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NEWS

> ST aims to miniaturise ultrasound scanners

STMicroelectronics has introduced an ultrasound pulse controller with four independent channels. Each channel of the device, which is fabricated using the firm's high-voltage BCD mixed-signal technology, generates precisely controlled high-voltage pulses to drive piezo-electric crystals or other transducers.
http://tiny.cc/ew308

> Spending on manufacturing equipment to double, says iSuppli

Global spending on semiconductor manufacturing equipment is expected to rise by 46.8% in 2010 compared to 2009, says iSuppli, ending three consecutive years of decline.
http://tiny.cc/ew621

ELECTRO-RAMBLINGS

> An Engineer in Wonderland: Two LEDs for one

That push-button bistable I have yet to get going is part of an attempt to replace an LED in an existing lamp with a choice of two.
electronicsweekly.com/electro-ramblings

> An Engineer in Wonderland: Anglo-Saxon metrology rules your feet

After my last blog on metrology, I came across something that I am hoping is true: an article on English units of measurement claims that the length of a barley seed – a barleycorn – was once the standard from which English measurement was derived, and it is still in use.
electronicsweekly.com/electro-ramblings

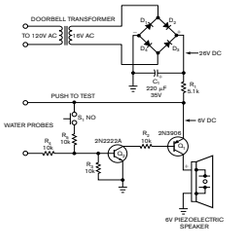
DESIGN IDEAS

> Four-quadrant lock-in amplifier generates two analogue outputs

The circuit in this Design Idea realises a simple, low-cost lock-in amplifier employing Analog Devices' AD630 balanced modulator-demodulator IC.
http://tiny.cc/ew172

> Simple water leak detector

The circuit detects hot-water-heater leakage, and you can also use it for detecting leaks in dishwashers, waste disposal units, ice makers, swimming pools, hot tubs and waterbeds.
http://tiny.cc/ew331



E-NEWSLETTERS

> Daily newsletter

Short and sweet, our daily e-mail newsletter contains the news on the site, the latest product releases, and the most popular content that your peers are reading to keep you up-to-date with developments in the electronics industry.
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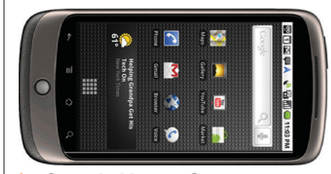
PICTURE GALLERIES

Taking a visual angle on stories or interesting subjects, the galleries complement *Electronics Weekly*'s more traditional text-based articles. Take a look behind the scenes and step through the photos.

> Slates from CES
http://tiny.cc/ew712



> Google Nexus One
http://tiny.cc/ew798

> iPhone apps for engineers
http://tiny.cc/ew323

> Electronics CEO viewpoints
http://tiny.cc/ew392

> Plastic electronics
http://tiny.cc/ew207

Modern LED drivers can bring new features to portable devices, write **Michael Bairanzade** and **Marie-Therese Capron**

Automatic gradual dimming for multiple LEDs

An embedded gradual dimming function provides an easy way to generate the special illumination sequences being requested by portable goods manufacturers, so that they can differentiate themselves from their rivals.

Not only will the LED peak current I(LED) tend to be fully programmable, but it will be expected that each LED can be dimmed to any value between zero and its maximum specified level.

Generally speaking, LED drivers provide a constant current to bias the LED in appropriate conditions. In a typical portable system, the power source is a battery with an output voltage ranging from 2.8 V to 4.2 V (assuming a standard Li-Ion battery is used).

Since the forward voltage of the low power LEDs currently on the market varies between 2.8V and 3.5V, depending upon bias current and room temperature, an interface is necessary to ensure the LED is properly biased during normal operation.

This is the purpose that the driver IC serves, and the first thing to be considered is the voltage span of the current control system. The next decision the design engineer needs to make is whether to connect the LEDs in parallel or series. Both of options have their advantages and their drawbacks.

In colour applications, the capability to independently and dynamically adjust the brightness of each LED is highly desirable.

Although it is possible to use a boost structure, with switches controlling each LED, the series arrangement is not the preferred solution, as a parallel structure is far easier to implement. The charge pump is the most appropriate type of DC/DC converter to generate a low voltage while keeping EMI issues to an absolute minimum.

