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MARKETING INNOVATIVE PRODUCTS

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SMART LIVING

Smart Living is a broad topic. In the traditional sense, it translates to improving the quality of life through the use of technology. The concept of smart living is as old as humanity itself, and it represents what sets us apart as a species from other animals: our constant pursuit for a better life. However, with the recent advancements in the semiconductors industry, the term 'smart' (technology) takes on a new meaning: technology that incorporates data processing capabilities. In that context, we can redefine the expression 'smart living' as improving the quality of life through the use of **smart** technology. As mentioned initially, the concept of Smart Living is a broad topic, but we will focus more closely on Smart Home & Building, Smart City & Infrastructure, and e-Health segments.

The Smart Home & Building segment covers smart technologies used in a house or building. These technologies can be related to the home or building automation, smart appliances (so-called white and brown goods), home security, access control, and more. By leveraging the advantages of modern technologies, manufacturers can now introduce new features into a broad range of traditional household applications, thus offering an edge over the competition while establishing new standards. Read more about it on page 5.

The Smart City & Infrastructure segment broadens the scope of Smart Living, extending it to the entire city infrastructure. It encompasses the previous segment, complementing it with a set of applications specific to the city infrastructure. Smart City segment covers a wide range of technologies with the same goal: improving the quality of life for its residents in terms of transportation, security, and connectivity while providing smarter and more efficient management of the available resources. Read more about these technologies on page 18.

The e-Health segment is interleaved with both of the previous segments. It focuses on providing smart solutions and technological innovations for people with chronic conditions. Smart Healthcare can significantly improve the quality of patients' lives, providing reliable diagnostics and treatment through automated or remotely assisted healthcare services (Telehealth, Telecare, Home Monitoring). It offers technologies that can relieve patients from frequent visits to the hospital, thus offloading the public healthcare system at the same time. The story continues on page 29.

The so-called smart technology is a common denominator for all three segments. It includes various devices that provide sensing, computing, and wide-area connectivity. In this MIP brochure, we will present some of the Most Innovative Products from our supplier line card that fit into the category of Smart Living. These devices were hand-picked by EBV's technology experts, with a special emphasis on their performances, power consumption, and reliability. However, EBV Elektronik is more than just a distribution: our technology experts are ready to help you kickstart your Smart Living project and provide you with the right solutions from the global semiconductors market.

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SMART HOME & BUILDING

A home is our sanctuary, the place where we can find our peace. A smart home can enhance our comfort by automatically adjusting just the right temperature, optimizing light to better suit our natural life cycle (circadian lighting), regulating air quality, and more. With the help of advanced edge computing platforms that can fit into a surveillance camera, smart home can even predict behavioral patterns while adjusting optimal conditions based on our mood, and provide enhanced security with face detection and recognition. Besides providing greater comfort, smart homes and buildings are also much more energy efficient: a connected home or a building can share data with a smart city grid and optimize its energy consumption. It can even participate in city-wide energy distribution, which is very important for the continuously growing cities, which are already struggling with a lack of resources.
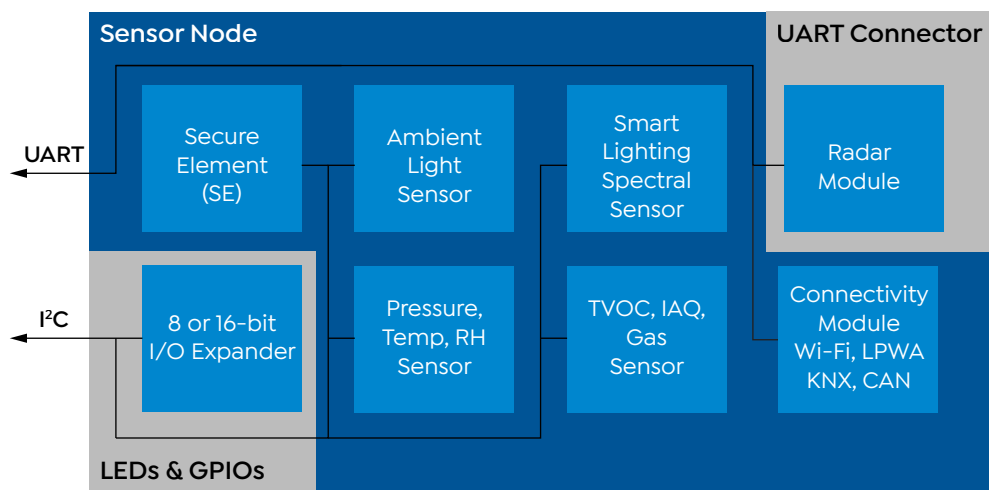
It all starts with a sensor. The block diagram above illustrates a generic sensor node with multiple sensors, a connectivity module (wired or wireless), an optional port expander, and a secure element. However, a real-world application might include only specific components relevant to its purpose. For example, a smart thermostat might only include a temperature, pressure and humidity sensor, a GPIO section with LED indicators, buttons and control lines, and a connectivity module. A more advanced version could also include touch display with a nice GUI, voice recognition via the Amazon Alexa™ service, memory modules, secure element, etc. To simplify the development and cut time to market, semiconductors suppliers often offer turnkey solutions, which can be customized by the OEMs to fit the specific needs of the broadest range of customers.

Connectivity is a crucial aspect of any smart device. It enables remote management and the ability to use various cloud services. Depending on the scope (building or home), there are serveral connectivity options available. The wireless option is most commonly used for smart home applications and it comes in several flavors: Wi-Fi, Bluetooth, ZigBee, Thread... It is provided in the form of a module, typically controlled by exchanging AT commands via the UART interface. The module manufacturer takes care of all the complexity associated with analog RF design and intermittent signal processing, significantly reducing time to market.

On a building level, wireless networks are not the preferred option, given the distance and the number of devices to be addressed. While devices used at home can benefit from being mobile and using less cabling, this is not the case for stationary building applications (front doors lock control, lighting, surveillance, and intercom). Therefore, a building control network is traditionally implemented using cable installations (e.g., twisted pairs) and specialized communication protocols, such as KNX or CAN/CAN FD.

As already mentioned, energy efficiency is an important topic in Smart Home & Building segment. Traditional lighting accounts for up to 40% of total energy consumption. For this reason, the lighting industry has turned towards using solid-state technologies. LED lighting provides several key advantages over traditional lighting, such as significantly lower power consumption and increased control flexibility. Smart lighting networks can be realized as both wired and wireless, using various protocols (DaLi, LoRa, BT Mesh...). However, Power Line Communication (PLC) technology is becoming increasingly popular due to its high reliability and low-cost implementation. It is a technology that relies on superimposing a modulated high-frequency signal on AC mains (50/60 Hz), allowing existing power lines to be used for both communication and power distribution.

Safety is another critical factor in a smart building, so it is imperative to implement a safe and reliable emergency lighting system that complies with stringent safety regulations. One of the advantages of using smart LED lighting is that the emergency lighting can be easily integrated into the existing system, allowing for improved safety through synchronous operation and further efficiency and cost reduction. PLC-based smart lighting networks can also operate in a power failure event, which is very important for battery-powered emergency lighting applications.

Recently, another very well-known technology is re-emerging as a comprehensive solution for smart and connected building: Power over Ethernet (PoE). This technology allows distributing both power and data over a single, standard CAT5e/6 Ethernet cable. Although it can supply power to any low- to a medium-power device, PoE is the most beneficial for LED lighting, eliminating the need for AC/DC conversion at every single fixture, thus providing a significant energy and cost savings. The Ethernet PoE PD is also perfectly suited to address applications with high data rate requirements, such as video surveillance. It ultimately opens up some unique opportunities for using well-established building automation protocols such as KNX or CAN via Ethernet. The biggest semiconductor manufacturers are competing to win this perspective market because PoE may be the ultimate solution for the smart and connected buildings of the future, bringing the paradigm of Smart City closer than ever.

If you are looking for a more comprehensive insight into current trends, don't hesitate to contact EBV's Smart Home & Building experts. They can help you make the right decision and select the optimal solutions for your Smart Home & Building applications.

ACNT-H511C

High CTI Optocoupler
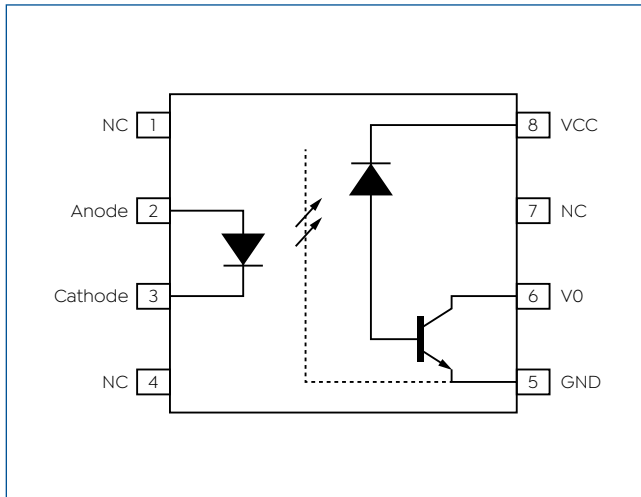
ACNT-H511C Block Diagram

The ACNT-H511C is a single-channel, high CTI, open collector optocoupler device in 15-mm stretched SO8 package. The device is equipped with an insulating layer between the light-emitting diode and an integrated photon detector to provide electrical insulation between the input and the output. Having separate connections for the photodiode bias and output transistor collector reduces the base-collector capacitance and enhances the data speed up to a hundred times compared to a conventional photo-transistor coupler.

- **More than 600 V CTI, Material Group I**
- **15 mm Stretched SO8 Package**
- **TTL Compatible**
- **Open-Collector Output**

Features

- High CTI, open collector output optocoupler in 15 mm stretched SO8 package
- AC and DC performance guaranteed over wide temperature:
  - From –40 to +105 °C
- Typical Current Transfer Ratio (CTR)
  - 50 % at T_A = 25 °C, V_{CC} = 5 V, I_F = 12 mA
- Wide operating supply voltage range:
  - 4.5 to 24 V
- Internal clearance (DTI):
  - 0.5 mm
- Typical common-mode rejection (CMR) at V_{CM} = 1500 V:
  - 40 kV/µs

- Safety and regulatory approvals:
  - UL 1577 Recognized: 7500 V_{RMS} for 1 minute
  - CSA approval
  - IEC/EN 60747-5-5 approval for reinforced insulation:
    - V_{IORM} = 2262 V_{PEAK}
    - V_{IOTM} = 12000 V_{PEAK}

Key Applications

- Industrial, Smart Grid:
  - 690 V(AC) variable speed motor drives
  - Feedback elements in switching power supplies
  - 1500 V Photovoltaic (PV) systems
  - Renewable energy inverters
  - Digital isolation for A/D and D/A conversion
  - Communications interfaces
  - MCU interfaces

The ACNT-H511C high CTI optocoupler can meet a wider range of creepage values for a higher working voltage or rated insulation voltage.

With high CTI, and material group upgrade from IIIa to I, the overall creepage requirements will reduce by half.

This device is well suited for isolated communication logic interface and control in high-voltage power systems.

PEX88T32

PCIe Gen 4.0 Retimer
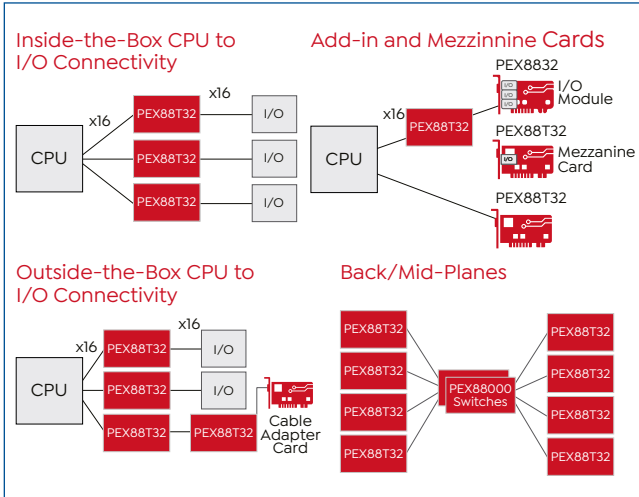
PEX88T32 Application Example Diagrams

PEX88T32 is a PCIe Gen 4.0 Retimer with 32 bi-directional PCIe lanes and the industry's best SerDes technology with extended reach. Broadcom has taken an innovative path by re-purposing its PCIe Gen 4.0 Switch to create a retimer, the PEX88T32, to fill this market need. The PEX88T32 offers a total of 32 bi-directional PCIe Gen 4.0 lanes where one x16 PCIe port can connect to a host and other x16 port to an I/O device, cable connector or mid-plane. The PEX88T32 retimer uses the same field-tested chip architecture and robust long-reach SerDes as PEX88000 PCIe Gen 4.0 Switch family.

- **PCIe 1.0, 2.0, 3.0 and 4.0 support**
- **32 bi-directional PCIe lanes: 16 lanes up and 16 lanes down**
- **Industry's best SerDes technology with extended reach (up to 39 dB loss)**
- **Low-power SerDes (under 90 mW per lane)**

Features

- SerDes technology with extended reach up to 39 dB loss
  - SerDes field-tested by Broadcom in various products
- Configurable with SBR
- Cut-through packet latency of 105 ns
- DPC/eDPC support, Read tracking for surprise removal
- SSC isolation, SRIS, SRNS, and Common Clock support
- Each lane is independent of other lanes
- No reference resistors, NV RAM is programmed during test
- CTLE, 9-tap DFE equalizer to support up to 39 dB channel loss
- CDR, pre/post-cursor settings
- Lane margining and loop-back supported
- Exceeds 20 dB normal channel loss handling set by PCI-SIG

- Handles 39 dB (spec = 28 dB) loss with the clean channel (5 to 11 dB margin)
- 800 mV PRBS-23 BERT + 28 dB CEM Channel + Package Loss
- Field-proven debug and bring-up tools
- IBIS-AMI Models, Arctic SerDes Eyescope, and other debug tools
- Reliability, availability, serviceability VisionPAK - SerDes Eye capture
- Very high jitter and interference tolerance (100% over PCIe spec)
- Exceeds 20 dB normal channel loss handling set by PCI-SIG

Key Applications

- Communication & Infrastructure:
  - Camera and video applications
  - Rugged embedded systems
  - Head-Up Displays (HUD)
- Industrial:
  - Data acquisition and processing
  - Communication modules

- Networking cards
- Custom servers

The PEX88T32 is an advanced retimer, based on Broadcom's latest PEX88000 PCIe Gen 4.0 switch family. It uses their proven and field-tested SerDes technology, which allows for extended range with lower power consumption.

Offering 32 bi-directional PCIe Gen 4.0 lanes and cut-through latency measured in nanoseconds, this device takes up a unique position on the market, and it is yet to be challenged by the competition.

PDS-408G

8+3 ports Indoor Switch, up to 90 W per port, IEEE 802.3bt compliant, PoE Managed

PDS 408G Switch – Product Image

The PDS-408G digital ceiling IEEE 802.3bt compliant PoE switch offers an optimal and cost-effective solution for PoE lighting and other digital ceiling applications. It allows lighting fixtures and other Ethernet terminals to receive power, along with data, over standard Ethernet cables in the most efficient way. The PDS-408G is a 480 W fan-less switch, designed to be deployed in the ceiling or in communications rooms. It supports full power mode by providing 60 W for all 8 ports simultaneously and any specific port can go up to 90 W.

- **IEEE 802.3bt compliance**
- **High energy efficiency and low power consumption in standby and in operation modes**
- **Supports legacy 60/90 W dynamic PoE devices**
- **Fanless Design, Enhanced Reliability and Silent Operation**

Features
- Digital ceiling PoE switch:
  - 8 x PoE 10/100/1000mbps ports
  - 3 x 10/100/1000 Mbps uplink ports
- IEEE 802.3bt compliant
  - Backward compatible with IEE 802.3at/af
- Supports legacy 60/90 W PoE devices
- Maximum power of 8 x 60 W
  - Any individual port up to 90 W
- Fanless design
- High energy efficiency:
  - Very low power consumption in standby and in operation modes
- Layer 2 switch including 802.1Q-based VLANs
  - Enables network segmentation for improved performance and security
  - 802.1Q VLAN switch with 8 k MACs and 4 k VLANs

- Push/pop up to two VLAN tags
- Port-isolation and private-VLAN
- Jumbo frame support up to 9.6 KB
- MAC address table: 8 k
- Link Aggregation:
  - IEEE 802.3ad LACP or static
- Access control list:
  - Limits the unit management to a range of IPs and network protocols
- Port Mirroring
  - Mirror Rx, Tx, both
- SNMP MIBs
- Remote management:
  - Web HTTP/HTTPS (encrypted TLS v1.2)
  - ACLAccess, Telnet, SSHv2, SNMPv2-v3
  - RADIUS/TACACS user authentication
- Regulatory compliance:
  - ROHS, WEE, CE

Key Applications
- Communication & Infrastructure:
  - Digital Ceiling
  - Building Automation
  - LAN infrastructure

The PDS-408G is the complete solution for digital ceiling applications that can benefit from using a single UTP cable for power and data transfer, offering up to 480 W of total power.

Built by the company with a long history in network solutions development, the PDS-408G offers exceptionally high efficiency that enables silent and reliable fanless performance. Software updates can be applied "on the go" without disrupting power to the connected devices.

AS3933 LF Receiver IC

Programmable 3D LF wake-up receiver
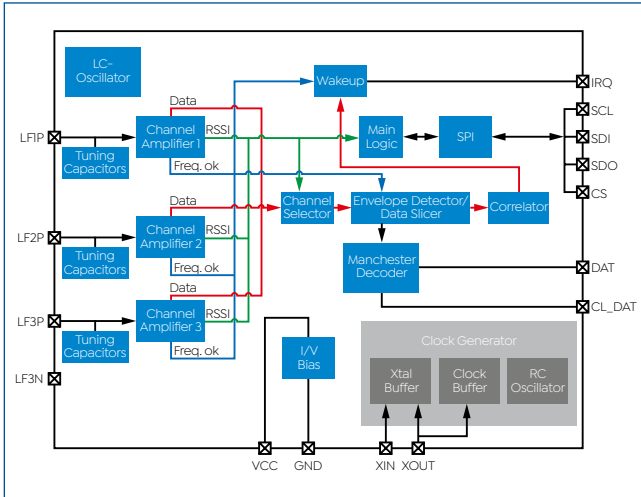
AS3933 Block Diagram

The AS3933 is a three-channel ASK receiver that generates a wake-up signal upon detecting data signal with an LF carrier frequency in the range from 15 to 150 kHz. The programmable features of AS3933 allow optimizing its settings to achieve a longer distance while retaining a reliable signal detection. The adjustable sensitivity level enables reliable detection even in noisy environments, while the automatic antenna tuning feature ensures perfect matching to the desired carrier frequency. The AS3933 can wake up active RF tags in RTLS, PKE, and other similar tracking and access control systems.

- **Reliable wakeup pattern detection**
- **High wake-up sensitivity of 80 µV$_{RMS}$**
- **Low power listening mode (2.3 µA)**
- **One, two, or three-channel operation**

Features
- Programmable wake-up protocols:
  - 16/32-bit single or double pattern detection
  - Frequency detection only (no pattern correlation)
- ASK, OOK, Manchester pattern decoding (with clock recovery)
- Periodical forced wake-up (1 s to 2 h)
- Adjustable data rate:
  - 0.5 to 4 kbps (Manchester)
- Adjustable sensitivity level
- Enables longer battery life:
  - Consumption in 3-channel listening mode: 2.3 µA (typ.)
- Bidirectional SPI interface
- Highly resistant to false wakeups
- Easy antenna tuning for perfect CF matching
- Self-calibration of the internal RC-oscillator

- False wakeup counter
- Long-range wake-up event detection
- Manchester decoding with clock recovery
- Digital RSSI values available for each channel
- Dynamic range: 64 dB
- 5-bit RSSI step (2 dB per step)
- Clock generator based on 32 kHz XTAL, RC-OSC, or external clock
- Operating temperature range –40 to +85 °C
- Package option: 16 pin TSSOP, QFN 4 x 4

Key Applications
- Smart Consumer & Building:
  - Asset tracking
  - ID systems
  - Wireless sensors
  - Real-time location systems
  - Active RFID tags

- Healthcare & Wearables:
  - Portable healthcare devices
  - Medical instruments

The AS3933 wake-up receiver can use up to three channels for 3-D pattern detection. The false wake-up detection ratio is reduced to a minimum, thanks to the 32-bit pattern detection capability and the pattern doubling support. The AS3933 can work outside of the conventional LF range, leveraging lower RF pollution.

