Industrial Automation Solutions

Industrial Communication with Sitara™ AM335x ARM® Cortex™-A8 Microprocessors

TI simplifies industrial designs with multiple, on-chip industrial communications protocols

Texas INSTRUMENTS

Key features and benefits

- Multiple, on-chip, production-ready industrial Ethernet and Fieldbus communication protocols with master and slave functionality including:
  - EtherCAT®   EtherCAT
  - Ethernet/IP   EtherNet/IP
  - PROFIBUS®   PROFIBUS
  - PROFINET®   PROFINET
  - POWERLINK   ETHERNET POWERLINK
  - SERCOS III   sercos the automation bus
- Unique Programmable Real-time Unit (PRU) + ARM architecture eliminates the need for an external ASIC/FPGA to reduce system complexity and save on bill of materials (BOM) costs by more than 30 percent
- One scalable ARM Cortex-A8 processor platform (275 MHz to 720 MHz) for many different industrial automation applications enables reuse with pin-to-pin and software-compatible devices
- Quick and easy time to market with industrial-specific reference designs, production-ready comprehensive software, including communication protocols and signal chain solution
- Software frameworks for SYS/BIOS™ realtime kernel
- Broad software support for Linux®, Windows® Embedded Compact 7 and StarterWare™ in addition to a variety of third-party RTOS offerings providing design flexibility
- Fully integrated solution including other key industrial peripherals such as CAN, 2-port Gigabit Ethernet switch, USB+PHY, graphics acceleration and LPDDR1/DDR2/DDR3 reduces BOM costs

The Sitara™ AM335x ARM Cortex-A8 microprocessors from Texas Instruments Incorporated (TI) are the industry's first low-power ARM Cortex-A8 devices to incorporate multiple industrial communication protocols on a single chip. The six pin-to-pin and software-compatible devices in this generation of processors, along with industrial hardware development tools, software and analog components, provide a total industrial system solution. Using this solution, developers can get to market faster with their industrial automation designs, including input/output (I/O) devices, human machine interface (HMI) and programmable logic controllers (PLCs).

30 percent BOM reduction

The unique PRU+ARM architecture in the Sitara AM335x ARM microprocessors eliminates the need for an external ASIC or FPGA to reduce system complexity and save on bill of materials (BOM) costs by more than 30 percent. The Sitara AM335x ARM microprocessors also include other key industrial peripherals on-chip for additional BOM savings, including CAN, ADC, USB + PHY and two-port Gigabit Ethernet with IEEE 1588 to enable fast network connectivity and rapid data throughput, as well as connection to sensors, actuators and motor control.

