



### ■ 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

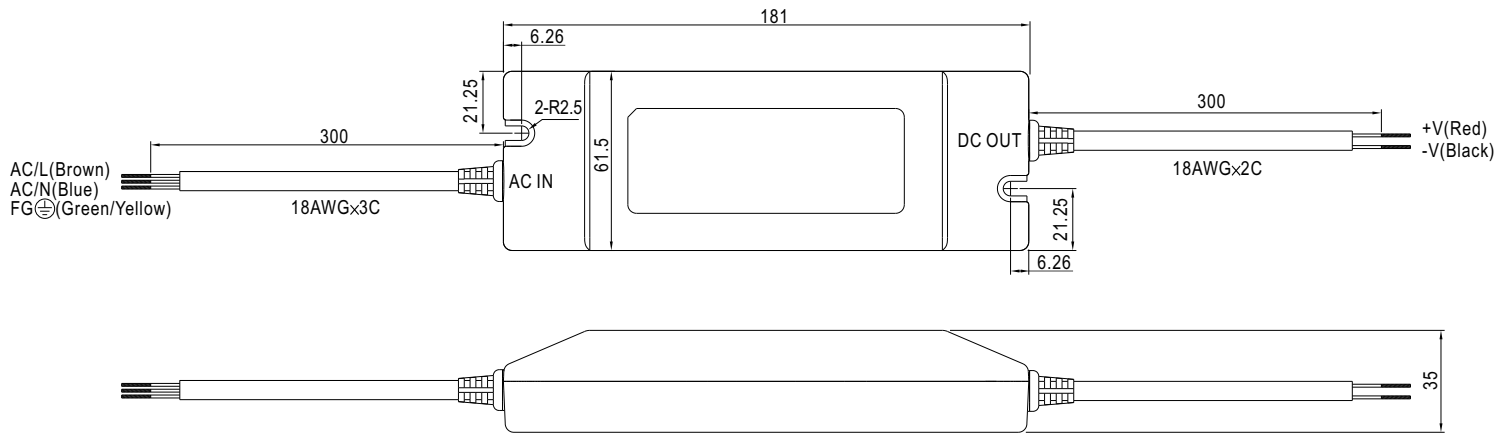


### SPECIFICATION

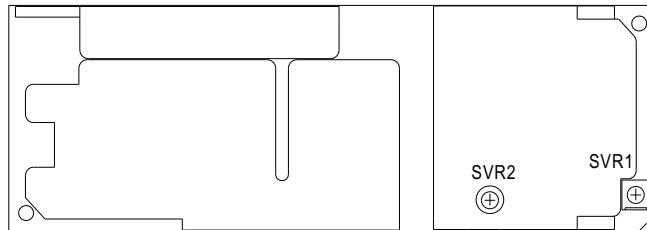
MODEL	PLN-60-12	PLN-60-15	PLN-60-20	PLN-60-24	PLN-60-27	PLN-60-36	PLN-60-48		
OUTPUT	DC VOLTAGE	12V	15V	20V	24V	27V	36V	48V	
	CONSTANT CURRENT REGION Note.6	8.4 ~ 12V	10.5 ~ 15V	14 ~ 20V	16.8 ~ 24V	18.9 ~ 27V	25.2 ~ 36V	33.6 ~ 48V	
	RATED CURRENT	5A	4A	3A	2.5A	2.3A	1.7A	1.3A	
	CURRENT RANGE	0 ~ 5A	0 ~ 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	23 ~ 26V	28 ~ 32V	31 ~ 35V	41 ~ 46V	54 ~ 60V	
Protection type : Shut down o/p voltage, re-power on to recover									
OVER TEMPERATURE	95°C ±10°C (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°C (Refer to output load derating curve)							
	WORKING HUMIDITY	20 ~ 95% RH non-condensing							
	STORAGE TEMP., HUMIDITY	-40 ~ +80°C, 10 ~ 95% RH							
	TEMP. COEFFICIENT	±0.03%/°C (0 ~ 50°C)							
	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°C / 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°C)							
	DIMENSION	181*61.5*35mm (L*W*H)							
	PACKING	0.5Kg; 24pcs/13Kg/0.75CUFT							
NOTE	<p>1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25°C of ambient temperature.</p> <p>2. Ripple &amp; noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf &amp; 47uf parallel capacitor. Direct connecting to LEDs is not suggested for models with "RIPPLE &amp; NOISE" &gt;±10% and using additional drivers is highly recommended.</p> <p>3. Tolerance : includes set up tolerance, line regulation and load regulation.</p> <p>4. Derating may be needed under low input voltage. Please check the static characteristics for more details.</p> <p>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.</p> <p>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.</p> <p>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.</p>								

