



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



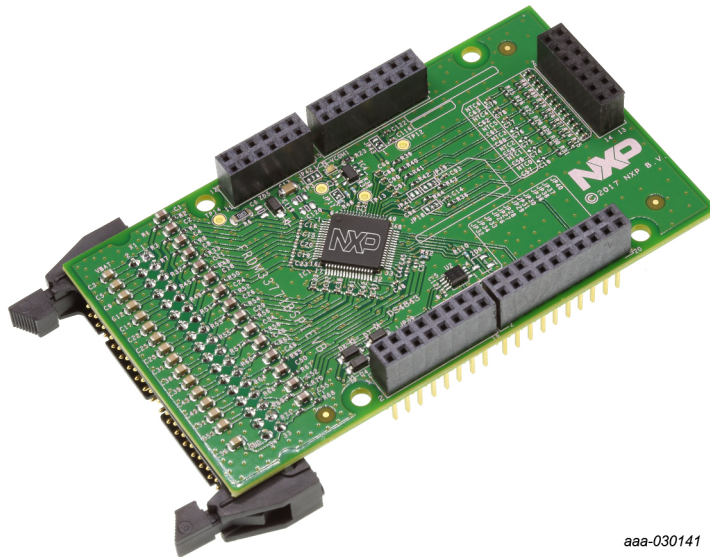
FRDM33771BSPIEBV

Featuring the MC33771B battery cell controller IC

Rev. 1.0 — 29 June 2018

User guide

1 FRDM33771BSPIEBV



aaa-030141



2 Important notice

NXP provides the enclosed product(s) under the following conditions:

This evaluation kit is intended for use of ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY. It is provided as a sample IC pre-soldered to a printed circuit board to make it easier to access inputs, outputs, and supply terminals. This evaluation board may be used with any development system or other source of I/O signals by simply connecting it to the host MCU or computer board via off-the-shelf cables. This evaluation board is not a Reference Design and is not intended to represent a final design recommendation for any particular application. Final device in an application will be heavily dependent on proper printed circuit board layout and heat sinking design as well as attention to supply filtering, transient suppression, and I/O signal quality.

The goods provided may not be complete in terms of required design, marketing, and or manufacturing related protective considerations, including product safety measures typically found in the end product incorporating the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. In order to minimize risks associated with the customers applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards. For any safety concerns, contact NXP sales and technical support services.

Should this evaluation kit not meet the specifications indicated in the kit, it may be returned within 30 days from the date of delivery and will be replaced by a new kit.

NXP reserves the right to make changes without further notice to any products herein. NXP makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does NXP assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typical", must be validated for each customer application by customer's technical experts.

NXP does not convey any license under its patent rights nor the rights of others. NXP products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the NXP product could create a situation where personal injury or death may occur.

Should the Buyer purchase or use NXP products for any such unintended or unauthorized application, the Buyer shall indemnify and hold NXP and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges NXP was negligent regarding the design or manufacture of the part. NXP and the NXP logo are trademarks of NXP B.V. All other product or service names are the property of their respective owners. © 2018 NXP B.V.

3 Getting started

The NXP analog product development boards provide an easy-to-use platform for evaluating NXP products. These development boards support a range of analog, mixed-signal, and power solutions. These boards incorporate monolithic integrated circuits and system-in-package devices that use proven high-volume technology. NXP products offer longer battery life, a smaller form factor, reduced component counts, lower cost, and improved performance in powering state-of-the-art systems.

The tool summary page for FRDM33771BSPIEBV is at nxp.com/FRDM33771BSPIEBV. The overview tab on this page provides an overview of the device, a list of device features, a description of the kit contents, links to supported devices and a **Get Started** section.

The **Get Started** section provides information applicable to using the FRDM33771BSPIEBV.

1. Go to nxp.com/FRDM33771BSPIEBV.
2. On the **Overview** tab, locate the **Jump To** navigation feature on the left side of the window.
3. Select the **Get Started** link.
4. Review each entry in the **Get Started** section.
5. Download an entry by clicking on the linked title.

After reviewing the **Overview** tab, visit the other related tabs for additional information:

- **Documentation:** Download current documentation.
- **Software & Tools:** Download current hardware and software tools.
- **Buy/Parametrics:** Purchase the product and view the product parametrics.

After downloading files, review each file, including the user guide, which includes setup instructions. If applicable, the Bill of Materials (BOM), supporting schematics, and layout are available via NXP DocStore. [5]

3.1 Kit contents/packing list

The kit contents include:

- Assembled and tested evaluation board/module in anti-static bag
- Quick-start guide

3.2 Required equipment

To use this kit, you need:

- A 7- to 14-cell battery pack, such as BATT-14AAAPACK, or a battery pack emulator, such as BATT-14EMULATOR

4 Getting to know the hardware

4.1 Board overview

The FRDM33771BSPIEBV serves as a hardware evaluation tool in support of NXP's MC33771B device. The MC33771B is a battery cell controller that monitors up to 14 lithium-ion battery cells. It is designed for use in both automotive and industrial

applications. The device performs ADC conversion on the differential cell voltages and currents. It is also capable of battery charge coulomb counting and battery temperature measurements. The FRDM33771BSPIEVB is an ideal platform for rapid prototyping of MC33771B-based applications that involve current, voltage, and temperature sensing.

