



Test Report: DDRH-60-48

60W 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

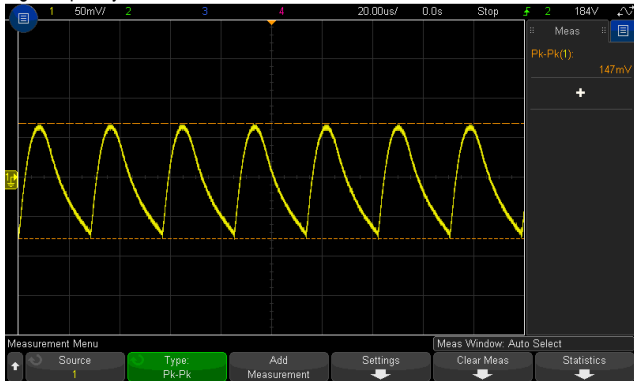
ENVIRONMENT TEST

DESIGN VERIFY TEST

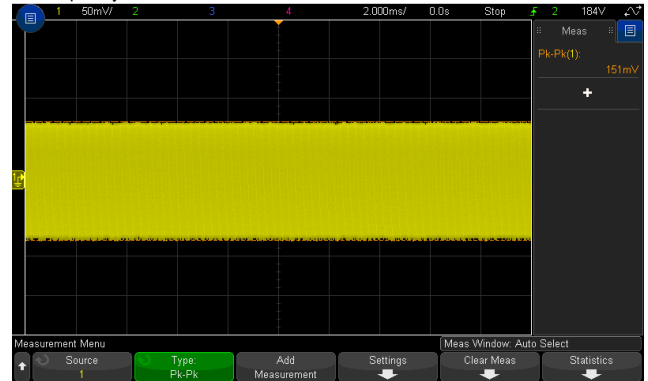
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 48 V~ 54 V	I/P : 1500VDC I/P : 600VDC I/P : 400VDC O/P : MIN LOAD Ta : 25°C	43.76V~55.27V/ 1500 VDC 43.78V~55.27V/ 600 VDC 43.78V~55.27V/ 400 VDC
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -1.0%~+1.0 %	I/P: 150 VDC~1500 VDC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.11%~0.15 %
3	LINE REGULATION (Max)	V1: -0.5%~+0.5 %	I/P: 150 VDC~1500 VDC O/P:FULL LOAD Ta:25°C	V1: -0.11%~ 0.15 %
4	LOAD REGULATION (Max)	V1: -0.5%~ +0.5 %	I/P: 600VDC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.07%~0.13 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 600 VDC O/P:FULL LOAD Ta:25°C	TEST: 0.4%
6	RIPPLE & NOISE (Max)	V1: 200mVp-p	I/P: 600 VDC O/P:FULL LOAD Ta:25°C	V1: 151 mVp-p

high frequency :

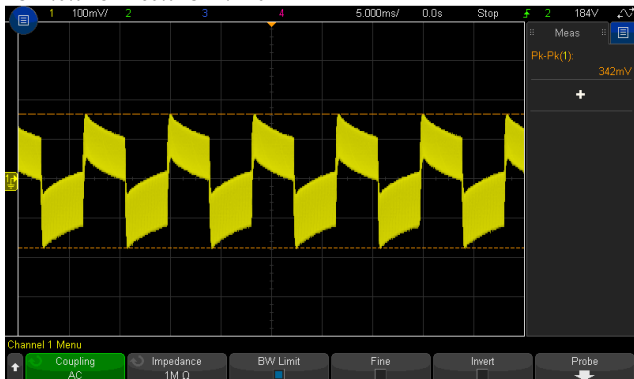


low frequency :

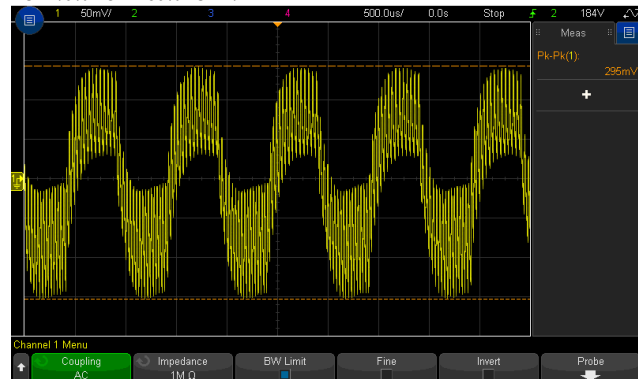


7	DYNAMIC LOAD	V1: 4800 mVp-p	I/P: 600VDC O/P: (1)FULL /0% LOAD 50%DUTY / 120HZ (2)FULL /0% LOAD 50%DUTY / 1KHZ Ta:25°C	342mVp-p 295mVp-p
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FULL /0% LOAD 50%DUTY / 120HZ



