

TS1108 Coulomb Counter User's Guide

The TS1108 coulomb counter accurately measures battery depletion while also indicating the battery charging polarity. The battery discharge current is monitored by a current-sense amplifier through an external sense resistor. Utilizing an Integrator and a Comparator plus a Monoshot, the TS1108 voltage-to-frequency converter provides a series of 90 μ s output pulses at COUT, which represents an accumulation of coulombs flowing out of the battery. The charge count frequency is adjustable by the integration resistor and capacitor.

The TS1108 CSA requires a very low 1.2 μ A supply current, while also combining a 150 μ V VOS(MAX) with a 0.6% gain error (MAX) for high precision current measurements. The TS1108 provides a buffered CSA output which can be connected with a RC Filter to reduce noise. The VDD supply requires a typical supply current of 1.93 μ A when VREF is disabled.

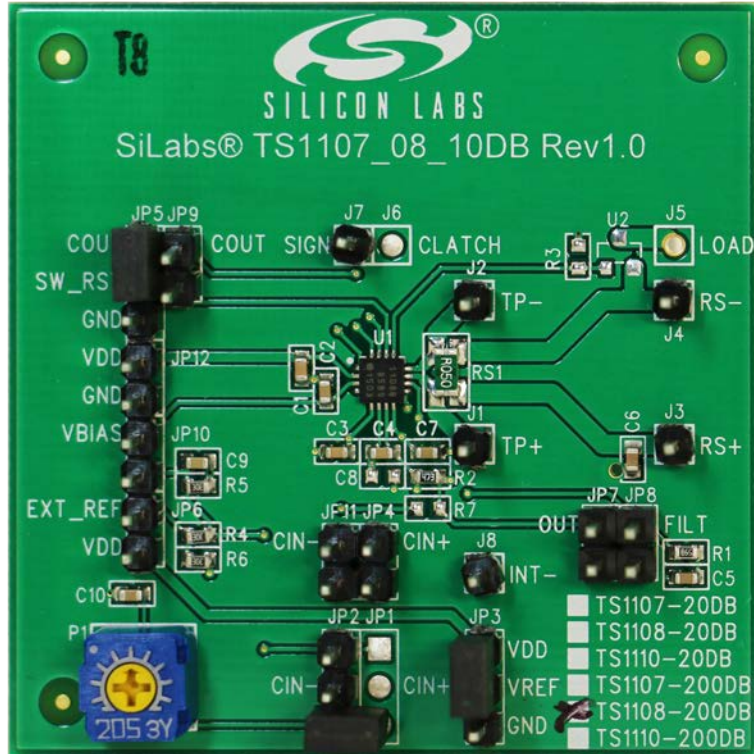
The TS1108 is fully specified to operate over the -40°C to $+85^{\circ}\text{C}$ temperature range and is available in a low-profile thermally-enhanced 16-pin 3 x 3 mm TQFN package with an exposed back-side paddle.

KEY FEATURES

- R_{SENSE} : 50 m Ω $\pm$ 0.5%
- Compatible for Both Gain Options
 - 20 V/V
 - 200 V/V

ORDERING INFORMATION

- TS1108-20DB
- TS1108-200DB



1. Description

The TS1108 Evaluation Board is intended for evaluating the coulomb counter functionality of the TS1108. The TS1108 Coulomb Counter function utilizes an Integrator and a Comparator plus a 90 μ s Monoshot. The CSA's buffered output is applied to the integrator's input. This signal is integrated by the comparator until it reaches a level which trips the comparator. The comparator's trip level is determined by the voltage applied to the comparator's non-inverting terminal, $CIN+$. The Monoshot produces a 90 μ s output pulse at $COUT$ and the integrator is reset. Therefore, each $COUT$ 90 μ s pulse represents an accumulation of coulombs (Please refer to Coulomb Counter Equations in Applications Information). The TS1108 Integrator works best when the 90 μ s Monoshot represents less than 2% of the total integration period. Therefore, the minimum integration time for a full-scale V_{SENSE} should be limited to 4.7 ms. To guarantee stable operation of the OUT buffer, an integration capacitance of 0.1 μ F should be used for integration capacitor, C_{INT} . The TS1108's Coulomb Counting interrupt is provided by the internal comparator with a push-pull output configuration.