The FRDM33771BSPIEVB supports standard SPI interface. The information is digitally transmitted to a microcontroller for processing.

4.2 Board features

This FRDM33771BSPIEVB's main features are as follows:

- Standard SPI communication
- LED indicator for operation mode
- Cell-balancing resistors
- Cell sense input with RC filter
- GPIO: digital I/O, wake-up inputs, convert trigger inputs, ratiometric analog inputs, analog inputs with absolute measurements
- EEPROM (connected to the IC with I²C interface) to store user-defined calibration parameters
- Fault detection pin report

4.3 Block diagram

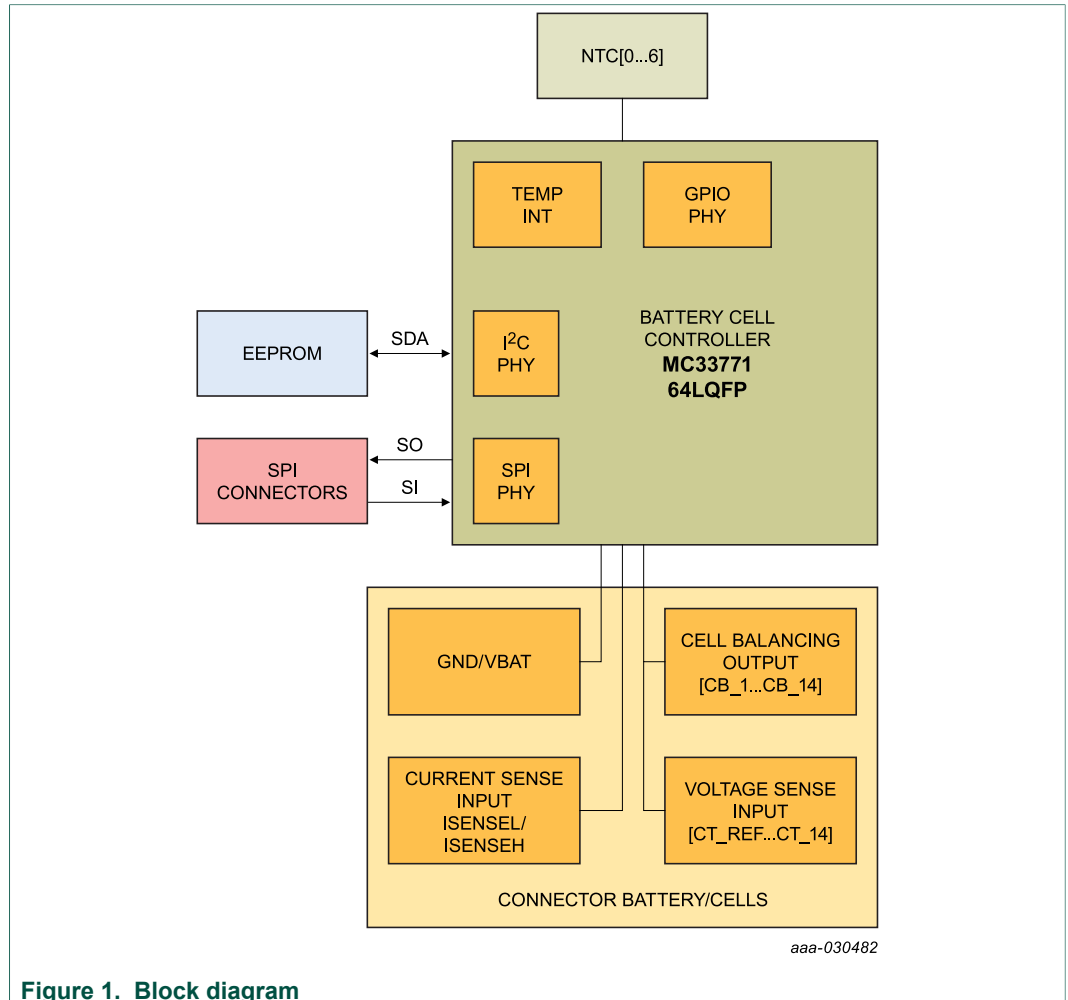


Figure 1. Block diagram

4.4 Device features

The MC33771B is a battery cell controller IC designed to monitor battery characteristics, such as voltage, current and temperature. The MC33771B contains all the circuit blocks necessary to perform synchronous battery cell voltage/current measurement, coulomb counting, cell temperature measurement and integrated cell balancing. The device supports the following functions:

Table 1. MC33771B device features

Device	Description	Features
MC33771B	Battery cell controller	<ul style="list-style-type: none"> • 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 • 0.8 mV maximum total voltage measurement error • Synchronized cell voltage/current measurement with coulomb count • 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 capability • Fully compatible with the MC33772 for a maximum of six cells • Qualified in compliance with AECQ-100

4.5 Board description

The FRDM33771BSPIEBV allows the user to exercise all the functions of the MC33771B battery controller cell.

