



Test Report: DDR-480B-12

480W 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

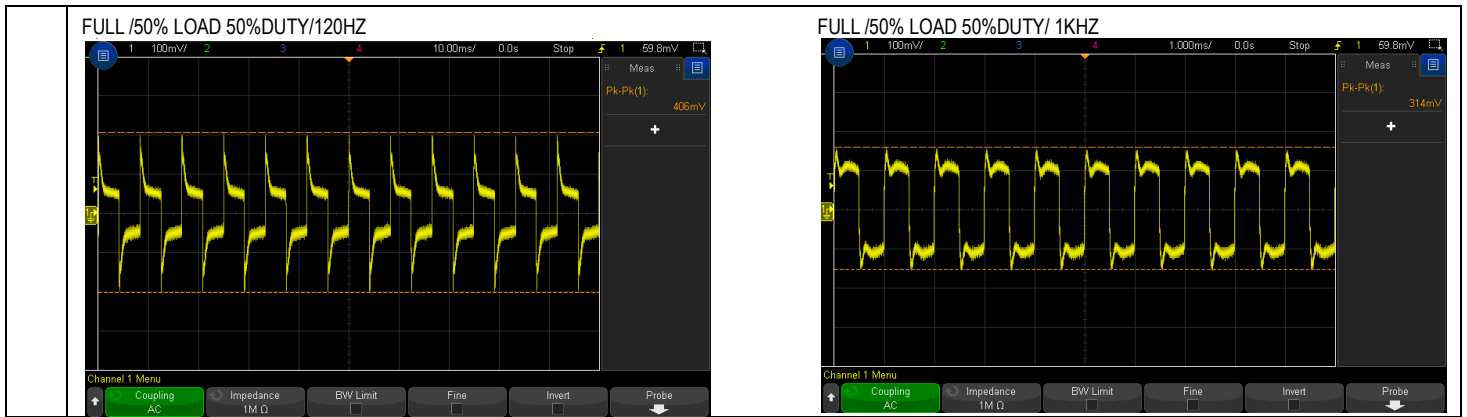
ENVIRONMENT TEST

DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 12V~ 14V	I/P: NORMAL VOLTAGE O/P: MIN LOAD Ta: 25°C	CH1: 11.28~14.40V
2	OUTPUT VOLTAGE TOLERANCE(Max)	V1: -1%~1%	I/P: 16.8 VDC /33.6VDC O/P: FULL / MIN. LOAD Ta: 25°C	V1: -0.54%~0.50%
3	LINE REGULATION(Max)	V1: -0.5%~ 0.5%	I/P: 16.8 VDC /33.6VDC O/P: FULL LOAD Ta: 25°C	V1: -0.22%~0%
4	LOAD REGULATION(Max)	V1: -1%~1%	I/P: 24VDC O/P: FULL ~MIN LOAD Ta: 25°C	V1: -0.54%~0.50%
5	OVER/UNDERSHOOT TEST	<±5%	I/P: 24 VDC O/P: FULL LOAD Ta: 25°C	TEST: 1.69%
6	Peak Loading	601.2W/5sec.	I/P: 24 VDC O/P: 601.2W Ta: 25°C	OK
7	RIPPLE & NOISE (Max)	V1: 100mVp-p	I/P: 24 VDC O/P: FULL LOAD Ta: 25°C	V1: 45mVp-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>				
8	SET UP TIME(Max)	24VDC/500ms	I/P: 24 VDC O/P: FULL LOAD Ta: 25°C	77ms
INPUT=24VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage				

