FTM

FUTURE TECHNOLOGY MAGAZINE

FUTURE ELECTRONICS

19-viii **AMERICAS**

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Arm® Cortex®-M-based microcontroller family offers high security and software flexibility

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Chip makers' latest design tools for machine learning

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Broad new family of Arm Cortex-M-based microcontrollers offers high security and software flexibility

RENESAS
BIG IDEAS FOR EVERY SPACE

The Renesas RA family is a new range of 32-bit MCUs which is based on the Arm® Cortex®-M core architecture, and which benefits from Renesas' best-in-class technology for embedded system peripherals.

The RA family includes the RA2, RA4 and RA6 series, giving users a wide choice of performance ratings and features. Designers using the Renesas RA family can meet the requirements for scalability, power consumption and performance of almost any embedded end product.

The launch of the RA family offers a new option for designers working in an Arm Cortex-M environment, and who want to retain existing software assets. It is an alternative to the Renesas Synergy™ family of MCUs, which includes parts based on various Arm Cortex-M cores. These parts enable re-use of software created in the Synergy environment when migrating from one MCU to another, to reduce PCB layout effort and increase manufacturing efficiency.

Now the addition of the RA MCU family gives designers a Renesas option which offers the flexibility to use existing and legacy software for the Arm Cortex-M architecture.

There is broad feature and pin compatibility across the three series of RA MCUs. This provides scalability and easy code re-use between one device and another. The RA family includes:

- RA2A1, offering highly integrated, high-accuracy analog capabilities and an Arm Cortex-M23 core
- RA4M1, for control applications which drive a segment LCD panel. It offers low-power operation and high performance thanks to its Arm Cortex-M4 core
- RA6M1, ideal for IoT endpoint devices because of its high-level security features
- RA6M2, suitable for automation applications. Upward-compatible with RA6M1 devices.
- RA6M3, offering the highest performance specifications in the family, with the largest memory options and a rich feature set including TFT LCD controller, 2D graphics engine, Ethernet connectivity and Hi-Speed USB. Like the other RA6 devices, the RA6M3 is based on an Arm Cortex-M4 core.

The RA family MCUs include an integrated capacitive touch-sensing unit for display control.

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APPLICATIONS

- Home and building automation
- Industrial automation
- Energy management systems
- Healthcare equipment
- Industrial IoT devices

FEATURES

- Supported by open Flexible Software Package (FSP)
  - Based on FreeRTOS
  - Can be replaced by any other RTOS or middleware
- IDE support:
  - Renesas e²studio
  - KEIL MDK
- Supports GNU Arm Compiler version 6
- Cryptography module
- True random number generator

FTM DEVELOPMENT BOARDS

Orderable Part Numbers: RTK7EKA2A1S00001BU RTK7EKA4M1S00001BU, RTK7EKA6M1S00001BU RTK7EKA6M2S00001BU, RTK7EKA6M3S00001BU

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AC-DC converter ICs' low standby current ideal for always-on appliances

DIODES INCORPORATED

Diodes Incorporated has announced the AP3917 family of non-isolated AC-DC switching buck converters for low-power applications powered by a mains electricity outlet.

The AP3917 family consists of the AP3917B, rated for a 170mA nominal load, AP3917C for a 270mA load and the AP3917D, which has a 370mA rating.

AP3917: High conversion efficiency

The small AP3917 parts offer direct, non-isolated AC-DC conversion at high efficiency, while drawing a low standby current. These attributes are in increasing demand due to the proliferation of small, mains-powered appliances operating as either stand-alone devices or as IoT endpoints. Offering high conversion efficiency both at full and light loads, the AP3917 parts support both discontinuous and continuous conduction modes.

The AP3917 buck switcher can convert a full-wave rectified AC input voltage of between 85V and 265V AC to a nominal 8.0V DC output. Its non-isolated design requires no external transformer and few external components, saving space and bill-of-materials cost.

Featuring no-load power consumption of <30mW, the AP3917 buck switchers are particularly suitable for small appliances which operate in standby mode for prolonged periods when connected to an AC outlet.

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APPLICATIONS

- Home appliances
- Office equipment
- Industrial devices
- IoT devices

FEATURES

- 200µA operating current
- 2W power rating
- Frequency modulation to suppress EMI
- Over-temperature protection
- Overload protection
- Short-circuit protection

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15Mbits/s optocouplers offer high noise tolerance for use in industrial applications

RENESAS
BIG IDEAS FOR EVERY SPACE

The Renesas RV1S9x60 family of optocouplers supports data-transfer rates of up to 15Mbits/s and offers high noise tolerance.

The RV1S9x60 devices operate at a low threshold input current, just 2.0mA in the case of the RV1S9160A, from a 3V to 5V power supply, to give low power consumption. Featuring a minimum common-mode ratio of 50kV/µs, these optocouplers are suitable for use in electrically noisy industrial environments, where they may be used to isolate sensitive components such as microcontrollers from high transient voltages while enabling the high-speed transmission of input signals.

Two of the parts, the RV1S9160A and RV1S9060A, also support operation in high ambient temperatures up to 125°C in a logic interface circuit, giving the board designer the freedom to place the optocoupler close to hot components such as IGBTs or MOSFETs.

There are three parts in this Renesas optocoupler family. The smallest, the RV1S9160A, is housed in a 5-pin SOP package, and offers 200V of basic insulation. Slightly bigger, the RV1S9060A in an LSO5 package gives increased creepage of 8mm and 200V/400V of reinforced insulation.

The largest part is the RV1S9960A in an LSDIP package. This gives 14.5mm of creepage and 690V of reinforced insulation in an inverter, or 1,000V of basic insulation in a solar power conditioner.

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APPLICATIONS

- Power inverters
- AC servo motor controls
- Programmable logic controllers
- Robot arm controllers
- Renewable energy generators
- Battery management systems

FEATURES

- 60ns maximum propagation delay time
- 25ns maximum propagation delay skew
- 20ns maximum pulse-width distortion
- 2.0mA maximum supply current
- Isolation voltage:
  - 5kV$_{rms}$ for the RV1S9060A
  - 3.75kV$_{rms}$ for the RV1S9160A
  - 7.5kV$_{rms}$ for the RV1S9960A
- UL, CSA, VDE approvals

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New module integrates low-profile reflective object sensor in complete PCB assembly

TT Electronics

TT Electronics has launched the versatile OPB9001, a complete reflective sensor module for industrial and medical applications.

The module integrates the OPB9000 reflective sensor alongside peripheral circuitry such as resistors, regulators and capacitors in a robust PCB assembly measuring 18mm x 12mm x 5mm.

The sensor can detect objects as far away as 50mm using standard 90% reflective material, and objects as small as 2.5mm depending on the range.

OPB9001: Detection range up to 50mm

The OPB9001 can also be programmed to measure distances within its reflective range. It rejects interference from ambient light at intensity up to 25,000lux.

The OPB9001 accepts a wide supply-voltage range from 3.3V to 30V, and is supplied with built-in over-voltage protection. An integrated, industry-standard four-pin Molex connector provides for easy connections, while on-board LED indicators indicate the module's status during power-on, output and calibration.

Factory calibrated for a 12mm distance and a white reflective surface, the OPB9001 can be re-calibrated in milliseconds with a single command to meet different requirements. An interface cable can be purchased separately to calibrate the OPB9001 using the OPB9000-KIT.

FTM DEVELOPMENT BOARD

Orderable Part Number: OPB9000-KIT

Available at FutureElectronics.com

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APPLICATIONS

- Industrial printing and high-speed paper detection
- Factory automation
- Automated sewing machines
- Automated banking machines
- Portable medical equipment
- Dispensing equipment
- Medical diagnostic equipment
- Materials handling
- Asset tracking

FEATURES

- 30V maximum output signal
- Integrated drive circuitry
- 8kV ESD protection
- Programmable output configuration and sensitivity level
- Operating-temperature range: -40°C to 85°C
- UL recognized
- CE approval

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New straddle-mount connectors for faceplate-pluggable OCP NIC 3.0 cards

TE Connectivity (TE) has introduced its Sliver straddle-mount connectors, the new standard form factor supporting a faceplate-pluggable Open Compute Project (OCP) NIC 3.0 card.

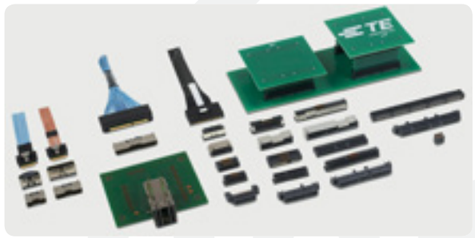
The OCP NIC 3.0 card is one of the formats supported by the SFF-TA-1002 standard. OCP NIC 3.0 cards are horizontal and faceplate-pluggable, which helps to increase airflow through the enclosure and eases system design. The new Sliver connectors for OCP NIC 3.0 cards have a low profile for ease of system maintenance and improved thermal management.

The new Sliver straddle-mount connectors for SFF-TA-1002 cards support high signal-transmission rates for communications protocols up to PCIe Gen 5. They also offer a roadmap for data rates up to 112Gbits/s.

SFF-TA-1002 is a proposed alternative to, or replacement for, many form factors, including M.2, U.2 and PCIe. The high-density 0.6mm pitch of the Sliver straddle-mount connectors also supports next-gen silicon PCIe lane counts.

With a proven 0.6mm contact pitch, Sliver products offer high density, allowing OEMs to fit more units inside an enclosure while maintaining easy routing. The contact lead-frames are highly modular to provide an increased number of lanes in a connector.

TE provides a robust metal housing on the cable connector with an active latch in the plug, providing additional connection security. This new technology simplifies design and helps lower costs by eliminating the need for re-timers and more costly low-loss PCB materials.



TE's Sliver: Robust metal housing on the cable connector

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APPLICATIONS

- Networking equipment
- Switches
- Routers
- Servers
- Storage devices
- High-Performance Computing (HPC)
- Wireless base transmitter stations

FEATURES

- Vertical, right-angle and card-edge configurations with active latch
- Supports 85Ω and 100Ω impedance values
- Flexible pin-out allows for mix of differential signal pairs and low-speed single-ended sidebands
- Flexible mounting and mating arrangements:
  - Cabled interconnects
  - Card-edge interconnects
- Receptacle-to-plug mating configurations:
  - Vertical to right-angle
  - Vertical to straight
  - Right-angle to right-angle
  - Right-angle to straight

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Quartz crystal oscillators operate from a wide supply-voltage range

The MultiVolt™ series of 32.768kHz oscillators, MHz oscillators and temperature-compensated oscillators (TCXOs) from ECS Inc operate over a wide voltage range of 1.6V to 3.6V DC.