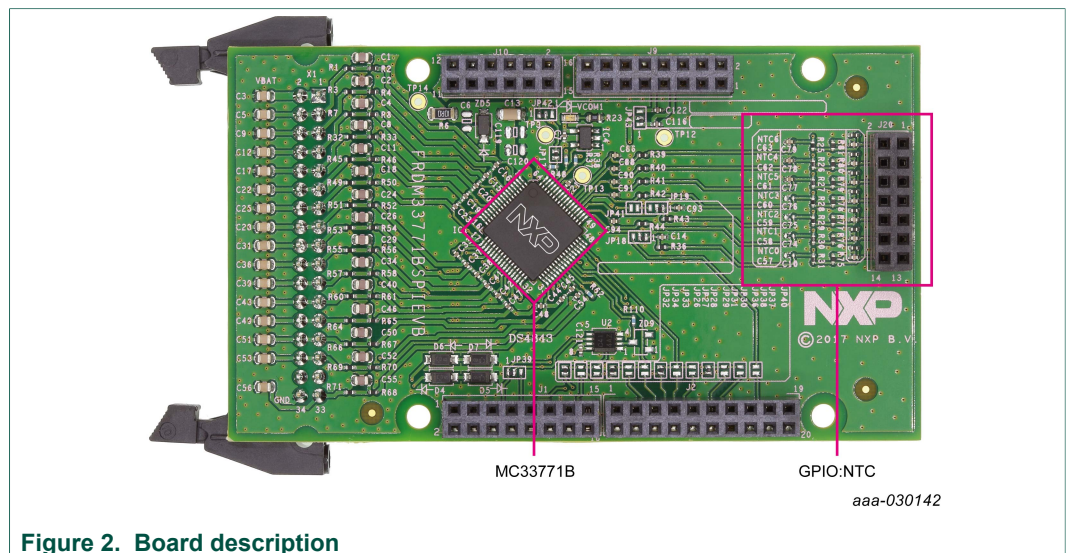


Figure 2. Board description

Table 2. Board description

Name	Description
MC33771B	Battery-cell controller IC
GPIO:NTC[0...6]	Support off-board NTC

4.6 VCOM LED

The VCOM LED is located on the board as shown in [Figure 3](#).

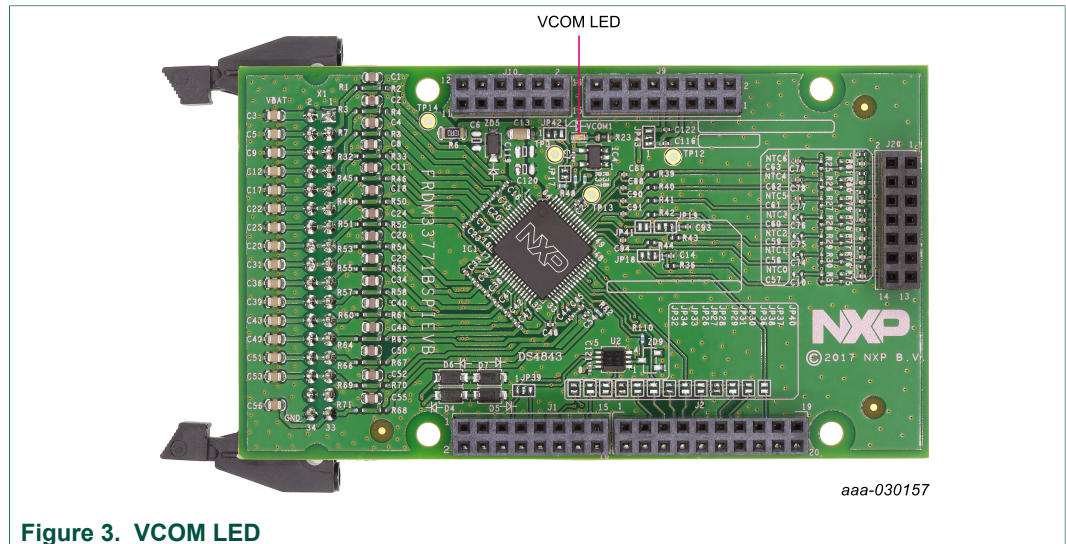


Figure 3. VCOM LED

The VCOM LED indicates when the device is in normal mode. Upon reset, the MC33771B enters into normal mode (VCOM turns on). If there is no activity on the bus after a timeout period of 60 seconds, the device enters low-power idle mode (VCOM turns off). Once the device is initialized, if no communication occurs on the TPL bus after one second, the device resets and the LED turns off (VCOM off). Depending on the device settings, the VCOM LED may flash 0.1...8 seconds during cyclic acquisition.

4.7 Test-point definitions

[Figure 4](#) shows the location of the test points on the board.

