V98XX Datasheet

Specifications are subject to change without notice.

Revision History

Date	Version	Description
2015.06.05	0.1	Initial release
2015.10.08	0.2	• Modified typical current load in sleeping mode from 10μA to 12μA • Modified "0b000" to "0b001" in Table 18-10 • Updated Table 4-3 Allocation of Info Area • Modified "SPC_FNC" to "SPCFNC" in Table 4-2 • Modified function description of "FWC" • Modified description of "CFWKEN" in Table 5-5
2015.11.12	0.3	• Updated Figure 4-2 Data Memory
2016.01.06	0.4	• Set the bit of "BGPCHOPN" to '0' in Table 18-10 BandGap Control Register (CtrlBGP, 0x2862) to improve the temperature measurement performance. • Modified the registers and related content of temperature measurement and temperature calibration. • Updated Table 17-10 RTC Timing Registers • Emphasized the setting of time information in sequence and at one time.
2016.10.01	0.5	• Modified "IOP14" to "P14WK", "PLLCNT" to "PLLCNTST" • Added V98XX Resource Comparison • Updated operating current in sleeping mode to 10μA and maximum current in sleeping mode to 14.5μA.
2016.12.02	0.6	• Updated pin8 to NC • Updated 10.16.3 Measuring Battery Voltage and External Voltage
2018.05.31	3.0	• Modify the formula of Phase Compensation. • Add V9811S/V9811A/V9811B/V9821/V9821S/V9881D

General Description

V98XX is a single-phase energy metering SoC chip, featuring very low power consumption and high performance. It integrates Analog Front-End (AFE), energy metering architecture, enhanced 8052 MCU core, RTC, WDT, Flash memory, RAM, and LCD driver. It can be used for the single-phase multi-functional energy meter applications.

Features

- Optional power supply 3.3 V or 5 V, wide input range: 2.5 V to 5.5 V
- Reference voltage: 1.185 V (Typical drift 10 ppm/°C), interrupt triggered by external capacitor leakage
- Typical current load in full operation mode: 5.5 mA
- Typical current load in sleeping mode: 10 μA
- Supporting anti-tampering energy metering application
- Package: 100-pin LQFP
- Operating temperature: -40 °C ~ +85 °C
- Storage temperature: -40 °C ~ +125 °C
- Energy metering features:
  - Four independent oversampling Σ/Δ ADCs
    - ✓ One voltage channel
    - ✓ Two current channels, supporting shunt or CT for current sensing
    - ✓ One multifunctional channel for various signal measurements
  - High metering accuracy:
    - ✓ Exceeding requirements of IEC 62053-21:2003, IEC 62053-22:2003, and IEC 62053-23:2003
    - ✓ Less than 0.1% error on active energy metering over dynamic range of 5000:1
    - ✓ Less than 0.1% error on reactive energy metering over dynamic range of 3000:1
    - ✓ Less than 0.5% error on current/voltage RMS calculation over dynamic range of 1000:1
  - Various measurements:
    - ✓ Raw waveform and DC component of current and voltage signals
    - ✓ Instantaneous/Average and active/reactive power
    - ✓ Positive/Negative and active/reactive energy
    - ✓ Average apparent power
    - ✓ Instantaneous/Average current and voltage RMS
    - ✓ Line frequency
    - ✓ Temperature with measurement accuracy of ±1°C
    - ✓ Battery voltage and external voltage signals
  - Two current inputs for active energy metering, or one current input for

active and reactive energy metering

- Programmable energy metering modes:
  - ✓ Accumulating power, current RMS, or a constant for energy metering
  - ✓ Accumulating energy at a configurable frequency
- Calibrating meters via software:
  - ✓ Phase compensation over a range of ±1.4° (min.), resolution of 0.0055°/lsb (min.).
  - ✓ Gain calibration of RMS and power, and offset calibration of power
  - ✓ Accelerating meter calibration when low current is applied
- CF pulse output and interrupt with configurable pulse width
- Zero-crossing interrupt
- Speeding current detection to lower power consumption
- Programmable threshold for no-load detection

– MCU and peripherals:

- High performance 8-bit 8052 MCU core, with programmable operation frequency, up to 26 MHz/6.5 mips
- One additional comparator
- Integrated oscillator, only one external 32768-Hz crystal is needed to generate crystal frequency
- Crystal supervised: Internal RC oscillator as a replacement when crystal oscillator stops running
- Integrated RTC and temperature sensor, digital crystal frequency compensation for calibration over temperature variation
- 128-KB Flash memory, ISP and IAP supported, with write protection and encryption function
- 4-KB extended SRAM memory
- Up to five UART serial interfaces, one supporting IR communication
- Up to two enhanced UART (EUART) serial interfaces, ISO/IEC 7816-3 compliant
- One GPSI (General-Purpose Serial Interface), I^2C compliant
- Up to 54 programmable GPIOs, with port interrupt
- Up to 16 fast IOs
- Up to 12 hardware timers
- Supporting PWM output
- LCD driver:
  - ✓ Up to 4×40, 6×38, or 8×36 segments
  - ✓ 1/3 bias or 1/4 bias ratio
  - ✓ Configurable frame frequency
  - ✓ Configurable drive voltage over a range of 2.7 V ~ 3.3 V, resolution 100 mV/lsb
- Various sleep/wakeup methods, configurable wakeup with reset
- Independent Watch-Dog Timer (WDT)
- Debugging via JTAG interfaces in real-time

V98XX Resource Comparison

Peripherals	V9801S	V9811S	V9811A	V9811B	V9821	V9821S	V9881D
Flash memory	128KB	128KB	64KB	64KB	64KB	64KB	64KB
SRAM	4KB	4KB	4KB	4KB	4KB	4KB	4KB
UART	Up to 5 UART serial interfaces, one supporting IR communication; up to 2 EUART, supporting ISO/IEC 7816-3 protocol	Up to 4 UART serial interfaces, one supporting IR communication	Up to 4 UART serial interfaces, one supporting IR communication	Up to 4 UART serial interfaces, one supporting IR communication	Up to 3 UART serial interfaces, one supporting IR communication	Up to 2 UART serial interfaces, one supporting IR communication	1 UART serial interfaces, supporting IR communication
GPIO	54	43	43	43	32	9	8
Rapid IO port	16	6	6	6	2	9	0
LCD	Up to 4×40/6×38/8×36 segments, 1/3 bias or 1/4 bias ratio	Up to 4×24/6×22/8×20 segments, 1/3 bias or 1/4 bias ratio	Up to 4×24/6×22/8×20 segments, 1/3 bias or 1/4 bias ratio	Up to 4×24/6×22/8×20 segments, 1/3 bias or 1/4 bias ratio	Up to 4×17/6×15/8×13 segments, 1/3 Bias or 1/4 Bias ratio		0