

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

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 (Vin = 24DC)	300mA-700mA	±1% typ, ±3% max.
	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

LIGHTLINE

DC/DC-Converter

with 5 year Warranty

RECOM

Constant Current LED Driver

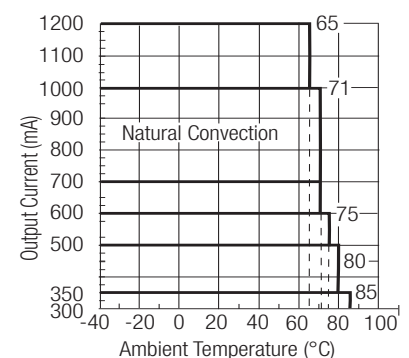


EN-50121-3-2 Certified
EN-60950-1 Certified
UL-60950-1 Certified

RCD-24

Derating-Graph

(Ambient Temperature)



Refer to Application Notes

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	
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Maximum Case Temperature	100°C	
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Thermal Impedance	Natural Convection	55°C/Watt
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Case Material (Pinned or Wired Versions)	Non Conductive Black Plastic	
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Potting Material (Pinned or Wired Versions)	Epoxy (UL94-V0)	
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Dimensions	Pinned/Wired	22.1 x 12.6 x 8.5mm
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Weight	Pinned/Wired	4.5g/6.8g
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Soldering Profile	Pinned	265°C/10 sec. max
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Packing Quantities	Pinned Versions	39pcs per Tube
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(Refer to App Notes for Tube sizes)	Wired Versions	5pcs per Bag
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PWM Dimming and ON/OFF Control (Leave open if not used - do not tie to +Vin)

Remote ON/OFF	DC/DC ON	300mA-700mA	Open or $0V < V_r < 0.6V$
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Threshold Voltages		1000mA-1200mA	Open or $0V < V_r < 0.8V$
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	DC/DC OFF (Standby)	300mA-700mA	$0.6 < V_r < 2.9V$
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		1000mA-1200mA	$1.4 < V_r < 2.2V$
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	DC/DC OFF (Shutdown)	300mA-700mA	$2.9V < V_r < 6V$
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		1000mA-1200mA	$2.2V < V_r < 15V$
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Remote Pin Drive Current	$V_r = 5V$	1mA max	
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Quiescent Input Current in Shutdown Mode	$V_{in} = 36V$	200µA max	
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Maximum PWM Frequency	For Linear Operation	200Hz max.	
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Frequency Limit	1000Hz max.		
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Analogue Dimming Control (leave open if not used - do not tie to +Vin)

Input Voltage Limits	Standard	-0.3V - 15V	
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	Vref Version	-0.3V - 5V	
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Control Voltage Range	Full On	$0.13V \pm 50mV$	
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(see Graphs)	300, 700, 1200mA: Full Off	$4.2V \pm 150mV$	
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	1000mA: Full Off	$4.35V \pm 100mV$	
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	Vref Version: Full Off	$2.6V \pm 100mV$	
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Analogue Pin Drive Current	$V_c = 5V$	0.2mA max.	
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Vref Version	Vref Voltage	$3.3V \pm 70mV$	
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	Vref Output Current	5mA	
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	Vref Output Short Circuit Current	18mA typ.	
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Environmental

Relative Humidity	5% to 95% RH, non-condensing		
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/W Versions	IP67		
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Shock / Vibration	EN61373		
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EMC Railways	EN50121-3-2:2006		
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Conducted Emissions	(with filter, see note)	EN55022	Class B
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Radiated Emissions	(all series except >700mA)	EN55022	Class B
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ESD	EN61000-4-2		
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Radiated Immunity	EN61000-4-3		
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Fast Transient	EN61000-4-4		
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Conducted Immunity	EN61000-4-6		
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MTBF (RCD-24-0.70, Nominal V_{in} , Full Load)	+25°C	605×10^3 hours	
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using MIL-HDBK 217F	+71°C	516×10^3 hours	
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Safety Standards	EN General Safety	Report: SPCLVD1109081EN60950-1 2nd Edition	
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	EMC Railway	Report: 12A082105E-C	EN50121-3-2
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	UL General Safety	Report: E358085-A3	UL60950-1
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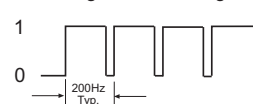
	CSA C22.2 No 60950-1-03		
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Note:

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

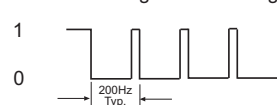
PWM Digital Control Signal



Output Current (LED appears dim)



