Test Report: DDR-480B-48

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

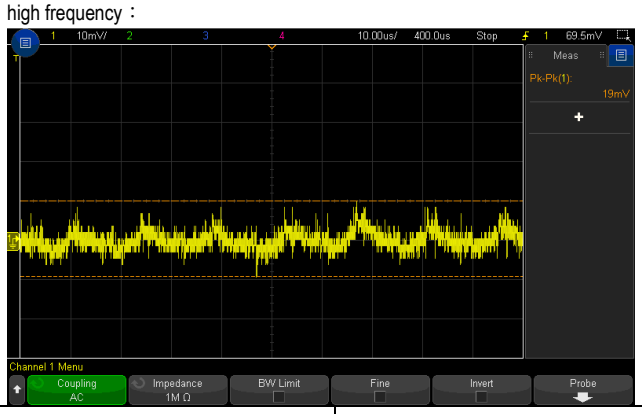
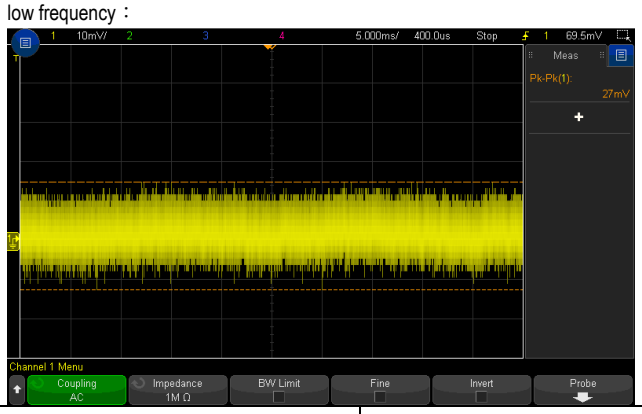
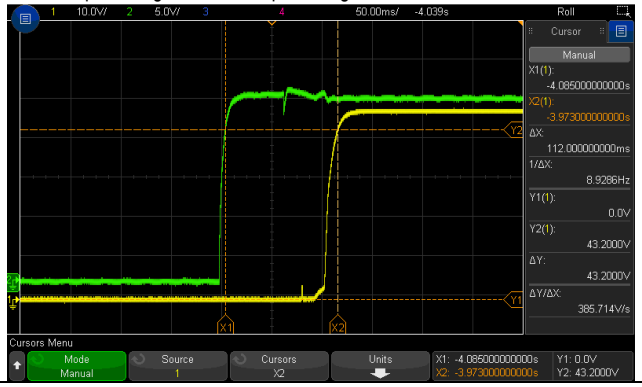
Safety Test
E.M.C. Test

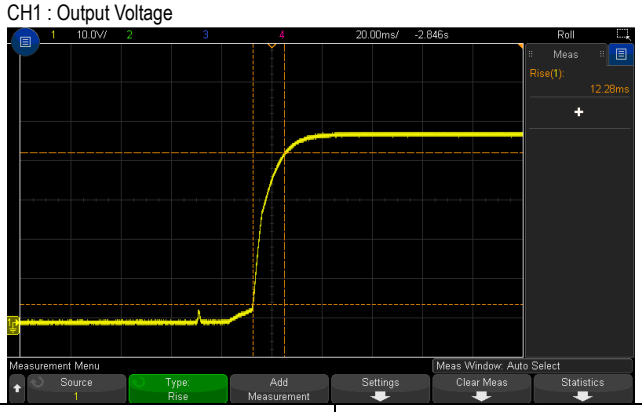
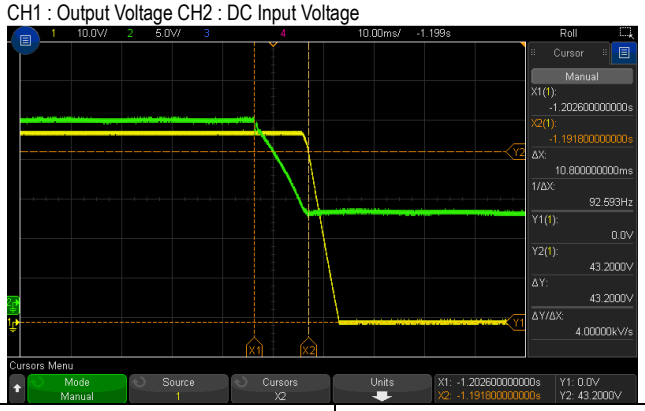
■ RELIABILITY TEST

