LDM60S SERIES AC-DC LED DRIVER

Application Note V10

LED Power Supply
LDM60S Series
Application Note

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Content

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1. Introduction

This application note describes the features and functions of Cincon's LDM60S series, Isolated AC-DC led driver. These are highly efficient, reliable and compact, high power density, single output AC/DC led driver. The modules are fully protected against short circuit and over-voltage conditions. Cincon's world class automated manufacturing methods, together with an extensive testing and qualification program; ensure that all LDM60S series led drivers are extremely reliable.

2. LDM60S Series LED Driver Features

- Universal Input: 90~305Vac or 127-420Vdc
- High Efficiency up to 90%
- Meets EN55015, EN61000-3-2 Class C
- Meets EN61347-1, EN61347-2-13
- Meets UL8750
- Meets UL1310 Class 2
- Dimming Range 5%-100%
- Active PFC Function
- IP67 Design for Indoor or Outdoor Installations
- Max. Output power 60W
- Dimming Function: Digital (Optional)
- Protections: Short Circuit, Over Current Over Voltage and Over Temperature
- Constant Voltage and Constant Current
- No Load Power Consumption<0.5W
- 3 Years Warranty

3. General Description

A block diagram of the LDM60S series led driver is shown in Figure 1. The LDM60S series topology is based on an isolated synchronous flyback converter. The control loop is optimized for unconditional stability, fast transient response and a very tight line and load regulation. The output voltage can be adjusted from +10% to –10% and the output current can be adjusted from +100% to 60% by a variable resistor for 02 and 04A version.

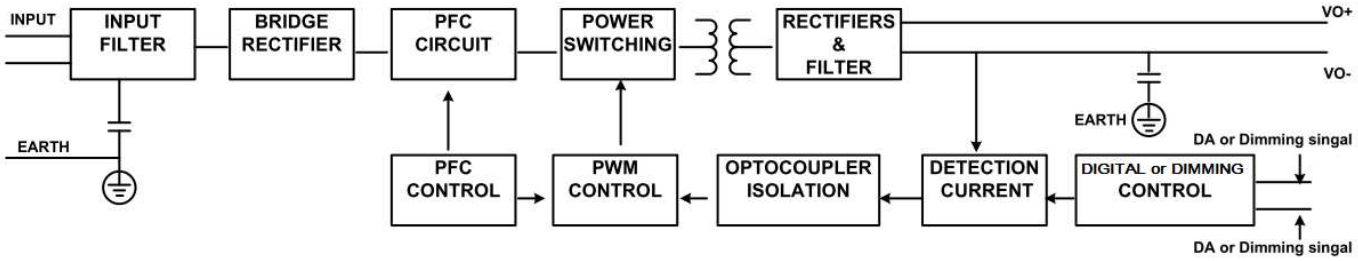

Figure 1. Electrical Block Diagram

4. Technical Specifications

(All specifications are typical at nominal input, full load at 25℃ unless otherwise noted.)

ABSOLUTE MAXIMUM RATINGS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input Voltage		All	90 127		305 420	Vac Vdc
Operating Temperature		All	-40		+70	℃
Storage Temperature		All	-40		+85	℃
Input/Output Isolation Voltage	1 minute	All	3750			Vac

INPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Operating Voltage Range		All	100		277	Vac
Input Frequency Range		All	50		60	Hz
Input Current	Input voltage is 110Vac, Pout=59W Input voltage is 230Vac, Pout=59W	All		0.6 0.31		A
Power Factor Correction	See **section 7.2** Power factor & THD V.S output current	AI		0.9		
Leakage Current	Maximum Input Voltage is 277Vac	All			0.75	mA
Inrush Current	Input voltage is 110Vac and 240Vac, cold start at 25℃	All			60	A

