



# Test Report: DDRH-120-48

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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

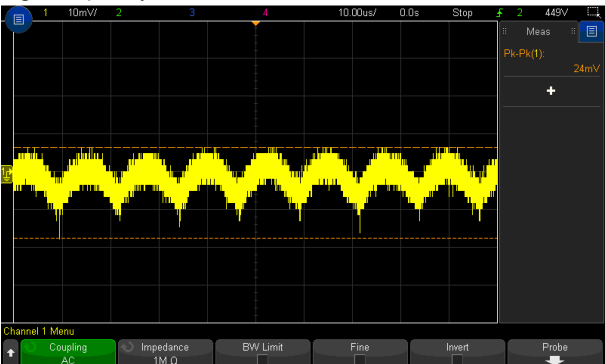
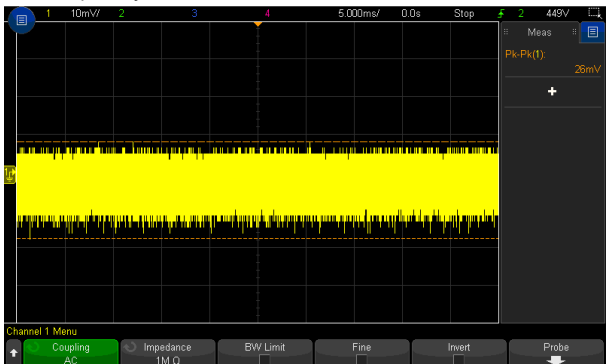
E.M.C. Test

## ■ RELIABILITY TEST

ENVIRONMENT TEST

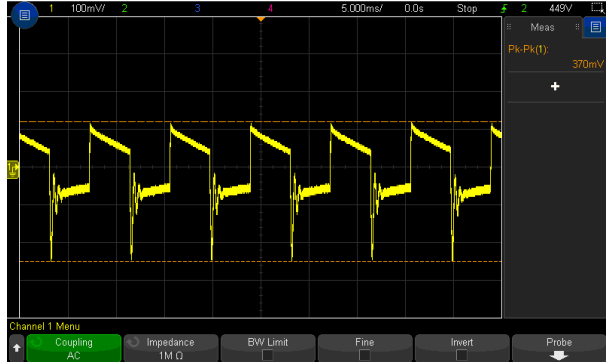
## DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

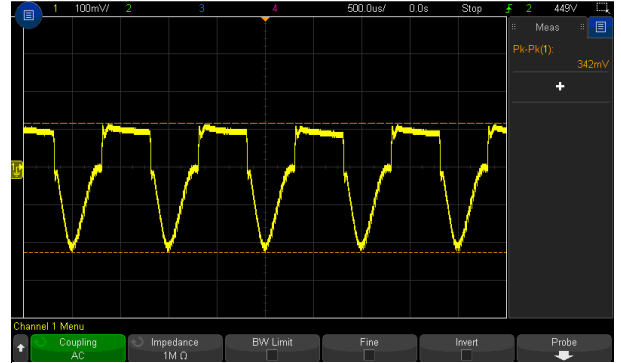
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 48V~ 58V	I/P : 800 VDC O/P : MIN LOAD Ta : 25°C	46.768V~60.09V/ 800 VDC
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -1.0%~ +1.0%	I/P: 1500VDC / 250 VDC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.1103%~ 0.0686%
3	LINE REGULATION (Max)	V1: -0.5%~+0.5 %	I/P: 1500VDC / 250 VDC O/P:FULL LOAD Ta:25°C	V1: 0.00%~ 0.0583%
4	LOAD REGULATION (Max)	V1: -1.0%~ +1.0 %	I/P: 800VDC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.1103%~ 0.0686%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 800 VDC O/P:FULL LOAD Ta:25°C	TEST: 2.1%
6	RIPPLE & NOISE (Max)	V1: 300mVp-p	I/P: 800 VDC O/P:FULL LOAD Ta:25°C	26mVp-p
		<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>high frequency :</p>  </div> <div style="text-align: center;"> <p>low frequency :</p>  </div> </div>		
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°C