		<p>Roll</p> <p>Cursor</p> <p>Manual</p> <p>X1(1): -7.9200000000000s</p> <p>X2(1): -7.8430000000000s</p> <p>ΔX: 77.000000000ms</p> <p>1/ΔX: 12.987Hz</p> <p>Y1(1): 0.0V</p> <p>Y2(1): 10.8000V</p> <p>ΔY: 10.8000V</p> <p>ΔY/ΔX: 140.260V/s</p> <p>Cursors Menu</p> <p>Mode Manual</p> <p>Source 1</p> <p>Cursors X2</p> <p>Units</p> <p>X1: -7.9200000000000s Y1: 0.0V</p> <p>X2: -7.8430000000000s Y2: 10.8000V</p>		
9	RISE TIME (Max)	24VDC/ 60ms	I/P: 24VDC O/P: FULL LOAD Ta: 25°C	3.01ms
INPUT=24VDC @ FULL LOAD				
CH1 : Output Voltage				
10	HOLD UP TIME (TYP)	24VDC/ 10 ms 24VDC/ 16 ms@70%LOAD	I/P: 24VDC O/P: FULL LOAD/70%LOAD Ta: 25°C	13.2ms@FULL LOAD 19ms@70%LOAD
INPUT=24VDC @ FULL LOAD				
CH1 : Output Voltage CH2 : DC Input Voltage				
INPUT=24VDC @ 70% LOAD				
CH1 : Output Voltage CH2 : DC Input Voltage				
11	TRANSIENT RECOVERY TIME	V1:1200mVp-p	I/P: 24VDC O/P: 40% LOAD CHANGE 50%DUTY/120HZ	326mVp-p
12	DYNAMIC LOAD	V1:1200mVp-p	I/P: 24VDC O/P: (1) FULL /50% LOAD 50%DUTY/120HZ (2) FULL /50% LOAD 50%DUTY/ 1KHZ Ta: 25°C	406mVp-p/120HZ 314mVp-p/1KHZ



INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																												
1	INPUT VOLTAGE RANGE	16.8VDC~33.6 VDC 14.4VDC~16.8 VDC ≥ 100ms	I/P: TESTING O/P: FULL LOAD Ta: 25°C	(1) 15.186V~ 33.6V (2) TEST : OK																																												
			I/P: LOW-LINE-0.2=16.6V HIGH-LINE+1V=34.6V O/P: FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec . OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST : OK																																												
2	INPUT CURRENT(TYP)	24VDC/23 A	I/P: 24VDC O/P: FULL LOAD Ta: 25°C	I = 18.09A																																												
3	EFFICIENCY(TYP)	90%	I/P: 24VDC O/P: FULL LOAD Ta: 25°C	90.24%																																												
<p>EFFICIENCY vs LOAD</p> <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>Load (%)</th> <th>21.6VDC (%)</th> <th>24VDC (%)</th> <th>33.6VDC (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>85</td><td>82</td><td>84</td></tr> <tr><td>20%</td><td>89</td><td>87</td><td>88</td></tr> <tr><td>30%</td><td>90</td><td>89</td><td>90</td></tr> <tr><td>40%</td><td>91</td><td>90</td><td>91</td></tr> <tr><td>50%</td><td>91</td><td>90</td><td>91</td></tr> <tr><td>60%</td><td>90</td><td>90</td><td>90</td></tr> <tr><td>70%</td><td>90</td><td>89</td><td>90</td></tr> <tr><td>80%</td><td>89</td><td>89</td><td>89</td></tr> <tr><td>90%</td><td>89</td><td>89</td><td>89</td></tr> <tr><td>100%</td><td>88</td><td>88</td><td>88</td></tr> </tbody> </table>					Load (%)	21.6VDC (%)	24VDC (%)	33.6VDC (%)	10%	85	82	84	20%	89	87	88	30%	90	89	90	40%	91	90	91	50%	91	90	91	60%	90	90	90	70%	90	89	90	80%	89	89	89	90%	89	89	89	100%	88	88	88
Load (%)	21.6VDC (%)	24VDC (%)	33.6VDC (%)																																													
10%	85	82	84																																													
20%	89	87	88																																													
30%	90	89	90																																													
40%	91	90	91																																													
50%	91	90	91																																													
60%	90	90	90																																													
70%	90	89	90																																													
80%	89	89	89																																													
90%	89	89	89																																													
100%	88	88	88																																													
4	INRUSH CURRENT(TYP)	24VDC/30 A COLD START	I/P: 24VDC O/P: FULL LOAD Ta: 25°C	26A																																												
	INPUT=24VDC @ FULL LOAD CH4 : Input current																																															