OUTPUT CHARACTERISTIC

PARAMETER	NOTES and CONDITIONS		Device	Min.	Typical	Max.	Units
Output Voltage Set Point	Input Voltage is 115Vac and 230Vac, 90% output current at ambient temperature 25℃	12V=4.5A 24V=2.25A 36V=1.5A 48V=1.13A	LDM60S120 LDM60S240 LDM60S360 LDM60S480	11.88 23.76 35.64 47.52	12 24 36 48	12.12 24.24 36.36 48.48	Vdc
Output Voltage Adjustment	Output voltage*output current ≦ Rated output power(60W) (Model: LDM60SXXX-02, -04A)		LDM60S120 LDM60S240 LDM60S360 LDM60S480	10.88 21.6 32.4 43.2	12 24 36 48	13.2 26.4 39.6 52.8	Vdc
Constant Current Region	Output Voltage		LDM60S120 LDM60S240 LDM60S360 LDM60S480	6.5 13 19 26		12 24 36 48	Vdc
Output Current	Constant current	CV Load=6.5V~11.5V CV Load=13V~23.5V CV Load=19V~35.5V CV Load=26V~47.5V	LDM60S120 LDM60S240 LDM60S360 LDM60S480		5 2.5 1.67 1.25		A
Output Current Adjustment	Output voltage*output current ≦ Rated output power(60W) (Model: LDM60SXXX-02, -04A)		LDM60S120 LDM60S240 LDM60S360 LDM60S480	3 1.5 1 0.75		5 2.5 1.67 1.25	A

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PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Constant Current Accuracy		All	-5		±5	%
No Load Consumption	Input Voltage is 230Vac	All			1.5	Watt
Start up Time	Input Voltage is 90~305Vac	All			2.5	S
Rise Time	Input Voltage is 90~305Vac	All		50		mS
Holdup Time	Input voltage is is 115Vac	All		16		mS
Load Regulation	Input voltage is 115Vac and 230Vac,10% output current to 90% output current	All			±2.0	%
Line Regulation	Input voltage is 90~305Vac with 90% output current	All			±1.0	%
Output Voltage Ripple and Noise Peak-to-Peak	20MHz bandwidth, full load, 0.1uF ceramic and 10uF E.L capacitor with 95% output current	All			120	mV

EFFICIENCY

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
95% Output Current		LDM60S120 LDM60S240 LDM60S360 LDM60S480		87 88 89 90		%

ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input to Output	1 minute	All			3750	Vac
Input to Earth	1 minute	All			1875	Vac
Output to Earth	1 minute	All			500	Vac
Isolation Resistance		All	100			MΩ

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency	100% Output Current	All			75	kHz
Surge	EN61000-4-5 Criteria A	All			±4	kV
Harmonic	EN61000-3-2 Class C (≧ 60% output current)	All				
Life Time	Ambient temperature is 25℃	All			40	k hours
MTBF	Ambient temperature is 25℃ per MIL-HDBK-217F	All		150		k hours
Weight				454		g
Dimension				207*40*28mm ((L*W*H)		

5. Main Features and Functions

5.1 Operating Temperature Range

The LDM60S series led driver highly efficient converter design has resulted in its ability to operate ambient temperature environment (-40℃ to 70℃). Due consideration must be given to the de-rating curves when ascertaining maximum power that can be drawn from the converter. The maximum power drawn is influenced by a number of factors, such as:

- Input voltage range.
- Permissible Output load (per derating curve)

5.2 Over current Protection & over voltage protection

The power modules provide full continuous short-circuit protection. The unit will auto recover once the short circuit is removed. To provide protection in a fault condition, the unit is equipped with internal over-current protection. The unit will operate normally once the fault condition is removed. The output voltage will decrease when the output current is above its constant current point. When the output current is continue increase the power module will go to hiccup mode if the output voltage is lower than 50% of rated output voltage.

All different voltage models have a full continuous over voltage protection. The power module will supply up to 115%~135% of rated voltage. In the event of an over voltage converter will go to hiccup mode. The module will automatically restart after he fault condition is removed.

5.3 Over Temperature Protection

The LDM60S has an over temperature protection circuit to safeguard against thermal damage. When the TH2 temperature rises above 110℃, the LDM60S will shut down (latch) to protect it from overheating.