Antenna design is greatly simplified, thanks to the best-in-class wake-up sensitivity and the antenna tuning feature that ensures optimized performances even with cheaper antenna coils.

A7670X

LTE Cat1 Module

Intelligent Terminal for E-scooters
Application Example
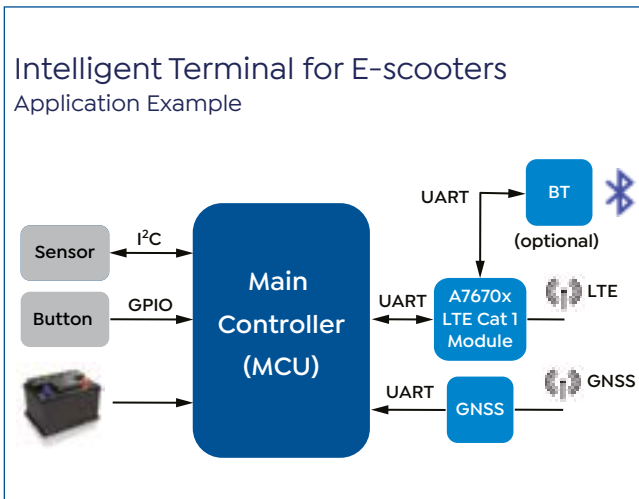
A7670X Application Example – Block Diagram

The A7670x is a Multi-Band LTE-FDD/LTE-TDD/GSM/GPRS/EDGE module solution in an LGA package that supports LTE Cat 1 up to 10 Mbps data transfer. It features great extensibility with a rich set of interfaces including UART, USB2.0, GPIO, and more. The module provides great flexibility and ease of integration in the customer's applications. It is designed for applications that need high throughput data communication in a variety of radio propagation conditions. Due to the unique combination of performance, security, and flexibility, this module is ideally suited for many different applications.

- **Small size LTE Cat 1 Module**
- **LGA package with a wide range of interfaces, compatible with SIM7070 series**
- **Suitable for LTE and GSM networks**
- **A rich set of software features: FOTA, LBS, SSL...**

Features
- Frequency bands:
  - A7670C:
    - LTE-FDD B1/B3/B5/B8
    - LTE-TDD B34/B38/B39/B40/B41
    - GSM 900/1800MHz
  - A7670E:
    - LTE-FDD B1/B3/B5/B7/B8/B20
    - GSM 900/1800MHz
  - A7670SA:
    - LTE-FDD B1/B2/B3/B4/B5/B7/B8/B28/B66
    - GSM 850/900/1800/1900MHz
- Operating temperature: -40 °C to +85 °C
- Power supply voltage: 3.4 V to 4.2 V
- Interfaces:
  - SIM Card: 1.8 V/3.0 V
  - UART, I²C, USB2.0
  - PCM audio
- Data transfer:
  - LTE: 10 Mbps(DL)/5 Mbps(UL)
  - GPRS/EDGE: 236.8 Kbps(DL)/236.8 Kbps(UL)

- Software features:
  - Protocol: TCP/IP/IPV4/IPV6/Multi-PDP/FTP/FTPS/HTTP/HTTPS/DNS
  - Android RIL: Android™ 5.0/6.0/7.0/8.0/9.0
  - USB Drivers: Microsoft® Windows® 2000/XP/Vista/Win7/Win8/Win10, Linux, Android™
  - Firmware upgrade: USB/FOTA
- Certification:
  - A7670C:
    - CCC/TA/CTA
  - A7670E:
    - CE-RED/RoHS/REACH
  - A7670SA:
    - CE-RED/RCM/FCC/Anatel/RoHS/REACH

Key Applications
- Smart Consumer & Building
  - Smart metering
  - Building automation
  - Remote access

- Healthcare & Wearables
  - Connected health

This compact size LTE CAT 1 module provides a wide range of connectivity options, supporting both LTE and GSM networks. The A7670x package is pin-compatible with the SIM7070 Series, offering design flexibility.

The A7670X module offers a rich set of hardware connectivity options, such as USB 2.0, UART, I2C, 1.8/3.3V compliant USIM interface, PCIM audio, as well as a set of software features, including full TCP/IP V4/V6 stack, SSL, USB drivers for most commonly used operating systems, Firmware update over the air (FOTA), and much more.

Product order code | • S2-108H3

SIM7070 series

CAT-M and NB-IoT Modules
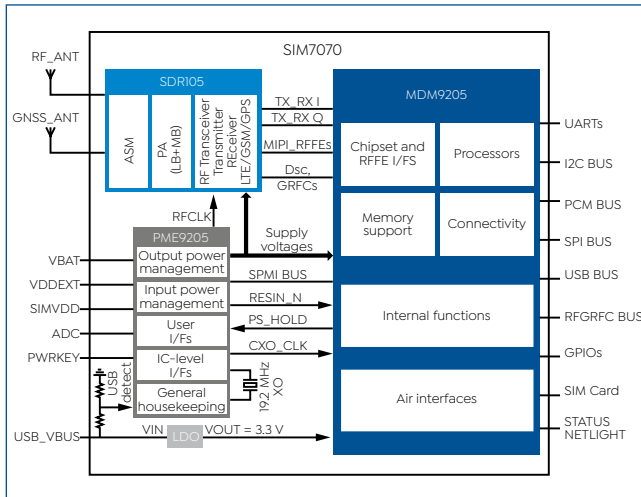
Sim7070 Block Diagram

The SIM7070 series is a multi-band CAT-M, NB-IoT, and GPRS module solution. It has a great extension capability with a rich set of interfaces including UART, GPIO, PCM, SPI, I²C, and more. The module provides a lot of flexibility and easy integration in any application. It is designed for applications that require low latency, low throughput data communication in a variety of radio propagation conditions. Due to the unique blend of performance, security, and flexibility, this module is ideally suited for M2M applications such as metering, asset tracking, remote monitoring, e-health, etc.

SIM7070G variant supports B71 band,
SIM7070E variant supports B31/B72 bands

- **Power Save Mode (PSM) and Extended Discontinuous Reception (eDRX)**
- **Supports 450 MHz LTE-M / NB-IoT operation**
- **The package of the SIM7070 series is pin-compatible with the SIM7000/SIM800F/SIM900 modules**
- **Dimensions: 24 x 24 x 2.3 mm**

Features

- Supported bands:
  - CAT-M:
    - B1/B2/B3/B4/B5/B8/B12/B13/ B14/B18/B19/B20/B25/B26/B27/ B28/B31*/B66/B71*/B72*/B85
  - CAT-NB:
    - B1/B2/B3/B4/B5/B8/B12/B13/ B18/B19/B20/B25/B26/B28/ B31*/B66/B71*/B85
  - GSM/GPRS:
    - 850/900/1800/1900MHz
- Data transfer:
  - Cat-M: 1119 Kbps (UL)/589 Kbps (DL)
  - Cat-NB1/NB2: 150 Kbps (UL)/136 Kbps (DL)
  - EDGE: 236.8 Kbps (UL)/236.8 Kbps (DL)
  - GPRS: 85.6 Kbps (UL)/85.6 Kbps (DL)
- Interfaces:
  - UART, SPI, I²C, GPIO
  - USB2.0 HS interface

- SIM card interface (1.8 V only)
- PCM/I²S
- Embedded SIM (optional)
- GNSS:
  - GPS, Beidou, GLONASS, Galileo
  - Protocol: NMEA
- Other Features:
  - TCP/UDP
  - HTTP/HTTPS/TLS/DTLS/PING/ LWM2M/COAP/MQTT
  - Ayla Cloud
  - Firmware update via USB
  - FOTA
  - EAT
  - Control via AT commands
- Supply voltage range: 3.2 V to 4.2 V
- Operation temperature: –40 °C to +85 °C
- Dimensions: 24 X 24 X 2.3 mm
- Weight: 2.9 ±0.2 g
- Regulatory: FCC/IC/CE/RCM/ JATE*/TELEC*/NCC*/ANATEL*/ GCF*/PTCRB*/RoHS/REACH

Key Applications

- Smart Consumer & Building:
  - Home security
  - Automation
  - Telematics
  - Smart metering
  - Fleet management
  - Asset tracking

The SIM7070 is a multi-band CAT-M, NB-IoT, and GPRS module series, perfectly suited for LPWAN applications and communication nodes in hard-to-reach places that prevent regular maintenance. By employing the Power Saving Mode (PSM), and Extended Discontinuous Reception (eDRX) functions, the SIM7070 series modules can extend battery life up to 10 years.

SIM8202G-M2

5G Module
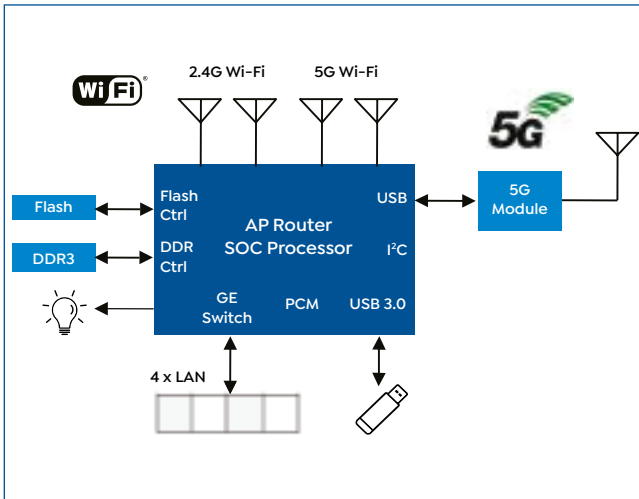
SIM8202G-M2 Application Example – Smart Home Gateway

The SIM8202G-M2 is an ultra-small multi-band 5G NR/LTE-FDD/LTE-TDD/HSPA+ module that supports R15 5G NSA/SA up to 2.4Gbps data transfer. It has a strong extension capability with abundant interfaces including PCIe, USB3.1, GPIO, etc. The module provides considerable flexibility and easy integration into customer's applications. The SIM8202G-M2 adopts the M.2 form factor, TYPE 3042-S3-B. AT commands of SIM8202G-M2 are compatible with SIM7912G/SIM8200X-M2 series modules. This also minimizes the investments of customers and enables a short time-to-market.

- **New 4-antenna design**
- **Compact size: 42.0 x 30.0 x 2.3 mm**
- **AT commands of the SIM8202G-M2 are compatible with SIM7912G/SIM8200X-M2 series modules**
- **Standard M.2 Interface**

Features
- Form factor: M.2
- Frequency bands:
  - Sub-6G: n1/n2/n3/n5/n7/n8/n12/n20/n25/n28/n40/n41/n66/n71/n77/n78/n79
  - LTE-FDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/B14/B17/B18/B19/B20/B25/B26/B28/B29/B30/B32/B66/B71
  - LTE-TDD: B34/B38/B39/B40/B41/B42/B48
  - WCDMA: B1/B2/B3/B4/B5/B8
- GNSS: optional
- Normal operation temperature: –30 °C to +70 °C
- Supply voltage: 3.135 V to 4.4 V
- Data transfer:
  - Sub-6G: 2.4 Gbps (DL)/500 Mbps (UL)
  - LTE: 1 Gbps (DL)/200 Mbps (UL)
  - HSPA+: 42 Mbps (DL)/5.76 Mbps (UL)

- Interfaces:
  - SIM Card: 1.8 V/2.95 V
  - USB (USB 3.1, USB 2.0)
  - PCM/I²S (echo cancellation, noise suppression…)
  - I²C
  - Diversity receiver
- Software features:
  - Protocol: TCP/IP/IPV4/IPV6/Multi-PDP/FTP/FTPS/HTTP/HTTPS/MQTTS/DNS/SSL3.0
  - TLS
  - FOTA
  - Android RIL: Android™ 6/7/8/9
  - USB Driver: Microsoft® Windows® (Win7/Win8/Win10), Linux, Android
  - MBIM: Win8/Win10
  - NDIS: Linux, Win7/Win8/Win10
  - Firmware upgrade: USB
- Regulatory: CCC/SRRC/CTA/RoHS/REACH/CE/FCC

Key Applications
- Industrial:
  - Robotics
  - 5G industrial (IIoT) gateways
- Smart Sensing & Connectivity:
  - Smart hospitals
  - Last-mile network deployment

The SIM8202G-M2 can be used to effectively solve the last-mile network deployment problem by turning the carrier network signal into a Wi-Fi signal, so that more devices can be connected to the network, and benefit form ultra-fast Internet experience brought by 5G technology.

The same concept applies to the industrial segment as well, where it can be used in 5G Industrial Gateways.

S2-LPTX

Ultra-Low Power, High Performance Sub-1GHz Transmitter
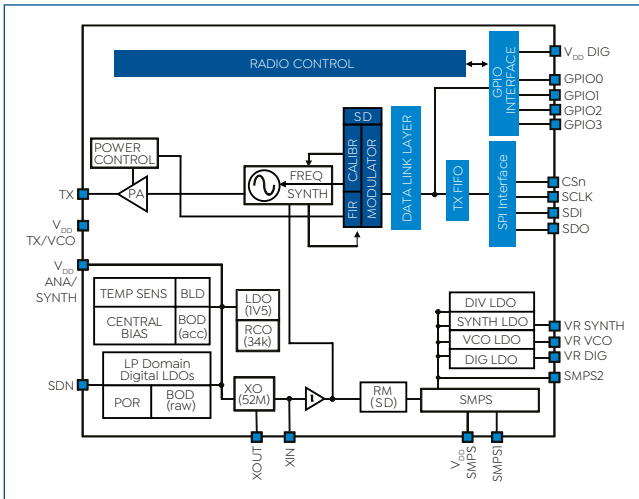
S2-LPTX Simplified Block Diagram

The S2-LPTX is a high-performance ultra-low-power RF transmitter, intended for RF wireless applications in the sub-GHz band. It is designed to operate in both the license-free ISM and SRD frequency bands at 433, 868, and 920 MHz, but can also be programmed to operate at other additional frequencies in the 413-479 MHz, 826-958 MHz. The S2-LPTX supports different modulation schemes: 2(G)FSK, 4(G)FSK, OOK, and ASK. The air data rate is programmable from 0.1 to 500 kbps. The S2-LPTX meets the regulatory requirements applicable in territories worldwide, including Europe, Japan, China, and the USA.

- **Output power: +16 dBm**
- **Tx peak current: 10 mA at +10 dBm**
- **Pin-to-pin compatible with S2-LP transceiver**
- **Operating temperature range from -40 to 105 °C**

Features
- Frequency bands:
  - 413-479 MHz
  - 826-958 MHz
- Modulation schemes:
  - OOK, ASK
  - 2(G)FSK, 4(G)FSK
- Air data rate:
  - From 0.1 to 500 kbps
- Ultra-low power consumption:
  - 10 mA TX at +10 dBm
- Programmable RF output power up to +16 dBm
- Programmable channel spacing
- Fast start-up and frequency synthesizer settling time
- Battery indicator and low battery detector
- TX 128 bytes FIFO buffers
- 4-wire SPI interface
- ST companion IPD ICs available
- Ultra-low-power RC oscillator
- Wake-up by internal or external events

- Flexible packet length
- IEEE 802.15.4g HW packet support with whitening, FEC, CRC
- Wireless M-BUS supported
- Enables operations in the SIGFOX™ network
- Suitable to build systems targeting:
  - Europe: ETSI EN 300 220, ETSI EN 303 131
- Operating temperature range:
  - From -40 to 105 °C

Key Applications
- Smart Consumer & Building:
  - Smart metering
  - Home energy management systems
  - Wireless alarm systems
  - Building automation
  - Smart street lighting
  - Remote control
- Industrial:
  - Industrial monitoring and control
  - Asset tracking

The S2-LPTX low-power sub-GHz transmitter builds on the success of the Spirit 1 transmitter series (STS1TX), offering almost 50% lower power consumption, combining it with a set of new options, including support for 802.15.4g and IPV6.

These features make the S2-LPTX perfectly suited for smart metering or smart home and building applications. The S2-LPTX is pin-compatible with the S2-LP sub-GHz transceivers and can operate in the extended temperature range from -40 to 105 °C.

TLP2312 & TLP2372

High-Speed, Low Voltage Photocouplers
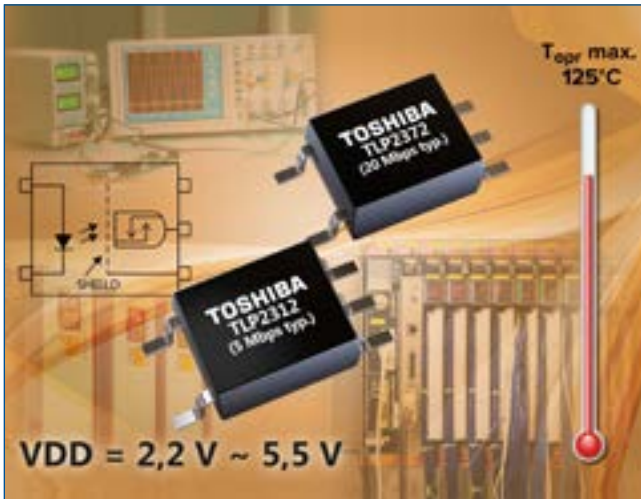
Toshiba TLP2312 and TLP2372

Toshiba's TLP2312 and TLP2372 are high-speed photocouplers that can operate with a supply voltage as low as 2.2 V while offering excellent isolation properties. The two devices have typical data transfer rates of 5 Mbps (TLP2312) and 20 Mbps (TLP2372) and are specifically designed to operate with low voltage rails, down to 2.2 V. These new photocouplers are housed in a 5-pin SO6 package with the maximum height of 2.3 mm, offering a low profile for height-constrained applications and bringing greater freedom for the components layout on PCBs.

- **Low supply voltage down to 2.2 V**
- **Low threshold input current of 1.6 mA**
- **Compact 5-pin SO6 package with max. height of 2.3 mm**
- **High operating temperature rating of 125 °C max.**

Features
- High data transfer rate:
  - TLP2312: 5 Mbps (typ.)
  - TPL2372: 20 Mbps (typ.)
- Supply voltage:
  - From 2.2 to 5.5 V
- Low threshold input and supply current:
  - I_{FLH} = 1.6 mA (max.)
  - I_{DDL}/I_{DDH} = 0.5 mA (max.)
  - Allows for direct driving via MCU
- Low total power consumption
- Totem-pole output configuration:
  - Current sourcing and sinking capabilities
- High common-mode transient immunity: ±20 kV/μs
- Pulse width distortion: 20 ns
- Total capacitance: 0.8 pF (typ.)
- Minimum isolation voltage: 3750 V(RMS)
- Creepage and clearance distances: 5.0 mm
- Internal isolation thickness: 0.4 mm

- Compact 5-pin SO6 package
- Safety standards:
  - UL and cUL recognized
  - VDE and CQC approved
- Wide operating temperature range:
  - –40 °C to 125 °C

Key Applications
- Industrial:
  - Programmable Logic Controllers (PLCs)
  - General-purpose inverters
  - Measuring equipment
  - Control equipment
  - High-speed digital interfaces

Toshiba's TLP23x2 series photocouplers are perfectly suited for low-voltage system designs operating at 2.5 V LVCMOS voltage levels. When used in such designs, these photocouplers do not require a dedicated power supply, saving valuable PCB space and reducing the components count.

Due to their low threshold input current and supply current requirements, the TLP23x2 series photocouplers can be directly driven by a microcontroller unit (MCU), reducing total power consumption even further.

