Mentor Embedded. support other tool chains like Keil, IAR and developers to use the full capability. We also Development Environment, which allows also got a free Code Composer Studio Integrated Community, Folkens said. Along with this, you monitor the Engineering-to-Engineering (or E2E) as assembled an online support team to cloud-based applications. "We have are well equipped to begin creating user guides, and ample online support comes complete with quick start and other Ethernet-ready kits. The LaunchPad $19.99 USD, it is less than half the price of is shipping now and the price is right; at The Tiva C Series Connected LaunchPad START DEVELOPING you are across the globe, Folkens explained. remotely with this product and a user even if It is basically showing how you can interact with them through their browser. a serial port from a terminal while someone interface to the Connected LaunchPad through supports a basic game by enabling someone to active and plugged-in to Exosite. "In addition, it other connected LaunchPad owners if they are the assigned IP address and display a map of all approximate geographic location based on reported temperature as well. It can also display and off remotely from the website and see the Internet and do things like turn an LED on and you can immediately interact with it across LaunchPad takes about 10 minutes to set up access to the LaunchPad from the Internet. The mentioned briefly above, to provide easy LaunchPad, TI has partnered with Exosite, For the launch of the Tiva C Series Connected READY TO LAUNCH:" ideas launched into the cloud. "As Folkens concluded, "The target audience actually are the hobbyists, students looking at it is that we are targeting people with the expansion of ingenious IoT applications in a broad audience and promises to facilitate
Apple is Using 20% of Worldwide Sapphire Capacity

By Paul O’Shea, Electronic Products

SAPPHIRE is the key material for LED manufacturing. But in 2015, 20% of sapphire will be used in Apple’s iPhone, for the camera lens, fingerprint readers and heart rate monitors covers, and the Apple watch’s window. The new Yole Développement (Yole) report on Sapphire Applications & Market 2015: from LED to Consumer Electronics provides a complete update of all sapphire uses, from LED substrates to consumer applications.

Today, the sapphire industry looks very different depending on your perspective. The market for sapphire wafers for LED manufacturing is depressed. Wafer prices often fall below manufacturing cost. There is excess capacity that will be able to supply the needs of the industry through to at least the end of the decade. Consequently, companies are shutting down one after the other.

By contrast, the use of sapphire is booming for non-LED applications, driven by Apple’s choice of this material to protect various sensors, and this may be just the beginning. The company decided not to use sapphire for the iPhone 6 family’s display covers, a decision that led to the bankruptcy of GTAT. But now there are signs in the industry that the mobile phone maker is again looking at sapphire as the solution for display covers. Multiple companies are apparently attempting to position themselves in the potential future supply chain. The moves include Lens Technology investing US$532 million investment in a new Chinese sapphire facility, a US$98 million injection in GTAT, the plans of Biel’s joint venture with Roshow for a huge expansion in Inner Mongolia, and several other initiatives.

There were many reasons for Apple’s 2014 decision not to use sapphire in display covers, but they can be summarized as “too fast, too much, too soon.” The project was ambitious in its timeframe and targeted outputs, but many of the necessary processes and technologies in crystal growth and finishing were still at an early stage of development. Yet the venture still set the stage for the future. The partners have developed unrivalled expertise in working with sapphire in a high-volume, cost-controlled environment. A lot was also learned in manufacturing of the complex 3D-shaped Apple Watch cover. But the question remains: why use sapphire?
TENTATIVE SUPPLY CHAIN LINE FOR A SAPPHIRE IPHONE RELEASE IN 2016
(Source: Sapphire Applications & Market 2015; From LED to Consumer Electronic report, Yole Development, July 2015)

At more than five times the cost of glass, benefits in terms of breakages are still far from obvious and its high reflectivity washes out displays. Sapphire won’t sell for a premium and increase Apple’s market share just on glamour and cachet. If the company eventually adopts sapphire, it means that it would have either demonstrated that it can improve breakage resistance compared to glass or developed entirely new functionalities enabled by some unique properties of sapphire.

To exist and thrive, the display cover market needs Apple to take the lead and succeed. Otherwise, only Huawei seems in a position to propel this market, but not at the same level. And alternative technologies are emerging. Various phone manufacturers recently adopted alumina-coated glass display covers to provide superior scratch resistance. Sapphire Applications & Market 2015: from LED to Consumer Electronic report from Yole presents and analyzes the recent trends in this market, including cost structures, investments and alternative technologies.

