SOLAROX®

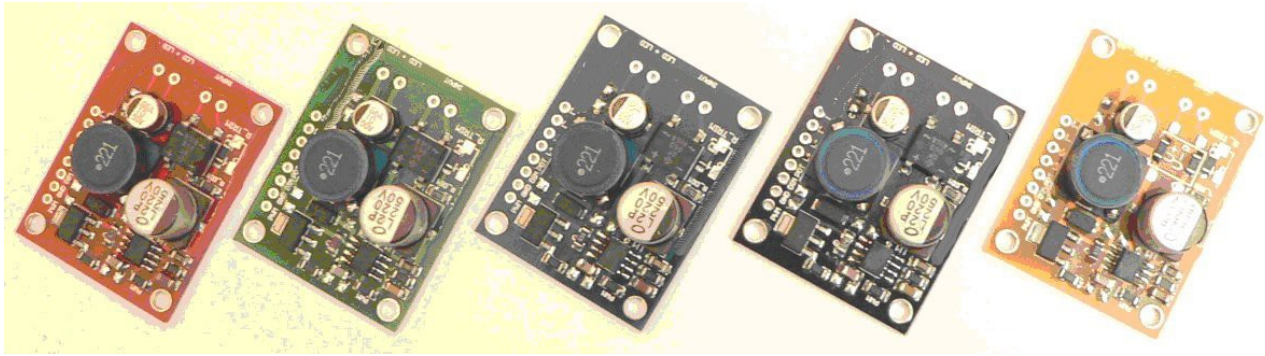
KSQ350, KSQ700, KSQ1000, KS1400

Features:

- Up to 91% IC efficiency with switch-mode power electronics
- Wide input voltage range: 9-40V AC/DC (KSQ1400 only DC!)
- AC/DC operation
- 350/700mA/1000mA/1400mA constant current
- PWM dimming
- Potentiometer dimming
- 0-10V dimming
- Soft-start to prevent any harm to the LEDs during start-up
- Reverse polarity protection at the inlet
- Small size: 4.2cm x 3.2cm x 1.2cm
- Cool operation *additional heatsink not required*
- 3mm mounting holes

Applications:

- General lighting
- Signage and decorative lighting
- Automotive
- Medical
- Advertising and backlighting
- Solar and other low voltage applications



SOLAROX®

PRODUCT DESCRIPTION *–minimum recommended input voltages-*

KSQ350 *350mA constant current driver*	**KSQ700** *700mA constant current driver*	**KSQ1000** *1000mA constant current driver*	**KSQ1400** *1400mA constant current driver*
• 9V AC/DC, 1 LED • 16V AC/DC, 2 LEDs in series • 21V AC/DC, 3 LEDs in series • 27V AC/DC, 4 LEDs in series • 33V AC/DC, 5 LEDs in series • 40V AC/DC, 6 LEDs in series	• 9V AC/DC, 1 LED • 18V AC/DC, 2 LEDs in series • 25V AC/DC, 3 LEDs in series • 33V AC/DC, 4 LEDs in series • 40V AC/DC, 5 LEDs in series	• 9V AC/DC, 1 LED • 19V AC/DC, 2 LEDs in series • 27V AC/DC, 3 LEDs in series • 34V AC/DC, 4 LEDs in series • 40V AC/DC, 5 LEDs in series	• 9V DC, 1 LED • 19V DC, 2 LEDs in series • 27V DC, 3 LEDs in series • 34V DC, 4 LEDs in series • 40V DC, 5 LEDs in series

SOLAROX® constant current drivers are designed to operate 1W, and 3W high power LEDs with a stable current that is independent of the input voltage.

For instance, most LED manufacturers recommend 350mA drive current for 1W LEDs. KSQ350 has an output current of 350mA for that purpose. Similarly KSQ700 will output 700mA respectively. Depending on the LED manufacturers data, the suitable driver must be used.

If the LEDs are connected to the circuit in parallel rows, the output current will be divided. For example if 2 LEDs are connected to KSQ700:

1. in series, the LED current will be 700mA
2. in parallel, the LED current will be 700/2=350mA (not recommended)

So it is possible to drive higher number of LEDs by using a higher current driver and connecting LEDs in parallel rows. Description of series and parallel connection is given in detail and can be reached from "connection diagrams" section. Advantages of SOLAROX® drivers can be given as:

Constant current

SOLAROX® drivers are designed to drive LEDs with constant current (cc), independent of the input voltage.

For example to drive 2 high power LEDs, connecting the driver to any input voltage between 12-40V will suffice. Normally the maximum voltage ripple at the output is 2% .