STR-RSL10-MESH-KIT-GEVK

Strata Enabled RSL10 Mesh Platform
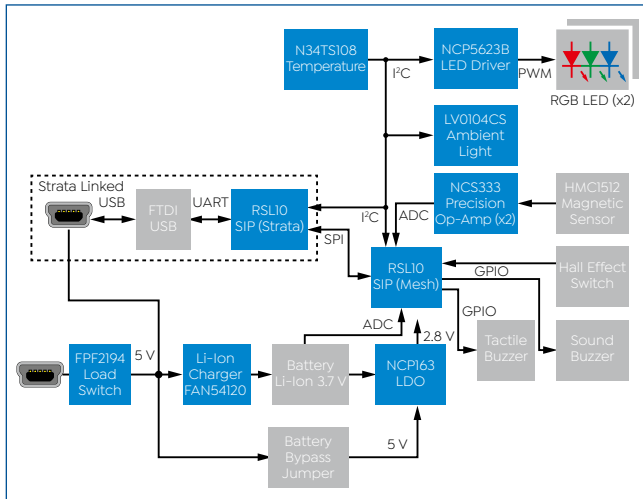
RSL10 Mesh Platform – Block Diagram

The RSL10 Mesh Platform is a versatile and easily configurable Strata-enabled development kit that allows easy development of mesh networking applications based on the industry's lowest power Bluetooth 5 radio. The platform includes two RSL10-based Mesh Nodes, with a variety of available smart sensors and indicators, and a Strata Gateway, which enables connectivity to the Strata Developer Studio™. The RSL10 itself is available as an SoC or SIP, with the SIP offering the size of only 6 x 8 mm while being fully certified according to worldwide wireless standards.

- **Based on RSL10 SIP, industry leading low power consumption for maximum battery life**
- **Multiple environmental sensors included**
- **RSL10 Mesh Package, Compliant with Bluetooth® SIG mesh specification**
- **RSL10 Mesh App and Strata Developer Studio™**

Features
- Strata Developer Studio™:
  - Includes support for FOTA updates, and connectivity to cloud service providers
- RSL10 Mesh Package, compliant with Bluetooth® SIG mesh specification
- RSL10 Software Development Kit:
  - Eclipse-based IDE with support for FreeRTOS™
- RSL10 Mesh App for mobile control of mesh networks
- RSL10 SIP:
  - industry-leading Bluetooth® solution with ultra-low power consumption
- Wheatstone bridge for angular magnetic field measurement, amplified by NCS333 chopper-stabilized op-amps
- Hall-effect switch for simple magnet detection
- Multiple environmental sensors:

- Low voltage temperature sensor (N34TS108)
- Ambient light sensor (LV0104CS)
- Magnetic sensors
- Dual RGB LEDs with 5-bit current-control for dimming and color mixing via LED driver (NCP5623B)
- Optional vibration buzzer connector that can also be used to control low-voltage and solid-state relays
- Battery charger (FAN54120) for Li-Ion or Li-Po batteries to facilitate powering the node with a rechargeable battery

Key Applications
- Smart Consumer & Building:
  - Home & building automation
  - Connected lighting
  - Smart thermostats
  - HVAC control and monitoring
  - Motion and light-sensing
  - Smart Security

- Industrial:
  - Smart retail
  - Autonomous factories

Combined with Strata Developer Studio™ RSL10 Mesh Platform allows a quck and simple implementation of Mesh network over RSL10 BT LE SIP.

Strata Developer Studio™ is a cloud-connected development environment that allows easy simulation with any Strata-enabled development kit, offering clean and intuitive GUI. It also automatically downloads all the available resources needed for development. It supports a large number of other Strata-enabled kits.

ON Semiconductor®

LIGHTING-1-GEVK

Connected Lighting Platform

Dual-Channel LED driver

2 Strings x 16 LEDs

AC/DC PSU Module

Bluetooth® LE Module
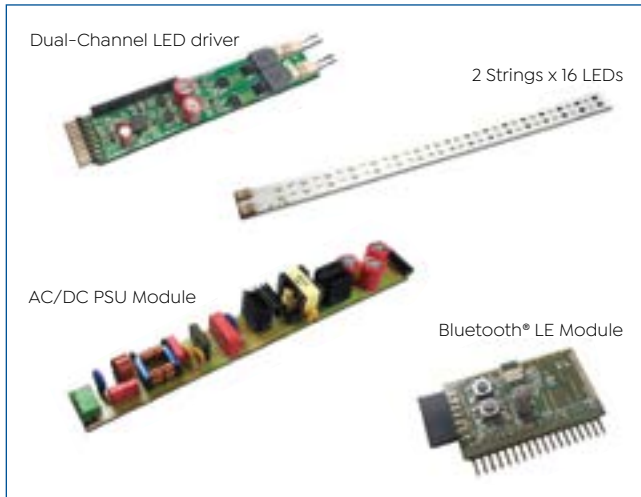
LIGHTING-1-GEVK Connected Lighting Platform

The LIGHTING-1-GEVK connected lighting platform is a modular development kit that combines an AC/DC power supply (optional PoE version), an LED driver board, and a wireless sensing and connectivity board – everything needed for an energy-efficient LED lighting solution. It can provide high-power lighting by driving up to two strings of 16 LEDs (up to 7000 lumens) and includes dual independent LED channels and white balance control. The platform also provides connectivity options, Power Over Ethernet (PoE), or Bluetooth® LE that connects to ON Semiconductor's RSL10 Sense and Control mobile app.

- **High-power lighting features**
- **Multiple connectivity options, Bluetooth® Low Energy (BLE) or Power Over Ethernet (PoE)**
- **Compliant with multiple industry standards**
- **High efficiency power conversion (>90 % at full load)**

Features

- High-power lighting:
  - Up to 2 strings of 16 LEDs (7000 lumens)
  - 10 to 70 W of output power, producing from 1000 to 7000 lumens
  - Dual independent LED channel
  - White balance control (12-bit dimmer from 0 to max)
  - 4000-step dimming
- Multiple connectivity options:
  - Power Over Ethernet (PoE)
  - Bluetooth® Low Energy
  - Compatible with the RSL10 Sense and Control App
  - Supports multi-sensor shields
- Compliant with multiple industry standards
- The platform consists of four components:
  - LED module, supporting 2 x 16 LEDs (warm white and cool white)

- BLE connectivity board, featuring RSL10 SIP
- AC/DC PSU board:
  - V_{IN}AC: 90 to 270 V(AC)
  - V_{OUT}DC: 55 V(DC)
  - P_{OUT}electrical: 70 W
  - Power factor: greater than 0.99 at full load
- LED driver board, featuring the FL7760 CCM buck controller
  - Dimming down to 0.6%, telemetry data, 12-bit PWM
- Optional LIGHTING-POWER-POE-GEVB PoE module is available:
  - PoE module replaces the AC/DC module

Key Applications

- Lighting:
  - Connected Lighting
- Smart Consumer & Building:
  - Smart Home

The Connected Lighting Platform is a modular development kit for prototyping cost-effective, industrial LED lighting solutions. This allows the developers to build their own lighting setups, by interchangeably switching between PoE-based or mains-powered AC/DC power supply.

The same applies to the LED strip that can be discussed with the Lightspeed team experts from EBV, which can suggest similar LED solutions with better performances and lower cost for a broadest range of use cases.

SMART CITY & INFRASTRUCTURE

In the Smart City concept, the energy distribution is one of the primary concerns. Ever-growing cities are continuously struggling to provide sufficient energy levels, especially during peak hours. Instead of using the brute force approach and building additional power plants and refineries, the smart city concept envisions more efficient use of the available resources and a higher level of optimization. The smart energy distribution is environmentally friendly and offers improved comfort features. The first step in smart energy distribution is to monitor energy consumption and forward readings to a data management system. By employing innovative technologies such as artificial intelligence (AI), it is possible to predict behavioral patterns and adjust distribution accordingly. Electricity is the most dominant form of energy used in homes and cities, with an exponentially growing tendency. The dynamic nature of the electric power market, combined with the possibility of energy exchange between the consumers and power distributors, have created the need for a reliable communication network, through which a bi-directional data exchange can be performed.

Communication between the data concentrator (DCU or eGTW - Energy Gateways) and the smart meter (AMR - Automatic Meter Reading) infrastructure can be established via existing power lines using Power Line Communication (PLC) technology. The PLC technology employs the superposition of a modulated high-frequency signal to the AC mains (as mentioned in the previous article). There are several types of PLC technologies, depending on the carrier frequency and modulation scheme. Narrowband PLC (NB-PLC) uses OFDM and FSK modulation and allows up to 500 kbps in an E-meter - eGTW range coverage. Noise immunity, longer range, and fast adaption to country specific algorithms are key benefits for the future of PLC grid infrastructure needs. Broadband PLC (BB-PLC) can achieve anywhere from 10 to 200 Mbps, depending on the grid quality and environmental noise. It operates on frequencies above 1 MHz but has a shorter range in comparison with NB-PLC. BB-PLC can be found in standards like HomePlug, Green PHY, and ISO15118 for the PLC communication between vehicle and EV charging station. Each HUB charging station contains more and more eGTW functionalities and applications to meet the future needs of smarter grids.

The key advantages of PLC technology include its ability to use the existing power grid installation, work in areas with no RF signal permeability, and its reasonably low maintenance costs. The main disadvantages are the high sensitivity to interference caused by the low-quality consumer equipment and the unknown propagation characteristics of the power lines. However, some innovative solutions that employ frequency hopping and adaptive signal amplification can help to mitigate these issues.

NB-PLC technology is perfectly suitable for use in smart grid systems. The focus of future market trends in NB-PLC is on using hybrid PLC + RF solutions in an SoC form-factor, combined with open standard protocols such as G3 (PLC) and WiSUN (RF). This imroves the robustnes through the network redundancy. Also, NB-PLC is compliant with several global regulatory bodies, including CENELEC-A/B, FCC, and ARIB, which simplifies the deployment requirements worldwide.

When it comes to wireless communications within the smart grid, mesh network topologies are the preferred option due to the high density of sensor nodes. On the other hand, mesh topologies with limited area coverage are not suitable for applications where the nodes are placed far apart. Such applications typically include water and gas metering (flow metering), municipal utility applications, and many other applications where wide coverage is required. Instead, these applications use Low Power Wide Area (LPWA) networks, which offer significantly broader coverage per node, along with extremely low power consumption.

There are many LPWA technologies available on the market. Unfortunately, there is no single standardized universal solution. As a result, cities suffer from RF pollution, making it difficult for LPWA devices to communicate, especially on the unlicensed ISM frequency bands. However, one relatively new technology offers a solution to this problem. The MIOTY technology is based on the new Telegram-Splitting Ultra-Narrow Band (TS-UNB) specification from the European Telecommunications Standards Institute (ETSI). It was initially designed as a replacement for the existing wireless M-Bus standard. However, due to its robustness and built-in package redundancy, this technology has far surpassed many similar LPWA solutions, including LoRaWAN, Sigfox, NB-IoT, and LTE-M. Providing significantly better performance in terms of reliability and scalability, this technology represents a potential solution to the problem of RF pollution.
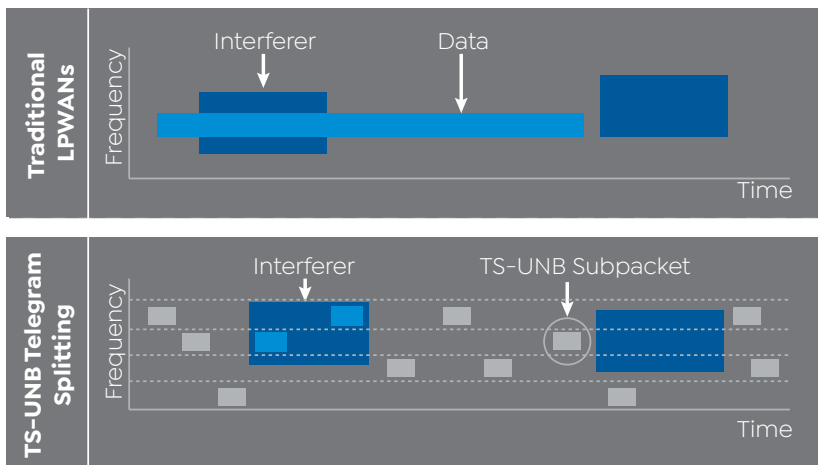
MIOTY operates on the unlicensed 868 MHz band (915 MHz in the US). Instead of sending singular data packets at relatively low speed, MIOTY splits the data packets into small sub-packets. These sub-packets are then transmitted over varying frequency and time. An algorithm in the base station continuously scans the RF spectrum for MIOTY subpackets and reassembles them into a complete message. Since the sub-packets are considerably smaller and travel at high speeds, their "on-air" time is considerably shorter, preventing collisions and reducing the overall power consumption. The result is an extremely reliable network with more than 15 km range that can handle up to 100 000 sensor nodes and 1.5 million messages per day. Backed up by the MIOTY alliance, this technology represents a perfect solution for reliable communication in any type of noisy environment.

i.MX RT106F

Machine Vision Solution: MCU-Based Offline Face Recognition
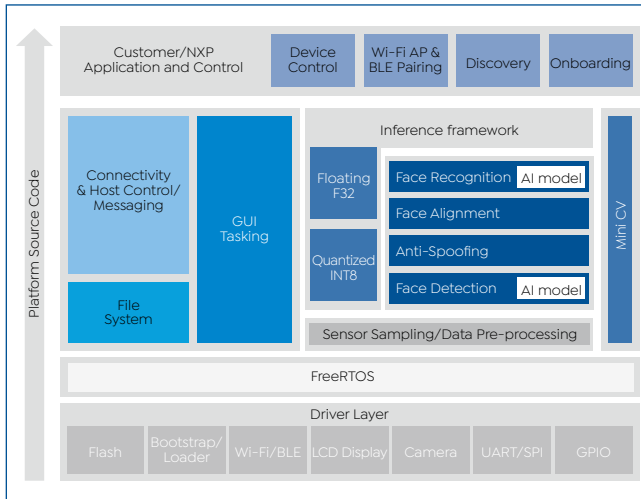
i.MX RT106F Face Recognition Software Block Diagram

NXP's latest face recognition solution leverages the i.MX RT106F Crossover MCU, an EdgeReady™ solution-specific variant of the i.MX RT1060 family, allowing developers to quickly and easily add face recognition capabilities to their IoT design. The SLN-VIZN-IOT is a small form-factor, production-ready HW design based on the i.MX RT106F MCU, which comes with fully integrated SW running on FreeRTOS, fully licensed to run NXP's OASIS run-time library for face recognition. It creates its own face models offline, without the need for cloud connectivity, reducing the total cost and design complexity.

- **Top-tier silicon, SW & IP: single point of contact for support, licensing & procurement**
- **Near-production ready hardware, cost and form-factor optimized**
- **Pre-integrated production-ready software, fully tested & FCC/CE certified**
- **Plug & play, Out-of-the-Box experience**

Features

- i.MX RT106F Crossover MCU:
  - EdgeReady™ variant of the i.MX RT1060 family running at 600 MHz
  - Comes with the pre-integrated face recognition engine
- MCU implementation lowers the overall BOM cost
- Familiar MCU platform for IoT developers
- NXP's turnkey solution reduces time-to-market:
  - The complete set of design resources available
- Pre-licensed to run NXP's OASIS run-time face recognition library, including:
  - Camera drivers
  - Image capture and pre-processing
  - Face detection
  - Face tracking
  - Face alignment

- Face recognition
- Anti-spoofing
- Face provisioning
- Confidence measure
- Face recognition quantified results
- Emotion recognition
- Built-in security, bootloader and application validation
- Connectivity:
  - MQTT, lwIP, TLS
  - Discovery and onboarding
  - Drivers, including Wi-Fi & Bluetooth™ (optional)
- RTOS OTW client:
  - OTW signing scripts
  - OTW rollback
  - Image redundancy
- USB MSD update
- Factory automation scripts
- Supported by MCUXpresso SDK, IDE and Config Tools

Key Applications

- Smart Consumer & Building:
  - Smart appliances
  - White goods
  - Thermostats, HVAC, lighting
  - Smart security
- Industrial:
  - Smart industrial devices
  - industrial workstations
  - Power tools

> In addition to the face recognition capability, the i.MX RT106F has plenty of available CPU horsepower, and a rich set of peripherals, making it suitable to be the main processor in many applications.
>
> "

i.MX RT600 Crossover MCUs

Powering the next generation of ML/AI, voice and audio applications
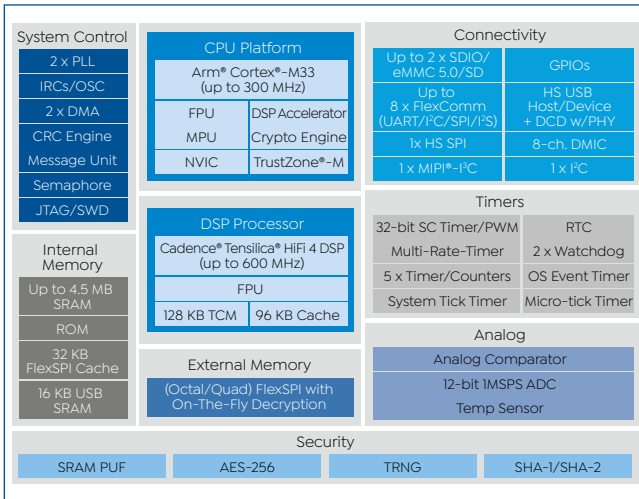
i.MX RT600 Crossover MCU Family Block diagram

The i.MX RT series is NXP's line of crossover MCUs, bridging the gap between the traditional MCUs and the applications processor space, allowing MCU customers a path for significant performance and integration improvements, without sacrificing ease-of-use. The i.MX RT600 MCU family is the latest product in the i.MX RT series, and offers significant differentiation compared to other i.MX RT products. The i.MX RT600 uses the Cortex®-M33 core, coupled with the Cadence® Tensilica® HiFi 4 DSP. It is optimized for consumer, low-power applications.

- **High performance, real-time processing**
- **Low power consumption**
- **Rich Integration**
- **Advanced security features**

Features

- High performance, real-time (RT) processing:
  - Arm® Cortex®-M33 up to 300 MHz
  - Ultra-fast, real-time responsiveness
  - Cadence® Tensilica® HiFi 4 audio DSP up to 600 MHz with Quad 32 x 32 MAC
  - Cryptography and math accelerators
  - Up to 4.5 MB on-chip SRAM with zero wait-state access
- Low power consumption:
  - 28 nm FD-SOI process optimized for both active and leakage power
- Rich integration:
  - Quad/Octal SPI Flash & PSRAM memory interface with on-the-fly memory decryption
  - USB 2.0 HS OTG interface with PHY
  - Flexible interfacing through 8 x Flexcomms - support up to 8 x SPI, 8 x I²C, 8x UART, 4 x I²S channels

- Two SD/eMMC memory card interfaces
- Digital microphone interface supporting up to 8 channels
- Advanced security:
- Secure boot with immutable hardware root-of-trust
- SRAM PUF-based unique key storage
- Acceleration for symmetric (AES-256 & SHA2-256) and asymmetric cryptography (ECC & RSA)
- Optional fuse-based root key storage mechanism

Key Applications

- Smart Consumer & Building:
  - Audio subsystem
  - ML-based edge applications
  - Voice recognition consumer electronics
  - Voice-enabled IoT devices

i.MX RT1050, the first crossover MCU, was launched in Q4 2017. Since then, the portfolio has expanded to include different products with increased performance and higher integration.

The i.MX RT600 MCU family now offers the perfect balance between high-performance and energy-efficiency with the Cortex-M33 core, HiFi 4 DSP co-processor, and cryptographic and DSP (PowerQuad) accelerators.

Another key feature is the additional security with Arm TrustZone-M technology in the Cortex-M33 architecture and SRAM PUF (Physical Unclonable Function).