In 2015, LEDs still consume 76% of the sapphire supply, but oversupply is affecting revenue and profitability. Capacity has increased non-stop since 2009, despite prices being at or below cost for most suppliers since late 2011. The market is oversupplied two or threefold, depending on product category, but the situation is complex. Tier one vendors often operate at high utilization rates and keep increasing capacity. Tier two companies operate at low utilization rates or not at all.

Companies such as BIEMT or Sumitomo Metal Mining recently disappeared or exited the business. The big winners in 2014 were Monocrystal, Aurora, Namiki, Rigidtech and Crystalwise, which all managed to increase volumes and revenue. Global revenue from sapphire cores, bricks and wafers reached US$1.1 billion. Adding finished components produced by Biel, Lens Technology, Crystal Optech and others, revenue reached US$1.8 billion, including the notable performance of Saifei, which supplied the Kyocera Brigadier’s sapphire display cover.

Under strong price pressure, the sapphire industry successfully reduced its costs—but prices are falling even faster. An 18% average selling price decrease in 2015 wiped out potential gains from a 16% volume increase in LED wafer shipments. “We expect prices to keep decreasing, resulting in an LED wafer market remaining essentially flat in revenue despite a 5.2% CAGR growth in volume expected through to 2020,” says Eric Virey, Senior, Technology & Market Analyst at Yole. Optical wafers may also struggle if Yole’s scenario of Apple phasing out its current sapphire fingerprint reader technology for an “In Display” fingerprint sensor materializes in 2018.

In addition to the publication of Yole’s new sapphire report, the “More than Moore” market research and strategy consulting company has teamed up with CIOE to organize a large sapphire conference, the 1st International Forum on Sapphire Market & Technologies, so that all stakeholders can interact and discuss the evolution of the industry. Yole & CIOE conference will take place in Shenzhen from August 31 to September 1. If you would like to take advantage of the early bird deal, register now.
Thanks to smart sensors and networked lighting systems, the Internet of Things (IoT) and big data have become viable for commercial buildings. The commercial building industry is no longer in the beta testing and data stage when it comes to collecting and analyzing big data. Market-proven systems and approaches are available today for collecting digital data, analyzing it on the back end and empowering commercial building owners with the ability to act—and benefits are significant.
Before diving into the IoT and big data for commercial buildings, it is important to understand the technology making all this possible. Networked lighting systems—a combination of lighting, advanced digital sensors, smart controls and data analytics—can provide information about what is happening in a building at any point in time.

For example, smart sensors (see Fig. 1) can detect natural daylight so lighting can be dimmed in relevant spaces to reduce energy use. But lighting is only the beginning. Intelligent, networked systems are collecting all types of data from motion to temperature and energy use. Additionally, these systems have the ability to connect and communicate with other building systems—such as HVAC, demand response systems, security, safety, and other space management applications.

The secret to collecting and interpreting big data is highly advanced sensors and the right architecture. Advanced, digital sensors can track temperature, light levels, daylight, motion, heat and energy use. Furthermore, these smart sensors can accurately distinguish people from other non-human heat sources and motion—such as fax machines, space heaters or boxes on a conveyer belt.

**Lighting**

Advanced sensors can provide valuable information on the most efficient approach for lighting a space. Facility managers are able to gather key insights, including what areas of the building are naturally lit during the day to which areas are being over lit.

Occupancy and vacancy sensors determine when a space is being utilized, so lighting can be adjusted accordingly. Facility managers can determine the best lighting schedule based on when occupants are most frequently in the space or building.

Daylight harvesting is also important in managing energy savings during daylight hours. Special sensors detect the amount of natural sunlight coming in from the windows and adjust artificial light levels accordingly.

Task tuning adjusts light levels for the task at hand, which helps make the space more comfortable for employees while also helping support energy savings. For example, an employee working on a manufacturing line might need more light than an employee working on a computer. This element of personalization can support an increase in employee productivity, and also help secure additional LEED points.

**Space Utilization**

The advanced sensors can also track occupancy motion, providing building owners, facility managers, architects and contractors valuable insight into how spaces are used or not used. So much is possible now from identifying traffic patterns in a space to creating heat maps of motion, motion trails, tracking when employees arrive and leave and more.

