



UM11124

Introduction to 6-cell and 14-cell slider battery pack emulator kit

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User manual

Document information

Information	Content
Keywords	battery cell controller, battery emulator, battery management systems
Abstract	This user manual provides the user with an overview of the BATT-6EMULATOR and BATT-14EMULATOR battery pack emulators.



Revision history

Rev	Date	Description
1	20180516	initial version

1 Introduction

The BATT-6EMULATOR and BATT-14EMULATOR boards can emulate a multi-cell battery pack that can be easily hooked-up to the evaluation boards for MC33771 and MC33772 battery cell controllers (BCC):

- FRDM33772BTPEVB (to be used with BATT-6EMULATOR)
- FRDM33772BSPIEV (to be used with BATT-6EMULATOR)
- FRDM33771BTPEVB (to be used with BATT-14EMULATOR)
- FRDM33771BSPIEV (to be used with BATT-14EMULATOR)

The user can connect the BATT-6EMULATOR and BATT-14EMULATOR boards 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 6 cells or 14 cells of an emulated battery pack as well as the voltage across an emulated current sense shunt resistor.

2 Specifications

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
Current sense output current	-	±1	µA
Operating ambient temperature	-10	+40	°C

Table 2. Electrical characteristics

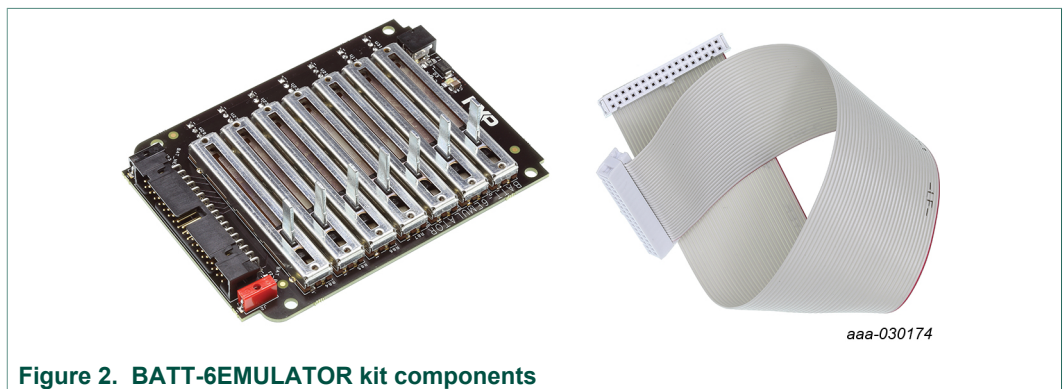
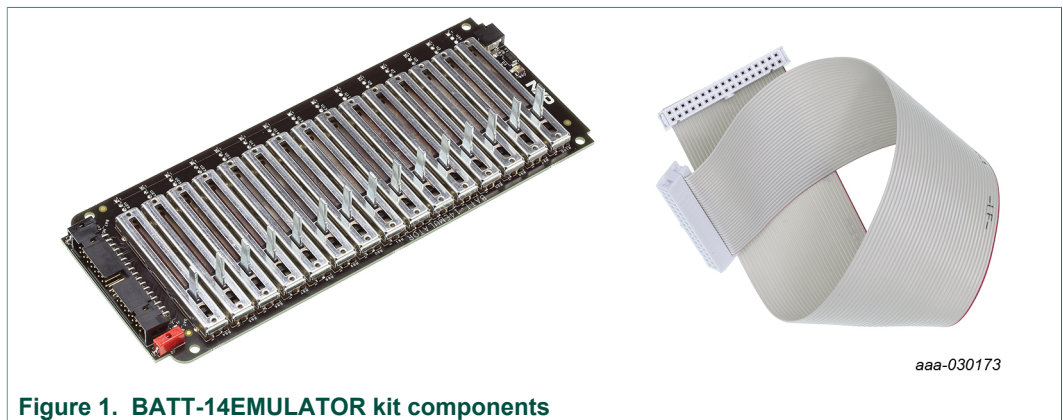
Description	Min	Typ	Max	Unit
Minimum cell voltage output (slider down)	-	1.25	-	V
Maximum cell voltage output (slider up)	-	4.6	-	V
Minimum current sensor voltage output (slider down)	-	-150	-	mV
Maximum current sensor voltage output (slider up)	-	150	-	mV
Voltage isolation between input power supply and battery emulator outputs	-	1	-	kV

3 Pack content

The kit includes:

One electronic board: The slider battery pack emulator board itself further referenced in this document as emulator board.

