



Test Report: XLC-60-24-MA

60W Constant Voltage LED Driver

■ 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

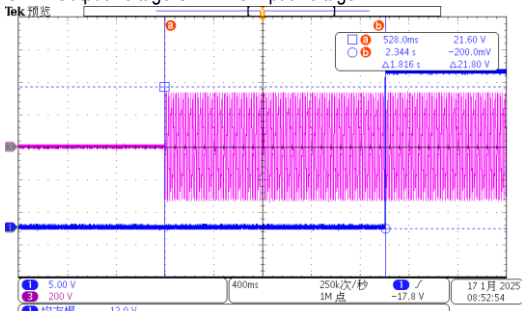
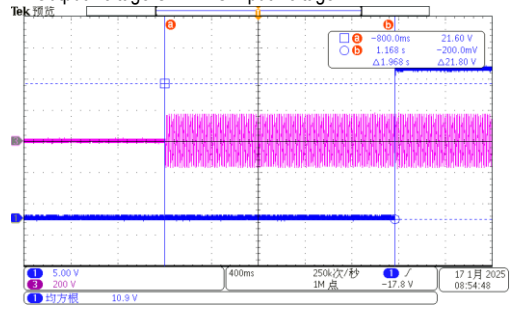
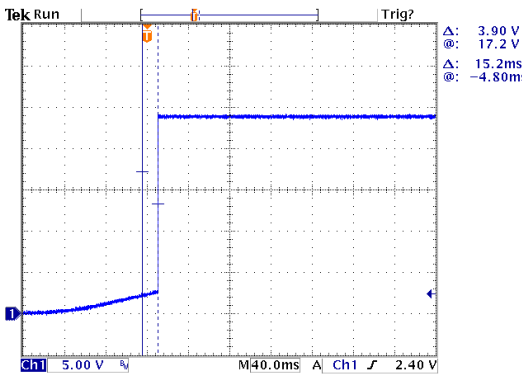
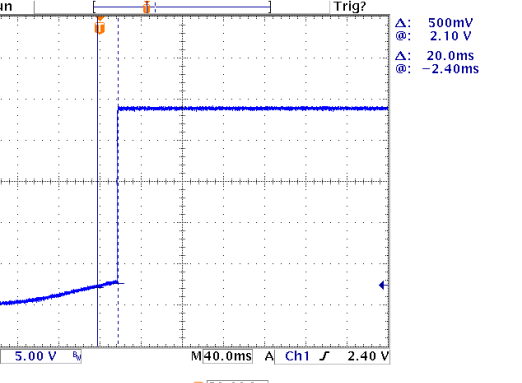
E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

