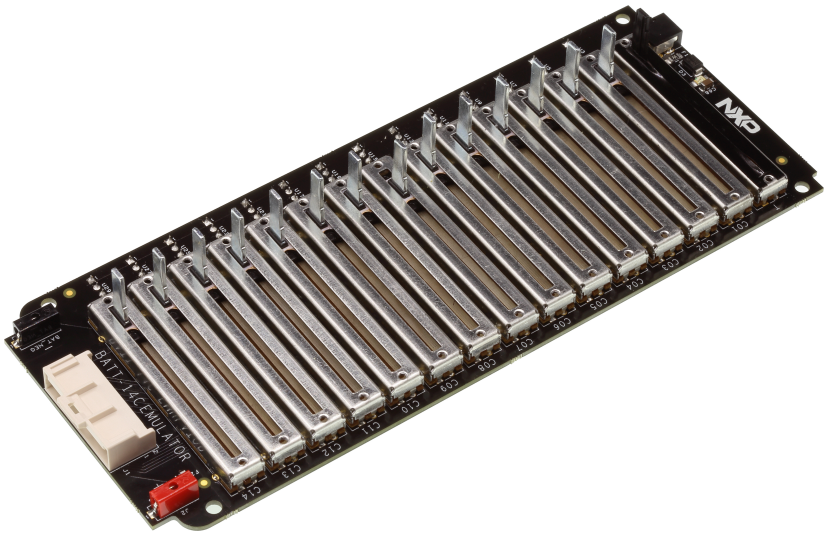
UM11349

Introduction to BATT-14CEMULATOR 14-cell slider battery pack emulator kit

Rev. 1 — 10 January 2020 User manual



aaa-036424

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1 Finding kit resources and information on the NXP web site

NXP Semiconductors provides online resources for this evaluation board and its supported device(s) on http://www.nxp.com.

The information page for BATT-14CEMULATOR, 14-cell slider battery pack emulator is at http://www.nxp.com/products/:BATT-14CEMULATOR. The information page provides overview information, documentation, software and tools, parametrics, ordering information and a Getting Started tab. The Getting Started tab provides quick-reference information applicable to using the BATT-14CEMULATOR, 14-cell slider battery pack emulator, including the downloadable assets referenced in this document.

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The NXP Community is at http://community.nxp.com.

2 Getting started

2.1 Kit contents

The **BATT-14CEMULATOR** contents include:

- BATT-14CEMULATOR, 14-cell slider battery pack emulator

2.2 Additional hardware

To use this kit, you need:

- Power supply 12 VDC with current capability 1.5 A

3 Getting to know the hardware

3.1 General description: BATT-14CEMULATOR

The BATT-14CEMULATOR board can emulate a multi-cell battery pack that can be easily hooked-up to the evaluation boards for MC33771C battery cell controllers (BCC):

- RD33771CNTREVM
- FRDM33771BSPIEVB

The user can connect the BATT-14CEMULATOR board for a quick evaluation of NXP BCC ICs, or to help the users in their software development. These boards basically provide a very intuitive way to change the voltage across any of the 14 cells of an emulated battery pack as well as the voltage across some analog inputs of the BCC IC that are typically used as temperature sensors.

3.2 Features: BATT-14CEMULATOR

- 14 slider potentiometers
- Each slider can modify the cell voltage between 1.25 V and 4.6 V

- Current capability of the cell output voltage is 110 mA
- Up to three evaluation boards can be connected in parallel
- Temperature sensor output voltage can vary from 0 V to +4.95 V
- Two output terminals to allow stack-up of several emulators

3.3 Board functions

These boards have been designed and optimized for the operating conditions described below. Usage of these boards beyond these conditions can lead to malfunction and damage.

