32-bit Microcontrollers

MC9S08LH64/36

Smart metering and medical design made easy

Energy Efficient Solutions optimized for low power

Target Applications

- Single-phase electricity meters
- Low-end utility metering
- Portable medical equipment
- Thermostats
- Automated test equipment
- Industrial process control and measurement
- Sensor interfacing
- Digital scales

Overview

Maximize battery life, measure more precisely and make development easier with Freescale's MC9S08LH64/36. The 16-bit SAR delivers outstanding precision to meet the needs of entry-level metering and medical applications. Cost is reduced with the integration of an LCD driver which supports more segments with fewer pins. Additionally, the MCU is the industry's best-in-class ultra-low-power MCU with LCD for long operation in battery-powered applications. These features are ideal for smart metering and medical applications such as glucometers and pulse oximeters.

Provides entry level flash-size part (64 KB) for cost-conscious, single-phase, electricity meter designs. The enhanced ADC, along with low-power technology, is ideal for electricity meters and medical devices operated by battery for more than five years.

Development Tools

Cost-Effective Development
TWR-S08LH64 ($69USD)
TWR-S08LH64-KIT ($99USD)

The MC9S08LH64 evaluation and demonstration board can be purchased individually or as part of a complete kit for quick and easy development.

- TWR-S08LH64 features the MC9S08LH64 MCU in a 80-pin LQFP package

Features	Benefits
S08 Central Processor Unit (CPU)	
• Up to 40 Mhz CPI at 3.6V to 2.1V • Up to 20 MHz CPU at 2.1V to 1.8V across temperature range of -40°C to +85°C	• Offers high performance, even at low voltage levels for battery-operated applications • Provides bus speed operation of 10 MHz from 1.8V to 3.6V
• HCS08 instruction set with added BGND instruction	• Easy to learn and use • Backward object code compatibility with 68HC08 and 68HC05 for reuse of existing libraries • BGND allows user to enter background debug mode that takes advantage of the on-chip in-circuit emulator (ICE)
Enablement and Development Support	
• Low-cost, reconfigurable Tower evaluation and demonstration platform	• Speeds time to market and enables advances development through rapid prototyping
• Breakpoint capability	• Allows single breakpoint setting during in-circuit debugging (plus two or more breakpoints in on-chip debug module)
Power-Saving Features	
• Two ultra-low-power stop modes, one of which allows limited use of peripherals	• Allows continued application sampling in a reduced power state, which extends battery life
• New low-power run and wait modes	• Allows use of all chip peripherals in a low-power state
• 6 µs typical wake-up time from stop mode	• Enables faster execution out of stop modes
• Internal clock source (ICS) module containing a frequency-locked loop (FLL) controlled by internal or external reference	• Provides choice of frequencies on the fly • Reducing frequency saves current
• Ultra-low-power oscillator (OSC)	• Accurate timebase in low-power modes
• Clock gating disables clocks to unused peripherals	• Provides flexibility to turn off individual modules • Reduces power consumption
16-bit Analog to Digital Converter for Metering Applications	
• 16-bit resolution ADC with 4.0625 µs sampling rate in 16-bit single ended mode and sample times as fast as 2.04 µs in 8 bit mode	• Sampling rate and resolution makes 9S08LH an ideal MCU integrated solution for energy metering
• One differential ADC input, and 8 single-ended ADC inputs or 10 single-ended inputs	• Having 10 channels allows up to ten analog devices to be sampled. The differential channel ideal for metering
• Automatic compare function and hardware average function	• Hardware averaging increases effective sensitivity for noise protection
• Internal temperature sensor	• Easily measure ambient temperature
• Selectable voltage reference	• Select between internal or external reference voltages. Internal VREFO allows a trimmable 1.15V reference source for ADC
• Operation in low-power modes	• Continue operating while saving power
• Built in self-calibration with user configurable offset register	• Minimize offset and gain errors. User configurable offset register can be used for custom calibration
• Hardware triggers using two TPM channels or TOD. Two control and result register	• Allow back-to-back conversion of two different ADC channels
• Input clock selectable from up to four sources and configurable sample time and conversion speed/power	• Great flexibility to customize your application and fulfill your needs
LCD Driver and Internal Charge Pump	
• Integrated LCD driver supports both standard 3V and 5V LCD glass	• Gives you flexibility when selecting the ideal glass for your application with respect to display quality, cost and power • Does not require expensive "chip-on-glass" display
• Configurable display for 8 x 36 or 4 x 40 segment display	• Up to eight-character alphanumeric display (six segment based), perfect for scrolling text with simple display. • Allows high mix numbers, text and icons

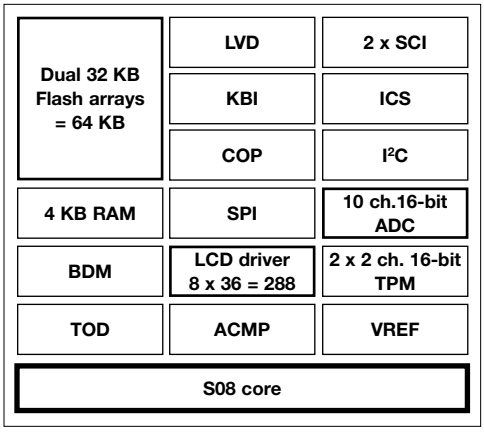
freescale semiconductor

TWR-S08LH64-KIT includes:

- TWR-S08LH64 stand-alone development board
- TWR-PROTO prototyping module provides access to all signals on the tower system, allowing for easy signal probing and circuit prototyping
- TWR-ELEV elevator modules that connect the MCU board and prototyping module, USB and Ethernet cables
- Interactive DVD complete with tools, software, lab supplements and other helpful resources

CodeWarrior Development Studio for Microcontrollers v6.3

Complimentary** Special Edition CodeWarrior Development Studio for Microcontrollers is a suite of tools that supports software development for Freescale's 8-bit MCUs and 32-bit V1 ColdFire devices. Designers can further accelerate application development with the help of Processor Expert, an award-winning rapid application development tool integrated into the CodeWarrior tool suite.



Package Options

Part Number	Temp Ranges	Package
MC9S08LH64CLK	-40°C to +85°C	80 LQFP
MC9S08LH64CLH	-40°C to +85°C	64 LQFP
MC9S08LH36CLH	-40°C to +85°C	64 LQFP

Features	Benefits
LCD Driver and Internal Charge Pump	
• Low-power blinking mode	• Low-power blinking mode does not require CPU intervention • Can be activated and CPU can go to sleep, but segments will remain blinking at the pre-set frequency. Plus, an alternate display feature can be activated to display alternate data (i.e., to blink temperature and time)
• Internal charge pump	• Provides option to run off a single supply a dual supply for sustained contrast or a customized implementation of contrast control
• Front plane (FP) and back plane (BP) re-assignments	• FB and BP can be software selectable, making layout an easier task and very flexible for design changes
• Capable of running in STOP3 and STOP2 mode	• Enables driving the display while the CPU sleeps, lowering the overall system power consumption
• LCD driver pins are muxed with GPIO and other functions	• Any LCD pin can be FP (segment) or BP (common), based on software configuration
On-Chip Memory	
• Up to 64 KB flash compromised of two separate arrays to facilitate read/program/erase over full operating voltage and temperature	• Allows you to take full advantage of operating voltage and temperature in-application reprogrammability benefits in virtually any environment
• 1.8V to 3.6V RAM	• Security circuitry prevents unauthorized access to RAM and flash contents, reducing system power consumption
Peripherals	
• Timer- two 2-channel (TPM1 and TPM2), selectable input capture, output compare, buffered-edge or center-aligned PWM on each channel	• Two TPMs allow for two different time bases, with a total of eight timer channels
• Two serial communications interfaces (SCI) modules, offering asynchronous communications, 13-bit break option, flexible baud rate generator, double buffered transmit and receive and optional HW parity checking and generation	• Provides standard UART communications peripheral • Allows full-duplex, asynchronous NRZ serial communication between MCU and remote devices • Edge interrupt can wake up MCU from low-power mode
• Analog comparator with selectable interrupt on rising, falling or either edge or comparator output, compare option to fixed internal bandgap reference voltage, outputs can be optionally routed to TPM module, operation in STOP3	• Requires only single pin for input signal, freeing additional pins for other use • Allows other components in system to see result of comparator with minimal delay • Can be used for single-slope ADC and RC time-constant measurements
• Serial peripheral interface (SPI) module with full-duplex or single-wire bidirectional, double-buffered transmit and receive master or slave mode, MSB-first or LSB first shifting	• Allows high-speed (up to 5 Mbps) communications to other MCUs or peripherals, such as MC1319x RF transceivers
• I^2C with up to 100 kbps with maximum bus loading, multi-master operation, programmable slave address, interrupt-driven byte-by-byte data transfer and support for broadcast mode and 10-bit addressing	• I2C port enables increased system memory by using an additional I^2C EEPROM. This also creates an opportunity to add an additional I^2C device
Input/Output	
• 39 general purpose input/output (GPIO), two output-only pins	• Results in large number of flexible I/O pins that allow developers to easily interface devices into their own designs
• Eight keyboard interrupt (KBI) pins with selectable polarity	• Can be used for reading input from a keypad or used as general pin interrupts
System Protection	
• Watchdog computer operating properly (COP) reset with option to run from dedicated 1 kHz internal clock source or bus clock	• Allows device to recognize runaway code (infinite loops) and resets processor to avoid lock-up states
• Low-voltage detection with reset or interrupt, selectable trip points	• Warns the developer of voltage drops outside of the typical operating range
• Illegal op code and illegal address detection with reset	• Allows the device to recognize erroneous code and resets the processor to avoid lock-up states
• Flash block protection	• Prevents unintentional programming of protected flash memory, which greatly reduces the chance of losing vital system code for vendor applications

Learn more: For current information about Freescale products and documentation, please visit **www.freescale.com/lcd** and **www.freescale.com/tower**.

Document Number: MC9S08LH6436FS Rev 1

freescale semiconductor