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Features

Regulated Converters

- UL/ RAILWAYS Certified Constant Current LED Driver
- Wide Input and Output Voltage Range
- Digital PWM and Analogue Voltage Dimming
- Short Circuit Protected
- Pinned or Wired Versions
- IP67 rated for /W Version
- 96% Efficiency
- 5 year Warranty

LIGHTLINE
DC/DC-Converter
with 5 year Warranty

RECOM

Constant Current LED Driver



RoHS 2011/65/EU 6/6

E358085

EN-50121-3-2 Certified
EN-60950-1 Certified
UL-60950-1 Certified

RCD-24

Description

The RCD series is a step-down constant current source designed for driving high power white LEDs. Standard output currents available are 300mA, 350mA, 500mA, 600mA, 700mA, 1000mA and 1200mA to make this driver compatible with a wide range of LEDs applications. Despite its compact size, the RCD series is fully featured with very high efficiency, wide input voltage range, high ambient operating temperature and two means of dimming: PWM/digital control and analogue voltage dimming. Both dimming controls are independent and can be combined. The driver is also designed to be as reliable as the LEDs it is driving, even at the full operating temperature. Options include an IP67-rated wired version (/W) and a version with built-in reference output voltage (/Vref) to power sensors or for easy analogue dimming.

Selection Guide

Part Number	Input Range (VDC)	Output Current (mA)	Output Voltage (Vmin-Vmax)	Dimming Control	Options	Mounting Style
RCD-24-0.30[a][b]	4.5-36V	0-300	2-35	Digital + Analogue	Vref	Pins or Wired
RCD-24-0.35[a][b]	4.5-36V	0-350	2-35	Digital + Analogue	Vref	Pins or Wired
RCD-24-0.50[a][b]	4.5-36V	0-500	2-35	Digital + Analogue	Vref	Pins or Wired
RCD-24-0.60[a][b]	4.5-36V	0-600	2-35	Digital + Analogue	Vref	Pins or Wired
RCD-24-0.70[a][b]	4.5-36V	0-700	2-35	Digital + Analogue	Vref	Pins or Wired
RCD-24-1.00[b]	6-36V	0-1000	3-31	Digital + Analogue		Pins or Wired
RCD-24-1.20[b]	6-36V	0-1200	3-31	Digital + Analogue		Pins or Wired

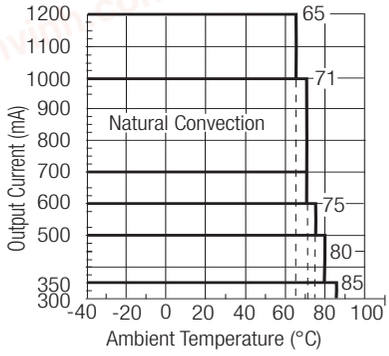
[a][b] Standard is no suffix with PCB Pins.
[a] Add suffix /Vref for pinned version with Vref output and analogue dimming
[b] Add suffix /W for wired version without dimming control (four wires)
[b] Add suffix /W/X1 for wired version with analogue dimming control (five wires)
[b] Add suffix /W/X2 for wired version with PWM dimming control (five wires)
[b] Add suffix /W/X3 for wired version with both analogue and PWM dimming controls (six wires)
[a] Add suffix /W/Vref for wired version with Vref output and analogue dimming (six wires)

Specifications (typical at 25°C, nominal input voltage, rated output current unless otherwise specified)