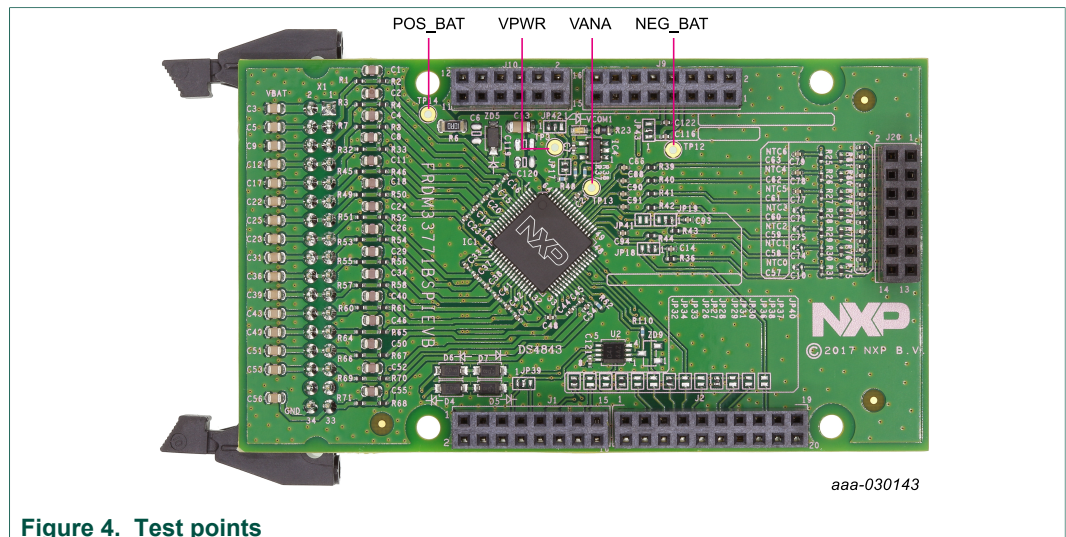


Figure 4. Test points

The following test points provide access to various signals to and from the board.

Table 3. Test points

Test-point name	Signal name	Description
NEG_BAT	GNDREF	Ground reference of the device
POS_BAT	V _{BAT}	Positive V _{BAT}
VPWR	VPWR	Power input to the device
VANA	VANA	Precision ADC analog supply output

4.8 Connectors

Figure 5 shows the location of connectors on the board. The following tables list the pinouts for each connector.

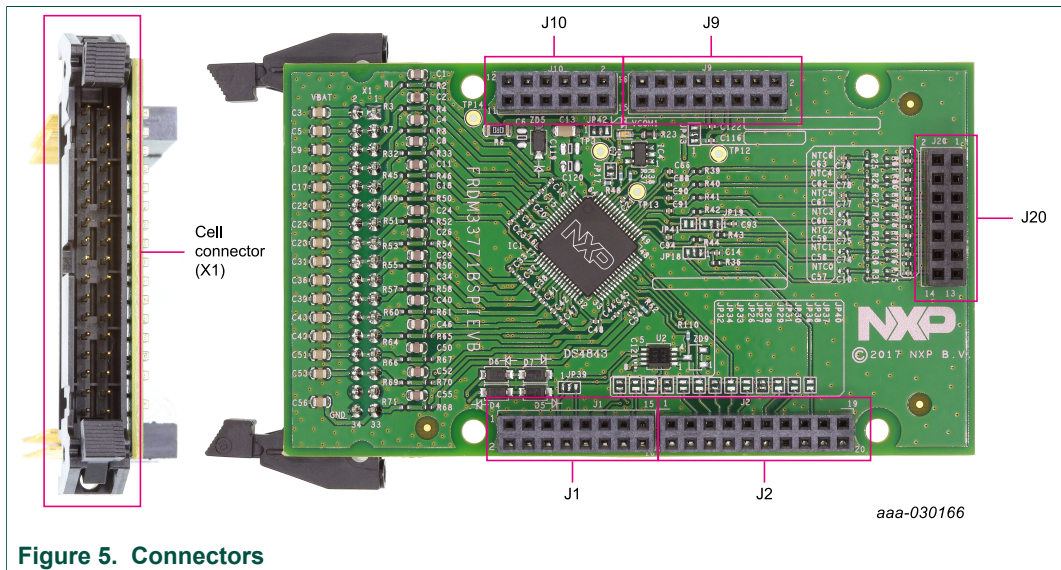


Figure 5. Connectors

Table 4. Connector (J1)

Pin #	Name	Description
6	FAULT_ALT0	Connected via J39_1-2 to FAULT_SPI_MCU
8	FAULT_ALT1	Connected via J39_3-2 to FAULT_SPI_MCU
9	SCLK_ALT0	Connected via J39 to SCLK
14	CSB_ALT0 and MISO_ALT2	Connected via J26 to CSB and VIA J34 to SO
Other	—	No connection

Table 5. Connector (J2)

Pin #	Name	Description
5	CSB_ALT2	Connected via J28 to CSB
6	CSB_ALT1	Connected via J27 to CSB
7	MOSI_ALT2	Connected via J31 to SI