Table 1. Maximum ratings

Description	Min	Max	Unit
Supply input voltage	10.8	13.2	V
Cell output current	—	110	mA
Operating ambient temperature	−10	+40	°C

Table 2. Electrical characteristics

Description	Min	Typ	Max	Unit
Minimum cell voltage output (slider down)	—	1.25	—	V
Maximum cell voltage output (slider up)	—	4.9	—	V
Minimum temperature sensor voltage output (slider down)	—	0	—	mV
Maximum temperature sensor voltage output (slider up)	—	4.95	—	mV
Voltage isolation between input power supply and battery emulator outputs	—	1	—	kV

3.4 BATT-14CEMULATOR featured components

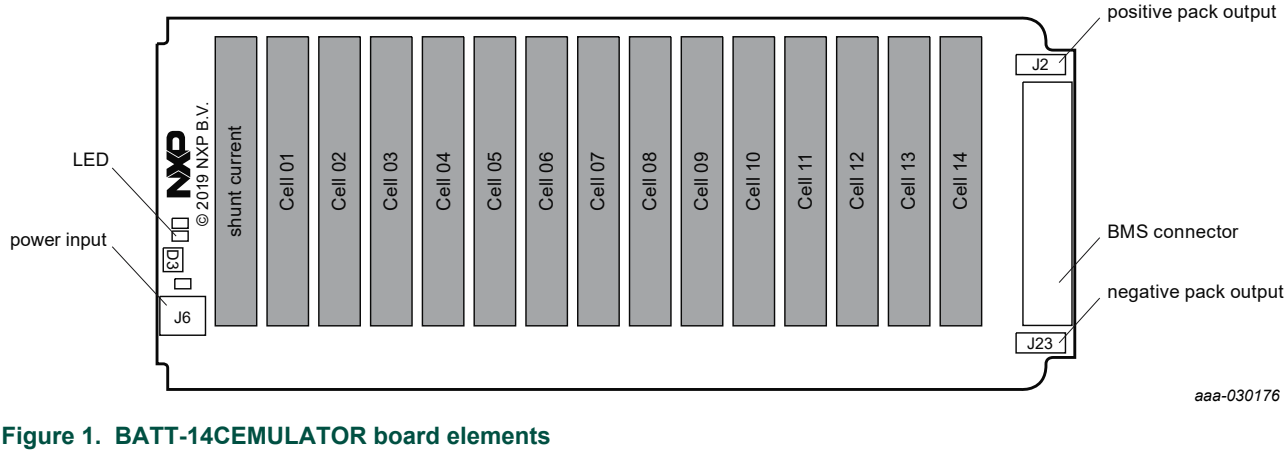

Figure 1. BATT-14CEMULATOR board elements

The emulator board requires a 12 V DC power supply with 1.5 A current capability. The power supply is to be connected to the board via J6, a Ø3.5 mm jack connector. The center pin is to be connected to the positive voltage and the ring terminal to the ground.

The input of the board is protected in case of wrong polarity. An LED allows the user to check that the board is powered up. If the voltage is present to the jack connector but the LED is off, then check the fuse F1.

Each of the sliders allows the user to change independently the differential voltage between two cell terminals (or cell voltage). A separate slider allows the variation of the voltage across the temperature sensors.

Using the slider potentiometers, the user can modify each cell voltage between 1.25 V and 4.6 V. The current capability of the cell output voltage is 110 mA, which allows the user to connect up to three evaluation boards in parallel to the same battery emulator.

The temperature sensor output voltage can vary from 0 V to +4.95 V. It can mimic the temperature variation from –48 °C to 200 °C of a 10 K NTC sensor. Note that this output voltage is connected to four different analog inputs on the BCC IC (GPI0-3) and that each of them has a 6.8 K pull-up resistor to VCOM (5 V typ.).

The emulator board features two output terminals, a red and a black 2 mm banana plug. The plugs can be used to connect several emulator boards in series. The isolation voltage between the power input and the cells is higher than 1000 V. If several emulator boards are connected in series, the voltage of the packs may exceed 75 V. The user has to take adequate precautions related to the high-voltage risks.