Input Voltage (absolute maximum)		40VDC max
Recommended Input Voltage	300mA-700mA	5V min. / 24V typ. / 36VDC max
	1000mA-1200mA	6V min. / 24V typ. / 36VDC max
Input Filter		Capacitor
Output Current Accuracy	300mA-700mA	±1% typ, ±3% max.
(Vin = 24DC)	1000mA-1200mA	±2% typ, ±5% max.
Internal Power Dissipation	Worst case load of 5 LEDs	800mW max
Output Current Stability	Vin=36V, Vout =1-9 LEDs	±1% max
Output Ripple and Noise (20MHz BW)	300mA-700mA	150mVp-p max
Vin=36V, Vout =1-9 LEDs	1000mA-1200mA	300mVp-p max
Temperature Coefficient	-40°C to +85°C ambient	±0.015%/°C max
Maximum Capacitive Load		100µF
Operating Frequency	300mA-700mA	210kHz min/ 250kHz typ/ 280kHz max
	1000mA-1200mA	350kHz min/ 450kHz typ/ 550kHz max
Efficiency at Full Load		96% max.
Short Circuit Protection		Regulated at rated output current

continued on next page

Derating Graph
(Ambient Temperature)



Refer to Application Notes

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LIGHTLINE
DC/DC-Converter

RCD-24 Series

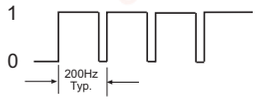
Specifications (typical at 25°C, nominal input voltage, rated output current unless otherwise specified)

Operating Temperature Range (free air convection)		300mA-350mA	-40°C to +85°C
		500mA	-40°C to +80°C
		600mA	-40°C to +75°C
		700mA-1000mA	-40°C to +71°C
		1200mA	-40°C to +65°C
Storage Temperature Range			-55°C to +125°C
Maximum Case Temperature			100°C
Thermal Impedance		Natural Convection	55°C/Watt
Case Material (Pinned or Wired Versions)			Non Conductive Black Plastic
Potting Material (Pinned or Wired Versions)			Epoxy (UL94-V0)
Dimensions		Pinned/Wired	22.1 x 12.6 x 8.5mm
Weight		Pinned/Wired	4.5g/6.8g
Soldering Profile		Pinned	265°C/10 sec. max
Packing Quantities		Pinned Versions	39pcs per Tube
(Refer to App Notes for Tube sizes)		Wired Versions	5pcs per Bag
PWM Dimming and ON/OFF Control (Leave open if not used - do not tie to +Vin)			
Remote ON/OFF Threshold Voltages	DC/DC ON	300mA-700mA	Open or 0V<Vr<0.6V
		1000mA-1200mA	Open or 0V<Vr<0.8V
	DC/DC OFF (Standby)	300mA-700mA	0.6<Vr<2.9V
		1000mA-1200mA	1.4<Vr<2.2V
	DC/DC OFF (Shutdown)	300mA-700mA	2.9V<Vr<6V
		1000mA-1200mA	2.2V<Vr<15V
Remote Pin Drive Current		Vr=5V	1mA max
Quiescent Input Current in Shutdown Mode		Vin=36V	200µA max
Maximum PWM Frequency		For Linear Operation	200Hz max.
		Frequency Limit	1000Hz max.
Analogue Dimming Control (leave open if not used - do not tie to +Vin)			
Input Voltage Limits		Standard	-0.3V - 15V
		Vref Version	-0.3V - 5V
Control Voltage Range (see Graphs)		Full On	0.13V ± 50mV
		300, 700, 1200mA: Full Off	4.2V ± 150mV
		1000mA: Full Off	4.35V ± 100mV
		Vref Version: Full Off	2.6V ± 100mV
Analogue Pin Drive Current		Vc=5V	0.2mA max.
Vref Version		Vref Voltage	3.3V± 70mV
		Vref Output Current	5mA
		Vref Output Short Circuit Current	18mA typ.
Environmental			
Relative Humidity			5% to 95% RH, non-condensing
/W Versions			IP67
Shock / Vibration		EN61373	
EMC Railways		EN50121-3-2:2006	
Conducted Emissions	(with filter, see note)	EN55022	Class B
Radiated Emissions	(all series except >700mA)	EN55022	Class B
ESD		EN61000-4-2	Class A
Radiated Immunity		EN61000-4-3	Class A
Fast Transient		EN61000-4-4	Class A
Conducted Immunity		EN61000-4-6	Class A
MTBF (RCD-24-0.70, Nominal Vin, Full Load)		+25°C	605 x 10³ hours
using MIL-HDBK 217F		+71°C	516 x 10³ hours
Safety Standards	EN General Safety	Report: SPCLVD1109081	EN60950-1 2nd Edition
	EMC Railway	Report: 12A082105E-C	EN50121-3-2
	UL General Safety	Report: E358085-A3	UL60950-1
			CSA C22.2 No 60950-1-03