Part Number	Minimum Frequency	Maximum Frequency	Size (mm)	Voltage Range	Operating-Temp. Range	Stability
32.768kHz Oscillators						
ECS-327MV	32.768kHz	32.768kHz	1.6 x 1.2 x 0.7	1.6V to 3.6V	-40°C to 85°C	±25ppm
ECS-327MVATX	32.768kHz	32.768kHz	2.0 x 1.6 x 0.9 2.5 x 2.0 x 1.0 3.2 x 2.5 x 1.2 5.0 x 3.2 x 1.3 7.0 x 5.0 x 1.4	1.6V to 3.6V	-40°C to 85°C	±25ppm
ECS-327ATQMV	32.768kHz	32.768kHz	3.2 x 2.5 x 0.9	1.62V to 3.63V	-40°C to 125°C	±100ppm
MHz Oscillators						
ECS-1612MV	3.000MHz	80.000MHz	1.6 x 1.2 x 0.7	1.6V to 3.6V	-20°C to 70°C -40°C to 85°C	±30ppm ±25ppm
ECS-2016MV	1.500MHz	54.000MHz	2.0 x 1.6 x 0.85	1.6V to 3.6V	-40°C to 85°C -40°C to 85°C	±25ppm ±50ppm
ECS-2520MV	0.750MHz	60.000MHz	2.5 x 2.0 x 0.8	1.6V to 3.6V	-40°C to 85°C -40°C to 85°C	±25ppm ±50ppm
ECS-3225MV	6.000MHz	50.000MHz	3.2 x 2.5 x 1.0	1.6V to 3.6V	-40°C to 85°C -40°C to 85°C	±25ppm ±50ppm
ECS-5032MV	0.750MHz	160.000MHz	5.0 x 3.2 x 1.3	1.6V to 3.6V	-20°C to 70°C -40°C to 85°C -40°C to 85°C	±50ppm ±25ppm ±50ppm
Tight Stability Oscillators						
ECS-2520SMV	8.000MHz	60.000MHz	2.5 x 2.0 x 0.8	1.62V to 3.63V	-40°C to 105°C -40°C to 105°C	±5ppm ±10ppm
ECS-3225SMV	8.000MHz	60.000MHz	3.2 x 2.5 x 1.2	1.62V to 3.63V	-40°C to 105°C -40°C to 105°C	±5ppm ±10ppm
TCXO						
ECS-TXO-3225MV	8.000MHz	60.000MHz	3.2 x 2.5 x 1.2	1.62V to 3.63V	-40°C to 85°C	±2.5ppm

They are supplied in industry-standard packages, and enable designers to build multiple product platforms with a single timing device.

Today's quartz-based oscillators offer better overall performance than the equivalent MEMS timing devices. The ECS MultiVolt products feature better jitter, phase noise and operating current, and at a lower unit cost.

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APPLICATIONS

- Portable and wearable devices
- IoT devices
- Handheld radios
- Video equipment
- Medical devices
- Navigation equipment

FEATURES

- HCMOS output
- Compatible with 1.8V, 2.5V or 3.3V power supply
- <1ps jitter
- Low operating current

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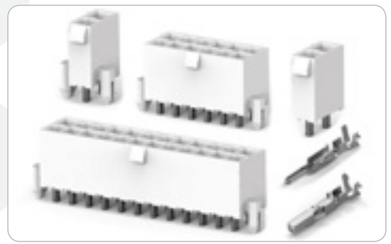
Popular connector line extended to provide new 13A current rating

TE Connectivity (TE) has introduced an extension to its VAL-U-LOK connector product line, adding new parts which offer a higher 13A maximum current capability on a 4.2mm centerline spacing. Earlier VAL-U-LOK connectors have a 9A rating.

These VAL-U-LOK connectors are also available in a new vertical header style which provides from two to 24 positions, and in a choice of UL 94 V-0 or Glow Wire test/UL94 V-2 or V-0 material.

The new high-current vertical headers are available with or without polarization pegs, and with or without drain holes. The new headers mate with existing UL 94 V-0 flammability and Glow Wire test housings populated with new high-conductivity socket terminals offered in 16 AWG and 18-22 AWG sizes. In addition, the new products use the same application tooling as the legacy 9A-rated contacts, allowing for backward compatibility.

The high-current pin and socket contacts are also designed for use in housings suitable for wire-to-wire applications.



VAL-U-LOK: 4.3mm centerline spacing

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APPLICATIONS

- Household appliances
- Industrial machinery
- Automotive systems
- Medical devices
- Vending machines
- Gaming equipment
- HVAC equipment
- Indoor and outdoor lighting
- Security systems
- Storage and networking systems

FEATURES

- Vertical and right-angle pin headers available
- Contacts available in strip form or loose pieces
- UL recognized
- CSA certified

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Compact wire-to-board connectors offer high current rating in industry-standard footprint

TE Connectivity's (TE) ELCON Micro wire-to-board power connectors provide a high current of 12.5A per pin in the common industry footprint of 3.0mm.

This high current density in a compact design is useful in various types of data networking equipment, as well as many other types of end product. A common industry footprint also allows for easy upgrades to existing designs.

The ELCON Micro connectors support configurations consisting of two up to 24 pins, and handle various current values, accommodating multiple combinations of different wire sizes.

The connectors offer easy assembly with fool-proof mating. They perform reliably in harsh environments, and feature a maximum operating temperature of 105°C.

Low maximum contact resistance of 5mΩ results in a low temperature rise and lower power loss at the connector.

New cable plugs and custom cable assemblies provide added design flexibility.

ELCON Micro: 5mΩ maximum contact resistance

New wire-to-board solutions

Part Number	Description	Number of Positions
1-2204749-8	Receptacle, tin contacts	–
2204748-2	Receptacle housing	4
2204748-4	Receptacle housing	8
2204748-8	Receptacle housing	16
2354149-1	Cable assembly	2x6
2354173-1	Cable assembly	2x8
2354120-1	Cable assembly	2x4

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APPLICATIONS

- Servers
- Switches and routers
- Power supplies and power distribution
- Gaming machines
- Printers
- Security systems
- Dryers
- Refrigerators
- Test and measurement equipment
- Diagnostic equipment
- Patient monitors

FEATURES

- 600V maximum voltage
- Operating-temperature range: -40°C to 105°C
- 8.0N maximum mating force per circuit
- Copper alloy contacts with tin plating

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Screw-terminal capacitors offer 10% higher energy density

Vishay Intertechnology's new 501 PGM-ST series screw-terminal aluminum capacitors provide 10% higher capacitance and 10% better ripple-current handling for a given can size than its previous generation of devices.

The 501 PGM-ST parts are polarized aluminum electrolytic capacitors with a non-solid electrolyte. They are ideally suited to applications that demand a high energy-storage capacity in a small form factor.

The series includes capacitors with a 500V rating, which provides a generous voltage headroom in products such as electric motors, uninterruptible power supplies and solar inverters. The use of the 501 PGM-ST capacitors enables solar inverters to be easily upgraded to handle a 1,000V maximum input.

In addition, design engineers can use a 501 PGM-ST part to re-use a three-phase, 380V design in a 480V system simply by upgrading the DC-link capacitor.

These high-capacitance parts are packaged in a cylindrical aluminum case insulated with a blue sleeve. Pressure relief is built into the sealing disc. They are available in case sizes from 50mm diameter x 80mm length to 90mm x 195mm.

501 PGM-ST: Built-in pressure relief for safe operation

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APPLICATIONS

- Motor drives
- HVAC equipment
- Welding equipment
- Solar inverters
- Uninterruptible power supplies
- X-ray equipment
- Microgrid interfaces
- Wind turbines
- Scientific test equipment

FEATURES

- Rated voltages of 400V, 450V and 500V
- Capacitance values from 1,000µF to 18,000µF
- Ripple-current ratings: 5.49A to 30.2A
- Operating-temperature range: -40°C to 85°C
- 5,000 hours useful life at 85°C

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New locking flexible printed circuit connectors feature high retention force

New 0.5mm locking Flexible Printed Circuit (FPC) connectors from TE Connectivity (TE) offer secure retention to prevent accidental de-mating when used in rugged environments.

The design of these FPC connectors, which have the part numbers 2041215-1 and 4-2041215-0, ensures their locking tabs remain in the retention cavity, resulting in a minimum 24N total unmating force. A robust actuator provides stronger retention of mated contacts, helping prevent breakage during assembly. The front-flip actuator allows the operator to ensure that the FPC cable is inserted correctly.

A Zero Insertion Force (ZIF) design results in less wear on the FPC contacts, and enables the connector to sustain a higher number of mating cycles.

In addition, the locking FPC connector requires no tooling for mating and unmating, simplifying installation and lowering overall cost.

TE's FPC connectors: Zero insertion force design

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APPLICATIONS

- Displays
- Tablets
- Wearable devices
- Cameras
- Inkjet, laser and 3D printers
- Copiers
- PCs
- Mobile phones
- Satellite navigation devices
- Set-top boxes
- Disk drives
- Medical equipment
- Automotive infotainment systems

FEATURES

- 0.5mm centerline spacing
- 0.5A current rating
- 250V AC voltage rating
- 500mΩ minimum insulation resistance at 100V DC
- 35mΩ maximum contact resistance
- 150V AC dielectric withstanding voltage

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Dual-Mode Choke Addresses Differential and Common Mode Noise

By: Lazaro Rodriguez, Standard Product Engineering Manager, Triad Magnetics

Circuit designers must deal with many types of noise: internal, external, RF, line frequency and more. Noise can be a limiting factor in system performance and so must be addressed and minimized.
The challenge is, 'at what effort and cost?'

Even the ubiquitous switched-mode power supply (SMPS) has noise issues. Due to its efficiency and small size, this device is used in applications including LED drivers and electronic ballasts, etc. Unfortunately, SMPS units also are subject to Differential Mode (DM) noise and Common Mode (CM) noise, both of which must be suppressed.

