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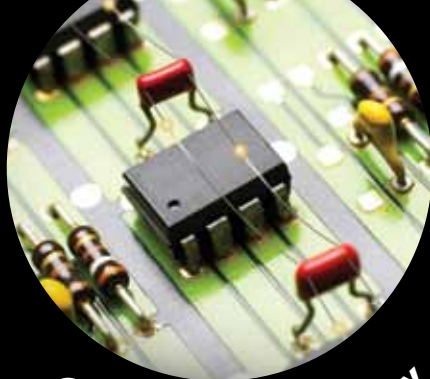
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06 POWER EFFICIENCY



14 MAXIMISING EFFICIENCY



24 PCB TOOL

Welcome to your latest edition of eTech. If you've scanned the contents section of this issue of eTech our theme can hardly have escaped you.

A startling statistic I came across recently is that the Earth absorbs more energy from the sun in an hour than the population of the world consumes in one year. In fact the amount of solar energy reaching the surface of the planet is so vast that in one year it is about twice as much as will ever be obtained from all of the Earth's non-renewable resources of coal, oil, natural gas, and mined uranium combined! The technologies that we have for extracting energy from this and other natural sources are developing rapidly, and we are starting to see the benefits. Projects like the prize-winning solar powered car on page 5 are turning sceptics everywhere into believers.

For some electronic devices, renewable energy is already supplementing existing power sources, and coupled with more efficient power design, this can greatly reduce the cost of operation, or extend battery life. The mobile technology revolution now demands batteries that come close to matching the energy density of dynamite, so a "greener" battery topped up via harvesting energy is desirable in more ways than one when you think about holding a smartphone up to your ear!

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Power efficiency and renewable energy go hand in hand, and together are driving a further shift. For environmental reasons, for economic reasons and for reasons of convenience, in the future I believe that we will move on from thinking about simple "power efficiency" to power "self-sufficiency" in our electronic designs.

I hope you enjoy this edition, which of course, is consumed with powerful discussions about, yes, power.

Place FSC logo here



Glenn Jarrett
Head of Electronics Marketing

INSIDE eTech

- 04** iSAY
- 05** RS NEWSLINE
- 06** POWER EFFICIENCY
- 10** PRODUCT NEWS
- 12** ESD PROTECTION
- 14** MAXIMISING EFFICIENCY
- 16** ePURCHASING INNOVATIONS
- 20** DESIGN REVIEW : EMBEDDED DEVELOPMENT WITH EDP
- 22** MARKET TRENDS : SOLAR MARKET
- 24** PCB TOOL
- 28** DESIGN TIPS : 3D LED PYRAMID
- 30** CUSTOMER PROFILE
- 31** REDUCING ENERGY
- 32** ELECTRONICS EXTRAS
- 34** FIBRE-OPTIC
- 36** DETECTING MOTION
- 40** LUNCH BREAK
- 42** INDUSTRY NEWS : FRAUNHOFER



How to harness the potential of energy harvesting technology?

Over ten years ago Energy Harvesting was known only to a small group of research engineers. But if you Google it today you will find nearly two million hits and there is now a diverse range of energy-saving electronic products on the market that draw energy from their surroundings.

In building and industrial automation alone, the opportunities for energy harvesting products are inexhaustible. Particularly now, with the arrival of wireless plug & play modules that work energy-autonomously and bidirectionally. This means, for example, that a room temperature sensor can transmit its telegram with the measured temperature value and can receive a message for set point correction along with the current time.

All energy harvesting wireless sensors incorporate three essential functional blocks: electronic components (wireless technology, sensors and process control), energy supply (energy converter, energy storage, energy management) and software (executive control, sensor profiles and wireless protocol).

Employing mechanical or thermoelectric converters and solar cells instead of batteries is a unique approach, cutting system error rate and maintenance costs considerably. Further benefit is derived from the ability of the sensor to bridge periods when no energy is available. Harvested energy is stored in a charge capacitor and can suffice for several days of operation in complete darkness.

When it comes to wireless transmission, an optimum wireless protocol should combine maximum reliability of transmission and proof against collision for 300

metres free-field range with a minimal energy requirement of about 30 µJ for a single wireless telegram. The process works with extremely short telegrams, randomly controlled and repeated twice in the space of 30 milliseconds to avoid any collision.

...the opportunities for energy harvesting products are inexhaustible

EnOcean, with its batteryless wireless modules, is a pacesetter in the development of fully energy-autonomous applications in building automation. The technology is also gaining traction in industrial plants for reliable monitoring of machine status, simplification of cabling and retrieval of data from inaccessible locations.

If you've got a strong opinion and would like the opportunity to get on your soapbox, write it up in around 300 words and email it to etech@rs-components.com

Outstanding Sales Award Presented to RS Components

Extension of relationship with EPCOS results in outstanding sales

At Electronica in November RS Components was delighted to be presented with the Sales Award for 2010 by EPCOS AG. The award is presented each year to one of EPCOS' sales channel partners for outstanding growth in sales in both the electronics and traditional side of the business based on online and NIC sales.

Announcing the award Peter Arch, Director Distribution at EPCOS commented, "We are very pleased with RS' outstanding sales performance. The extension of our mutual product and service offerings has been a success story, helping us to gain market share in a challenging supply period."

Chris Page, General Manager, Electronics at RS Components continued, "The strengthening of our relationship with EPCOS over the last year has enabled us to provide our customers with a wider product selection as well enhanced support services. We are delighted this has resulted in this superb sales award."

To search the full EPCOS range visit www.rs-components.com

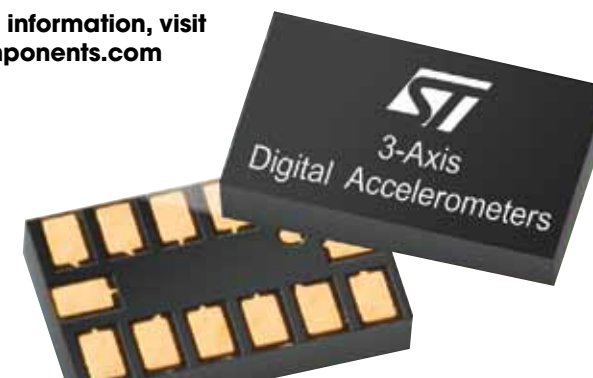
STMicroelectronics MEMS Sensor range now available

STMicroelectronics and RS bring together an innovative range of motion sensing solutions

STMicroelectronics' MEMS sensors have revolutionized the way we interact with everyday technology, making it easier and more user friendly by making electronic devices sensitive to motion. MEMS sensors allow smarter human-machine interfaces for both consumer and industrial applications.

The MEMS sensors family available from RS, includes 2 and 3-axis linear accelerometers to single and multi-axis gyroscopes, for high performance and smarter power management.

For detailed information, visit www.rs-components.com



RS sponsored team wins the Solar Challenge Race

RS supports Tokai University solar car team to win the race held in South Africa.

This is their second successive victory at the SA Solar Challenge from Pretoria towards Cape Town, George and Mpumalanga to Pretoria. A total distance of 4062km was covered with an average speed of 90.1km/hr in the 10 day challenge.

The Solar Challenge is organized by the Advanced Energy Foundation and the Innovation Hub. The primary aim of the Solar Challenge is to promote science and technology in South Africa and demonstrate the potential of renewable energy sources to the motoring and other industries. RS Japan supported the supply of parts for the design and build of the car. Once the car arrived in South Africa, RS SA provided the chemical products to support the car.

Professor Kimura from Tokai University has personally thanked RS across the world for sponsoring for the Tokai University Solar car continuously.

Find out more on this project on www.designspark.com



Vishay range expands to over 11,000 products

RS and Vishay announce new distribution agreement

RS Components has concluded a European distribution agreement with Vishay which means that RS formally represents Vishay around the globe through three regional agreements. Vishay is one of the world's largest manufacturers of discrete semiconductors (diodes, MOSFETs, and infrared optoelectronics) and passive electronic components (resistors, inductors, and capacitors). RS has a stock profile of over 11,000 Vishay products available online for next-day delivery from capacitors and resistors to semiconductors.

For more information visit www.rs-components.com

Power Efficiency

for the modern electronics system



By Dr. Iain Mosely, Technical Director of Zonetech
www.zonetech.com

Modern electronic systems require an ever increasing number of different system DC voltage rails to operate. These complex power requirements combined with a drive towards more energy efficient products and ever shorter product design cycles can become a burden to companies who would rather focus resource on developing the key differentiating technology of their new product.

This article discusses some of the high level power architecture choices which are useful to consider at an early stage in the product design cycle. Choice of high level architecture has a significant impact on the cost, efficiency and type of power topologies used to provide each of the required power rails.

System Approach

The power supply system for any product generally has a single energy source and requires many regulated DC outputs. The energy source depends on the product type but could be mains power, battery supply, telecoms DC input or a renewable energy source.

The power subsystem must normally provide a number of key functions:-

- Protect safely against abnormal conditions (faults in the product electronics or problems with the primary energy source)
- Provided regulated voltages to the product electronics independent of changes in the primary energy source or output load demand
- In many cases, provide galvanic isolation between the primary energy source and the product electronics
- Control the power on/off sequence of the DC power rails as required by the product electronics
- Provide all the above functionality whilst wasting the minimum amount of energy

In general the most energy efficient way to provide each DC output is with a single power converter stage for each power rail. In this case, the energy provided to each output passes through only a single power stage and suffers only one stage of conversion loss. In the case of mains power

systems, often this is not commercially viable since isolated power stages are generally more expensive than non-isolated converters. One alternative option is to use an intermediate bus architecture (IBA) whereby a front end high efficiency isolated converter steps the input power down to a safe low voltage which then powers secondary side power converters. The IBA approach allows the majority of the system power converters to use non-isolated topologies which saves significant cost. The only downside of this approach is that the energy delivered on most of the output rails will experience power loss in two converter stages rather than one. In the case of the IBA shown in Figure 2, all the energy delivered on rails #2, #3 and #4 experiences loss in the front end converter PSU#1 as well as each respective secondary converter.

Since the IBA approach is often chosen to minimise cost, there are a number of guidelines which can be followed to maximise the IBA overall system efficiency:-

1. Choose an intermediate bus voltage equal to the DC output rail with the highest power requirement. This ensures that the largest possible share of the total system power flows through a single converter stage.
2. Where possible try to keep the intermediate bus voltage just slightly higher than the majority of the required DC output voltages. This allows for the most efficient conversion of the intermediate bus voltage down to the DC output voltages.
3. DC outputs with a very low load compared to the total system load will have minimal impact on the overall system efficiency. Rails with higher power requirements should be used to justify a particular intermediate voltage.

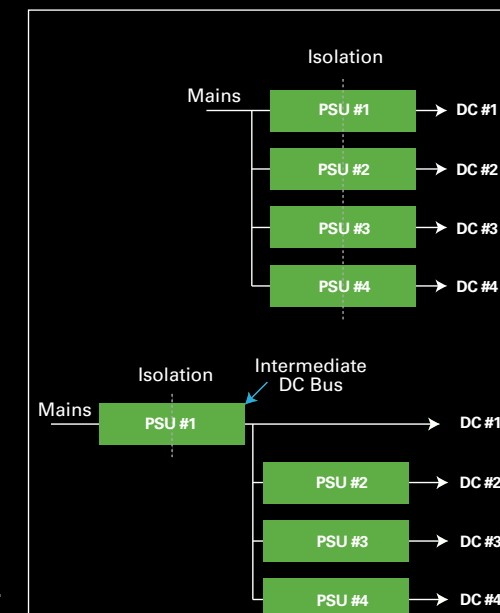


Figure 2
Independent Converter Architecture (Top)
and Intermediate Bus Architecture (Bottom)

When considering the commercial implications of intermediate bus voltage choice, it is good to remember that the secondary side converters with a high input voltage capability are likely to be more expensive and have poorer efficiency than those where input voltage range is low. Conversely, the conversion efficiency of the front end mains power converter tends to improve with higher intermediate voltages. The best intermediate voltage choice is often driven by a combination of commercial and technical factors which are unique to each product. For many products, a good choice for system DC voltage rails of around +5V or lower is an intermediate bus voltage of around 12V. The +12V output mains power converter often represents a good compromise between commercial and technical constraints for output power levels up to around 60W.