Note:
1. Requires an input filter to meet EN55022 Class B conducted emissions - see next page
2. All LED Drivers may not be used without a load. They must be switched on the primary side only. Noncompliance may damage the LED or reduce its lifetime.

Digital Dimming

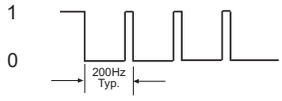
PWM Digital Control Signal



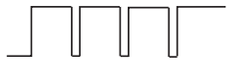
Output Current (LED appears dim)



PWM Digital Control Signal

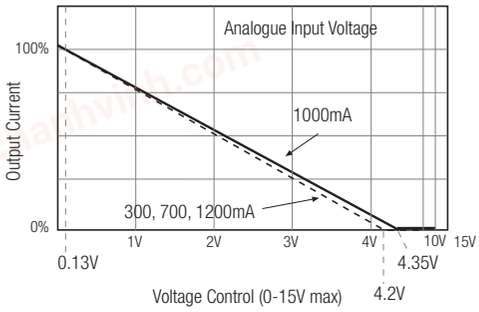


Output Current (LED appears bright)

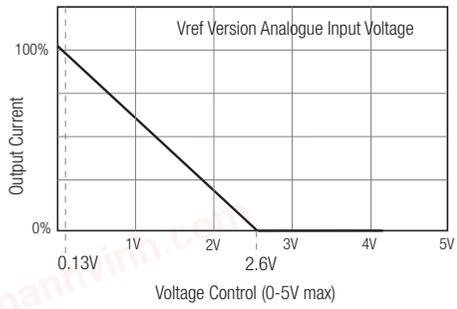


Analogue Dimming

Standard Version:



Vref Version:

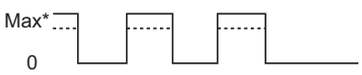


Combined PWM and Analogue Dimming

PWM Digital Control Signal



Output Current



* Max output current can also be set using Analogue input

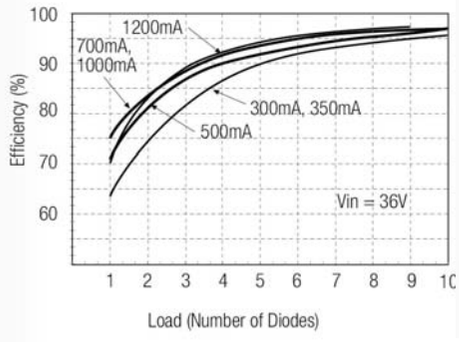
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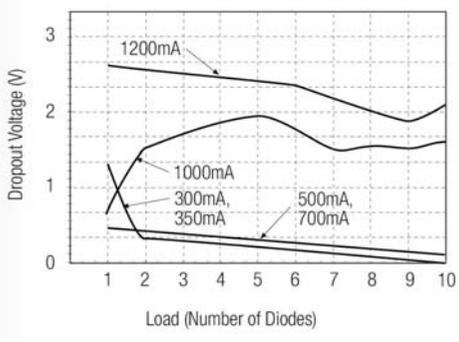
RCD-24 Series