5.4 CC and CV Mode

The latest design from LDM60S takes the two mode of operation and combines them onto one design. Figure2 you can see how the unit will initially behave as a constant voltage unit. Once the max output current is reached, the control loop will then hold the supply current at a constant value and reduce the output voltage accordingly. This type of approach has many benefits to the end designer in that if chosen correctly both CC and CV mode designs can be achievable with one supply.

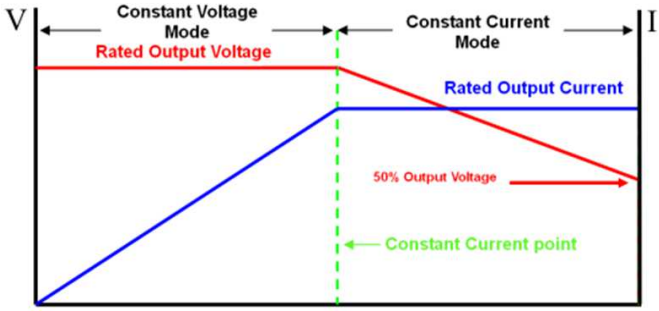


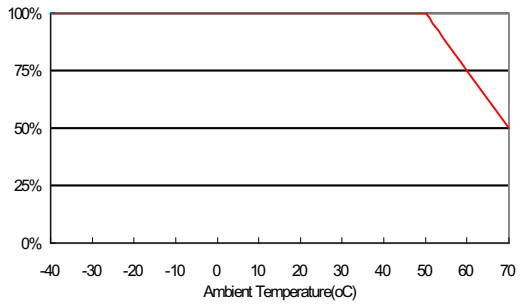
Figure 2 CC/CV Mode

6. Safety

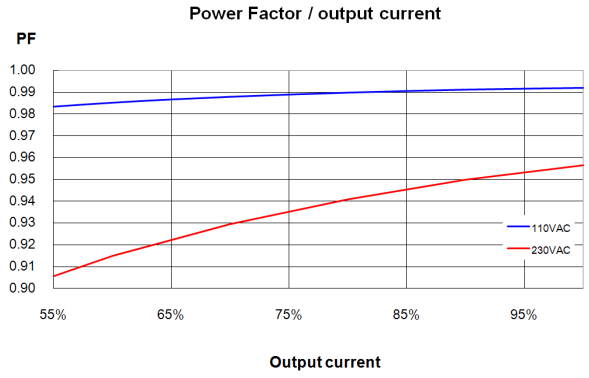
- CB Approval (IEC/EN61347-1, IEC/EN61347-2-13)
- VDE Approval
- UL Approval (UL8750)

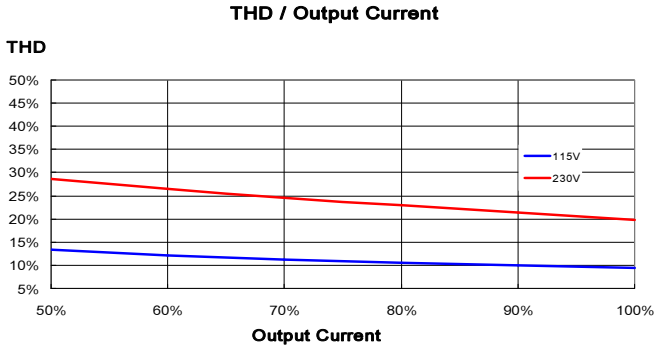
7. Applications

7.1 Power De-Rating Curves



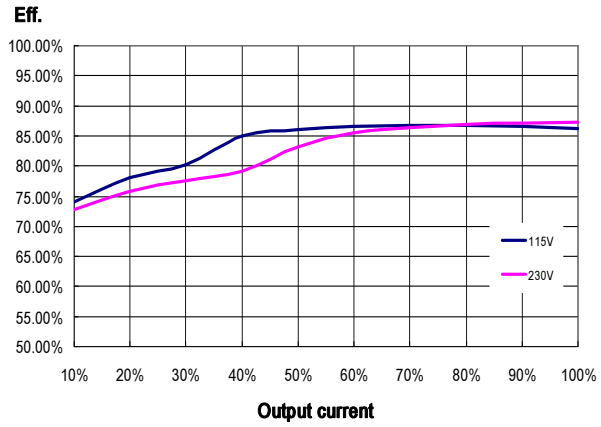
7.2 Power Factor & THD vs. Output Current





