Harvard Power Systems

REV 1.5

CoolLED PRO LED DRIVERS

CLi40 (40 watt)

0-10V / 1-10V Analogue Dimmable

40W (up to 1400mA)

The all new CLi LED driver range from Harvard uses uniquely developed technology solutions to achieve high dimming accuracy, safety and reliability in an ultra slim compact format.

This new addition to the CoolLEDpro range offers low dimming to 0.1%.

A new soft on and soft off operation coupled with a range of programmable dimming features, achieves an ideal lighting performance.

The exceptionally low flicker performance over the full operating range means the CLi range can suit the most demanding applications.

- Ultra Compact- Fits through a 56mm hole.
- Support for most COB modules/lamps up to 5000 lumens (typical).
- Support for 1-18 LEDs.
- Loop-through terminals for easy installation.
- Isolated output.
- Programmable current.
- RFID Programming.
- Smooth dimming to 0.1%
- 0-10V / 1-10V Analogue dimming (Fully isolated interface).
- Low inrush current.
- Exceptionally low LED flicker. Near perfect light quality.
- Passes IEEE1789:2015
- Power Factor corrected.
- Wireless ready.
- DALI dimming version also available. See separate data sheet.
- Designed in the U.K. Manufactured in India.

Technical Highlights

- Fully programmable in 1mA step increments
- Less than 1% flicker at 100Hz/120Hz - Meets IEEE1789:2015 'No Effect' Region 1Hz to greater than 3kHz
- Minimum dimming of 350µA - 25 bit dimming resolution
- Small size 22mm x 55.5mm x 137mm (175mm remote version)
- Input voltage range 220-240V
- Remote mount version (order end caps separately)
- Up to 15 Years Operation (See Driver lifetime graph for more details)
- Up to 89% efficiency
- Power factor corrected (0.98)
- Operation up to 50°C ambient
- Supports a large LED string voltage range, 2.5V to 38V or 4.5V to 52V (model dependent)

- Self-resetting thermal trip
- Mains to LED output: Reinforced insulation 3kV
- 0-10V/1-10V to Mains: Reinforced isolation 3kV
- 0-10V/1-10V to LED output: Reinforced isolation 3kV
- 100% - 0.1% dimming
- DTO (Smooth dim to off option with two programmable level choices)
- Logarithmic dimming
- Three other dimming curve options
- Surge protection 2kV Differential, 4kV Common mode

LOW Flicker | 0-10V 1-10V | analogue dim

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CoolLED PRO

LED DRIVERS

Technical Specification

	CLi40-A01-240			CLi40-A02-240		
AC input Voltage	220 to 240VAC Nominal					
Input Frequency	0/50/60Hz					
Input Current	0.25A Max					
Input Power	47W Max					
Input Power Factor	0.98					
Input Current THD	6% typical @ full load					
Input Harmonics	IEC/EN61000-3-2 Class C limit, Table 2					
DC Input Voltage	220 - 240V Nominal / 176 -280V Operational range					
Emergency Supply Currents	@220VDC - 224mA (±10%) / @240VDC - 210mA (±10%)					
Driver emergency output factor (EOF_i)	1.00 (Light output on AC or DC supply is identical)					
Inrush Current	25A peak decaying to zero over 30µS (0.1R + 100µH mains impedance)					
Number of Drivers per MCB (maximum typical)	B6	B10	B16	C6	C10	C16
	10	17	27	13	21	35
Input Surge Protection	4kV common-mode 2kV differential-mode					
Input Output Isolation	3kV AC rms					
Output Current Programme Range	100-1400mA			100-1050mA		
Output Voltage Range	A01: 2.5-38V			A02: 4.5-52V		
Dimming Range	100 - 0.1% (350µA Minimum)					
Dimming Method	LED current dimming (No PWM dimming)					
Dimming Control	0-10V / 1-10V					
Touch Current (0-10V/1-10V)	50µA					
Dimmer supply current	330µA Typical					
100/120 Hz Ripple	<1%					
Flicker	IEEE1789:2015 compliant with NO RISK category					
Output Protection	Overvoltage, short, reverse polarity. Auto re-start					
Off Load Peak Voltage	A01: <45V			A02: <58V		
"Cold" start time	250ms typical					
Touch Current (LED output)	0.28mA (spec limit is 0.7mA) @ 240V mains EN60990					
Dimming Port Classification	SELV (Nominal 12V)					
Ambient Temperature	-25°C to 50°C					
Maximum Case Tc Temperature	85°C					
Thermal Control	Light reduction above 90°C (Self-resetting)					
Humidity	85% max non-condensing					
EMC Emissions	Meets EN55015:2013. Conducted (9kHz-30MHz), Radiated (30MHz-300MHz)					
Terminal Blocks	45° Push fit connectors, 3.5mm pitch					
Loop in/out Terminals	Maximum load 2A (8 units in series)					
Earth Terminal	For earth termination or loop in/out (Not required for driver safety or operation)					
Wire Sizes	0.5mm² to 1.5mm² (Earth loop-through - 1.5mm²)					
Enclosure	White polycarbonate UL94-V0 rated					