DESIGN VERIFY TEST

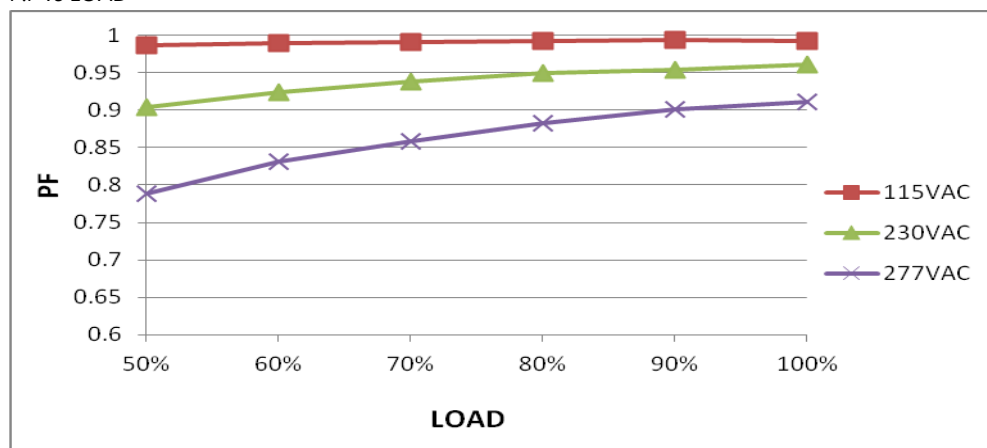
OUTPUT FUNCTION TEST

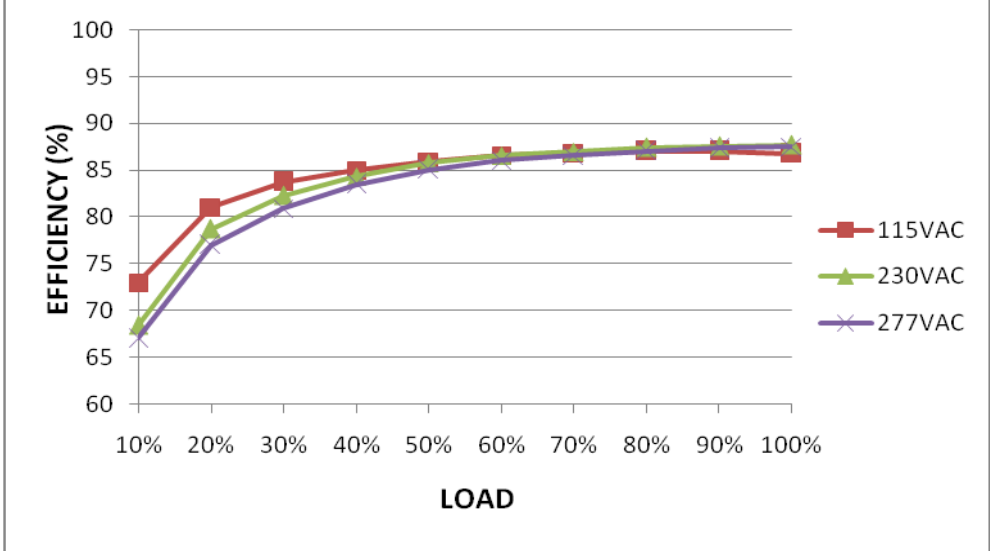
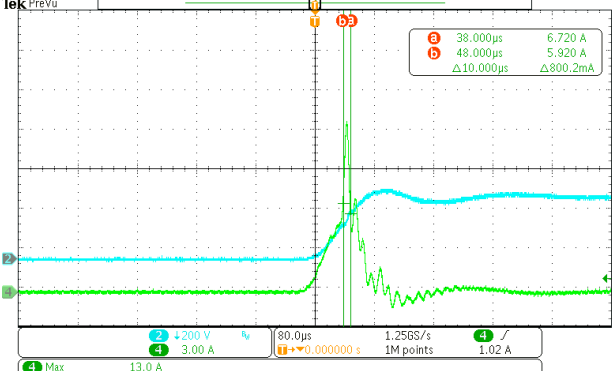
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -5% ~ +5% (Max)	I/P: 230VAC O/P:100%load Ta:25°C	1.5%~1.69%
2	OVER/UNDERSHOOT TEST	< +5%	I/P: 230VAC O/P:100% /0% Ta:25°C	1.6 %
3	SET UP TIME(Max)	230VAC/ 2500ms (Max) 115VAC/2500 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta:25°C	230VAC/1816ms 115VAC/1968ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage  INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 				
4	RISE TIME (Max)	230VAC/ 180ms (Max) 115VAC/ 180ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta:25°C	230VAC/15.2ms 115VAC/20 ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage  INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 				