Scalability

Designers can take advantage of the pin-to-pin and software compatibility of the Sitara AM335x ARM Cortex-A8 microprocessors
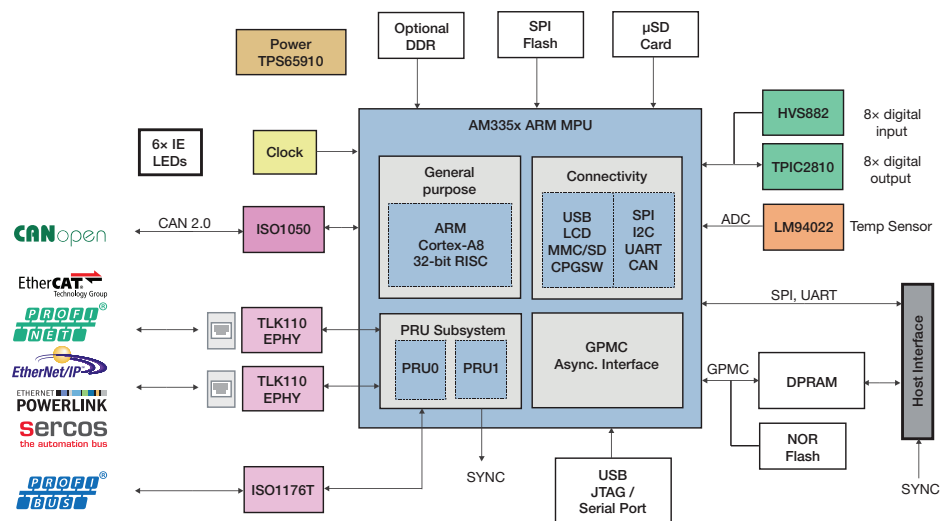
▲ A look at the system configuration using the AM335x industrial solution
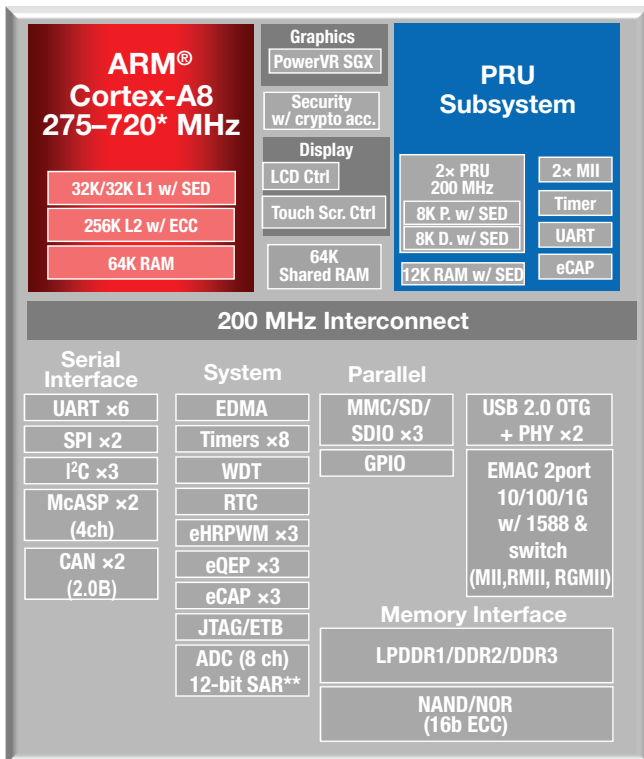
▲ Block diagram for Sitara™ AM3359 ARM Cortex-A8 microprocessor

and design several end equipments with the devices that best fit their industrial automation need, such as:

- **Drives and I/O-level devices:** Specifically targeted to enable sensors, actuators, motor drives, communications modules and gateways needing industrial slave communications the AM3357 and AM3356 ARM® microprocessors offer a low-performance 275-MHz solution. These two devices do not require an external memory or an operating system making the system solution simple and compact.

- **Industrial PLC applications:** Offering high-performance of up to 720 MHz, the AM3357 and AM3359 ARM microprocessors are well-suited for high-performance PLC applications that need to control various I/O devices in an automation system such as electric motors, pneumatic or hydraulic cylinders, magnetic relays solenoids and more.

- **HMI products:** Perfect for designing HMI products, the AM3354, AM3358 and AM3359 ARM microprocessors offer an on-chip 3D graphics accelerator, which combined with the integrated touch-screen controller, enables rich and intuitive graphical user touch-screen interfaces. For HMI applications not requiring integrated industrial communications, the AM3354 and AM3352 ARM microprocessors offer low-cost options.
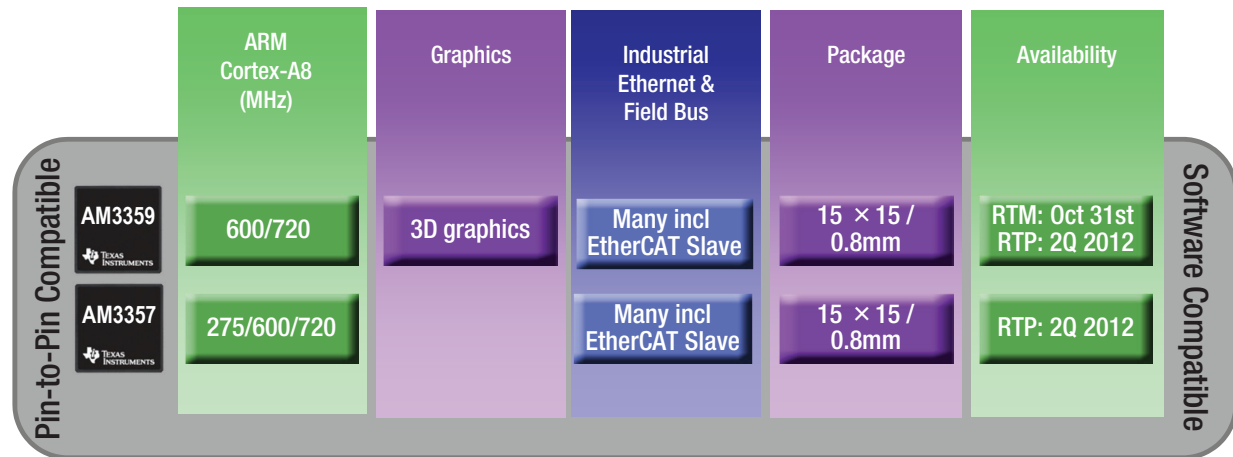