For the situations that the distance between the power supply and the LEDs is 10-15m or higher, the input voltage may drop significantly because of the resistance of the cable. If constant current drivers are not used, the brightness and colors/color temperatures of the LEDs may vary and this can be easily noticed. Constant current drivers, which are also

recommended by LED manufacturers, will protect the LEDs from voltage transients and helps to design long-life, reliable systems.

High efficiency

The most known and used method to drive ultra-bright LEDs is connecting a resistor in series to the LEDs to limit the current. However by improvements in LED industry, the LED currents are increasing rapidly. Some high power LEDs are rated up to 2800mA while the old fashioned LEDs are still being driven at 20mA. Using resistors at that current levels may cause the resistor to overheat dangerously and most of the energy to turn into heat instead of light.

SOLAROX® constant current drivers are one of the highest efficiency products in the market with 91% IC efficiency.

AC/DC operation

Some conventional lighting systems use 12V AC input as default. For the cases that those systems will be replaced with LEDs, SOLAROX® drivers can be used without any modification of the electrical wiring.

Additionally while designing a product, a simple transformer can be used to reduce the voltage from the mains supply(110/220V AC) to 9-40V AC and a SOLAROX® drivers can be operated with AC. **Important! KSQ1400 is only suitable for DC!**

Reverse polarity protection

Wrong wiring of (+) and (-) input voltage is a common problem during the assembly many lighting fixtures to a single line. This may not only increases the assembly durations, but also increases the cost and may even cause system failures. The reverse polarity protection at the inlet of SOLAROX® drivers helps to overcome that problem. (+) and (-) can be connected in any order. *That's not true for KSQ1400! Consider polarity for it!*

PWM dimming

For some systems the on/off control of the LEDs by the user is enough, while for some cases it may be desirable to control light output with a microcontroller (or by a distant user). This is the case for RGB (color-changing) systems. Most color controller circuits are not capable of giving high currents at their outputs, but only generate PWM (pulse width modulation) signals.

If the frequency of the PWM signal is lower than or equals to 1000Hz, that signal can be easily connected to PWM input of SOLAROX® drivers to dim the LEDs. The brightness of the LEDs will be controlled by the duty cycle in that case.

The recommended voltage for PWM signal is 5V (TTL), but it will still operate down to 2.7V. For PWM signals above 5V, a 50-100kΩ resistor must be connected in series before connecting the signal to PWM input of the driver.

*In order to use that feature, the PWM input of the driver must be activated on-board. Drivers are shipped with PWM disabled and can be easily activated by removing a jumper. It is described in detail and can be found in connection diagrams section (PWM dimming).

Dimming with potentiometer

SOLAROX® drivers offer an easy solution when the brightness of the LEDs will be controlled by a potentiometer..

This feature can be used simply by connecting a 1kΩ potentiometer as described in connection diagrams section (potentiometer dimming).

*In order to use that feature, the DIM input of the driver must be activated on-board. Standard drivers are shipped with DIM disabled. To receive drivers with DIM input enabled, it must be stated in the order form. The drivers can be easily activated by removing a jumper. It is described in detail and can be found in connection diagrams section (potentiometer dimming).

Dimming with 0-10V voltage input

Some lighting systems used for stage lighting are controlled by 0-10V analog voltage input. When the output of the controller is 0V the brightness of the lights is about 5%, and when 10V is applied to the lighting the equipment brightness is 100%.

SOLAROX® drivers have the feature to dim the LEDs with 0-10V analog voltage input. The sample setup can be found in connection diagrams section (0-10V dimming).

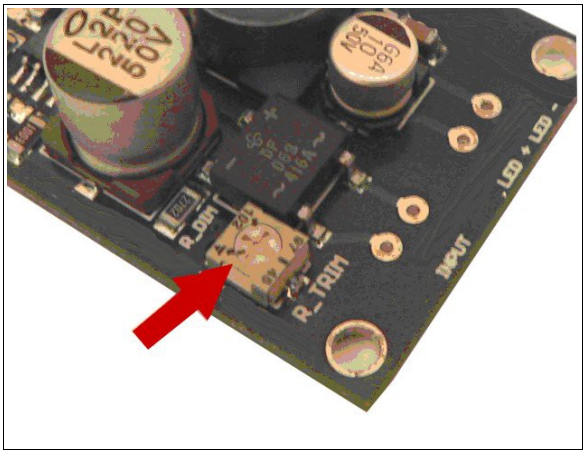
*In order to use that feature, the DIM input of the driver must be activated on-board. Standard drivers are shipped with DIM disabled. To receive drivers with DIM input enabled, it must be stated in the order form. Standard drivers can be easily activated by removing a jumper. It is described in detail and can be found in connection diagrams section (0-10V dimming).