One ribbon cable that allows the user to connect the slider battery pack emulator to the MC3377x evaluation kits.



4 Getting started with the emulator board

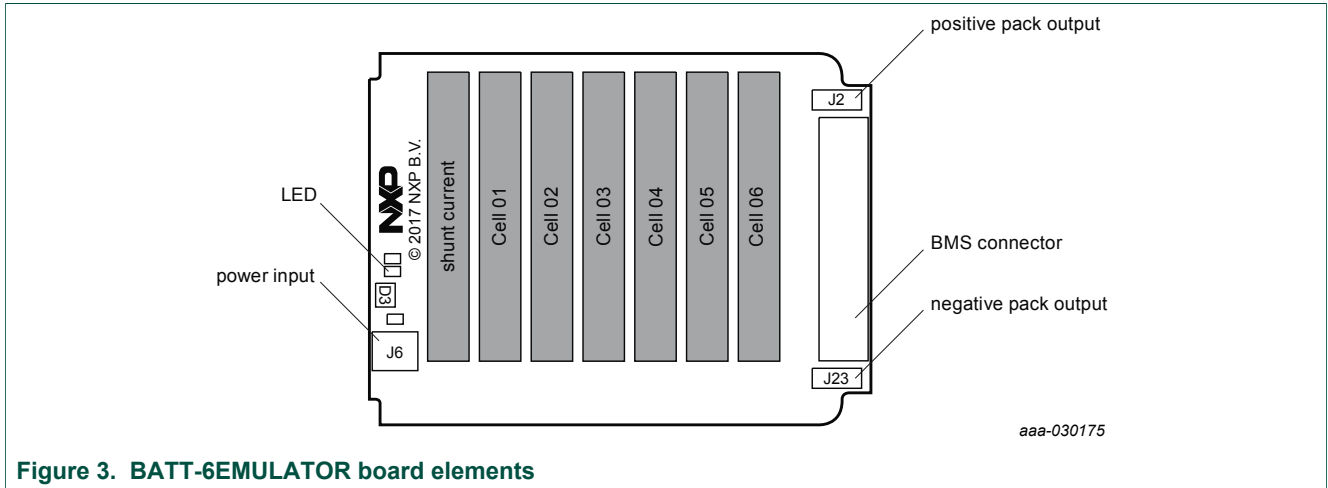


Figure 3. BATT-6EMULATOR board elements

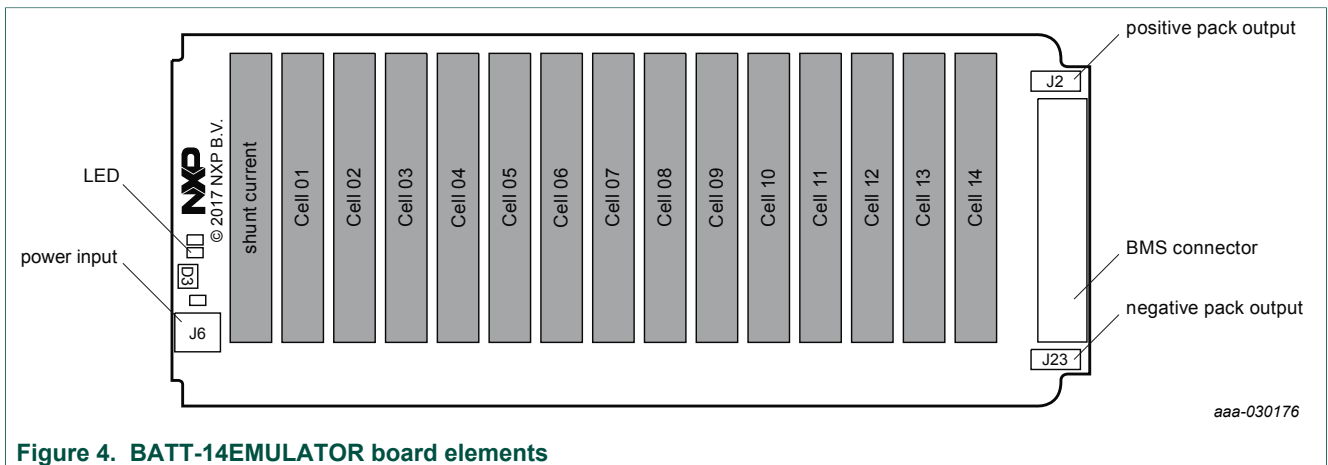


Figure 4. BATT-14EMULATOR board elements

The emulator board requires a 12 V DC power supply with 1.5 A current capability (1 A is enough for BATT-6EMULATOR). 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.

