60W Single Output LED Power Supply — PLN-60 series

Features :

- Universal AC input / Full range (up to 295VAC)
- High efficiency 89%
- Fully isolated plastic case with IP64 level
- Built-in constant current limiting circuit with adjustable OCP level
- Protections: Short circuit / Overload / Over voltage / Over temperature
- Built-in active PFC function
- IP64 design for indoor or outdoor installations
- UL1310 Class 2 power unit
- Pass LPS
- Cooling by free air convection
- 100% full load burn-in test
- High reliability
- Suitable for LED lighting and moving sign applications (Note.2)
- Suitable for dry / damp locations
- Compliance to worldwide safety regulations for lighting
- 2 years warranty

SPECIFICATION

SELV LPS (for 48V only) (except for 48V) IP64

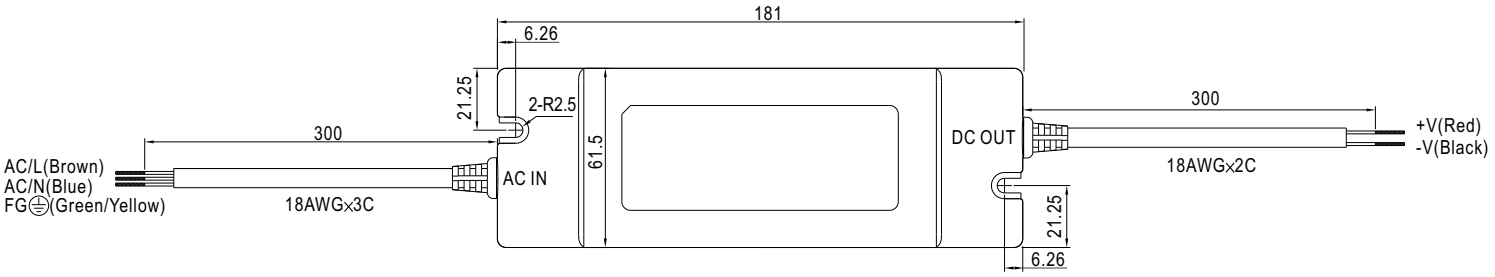
MODEL		PLN-60-12	PLN-60-15	PLN-60-20	PLN-60-24	PLN-60-27	PLN-60-36	PLN-60-48
OUTPUT	DC VOLTAGE	12V	15V	20V	24V	27V	36V	48V
	CONSTANT CURRENT REGION Note.6	8.4 ~ 12V	10.5 ~15V	14 ~ 20V	16.8 ~24V	18.9 ~27V	25.2 ~ 36V	33.6 ~ 48V
	RATED CURRENT	5A	4A	3A	2.5A	2.3A	1.7A	1.3A
	CURRENT RANGE	0 ~ 5A	0 ~ 4A	0 ~ 3A	0 ~ 2.5A	0 ~ 2.3A	0 ~ 1.7A	0 ~ 1.3A
	RATED POWER	60W	60W	60W	60W	62.1W	61W	62.5W
	RIPPLE & NOISE (max.) Note.2	2Vp-p	2.4Vp-p	1.8Vp-p	2.7Vp-p	2.7Vp-p	3.6Vp-p	4.6Vp-p
	VOLTAGE ADJ. RANGE Note.5	11.5 ~ 13V	14.5 ~ 16.2V	19.5 ~ 22V	24 ~ 26V	25 ~ 30V	32.5 ~ 39V	43.6 ~ 51.8V
		Can be adjusted by internal potential meter SVR1						
	CURRENT ADJ. RANGE Note.5	3% ~ -25%. Can be adjusted by internal potential meter SVR2						
	VOLTAGE TOLERANCE Note.3	±10%						
	LINE REGULATION	±3.0%						
	LOAD REGULATION	±5.0%						
	SETUP TIME	1500ms / 230VAC 3000ms / 115VAC at full load						
INPUT	VOLTAGE RANGE Note.4	90 ~ 295VAC 127 ~ 417VDC						
	FREQUENCY RANGE	47 ~ 63Hz						
	POWER FACTOR	PF≧0.9 at 75 ~ 100% load, 115VAC / 230VAC						
	EFFICIENCY(Typ.)	85%	86%	87.5%	87%	88%	89%	89%
	AC CURRENT	0.8A/115VAC 0.4A/230VAC						
	INRUSH CURRENT(max.)	40A/230VAC						
	LEAKAGE CURRENT	<0.75mA / 240VAC						
PROTECTION	OVER CURRENT	95 ~ 110%						
		Protection type : Constant current limiting, recovers automatically after fault condition is removed						
	SHORT CIRCUIT	Hiccup mode, recovers automatically after fault condition is removed.						
	OVER VOLTAGE	13.8 ~ 16V	17.5 ~ 21V	22.8 ~ 25V	28 ~ 32V	31 ~ 35V	41 ~ 46V	54 ~ 60V
		Protection type : Shut down o/p voltage, re-power on to recover						
	OVER TEMPERATURE	95℃ ±10℃ (TSW1) detect on heatsink of power transistor						
		Protection type : Shut down o/p voltage, recovers automatically after temperature goes down						
ENVIRONMENT	WORKING TEMP.	-30 ~ +50℃ (Refer to output load derating curve)						
	WORKING HUMIDITY	20 ~ 95% RH non-condensing						
	STORAGE TEMP., HUMIDITY	-40 ~ +80℃, 10 ~ 95% RH						
	TEMP. COEFFICIENT	±0.03%/℃ (0 ~ 50℃)						
	VIBRATION	10 ~ 500Hz, 2G 12min./1cycle, period for 72min. each along X, Y, Z axes						
SAFETY & EMC	SAFETY STANDARDS	UL879, UL8750, UL1310 Class 2, TUV EN61347-1, EN61347-2-13 independent, CAN/CSA C22.2 No. 223-M91(except for 48V), IP64 approved						
	WITHSTAND VOLTAGE	I/P-O/P:3.75KVAC I/P-FG:1.88KVAC O/P-FG:0.5KVAC						
	ISOLATION RESISTANCE	I/P-O/P:100M Ohms / 500VDC / 25℃/ 70% RH						
	EMI CONDUCTION & RADIATION	Compliance to EN55015, EN55022 (CISPR22) Class B						
	HARMONIC CURRENT	Compliance to EN61000-3-2 Class C (≧75% load) ; EN61000-3-3						
	EMS IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, EN55024,EN61547, light industry level, criteria A						
OTHERS	MTBF	497.8Khrs min. MIL-HDBK-217F (25℃)						
	DIMENSION	181*61.5*35mm (L*W*H)						
	PACKING	0.5Kg; 24pcs/13Kg/0.75CUFT						