PWM Digital Control Signal

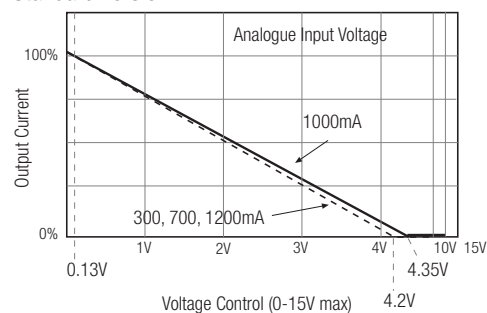


Output Current (LED appears bright)

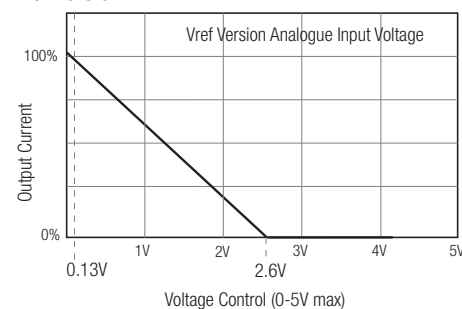


Analogue Dimming

Standard Version:



Vref Version:

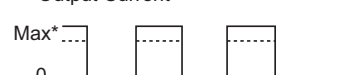


Combined PWM and Analogue Dimming

PWM Digital Control Signal

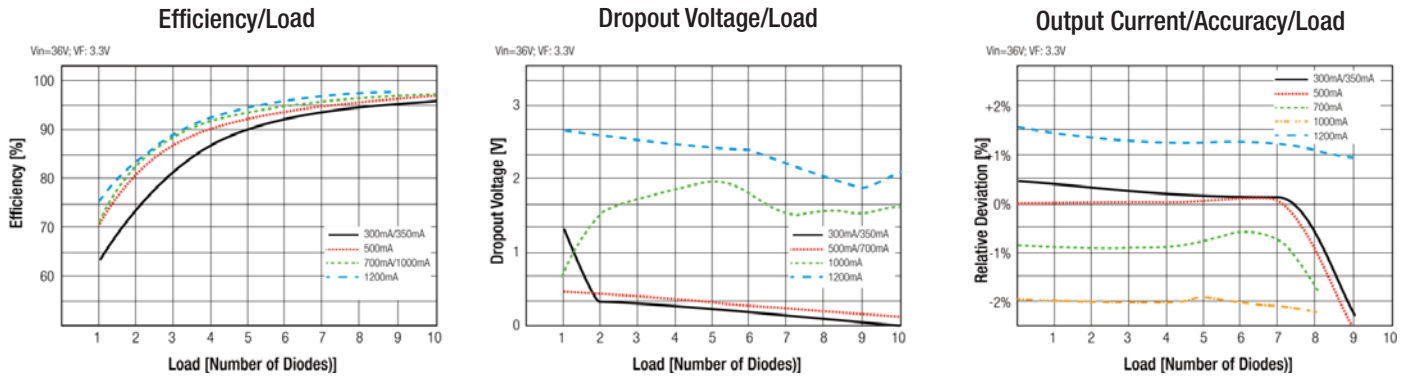


Output Current

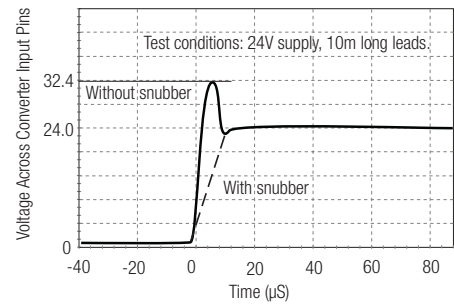
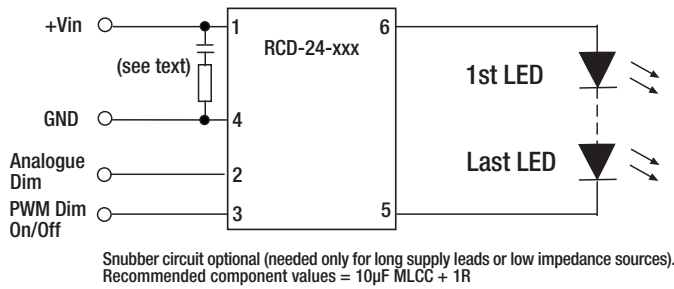