Case Style	Dimensions	Weight	Box Quantity	IP Rating
Integral	137mm x 22mm x Ø55.5mm	159g	18	IP20
With cable clamps	175mm x 22mm x Ø55.5mm	190g	18	IP40

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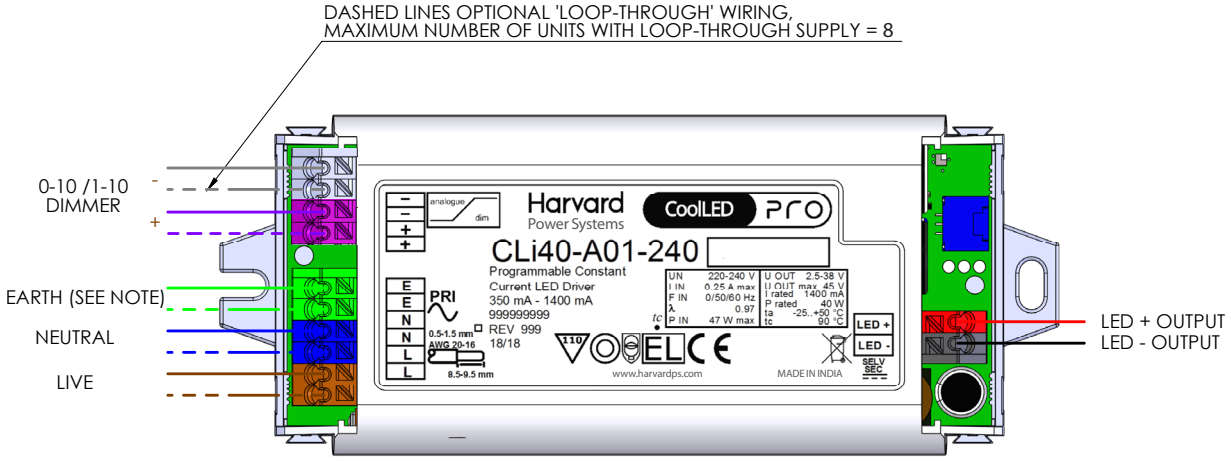
CLi40 Analogue Dimming LED Driver - Wiring Diagram

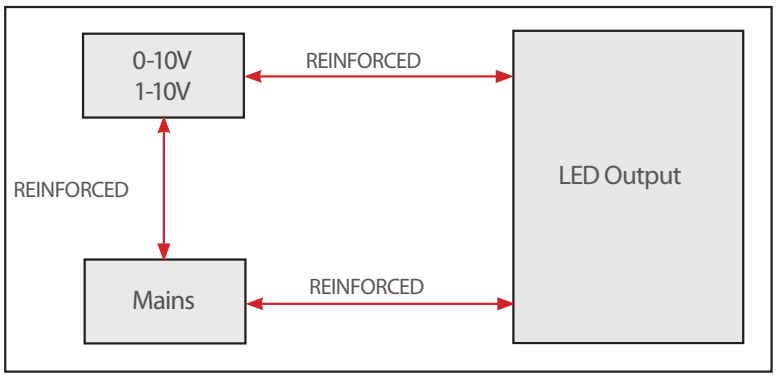


Note:

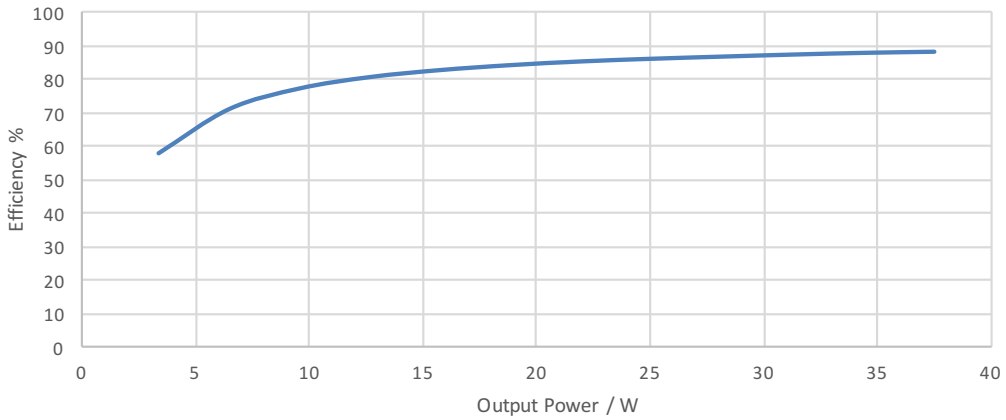
- 2 Earth terminals are for loop-through or use as earth 'parking terminals'
- For functional earth loop-through / parking terminal, cable range is 0.5 - 1.5mm²

Insulation classes for isolated circuits

CLi analogue model isolation barrier definition



Efficiency



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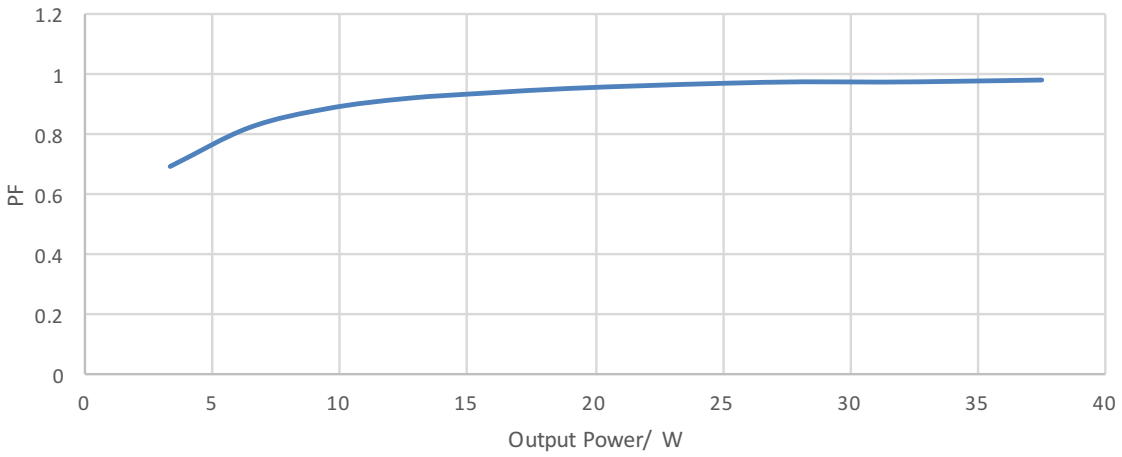
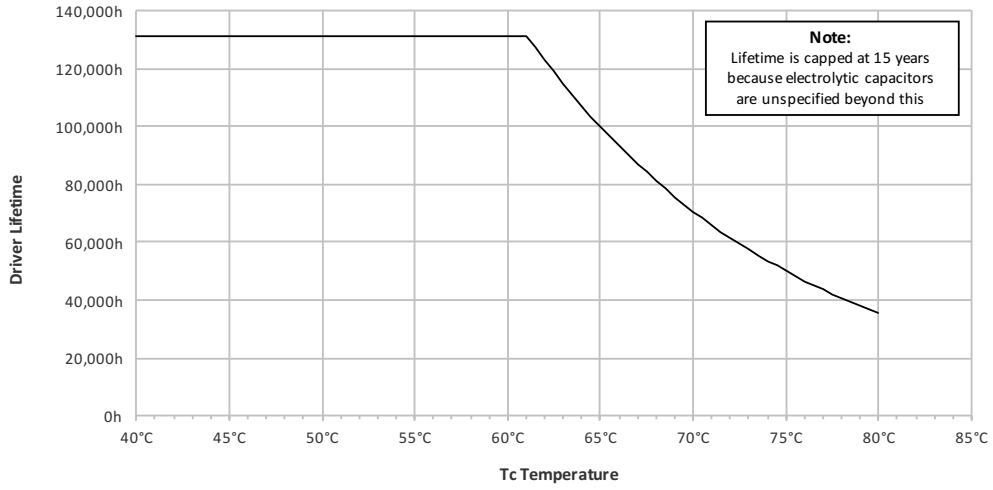
Power Factor