**Mechanical Specification**

Case No.960A Unit:mm



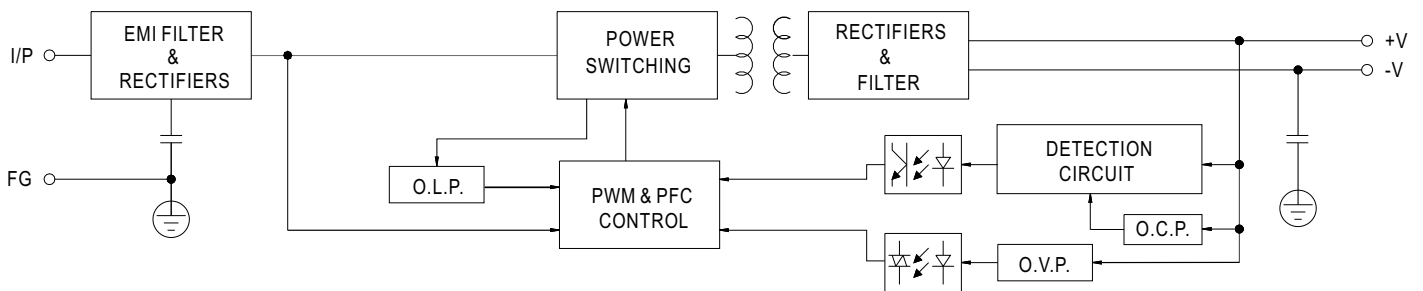
Output voltage and current adjustment : remove the upper case and adjust through SVR1 & SVR2 shown in the diagram.



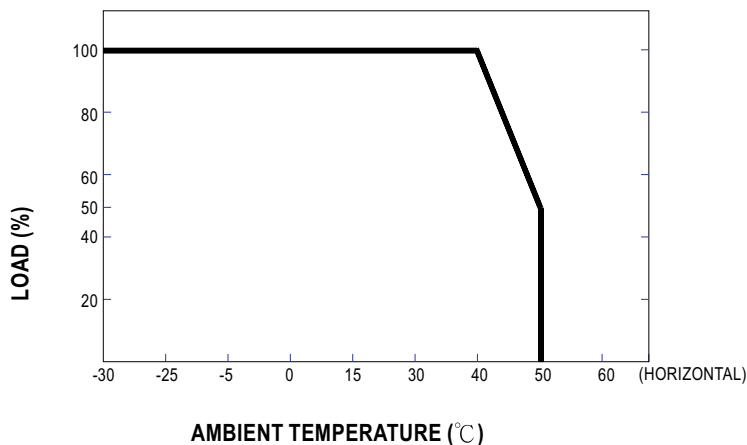
SVR1	Output voltage adjustment
SVR2	Output current adjustment

**Block Diagram**

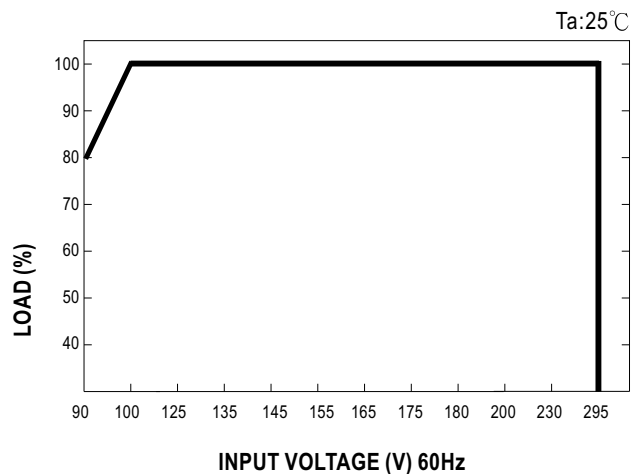
fosc : 90KHz(115VAC)  
120KHz(230VAC)