Soft-start

At the beginning of operation, power supplies may generate voltage transients which are normally harmful to the LEDs. Most light sources are turn on/off many times in a day, and LEDs are exposed to high voltage (high current) each time the power supply is turned on. The soft-start feature of SOLAROX® drivers eliminates the voltage transients at the beginning of operation and prevents them to cause any harm to the LEDs.

Trimpot for accurate current adjustment (optional)

For the cases where the current must be accurately adjusted to a specific level, the on-board potentiometer option can be used. The drivers does not have this option, but mini-trimpots can be mounted by user himself.



Parallel connection (not recommended)

- To drive "more number of LEDs", it is possible to connect multiple rows of LEDs to the driver in parallel. This is only possible if you are sure that forward voltages of all LEDs are equal!
- To drive "LEDs with higher drive currents", it is possible to connect multiple drivers to the LEDs in parallel.

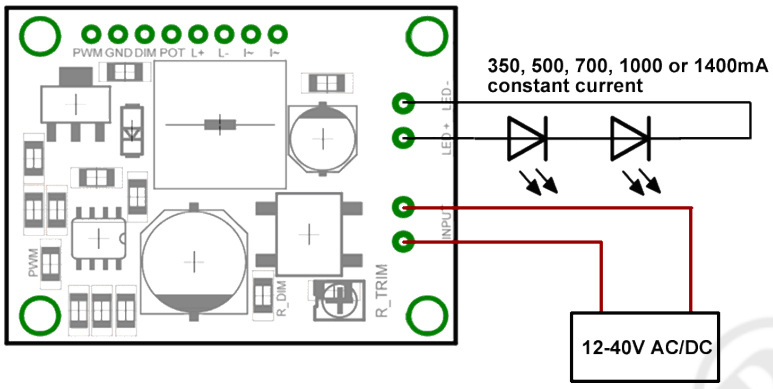
Ratings

Model	Current (A)			Input Voltage (V)	Operating Temperature (°C)
	Min.	Typ.	Max.		
 KSQ 350	0,33	0,38	0,42	9-40V AC/DC	-40 to 80
 KSQ 700	0,71	0,75	0,8	9,5-40V AC/DC	-40 to 80
 KSQ 1000	1,01	1,04	1,12	10-40V AC/DC	-40 to 80
 KSQ 1400	1,31	1,38	1,45	9-40V DC	-40 to 80

SOLAROX®

Connection Diagrams

1. SERIES CONNECTION



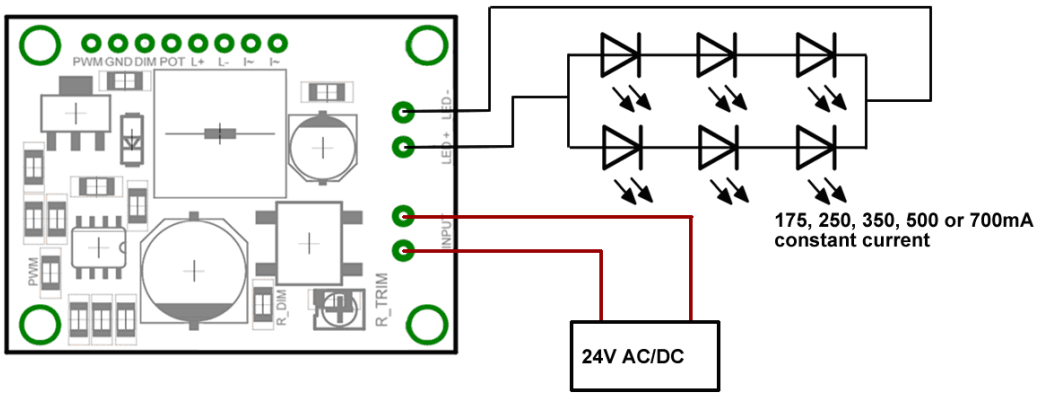
In series connection, input voltage must be selected according to the number of LEDs connected in series like described on page 2.

must be used. In the 2nd page of this document, recommended input voltages are specified for each drive current. It must be taken into account that with lower input voltages, the output current will be slightly affected. To drive more LEDs with a single driver, it is often recommended to use a higher input voltage.

Because of the reverse polarity protection at the inlet, (+) and (–) input voltage can be connected in any order to the driver.