Pin #	Name	Description
8	MOSI_ALT0 and MISO_ALT1	Connected via J29 to SI, J33 to SO
10	MISO_ALT0 and MOSI_ALT1	Connected via J32 to SO, J30 to SI
11	SCLK_ALT2	Connected via J38 to SCLK
12	SCLK_ALT1	Connected via J37 to SCLK
14	GND	Connected to GND
18	GPIO0_WKU	Connected via J40 and J18_2-3 to GPIO0
Other	—	No connection

Table 6. Connector (J9)

Pin #	Name	Description
8	+3V3	+3.3 V supply
10	+5V_USB	+5 V USB supply
12	GND	Connected to GND
14	GND	Connected to GND
Other	—	No connection

Table 7. Connector (J10)

Pin #	Name	Description
2	RESET_ALT0	Connected via J42_1-2 and J19_2-3 to GPIO2
6	GPIO2_SOC	Connected via J41 to GPIO2_SOC
Other	—	No connection

Table 8. GPIO connector (J20)

Pin #	Name	Description
1	GND	To GND
2	NTC6_P	To GPIO6
3	GND	To GND
4	NTC5_P	To GPIO5
5	GND	To GND
6	NTC4_P	To GPIO4
7	GND	To GND
8	NTC3_P	To GPIO3
9	GND	To GND

Pin #	Name	Description
10	NTC2_P	To GPIO2
11	GND	To GND
12	NTC1_P	To GPIO1
13	GND	To GND
14	NTC0_P	To GPIO0

Table 9. Cell connector (X1)

Pin #	Connection	Description
X1-1 X1-2	VBAT	MC33771B Power supply
X1-3 X1-4	CT_14 CB_14	Cell pin 14 input with external LPF resistor. Cell balance driver. Terminate to cell 14 cell balance load resistor
X1-5 X1-6	CT_13 CB_14:13_C	Cell pin 13 input with external LPF resistor. Cell balance 14:13 common. Terminate to cell 14 and 13 common pin
X1-7 X1-8	CT_12 CB_13/CB_12	Cell pin 12 input with external LPF resistor. Cell balance driver. Terminate to cell 13 and 12 cell balance load resistor
X1-9 X1-10	CT_11 CB_12:11_C	Cell pin 11 input with external LPF resistor. Cell balance 12:11 common. Terminate to cell 12 and 11 common pin
X1-11 X1-12	CT_10 CB_11/CB_10	Cell pin 10 input with external LPF resistor. Cell balance driver. Terminate to cell 11 and 10 cell balance load resistor
X1-13 X1-14	CT_9 CB_10:9_C	Cell pin 9 input with external LPF resistor. Cell balance 10:9 common. Terminate to cell 10 and 9 common pin
X1-15 X1-16	CT_8 CB_9/CB_8	Cell pin 8 input with external LPF resistor. Cell balance driver. Terminate to cell 9 and 8 cell balance load resistor
X1-17 X1-18	CT_7 CB_8:7_C	Cell pin 7 input with external LPF resistor. Cell balance 8:7 common. Terminate to cell 8 and 7 common pin
X1-19 X1-20	CT_6 CB_7/CB_6	Cell pin 6 input with external LPF resistor. Cell balance driver. Terminate to cell 7 and 6 cell balance load resistor
X1-21 X1-22	CT_5 CB_6:5_C	Cell pin 5 input with external LPF resistor. Cell balance 6:5 common. Terminate to cell 6 and 5 common pin
X1-23 X1-24	CT_4 CB_5/CB_4	Cell pin 4 input with external LPF resistor. Cell balance driver. Terminate to cell 5 and 4 cell balance load resistor
X1-25 X1-26	CT_3 CB_4:3_C	Cell pin 3 input with external LPF resistor. Cell balance 4:3 common. Terminate to cell 4 and 3 common pin
X1-27 X1-28	CT_2 CB_3/CB_2	Cell pin 2 input with external LPF resistor. Cell balance driver. Terminate to cell 3 and 2 cell balance load resistor
X1-29 X1-30	CT_1 CB_2:1_C	Cell pin 1 input with external LPF resistor. Cell balance 2:1 common. Terminate to cell 2 and 1 common pin
X1-31	ISENSE_+	Current measurement input+ with external filter RC

Pin #	Connection	Description
X1-32	ISENSE_–	Current measurement input– with external filter RC
X1-33	CT_REF CB_1	Cell pin REF input with external LPF resistor. Cell balance driver. Terminate to cell 1 cell balance load resistor.
X1-34	GND	Negative_Battery

4.9 External EEPROM

The FRDM33771BSPIEBV has an integrated gateway communication link to an external local EEPROM. The MC33771B's I²C Communication Interface manages communication with the EEPROM.

After a reset, the EEPROM is not enabled. When the EEPROM is enabled, the device can load the EEPROM calibration parameters into the MC33771B registers.

4.10 GPIO configuration

The FRDM33771BSPIEBV offers seven customizable GPIOs [GPIO_0...GPIO_6] for measuring external temperature with a bridge divider. [GPIO_0] can be used as the input for wake-up or fault daisy chain.

4.11 Cell terminal voltage measurement

The differential measurement of each cell terminal input is designed to function in conjunction with an external anti-aliasing filter with a corner frequency.

