Integrated Power Management/Audio CODEC

FEATURES

- Power
  - Three Efficient Stepdown Converters
  - Four External Linear Low-Dropout Regulators (LDOs) for Clocks and Peripherals
  - SmartReflex™ Dynamic Voltage Management
- Audio
  - Differential Input Main Microphones
  - Mono Auxiliary/FM Input
  - External Predrivers for Class-D (Stereo)
  - TDM Interface
  - Automatic Level Control (ALC)
  - Digital and Analog Mixing
  - 16-bit Linear Audio Stereo DAC (96 kHz, 48 kHz, 44.1 kHz, 32 kHz, and Derivatives)
  - 16-Bit Linear Audio Stereo Analog-to-Digital (ADC) (48 kHz, 44.1 kHz, 32 kHz, and Derivatives)
  - Carkit
- USB
  - USB 2.0 OTG-Compliant High-Speed Transceivers
  - 12-Bit (UTMI) + Low Pin Interface (ULPI)
  - USB Power Supply (5V charge pump for VBUS)
  - CEA-2011: OTG Transceiver Interface Specification
  - CEA-936A: Mini-USB Analog Carkit Specification
- Additional
  - LED Driver Circuit for Two External LEDs
  - Two External 10-Bit Monitoring ADC Inputs
  - Real-Time Clock (RTC) and Retention Modules
  - High-Speed I^2C Serial Control
  - Thermal Shutdown and Hot-Die Detection
  - Keypad Interface (up to 6 × 6)
  - External Vibrator Control
  - 15 GPIOs
  - 0,65mm Pitch, 139 Pin, 10 × 10 mm Package

PRODUCT PREVIEW

DESCRIPTION

The TPS65930 is an integrated power-management/audio codec device for use in portable cellular phones, portable media players, and other portable devices that derive their power from batteries based on Li-ion, Li-ion polymer, or manganese-cobalt chemistries. The TPS65930 receives commands from the host controller and provides power conversion/regulation and a complete audio codec section and class-D audio amplifier.

In addition to generic support capabilities, the TPS65930 meets the specific power requirements of the TI OMAPV1230, OMAP2430, and OMAP3430 devices.