A very simple application of this data is if a conference room is not being used, building managers can allocate the space for another use. Retailers can use the motion trail information to track aisle traffic or how moving product effects traffic patterns. This data is available real-time down to the second or can be viewed over time to identify trends.
The data becomes even more useful for large campuses or buildings in a variety of cities and states. Headquarters staff now has access to data about all their facilities at their fingertips. They can help support the local offices more effectively by expanding when needed or identifying opportunities to better utilize space.

**HVAC**

Temperature and occupancy/vacancy sensors can provide data to better optimize HVAC. Temperature monitoring can identify hot and cold spots to help facility managers identify areas being over or under heated/cooled. Furthermore, occupancy and vacancy sensors can help identify spaces not being used frequently so heating or cooling can be adjusted accordingly.

Temperature and occupancy/vacancy data not only can increase energy savings, but also occupant comfort. Increasing employee comfort can lead to increased productivity, potentially increasing the bottom line.

**Safety and Security**

Data from smart sensors can be used to support the overall safety and security of a building and building occupants. Smart sensors can monitor where occupants are in a building at any time, providing essential information regarding any intruders, disaster recovery and business planning.

Applications of occupancy monitoring to increase safety and security includes dim-andlinger occupancy and sequential and pathway lighting control. Dim-andlinger occupancy control warns occupants prior to lights being turned off. Furthermore, they enable users to override the control system prior to the lights turning off. Sequential and pathway lighting controls also provide additional safety and security by anticipating and illuminating the pathway in front of pedestrians, customers, and employees.

**Meaningful Data = Meaningful Results**

With the right technology, data collected from smart sensors provides building owners, facility managers, engineers, and lighting designers more information about what is happening in a space at any point in time. This intelligence and connectivity among key building systems—lighting, HVAC, safety, and security, and space planning—can enable an entirely new set of monitoring, control, optimization, and autonomy.

However, data alone is not the answer. The data needs to be presented in a way to building owners, managers, and contractors so it is actionable. This is where desktop, tablet, and mobile apps come into play, providing any easy way to read, assess, and interpret the data.

System integration is also key, allowing the lighting, HVAC, safety, and security systems to automatically utilize the data to achieve better energy efficiency, occupant comfort and safety, and security.

**Figure 3** With the right technology, data collected from smart sensors provides information about what is happening in a building space at any point in time.
Littelfuse Provides **SURGE PROTECTION** for New Generation of LED Bulbs

**LED** lighting is quickly replacing incandescent and fluorescent tube lights in a wide variety of applications. The benefits of LED lighting are well known, and include reduced energy consumption and longer product life. However, the design of LED lighting requires specific attention to power management and circuit protection. In a recent interview with EEWeb, Bharat Shenoy of the Electronics Business Unit at Littelfuse explained. “LED technology is a great breakthrough in the overall electronics landscape and within the lighting industry in particular. But there’s an issue with LEDs that is often taken for granted: LED lighting incorporates additional componentry not required in incandescent or even CFL lighting solutions.” Shenoy elaborates, “LED lighting includes an AC/DC power supply and an LED driver with some very sensitive ICs that are driving the LEDs. What you’re replacing is the legacy incandescent light with a filament or a CFL bulb that typically has a magnetic ballast assembly at the input.”
Lightning interference, or indirect lightning, is usually the result of a lightning strike a few miles away, which inserts induced currents into the electrical grid. It’s not just lightning strikes that put LED lighting at risk, however. Inductive spikes on the power lines can also result in harmful surges. Shenoy recounts the story of a customer who installed LED lights inside a parking garage. “The customer would lose a bank of lights and initially couldn’t identify the root cause. They discovered that when the elevator pulled a big load, it caused inductive spikes to be induced on the grid and those inductive spikes caused induced currents to seep into the LED fixtures, which then blew out the LED drivers.”

Yet another concern for LEDs is so-called “dirty power” or line swell. This concern is more common in poorly conditioned power infrastructures, such as in developing nations or where older systems are still in use. LED lighting adoption is occurring globally, adding to the need for proper protection. Shenoy offers a real-world example: “Maybe the line is supposed to be 277 volts with some tolerance, but the line drifts up to 305 volts for a couple of seconds. This line swell represents a very dangerous scenario for the surge protection component, which is often a varistor, potentially causing a catastrophic failure of the component. Varistors can’t withstand high voltages for more than microseconds; they will heat up and continually conduct and then fail. To guard against this possibility, Littelfuse produces thermally protected varistor modules, which are designed to open safely without causing a catastrophic failure.”

