



Test Report: DDRH-60-24

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

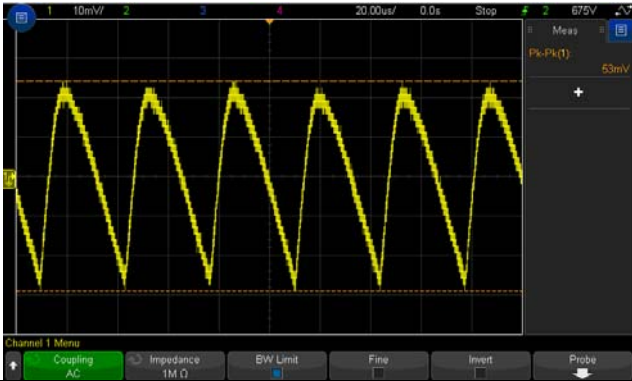
ENVIRONMENT TEST

DESIGN VERIFY TEST

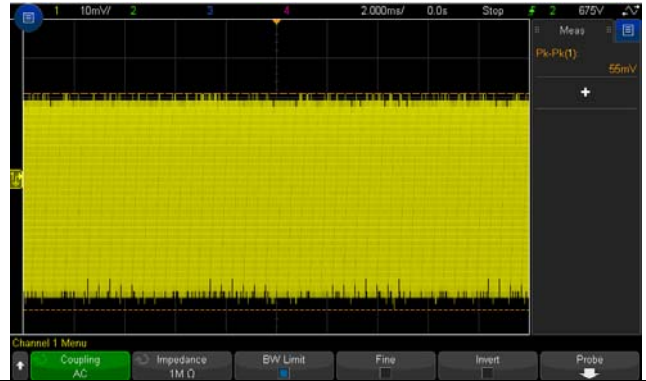
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 24 V~ 29 V	I/P : 1500VDC I/P : 800VDC I/P : 400VDC O/P : MIN LOAD Ta : 25°C	23.29V~30.08V/ 1500 VDC 23.29V~30.08V/ 800 VDC 23.28V~30.08V/ 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:-0.14%~ 0.17%
3	LINE REGULATION (Max)	V1: -0.5%~+0.5 %	I/P: 150 VDC~1500 VDC O/P:FULL LOAD Ta:25°C	V1:-0.01%~ 0.16 %
4	LOAD REGULATION (Max)	V1: -0.5%~ +0.5 %	I/P: 800VDC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.14%~ 0.17%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 800 VDC O/P:FULL LOAD Ta:25°C	TEST: 1.3%
6	RIPPLE & NOISE (Max)	V1: 150mVp-p	I/P: 800 VDC O/P:FULL LOAD Ta:25°C	V1: 55mVp-p

high frequency :

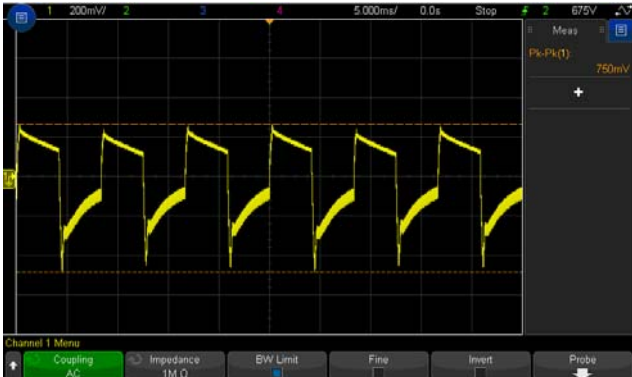


low frequency :

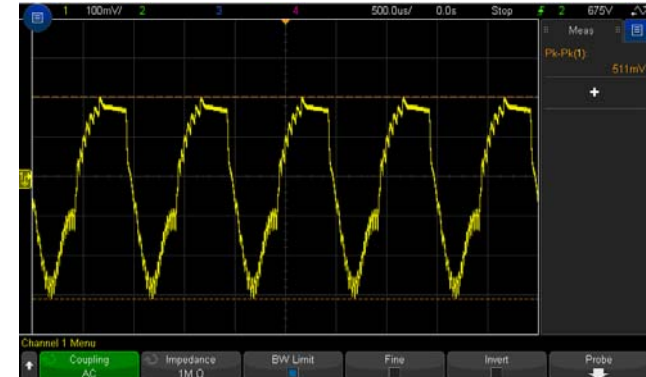


7	DYNAMIC LOAD	V1: 2400 mVp-p	I/P: 800VDC O/P: (1)FULL /0% LOAD 50%DUTY / 120HZ (2)FULL /0% LOAD 50%DUTY / 1KHZ Ta:25°C	750mVp-p 511mVp-p
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FULL /0% LOAD 50%DUTY / 120HZ



