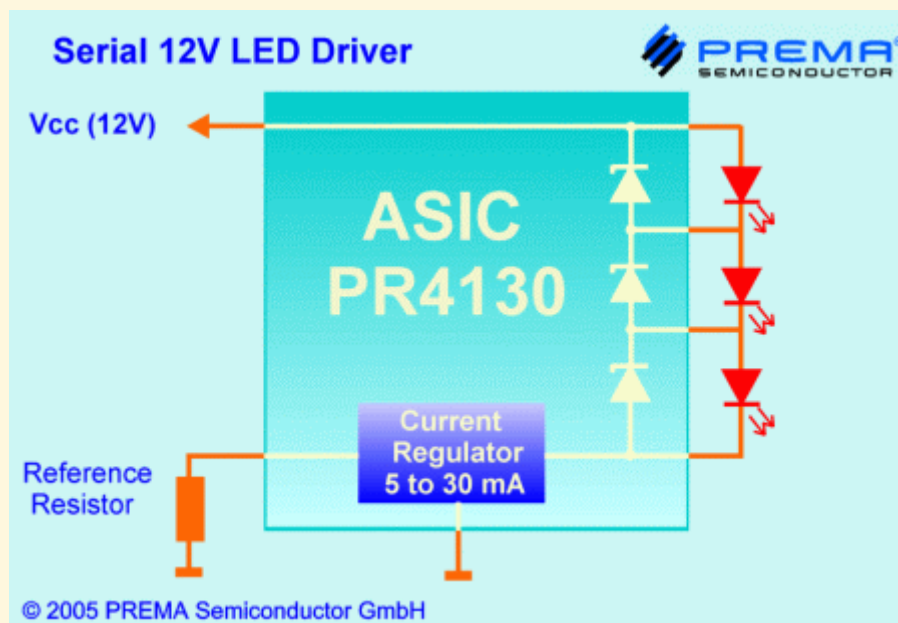


Serial 12V-LED Driver for up to three LEDs PR4130

Standard light sources such as bulbs are replaced by LEDs or LED strings in more and more applications now. A new constant current driver PR4130 controlling up to three LEDs in series is offered now. Even if one or two LEDs are disconnected or short circuited, the current and the brightness remain constant, thus providing a high reliability.

The supply voltage of the PR4130 ranges from 10V up to 14.4V or a maximum voltage of 21V for short time. Only one external resistor is necessary for operation of the IC, which defines the LED current in a range from 5mA up to 30mA. Due to the very accurate current control the brightness of the LEDs is very constant and almost independent of the supply voltage and the number of connected LEDs.

The PR4130 circuit is compensating the disadvantage of serial LED circuits, that a failure in one LED will lead to the disfunction of the whole string. A Zener diode circuit provides a current flow also with a break of one LED and together with the current control the brightness of all connected LEDs stays smooth and constant also with short circuit or break of one or two LEDs. The Zener diode circuit has been defined for forward voltages of the LEDs of up to 2.3V.



Due to the supply voltage of around 12V the PR4130 is well suited for automotive applications such as a driver for the third high mounted stop light (Center High Mount Stop Light) consisting of a string of more LEDs. In this case several PR4130 can be used in parallel, uniformly distributed current is guaranteed by the current control also at a failure of a single LED. Further applications are decoration light strings with 12V power supplies. The PR4130 is offered as a standard cell for design of an analog ASIC. Production of a custom specific standard cell IC can be reasonable for annual amounts from several 10 k units. The NRE cost are comparatively low and possible customised adaptations are often quickly implemented.

Further information and a datasheet of the PR4130 are available on the web site www.prema.com/Application/pr4130_e.html.

Triple Serial LED Driver PR4130 and LED controller PR4230 With Integrated LED Break Detection and Bypass Function

