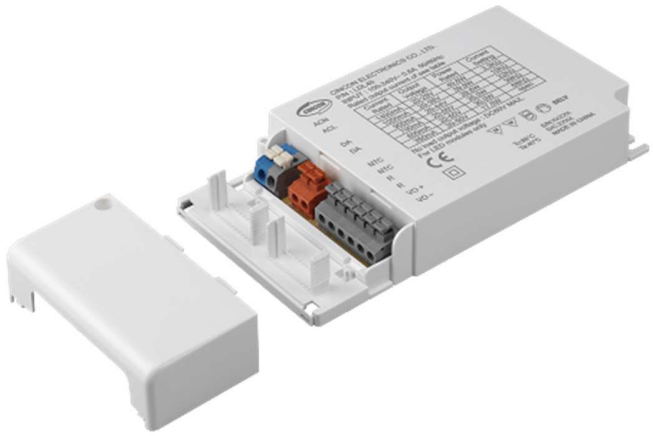
LED Power Supply
LDL40 Series
Application Note



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LDL40 Series

Application Note V11

Content

LDL40 Series

Application Note V11

1. Introduction

This application note describes the features and functions of Cincon's LDL40 series of LED Driver, Isolated AC-DC power supply. These are highly efficient, reliable and compact power supply with high power density. The drivers 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 LDL40 series converters are extremely reliable.

2. LDL40 Series LED Driver Features

- Universal Input: 90 ~ 264Vac
- Low AC Inrush Current < 5A
- Standby Power Consumption<0.5W
- PF>0.9
- Digital Dimming, 1~100%
- Adjustable Output Current Setting
- Continuous Short Circuit Protection
- Up to 2.5Φ Diameter Wire for Terminals of CN1(L/N)
- Up to 1.5Φ Diameter Wire for Other Terminals

3. General Description

A block diagram of the LDL40 series led driver is shown in Figure 1. The LDL40 series topology is based on an isolated one stage flyback converter. The control loop is optimized for unconditional stability, a very tight line and load regulation.

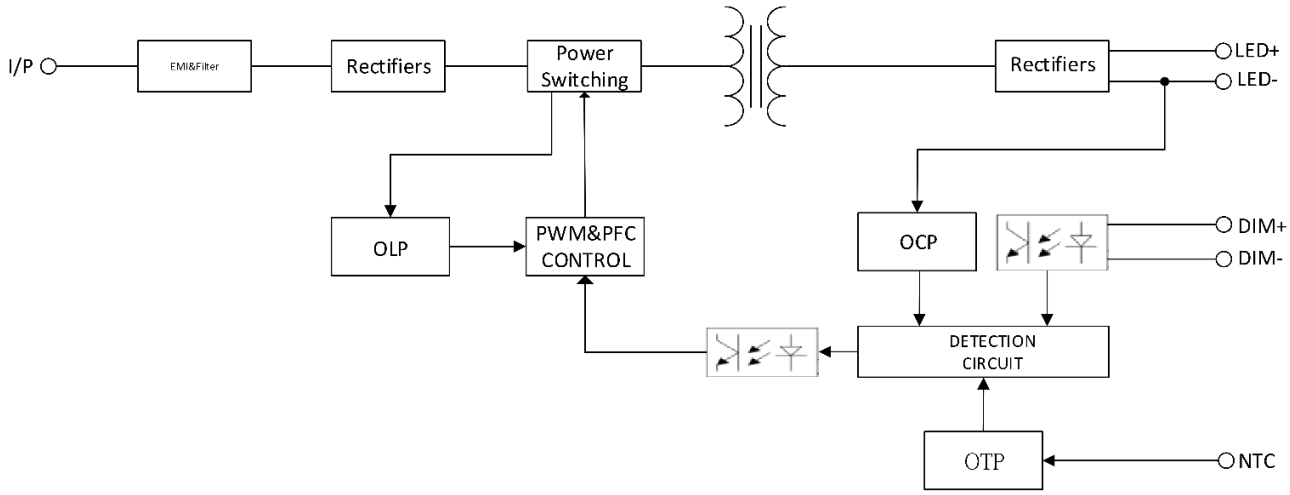


Figure 1. Electrical Block Diagram

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		264	Vac
Operating Temperature	See Derating Curve	All	-30		+60	℃
Storage Temperature		All	-40		+85	℃

INPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Operating Voltage Range		All	100		240	Vac
Input Frequency Range		All	47		63	Hz
Maximum Input Current	100% Output current @115Vac	All			0.6	A
	100% Output current @230Vac				0.25	
Power factor correction	115Vac/230Vac at 100% Load		0.9			
Leakage Current	Maximum Input voltage is 264 Vac	All			0.75	mA
Inrush Current	@Vin=240Vac,	All			5	A

OUTPUT CHARACTERISTIC

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
No Load Output Voltage	Vin=Nominal , No Load Tc=25℃	LDL40(3.3KΩ)			40	V_{dc}
		LDL40(10KΩ)			49	
		LDL40(22KΩ)			55	
		LDL40(39KΩ)			60	
		LDL40(68KΩ)			60	
		LDL40(OPEN)			60	
Output Current		LDL40(3.3KΩ)		1400		mA
		LDL40(10KΩ)		1050		
		LDL40(22KΩ)		900		
		LDL40(39KΩ)		700		
		LDL40(68KΩ)		600		
		LDL40(OPEN)		350		
Output Constant Current Accuracy		All	-5		+5	%
Output Constant Region		LDL40(3.3KΩ)	15		29	V_{dc}
		LDL40(10KΩ)	20		38	
		LDL40(22KΩ)	20		44	
		LDL40(39KΩ)	20		50	
		LDL40(68KΩ)	20		50	
		LDL40(OPEN)	20		50	

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Load Regulation	Measured minimum to maximum of the constant current region	All	-5		+5	%
Line Regulation	Measured from high line to low line with full load	All	-5		+5	%
Output Voltage Ripple and Noise Peak-to-Peak	20MHz Bandwidth, full load, 0.1uF ceramic and 10uF aluminum capacitor with 100% output current	All			600	mV
No Load Consumption		All			0.5	W

EFFICIENCY

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
	Vin=230Vac Vout=29V, Iout=1.4A, 100% Load	All		86		%

ISOLATION CHARACTERISTICS

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

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency		All		36		kHz

GENERAL SPECIFICATIONS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Life Time	Vin=115Vac, Vout=29V, Io=1.4A 100% Load Ambient temperature is 40℃	All		40		k hours
MTBF	Vin=115Vac, Vout=29V, Io=1.4A 100% Load Ambient temperature is 25℃ per MIL-HDBK-217F	All		264		k hours
Weight		All		220		g
Dimension	150.0x80.0x23.2mm ((W*L*H)					
Safety	IEC61347-1:2015, IEC61347-2-13:2014, IEC61347-2-13:2014/AMD:20116 EN61347-1:2015, EN61347-2-13:2014;A1, EN62384:2006;A1					
Digital Dimming Standards	Meets IEC62386 part 101.102, 207 Ver.2					
EMC Emission	EN55015:2013+A1:2015, EN61000-3-2:2014, EN61000-3-3:2013					
Conducted Emissions	EN55015				Class B	
Radiated Emissions	EN55015				Class B	
Harmonic Current Emissions	IEC 61000-3-2:2014				Class C	
EMC Immunity	EN61547:2009, IEC 61000-4-2,3,4,5,6,8,11					
Electrostatic Discharge (ESD)	IEC 61000-4-2 Air ±8kV, Contact ±4kV				Criteria A	
Radio-Frequency, Electromagnetic Field	IEC 61000-4-3 80-1000 MHz, 3V/m				Criteria A	

GENERAL SPECIFICATIONS

Electrical Fast Transients (EFT)	IEC 61000-4-4 ±1.0kV AC Power, ±0.5kV Signal and Control Ports	Criteria A
Surge	IEC 61000-4-5 Line to Line ±2.0kV	Criteria A
Power-Frequency Continuous Conducted	IEC 61000-4-6 0.15-80 MHz, 3V	Criteria A
Power-Frequency Magnetic Field	IEC 61000-4-8 3 A/m	Criteria A
Voltage Dips and Interruptions	IEC 61000-4-11 30% Reduction, 100% Reduction	Criteria B

5. Main Features and Functions

5.1 Operating Temperature Range

The LDL40 series led driver highly efficient converter design has resulted in its ability to operate ambient temperature environment -30°C~60°C (see derating curve). 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 Short Protection

All different voltage models have a 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 operates normally once the fault condition is removed. In the event of an over current converter will go into a hiccup mode protection.

5.3 Over Voltage Protection

All different voltage models have over voltage protection. In the event of an over voltage converter will be clamped by a TVS component.

5.4 DIGITAL Dimming Operation

Please refer to **section 9**.