4.12 Current sensing

The FRDM33771BSPIEBV supports current sense function with off-board shunt resistor. The off-board shunt resistor shall be connected between X1-31 (ISENSE+) and X1-32 (ISENSE–). On-board current sensing filter and protection circuits can be found in EVB schematic shared via NXP DocStore (NDA required).

4.13 SPI communication interface

The MC33771B SPI interface is a standard SPI slave interface with a chip select (CSB), clock (SCLK), Slave Out (SO), and Slave In (SI). The SI/SO shifting of the data follows a first-in-first-out protocol, with both input and output words transferring the Most Significant Bit (MSB) first.

All SPI communication to the MC33771B is controlled by the microcontroller. One 40-bit register of previously requested data is retrieved through serial out for each current serial in message sent by the MCU. For message integrity and communication robustness, each SPI transmit message consists of six fields containing 40 bits.

The six transmit fields are defined as the following:

1. Cyclical redundancy check (8 bits)
2. Command field (4 bits)
3. Cluster ID field (4 bits)
4. Memory address field (7 bits)
5. Master/slave field (1 bit)

6. Memory data field (16 bits)

Messages having less or more than 40 bits or incorrect CRC are disregarded. Communication faults set the COM_ERR_FLT fault bit in the FAULT1_STATUS register and increments the COM_STATUS[COM_ERR_COUNT] register.

Detailed schematic, component selection, and layout recommendations can be obtained from the NXP DocStore (NDA required) [5].

5 Configuring the hardware

The FRDM33771BSPIEBV can be configured as a shield board connected to selected Freedom boards.

5.1 Compatible NXP MCU development platforms

FRDM33771BSPIEBV is compatible with multiple NXP MCU development platforms:

- FRDM-KL25Z (default)
- FRDM-KE06Z
- FRDM-KL43Z
- FRDM-KV31F
- FRDM-KW40Z
- FRDM-KEAZ128
- S32K144EVB
- Arduino R3

MCU development platform ordering, instruction, and other information is on nxp.com.

Table 10. Jumper setting to work with FRDM-KL25Z (default)

Jumper	Setting	Description
JP26	1-2	CSB
JP27	open	—
JP28	open	—
JP29	1-2	MOSI
JP30	open	—
JP31	open	—
JP32	1-2	MISO
JP33	open	—
JP34	open	—
JP36	1-2	SLCK
JP37	open	—
JP38	open	—
JP39	1-2	FAULT
JP42	1-2	RESET
JP43	1-2	3.3 V

Table 11. Jumper setting to work with FRDM-KE06Z

Jumper	Setting	Description
JP26	open	—
JP27	1-2	CSB
JP28	open	—
JP29	1-2	MOSI
JP30	open	—
JP31	open	—
JP32	open	—
JP33	open	—
JP34	1-2	MISO
JP36	open	—
JP37	1-2	SLCK
JP38	open	—
JP39	2-3	FAULT
JP42	2-3	RESET
JP43	1-2	3.3 V

Table 12. Jumper setting to work with FRDM-KL43Z

Jumper	Setting	Description
JP26	open	—
JP27	1-2	CSB
JP28	open	—
JP29	1-2	MOSI
JP30	open	—
JP31	open	—
JP32	1-2	MISO
JP33	open	—
JP34	open	—
JP36	open	—
JP37	1-2	SLCK
JP38	open	—
JP39	2-3	FAULT
JP42	2-3	RESET
JP43	1-2	3.3 V

Table 13. Jumper setting to work with FRDM-KV31F

Jumper	Setting	Description
JP26	open	—
JP27	1-2	CSB
JP28	open	—
JP29	1-2	MOSI
JP30	open	—
JP31	open	—
JP32	1-2	MISO
JP33	open	—
JP34	open	—
JP36	open	—
JP37	1-2	SLCK
JP38	open	—
JP39	2-3	FAULT
JP42	2-3	RESET
JP43	1-2	3.3 V

Table 14. Jumper setting to work with FRDM-KW40Z

Jumper	Setting	Description
JP26	1-2	CSB
JP27	open	—
JP28	open	—
JP29	open	—
JP30	1-2	MOSI
JP31	open	—
JP32	open	—
JP33	1-2	MISO
JP34	open	—
JP36	open	—
JP37	1-2	SLCK
JP38	open	—
JP39	2-3	FAULT
JP42	2-3	RESET
JP43	1-2	3.3 V

Table 15. Jumper setting to work with FRDM-KEAZ128

Jumper	Setting	Description
JP26	open	—
JP27	1-2	CSB
JP28	open	—
JP29	1-2	MOSI
JP30	open	—
JP31	open	—
JP32	1-2	MISO
JP33	open	—
JP34	open	—
JP36	open	—
JP37	1-2	SLCK
JP38	open	—
JP39	1-2	FAULT
JP42	1-2	RESET
JP43	1-2	3.3 V

Table 16. Jumper setting to work with S32K144EVB

Jumper	Setting	Description
JP26	open	—
JP27	1-2	CSB
JP28	open	—
JP29	1-2	MOSI
JP30	open	—
JP31	open	—
JP32	1-2	MISO
JP33	open	—
JP34	open	—
JP36	open	—
JP37	1-2	SLCK
JP38	open	—
JP39	2-3	FAULT
JP42	1-2	RESET
JP43	2-3	5 V

Table 17. Jumper setting to work with Arduino R3

Arduino R3 has a single-line connector that connects to the outer row of the FRDM33771BSPIEBV connectors.