Product order code
- R7FA6M4AF3CFB#AA0
- R7FA6M4AF3CFP#AA0
- R7FA6M4AF3CFM#AA0
- R7FA6M4AE3CFB#AA0
- R7FA6M4AE3CFP#AA0
- R7FA6M4AE3CFM#AA0

RA6M4

32-bit ARM® Cortex®–M33 200MHz MCU with Trust Zone and Secure Element Functionality
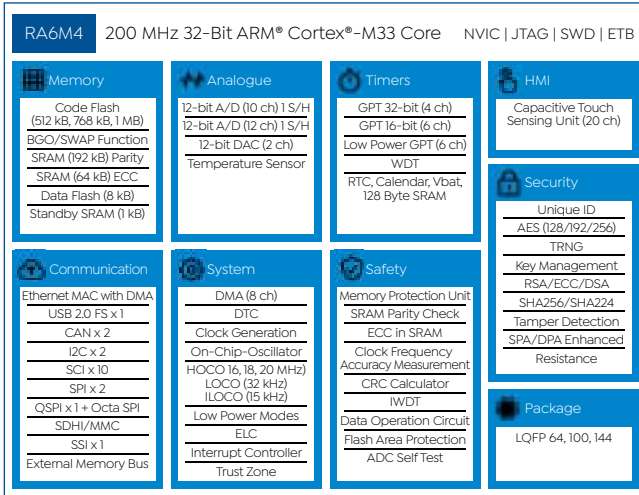
RA6M4 Block Diagram

The RA6M4 group of MCUs offers the widest integration of communication interfaces as well as the best performance level. These MCUs deliver up to 200 MHz of CPU performance using an ARM® Cortex®-M33 core, with the memory range from 512 KB to 1 MB Flash. The RA6M4 group offers Ethernet, USB, CAN, QSPI, OctaSPI, integration. Its embedded Secure Crypto Engine is rich with features that can be leveraged in various higher-level security solutions. The RA6M4 group addresses a broad range of applications for IoT endpoints such as white goods, metering, and other industrial and consumer applications.

- **The latest ARM®v8-M core architecture with TrustZone® + Secure element functionality (SCE)***
- **Symetrical & asymetrical cryptography, secure key management, additional secure MPUs**
- **A rich set of peripherals and embedded low power oscillator for BOM cost reduction**
- **15 years longevity, device life-cycle management, pin-to-pin compatibility to RA family**

Features
- Interfaces:
  - Simple I²C x 2, SPI x 2, Quad-SPI (QSPI), Octa-SPI (OSPI)
  - Manchester coding (SCI3, SCI4)
  - USB 2.0 Full-Speed Module (USBFS)
  - Control Area Network module (CAN) × 2
  - Ethernet MAC/DMA Controller (ETHERC/EDMAC)
  - Smart card interface
  - SD/MMC Host Interface (SDHI)
  - Serial Sound Interface Enhanced (SSIE)
- Security and Encryption:
  - Secure Crypto Engine 9, Trust Zone®
  - Symmetric algorithms: AES
  - Asymmetric algorithms: RSA, ECC, and DSA
  - Hash-value generation: SHA224, SHA256, GHASH
  - 128-bit unique ID

- Up to three or six regions for the code flash, depending on the bank mode
- Up to two regions for the data flash
- Up to three regions for the SRAM
- Individual secure or non-secure security attribution for each peripheral
- Device lifecycle management
- Up to three tamper pins
- Secure pin multiplexing
- IDE: SecureRenesas e2Studio, Keil MDK, IAR Embedded Workbench
- Compilers: GNU, Keil, IAR Systems
- Software Support:
  - FSP (Flexible Software Package)
  - Smart configurator
  - Driver selection
  - Intelligent pin mapping
  - Trust Zone® configurator
- On-Chip Debug: Renesas E2/E2 Lite, Segger J-Link

Key Applications
- Smart Consumer & Building:
  - Building automation
  - White goods & home appliances
- Industrial:
  - Industrial automation

* SCE = Secure Crypto Engine

The RA MCU family features a rich set of differentiating features providing more robust embedded security, superior CoreMark® performance, and ultra-low power consumption.

PSA certification provides customers with the confidence and assurance to quickly deploy secure IoT endpoint and edge devices, and smart factory equipment for Industry 4.0

Product order code
• STM32L552CCT6
• STM32L552CCU6
• STM32L552CET6
• STM32L552CET6P
• STM32L552CET6Q
• STM32L552CEU6

STM32L5 Series

STM32L5 Series of Ultra-Low-Power MCUs

Parallel interface
FSMC 8-/16-bit
(TFT-LCD, SRAM,
NOR, NAND)

Digital
2x SAI, DFSDM
(4 channels)

Timers
14 timers including:
2x 16-bit advanced
motor control timers
2x LPUART timers
3x 16-bit-timers
2x 32-bit timers

I/Os
Up to 115 I/Os
Touch-sensing
controller

Arm®Cortex®-M33 CPU
110 MHz
TrustZone®
FPU
MPU
ETM

DMA

ART Accelerator™

Up to 512+Kbyte
Flash memory
Dual Bank

256-Kbyte
RAM

Connectivity
USB Device Crystal-less,
USB Type-C and PD,
1x SD/SDIO/MMC, 3x SPI,
4x I²C, 1X CAN FD,
1x Octo-SPI,
5x USART + 1x LPUART

Encryption
AES (256-bit), PKA,
SHA-1, SHA-256, TRNG,
CRC, OTFDEC

Analog
2x 12-bit ADC 12/16 bits
5 MSPS, 2x DAC,
2x comparators,
2x op amps
1x temperature sensor

STM32L5 Series Block Diagram

Security has emerged as one of the three key areas that developers of embedded and IoT applications are thriving to improve. The STM32L5 microcontroller series is the solution and provides an optimal balance between performance, power, and security. The STM32L5 MCU series harnesses the security features of the Arm® Cortex®-M33 processor and its TrustZone® for Armv8-M, combined with ST security implementation. STM's proprietary ultra-low-power technologies create a class-leading MCU for energy-critical applications such as IoT, medical, industrial, and consumer applications.

23

MICROCONTROLLERS

- **Advanced security with TrustZone® and ST Security implementation**
- **Lower power consumption**

- **Integration, size, performance: more performance, larger memory size, wide portfolio**
- **Rich set of analog and digital peripherals (CAN FD, USB Type-C with PD, and more)**

Features

- Flexible hardware and software secure isolation with TrustZone
- Enhanced security services:
  - Dedicated secure user memory space:
    - Secure Boot, crypto-accel, memory and IP protection
  - Independent readout protection between security domains
  - Active I/O tamper detection
  - Certified crypto lib
  - Embedded Secure Firmware Install (SFI) loader and ecosystem
- Low power consumption:
  - 33 nA in shutdown mode
  - 3.6 µA in stop mode
  - Full SRAM and peripheral states retention with 5 µs wake-up time
  - Down to 60 µA/MHz in active mode
- EEMBC ULPBench®:
  - 402 ULPMark-CP score

- Embedded SMPS step down converter (optional)
- Better application responsiveness:
  - New Cortex®-M33 core at 110 MHz:
    - +20% vs. Cortex®-M4
  - New ST ART Accelerator™:
    - Works both on internal and external flash
    - 8 Kb of instruction cache
- 165 DMIPS and 442 CoreMark scores
- An extensive set of analog and digital peripherals, including:
  - USB Type-C with PD controller, CAN FD
  - SD/SDIO/MMC controller
- 7 package types available:
  - LQFP48, QFN48, LQFP64, WLCSP81, LQFP100, UFBGA132, and LQFP144

Key Applications

- Industrial:
  - Factory automation
  - Motor control
- Smart Consumer & Building:
  - Home automation
  - Smart bike
  - Electronic door-lock

Featuring industry-leading security features combined with the low power consumption and excellent processing performance, the STM32L5 family is a perfect choice for a broad range of applications. ST also offers evaluation kits for the STM32L5 family, including STM32L562E-DK and NUCLEO-L552ZE-Q, allowing simple evaluation of these MCUs.

STM32WB50CG

Ultra-low Power, Dual-Core ARM® Cortex®-M4/M0+ MCU with BLE 5.0 and 802.15.4 Support

MICROCONTROLLERS

Control	ARM® Cortex®-M4 FPU/DSP 64 MHz	Memory
Power supply 2.0 V to 3.6 V (LDO) POR/PDR/PVD/BOR	Nested Vector Interrupt Controller (NVIC)	512-Kbyte Flash memory
		96-Kbyte SRAM
Crystal oscillators 32 MHz (Radio) 32.769 KHz (LSE)	Memory Protected Unit (MPU)	Boot ROM
		Secure boot loader
Internal RC oscillators 32 KHz (LSI) 16 MHz (HSI)	JTAG/SW debug	**Connectivity**
RTC/AWU/CSS	ART Accelerator™	1 x SPI, 1 x I²C
PLL/FLL	AHB Bus matrix	**Timers**
SysTick timer	1 x DMA 7 channels	3 x 16-bit 32-bit timers
2 watchdogs (WWDG/IWDG)	Multi-protocol RF stack	2 x ULP 16-bit timers
	Bluetooth LE™ 5.0	**Security**
30 GPIOs	IEEE 802.15.4	PKA
48 pins QFN		TRNG/PCROP
Cyclic redundancy check	ARM® Cortex®-M0+ 32 MHz	**Analog**
		1 x 12-bit ADC SAR 4.1 MSPS
	Nested Vector Interrupt Controller (NVIC)	Temperature sensor

STM32WBx0 Block Diagram

The STM32WB50CG multiprotocol wireless and ultra-low-power device embeds a high-performance ARM® Cortex®-M4 32-bit RISC core operating at up to 64 MHz, and a dedicated ARM® Cortex®-M0+ core with a powerful and ultra-low-power radio frontend, compliant with the Bluetooth® Low Energy SIG specification v5.0 or with IEEE 802.15.4-2011, supporting Thread or ZigBee implementation. The STM32WB50CG device embeds high-speed memories and an extensive range of enhanced I/Os and peripherals. Most I/Os are 5 V-tolerant, offering improved compatibility. The STM32WB50CG is supported by the P-NUCLEO-WB55 pack, which allows easy evaluation and rapid development of user applications.

- **Dual-core ARM® 32-bit Cortex®-M4 CPU with FPU and ARM® 32-bit Cortex®-M0+ CPU**
- **1 MB Flash memory and 128 KB SRAM**
- **Multiprotocol 2.4 GHz radio with Bluetooth® 5 and IEEE 802.15.4 for Thread or ZigBee support**
- **Security and ID features (incl. AES256)**

Features

- ARM® Cortex®-M4 CPU with ART accelerator:
  - 64 MHz, 0 WS execution, 80 DMIPS, DSP instructions
  - 128 KB SRAM, 64 KB with HW parity check
  - Boot loader supporting USART, SPI, I²C
  - OTA BLE and 802.15.4 update
- Integrated Multiprotocol 2.4 GHz RF front-end:
  - Supports Bluetooth®5 specs
  - Embedded IEEE 802.15.4-2011 HW MAC
  - Programmable output power up to +4 dB
  - Integrated balun for reduced BOM
  - Dedicated Cortex®-M0+ CPU core for real-time radio layer
- Ultra-low power consumption:
  - Power supply from 2.0 to 3.6 V
  - 14 nA Shutdown mode

- 700 nA Standby mode + RTC + 32 KB RAM
- 2.25 µA Stop mode + RTC + 128 KB RAM
- Radio Rx: 7.9 mA
- Radio Tx (at 0 dBm): 8.8 mA
- 1MB Flash memory with sector protection
- PSU and reset management
- independent Systick, watchdog, 16/32-bit timers
- Rich set of peripherals:
  - 12-bit SAR ADC, 2.13 Msps, HW oversampling
  - Inter-processor communication controller for BT and 802.15.4
  - HW semaphores for resource sharing
  - SPI, I²C, USART
  - USART with ISO7816, IrDA, SPI Master, Modbus, Smartcard mode
- 5 V-tolerant GPIOs
- ECOPACK2 compliant package

Key Applications

- Smart Consumer & Building:
  - Battery-operated applications with BLE connectivity
  - Low power IoT nodes
  - BLE, Thread, and ZigBee MESH networks

The STM32WB50CG is supported by the STM32 microcontroller ecosystem, which simplifies the development and cuts the time to market.

The RF design complexity can be significantly reduced by using an integrated passive device (IPD) chip solution to replace the discrete antenna matching network and LP filter. More information available in the AN5165 application note.

Product order code
- STM32MP153CAA3
- STM32MP153CAA3T
- STM32MP153CAB3
- STM32MP153CAB3T
- STM32MP153CAC3
- STM32MP153CAC3T

STM32MP153

Arm® Dual Cortex®-A7 650 MHz + Cortex®-M4 MPU
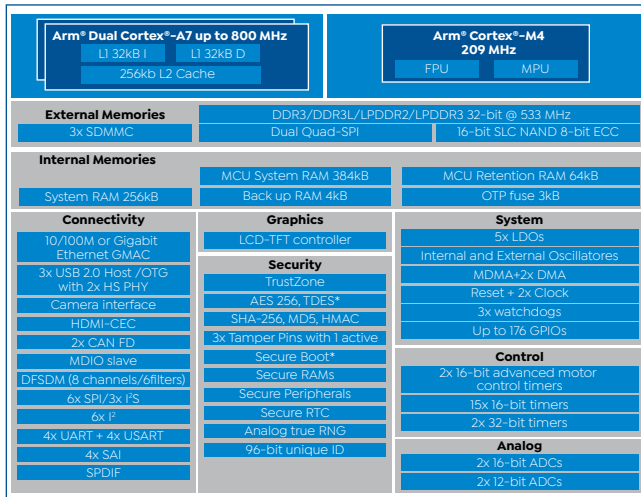
STM32MP153 Block Diagram

STM32MP153 microprocessors are based on the flexible architecture with the dual Arm® Cortex®-A7 core running up to 800 MHz and Cortex®-M4 at 209 MHz combined with a CAN FD interface. Besides the LCD-TFT display controller, the STM32MP153 line embeds up to 37 communication peripherals including 10/100/1GbE, 3 x USB 2.0 Host/OTG, 29 timers, and advanced analog peripherals. In addition to true random number generators (TRNG), hardware cryptographic and hash processors, the security option includes Secure Boot, TrustZone® peripherals, and an active tamper-detect feature.

- **32-bit dual-core Arm® Cortex®-A7**
- **32-bit Arm® Cortex®-M4 with FPU/MPU – Isolated**
- **Low-power consumption**
- **10 years longevity commitment renewed every year**

Features
- Memory:
  - External DDR memory:
    - up to 1 GB
  - 708 KB of internal SRAM
  - Dual-mode Quad-SPI memory interface
  - Flexible external memory controller:
    - Up to 16-bit data bus
- Advanced security for Industry 4.0:
  - True-Random Number Generator (TRNG)
  - HW crypto and hash processor
  - TrustZone® peripherals
  - Active tamper detection
  - Cortex®-M4 resources isolation
- Reset and power management
- Clock management
- Interconnect matrix
- TFT Display controller
- 10/100/1GbE, CAN FD, USB 2.0
- 3 DMA controllers to unload the CPU

- 6 advanced analog peripherals
- Up to 29 timers and 3 watchdogs
- Pin-to-pin compatibility across all part numbers
- Full HW compatibility with STPMIC1 (power management IC)
- Available in 4 different packages:
  - 448-pin LFBGA, 354-pin LFBGA
  - 361-pin TFBGA, 257-pin TFBGA
  - 0.5 and 0.8 mm pitch

Key Applications
- Industrial:
  - Industrial control and automation
  - robotics
  - Human Machine Interface (HMI)
- Smart Consumer & Building:
  - Home & building control and automation
  - IoT Gateway

The STM32MP153 MPUs offer uncompromised performance for the most demanding applications. Featuring a dual-core Cortex®-A7 32-bit RISC processor combined with a Cortex®-M4 real-time coprocessor, and a rich set of peripherals including a GbE and two CAN-FD interfaces, it is a perfect solution for industrial automation applications.

However, thanks to the high power efficiency of the Cortex®-A7 processor, the STM32MP153 MPU is also perfectly suited for high-end wearables and other low-power embedded and consumer applications.

XILINX®

VITIS™ Software Platform

Unified Programming Model for Accelerating Edge, Cloud, and Hybrid Computing Applications

All developers can build and deploy on all platforms

The Vitis™ unified software platform enables the development of embedded software and accelerated applications on heterogeneous Xilinx platforms including FPGAs, SoCs, and Versal ACAPs. It provides a unified programming model for accelerating Edge, Cloud, and Hybrid computing applications.

Leverage integration with high-level frameworks, develop in C, C++, or Python using accelerated libraries or use RTL-based accelerators & low-level runtime APIs for more fine-grained control over implementation – choose the level of abstraction you need.

- **AI Development Environment: TensorFlow, Caffe, PyTorch**
- **Core Development Kit: set of developers tools support C, C++ or OpenCL**
- **Accelerated Libraries: Open-source, out-of-the-box written in C, C++ or Python**
- **Xilinx Runtime library, host ARM or x86, APIs, kernel drivers, firmware, board utilities**

Features

- **Vitis IDE includes:**
- Feature-rich C/C++ code editor and compilation environment
- Project management
- Application build configuration and automatic Makefile generation
- Error navigation
- An integrated environment for seamless debugging and profiling of embedded targets
- Source code version control
- System-level performance analysis
- Focused special tools to configure FPGA
- Bootable image creation
- Flash programming
- Script-based command-line tool

- **Vitis AI provides:**
- Support for mainstream frameworks and the latest models capable of diverse deep learning tasks

- A comprehensive set of pre-optimized models that are ready to deploy on Xilinx®devices
- Powerful quantizer that supports model quantization, calibration, and fine-tuning; optional AI optimizer can prune a model by up to 90%
- The AI profiler provides layer by layer analysis to help with bottlenecks
- The AI library with unified high-level C++ and Python APIs for maximum portability from edge to cloud
- Customizes scalable IP cores to meet the needs of many different applications from a throughput, latency, and power perspective

Key Applications

- Aerospace & defense
- Radar & EW
- Wireless & wired communications

- High-performance computing
- Medical
- Smart city – vision system AI

One of the key component of the unified platform is the Vitis AI – a specialized development environment for accelerating AI inference on Xilinx embedded platforms, Alveo accelerator cards, or on the FPGA-instances in the cloud.

Vitis AI supports the industry's leading deep learning frameworks and offers comprehensive APIs to prune, quantize, optimize, and compile your trained networks to achieve the highest AI inference performance for your deployed application.

Product order code

- MTSD032AHC6MS-1WT
- MTSD064AHC6MS-1WT
- MTSD128AKC7MS-1WT
- MTSD256AKC7MS-1WT
- MTSD512AKC7MS-1WT
- MTSD1T0AKC7MS-1WT

Industrial microSD Cards

World's first 1 TB surveillance-grade microSD card eliminates need for NVRs

Industry's smallest 128GB 96-layer 3D NAND die

115.77mm²

We stack 8 of these die into a small microSD card

Micron's 96-layer 3D NAND

Micron introduces a high capacity industrial microSD card, leveraging Micron's 3D NAND to deliver up to 1 TB storage at a breakthrough price point enabling 3 years 24 x 7 recordings and up to 3 months of surveillance grade storage at the edge. By enabling primary video storage locally in the camera, the network bandwidth requirement is reduced and the high cost of continuous storage in the cloud is avoided, lowering the total cost of ownership (TCO) compared to cloud-only storage solutions. Bringing primary storage right up to the edge, on the camera, enables faster real-time analytics.