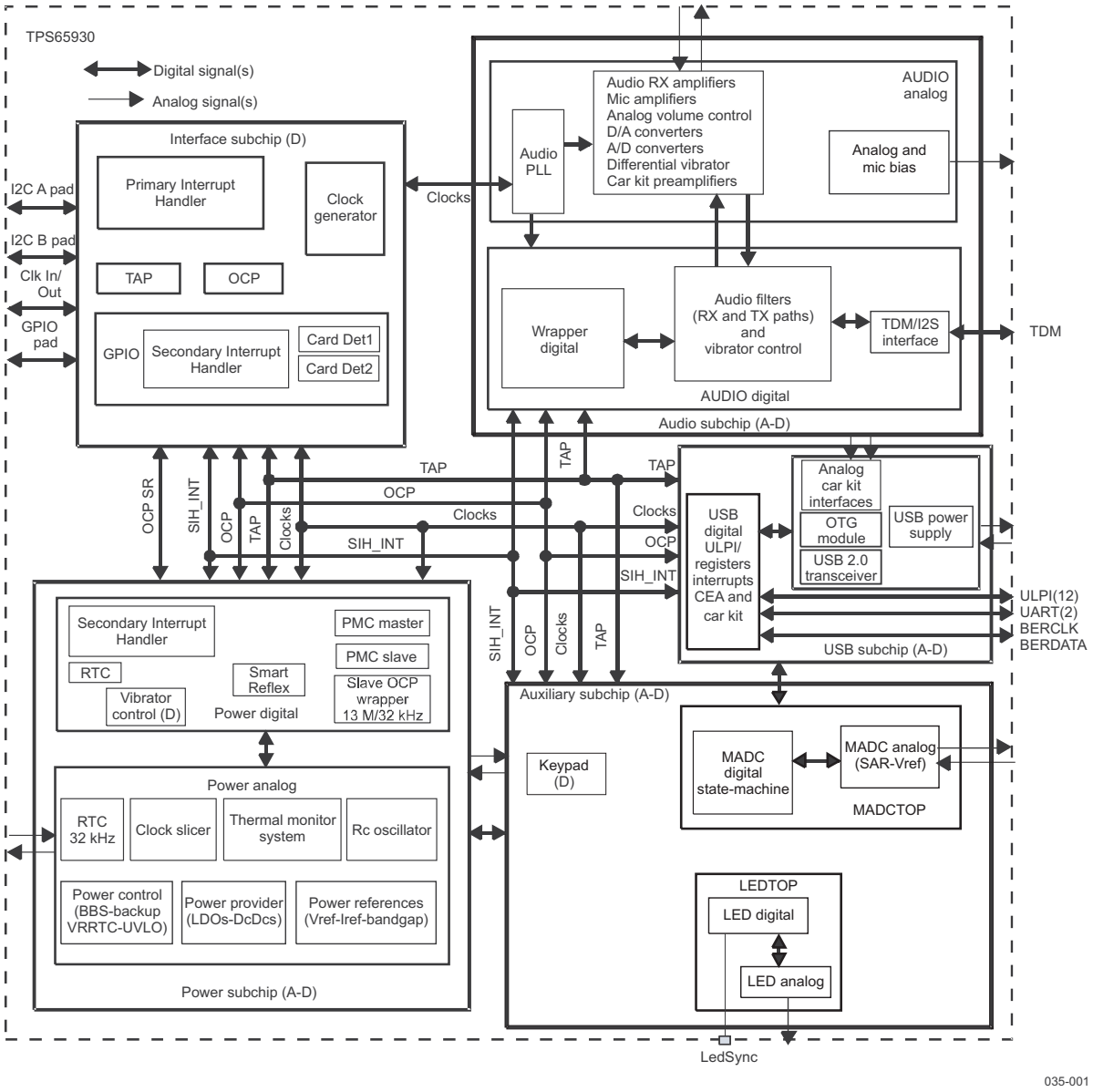


Figure 1. Block Diagram

MODULE DESCRIPTION

Power subchip:

The SMPS have configurable output voltages. The LDO regulators provide power to internal analog and digital circuits and to the external components. The output voltages of the external LDOs are also configurable.

The power resources also have configurable modes of operation. The possible modes for the power resources are SLEEP, ACTIVE, and OFF. The modes and output values can be programmed using the I2C interface on the TPS65930 device.

Programming for all the power resources is done through the I2C interface. The power subchip interfaces the interface subchip and carries out commands to the rest of the device. The digital section has a finite state-machine (FSM) that manages commands to the resources through the power bus.

Audio subchip:

The audio subchip has one interface: I2S for audio signaling. I2S can function as master or slave.

Sampling modes available are:

Audio channel with 8, 11.025, 12, 16, 22.05, 24, 32, 44.1, or 48-kHz sampling modes. 96 kHz is supported on the RX path voice codec with MCLK = 26MHz.

The audio phase-locked loop (PLL) supports 26-MHz, 19.2-MHz, or 38.4-MHz ability to work with two ports with the clock frequencies 19.2 MHz or 26 MHz, or with a single TDM port with the frequencies 19.2 MHz, 26 MHz, or 38.4 MHz.

The audio supports common features like pop-noise reduction, sidetone functionality, bass boost function, uplink and downlink programmable gain amplifiers, and the DTMF tone generator.

The external vibrator control is provided in this module and can be controlled through an audio signal or direct I2C writes to the registers.

USB subchip:

The primary function of the universal serial bus (USB) physical layer (PHY) is to transmit and receive USB data at high speed (480M bit/s), full speed (12M bit/s), and low speed (1.5M bit/s). It also provides a pin-optimized standard ULPI interface to a main USB controller device (LINK). In addition to the higher speeds, it supports 3-pin and 4-pin serial modes of operation.

The TPS65930 has a 5V-tolerant data line at all supported speeds. VBUS is tolerant up to 6 V. This device has an on-chip 480MHz PLL from the internal system clock.

Auxiliary subchip:

The auxiliary subchip includes the following modules:

- Monitoring Analog-to-Digital Conversion (MADC)
- Keypad
- LED

MADC:

The MADC enables the host processors to monitor analog signals (such as RF module temperature, battery temperature, battery type, and battery level) using analog-to-digital conversion (ADC) on the input source. After the conversion is complete, the host processor reads the results of the conversion through the I2C interface. The MADC also performs analog signal conversion for the USB subchip.

Keypad:

The keypad controller supports up to 6× 6 keypad matrix. The keypad includes an integrated programmable timer for debounce, long key press, and time-out events. It supports programmable interrupt generation on key events, multikey press detection and decoding, and long key detection on prolonged key press.

The keypad can be used in software scanning mode or hardware decoding mode.

PRODUCT PREVIEW

LED:

The TPS65930 device provides light-emitting diode (LED) driver circuitry to power two LED (dc power) circuits that can illuminate a panel or provide user indicators. The two circuits (LEDA and LEDB) are identical except for their current capabilities: LEDA is rated for 160 mA and LEDB is rated for 60 mA.