Jumper	Setting	Description
JP26	open	—
JP27	1-2	CSB
JP28	open	—
JP29	1-2	MOSI
JP30	open	—
JP31	open	—
JP32	1-2	MISO
JP33	open	—
JP34	open	—
JP36	open	—
JP37	1-2	SLCK
JP38	open	—
JP39	2-3	FAULT
JP42	2-3	RESET
JP43	1-2	3.3 V

5.2 Freedom board configuration

The layout of the connectors allow MCU development boards mentioned in [Section 5.1 "Compatible NXP MCU development platforms"](#) to be mounted directly to the FRDM33771BSPIEBV. See [Figure 6](#). When both boards are connected together, the SPI connector is directly connected with the MCU SPI pins. The routing of SPI signals through the Arduino connectors depends on the specific Freedom board being used. In this configuration, power is supplied to the FRDM33771BSPIEBV through a USB cable connected between the Freedom board and a PC. No external power supply is required.

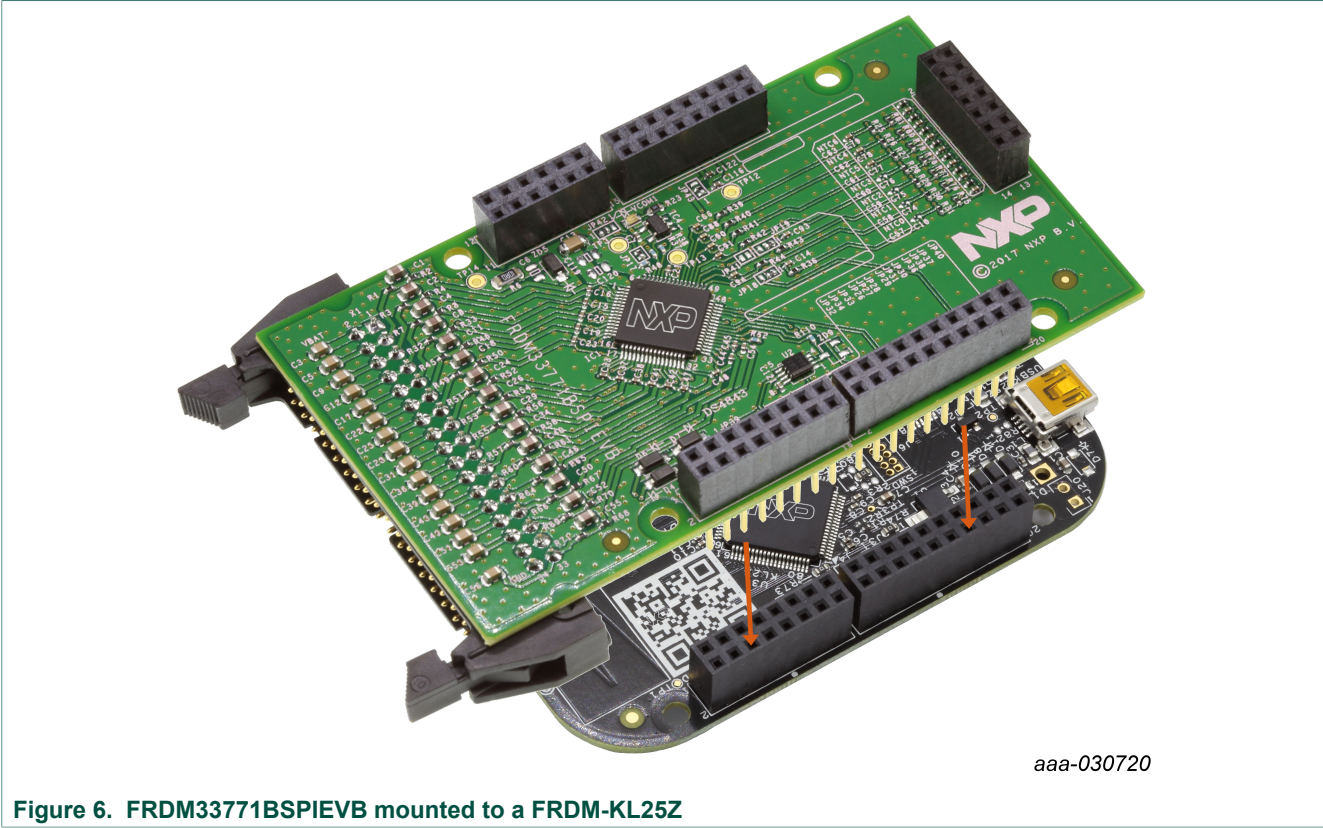


Figure 6. FRDM33771BSPIEBV mounted to a FRDM-KL25Z

The board must be modified to be compatible with each specific Freedom board. This modification is described in [Section 5.1 "Compatible NXP MCU development platforms"](#).