- **3 Years of High Quality Continuous 24x7 Recording**
- **Up to 3 Months of Edge Storage**
- **Sustained 30 FPS Recording with Minimal Frame Loss**
- **2 Million Hours Mean Time to Failure (MTTF)**

Features
- High endurance (32 GB to 1 TB):
  - Supports 3 years of continuous HQ recording
  - Reduces maintenance and replacement costs
- Outstanding recording performance:
  - Optimized firmware for steady-state performance
  - 24 x 7 at 30 FPS HQ video recording
  - Minimal frame drop
- Sequential speed:
  - Up to 100 MB/s (RD), 35 MB/s (WR)
- Random speed:
  - 4000 IOPs (RD), 2000 IOPs (WR)
- Speed Class:
  - UHS-I C10, U3, A2
- Industrial quality and durability:
  - 2 million hours MTTF or AFR of 0.44%
  - Terrabytes Written (TBW) up to 960 TB (1 TB)

- Designed for harsh conditions
- Lifetime health monitoring:
  - Card usage and remaining lifetime reporting
- Optimizing storage costs in video surveillance:
  - Enables cloud-based video surveillance as a service (VSaaS)
  - IT management overhead is reduced due to easy scalability
- Faster real-time analytics:
  - Brings primary storage to the edge device or the camera
  - Enables faster real-time analytics for AI-based surveillance
- Operating temperature:
  - From –25 °C to +85 °C

Key Applications
- Smart Consumer & Building:
  - Video Surveillance as a Service (VSaaS)
  - Cloud surveillance with on-camera storage

- Mobile surveillance
- In-vehicle dashboard camera and recorder
- Space-constrained applications

Micron's 96-layer 3D NAND QLC is produced using their proprietary 3rd Gen CMOS under Array (CuA) technology, resulting in a very high memory density and significantly increased performance.

Managing to pack eight such dies into the narrow space of a microSD card, they were able to reach up to 1 TB capacity for their latest microSD cards series, offering excellent performances and high endurance, at a lower cost.

Product order code
- MTFC128GAPALBH-AAT
- MTFC128GAPALBH-AIT
- MTFC128GAPALNA-AAT
- MTFC128GAPALNA-AIT
- MTFC128GAPALNS-AAT
- MTFC128GAPALNS-AIT

e.MMC 5.1

Broadest Range of e.MMC Devices for Automotive, Industrial and Consumer Applications
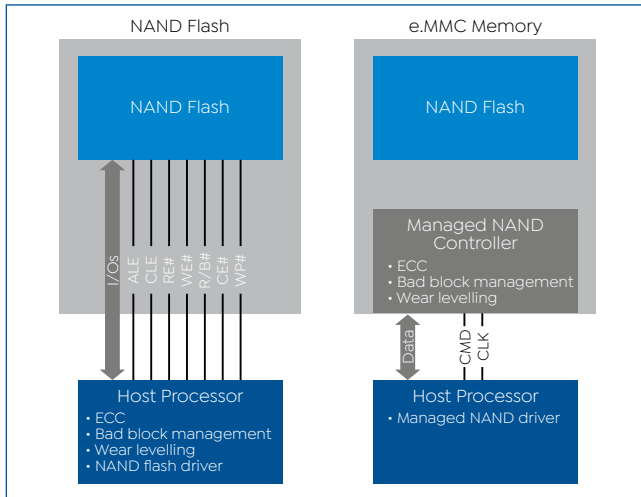
Traditional NAND vs. e.MMC Memory – Block Diagram

Micron® e.MMC memory is designed for automotive, industrial, and consumer segments, which require high data retention, longer life-cycle, and improved performance. It combines a NAND flash memory device with a JEDEC-compliant controller in the same package. For system designs with mass-storage needs, system developers must keep up with the increasingly complex ECC implementation and data management requirements of the traditional MLC NAND flash devices. Micron's e.MMC memory can help them overcome these challenges, offering a quick system integration suited for a wide range of applications.

- **Wide density range: from 8 GB to 128 GB**
- **Optimized performance and endurance across automotive and industrial temperature ranges**
- **Internal NAND data retention management within e.MMC controller**
- **Advanced security features**

Features
- A broad range of e.MMC devices, suitable for a wide range of applications
- A set of e.MMC 5.1 specific features, including:
  - CMD Queueing
  - Cache barrier
  - BKOP control
  - RPBM throughput improvement
  - Power loss counter
  - CMD56 health status command
  - Device ON recording time
  - Non-volatile booking queue
- Optimized performance and endurance across automotive and industrial temperature ranges:
  - Automotive-grade: from –40 °C to +105 °C
  - Industrial grade: from –40 °C to +85 °C
- Internal NAND data retention management within e.MMC controller:

- Uses Micron's refresh firmware
- Provides ECC, wear leveling, block management, performance optimization
- Standardized Interface:
  - Utilizes industry standard MMC bus
  - Compatible with the previous e.MMC versions
- Security:
  - Write protection
  - Password lock
  - Replay protected memory block

Key Applications
- Automotive:
  - Car Infotainment
  - Car Telematics
  - Cluster/Dashboard
- Industrial:
  - Industrial Equipment
- Hi-Rel:
  - Medical and military-grade equipment

- Smart Consumer & Building:
  - Set-Top Boxes & Smart TVs
  - Digital Cameras

e.MMC 5.1 is the latest version of e.MMC specifications defined by JEDEC. It is designed to provide even higher bandwidth and richer set of features, optimized for the next-gen applications while retaining the backward compatibility with previous versions.

Micron® e.MMC 5.1 implementation offers performance boost and a rich set of security and reliability features, covering a broad range of applications in automotive, industrial, and consumer market segments.

SMART HEALTHCARE

As discussed in previous articles, Smart Living as a concept implies both increased comfort and smarter management of the resources. Healthcare is one example where there is still much room for improvement, especially for patients with chronic medical conditions. With some help from modern technology, they could enjoy the benefits of Home Monitoring and Telehealth from the comfort of their homes. Due to the recent development of events (Covid-19 pandemic), the Home Monitoring becomes a hot topic.

Home Monitoring (or Remote Patient Monitoring) is a technology that allows the monitoring of patients outside the clinical environment. The purpose of Home Monitoring is to keep patients as long as possible in their own living environment, reducing overall healthcare costs. Home Monitoring is a part of Telehealth or Telecare services, and it describes the monitoring and remote therapy of patients with chronic conditions. A standard Home Monitoring system consists of three main components: medical devices for data collection and processing, gateways to receive and transmit the data, and Cloud platforms to perform data analytics.

There are different chronic health conditions, and therefore different data sets are needed to monitor patients at their homes effectively. For example, patients with hypertension must have their blood pressure, heart rate, and weight monitored. For patients with Covid-19, the list of parameters may include body temperature, heart rate, oxygen saturation (SpO2), and respiration rate. There are various devices and technologies used to measure, collect, and transmit patients' data.
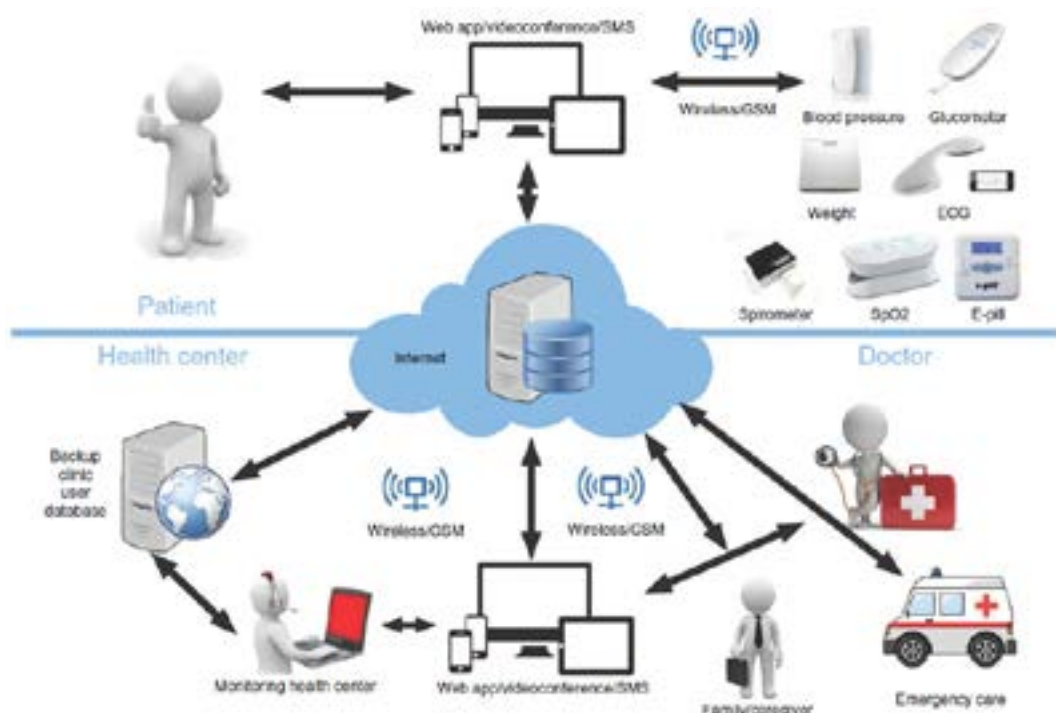
A block diagram of a typical Home Monitoring device contains six main blocks: sensors, sensor interfaces, MCUs, connectivity modules, power management, and storage elements. For example, a heart rate can be measured using either PPG or ECG technologies. The ECG (electrocardiography) relies on using ECG electrodes and a specialized medical-grade AFE IC for signal conditioning. On the other hand, PPG (photoplethysmography) uses light-sensing technology to detect the expansion and dilatation of the blood vessels as the blood traverses through the body. The signals from the sensors are sampled and processed by an MCU. In many cases, specialized algorithms are needed to extract useful information from the raw sensor data, providing the required level of accuracy. Because MCU memory may not always be a suitable solution for data storage, some devices include additional internal or external memory, such as SD cards or NAND Flash ICs (or both), where they can log and store data locally.

Most of the devices used in Home Monitoring systems are portable and therefore powered by batteries. Power management and monitoring are critical aspects of such devices, so they should be carefully considered at the design stage. In most cases, these devices use disposable batteries that allow lighter and more compact designs, which is essential for the wearables (e.g., blood glucose measurement patches). However, not all healthcare devices are wearable and may include USB interfaces that provide wired connectivity (e.g., for processing the measurements on a personal computer), as well as external power supply, allowing rechargeable batteries to be used instead of disposable ones.

Security and connectivity are some of the most important aspects of the devices used in Home Monitoring systems. Data collected from Home Monitoring systems can be susceptible to hacker attacks; therefore, proper encryption and data security are imperatives on these devices. In some cases, mainly in cost- and space-constrained applications, the data encryption is done in the MCU itself or on the wireless module. There are specialized single-chip solutions for more demanding applications, specifically designed to provide the highest level of data protection. The connection to the gateway or personal server is usually established wirelessly, using BLE or Wi-Fi. These short-range networks are sufficient to enable reliable data transfer to the nearby gateway device. After all the required parameters are collected and filtered locally by the personal server or a gateway device, they are forwarded to the Cloud service via the Internet, making them available for the remote healthcare personnel. Based on the received data, doctors can take the necessary actions and adjust the therapy accordingly.

In times of a pandemic or a severe medical crisis, Telehealth, Telecare, and Home Monitoring represent invaluable tools to support the patient with chronic conditions and offload the public healthcare system (i.e., hospitals). With the right legislation and reimbursement processes in place, these three pillars of modern and reliable medical support will play a significant role in creating a smarter, healthier, and more comfortable future.

www.ams.com

AS7341L Spectral Sensor

Spectral Sensor Frontend for Optical Readout of Lateral Flow Tests
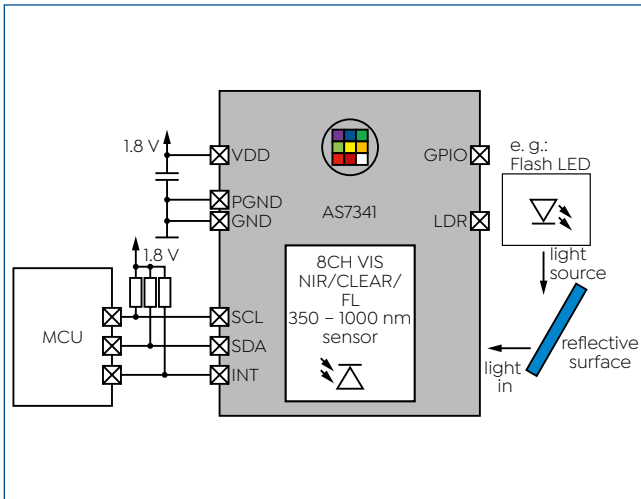
AS7341L – Simplified Schematic Diagram

The AS7341L is a 10-channel spectral sensor for color matching and identification in lateral flow and health-related applications. Its spectral response ranges from 350 to 1000 nm. Eight optical channels cover the visible spectrum, one channel covers the NIR range, and one has no filter applied (clear channel). Features, such as the integrated LED driver and a GPIO that can be used as the electronic shutter/external trigger pin or as the input for an external PD for extended range (e.g., InGaAs PD for the MIR range), make the AS7341L a perfect solution for portable Covid-19 test equipment.

- **Low power consumption (1.8 VDD operation)**
- **Electronic shutter/external trigger functionality**
- **External photodiodes to expand detection range**
- **Ultra-low profile package (3.1 mm x 2 mm x 1 mm)**

Features

- Six independent 16-bit ADC channels for signal processing:
  - Configurable gain, auto-gain control (AGC), and auto-zero compensation
- Integrated 4 x 4 photodiode (PD) array with 8 color groups, plus dedicated PDs for NIR and Clear channel
- Integrated 11 x 6 SMUX for custom routing of any of the 10 PD groups to available ADC channels
  - External PD connected via GPIO pin is also routable via SMUX
- Filters implemented on CMOS silicon die via nano-optic deposited interference filter technology:
  - High stability both over time and temperature
- The package provides a built-in aperture to control the light entering the sensor array

- Highly precise color measurements: ΔE < 1.5 (ΔE < 2 is not resolvable by the human eye)
- Configurable interrupt engine with a dedicated open-drain INT pin
- The clear channel allows self-test upon initialization
- Configurable sleep mode
- I²C digital interface
- Digital output allows for a Bluetooth® Low-Energy (BLE) connection to mobile devices and medical-approved cloud services
- Main advantages of digital lateral flow testing:
  - Ease of use allows on-site testing
  - Delivery of results is fast (minutes)
  - Design is simple and cost-effective

Key Applications

- Healthcare & Wearables:
  - Multi-analyte detection
  - Fluorescent-based measurement

- Reflectivity- or transmissivity-based color detection in LFT applications
- Clinical, home, and veterinary testing (e.g., Covid-19)
- Point-of-Care diagnostics

The AS7341L spectral sensor frontend is ideally suited for lateral flow test equipment.

There is a reference design for the Corona antibody test available based on this device, including the complete disposable module for one-time tests.

BROADCOM®
connecting everything ®

AFBR–S50LV85D

Time-of-Flight Sensor Module for Distance and Motion Measurement
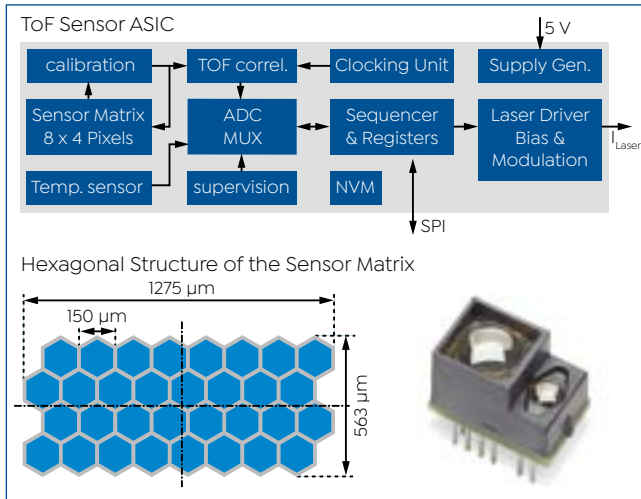
AFBR-S50 Series Block Diagram

The AFBR-S50LV85D is the new addition to Broadcom's Time of Flight (ToF) sensor family and has been developed with a special focus on industrial sensing applications for large distances of up to 30 m. The module has an integrated 850 nm laser light source, and due to a 2° x 2° emission cone, it typically uses 1 to 3 pixels at a time, depending on distance and remission of the measured object. It is an ideal solution for industrial sensing applications over large distances up to 30 m, typically. The sensor can measure the distance of objects regardless of their surface type.

- **Typical distance range up to 30 m**
- **Field–of–View (FoV) of 1.55° x 3.1°**
- **Works well on all surface types**
- **Accuracy error typically below ± 1%**

Features

- Integrated 850 nm laser light source
- Transmitter beam of 2° x 2° to illuminate between 1 and 3 pixels
- Receiver with 32 pixels
  - Field-of-View (FoV): 1.55° x 3.1°
  - FoV per pixel: 1.55° × 1.55°
- Distance range:
  - Typical distance range up to 30 m
  - Unambiguous range up to 100 m with dual-frequency mode
- Reference pixel for system health monitoring
- Measurement rates of up to 3 kHz
- Operation of up to 200 klx ambient light
- Single voltage supply: 4.5 to 5.5 V
- Current consumption: 33 mA (typ.)
- Integrated voltage and temperature sensors
- SPI digital interface

- Integrated calibrated clock source
- Laser Class 1 eye-safe ready
- Drop-in compatible within the AFBR-S50 sensor platform
- Size without pins, L × W × H:
  - 12.4 × 7.6 × 7.9 mm
- Operating ambient temperature range:
  - −20 °C to 70 °C
- RoHS6 compliance

Key Applications

- Smart Consumer & Building:
  - Distance measurement
  - Security surveillance
- Industrial:
  - Robotics
  - Human Machine Interfaces (HMI)
  - Automation and control
  - Inventory monitoring

The module has an integrated infrared laser light source and an internal clock source. A single 5.0 V power supply is required, while data is transferred via SPI using standard 3.3 V CMOS levels.

For system health monitoring a Reference Pixel is used in addition to the integrated voltage and temperature sensors.

A universal evaluation kit is available for all AFBR-S50 series sensors, offering an easy and effortless evaluation. EBV's dedicated ToF specialists provide full support for an easy design-in and fast time to market.

BROADCOM
connecting everything ®

AFBR-S50MV85I

Time-of-Flight Sensor Module for Distance and Motion Measurement
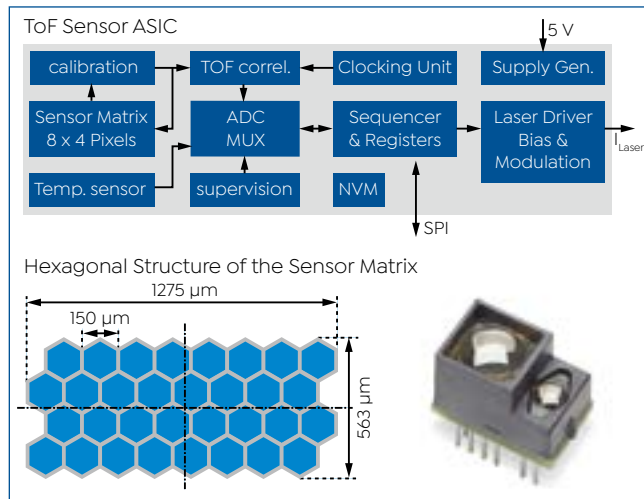
AFBR-S50 Series Block Diagram

AFBR-S50MV85I is a multi-pixel optical distance and motion measurement sensor module, based on the optical Time of Flight (ToF) principle. The technology has been developed with a special focus on applications that require the highest speed and accuracy at short to medium distances with a small form-factor and very low power consumption. Due to the best-in-class ambient light suppression, the sensor can be used in outside environments, in full sunlight. The sensor accurately measures the distance of objects with white, black, and colored, as well as with metallic and retroreflective surfaces.

- **Typical distance range up to 5 m**
- **Field-of-View (FoV): 12.4° x 6.2°**
- **Multi-pixel sensor for 3D motion detection**
- **Accuracy error typically below ±1.5%**

Features

- Integrated 850 nm laser light source
- Transmitter beam of 13° x 6° to illuminate all 32 pixels
- Receiver with 32 pixels
  - Field-of-View (FoV): 12.4° x 6.2°
  - FoV per pixel: 1.55° × 1.55°
- Distance range:
  - Short to medium (up to 3 m and beyond)
  - Unambiguous range up to 100 m with dual-frequency mode
- Reference pixel for system health monitoring
- Measurement rates of up to 1 kHz with all 32 pixels
- Operation up to 200 kLux
- Single voltage supply: 4.5 to 5.5 V
- Current consumption: 33 mA (typ.)
- Optical peak output power: 40 mW (typ.)
- Integrated voltage and temperature sensors

- SPI digital interface
- Integrated calibrated clock source
- Laser Class 1 eye-safe ready
- Drop-in compatible within the AFBR-S50 sensor platform
- Size without pins, L × W × H:
  - 12.4 × 7.6 × 7.9 mm
- Operating ambient temperature range:
  - From –20 °C to 70 °C
- RoHS6 compliance

Key Applications

- Smart Consumer & Building:
  - Distance measurement
  - Security surveillance
  - Inventory monitoring
  - Augmented reality
- Industrial:
  - Human Machine Interfaces (HMI)
  - Robotics
  - Automation and control

The module has an integrated infrared laser light source and an internal clock source. A single 5.0 V power supply is required, while data is transferred via SPI using standard 3.3 V CMOS levels.

