



Test Report: XLN-60-24

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

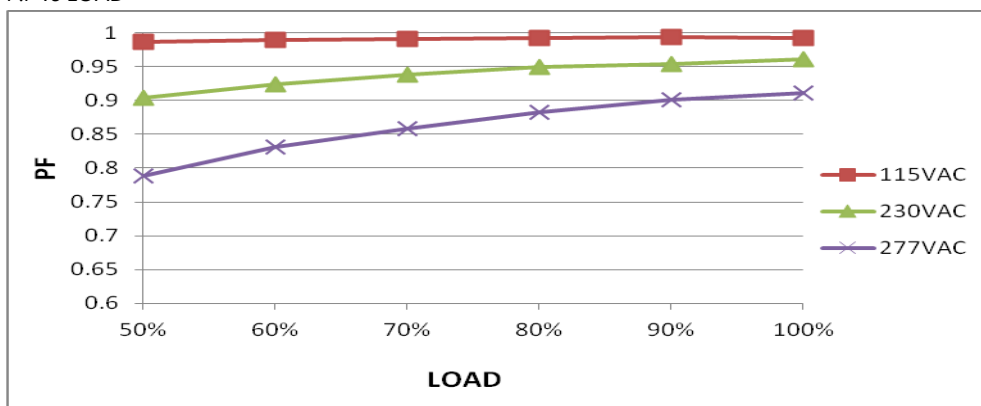
OUTPUT FUNCTION TEST

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/ 800ms (Max) 115VAC/1000 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P: FULL LOAD Ta:25°C	230VAC/427ms 115VAC/641ms
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/149ms 115VAC/153ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 		

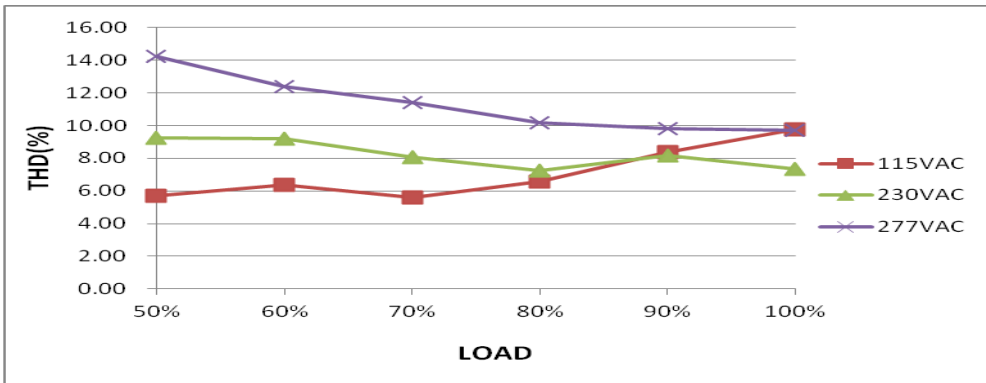
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	110VAC~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= 0.61A/277VAC I =0.31A/ 230VAC I =0.27A/ 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