Noise Mechanisms and Solutions

Differential mode and common mode noise have different causes and thus different solutions. Differential mode noise is noise that is conducted on the line and neutral in opposite directions, as shown in Figure 1. Common mode noise is conducted on the line and neutral in the same direction returning through ground, also Figure 1.

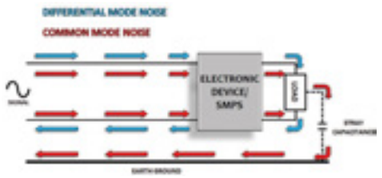

Fig. 1

The basic DM filter uses a single-winding choke (inductor) inserted in series with the line path, along with a capacitor from line to neutral, thus blocking noise propagation through the system.

Since the DM inductor is in series with the line path, it handles the noise and DC offset current being supplied to load.

Therefore, it must be designed to provide the needed inductance, but do so with low DC resistance to handle the RMS current and peak line current without saturating, as shown in Figure 2.

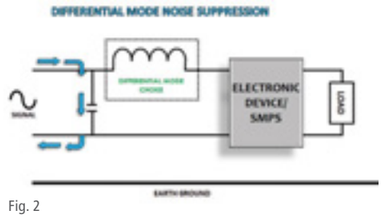

Fig. 2

The basic CM filter uses a dual-winding inductor in both the line and neutral paths, plus a capacitor from line to ground, as shown in Figure 3.

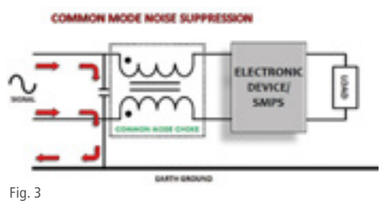

Fig. 3

Since the line and neutral currents pass through the CM windings in opposite directions, there is no net magnetic flux and therefore no possibility of saturating the CM choke. The CM filter choke only needs to have the required inductance along with sufficiently low DCR for the RMS current.

A Better Idea from Triad Magnetics

Since the DM and CM noise mechanisms are largely unrelated, their solutions require two different chokes. It would be fortunate if the two noise-suppressing approaches could be implemented by one choke – saving space, simplifying the Bill of Materials (BOM) and reducing cost.

Fortunately, a new solution from Triad Magnetics combines both chokes into a dual-function, open-frame design that provides the features of both chokes in a single, smaller, more cost-effective package. CMF Series Dual Mode Chokes, as shown in Figure 4, are more than a simplistic co-packaging of two distinct devices into a single component. Instead, their design enhances the electrical performance, while yielding savings in size and cost.

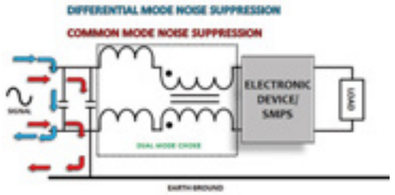

Fig. 4

There are 21 CMF models with current ratings from 0.45 to 2.3A; inductances from 10 to 100mH; stray inductances from 200 to 2100mH. DC resistances are 188 to 2930mΩ, depending on model. They are available in horizontal packages (13.5h × 15 × 24.5mm to 14h × 25 × 29mm) and vertical packages (27h × 15 × 29mm) to fit tight clearance situations.

Despite their small size, the creepage and clearance parameter is greater than 3mm and they are rated for 300VAC operation. They are an excellent solution for most designs.

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How new PoE controllers support higher power demands of IoT end-points

ON Semiconductor®

As networks have become larger and more complex, the amount of power needed to support new Internet of Things (IoT) applications, such as connected lighting and closed-circuit security cameras, has risen above the 25W maximum supplied by the first generation of Power-over-Ethernet (PoE) standards.

To match this demand, a new universal standard for PoE, IEEE 802.3bt, was ratified in September 2018 to support power requirements up to 100W. Also referred to as 'PoE++', IEEE 802.3bt is backwards-compatible with the existing standards including IEEE 802.3af and 802.3at, which will remain in use by many existing PoE applications. Another benefit that the new IEEE 802.3bt standard offers is improved smart power budgeting, which enables devices to communicate their power needs.

Now ON Semiconductor has introduced new interface controllers which implement PoE++, to support the higher power demands of new IoT end-points.

The operation of a PoE power supply

PoE technology enables the transfer of power and data over Ethernet cables. The amount of power transferred is managed through the connection between the Power Sourcing Equipment (PSE) and the Powered Device (PD). The PSE can recognize the type and class of PD device, and then ensure it safely receives the appropriate amount of power.

The new IEEE 802.3bt standard adds two new types (3 and 4) and four new classes (5 to 8) of PoE devices, which increases the maximum output power the PSE can provide to 90W. Key to this increase in power is the ability to use all four paired conductors in an Ethernet cable.

With up to 90W of power available, compared to the 30W provided by the earlier IEEE 802.at standard, IEEE 802.3bt can provide both power and connectivity to new applications that would otherwise require a dedicated power source, typically the mains power grid. PoE++ will therefore simplify network topologies and provide a more robust plug-and-play user experience.

The IEEE 802.3bt standard optimizes energy management through a new Autoclass feature, which enables PDs to communicate their specific power needs to the PSE. This in turn allows each PSE to allocate the right amount of power to each PD, maximizing both the available energy and network bandwidth.

During the first class event, Autoclass automatically detects the maximum power draw from the PD and then adjusts the classification current accordingly, in a range from 40mA for Class 4 to 2.5mA for Class 0. It typically performs this classification within 81.5ms. The timing is critical, and the power detection can only be performed by an 802.3bt-qualified PSE.

After system power-up, the PD will draw the maximum power required for operation, as measured by the PSE. Using this measurement, the PSE can determine the exact power needs of the PD and adjust its output accordingly.

New controllers for PoE PD interface

To provide the high-power PoE capability specified in the IEEE 802.3bt standard, ON Semiconductor has developed a new family of compliant solutions, including the NCP1095 and NCP1096 interface controllers. These ICs incorporate all the features needed to implement a PoE interface at the PD, including detection, auto-classification and current limiting.

The NCP1095 controller operates via an external hot-swap FET, while in the case of the NCP1096 this FET is integrated into the chip, as shown in Figure 1. The integrated hot-swap FET in the NCP1096 offers lower on-resistance than that of any other Type 3 or Type 4 PoE controller.

The controllers are complemented by the NCP1566 DC-DC controller, the FDMC8622 single MOSFET, and the FDMQ8203 and FDMQ8205A GreenBridge™ Quad MOSFETs, which provide a more efficient alternative to a diode bridge in PoE applications.

Together, these devices enable the designers to create highly efficient PoE interfaces with up to the standard limit of 90W of power, or up to a proprietary 100W solution if more power is needed in applications such as telecoms equipment or digital signage.

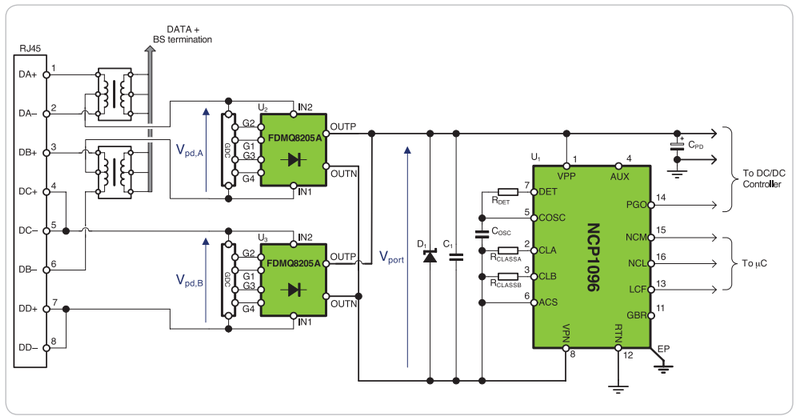

Fig. 1: Typical PoE PD circuit based on the NCP1096 PoE interface controller

ON Semiconductors' NCP1096GEVB evaluation board

FTM DEVELOPMENT BOARD
Orderable Part Number: NCP1096GEVB
Available at FutureElectronics.com

TO BUY PRODUCTS OR DOWNLOAD DATA
FUTUREELECTRONICS.COM/RESOURCES/FTM

IPMs provide high thermal and electrical performance in motor or inverter power stage

Infineon's energy-efficient CIPOS™ Mini Intelligent Power Modules (IPMs) integrate the power and control components of an inverter, motor or Power Factor Correction (PFC) power stage in a single package, enabling designers to achieve higher reliability and to optimize PCB size and system cost.

CIPOS Mini inverter can efficiently drive AC unit's fan

The high level of integration in a CIPOS™ Mini IPM simplifies the design of power systems and markedly shortens time to market. These IPMs may be used to control AC motors in variable-speed drives consuming up to 3kW.

The CIPOS Mini package, a fully isolated dual in-line molded module with Direct Copper Bonding (DCB) offers good thermal conductivity and high electrical isolation. The IPMs are also notable for their high immunity to EMI. Circuit protection is well catered for, and includes an accessible Fault pin and overload protection.

The CIPOS Mini IPM power stage is implemented with either:

- Infineon's reverse-conducting IGBTs, which offer low saturation voltage and an optimal anti-parallel diode for better EMI performance
- TRENCHSTOP™ IGBTs, which feature a low saturation voltage
- Or high-efficiency CoolMOS™ power MOSFETs

They are controlled by a new, optimized Infineon silicon-on-insulator gate driver for excellent electrical performance, including stability in the presence of transient or negative voltages.

