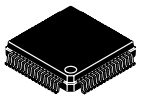

SC33771CD1

Battery cell controller IC

Rev. 1.0 — 12 December 2019

Data sheet: technical data
COMPANY CONFIDENTIAL

1 General description

The MC33771C is a SMARTMOS lithium-ion battery cell controller IC designed for automotive applications, such as hybrid electric (HEV) and electric vehicles (EV) along with industrial applications, such as energy storage systems (ESS) and uninterruptible power supply (UPS) systems.

The device performs ADC conversions of the differential cell voltages and current, as well as battery coulomb counting and battery temperature measurements. The information is transmitted to MCU using one of the microcontroller interfaces, Serial Peripheral Interface (SPI) or Transformer physical layer (TPL), of the IC.

Note: *Refer to the MC33771C data sheet for all specifications, except those in this document.*

2 Features

- 9.6 V ≤ V_{PWR} ≤ 61.6 V operation, 75 V transient
- 7 to 14 cells management
- Isolated 2.0 Mbps differential communication or 4.0 Mbps SPI
- Addressable on initialization
- Bidirectional transceiver to support up to 63 nodes in daisy chain
- Synchronized cell voltage/current measurement with coulomb count
- Averaging of cell voltage measurements
- Total stack voltage measurement
- Seven GPIO/temperature sensor inputs
- 5.0 V at 5.0 mA reference supply output
- Automatic over/undervoltage and temperature detection routable to fault pin
- Integrated sleep mode over/undervoltage and temperature monitoring
- Onboard 300 mA passive cell balancing with diagnostics
- Hot plug capable
- Detection of internal and external faults, as open lines, shorts, and leakages
- Designed to support ISO 26262, up to ASIL D safety system
- Qualified in compliance with AECQ-100

3 Applications

- Automotive: 48 V and high-voltage battery packs
- E-bikes, e-scooters
- Energy storage systems
- Uninterruptible power supply (UPS)

4 Ordering information

Table 1. Ordering information

Temperature range is −40 to 105 °C

Package type is 64-pin LQFP-EP

Orderable part	Number of channels	OV/UV	Precision GPIO as temperature channels and OT/UT	Current channel or coulomb count
SC33771CTA1MAE	7 to 14	Yes	Yes	No
SC33771CTP1MAE	7 to 14	Yes	Yes	Yes

5 Electrical characteristics

Note: *Electrical characteristics in this document supersede those maintained in the MC33771C data sheet.*

Table 2. Static and dynamic electrical characteristics

Characteristics noted under conditions 9.6 V ≤ V_{PWR} ≤ 61.6 V, −40 °C ≤ T_A ≤ 105 °C, GND = 0 V, unless otherwise stated. Typical values refer to V_{PWR} = 56 V, T_A = 25 °C, unless otherwise noted.

Symbol	Parameter	Min	Typ	Max	Unit
$V_{ERR33RT}$	Cell voltage measurement error [1] [2] [3] V_{CELL} = 3.7 V, T_A = 25 °C	−2.0	—	2.0	mV
V_{ERR_4}	Cell voltage measurement error [1] [2] [3] 0.2 V ≤ V_{CELL} ≤ 4.3 V, −20 °C ≤ T_A ≤ 60 °C	−4.0	—	4.0	mV
V_{ERR_5}	Cell voltage measurement error [1] [2] [3] 0.2 V ≤ V_{CELL} ≤ 4.5 V, −40 °C ≤ T_A ≤ 105 °C	−6.0	—	6.0	mV
V_{ERR}	Cell voltage measurement error [1] [2] [3]	—	—	—	mV
V_{ERR_1}	Cell voltage measurement error	—	—	—	mV
V_{ERR_2}	Cell voltage measurement error	—	—	—	mV
V_{ERR_3}	Cell voltage measurement error	—	—	—	mV
V_{ERR_4}	Cell voltage measurement error	—	—	—	mV
V_{ERR_5}	Cell voltage measurement error	—	—	—	mV
$V_{ERR33RTA}$	Cell voltage measurement error	—	—	—	mV
V_{ERR_A}	Cell voltage measurement error	—	—	—	mV
V_{ERR_1A}	Cell voltage measurement error	—	—	—	mV
V_{ERR_2A}	Cell voltage measurement error	—	—	—	mV
V_{ERR_3A}	Cell voltage measurement error	—	—	—	mV
V_{ERR_4A}	Cell voltage measurement error	—	—	—	mV
V_{ERR_5A}	Cell voltage measurement error	—	—	—	mV

[1] The cell voltage error includes all internal errors, for example; ADC offset, gain error, INL and DNL. Current measurement is not active when measuring the cell voltage. Single shot measurements are affected by noise, which has zero mean and standard deviation given by VV_NOISE and is not included in the cell voltage error. In order to reduce it, SW implemented IIR or FIR low pass filters may be used; example, a moving average, whose length is N samples, has output standard deviation VOUTPUT_NOISE = VV_NOISE /sqrt(N). Performance can be granted only if ADC1-A,B are configured at 16-bits resolution (ADC_CFG[ADC1_A_DEF] =ADC_CFG[ADC1_B_DEF] = 11) and if -100mV ≤ CTREF - GND ≤ 100 mV.

[2] If the battery stack has at least eight cells, for all accuracy ranges, the accuracy for a given cell can be guaranteed if all other cells are at least at 1.2 V. If the battery stack has seven cells, for all accuracy ranges, the achievement of the accuracy spec for a given cell can be guaranteed if all other cells are at least at 1.8 V.

[3] Inaccuracies from soldering or aging are not included.

6 Revision history

Table 3. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
SC33771CD1 v.1.0	20191212	Technical data	—	—

7 Contact information

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8 Legal information

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