FULL /0% LOAD 50%DUTY / 1KHZ

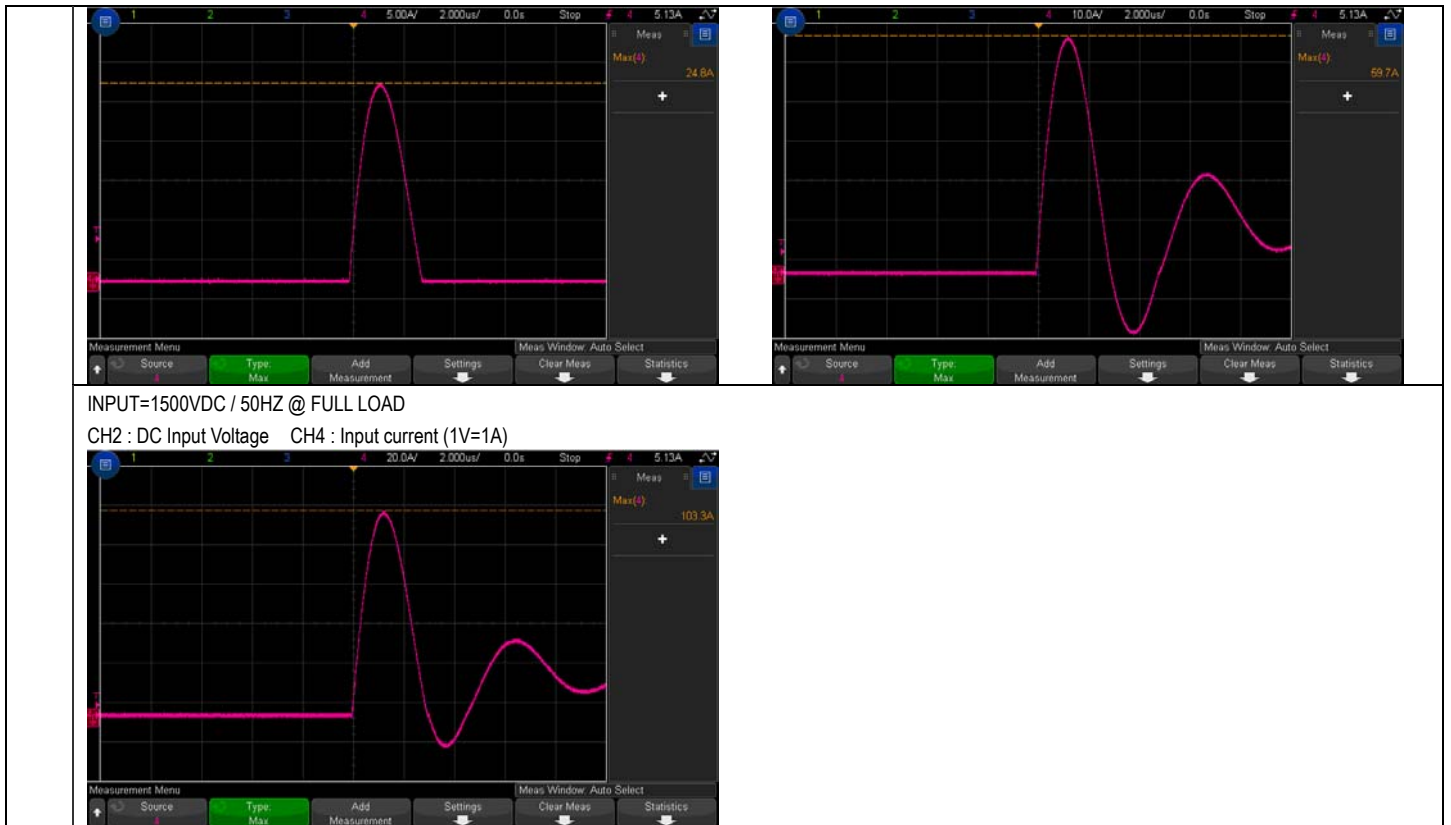




8	TRANSIENT RECOVERY TIME	V1: 2400 mVp-p	I/P: 800VDC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	197mVp-p
9	EXERNAL CAPACITANCE LOAD(Max.)	2500uF	I/P : 800VDC O/P : NO LOAD Ta : 25°C	OK