5.5 Temperature Compensation Operation

Between the NTC terminal, by connecting a temperature sensor (NTC resistor), Output current could be correspondingly changed, based on the sensed temperature. LDL40 can still be operated normally when the NTC resistor is not connected and the value of output current will be the current level selected

NTC resistance	Output Current
100K	< 50℃, 100% of the rated current > 50℃, output current begins to reduce, please refer to the Figure 4. NTC De-rating

- CINCON does not offer the NTC resistor and all the data above are measured by using THINKING TTC03 series.
- If other brands of NTC resistor are applied, please check the temperature curve first.

6. Safety

- IEC62386-101, 102,207
- IEC61347-1:2015, IEC61347-2-13:2014
- IEC61347-2-13:2014/AMD:2016
- EN61347-1:2015, EN61347-2-13:2014;A1
- EN62384:2006;A1
- EN55015:2013+A1:2015
- EN61000-3-2:2014, EN61000-3-3:2013
- EN61547:2009
- IEC61000-4-2, 3, 4, 5, 6, 8, 11

7. Applications

7.1 Power De-rating Curves

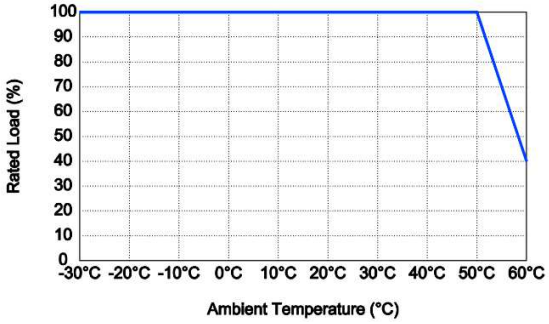


Figure 2. Typical Output power of LDL40 Series

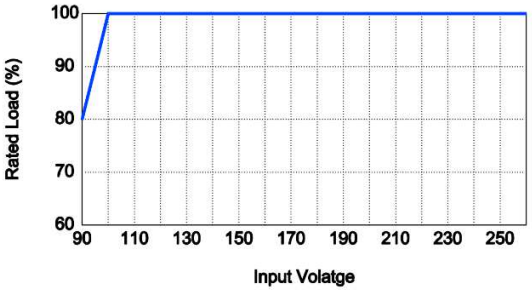


Figure 3. Typical Output Power De-rating of LDL40 (to AC input)

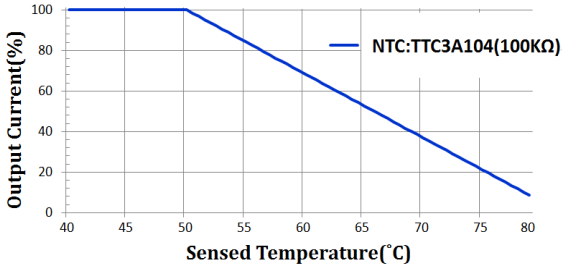


Figure 4. Typical NTC De-rating of LDL40 Series

7.2 Efficiency vs. Output Power

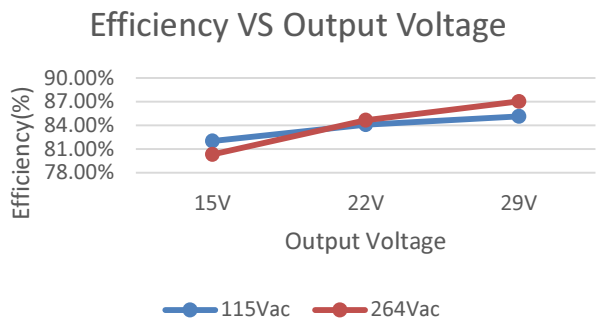


Figure 5. Efficiency vs. Output Power of LDL40 (to Output Current =1400mA)

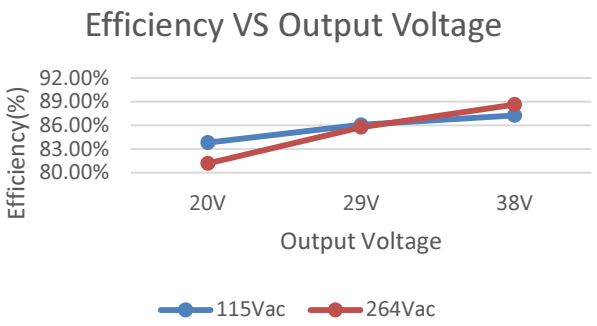


Figure 6. Efficiency vs. Output Power of LDL40 (to Output Current =1050mA)