FULL /0% LOAD 50%DUTY / 1KHZ



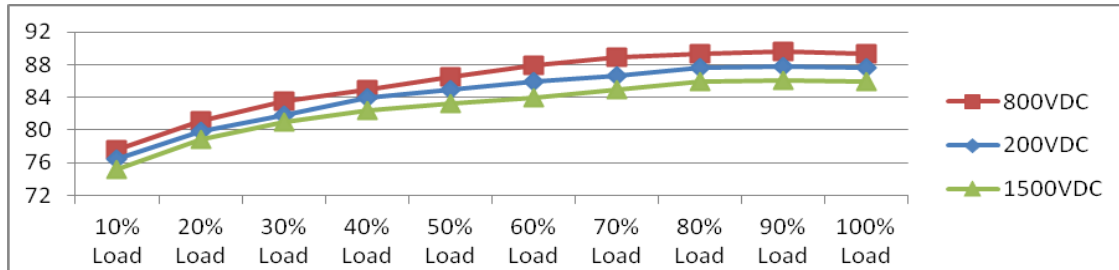


8	TRANSIENT RECOVERY TIME	V1: 4800 mVp-p	I/P: 600VDC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	308 mVp-p
9	EXERNAL CAPACITANCE LOAD(Max.)	1000uF	I/P : 600VDC O/P : NO LOAD Ta : 25°C	OK

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	150VDC~ 1500 VDC	I/P:TESTING O/P:FULL LOAD Ta:25°C	141.5V~ 1500 V
			I/P: LOW-LINE-0.2= 198.2 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 <u>OK</u>
2	EFFICIENCY(TYP)	87%/200VDC	I/P: 200VDC	87.65%/200VDC
		88%/800VDC	I/P: 800VDC	89.38%/800VDC
		83%/1500VDC	I/P: 1500VDC O/P:FULL LOAD Ta:25°C	85.94%/1500VDC

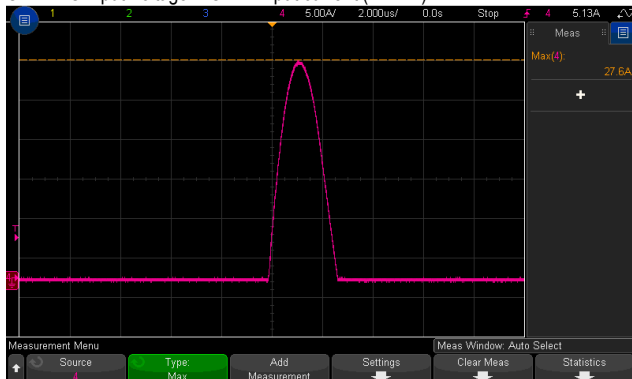
EFFICIENCY vs LOAD



3	INRUSH CURRENT(TYP)	30A/150VDC 80A/800VDC 120A/1500VDC COLD START	I/P: 150VDC I/P: 800VDC I/P: 1500VDC O/P:FULL LOAD Ta:25°C	I=27.6A/ 150VDC I=57.7A/ 800VDC I=102.5A/ 1500VDC
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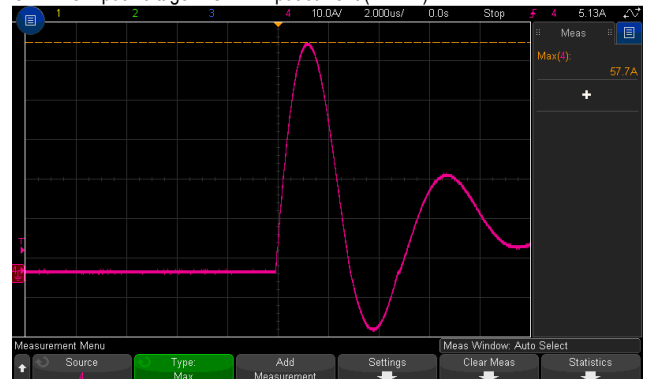
INPUT=150VDC @ FULL LOAD