SOLATOX®

2. PARALLEL CONNECTION



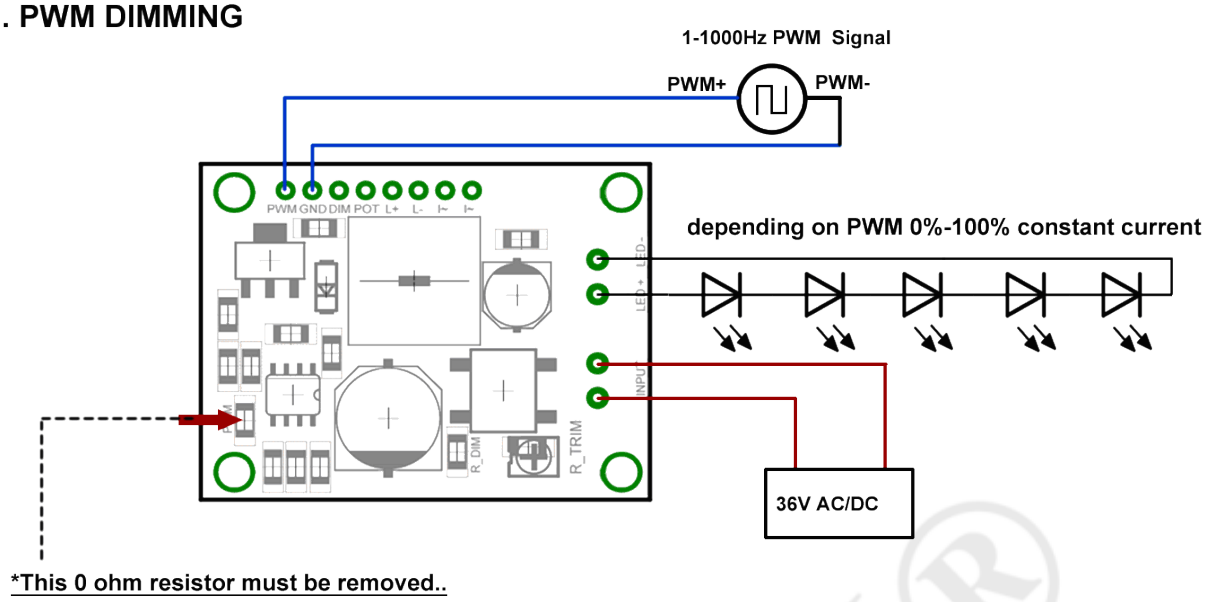
Input voltage must be determined according to the number of LEDs connected in series. In the figure 24V is used for 3 LEDs are connected in series.

In parallel connection, output current is divided into multiple rows. In the above figure, current is divided into 2 rows. In that case if a KSQ700 is used, the 700mA at the output of the driver will be divided into 2 rows and supply 350mA to the LEDs. So 6 LEDs can be powered with 24V instead of 3. It is also possible to divide the output current into 3 or more rows.

But each row must contain same number of LEDs with same properties (the total LED forward voltages must be same for each row). The forward voltage can vary production-related, so you need to measure the forward voltage of the leds by yourself. Otherwise the current will not be divided equally and the leds could be damaged. Please note that parallel connection is strongly NOT recommended!

SOLAROX®

3. PWM DIMMING



Input voltage must be determined according to the number of LEDs connected in series.

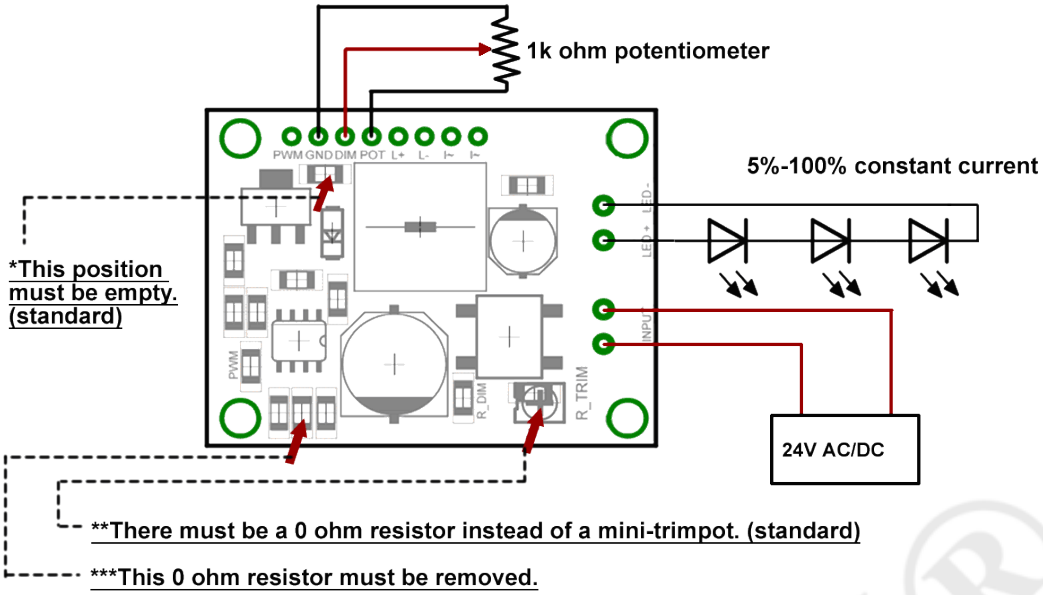
The recommended frequency for PWM dimming is 0-1000Hz.