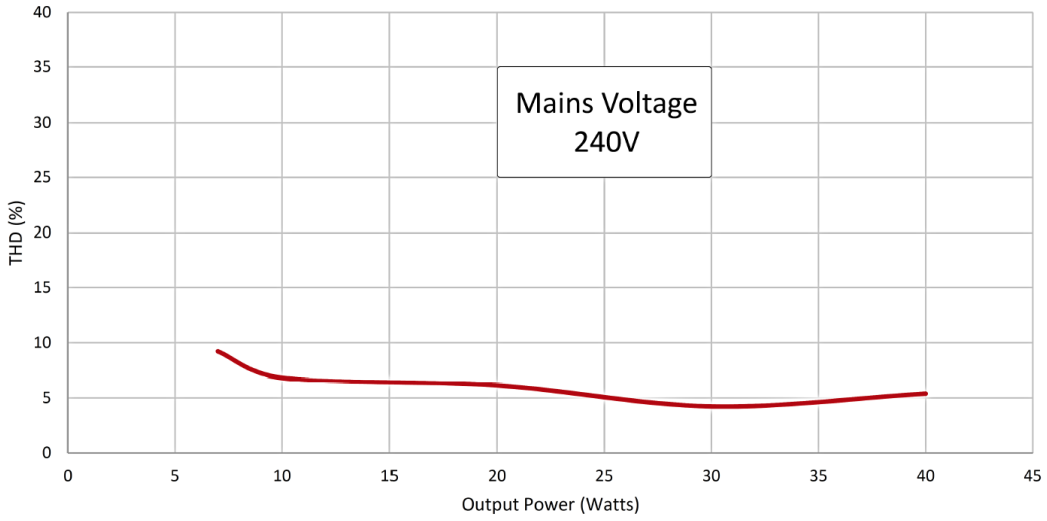


Driver Lifetime with Temperature at Full Load

(with failure rate <0.1% per 1000h)