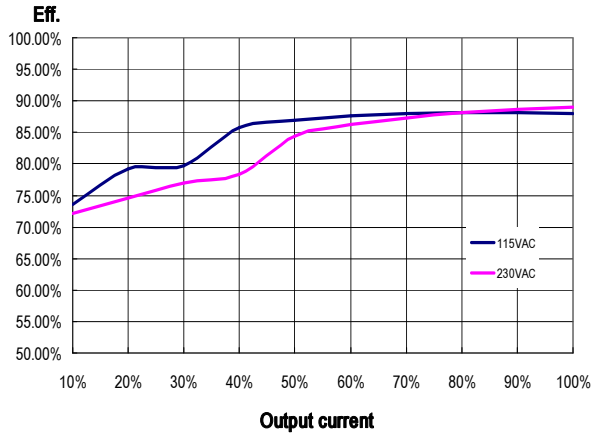
7.3 Efficiency vs. Output Current Curves

12V



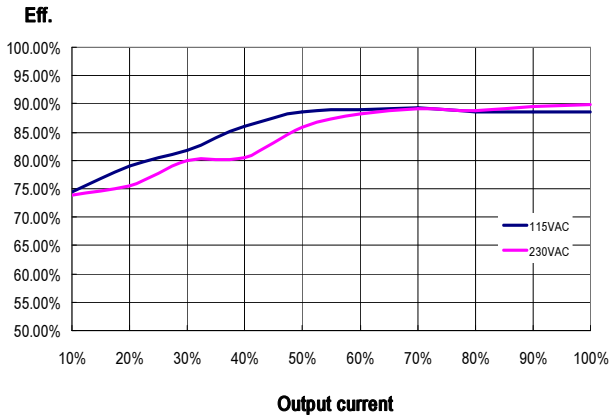
LDM60S120

24V



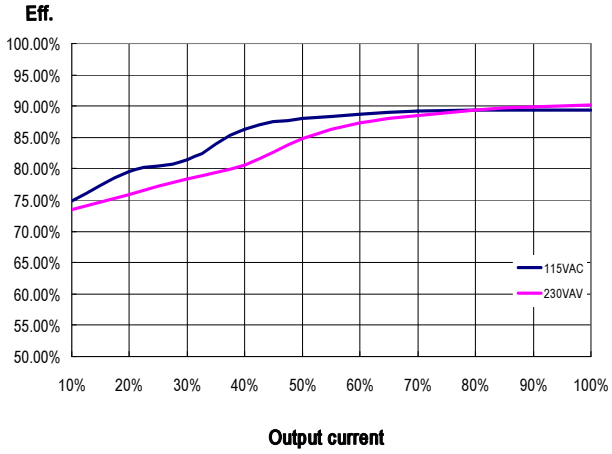
LDM60S240

36V



LDM60S360

48V



LDM60S480

7.4 Test Set Up

The basic test set-up to measure parameters such as efficiency and load regulation is shown in Figure 3. When testing the Cincon's LDM60S series under any transient conditions please ensure that the transient response of the source is sufficient to power the equipment under test. We can calculate the

- Efficiency
- Load regulation and line regulation

The value of efficiency is defined as:

$$\eta = \frac{Vo \times Io}{Pin} \times 100\%$$

Where: Vo is output voltage,
Io is output current,
Pin is input power (Pin=Vin x Iin x PF)

The value of load regulation is defined as:

$$Load.reg = \frac{V_{FL} - V_{NL}}{V_{NL}} \times 100\%$$

Where: V_{FL} is the output voltage at 90% output current

V_{NL} is the output voltage at 10% output current

The value of line regulation is defined as:

$$Line.reg = \frac{V_{HL} - V_{LL}}{V_{LL}} \times 100\%$$

Where: V_{HL} is the output voltage of maximum input voltage at 90% output current.