Drivers are sold with PWM input disabled, it must be activated (on-board) to use that feature. PWM input can be activated simply by removing the jumper (R0 resistor) shown with red arrow. In that case the LEDs will not light up until a PWM signal is applied to the PWM pin (blue connections).

The recommended voltage that should be applied to the PWM pin is 5V TTL. The driver will continue operation until the PWM signal voltage drops down to 2.7V. To use a higher voltage for PWM dimming, a 50-100 kΩ resistor must be connected in series to the PWM signal before it is connected to the driver.

SOLAROX®

4. POTENTIOMETER DIMMING

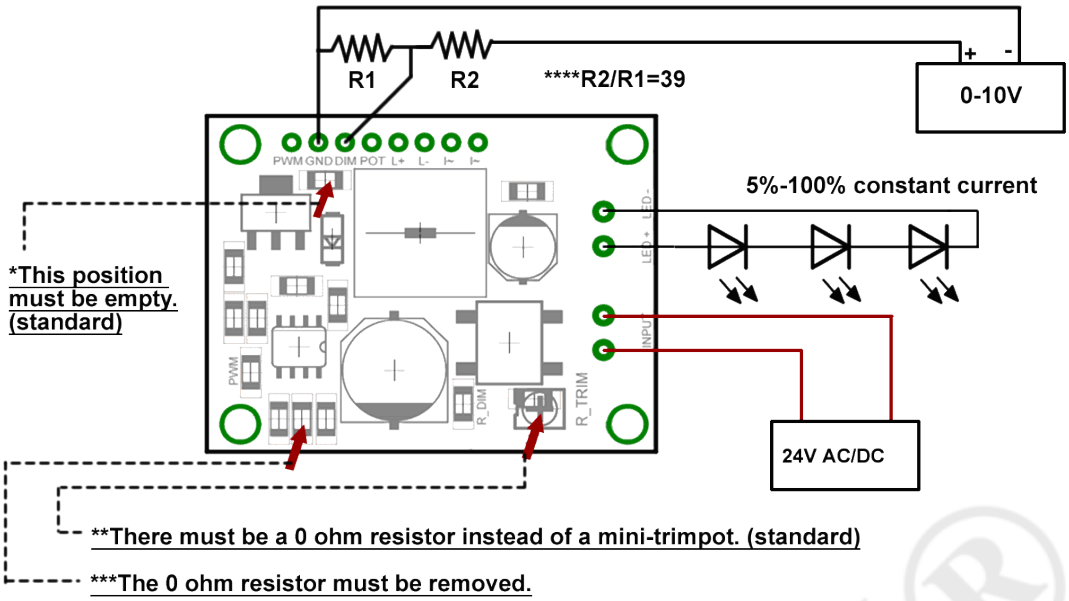


Input voltage must be determined according to the number of LEDs connected in series.

Standard drivers are sold with DIM input disabled, it must be activated (on-board) to use that feature. DIM input can be activated simply by removing the jumper (R0 resistor) shown with red arrow (left hand side bottom corner). 0-10V dimming can not be done without removing this jumper.