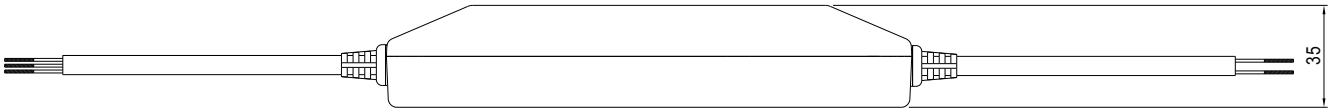
NOTE

1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25℃ of ambient temperature.
2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor. Direct connecting to LEDs is not suggested for models with "RIPPLE & NOISE" >±10% and using additional drivers is highly recommended.
3. Tolerance : includes set up tolerance, line regulation and load regulation.
4. Derating may be needed under low input voltage. Please check the static characteristics for more details.
5. Output voltage can be adjusted through the SVR1 on the PCB ; limit of output constant current level can be adjusted through the SVR2 on the PCB.
6. Constant current operation region is within 70% ~100% rated output voltage. This is the suitable operation region for LED related applications, but please reconfirm special electrical requirements for some specific system design.
7. The power supply is considered as a component that will be operated in combination with final equipment. Since EMC performance will be affected by the complete installation, the final equipment manufacturers must re-qualify EMC Directive on the complete installation again.

