



Analog, Mixed-Signal and Power Management

MM912_637

Xtrinsic Integrated Precision Battery Sensor

Overview

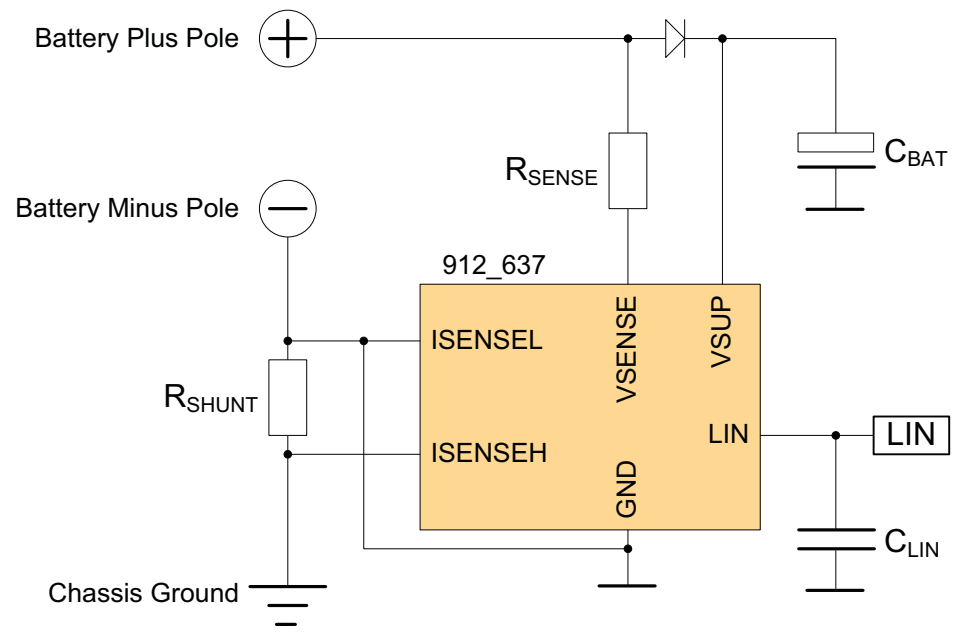
The MM912_637 enables precision measurement of key battery parameters in automotive and other applications. The device integrates an HCS12 microcontroller and a SMARTMOS analog control IC into a single package solution. The analog die combines system basis and application specific functions, including a Local Interconnect Network (LIN) transceiver, and a two-channel 16-bit sigma delta analog to digital converter (ADC) for simultaneous measurement of battery voltage and current. An

integrated temperature sensor combined with battery mounting allows measurement of battery temperature. Control of the analog die is through a new high performance internal Die-to-Die interface (D2D), which seamlessly integrates the analog IC registers into the MCU register map, to provide faster access than SPI-based systems. The MM912_637 also includes an internal oscillator, 96 k or 128 k Bytes of Flash memory, and 6.0 k Bytes of RAM. An optional external temperature sensor is also supported.

Applications

- Battery Current / Voltage / Temperature Monitoring
- Battery State of Charge Monitoring
- Battery State of Health Monitoring

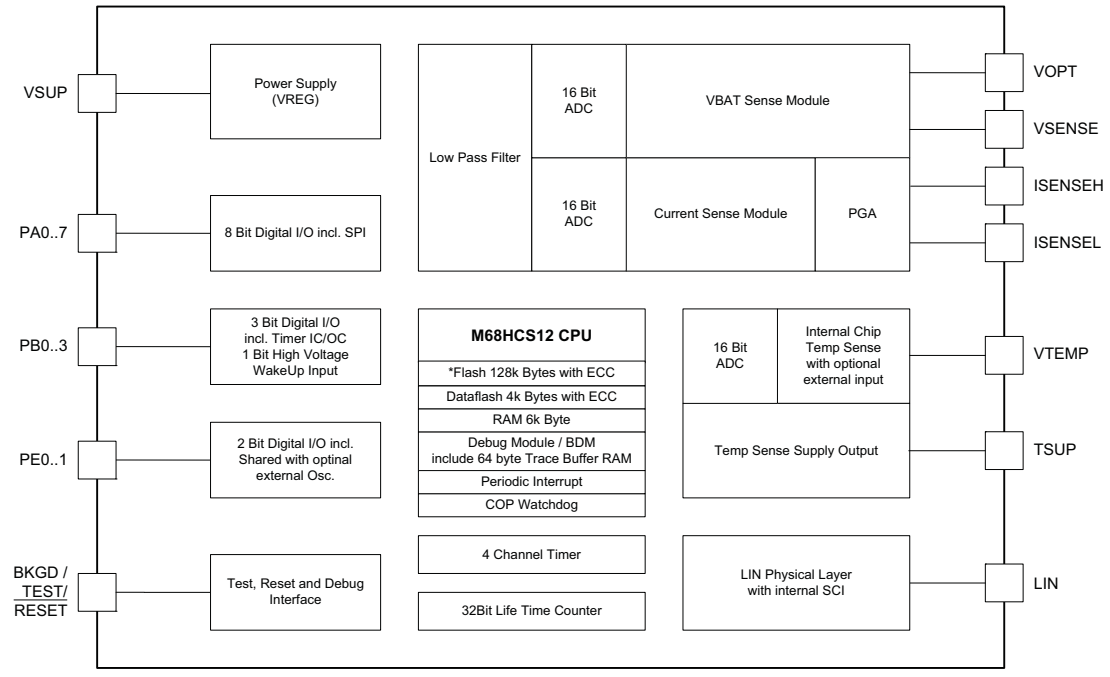
MM912_637 Simplified Application Drawing



