Bright ideas for LED applications

LED solutions for gaming, mobile, signage, LCD TV backlighting, LED indication, and more

NXP founded by Philips

Bright ideas for LED applications

At NXP Semiconductors, we have a portfolio filled with bright ideas for LED applications. We design for high performance and lower overall cost, focusing on power efficiency and flexible design-in.

As the world's leading provider of products based on the I²C-bus, we work closely with our customers and partners to develop next-generation LED solutions. That means you get options like Fast-mode Plus, a wide supply range (2.3 to 5.5 V), and flexible PWM functions. It also means ultra-low standby modes (<1 μA), lower overhead on the CPU, and extended battery life in mobile applications.

We even give you a head start on design, with application boards and daughter cards, and have an established manufacturing infrastructure that supports very high volumes.

It's everything you need to make lighting affordable, in everything from mobile handsets and gaming systems to outdoor billboards, signage, and more.

The table below provides an overview of the special benefits we bring to specific LED applications. The rest of the brochure highlights key products in the portfolio.

| NXP LED applications	
Gaming	▸ I²C-bus enables easy system modification and designs that are easy to scale ▸ Voltage-switch PWM dissipates current in external resistor to reduce on-chip heating ▸ Long-distance communication is easy to implement ▸ Individual addresses are available, as are programmable sub-calls. That means groups of devices can responds to the same software commands, and thus reduce overhead ▸ Bus controllers and bus buffers make it easy to combine the I²C-bus with any processor
Mobile	▸ Up to 30% longer battery standby times ▸ Ultra-low power consumption in standby modes (< 1 μA) ▸ Memorizes complex blink patterns, offloads CPU
Signage	▸ Lower-cost, drop-in replacements for Silicon Touch ST2221A and STMicroelectronics STP08CDC596 ▸ Ample manufacturing capacity for high-volume production
LED TV backlighting	▸ Very low power surge, due to staggered ON time, which reduces EMI ▸ Supports driving external FETs or switched-mode regulators, for higher voltage/current LED strings ▸ External clock input supports device synchronization, to eliminate noise and artifacts
LED indication	▸ Simple I²C-bus firmware ▸ Offload the microcontroller, since it doesn't have to communicate after the LED is programmed, and it doesn't have to manage LED power ▸ Unused bits can be put to use as GPIO

For more information, visit www.nxp.com/i2c

NXP I²C-bus interface LED voltage sources PCA962x and PCA963x

PCA962x family

- I²C-bus interface = Fast-mode Plus
- SDA/SCL = 1 MHz and 30 mA
- Supply = 2.3 to 5.5 V
- 256 step duty cycle adjustment PWM for each bit plus global PWM for all bits
- Operation = 40 V, 100 mA for all outputs
- SO, TSSOP, HVQFN packages

|	
PCA9623	4-channel I²C-bus interface LED voltage source
PCA9624	8-channel I²C-bus interface LED voltage source
PCA9622	16-channel I²C-bus interface LED voltage source
PCA9626	24-channel I²C-bus interface LED voltage source
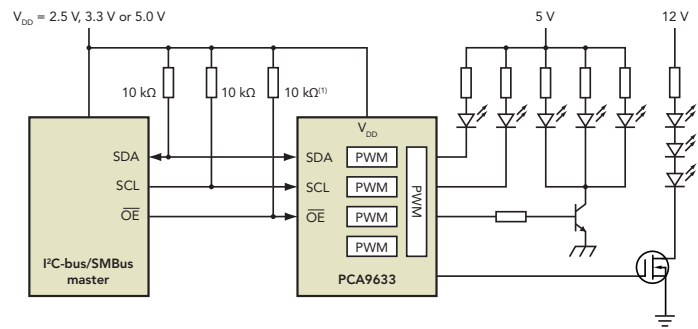
The PCA9633 driving LEDs directly, or for higher voltage/current capability, through transistors or through a FET.

