2) 390V (3) 382V (4) 382V
4	Control IC Voltage Test	PWM IC U1 Rated：8.3V~ 28 V I/P IC U4 Rated：6.5V~ 30V O/P IC U100 Rated：3V~ 30V IC U101 Rated：3V~30V	DC ON/OFF I/P: High-Line +3V = 1503V 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) 17.3V (2) 17.2V (3) 17.2V (4) 17.2V (5) 17.2V U100/U101 (1) 11.1V (2) 10.9V (3) 7.29V (4) 17.1V (5) 9.9V	
5	Clamp Diode Peak Voltage	D1 / D2 / D3/ D4 Rated：1000 V /1 A	I/P：High-Line +3V =1503 V DC ON/OFF O/P： (1) Dynamic Load 90%Duty/1KHz (2) Full load continue Ta:25℃	D1: (1) 480V (2) 468V D3: (1) 478V (2) 468V	D2: (1) 478V (2) 468V D4: (1) 476V (2) 468V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P:4KVDC/min I/P-FG:2 KVDC/min O/P-FG:2KVDC/min O/P-DC OK: 0.5KVDC/min	I/P-O/P: 4.4KVDC/min I/P-FG: 2.4 KVDC/min O/P-FG:2.4KVDC/min O/P-DC OK: 0.6KVDC/min Ta:25℃	I/P-O/P: 4.59 mA I/P-FG: 3.72 mA O/P-FG: 2.91mA O/P-DC OK: 0.01mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ	I/P-O/P: 600VDC Ta:25℃	I/P-O/P: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	3 mΩ

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℃	PASS Test by certified Lab

2	CONDUCTION	EN55032 CLASS A	I/P: 400 VDC/800VDC O/P:FULL LOAD Ta:25℃	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℃	CRITERIA A
4	E.F.T	EN61000-4-4 INPUT: 2KV	I/P: 400 VDC/800VDC O/P:FULL LOAD Ta:25℃	CRITERIA A
5	SURGE	IEC61000-4-5 Vin+~Vin- :2KV Vin~FG:4KV	I/P: 400 VDC/800VDC O/P:FULL LOAD Ta:25℃	CRITERIA A
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-240-12 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	L1	40.0℃	59.7℃
2	RTH1	42.4℃	62.4℃
3	C10	47.2℃	66.0℃
4	LF2	52.9℃	72.0℃
5	LF3	56.2℃	75.2℃
6	BD1	64.0℃	82.5℃
7	C6	52.3℃	69.9℃
8	C8	62.4℃	80.8℃
9	ZNR6	63.6℃	81.9℃
10	Q4	88.5℃	74.6℃
11	Q3	84.7℃	99.4℃
12	Q2	71.9℃	72.5℃
13	R48	70.4℃	88.3℃
14	U1	75.3℃	92.8℃
15	C71	67.4℃	85.6℃
16	C56	67.6℃	86.8℃

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 50 ℃
17	T3	55.5℃	76.2℃
18	Q10	53.1℃	68.3℃
19	U100	65.4℃	84.3℃
20	U101	67.8℃	86.9℃
21	C110	59.9℃	78.6℃
22	C107	69.7℃	88.8℃
23	Q100	81.6℃	104.5℃
24	Q103	88.8℃	112.7℃
25	T1coil	58.4℃	78.6℃
26	T1core	63.5℃	83.5℃
27	T2 coil	72.6℃	90.9℃
28	T2core	65.4℃	85.0℃
29	U2	57.4℃	77.6℃
30	C111	61.3℃	80.8℃
31	C1	37.9℃	58.2℃
32	LF100	73.8℃	94.0℃
33	TSW1	56.2℃	75.9℃
34	RA6	74.3℃	93.6℃
35	C15	75.2℃	95.9℃
36	Q11	69.9℃	83.2℃
37	D10	83.2℃	97.1℃
38	R111	70.3℃	90.4℃
39	C125	73.3℃	94.6℃

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：250 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) 122405.4HRS (2) 23843.5HRS (3) 59772.6HRS (4) 108532.8HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1391.8K hrs min. Telcordia SR-332 (Bellcore) ; 214.2K 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