Product	Package	Rated Voltage	Configuration	Switch Type	Rated Current
IFCM20T65GD	DIP 36x21D	650V	Two-phase interleaved PFC	IGBT	20A
IFCM20U65GD	DIP 36x21D	650V	Three-phase interleaved PFC	IGBT	20A
IFCM30T65GD	DIP 36x21D	650V	Two-phase interleaved PFC	IGBT	30A
IFCM30U65GD	DIP 36x21D	650V	Three-phase interleaved PFC	IGBT	30A
IFCM10P60GD	DIP 36x21D	600V	PFC integrated	IGBT	10A
IFCM10S60GD	DIP 36x21D	600V	PFC integrated	IGBT	10A
IFCM15P60GD	DIP 36x21D	600V	PFC integrated	IGBT	15A
IFCM15S60GD	DIP 36x21D	600V	PFC integrated	IGBT	15A
IGCM04F60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	4A
IGCM04G60GA	DIP 36x21	600V	Three-phase closed emitter	IGBT	4A
IGCM06F60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	6A
IGCM06G60GA	DIP 36x21	600V	Three-phase closed emitter	IGBT	6A
IGCM10F60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	10A
IGCM15F60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	15A
IGCM20F60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	20A
IKCM10H60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	10A
IKCM10L60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	10A
IKCM15F60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	15A
IKCM15H60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	15A
IKCM15L60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	15A
IKCM15L60GD	DIP 36x21D	600V	Three-phase open emitter	IGBT	15A
IKCM15R60GD	DIP 36x21D	600V	Two-phase asymmetric inverter	IGBT	15A
IKCM20L60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	20A
IKCM20L60GD	DIP 36x21D	600V	Three-phase open emitter	IGBT	20A
IKCM20R60GD	DIP 36x21D	600V	Two-phase asymmetric inverter	IGBT	20A
IKCM30F60GA	DIP 36x21	600V	Three-phase open emitter	IGBT	30A
IKCM30F60GD	DIP 36x21D	600V	Three-phase open emitter	IGBT	30A
IM512-L6A	DIP 36x21	600V	Two-phase open source	MOSFET	10A
IM513-L6A	DIP 36x21	600V	Three-phase open source	MOSFET	10A
IGCM04G60HA	DIP 36x21	600V	Three-phase closed emitter	IGBT	4A

ENERGY INDUSTRIAL LIGHTING MEDICAL TRANSPORT SECURITY CONSUMER TELECOMS

APPLICATIONS

- Air-conditioning units
- Washing machines
- Refrigerators
- Vacuum cleaners
- Compressors
- Industrial drives

FEATURES

- Matched propagation delay for all channels
- Switching frequency up to 20kHz
- Compatible with 3.3V and 5V microcontrollers
- Optional temperature sensor
- Under-voltage lock-out on all channels
- Cross-conduction prevention
- Low-side Emitter pins accessible for phase current monitoring

FTM DEVELOPMENT BOARD

This evaluation board is a complete power stage for driving three-phase motors rated for up to 750W. It is equipped with an MADK M1 20-pin interface connector for use with EVAL-M1-099M-C control boards.

Orderable Part Number: EVAL-M1-CM610N3

Paired with an iMOTION™ control board, the EVAL-M3-102T, this board provides a powerful inverter and PFC system based on TRENCHSTOP™ IGBTs.

Orderable Part Number: EVAL-M3-CM615PN

Available at FutureElectronics.com

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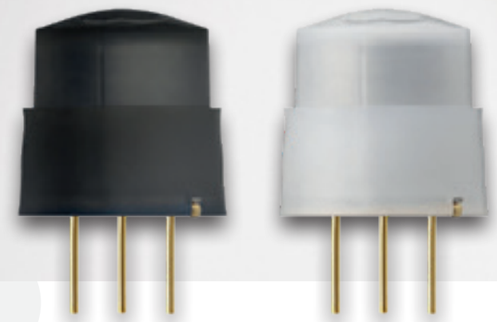
New PIR motion sensors feature low 10.9mm profile for size-sensitive designs

Panasonic

Panasonic has introduced new low-profile Passive Infrared (PIR) motion sensors, extending its EKMB and EKMC series of products.



Featuring a new lens design, the low-profile PIR sensors are 10.9mm high, while regular EKMC and EKMB products are 14.4mm high. The low-profile sensors offer a good detection range of 5m.

The new products are composed of a lens which creates a number of detection zones, an optical filter to block non-infrared light, pyroelectric sensing elements, and an impedance converter which provides an electrical output signal.

In addition, Panasonic also integrates an amplifier and comparator circuit on the same sensor ASIC in the stem block, an architecture which saves space and allows for electro-magnetic shielding of all circuitry while reducing component count. A high signal-to-noise ratio ensures that the sensors avoid false triggering events.

The EKMC and EKMB PIR sensors are available with a white, black or pearl white lens. The EKMC7607 parts are classed as 'low sensitivity' types, and the EKMC4607 as 'high sensitivity' types.

Part Number	Standby Current	Lens Color	Output Type
EKMB1107111	1µA	White	Digital
EKMB1107112	1µA	Black	Digital
EKMB1107113	1µA	Pearl white	Digital
EKMB1207111	2µA	White	Digital
EKMB1207112	2µA	Black	Digital
EKMB1207113	2µA	Pearl white	Digital
EKMB1307111K	6µA	White	Digital
EKMB1307112K	6µA	Black	Digital
EKMB1307113K	6µA	Pearl white	Digital
EKMC1607111	170µA	White	Digital
EKMC1607112	170µA	Black	Digital
EKMC1607113	170µA	Pearl white	Digital
EKMC4607111K	170µA	White	Digital
EKMC4607112K	170µA	Black	Digital
EKMC4607113K	170µA	Pearl white	Digital
EKMC7607111K	170µA	White	Digital
EKMC7607112K	170µA	Black	Digital
EKMC7607113K	170µA	Pearl white	Digital
EKMC2607111K	170µA	White	Analog
EKMC2607112K	170µA	Black	Analog
EKMC2607113K	170µA	Pearl white	Analog

ENERGY INDUSTRIAL LIGHTING MEDICAL TRANSPORT SECURITY CONSUMER TELECOMS

APPLICATIONS

- Lighting controls
- Thermostats
- HVAC units
- Smart home equipment
- IoT devices
- IP cameras
- Surveillance systems
- Digital signage

FEATURES

- High reliability
- 100µA operating current in detection mode (EKMB series)

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Custom and standard antennas support wide range of frequencies and radio protocols

TE Connectivity's (TE) portfolio of standard and custom antennas features technologies including two-shot molding, stamped metal, Flexible Printed Circuit (FPC), PCB and Laser Direct Structuring (LDS).

Available as embedded or multi-element external antennas, these solutions provide clear transmission in wireless devices over a wide variety of frequencies, including the bands used by Bluetooth®, Wi-Fi®, LTE™ and ZigBee® radio systems.

TE antennas are available for wireless voice and networking applications

Antennas supplied by TE may be tested before shipping for near- and far-field patterns, scattering parameters, specific absorption rate, vibration, humidity, temperature shock, salt fog, throughput and acoustic characteristics.

ENERGY INDUSTRIAL LIGHTING MEDICAL TRANSPORT SECURITY CONSUMER TELECOMS

APPLICATIONS

- Wearable devices
- Wireless printers
- Smart meters
- Power distribution equipment
- Data communications equipment
- Connected cars and trucks
- Remote radio equipment

FEATURES

- Antennas for wireless networking and voice applications
  - IEEE 802.11a/b/g/n/ac/ad at 2.4 and 5GHz
  - LTE bands 700 to 2700MHz with multi-band and MetaSpan antenna technology
  - GSM/UMTS bands 850 to 2170MHz, single and multiband
  - WiMax bands 2300 to 3800MHz
- Antennas for other technologies
  - ISM ZigBee band 902 to 928MHz
  - Bluetooth band 2400 to 2483.5MHz
  - Zigbee band 2400 to 2483.5MHz
  - UWB band 3100 to 6000MHz
  - DVB-H band 1670 to 1675MHz
  - NFC band 13.56MHz

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High-performance antennas in standard and custom designs

Ethertronics, an AVX group company, provides a wide-ranging antenna supply service to OEMs, from design concept to volume production.

AVX's Ethertronics off-the-shelf, ready-to-use RF antennas are compact, high-performance devices, and are available in multiple form factors to meet the requirements of all common signaling protocols and frequencies. AVX antennas are also available in custom configurations using a wide variety of materials to ease antenna integration and maximize performance.

AVX passive antennas establish benchmarks for speed, range, efficiency and reliability across various applications, from mobile phones to Wi Fi® routers to IoT devices. AVX has supplied billions of antennas to leading wireless handset and device manufacturers worldwide.

Bands	 Broadband LTE	 Wi-Fi®	 ISM	 GNSS
Protocols	LTE CAT-M, NB-IoT Sigfox, LoRa®, Cellular LPWA, RPMA	Bluetooth®, ZigBee®, WLAN 6LoWPAN	LoRa®, Z-Wave Sigfox	GPS, GLONASS Beidou, Galileo L-Band
Frequencies	670MHz to 960MHz 1710MHz to 2700MHz	2.4GHz, 5GHz	868MHz, 915MHz 970MHz	1575MHz, 1560MHz to 1606MHz

ENERGY INDUSTRIAL LIGHTING MEDICAL TRANSPORT SECURITY CONSUMER TELECOMS

APPLICATIONS

- Automotive
- Mobile phones
- M2M communications
- Wearable devices and headsets
- Smart grid devices
- Laptop computers and tablets
- Point-of-sale terminals
- Smart metering and home automation
- Healthcare equipment
- Navigation equipment and tracking devices
- Radar equipment

BENEFITS OF AVX ANTENNAS

- Shorter time to market
- Better performance and isolation with patented Isolated Magnetic Dipole™ technology
- Tuning capabilities for performance optimization
- Embedded on-board, embedded off-board and external standard antenna options available for all main frequencies
- Sample kits, evaluation boards, datasheets, application notes, and DXF files available
- Testing services provided

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Automotive-qualified LDOs operate over wide input-voltage range up to 55V

Microchip's MCP1792 and MCP1793 are high-voltage, Low Dropout (LDO) regulators which supply a maximum output current of 100mA from a wide input-voltage range of 4.5V-55V. This capability makes the LDOs ideal for use in 12V, 24V or 48V power rails, and in high-voltage battery packs.

A low under-voltage lock-out threshold of 2.4V at shut-down makes these LDOs applicable in cold-cranking conditions in automotive electronic circuits.

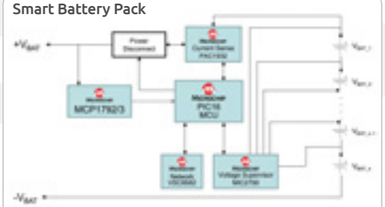
The MCP1792 and MCP1793 parts are available as standard with a fixed output voltage of either 3.3V or 5.0V. The regulator's output is stable with 2.2µF ceramic capacitors.

The device is protected from short circuits by a current fold-back function, and from overheating through thermal shut-down protection.

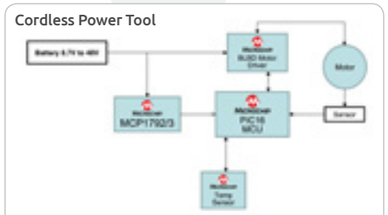
The MCP1792 has three leads, and the MCP1793, which offers shut-down functionality through its Shdn pin, has five. While in shut-down mode, current drops to 2µA.