* Max output current can also be set using Analogue input

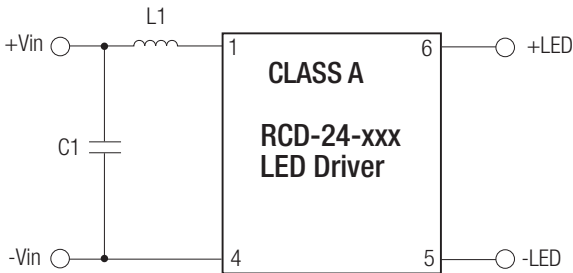
Typical Characteristics



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



EMI Filter Suggestions



RCD-24-0.30 - RCD-24-0.70

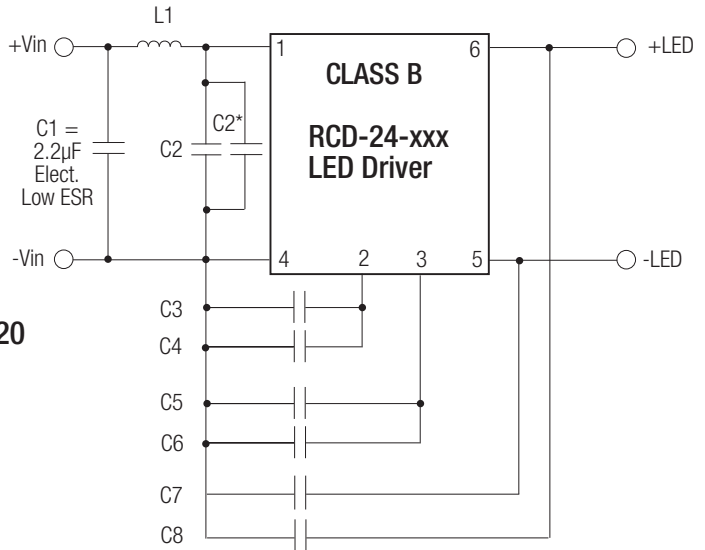
$C1 = 1\mu F$ MLCC

$L1 = 22\mu H$

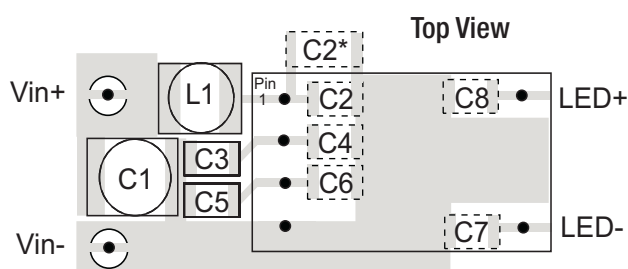
RCD-24-1.00 - RCD-24-1.20

$C1 = 2.2\mu F$ MLCC

$L1 = 47\mu H$



Recommended Class B PCB Layout for Pinned Version



RCD-24-0.30 - RCD-24-0.70

No dimming or PWM dimming:

$L1 = 47\mu H$

$C2 = C3 = 10nF$ MLCC

Other caps not required

Analogue Dimming used:

$L1 = 120\mu H$

$C2 = C7 = 10nF$ MLCC

Other caps not required

RCD-24-1.00 - RCD-24-1.20

$L1 = 220\mu H$

$C2 = 10nF$

$C3 = C5 = 2.2nF$

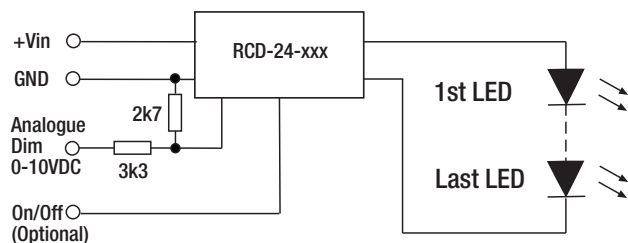
$C4 = C6 = C7 = C8 = 100nF$

All capacitors MLCC

$C2^*$ = optional $2\mu F$ MLCC only if $L1$ starts to resonate with the back ripple current.

RCD-24 Series

LED DRIVER with 0-10V Interface



The diagram shows the RCD-24-0.70 LED driver IC connected to a 2x NPN transistor array. The IC has four inputs: +Vin, GND, Analogue Dim, and PWM Dim/On/Off. The output of the IC is connected to the base of the first transistor in the 2x NPN array. The array is labeled '2x NPN' and '0.5-1.0 Ohm'. The array drives two LEDs, labeled '1st LED' and 'Last LED'.