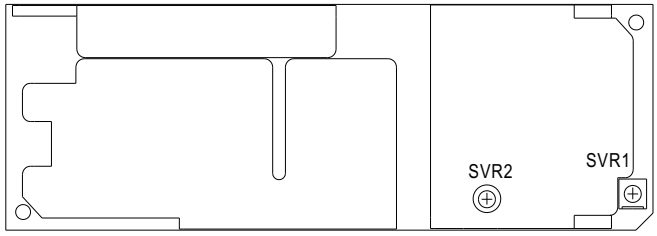
■ Mechanical Specification

Case No.960A Unit:mm





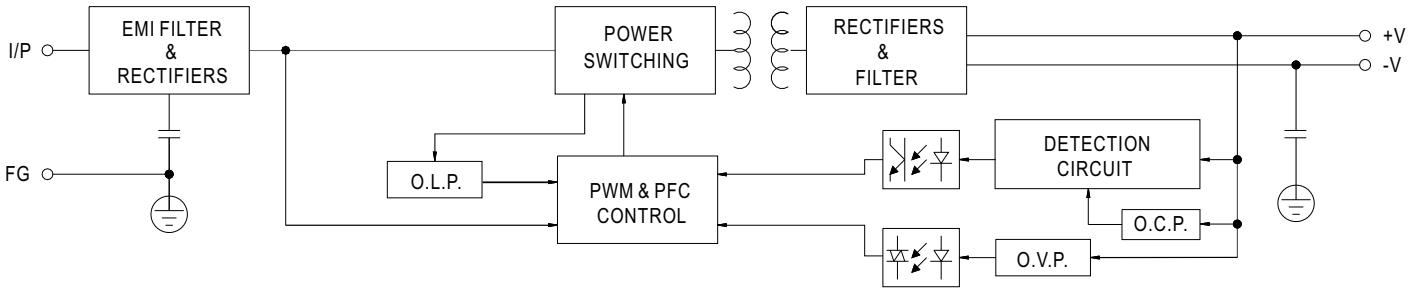
Output voltage and current adjustment : remove the upper case and adjust through SVR1 & SVR2 shown in the diagram.



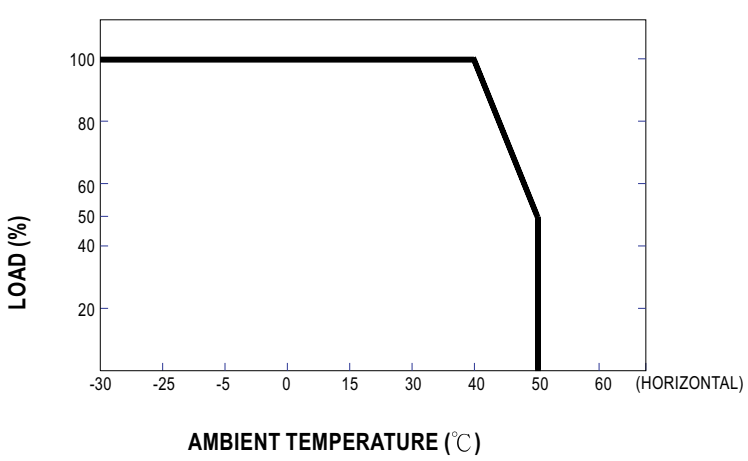
SVR1	Output voltage adjustment
SVR2	Output current adjustment

■ Block Diagram

fosc : 90KHz(115VAC)
120KHz(230VAC)



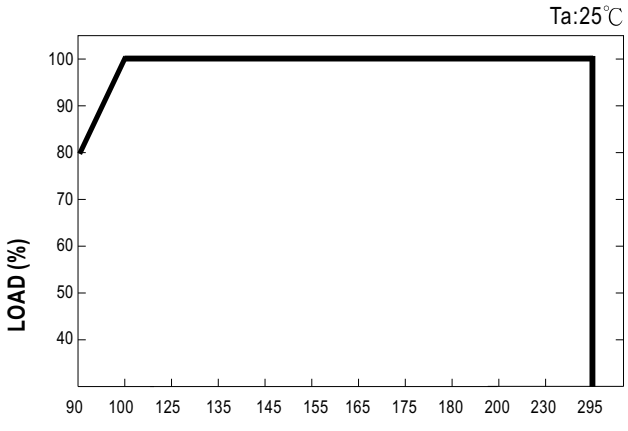
■ Derating Curve



AMBIENT TEMPERATURE (℃)