Typical Characteristics

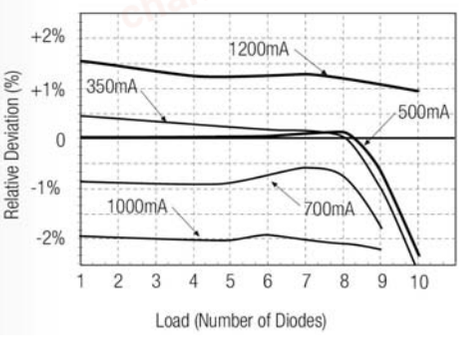
Efficiency/Load



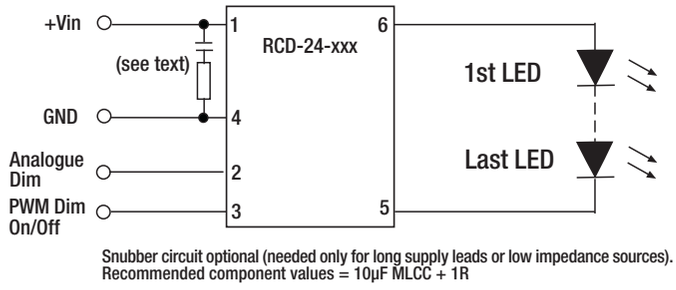
Dropout Voltage/Load



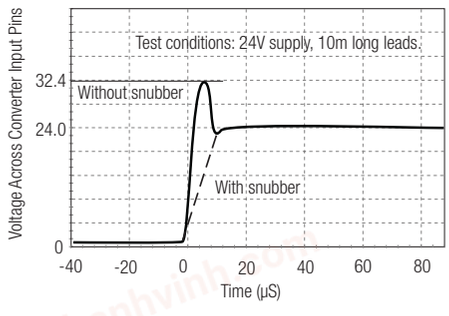
Output Current Accuracy/Load



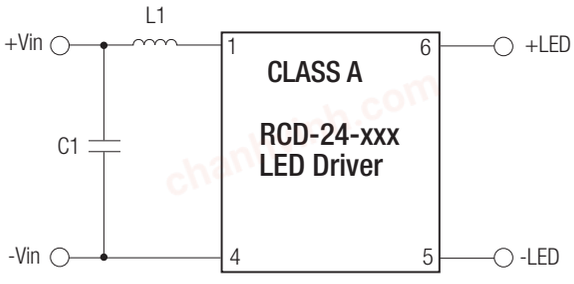
Standard Application Circuit (no external components required for normal use)



Snubber circuit optional (needed only for long supply leads or low impedance sources).
Recommended component values = 10µF MLCC + 1R