▲ Industrial automation support within the AM335x MPU

Industrial hardware and software tools

Accompanying the Sitara AM335x ARM microprocessors are two industrial hardware development tools to enable customers to easily incorporate industrial communication standards in their industrial automation products:

1. **AM3359 Industrial Development Kit (IDK)** (TMDXIDK3359) from TI is available for $895 USD. The IDK is an extensive development platform enabling customers

to evaluate all popular industrial communications and motor-control applications. The IDK has many different evaluation features such as 512 MB of DDR2 memory, dual motor drivers, digital I/O, a C2000™ Piccolo™ microcontroller with integrated analog-to-digital converters, a Stellaris® ARM Cortex™-M3 microcontroller, USB, Ethernet, SPI, I²C and much more.

(continued)
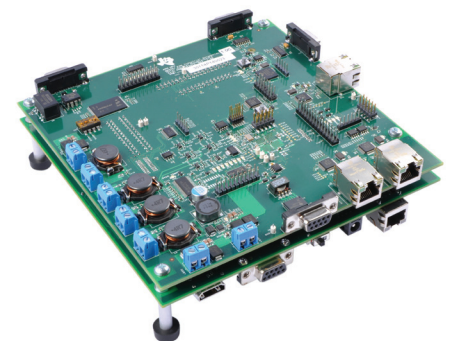
▲ Industrial Development Kit available for $895.

2. **AM3359 Industrial Communications Engine (ICE)** (TMDXICE3359) from TI is available for $99 USD. It is a pocket-sized, cost-optimized and form-factor optimized reference design for I/O devices and sensors needing to add industrial communications quickly and easily.
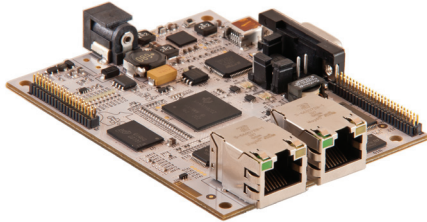
▲ *Industrial Communications Engine available for $99 USD.*

Designers can also utilize the previously announced AM335x EVM. Available to aid development is free, production-ready, certified system solution software for industrial automation protocols, including industrial design-specific demos, applications notes and videos to make development easy. Software resources required for physical and data link layer implementations of many industrial communications standards are available as well as software frameworks for SYS/BIOS™ real-time kernel and applications stacks for industrial communication standards, allowing customers to focus on the differentiating application level aspects of their system.

TI offers the ability to complete an entire industrial system design with TI analog ICs, including industrial Ethernet and isolated CAN transceivers, motor drivers, temperature sensors and power management devices, plus wireless connectivity options to complement the AM335x ARM microprocessors.

Community support

TI's online community at **e2e.ti.com** supports AM335x ARM Cortex-A8 MPUs. Ask questions, share knowledge, explore ideas, and help solve problems with fellow engineers.

Industrial Automation Solutions
Industrial Communication portfolio at a glance

High-Performance Analog Solutions

Description	Device	Key Benefits
5kVrms Isolated CAN Transceiver	ISO1050	• Reduced components and board space • Life span > 25 years @ 125ºC • Allows longer cable length
Low-Power Dual-Channel Digital Isolator	ISO7420E/FE	• Signaling rate above 50 bps • Low power consumption: 2.5 mA per ch @ 25 Mbps • Low popagation delay: 7 ns
Isolated RS-485 (PROFIBUS) Transceiver (ISO1176T with Integrated Transformer Driver)	ISO1176/1176T	• Reduced components and board space • Life span > 25 years @ 125ºC
Industrial Ethernet PHY	TLK110	• Lowest deterministic channel latency • Handles both MII and RMII interface • PROFINET®, EtherCAT® and SERCOS III friendly • Robust ESD protection
Power	TPS 65910A	• All power functions integrated in one IC • Take care of the correct processor • Power up/down sequencing • Complete reference design /schematic available
SVA Temperature Sensor	LM94022	• Analog output temperature sensor • Wide temperature range up to 150°C • High accuracy ±1.5°C • Footprint compatible with the industry-standard LM20/TMP20
HVAL	SN65HVS882 TPIC 2810	• Cost optimized control of eight outputs with serial I²C interface (TPIC2810) • High input density (cascadeable to >160) (SN65HVS882) • Reduced system power consumption over voltage (SN65HVS882)