THD vs Output Power



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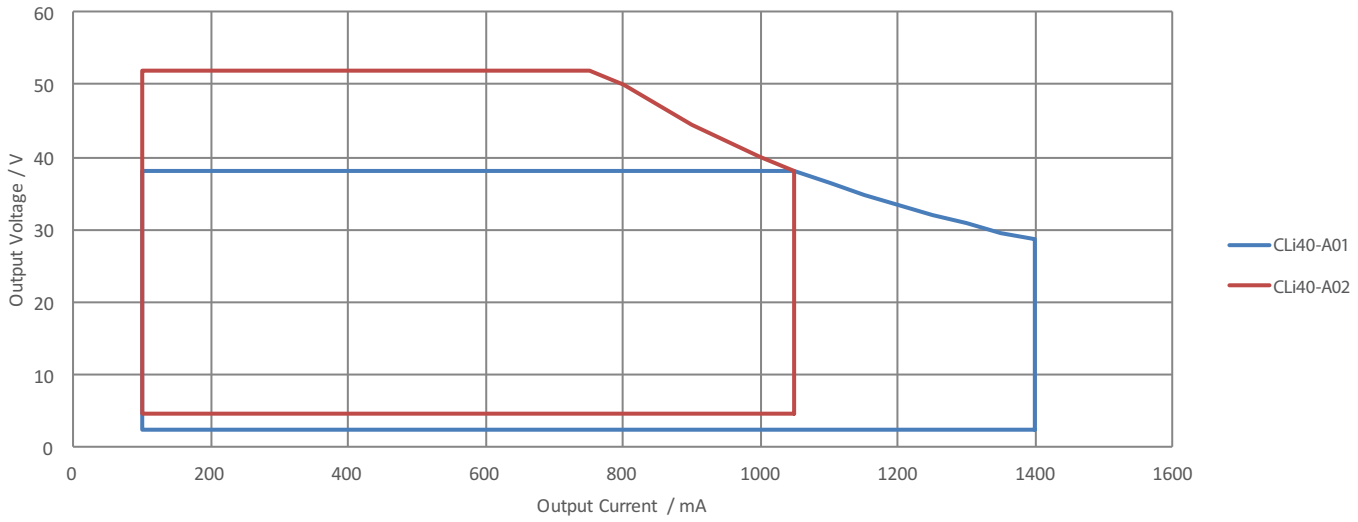
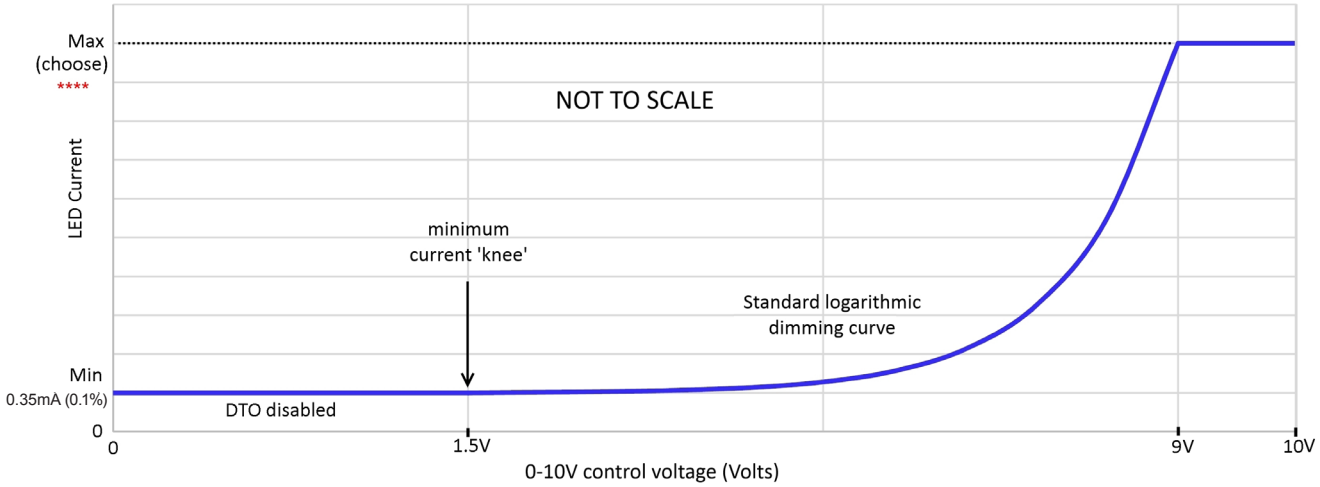
Operating Range (undimmed)



CLi40 Analogue dimming LED Driver: Default dimming control curve (No A,B or C options specified)



CoolLED PRO LED DRIVERS

Variants

Part number	Programmable Current Range	LED String Voltage	Max. Tc Temperature	Ambient Temperature Range	Maximum Power	Power factor at full load	Efficiency at full load
CLi40-A01-240/xxxx	100 - 1400mA* (±5%)	2.5V to 38V	85°C	-25 - 50°C	40W	0.98	87%
CLi40-A02-240/xxxx	100 - 1050mA* (±5%)	4.5V to 52V	85°C	-25 - 50°C	40W	0.98	88%

*Minimum dimmed current is 350µA (-50 + 250µA)

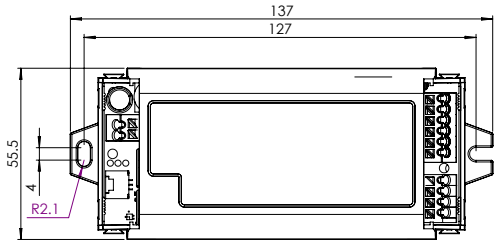
Product part number example:

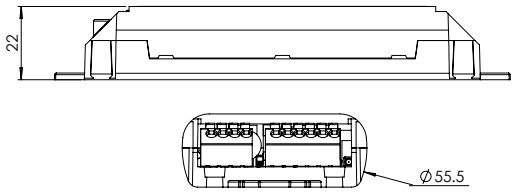
Customer requirement= 3 LED (9V) 1000mA current. Power is 9 watts. Default features: No DTO, Log dimming curve, 350µA minimum dimming.
Product choice = A01 model programmed to 1000mA. Part number = CLi40-A01-240/1000