3.5 Schematics

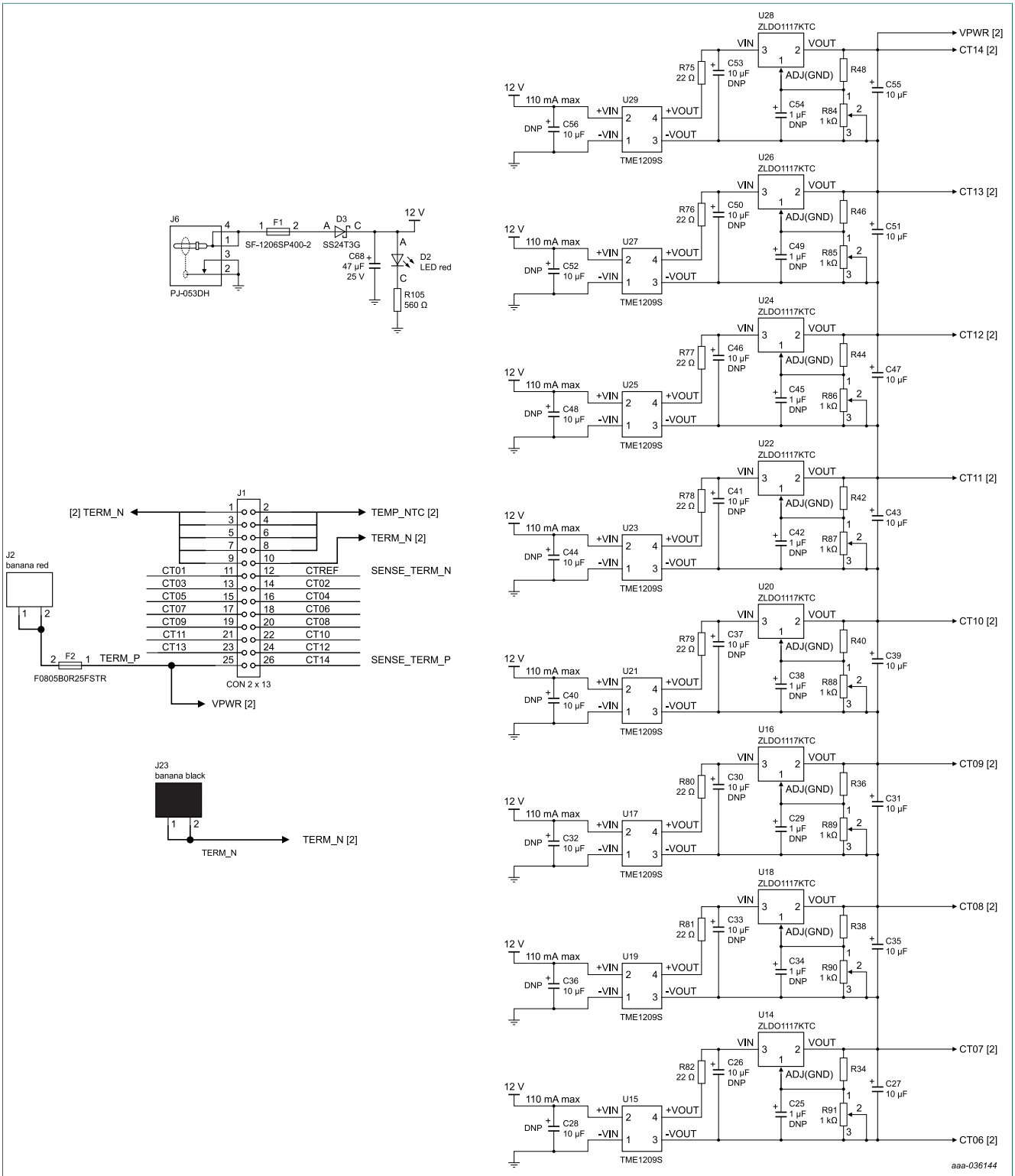

Figure 2. BATT-14CEMULATOR schematic (part 1)