Embedded Processing Solutions

Description	Device	Key Benefits
Sitara™ ARM9™ and ARM® Cortex™-A8 Microprocessors (MPUs)	AM18x, AM35x, AM335x, AM37x, AM389x	• Up to 450-MHz ARM9 to 1.5-GHz Cortex-A8 devices • Extensive peripheral set (PRU, EMAC, PCIe, CAN, USB, multiple UARTs, ...) • Flexible industrial communication protocols • Linux® Community, Android™, Windows® Embedded CE and RTOS ecosystem of development partners

For more information including selection guides, datasheets and application notes please visit **www.ti.com/automation**

TI Worldwide Technical Support

Internet

TI Semiconductor Product Information Center Home Page
support.ti.com

TI E2E™ Community Home Page
e2e.ti.com

Product Information Centers

Americas	Phone	+1(972) 644-5580
Brazil	Phone	0800-891-2616
Mexico	Phone	0800-670-7544
	Fax	+1(972) 927-6377
	Internet/E-mail	support.ti.com/sc/pic/americas.htm

Europe, Middle East, and Africa

Phone

European Free Call	00800-ASK-TEXAS (00800 275 83927)
International	+49 (0) 8161 80 2121
Russian Support	+7 (4) 95 98 10 701

Note: The European Free Call (Toll Free) number is not active in all countries. If you have technical difficulty calling the free call number, please use the international number above.

Fax	+(49) (0) 8161 80 2045
Internet	support.ti.com/sc/pic/euro.htm
Direct E-mail	asktexas@ti.com

Japan

Phone	Domestic	0120-92-3326
Fax	International	+81-3-3344-5317
	Domestic	0120-81-0036
Internet/E-mail	International	support.ti.com/sc/pic/japan.htm
	Domestic	www.tij.co.jp/pic

Asia

Phone

International	+91-80-41381665
Domestic	Toll-Free Number

Note: Toll-free numbers do not support mobile and IP phones.

Australia	1-800-999-084
China	800-820-8682
Hong Kong	800-96-5941
India	1-800-425-7888
Indonesia	001-803-8861-1006
Korea	080-551-2804
Malaysia	1-800-80-3973
New Zealand	0800-446-934
Philippines	1-800-765-7404
Singapore	800-886-1028
Taiwan	0800-006800
Thailand	001-800-886-0010
Fax	+8621-23073686
E-mail	tiasia@ti.com or ti-china@ti.com
Internet	support.ti.com/sc/pic/asia.htm

Important Notice: The products and services of Texas Instruments Incorporated and its subsidiaries described herein are sold subject to TI's standard terms and conditions of sale. Customers are advised to obtain the most current and complete information about TI products and services before placing orders. TI assumes no liability for applications assistance, customer's applications or product designs, software performance, or infringement of patents. The publication of information regarding any other company's products or services does not constitute TI's approval, warranty or endorsement thereof.

A122010

The platform bar, C2000, e2e, Piccolo, Sitara, StarterWare and SYS/BIOS are trademarks and Stellaris is a registered trademark of Texas Instruments. All other trademarks are the property of their respective owners.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Audio	www.ti.com/audio	Communications and Telecom	www.ti.com/communications
Amplifiers	amplifier.ti.com	Computers and Peripherals	www.ti.com/computers
Data Converters	dataconverter.ti.com	Consumer Electronics	www.ti.com/consumer-apps
DLP® Products	www.dlp.com	Energy and Lighting	www.ti.com/energy
DSP	dsp.ti.com	Industrial	www.ti.com/industrial
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Security	www.ti.com/security
Logic	logic.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Power Mgmt	power.ti.com	Transportation and Automotive	www.ti.com/automotive
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Mobile Processors	www.ti.com/omap		
Wireless Connectivity	www.ti.com/wirelessconnectivity		

TI E2E Community Home Page　　　　e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2011, Texas Instruments Incorporated