Interface subchip:

The interface subchip is the main interface between the external components and the TPS65930 device. This module includes the primary and secondary interrupt handlers that generate interrupt and provides it to the host processor for further action. There is one interrupt line that can be routed to external host. The device provides the interrupt mapping to track down the interrupt originator. Each subchip has several interrupts that get mapped on to the external interrupt.

The device handles all I2C communication with the external host processors, and internal communication is managed by the OCP (Open Core Protocol) standard. This also includes the GPIOs.

PACKAGING INFORMATION

Package Thermal Resistance Characteristics

Table 1 lists the thermal resistance characteristics for the recommended package types used on the TPS65930 device.

Table 1. TPS65930 Thermal Resistance Characteristics

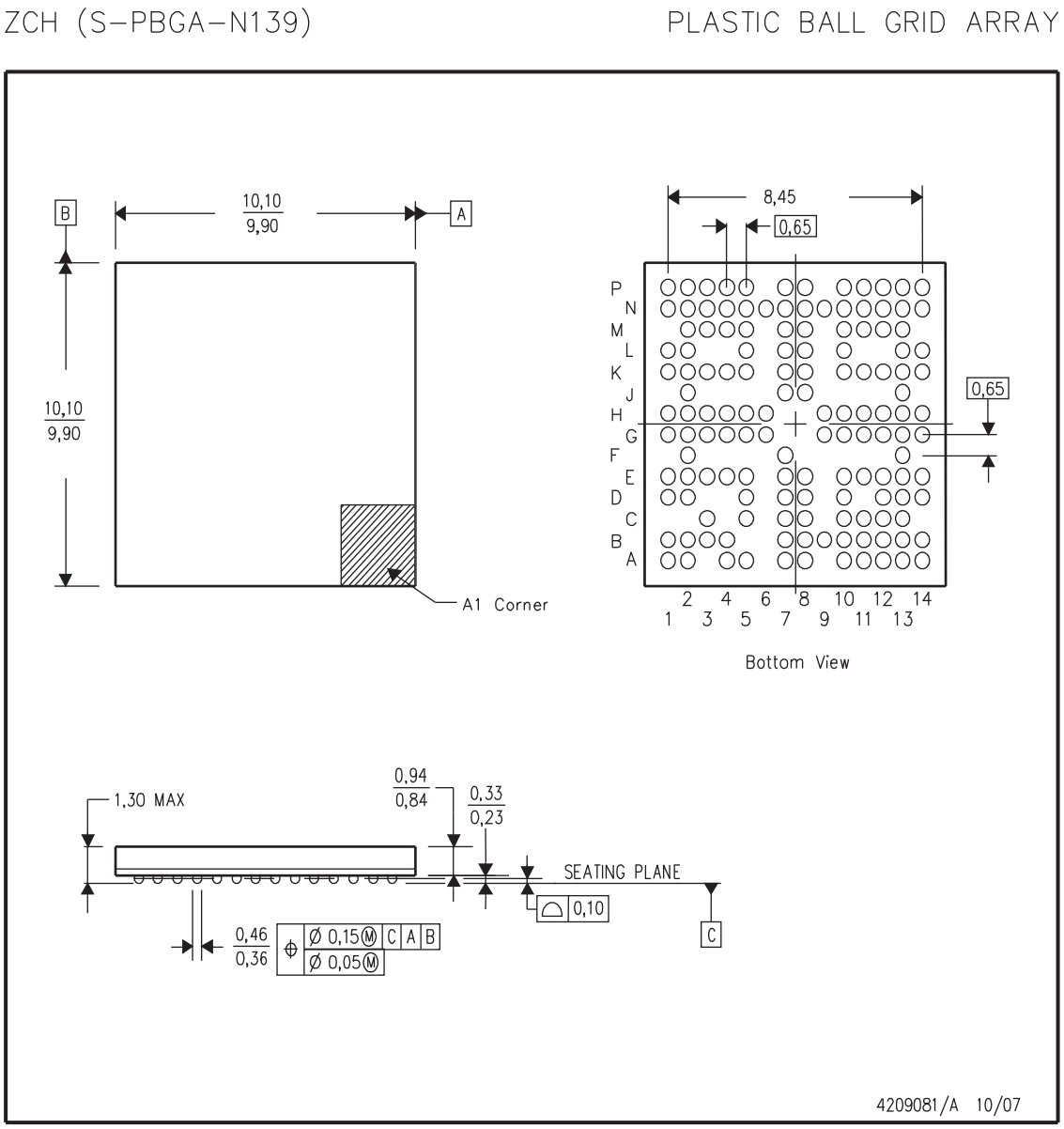
PACKAGE	$R_{\theta JA}$ (C/W)	$R_{\theta JB}$ (C/W)	$R_{\theta JC}$ (C/W)	BOARD TYPE
TPS65930	33.42	13.81	6.74(1)	2S2P(2)
TPS65930	57.05	14.51	6.74(1)	1S0P(2)