Continued page 08 >

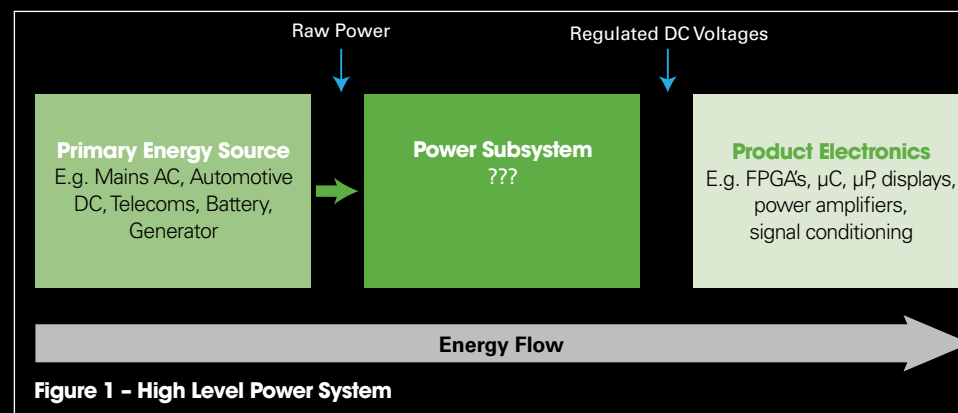


Figure 1 - High Level Power System

Choice of high level architecture has a significant impact on the cost, efficiency and type of power topologies

Figure 3

Topology	Schematic	Considerations
Buck		$V_{OUT} < V_{IN}$, Efficiency degrades if V_{OUT} is significantly lower than V_{IN} .
Synchronous Buck		$V_{OUT} < V_{IN}$, Efficiency better than Buck topology when V_{OUT} is significantly lower than V_{IN} . Generally more expensive than buck.
Boost		$V_{OUT} > V_{IN}$, Best efficiency when V_{OUT} is not too far above V_{IN} . Difficult to turn V_{OUT} off due to DC current path through inductors and diode.
Inverting (Buck Boost)		Generates a negative voltage from a positive voltage. High peak currents can degrade efficiency.
Linear Regulator		$V_{OUT} < V_{IN}$, simple but poor efficiency unless input and output voltages are very close.

Once the intermediate bus voltage has been chosen, the power topologies for the main isolated converter and secondary converters can be chosen. For a 60W total power capability with 12V intermediate bus voltage, a flyback converter can give good front end performance with conversion efficiency of 85 to 90%. The topologies used for the downstream converters depend on the output voltages and power levels required.

Conclusions

The complex power requirements of modern electronic products can present

a significant challenge to designers who wish to maximise their new product energy efficiency. Commercially, the IBA architecture is often the best system level approach but the choice of bus voltage and secondary side power converter topologies then has a significant impact on product energy use. Key to minimising development risk is to use a flexible modular approach to system power design whereby the power system can be easily modified during the design process to optimise system power use. Often, power consumption measurements are just performed on the primary energy source (e.g. mains input

power) but this can hide which parts of a product subsystem are really dominating power consumption. Wouldn't it be great at design time if we could understand the product power use at a much deeper level....? ●

Zonetech products will shortly be introduced to the RS stocked product range. Find them first at www.rs-components.com

TRACO
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Latest Innovation

Miniaturized 2 Watt and 3 Watt DC/DC Converters

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- Wide Input Ranges 2: 1 or 4:1 cover 4.5 VDC through 75 VDC
- Tightly regulated Output Voltages
- No minimum Load required
- Remote On/Off Function
- 1500 VDC I/O-Isolation
- Operating temp. Range -40 to 85°C

Series

TDR 2:	2 W, DIP 24, 2:1 Input
TDR 2WI:	2 W, DIP 24, 4:1 Input
TDR 2SM:	2 W, SMD, 2:1 Input
TDR 2WISM:	2 W, SMD, 4:1 Input
TDR 3:	3 W, DIP 24, 2:1 Input
TDR 3WI:	3 W, DIP 24, 4:1 Input
TDR 3SM:	3 W, SMD, 2:1 Input
TDR 3WISM:	3 W, SMD, 4:1 Input

Semi-Regulated 1 Watt DC/DC Converters

- Compact SIP-Pachckage
- Load regulation within 5%
- 1000 or 3000 VDC I/O-Isolation
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- Very high Efficiency up to 88%

Series

TRA 1:	1000 VDC I/O-Isolation
TRV 1:	3000 VDC I/O-Isolation

Highest Power Density in DIP-24, 1" x 1" and 1" x 2" Package

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- Input Filter to meet EN 55022 Class A
- Low standby Current
- 1500 VDC I/O-Isolation
- Very high Efficiency up to 91%

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THD 15N:	15 W, DIP 24, 2:1 Input
THD 15WIN:	15 W, DIP 24, 4:1 Input
THN 20:	20 W, 1"x 1", 2:1 Input
THN 20WI:	20 W, 1"x 1", 4:1 Input
THL 20WI:	20 W, 1"x 1", 4:1 Input
TEN 40N:	40 W, 1"x 2", 2:1 Input

High Power DC/DC Modules 75 – 200 Watt

- 2:1 and 4:1 Input Range
- Output Voltages 5 to 53 VDC
- Ultra high Efficiency up to 93%
- Series with EN50155 Approval for Railway Applications
- Multiple Options: Chassis / DIN-Rail Mount Adapter; EMI Filter; Heat Sink
- Soft Start and reverse Input Voltage Protection

Series

TEP 75WI:	75 W, 2.4 x 2.3", 4:1 Input
TEP 100:	100 W, 2.4 x 2.3", 2:1 Input
TEP 150WI:	150 W, 2.4 x 2.3", 4:1 Input
TEP 160:	160 W, 2.4 x 2.3", 2:1 Input
TEP 160WI:	160 W, 2.4 x 2.3", 4:1 Input
TEP 200:	200 W, 1"x 1", 2:1 Input
TEP 200WI:	200 W, 1"x 1", 4:1 Input

100 W & 200W AC/DC Power Supplies with «cool» Design

- No Fan required at full Power up to 50°C!
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- Highest Efficiency: 90% typ.
- Protection Class I or Class II Operation

Series

TOP 100:	100 W in 2" x 4" Format
TOP 200:	200 W in 3" x 5" Format





PCI AND PCI EXPRESS MINI CARDS

SBC's exclusive from RS for PCI and PCI Express mini cards

■ PCI Express Mini Card is a replacement for the Mini PCI form factor based on PCI Express. PCI Express Mini Cards are 30 x 56 mm and smaller than other add-in card form factors.

This reduced size permits a higher level of integration into an embedded PC providing a number of benefits, including Flexibility for Build-To-Order, Upgradeability for the newest technology, Serviceability and Reliability.

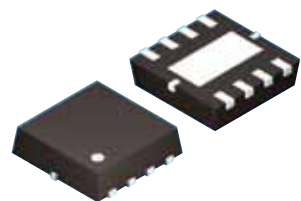
Online search term: **commell, mp***

PRECIP-DIP SPRING-LOADED CONNECTORS

A perfect alternative for electrical continuity in problematic environments.

■ Ideal for all mobile communications including medical and military applications. Their unique, patented design combines a contact body, piston and spring to create a self-adjusting contact. This assures low, stable electrical resistance giving maximum reliability.

Online search term: **Preci-dip, Spring Loaded**



MICREL BUCK REGULATORS

Hyper light load switching regulators

■ The MIC23153 is a high efficiency 4MHz 2A synchronous buck regulator with HyperLight Load™ mode, Power Good output indicator, and programmable soft-start. HyperLight Load™ provides very high efficiency at light loads and ultra-fast transient response which makes the MIC23153 perfectly suited for supplying processor core voltages. The tiny 2.5mm x 2.5mm package saves precious board space and requires only four small external components.

Online search term: **711-7423**

PV FUSES FROM SCHURTER

High performance Fuse for PV systems with Touch safe Fuseholder

■ A new solar fuse ASO and fuseholder FSO from SHURTER with quick-acting characteristic to protect photovoltaic and similar DC-applications. The products are well suited for "renewable energy" systems with a 1000 VDC fuse. A current range from 1 A to 30 A and a touch safe fuseholder in a compact 10.3x38 mm package.

Online search term: **71247* fuse**

STEGO SMALL FAN HEATER

High power compact fan heaters, ideal for use where space is at a premium

■ DIN Rail Mount Enclosure Heaters specifically intended for anti-condensation and frost protection in control and equipment cabinets. These compact fan heaters prevent formation of condensation, are quiet in operation and provide an evenly distributed interior air temperature in enclosures with electric/electronic components.

Online search term: **Stego, "small fan heater"**



OXLEY LED LAMPS
New and exclusive to RS. Energy efficient incandescent lamp replacements.

■ Oxley LED bulb replacements provide an optically designed "fit and forget" alternative to traditional filament bulbs. They give an excellent spread of illumination. and over 90,000 hours of operating life. Applications range from push button switches, mimic panels to rail, automotive, military and airborne applications. This true "fit and forget" product ensures maintenance costs are all but eliminated, and the added advantage of using LED technology means little or no heat build up occurs within the equipment.

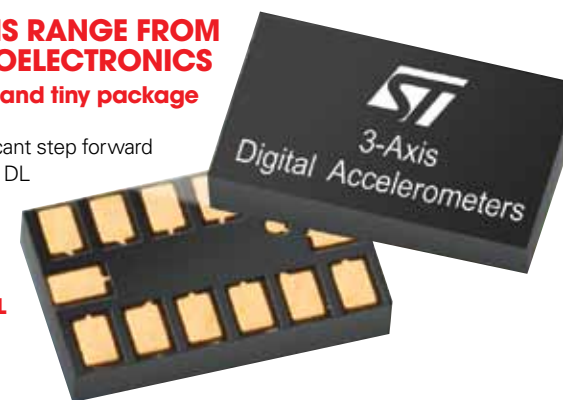
Online search term: **Oxley, "led lamps"**

MEMS RANGE FROM ST MICROELECTRONICS

3-axis LIS331DL, Low power and tiny package

■ ST's 3-axis motion sensors represent a significant step forward in the product's miniaturization. The LIS331DL accelerometers deliver high performance at low power consumption and their ultra-compact robust design provides very high immunity to vibration and shock survivability up to 10,000g.

Online search term: **LIS331DL**



LEDIL OPTICS FOR MULTIPLE LEDs

Triple and Quad Optics for Osram OSLOM SSL Series of LEDs

■ Designed for Osram OsloM SSL series of LEDs. The lens material is an optical grade PMMA with high UV and temperature resistance with a High optical efficiency of over 85%. There is no need for a lens holder with fastening; all that's required to attach the heatsink is a few droplets of glue.

Online search term: **ledil**

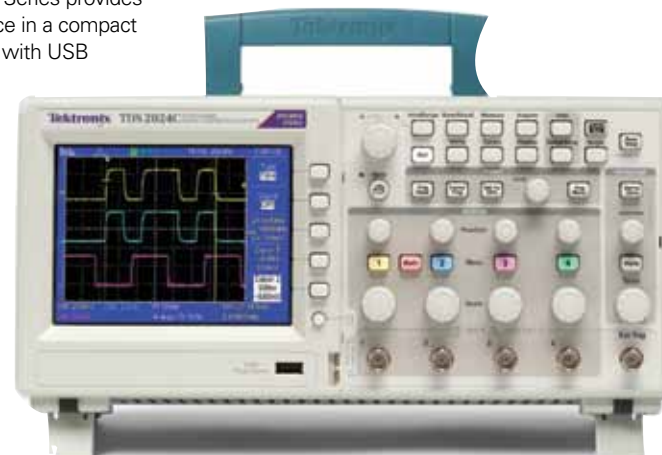


TEKTRONIX TDS2000C OSCILLOSCOPE SERIES

Performance at a reasonable price

■ The TDS2000C Oscilloscope Series provides you with affordable performance in a compact design. Every model is packed with USB connectivity, 16 automated measurements, limit testing and built-in help menu. Get more done in less time with the TDS2000C Oscilloscope Series.