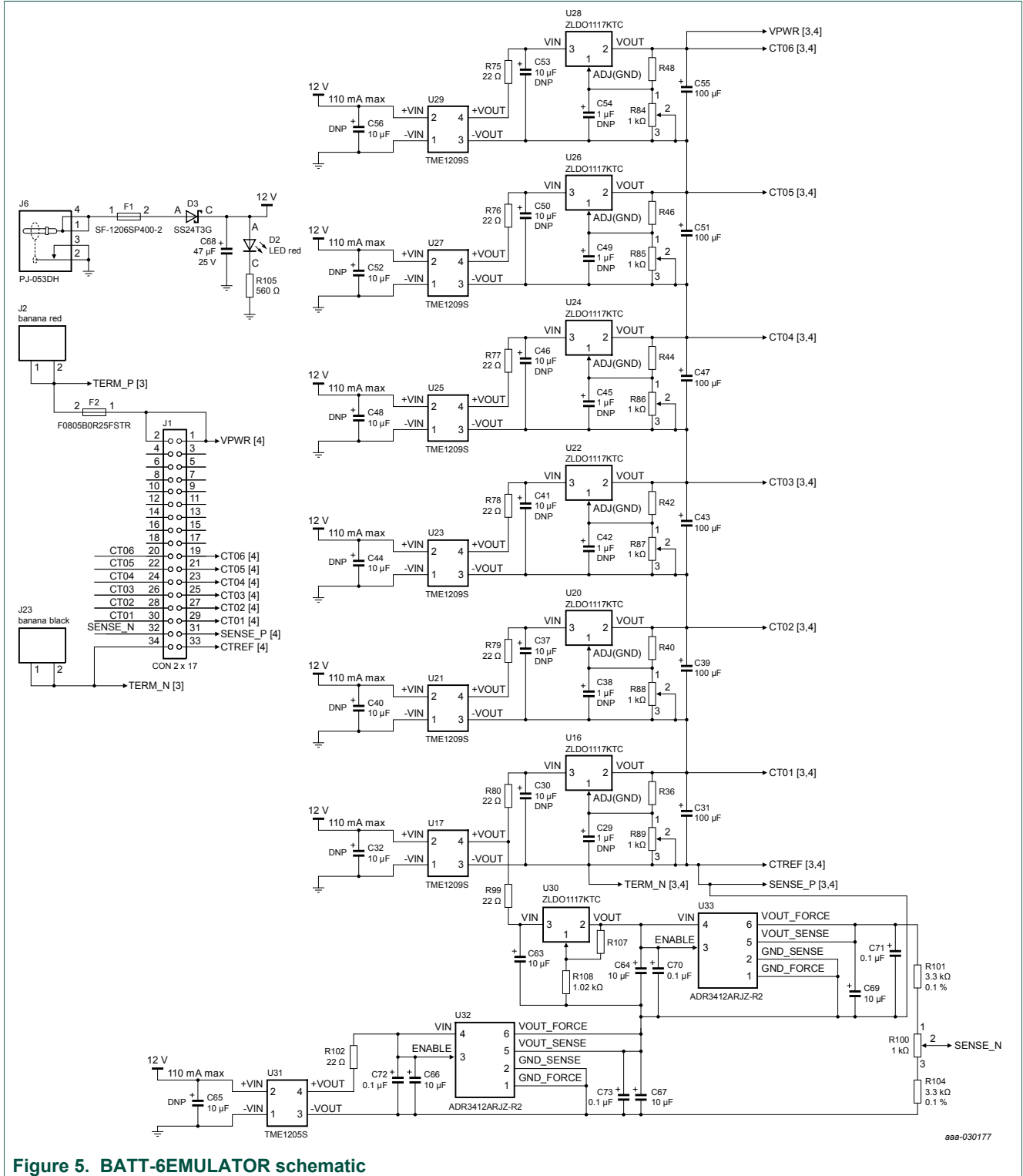
Each of the sliders allows the user to change independently the differential voltage between two cell terminals (or cell voltage). A separate slider allows the variation of the voltage across the current shunt resistor.

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.