V_{LL} is the output voltage of minimum input voltage at 90% output current.

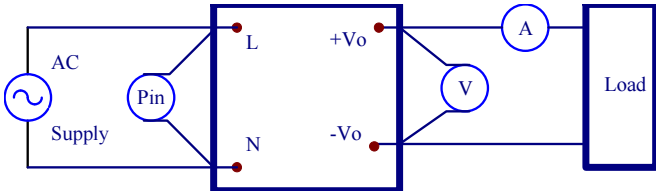


Figure 3. LDM60S Series Test Setup

7.5 Output Ripple and Noise Measurement

The test set-up for noise and ripple measurements is shown in Figure 4. Measured method:

Add a 0.1 uF ceramic capacitor and a 10 uF electrolytic capacitor to output at 20 MHz Band Width

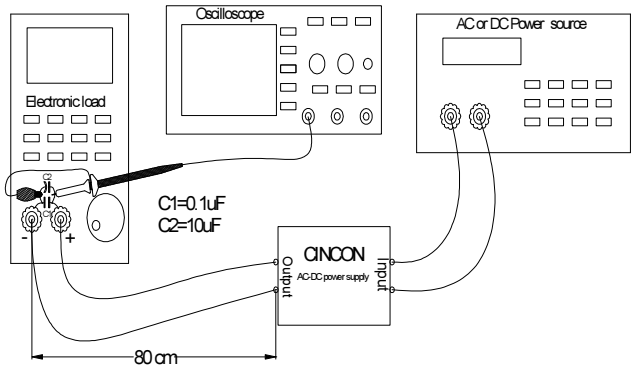


Figure 4. Output Voltage Ripple and Noise Measurement Set-Up

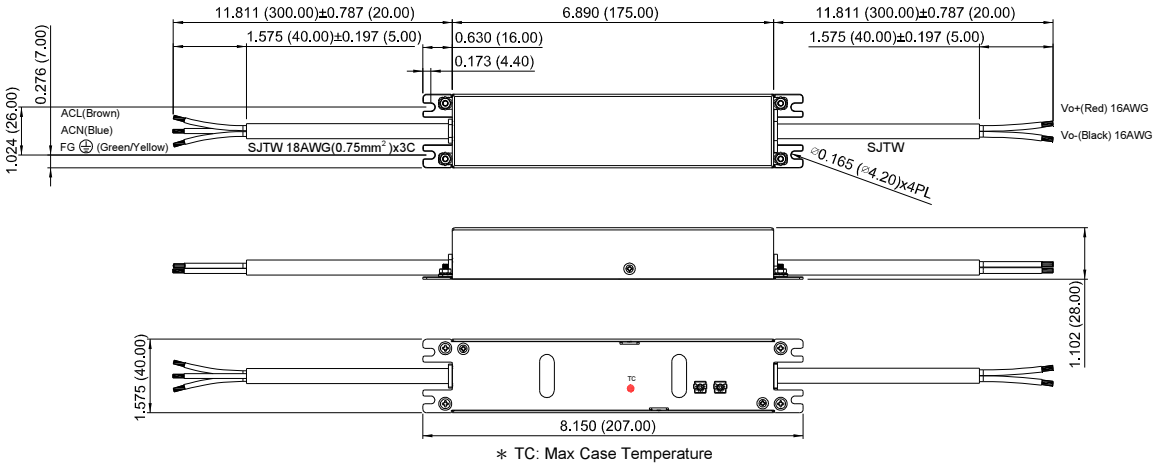
7.6 EMI

- EN55015 CISPR22

8. Mechanical Outline Diagrams

8.1 LDM60S Mechanical Outline Diagrams

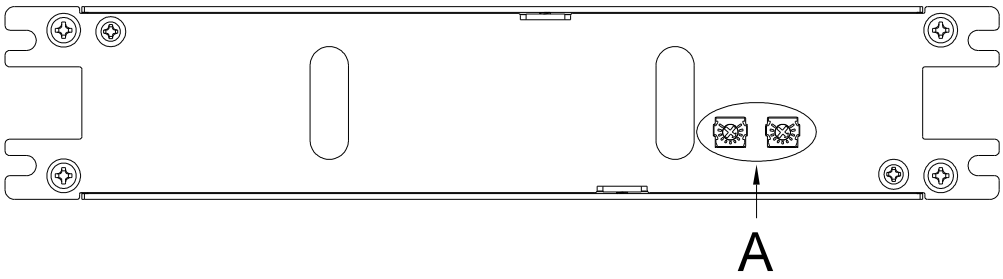
All Dimensions in Inches(mm)
Tolerance Inches:x.xxx±0.02
Millimeters:x.xx±0.5