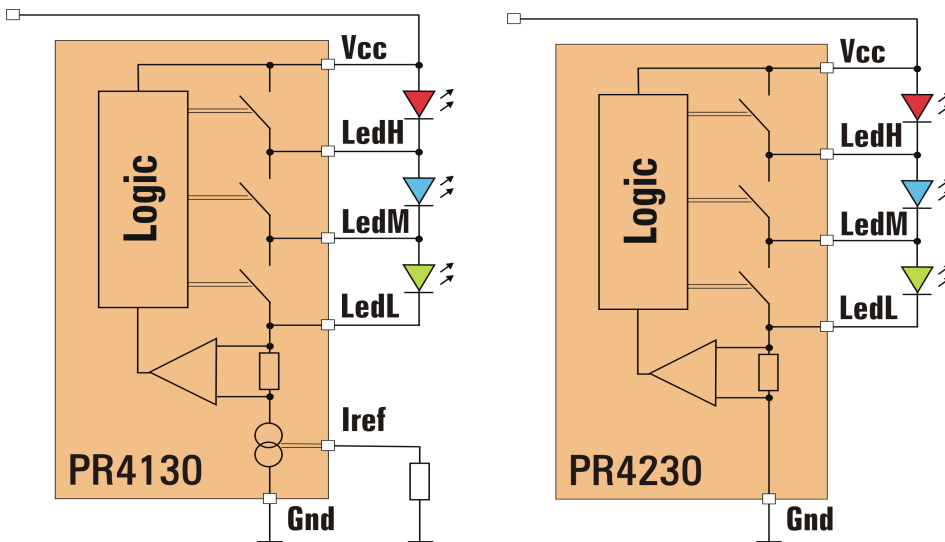
Features

- Drives up to 3 LEDs in series
- Programmable current sink for 5 to 30mA (only PR4130)
- Checks LED current and by-passes broken LEDs
- A broken LED break does not lead to a black-out of a complete LED string
- Compatible with all LED colors (red, yellow, green, blue, white, UV)
- Minimum number of external components required

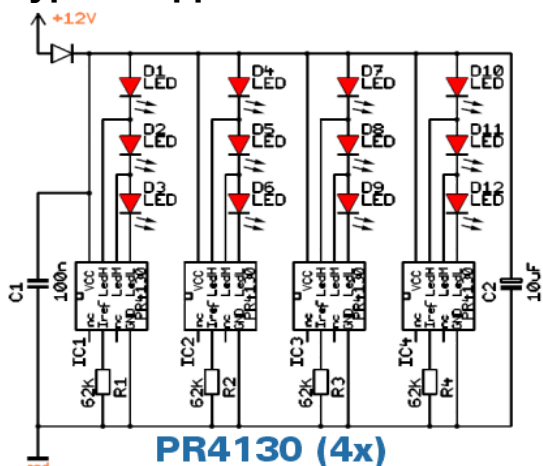
Applications

- Decoration string lights
- LCD backlighting units
- Third (High Mounted) Brake Lights

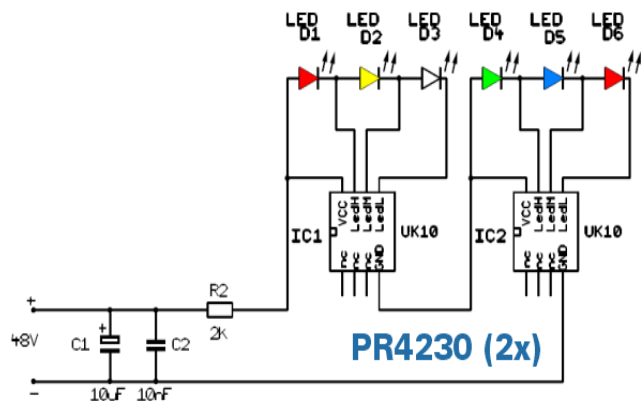
Block Diagrams



Typical Applications

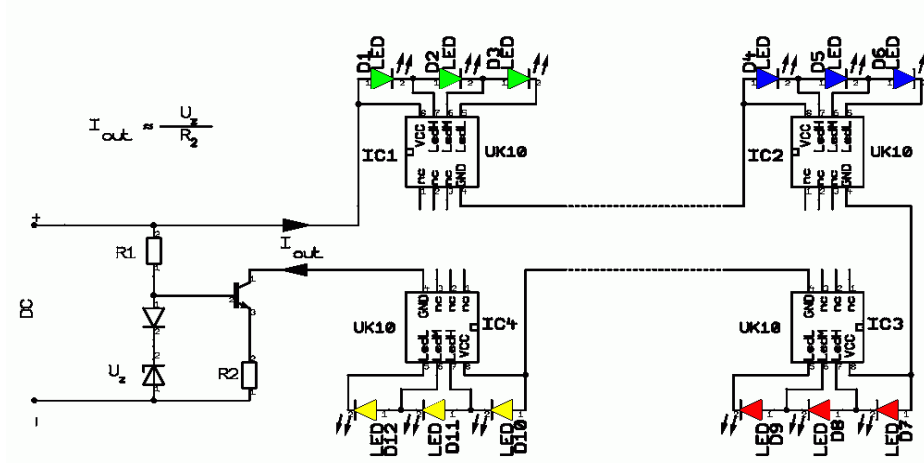


4 chains of 3 LEDs each are driven in parallel



Driving LEDs of different colors

Typical Application PR4230



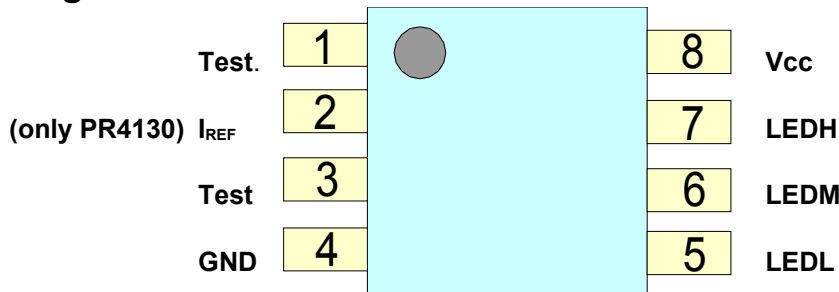
Decoration string light for 230Vac (Driving 78 green LEDs in series (PR4230))