SOLAROX®

5. 0-10V DIMMING



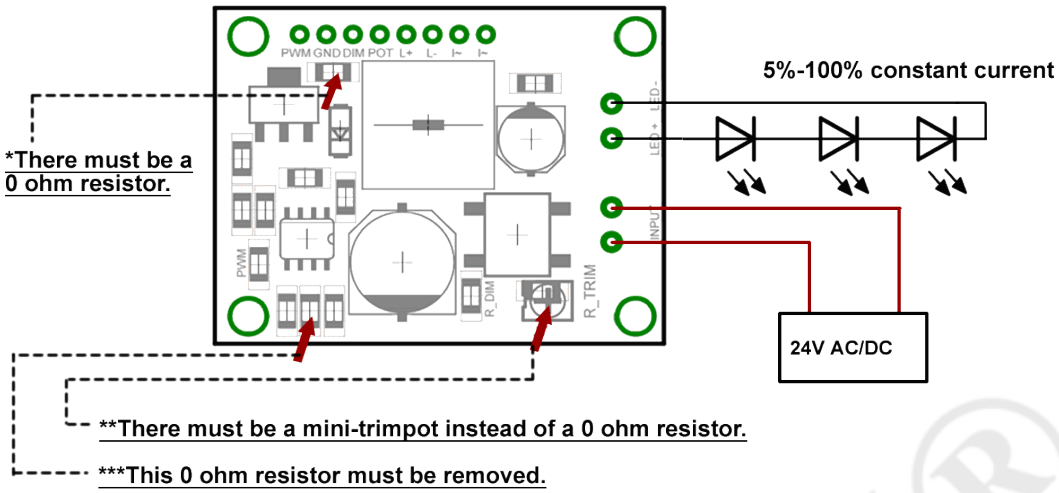
Input voltage must be determined according to the number of LEDs connected in series.

Drivers are sold with DIM input disabled, it must be activated (on-board) to use that feature. DIM input can be activated simply by removing the jumper (R0 resistor) shown with red arrow (left hand side bottom corner). 0-10V dimming can not be done without removing this jumper.

In this connection type two resistors, R1 and R2, must be connected externally as shown in the figure. The ratio of the two resistors must be selected so that R2/R1=30-40. For instance if R1 is selected as 1 kohm, R2 should be 33 kohm or 39 kohm.

SOLAROX®

6. ON-BOARD TRIMPOT (OPTIONAL)

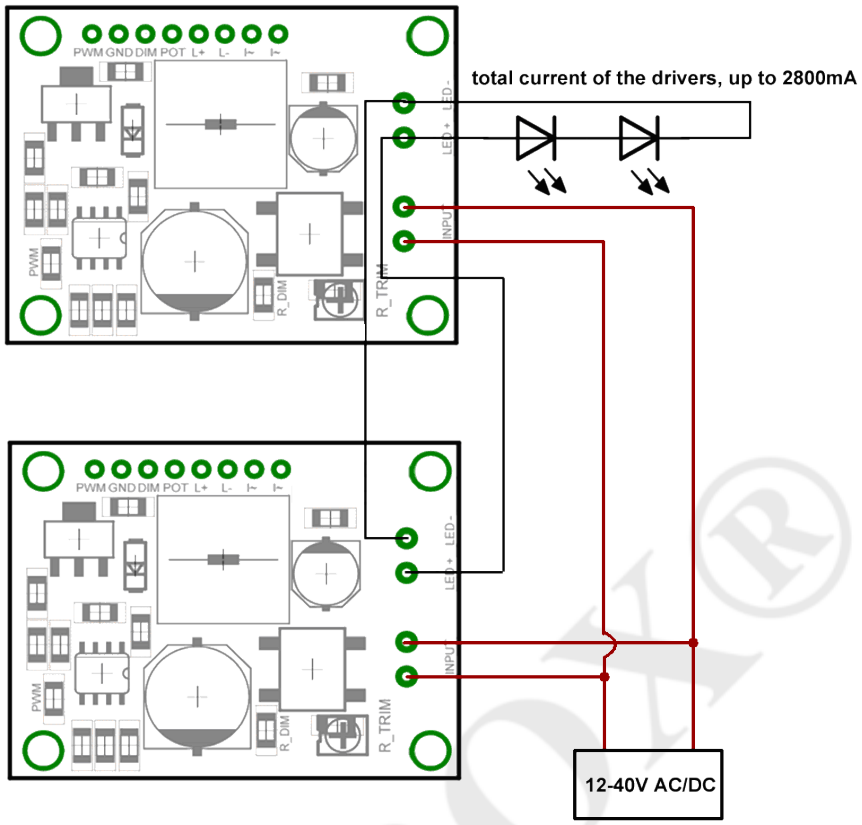


Input voltage must be determined according to the number of LEDs connected in series.

Drivers are sold with DIM input disabled, it must be activated (on-board) to use that feature. DIM input can be activated simply by removing the jumper (R0 resistor) shown with red arrow (left hand side bottom corner). On-board trimpot dimming can not be done without removing this jumper.

