

Power Management Unit with DCDC Controller

Check for Samples: [TPS659110](#), [TPS659112](#), [TPS659113](#)

FEATURES

The purpose of the TPS659110 device is to provide the following resources:

- Embedded power controller (EPC) with EEPROM programmability
- Two efficient step-down DCDC converters for processor cores (VDD1, VDD2)
- One efficient step-down DCDC converter for I/O power (VIO)
- One controller for external FETs (VDDCtrl)
- Dynamic voltage scaling for processor cores
- Eight LDO voltage regulators and one RTC LDO (supply for internal RTC)
- One high-speed I²C interface for general-purpose control commands (CTL-I²C)
- Two independent enable signals for controlling power resources (EN1, EN2). Alternatively, these pins can be used as a high-speed I²C interface dedicated for voltage scaling for VDD1 and VDD2.
- Thermal shutdown protection and hot-die detection
- A real-time clock (RTC) resource with:
 - Oscillator for 32.768-kHz crystal or 32-kHz built-in RC oscillator
 - Date, time and calendar
 - Alarm capability
- Nine configurable GPIOs with multiplexed feature support:
 - Four can be used as enable for external resources, included into power up sequence and controlled by state-machine.
 - As GPI, GPIOs support logic-level detection and can generate maskable interrupt for wake-up.
 - Two of the GPIOs have 10 mA current sink capability for driving LEDs.
 - DCDCs switching synchronization through an external 3-MHz clock.
- Two reset inputs, for cold reset (HDRST) and a

power initialization reset (PWRDN) for thermal reset input

- 32-kHz clock and reset (NRESPWRON) for system and an additional output for reset signal
- Watchdog
- Two ON/OFF LED pulse generators and one PWM generator
- Two comparators for system control, connected to VCCS pin
- A JTAG[®] and boundary scan, but not accessible in functional mode (test purpose)

APPLICATIONS

- Portable and handheld systems

DESCRIPTION

The TPS659110 is an integrated Power Management IC available in 98-pin 0.65-mm pitch BGA package and dedicated to applications powered by one Li-Ion or Li-Ion polymer battery cell or 3-series Ni-MH cells or a 5 V input, and which require multiple power rails. The device provides three step-down converters, one controller for external FETs to support high current rail, eight LDOs, and is designed to be flexible PMIC for supporting different processors and applications.

Two of the step-down converters provide power for dual processor cores and support dynamic voltage scaling by a dedicated I²C interface for optimum power savings. The third converter provides power for the I/Os and memory in the system.

The device includes eight general-purpose LDOs providing a wide range of voltage and current capabilities. Five of the LDOs support 1.0 to 3.3 V with 100-mV step and three (LDO1, LDO2, LDO4) support 1.0 to 3.3 V with 50-mV step. All LDOs are fully controllable by the I²C interface.