The following equation can be used to calculate how many ampere-hours (Ah) each comparator interrupt pulse represents:

$$ComparatorPulse = \frac{R_{INT}C_{INT}(V_{CIN-} - V_{VBIAS})}{3600 \times GAIN \times R_{SENSE}} Ah$$

Table 1.1. Component List

Designation	Quantity	Description
U1	1	TS1108-20, TS1108-200
RS1	1	50 m Ω $\pm$ 0.5%, 1/2 W (1206)
C1, C6	2	1 μ F $\pm$ 10%, 10 V (0603)
C2, C4, C7, C9, C10	5	0.1 μ F $\pm$ 10%, 10 V (0603)
C3	1	1 nF $\pm$ 10%, 25 V (0603)
C5	1	0.47 μ F $\pm$ 10%, 10 V (0603)
R1	1	4.02 k Ω $\pm$ 1%, 1/16 W (0603)
R2	1	47 k Ω $\pm$ 1%, 1/16 W (0603)
R4, R5, R6	3	2 M Ω $\pm$ 1%, 1/10 W (0603)
J1, J2, J3, J4, J7, J8	6	Header 1x1
JP2, JP3, JP5	3	Header 1x3
JP4, JP6, JP7, JP8, JP9, JP10, JP11, JP12	8	Jumper
JS1, JS2, JS3	3	Jumper Shunt

2. Quick Start Procedure

Required Equipment

- 3 V Power Supply or 3 V Battery
- 2 Digital Multimeters
- 1 Oscilloscope
- 1 Potentiometer

To use the TS1108 evaluation board, perform the following steps:

1. Configure JP3 so that the Jumper Shunt is connecting VDD to VREF.
2. Configure JP5 so that the jumper shunt is connecting COUT and SW_RST.
3. Connect the 3 V power source to RS+ and VDD.
4. Use a voltmeter to measure the V_{BIAS} and the $CIN-$ voltage. V_{BIAS} should be 50% of VDD, 1.5 V. $CIN-$ should be 90% of VDD, 2.7 V.
5. Connect a voltmeter to measure V_{OUT} . With no load connected V_{OUT} should be equal to V_{BIAS} . The expression for the V_{OUT} output voltage is defined by:

$$V_{OUT} = V_{BIAS} - I_{LOAD} \times 50m\Omega \times GAIN$$

6. Connect an ammeter in series from RS- to a potentiometer. Adjust the POT until the ammeter reads:
 - TS1108-20: 500 mA
 - TS1108-200: 50 mA

V_{OUT} should equal 1 V.

7. Connect the oscilloscope to COUT. COUT should produce a periodic pulsing waveform with a period of 11.28 ms, where each monoshot pulse width is 90 μ s (typ).