The device itself draws a ground current of 100µA, while delivering a maximum output current of 100mA.

Smart Battery Pack



Cordless Power Tool



ENERGY INDUSTRIAL LIGHTING MEDICAL TRANSPORT SECURITY CONSUMER TELECOMS

APPLICATIONS

- Voltage supply to MCU or FPGA from battery power source
- Automotive electronics systems
- Power tools
- E-bikes
- Smoke detectors
- Alarm sensors

FEATURES

- Handles transient voltages up to 70V
- AEC-Q100 qualified to Grade 0
- PPAP capable
- 25µA quiescent supply current

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CYPRESS CONNECTIVITY TECHNOLOGIES

Industry-leading wired & wireless connectivity for any application.

CYPRESS EMBEDDED IN TOMORROW™

Whether an application requires integrated cloud connectivity capabilities, or the ability to enable display as well as power delivery via the same connector, Cypress is the partner of choice for companies everywhere needing to integrate robust, reliable, and easy-to-use wired and/or wireless connectivity into their next product. Cypress has a best-in-class portfolio of USB controllers as well as Wi-Fi, Bluetooth, and Wi-Fi/Bluetooth combo radios.

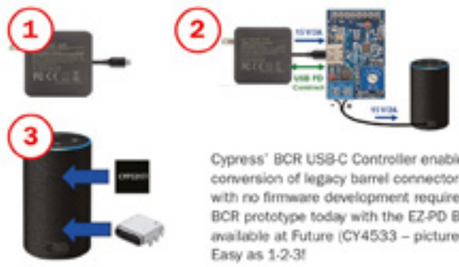
Cypress USB Connectivity Portfolio

Cypress has been "Making USB Universal®" since 1996, being the market leader and surpassing 2.2 billion units shipped in 2018. Cypress provides software, reference designs, and driver suites to enable developers with the industry's most complete USB portfolio.

Cypress Product Offering Overview	
USB-C	Full portfolio of USB-C & PD Controllers (applies to any USB speed) for auto, notebooks, chargers, cables, power banks, power adapters etc.
USB 3.1	Full portfolio of Device (FX3), Hub (HX3), Bridge (CX3 & GX3), and Storage (FX3S & SD3) controllers in production.
USB 2.0	Full portfolio of Device (FX2), Hub (HX2), Bridge (NX2/AT2), and Storage Arroyo/Astoria/Bay) controllers in production.
USB 1.1	Full portfolio of Device, Bridge, and Host controllers in production (legacy)

Featured USB Solutions

EZ-PD™ Barrel Connecter Replacement (BCR)
Power your next product with any USB-C Power Adapter



Cypress' BCR USB-C Controller enables conversion of legacy barrel connectors to USB-C with no firmware development required! Start a BCR prototype today with the EZ-PD BCR Dev Kit available at Future (CY4533 – pictured above). Easy as 1-2-3!

Cypress Wireless Connectivity Portfolio

Cypress provides the industry's broadest portfolio of Wi-Fi & Bluetooth radios with the largest worldwide install base maximizing interoperability. Cypress guarantees the best range and throughput through world class RF performance in transmit power and receive sensitivity. Cypress is simply the ideal partner of choice for IoT developers enabling wireless connectivity in their next design.

Cypress Product Offering Overview	
Bluetooth	Industry's broadest Bluetooth portfolio consisting of BLE-only devices as well as Dual-Mode Bluetooth solutions supporting Bluetooth Classic (BCR/EDR) as well as BLE. Cypress also designs in-house, fully certified Bluetooth modules.
Wi-Fi	Cypress provides a broad portfolio of Wi-Fi only radios and SoCs, with support ranging from 802.11b/g/n to the industry-leading 802.11ac. Cypress' global network of IoT partners provide production-ready, fully certified Wi-Fi modules.
Wi-Fi + BT	Cypress offers robust single-chip solutions supporting both Wi-Fi and Bluetooth, with both 802.11n and 802.11ac + BT options. Cypress' global network of IoT partners provide production-ready, fully certified Wi-Fi + Bluetooth combo modules.

Featured Bluetooth Solutions

Best-in-class Bluetooth Mesh
Complete solution with hardware, software, and mobile apps
hardware, software, and
and mobile apps

Cypress is enabling the masses to get started implementing Bluetooth Mesh into their next design with the Cypress Bluetooth Mesh Eval Kit (CYBT-213043-MESH) featuring 4 node boards each with a certified module hosting the CYW20819 Bluetooth 5 MCU, multiple mesh example projects, and iOS, Android, and Windows mobile apps.

Cutting-edge Wi-Fi Connectivity
Develop with the fastest Wi-Fi on the market

Cypress' CYW54907 is enabling the future of Wi-Fi for the IoT supporting lighting fast and high-throughput dual-band 802.11ac along with an integrated Arm® Cortex® -R4 application processor. Get started today with the CYW54907 Wi-Fi Dev Kit (CYW954907AEVAL1F).

Featured Wi-Fi & Wi-Fi/BT Combo Solutions

Market Proven Wi-Fi + Bluetooth Connectivity
Easily implement small form factor, low-cost Wi-Fi + Bluetooth

The Cypress CYW4343W chipset radio supports 802.11n Wi-Fi and Bluetooth (BR/EDR/BLE) on a single chip. Developers can get started developing with this widely popular solution using the PSoC 6 Wi-Fi-BT Prototyping Kit (CY8CPROTO-062-4343W)

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FTM DEVELOPMENT BOARD
Orderable Part Number: CY8CPROTO-062-4343W
Available at FutureElectronics.com

Fast new crypto chip improves security and performance of IoT devices and services

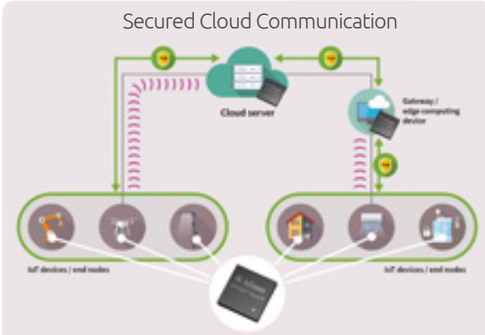
The new OPTIGA™ Trust M solution from Infineon Technologies helps manufacturers of IoT devices connected to cloud-computing services to enhance the security of their products while at the same time improving system performance.

The OPTIGA Trust M SLS32AIA series, a single-chip security controller solution, stores unique device credentials, and enables devices to connect to the cloud up to ten times faster than software-only alternatives.

When embedded in an IoT end-point device, an SLS32AIA chip can enable security functions such as:

- Mutual authentication
- Secure communication
- Data store protection
- Lifecycle management
- Power management
- Secure updates
- Platform integrity protection

Secured Cloud Communication



OPTIGA Trust family: End-to-end security from device to cloud

The OPTIGA Trust M solution also eases the provisioning of cloud services in IoT end-points. When deploying an OPTIGA Trust M solution in an embedded device, critical assets such as certificates and key pairs used to identify a device can be programmed into the chip at a secure Infineon factory.

Infineon minimizes design and deployment effort by providing a cryptographic toolbox, a protected I²C interface, and open-source code hosted on GitHub. In addition, the SLS32AIA high-end security controller is certified according to CC EAL6+, offering a high level of security, and provides advanced asymmetric cryptography functions, including 256-bit and 384-bit ECC and 1024-bit and 2048-bit RSA. It also supports secure software updates in the field.

There are two variants of the OPTIGA Trust M solution, both supplied in a 3mm x 3mm USON package:

- SLS32AIA010MS covering a standard temperature range of -25°C to 85°C for most commercial implementations
- SLS32AIA010MH offering an extended temperature range of -40°C to 105°C for harsh industrial environments

A member of the OPTIGA Trust family

Infineon's OPTIGA™ Trust M is the latest addition to the OPTIGA Trust family of embedded security solutions, which provide an anchor of trust for IoT devices connected to the cloud.

The need for strong device authentication has never been higher. Software alone is not enough to protect embedded systems as it can be copied, reverse-engineered and exploited with ease. Secured hardware is needed to store sensitive data, provide encryption functionality, and detect manipulation.

Embedded system designers can rely on Infineon's OPTIGA™ family of security solutions to protect the confidentiality, integrity and authenticity of information and devices.

New shield board for OPTIGA Trust M enables fast development of secure IoT systems

Infineon's Shield2Go board for the OPTIGA™ Trust M security chip supports fast evaluation and development of IoT end-point devices which require secure cloud connections. It features one OPTIGA Trust M security chip on an easy-to-handle PCB.

Design engineers can build systems by combining multiple Shield2Go boards with the Infineon My IoT adapter board. The adapter board is compatible with the Arduino form factor, and enables fast development in a familiar project environment.

Infineon also supports the Shield2Go board with open-source host code for the OPTIGA™ Trust M, supplied via GitHub. This provides information directly about new versions, features and bug fixes, and enables easy integration of standard open-source cryptographic software libraries or of the host code into other systems. The host code is licensed under the MIT License.

FTM DEVELOPMENT BOARD

Orderable Part Number:
S2GOSECURITYOPTIGAMTOBO1
Available at FutureElectronics.com

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APPLICATIONS

- Industrial automation
- Building automation
- Smart home devices
- Consumer devices
- Drones

FEATURES

- True random number generator
- Hibernate mode for zero power consumption
- Up to 10kbytes of user memory
- Device security monitor
- Lifetime of up to 20 years

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Discrete magnetics for Ethernet interfaces help ease EMI concerns

Industrial discrete magnetics products from TE Connectivity (TE) provide flexibility to designers of equipment that includes embedded Ethernet interfaces, enabling them to realize improved transmission characteristics and meet over-voltage requirements. The dielectric withstanding voltage rating of the TE discrete magnetics products is 1,500V AC_{rms}.

TE magnetics operate in temperatures up to 105°C

These TE parts offer an extended operating-temperature range of -40°C to 105°C, allowing customers to use them in industrial environments subject to high ambient temperatures. They are compatible with standard 10/100Mbits/s or 1Gbit/s Ethernet interfaces.