5	INTERRUPTION OF VOLTAGE SUPPLY	COMPLY WITH S2 LEVEL (10ms)	I/P: 24VDC O/P: FULL LOAD Ta: 25°C	12.6ms

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~135% RATED OUTPUT POWER	I/P: 21.6VDC I/P: 24VDC I/P: 33.6VDC O/P: TESTING PEAK LOAD (5S) Ta: 25°C	123.44% / 21.6VDC 123.11% / 24VDC 122.69% / 33.6VDC PROTECTION TYPE : Normally works within 150% rated output power for more than 5 seconds and then constant current protection 105%~135% rated output power with auto-recovery.
2	OVER VOLTAGE PROTECTION	CH: 14.4 V~17.5V	I/P: 16.8VDC I/P: 24VDC I/P: 33.6VDC O/P: MIN LOAD Ta: 25°C	15.8V 16.8VDC 15.8V 24VDC 15.8V 33.6VDC PROTECTION TYPE : Shut down O/P voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	SPEC: Shut down O/P voltage, re-power on to recover	I/P: 33.6 / 21.6VDC O/P: FULL LOAD Ta: 25°C	O.T.P. Active PROTECTION TYPE : Shut down O/P voltage, re-power on to recover
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 33.6 / 21.6VDC O/P: FULL LOAD Ta: 25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting with auto-recovery recovers automatically after fault condition is removed.
5	INPUT REVERSE	POWER OK	I/P: 33.6 / 21.6VDC O/P: FULL LOAD Ta: 25°C	NO DAMAGE
6	INPUT UNDER VOLTAGE PROTECTION	24 VIN (B-TYPE) : POWER ON >=16.8V POWER OFF <=16.5V	I/P: TESTING O/P: FULL LOAD Ta: 25°C	POWER ON >=15.198V POWER OFF <=14.995V

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
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1	REMOTE ON/OFF CONTROL	I/P: 24VDC O/P: FULL LOAD Ta: 25°C		
		Remote ON-OFF (TB1 PIN2,4)	Power Supply Status	
		Open or 5.5~10VDC	ON	2.32VDC
		Short or 0~0.8VDC	OFF	0.87VDC
2	DC OK CONTACT RATINGS	30VDC/1A RESISTIVE LOAD	I/P: 24VDC 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	Q 8/Q19 Rated : 100 A/ 100 V Q12/Q17 Rated : 100 A/ 100 V	DC ON/OFF I/P: High-Line +1V =34.6V 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	Q17 VDS: (1) 58.4V (2) 65.2V (3) 72.8V (4) 70.2V (5) 63.7V (6) 60.9V (7) 64.7V Q8 VDS: (1) 58.9V (2) 66.2V (3) 76.8V (4) 75.2V (5) 69.6V (6) 62.9V (7) 65.1V Q12 VDS: (1) 58.4V (2) 61.6V (3) 69.3V (4) 66.1V (5) 60.4V (6) 61.2V (7) 61.4V Q19 VDS: (1) 58.5V (2) 62.5V (3) 74.4V (4) 69.6V (5) 65.3V (6) 61.7V (7) 63.1V
2	Clamp MOSFET (D to S) or (C to E) Peak Voltage	Q20/Q4 Rated : 73 A/ 100 V	DC ON/OFF I/P: High-Line +1V =34.6V 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	Q20 VDS: (1) 53.0V (2) 53.0V (3) 73.7V (4) 68.6V (5) 65.8V (6) 64.6V (7) 62.2V Q4 VDS: (1) 49.7V (2) 53.0V (3) 69.8V (4) 67.0V (5) 60.2V (6) 63.8V (7) 63.0V
3	Diode Peak Voltage	Q101 Rated : 100 A/ 120V Q105 Rated : 100 A/ 120V Q200 Rated	DC ON/OFF I/P: High-Line +1V =34.6 V VOmax: O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/	Q101: VOmax: VDS: (1) 87.5V (2) 85.9V (3) 89.9V Q200: VOmax: VDS: (1) 65.1V (2) 65.1V (3) 87.5V