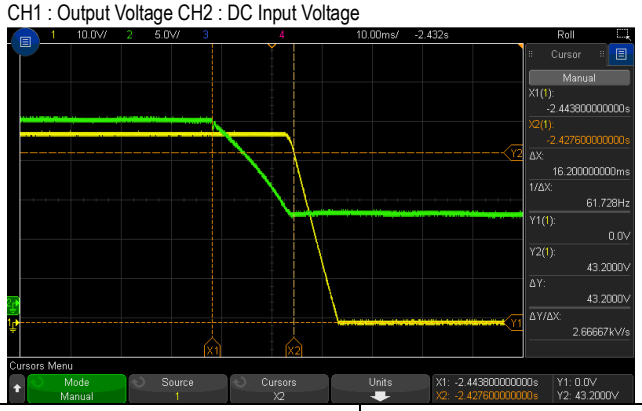
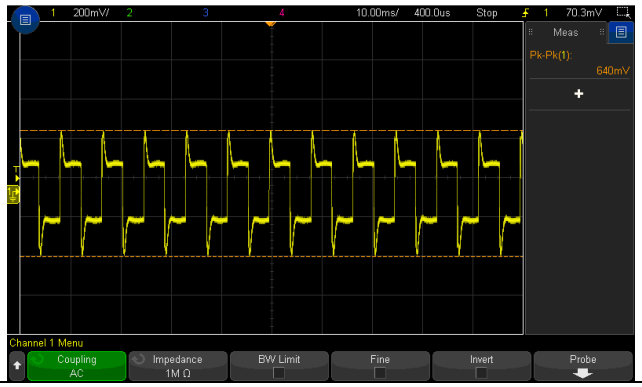
ENVIRONMENT TEST

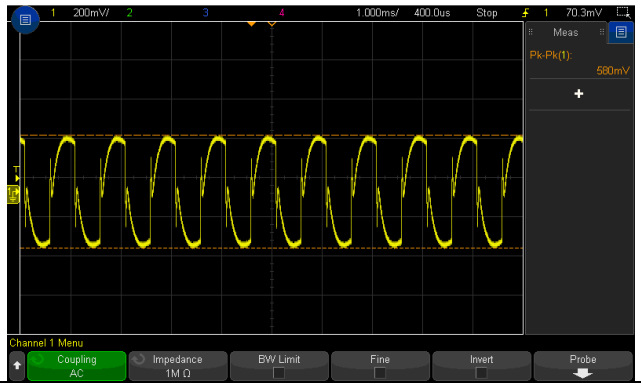
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 48V~56V	I/P:NORMAL VOLTAGE O/P:MIN LOAD TA:25℃	CH1：45.23 V~57.86 V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1: -1%~1 %	I/P: 16.8 VDC / 33.6 VDC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.102 %~ 0.0999 %
3	LINE REGULATION (Max)	V1: -0.5 %~ 0.5%	I/P: 16.8 VDC / 33.6 VDC O/P:FULL LOAD Ta:25℃	V1: -0.043 %~ 0 0063%
4	LOAD REGULATION (Max)	V1: -1 %~ 1 %	I/P: 24VDC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.102 %~ 0.0999%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 24VDC O/P:FULL LOAD Ta:25℃	TEST：2.1%
6	Peak Loading	720W/5sec.	I/P: 24VDC O/P:720W Ta:25℃	TEST：OK
7	RIPPLE & NOISE (Max)	V1: 150mVp-p	I/P: 24VDC O/P:FULL LOAD Ta:25℃	V1: 27 mVp-p
	high frequency：  		low frequency：  	
8	SET UP TIME (Max)	24VDC/ 500 ms	I/P: 24VDC O/P:FULL LOAD Ta:25℃	112ms
	INPUT=24VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage  			