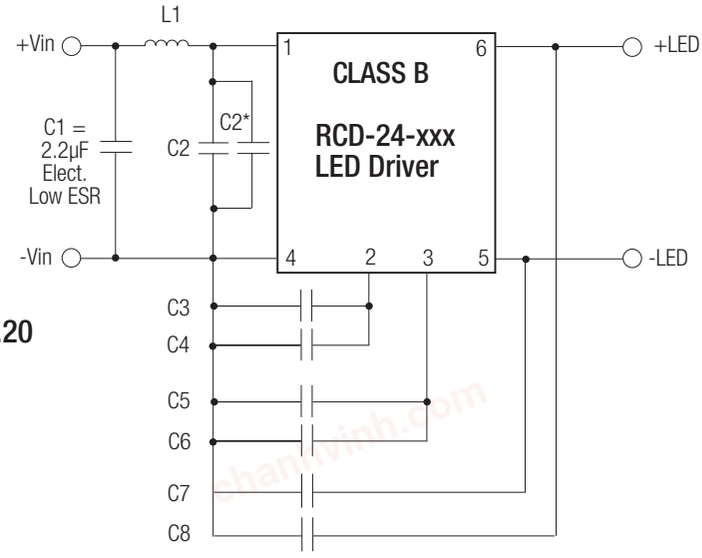


EMI Filter Suggestions

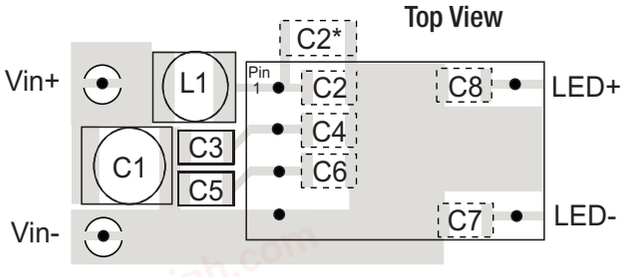


RCD-24-0.30 - RCD-24-0.70
C1=1µF MLCC
L1 = 22µH

RCD-24-1.00 - RCD-24-1.20
C1=2.2µF MLCC
L1 = 47µH



Recommended Class B PCB Layout for Pinned Version



RCD-24-0.30 - RCD-24-0.70
No dimming or PWM dimming:
L1 = 47µH
C2 = C3 = 10nF MLCC
Other caps not required
Analogue Dimming used:
L1 = 120µH
C2 = C7 = 10nF MLCC
Other caps not required

RCD-24-1.00 - RCD-24-1.20
L1 = 220µH
C2 = 10nF
C3 = C5 = 2.2nF
C4 = C6 = C7 = C8 = 100nF
All capacitors MLCC
C2* = optional 2µ2 MLCC only if L1 starts to resonate with the back ripple current.

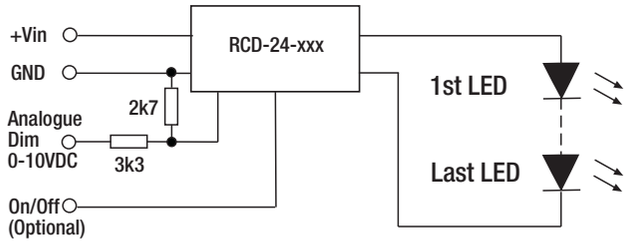
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LIGHTLINE
DC/DC-Converter

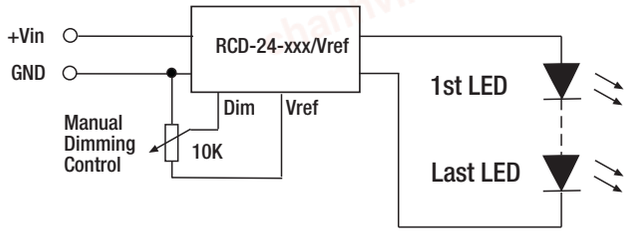
RCD-24 Series

Application Examples

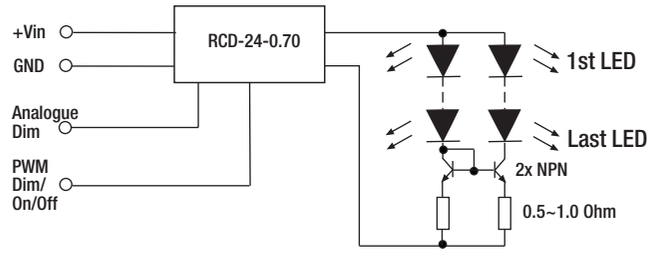
LED DRIVER with 0-10V Interface



LED DIMMER for up to 10 white LEDs

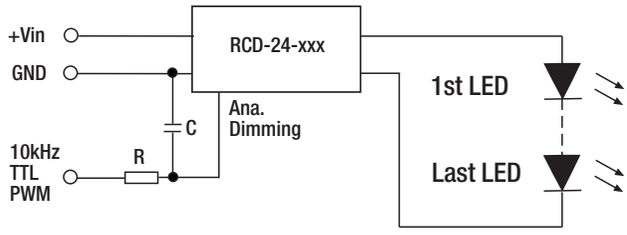


MULTIPLE LED DRIVER (up to 20 LEDS)



Driving Two Strings of 350mA LEDs with one 700mA Driver using a current mirror

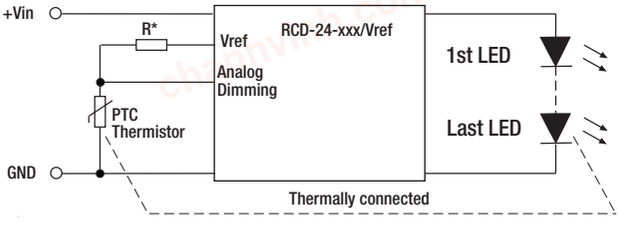
LED DIMMER with high frequency PWM control



Note:
It is not possible to parallel the drivers to increase the current.