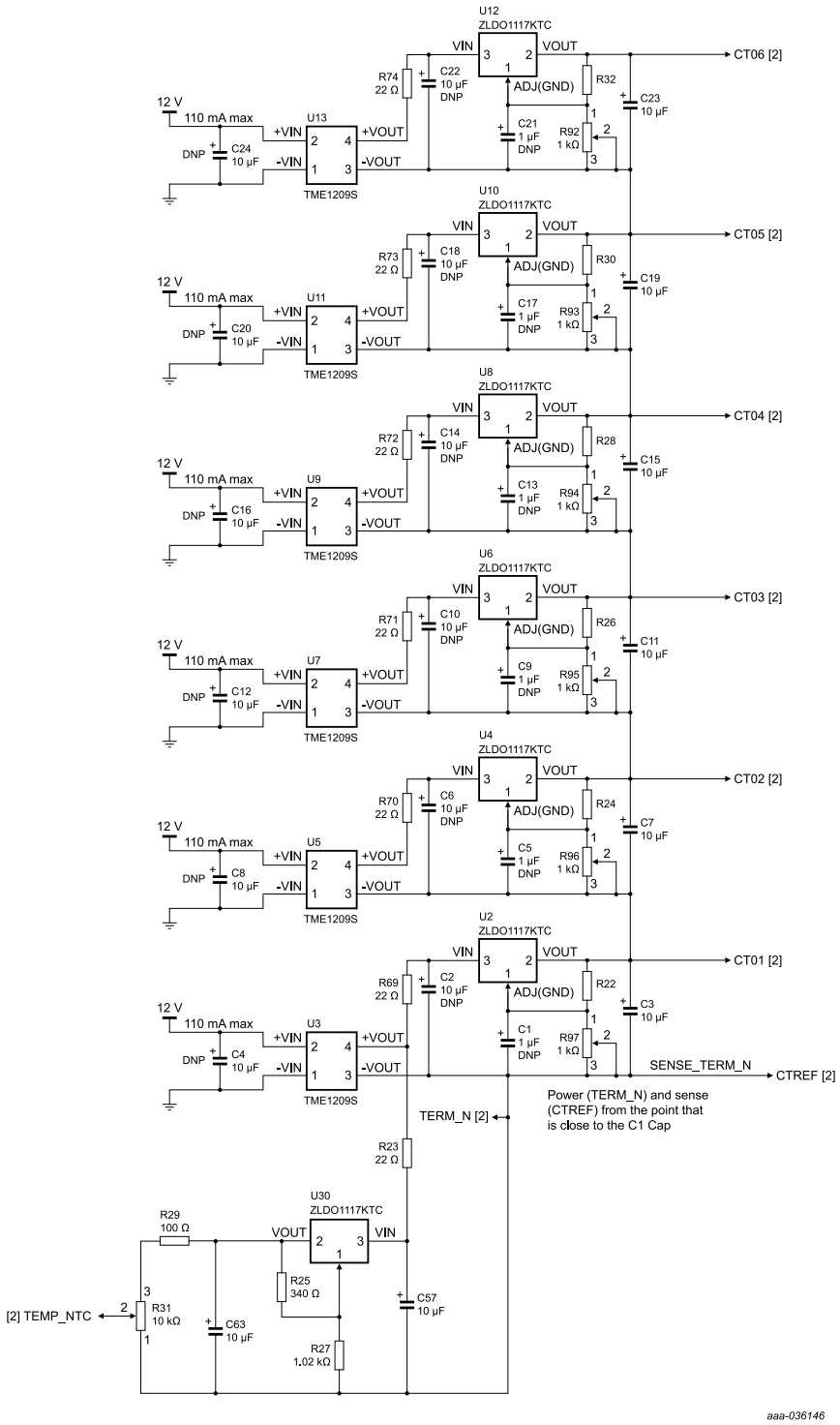

Figure 3. BATT-14CEMULATOR schematic (part 2)

3.6 Board bill of materials

Table 3. BATT-14CEMULATOR bill of materials

NXP does not assume liability, endorse, or warrant components from external manufacturers are referenced in circuit drawings or tables. While NXP offers component recommendations in this configuration, it is the responsibility of the customer to validate.