<table>
<tr><td rowspan="2">9</td><td>RISE TIME (Max)</td><td>24VDC/ 60 ms</td><td>I/P: 24VDC
O/P:FULL LOAD
Ta:25℃</td><td>12.28 ms</td></tr>
<tr><td colspan="4">INPUT=24VDC @ FULL LOAD
CH1 : Output Voltage
 
</td></tr>
<tr><td rowspan="2">10</td><td>HOLD UP TIME (TYP)</td><td>24VDC/ 10 ms
24VDC/ 16 ms@70%LOAD</td><td>I/P: 24VDC
O/P:F ULL LOAD/70%LOAD
Ta:25℃</td><td>10.8 ms @FULL LOAD
16.2 ms@70% LOAD</td></tr>
<tr><td colspan="4">INPUT=24VDC @ FULL LOAD
CH1 : Output Voltage CH2 : DC Input Voltage
 

INPUT=24VDC @ 70% LOAD
CH1 : Output Voltage CH2 : DC Input Voltage
 
</td></tr>
<tr><td>11</td><td>TRANSIENT RECOVERY TIME</td><td>V1:4800mVp-p</td><td>I/P: 24VDC
O/P:40% LOAD CHANGE
50%DUTY/120HZ</td><td>520mVp-p</td></tr>
<tr><td rowspan="2">12</td><td>DYNAMIC LOAD</td><td>V1: 4800mVp-p</td><td>I/P: 24VDC
O/P:
(1)FULL /50% LOAD 50%DUTY / 120HZ
(2)FULL /50% LOAD 50%DUTY / 1KHZ
Ta:25℃</td><td>640mVp-p/120HZ
580mVp-p/1KHZ</td></tr>
<tr><td colspan="4">FULL /50% LOAD 50%DUTY / 120HZ
 

FULL /50% LOAD 50%DUTY / 1KHZ
 
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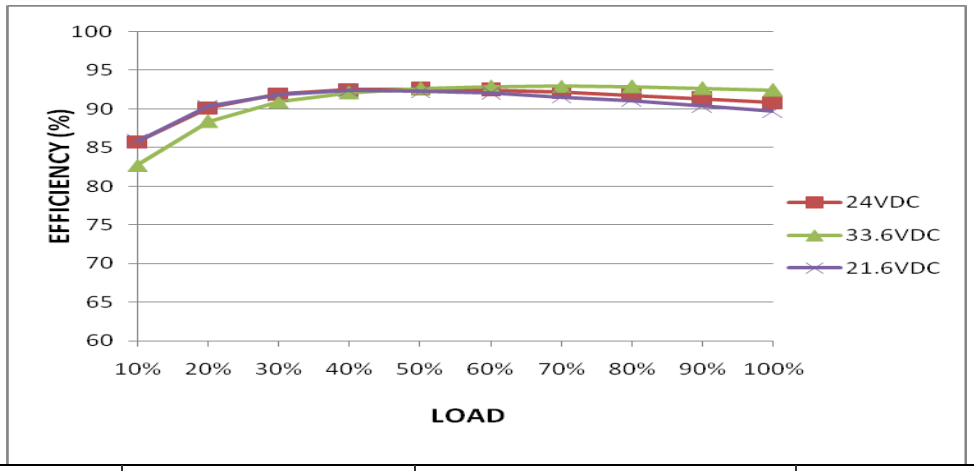
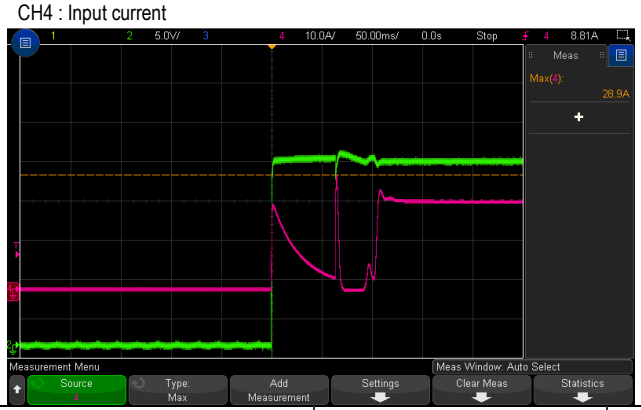
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	16.8VDC~33.6 VDC 14.4VDC~16.8VDC≥100ms	I/P:TESTING O/P:FULL LOAD Ta:25℃	（1）14.07V~ 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℃	I =21.84 A / 24VDC
3	EFFICIENCY(TYP)	90.5 %	I/P:24VDC O/P:FULL LOAD Ta:25℃	90.84%
	EFFICIENCY vs LOAD 			
4	INRUSH CURRENT(TYP)	24VDC/ 30 A COLD START	I/P: 24VDC O/P:FULL LOAD Ta:25℃	28.9A
	INPUT=24VDC @ FULL LOAD CH4 : Input current 			
5	INTERRUPYION OF VOLTAGE SUPPLY	COMPLY WITH S2 LEVEL (10ms)	I/P: 24VDC O/P:FULL LOAD Ta:25℃	11.6ms