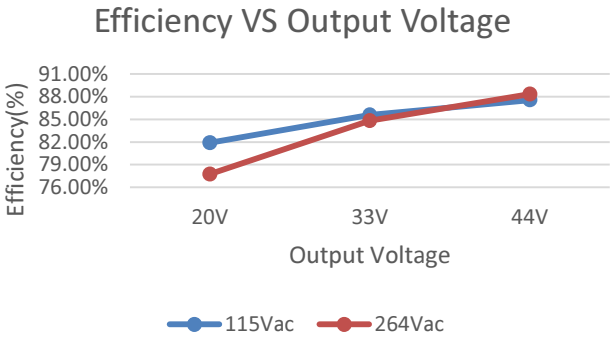


Figure 7. Efficiency vs. Output Power of LDL40 (to Output Current =900mA)

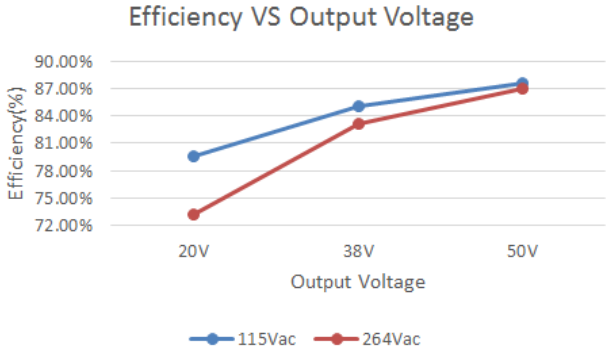


Figure 8. Efficiency vs. Output Power of LDL40 (to Output Current =700mA)

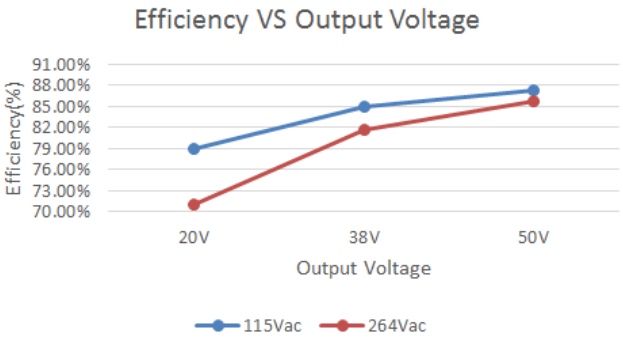


Figure 9. Efficiency vs. Output Power of LDL40 (to Output Current =600mA)

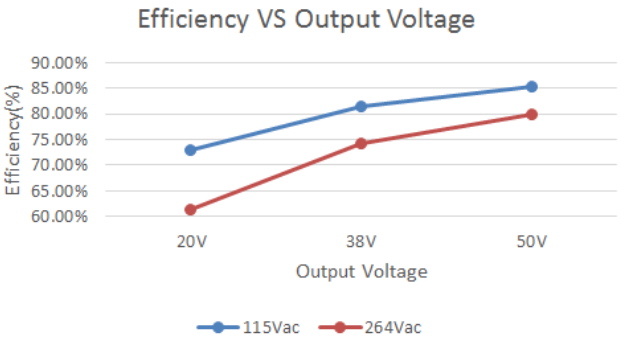


Figure 10. Efficiency vs. Output Power of LDL40 (to Output Current =350mA)

7.3 Test Set-Up

The basic test set-up to measure parameters such as efficiency and load regulation is shown in Figure 11. When testing the Cincon's LDL 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:

$$\eta = \frac{V_o \times I_o}{P_{in}} \times 100\%$$

Where: Vo is output voltage,
Io is output current,
Pin is input power,

The value of load regulation is defined as:

$$Load.reg = \frac{I_{max} - I_{min}}{I_{min}} \times 100\%$$

Where: Imax is the output current at maximum rated output voltage

Imin is the output current at minimum rated output voltage

The value of line regulation is defined as:

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

Where: I_{HL} is the output current of maximum input voltage at full load.

I_{LL} is the output current of minimum input voltage at full load.