		<p>: 100 A/ 120V</p> <p>Q203 Rated</p> <p>: 100 A/ 120V</p>	<p>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</p> <p>VO: O/P: (1)Full Load</p> <p>Ta:25°C</p>	<p>(4) 89.1V (5) 89.1V (6) 87.5V (7) 62.7V (8) 59.0V</p> <p>VO: (1) 69.9V</p> <p>Q105: VOmax: VDS: (1) 93.1V (2) 93.1V (3) 93.1V (4) 93.9V (5) 93.9V (6) 94.8V (7) 93.9V (8) 92.3V</p> <p>VO: (1) 91.5V</p>	<p>(4) 87.5V (5) 81.1V (6) 83.5V (7) 56.6V (8) 50.6V</p> <p>VO: (1) 58.6V</p> <p>Q203: VOmax: VDS: (1) 97.2V (2) 96.4V (3) 97.2V (4) 100.4V (5) 97.3V (6) 102.8V (7) 100.4V (8) 98.0V</p> <p>VO: (1) 94.8V</p>
4	Input Capacitor Voltage	<p>C20/C28 Rated: : 2200 μ/ 35V</p>	<p>I/P:High-Line +1V =34.6V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue</p> <p>Ta:25°C</p>	<p>C20 (1) 34.5V (2) 34.3V (3) 34.3V (4) 33.9V</p>	<p>C28 (1) 34.1V (2) 34.1V (3) 34.7V (4) 33.9V</p>
5	Control IC Voltage Test	<p>PWM IC U1 Rated 7.5V~ 15 V/VCC O/PU102/ U104/ U203/ U204Rated -0.3V~ 27 V O/PU100Rated -0.3V~ 32 V</p>	<p>DC ON/OFF I/P:High-Line +1V =34.6 V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(LOW LINE)</p> <p>Ta:25°C</p>	<p>U1 /VCC1/VCC2 (1) 13.18V/13.26V (2) 13.26V /13.34V (3) 13.34V/13.42V (4) 13.26V/13.09V (5) 10.84V/10.92V</p> <p>U102 (1) 10.92V (2) 11.00V (3) 10.92V (4) 11.84V (5) 10.76V</p> <p>U100 (1) 11.65V (2) 11.73V (3) 11.89V (4) 11.81V (5) 11.41V</p>	<p>U104 (1) 10.92V (2) 11.00V (3) 11.00V (4) 10.92V (5) 10.76V</p> <p>U203 (1) 11.08V (2) 11.49V (3) 11.25V (4) 11.17V (5) 10.76V</p> <p>U204 (1) 10.92V (2) 11.41V (3) 11.25V (4) 11.08V (5) 10.76V</p>

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTANDVOLTAGE	<p>I/P-O/P:4KVDC/min I/P-FG:2.5KVDC/min O/P-FG:0.71KVDC/min</p>	<p>I/P-O/P: 4.4KVDC/min I/P-FG: 3KVDC/min O/P-FG:0.852KVDC/min Ta:25°C</p>	<p>I/P-O/P:0.1uA I/P-FG:0.1uA O/P-FG:0.2uA NO DAMAGE</p>

2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 600 VDC I/P-FG: 600VDC O/P-FG: 600VDC Ta:25°C	I/P-O/P:9999MΩ I/P-FG:9999MΩ O/P-FG:9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	3mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	EN55032 CLASS B	I/P: 24VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
2	CONDUCTION	EN55032 CLASS A	I/P:24VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 <input type="checkbox"/> MEDICAL AIR: 15KV / Contact: 8KV <input type="checkbox"/> LIGHT INDUSTRY AIR: 8KV / Contact: 4KV <input checked="" type="checkbox"/> INDUSTRY AIR: 8KV / Contact: 6KV	I/P: 24VDC 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 <input type="checkbox"/> LIGHT INDUSTRY INPUT: 0.5KV <input type="checkbox"/> MEDICAL <input checked="" type="checkbox"/> INDUSTRY INPUT: 2KV	I/P:24VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
5	SURGE	IEC61000-4-5 <input checked="" type="checkbox"/> INDUSTRY L-N :1KV L,N-PE:2KV	I/P: 24VDC 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 : DDR-480B-48 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 24 VDC O/P : FULL LOAD Ta= 26.2 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 24 VDC O/P : FULL LOAD Ta= 60.6 °C		