However, using multi-mode operation (1X, 1.5X, 2X) provides a net efficiency improvement, saving energy and extending battery life.

The next key parameter to be considered is the current matching between the LED emitters. An RGB structure cannot accommodate bias current differences between the LEDs, since such differences would affect colour rendering. The problem is solved by using a set of accurate current mirrors (as depicted in Figure 1).

To achieve precise and stable forward bias conditions in the LEDs, a reference current is generated by means of the external resistor and a constant voltage sourced from a band gap reference. Transistor Q2, associated with operational amplifier U2, outputs a constant voltage at the Vref pin.

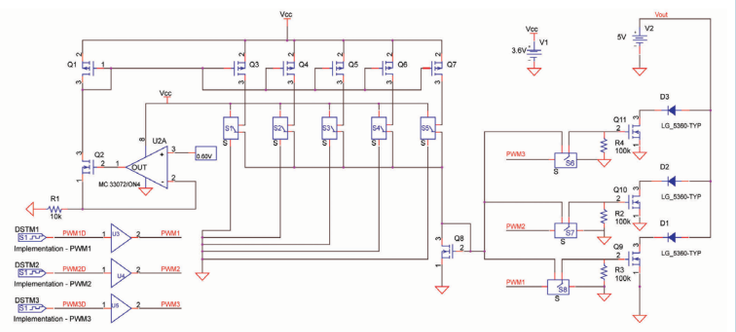
The external resistor, connected across Vref and ground, creates a constant current flow through transistors Q1 and Q2. This current is mirrored and amplified by the set of transistors Q3-Q7, connected via switches S1-S5, and summed by transistor Q8. Finally, transistor Q9 copies the reference current into LED1.

Such a structure is duplicated for each LED, the layout of the chip optimising the matching between them. As a consequence, every LED emitter shares the same I(LED) peak and extra electronic circuits are necessary to independently control the brightness of each LED. This is achieved by using an independent PWM modulation for each emitter.

The switches S6-S8, controlled by the digital signals PWM1-PWM3, turn ON/OFF the associated current mirrors, thus generating a brightness control for each LED. A constant peak current is realised in the LEDs, ensuring the colour rendering is not hampered by the brightness control. The operating point for each LED stays in the reference colour defined by the standard colour map.

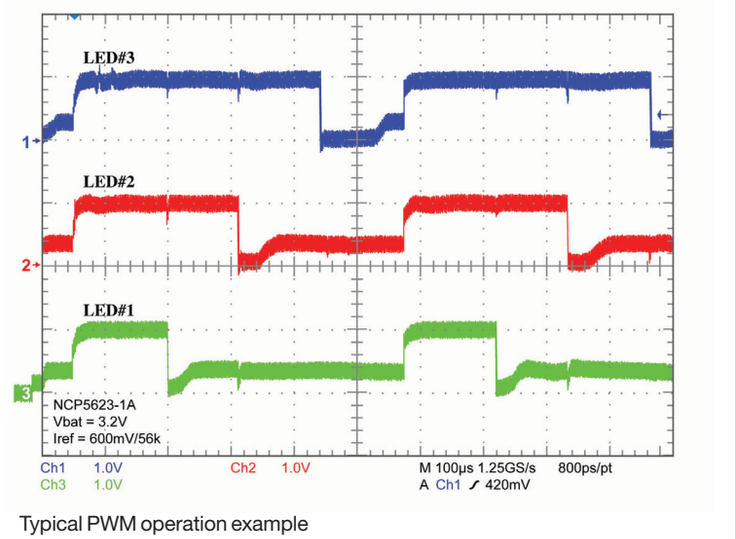
The waveforms, coming from a typical application (see Figure 2), illustrate the behaviour of the three PWMs. The LEDs are controlled by a common low-frequency clock with a duty cycle set for that specific application. It is possible to independently decrease/increase each PWM, from 0%-100% duty cycle, with the I(LED) peak being constant. For digital control, LED current is preset via the I²C port and the PWM.

FIGURE 1



Typical current mirrors and independent PWM control

FIGURE 2



Typical PWM operation example

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