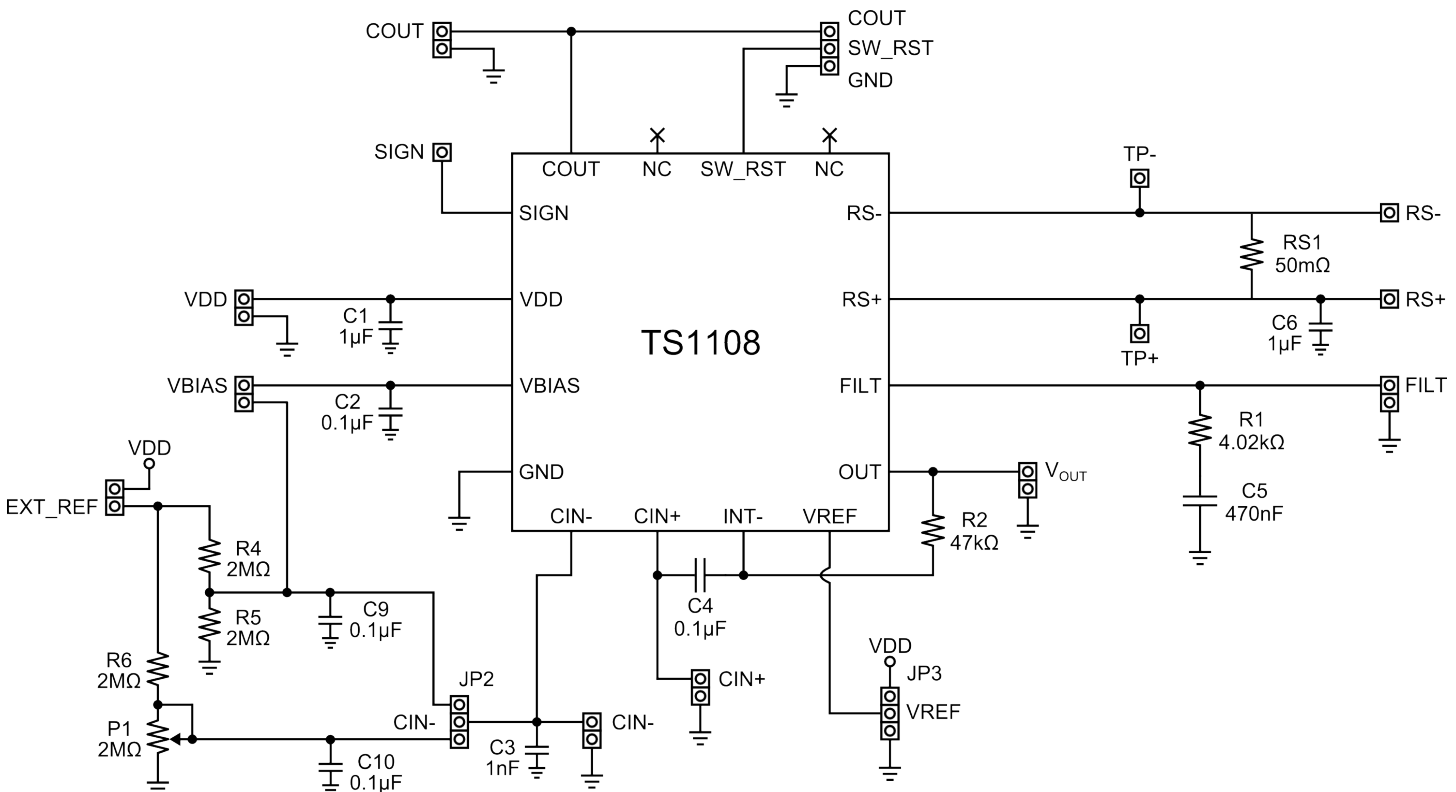
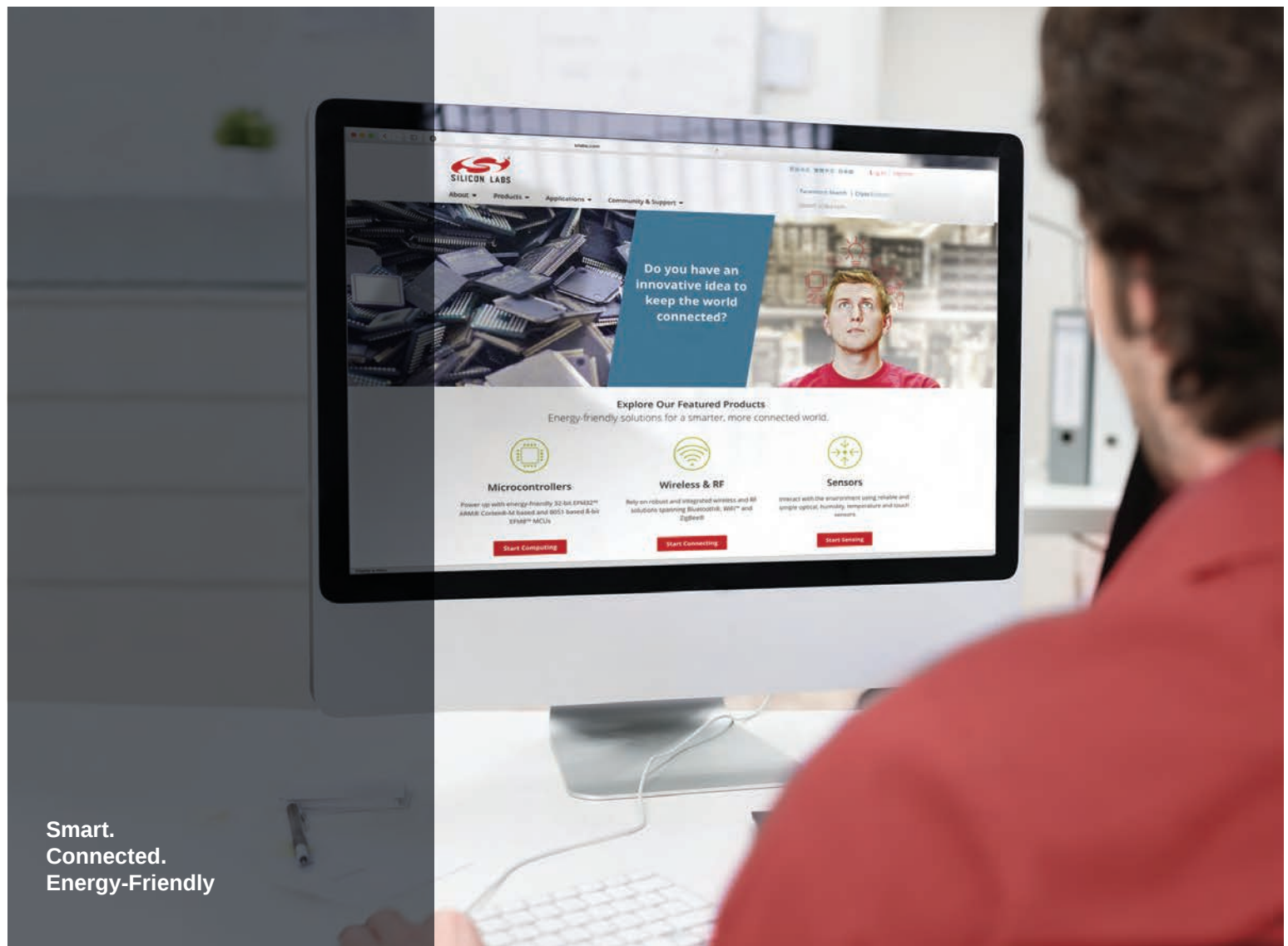