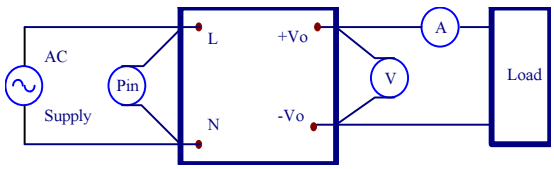


Figure 11. LDL40 Series Test Setup

7.4 Output Ripple and Noise Measurement

The test set-up for noise and ripple measurements is shown in Figure 12. Measured method:

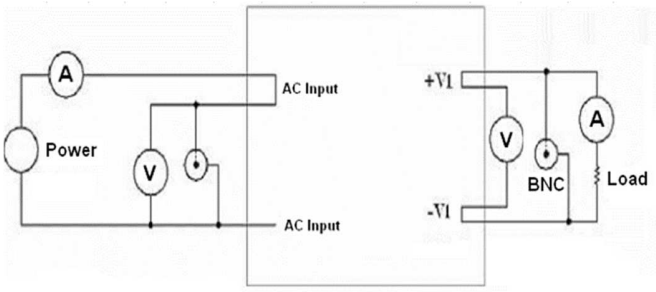
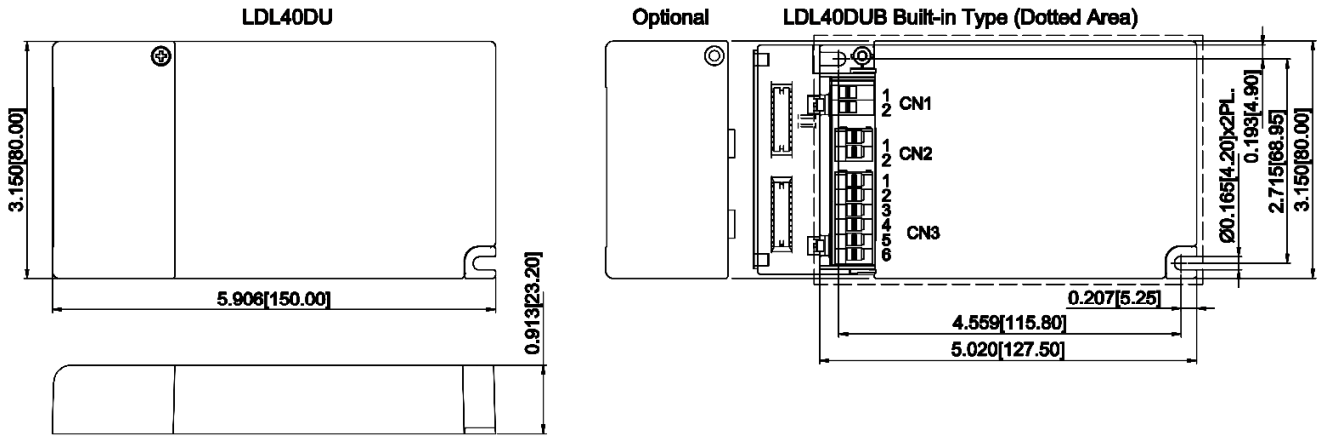


Figure 12. Output Voltage Ripple and Noise Measurement Set-Up

8. Mechanical Outline Diagrams

8.1 LDL40 Mechanical Outline Diagrams

All Dimensions in Inches[mm]
Tolerance Inches:x.xxx±0.02
Millimeters:x.xx±0.5



CN1:

PIN CONNECTION		
Pin	Function	Terminal Color
1	ACN	Blue
2	ACL	Gray

CN2:

PIN CONNECTION		
Pin	Function	Terminal Color
1	DA	Orange
2	DA	Orange

LDL40DUB Single Without Wire Box
LDL40DU with Wired Box
CN1 use the wire diameter with 0.75~2.5mm²
CN2 / CN3 use the wire diameter with 0.2~1.5mm²

CN3:

PIN CONNECTION								
Pin	Function	Terminal Color	Pin	Function	Terminal Color	Pin	Function	Terminal Color
1	NTC	Gray	3	R	Gray	5	Vo+	Gray
2	NTC	Gray	4	R	Gray	6	Vo-	Gray