The new discrete magnetics range complements TE's existing RJ45 jacks with integrated magnetics, giving designers a choice between:

- Greater flexibility when using the discrete parts
- Reduced board footprint and a lower component count when using the integrated jacks

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APPLICATIONS

- Programmable logic controllers
- I/O modules
- Servo drives
- Industrial PCs
- Other industrial equipment

FEATURES

- Supports voltage- or current-mode applications
- Three-wire choke for Power-over-Ethernet interfaces
- Compatible with reflow soldering profiles at 260°C
- Supplied in surface-mount and optional through-hole packages

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Single-pole spring-type terminal blocks

METZ CONNECT's SM99 and SR99 are spring-clamp terminal blocks which have a compact footprint, and accept wire sizes up to 16 AWG.

The SM99 blocks are for surface-mount assembly, and the SR99 are for through-hole mounting. Both types are reflow-capable according to the JEDEC 20 MSL 1 standard.

Featuring a push-in method for wire insertion and a large finger push-button for wire release, they are easy to install and use.

The SM99 and SR99 series offer good connection reliability, thanks to a wire connection indicator and a test point for a continuity check. They give the board designer great flexibility, as they can be placed as single poles nearly anywhere on a PCB.

METZ CONNECT terminal blocks: Available in versions for surface and through-hole mounting

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APPLICATIONS

- Consumer devices
- Lighting
- Heating, ventilation and air-conditioning units
- Security systems
- Industrial equipment

FEATURES

- 90° connection angle
- Single wire size range: 24 AWG to 16 AWG
- 9A nominal current
- Color variants for finger latch
- IP20 ingress rating

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Radio module supports simultaneous operation of Bluetooth and 802.15.4 radios in smart home and building networks

Panasonic

Panasonic has introduced the PAN4620, a dual-mode radio module which enables simultaneous and independent connections over Bluetooth® Low Energy and Thread or other 2.4GHz IEEE 802.15.4 wireless networks.

The module incorporates all the required hardware elements, including a chip antenna, and the protocol software, providing a simple and quick way for OEMs to implement wireless connectivity in devices for applications such as smart homes and building automation.

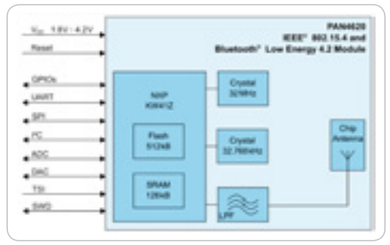
The PAN4620 module is based on the NXP Semiconductors Kinetis KW41Z system-on-chip, which combines a 2.4GHz radio supporting 802.15.4 and Bluetooth Low Energy wireless connectivity, and a microcontroller based on an Arm® Cortex®-M0+ core.

Because it includes a built-in MCU, the module offers design flexibility. Featuring 512kbytes of Flash memory and 128kbytes of SRAM, the PAN4620 can easily be used as a stand-alone controller in small and low-power devices. This architecture eliminates the need for an external processor, reducing system complexity and saving space and cost.

The module can also be used alongside a host microcontroller or applications processor to provide a complete solution for 802.15.4 and Bluetooth Low Energy connectivity.

Supplied with NXP's certified Thread and Bluetooth Low Energy protocol stacks, the module supports concurrent operation of two radio systems. This is ideal for IoT applications, since it enables end-points to connect wirelessly to the internet without the need for a gateway. In addition, the Thread network protocol does not define an application layer, so various application layers can be used such as dotdot, IoTivity or OpenDOF.

The PAN4620 is supplied with FCC, IC and CE approvals. The surface-mount module measures 15.6mm x 8.7mm x 1.9mm. Its orderable part number is ENW-C9B01A1EF.

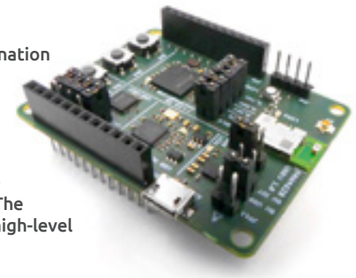


PAN4620: Can be used as a stand-alone controller

Daughterboard provides for easy evaluation of the PAN4620

Panasonic provides an evaluation board for its combination 802.15.4 and Bluetooth radio module. The compact PAN4620 daughterboard provides access to all the module's pins. It also features an on-board LED, three user buttons and a Micro-USB connector.

Panasonic recommends using NXP's Bluetooth®, ZigBee® and Thread Software Development Kit (SDK) to implement applications on the PAN4620 module. The SDK offers full software development support via a high-level application programming interface.



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APPLICATIONS

- Smart home devices
- Building automation

FEATURES

- Bluetooth Low Energy v4.2 certified
- Footprint- and pin-compatible with Panasonic PAN1026, PAN1760, PAN1760A and PAN1761 modules
- IEEE 802.15.4 physical layer implementation and Simple Media Access Controller (SMAC)
- Supports Bluetooth mesh networking
- Supports IPv6 6LoBLE
- Bluetooth Developer Studio plug-In

FTM DEVELOPMENT BOARD
Orderable Part Number: ENW-C9B01AQEF
Available at FutureElectronics.com

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Two new USB Power Delivery controller families simplify implementation of USB Type-C charging capability

Microchip Technology has introduced two new device families which simplify the implementation of USB Type-C™ Power Delivery (PD) functionality across a range of applications.

The new products remove the complexity and high cost involved in implementing USB Type-C, enabling OEMs to bring the convenience and fast-charging capability of USB Type-C PD to more devices.

USB705x family: concurrent charging and SuperSpeed data transmission

The new USB705x family is a set of USB 3.1 SmartHub devices with integrated support for Power Delivery, to enable fast device charging while removing the cause of users' confusion about USB Type-C ports.

The USB705x parts include two unique features which simplify USB Type-C PD implementations: HostFlexing and PDBalancing. HostFlexing simplifies the experience of using a docking station, making all USB Type-C ports function as the 'notebook' port.

This eliminates the need for the cryptic labels on USB devices which try to explain the functionality of each USB Type-C port.

PDBalancing provides a means for manufacturers to manage system power centrally, saving consumers money by enabling them to charge multiple USB PD devices with less power overall.

To meet consumer demand for both faster mobile device charging and faster data streaming, the USB705x family combines native support for USB Type-C PD with the 5Gbits/s SuperSpeed data rate specified by the USB 3.1 protocol.

The USB705x family provides a range of USB configurations. It also supports automotive use cases, allowing the graphical user interface of a mobile phone handset to be displayed on a vehicle's screen while simultaneously charging the device.

Part Number	PD Upstream	PD Type-C Downstream	Standard Type-C Downstream*	Type-A Downstream
USB7050**	Yes	2 ports	None	2 ports
USB7051	Yes	1 port	1 port	2 ports
USB7052	Yes	None	2 ports	2 ports
USB7056	Yes	None	1 port	5 ports

*Standard Type-C means 15W power only (does not include PD). **AEC-Q100 qualified for automotive applications

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APPLICATIONS

- Docking stations
- PC monitors
- Automotive infotainment equipment

FEATURES

- Certified compliant with USB 3.1 Gen 1 specifications
- Integrated USB 2.0 hub controller to support legacy devices
- Supported by MPLAB Connect Configurator tool
- Supports USB-IF BC1.2 charging profiles:
  - DCP: Dedicated Charging Port for power brick with no data
  - CDP: Charging Downstream Port, supplying 1.5A with data
  - SDP: Standard Downstream Port, supplying 0.5A with data
  - Custom profiles

FTM DEVELOPMENT BOARD

The EVB-USB7050 evaluation platform supports four downstream ports: two USB 3.1 Gen 1 PD ports with USB Type-C connectors, and two USB ports with Type-A connectors. The platform also supports battery charging on all four downstream ports, supplying a maximum of 10A at any one time, and FlexConnect, a role-reversal technology which enables any of the downstream ports to be the Host port.

Orderable Part Number: EVB-USB7050

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UPD301A: dedicated, stand-alone controller for USB Type-C charging

Microchip's new UPD301A is a stand-alone USB Type-C Power Delivery controller which greatly simplifies the implementation of basic USB Type-C PD charging functionality.

UPD301A: Supports standard USB Power Delivery profiles

With smartphones increasingly requiring more than the power supplied under the Battery Charging (BC) 1.2 standard, designers of various types of electronic system need to easily implement basic high-power charging.

The UPD301A provides a simple, stand-alone solution for implementing USB Type-C PD charging. It supports both single- and dual-port operation.

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Orderable Part Number: EVB-UPD301A

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APPLICATIONS

- Rear-seat charging in vehicles
- Portable devices
- Public charging stations

FEATURES

- Supported by MPLAB Connect Configurator tool
- Standard PD power profiles: 15W/27W/45W/60W
- USB Power Delivery 3.0 media access controller
- Easily supports second port with additional UPD350 USB-C transceiver

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Advances in UV LED technology promise faster rate of adoption

By François Mirand
EMEA Technical Director at Future Lighting Solutions, a division of Future Electronics

One battle is already over: the LED has defeated conventional visible light-source technologies in every important indoor and outdoor general lighting application.

But what about applications for invisible light in the ultraviolet part of the spectrum? The same characteristics that have made LEDs so attractive for general lighting also apply, in theory at least, to the applications for which UV light can be used, such as curing, disinfection, chemical analysis and synthesis:

- **Small light-emitting surface and small overall package size**
- **Long operating life, and low maintenance and repair costs**
- **Low-voltage operation and low power consumption**
- **Tight control of the wavelength of the emitted light**
- **Freedom from harmful chemical components**

These characteristics have led specialist lighting engineers to propose innovative new uses for UV light. They also give good reason for UV equipment manufacturers to evaluate LEDs as a straightforward replacement for legacy UV light-source technologies.

Although the advantages of UV LEDs look attractive on paper, in practice the rate of adoption of UV LED technology has lagged far behind that of visible light LEDs. Now the introduction of new LED products offering a dramatic reduction in unit costs alongside higher optical-power output looks set to launch a wave of new UV product developments, promising valuable cost, environmental and operational benefits for users.

Why UV LED light sources are in growing demand

The classification of the UV part of the spectrum of electromagnetic radiation covers the range of wavelengths between 100nm and 400nm, as shown in Figure 1.