Online search term: **Tektronix, "Digital Oscilloscopes"**

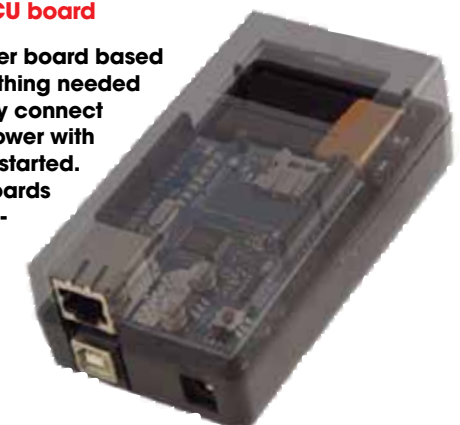


ARDUINO ATMEL PROCESSOR BOARDS

Arduino Uno Atmel Atmega 328 MCU board

■ The Arduino Uno is a microcontroller board based on the ATmega328. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable, power with an AC/DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter

Online search term: **715-4081**



ESD Protection

Spend a Little – Save a Lot

ESD (ElectroStatic Discharge) is a significant threat to quality in the electronics industry. Major companies state that 25% of all unidentified failures of electronic equipment result from damage caused by ESD. In total, ESD-related failures are estimated to cost the industry billions of dollars annually.

Investing in a high-quality ESD control plan has been shown to deliver typical ROI from 5:1 up to 20:1 according to articles in the compliance press. One high-tech company recently reported equivalent savings of €95 for every €1 spent on ESD protection.

An ESD protection plan meeting international standards can be implemented using relatively inexpensive equipment. To remain effective, it needs to be continuously monitored and improved. ElectroStatic charge generation increases significantly as relative humidity decreases; so typically if mysterious quality and reliability problems are observed in products manufactured during your lowest humidity season, it's likely to be ESD related.

Need for a Plan

Most firms use the EN61340-5-1 standard to construct their ESD control plan. The standard addresses grounding and bonding systems, personnel grounding, protective packaging, and marking. In addition to setting out a control program plan, EN61340-5-1 also describes requirements for ESD training and compliance verification.

Specified grounding measures include wrist straps for seated operators, as well as ESD flooring and ESD footwear such as foot grounders for standing or mobile workers. Insulators in the ESD Protected Area (EPA), however, cannot be discharged by grounding. EN 61340-5-1 clause 5.3.3 states that "All non-essential insulators (plastics and paper) such as coffee cups, food wrappers and personal items shall be removed from the workstation or any operation where unprotected ESDS items are handled."

Process-essential insulators present in the EPA can present significant ESD threats such as Field Induced Discharges. These can occur even at a properly

grounded ESD work surface. According to IEC61340-5-1, the electrostatic field at the position where the ESDS device is handled must not exceed 10,000V/m. All insulators with electrostatic potential greater than 2kV must be kept a minimum of 30cm from the device. If the measured electrostatic field or surface potential exceeds the stated limits, ionisation or other techniques must be used. By generating positive and negative ions, which are attracted or repelled by the charge accumulated on the insulator, an air ioniser can neutralise an insulator in a matter of seconds.

The third fundamental principle of the ESD control system covers packaging. Shielding bags or containers having a conductive outer surface are commonly used. To be effective, bags and containers should be closed, and opened only by a grounded operator at an ESD workstation.

Conclusion

All ESD control costs should provide the user with improved quality and reliability. To maximize ROI, highest loss operations, areas and products should be identified and addressed first. By keeping ESD Control an on-going quality process, program costs and resulting ROI can be monitored so that the company can maximize total program value. Businesses that get ESD right will see a direct and measureable contribution to their bottom line, as well as an improvement in customer satisfaction. ●

Get more online...

For more information download the Charleswater ESD Awareness Booklet from www.designspark.com





MAXIMISING EFFICIENCY

FROM RENEWABLE ENERGY SOURCES

Digital signal controllers can deliver significant efficiency benefits for power inverters in green energy installations.

From Helga Stevenson

The need for alternative forms of power generation are well established and with a current focus on renewable sources, solar panels and wind turbines are receiving considerable attention. As an example, there are now commercial companies offering free panels with installation and maintenance contracts for domestic and commercial users, which provide the property owner with power when they need it, while feeding surplus power back in to the national grid.

This form of energy generation is, unfortunately, susceptible to inefficiencies. Photo voltaic (PV) cells offer limited conversion efficiency under the best conditions, but maximising their potential also requires significant system intelligence, in order to provide the best return on investment.

Using complex algorithms, it is possible to achieve high levels of output power even under less than ideal conditions and the power conversion stage is key in this.

Typically a solar panel installation will use a number of PV cells connected in series and parallel, along with a number of DC/AC inverters to convert the PV output to a mains-rated voltage for use within domestic or commercial premises, or to feed back in to the national grid. Some installations may also use batteries to store energy during good weather conditions, to provide energy during periods of cloud cover or even through the night. In these installations a number of DC/DC converters will also be used.

Maximising the efficiency of the PV output is crucial and is typically controlled by the duty cycle of the pulse width modulation (PWM) signal controlling the DC/DC and/or DC/AC converters. Achieving the most efficient power conversion requires close monitoring of the power (product of the voltage and current outputs) from the PV cell. For this a microprocessor is used, along with a number of ADCs. The processor must be capable of calculating the PWM signal to achieve optimal conversion conditions, predominantly using a technique known as Maximum Power Point Tracking (MPPT).

Due to the constantly variable conditions, the MPPT process is cyclic; it must be performed reiteratively to compensate for changes in output caused by temperature, cloud cover, the time of day and even seasonal variations. The objective is to continuously tune the inverters, through PWM control, to match the peak voltage and peak current outputs of the cell(s). This involves measuring and converting the voltage and current outputs and passing their values to the MPPT algorithm, calculating the optimal control and feeding that back in the form of a PWM control signal. While this can be achieved using several discrete devices, a digital signal controller such as Texas Instruments' TMS320C200 family of DSP controllers has the right combination of peripherals, processing power and architectural features to perform this complex process in real time in a single chip, thereby delivering the maximum possible efficiency for a PV installation.

The Maximum Peak Power algorithm is the most commonly used solution for maximising power output, but is inherently variable. Another solution sometimes employed is the incremental inductance algorithm, which solves the derivative of the voltage/current product (power) curve for 0, which is by definition a peak. However this method is prone to errors caused by settling on 'false' peaks. A more elegant solution is to employ a combination of the two and while this is the most efficient, it also requires the most processing power.

TI's TMS320F28x digital signal controller is ideally suited to this task; it uses a 32bit device that can deliver up to 150 MIPS performance and integrates a range of peripherals that enable a highly efficient solar panel inverter. Its use has already been reported to have cut conversion inefficiency by up to 50% in some installations. 

Find the latest TI range of digital signal controllers at www.rs-components.com

Get more online... 

Share your views on this article at www.designspark.com/etech

ePurchasing Innovations

for Switched-on Supply Chain Management

By Carlene Garvey, RS Components

While bringing tremendous opportunities, Internet shopping also poses a threat to financial control. Many householders have already discovered this fact. Businesses, also, need help to make best use of features such as the web's high speed and vast search powers.

Getting it right can help product marketers cut costs and deliver innovations to market more quickly. However, the temptation to exploit potentially dangerous aspects of the web - such as to locate non-approved suppliers offering apparently better prices - can lead to serious problems.

Responsible suppliers must recognise these challenges facing their customers and provide innovative online tools, via their websites, that harness the best features of the Internet to provide a trusted source of competitive advantage.

Harnessing Search Powers

An obvious starting place is to enhance product-search capabilities for online customers.

For component suppliers, this means providing parametric-search tools to help customers locate components meeting their exact specification. RS Components has built Component Chooser to provide this facility for its customers. Component Chooser is now the world's largest and most extensive parametric search engine of electronic components. RS Components also provides online Technical Notes, situated at product level, which can provide answers to technical questions and help to inform purchasing decisions.

Continued page 18 >



< Continued from page 16

Expanded search capabilities are also valuable for products such as test equipment as well as industry-standard subsystems or modules. Searching the RS website automatically locates compatible alternatives of suitable quality; examples include families of RS own-brand products, which are conceived to deliver high value at extremely competitive prices.

For larger companies, in particular, coordinating aspects such as purchasing decisions, delivery arrangements and spending by multiple individual users is much tougher in the Internet age. Emerging generations of intelligent tools can provide the flexibility for individuals to purchase up to pre-set limits or to work within other constraints such as a limited supplier list. RS Components' Purchasing Manager is an example of this type of tool. It allows companies to tailor access privileges and available facilities, and so match the purchasing needs of each individual's role. Taking purchasing automation to a higher level, tools such as eProcurement use web protocols to open up communications between systems. This is another example of how the Internet is improving supply-chain efficiency by allowing customers to integrate their internal procurement systems seamlessly with the RS Components online store. This provides instant access to over 300,000 products, with live stock availability and the latest pricing information. RS is already expanding this service with enhancements to features such as the 'My Account' area.

Personalised Automation

In fact, customer self service, featuring facilities for customers to manage their own account and even personalise their purchasing environment, is a powerful aspect of internet-based commerce throughout the retail as well as trade sectors. Perceived benefits include increased customer satisfaction, reduced instances of errors and misunderstandings, and lower costs. Enhanced facilities for trade customers can include copy invoicing and online quotes, as well as the ability to place scheduled and forward orders. RS Components has already implemented these services online, which help avoid time delays and generally empower customers to improve control over their own orders, costs and administration. In addition, the RS Components Store Manager tool provides complete multi-vendor inventory management system, helping customers control spend and maximise stock efficiency.

On top of this, in situations where customers have negotiated special purchasing terms

or prices, web-based purchasing tools now have the ability to apply these automatically to orders placed by any authorised member of the customer's staff. Internet shoppers everywhere are also familiar with the power of price checking. With just a few clicks, it is easy to locate the best deal in terms of price alongside other important considerations such as availability, shipping costs and delivery time. Online price checking is also widely used by leading national retailers, and is now entering the industrial supply chain in facilities such as RS' Price Checker price-comparison service. The service provides instant visibility of equivalent prices from alternative suppliers, which is frequently updated to help online customers assess the savings on offer.

Innovation-to-Market, at Internet Speed For high-tech companies, whose success depends on being the first to market, the Internet is opening up numerous opportunities at every stage of product realisation. Online technical communities sharing information and resources such as internet-based tools and open-source software are just the beginning. There is tremendous scope for web-based design to improve, not only by offering more powerful design resources but also by integrating more efficiently with commercial functions such as purchasing. The DesignSpark PCB environment available through www.rs-components.com provides an interesting example.

DesignSpark PCB is a free-of-charge Windows-based EDA tool, created in partnership with a third-party specialist EDA vendor, which engineers can access online. It is compatible with industry-standard design-file formats, and hence allows engineers to access IP supported by commercial companies as well as designs available through open-source hardware communities. Consistent with its Internet-based nature, DesignSpark PCB includes its users within a dedicated social network providing access to information in using the tool as well as other aspects of PCB design.

The important aspect of DesignSpark PCB, from the purchasing perspective, is its ability to export a full bill-of-materials file that can be uploaded directly to the RS Components online quotation tool to fully cost a prototype or manufacturing run of assembled boards and then seamlessly order the necessary components. Driving this high level of automation into component engineering

tasks that traditionally require a mix of technical and commercial expertise can simplify product realisation and speed up time to market.

Looking to Web x.0

As the mobile Internet is now a fast-spreading reality for business communities (as well as high-end consumer users) thanks to technologies such as 3G and Wi-Fi, smaller and more opportunistic design companies need to manage supply-chain services on the move. Supporting this trend, RS Mobile is a fully mobile transactional site that can be viewed on most smart phones.

The arrival of RS Mobile, as a next-generation online tool, reminds us all that the Internet is about change. As opportunities develop, the nature of any threats will also change. Switched-on suppliers have an important role to play through continual innovation of their online services to help their customers harness the power of the Internet while minimising associated risks. ○



LeCroy WaveAce Oscilloscopes

Get More Scope for Less Cost – LeCroy Quality does not come at a high price

WaveAce combines long memory, a colour display, extensive measurement capabilities, advanced triggering and excellent connectivity to improve troubleshooting and shorten debug time. With bandwidths from 40 MHz to 300 MHz, sample rates up to 2 GS/s and waveform memory up to 20 kpts it exceeds all expectations of a small affordable oscilloscope.