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~ 135 % RATED OUTPUT POWER	I/P: 21.6 VDC I/P: 24 VDC I/P: 33.6 VDC O/P:TESTING PEAK LOAD (5S) Ta:25℃	117.1%/ 21.6 VDC 116.9%/ 24 VDC 116.9%/ 33.6 VDC 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 过压时产品异响	CH: 57.6 V~ 65 V	I/P: 16.8VDC I/P: 24VDC I/P: 33.6VDC O/P:MIN LOAD Ta:25℃	62.4V/16.8VDC 62.4V/24VDC 62.4V/33.6VDC PROTECTION TYPE： Shut down O/P voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	SPEC: NO DAMAGE	I/P: 33.6/16.8VDC O/P: FULL LOAD Ta:25℃	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: 33.6/16.8VDC O/P: FULL LOAD Ta:25℃	NO DAMAGE PROTECTION TYPE： Constant current limiting with auto-recovery recovers automatically after fault condition is removerd
5.	INPUT REVERSE	POWER OK	I/P: 33.6/16.8VDC O/P: FULL LOAD Ta:25℃	NO DAMAGE
6	INPUT UNDER VOLTAGE PROTECTION	24VIN (C-TYPE) : POWER ON >=16.8V POWER OFF<=16.5V	I/P: TESTING O/P: FULL LOAD Ta:25℃	POWER ON >=14.046 V POWER OFF<=13.929 V

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	REMOTE ON/OFF CONTROL	I/P: 24VDC O/P:FULL LOAD Ta:25℃ **Test Result：**		
2	DC OK CONTACT RATINGS	30VDC/1A RESISTIVE LOAD	I/P:24VDC O/P:FULL LOAD Ta:25℃	TEST : OK

Remote ON-OFF（TB1 PIN2,4）	Power Supply Status
Open or 4~10VDC	ON 3.44VDC
Short or 0~0.8VDC	OFF 0.84vdc

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/ Q12/Q17 Rated : 100 A/ 100V	DC ON/OFF I/P:High-Line +1V =34.6V VDS: O/P: (1)Full Load	**Q8** VDS: (1) 55.3V (2) 74.5V	**Q19** VDS: (1) 59.9V (2) 74.5V