■ Static Characteristics

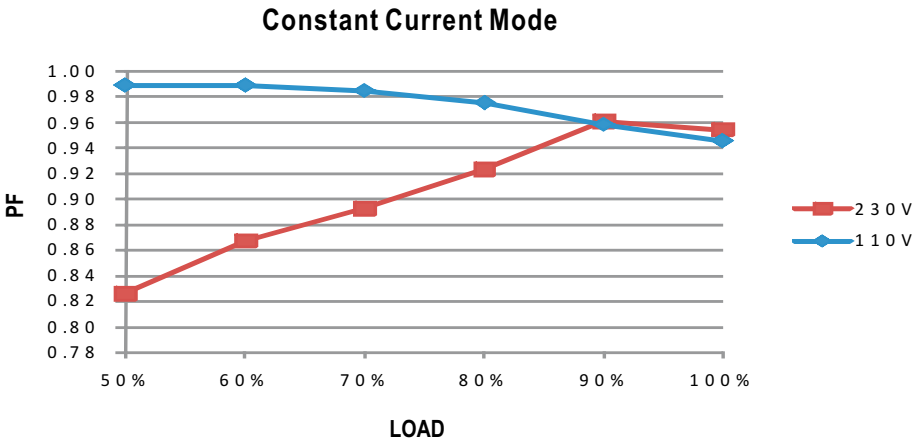
Ta:25℃



INPUT VOLTAGE (V) 60Hz

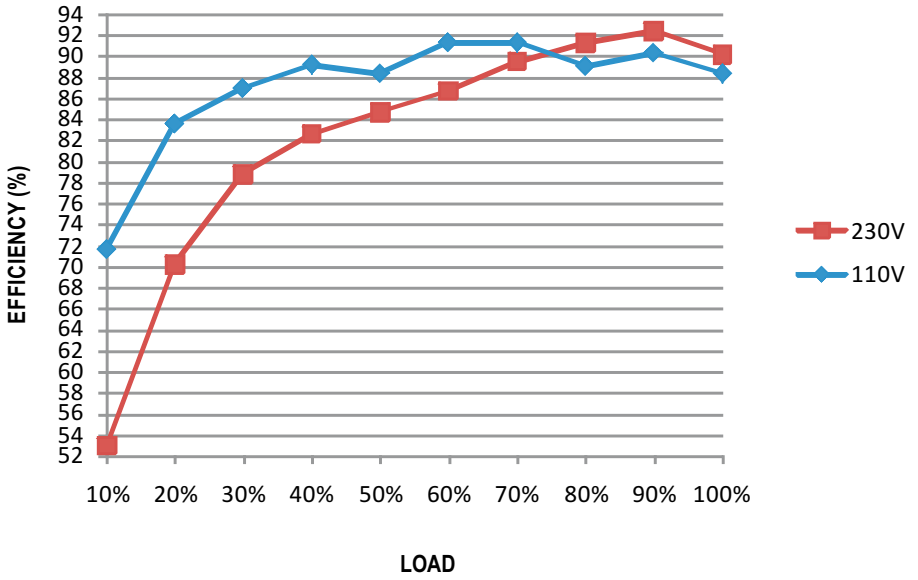
■ Power Factor Characteristic

Power factor will be higher than 0.9 when output loading is 75% or higher.



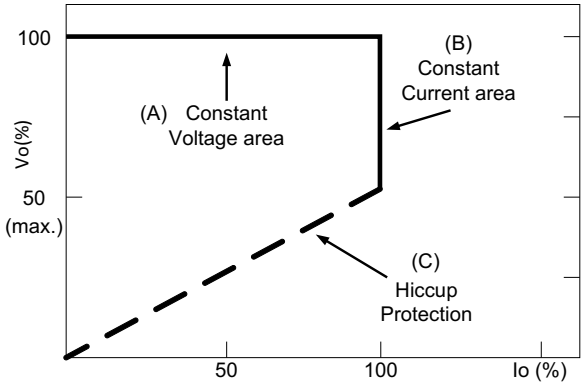
■ EFFICIENCY vs LOAD (48V Model)

PLN-60 series possess superior working efficiency that up to 89% can be reached in field applications.