SOLAROX®

7. CONNECTING MULTIPLE DRIVERS IN PARALLEL

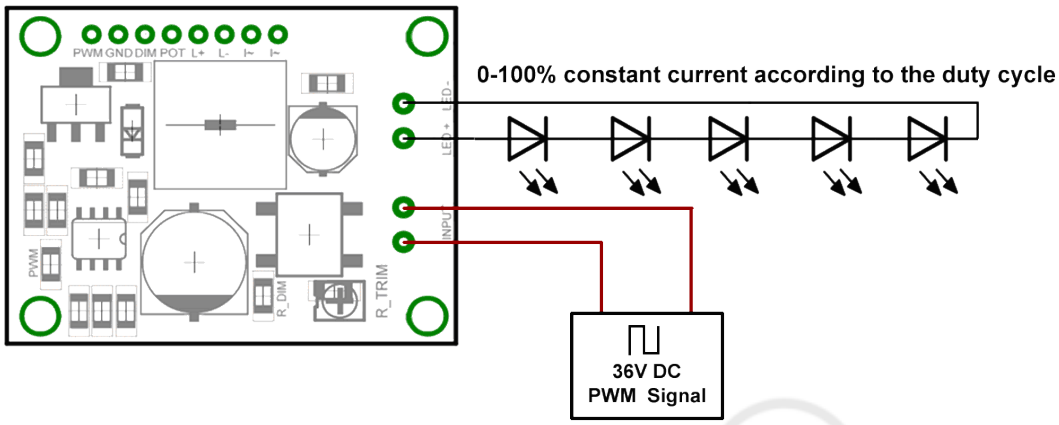


Input voltage must be determined according to the number of LEDs connected in series.

The datasheet of the LED must be read carefully before deciding the current. Most datasheets have both "*peak pulse current*" and "*DC Forward current*". *Peak pulse current* is the amplitude of PWM signal at the output, and the duty cycle must be controlled (as manufacturers recommend). *DC forward current* is the limit at which the LED can be driven continuously (as soon as the junction temperature is below the limit).

SOLAROX®

8. APPLYING PWM AT THE VOLTAGE INPUT

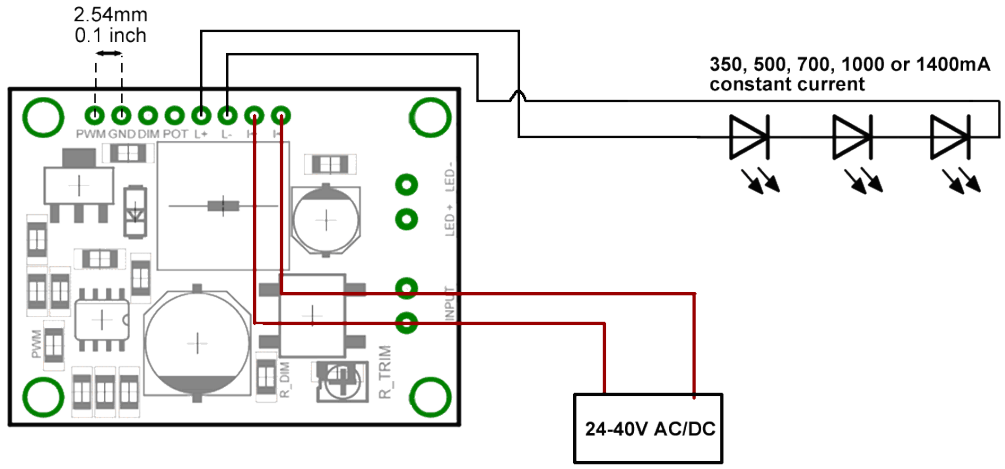


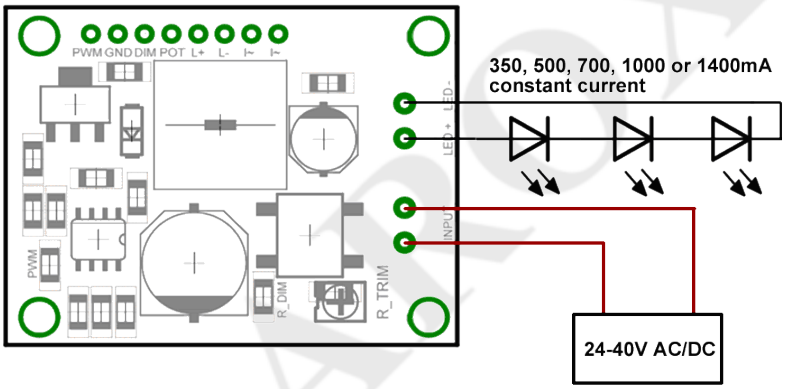
Input voltage must be determined according to the number of LEDs connected in series.

PWM can be applied at the inlet of the driver for the cases where otherwise is not possible. It is normally recommended to do use the schematic #3 to do PWM dimming.