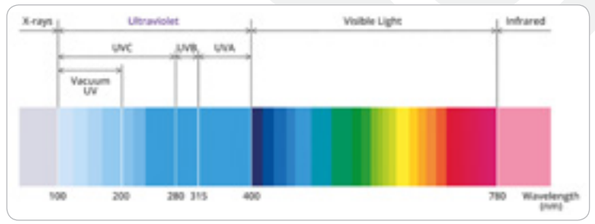

Fig. 1: UV light's position in the spectrum of electromagnetic radiation. (Image credit: Seoul Viosys)

By convention, this UV part of the spectrum is itself split into three: UVA, UVB and UVC. As Table 1 shows, some applications are better served by one class of UV light than by another.

The value of UV light derives from the powerful chemical and biological effects that it has on irradiated objects, effects which are far greater than simple heating. Many practical applications of UV radiation derive from its interactions with organic molecules.

Read this to find out about:

- **The different uses to which UVA, UVB and UVC light can be put**
- **Examples of applications in which UV LEDs can replace conventional UV light sources**
- **The improved features and performance of the latest UV LED products to reach the market**

Type of UV Light	Wavelength Range (nm)	Applications
UVA	315-400 Not absorbed by the atmospheric ozone layer	Curing of polymers: ink, paint, coatings, glue Air deodorization, airborne pathogen reduction Insect traps Medical analysis and physiological monitoring Photochemistry, molecule synthesis Optical sensing and imaging of dyes, inks and markers
UVB	280-315 Mostly absorbed by the atmospheric ozone layer	Curing Phototherapy Horticulture, growing and post-harvesting treatment Forensic analysis
UVC	100-280 Completely absorbed by the atmospheric ozone layer	Surface disinfection Water purification Food processing

Table 1: The characteristics of and typical applications for the classes of UV light

For instance, the energy of UVA photons may be used to activate chemical reactions through photo-initiators, a useful function in applications such as curing of paint or other coatings, curing of glue or varnish, and photolithography.

For disinfection and sterilization, UVC light is required. A combination of UVC, UVB and UVA light may be used in curing: for instance, UVC hardens the surface, while the more penetrative UVB and UVA cure the bulk of the material. UVB is also preferred for phototherapy such as psoriasis treatment, for which it provides the best combination of effectiveness and safety.

Today, these applications are typically served by conventional UV light sources. These UV lamp types remain in common use because of their relatively low unit cost, or more properly, their low cost:radiant power ratio, and also the high radiant power capability. The effectiveness of a UV light application is essentially a function of irradiance and exposure time. To disinfect the water in a municipal swimming pool, a UV light source must irradiate a large volume of water flowing at a constant fast rate: this calls for high irradiance because the exposure time is short.

By contrast, disinfection of the drinking water stored in a small pleasure boat's tank can be performed slowly, giving a long exposure time and thus requiring low radiant power which is an ideal application for UV LEDs.

In fact, UV LEDs are superior to conventional UV light sources in almost every respect: the LED's chief drawback is that its cost:radiant power ratio is markedly higher than that of conventional UV light sources. This means that swimming pool disinfection will remain, as it is now, an application for UV arc lamps for the foreseeable future.

For many applications, however, the characteristics of LEDs are markedly superior.

Characteristics of Conventional UV Light Sources	Characteristics of UV LEDs
Bulky	Compact package
Omnidirectional light emission and large light-emitting surface make light beam hard to control	Small point source of light can be directed at the target
Brittle glass bulb is easily damaged or broken	LED's solid-state technology is robust and withstands high levels of shock and vibration
Lifetime is often <2,000 hours	Long operating lifetime
High operating voltage	Low forward voltage
Radiant power distribution covers wide range of UV spectrum	Peak wavelength may be precisely specified

For instance, nail bars use UV light to fast-cure nail varnish. Here the LED offers superior value:

- Small size and light weight, making the curing equipment compact and easy to handle
- Robust and tolerant of being knocked or dropped from a work surface
- Low operating voltage, making it easy to ensure the electrical safety of the operator

LEDs also support the development of new applications for which a conventional light source such as a mercury vapor lamp is unsuitable. For instance, a small UVC LED may be mounted inside the tank of a coffee machine or drinking-water fountain to inhibit the growth of micro-organisms in the water. This application is particularly well suited to UV LEDs because:

- The LED is small, so is easily accommodated in tight spaces
- The low-voltage operation of the LED in a wet environment is electrically safe
- The LED's long operating lifetime eliminates the need for expensive lamp replacement

The same features of UV LEDs are also valuable in new, compact air purifiers or deodorizers. In these devices, UVA light irradiates a titanium dioxide-coated catalyser to generate free radicals which break down large organic molecules. These purifiers can be embedded in refrigerators and air-conditioning systems. In cars, they can remove odoriferous volatile organic compounds such as cigarette smoke or plastic outgassing residue. Combined with bactericidal UVC light, a purifier will keep a car's air-conditioning system fresh and free of airborne pathogens while reducing the frequency of cleaning and filter replacement.

These practical advantages of UV LED light sources are now gaining even greater value with the recent introduction of new LED products with superior specifications.

New LED products spur faster adoption

For curing applications such as varnish-drying in a nail bar, speed is of the essence, and speed correlates with UV irradiance. Compared to traditional technologies, compact LED light sources are easier to focus and to install close to the target, keeping optical losses to a minimum and producing good irradiance at a small target area.

But the introduction of new multi-die modules enables compact LED light sources to reach even higher irradiance. A good example is Nichia's new NVCUQ096A-D4 UVA module, as shown in Figure 2. At a peak wavelength of 385nm, it produces an optical power output of 150W in a ±30° beam. The module has a small footprint of just 25mm x 45mm.

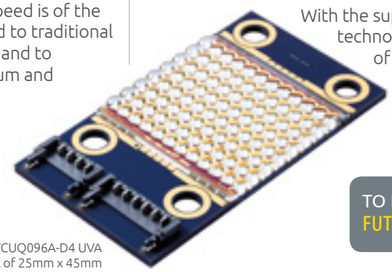

Fig. 2: Nichia's NVCUQ096A-D4 UVA module has a footprint of 25mm x 45mm

Seoul Viosys is also producing interesting innovations in the UV LED market. While mainstream UVC LEDs have a vertical chip structure in a ceramic package sealed with a quartz glass window, Seoul Viosys has developed a streamlined chip-scale package under the WICOP UV brand. This 'package-free' surface-mount chip technology removes both the cost and the optical losses associated with the conventional ceramic + quartz glass architecture.

When implemented in new UV equipment designs, WICOP UV LEDs promise to provide a higher optical power output in a smaller space at a lower unit cost.

The WICOP UV technology is rivalled on the UVA side by Lumileds' LUXEON UV FC Line of products, in which FC denotes FlipChip platform technology, as shown in Figure 3. The LUXEON UV FC Line products, which have a 1mm² die, are supplied as a Chip-Scale Package (CSP) LED which can be reflowed on to a substrate with standard surface-mount assembly equipment and processes.

Examples of applications for these devices include off-the-shelf, fully-packaged UVA emitters. Both the LUXEON UV U1 (1mm²) and the LUXEON UV U2 (2mm²) are powered by Lumileds' FlipChip platform technology.

Fig. 3: The LUXEON UV FC Line LEDs, showing top and back views. (Image credit: Lumileds)

Support for integration of UV LEDs in end product designs

UV LED selection and specification are key tasks in system design. LED manufacturers allocate produced units to bins, allowing the buyer to specify products according to flux (optical power output), forward voltage and peak wavelength.

Selection from a broad market provision of binned UV LEDs will be made easier by use of product comparison software such as Future Lighting Solutions' Usable Light Tool. The user can specify a required flux and peak wavelength, and the tool will provide a detailed list of products meeting the specification. Use of the tool can save many hours of tedious online datasheet searches, while providing valuable application-specific comparison data.

System designers can also use the tool, together with guidance from Future Lighting Solutions' applications engineering experts, to specify appropriately the supporting components:

- LED drivers are readily available, providing a constant-current output and any standard output-voltage rating
- Optics for beam control are beginning to come on to the market. Standard LED thermoplastics are not transparent to UV light, but LEDiL has developed silicone optics which are compatible with UVA LEDs. Development work on optics for UVB and UVC LEDs continues.

With the support of Future Lighting Solutions' optical technology experts and software tools, designers of UV lighting equipment can now use the latest UV LEDs in confidence, benefiting from the space, cost and power savings promised by this technology.

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TECHNICAL VIEW FUTURE ELECTRONICS

MCU, MPU or FPGA: which device type is best for AI at the edge?

By Future Electronics

Sophisticated and complex applications of Artificial Intelligence (AI), such as autonomous vehicles, have to take safety-critical decisions in nanoseconds without ever making a mistake. The lives of an autonomous vehicle's occupants, as well as other road users, depend on the ability of high-powered Graphics Processing Units (GPUs) and complex neural network algorithms to recognize in real time objects such as pedestrians, cyclists, traffic lights and road warning signs.

It is not only autonomous vehicles that use the most sophisticated hardware to run mathematically complex neural networking models. The most famous examples of AI in practice, such as 'chatbot' automated online customer services powered by IBM's Watson platform, run on banks of servers which contain arrays of ultra-powerful processors.

But it does not follow that all AI implementations require the fastest, most powerful processing engine that the application can sustain. In fact, the correct principle to follow is the one that embedded developers have always followed: the application's functional requirements should determine the hardware specifications, and not vice versa. Over-specifying the hardware is no more correct or sensible in the field of AI than it is in any other field of embedded computing.

And in fact, it is surprising how many AI systems can run at the edge, completely independently of cloud computing services, on low-cost hardware platforms such as a 32-bit microcontroller or a mid-density FPGA.

The benefits of edge computing

Of course, developers of AI applications can choose to perform inferencing in the cloud, where hardware resources are hardly constrained at all. This is the architecture adopted, for instance, by Amazon's Alexa Voice Service: a device such as a smart speaker will 'hear' the user speaking the 'Alexa' wake word, and then connect to Amazon's speech-recognition cloud service to interpret the spoken command.

But there are often good reasons for embedded systems to perform inferencing locally, at the edge.

- When a network connection runs slowly, it can cause high latency. If the network connection goes down, the inferencing function will fail completely. Local inferencing eliminates this cause of unreliability.
- Inferencing is a data-intensive activity, and some network service providers will charge high prices for transferring large amounts of data.
- A network connection is a critical point of vulnerability to attack by malware, hackers or other threats. A stand-alone device performing inferencing at the edge is safe from network-borne attacks.
- Inferencing in the cloud calls for substantial infrastructure, including networking hardware, network service provision and cloud service provision. The OEM eliminates the need to specify and maintain this infrastructure by performing inferencing at the edge.

