Going green

Backlight driver helps automotive designers to meet environmental challenges.

*By **Graham Pitcher**.*

The world is going green, with some sectors moving ahead more quickly than others. Green technology is particularly relevant in the automotive sector, where issues such as emissions control and safety become ever more critical.

The automotive sector is now a major consumer of electronics devices – both 'under the hood' and in the cabin in the form of infotainment. The latter technology is a major consumer of lcds and it is here that Maxim Integrated Products has focused its efforts to create what it believes is a breakthrough device which not only increases efficiency, but also helps manufacturers to progress their green agendas.

According to Maxim, automotive OEMs are shifting from using cold cathode fluorescent (ccfl) to high brightness leds (HB LED) for automotive backlighting applications. High brightness leds, the company notes, consume less power and do not contain hazardous materials, such as mercury in ccfls. Another benefit is the enhanced colour reproduction and longer life span of the HB LED.

Yet, it continues, HB LEDs also pose challenges, particularly when used in the harsh automotive operating environment. It points to two main challenges: price/performance; and integration.

HB LED solutions need to be more cost competitive with ccfls, says Maxim. Because of this, there is 'significant demand' for integrated devices that reduce the bill of materials and implementation costs. "Automotive applications, in particular, require solutions that are highly flexible and scalable from low end cars to luxury vehicles with development costs dispersed over many different platforms and car models," the company observes.

Because of this, it is difficult to meet the needs of multiple designs with the same HB LED driver circuit. Typically, designers must change components in their design in order to accommodate led binning (brightness variation), whilst maximising efficiency and reducing power dissipation for each project. This process, it notes, is time consuming and costly.

The second main challenge is to integrate fault protection and maximise conversion efficiency. Because automotive applications are inherently high reliability, HB LED driver circuits need fault protection. If an led fails, it can suddenly short or become an open circuit. In both cases, the HB LED driver circuit must be able to protect itself and the automotive electrical system. Ideally, says Maxim, it should also alert the electrical system of the fault condition.

Alongside the two main challenges, thermal management is another 'must have'. If leds get too hot, their operating life is shortened and failure is possible. "It is therefore important that the driver circuit includes a feature to limit the led temperature if it exceeds a predetermined threshold."

Lastly, with all of the electronics in modern cars increasing power demand, the efficiency of the hb led driver circuit should be maximised in order to keep energy consumption as low as possible.

Designed specifically for automotive applications, the MAX16826 is intended

to provide OEMs with a cost efficient, scalable solution. Its programming features allow it to be used for multiple designs with minimal component changes. And its ability to accommodate led binning variations reduces overall manufacturing cost.

The MAX16826 integrates a switching regulator controller, a four channel linear current source driver, an a/d converter and an i²c interface. The i²c interface allows dynamic programming of the output voltage to maximise power efficiency, while allowing manufacturers to program led current for each string to accommodate binning variations. This latter feature helps to reduce implementation cost.

Maxim claims the MAX16826 – produced on a bicmos process – employs an innovative architecture that allows dynamic programming of the switching regulator's output voltage and the led current amplitude in each channel.

An internal a/d converter measures the drain voltage of each HB LED string. It then makes the measurements available to an external microcontroller through an i²c interface for output voltage optimisation and led fault monitoring.

"Dynamic programmability allows the same driver circuit to be used for multiple projects by simply adjusting the led current or voltage through the i²c interface," says Maxim. "This eliminates the need for component changes and greatly simplifies production. Moreover, output voltage optimisation maximises conversion efficiency by reducing the voltage drop across the linear drivers. Consequently, it also reduces power dissipation and heat in the display."

> *"'Practically the same design' can be reused for many projects without changing components."* *Maxim Integrated Products*

Because of this ability, Maxim claims that 'practically the same design' can be reused for many projects without changing components. The driver can be changed for a specific project by programming the device via its i²c interface during the production process.

Current designs employ integrated mosfets for led current regulation, but the MAX16826 drives external mosfets for both the switching converter and led current regulators. This approach not only allows the device to drive more hb leds per string, but also to support more led current across each string. The benefit, Maxim notes, is that it enables the MAX16826 to be used in multiple projects. Thermal management is also improved because heat is dissipated by more components, and over a larger board area.

The MAX16826 can detect and react to led open and short circuit faults. Whenever such faults are detected, internal circuits immediately disable the faulty elements. This approach protects both the HB LED driver and the automotive electrical system from damage. In addition, the automotive electrical system can read the fault condition through the i²c interface, and react accordingly.

These features enable designers to meet the high reliability requirements of automotive applications, while minimising external component count and, therefore, solution cost.

Enhanced flexibility

For enhanced flexibility, the switching regulator can be configured as a boost or as a single ended primary inductor converter (SEPIC); the voltage across the driven leds can therefore be both higher and lower than the supplied input voltage. Meanwhile, a switching frequency that is programmable between 100kHz and 1MHz reduces electromagnetic interference in noise sensitive applications, such as automotive displays.

Each current sink features a direct pwm input to enable independent led dimming control for each channel, allowing designers to adjust the brightness of each colour in RGB applications. By optimising voltage supply to the leds, dynamic brightness control allows the use of different led 'bins' and supports a dimming range of 3000:1.

Additional features include cycle by cycle current limiting, along with output overvoltage and overtemperature protection.

Maxim believes the part will have application outside of the automotive industry. "Desktop and lcd tv makers are considering white and rgb leds for backlighting," it concludes, "and the MAX16826 can also be used for these applications." ■

Figure 1: Typical MAX16826 application