PCA963x family

- I²C-bus interface = Fast-mode Plus
- SDA/SCL = 1 MHz and 30 mA
- Supply = 2.3 to 5.5 V
- 256 step duty cycle adjustment PWM for each bit plus global PWM
- Operation = 5 V, 25 mA for all outputs
- Push-pull outputs enable glue less connection to FET or switched-mode regulators
- PCA9632 with ultra-low power standby mode (< 1 μA)
- SO, TSSOP, HVSON, HVQFN packages

PCA9632	Low-power, 4-channel I²C-bus interface LED voltage source
PCA9633	4-channel I²C-bus interface LED voltage source
PCA9634	8-channel I²C-bus interface LED voltage source
PCA9635	16-channel I²C-bus interface LED voltage source

Also recommended

PCA9600	I²C-bus buffer
PCA9665	I²C-bus controller
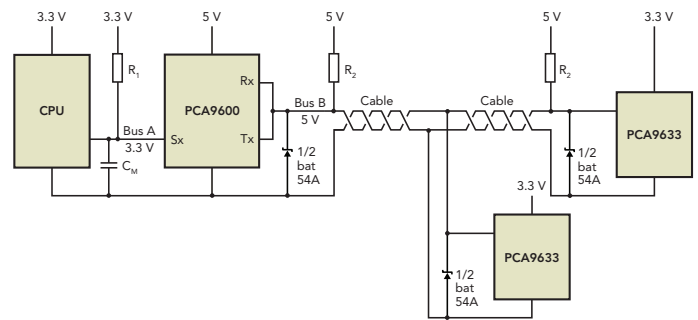
The PCA9633 in a typical long-distance cable architecture

NXP I²C-bus interface LED voltage source with 12-bit PWM PCA9685

Features

- I²C-bus interface = Fast-mode Plus
- SDA = 1 MHz and 30 mA
- Supply = 2.3 to 5.5 V
- 4096 step duty cycle adjustment PWM for each bit
- Frequency = 100 to 1000 Hz
- External clock option allows synchronization and frequency control
- Staggered ON times reduce current surge
- Operation = 5 V, 25 mA for all outputs
- Push-pull outputs enable glue less connection to FET or switched-mode regulators
- TSSOP, HVQFN packages
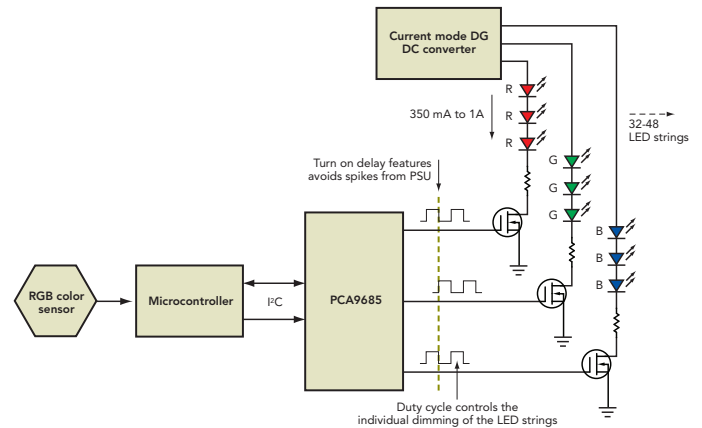
The PCA9685 in a typical RGB LED architecture with FET and current source

NXP 1-wire interface current source LED driver PCA9901

Features

- Supply = 2.1 to 5.5 V
- 1.8-V interface
- LED supply = 1 to 20 mA with 40-mV dropout at 20 mA
- 12-bit adjustments of OFF time between 20 ms and 5.1 seconds
- 12-bit adjustments of ON time between 1 and 255 ms
- Options for training sequences: training, run once/ continuous, stop, reset, bypass mode
- Offloads CPU from blinking operation, extending battery standby time by 30% in mobile applications
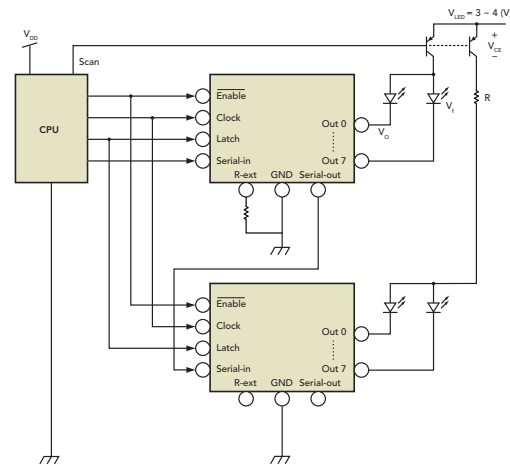- TSSOP, HVSON, CSP packages
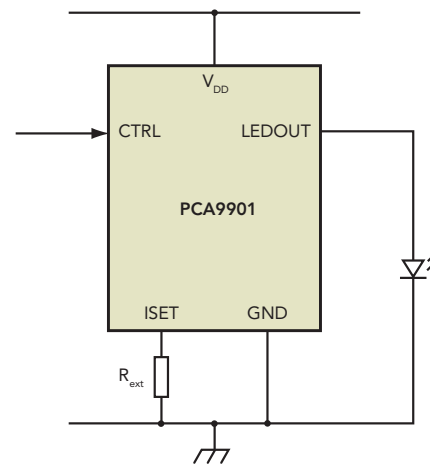
PCA9901 block diagram
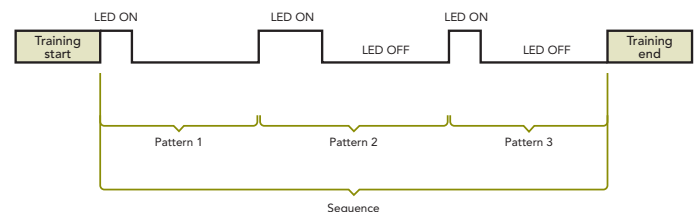
PCA9901 blinking patterns