Class Leading Specs and Features:

- 40 MHz, 60 MHz, 100 MHz, 200 MHz and 300 MHz
- 2/4 channel models
- Sample rates up to 2 GS/s
- Class leading memory – up to 20 kpts
- Advanced Triggering
- 5.7" colour QVGA display on all models
- 32 parameter measurements
- Waveform Math incl. FFT
- Pass/Fail Testing & Digital Filtering
- Waveform Sequence Recorder
- Multiple language user-interface and help
- LAN/USB connections for printers, memory sticks and PC remote control
- 3 years warranty

WaveAce is the ideal oscilloscope for:

- Digital design and debug
- Education and training
- Manufacturing test and quality control
- Service and repair
- General bench test

Product Overview

	WaveAce 101	WaveAce 102	WaveAce 112	WaveAce 202	WaveAce 204	WaveAce 212	WaveAce 214	WaveAce 222	WaveAce 224	WaveAce 232	WaveAce 234
Channels	2	2	2	2	4	2	4	2	4	2	4
Bandwidth	40 MHz	60 MHz	100 MHz	60 MHz	60 MHz	100 MHz	100 MHz	200 MHz	200 MHz	300 MHz	300 MHz
Sample Rate per ch./max.	250 MS/s / 500 MS/s	250 MS/s / 500 MS/s	250 MS/s / 500 MS/s	1 GS/s / 2 GS/s	1 GS/s / 2 GS/s	1 GS/s / 2 GS/s	1 GS/s / 2 GS/s	1 GS/s / 2 GS/s	1 GS/s / 2 GS/s	1 GS/s / 2 GS/s	1 GS/s / 2 GS/s
Record Length	4 kpts/ch	4 kpts/ch	4 kpts/ch	18 kpts	20 kpts	18 kpts	20 kpts	18 kpts	20 kpts	18 kpts	20 kpts
Colour Display	5.7" QVGA	5.7" QVGA	5.7" QVGA	5.7" QVGA	5.7" QVGA	5.7" QVGA	5.7" QVGA	5.7" QVGA	5.7" QVGA	5.7" QVGA	5.7" QVGA
RS Stock No.	685-2725	672-1589	672-1582	672-1586	685-2734	672-1595	685-2737	672-1598	685-2731	672-1592	685-2740

Find out more about RS ePurchasing solutions at www.rs-components.com



www.rs-components.com



EMBEDDED DEVELOPMENT WITH EDP

By Dr William Marshall, RS Components

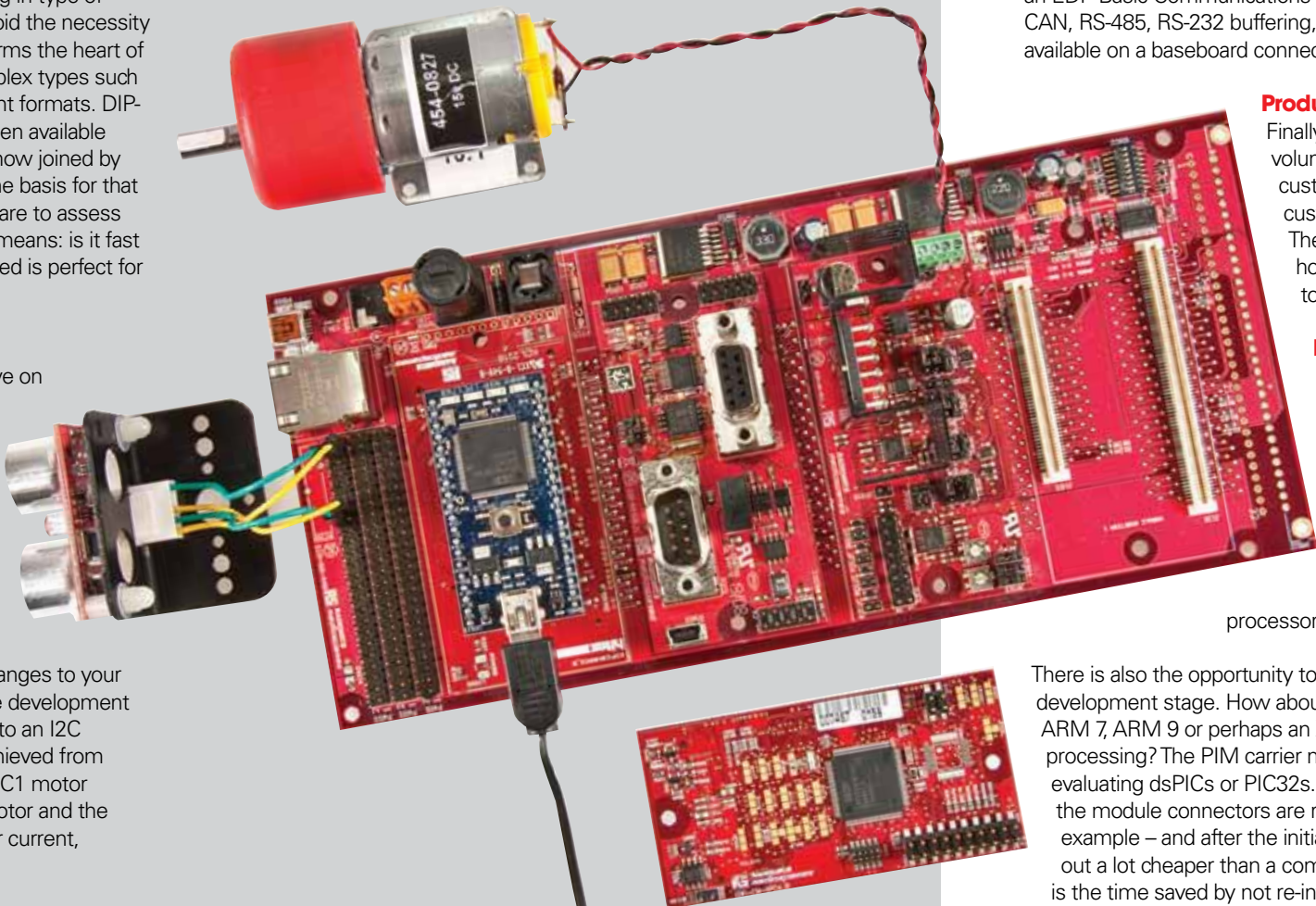
The RS Embedded Development Platform offers an alternative path to the engineering prototype stage of a project allowing quick and easy changes of processor at the time of initial design or for upgrades in the future.

The Route to Production: Phase 1

Most new electronics products start with an idea followed by a quick ‘lash-up’ at the bench to test the feasibility. The plug-in type of prototyping board is most often used at this stage to avoid the necessity of soldering or making PCBs. When a microcontroller forms the heart of such a system, there is the difficulty that the more complex types such as ARM-cored devices are only available in surface-mount formats. DIP-modules suitable for plugging into a breadboard have been available for some time for PICs and the Propeller and these are now joined by the ARM mbed discussed in issue 4 of eTech. Here is the basis for that quick ‘lash-up’: no robust interfaces but sufficient hardware to assess the suitability of the processor for the task. Usually this means: is it fast enough for my real-time processing application? The mbed is perfect for this stage of development.

The Route to Production: Phase 2

Having established the viability of the initial idea we move on to the support hardware such as anti-aliasing filters for ADC channels, buffering and protection for I/O channels such as Ethernet, USB and CAN. The breadboard is looking rather crowded and messy now with possible noise problems on long trailing wires. This is where EDP comes in, providing all these filters, buffers and connectors in one small modular system. The mbed module is simply plugged into an EDP adapter or carrier to make it compatible with the baseboard. A few jumper connections may have to be made to suit the project with some minor changes to your mbed program. Otherwise, that’s it and further software development can take place ‘in the cloud’ as before. I needed access to an I2C bus for the ultrasonic rangefinder and this was easily achieved from the I/O ‘breakout’ headers on the EDP baseboard. An MC1 motor control module provides an interface to the brush DC motor and the recommended EDP power supply copes with the motor current, although a heavier PSU can be connected directly to the MC1 if necessary.



The Route to Production: Phase 3

At some point the limitations of the mbed development system will become apparent. The most obvious limitation is the lack of debugging tools, and perhaps by now the realisation that revealing all your code to competitors via the web may not be advantageous to your company! The next step is to replace the mbed and its carrier with the LPC1768 EDP module. The new unit has a number of jumper options that need to be made depending upon the peripheral application boards present. A micro-SD card socket is provided along with a programming header for the Keil µVision 4 IDE. If you already have the Keil system with its µLink debug ‘dongle’ then you can get started straight away, otherwise you will need to purchase a dongle from RS separately. Fortunately it can be used with all the EDP ARM-based boards. A free code-limited version of µVision can be downloaded from the Keil website.

Listing 1. is the EDP version of our object avoidance program. Compare it with the mbed program listing in eTech 4. The main difference, apart from the different names for the peripheral driver routines, is the C++ object-oriented structure of the mbed program relative to the plain C code of the EDP. The mbed program was shorter because all the driver files were called by one single ‘Include’ statement: mbed.h. The initialisation steps were also hidden from the user. You can see that translation from mbed to EDP is not going to be a difficult job once you are familiar with the sophisticated new IDE with all its project management and debug facilities. Note however that the COM port functions such as ‘printf’ now work through the RS-232 channel via an EDP Basic Communications module. The latter also provides USB, CAN, RS-485, RS-232 buffering, protection and connections. Ethernet is available on a baseboard connector.

Production

Finally, if the finished design is for a low-volume specialist application not justifying a custom PCB, then why not just supply the customer with an EDP-based solution? The boards are robust and mounting holes are provided for securing modules to the baseboard.

Future-proofing

Now there is an over-used phrase. In the case of EDP it means that obsolete or superseded components (usually the processor chips) can be removed and replaced with the latest types, leaving the rest of your developed prototype intact. The key time-saver is that your precious software will still work when re-compiled for the new processor using the supplied low-level drivers.

There is also the opportunity to try out different processors at the development stage. How about a different Cortex-M3, Cortex-M0, ARM 7, ARM 9 or perhaps an XC167 optimised for fast real-time processing? The PIM carrier module brings in the possibility of evaluating dsPICs or PIC32s. EDP is not cheap, but it is built to last – the module connectors are rated for many insertions/extractions for example – and after the initial investment future additions will work out a lot cheaper than a complete new development kit. Then there is the time saved by not re-inventing the wheel.

```
/* *****  
/* Robot Collision-Avoidance Test Program for EDP LPC1768 Module WGM 10/2010 */  
/* Project built using Keil uVision 4 development tool and compiler */  
/* *****  
  
#include <lpc17xx.h>  
#include "misra_types.h" /* MISRA type definitions */  
#include "defines.h" /* General EDP defines */  
#include "Slave_Address_Defines.h" /* EDP I2C slave addresses */  
#include "Portst.h" /* I/O port structure */  
#include "i2c0.h" /* I2C0 low-level driver */  
#include "I2C0_MASTER.h" /* I2C Master functions */  
#include "timer1.h" /* Timer 1 driver, delay */  
#include "UART0.h" /* UART0 low-level driver */  
#include "Terminal.h" /* Serial terminal functions */  
#include "delays.h" /* Software delays */  
#include "MC1.h" /* Motor module functions */  
  
uint8_t cmd[2] = {0u,0u}; /* I2C command buffer */  
uint8_t echo[2] = {0u,0u}; /* I2C sonar results buffer */  
uint16_t range = 0u;  
  
sint32_t main (void) {  
    SystemInit(); /* Basic MCU initialisation */  
    setup_TIMER1(1u); /* Set lms wait increment */  
    setup_ports_default(); /* Set up I/O for EDP board */  
    setup_I2C0_Master_Mode(); /* Initialize I2C bus */  
    MC1_Configure_Hardware(); /* Set up EDP MC1 module */  
    UART0Init(115200u,8u,NO_PARITY,1u); /* Set up COM channel */  
  
    // Set up SRF08 max range and receiver sensitivity over I2C bus  
    cmd[0] = 0x02u; /* Range register */  
    cmd[1] = 0x1Cu; /* Set max range about 100cm */  
    I2C0_Master_Mode_Transmit(SRF08_addr, cmd, 2u);  
    cmd[0] = 0x01u; /* Receiver gain register */  
    cmd[1] = 0x1Bu; /* Set receiver gain */  
    I2C0_Master_Mode_Transmit(SRF08_addr, cmd, 2u);  
  
    while(1) { /* Main program loop */  
  
        // Get range data from SRF08  
        // Send Tx burst command over I2C bus  
        cmd[0] = 0x00u; /* Command register */  
        cmd[1] = 0x51u; /* Ranging results in cm */  
        I2C0_Master_Mode_Transmit(SRF08_addr, cmd, 2u); /* Send ranging burst */  
  
        delay_ms(70u); /* Wait for echo */  
  
        // Read back range over I2C bus  
        cmd[0] = 0x02u; /* Address of first echo */  
        I2C0_Master_Mode_Transmit(SRF08_addr, cmd, 1u); /* Send address */  
        I2C0_Master_Mode_Receive(SRF08_addr, echo, 2u); /* read echo result */  
  
        // Generate PWM mark/space ratio from range data  
        range = (echo[0]<8u)+echo[1];  
        MC1_Set_Motor_Speed(100u-range); /* Update PWM ratio (0->100) */  
        rs232_printf("PWM = %d\r",range,3u); /* Display PWM ratio on PC */  
  
        delay_ms(100u); /* Wait for 100ms */  
    }  
}
```