Functional Description

Normally, if LEDs are driven in series, a failure in one LED will lead to the malfunction of the whole chain. The Triple LED driver PR4130 as well as the LED controller PR4230 supervises the current through the LED chain and bypasses all defective LEDs, keeping the remaining LEDs functional. If an anomaly in the current through the LED chain is detected, it tries to re-establish the current flow by bypassing different LEDs and combinations of LEDs. The maximum test time is 1.4ms.

In addition, the PR4130 provides a constant current sink, keeping the LED current independent of V_{CC} and the number of LEDs in a string.

Pin Assignment



PR4130 / PR4230 in SO8 package

PIN No	PIN Name	PIN Function Description
1	test	do not connect
2	I_{REF}	Reference Current (only PR4130) / do not connect for PR4230
3	test	do not connect
4	GND	Ground
5	LEDL	LED Low
6	LEDM	LED Mid
7	LEDH	LED High
8	V_{CC}	Input Voltage

Absolute Maximum Ratings

Parameter	Min	Max	Units
V _{CC}	-0.3	18,5	V
Output Current	0	100	mA
Operating Junction Temperature Range	-20	125	°C
Storage Temperature Range	-40	150	°C

Electrical Characteristics

Conditions: V_{CC}=12.4V; T_a=22.5°C unless otherwise indicated

LED Current as a function of the reference resistor only for PR4130

R _{REF}	I _{LED}
332 kΩ	5 mA ± 5%
157 kΩ	10 mA ± 5%
74 kΩ	20 mA ± 5%
48 kΩ	30 mA ± 5%

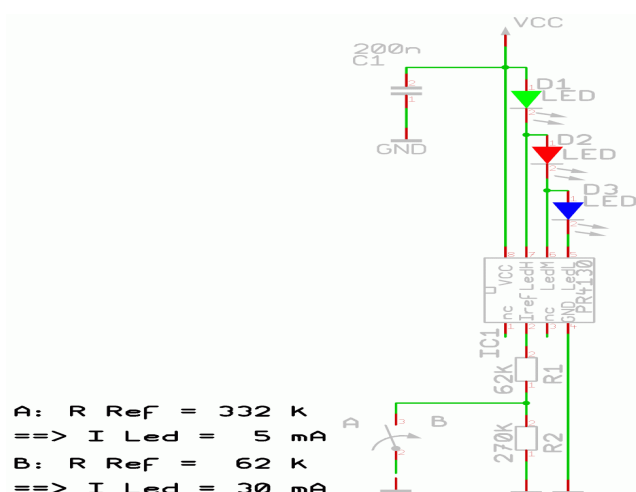
Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage V _{CC}		7.0		18.0	V
LED Current I(LED _L)		4.5		33	mA
V(LED _H), V(LED _M), V(LED _L)	switch off (current flow through LED)			V _{CC}	V
Clamping voltage V _{CC} -V(LED _H), V(LED _H)-V(LED _M), V(LED _M)-V(LED _L)	switch on (current flow through switch)			2.6	V
Voltage at I _{ref} pin			4.4		V
V _{CC} clamping voltage		18.4			V
Current through V _{CC} clamping diode				100	mA

Application Note for PR4130

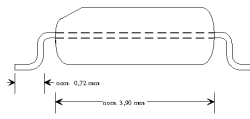
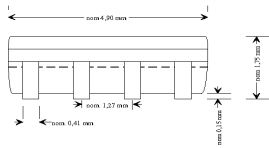
Operation with PWM Control

As a zero LED current state may interfere with the break detection sequence, it should be avoided to switch the LED completely on and off to control brightness by a PWM signal.

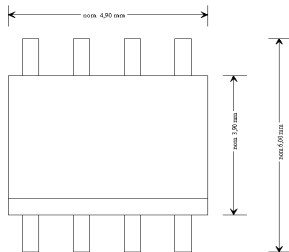
It is however possible to switch between minimum and maximum current by switching the reference current I_{ref} with a PWM signal - see drawing.



Mechanical Dimensions of a SO8 package



All parts delivered comply with RoHS.
Finish is pure tin.



Thermal Design

Worst-case conditions for the power are when all LEDs are broken, so the full voltage drops along the IC. Roughly the power can be calculated as the product of supply voltage and LED current, neglecting the current consumption by the PR4130 / PR4230 itself. Values for maximum power are given for parts in SO-8 package.

T_a	P_{max}
25°C	550 mW
50°C	420 mW
75°C	280 mW
100°C	140 mW

Disclaimer

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