(1) This measurement is not affected by the board that the device is mounted on.
(2) The board types are defined by JEDEC (reference JEDEC standard JESD51-9, Test Board for Area Array Surface Mount Package Thermal Measurements).

PRODUCT PREVIEW

Mechanical Data

Figure 2, Figure 3, and Figure 4 show the TPS65930 mechanical package.



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. nFBGA configuration
D. This is a lead–free solder ball design.

035-002

Figure 2. TPS65930 Mechanical Package

PRODUCT PREVIEW

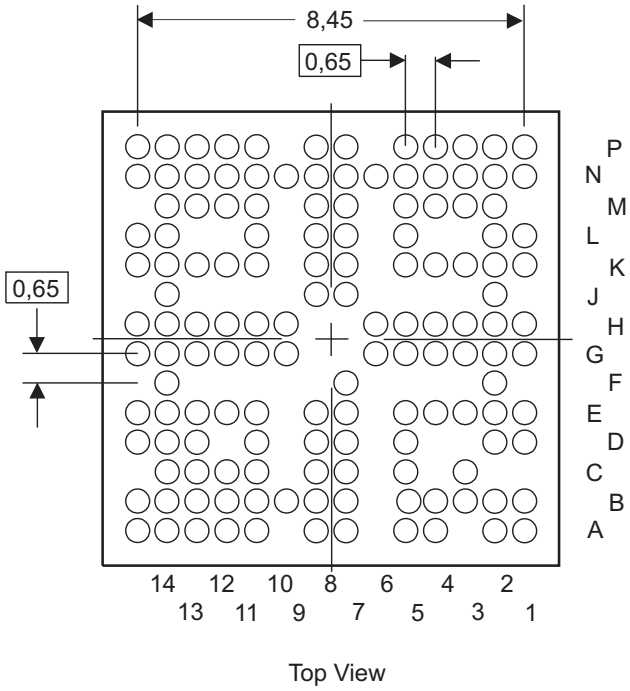


Figure 3. TPS65930 Mechanical Package –- Top View

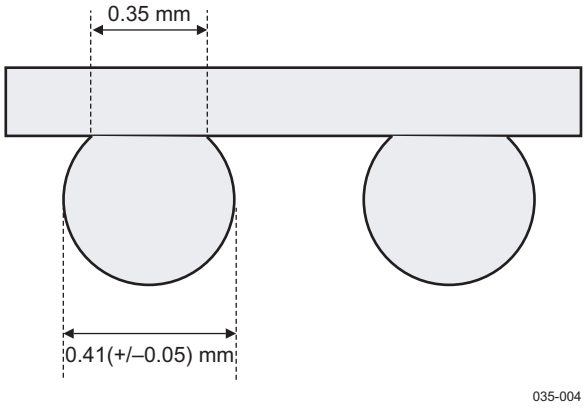


Figure 4. TPS65930 Ball Size

PRODUCT PREVIEW

GLOSSARY

TERM	MEANING
DTMF	Dual Tone Multi-Frequency Sixteen pairs of audio tones developed when telephones in the United States evolved from rotary to push-button dialing.
GPIO	General Purpose Input/Output Input and output port of a device that has no dedicated purpose and so is available for general applications.
PCM	Pulse Code Modulation The process of representing a signal by a sequence of pulses. Two commonly used forms of PCM are pulse-width modulation (PWM) and pulse-frequency modulation (PFM).
SMPS	Switched Mode Power Supply A power supply in which the output is being turned on and off at a rapid rate and the output voltage is controlled by changing the duty cycle; that is, the percentage of time it is turned on compared to the amount of time it is turned off. The desired dc output is obtained from the SMPS by use of a filtering network that converts the switched output to its averaged value. The output of a SMPS is fully on or off; it is not partially on or off as is true of a linear power supply.
TDM	Time Division Multiplex The technique used to put multiple digital signals onto the same path by assigning each signal its own time slot.

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**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Clocks and Timers	www.ti.com/clocks	Digital Control	www.ti.com/digitalcontrol
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265