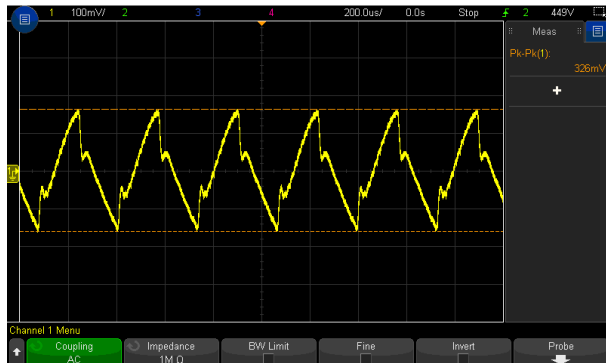
FULL /50% LOAD 50%DUTY / 120HZ



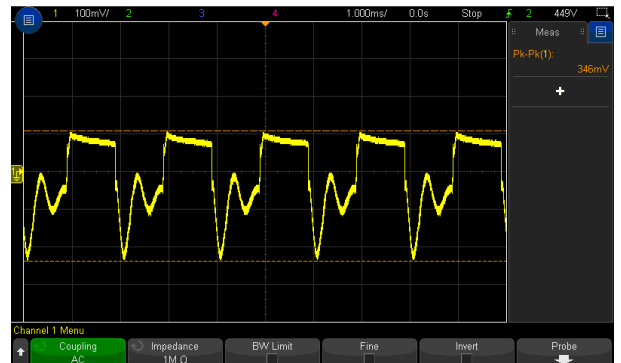
FULL /50% LOAD 50%DUTY / 1KHZ



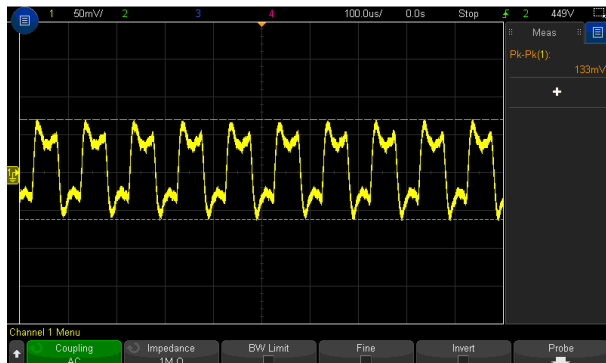
FULL /50% LOAD 50%DUTY / 3KHZ



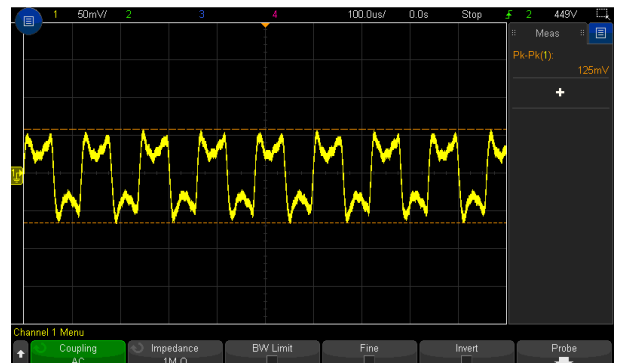
FULL /50% LOAD 50%DUTY / 500HZ



FULL /50% LOAD 50%DUTY / 10KHZ

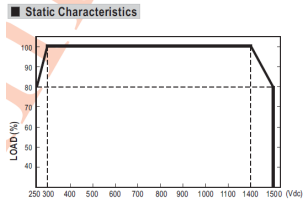


FULL /50% LOAD 50%DUTY / 8KHZ



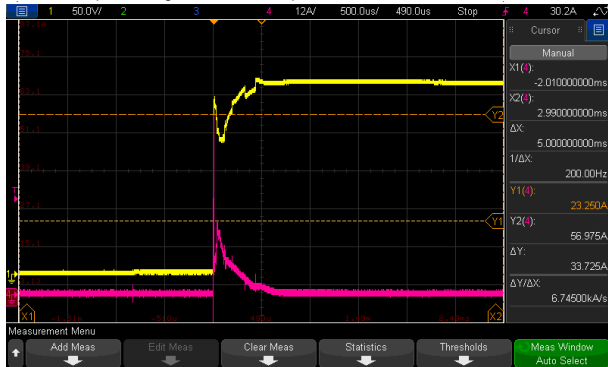
8	TRANSIENT RECOVERY TIME	V1:4800mVp-p	I/P: 800 VDC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	143mVp-p
9	EXERNAL CAPACITANCE LOAD(Max.)	1000uF	I/P : 800VDC O/P : TESTING LOAD Ta : 25°C	TEST: <u>  OK  </u>