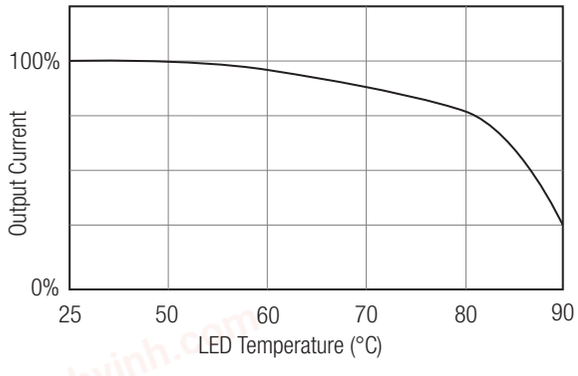
LED Temperature Monitoring

Automatic LED Overtemperature Protection



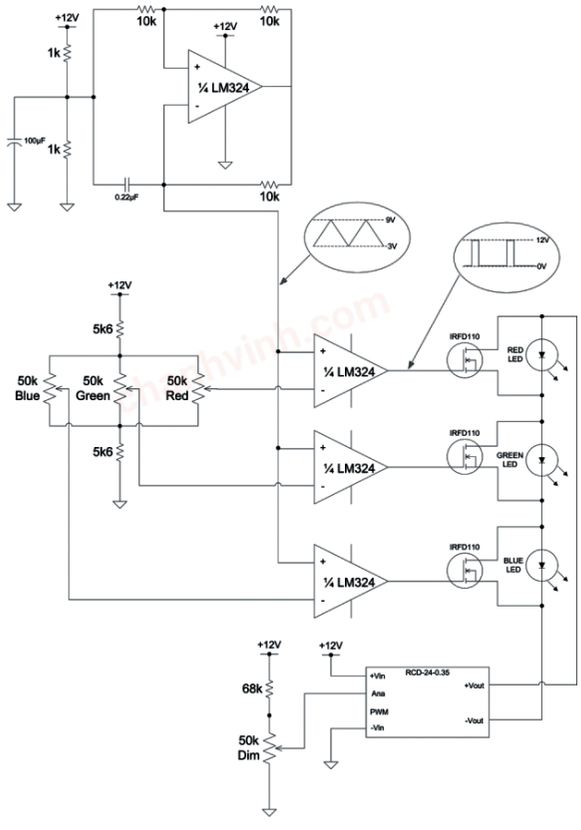
*Typically, choose R so that R=Rptc @ 85°C and R>660 Ohm.

Typical Response Curve (PTC = 500 Ohm @ 70°C)



RGB Driver

SIMPLE RGB Mixer



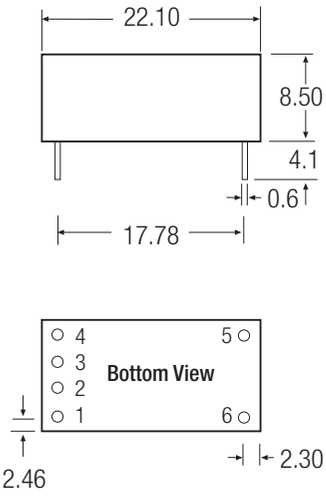
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LIGHTLINE
DC/DC-Converter