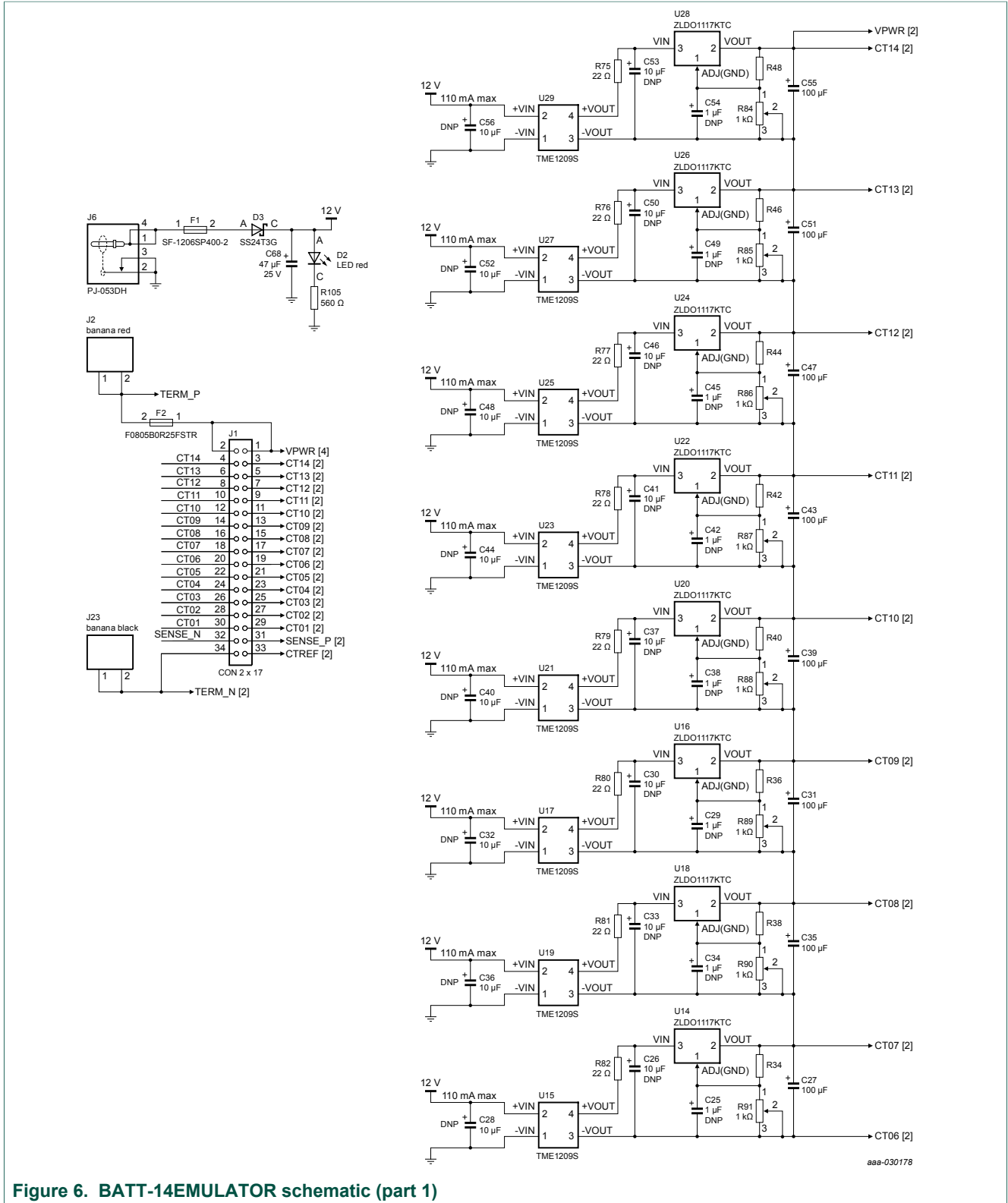
The current sense output voltage can vary from -150 mV to +150 mV. This output is not designed to drive a large current since the current sense input from the MC3377x needs as little as 100 nA. If more than 1 µA is pulled from this output, the voltage may drop by a few mV.

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.

