PMU FOR PROCESSOR POWER

Check for Samples: TPS65913, TPS65914

FEATURES

- Seven step-down switched-mode power supply (SMPS) regulators:
  - Two 0.5 to 1.65 V (10-mV steps) up to 8A
    - SMPS12 and SMPS45, dual-phase configuration with dynamic voltage scaling (DVS) control
    - WCSP package 8 A peak
    - QFN package 6 A
  - One 0.5 to 3.3 V (10-mV or 20-mV steps) up to 4 A
    - SMPS3, single-phase configuration
    - WCSP package 4 A peak
    - QFN package 3 A
    - Can be combined with SMPS12 as a 12 A (peak) triple-phase regulator
  - Two 0.5 to 3.3 V (10-mV or 20-mV steps) up to 4 A
    - SMPS6 and SMPS7, single-phase configuration
    - SMPS6 with DVS
    - WCSP package 4 A peak
    - QFN package 3 A
    - SMPS7 can be combined with SMPS45 as a triple-phase regulator
  - Two 0.5 to 3.3 V (10-mV or 20-mV steps) 1 A
    - SMPS8 and SMPS9, single-phase configuration
    - SMPS8 with DVS
  - Output current measurement in all except 1-A SMPS regulators
  - Differential remote sensing (output and ground) in dual-phase and triple-phase regulators
  - Automatic pulse frequency modulation (PFM) at light load current
  - Software-controlled ECO mode up to 5 mA with 15-µA quiescent current
  - 25-µA quiescent current in auto-mode (PFM and pulse width modulation [PWM])
  - 100% duty cycle for lowest dropout
  - Short-circuit protection
  - Powergood indication (under voltage and overcurrent indication)
  - Internal soft-start for in-rush current limitation
- One 5 V dual-output step-up converter for USB OTG, USB LDO, HDMI or D-class:
  - 0.5 A for USB OTG (OUT1) + 0.1 A (OUT2) for USB LDO, HDMI
  - OUT2 up to 1A (when OUT1 not active)
  - 3.6-V voltage selection for USB LDO to minimize power dissipation
  - Bypass mode to supply USB LDO from system supply
- Eleven general-purpose LDOs (50-mV steps):
  - Two 0.9 to 3.3 V @ 300 mA with battery or preregulated supply
  - Six 0.9 to 3.3 V @ 200 mA with battery or preregulated supply
    - One can be used as a vibrator driver.
  - One 0.9 to 3.3 V @ 50 mA with battery or preregulated supply
    - Bypass mode for SD® card I/O supply
  - One 100 mA USB LDO
  - One low-noise LDO 0.9 to 3.3 V @ up to 100 mA (low noise performance up to 50 mA)
  - Two additional LDOs for PMU internal use
  - Short-circuit protection
- Low power consumption
  - 5 µA in backup mode
  - 20 µA in off mode
  - 90 µA in sleep mode with two SMPSs active
- Clock management 32-kHz crystal oscillator or RC oscillator:
  - Three buffered 32-kHz outputs
- Real-time clock (RTC) with alarm wake-up mechanism
- USB OTG support
  - USB ID detection
  - Accessory Charger Adapter (ACA) detection

  - Attach Detection Protocol (ADP)
- SD card detection capability
- Backup battery charger
- 12-bit sigma-delta general-purpose analog-to-digital converter (GPADC) with 16 input channels (6 external and 10 internal)
- Thermal monitoring:
  - High temperature warning
  - Thermal shutdown
- Control:
  - Configurable power-up and power-down sequences (one-time programmable [OTP])
  - Configurable sequences between the SLEEP and ACTIVE states (OTP)
  - Two dedicated digital output signals (REGEN) that can be included in the sequences
  - Three digital output signals muxed with GPIO that can be included in the sequences
  - LED drivers: two 10-mA current sinks muxed with GPIO
  - Selectable I^2C™ control interface:
    - One serial peripheral interface (SPI) for resource configurations and DVS control
    - Two I^2C™ interfaces for resource configuration and DVS control
    - The I^2C interfaces can be combined.
- Undervoltage lockout and battery fault comparator
- Long button-press detection
- Battery or system voltage range from 2.5 to 5.5 V
- Package options:
  - 5.80 × 5.86-mm 13 × 13 169-pin WCSP with 0.4-mm ball pitch
  - 9.15 × 9.15-mm 108-pin QFN with 0.5 or 0.55-mm pitch

APPLICATIONS

- Mobile phones and smart phones
- Tablets
- Gaming handsets
- Portable media players
- Portable navigation systems
- Hand-held devices

DESCRIPTION

The TPS65913 and TPS65914 are integrated PMICs for applications powered by a rechargeable battery. The devices include seven configurable step-down converters for memory, processor core, I/O, or preregulation of LDOs. Two of these configurable step-down converters can be combined with another regulator for triple-phase operation and increased output current. A 5 V dual-output step-up converter is available to supply USB OTG and USB LDO, HDMI or D-class, for example. The devices also contain 11 LDO regulators for external use. LDOs can be supplied from either a battery, the system supply, or a preregulated supply. An integrated general-purpose sigma-delta analog-to-digital converter (ADC) supports measurement of 6 external inputs and 10 internal signals.

An OTP configurable controller enables customized power-up and power-down sequences. The TPS65913 and TPS65914 devices include a 32-kHz oscillator to sequence all resources during power up and power down. Two dedicated pins in the wafer chip scale package (WCSP) and one dedicted pin in the quad-flat no-leads (QFN) can be configured as part of the power-up sequence to control external resources. All LDO and SMPS regulators can be controlled by the SPI or I^2C interface, or by dedicated power request signals. In addition, voltage scaling registers allow transitioning the SMPS to different voltages by SPI, I^2C, or roof and floor control. General-purpose input/output (GPIO) functionality is available and three GPIOs can be configured as part of the power-up sequence to control external resources. Power request signals enable power mode control for power optimization.

