Power Management Solutions

MC13783 Power Management and Audio Component

Overview

The MC13783 is a highly integrated power management, audio and user interface component dedicated to handset and portable applications covering GSM, GPRS, EDGE and UMTS standards. This device implements high-performance audio functions suited to high-end applications, such as smartphones and UMTS handsets.

Applications

The highly integrated mixed-mode power management, audio and user interface content of the MC13783 is well-suited for the latest 2.XG and 3G protocols. This device may be used to support a variety of system architectures including:

- GSM/GPRS/EDGE/UMTS mobile handsets
- Code division multiple access (CDMA) mobile handsets
- Non-cellular battery-powered devices such as portable media players, digital still cameras, toys, remote-controlled devices etc.

Key Benefits

- Full power management and audio functionalities in one module that optimizes system size
- High level of integration reduces the power management and audio system bill of materials
- Simple programming for versatile, flexible solutions
- Implemented dynamic voltage scale (DVS) saves significant battery resources in every mode (compatibility with a large number of processors)
- Dual-channel voice analog to digital converter (ADC) improves intelligibility

Key Features

- Battery-charger interface for wall charging and Universal Serial Bus (USB) charging
- 10-bit ADC for battery monitoring and other readout functions
- Buck switchers for direct supply of the processor cores
- Boost switcher for backlight and USB On-The-Go (OTG) supply
- Regulators with internal and external pass devices

MC13783 Power Management Component Block Diagram

- Transmit amplifiers for two handset microphones and a headset microphone
- Receive amplifiers for earpiece, loudspeaker, headset and line out
- 13-bit voice codec with dual ADC channel and both narrow and wideband sampling
- 13-bit stereo recording from analog input source such as FM radio
- 16-bit stereo digital to analog converter (DAC) supporting multiple sample rates
- Dual synchronous serial interface (SSI) audio bus with network mode for connection to multiple devices
- Power control logic with processor interface and event detection
- Real-time clock (RTC) and crystal oscillator circuitry
- Dual serial peripheral interface (SPI) control bus with arbitration mechanism and capability to support two processor applications
- Multiple backlight drivers and LED control, including funlight support
- USB/RS-232 transceiver with USB carkit support (compatible with industry standard CEA-936-A)
- Touch-screen interface
- Integrated funlights and audio modulation features
- 247 BGA 0.5 mm pitch (10 mm x 10 mm) to optimize the size of the system

freescale semiconductor

Energy Management

Power Distribution

- Optimized power distribution to increase battery life
  - 18 linear regulators
  - Four buck switchers with DVS control
  - Boost switcher
- Ultra-low dropout voltage regulator (200 mV)
- Switcher frequency adjustment to reduce RF spurious
- Specific low-noise regulators for RF domain
- Regulators are fully controlled by processors
- Integrated protections (I and T°)
- Power-up sequencer
- Low-power standby mode

Integrated Multimode Charger

- Trickle, linear, pulse and USB charging modes
- Accessories supply mode (bottom plug)
- Charge current controlled by SPI
- Current and voltage monitored by ADC
- Overvoltage protections

Audio Interfacing

Audio Inputs

- Three amplified inputs and bias for microphone
- Stereo input for external stereo source (polyphonic sound generator)

Audio Outputs

- High-power differential amplifier for earpiece/ hands free/polyphonic music
- 500 mW/8 ohm typical (6.4 ohm supported)
- Two single-ended amplifiers for stereo headset
- 16 ohm typical (from 12.8 ohm to 38 ohm supported)
- Earpiece amplifier
- Prepared for stereo loudspeakers
- Mono adder for playing stereo source on mono speaker or mono source on stereo headset
- Anti-pop
- Phantom ground for stereo headset

Voice Codec

- 13-bit linear Tx and Rx mode
- 8 kHz and 16 kHz supported
- Additional ADC for stereo or noise cancellation
- Network mode supported (four slots)
- Audio data from two time slots can be added with reduced volume for secondary flow

Stereo DAC

- 16-bit linear/multirate, multiclock modes (phase-lock loop)
- Network mode supported (four slots)
- Audio data from two time slots can be added with reduced volume for secondary flow

Audio Buses Interface

- Two interchangeable SSI buses, master/slave mode supported

System Control

- On/off phone power cycling
  - Three on/off inputs
  - On/off state machine
  - Power-up events (on/off switch buttons, alarms)
  - Power-off events (watchdog failure, OV, UV, T°)
- Reset
  - System RST output
  - MCU RST for warm start
  - Warm/cold start flag
  - Hardware handshaking with main processor
- Specific power modes (for battery life optimization)
  - Memory hold mode
  - User off mode
- Processors interface
  - Two independent SPI buses with arbitration mechanism
  - System control and programming
  - Maskable interrupt events

Analog Sensor Control ADC

- 10-bit ADC
- Four-wire resistive touch-screen interface with state machine
- Thermal bias (battery)
- Six external inputs mux
- Eight internal senses channels (including voltage and current reading on battery and charger)
- Fully controlled via SPI
- State machine to control various modes including multiple requests
- External pin for synchronous conversions
- Programmable digital comparators
- Multimodes (scan same/multiple channels)

Wired Connectivity

USB Transceiver

- USB 2.0 compatible
- LS and FS supported
- USB-OTG supported
- Pull-up, pull-downs integrated
- Processor interface: single and differential modes
- USB boot mode

RS-232 Transceiver

- Muxed with USB
- RS-232 boot mode

Bottom Connector

- Option for separate pins for USB power and charger
- RS-232 and USB data pins muxed
- Compliant to CEA-936-A carkit specification
- Includes analog audio routing via D+ and D- lines

Peripherals

Lighting

- Three backlight drivers for LCDs and keypad
  - Matched current sources for parallel LED drive
  - Programmable level and PWM control
- Three sets of RGB tricolor LED drivers
  - Built-in funlight patterns
  - Allows for audio modulation
  - Programable level and PWM control

Signaling

- Vibrator interface
- Programmable voltage

Clocks and Timing

Clocks

- 32 kHz system clock
- Two clock outputs with different voltage domain

Real-Time Clock

- Time and date
- Alarm including phone wake-up functions
- Timebase by crystal oscillator
- System timekeeping
- Supply backup by coin cell
- RC mode until crystal is stabilized

Current Consumption

- Standby mode (RTC and regulators into low-power mode): 140 µA
- Off mode (RTC and core logic): 30 µA
- RTC only: 5 µA

Learn More: For current information about Freescale products and documentation, please visit **www.freescale.com/pmui**.

Document Number: MC13783PMFS
REV 1

freescale semiconductor