For other programmable options, See Page 7

Dimensions

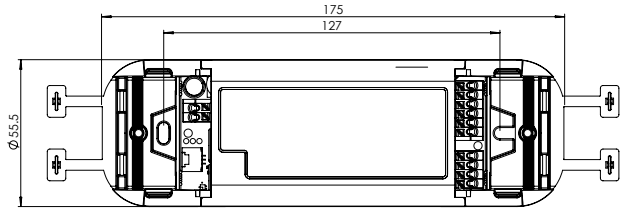
Integral style

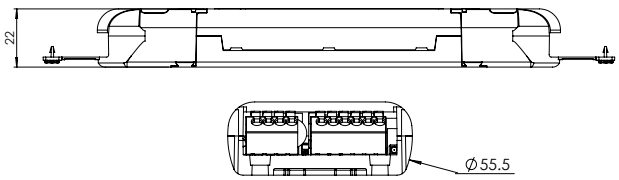




Cable clamps (remote) style

For remote mount, cable clamps are required
Order CLi40 clamp kit part number: CLi-CC55-SET





Compliance

Approval	Standards
CE (Europe)	LVD:2014/35/EU, EMC:2014/30/EU, RoHS:2011/65/EU, ECOD/2009/125/EC
ENEC (Europe)	EN61347-1:2015, EN61347-2-13+A1:2017+ANNEX J, EN62384+A1:2009
CB (International)	IEC61347-1:2015, IEC61347-2-13+A1:2016+ANNEX J, IEC62384+A1:2009
RCM (Australia/NZ)	ASNZS61347.1:2016, ASNZS61347.2.13:2013, ASNZS-CISPR15, ASNZS4417.1:2012

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Additional programmable options

Dimming Defaults, Options and Part Numbering System

The CLi40 analogue dimming LED driver is fully programmable to match customer requirements.
Sensible default limits have been chosen which consider ease of adjustment and typical dimmer performance limits.
In certain cases, a customer may need alterations to the defaults. The following parameters can be adjusted:
Please note: Expert knowledge is required to define the correct configuration for the end user.

A. DTO (Dim To Off):

The Default is DTO disabled.

If Dim to off is enabled, below a certain control voltage the driver output is turned off and it goes into a low power mode (<600mW).
DTO can affect the Knee voltage range. Knee voltages are the two analogue voltages at which minimum and maximum current occur.

Programmable Options:

Low level DTO: Turns off at 0.5V, on at 0.8V. Dimming 'knee' voltages 1.5V to 9V

High Level DTO: Turns off at 1.3V, on at 1.5V. Dimming 'knee' voltages 2V to 9V

B. Dimming curve:

The Default is a Logarithmic curve (Closely matches human luminance perception and allows precise light control)

Programmable Options:

Soft-logarithmic, Linear and Soft-linear (see performance curves on next page)

C. Minimum dimmed current:

Default current - 0.35mA.

Programmable Options:

The minimum dimmed current can be programmed to customer requirements over the range 0.35mA to 99.95mA in 0.05mA steps.
Note: If linear dimming curve is specified, the minimum dimming may need to be increased significantly to maintain good adjust-ability.

Note: Analogue Dimmer types

1. Passive dimmer (variable resistor). These are simple but imprecise and care is required in choosing the correct value resistance for the number of drivers being controlled. Adequate for general use. If DTO is required, Low Level DTO is recommended.

2. Electronic dimmer which is powered from the 0-10V terminals. These have variable performance, typically they cannot reduce the control voltage to less than 1V. If DTO is required, High Level DTO option is recommended.
Recommended dimmers: Varilight FQP1M1W or MFP1M1 / Aurora AU-DSPLED (1 to 20 drivers for either type recommended)

3. Electronic dimmer which is mains powered. These types should offer the best performance and be capable of reducing the control voltage close to 0V. If DTO is required, check dimmer performance before specifying DTO type (High or Low).

Extended Part Number System

In most cases the end user only has to specify the maximum current which is a 3 or 4-digit number (mA) added to the model number.
Up to 3 additional options adds extra suffix(s) to the part number.
Note: LED string voltage should always be less than the driver maximum voltage and power capability. A01 model max is 38V. A02 model max is 52V.
Minimum dimmed programmable current range is 0.35mA to 99.95mA in 0.05mA steps