*Part Number Dependent

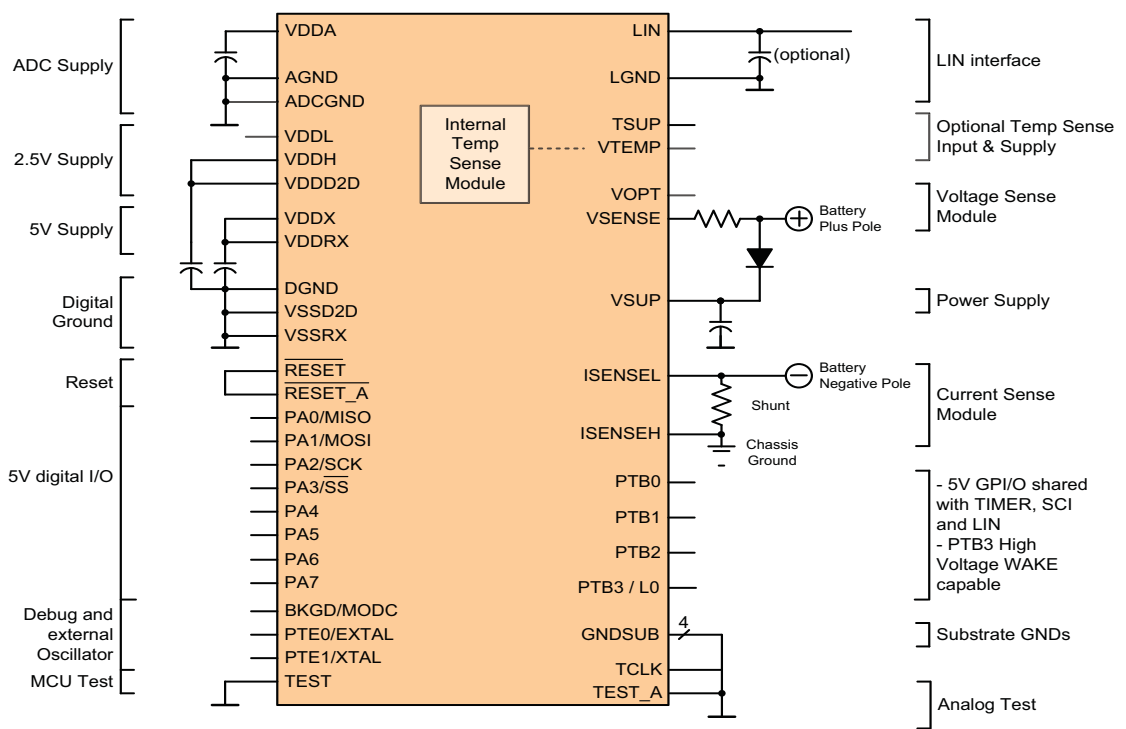


MM912_637 Block Diagram



*Part Number Dependent

MM912_637 Detailed Application Diagram



Features

Battery Voltage Measurement

- Dedicated 16-Bit, 2nd order sigma delta ADC
- High precision divider
- Optional external voltage input "VOPT"
- Full measurement range 3.5 to 28 V, with an accuracy of 0.15% for 5.0 to 18 V range
- Measurement resolution 0.5 mV
- Simultaneous sampling with current channel
- Programmable signal filtering shared with current measurement: low-pass: 3.0 dB @100 Hz
- Reverse battery protected