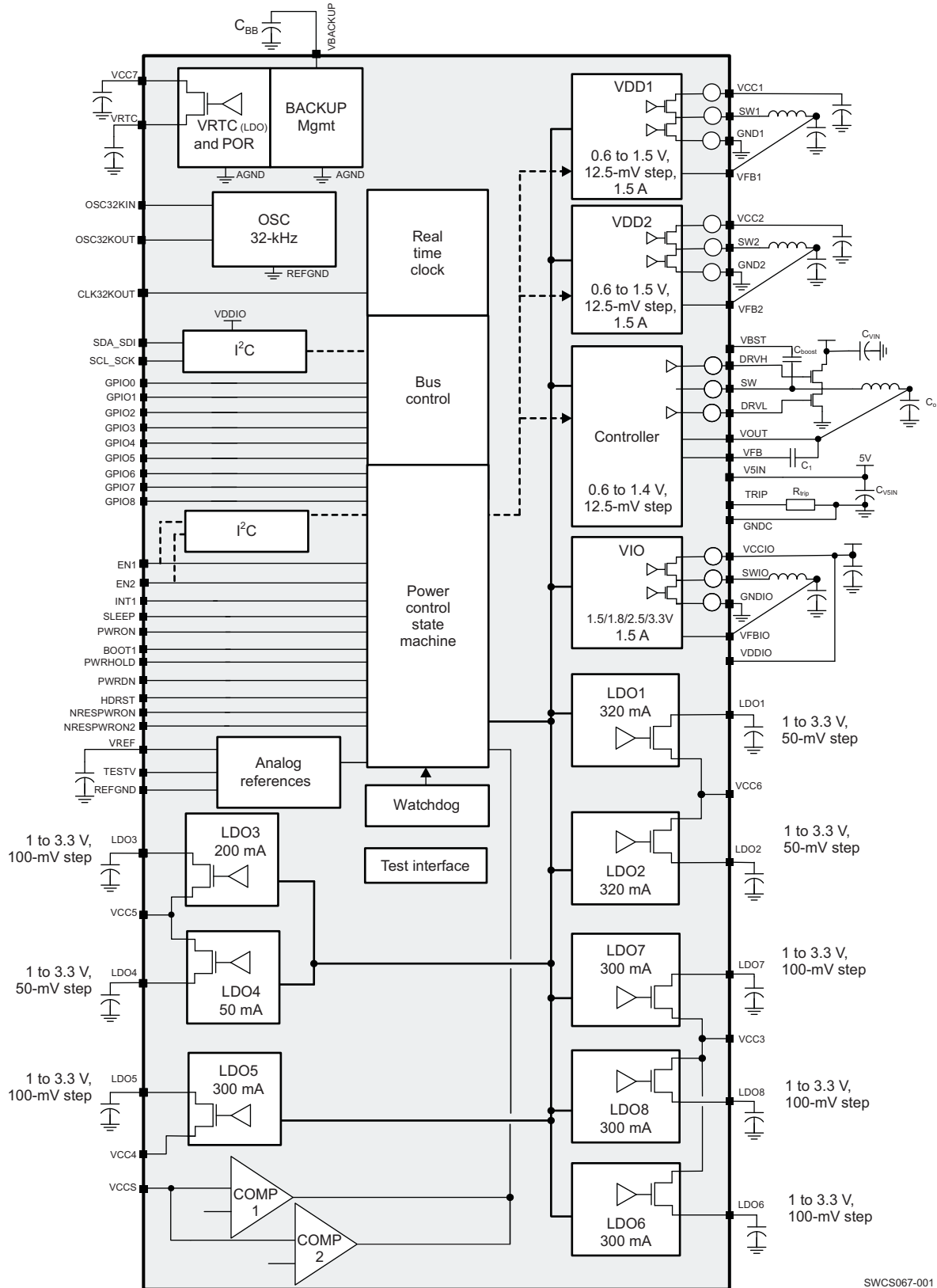
In addition to the power resources, the device contains an EPC to manage the power sequencing requirements of systems and an RTC. Power sequencing is programmable by EEPROM.

[Figure 1](#) shows the top-level diagram of the device.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

JTAG is a registered trademark of JTAG Technologies, Inc.



SWCS067-001

Figure 1. Top-Level Diagram

For the complete TPS65911 data sheet, contact your TI sales representative. The document is internally available for download on ESP under the corresponding TPS659110/2/3 product folders and can be shared with customers.

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
TPS6591102A2ZRC	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	240	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS6591102A2ZRCR	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	2500	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS6591102AA2ZRC	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	240	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS6591102AA2ZRCR	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	2500	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS6591103A2ZRC	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	240	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS6591103A2ZRCR	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	2500	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS6591104A2ZRC	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	240	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS6591104A2ZRCR	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	2500	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS6591109A2ZRC	PREVIEW	BGA MICROSTAR JUNIOR	ZRC	98		Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS6591109A2ZRCR	PREVIEW	BGA MICROSTAR JUNIOR	ZRC	98		Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS659110A2ZRC	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	240	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS659110A2ZRCR	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	2500	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
TPS659112A2ZRC	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	240	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS659112A2ZRCR	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	2500	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS659113A2ZRC	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	240	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	
TPS659113A2ZRCR	ACTIVE	BGA MICROSTAR JUNIOR	ZRC	98	2500	Green (RoHS & no Sb/Br)	CUNIAU	Level-3-260C-168 HR	

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBsolete: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

