

MC9S08LC60/36

Target Applications

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

Overview

Continuing the commitment to the S08 family, Freescale introduces the first S08 with LCD driver. The MC9S08LC60/36 provides design flexibility with a large segment-based (4 x 40) driver and an integrated charge pump for true system-on-chip. Dual flash blocks allow enhanced EEPROM emulation, saving board space and cost.

MC9S08LC60 BLOCK DIAGRAM

| | | |
|--|------------------|------------------------|
| Up to 60 KB Flash | I ² C | ICG (Up to 20 MHz bus) |
| | SCI | |
| Up to 4 KB RAM | 2 X SPI | ACMP |
| | KBI | |
| S08 Core | COP | 2 x 2-ch., 16-bit TPMs |
| | POR | |
| ICE + BDM | RTI | 8-ch., 12-bit ADC |
| | | |
| 4 X 40 Segment-Based LCD with Internal Charge Pump | | |

Package Options

| Part Number | Package | Temp. Range |
|--------------|---------|------------------|
| MC9S08LC60LK | 80LQFP | -40° C to +85° C |
| MC9S08LC60LH | 64LQFP | -40° C to +85° C |
| MC9S08LC36LK | 80LQFP | -40° C to +85° C |
| MC9S08LC36LH | 64LQFP | -40° C to +85° C |

Features

S08 Central Processor Unit (CPU)

- 40 MHz (20 MHz bus) at >2.1V operation for 50 ns minimum instruction time and 16 MHz (8 MHz bus) frequency at <2.1V

LCD Driver and Internal Charge Pump

- Integrated LCD driver supports both standard 3V and 5V LCD glass

- Configurable display for 4 x 40 or 3 x 41 segment display

- Automatic blink and refresh

- Internal charge pump

- Capable of running in STOP3 mode

Benefits

- Offering high performance, even at low voltage levels for portable applications

- Gives end customer flexibility in selecting ideal glass for application with respect to display quality, cost and power
- Does not require expensive “chip-on-glass” display

- Up to 16 alpha-numeric display, perfect for scrolling text with simple display
- Allows high mix of numbers, text, icons, etc

- Implements common display uses, while reducing code complexity, leaving more code space for application code

- Provides option to run off single supply, dual supply for sustained contrast or customized implementation of contrast control

- Capable of driving display while the micro sleeps, lowering overall system power consumption

Flash Memory

- In-application re-programmability

- Dual flash block for enhanced EEPROM emulation

- Provides users a single silicon solution for multiple platforms
- Allows field re-programmability and upgradeability to future-proof designs

- Reduce system cost and required board space by removing extraneous EEPROM
- Dual block allows continued execution of code out of one block while writing to/erasing in the other

Clock Source Options

- Internal clock generator (ICG) module containing a frequency-locked loop (FLL), controlled by internal or external reference

- Can eliminate the cost of all external clock components, reduce board space and increase system reliability

Serial Communication Ports

- Serial communications interface (SCI) module offering asynchronous communications
- Serial peripheral interface (SPI) module
 - Full-duplex, 3-wire synchronous transfer
 - Maximum bit rate of 5 MHz for 10 MHz bus frequency

- Provides standard UART communications peripheral

- Seamless interface to ZigBee and other RF radios for networked applications
- Cost-effective serial peripheral expansion for applications, including EEPROM, high-precision analog-to-digital (ADC) and digital-to-analog converters (DAC)
- High-speed synchronous communication between multiple MCUs or between MCU and serial peripherals

Documentation

| Freescaler Document Number | Title | Description |
|----------------------------|--|--|
| AN3280 | Interfacing an LCD to the MC9S08LC60 | Describes how to utilize LCD on the LC60 device with examples |
| AN2717 | M68HC08 to HCS08 Transition | Introduces users of the M68HC08 family of MCUs to the changes on the HCS08 family of MCUs |
| AN2764 | Improving the Transient Immunity Performance of Microcontroller-Based Applications | Discusses the effects of transient electrical disturbances on embedded MCUs |
| AN2111A | Coding Standard for HCS08 Assembly Language | Details an HCS08 assembly language coding standard |
| AN3404 | How to Do EEPROM Emulation Using Double Flash Array on MC9S08LC60 | Provides details on how to use flash as EEPROM and add initialization code for SCI on LC60 |
| AN3405 | Hardware Triggered ATD Using the Real-Time Interrupt to Start an Analog Conversion | Provides initialization and use of 12-bit ADC and RTC for the LC60 device |

Data Sheets

MC9S08LC MC9S08LC Data Sheet

Development Tools

DEMO9S08LC60 **US\$75 MSRP**

The 9S08LC60 demonstration kit contains everything a designer needs to develop and evaluate application code. An integrated BDM requires only a USB cable to connect the board to begin development. Included custom LCD glass demonstrates the capabilities of all LCD segments in an end application format.

Features

Serial Communication Ports cont.

- Inter-integrated Circuit (I²C) bus module
 - 2-wire synchronous serial module to connect to standard I²C bus
 - Designed to operate up to 100 kbps with maximum bus loading and timing

Benefits

- Fewer pins required for synchronous communications allows more pins to be reserved for I/O or other peripheral functions

Keyboard Interrupts (KBI) and I/O

- Up to 16 KBI with software selectable polarity on edge or edge/level modes

- Keyboard scan with programmable pull-ups/pull-downs virtually eliminates external glue logic when interfacing to simple keypads

Analog Integration

- 8-channel, 12-bit ADC

- Easily interface to analog inputs, such as sensors

- Automatic compare function, software programmable for greater than, equal to or less than conditions

- Used to set conversion complete and generate interrupt only when result matches condition, freeing up system resources

- Temperature sensor

- Calculates temperature without any external components and saves an ADC input channel for other use

- Internal bandgap reference channel

- Constant voltage source for calibrating ADC results requires no external components

- Trigger conversion using the real-time interrupt (RTI) counter

- Takes periodic measurements without CPU involvement
- Can be used in STOP3 with compare function to take measurements and wake MCU only when compare value is reached

- Analog comparator module
 - Option to compare to internal reference
 - Output can be optionally routed to timer/pulse width modulation module (TPM) as input capture trigger

- Requires only single pin for input signal, freeing up other pin 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

Timers

- Programmable 16-bit TPM
- Each channel can be independently programmed for:
 - Input capture
 - Output compare
 - Buffered, edge-aligned pulse width modulation (PWM)
 - Buffered center-aligned PWM

- One of the most flexible and cost-effective timer modules
- PWM functionality ideal for motor control applications, as well as cost-effective DAC (with some external components)
- Center-aligned PWMs keeps both PWM channels from transitioning on the same clock edge when both are enabled, reducing EMI noise emissions
- TCLK input can be used as an event counter

System Security Features

- Watchdog computer operating properly reset with option to run from dedicated 1 kHz internal clock source or from bus clock

- Resets device in instance of runaway or corrupted code
- Independent clock source provides additional protection in case of loss of clock

- Low-voltage detection (LVD) generates reset, interrupt or flag with two software selectable trip points
- Low-voltage warning sets flag, with higher trip points than LVD

- On power-up, holds device in reset until a reliable voltage level is applied to the part
- Prevents MCU from operating at lower-than-spec voltage when reset is enabled
- Flexibility to allow system to write/save important variables before voltage drops too low

Learn More:

For current information about Freescale products and documentation, please visit www.freescale.com/S08.