### 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  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 )	244.74V~ 1400V/FULL LOAD 244.74V~ 1500V/80% LOAD  TEST: <u>OK</u>
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°C	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°C	I = 23.25A/ 250VDC I =73.075 A/ 800VDC I =138.75A/ 1500VDC

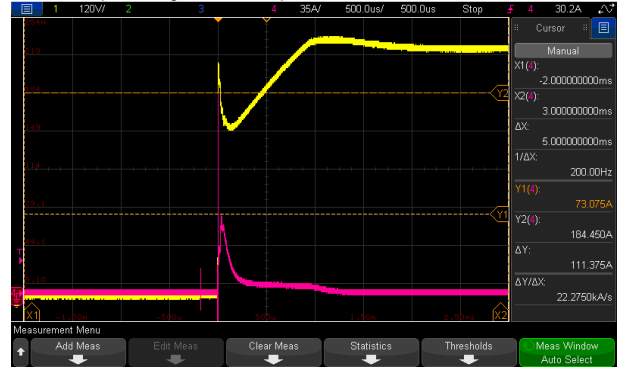
INPUT=250VDC @ TEST LOAD

CH1: DC Input Voltage CH4: Input current



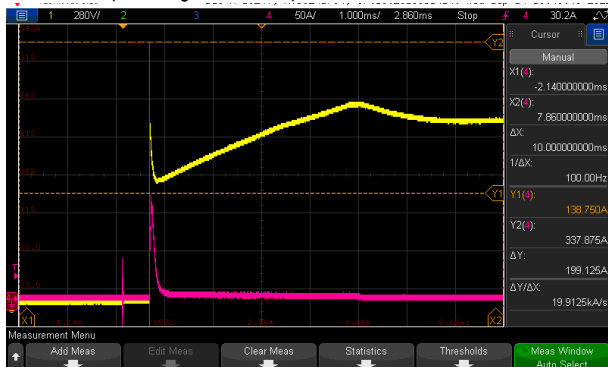
INPUT=800VDC @ FULL LOAD

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°C	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°C	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°C	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°C	NO DAMAGE Under voltage protection range TEST: <u>227.38</u> Vdc, Under voltage release range TEST: <u>244.57</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



### 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°C	TEST : OK

### COMPONENT STRESS TEST

N O	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°C	Q1 Q2 VDS: VDS: (1) 481V (1) 489V (2) 497V (2) 501V (3) 485V (3) 485V (4) 489V (4) 485V (5) 477V (5) 481V (6) 485V (6) 485V (7) 477V (7) 481V Q3 Q4 VDS: VDS: (1) 477V (1) 497V (2) 525V (2) 577V (3) 485V (3) 501V (4) 489V (4) 501V (5) 485V (5) 497V (6) 485V (6) 501V (7) 493V (7) 505V
2	Diode Peak Voltage	Q101/Q102 Rated: 20 A/ 600V	DC ON/OFF I/P:High-Line +3V =1503 V <u>Vo=Vmax</u> 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 <u>Vo=Vnormal</u> O/P: (1)Full Load	Q101 / Q102: VDS: <u>Vo=Vmax</u> (1) 485V (2) 581V (3) 485V (4) 485V (5) 485V (6) 485V (7) 485V (8) 485V <u>Vo=Vnormal</u> (1) 473V

			Ta:25°C	
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°C	C5 C9 (1) 384V (1) 384V (2) 380V (2) 384V (3) 376V (3) 376V (4) 376V (4) 376V  C7 C18 (1)380V (1)384V (2)380V (2)384V (3)384V (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	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°C	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°C	D1: D2: (1) 436V (1) 436V (2) 436V (2) 436V  D3: D4: (1) 436V (1) 441V (2) 432V (2) 432V