Listing 1

Component List

	RS Stock No.
EDP 4-channel Baseboard	460-285
EDP LPC1768 Command Module	703-9229
EDP mbed Carrier Module	703-9235
ARM mbed LPC1768 Module	703-9238
EDP Communications Module	460-310
EDP MC1 Motor Control Module	460-304
Program/debug dongle	703-9241

Get more online...

Download the program listing and read previous mbed article in eTech Issue 4 at www.rs-components.com/etech

Fastest-Growing Solar Market in 2010

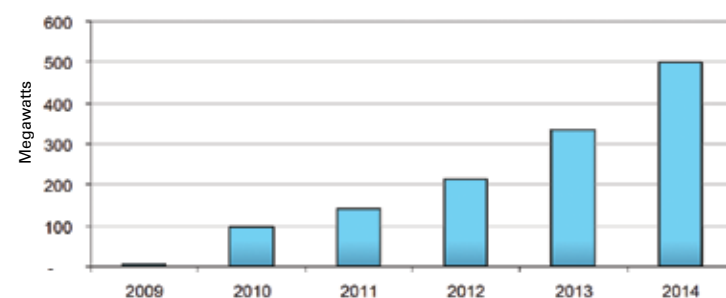
PV installations up 1,500 percent this year

The sun was rising on United Kingdom's solar market in 2010, as attractive government incentives made it the world's fastest-growing country for Photovoltaic (PV) installations, according to iSuppli Corp.

Installations of PV systems in United Kingdom amounted to 96 Megawatts (MW) in 2010, up an astounding 1,500 percent from 6MW in 2009. Starting from a nearly negligible level in 2009, the expansion dramatically outpace the growth of the next fastest-growing nation – Spain – which rose by approximately 730 percent in 2010.

Figure 4 presents iSuppli's forecast of annual PV installations in the United Kingdom.

Figure 4: UK Photovoltaic System Installation Forecast (in Megawatts)



The United Kingdom in 2010 adopted attractive Feed-in-Tariffs (FIT) to promote PV adoption. Furthermore, with leading solar country Germany cutting its FITs, the focus of the PV world shifted to places with more favourable incentives – making the United Kingdom a solar hotspot.

While growth in the United Kingdom is expected to slow down from such a blistering rate after 2010, PV installations will continue to rise in the 50 Percent range for each year through 2014.

Giving the solar market FITs

FITs promote the use of solar energy by guaranteeing that utility companies will buy excess electricity produced by solar installations. This helps individuals or organisations to defray the upfront costs of investing in a PV system.

Extensive use of FITs has helped Germany to become the world's leading country for PV, with 3.8 Gigawatts (GW) worth of installations in 2009. However, Germany government's move to reduce FITs will cool off growth in the country from 2012 on.

Energy in the UK

The overall goal of United Kingdom's program is to encourage smaller, distributed, self-generation in an effort to reduce CO2 emissions and to contribute to the renewing of the U.K. energy park. The United Kingdom is using above-market FIT rates to incentivise PV adoption.

The average residential price for electricity in the United Kingdom is currently 0.12 pounds per kilowatt hour (kWh). A residential PV system of up to 4 Kilowatts (KW) in size can earn 0.36 pounds for every generated kWh that is consumed by the owner itself, or 0.39 pounds for every kWh fed into the grid. This translates into a financial benefit of 0.48 pounds per kWh for self-consumption.

According to the United Kingdom's Department of Energy and Climate Change, a typical household that installs a well-positioned 2.5 Kilowatt (KW) system could save 140 pounds per year on its electricity bill. Installations conducted since July 2009 can retroactively qualify for the tariff. Returns on Investments (ROIs) for advantageous residential projects can approach 12 percent, iSuppli calculates.

iSuppli's initial estimate is that the U.K. PV installation market will reach 214 MW in 2012 and 501 MW in 2014. This assumption is modelled after the ramp-up rates of other countries and by accounting for the United Kingdom's level of insulation, or the amount of sunlight it receives.

By Henning Wight

Get the Latest Photovoltaics Research at
www.isuppli.com/photovoltaics or by contacting
iSuppli via info@isuppli.com

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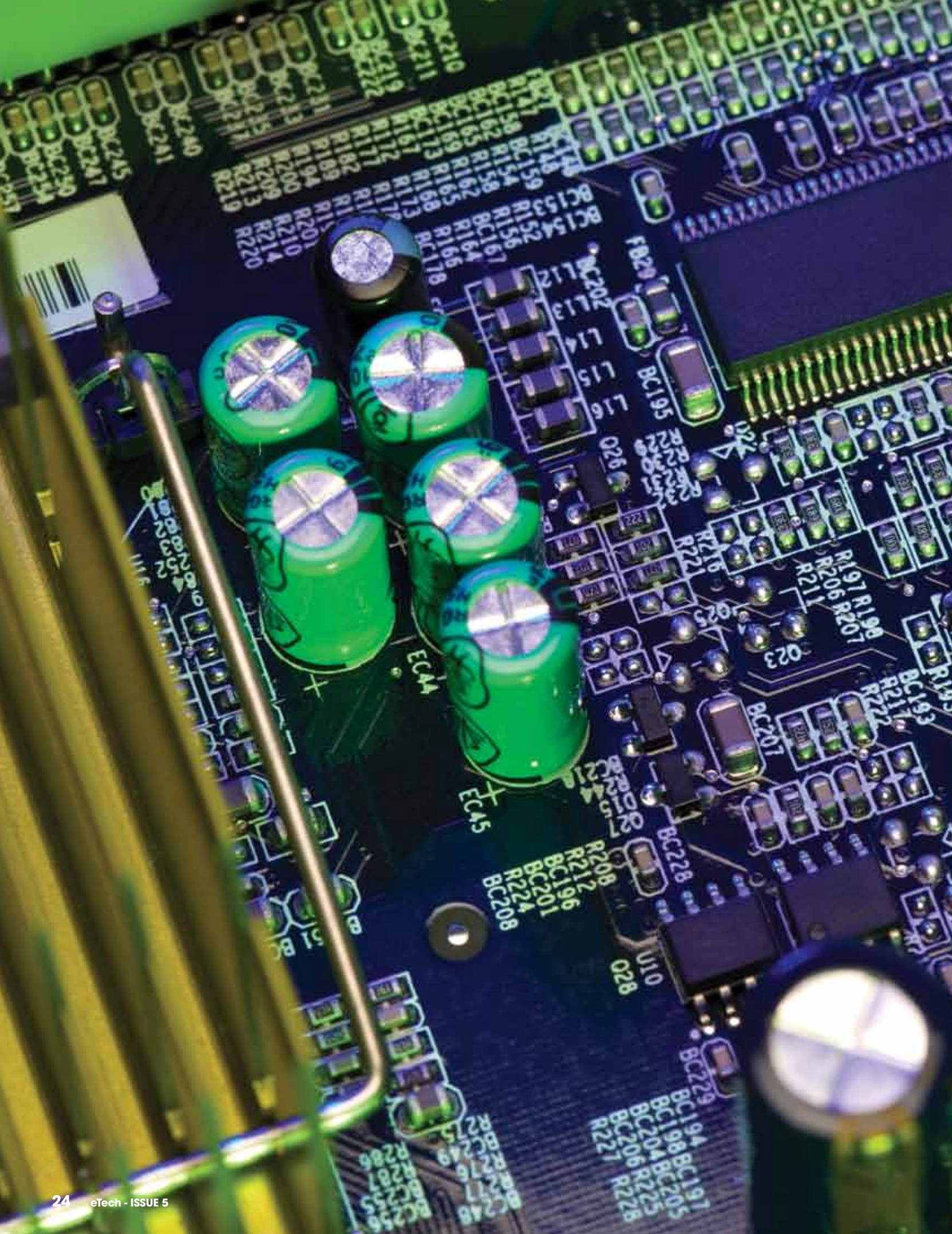


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PCB tool

lowers the barrier to innovation

By Martin Keenan
Technical Marketing Engineer, RS Components

A movement is gathering steam in electronics engineering. Similar to the open-source software movement that has opened up access to a wide range of IT applications, open-source hardware is helping to remove a number of barriers to innovation in technology. Unlike the open-source software community, however, hardware designers wanting to open up their work haven't had access to as many freely accessible tools of the same level. This issue is now being addressed.

Open source hardware

Open-source hardware (OSHW) makes it possible to take designs and make them without paying royalties or, more importantly, modify and extend them to build new things. It means less time reinventing the wheel, implementing subsystems when someone who has done the work and provided it as an open-source design has already optimised those designs.

Companies such as Arduino have embraced the open-source hardware model to make it easier to prototype and develop new systems. The core boards made by Arduino are supplied with all the documentation and source files needed to recreate them and to adapt them.

Open-source hardware has made it past prototypes and into finished systems. Openmoko kicked off the idea of building an entirely open-source cellular handset and the project has yielded not just a software stack but spawned a community effort to provide a reusable hardware design for a complete mobile device. The MakerBot 3D printer, designed to construct plastic objects at home, is sold as a kit. But the company provides all the design files and information needed to make one, or to improve on the design to create a better MakerBot.

Open source design tools

Although there is a growing community of electronics and systems designers willing to open up their work and provide a head start to people with ideas on how to extend them, there has been a gap when it comes to the design tools. The open-source software community has access to many free tools to create new software. However, before now, freely accessible tools for electronic-hardware design have not reached the same level.

There are a number of free PCB design tools available to download but they frequently have serious limitations. For example, they may have very limited import or export facilities because they are designed to work with a particular PCB manufacturer's equipment. There are also open-source tools that can be downloaded from the internet. They are generally free of artificial restrictions on attributes such as board size and the number of layers a project can have. But, being developed by a loose community of programmers, they can lack key features that PCB users have come to expect from commercial tools.