5 Schematics



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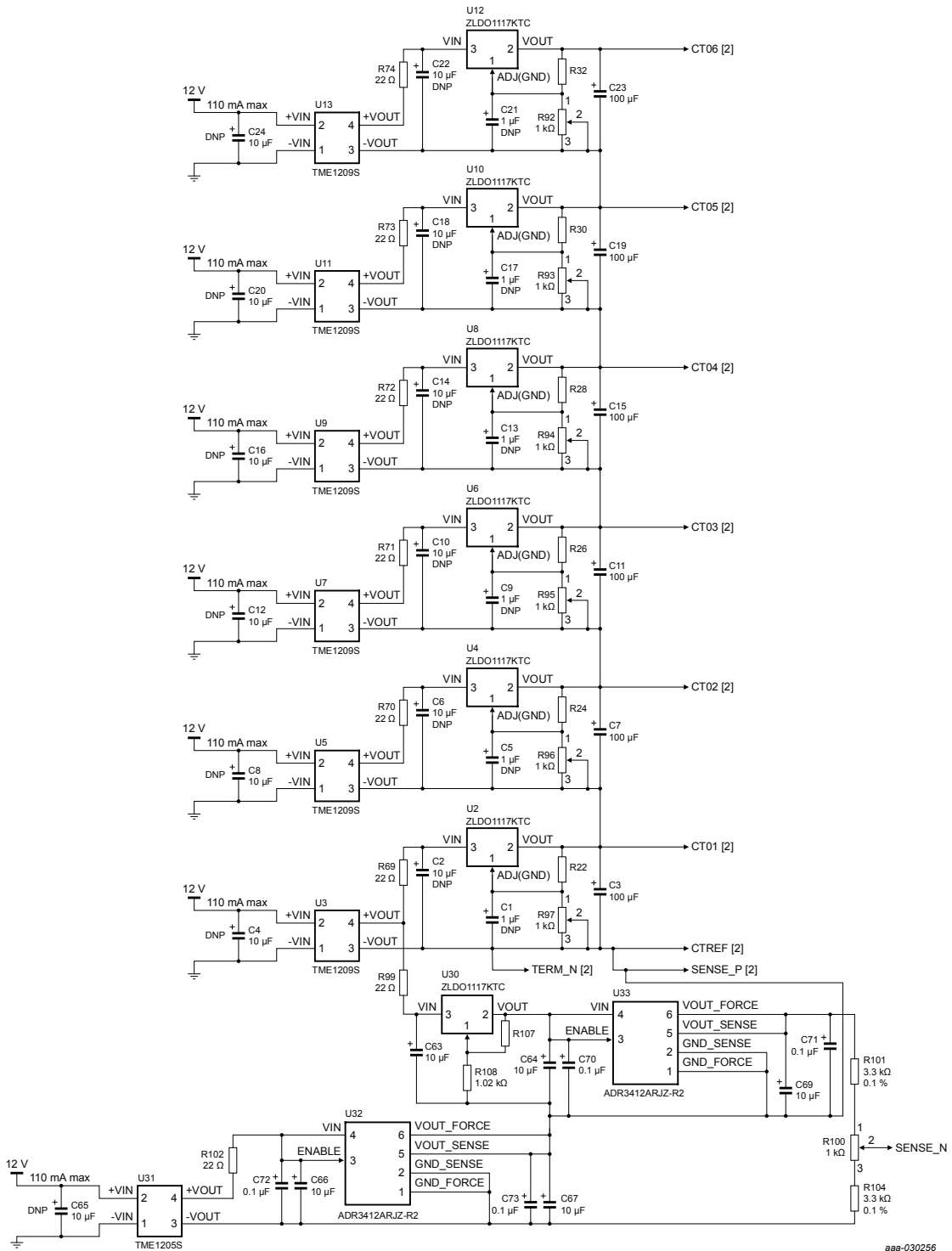


Figure 7. BATT-14EMULATOR schematic (part 2)