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	141V~ 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)	86%/200VDC 87%/800VDC 84%/1500VDC	I/P: 200VDC	86.4%/200VDC																																												
			I/P: 800VDC I/P: 1500VDC O/P:FULL LOAD Ta:25°C	87.9%/800VDC 84.8%/1500VDC																																												
EFFICIENCY vs LOAD <table border="1"> <caption>Efficiency vs Load Data (Approximate)</caption> <thead> <tr> <th>Load (%)</th> <th>800VDC (%)</th> <th>200VDC (%)</th> <th>1500VDC (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>78</td><td>76</td><td>74</td></tr> <tr><td>20%</td><td>81</td><td>79</td><td>77</td></tr> <tr><td>30%</td><td>83</td><td>81</td><td>79</td></tr> <tr><td>40%</td><td>84</td><td>82</td><td>80</td></tr> <tr><td>50%</td><td>85</td><td>83</td><td>81</td></tr> <tr><td>60%</td><td>86</td><td>84</td><td>82</td></tr> <tr><td>70%</td><td>87</td><td>85</td><td>83</td></tr> <tr><td>80%</td><td>87.9</td><td>86</td><td>84</td></tr> <tr><td>90%</td><td>88</td><td>86.5</td><td>84.5</td></tr> <tr><td>100%</td><td>88</td><td>86.5</td><td>84.5</td></tr> </tbody> </table>					Load (%)	800VDC (%)	200VDC (%)	1500VDC (%)	10%	78	76	74	20%	81	79	77	30%	83	81	79	40%	84	82	80	50%	85	83	81	60%	86	84	82	70%	87	85	83	80%	87.9	86	84	90%	88	86.5	84.5	100%	88	86.5	84.5
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90%	88	86.5	84.5																																													
100%	88	86.5	84.5																																													
3	INRUSH CURRENT(TYP)	30A/150VDC 80A/800VDC 120A/1500VDC COLD START	I/P: 150VDC	I=24.8A/ 150VDC																																												
			I/P: 800VDC I/P: 1500VDC O/P:FULL LOAD Ta:25°C	I=59.7A/ 800VDC I=103.3A/ 1500VDC																																												
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: 800VDC I/P: 1500VDC O/P: TESTING Ta:25°C	117.6%/ 200 VDC 120.0%/ 800 VDC 118.0%/ 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: 30 V~ 38 V PROTECTION TYPE : Hiccup mode , recovers automatically after fault condition is removed	I/P: 150VDC I/P: 800VDC I/P: 1500VDC O/P: MIN LOAD Ta:25°C	34.6V/ 150 VDC 34.6V/ 800 VDC 34.6V/ 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: 130 V~ 140 V O/P:MIN LOAD Ta:25°C	PROTECTION VOLTAGE: 128V RELEASE VOLTAGE: 141V NO DAMAGE
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:800VDC 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) 665V (2) 894V (3) 665V (4) 665V (5) 665V (6) 673V (7) 690V Q2 VDS: (1) 665V (2) 826V (3) 673V (4) 665V (5) 665V (6) 665V (7) 673V Q3 VDS: (1) 690V (2) 883V (3) 690V (4) 690V (5) 681V (6) 690V (7) 762V
4	Diode Peak Voltage	Q100 Rated : 10 A/ 600 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	VDS: (1) 365V (2) 378V (3) 353V (4) 349V (5) 378V (6) 369V (7) 333V (8) 309VV



			Ta:25°C	
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) 1.196KV (2)1.212 KV (3) 1.196KV
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) 498V (2) 498V (3) 498V (4) 498V C6 (1) 502V (2) 498V (3) 502V (4) 502V C7 (1) 502V (2) 506V (3) 506V (4) 502V
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) 17.1V (3) 17.3V (4) 17.1V (5) 17.1V U200 (1) 24.1V (2) 24.3V (3) 24.3V (4) 34.4V (5) 23.9V
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) 594V (2)590 V D2 (1)582 V (2) 582V D3 (1)590V (2) 590V

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: 5.44mA 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: 800 VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab



2	CONDUCTION	EN55032 CLASS A	I/P: 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: 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: 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: 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 : 800 VDC O/P : FULL LOAD Ta= 25.4 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 800 VDC O/P : FULL LOAD Ta= 60.7 °C		



		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
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)		I/P : 800 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 : 800VDC 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: 800 VDC / FULL LOAD AC ON 3sec/AC 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 C106 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= 55 °C LIFE TIME (3) I/P : 800VDC O/P : 75% LOAD Ta= 55 °C LIFE TIME (4) I/P : 800VDC 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 503K hrs min. Telcordia TR/SR-332 (Bellcore) ; 454.5K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 800VDC 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