DesignSpark PCB

DesignSpark PCB, on the other hand, is a free tool but with the attributes of a commercial tool that has not been artificially

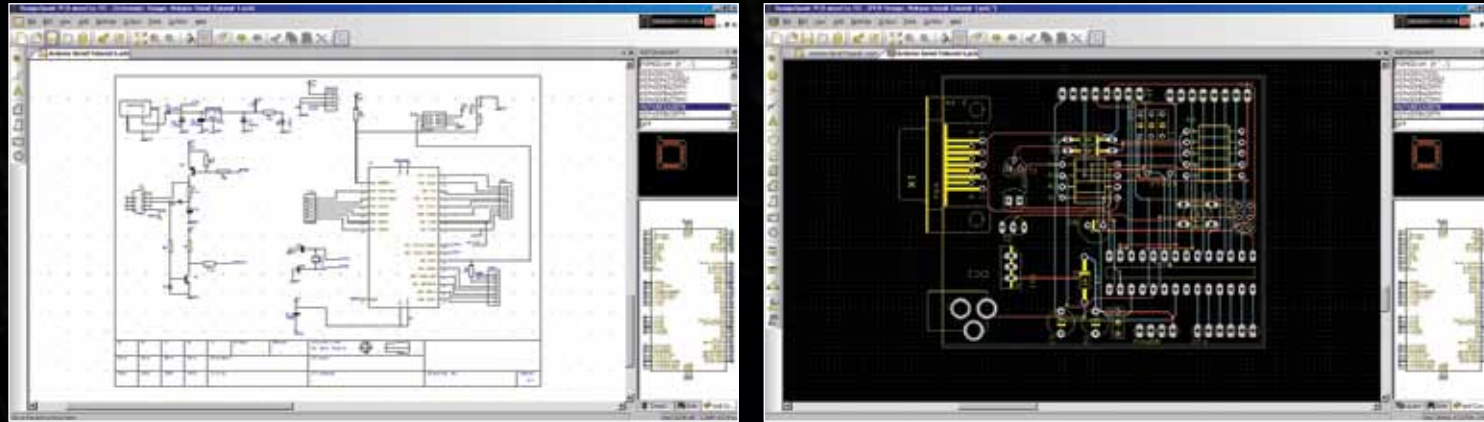
restricted in any way, whether you look at board size, layers, pin counts or file output. Created in partnership with a third party EDA tools company, the development team totals over 150 man years experience in PCB CAD software development and DesignSpark PCB product is the result of this vast experience, together with feedback from CAD users all over the world, plus detailed analysis of tools currently available for PCB Layout. As well as the schematic capture and layout features essential to any PCB design tool, DesignSpark PCB includes a full autorouter with full support for design-rule checks to ensure that the board is manufacturable. As a result, it allows a new generation of electronics engineers to work on projects with a class of tool that would, previously, have cost hundreds or even thousands of pounds.

The tool makes it possible to take a wide range of designs that are already available. That is not just those in the OSHW space but the many reference designs produced by manufacturers such as Texas Instruments, which provide design files compatible with industry standard tools.

In contrast to free tools made available to

Continued page 26 >

“... less time reinventing the wheel, implementing subsystems when someone who has done the work and provided it as an open-source design has already optimised those designs”



< Continued from page 25

educational or hobbyist users, there are no usage restrictions on DesignSpark PCB. It can be used for commercial designs as well as those that are passed to the OSHW communities.

Designed from the ground up for Microsoft's Windows, DesignSpark PCB fully embraces the approach that the operating system recommends for application design. This makes the tool much easier to learn. When the software first opens, the user is not presented with a matrix of inscrutable buttons and commands. Instead, the user interface is very clean with the core functions sitting on two icon bars to the top and to the side of the main screen. Commonly used PCB design functions are available from context-sensitive menus.

Because it was written for Windows, DesignSpark PCB fully supports copy and paste as well as drag and drop. This makes it easy to take portions of a design file and transfer it to a new project. If a reference design for a microcontroller has a section that you can use in a larger project, it is simple to copy it over. Or the functions can be used to rapidly duplicate sections that would otherwise be very tedious to draw time and again by hand.

As DesignSpark PCB users are automatically part of the DesignSpark social network for engineers, it is easy to get tips on using the tool as well as other aspects of PCB design. Instead of hunting through documentation to work out how to get

something done, you can search through the Q&As or simply ask.

And on to production...

It is not the only way that DesignSpark PCB is connected to online tools. The tool makes it much easier to cost a design and get it manufactured through the ability to export a full bill of materials. This bill-of-materials file can be uploaded to RS Components online quotation tool to fully cost a prototype or manufacturing run of assembled boards and then seamlessly order the necessary components.

The tool is supplied with a full database of components, from resistors to microcontrollers. If a component is not in the parts database, it is easy to create a new one by selecting the relevant package type, such as a SOT-23 or a large land-grid array, and then assigning the pins entered on the schematic to their relevant positions on the package.

As many of the designs in the open-source world are not just components on PCBs, but robots, 3D printers and even an experimental hybrid car in one case, how the electronics fit into the system is critical to success. This is where DesignSpark PCB looks to the future. The tool can take a PCB design and export IDF files, a format understood by mechanical 3D CAD tools.

Many of the electromechanical components within Component Chooser, which makes it easier to select which parts to use for a particular job, have corresponding 3D models. Thanks to this, it is now much

easier for those tools to incorporate the real 3D shapes into mechanical designs – so you can easily see whether a heatsink has enough clearance and, if not, nudge it into the right place with DesignSpark PCB.

Once the design is ready, DesignSpark PCB will generate a standard Gerber file ready for production at any PCB supplier, providing the final link in the chain.

The OSHW vision

Open-source hardware can change the way the engineering community looks at design – focusing effort on differentiable areas rather than forcing everyone to recreate common subsystems from scratch and lowering the barriers to innovation. DesignSpark PCB removes another barrier by providing, for free, the ability to take, adapt and create new electronics hardware designs. 

Download DesignSpark PCB for free at www.designspark.com/pcb

Get more online...

Share your views on this OSHW vision at www.designspark.com/etech

Add Advanced Graphics Displays Using Integrated PIC24F Microcontrollers



Microchip's new PIC24FJ256DA microcontroller family reduces costs by eliminating external RAM and controllers for graphics displays, USB and touch sensing.

The PIC24FJ256DA microcontroller family integrates three graphics acceleration units and a display controller, along with 96 Kbytes of RAM. This integration reduces system costs and makes it practical to add advanced graphics displays for a wide range of embedded applications by eliminating the need for external RAM and a display controller. Additional savings are achieved through the integrated peripherals for USB and capacitive touch sensing.

Microchip gets you there with:

- Free performance-optimized Graphics Library - with full source code, supports multiple fonts and languages, and includes a host of pre-made graphics objects.
- Free Graphics Display Designer software - which enables first-time users with a visual wizard for designing user interfaces.
- The PIC24FJ256DA210 Development Board interfaces directly with Microchip's Truly 3.2" Display Board but can connect to other display boards by the use of adapters boards AC164139 (RS Part No 715-4214). Users will need an MPLAB® ICD 3, MPLAB REAL ICE™ or MPLAB PICKIT™ 3 to carry out debug.

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2. Download free library and designer software
3. Start designing!
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PIC24FJ256DA210 Demo Board DM240312 - RS Part No 715-4249
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3D LED PYRAMID

By Lothar Goede (Germany)

The author ‘just wanted to do a bit of microcontroller programming’. However, the project rapidly grew into this impressive and visually attractive pyramid. The circuit consists essentially of a specially-sawn printed circuit board, 23 LEDs and a microcontroller. Despite the fact that the microcontroller is a rather modest Atmel ATtiny2313, the author nevertheless has found room in the 2 KB flash memory for 16 different light sequences.

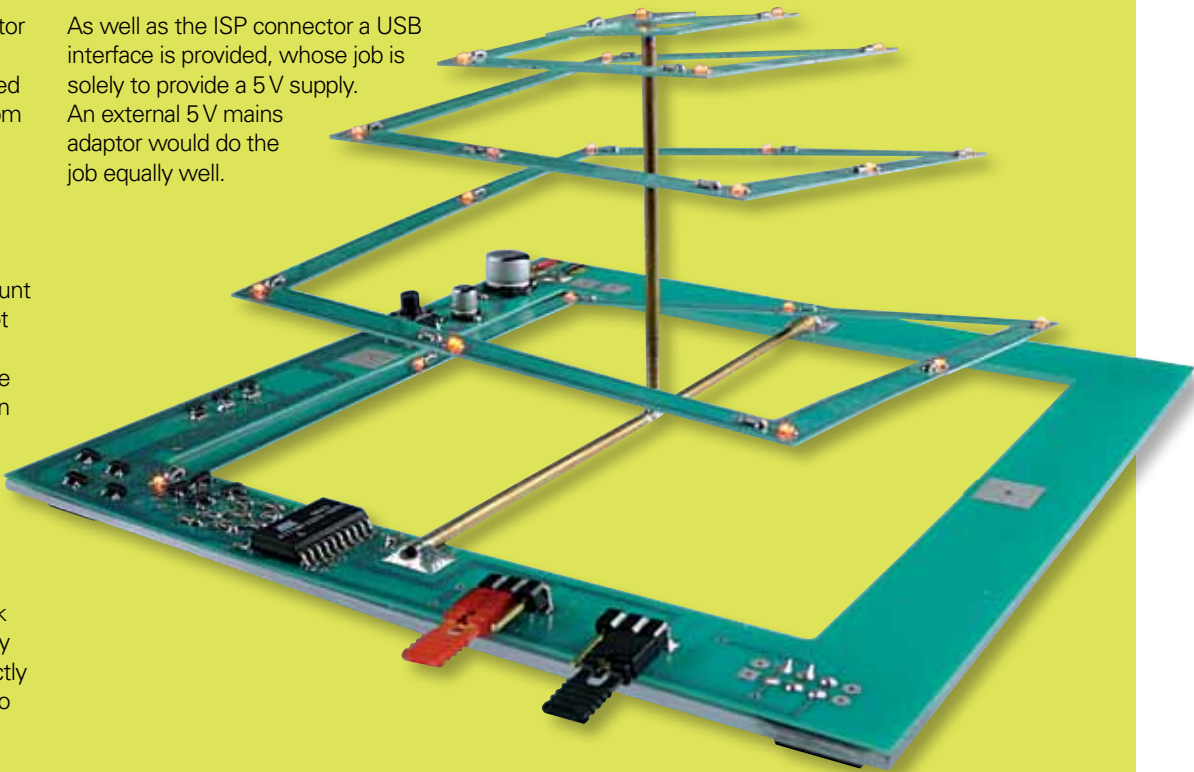
The 23 LEDs are divided into three groups. The lower and middle sections consist of eight LEDs, while the upper section has just seven. The microcontroller has only 20 pins, and so it is not feasible to provide a direct individual drive for each LED. The multiplexing approach adopted uses just eleven output port pins. Buffer transistors are used to increase the current drive capability of each output.

The software was written in assembler and can, as usual, be downloaded from the Elektor web pages accompanying this article [1] as either source code or as a hex file. The printed circuit board layout files are also available from the same place, as well as a link allowing purchase of ready-made boards and pre-programmed microcontrollers.