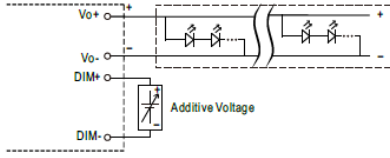
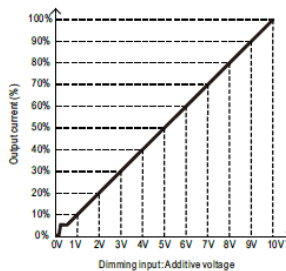
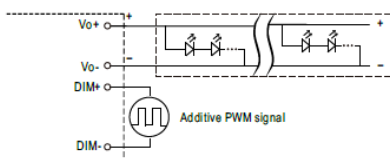
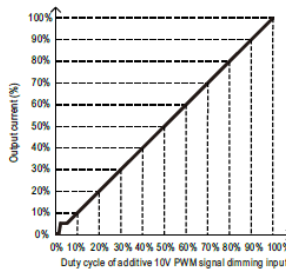
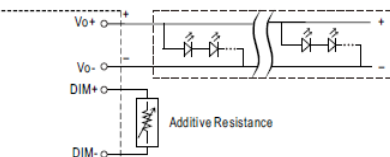
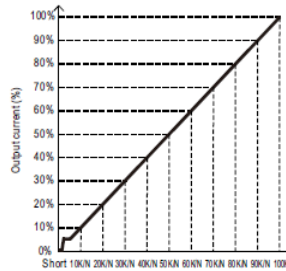
5	EFFICIENCY (TYP)	87%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C CCH MODE TEST	87.18%																																												
<p>EFFICIENCY vs LOAD</p> <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>115VAC (%)</th> <th>230VAC (%)</th> <th>277VAC (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>73</td><td>68</td><td>67</td></tr> <tr><td>20%</td><td>81</td><td>78</td><td>77</td></tr> <tr><td>30%</td><td>84</td><td>82</td><td>81</td></tr> <tr><td>40%</td><td>85</td><td>84</td><td>83</td></tr> <tr><td>50%</td><td>86</td><td>85</td><td>84</td></tr> <tr><td>60%</td><td>86.5</td><td>86</td><td>85</td></tr> <tr><td>70%</td><td>87</td><td>86.5</td><td>86</td></tr> <tr><td>80%</td><td>87</td><td>87</td><td>86.5</td></tr> <tr><td>90%</td><td>87</td><td>87</td><td>87</td></tr> <tr><td>100%</td><td>87</td><td>87</td><td>87</td></tr> </tbody> </table>					LOAD (%)	115VAC (%)	230VAC (%)	277VAC (%)	10%	73	68	67	20%	81	78	77	30%	84	82	81	40%	85	84	83	50%	86	85	84	60%	86.5	86	85	70%	87	86.5	86	80%	87	87	86.5	90%	87	87	87	100%	87	87	87
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6	INRUSH CURRENT (TYP)	230 V/ 15 A COLD START (twidh=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																																												
<p>INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current (1V=1A)</p> <p>Max 13.0 A</p> <p>80.0µs 1.25GS/s 1M points 1.02 A</p> <p>38.000µs 6.720 A 48.000µs 5.920 A Δ10.000µs Δ800.2mA</p>																																																
7	LEAKAGE CURRENT	< 0.75mA / 277VAC	I/P: 277 VAC O/P:Min LOAD Ta:25°C	L-FG: 0.029mA N-FG:0.023mA																																												
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%																																												

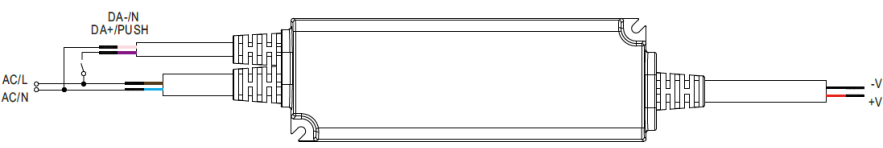
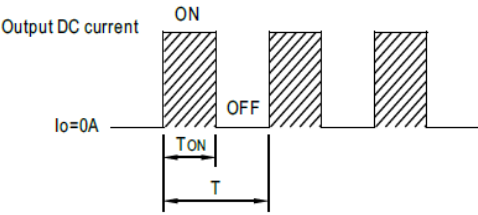
<p>THD vs LOAD</p> 				
9	STANDBY POWER CONSUMPTION	Standby power consumption < 0.5W (Dimming OFF, only for standard version B/DA2-type)	I/P : 230VAC O/P : TESTING Ta : 25°C	0.4375W for B-type 0.4426W for DA2-type

