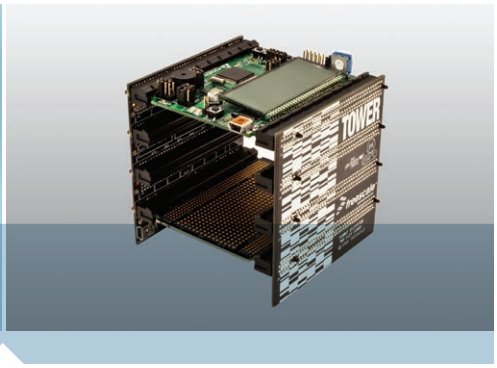


8-bit Microcontrollers

MC9S08LL64/36

Energy Efficient Solutions optimized for low power

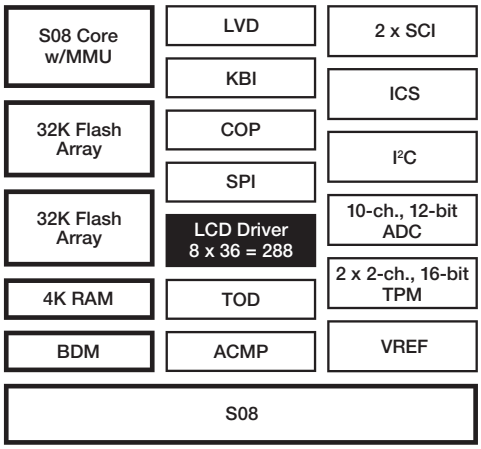
Target Applications

- Battery-operated hand-held devices
- Portable health care devices
- Thermostats
- Alarms/clocks
- Exercise equipment
- Personal diagnostics
- Low-end utility metering
- Scrolling text displays
- Small appliances

Overview

Freescale expands the industry's best-in-class ultra-low-power MCU with LCD driver. The MC9S08LL64/36 helps you reach your target performance levels while minimizing power consumption in your design, demonstrating extreme energy efficiency for ultra-long operation in battery-powered applications.

9S08LL64/36 Block Diagram



Features	Benefits
S08 Central Processor Unit (CPU)	
• Up to 40 MHz CPU 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 • Allows for efficient, compact module coding in assembly or C compiler • 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 advanced development through rapid prototyping
• Breakpoint capability	• Allows single breakpoint setting during in-circuit debugging (plus two more breakpoints in on-chip debug module)
• ICE debug module containing three comparators and nine trigger modes. Eight deep FIFO for storing change-of-flow addresses and event-only data—debug module supports both tag and force breakpoints.	• Provides built-in full emulation without expense of traditional simulator
• Migration path from smaller flash size devices (LL16)	• Speeds time to market with pin to pin compatibility and shared software drivers
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
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 eighteen-character alphanumeric display (sixteen segment based), perfect for scrolling text with simple display • Allows high mix of numbers, text and icons
• 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 black plane (BP) re-assignments	• FP and BP can be software selectable, making layout an easier task and very flexible for design changes

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TOWER SYSTEM

The S08LL64 solution speeds development time by providing an easy migration path with pin-to-pin compatibility from 8K to 64K and a reusable and expandable Tower System.

The LL family provides design flexibility with a large segment-based 8 x 36 driver and an integrated charge pump to provide a true system-on-chip solution.

Cost-Effective Development Tools

TWR-S08LL64 ($69USD)
TWR-S08LL64-KIT ($99USD)

The MC9S08LL64 evaluation and demonstration board can be purchased individually or as part of a complete kit for quick and easy development.

- TWR-S08LL64 features the MC9S08LL64 MCU in a 80-pin LQFP package

TWR-S08LL64-KIT includes:

- TWR-S08LL64 standalone 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.

* Prices indicated are MSRP. ** Subject to license agreement

Features, cont.	Benefits, cont.
• Capable of running in STOP3 and STOP2 mode	• Enables driving the display while the CPU sleeps, lowering 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 64K flash comprised 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
Peripherals	
• Analog-to-digital converter (ADC)—10-channel, 12-bit resolution, 2.5 µs conversion time, automatic compare function, internal temperature sensor, internal bandgap reference channel, operation in stop mode	• Having ten channels allows up to ten analog devices to be sampled at extremely high speeds • Accuracy and full functionality guaranteed across 1.8V to 3.6V operating voltage of the MCU
• 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 interface (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 of 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
• TOD — (Time-of-day) 8-bit, quarter second counter with match register, external clock source for precise time base, time-of-day, calendar, or task scheduling functions	• Allows MCU to keep accurate track of time in all low-power modes Also cyclical wakeup from low-power modes without external components
• Serial peripheral interface (SPI)—one 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, supports broadcast mode and 10-bit addressing	• I^2C port enables increased system memory by using an additional I^2C EEPROM. This also creates an opportunity to add an additional I^2C device.
• Internal Voltage Reference (VREF) intended to supply an accurate voltage output that is trimmable by an 8-bit register in 0.5 mV steps	• Provides an internal voltage reference to analog peripherals such as the ADC, or analog comparator. This reduces component count.
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

Package Options

Part Number	Package	Temp. Range
MC9S08LL64CLK	80 LQFP	-40°C to +85°C
MC9S08LL64CLH	64 LQFP	-40°C to +85°C
MC9S08LL36CLH	64 LQFP	-40°C to +85°C
MC9S08LL36CLK	80 LQFP	-40°C to +85°C

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

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