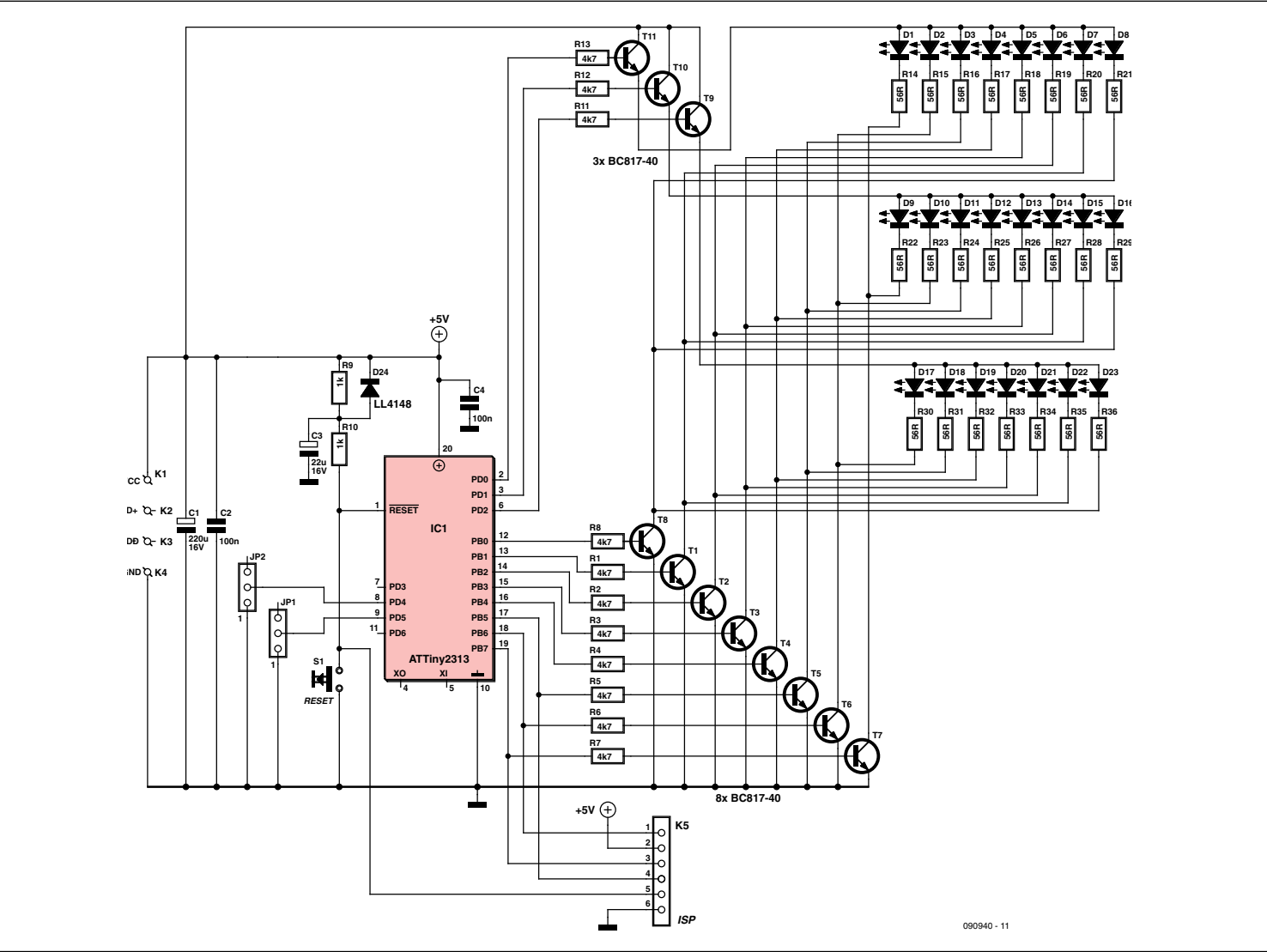
Populating the printed circuit board is straightforward: there are some surface-mount components to be soldered, but space is not tight. For best results, it is best to choose LEDs with the widest possible viewing angle so that the pyramid looks its best even when seen from the side. The author used type LO L296 orange LEDs from Osram, which have a viewing angle of 160 °. A six-way connector is provided to allow in-system programming (ISP) of the microcontroller. The configuration fuses are set to enable use of the internal 4 MHz clock source, which is divided down to 0.5 MHz by an internal divider. If the fuses are not correctly programmed the light sequences will run too quickly, too slowly, or even not at all!

When everything is working, take an 11 cm length and a 5.5 cm length of 1.5 mm² solid copper wire and solder one end of the shorter piece to the middle of the longer piece to make a ‘T’ shape. Pull the printed circuit board spiral apart so that the T-shaped wire assembly fits underneath, and then solder it to the two pads as shown in the photograph. Fine-bore brass tubing can also be used instead of solid copper wire.

As well as the ISP connector a USB interface is provided, whose job is solely to provide a 5V supply. An external 5V mains adaptor would do the job equally well.



IN ASSOCIATION WITH
elektor



Component List

Resistors

R1–R8, R11, R12, R13 = 4.7kOhm
R9, R10 = 1kOhm
R14–R36 = 56Ohm

Capacitors

C1 = 220µF 16V
C2, C4 = 100nF
C3 = 22µF 16V

Semiconductors

D1–D23 = SMD ED, wide angle e.g. LO L296
T1–T11 = BC817-40
IC1 = ATtiny2313-20SU (SMD), programmed

RS Stock No.

698-0126
698-0072
678-7059

RS Stock No.

568-947
698-2995
565-807

RS Stock No.

665-6088
445-1991
720-441

Miscellaneous

K1–K4 = solder points
K5 = 6-pin (2x3) pinheader, lead pitch 0.1 inch (2.54mm)
S1 = pushbutton
S2, S3 = 3-pin pinheader, lead pitch 0.1 inch (2.54mm)
Copper wire 1.5mm² csa, l = 110mm
Copper wire 1.5 mm² csa, l = 55mm
PCB jumper
PCB # 090940-1 <http://be.eurocircuits.com/Offtheshelf/Offtheshelfdefault.aspx?type=E&lang=en&an=090940-1>

RS Stock No.

434-138
251-8137
682-1399
681-2521,
251-8654,
468-074
357-930 (30M)
357-930 (30M)
334-561

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Quick Questions

Key Facts

Company Name	GEM elettronica
Year established	1977
Location	Headquarter in San Benedetto del Tronto, Italy.
Number of employees	Over 180
Website	www.gemrad.com
Interviewee name	Andrea PIZZARULLI
Interviewee position	GEM elettronica Technology Institute Responsible



What is your latest product?

Accurate FOG-100 gyro compass and attitude reference system for navigation

What differentiates your products?

High accuracy, high MTBF without maintenance, low cost

What new technologies does your product employ?

Fiber Optic Technology versus electromechanical classical approach

How did you equip yourselves with knowledge of this new technology?

Internal R&D effort and long term investment

Give an example of the impact one of your products has on, or the benefits it provides to, the end user.

Reduced operating expenses for product maintenance, Best performance for the user and Faster operation due to faster start-up time of the gyrocompass

How do you learn about new technologies?

International conferences, sector workshops

How do you gain new skills?

Hiring high qualified people and international consultants

What RS service do you find most useful in your job and why?

RS is a valuable supplier to us for prototyping and for small/medium production, as we can order very small quantities for delivery very quickly, within 24 hours. In addition, we appreciate the very good RS instrumentation repair and calibration service.

What technology do you foresee having the biggest impact on your next product?

Optical technologies and signal processing

What is the biggest threat to your business?

Extremely innovative and new products may have slow penetration to the market

Where do you see your industry in 5 years?

Avionics and aerospace



REDUCING energy dependencies through efficiency

The global attitude to generating and consuming power is changing, thanks in part to legislation. This is forcing manufacturers at all levels to understand the way their products use power and how their customers use their products, in order to minimise the overall power consumed by those products throughout their operational life.

Today, consumers are often seen as being responsible for a disproportionately small amount of power conservation; that is, domestic power usage may be lower than the power attributable to the industrial sector, but the industrial sector is more aware of energy conservation.

The concepts of energy conservation and developing 'smarter' devices are now beginning to permeate in to the consumer sector and as a result the use of more energy efficient power supplies is growing. RS offers a number of energy efficient power supplies from leading manufacturers, including switched mode power supplies for the delivery of DC voltage levels from AC inputs.

Many of these products are already certified against European legislation; the EuP Directive. While the legislation may be in a state of flux, the essential requirement remains

the same and the deployment of energy-aware and energy-efficient power supplies will continue. By selecting energy efficient solutions, such as those available from RS, OEMs and their customers can contribute in a positive way to the spirit of recent legislation, as well as the law.

Another area where greater efficiency can be introduced is in DC/DC conversion. Often the conversion from one DC level to another is unavoidable in modern electronic devices; the number of power supply levels in a single device can be numerous, and typically all the required supply voltages would stem from a single DC source coming from a switched mode power supply. Being able to generate enough power to drive all the electronic components is the primary requirement for a system level power supply, but when the inefficiencies of DC/DC converters

are factored in it can result in specifying a larger, more powerful power supply – which will inevitably also be more expensive.

The use of energy efficient DC/DC converters, therefore, can save power, cost and space in an end-application. RS now offers a range of energy efficient DC/DC converter products from leading manufacturers including Recom Electronic GmbH, National Semiconductor, International Rectifier and Zetex.

The electronics industry is inherently dependent on power, but through continued innovation and the ambition to deliver greater energy efficiency that dependency is reducing to the benefit of all involved. ○

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Online search term: **ESD grounding**

**PRECISION CLEANING**

RS have a wide variety of products from a variety of manufactures whatever your application.

■ Whether you're looking for contact cleaners, flux removers, reflow oven cleaners or the wipes and swabs to apply it, RS have the products you need.

Online search term: **EEM Cleaning**

**MFR-1110 SOLDERING AND REWORK KIT**

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■ The system incorporates SmartHeat® Technology that precisely delivers the required energy for each connection whilst protecting sensitive components from damage. Its high power output at a fixed temperature provides high throughput.

Online search term: **672-2692**

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Online search term: **rs alkaline batteries**

FLUKE 287 MULTIMETER

True-rms electronics logging multimeter with TrendCapture

■ Quickly documents design performance and graphically displays what happened. Its unique logging and graphing capabilities mean you no longer need to download logged readings to a PC to detect a trend. The Fluke 287 packs more accuracy and convenience into a handheld multimeter than ever before.

Online search term: **156-724**

**LINDSTROM PRECISION TOOLS**

Lindstrom have been developing and producing high precision tools since 1856 and are a recognised name in the electronics industry.

■ Originally thought of for only pliers and cutters they also produce high precision screwdrivers, tweezers, torque drivers as well as a full ergonomic range. Their products are engineered to satisfy customer requirements of better performance and longer life.

Online search term: **Lindstrom**

**CRYDOM SSR MODULES**

Ready to use SSR modules with a choice of AC or DC load switching

■ The experts in solid-state have introduced a new range of slimline SSR modules that offer a choice of control voltages and instantaneous or zero-cross switching. Ratings available up to 10A, and all modules can fit either TS35 and TS32 DIN rail.

Online search term: **Crydom DRA1***

**2.8" TFT PROGRAMMABLE DISPLAY**

A low cost full colour programmable panel meter with analogue & I²C interfaces

■ The SGD-28M gives the electronic design a choice of metering display formats and colours, with fully adjustable input scaling. With a wide supply range of 4-30Vdc, and a dual analogue input of 0-40Vdc its suitable for many metering applications where a simple LED display just doesn't do enough.

Online search term: **704-8131**

Fibre-Optic

Choices for Today's Energy Challenges

By Mike Caddy, RS Components

Rising fuel prices, increasing use of green energy, and demands for greater safety and comfort are key factors challenging engineers to optimise management of motors and generators in applications such as railway engines and wind turbines.

Sophisticated data acquisition and control electronics must communicate reliably; often over long distances and amid hazards such as high voltages, high levels of electromagnetic interference (EMI) and harsh electrostatic discharge (ESD).

Optical fibre provides an ideal medium for reliable data links, delivering the benefits of high galvanic isolation from high-voltage circuitry, immunity to EMI and ESD, and long transmission range. This article reviews two specific applications: in wind turbines and in the rail industry, to demonstrate the general point.

Maximising Wind Power Quality

In a wind turbine, industrial fibre products covering a wide range of data rates and link lengths are used within the turbine-control unit, power-conversion stages, condition-monitoring equipment, and longer-range connections to the wind farm's control centre.

For power conversion, producing clean grid-quality electricity from the noisy, intermittent raw generator output, control signals for key functional blocks such as the rectifier and inverter are usually managed by a DSP-embedded controller via a

fibre is preferred for its high voltage and current isolation compared to optocouplers or similar components.

In the nacelle of the wind turbine, short-distance fibre-optic links can utilise Plastic Optical Fibre (POF) with optical transmitters and receivers such as Avago Technologies' HFBR-0500Z. Snap-in, latching, and screw-in terminations are available, permitting fast and efficient installation, maintenance or repair in the field.

Where higher levels of ESD and EMI protection are required, Avago's HFBR-0506AMZ series with metallised packaging provides enhanced shielding. The SMA-styled connector also withstands vibration and mechanical shocks.

For networking applications in wind farms, the short-distance POF links are typically multiplexed into Hard-Clad Silica (HCS) or multi-mode fibre supporting greater bandwidth and link distances. If the turbine tower is more than 100m tall, using optical fibre as the vertical interconnect also delivers a valuable weight saving compared to copper cabling. Transmitters and receivers such as the Avago HF BR-0400Z series operate over HCS or

subsystems such as braking, door control, air conditioning, passenger information and lighting. Fibre is also used for sending and receiving monitoring signals for voltage and current protection at DC links and converters.

Communication between the train's central computer and the braking, door control and comfort subsystems typically uses the international IEC 61375 Train Communication Network (TCN) standard. In general, the TCN defines a Wire Train Bus (WTB) for connecting vehicles, and a Multifunction Vehicles Bus (MVB) to connect equipment in a vehicle or group of vehicles. MVB specifies three media types, including RS-485, transformer-coupled twisted wire pairs, and optical fibre. Optical fibre is often preferred for its high immunity to the electrical noise in the locomotive environment.