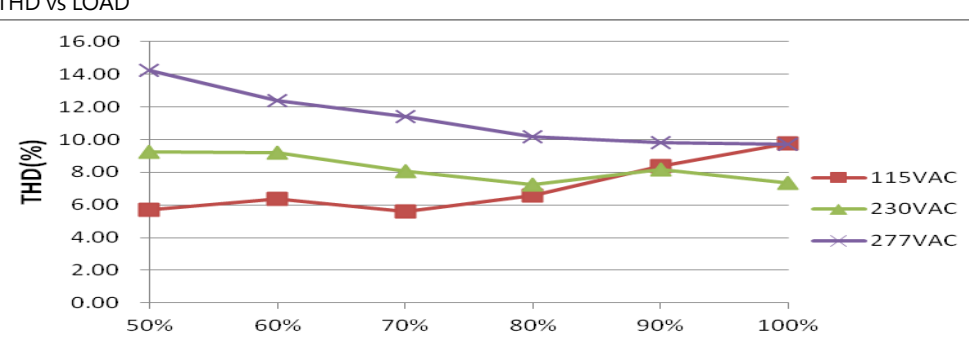
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	100VAC~305 VAC 155VDC~400VDC	(1) I/P: TESTING O/P: FULL LOAD (2) I/P: DC TESTING (L: + N:-) O/P: FULL / 50% LOAD (3) I/P: DC TESTING (L: - N: +) O/P: FULL / 50% LOAD (4) I/P: LOW-LINE=141VDC HIGH-LINE=431VDC O/P: Dimming on/off 【for Dimming type】 Ta:25°C	(1) 97V~308V (2) 155Vdc~400Vdc/FULL LOAD 155Vdc~400Vdc/50% LOAD (3) 155Vdc~400Vdc/FULL LOAD 155Vdc~400Vdc/50% LOAD (4) OK
			I/P: LOW-LINE-3V=107 V HIGH-LINE+10V=315 V 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 FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 90 VAC ~305VAC O/P:FULL~MIN LOAD Ta:25°C	OK
3	INPUT CURRENT (TYP)	277VAC/ 0.30 A 230 VAC/ 0.35 A 115 VAC/ 0.75 A	I/P: 277VAC/230 VAC/115 VAC O/P:FULL LOAD Ta:25°C CCH MODE TEST	I= 0.27A/277VAC I =0.31A/ 230VAC I =0.61A/ 115VAC
4	POWER FACTOR(TYP)	0.95/230 VAC FULL LOAD 0.95/115 VAC FULL LOAD 0.9/277 VAC FULL LOAD	I/P: 230 VAC/115VAC/277VAC O/P:FULL LOAD Ta:25°C CCH MODE TEST	PF= 0.961/230V/100%LOAD PF= 0.992 /115V/100%LOAD PF= 0.911/277V/100%LOAD

P.F vs LOAD



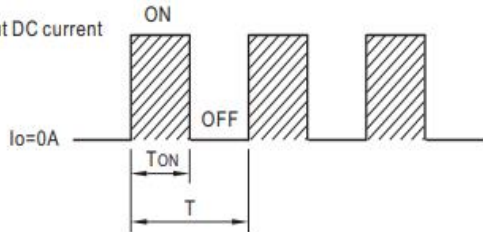
5	EFFICIENCY (TYP)	87%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C CCH MODE TEST	87.18%
EFFICIENCY vs LOAD 				
6	INRUSH CURRENT (TYP)	230 V/ 15 A COLD START (twidth=310us measured at 50% Ipeak) COLD START	I/P: 230 VAC O/P:FULL LOAD Ta:25°C CCH MODE TEST	I = 13A/ 230VAC T50= 10 us
INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current (1V=1A) 				
7	LEAKAGE CURRENT	< 0.75mA / 277VAC	I/P: 277 VAC O/P:Min LOAD Ta:25°C	L-FG: 0.015mA N-FG:0.017mA
8	TOTAL HARMONIC DISTORTION	THD< 20%(@load ≥ 60%/230VAC; @load ≥ 75%/277VAC); THD<10%@load 100%/230VAC	I/P : 230VAC/277VAC O/P : 60% /75% /100% LOAD Ta : 25°C	THD : 9.22% 230VAC 60% THD : 10.86% 277VAC 75% THD : 7.34% 230VAC 100%

THD vs LOAD <table><caption>THD vs LOAD Data</caption><thead><tr><th>LOAD (%)</th><th>115VAC THD (%)</th><th>230VAC THD (%)</th><th>277VAC THD (%)</th></tr></thead><tbody><tr><td>50%</td><td>5.5</td><td>9.5</td><td>14.5</td></tr><tr><td>60%</td><td>6.5</td><td>9.5</td><td>12.5</td></tr><tr><td>70%</td><td>5.5</td><td>8.5</td><td>11.5</td></tr><tr><td>80%</td><td>6.5</td><td>7.5</td><td>10.5</td></tr><tr><td>90%</td><td>8.5</td><td>8.5</td><td>10.0</td></tr><tr><td>100%</td><td>10.0</td><td>7.5</td><td>10.0</td></tr></tbody></table>					LOAD (%)	115VAC THD (%)	230VAC THD (%)	277VAC THD (%)	50%	5.5	9.5	14.5	60%	6.5	9.5	12.5	70%	5.5	8.5	11.5	80%	6.5	7.5	10.5	90%	8.5	8.5	10.0	100%	10.0	7.5	10.0
LOAD (%)	115VAC THD (%)	230VAC THD (%)	277VAC THD (%)																													
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9	STANDBY POWER CONSUMPTION	Standby power consumption<0.5W (Dimming OFF)	I/P : 230VAC O/P : TESTING Ta : 25°C	0.4782W																												