The block diagram shows the RCD-24-xxx module with the following connections:

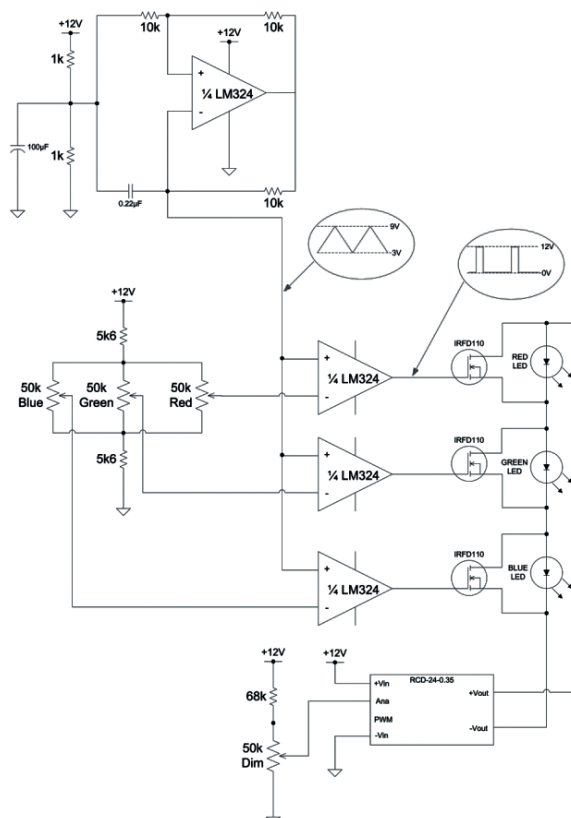
- Inputs:**
 - +Vin** and **GND** are connected to the top-left terminals.
 - 10kHz TTL PWM** is connected to the bottom-left terminal, passing through a resistor **R** and a capacitor **C** to the **Ana. Dimming** input.
- Outputs:**
 - The top-right output line connects to the **1st LED**.
 - The bottom-right output line connects to the **Last LED**.
 - Each LED is represented by a triangle pointing right, with a dashed line and an arrow indicating light emission.

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

SIMPLE RGB Mixer

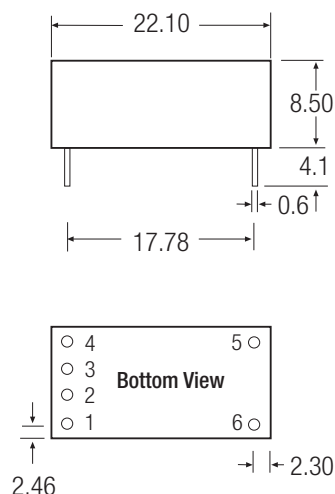
*Typically, choose R so that $R=R_{ptc} @ 85^{\circ}\text{C}$ and $R>660\ \Omega$.

LED Temperature (°C)	Output Current (%)
25	100
50	100
60	98
70	92
80	85
90	0

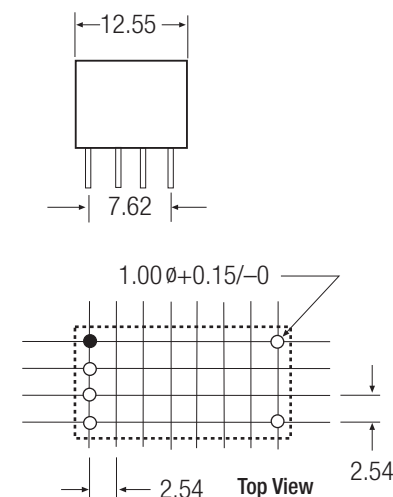
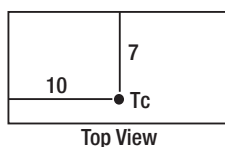


Package Style and Pinning

Pinned Version



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

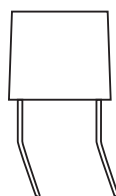
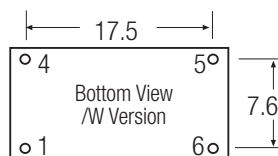


Recommended Footprint Details

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

Wired Versions

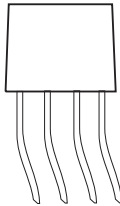
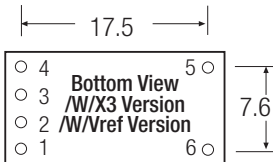
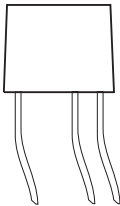
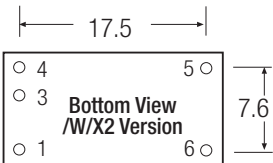
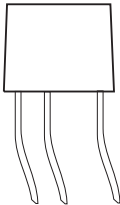
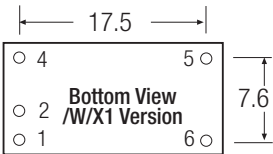


Wire Connections RCD-24/W Series		
Wire #	Function	Comments
1 (Red)	+Vin	DC Supply
4 (Black)	GND	Do not connect to -Vout
5 (Brown)	-Vout	LED Cathode Connection
6 (Yellow)	+Vout	LED Anode Connection

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

Package Style and Pinning

Wired Versions



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.

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