■ DRIVING METHODS OF LED MODULE

There are two major kinds of LED drive method "direct drive" and "with LED driver".
A typical LED power supply may either work in "constant voltage mode (CV) or constant current mode (CC)" to drive the LEDs.
Mean Well's LED power supply with CV+ CC characteristic can be operated at both CV mode [with LED driver, at area (A)] and CC mode [direct drive, at area (B)].



Typical LED power supply I-V curve

MODEL：PLN-60-27

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	RIPPLE & NOISE	V1： 2.7 Vp-p (Max)	I/P： 230VAC O/P： 100% LOAD Ta：25℃	V1： 1.29 mVp-p (Max)	P
2	OUTPUT VOLTAGE ADJUST RANGE	CH1： 25 V~ 30V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	24.5 V~ 30.78 V/ 230 VAC 24.5 V~ 30.78 V/ 115 VAC	P
3	OUTPUT CURRENT ADJUST RANGE	CH1： 2.369 A~1.725 A	I/P： 230 VAC I/P： 115 VAC Ta：25℃	1.35 A~ 3.4 A/ 230 VAC 1.3 A~ 3.17 A/ 115 VAC	P
4	OUTPUT VOLTAGE TOLERANCE	V1： 10 %~ -10 % (Max)	I/P： 100 VAC / 295 VAC O/P： 100% LOAD / MIN LOAD Ta：25℃	V1： 2.4 %~ -2.4 %	P
5	LINE REGULATION	V1： 3 %~ -3 % (Max)	I/P： 100VAC ~ 295 VAC O/P： 100% LOAD Ta：25℃	V1： 0.05 %~ -0.05 %	P
6	LOAD REGULATION	V1： 5 %~ -5 % (Max)	I/P： 230 VAC O/P： 100% LOAD ~MIN LOAD Ta：25℃	V1： 0.3 %~ -0.3 %	P
7	SET UP TIME	230VAC： 1500 ms (Max) 115 VAC： 3000 ms (Max)	I/P： 230 VAC I/P： 115 VAC O/P： 100% LOAD Ta：25℃	230VAC/ 1124 ms 115VAC/ 2248 ms	P
8	OVER/UNDERSHOOT TEST	< ±10%	I/P： 230 VAC O/P： 100% LOAD Ta：25℃	TEST： <10 %	P

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	90VAC~295 VAC	I/P：TESTING O/P： 100% LOAD Ta：25℃	76 V~295V	P
			I/P： LOW-LINE-3V= 87V HIGH-LINE+15%=300 V O/P： 100% LOAD /MIN LOAD ON： 30 Sec . OFF： 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE)	TEST： OK	
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P： 90 VAC ~ 295 VAC O/P： 100% LOAD ~MIN LOAD Ta：25℃	TEST： OK	P
3	POWER FACTOR	0.90 / 230 VAC(TYP) 0.90 / 115 VAC(TYP) ≧0.9 at 75 ~ 100% load	I/P： 230 VAC I/P： 115 VAC O/P： 100% LOAD Ta：25℃	PF= 0.928 / 230 VAC PF= 0.99 / 115 VAC ≧0.9 at 75 ~ 100% load	P
4	EFFICIENCY	86.5% (TYP)	I/P： 230 VAC O/P： 100% LOAD Ta：25℃	88.3 %	P
5	INPUT CURRENT	230V/ 0.4 A (TYP) 115V/ 0.8 A (TYP)	I/P： 230 VAC I/P： 115 VAC O/P： 100% LOAD Ta：25℃	I = 0.33 A/ 230 VAC I = 0.62 A/ 115 VAC	P
6	INRUSH CURRENT	230V/ 40 A (TYP) COLD START	I/P： 230 VAC O/P： 100% LOAD Ta：25℃	I = 30 A/ 230 VAC	P
7	LEAKAGE CURRENT	< 0.75 mA / 240 VAC	I/P： 264 VAC O/P：Min LOAD Ta：25℃	L-FG： 0.4 mA N-FG： 0.4 mA	P