**Derating Curve**



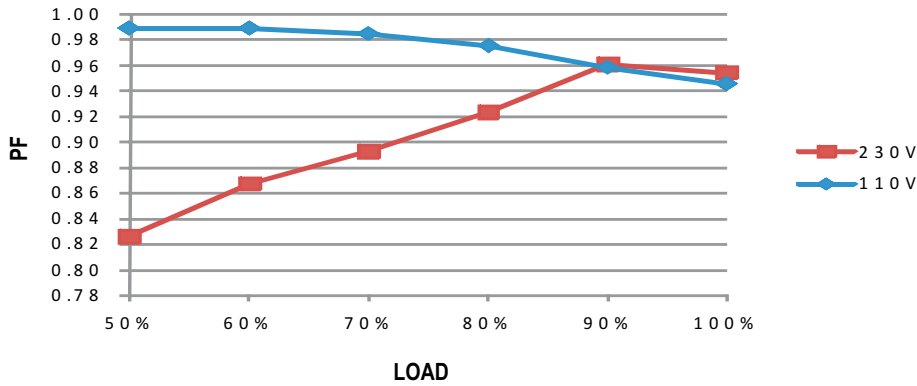
**Static Characteristics**



**Power Factor Characteristic**

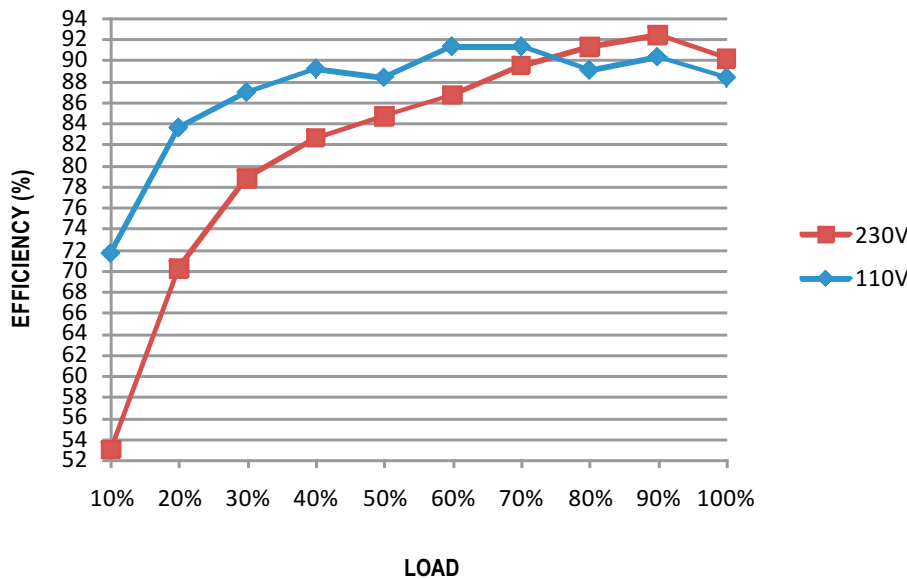
Power factor will be higher than 0.9 when output loading is 75% or higher.