With so many potential causes for damage or failure, what can be done to ensure that LED lighting remains an energy- and cost-efficient solution? Shenoy describes the solution Littelfuse has developed: “With any LED design, there are a couple of basic subsystems. An AC/DC power supply takes in AC voltage at some level, say 120 or 277 volts, rectifies it to DC and then it goes into an LED driver. The driver, in turn, drives the LEDs at whatever voltage is required, for example, 3 volts. So you have to DC-to-DC convert down. Typically, all of these electronics are collectively referred to as the LED driver, separate from the LEDs and optics themselves. It is before the driver or sometimes in the driver that protection is added.” Shenoy explains that there are two forms of protection: over-current protection and over-voltage protection. “Over-current protection is typically in the form of a fuse, the purpose of which is to prevent a shock or fire hazard when something short-circuits within the LED fixture itself. This fuse should be chosen so that it will not open during a lightning surge so the system remains operational. The over-voltage protection is the more challenging piece of the solution. This is the protection component that diverts the lightning surge or transient surge away from sensitive circuits.”

Shenoy gives an example scenario in which over-voltage protection saves a streetlight from damage. “Suppose you have 277 volts supplied from the street and there’s lightning interference and it creates 20,000 volts on the grid being applied across the LED driver, which will drive a surge current of up to 10,000 amps in a microsecond timeframe.” It is during this high-energy pulse that the over-voltage protection senses the built-up voltage and conducts current away from the load, typically to the ground or back into the line. The solution Littelfuse employs for over-voltage protection is the varistor. “In the ‘off’ state, the varistor has high impedance, allowing the current to flow into the driver, but in the ‘on’ state, when it senses a higher voltage, it conducts all that surge current away from the driver and out to ground or to the line,” Shenoy explains.

Varistors offer a number of advantages over alternative protection components such as zener diodes. Varistors are optimized for AC lines and high voltages. They combine the ability to tolerate extreme levels of surge energy with efficient form factors. They are also very cost effective. Zener diodes typically respond faster than varistors, but varistors act fast enough for the characteristic lightning surges with which LED fixture manufacturers are concerned. “Lightning strikes are simulated by what are called an 8x20 microsecond waveform (Figure 1), in which the waveform reaches its current peak at about 8 microseconds, and decays to half of its peak at the 20 microsecond point,” Shenoy explains.
However, varistors react on the nanosecond time scale. Nonetheless, robust driver design is important because some current is let through before the varistor has fully conducted.

Over-voltage protection is traditionally placed in parallel with the load. Littelfuse manufactures discrete surface-mount and through-hole components to accomplish this kind of design but also offers complete protection modules that can be placed ahead of the driver as a single, simple solution to achieve both kinds of necessary protection. Littelfuse is also soon set to offer a multi-stage protection module that includes a diode to help protect against the small let-through current that varistors don’t prevent.

Occasionally, the LED component itself fails. This can be caused by a surge, but it may be caused by other events, such as physical stress on the element. It is often assumed that LEDs fail short, but they can also fail open, and when this occurs, they can black out an entire fixture. Littelfuse offers their PLED line as a solution to handling these open failures in critical applications. The PLED is placed across an LED or bank of LEDs and when an LED fails open, the PLED acts as a shunt, passing current around the open LEDs.

According to the U.S. Department of Energy, by 2030 the energy savings attributable to LED lighting in the United States could be up to 300 terawatt-hours. This is the equivalent of approximately fifty 1000-megawatt power plants. In turn, this would reduce greenhouse gas emissions by 210 metric tons of carbon and decrease the electricity consumption equivalent to powering 24 million homes. Based on current LED efficiencies, if the United States made an immediate switch to all LED lighting, it would save about 3.9 quadrillion BTU.

LED lighting costs less to operate, too. If a given space costs $8 to light with traditional incandescent lighting, that same space would cost $2 to light with LED lighting. Further, Energy Star qualified LED lights last up to 25 times longer and use only 20–25% of the energy consumed by incandescents. A research report by Memoori Business Intelligence Ltd., utilizing International Energy Agency data, found if the United States reduced energy used for lighting by 40%, it would save $53 billion in annual energy costs and reduce energy demand equivalent to almost 200 mid-size power stations. A similar report from Crain’s Detroit Business showed the conversion to LED lighting in the United States could save $120 billion and reduce electricity use by 25% over the next 20 years.

