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

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	Benefits
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	• Offering high performance, even at low voltage levels for portable applications
LCD Driver and Internal Charge Pump	
• Integrated LCD driver supports both standard 3V and 5V LCD glass	• 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
• Configurable display for 4 x 40 or 3 x 41 segment display	• Up to 16 alpha-numeric display, perfect for scrolling text with simple display • Allows high mix of numbers, text, icons, etc
• Automatic blink and refresh	• Implements common display uses, while reducing code complexity, leaving more code space for application code
• Internal charge pump	• Provides option to run off single supply, dual supply for sustained contrast or customized implementation of contrast control
• Capable of running in STOP3 mode	• Capable of driving display while the micro sleeps, lowering overall system power consumption
Flash Memory	
• In-application re-programmability	• Provides users a single silicon solution for multiple platforms • Allows field re-programmability and upgradeability to future-proof designs
• Dual flash block for enhanced EEPROM emulation	• 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	• Provides standard UART communications peripheral
• Serial peripheral interface (SPI) module ○ Full-duplex, 3-wire synchronous transfer ○ Maximum bit rate of 5 MHz for 10 MHz bus frequency	• 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

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Documentation

Freescale 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	Benefits
Serial Communication Ports cont.	

• Inter-integrated Circuit (I^2C) bus module
  ○ 2-wire synchronous serial module to connect to standard I^2C bus
  ○ Designed to operate up to 100 kbps with maximum bus loading and timing
	• 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**.

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