For system health monitoring a Reference Pixel is used in addition to the integrated voltage and temperature sensors.

A universal evaluation kit is available for all AFBR-S50 series sensors, offering an easy and effortless evaluation. EBV's dedicated ToF specialists provide full support for an easy design-in and fast time to market.

XENSIV™ Sense2GoL Pulse

**XENSIV™ Sense2GoL Pulse –
Radar Development Kit**

XENSIV™ Sense2GoL Pulse – Product Picture

This development kit allows the user to implement and test several sensing applications at the 24 GHz ISM band such as motion detection and speed measurement. The kit operates in a pulsed mode achieving 18 m detection range with a sensor power consumption less than 5 mW. The demonstration kit consists of two boards, the radar front end board: SHIELD_BGT24LTR11 and the microcontroller board: RADAR BB XMC4700. The baseboard adds additional flexibility by allowing battery operation, current measurements, SD card reader for storage and Arduino compatible pin connectors.

- **Capability to detect motion, speed, and direction of movement (approach or retreat)**
- **Detection range of 18 m for human targets**
- **Can be operated in harsh environments**
- **Multiple power supply choices**

Features
- Movement detection through non-metallic materials
- Low power consumption:
  - Power consumption is lower than 5 mW for 18 m target detection
- Higher detection sensitivity compared to PIR-based sensors
- Multiple power supply choices:
  - Micro USB, external power supply, battery
- Arduino compatible microcontroller board:
  - Arduino standard connectors
- Modulation parameters can be changed to suit the application requirements
- Multiple current sensors for current consumption monitoring and optimization

- RADAR BB XMC4700 MCU board, main components:
  - XMC4000 family MCUs for industrial applications
  - XMC4700-E196K2048, as the main application MCU
  - XMC4200Q48K256ABXUMA1, as the programmer/debugger MCU
- SHIELD_BGT24LTR11 radar front-end board, main components:
  - BGT24LTR11N16 24 GHz SiGe radar transceiver MMIC

Key Applications
- Smart Consumer & Building:
  - Smart Home
  - Automatic door opener
  - Speed measurement
  - Security
- Lighting:
  - Intelligent switches
  - Indoor and outdoor lighting

In addition to their 24 GHz radar portfolio, Infineon will soon offer a new chip operating at 60 GHz (BGT60LTR11AiP) aimed at smart motion sensing, which is capable of detecting a human target up to 5 m with a low power consuption of less than 5 mW of power.

The upcoming 60 GHz radar solution (Smart Entrance Counter) will be able to provide information on how many people are inside a facility, helping to prevent overcrowding.

XENSIV™ DPS368

XENSIV™ DPS368 – ultra small waterproof pressure sensor
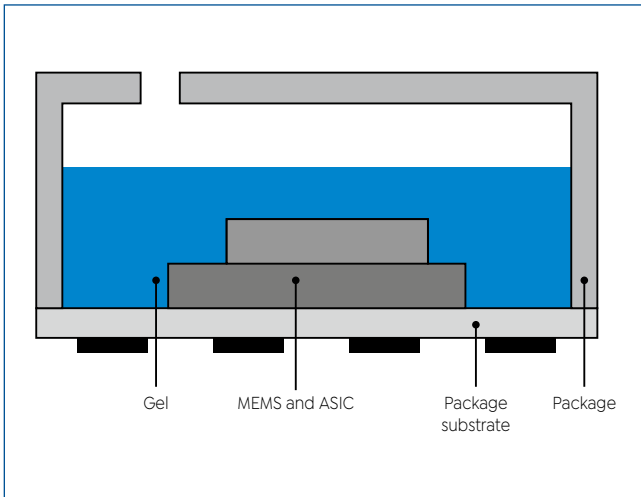
Schematic Drawing of the DPS368 Package

Gel | MEMS and ASIC | Package substrate | Package

XENSIV™ DPS368 is a miniature digital barometric pressure and temperature sensor, based on the capacitive sensing principle. The internal signal processor converts the output from the sensor elements into 24-bit measurement data, offering a resolution of 0.002 hPa (2 cm) for accurate measurement of altitude, airflow, and body movement. Due to its robust package, it can withstand 50 m underwater for one hour (IPX8). Its environmentally resistant package also facilitates handling in the assembly line, providing protection from dust and humidity.

- **Compact 8-pin PG-VLGA-8 package: saves up to 80% of space compared to competing solutions**
- **IPX8 protection: pressure sensor with environmentally resistant package**
- **Wide operation range: from 300 to 1200 hPa, and from –40 to 85 °C**
- **Best-in-class pressure sensor precision: ± 0.002 hPa (or ±0.02 m)**

Features
- Relative accuracy:
  - ±0.06 hPa (or ±0.5 m)
- Absolute accuracy:
  - ±1 hPa (or ±8 m)
- Pressure sensor precision:
  - ±0.002 hPa (±0.02 m)
- Temperature accuracy:
  - ±0.5 °C
- IPX8 certified:
  - Temporary immersion of 50 m for 1 hour
- Average current consumption:
  - 1.7 µA during measurement at 1Hz sampling rate
  - 0.5 µA during Standby
  - Well-suited for battery-powered applications
- Integrated FIFO buffer:
  - Up to 32 measurements
- Data interfaces:
  - Standard I²C and SPI
  - Optional interrupt (with both)
- Multiple operating modes:
  - Manual, automatic, standby
- High sampling rate up to 200 Hz
  - Fast read-out, quick response
- Compact 8-pin PG-VLGA-8-2 package:
  - 2.0 x 2.5 x 1.1 mm
  - 0.65mm pitch
- Green Product (RoHS) Compliant

Key Applications
- Smart Consumer & Building
  - Vacuum cleaner
  - Washing machines
  - Air purifiers
  - HVAC and smart building
- Healthcare & Wearables
  - Smart Inhalers
  - CPAP and respiratory devices
  - GPS

XENSIV™ DPS368 sensor is a compact barometric pressure sensor, designed for compact, battery-operated applications, but also for applications that require uncompromised accuracy and reliability, even in harsh conditions (e.g., drones).

Each unit is individually calibrated with its calibration coefficients stored in the NV memory, which, combined with the 24-bit A/D conversion, results in superior measurement accuracy.

The DPS368 is one of the smallest IPX8 (50 m) certified pressure sensors currently available on the market.

MAX86171

Best-in-Class Optical Pulse Oximeter and Heart-Rate Sensor AFE for Wearable Health
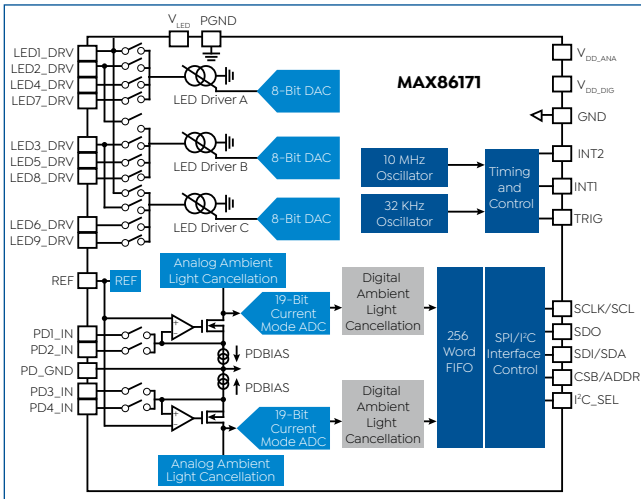
MAX86171 Block Diagram

The MAX86171 is an ultra-low-power optical data acquisition system with both transmit and receive channels. On the transmitter side, the MAX86171 has nine LED driver output pins, programmable from three high-current, 8-bit LED drivers. On the receiver side, MAX86171 has two low-noise charge integrating front-ends that each includes independent 19.5-bit ADCs and best-in-class ambient light cancellation (ALC) circuits, producing the highest performing integrated optical data acquisition system on the market today.

- **Complete dual-channel optical data acquisition system**
- **Excellent top-end dynamic range > 91 dB in white card loopback Test (Nyquist StS variance)**
- **Extended dynamic range up to 110dB (averaging and off-chip filtering)**
- **Supports frame rates from 1 FPS to 2.9 kFPS**

Features

- Ultra-low-power operation:
  - optical readout channel < 11 µA at 25 FPS
  - Low Shutdown Current < 1 µA
  - Perfect for wearable devices
- Exposure integration period:
  - From 14.6 µs to 117.1 µs
- High-resolution 19.5-bit charge integrating ADCs
- Supports 4 PD inputs for multi-parameter measurements
- Supports 9 LED driver output pins generated from 3 x 8-bit LED current drivers
- Low dark current Noise:
  - Less than 50 pA RMS
  - Sample-to-Sample (StS) variance in 117.1 µs integration time
- Excellent ambient range and rejection capability:
  - Less than 100 µA ambient photodetector current
- Less than 70 dB ambient rejection at 120 Hz (average mode > 2)
- Clinical-grade accuracy
- Suitable for the wrist, finger, ear, and other locations
- Miniature WLP package size:
  - 2.78 x 1.71 mm
  - 7 x 4, 0.35 mm ball pitch
- Operating temperature range
  - –40 °C to +85 °C

Key Applications

- Healthcare & Wearables:
  - Fitness, wellness, and medical wearable applications
  - Suitable for measuring:
    - Optical Heart Rate (HR)
    - Oxygen saturation (SpO_2)
    - Body hydration
    - Muscle and tissue oxygen saturation (SmO_2 and StO_2)
    - Maximum oxygen consumption (VO_2 max)

The MAX86171 features an exceptionally high Signal-to-Noise ratio (SNR), enabling SpO2 on the wrist for low perfusion cases (greater than 0.02% PI, where PI is defined as AC/DC and AC is the useful signal). The typical PI on the wrist is 0.3%.

Both the MAX86170A and MAX86171 offer two read-out channels, allowing for the lowest power consumption of HR measurements, consuming 2x less energy compared to typical single-channel devices, while solving loose wrist issues.

MAX86916

Integrated Optical Sensor Module for Mobile Health
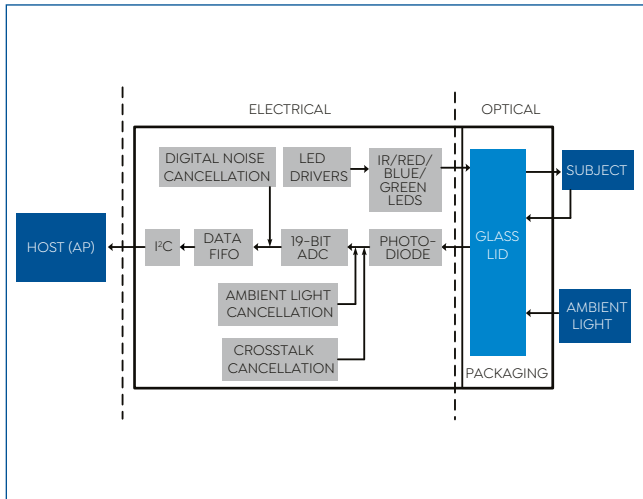
MAX86916 Simplified Block Diagram

The MAX86916 is an integrated optical sensor platform with applications in bio-sensing, proximity, and color. It includes internal LEDs, photodetectors, and low-noise electronics with ambient-light-rejection circuitry. The MAX86916 helps ease the design-in effort to all mobile and wearable devices. The MAX86916 operates on a 1.8 V supply voltage, with a separate 5.5 V power supply for the internal LEDs. Communication with the module is accomplished through the standard I²C-compatible interface. The module can be shut down through software with near-zero standby current.

- **Miniature 3.5 x 7.0 x 1.5 mm, 14-pin optical module**
- **Optical-grade glass for optimal and robust long-term performance**
- **Ultra-low-power operation for mobile devices**
- **Ultra-low shutdown current**

Features

- Miniature, multipurpose device:
  - Reflective Heart Rate (HR) monitor
  - Medical-grade pulse oximeter
  - Bio-optical sensor platform
- Integrated LEDs (R, G, B, IR), and PD
- Built-in low noise crosstalk cancellation
- Proprietary ambient light cancellation (ALC):
  - Flicker rejection at 100/120 Hz
- Finger proximity detection
- 19-bit ADC for the optical sensor
- FIFO buffer with 32 samples depth
- Advanced interrupt engine
- Separate power supply for the optical subsystem
- Power supply voltage:
  - From 1.7 to 2.0 V
- LED supply voltage:
  - From 3.5 to 5.5 V

- Ultra-low-power shutdown mode:
  - Supply current: 0.7 µA (typ.)
  - LED supply current: 0.7 µA (typ.)
- Adjustable LED drive current:
  - From 0 to 150 mA
- LED pulse width:
  - From 70 to 420 µs, in 4 discrete steps
- Operating temperature range:
  - From -40 °C to +85 °C

Key Applications

- Healthcare & Wearables:
  - Smartphones/Accessories
  - Tablets
  - Wearable Devices
  - Fitness Assistant Devices

The MAX86916 is aimed at portable and battery-powered devices, thanks to its ultra-low power consumption and smart energy-saving features.

Shutdown mode allows the power rails of the module to be continuously connected to the battery, consuming almost no energy from it.

The proximity function enables finger detection and saves energy if the finger is not placed over the sensor, by shutting the LED driver down.

This module meets FDA requirements for SpO2 on the finger with Maxim's FAST algorithms.

ENS210

Humidity and Temperature Sensor
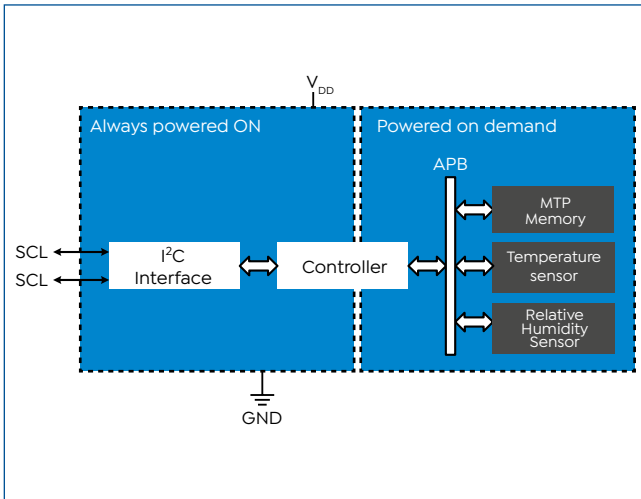
ENS210 Block Diagram

The ENS210 is a high-performance digital output sensor that monolithically integrates one relative humidity sensor and one high-accuracy temperature sensor. The device is encapsulated in a compact QFN4 package and includes an I²C slave interface for communication with the master controller. Sciosense also provides an EVK for this sensor, allowing it to be interfaced with a PC and quickly evaluated. The PC application can be used for logging the sensor data, as well as for monitoring the I²C traffic. The evaluation kit can also be used for quick integration into the customer's end application.

- **Ultra-accurate & low power**
- **Small footprint**
- **Wide operating voltage and sensing range**
- **Fast response**

Features
- Digital pre-calibrated output in K and %RH
- I²C digital interface (Slave mode):
  - Standard (100 kbps)
  - Fast (400 kbps)
- Wide supply voltage range:
  - Operating voltage: from 1.71 to 3.60 V
  - Absolute maximum voltage: from -0.30 to 4.60 V
- Wide sensing ranges:
  - Temperature range: -40 to 100 °C
  - Relative Humidity (RH) range: 0 to 100 %RH
- Max. accuracy:
  - Temperature: ±0.2 °C (T_A = 0 to 70 °C)
  - RH: ±2.2 %RH (T_A = 25 °C, RH = 20 to 80 %RH)
- Fast response:
  - τT < 1 s, τRH < 3 s
- Automatic low-power standby mode when not measuring
- Ultra-low power consumption:
  - Standby current 40 nA,
  - Active current 7.1 µA (1 Hz, 1.8 V)
- Excellent long-term stability with low drift:
  - Temperature: 0.005 °C per year
  - RH: 0.25 %RH per year (T_A = 25 °C)
- Compact size:
  - QFN4 package, 2.0 x 2.0 x 0.75 mm

Key Applications
- Smart Consumer & Building:
  - Home Appliances
  - Home and building climate control systems
  - Cold-chain and transport monitoring
  - Wireless sensor nodes
- Healthcare & Wearables:
  - Personal health and wellness monitoring
  - Baby monitoring devices
- Industrial:
  - Industrial automation (e.g., server rooms)

The ENS210 RH and temperature sensor comes factory-calibrated, with its calibration parameters stored into its internal NVM memory, along with an unique ID, allowing tracking in e.g., cold-chain and transport monitoring applications.

The measurement data is double-buffered, which allows consistent readout even while the sensor still actively performs measurement. As an additional measure of data integrity protection, the CRC checksum is also included in the digital readout.

Product order code
• VCNL36826S
• VCNL36821S
• VCNL36826S-SB
• VCNL36821S-SB
• SENSORXPLORER

VCNL3682xS

Compact Proximity Sensors With Interrupts and I²C Interface
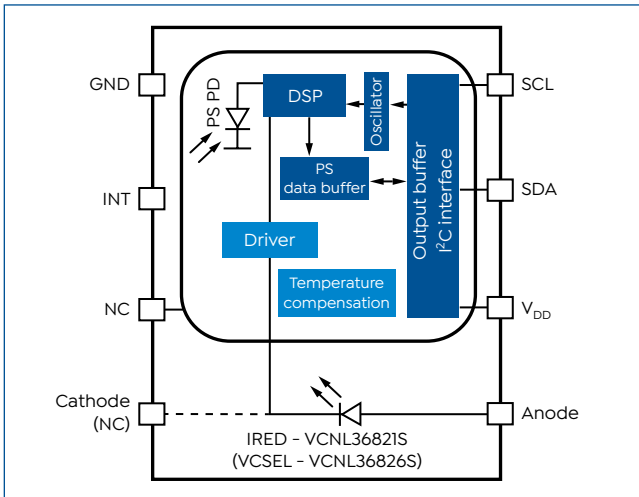
VCNL3682xS Block Diagram

Vishay introduced two new fully integrated proximity sensing (PS) devices designed to increase efficiency and performance in consumer and industrial applications. The VCNL36826S integrates a VCSEL, while the VCNL36821S integrates an IRED on-chip. Both VCNL36821S and VCNL36826S combine a photodiode, 12-bit ADC, and the signal processing ASIC, in a compact 2.55 x 2.05 x 1.0 mm surface-mount leadless (LLP) package. Their programmable interrupt features offer individual high and low thresholds enabling the optimal utilization of resources and power consumption for the host microcontroller.

- **Low power consumption I²C/SMBus compatible interface**
- **Smallest light hole opening design**
- **Integrated modules: VCSEL/IRED, PS, and DSP signal conditioning**
- **Sunlight cancellation and red glow immunity**

Features

- Immunity to red glow (940 nm IRED)
- Ambient light immunity:
  - Sunlight cancellation up to 100 klx
- Adjustable sensitivity in four discrete steps
- No isolation barrier between the emitter and receiver is required
- Intelligent cancellation to reduce cross-talk phenomenon
- Smart persistence scheme to reduce PS response time
- Low power consumption mode down to 6 µA
- VCNL36821S specific features:
  - IRED photo emitter
  - Up to 30 cm detection range
  - Programmable I_{RED} sink current:
    - 50 to 156 mA, in 8 discrete steps
- VCNL36826S specific features:
  - VCSEL photo emitter
  - Up to 20 cm detection range

- Programmable I_{VCSEL} sink current:
  - 6 to 20 mA, in 8 discrete steps
- Advanced interrupt engine:
  - Programmable interrupt function for PS
  - Programmable upper and lower thresholds
  - Adjustable persistence to prevent false triggering
- Operational temperature range (T_{AMB}):
  - –40 to +85 °C

Key Applications

- Smart Sensing & Connectivity:
  - Handheld devices
  - Smartphones
  - Digital cameras
  - Tablet PC applications
- Industrial:
  - Human-Machine Interfaces (HMI)
  - Industrial applications

Compared to previous generations, these new proximity sensors offer superior functionality in a smaller package at a lower cost, making them ideal for space-constrained battery-powered applications.