Differential Battery Current Measurement

- Dedicated 16-Bit 2nd order sigma delta ADC
- PGA (programmable gain amplifier) with 8 programmable gain factors (4 to 512), synchronisation with ADC
- GCB (gain control block) for automatic gain adjustment
- Simultaneous sampling with voltage channel
- Measurement range +/-15 A (up to +/-2000 A) with an accuracy of 5.0 mA and a resolution of 1.0 mA
- Programmable signal filtering shared with voltage measurement: low-pass: 3.0 dB @100 Hz

Temperature Measurement

- Internal on-chip temperature sensor
- Optional external temperature sensor input
- Dedicated 16-Bit ADC with anti-aliasing filter
- Temperature range -40 to 125 °C (Part number dependent)
- Accuracy: +/-2.0 °C (-20 to 60 °C) and +/-3.0 °C (-40 to 125 °C)

Normal and Low Power Mode

- Current integration through a 32-Bit accumulator during low power mode, wake-up with programmable threshold
- Programmable current threshold detection during low power mode
- Programmable wake-up timer
- Maximum of 100 µA consumption in low power mode
- Triggered wake-up from LIN

Internal Oscillator with 1% Accuracy

Communication through LIN 2.1, LIN 2.0 Interface with Fast Mode for Flash Programming over LIN

High Performance 16-Bit S12 CPU

32 MHz, 96 k or 128 k Flash, 6.0 k RAM, 4.0 k Data Flash

Fast Die-to-Die Bus Interface with Transparent Integration of Analog IC Registers to the MCU Register Map

Background Debug Module (BDM), Debug Module (DBG), Serial Peripheral Interface (SPI)

Six Digital (5.0 V) General Purpose Input/Output (GPIO) Shared with SPI

Three Low Voltage GPIO Shared with SCI with Selectable Pull-up Resistor Per Terminal

Cascaded Low Drop Out (LDO) Voltage Regulators (5.0 V and 2.5 V)

Industry Standard EMC and ESD Compliance

Performance	Typical Values		
Operating Voltage	3.5 V to 28 V		
Ambient Operating Temperature (T_A)	$-40\text{ }^\circ\text{C} \leq T_A \leq 125\text{ }^\circ\text{C}^*$		
Junction Temperature (T_J)	$-40\text{ }^\circ\text{C} \leq T_J \leq 150\text{ }^\circ\text{C}$		
Protection	Detect	Shut Down	Status Reporting
LIN Bus Line Protection (Over-temperature)	•	•	•

*Part Number Dependent

Customer Benefits

Integration of MCU and analog features into a system-in-package solution, results in an optimized, economical, and autonomous multi-function solution, which provides enhanced reliability, and requires few external components when compared to discrete solutions

- Fully integrated and optimized signal chains, using 3 individual Sigma Delta ADC to measure current, voltage, and temperature
- Optional external temperature sense input and secondary voltage sense input
- Low current consumption, low-power mode flexibility, and wake-up options, including configurable wake-up sources
- Reverse battery protected voltage sense pins
- Full LIN solution with integrated physical interface
- Fully AEC-Q100 automotive qualified, and designed to meet highest automotive robustness standards for ESD, EMC, and Zero Defect Quality levels

Questions

- Do you need to monitor battery conditions over a wide current range with high precision and signal filtering capabilities?
- Do you need a single package solution, integrating a microcontroller, a LIN node, voltage regulators and full battery monitoring features?
- Do you need high precision synchronous voltage and current measurements?
- Are you using a LIN communication system?
- Do you need a low current consumption device?
- Do you need a device which is compliant with EMC and ESD industry standards?
- Do you need a fully automotive qualified product?
- Do you have to minimize the size of your PCB application?

Orderable Part Numbers

Part Number	Max Input Voltage	Flash (kB)	Temperature Range T _A	Package	Analog Option
MM912I637AM2EP/R2	42V	96	-40 to 125 °C	48 QFN-EP	2
MM912J637AM2EP/R2		128			
MM912I637AV1EP/R2		96	-40 to 105 °C		1
MM912J637AV1EP/R2		128			
Feature		Analog Option 1		Analog Option 2	
Cranking Mode		No		Yes	
External Wake-up (PTB3/L0)		No		Yes	
External Temperature Sensor Option (VTEMP)		No		Yes	
Optional 2nd External Voltage Sense Input (VOPT)		No		Yes	

Documentation

Document	Description
MM912_637D1	Data Sheet - Presents the specifications for the product
SG1002	Selector Guide - Analog and power management device comparison
SG187	Selector Guide - Automotive device comparison

Development Tools

Part Number	Description
KIT912J637EVME	Evaluation board to demonstrate the key features of the MM912_637.



(PB-FREE)
48-PIN QFN-EP
98ASA00343D

Freescale: A Leader in Automotive Solutions

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Document Number: MM912J637FS REV 3.0