Given the ubiquity of LED lighting, with applications ranging from being plugged directly into the AC wall outlet in the home to commercial outdoor lighting, the need for surge protection is obvious. LED lighting can’t provide a return on investment if the light fails. Fortunately, the market has embraced solutions such as those offered by Littelfuse, and LED lighting is increasingly living up to its promises of lower energy consumption and maintenance costs.
Littelfuse LED Surge Protection

Extending the life of power supplies and light engines

LED Lighting and Surge Protection
Older methods of outdoor lighting have relied upon metal halide and high-pressure sodium solutions which are quickly being replaced by new options containing LED technology. The initial cost of installing outdoor LED lighting can be substantial, however, this cost is justified and offset (roughly over five years) by...

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Infineon Technologies is a leading semiconductor company with a broad range of product offerings. Through the company’s line of power management ICs for industrial, automotive, and alternative energy solutions, a common thread becomes apparent: the need for more energy efficient solutions to meet the demands of our evolving infrastructure. It should be no surprise then that the company’s most recent endeavor has been in the lighting industry, developing a line of .dp digital power ICs that will spark the migration from analog to digital lighting infrastructure. Offering unparalleled flexibility and adaptability, the .dp IC family is an all-in-one solution that integrates digital power with key peripherals, so engineers can change parts of their lighting designs on the fly. EEWeb recently spoke with Infineon’s Brandon Cartwright about this innovative product line and how it will make LED lighting infrastructure easier than ever to implement.
Could you give us some background about yourself and Infineon as a company?

I have worked in the lighting industry for the last 15 years in some form or fashion starting from the design of battery backup systems for fluorescent lamps, to creating high performance LED-based MRI luminaires, all the way to creating integrated circuits that help customers implement their state of the art products. At Infineon, my focus is on enabling innovative solutions for a host of lighting applications—from the IC controller (AC/DC), to the MOSFET, to the microcontroller and even to employing radar sensors. As far as Infineon goes, we are number one in the world in the power electronics segment. We recently acquired International Rectifier, which increased our combined market share up to more than 19% of the power market. The company as a whole isn’t just engaged in power, we are also a system leader in automotive electronics and a leader in security solutions, which includes protecting personal identity and hardware-based security for computers and the IoT—if you have a US passport, the odds are high that our security chips are inside. In a nutshell: Infineon is a world leader in semiconductor solutions that make life easier, safer and greener.

**WE ALSO SEE COST REDUCTION AS A BIG ADVANTAGE OF THE MOVE TO DIGITAL...**

What are some of the challenges for LED lighting versus incandescent and fluorescent lighting?

Incandescent lighting has been around for over a hundred years now. It is a very simple and very low cost technology, but as we know, it’s not as energy efficient as fluorescent or LED lighting. With the recent ban on incandescent, the industry now has to confront some challenges to move forward with LED lighting. These challenges revolve around selling price and achieving high performance in the existing lighting infrastructure.

The upfront cost of LED products is higher than other lighting technologies. However, LED component pricing is on a steep downward curve and affordability is less of an issue when doing an ROI calculation. We also see cost reduction as a big advantage of the move to digital, since it allows reduction in the bill of materials (BOM) needed for the complete solution.

The second challenge is that LEDs need to work just like or even better than the lights people have always used. In terms of the infrastructure for dimming, input power and the overall performance of the light. For example, not all LED products are dimmable. It’s hard to get dimming right in residential lighting, where the traditional TRIAC, or phase-cut, dimming approach is hard to implement with a switched-mode power supply. In the commercial and industrial space, dimming is traditionally done with a zero- to ten-volt dimmer, and this analog signal can easily be converted to a certain percentage of light.

What are the benefits of lighting going digital?

The main benefit we are seeing from our customers is the ability to design a new solution in a very short amount of time. What would normally take many months to accomplish in an analog-based solution for a design can now be done in a matter of days or even hours. Another challenge with LEDs is that they are constantly evolving—the lumens-per-watt are getting better and the cost is consistently going down. It would be ideal to then reduce the output current to the LEDs as they get more efficient, so the power to the bulb would go down with no change in the lighting output. With an analog solution, you may or may not be able to change the output current or overvoltage protection very easily. Infineon offers a digital solution where the engineer can go into a graphical user interface and change the output current and other parameters. These are real-time changes and they don’t require any change to the hardware.