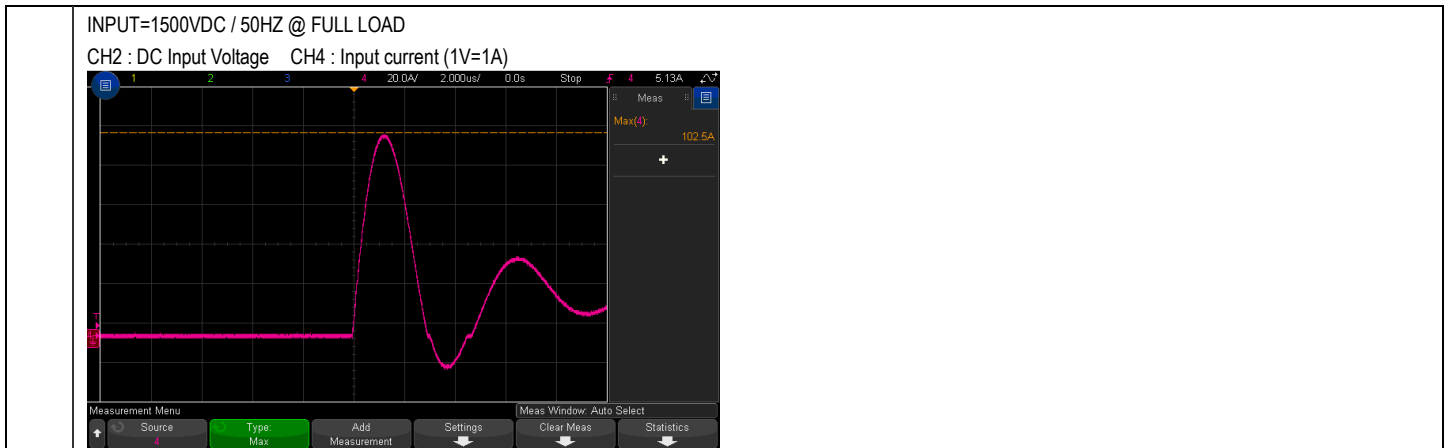
CH2 : DC Input Voltage CH4 : Input current (1V=1A)



INPUT=800VDC / 50HZ @ FULL LOAD

CH2 :DC Input Voltage CH4 : Input current (1V=1A)





PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~ 135 % RATED OUTPUT POWER	I/P: 200VDC I/P: 600VDC I/P: 1500VDC O/P: TESTING Ta:25°C	120.0%/ 200 VDC 122.4%/ 600 VDC 118.8%/ 1500 VDC PROTECTION TYPE : Hiccup mode when output voltage < 55%, recovers automatically after fault condition is remove; constant current limiting within 55-100% rated output voltage · recovers automatically after fault condition is remove
2	OVER VOLTAGE PROTECTION	CH: 55 V~ 60 V PROTECTION TYPE : Hiccup mode , recovers automatically after fault condition is removed	I/P: 150VDC I/P: 600VDC I/P: 1500VDC O/P: MIN LOAD Ta:25°C	58.1V/ 150 VDC 58.1V/ 600 VDC 58.1V/ 1500 VDC PROTECTION TYPE : Hiccup mode , recovers automatically after fault condition is removed
3	OVER TEMPERATURE PROTECTION	PROTECTION TYPE : Hiccup mode , recovers automatically after fault condition is removed	I/P: 150VDC I/P: 1500VDC O/P: FULL LOAD	O.T.P. Active PROTECTION TYPE : Hiccup mode , recovers automatically after fault condition is removed
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE PROTECTION TYPE : Hiccup mode , recovers automatically after fault condition is removed	I/P: 150VDC I/P: 1500VDC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Hiccup mode , recovers automatically after fault condition is removed
5	INPUT UNDER VOLTAGE	PROTECTION RANGE: 120 V~ 130 V RELEASE RANGE: 130 V~146.5 V NO DAMAGE	INPUT: TESTING O/P: MIN LOAD Ta:25°C	INPUT: 132.2V RELEASE: 145.4V NO DAMAGE PROTECTION TYPE : Hiccup mode , recovers automatically after fault condition is removed
6.	REVERSE POLARITY	NO DAMAGE	I/P: 1500 VDC O/P: FULL LOAD Ta:25°C	NO DAMAGE



CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
7	DC OK SIGNAL	30VDC/1A RESISTIVE LOAD	I/P:600VDC O/P:FULL LOAD Ta:25°C	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 Rated : 8A/ 950 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 VDS: (1) 632V (2) 616V (3) 632V (4) 637V (5) 641V (6) 637V (7) 608V Q3 VDS: (1) 744V (2) 776V (3) 744V (4) 744V (5) 752V (6) 744V (7) 768V
4	Diode Peak Voltage	Q100 Rated : 8 A/ 800 V	DC ON/OFF I/P:High-Line +3V =1503 V 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 Ta:25°C	Q101: VDS: (1) 599V (2) 616V (3) 599V (4) 599V (5) 599V (6) 599V (7) 609V (8) 599V
5	Diode Peak Voltage	Q10 Rated : 0.1A/ 1500 V	DC ON/OFF I/P:High-Line +3V =1503 V O/P: (1)Full Load (2)Output Short (3) NO LOAD Ta:25°C	(1) 1.218KV (2) 1.218KV (3) 1.202KV
6	Input Capacitor Voltage	C5 / C6/ C7 Rated: : 22 μ / 550 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 (1) 500V (2) 500V (3) 492V (4) 492V C7 (1) 508V (2) 504V (3) 508V (4) 508V



				C6 (1) 504V (2) 500V (3) 504V (4) 504V	
7	Control IC Voltage Test	PWM IC U1 Rated -0.3V~ 28 V O/P IC U200 Rated -0.3 V~ 38 V	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°C	U1 (1) 17.1V (2) 17.3V (3) 17.7V (4) 17.3V (5) 17.1V	U200 (1) 27.1V (2) 27.1V (3) 27.1V (4) 35.4V (5) 26.6V
8	Clamp Diode Peak Voltage	D1 / D2 / D3 Rated : 1000V / 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°C	D1 (1) 555V (2) 539V D2 (1) 551 V (2) 551V	D3 (1) 567 V (2) 563V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P:4KVAC/min O/P-DC OK:0.5KVAC/min	I/P-O/P: 4.4 KVAC/min O/P-DC OK:0.6KVAC/min Ta:25°C	I/P-O/P: 5.67mA O/P-DC OK: 0.005mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ	I/P-O/P: 600 VDC Ta:25°C	I/P-O/P: 9999MΩ NO DAMAGE