		NO	Position	ROOM AMBIENT Ta= 26.2 °C	HIGH AMBIENT Ta= 60.6 °C
		1	LF3	74.4°C	116.4°C
		2	C29	57.9°C	98.8°C
		3	T7	61.6°C	103.3°C
		4	U1	53.8°C	96.5°C
		5	T3	74.1°C	117.6°C
		6	Q4	62.5°C	105°C
		7	R23	62.3°C	104.7°C
		8	Q17	69.2°C	111.8°C
		9	T2	73.4°C	117.5°C
		10	L200	81.6°C	124.1°C
		11	Q200	75.3°C	115.6°C
		12	Q202	75.3°C	118.1°C
		13	C204	69.4°C	109.8°C
		14	U101	66.4°C	108.1°C
		15	U100	67.3°C	107.8°C
		16	D210	69.1°C	110.4°C
		17	ZD209	69°C	110.3°C
		18	R203	68°C	108.9°C
		19	Q204	68.5°C	110.3°C
		20	TB1	59.8°C	99.3°C
		21	ZNR1	62.8°C	106.2°C
		22	LF1	67.7°C	109.2°C
		23	LF2	73.2°C	115.8°C
		24	Q6	62.2°C	103°C
		25	Q13	73.1°C	115.2°C
		26	C64	62.4°C	101.8°C
		27	LF4	75.7°C	116.8°C
		28	T8	65.4°C	106.5°C
		29	Q103	75.2°C	95.9°C
		30	T4	76.8°C	118.1°C
		31	Q19	75.1°C	115.5°C
		32	Q8	69.9°C	109.7°C
		33	Q20	72.6°C	113.3°C
		34	R91	66°C	106°C
		35	T1	73.6°C	115.4°C
		36	L101	82.4°C	123.5°C
		37	Q105	77.9°C	107.6°C
		38	C110	68.9°C	108.8°C
		39	C111	67.2°C	106.4°C
		40	ZD109	68.7°C	108.7°C
		41	Q14	69.2°C	109.3°C
		42	D17	75.9°C	116.7°C
		43	D106	68.8°C	108.8°C
		44	TB2	64.2°C	102°C
		45	LF100	69.2°C	108.9°C
		46	RY100	70.6°C	109.1°C
		47	C207	65.5°C	105.1°C
		48	Q22	65.9°C	106.1°C
		49	C65	75.8°C	118.4°C
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)		I/P : 24 VDC O/P : 144% LOAD Ta : 25°C	TEST : OK



3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 21.6VDC /33.6VDC O/P : 100% LOAD Ta= -45°C	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60 °C /95 %R.H NO DAMAGE	I/P : 35VDC O/P : FULL LOAD Ta= 60°C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	± 0.03%/ (0~55°C)	I/P : 24C O/P : FULL LOAD	± 0.0051%/°C (0~55°C)
6	STORAGE TEMPERATURE TEST	-40~85°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	-40~60°C	1. Thermal shock Temperature : -45°C~ +65°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: 24 VDC / FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle: 24 VDC / FULL LOAD Burn In Test	
8	VIBRATION TEST	10 ~ 500Hz, 5G 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 : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C	
9	CAPACITOR LIFE CYCLE	SUPPOSE C111 IS THE MOST CRITICAL COMPONENT (1) I/P : 24VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 24VDC O/P : FULL LOAD Ta= 60 °C LIFE TIME (3) I/P : 24VDC O/P : 75% LOAD Ta= 60 °C LIFE TIME (4) I/P : 24VDC O/P : 50% LOAD Ta= 60 °C LIFE TIME		(1) 364259.9HRS (2) 23084 HRS (3) 63100.7HRS (4) 113321.8HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 750.3 K hrs min. Telcordia SR-332 (Bellcore) ; 101.7K hrs min. MIL-HDBK-217F (25°C)		
11	Ongoing Reliability Test	I/P : 24VDC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30000hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		Wangdz

2018.4.30 GP-A50-F010