Another big advantage that digital solutions offer is the platform approach. This is a SKU reduction value proposition. If Customer A uses 12 power supplies for different products and those supplies range from 80–W to 20–W, they may consider creating a platform solution. With a digital power supply strategy, they may only have to produce three actual supplies to cover the operating range—20W-39W, 40W-59W and 60W-80W. Each is controlled with software to set the final output current and voltage range. In the end, this is a great thing for time-to-market and achieving economies of scale. If you have a product on the shelf that maybe is not in demand, now you can program it for one that is in demand. These are factors that a lot of customers are considering in the switch to buying digital versus analog.

Infineon demonstrated its new digital PSR flyback controller—the ICL8105—at the recent Light Fair International conference. We had our graphical user interface set up whereby attendees

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**WHAT WOULD NORMALLY TAKE MANY MONTHS TO ACCOMPLISH IN AN ANALOG-BASED SOLUTION FOR A DESIGN CAN NOW BE DONE IN A MATTER OF DAYS OR EVEN HOURS.**

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**DIGITAL CONTROL**

- **HIGHER POWER DENSITY**
  - Less footprint, less components

- **HIGHER PERFORMANCE**
  - Better power factor, low EMI

- **FLEXIBLE & INTELLIGENT**
  - Power management, programmable

- **LOWER COST**
  - Less components, short time to market, standardized
What is the cost of hardware per unit in going from analog to digital power supplies?

Every solution we offer has a different price point. In the lighting industry there is clearly a wide margin difference between low-cost A19 type bulb replacement and very high-end fixtures in segments like medical lighting. With the unit cost for LEDs already low, cost reduction for the LED solution comes by reducing the bill of materials. With that, analog-based solutions can only be improved to the extent allowed by the laws of physics. The goal for digital solutions is to come very close to analog prices and to add value. If you look at it from a circuit design point of view, the digital solutions should look very similar to the analog solutions—the difference is that the main controller might be programmable and the number of components around it will be reduced. Therefore, if you open up a power supply you will find fewer discrete components, a higher level of integration and the bill of materials will be smaller. On average, there is not much of a premium being charged for the fully digital solution. The digital controller IC will have a small premium, but because these ICs reduce the overall bill of materials, the solution costs compared to an analog solution should be very similar.

Will the cost savings for LED be realized in commercial applications where there are no retrofit requirements?

The cost savings will be big in the commercial space. Every OEM wants the advantage of lowering the cost of the system as well as enabling longer lifetime and reducing total cost of ownership for customers. There also is a need for more flexibility and value-add in this space. There are very different requirements in an office than at home in a residential space.

What are some of the different aspects and features of the .dp controller?

“.dp” is a general term Infineon uses that stands for “digital power.” We use our base IP and know-how to create specific ICs targeted at different applications. Inside a .dp controller, we included an embedded CPU. We use a 16-bit digital architecture that serves as a dedicated DSP controller. From that DSP controller, we build outwards, so the DSP serves as the central brain of the controller. The next phase outwards is the power conversion peripherals and protection peripherals that ensure safe operation in all conditions.
protection peripherals, which serve as the interface with the different ADCs, different overvoltage protection components, high-voltage start-up cell and applicable gate drivers. These are dedicated for a specific controller; every controller might have a specific function, so LED lighting might have a specific need for control of current with the primary-side regulated flyback. A TV power supply may utilize a two-stage PFC boost stage followed by a resonant stage to control different output voltages needed for that application.

What is the plan for the next generation of power ICs?

As we move forward, the goal is to further innovate in the digital power solutions space by integrating and reducing the bill of materials, size and cost. We also aim to further reduce the power consumption used—we are going to be working on our internal core improving the standby power. There are a lot of standards coming out that are aiming towards lower power consumption for next year’s products. We will also target specific functions in the software that are currently not available in the market today. We are looking at how to innovate by adding functionality and control through software versus hardware.

How can you protect intellectual property by using digital power supplies?

The IC itself comes with standard firmware, which has been developed, tested, and verified over a long period of time to make sure that it is a good core firmware. The firmware will include the algorithms for a certain topology of operation and functions that will allow the end designer to tweak. The customer-specific ideas can then be implemented in that firmware, such as their own patented IP or digital control loops. The ICL8105 LED IC, which we just launched, has specific firmware. The engineer can go in and tweak 300 parameters to meet their individual specifications. It is a combination of putting our IP in the software and allowing the designer to take it to the next level by customizing it and adding in their external parameters. All of these are controllable through our user interface, which we call .dp Vision. This tool is made available once the user gets access to our hardware; we then train the company or user how to access libraries and change things on the end of the line or program the IC for production ahead of time.