SOLAROX®

9. USING THE CONNECTOR INPUT/OUTPUT



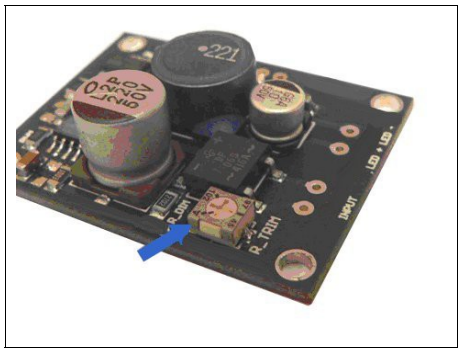


For input/output connections, one can either use the solder pads at the right hand side or solder pads at the top of the driver (intended to be used with connectors/headers). Integration to another system becomes easier with the upper pads.

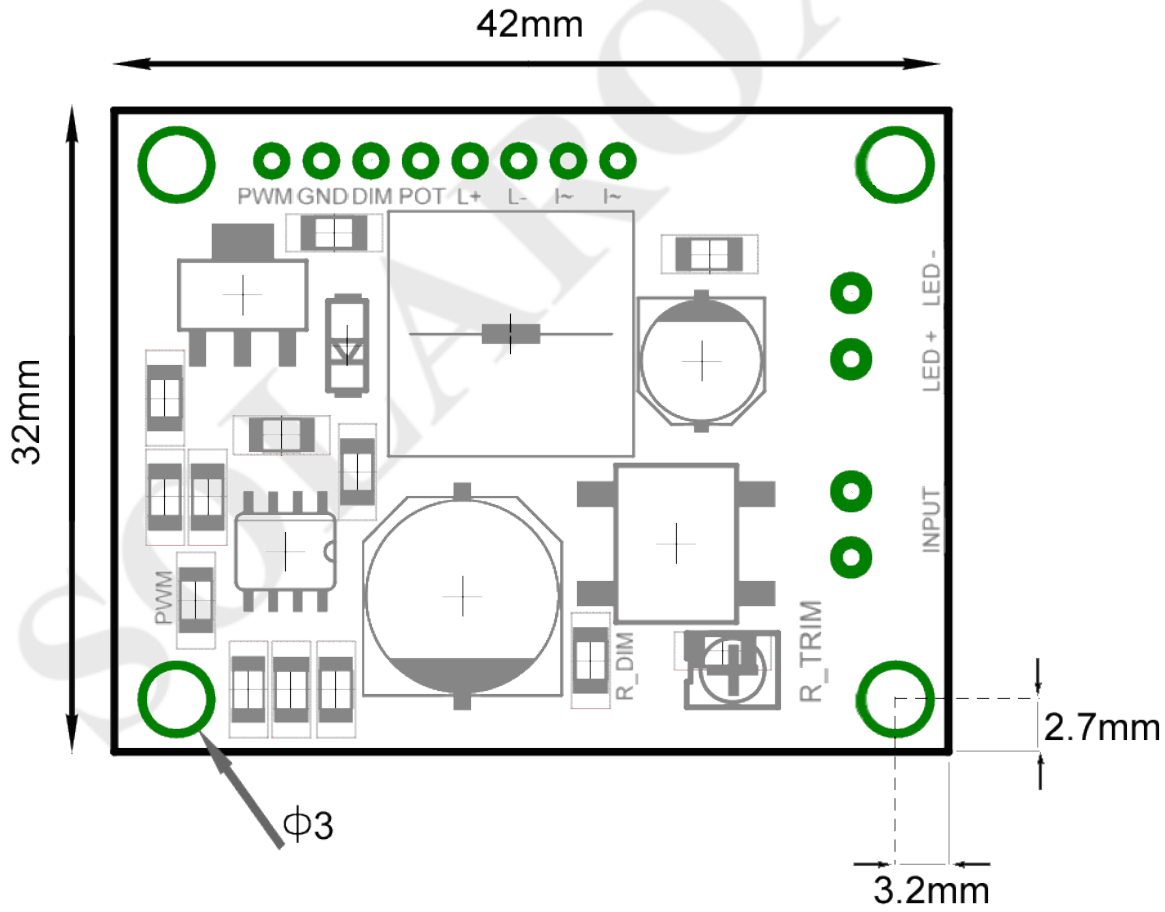
SOLAROX®

On-board mini-trimpot

For the cases where the current must be accurately adjusted to a specific level or it will be readjusted time to time, an 1Kohm trimpotentiometer can be assembled by yourself.



Dimensions



©LED1.de
Falko Glanert