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~ 200 %	I/P: 305VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta: 25°C	149.5%/ 305VAC 149.2%/ 230VAC 149.3%/100VAC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	26V~ 35V	I/P: 305VAC I/P: 230VAC I/P: 100VAC O/P: MIN LOAD Ta: 25°C	27.75V/ 305VAC 27.62V/ 230VAC 27.65V/ 90VAC PROTECTION TYPE : Shut down output voltage , re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 305 VAC I/P: 100 VAC O/P: FULL LOAD	O.T.P. Active PROTECTION TYPE : Shut down output voltage, recovers automatically after fault condition is removed
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 305VAC I/P: 100 VAC O/P: FULL LOAD Ta: 25°C	NO DAMAGE PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM OUTPUT DIMMING PRINCIPLE	※ For 12V/24V/48V PWM style output dimming • Dimming is achieved by varying the duty cycle of the output current. Output DC current  Duty cycle(%) = $\frac{T_{ON}}{T} \times 100\%$ Output PWM frequency : 3.2kHz(Typ.) I/P : 230 VAC O/P : FULL LOAD Ta : 25°C TEST RESULT : OK		

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated 800 V/11A	AC ON/OFF I/P: High-Line +3V =308V 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. I/P: Low-Line -3V = 97V 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	VDS: (1) 782V (2) 652V (3) 778V (4) 771V (5) 775V (6) 773V (7) 633V VDS: (1) 478V (2) 296V (3) 486V (4) 483V (5) 485V (6) 479V (7) 461V

2	Diode Peak Voltage	Q100 Rated 10A/300V	AC ON/OFF I/P: High-Line +3V =308 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	Q100: VDS: (1) 273V (2) 206V (3) 283V (4) 273V (5) 268V (6) 284V (7) 208V (8) 178V																				
3	Control IC Voltage Test	U300 Rated 8V~100V U301 Rated 2.9V-3.3V	AC ON/OFF I/P: High-Line +3V =308 V FOR C.V MODE TYPE O/P (1) FULL LOAD (2) Output Short (3) NO LOAD (4) Dim off Ta:25°C	U300 (1) 35.4V (2) 34.1V (3) 34.1V (4) 33.8V U301 <table><tr><td>FOR C.V MODE TYPE</td><td>Level</td><td>Ripple</td><td>Spike</td></tr><tr><td>FULL LOAD</td><td>3.320V</td><td>0.387%</td><td>2.59%</td></tr><tr><td>Output Short</td><td>3.318V</td><td>0.06%</td><td>2.73%</td></tr><tr><td>NO LOAD VRmin.LO W LINE</td><td>3.322V</td><td>0.06%</td><td>2.83%</td></tr><tr><td>DIM OFF</td><td>3.320V</td><td>0.436%</td><td>0.7%</td></tr></table>	FOR C.V MODE TYPE	Level	Ripple	Spike	FULL LOAD	3.320V	0.387%	2.59%	Output Short	3.318V	0.06%	2.73%	NO LOAD VRmin.LO W LINE	3.322V	0.06%	2.83%	DIM OFF	3.320V	0.436%	0.7%
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4	Clamp Diode Peak Voltage	D10 Rated : 1000V/1A	AC ON/OFF I/P : High-Line +3V = 308 V O/P : (1) Dynamic Load 90%Duty/1KHz (2) Full load continue Ta : 25°C	(1)572V (2)568V																				

5	Buck Diode Peak Voltage MOS	Q110 Rated : 90A/60V Q111 Rated : 90A/60V	AC ON/OFF I/P : High-Line +3V = 308 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. Ta : 25°C	Q111 (1) 46.6V (2) 44.6V (3)58.2 V (4)58.6V (5)50.3V (6)58.7V (7)46.2V	Q110 (1) 47V (2) 51V (3) 47.8V (4)47.4V (5)47.8V (6)46.2V (7)48.2V
6	Dimming MOS	Q200 Rated : 80A/60V	AC ON/OFF I/P : High-Line +3V = 308 V O/P: (1) FULL Load (2) FULL Load continue (3) Output Short (4) DIM OFF Ta : 25°C	(1) 40.8A (2)3.02A (3)79.3A (4)0.05A	