∗ TC: Max Case Temperature

9. Potentiometer for Output Voltage/Output Current Adjustment

The LDM60SXXX-02, 04A have output voltage & output current adjustment (Output voltage*output current ≦ Rated output power (60W)). There are two potentiometers for every driver. Each of potentiometers has 11 tick marks. Tables with values for potentiometers tick marks as follows:



A
DETAIL VIEW

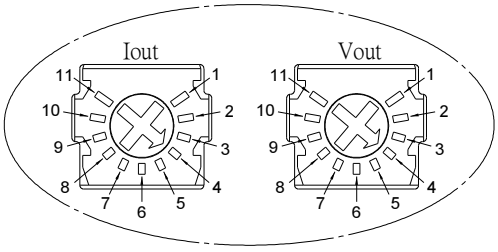


Table for Output Current (Typical)

	Output Current (Iout)			
Tick marks for potentiometer	LDM60S120 -02, 04A	LDM60S240 -02, 04A	LDM60S360 -02, 04A	LDM60S480 -02, 04A
1	5.4A	2.6A	2.0A	1.33A
2	5.4A	2.6A	2.0A	1.33A
3	5.1A	2.5A	1.9A	1.27A
4	4.9A	2.3A	1.8A	1.18A
5	4.6A	2.2A	1.7A	1.14A
6	4.3A	2.0A	1.5A	1.00A
7	3.9A	1.9A	1.3A	0.97A
8	3.5A	1.7A	1.2A	0.89A
9	3.2A	1.6A	1.1A	0.81A
10	2.9A	1.4A	0.9A	0.70A
11	2.8A	1.3A	0.9A	0.70A

Table for Output Voltage (Typical)

	Output Voltage (Vout)			
Tick marks for potentiometer	LDM60S120 -02, 04A	LDM60S240 -02, 04A	LDM60S360 -02, 04A	LDM60S480 -02, 04A
1	10.6V	21.3V	31.6V	43.1V
2	10.6V	21.3V	31.6V	43.1V
3	10.9V	21.7V	32.2V	43.9V
4	11.1V	22.3V	33.2V	44.2V
5	11.3V	22.8V	34.1V	45.1V
6	11.6V	23.5V	35.2V	46.3V
7	12.0V	24.2V	36.4V	47.3V
8	12.5V	25.0V	37.5V	48.9V
9	12.8V	25.6V	38.8V	50.9V
10	13.1V	26.4V	40.0V	53.2V
11	13.3V	26.6V	40.3V	53.4V

10. Installation Instruction

10.1 The maximum number of the LDM60S That Can be Connected to a Circuit Breaker at 240V is Shown as Below

LDM60S series calculated values are based on MCB S200 series manufactured by ABB.

Breaker Type	B10	B16	C10	C16
Amount	3	6	6	10

10.2 Direct Driving Link Diagrams

Output voltage of power supply must be higher than total forward voltage of series connecting LED

10.3 Digital Dimming Function Link Diagrams

Output constant current can be adjusted through output cable by connecting digital dimming controller which meets IEC62386.

11. Ordering Information

LDM60SXXX-XX

Optional type

01: Constant Current Mode (IP67)
No dimming
No adjustment for output voltage and output current

02: Constant Current Mode (IP65)
No dimming
With adjustment for output voltage and output current

04: Constant Current Mode (IP67)
Dimming: Digital
No adjustment for output voltage and output current

04A: Constant Current Mode (IP65)
Dimming: Digital
With adjustment for output voltage and output current

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