			Extra Options		
			A	B	C
Base Model		Programmable current range	DTO (Dim to off)	Dimming curve	Minimum dimmed current
CLi40-A01-240	/	100-1400 (mA) 3 or 4 digit number 1400mA (default)	Empty (No DTO) A1 (Low level) A2 (High level)	Empty: Logarithmic (default) B1: Linear B2: Soft Linear B3: Soft Logarithmic	Empty 350µA C**** **** = Programmed min current
CLi40-A02-240	/	100-1050 (mA) 3 or 4 digit number 1050mA (default)	Empty (No DTO) A1 (Low level) A2 (High level)	Empty: Logarithmic (default) B1: Linear B2: Soft Linear B3: Soft Logarithmic	Empty 350µA C**** **** = Programmed min current

Minimum dimmed current code examples: 0.85mA = C0085, 55mA = C5500, 99.95mA = C9995

Product part number example:

Customer requirement= 7 LED (21V) 1200mA current. Power is 25 watts. Default features: No DTO, Log dimming curve, 1.2mA minimum dimming.
Product choice = A01 model programmed to 1200mA. Part number = CLi40-A01-240/1200
Customisation to this product:

- Add high level Dim To Off = CLi40-A01-240/1200A2
- Change dimming curve to Soft Logarithmic = CLi40-A01-240/1200A2B3
- Set minimum dimmed current to 1% of programmed maximum = 10mA = CLi40-A01-240/1200A2B3C1000

Note: To add cable clamps: order CLi40 clamp kit part number: CLi-CC55-SET

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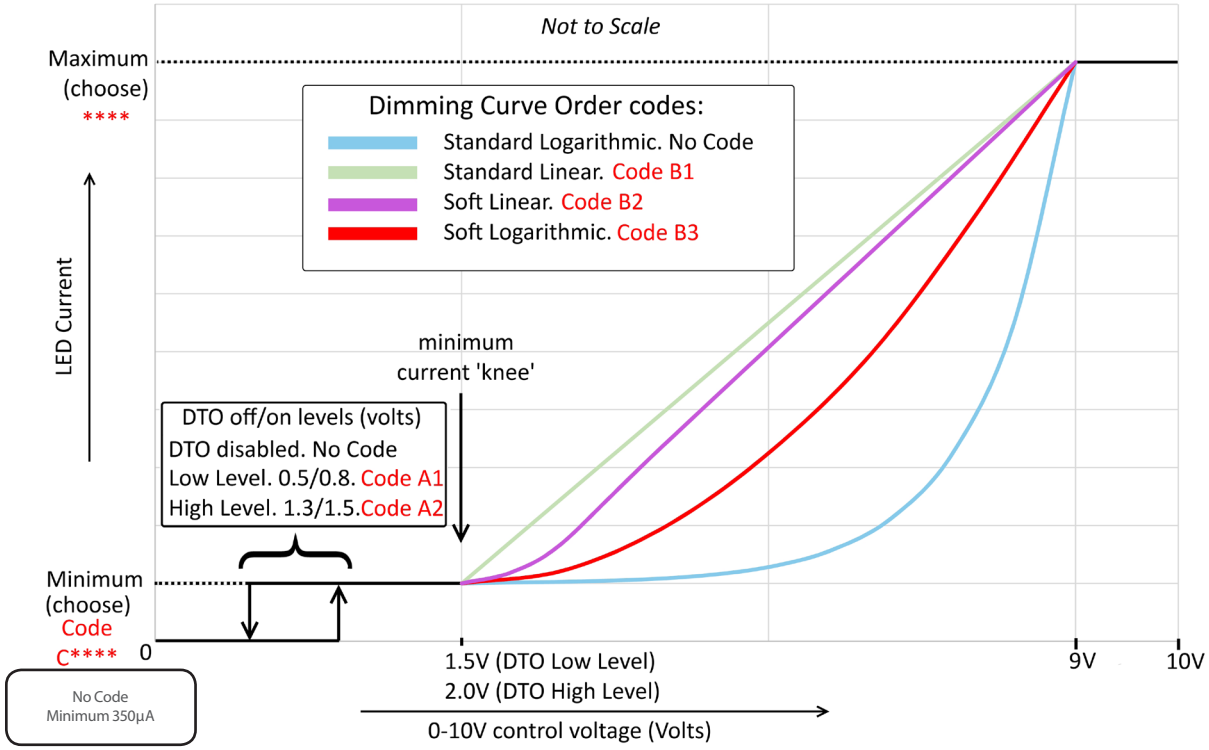
CLi40 Analogue Dimming LED Driver. Programmable dimming options (A, B & C)



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