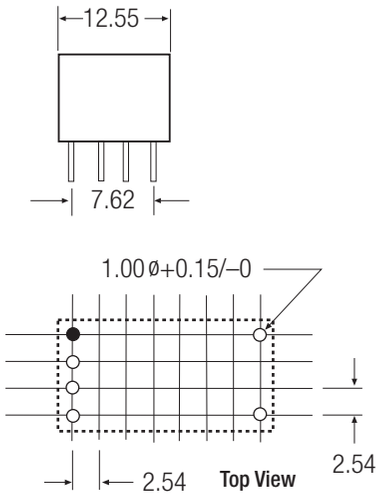
RCD-24 Series

Package Style and Pinning

Pinned Version



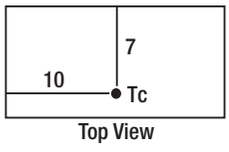
Leave >1mm space arround case on PCB for air circulation



Recommended Footprint Details

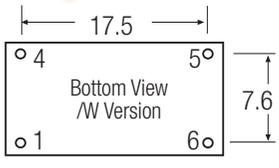
Pin Connections	RCD-24 Series	
Pin #	**Out**	**Comments**
1	+Vin	DC Supply
2	Analogue Dimming	Leave open if not used
3	PWM/ON/OFF	Leave open if not used
(3	Vref	Vref Version only)
4	GND	Do not connect to -Vout
5	-Vout	LED Cathode Connection
6	+Vout	LED Anode Connection

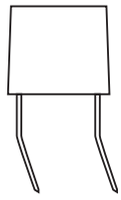
XX.X ± 0.5 mm
XX.XX ± 0.25 mm
Pin Tolerance ± 0.1 mm



Top View

Wired Versions





Wire Connections	RCD-24/W Series	
Wire #	**Function**	**Comments**
1 (Red)	+Vin	DC Supply
4 (Black)	GND	Do not connect to -Vout
5 (Brown)	-Vout	LED Cathode Connection
6 (Yellow)	+Vout	LED Anode Connection

Wire length = 100mm + 10mm stripped & tinned = 110mm total
Wire outside diameter = 1.6mm
Wire core diameter = 0.75mm
Wire is UL/CSA listed/ 22AWG / 300V Rated

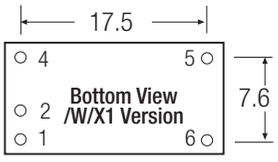
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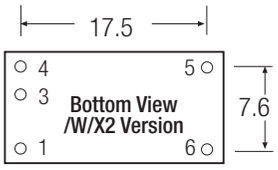
LIGHTLINE
DC/DC-Converter

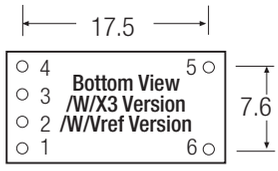
RCD-24 Series

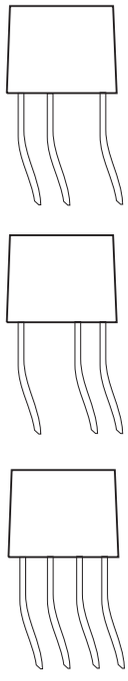
Package Style and Pinning

Wired Versions









Wire Connections	RCD-24/W/X Series	
Wire #	**Function**	**Comments**
2 (Green)	Ana Dimming	/X1
3 (Blue)	PWM Dimming	/X2
2 + 3 (Green + Blue)	Ana + PWM Dimming	/X3
2 + 3 (Green + Yellow)	Ana Dimming + Vref	/Vref

Wire length = 100mm + 10mm stripped & tinned = 110mm total
Wire outside diameter = 1.6mm
Wire core diameter = 0.75mm
Wire is UL/CSA listed/ 22AWG / 300V Rated

Wired Versions are packed in bags - 5pcs per bag.

Warning: Do not connect or disconnect the LED load while the converter is powered on.
This may damage or reduce the lifetime of the LED.

The product information and specifications are subject to change without prior notice. All products are designed for non-safety critical commercial and industrial applications.
The Buyer agrees to implement safeguards that anticipate the consequences of any failures that might cause harm, loss of life and/or damage property.