Vishay's SensorXplorer EVK enables easy evaluation of many different sensors, utilizing a PC application with an intuitive GUI. Both the VCNL36826S and VCNL36821S are available as add-on boards for the SensorXplorer EVK (VCNL36826S-SB and VCNL36821S-SB) allowing for quick evaluation using the included PC software.

maxim integrated™

MAX77962

23 V IN 3.2 A OUT USB-C Buck-Boost Charger with Integrated FETs for 2S Li-Ion Batteries
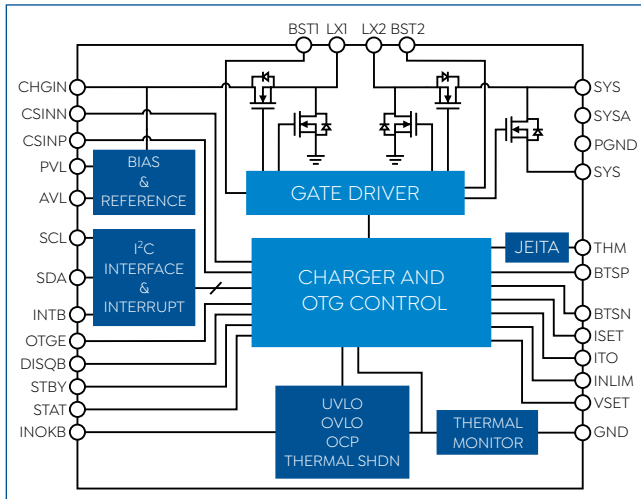
MAX77962 Block Diagram

The MAX77962 is a high-performance wide-input 3.2 A buck-boost charger with a Smart Power Selector™. It operates as a reverse buck converter without an additional inductor, allowing the IC to power USB On-the-Go (OTG) accessories. The device integrates low-loss power switches and provides small solution size, high efficiency, low heat, and fast battery charging. The reverse buck has a true load disconnect and is protected by an adjustable output current limit. The MAX77962 is highly flexible and programmable through the I²C interface, or autonomously, through resistor configuration.

- **3.5 V to 23 V input operating range, withstands up to 30 V (DC)**
- **reverse leakage protection**
- **50 mA to 3.15 A programmable input current limit**
- **50 mA to 3.2 A programmable constant current charge**

Features
- Remote differential voltage sensing
- 600 kHz or 1.2 MHz switching frequency options
- System instant-ON with Smart Power Selector™ power-path
- Charge safety timer
- Die temperature regulation with thermal foldback loop
- Thermal shutdown
- Input power management:
  - Adaptive Input Current Limit (AICL)
  - Input voltage regulation
- 10 mΩ BATT to SYS switch
- Up to 10 A overcurrent threshold
- USB OTG support:
  - Reverse buck mode 5.1 V / 1.5 A to support USB OTG
- JEITA compliant with NTC thermistor monitor
- Programmable via I²C or external resistors
- Compact package:
  - 49-Bump WLP (3.458 x 3.458 mm)

Key Applications
- Smart Consumer & Building:
  - USB Type-C powered wide-input charging applications
  - 2-cell battery-powered devices

MAX77962 offers an ultra-compact solution for USB-C PD buck-boost charging. It offers 50 % smaller solution size than competing discrete solutions.

High switching frequency reduces the required size of the inductor and the capacitors. All power switches are integrated within the IC itself, including the buck-boost and battery FETs

Featuring very high efficiency, it minimizes heat dissipation and simplifies thermal management.

FUSB3307

Autonomous USB PD Source Controller for DC–DC or AC–DC Applications
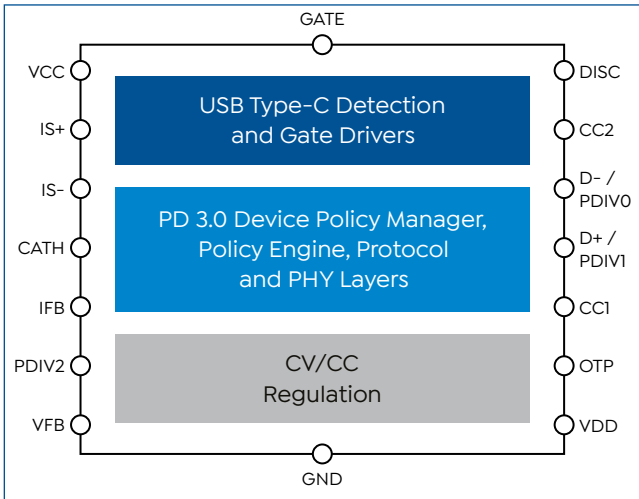
FUSB3307 Simplified Block Diagram

The FUSB3307 is a fully autonomous Rev. 2.0 Type-C and Rev. 3.0 Power Delivery-compliant power source controller. It can control a DC-DC port power regulator such as the NCP81599 or an optocoupler on the secondary side of an AC-DC adapter. It implements the Source finite state machines of USB Power Delivery 3.0 (PD3.0) and Type-C™, which includes Programmable Power Supplies (PPS). In order to meet the PPS specification, FUSB3307 supports down to 3.3 V minimum and up to 21 V maximum output voltage control.

- **Autonomous USB Power Delivery Rev. 3.0 (PD3.0) v2.0 and Type-C™ Rev. 2.0 compliant**
- **Built–in cable–drop compensation**
- **Programmable Power Supplies (PPS) solution for DC-DC and AC-DC applications**
- **Very low active power, highly power efficient**

Features

- Constant Voltage (CV) regulation
- Constant Current Limit (CL) regulation
- Small current sensing resistor (5 mΩ) for high efficiency
- Gate driver for N-channel MOSFET as a load switch
- Built-in cable-drop compensation
- Selectable resistor divider or battery charging (BC1.2) modes
- Built-in output capacitor bleeding function for fast discharge
- Adaptive Under and Over-Voltage protection (UVP, OVP)
- CC1/CC2 pin OVP up to 26 V
- Overcurrent Protection (OCP)
- Internal and external Over-Temperature Protection (OTP):
  - External OTP via NTC resistor (QFN package version only)
- V_{BUS} fault detection

- Operating junction temperature (T_J):
  - Absolute maximum T_J: –40 to 150 °C
  - T_J warning threshold: 125 °C
  - T_J shutdown threshold: 135 °C
- Available in 14-pin SOIC and 20-pin QFN packages

Key Applications

- Smart Consumer & Building:
  - Travel adapters
  - Power banks
  - USB-C hubs
- Automotive:
  - Infotainment and dashboard

The FUSB3307 enables a fully autonomous Power Delivery (PD) in compliance with the Type-C Rev. 3.0 specifications.

It provides Programmable Power Supplies (PPS) solution for DC-DC and AC-DC power sources, delivering pin-programmable power output from 16 W up to 100 W.

FAN54120

Fully Integrated, 500 mA Single-cell Li-Ion Battery Charger

FAN54120 Block Diagram
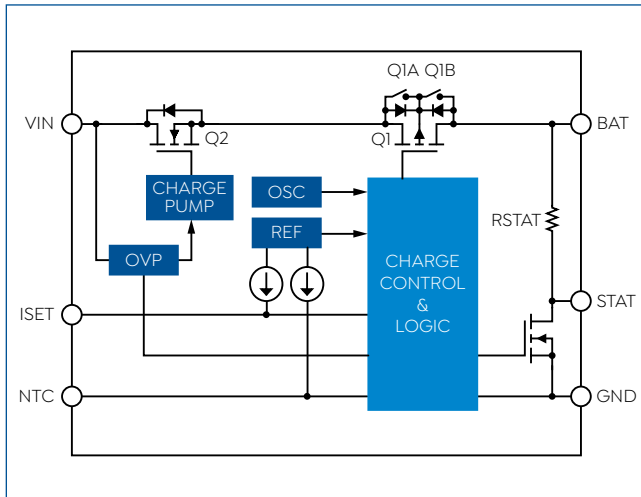
The FAN54120 is a compact, low-cost, fully integrated single-cell Li-Ion battery charger supporting dead battery revival, pre-charge, fast charge, and float charge states. It does not require any firmware or software to work, thereby allowing highly-secure, tamper-proof systems to be built. An open-drain STAT pin provides charging and/or fault status indication. Fast charging current (I_{FAST}) can be set up to 500 mA with an external resistor. The FAN54120 is available in an ultra-compact DFN6 or WLCSP6 package, making it the smallest battery charger on the market.

- **Fully Integrated stand-alone charger for single cell Li-Ion or Li-Polymer batteries**
- **No firmware or software required**

- **Ultra-compact package size**
- **Wide range of input voltages**

Features

- Fully integrated stand-alone charger:
  - Designed for single-cell Li-Ion or Li-Po batteries
- Factory configured charging voltage via OTP:
  - 4.2 V, 4.25 V, and 4.35 V
- No firmware or software required
- ±0.5% charging voltage accuracy
- ±4% charge current accuracy
- 28 V absolute maximum input voltage
- Up to 6 V (max) on V_{BAT} pin
- User-selectable fast charging current via an external resistor:
  - Charging current up to 500 mA
- Ultra-low battery discharge current (less than 150 nA)
- True reverse current blocking
- Adaptive thermal regulation
- Supports JEITA Safe-to-Charge operation with an external NTC

- Supports multiple charging modes:
  - Dead battery revival
  - Battery pre-charge
  - Fast charge
  - Float charge
- Power Back functionality:
  - Allows powering accessories from the battery
- STAT pin can be used to control a LED indicator:
  - Battery charging (LED ON)
  - Charge complete (LED OFF)
- Available in DFN6 (2 x 2 mm) or a WLCSP6 package (1.36 x 0.76) mm
- Operating temperature range:
  - T_J: from –30 to 120 °C
  - T_{AMB}: from –30 to 85 °C

Key Applications

- Smart Consumer & Building:
  - IoT sensor nodes
  - E-Cigs
  - Point-of-Sale (PoS) devices

- Healthcare & Wearables:
  - Wearable electronics
  - Medical monitors
  - Low-power handheld devices

The FAN54120 is one of the smallest battery charger ICs on market, which is ideally suited for space-constrained applications.

However, it also offers some additional benefits, such as wide input voltage range and autonomous operation, a great choice for battery-operated IoT nodes that require high robustness against tampering and physical misuse.

It also offers dead battery revival, a very welcomed option in situations when battery can't be charged regularly and is drained too much.

NCP1095 & NCP1096

Power Over Ethernet (PoE) Powered Device (PD) Interface Controller IEEE 802.3bt
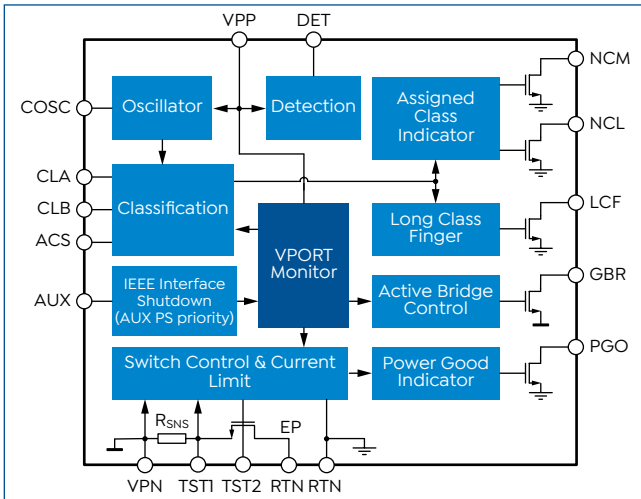
NCP1096 Block Diagram

The NCP1095 and NCP1096 PoE PD interface controllers contain all features needed to implement an IEEE.3bt, IEEE 802.3af, and/or IEEE 802.3at application. This includes detection, classification, and current limiting during the inrush phase. The NCP1096 supports applications up to 90 W through an integrated pass transistor, while the NCP1095 supports applications up to 90 W through an external pass transistor. The Power Good (PGO) and Auxiliary PSU Detection (AUX) pins guarantee proper enabling or disabling of the DC/DC converter to comply with type I, II, III, and IV operation.

- **IEEE 802.3bt compliant, supporting high-power applications up to 90 W**
- **External/integrated hot-swap transistor options are available**
- **Auxiliary PSU detection feature and Power Good pin**
- **Inrush current limiting, current and temperature protection features**

Features
- NCP1095-specific:
  - Supports external N-channel MOSFET load switch
  - Supports external sensing resistor
- NCP1096-specific:
  - Integrated N-channel MOSFET load switch
  - Exceptionally low $R_{DS(ON)}$ < 70 mΩ at T_J = 125 °C
  - Integrated current sensing resistor (RSNS = 25 mΩ)
  - Exposed pad for thermal management (MOSFET drain)
- Common features:
- 802.3bt UHP 90 W compliant PoE PD device
- Classification:
  - 5 finger (type 1, 2, 3, and 4 PSE)
  - Auto-classification
- Inrush current limiting: 110 mA (typ.)
- Over-current, over-temperature protection, standard UVLO

- Short MPS (Maintain Power Signature)
- Interface to MCU
  - Classification result
  - LCF for Short MPS
- Interface to external DC/DC:
  - Power Good (PGO) pin
- Auxiliary power supply detection:
  - Pass switch disabling & back-feed protection
- Junction Temperature Range (T_J):
  - From –40 °C to +125 °C
- Compact TSSOP16 (EP) package
- Pb-Free and RoHS Compliant

Key Applications
- Communication & Infrastructure:
  - Audio/video conferencing
  - Wireless access points
  - IP cameras
  - Mini base stations
- Smart Consumer & Building
  - USB-PD bridge
  - LED lighting

The NCP1095 and NCP1096 are IEEE802.3bt/at/af certified PoE PD solutions with Auto-class functionality for efficient power delivery over Ethernet. They can provide enough power even for more demanding applications such as LED lighting, outdoor heated cameras, and similar. Both integrated and external pass-switch options are available, for greater design flexibility.

The LIGHTING-POWER-POE-GEVB eval kit demonstrates their functionality and It can be combined with the LIGHTING-1-GEVK lighting platform, where it replaces the mains-powered PSU module.

STPW12

Programmable Electronic Power Breaker for 12 V Bus
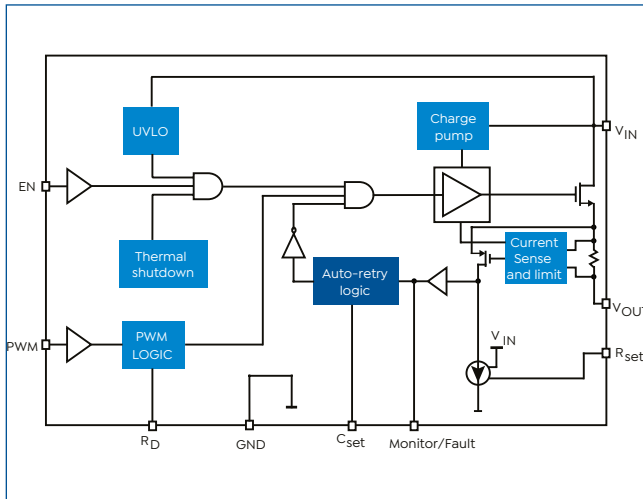
STPW12 Block Diagram

The STPW12 is an integrated electronic power breaker, optimized to monitor the input power. Connected in series to the power rail, it is able to disconnect the electronic circuitry on its output if the power consumption overcomes the programmed limit. When this happens, the device automatically opens the integrated power switch and disconnects the load. The intervention is communicated through a signal on the fault pin and after a certain delay time, programmable by the user, the device automatically tries again to close the internal switch and re-connect the load.

- **Input voltage range: 10.5 V to 18 V**
- **Continuous current: 1.5 A (typ.)**
- **Real-time input power sensing**
- **Operative junction temperature: –40 °C to 125 °C**

Features
- P-channel ON resistance: 50 mΩ (typ.)
- Power limit accuracy: 3% (typ.)
- Undervoltage lockout
- Adjustable power limiting threshold (with R_{SET})
- Programmable power limit masking time (with R_D)
- Programmable auto-retry delay (with C_{SET})
- Internal self-protection:
  - Current limit
  - Thermal shutdown
- Chip Enable function
- PWM mode with masking
  - PWM signal: square wave, up to 2 kHz
  - Duty cycle: from 20% to 100%
  - Masking time:
    - Duration: 45 µS to 2000 ms
    - Programmable via a resistor (R_D)
    - Table of R_D values provided in the datasheet

- Short-circuit current limit
- Available in power SO8 package
- Simplifies UL compliance and certification

Key Applications
- Smart Consumer & Building:
  - White goods
  - Consumer electronics
  - Air conditioners
  - Fan motor control
- Industrial:
  - HMI
  - Controllers

The STPW12 is more than just a simple electronic fuse: along with the full set of protection features, it also provides continuous power monitoring with fault detection, via a dedicated monitoring pin.
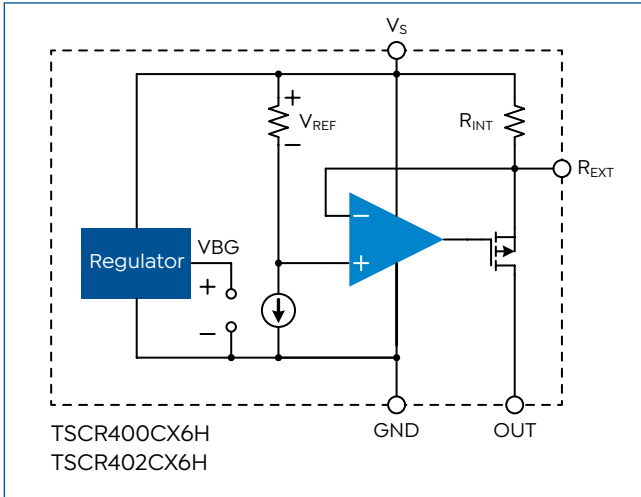
The STPW12 can be enabled or disabled via the EN pin, but it also offers a direct PWM control mode, using an external PWM signal up to 2 kHz, applied to a dedicated PWM pin.

Low & High-Side CCRs

Taiwan Semiconductor Expands its Portfolio of Automotive Lighting ICs

TSCR400CX6H
TSCR402CX6H

TSCR40XCX6H HS CCR LED Driver – Block Diagram

Taiwan Semiconductor enters the market for automotive LED Driver and reaches another milestone to systematically expand its position as a supplier to the automotive industry. The TSCR400CX6H & TSCR402CX6H are high-side constant current regulators for linear LED driving, with presets of 0.1 mA and 20 mA nominal (respectively), adjustable up to 65 mA with an external resistor. The TSCR420CX6H & TSCR421CX6H are low-side constant current regulators for linear LED driving, with a present of 10 mA nominal, adjustable up to 300 mA with an external resistor.

