

All-in-one power management for feature-rich phones

Philips single-chip power management unit PCF50626 for feature-rich handsets

Designed for feature-rich handheld applications, this analog companion chip provides everything necessary for complete, programmable power management – from fully integrated charging to touch-screen support and sophisticated digital rights management – in a package that measures only 7 × 7 mm.

Key features

- 21 programmable power supplies on a single chip
 - Four high-efficiency DC/DC converters
 - 17 LDOs
 - Support for ECO mode
- Fully integrated main and back-up battery chargers (CCCV or Pulse Mode)
 - Thermal regulation loop for increased reliability
 - Fully integrated pass device for currents up to 1 A
 - USB or wall-mount charging
- RTC module with wake-up alarm
 - Up to 130 hours on conventional Li-Ion backup battery
 - Suitable for Digital Rights Management
- 10-bit ADC for general-purpose housekeeping tasks
- Touch-screen interface with support for 4- and 5-wire resistive formats
- Enhanced display performance
 - Support for up to 5 series white LEDs for uniform backlighting
 - Manual dimming down to 1% of maximum light output
 - Ambient light control module
- Fully programmable via I²C interface
- 10 GPO/IO for flexible control, host communications, and system functions
- Small footprint: HVQFN12 (7 × 7 mm) package
- Requires only a few, low-cost external components

The PCF50626 is an analog companion chip that provides complete power management in feature-rich handheld applications like cellular handsets, smart phones, and VoIP phones. It includes 21 programmable power supplies (most support ECO mode) and fully integrated main and back-up battery chargers that support CCCV and other modes.

There is a real-time-clock (RTC) module that includes wake-up alarm functionality and runs for up to 130 hours on a conventional Li-Ion backup battery, so it's suitable for Digital Rights Management. A 10-bit Analog-to-Digital (ADC) converter is included to carry out general housekeeping tasks.

An integrated touch-screen interface supports a rich user-interface experience, while special features for ambient light control enhance display performance. Flexible charging options, including USB and wall-plug adaptors, make the system easy to use.

The entire power management unit (PMU) is fully software-controllable through its integrated digital interface and is available in a space-saving HVQFN12 package that measures only 7 × 7 mm.

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Programmable power supplies

All 21 power supplies are fully software- and hardware-controllable and support staggered start-up and shut-down. The four high-efficiency (up to 95%) DC/DC converters have programmable output voltages and feature auto PWM/PFM mode, low ripple, support for dynamic voltage management and multiple cores, and a hibernate mode:

- Two step-down (900 and 600mA respectively) converters with an output range of 0.625 to 2.7 V.
- One manually configured converter for step-up (300 mA) or step-down (600 mA) operation with an output voltage range of 0.625 to 5.0 V.
- A 25-mA step-up converter that supports up to five white LEDs in series. It has a 4-point programmable ambient light compensation curve, an ambient low-pass filter, and programmable calibration.

There are seventeen LDOs:

- Two 150-mA and two 100-mA LDO voltage regulators (1.2 to 3.0 V) optimized for low noise
- Eight general-purpose, 150-mA regulators (1.2 to 3.3 V)
- A 250-mA high-current regulator (2.6 to 3.2 V)
- A 150-mA regulator (1.2 to 3.3 V) for supplying I/O pads
- A 70-mA regulator (1.8 or 3.0 V) for supplying a USIM card
- A 50-mA regulator (1.2 to 3.3 V) for supplying a USB controller
- A 5-mA low current regulator (0.6 to 2.9V)

Eleven of the LDOs, along with a microphone bias low-noise regulator (2.15 V), support ECO mode, a low-power mode that reduces output current capability to 5 mA and standby currents to less than 7 μ A while significantly reducing internal power consumption.

Integrated charging and battery management

There are two fully integrated battery chargers: a main and a backup. The main battery charger works with single-cell Li-Ion/Li-Pol battery packs and features an on-chip pass device for charging currents of up to 1 A. The battery charger works with USB or a wall-plug adaptor, supports single- and dual-bottom port connectors, and can operate in Constant Current / Constant Voltage (CCCV) mode, Pulse Mode (PM), or reverse mode. It also has a thermal-regulation loop that automatically reduces the charging current should the die temperature exceed a specified limit, and uses programmable threshold levels to detect and report low main-battery voltage.

The backup battery charger supports programmable constant voltage charging for Li-Ion cells or Goldcaps.