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	110 % (MAX)	I/P： 230 VAC I/P： 115 VAC O/P：TESTING Ta：25℃	105 %/ 230 VAC 105 %/ 115 VAC Constant Current Limiting	P
2	OVER VOLTAGE PROTECTION	CH1： 31V~ 35V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	33.4 V/ 230 VAC 33.4 V/ 115 VAC Shunt down Re- power ON	P
3	OVER TEMPERATURE PROTECTION	SPEC： TSW1： 95±10℃ O.T.P. NO DAMAGE	I/P： 230 VAC O/P： 100% LOAD	O.T.P. Active Shut down o/p voltage, recovers automatically after temperature goes down	P
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P： 264 VAC O/P： 100% LOAD Ta：25℃	NO DAMAGE Hiccup Mode	P

ENVIRONMENT TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th><th>VERDICT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL：PLN-60-24
1. ROOM AMBIENT　BURN-IN：1HRS
I/P： 230VAC　O/P： 100% LOAD　Ta= 30.6 ℃
2. HIGH AMBIENT　BURN-IN：2 HRS
I/P： 230VAC　O/P： 100% LOAD　Ta= 39.6 ℃

<table>
<tr><th>NO</th><th>Position</th><th>P/N</th><th>ROOM AMBIENT
Ta= 30.6 ℃</th><th>HIGH AMBIENT
Ta= 39.6 ℃</th></tr>
<tr><td>1</td><td>BD1</td><td>US4KB80 4A/800V SHI</td><td>75.1℃</td><td>81.9℃</td></tr>
<tr><td>2</td><td>Q1</td><td>K2843 10A/600V TOS</td><td>85.4℃</td><td>91.4℃</td></tr>
<tr><td>3</td><td>LF2</td><td>TR-689</td><td>64.9℃</td><td>71.5℃</td></tr>
<tr><td>4</td><td>L1</td><td>TR-623</td><td>73.2℃</td><td>79.6℃</td></tr>
<tr><td>5</td><td>R5</td><td>100K/2W R/MO</td><td>90.6℃</td><td>96.6℃</td></tr>
<tr><td>6</td><td>D2</td><td>GP30J 3A/600V ZOW</td><td>96.5℃</td><td>103.1℃</td></tr>
<tr><td>7</td><td>C46</td><td>100U/25V RUB 105℃ YXG</td><td>78.8℃</td><td>85.5℃</td></tr>
<tr><td>8</td><td>T1 COIL</td><td>TF-1547 LS</td><td>83.0℃</td><td>89.9℃</td></tr>
<tr><td>9</td><td>D100</td><td>BYV32E 20A/200V PH</td><td>79.7℃</td><td>87.0℃</td></tr>
<tr><td>10</td><td>C106</td><td>1000U/35V NCC 105℃ KY</td><td>78.0℃</td><td>85.2℃</td></tr>
<tr><td>11</td><td>TSW1</td><td>ST-95</td><td>75.5℃</td><td>82.6℃</td></tr>
<tr><td>12</td><td>U1</td><td>TDA4863G INFINEON</td><td>81.4℃</td><td>88.0℃</td></tr>
<tr><td>13</td><td>LF100</td><td>TR-706</td><td>68.7℃</td><td>76.6℃</td></tr>
<tr><td>14</td><td>C7</td><td>474/450V/105℃ NISSEI</td><td>80.0℃</td><td>86.3℃</td></tr>
<tr><td>15</td><td>CASE</td><td>UP CASE</td><td>58.3℃</td><td>62.3℃</td></tr>
</table>
</td><td>P</td></tr>
<tr><td>2</td><td>OVER LOAD BURN-IN TEST</td><td>NO DAMAGE
1 HOUR (MIN)</td><td>I/P： 230 VAC
O/P： 103 % LOAD
Ta：25℃</td><td>TEST：OK</td><td>P</td></tr>
<tr><td>3</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER　2　HOUR</td><td>I/P： 230 VAC
O/P： 100 % LOAD
Ta= -30 ℃</td><td>TEST：OK</td><td>P</td></tr>
<tr><td>4</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12　HOURS
IN CHAMBER ON
CONTROL　40℃
NO DAMAGE</td><td>I/P： 295 VAC
O/P： 100% LOAD
Ta= 40℃
HUMIDITY=　95 %R.H</td><td>TEST：OK</td><td>P</td></tr>
<tr><td>5</td><td>TEMPERATURE
COEFFICIENT</td><td>± 0.03 %(0~50℃)</td><td>I/P： 230 VAC
O/P：100% LOAD</td><td>± 0.01 %(0~50℃)</td><td>P</td></tr>
<tr><td>6</td><td>VIBRATION TEST</td><td colspan="2">1 Carton & 1 Set
(1) Waveform： Sine Wave
(2) Frequency：10~500Hz
(3) Time：72min
(4) Acceleration：2G
(5) Test Time：1 hour in each axis (X.Y.Z)
(6) Ta：25℃</td><td>TEST：OK</td><td>P</td></tr>
</table>