NXP serial interface current sink LED drivers PCA9922 and PCA9926

Features

- Ideal for LED billboards and bus signs
- Supply = 2.3 to 5.5 V
- 25-MHz serial interface
- 8 channels supporting 15 to 60 mA at 5V
- Output error detection: LED open, LED short, pin shorted to GND
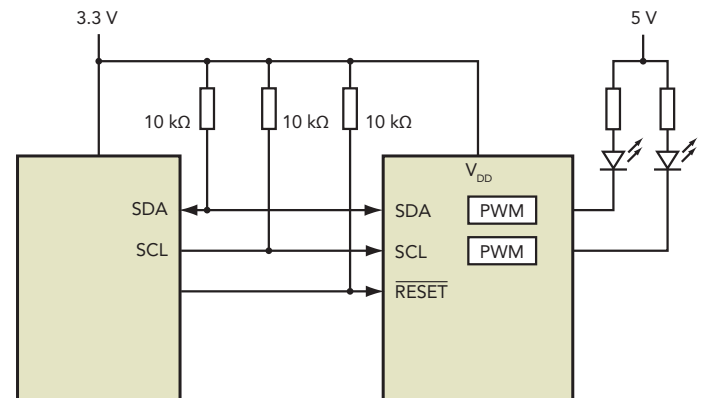- DIP, TSSOP, HVQFN packages

The PCA9922 in a typical multi-device architecture

# NXP I²C-bus interface voltage sources PCA953x and PCA955x

Features

- SDA = 400 kHz and 3 mA
- Supply = 2.3 to 5.5 V
- Open-drain output = 25 mA at 5 V with 100 mA max (200 mA max for 16-bit)
- 256-step duty cycle and frequency adjustment on two PWMs
- Each output selects OFF, ON, PWM0 or PWM1
- PCA953x Dimmer PWM = 160 Hz to 1.6 sec
- PCA955x Blinker PWM = 40 Hz to 6.2 sec
- SO, TSSOP, HVSON, HVQFN package

Dimmer	Blinker	Description
PCA9530	PCA9550	2-LED control
PCA9531	PCA9551	8-LED control
PCA9532	PCA9552	16-LED control
PCA9533	PCA9553	4-LED control

Typical application for LED controller
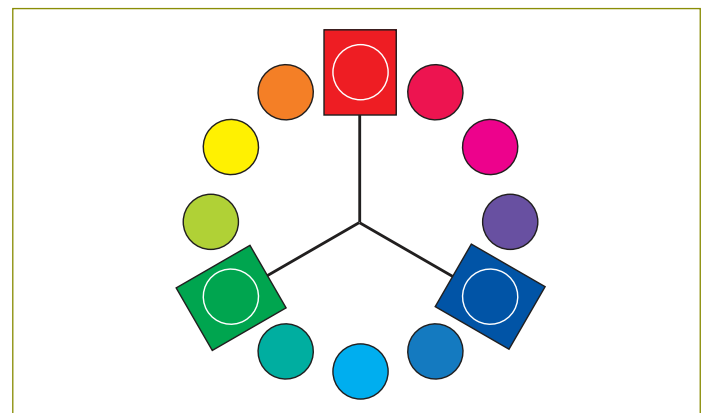
Color wheel

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