6 Board bill of materials

Table 3. BATT-6EMULATOR 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	6	DNP	C29, C38, C42, C45, C49, C54	1 μ F		50 V capacitor 1206
2	13	DNP	C30, C32, C37, C40, C41, C44, C46, C48, C50, C52, C53, C56, C65	10 μ F		50 V capacitor 1206
3	6		C31, C39, C43, C47, C51, C55	100 μ F		10 V capacitor 1206
4	5		C63, C64, C66, C67, C69	10 μ F		50 V capacitor 1206
5	1		C68	47 μ F		25 V capacitor 1206
6	4		C70, C71, C72, C73	0.1 μ F		50 V capacitor 0603
7	1		D2		APT3216SURCK	LED red
8	1		D3	40 V	SS24T3G	diode 2 A 40 V SMB
9	1		F1	4 A	SF-1206SP400-2	fuse 4 A SMD 1206
10	1		F2	0.25 A	F0805B0R25FSTR	fuse 0.25 A SMD 0805
11	1		J1		N2534-5002-RB	CON 2X17
12	1		J2		930224101	banana red
13	1		J6		PJ-053DH	PWR jack 1.3 mm
14	1		J23		930224100	banana black
15	7		R36, R40, R42, R44, R46, R48, R107	340 Ω		RES 0.125 W 1 % 0603
16	8		R75, R76, R77, R78, R79, R80, R99, R102	22 Ω		RES 0.25 W 5 % 1206
17	7		R84, R85, R86, R87, R88, R89, R100	1 k Ω	PTA4543-2015CPB 102	RES POT 1 k Ω 0.25 W
18	2		R101, R104	3.3 k Ω		RES 0.1 W 0.1 % 0603
19	1		R105	560 Ω		RES 0.125 W 1 % 0603
20	1		R108	1.02 k Ω		RES 0.1 W 1 % 0603
21	7		U16, U20, U22, U24, U26, U28, U30		ZLDO1117KTC	voltage regulator
22	6		U17, U21, U23, U25, U27, U29		TME1209S	9 V DC-to-DC converter
23	1		U31		TME1205S	5 V DC-to-DC converter
24	2		U32, U33		ADR3412ARJZ-R2	voltage reference 1.2 V

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Table 4. BATT-14EMULATOR 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 μ F		50 V capacitor 1206
2	29	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, C65	10 μ F		50 V capacitor 1206
3	14		C3, C7, C11, C15, C19, C23, C27, C31, C35, C39, C43, C47, C51, C55	100 μ F		10 V capacitor 1206
4	5		C63, C64, C66, C67, C69	10 μ F		50 V capacitor 1206
5	1		C68	47 μ F		25 V capacitor 1206
6	4		C70, C71, C72, C73	0.1 μ F		50 V capacitor 0603
7	1		D2		APT3216SURCK	LED red
8	1		D3	40 V	SS24T3G	diode 2 A 40 V SMB
9	1		F1	4 A	SF-1206SP400-2	fuse 4 A SMD 1206
10	1		F2	0.25 A	F0805B0R25FSTR	fuse 0.25 A SMD 0805
11	1		J1		N2534-5002-RB	CON 2X17
12	1		J2		930224101	banana red
13	1		J6		PJ-053DH	PWR jack 1.3 mm
14	1		J23		930224100	banana black
15	15		R22, R24, R26, R28, R30, R32, R34, R36, R38, R40, R42, R44, R46, R48, R107	340 Ω		RES 0.125 W 1 % 0603
16	16		R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R99, R102	22 Ω		RES 0.25 W 5 % 1206
17	15		R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R100	1 k Ω	PTA4543-2015CPB 102	RES POT 1 k Ω 0.25 W
18	2		R101, R104	3.3 k Ω		RES 0.1 W 0.1 % 0603
19	1		R105	560 Ω		RES 0.125 W 1 % 0603
20	1		R108	1.02 k Ω		RES 0.1 W 1 % 0603
21	15		U2, U4, U6, U8, U10, U12, U14, U16, U18, U20, U22, U24, U26, U28, U30		ZLDO1117KTC	voltage regulator
22	14		U3, U5, U7, U9, U11, U13, U15, U17, U19, U21, U23, U25, U27, U29		TME1209S	9 V DC-to-DC converter

Item	Qty	Assembly option	Reference	Value	Manufacturing part number	Description
23	1		U31		TME1205S	5 V DC-to-DC converter
24	2		U32, U33		ADR3412ARJZ-R2	voltage reference 1.2 V

7 References

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

Table 5. References

Item	Description	Link
BATT-6EMULATOR	tool summary page	http://www.nxp.com/BATT-6EMULATOR
BATT-14EMULATOR	tool summary page	http://www.nxp.com/BATT-14EMULATOR
MC33771 MC33772	battery cell controllers page	http://www.nxp.com/Battery-Cell-Controllers
FRDM33771BSPIEBV	evaluation kit	http://www.nxp.com/FRDM33771BSPIEBV
FRDM33771BTPLEVB	evaluation kit	http://www.nxp.com/FRDM33771BTPLEVB
FRDM33772BSPIEBV	evaluation kit	http://www.nxp.com/FRDM33772BSPIEBV
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