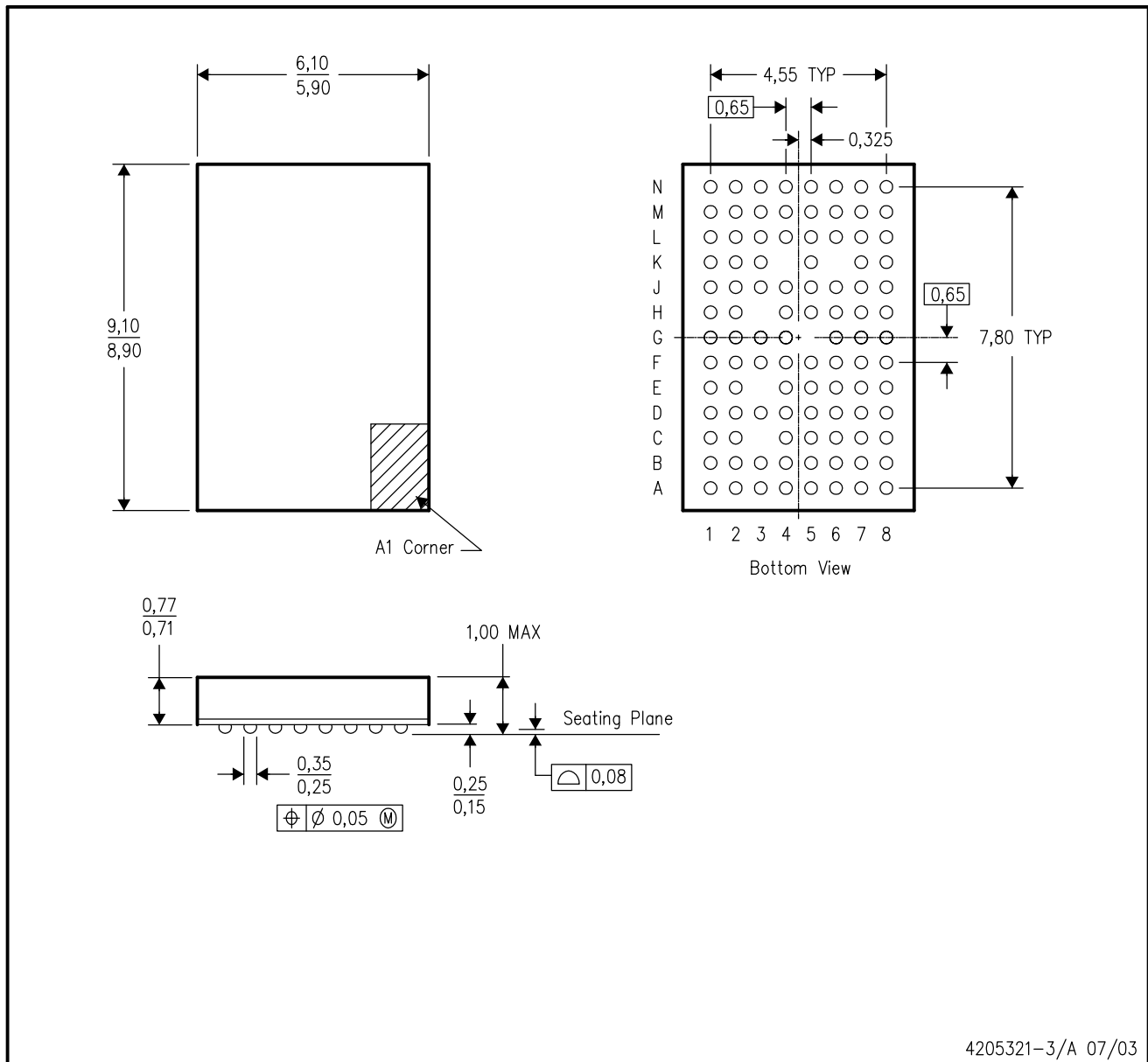
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

ZRC (S-PBGA-N98)

PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. MicroStar Junior™ BGA configuration
 - D. Falls within JEDEC MO-225
 - E. This package is lead-free.

MicroStar Junior BGA is a trademark of Texas Instruments.

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

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2012, Texas Instruments Incorporated