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P： 3.75 KVAC/min I/P-FG：1.88KVAC/min O/P-FG：0.5KVAC/min	I/P-O/P： 4.2KVAC/min I/P-FG：2.25KVAC/min O/P-FG：0.6KVAC/min Ta：25℃	I/P-O/P： 2.211 mA I/P-FG： 4.76 mA O/P-FG： 5.35 mA 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： 500 VDC Ta：25℃	I/P-O/P： 30 GΩ I/P-FG： 30 GΩ O/P-FG： 30 GΩ NO DAMAGE	P
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta：25℃	49 mΩ	P
4	APPROVAL	TUV： Certificate NO ：R50102381 UL： File NO ：E307078			P

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS C	I/P： 230 VAC/50HZ O/P： 100% LOAD/75%LOAD Ta：25℃	PASS	P
2	CONDUCTION	EN55022 CLASS B	I/P： 230 VAC (50HZ) O/P： 100% LOAD /50% LOAD Ta：25℃	PASS Test by certified Lab	P
3	RADIATION	EN55022 CLASS B	I/P： 230 VAC (50HZ) O/P： 100% LOAD Ta：25℃	PASS Test by certified Lab	P
4	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR：8KV / Contact：4KV	I/P： 230 VAC/50HZ O/P： 100% LOAD Ta：25℃	CRITERIA A	P
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT： 1KV	I/P： 230 VAC/50HZ O/P： 100% LOAD Ta：25℃	CRITERIA A	P
6	SURGE	IEC61000-4-5 LIGHT INDUSTRY L-N ：1KV L,N-PE：2KV	I/P： 230 VAC/50HZ O/P： 100% LOAD Ta：25℃	CRITERIA A	P
7	Test by certified Lab & Test Report Prepare				

M.T.B.F & LIFE CYCLE CALCULATION

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	CAPACITOR LIFE CYCLE	PLN-60-24 ： SUPPOSE C105 IS THE MOST CRITICAL COMPONENT I/P： 230VAC O/P： 100% LOAD Ta= 25 ℃ LIFE TIME= 116971 HRS I/P： 230VAC O/P： 100% LOAD Ta= 50 ℃ LIFE TIME= 46886 HRS			P
2	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE： 497.8K HRS			P
3	ORT (Ongoing Reliability test)	I/P：230VAC O/P：FULL LOAD TA=50.6℃ Sample=20pcs TEST TIME=840HRS			P

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 2SK2843 ： 600V 10 A	I/P：High-Line +3V = 298 V O/P： (1) 100% LOAD Turn on (2) Output Short Ta：25℃	(1) 512 V (2) 442 V	P
2	Diode Peak Voltage	D100 Rated BYV32E-200 ： 200V 20A	I/P：High-Line +3V = 298 V O/P： (1) 100% LOAD Turn on (2)Output Short Ta：25℃	(1) 165 V (2) 137 V	P
3	Clamp Diode Peak Voltage	D2 Rated GP30J ： 600V 3A	I/P：High-Line +3V = 298 V O/P： (1) Dynamic Load 90%Duty/1KHz Ta：25℃	(1) 492 V	P
4	Control IC Voltage Test	U1 Rated TDA4863G ： 22V	I/P：High-Line +3V = 298 V O/P： (1) 100% LOAD Turn on /Off (2) Min load Turn on /Off (3) 100% /Min load Change Ta：25℃	(1) 14.99 V (2) 12.2 V (3) 14.99 V	P

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2006/10/5	RD SAMPLE	PASS	VINCENT TSENG	MAX LIN
2007/1/9	PRODUCT SAMPLE W0611B31	PASS	VINCENT TSENG	MAX LIN

2003/12/12 A50-F023