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	DIMMING OPERATION(B-Type)	<p>◎ B type</p> <p>※ 3 in 1 dimming function</p> <ul style="list-style-type: none"> Output constant current level can be adjusted by applying one of the three methodologies between DIM+ and DIM-: 0~10VDC, or 10V PWM signal or resistance. Direct connecting to LEDs is suggested. It is not suitable to be used with additional drivers. Dimming source current from power supply: 100 μA (typ.) <p>◎ Applying additive 0~10VDC</p>  <p>*DO NOT connect *DIM- to Vo-*</p>  <p>◎ Applying additive 10V PWM signal (frequency range 300Hz~3KHz):</p>  <p>*DO NOT connect *DIM- to Vo-*</p>  <p>◎ Applying additive resistance: 0~100k Ω</p>  <p>*DO NOT connect *DIM- to Vo-*</p>  <p>Note: 1. Min. dimming level is about 8% and the output current is not defined when 0% < I_{out} < 8%. 2. The output current could drop down to 0% when dimming input is about 0kΩ or 0Vdc, or 10V PWM signal with 0% duty cycle.</p> <p>I/P : 230 VAC ; O/P : DIMMING TEST ; Ta : 25°C</p>																																									
1		<table border="1"> <thead> <tr> <th>Resistance value</th> <th>Short</th> <th>10K</th> <th>20K</th> <th>30K</th> <th>40K</th> <th>50K</th> <th>60K</th> <th>70K</th> <th>80K</th> <th>90K</th> <th>100K</th> <th>OPEN</th> </tr> </thead> <tbody> <tr> <td>Output Current</td> <td>0</td> <td>0.380A</td> <td>0.618A</td> <td>0.840A</td> <td>1.080A</td> <td>1.370A</td> <td>1.570A</td> <td>1.870A</td> <td>2.140A</td> <td>2.440A</td> <td>2.620A</td> <td>2.650A</td> </tr> <tr> <td>Output Current duty</td> <td>0%</td> <td>14.73%</td> <td>23.95%</td> <td>32.56%</td> <td>41.86%</td> <td>53.10%</td> <td>60.85%</td> <td>72.48%</td> <td>82.95%</td> <td>94.57%</td> <td>101.55%</td> <td>102.71%</td> </tr> </tbody> </table>	Resistance value	Short	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN	Output Current	0	0.380A	0.618A	0.840A	1.080A	1.370A	1.570A	1.870A	2.140A	2.440A	2.620A	2.650A	Output Current duty	0%	14.73%	23.95%	32.56%	41.86%	53.10%	60.85%	72.48%	82.95%	94.57%	101.55%	102.71%		
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<p>2</p>	<p>DA2 type (DALI-2 digital dimming function)</p>	<p>◎ DA2 type (DALI-2 digital dimming function)</p> <p>※ Input wiring diagram</p>  <p>※ PUSH dimming (primary side)</p> <ul style="list-style-type: none"> The factory default dimming level is at 100%. If the push action lasts less than 0.05 sec., it will not lead to a change for the status of the driver. Up to 10 drivers can perform the PUSH dimming at the same time when utilizing one common push button. The maximum length of the cable from the push button to the last driver is 20 meters. <table border="1" data-bbox="534 604 1181 712"> <thead> <tr> <th>Action</th> <th>Action duration</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>Short Push</td> <td>0.1~1s</td> <td>Turn ON-OFF the driver</td> </tr> <tr> <td>Double Click</td> <td>Click twice in 1.5s</td> <td>Set up the dimming level to 100%</td> </tr> <tr> <td>Long Push</td> <td>1.5~10s</td> <td>Every Long Push changes the dimming direction, dimming up or down</td> </tr> </tbody> </table> <p>I/P : 230 VAC O/P : DIMMING TEST Ta : 25°C TEST RESULT : OK</p>	Action	Action duration	Function	Short Push	0.1~1s	Turn ON-OFF the driver	Double Click	Click twice in 1.5s	Set up the dimming level to 100%	Long Push	1.5~10s	Every Long Push changes the dimming direction, dimming up or down
Action	Action duration	Function												
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<p>3</p>	<p>PWM OUTPUT DIMMING PRINCIPLE</p>	<p>※ For 12V/24V/48V PWM style output dimming</p> <ul style="list-style-type: none"> Dimming is achieved by varying the duty cycle of the output current.  <p>Duty cycle(%) = $\frac{T_{ON}}{T} \times 100\%$</p> <p>Output PWM frequency : 4kHz for B-Type fixed (Typ.) 3.2kHz for DA2-Type fixed (Typ.)</p> <p>I/P : 230 VAC O/P : FULL LOAD Ta : 25°C TEST RESULT : OK</p>												