The TPS65913 device is available in a 13-ball × 13-ball WCSP package with a 0.4-mm pitch; TPS65914device in a dual row QFN package with a 0.5 / 0.55-mm pitch.

Because of the limited number of balls, some of the features are not available in the QFN package.

For the complete TPS65913/14 data sheet, please contact your TI sales representative. The document is internally available for download on ESP under the corresponding product folders and can be shared with customers.

DEVICE INFORMATION

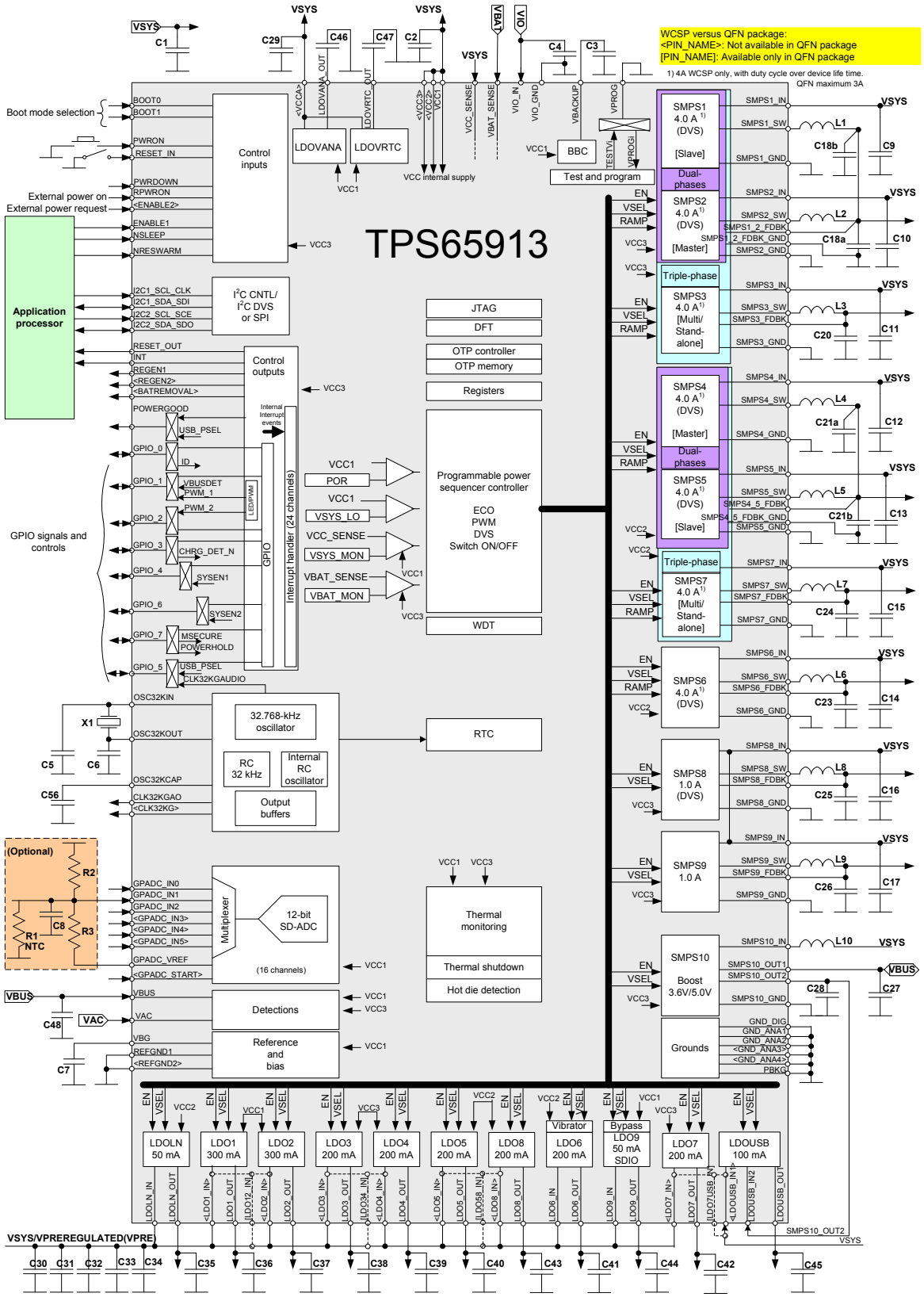

Figure 1. Functional Block Diagram

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
TPS65913B2B5YFFR	PREVIEW	DSBGA	YFF	169	3000	Green (RoHS & no Sb/Br)	Call TI	Level-1-260C-UNLIM	-40 to 85	T65913B2B5 ES2.2	
TPS65913B2B5YFFT	PREVIEW	DSBGA	YFF	169	250	Green (RoHS & no Sb/Br)	Call TI	Level-1-260C-UNLIM	-40 to 85	T65913B2B5 ES2.2	
TPS65913B2B6YFFR	PREVIEW	DSBGA	YFF	169	3000	TBD	Call TI	Call TI	-40 to 85		
TPS65913B2B6YFFT	PREVIEW	DSBGA	YFF	169	250	TBD	Call TI	Call TI	-40 to 85		
TPS65913B2B8YFFR	PREVIEW	DSBGA	YFF	169	3000	Green (RoHS & no Sb/Br)	Call TI	Level-1-260C-UNLIM	-40 to 85	T65913B2B8 ES2.2	
TPS65913B2B8YFFT	PREVIEW	DSBGA	YFF	169	250	Green (RoHS & no Sb/Br)	Call TI	Level-1-260C-UNLIM	-40 to 85	T65913B2B8 ES2.2	

(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.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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