When MVB is implemented with optical fibre, a star coupler is used to restore the signal quality for connecting up to 4095 devices in one bus. The Avago HFBR-1412Z transmitter and HFBR-2412Z receiver can easily handle the fixed MVB data rate of 1.5 Mbps.

Conclusion

As demand increases for precision management of power-conversion, control and safety systems, optical connectivity is preferred in unfriendly industrial environments where high signal integrity and ruggedness are critical.

Avago Technologies has developed several families of fibre-optic transmitters, receivers, and transceivers for monitoring systems and networking applications in numerous power generation, transportation and industrial applications. 

“Optical fibre provides an ideal medium for reliable data links, delivering the benefits of high galvanic isolation from high-voltage circuitry, immunity to EMI and ESD, and long transmission range.”

fibre-optic link. This maintains efficient and reliable control with high galvanic isolation.

Condition monitoring is also important, using atmospheric sensors to detect wind speed and direction as well as various additional sensors monitoring the turbine's mechanical components to avoid run-to-failure. The monitoring system must provide high voltage and current isolation to be able to operate reliably during atmospheric disturbances such as lightning. Here, optical

multi-mode fibre and are commonly used in wind turbine towers and over long distance wind farm networks.

Managing Mass Transportation

POF, HCS or multi-mode fibre data links are also used in the rail industry, to control power semiconductors such as IGBTs used in the converters feeding electrical traction motors and the train's electrical system. These links are also used to manage communication with safety and comfort

Go to www.rs-components.com and search “Avago Optical Fibre” to view the latest new fibre optic devices.



“ We have succeeded in massively reducing the compute overhead for performing moving-object detection... ”

Detecting motion

with a moving camera

By Lamine Lemmou and Naim Dahnoun
School of Electronics, University of Bristol

Video surveillance has become a major part of our lives. Low-cost camera technology has made it possible to deploy video surveillance for a wide range of applications, from monitoring secure areas to traffic-law enforcement. The most important task in automated video surveillance systems to monitor the video channels for moving objects that may represent intruders or vehicles on the road that need to be registered and logged.

Algorithms exist to distinguish moving foreground objects from a static background. But these techniques cannot cope with panning or tilting cameras that are used to monitor a much wider field of view than a fixed camera. Various methods of moving object detection for non-static camera have been proposed but none of them achieved real-time performance.

We have developed an approach that compensates for the motion of a camera and optimises it for real-time performance on low-cost embedded hardware. One

well-known technique detecting a moving foreground object with a panning camera is to build a static mosaic image from a series of frames. It works well when the camera motion is very slow and where the target object motion is likely to be higher. The differences between each individual image should be very low.

To build the composite picture, the image is first divided into blocks measuring 64x64pixel. Phase correlation using fast Fourier transforms (FFT) is used to calculate a motion vector. The disadvantage of this approach is the huge

computational complexity, because of the demands of the FFT, making it unsuitable for real-time applications.

A further disadvantage is that the technique only compensates for panning motion, not tilting. However, it can tolerate some camera vibrations in the vertical direction. A second approach is to build up a database of background objects and reference frames which can then be compared with incoming

Continued page 38 >

images. This Minimum Camera Parameter Settings (MCPS) technique, however, can only be used in a fixed environment. Our approach uses the fact that almost 80 per cent of the information in images is common to two successive frames to help construct a motion-corrected image. With panning and tilting, the bulk of the pixels will simply be translated horizontally or vertically. So, we use 2D correlation techniques to find the translation coordinates between two successive frames. However, there are a number of tradeoffs that can be made to optimise for algorithm performance or to reduce compute time. It is not necessary to perform a correlation across entire frames. One way to reduce the amount of data needed for correlation is to split the images into four sub-frames and then take a mask, measuring 120x120 in our tests, from the centre of each one. The result of the correlations is a set of displacement coordinates. However, these displacements will not be entirely accurate so a 2D correlation between the corrected frame and its neighbour for each sub-frame is used to obtain the best correlation result.

It is possible to reduce the computation time by reducing the square mask to a 60pixel line and for the second correlation using a mask of just 120x120pixel taken from the centre of the corrected image. This second method greatly reduces the amount of data that needs to be transferred between external memory and the processor's internal memory.

A third method attempts to reduce overhead even further by taking a 520pixel line from one image and then correlating that with a 120x520pixel block from the following frame centred on the position of the chosen line. Initially, the line is placed roughly in the centre of the image – we avoid the exact centre to avoid accuracy problems caused by fixed-point processing. However, we need to ensure that the line does not contain any pixels from a moving, foreground object. If a check finds that is the case, the position of the line is changed randomly within a range of 60 pixels in any direction.

The second method provides very similar results to the first but cuts execution time almost ten-fold. The third method cuts execution time by a further 40 per cent but the quality of detection degrades. The process of aligning images makes it possible to perform moving object detection using techniques developed for static cameras. Several approaches exist for resolving the problem of object detection with static background.



The simplest approach is to subtract one image from the other and using a threshold function to work out whether each pixel is a foreground or background object. The problem with this simple approach is that the results depend heavily on the choice of threshold value.

By using an adaptive Gaussian mixture model it is possible to compensate for the variation of each pixel in the image over time. Each Gaussian has a mean and variance value and is weighted according to its probability – each curve is conceptually linked to a source of variation, such as changes in illumination. The Gaussian mixture model approach is based on the assumption that each background pixel is a member of one of these distributions. The algorithm determines how likely a pixel is to belong to the background rather than the foreground. Thresholding results tend to improve with the number of Gaussians used but for video surveillance, three are generally enough.

“ Several approaches exist for resolving the problem of object detection ”

There are also predictive techniques that use temporal colour variations in each pixel of the video. Some use Bayesian update mechanisms to cope with changes in the scene such as varying illumination levels.

For the final implementation, however, we opted for the frame difference approach using a fixed threshold because of its lower

complexity compared with the technique that employs a Gaussian mixture model.

To implement the algorithm, we used a Texas Instrument TMS320DM643x digital signal processor (DSP). By using the company's evaluation module, we were able to minimise the amount of external hardware to a video I/O module and some external memory.

We spent a considerable amount of time on memory management so that image lines could be transferred efficiently from external to internal memory. We settled on a combination of direct memory access, making use of the DSP's enhanced DMA (EDMA) unit, and double-buffering to minimise processor load. Processing for the production of the position-corrected frames is performed line by line. Each time we load two lines, one for each buffer. While buffer one is being processed, buffer two is getting data from the external memory using the EDMA.

However, the full frames are needed for the stage that detects moving foreground objects, so we need to save the incoming frame in external memory. It makes sense to initiate the transfers during the frame's alignment and matching stage, just after using the DMA to load the current frame line in the internal buffers. This is to avoid loading the buffers twice. This can be achieved in 7.19 ms with a processor running at 700MHz. Executing the optimised algorithms, the DM6437 can sustain a performance of 28 frames per second, meeting its real-time constraints and allowing more algorithms to be integrated if needed. We have succeeded in massively reducing the compute overhead for performing moving-object detection in automated video surveillance systems that use panning and tilting cameras, making it possible to run the algorithms in real time on low-cost embedded hardware. **o**

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WIN

a Polaroid PoGo 2 5MP Instant Digital Camera with our killer sudoku

How to play:
As with standard sudoku, every row and column and 3 x 3 square must contain the numbers 1 through 9 exactly once.

The grid is composed of shapes with a dotted outline. At the top of each shape is a number, this signifies the sum of the cell. For example; if there is a shape composed of two cells with a '3' in the corner, the total of those cells is '3'. From that you can tell that the values of the cells must be '1' and '2' or '2' and '1'.

It is not permitted to repeat a number in a shape. If you have a sum of 8 across three cells, this cannot be '2', '4', '2' as the '2' is then repeated in the shape.

No numbers are placed in the grid to start with, unlike in normal sudoku; however you can work out every number with no guesswork but applying logic alone to reach the unique solution for each puzzle.



8		17			39			
15		11	15					8
	18				45		11	
		17	11					12
11					9	9		
	10						20	
7				22		9		20
	42							
				8			11	

Name: _____

Job Title: _____

Ship-To-Number: _____

Tel: _____

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Send your completed Sudoku to:
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How efficient are your answers?

- 1 Do Visible LEDs have a higher or lower luminous efficacy than incandescent or fluorescent bulbs ?

a. _____
- 2 Crystalline Silicon Wafers have a negative correlation with temperature. What is the decline in efficiency. 0.05, 0.50, 2.5, 5.0 %/°C.?

a. _____
- 3 How much water on average does an automatic washing machine use on one wash. Assuming no "smart energy" use. (to the nearest 10 gallons)

a. _____

- 4 One of the uses for Hydrogen fuel cells are in a ZEV. What does ZEV stand for?

a. _____
- 5 Name 3 sources of energy scavenging that may be used in energy harvesting applications.

a. _____
- 6 What is the efficiency of inverter style variable speed electronic motors, over traditional mechanical motors?

a. _____

- 7 If high efficient motors replaced all applications in Europe for pump, fan and compressed air supplies. What would the reductions in CO2 emissions be? (0.8 , 8, 80, 800 million tonnes)

a. _____
- 8 One way of saving energy using digital control is with PWM. What does this stand for and how does it save energy.

a. _____

- 9 Power line modems are an efficient way of communicating data over large distances. What does S-FSK and OFDM stand for.

a. _____
- 10 Lighting controls that can be controlled remotely in buildings are expected to reduce lighting energy by how much 20,30,60 or 80%?

a. _____

Using the rays of the sun to convert sea - to drinking water

Worldwide, more and more people are obtaining their drinking water either from the sea or from increasingly salty inland sources. Analysts at Global Water Intelligence, an industry service, estimate that in 2008, desalination facilities around the world produced nearly 52 million cubic meters (12 billion gallons) of water each day - the equivalent of four or five times the daily production of water in Germany. This amount is expected to more than double by the year 2016.

The bulk of this amount is attributable to the Arab countries around the Persian Gulf. Spain ranks fourth worldwide. Other European countries are increasingly turning to desalination as well, including France, Greece and Italy. The goal: To secure the water supply for islands, settlements or entire cities, to supply water to tourist resorts, or to irrigate farmland. While most of the large desalination plants are fueled by oil or gas, smaller and medium-sized plants can run partly or even entirely on renewable energies.

"Often, the people in charge aren't even aware of the opportunities they have here. They also don't know how reliable and efficient solar-powered desalination plants, or wind-powered and perhaps some day tidal-energy-driven plants, work," regrets Marcel Wieghaus of the Fraunhofer Institute for Solar Energy Systems ISE in Freiburg, Germany.

The European "ProDes" initiative, of which ISE is a member, intends to change that. Its goal is to provide outreach while bringing all participants together to promote use of renewable energies for water desalination: "ProDes" stands for "Promotion of Renewable Energy for Water Production through Desalination."

The initiative has established an array of processes for desalinating seawater and brackish water. Most major European desalination plants rely on reverse osmosis: High pressure and semi-permeable membrane separate water from salt and unwanted organic constituents. Plants run on conventional energy forms can deliver up to around 400,000 cubic meters (91 million gallons)



Fraunhofer ISE intends to contribute to the development of solar-powered water desalination plants such as the one shown here, in Gran Canaria. (© Fraunhofer ISE)

of drinking water each day. When it comes to desalination plants run on renewable energies, the spectrum ranges from simple solar distillation plants with a capacity of a few litres a day to wind-powered reverse-osmosis plants capable of desalinating up to nearly 2,000 cubic meters (half a million gallons).

Not every plant is suited to every location, however. The best technology for the task depends on the salinity of untreated water, the local infrastructure and the quantity of water required. "The more remote the location, the more worthwhile and profitable it is to use plant systems run on renewable energy and to set up a water treatment operation that is not dependent on an external energy supply," Wieghaus observes. 

“Often, the people in charge aren't even aware of the opportunities they have here...”

**Marcel Wieghaus
Fraunhofer Institute for Solar Energy
Systems ISE in Freiburg, Germany**



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