Figure 13 LDL40 Mechanical Outline Diagrams

9. Installation Instruction

9.1 The Maximum Number of Circuit Breakers

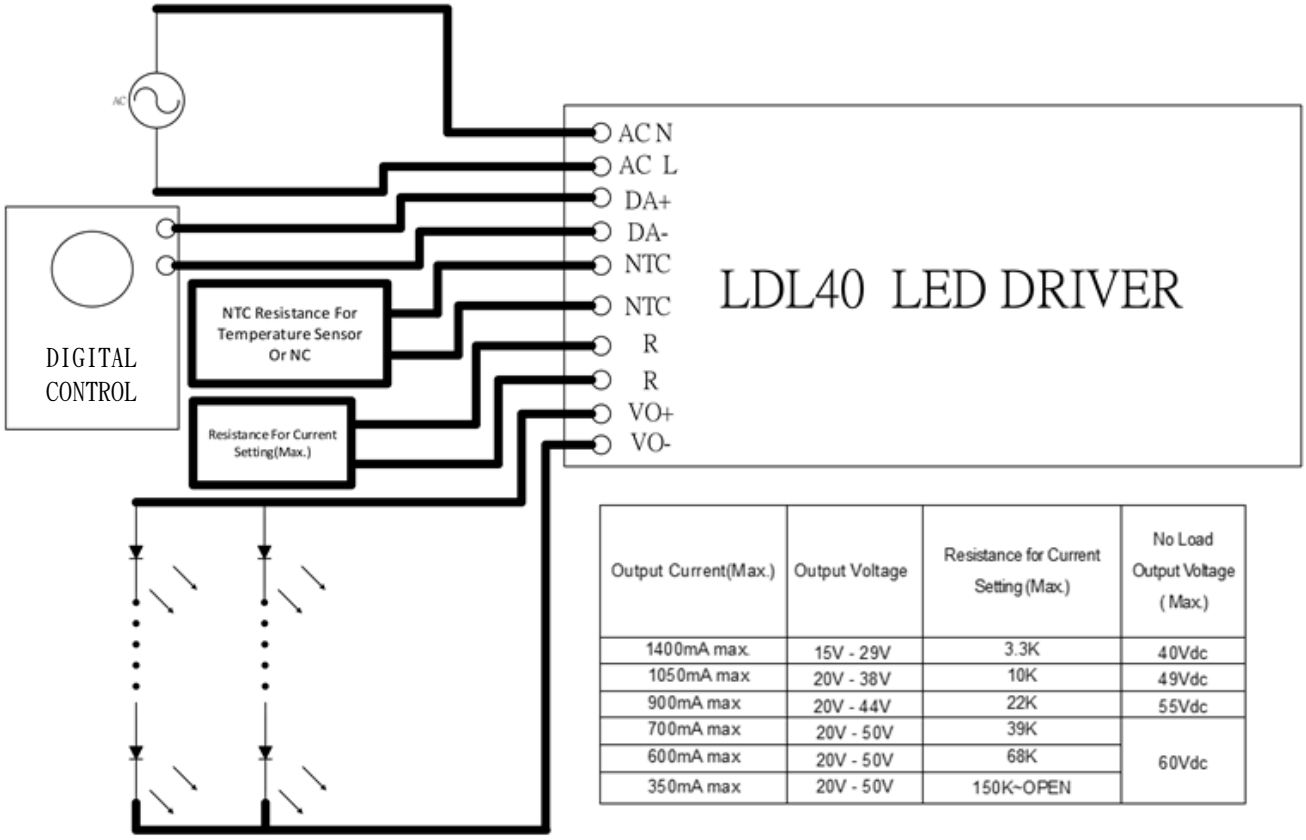
LDL40 Series calculated values are based on MCB S200 Series manufactures by ABB

Application Area	Series	Current	C10	C13	C16	C20	B10	B13	B16	B20	Inrush Current	
											Imax	time
230Vac	LDL40	0.25	24	31	38	48	20	26	32	40	5A	<100us

$$\text{Type C} = \frac{\text{breaker rated current}}{\text{AC input current labeled}} \times 60\% \text{ (Safe margin)}$$

$$\text{Type B} = \frac{\text{breaker rated current}}{\text{AC input current labeled}} \times 50\% \text{ (Safe margin)}$$

9.2 DIGITAL Dimming Function (Optional); Needs The from Dimming Controller



Output Current(Max.)	Output Voltage	Resistance for Current Setting (Max.)	No Load Output Voltage (Max.)
1400mA max.	15V - 29V	3.3K	40Vdc
1050mA max	20V - 38V	10K	49Vdc
900mA max	20V - 44V	22K	55Vdc
700mA max	20V - 50V	39K	60Vdc
600mA max	20V - 50V	68K	
350mA max	20V - 50V	150K~OPEN	

Figure 14 DIGITAL Dimming Function

10. Order Information

Series	Model	Dimming Function	AC Input Range	Type
LDL	**40**	**X**	**X**	**X**
LDL	40	D: DIGITAL + Current setting	U:90~264Vac	Blank: Standard type B: Built-in type

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