Item	Qty	Assembly option	Reference	Value	Manufacturing part number	Description
1	14	DNP	C1,C5,C9,C13,C17,C21,C25,C29, C34,C38,C42,C45,C49,C54	1 µF		50 V capacitor 1206
2	28	DNP	C2,C4,C6,C8,C10,C12,C14,C16,C18, C20,C22,C24,C26,C28,C30,C32,C33, C36,C37,C40,C41,C44,C46,C48,C50, C52,C53,C56	10 µF		50 V capacitor 1206
3	14		C3,C7,C11,C15,C19,C23,C27,C31, C35,C39,C43,C47,C51,C55	10 µF		10 V capacitor 1206
4	2		C57,C58	10 µF		50 V capacitor 1206
5	1		C68	47 µF		25 V capacitor 1206
6	1		D2		APT3216SURCK	LED red
7	1		D3	40 V	SS24T3G	diode 2 A 40 V SMB
8	1		F1	4 A	SF-1206SP400-2	fuse 4 A SMD 1206
9	1		F2	0.25 A	F0805B0R25FSTR	fuse 0.25 A SMD 0805
10	1		J1		MOLEX 501876-2640	CON 2X13
11	1		J2		930224101	banana red
12	1		J6		PJ-053DH	PWR jack 1.3 mm
13	1		J23		930224100	banana black
14	15		R22,R24,R25,R26,R28,R30,R32, R34,R36,R38,R40,R42,R44,R46,R48	340 Ω		RES 0.125 W 1 % 0603
15	15		R23,R69,R70,R71,R72,R73,R74, R75,R76,R77,R78,R79,R80,R81,R82	22 Ω		RES 0.25 W 5 % 1206
16	1		R27	1.02 KΩ		RES 0.1 W 1 % 0603
17	1		R29	100 Ω		RES 0.1 W 1 % 0603
18	1		R31	10 KΩ	PTA4553-2215CIB103	RES POT 10 kΩ 0.25 W
19	14		R84,R85,R86,R87,R88,R89,R90, R91,R92,R93,R94,R95,R96,R97	1 kΩ	PTA4543-2015CPB102	RES POT 1 kΩ 0.25 W
20	2		R101, R104	3.3 kΩ		RES 0.1 W 0.1 % 0603
21	1		R105	560 Ω		RES 0.125 W 1 % 0603
22	15		U1,U2,U4,U6,U8,U10,U12,U14,U16, U18,U20,U22,U24,U26,U28		ZLDO1117KTC	voltage regulator
23	14		U3,U5,U7,U9,U11,U13,U15,U17, U19,U21,U23,U25,U27,U29		TME1209S	9 V DC-to-DC converter

4 References

The following are URLs where the user can obtain information on related NXP products and application solutions.

Table 4. References

Item	Description	Link
BATT-14CEMULATOR	tool summary page	http://www.nxp.com/BATT-14CEMULATOR
MC33771C	battery cell controllers page	http://www.nxp.com/MC33771C
FRDM33771CSPIEVB	evaluation kit	http://www.nxp.com/FRDM33771CSPIEVB
RD33771CDSTEVB	evaluation kit	http://www.nxp.com/RD33771CDSTEVB

5 Revision history

Revision history

Revision number	Date	Description
1	20200110	Initial release

6 Legal information

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Tables

Figures