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	D101: VDS: (1) 273V (2) 206V (3) 283V (4) 273V (5) 268V (6) 284V (7) 208V (8) 178V

3	Control IC Voltage Test	<p>U1 Rated 7V~18V</p> <p>U100 Rated 6V~ 75V</p> <p>U451 Rated 1.7V-3.6V</p>	<p>AC ON/OFF I/P: High-Line +3V =308 V FOR C.V MODE TYPE O/P (1) FULL LOAD (2) Output Short (3) O.L.P (4) O.V.P. (5) NO LOAD VRmin.LOW LINE (6) Dim off</p> <p>Ta:25°C</p>	<p>U1 (1) 15.3V (2) 15.4V (3) 15.3V (4) 15.2V (5) 11.5V (6) 11.5V</p> <p>U100 (1)32.6V (2) 31.0V (3) 32.2V (4)32.2V (5) 31.0V (6) 34.6V</p> <p>U451</p> <table border="1" data-bbox="1121 831 1493 1173"> <thead> <tr> <th>FOR C.V MODE TYPE</th> <th>Level</th> <th>Ripple</th> <th>Spike</th> </tr> </thead> <tbody> <tr> <td>FULL LOAD</td> <td>3.301</td> <td>0.71%</td> <td>1.523%</td> </tr> <tr> <td>Output Short</td> <td>3.302</td> <td>0.65%</td> <td>0.981%</td> </tr> <tr> <td>O.L.P</td> <td>3.301</td> <td>0.53%</td> <td>1.07%</td> </tr> <tr> <td>O.V.P</td> <td>3.302</td> <td>0.39%</td> <td>0.865%</td> </tr> <tr> <td>NO LOAD VRmin.LOW LINE</td> <td>3.302</td> <td>0.52%</td> <td>0.953%</td> </tr> <tr> <td>DIM OFF</td> <td>3.302</td> <td>0.28%</td> <td>1.108%</td> </tr> </tbody> </table>	FOR C.V MODE TYPE	Level	Ripple	Spike	FULL LOAD	3.301	0.71%	1.523%	Output Short	3.302	0.65%	0.981%	O.L.P	3.301	0.53%	1.07%	O.V.P	3.302	0.39%	0.865%	NO LOAD VRmin.LOW LINE	3.302	0.52%	0.953%	DIM OFF	3.302	0.28%	1.108%
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4	Clamp Diode Peak Voltage	D10 Rated : 1000V/1A	<p>AC ON/OFF I/P : High-Line +3V = 308 V O/P : (1) Dynamic Load 90%Duty/1KHz (2) Full load continue</p> <p>Ta : 25°C</p>	<p>(1)572V (2)568V</p>																												
5	Buck Diode Peak Voltage MOS	<p>Q110 Rated : 90A/60V</p> <p>Q111 Rated : 90A/60V</p>	<p>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.</p> <p>Ta : 25°C</p>	<p>Q110</p> <p>(1) 46.6V (2) 44.6V (3)58.2 V (4)58.6V (5)50.3V (6)58.7V (7)46.2V</p> <p>Q111</p> <p>(1) 47V (2) 51V (3) 47.8V (4)47.4V (5)47.8V (6)46.2V (7)48.2V</p>																												

6	Dimming MOS Only B or DA2-type	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
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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 : XLN-60-24B 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=23.8 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=49.9 °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) 73775HRS (2) 127970HRS (3) 370097HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 4053.7K hrs min. Telcordia SR-332 (Bellcore) ; 329.4K 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	WUWQ/HUANGMK	WENF	LINKX

2020.10.1 TAG-QA-009