**Constant Current Mode**



**EFFICIENCY vs LOAD (48V Model)**

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

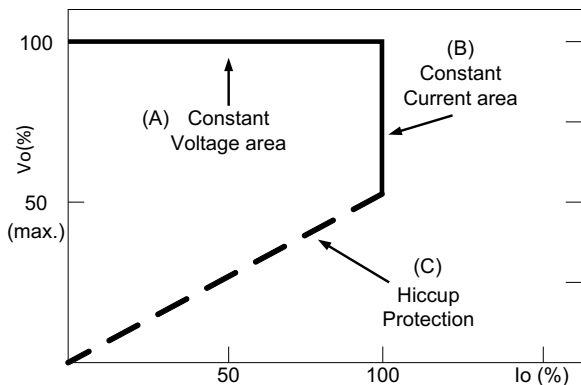


**DRIVING METHODS OF LED MODULE**

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-60-20

### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	RIPPLE & NOISE	V1 : 1.8 Vp-p (Max)	I/P : 230VAC O/P : 100% LOAD Ta : 25°C	V1 : 1.2 Vp-p (Max)	P
2	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 19.5 V- 22 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	17.3 V- 22.59 V / 230 VAC 17.3 V- 22.59 V / 115 VAC	P
3	OUTPUT CURRENT ADJUST RANGE	CH1 : 3.09 A-2.25 A	I/P : 230 VAC I/P : 115 VAC Ta : 25°C	1.55 A- 4.77 A / 230 VAC 1.49 A- 4.53 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°C	V1 : 0.5 %- -0.5 %	P
5	LINE REGULATION	V1 : 3 %- -3 % (Max)	I/P : 100VAC ~ 295 VAC O/P : 100% LOAD Ta : 25°C	V1 : 0.2 %- -0.2 %	P
6	LOAD REGULATION	V1 : 5 %- -5 % (Max)	I/P : 230 VAC O/P : 100% LOAD -MIN LOAD Ta : 25°C	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°C	230VAC/ 1109 ms 115VAC/ 2218 ms	P
8	OVER/UNDERSHOOT TEST	< ±10%	I/P : 230 VAC O/P : 100% LOAD Ta : 25°C	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°C	80 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°C	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°C	PF= 0.93 / 230 VAC PF= 0.99 / 115 VAC ≥0.9 at 75 ~ 100% load	P
4	EFFICIENCY	86% (TYP)	I/P : 230 VAC O/P : 100% LOAD Ta : 25°C	87.2 %	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°C	I = 0.33 A/ 230 VAC I = 0.6 A/ 115 VAC	P
6	INRUSH CURRENT	230V/ 40 A (TYP)  COLD START	I/P : 230 VAC O/P : 100% LOAD Ta : 25°C	I = 29 A/ 230 VAC	P
7	LEAKAGE CURRENT	< 0.75 mA / 240 VAC	I/P : 264 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.34 mA N-FG : 0.34 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°C	103 %/ 230 VAC 102 %/ 115 VAC Constant Current Limiting	P
2	OVER VOLTAGE PROTECTION	CH1 : 22.8 V- 25V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	23.7 V/ 230 VAC 23.7 V/ 115 VAC Shunt down Re- power ON	P
3	OVER TEMPERATURE PROTECTION	SPEC : TSW1 : 95 ± 10°C 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°C	NO DAMAGE Hiccup Mode	P

## ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT	
1	TEMPERATURE RISE TEST	MODEL : PLN-60-24				
		1. ROOM AMBIENT BURN-IN : 1HRS				
		I/P : 230VAC O/P : 100% LOAD Ta= 30.6 °C				
		2. HIGH AMBIENT BURN-IN : 2 HRS				
		I/P : 230VAC O/P : 100% LOAD Ta= 39.6 °C				
		2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 103 % LOAD Ta : 25°C	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 230 VAC O/P : 100 % LOAD Ta= -30 °C	TEST : OK	P	
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 40°C NO DAMAGE	I/P : 295 VAC O/P : 100% LOAD Ta= 40°C HUMIDITY= 95 %R.H	TEST : OK	P	
5	TEMPERATURE COEFFICIENT	± 0.03 %(0-50°C)	I/P : 230 VAC O/P : 100% LOAD	± 0.01 %(0-50°C)	P	
6	VIBRATION TEST	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°C		TEST : OK	P	

### 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°C	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°C	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°C	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°C	PASS	P
2	CONDUCTION	EN55022 CLASS B	I/P : 230 VAC (50HZ) O/P : 100% LOAD /50% LOAD Ta : 25°C	PASS Test by certified Lab	P
3	RADIATION	EN55022 CLASS B	I/P : 230 VAC (50HZ) O/P : 100% LOAD Ta : 25°C	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°C	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°C	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°C	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 °C LIFE TIME= 116971 HRS I/P : 230VAC O/P : 100% LOAD Ta= 50 °C 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°C 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 10A	I/P : High-Line +3V = 298 V O/P : (1) 100% LOAD Turn on (2) Output Short Ta : 25°C	(1) 520 V (2) 482 V	P
2	Diode Peak Voltage	D100 Rated STPS20170C : 170V 20A	I/P : High-Line +3V = 298 V O/P : (1) 100% LOAD Turn on (2) Output Short Ta : 25°C	(1) 118 V (2) 108 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°C	(1) 498 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°C	(1) 16.75 V (2) 13.38 V (3) 16.75 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