			(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℃	(3) 60.9V (4) 62.2V (5) 61.7V (6) 58.5V (7) 61.7V **Q12** VDS: (1) 55.9V (2) 73.3V (3) 56.3V (4) 56.3V (5) 56.3V (6) 56.7V (7) 56.3V	(3) 59.3V (4) 58.9V (5) 59.3V (6) 56.1V (7) 57.3V **Q17** VDS: (1) 55.9V (2) 74.9V (3) 57.5V (4) 58.3V (5) 58.3V (6) 57.1V (7) 58.3V
2	Clamp MOSFET (D to S) or (C to E) Peak Voltage	Q20/Q4 Rated : 73 A/ 100 V VGS ±20 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℃	**Q20** VDS: (1) 47.7V (2) 50.9V (3) 56.9V (4) 54.9V (5) 54.9V (6) 58.1V (7) 59.7V	**Q4** VDS: (1) 48.7V (2) 50.7V (3) 68.5V (4) 63.9V (5) 62.3V (6) 63.9V (7) 57.9V
3	Diode Peak Voltage	Q101/Q104/ Q200/Q202 Rated : 10 A/ 400V	DC ON/OFF I/P:High-Line +1V =34.6V VOmax: 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: O/P: (1)Full Load Ta:25℃	**Q101:** VOmax: VDS: (1) 307V (2) 217V (3) 346V (4) 350V (5) 346V (6) 314V (7) 164V (8) 152V VO: (1) 267V **Q104**: VOmax: VDS: (1) 347V (2) 360V (3) 368V (4) 354V (5) 347V (6) 380V (7) 380V (8) 380V VO: (1) 356V	**Q200:** VOmax: VDS: (1) 239V (2) 193V (3) 291V (4) 299V (5) 291V (6) 269V (7) 148V (8) 140V VO: (1) 211V **Q202:** VOmax: VDS: (1) 323V (2) 331V (3) 360V (4) 335V (5) 335V (6) 380V (7) 380V (8) 376V VO: (1) 319V

4	Input Capacitor Voltage	C20/C28 Rated: 2200 μ / 35 V	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 Ta:25℃	**C20** (1) 34.3V (2) 33.3V (3) 33.9V (4) 33.7V	**C28** (1) 34.7V (2) 33.8V (3) 33.9V (4) 33.1V
5	Control IC Voltage Test	PWM IC U1 Rated 7.5V~ 15 V / VCC O/P U100 Rated -0.3V~ 32 V	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) Ta:25℃	**U1 VCC1/VCC2** (1) 13.21V/13.21V (2) 13.45V13.45V (3) 13.45V13.37V (4) 13.05V/13.13V (5) 10.80V/10.88V	**U100** (1) 11.60V (2) 11.60V (3) 11.84V (4) 11.68V (5) 11.36V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTANDVOLTAGE	I/P-O/P:4KVDC/min I/P-FG:2.5KVDC/min O/P-FG:0.71KVDC/min	I/P-O/P: 4.4KVDC/min I/P-FG: 3KVDC/min O/P-FG:0.852KVDC/min Ta:25℃	I/P-O/P:0.1uA I/P-FG:0.1uA O/P-FG:0.3uA NO DAMAGE
2	ISOLATIONRESISTANCE	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℃	I/P-O/P:9999MΩ I/P-FG:9999MΩ O/P-FG:9999MΩ NO DAMAGE
3	GROUNDINGCONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	4mΩ

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℃	PASS Test by certified Lab
2	CONDUCTION	EN55032 CLASS A	I/P:24VDC O/P:FULL LOAD Ta:25℃	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 □MEDICAL AIR：15KV / Contact：8KV □LIGHT INDUSTRY AIR：8KV / Contact：4KV ■INDUSTRY AIR：8KV / Contact：6KV	I/P: 24VDC O/P:FULL LOAD Ta:25℃	■CRITERIA A □CRITERIA B
4	E.F.T	EN61000-4-4 □LIGHT INDUSTRY INPUT: 0.5KV □MEDICAL ■INDUSTRY INPUT: 2KV	I/P:24VDC O/P:FULL LOAD Ta:25℃	■CRITERIA A □CRITERIA B
5	SURGE	IEC61000-4-5 ■INDUSTRY L-N :1KV L,N-PE:2KV	I/P: 24VDC O/P:FULL LOAD Ta:25℃	■CRITERIA A □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 ℃ 2. HIGH AMBIENT BURN-IN：2 HRS I/P：24 VDC O/P： FULL LOAD Ta= 60.6 ℃		