- **AEC-Q100 qualified**
- **PPAP capable**
- **Easy paralleling of drivers for increased current**
- **Good temperature coefficient vs. output current**

Features

- Low-side linear Constant Current Regulator (CCR):
- Available devices:
  - TSCR420CX6H, TSCR421CX6H
- LED drive current (adjustable with an external resistor):
  - Preset current (no external resistor): 10 mA
  - With an external resistor: up to 300 mA
- Dimming with PWM signal up to 10 kHz (TSCR421CX6H)
- High-side linear Constant Current Regulator (CCR):
- Available devices:
  - TSCR400CX6, TSCR402CX6
- LED drive current (adjustable with an external resistor):
  - Preset current (TSCR400CX6): 0.1 mA
  - Preset current (TSCR402CX6): 20 mA

- With an external resistor: up to 65 mA
- Common features:
- Supply Voltage up to 40 V
- Thermal drift of the output current ($\Delta I_{OUT}/I_{OUT}$):
  - −0.07% per °C
- AEC-Q100 Qualified with the Following Results:
  - Device Temperature Grade 1: −40 °C to 125 °C
  - Device HBM ESD Classification Level H2
  - Device CDM ESD Classification Level C6
- Compact SOT-26 package
- RoHS compliant and halogen-free

Key Applications

- Automotive:
  - Interior light
  - Turning signals
  - Rear cluster lighting
  - Cluster illumination
- Smart Consumer & Building
  - Architectural LED lighting
  - Emergency lighting
  - Advertising and signage lighting

With its entry into the automotive LED driver market, Taiwan Semiconductor reaches another milestone in systematically expanding its position as a supplier to the automotive industry.

The TSCR40xCX6/TSCR42xCX6 linear CCR LED driver series are AEC-Q100 qualified and offer excellent thermal stability. Besides automotive, these CCR LED drivers can be equally useful for the broadest range of applications in many different market segments.

TOSHIBA

TB67H451FNG

Brushed DC Motor Driver IC with wide voltage range and non-latching overcurrent detection
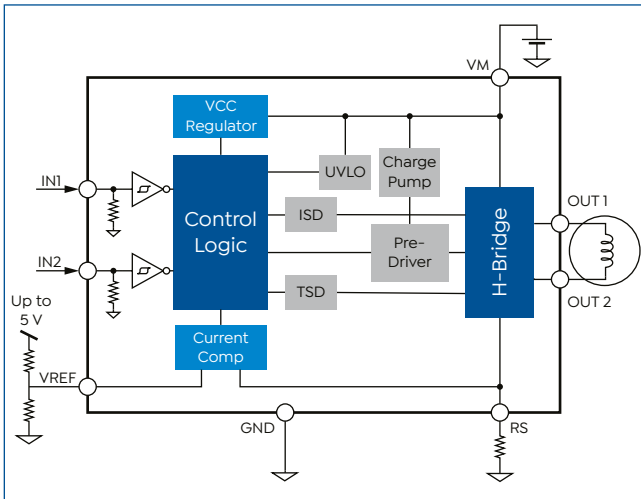
TB67H451FNG – Simplified Block Diagram

Toshiba's TB67H451FNG is a single-channel PWM chopper-type brushed DC Motor driver, which features an automatic return to normal operation after overcurrent detection. While the TB67H450FNG is a latch-type device where output is turned off indefinitely until a power cycle or entering and leaving the standby mode, the TB67H451FNG features an auto-return function, without the need for any external control. When the overcurrent condition subsides, operation returns to normal. The device can operate with a wide range of input voltages, from 4.5 V to 44 V.

- **Wide operating voltage range**
- **Low stand-by current**
- **Overcurrent detection with auto-return**
- **Small HTSSOP8 package**

Features
- Wide input voltage range:
  - From 4.5 to 44 V (operating)
- Output voltage:
  - Up to 44 V (operating)
- High current drive capability :
  - Up to 3 A (operating)
- Automatic blanking time insertion to increase noise immunity
- Automatic transition into standby mode (IN1, IN2 = LOW)
- PWM constant current (CC) and direct PWM drive capability
  - Direct PWM driving via IN1, IN2 pins
  - Maximum PWM frequency: 400 kHz
  - CC programmable by an external resistor
- Supports four modes of operation:
  - Forward, reverse, brake, stop (OFF)
  - Mode selection by logic states on IN1, IN2 pins
  - 5 V logic-level compatibility
- Rich set of fault detection features:

- Overcurrent detection (ISD) with auto-return
- Thermal shutdown (TSD)
- Under-voltage lockout (UVLO)
- Ultra-low standby power of only 1 µA
  - Enables efficient use in battery-operated applications
  - Simplifies compliance with low power requirements
- Compact HTSSOP8 package:
  - 4.9 x 6.0 mm
- Industry-standard pinout:
  - Enables easy drop-in replacement

Key Applications
- Industrial:
  - Industrial equipment
  - OA equipment
- Smart Consumer & Building:
  - Robotic vacuum cleaners
  - Home Appliances
  - Battery-powered devices

- USB-powered devices
- EV charging (plug lock)
- Electronic door lock
- POS terminals

Toshiba's TB67H451FNG PWM chopper-type brushed DC motor driver is manufactured using the BiCD fabrication process.

This sophisticated 0.13-micron technology enables increased operating current and voltage, as well as reduced ON resistance of the driver MOSFETs. As a result, it is possible to achieve high motor driving efficiency, as well as the reduced power consumption of the IC itself.

TCKE8xxNA and TCKE8xxNL

Resettable eFuse ICs Providing Safety for Low Voltage Applications
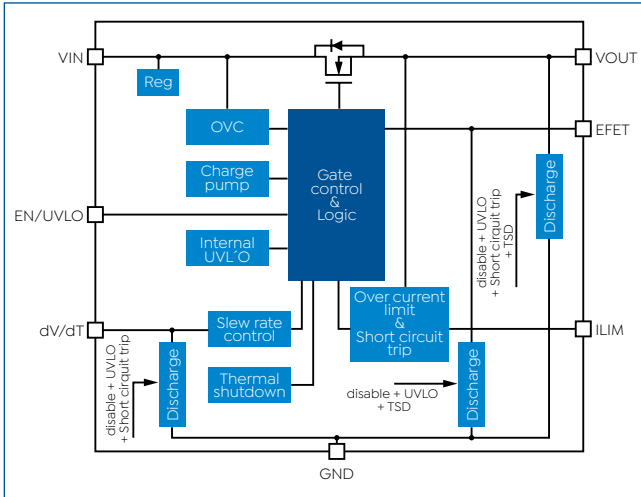
TCKE8xx Series Block Diagram

Toshiba's new eFuse solution provides multiple protection options for power supply lines. Whereas conventional fuses perform a sacrificial function physically breaking the electrical link to the circuit they are protecting, eFuses offer a resettable solution that additionally provides further protection features. This includes functions such as a highly accurate over-current limit, overvoltage protection, and over-temperature protection, in addition to the conventional short-circuit protection. The TCKE8xxNA/TCKE8xxNL series consists of six devices that support various protection options.

- **Thin WSON10B package (3.00 x 3.00 x 0.75 mm)**
- **Typical R$_{ON}$ of only 28 mΩ**
- **Input voltages from 4.4 to 18.0 V are supported**
- **Output current up to 5 A**

Features
- High input voltage:
  - V$_{IN}$ max. = 18.0 V
- High output current:
  - I$_{OUT}$ (DC) = 5.0 A
- Low ON resistance :
  - R$_{ON}$= 28 mΩ (typ.)
- Adjustable overcurrent limit:
  - Up to 5.0 A
- Fixed overvoltage clamp
- Fault response options:
  - Latched (NL suffix),
  - Auto-retry (NA suffix)
- Fast-trip comparator delay:
  - 150 ns (typ.)
- Programmable slew rate control by external capacitance
- Reverse current blocking support by built-in MOSFET driver
- Adjustable under-voltage lockout (UVLO) by an external resistor
- Thermal shutdown
- Auto-discharge
- Small package:
  - WSON10B (3.0 mm x 3.0 mm x 0.7 mm)
- Operating temperature range (T$_{AMB}$):
  - From –40 to +85 °C
- Certified to IEC 62368-1

Key Applications
- Smart Consumer & Building:
  - Circuit protection of PSU lines
  - IoT equipment
  - Servers
  - Cleaning robots
  - Smart speakers
  - Wireless chargers

In addition to the highly accurate over-current protection function, the TCKE8xx series eFuses are equipped with functions for highly accurate over-voltage protection, inrush current reduction through slew rate control, short-circuit protection, over-temperature protection, and reverse-current blocking, as well.

The TCKE8xxNA/TCKE8xxNL eFuse IC series features a thin package, suitable for protection in high-density PCB designs.

Product order code
- HSM9-C190
- HSM9-C450
- HSM9-C380
- HSM9-V380
- HSM9-C191
- HSM9-C192

BROADCOM®
connecting everything®

HSM9-C190

Top Mount IR Emitter

HSM9-C190 Product Picture

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DISCRETE

The HSM9-C190 is a top view surface-mount IR ChipLED that comes in an industrial standard 1.6 x 0.8 mm footprint. It features a small form-factor that allows for flexible board design, and the IR chip LED can be closely mounted. This allows for maximum-miniaturization benefits to the designers, especially in portable devices where space is a constraint. The HSM9-C190 LED is part of the HSM9-xxxx and HSM8-xxxx family of surface mount IR ChipLEDs and it is compatible with industry-standard automatic machine placement and reflow soldering.

- **SMD LED**
- **Compatible with reflow soldering**
- **Available in 8-mm tape and 7" diameter reel**
- **Compact size, well suited for space-constrained applications**

Features
- Radiant Intensity (I_e):
  - 0.80 mW/sr (typ.)
  - 1.5 mW/sr (max.)
- Beam angle ($2\theta_{1/2}$):
  - 150° (typ.)
- Color range:
  - Infrared
- Peak wavelength (λ_p):
  - 940 nm (typ.)
- Forward voltage (V_F):
  - 1.2 V (typ.)
- Absolute maximum DC forward current:
  - 70 mA (T_{AMB} = 0 to 30 °C)

- Dimensions (W x L x H):
  - 1.6 x 0.8 x 0.8 mm
- Operating temperature range:
  - From −40 to +85 °C
- RoHS6 Compliant

Key Applications
- Industrial:
  - Light Curtain
  - Smart utility metering
- Smart Consumer & Building:
  - Smoke Detector
  - Home Appliances
  - Remote Controller

Broadcom's HSM9-xxxx and HSM8-xxxx families of SMT IR ChipLEDs offer different options for a wide range of applications.

Two different peak wavelengths are available, as well as several different beam angle options (with or without integrated optical lens), covering a wide range from 18° to 150°

The HSM8 series offers a peak wavelength of 850 nm, while the HSM9 series offers a 940 nm peak wavelength option.

Product order code
- BZX884S-C2V7YL
- BZX884S-C3V0YL
- BZX884S-C3V3YL
- BZX884S-C3V6YL
- BZX884S-C3V9YL
- BZX884S-C4V3YL

Zener Diodes

Leaded and Leadless Packages for Compact Design

DFN1006-2
1 x 0.6 x 0.27

SOT23
2.9 x 1.3 x 1

SOD323F
1.7 x 1.25 x 0.7

SOD123F
2.6 x 1.6 x 1.1

SOT223
6.5 x 3.5 x 1.65

SOT323
2 x 1.25 x 0.95

Nexperia's Zener Diodes in Compact Packages

Nexperia's Zener diodes can act as voltage regulator diodes in most electronic applications. The broad AEC-Q101 qualified portfolio includes both Japanese and European selection groups in a wide variety of voltage, package, and configuration options. In fact, the comprehensive selection guide (± 1500 product types) provides the option of customized designs on a small scale, allowing high-density circuit designs. The widely used Zener diodes portfolio has been expanded.

- **Comprehensive range of packages and power dissipation options**
- **Customized, effective protection in small-scaled, high density circuit designs**
- **Wide range of working voltages**
- **Nexperia is able to offer A-Zeners with a tolerance of 1%**

Features

- 150 leadless DFN part numbers available in:
  - DFN1006(BD)-2 (SOD-882) incl. parts with side-wettable flanks
- Complete series of Zener diodes
- Industrial standard E24 voltage range
- Suitable for wave soldering and reflow soldering
- Reverse voltage range V_Z from 2.4 to 75 V
- Forward current I_F max 200 mA
- Reverse power dissipation PZSM max 40 W
- 1 series with European spec with B- & C- selection
- AEC-Q101 qualified
- 1051 standard leaded part numbers available in:
  - SOT-23, SOT-323, SOT-89, SOT-223, SOD-123(F), SOD-323(F), SOD-523, SOD-27, SOD-80, and SOD-66 packages

- Technical Specification Ranges:
  - I_{max} from 200 mA to 500 mA
  - V_{max} from 2 V to 105 V
  - P_{tot} from 250 mW to 1500 mW

Key Applications

- Suitable for compact industrial, automotive, and consumer applications:
  - Voltage regulation
  - Voltage stabilization
  - Voltage reference
  - Over-voltage protection

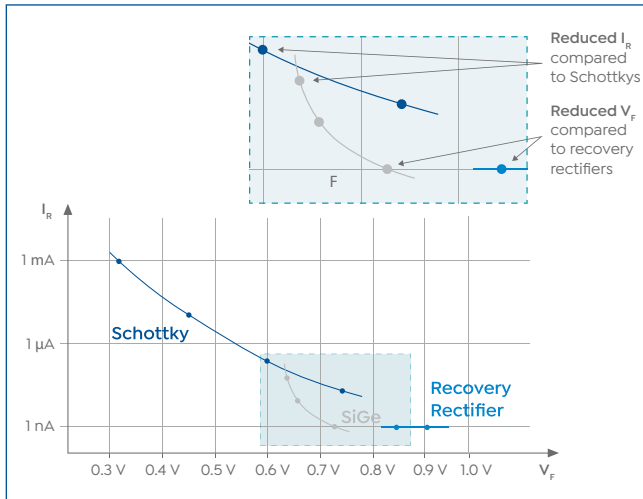Nexperia's general-purpose Zener diodes in a compact leaded and leadless package offer a wide range of operating voltages with narrow tolerances.

Due to their compact size - especially DFN1006 devices with wettable flanks to make visual inspection possible - these Zener diodes are perfectly suited to be used a wide range of applications in many different segments, including automotive, industrial, and consumer electronics.

Product order code
- PMEG120G10ELRX
- PMEG120G20ELRX
- PMEG120G20ELPX
- PMEG120G30ELPX
- PMEG150G10ELRX
- PMEG150G20ELRX

Silicon Germanium Rectifiers

Cutting-edge high efficiency, thermal stability and space-savings

Reduced I_R compared to Schottkys

Reduced V_F compared to recovery rectifiers

Nexperia SiGe Rectifiers – Benefits

Nexperia's SiGe rectifiers combine the high efficiency of Schottky rectifiers with the thermal stability of fast recovery diodes. Targeting automotive, server markets, and communications infrastructure, the AEC-Q101 compliant rectifiers are of particular benefit in high-temperature applications. These extremely low leakage devices allow an extended safe-operating area with no thermal runaway up to 175 °C, while at the same time, they offer significant room to optimize designs towards higher efficiency. SiGe rectifiers are housed in a clip-bonded FlatPower (CFP) packages CFP-3 and CFP-5.

- **Excellent Efficiency**
- **Extraordinary Safe Operation Area (SOA)**
- **Minimal impact on EMC allowing simplified certification**
- **Thermal stability up to 175 °C T$_j$**

Features
- Available options:
  - Reverse voltages (V_R): 120 V, 150 V, and 200 V
  - Forward currents (I_F): 1, 2, and 3 A
- Reduced forward voltage (V_F)
- Reduced parasitic capacitance and Q_{RR}
- Reduced reverse leakage current (I_R):
  - Less than 1 nA
- Fast and smooth switching
- Space-saving, rugged CFP packaging with superior performances:
  - Reduced package resistance
  - Reduced package inductance
  - Superior thermal performance (solid copper clip)
  - Easy pin to pin replacement
- AEC-Q101 qualified

Key Applications
- Automotive:
  - Automotive LED lighting
  - Engine Control Unit (ECU)
  - High-efficiency power conversion
- Communications & Infrastructure:
  - Server power supply
  - Base station power supply
  - Reverse polarity protection
  - Power OR-ing

One of the most significant advantages of Silicon Germanium (SiGe) technology is much higher electron mobility, which enables the use of SiGe devices in high speed applications.
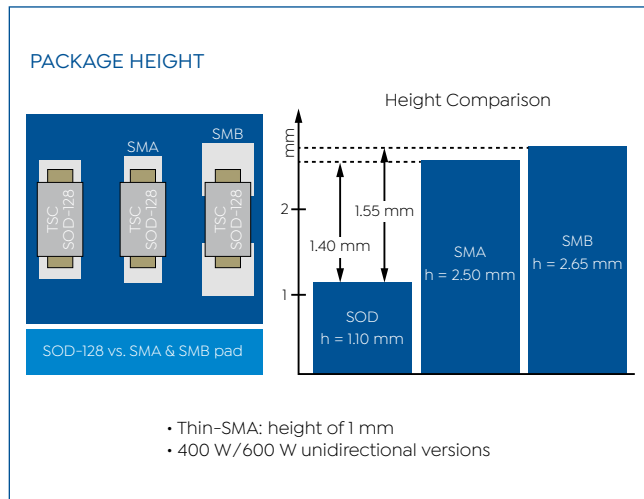
Built on top of inexpensive Si wafers, SiGe devices are becoming increasingly popular for highly efficient high-speed switching applications.

Nexperia's SiGe rectifiers are housed in a clip-bonded FlatPower (CFP) packages allowing them to maintain excellent thermal and speed performances offered by this technology.

TAIWAN SEMICONDUCTOR

Product order code
- SMA4F12AH MXG
- SMA4F15AH MWG
- SMA4F15AH MXG
- SMA4F18AH MWG
- SMA4F18AH MXG
- SMA4F20AH MWG

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DISCRETE

TVS Diodes in New Packages

Five TVS Diodes Families in New Compact Packages

PACKAGE HEIGHT

Height Comparison

SMA

SMB

TSC SOD-128

TSC SOD-128

TSC SOD-128

SOD-128 vs. SMA & SMB pad

1.55 mm

1.40 mm

SOD
h = 1.10 mm

SMA
h = 2.50 mm

SMB
h = 2.65 mm

- Thin-SMA: height of 1 mm
- 400 W/600 W unidirectional versions

TVS Diodes in Compact Packages – Height Comparison

Taiwan Semiconductor recently released five new Transient Voltage Suppressor (TVS) diodes families. They include unidirectional 200 W, 400 W, and 600 W products in innovative low-profile packages. The SMA4S/6S series is a range of unidirectional TVS diodes rated at 400/600 W, available in the SOD-128 package. The SMA4F/6F series is rated at 400/600 W in the ThinSMA package, and the SMF series of unidirectional TVS diodes are rated at 200W in the SOD-123W package. All products are AEC-Q101 qualified and have a maximum junction temperature rating of 175 °C.

- **AEC-Q101 qualified**
- **Photo-glass passivated junction**

- **Maximum junction temperature: 175 °C**
- **Available in three small package types: SOD-128, SOD-123W, ThinSMA**

Features
- 1 mm height, more than a 50% reduction from the traditional SMA package
- Low power loss, high efficiency
- Ideal for automated placement
- Excellent clamping capability
- Compliant to RoHS directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21
- All products AEC-Q101 qualified
- The SMA4S series:
  - Unidirectional TVS diodes rated at 400 W
  - SOD-128 package
  - Working voltages from 12 to 60 V
  - The SMA6S version is rated at 600 W for a 10/1000 µs pulse
- The SMA4F series:
  - Unidirectional TVS diodes rated at 400 W
- ThinSMA package
- Working voltages from 12 to 60 V
- The SMA6F version is rated at 600 W for a 10/1000 µs pulse
- The SMF series:
  - Unidirectional TVS diodes rated at 200 W
  - SOD-123W package
  - Working voltages from 5 to 100 V
  - Products with working voltages up to 60 V are rated up to 200 W for a 10/1000 µs pulse
  - Products with working voltages over 60 V are rated to 175 W

Key Applications
- Automotive, Industrial:
  - Switching mode power supplies (SMPS)
  - BLDC motor controllers
  - Battery Management Systems (BMS)
  - ESD protection in automotive applications

Taiwan Semiconductor offers a wide range of TVS diodes in five product families and three smaller package versions. With only 1 mm in height, these devices offer more than 50% size reduction compared to traditional SMA packages.

All products have a maximum junction temperature (Tj) of 175 °C and are qualified for AEC Q101. By employing the photo-glass junction passivation technology, these TVS diodes can offer more robust performance and lower failure rates, even at elevated temperatures.

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