So there are strong reasons to prefer local inferencing performed on devices such as microcontrollers, applications processors and FPGAs. But does the developer's preferred hardware platform affect the type of AI application that they will be able to successfully implement?

Read this to find out about:

- **The advantages of performing AI inferencing at the edge**
- **The different hardware requirements of different inferencing techniques**
- **Why predictive maintenance applications can run well on an MCU, and image recognition is well suited to an FPGA**

The right answer, quickly

There are in fact two important parameters that determine the hardware requirement in an embedded AI design, as shown in Figure 1:

- Speed (or latency)
- Accuracy

Broadly speaking, the more time your system can take to decide on the input presented to it, and the higher your tolerance for error, the less powerful your hardware needs to be. An autonomous vehicle's object-detection system is at the extreme end of the spectrum of use cases, requiring both nanosecond-level latency and near 100% accuracy.

Fig. 1: Speed and accuracy determine hardware requirements for AI. (Image credit: Future Electronics)

By contrast, consider a smart cat flap, which unlocks for the owner's pet and excludes all other animals, feline or non-feline. It would be reasonable for this device to take up to 500ms to process an input from the camera mounted at the exterior of the cat flap. And pet owners might accept accuracy of 98%, so that once in every 50 instances it fails to admit the pet at the first attempt, and so runs the recognition program a second time.

It would be possible to reduce the cat flap's latency to 10ms and to raise its accuracy to 99%, but the additional bill-of-materials cost would be substantial. The question for the developer must be, will the improved performance make any difference to the value the consumer derives from it?

It is actually remarkable how much AI work can be done by how little hardware. Figure 2 implies that the minimum hardware requirement for AI is a 32-bit Arm® Cortex®-M-based MCU. In fact, STMicroelectronics has found a way to implement AI without an MCU at all.

ST has embedded a small computation block called a Machine Learning Core (MLC) in some MEMS motion sensors such as the LSM6DSOX accelerometer/gyroscope. This sensor may be used to collect classes of motion data, such as jogging, walking, sitting and driving. Features of this data, such as mean, variance, energy and peak-to-peak values, are analyzed offline to produce a type of detection algorithm called a decision tree.

If the LSM6DSOX is embedded, for instance, in a sports wristband, its MLC is capable of applying the decision tree in real time to the motion measurements it takes and of classifying the activity of the wearer.

Programmable System-on-Chip (SoC) manufacturer QuickLogic uses a similar approach to enable sophisticated predictive maintenance applications on low-cost hardware devices such as its QuickAI™ platform or on Arm Cortex-M4-based MCUs.

Predictive maintenance depends on the recognition of various types of time-series data, such as vibration and sound. Deep learning and neural networks are commonly used to detect fault indicators in the patterns of these time-series data. These algorithms are a subset of a broader set of algorithms known as classifiers. Classifiers transform available inputs into desired discrete output classifications through inferencing, a term which covers a broad range of methods.

QuickLogic's SensiML AI development toolkit provides a complete environment for building intelligent IoT sensing end-points using the most appropriate of these machine learning techniques, as shown in Figure 2.

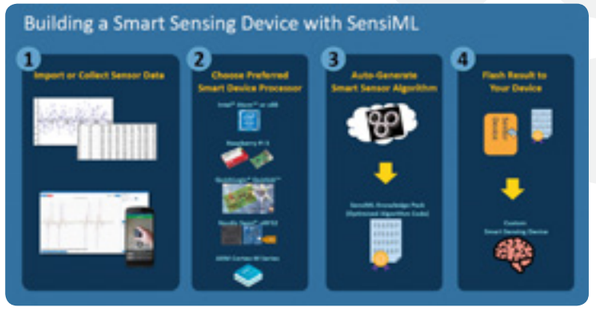

Fig. 2: The machine learning development flow using QuickLogic's SensiML AI toolkit. (Image credit: SensiML)

This includes capturing and labelling raw sensor data, analyzing the dataset for the most efficient algorithm that meets the design constraints, and auto-generating code from signal acquisition through to the classifier output. This process is optimized for the targeted hardware such as QuickAI or other supported platforms.

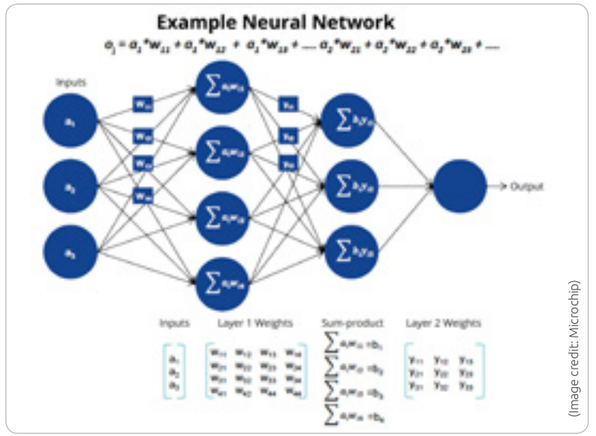

Fig. 3: Neural network inferencing involves millions of math calculations performed at high speed.

Some AI applications, then, can run on extremely constrained, low-power hardware. But not all can.

Image recognition and object detection, for instance, require a neural network, and performing local inferencing of a trained neural network model is a more processor-intensive exercise than running a decision tree.

Microchip Technology, with its high-performance mid-density PolarFire® FPGA family, argues that its FPGAs are inherently more efficient and faster at performing local inferencing of neural network algorithms than other digital devices. Like any FPGA, PolarFire devices inherently support parallel processing, rather than the sequential processing performed by the CPU in an MCU or applications processor. The PolarFire FPGAs also provide a huge DSP capacity in the form of 8-bit math blocks, the MPF500T PolarFire FPGA, for instance, contains 1480 math blocks. And as Figure 3 shows, a neural network inferencing event essentially involves a vast number of calculations performed in parallel.

Microchip testing shows that an MPF300 PolarFire FPGA can run the open TinyYolo v2 image-recognition algorithm to detect animals such as cows and horses at a frame rate of 43 frames/s, while consuming less than 3W of power.

This is testament to the efficiency with which a PolarFire FPGA implements neural network algorithms locally. For the most advanced forms of embedded AI, such as voice control, face recognition and machine condition monitoring, both NXP and ST provide a comprehensive hardware and software offering, ranging from Arm Cortex-M-based microcontrollers up to applications processors: the STM32MP1 from ST features dual Arm Cortex-A7 processor cores, and NXP offers a broad range of i.MX applications processors based on Arm Cortex-A cores.

Both manufacturers back up these hardware offerings with AI enablement and development tools. NXP even provides turnkey reference designs which demonstrate that applications such as local voice control, anomaly detection and face recognition can be performed on its i.MX RT series of crossover processors – devices which feature a high-end Arm Cortex-M7 microcontroller core rather than a Cortex-A processor core.

Lattice Semiconductor also provides AI solutions based on its iCE40 and ECP5 families of FPGAs. For instance the HM01B0, a low-power image sensor module based on the iCE40, implements reference designs for hand gesture recognition and human presence detection. The human presence detection application consumes as little as 1mW in a small form-factor, low-cost device. The reference design comes with all the material a customer needs to recreate the code, including input tools, training datasets and bitstreams. The design can be scaled up to run on the ECP5 platform for higher performance and greater functionality, while retaining low power consumption.

Low-cost hardware choices

For many applications, the right choice will be to perform AI inferencing at the edge, rather than in the cloud. As the examples above show, the hardware to enable this exists today and it is the same hardware with which embedded developers are already familiar. It is true that, for high-speed neural network inferencing, FPGAs such as the PolarFire devices offer certain speed and power advantages, but some applications do not even need a neural network and where a simpler algorithm is effective, the hardware to support it can be simpler too.

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Thin-film precision resistor series sets new standard for reliability

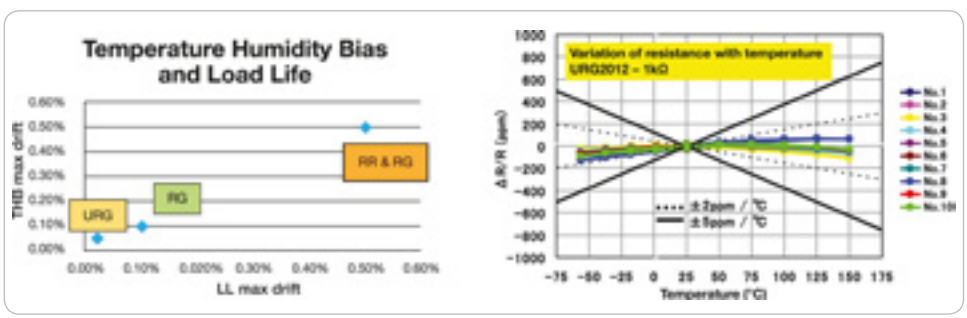
SUSUMU
Thin Film Specialist and Innovator

Susumu's new URG series of thin-film chip resistors offers an improvement in reliability as well as in the linearity of its Temperature Coefficient of Resistance (TCR) compared to the high standard set by the existing RG series.

The URG series offers better absolute tolerance of resistance, at ±0.01%, than any other thin-film chip resistor on the market. It also offers the lowest TCR of ±2ppm/°C. It offers all the advantages of the thin-film type of resistor, such as low noise of -25dB to -35dB, and support for high frequencies up to 1GHz. In addition, the linearity of the URG series' TCR makes it easy to develop an appropriate compensation algorithm.

For applications that require extreme precision and reliability, Susumu now offers a wide choice of resistor families, providing in addition to the URG series:

- The RG-VP series offering tolerance of ±0.02% and TCR of ±5ppm/°C
- The RG-LL series with tolerance of ±0.01% and TCR of ±2ppm/°C



Susumu's URG series: For applications requiring extreme precision and reliability

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APPLICATIONS

- Precision industrial instruments
- Test and measurement instruments
- Automotive electronics
- Laboratory-grade scales

FEATURES

- ±0.02% maximum drift for load life (2,000 hours at 70°C)
- ±0.05% humidity bias drift
- ±0.02% temperature cycle drift
- ±0.02% high-temperature exposure drift
- Stable when exposed to atmospheric sulfur
- EIA standard package sizes: 0603, 0805 and 1206

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