Sophisticated communication and control

The PMU controls the power ramp-up and ramp-down sequences in the phone and controls several system operating modes, including Active, Off, Hibernate, and Nopower. Control data and status information can be delivered to and from the host controller by a serial, 400-kHz I²C-bus software interface or a hardware interface. Interrupt requests for the host processor are generated by an integrated interrupt controller and can be masked for custom operation. For thermal protection, there is an integrated temperature-high sensor that monitors the entire PMU.

Two pins are provided for accessory recognition. When a charger is inserted in the phone's bottom connector, the PMU automatically boots up the phone. The PMU also responds to headset connection or removal, the pressing of a button, or touch-screen pen-down. Two reset signals are provided, one for the host controller and one for memory.

An external 32.768-kHz oscillator is recommended for generating the RTC and providing time-reference and alarm functions with wake-up control. A secure clock for digital rights management is provided by means of the RTC, which can be particularly important if the main the main battery goes empty.

Special functions

The PCF50626 features a flexible touch-screen interface that can connect directly to a 10-bit ADC for high-resolution measurements. It measures X and Y for four- and five-wire resistive touch screens, enables pressure measurement for four-wire touch screens, and can detect pen up or down. To reduce loading on the host controller due to touch screen interrupts, there is also a FIFO buffer that is 64 words deep.

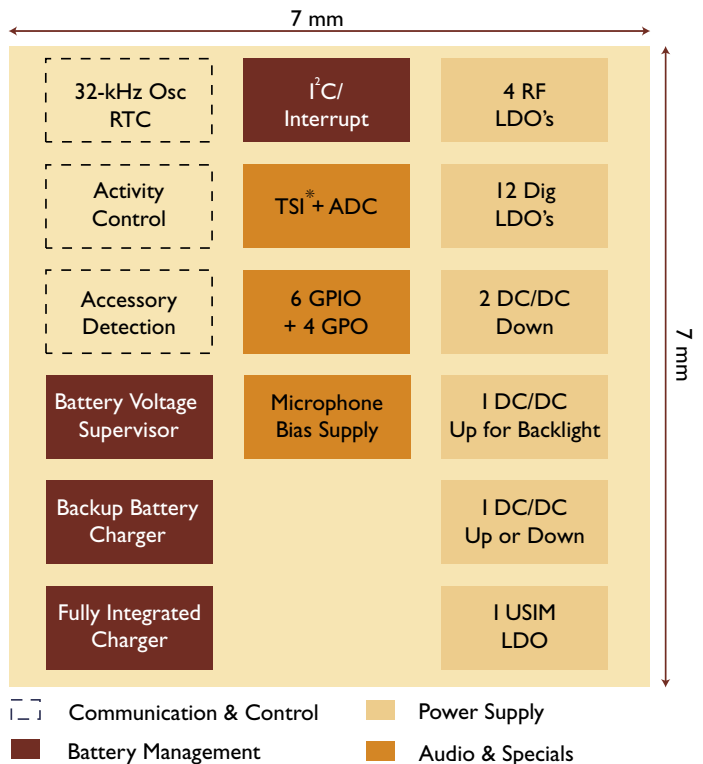
The built-in ADC is an accurate successive-approximation converter. It can be used on its own or in conjunction with the touch-screen interface and can be selected to have either an 8- or 10-bit resolution. For analog voltage measurements, two independent analog inputs are provided.

There are six general-purpose I/O (GPIO) and four general-purpose outputs (GPO). In output mode, the GPIO have open-drain NMOST outputs capable of handling the full battery voltage range and high sink currents. In input mode, the GPIO act as programmable on/off control inputs for the supply modules or for synchronization purposes. The GPO have push-pull outputs. The GPIO and GPO are programmable via the I²C-bus serial interface and can be connected to the output signals from either of the two on-chip pulse-width modulators (PWMs), or the two on-chip LED drivers. They can also be programmed to output a range of control signals.

Enhanced display performance

An ambient light module, in combination with a backlight set-up converter, compensates backlight intensity as a function of ambient light levels. In doing so, the display retains its contrast while minimizing its power consumption. A four-point programmable ambient light curve allows for custom compensation. Intelligent filtering mechanisms help avoid 50/60-Hz interference and a built-in programmable calibration register increases robustness against external component tolerances.

In addition to the ambient light module, the PCF50626 also supports PWM light dimming down to 1%, which can be used to control the brightness of the EL foil or the LED backlighting.



Block diagram of the power management unit PCF50626

*Touch-screen interface

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