**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°C	I/P-O/P:8.39 mA I/P-FG: 6.92 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°C	I/P-O/P: 9999 MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	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°C	PASS Test by certified Lab
2	CONDUCTION	BS EN/EN55032(CISPR32) CLASS A	I/P: 400VDC/800 VDC O/P:FULL LOAD Ta:25°C	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°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
4	E.F.T	BS EN/EN61000-4-4 INPUT:2KV	I/P: 400VDC/800 VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> 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°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> 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 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 800 VDC O/P : FULL LOAD Ta= 50 °C																																														
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 25 °C</th> <th>HIGH AMBIENT Ta= 50 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>RTH1</td><td>42.7°C</td><td>64.9°C</td></tr> <tr><td>2</td><td>R5</td><td>38.9°C</td><td>62.2°C</td></tr> <tr><td>3</td><td>ZNR3</td><td>43.0°C</td><td>65.9°C</td></tr> <tr><td>4</td><td>C10</td><td>39.9°C</td><td>63.1°C</td></tr> <tr><td>5</td><td>BD1</td><td>50.6°C</td><td>72.5°C</td></tr> <tr><td>6</td><td>LF2</td><td>45.1°C</td><td>68.4°C</td></tr> <tr><td>7</td><td>LF3</td><td>46.3°C</td><td>69.0°C</td></tr> <tr><td>8</td><td>C5</td><td>40.6°C</td><td>64.6°C</td></tr> <tr><td>9</td><td>C18</td><td>52.5°C</td><td>74.2°C</td></tr> <tr><td>10</td><td>C71</td><td>58.4°C</td><td>80.5°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 50 °C	1	RTH1	42.7°C	64.9°C	2	R5	38.9°C	62.2°C	3	ZNR3	43.0°C	65.9°C	4	C10	39.9°C	63.1°C	5	BD1	50.6°C	72.5°C	6	LF2	45.1°C	68.4°C	7	LF3	46.3°C	69.0°C	8	C5	40.6°C	64.6°C	9	C18	52.5°C	74.2°C	10	C71	58.4°C	80.5°C
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3	ZNR3	43.0°C	65.9°C																																													
4	C10	39.9°C	63.1°C																																													
5	BD1	50.6°C	72.5°C																																													
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9	C18	52.5°C	74.2°C																																													
10	C71	58.4°C	80.5°C																																													





		NO	Position	ROOM AMBIENT Ta= 25 °C	HIGH AMBIENT Ta= 50 °C
		11	C56	59.3°C	81.4°C
		12	T1 coil	62.3°C	83.9°C
		13	T1 core	63.1°C	85.1°C
		14	D10	64.4°C	85.4°C
		15	TSW1	64.5°C	86.6°C
		16	Q10	37.5°C	61.5°C
		17	T3	47.4°C	71.6°C
		18	U1	58.8°C	81.6°C
		19	U200	57.2°C	79.2°C
		20	C107	56.7°C	80.0°C
		21	C108	56.6°C	78.7°C
		22	LF100	56.7°C	79.1°C
		23	C114	52.4°C	75.2°C
		24	RY1	63.0°C	84.1°C
		25	U2	55.0°C	77.0°C
		26	R48	58.7°C	79.1°C
		27	R232	60.6°C	82.1°C
		28	Q1	55.8°C	74.0°C
		29	Q2	62.2°C	79.4°C
		30	Q3	55.1°C	75.7°C
		31	Q4	57.8°C	76.8°C
		32	Q11	61.5°C	82.5°C
		33	R46	66.7°C	87.2°C
		34	R54	60.5°C	80.2°C
		35	Q101	58.5°C	81.7°C
		36	Q102	59.0°C	81.6°C
		37	C15	61.6°C	82.5°C
		38	U4	38.5°C	62.8°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )		I/P : 800 VDC O/P : 119 %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 50 °C/95 %R.H NO DAMAGE		I/P : 1500 VDC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C(0~50°C)		I/P : 800 VDC O/P : FULL LOAD	± 0.0011 %/°C(0~50°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	-40~50°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: 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°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C107 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= 50 °C LIFE TIME (3) I/P : 800VDC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 800VDC O/P : 50% LOAD Ta= 50 °C 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°C); 1596.3 hrs min. Telcordia TR/SR-332 (Bellcore) (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