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	EN55032 CLASS A	I/P: 400/800 VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
2	CONDUCTION	EN55032 CLASS A	I/P: 400/800 VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 LEVEL 3 AIR: 8KV / Contact: 4KV	I/P: 400/ 800 VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
4	E.F.T	EN61000-4-4 LEVEL 3 INPUT:2KV	I/P: 400/800 VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
5	SURGE	IEC61000-4-5 LEVEL 4 Vin+-Vin:-2KV	I/P: 400/800 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-60-24 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 600 VDC O/P : FULL LOAD Ta= 25.4 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 600 VDC O/P : FULL LOAD Ta= 60.7 °C																																																																																																																						
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 25.4 °C</th> <th>HIGH AMBIENT Ta= 60.7 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>L1</td><td>41.8°C</td><td>75.9°C</td></tr> <tr><td>2</td><td>RTH1</td><td>46.9°C</td><td>80.1°C</td></tr> <tr><td>3</td><td>C2</td><td>46.3°C</td><td>79.9°C</td></tr> <tr><td>4</td><td>LF2</td><td>49.0°C</td><td>82.6°C</td></tr> <tr><td>5</td><td>BD1</td><td>47.5°C</td><td>81.3°C</td></tr> <tr><td>6</td><td>Q10</td><td>50.2°C</td><td>83.0°C</td></tr> <tr><td>7</td><td>C5</td><td>57.1°C</td><td>89.9°C</td></tr> <tr><td>8</td><td>C6</td><td>53.8°C</td><td>86.7°C</td></tr> <tr><td>9</td><td>Q1</td><td>55.1°C</td><td>88.3°C</td></tr> <tr><td>10</td><td>Q3</td><td>53.8°C</td><td>86.8°C</td></tr> <tr><td>11</td><td>D1</td><td>54.9°C</td><td>88.2°C</td></tr> <tr><td>12</td><td>D3</td><td>59.0°C</td><td>94.9°C</td></tr> <tr><td>13</td><td>T3</td><td>51.4°C</td><td>84.3°C</td></tr> <tr><td>14</td><td>Q70</td><td>49.8°C</td><td>82.5°C</td></tr> <tr><td>15</td><td>C56</td><td>55.9°C</td><td>88.9°C</td></tr> <tr><td>16</td><td>U1</td><td>53.0°C</td><td>86.3°C</td></tr> <tr><td>17</td><td>T1coil</td><td>62.3°C</td><td>95.1°C</td></tr> <tr><td>18</td><td>T1core</td><td>60.7°C</td><td>94.0°C</td></tr> <tr><td>19</td><td>Q100</td><td>61.1°C</td><td>93.7°C</td></tr> <tr><td>20</td><td>C71</td><td>53.5°C</td><td>86.9°C</td></tr> <tr><td>21</td><td>C106</td><td>55.1°C</td><td>87.7°C</td></tr> <tr><td>22</td><td>C107</td><td>53.8°C</td><td>86.5°C</td></tr> <tr><td>23</td><td>C113</td><td>48.2°C</td><td>80.9°C</td></tr> <tr><td>24</td><td>LF100</td><td>49.5°C</td><td>81.8°C</td></tr> <tr><td>25</td><td>U2</td><td>54.9°C</td><td>87.6°C</td></tr> <tr><td>26</td><td>U200</td><td>55.0°C</td><td>87.2°C</td></tr> <tr><td>27</td><td>D10</td><td>56.7°C</td><td>89.5°C</td></tr> <tr><td>28</td><td>C3</td><td>51.5°C</td><td>84.1°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 25.4 °C	HIGH AMBIENT Ta= 60.7 °C	1	L1	41.8°C	75.9°C	2	RTH1	46.9°C	80.1°C	3	C2	46.3°C	79.9°C	4	LF2	49.0°C	82.6°C	5	BD1	47.5°C	81.3°C	6	Q10	50.2°C	83.0°C	7	C5	57.1°C	89.9°C	8	C6	53.8°C	86.7°C	9	Q1	55.1°C	88.3°C	10	Q3	53.8°C	86.8°C	11	D1	54.9°C	88.2°C	12	D3	59.0°C	94.9°C	13	T3	51.4°C	84.3°C	14	Q70	49.8°C	82.5°C	15	C56	55.9°C	88.9°C	16	U1	53.0°C	86.3°C	17	T1coil	62.3°C	95.1°C	18	T1core	60.7°C	94.0°C	19	Q100	61.1°C	93.7°C	20	C71	53.5°C	86.9°C	21	C106	55.1°C	87.7°C	22	C107	53.8°C	86.5°C	23	C113	48.2°C	80.9°C	24	LF100	49.5°C	81.8°C	25	U2	54.9°C	87.6°C	26	U200	55.0°C	87.2°C	27	D10	56.7°C	89.5°C	28	C3	51.5°C	84.1°C
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 600 VDC O/P : 121% LOAD Ta : 25°C	TEST : OK																																																																																																																				
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 200 VDC / 1500 VDC O/P : 100 % LOAD Ta= -30 °C	TEST : OK																																																																																																																				
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 55 °C /95 %R.H NO DAMAGE	I/P : 1503 VDC O/P : FULL LOAD Ta= 60.7 °C HUMIDITY= 95 %R.H	TEST : OK																																																																																																																				
5	TEMPERATURE COEFFICIENT	±0.03%/°C (0-55°C)	I/P : 600VDC O/P : FULL LOAD	± 0.012%/°C (0-55°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	-30~55°C	1. Thermal shock Temperature : -35°C~ +60°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: 600 VDC / FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle: 600 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 : 3G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C106 IS THE MOST CRITICAL COMPONENT (1) I/P : 600VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 600VDC O/P : FULL LOAD Ta= 55 °C LIFE TIME (3) I/P : 600VDC O/P : 75% LOAD Ta= 55 °C LIFE TIME (4) I/P : 600VDC O/P : 50% LOAD Ta= 55 °C LIFE TIME	(1) 232495.8HRS (2) 35043.2HRS (3) 50896.2HRS (4) 71189.8HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1439.7K hrs min. Telcordia TR/SR-332 (Bellcore) ; 454.5K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 600VDC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		Wangdz

2018.4.30 GP-A50-F010