Figure 2.1. TS1108DB Circuit Schematic

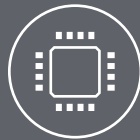


Smart.
Connected.
Energy-Friendly



Products

www.silabs.com/products



Quality

www.silabs.com/quality



Support and Community

community.silabs.com

Disclaimer

Silicon Laboratories intends to provide customers with the latest, accurate, and in-depth documentation of all peripherals and modules available for system and software implementers using or intending to use the Silicon Laboratories products. Characterization data, available modules and peripherals, memory sizes and memory addresses refer to each specific device, and "Typical" parameters provided can and do vary in different applications. Application examples described herein are for illustrative purposes only. Silicon Laboratories reserves the right to make changes without further notice and limitation to product information, specifications, and descriptions herein, and does not give warranties as to the accuracy or completeness of the included information. Silicon Laboratories shall have no liability for the consequences of use of the information supplied herein. This document does not imply or express copyright licenses granted hereunder to design or fabricate any integrated circuits. The products must not be used within any Life Support System without the specific written consent of Silicon Laboratories. A "Life Support System" is any product or system intended to support or sustain life and/or health, which, if it fails, can be reasonably expected to result in significant personal injury or death. Silicon Laboratories products are generally not intended for military applications. Silicon Laboratories products shall under no circumstances be used in weapons of mass destruction including (but not limited to) nuclear, biological or chemical weapons, or missiles capable of delivering such weapons.

Trademark Information

Silicon Laboratories Inc., Silicon Laboratories, Silicon Labs, SiLabs and the Silicon Labs logo, CMEMS®, EFM, EFM32, EFR, Energy Micro, Energy Micro logo and combinations thereof, "the world's most energy friendly microcontrollers", Ember®, EZLink®, EZMac®, EZRadio®, EZRadioPRO®, DSPLL®, ISOmodem®, Precision32®, ProSLIC®, SiPHY®, USBXpress® and others are trademarks or registered trademarks of Silicon Laboratories Inc. ARM, CORTEX, Cortex-M3 and THUMB are trademarks or registered trademarks of ARM Holdings. Keil is a registered trademark of ARM Limited. All other products or brand names mentioned herein are trademarks of their respective holders.



Silicon Laboratories Inc.
400 West Cesar Chavez
Austin, TX 78701
USA

<http://www.silabs.com>



**Стандарт
Электрон
Связь**

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331