NO	Position	ROOM AMBIENTTa= 26.2 ℃	HIGH AMBIENT Ta= 60.6 ℃
1	LF3	74.4℃	116.4℃
2	C29	57.9℃	98.8℃
3	T7	61.6℃	103.3℃
4	U1	53.8℃	96.5℃
5	T3	74.1℃	117.6℃
6	Q4	62.5℃	105℃
7	R23	62.3℃	104.7℃
8	Q17	69.2℃	111.8℃
9	T2	73.4℃	117.5℃
10	L200	81.6℃	124.1℃
11	Q200	75.3℃	115.6℃
12	Q202	75.3℃	118.1℃
13	C204	69.4℃	109.8℃
14	U101	66.4℃	108.1℃
15	U100	67.3℃	107.8℃
16	D210	69.1℃	110.4℃
17	ZD209	69℃	110.3℃
18	R203	68℃	108.9℃
19	Q204	68.5℃	110.3℃
20	TB1	59.8℃	99.3℃
21	ZNR1	62.8℃	106.2℃
22	LF1	67.7℃	109.2℃
23	LF2	73.2℃	115.8℃
24	Q6	62.2℃	103℃
25	Q13	73.1℃	115.2℃
26	C64	62.4℃	101.8℃
27	LF4	75.7℃	116.8℃
28	T8	65.4℃	106.5℃
29	Q103	75.2℃	95.9℃
30	T4	76.8℃	118.1℃
31	Q19	75.1℃	115.5℃
32	Q8	69.9℃	109.7℃
33	Q20	72.6℃	113.3℃
34	R91	66℃	106℃

			35	T1	73.6℃	115.4℃
			36	L101	82.4℃	123.5℃
			37	Q105	77.9℃	107.6℃
			38	C110	68.9℃	108.8℃
			39	C111	67.2℃	106.4℃
			40	ZD109	68.7℃	108.7℃
			41	Q14	69.2℃	109.3℃
			42	D17	75.9℃	116.7℃
			43	D106	68.8℃	108.8℃
			44	TB2	64.2℃	102℃
			45	LF100	69.2℃	108.9℃
			46	RY100	70.6℃	109.1℃
			47	C207	65.5℃	105.1℃
			48	Q22	65.9℃	106.1℃
			49	C65	75.8℃	118.4℃

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P：24 VDC O/P：144% LOAD Ta：25℃	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℃	TEST：OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 60 ℃ / 95 %R.H NO DAMAGE	I/P：35VDC O/P：FULL LOAD Ta= 60℃ HUMIDITY= 95 %R.H	TEST：OK
5	TEMPERATURE COEFFICIENT	± 0.03%/ (0~55℃)	I/P：24C O/P：FULL LOAD	± 0.0051%/℃ (0~55℃)
6	STORAGE TEMPERATURE TEST	-40~85℃	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	-40~60℃	1. Thermal shock Temperature： -45℃~ +65℃ 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: 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℃	
9	CAPACITOR LIFE CYCLE	SUPPOSE C111 IS THE MOST CRITICAL COMPONENT (1) I/P： 24VDC O/P：FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P： 24VDC O/P：FULL LOAD Ta= 60 ℃ LIFE TIME (3) I/P： 24VDC O/P：75% LOAD Ta= 60 ℃ LIFE TIME (4) I/P： 24VDC O/P：50% LOAD Ta= 60 ℃ 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℃)
11	Ongoing Reliability Test	I/P：24VDC O/P：FULL LOAD TA=50℃ Demonstration Mean Time Between Failure : 30000hours

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		Wangdz

2018.4.30 GP-A50-F010