SAFETY & EMC TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3.75KVAC/min	I/P-O/P: 4.125 KVAC/min Ta:25°C	I/P-O/P:2.672mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ	I/P-O/P: 500 VDC Ta:25°C	I/P-O/P: 9999MΩ NO DAMAGE

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS C	I/P: 230VAC/50HZ O/P:FULL LOAD Ta:25°C	PASS
2	CONDUCTION	EN55015	I/P: 230 VAC (50HZ) O/P:FULL/50% LOAD Ta:25°C	PASS Test by certified Lab
3	RADIATION	EN55015	I/P: 230 VAC (50HZ) O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 AIR : 8KV / Contact : 4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INPUT: 1KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
6	SURGE	IEC61000-4-5 L-N :1KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
7	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 : XLC-60-24-MA 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=26.3 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=49.9 °C <table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=27°C</th><th>HIGH AMBIENT Ta=46.4°C</th></tr><tr><td>1</td><td>Q1</td><td>79.5°C</td><td>103.1°C</td></tr><tr><td>2</td><td>U1</td><td>81.8°C</td><td>105.4°C</td></tr><tr><td>3</td><td>T1</td><td>81.1°C</td><td>104.7°C</td></tr><tr><td>4</td><td>Q100</td><td>85.1°C</td><td>108.7°C</td></tr><tr><td>5</td><td>Q200</td><td>79.5°C</td><td>103.1°C</td></tr><tr><td>6</td><td>Q110</td><td>89.4°C</td><td>113.0°C</td></tr><tr><td>7</td><td>Q111</td><td>84.1°C</td><td>107.7°C</td></tr><tr><td>8</td><td>U100</td><td>82.8°C</td><td>106.4°C</td></tr><tr><td>9</td><td>C101</td><td>81.8°C</td><td>105.4°C</td></tr><tr><td>10</td><td>L100</td><td>83.3°C</td><td>106.9°C</td></tr><tr><td>11</td><td>U300</td><td>71.5°C</td><td>95.1°C</td></tr><tr><td>12</td><td>U301</td><td>62.4°C</td><td>86.0°C</td></tr><tr><td>13</td><td>RTH3</td><td>75.3°C</td><td>98.9°C</td></tr><tr><td>14</td><td>TC</td><td>68.4°C</td><td>92.0°C</td></tr></table>			NO	Position	ROOM AMBIENT Ta=27°C	HIGH AMBIENT Ta=46.4°C	1	Q1	79.5°C	103.1°C	2	U1	81.8°C	105.4°C	3	T1	81.1°C	104.7°C	4	Q100	85.1°C	108.7°C	5	Q200	79.5°C	103.1°C	6	Q110	89.4°C	113.0°C	7	Q111	84.1°C	107.7°C	8	U100	82.8°C	106.4°C	9	C101	81.8°C	105.4°C	10	L100	83.3°C	106.9°C	11	U300	71.5°C	95.1°C	12	U301	62.4°C	86.0°C	13	RTH3	75.3°C	98.9°C	14	TC	68.4°C	92.0°C
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13	RTH3	75.3°C	98.9°C																																																													
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 150.4 % LOAD Ta : 25°C	TEST : OK																																																												
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/110VAC 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 45 °C NO DAMAGE	I/P : 305 VAC O/P : FULL LOAD Ta=45 °C HUMIDITY= 95 %R.H	TEST : OK																																																												
5	TEMPERATURE COEFFICIENT	± 0.03 %/(0°C~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.006 %/°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 : 10CYCLE 5. Input/output condition : STATIC TEST : OK																																																													

7	THERMAL SHOCK TEST	-25~45°C	1. Thermal shock Temperature : -30°C~ +50°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:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test
8	VIBRATION TEST	10 ~ 500Hz, 2G 10min./1cycle, period for 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 C101 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Tc=75 °C LIFE TIME (2) I/P : 230VAC O/P : 75% LOAD Tc=75 °C LIFE TIME (3) I/P : 230VAC O/P : 50% LOAD Tc=75 °C LIFE TIME	(1) 51093HRS (2) 93032HRS (3) 140240HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 4130.5K hrs min. Telcordia SR-332 (Bellcore) ; 317.7K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 50,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	WUWQIN/ZHOUBIAO	WENF	WUWQ

2020.10.1 TAG-QA-009