5.3 Off-board NTC configuration

FRDM33771BSPIEBV supports off-board NTC, please follow the instruction in the following table.

Table 18. Off-board NTC configuration

Remove	Connect off-board NTC between
NTC0	J20 13-14
NTC1	J20 11-13
NTC2	J20 9-10
NTC3	J20 7-8
NTC4	J20 5-6
NTC5	J20 3-4
NTC6	J20 1-2

6 Available accessories

Note: 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 customer's responsibility to validate their application.

Table 19. Bill of materials

Part number	Description
M50-9101742	34-pin ribbon cable
BATT-14AAAPACK	3- to 14-cell configurable AAA battery pack
BATT-14EMULATOR	14-cell slider battery pack emulator kit with shunt for current sense

7 References

- [1] Board summary page — nxp.com/FRDM33771BSPIEBV
- [2] Product summary page — nxp.com/BATTERY-CELL-CONTROLLERS
- [3] Tool summary page for BATT-14AAAPACK battery pack — nxp.com/BATT-14AAAPACK
- [4] Tool summary page for battery emulators — nxp.com/BATT-14EMULATOR
- [5] NXP DocStore — docstore.nxp.com

8 Revision history

Table 20. Revision history

Rev	Date	Description
v.1.0	20180629	Initial release

9 Legal information

9.1 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

9.2 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors. In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory. Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification. Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products. NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Evaluation products — This product is provided on an "as is" and "with all faults" basis for evaluation purposes only. NXP Semiconductors, its affiliates

and their suppliers expressly disclaim all warranties, whether express, implied or statutory, including but not limited to the implied warranties of non-infringement, merchantability and fitness for a particular purpose. The entire risk as to the quality, or arising out of the use or performance, of this product remains with customer. In no event shall NXP Semiconductors, its affiliates or their suppliers be liable to customer for any special, indirect, consequential, punitive or incidental damages (including without limitation damages for loss of business, business interruption, loss of use, loss of data or information, and the like) arising out of the use of or inability to use the product, whether or not based on tort (including negligence), strict liability, breach of contract, breach of warranty or any other theory, even if advised of the possibility of such damages. Notwithstanding any damages that customer might incur for any reason whatsoever (including without limitation, all damages referenced above and all direct or general damages), the entire liability of NXP Semiconductors, its affiliates and their suppliers and customer's exclusive remedy for all of the foregoing shall be limited to actual damages incurred by customer based on reasonable reliance up to the greater of the amount actually paid by customer for the product or five dollars (US\$5.00). The foregoing limitations, exclusions and disclaimers shall apply to the maximum extent permitted by applicable law, even if any remedy fails of its essential purpose.

Safety of high-voltage evaluation products — The non-insulated high voltages that are present when operating this product, constitute a risk of electric shock, personal injury, death and/or ignition of fire. This product is intended for evaluation purposes only. It shall be operated in a designated test area by personnel that is qualified according to local requirements and labor laws to work with non-insulated mains voltages and high-voltage circuits. The product does not comply with IEC 60950 based national or regional safety standards. NXP Semiconductors does not accept any liability for damages incurred due to inappropriate use of this product or related to non-insulated high voltages. Any use of this product is at customer's own risk and liability. The customer shall fully indemnify and hold harmless NXP Semiconductors from any liability, damages and claims resulting from the use of the product.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Suitability for use in automotive applications — The use of this NXP Semiconductors product is restricted to automotive applications only. It has not been fully qualified for use in automotive applications. The customer of this NXP Semiconductors product therefore understands and accepts that: The Customer shall only use this NXP Semiconductors product for automotive applications. This product was not originally designed for automotive use. It will therefore, not be possible to achieve the levels of quality and failure analysis that are normally associated with products explicitly designed for automotive use. With respect to test-coverage, this product is not fully compliant to AEC-Q100. All product manufacturing locations are certified according to ISO/TS16949. Unless otherwise agreed in writing, the product is not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

9.3 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Tables

Tab. 1.	MC33771B device features	6	Tab. 11.	Jumper setting to work with FRDM-KE06Z	13
Tab. 2.	Board description	6	Tab. 12.	Jumper setting to work with FRDM-KL43Z	13
Tab. 3.	Test points	8	Tab. 13.	Jumper setting to work with FRDM-KV31F	14
Tab. 4.	Connector (J1)	8	Tab. 14.	Jumper setting to work with FRDM-KW40Z	14
Tab. 5.	Connector (J2)	8	Tab. 15.	Jumper setting to work with FRDM-KEAZ128	15
Tab. 6.	Connector (J9)	9	Tab. 16.	Jumper setting to work with S32K144EVB	15
Tab. 7.	Connector (J10)	9	Tab. 17.	Jumper setting to work with Arduino R3	16
Tab. 8.	GPIO connector (J20)	9	Tab. 18.	Off-board NTC configuration	17
Tab. 9.	Cell connector (X1)	10	Tab. 19.	Bill of materials	18
Tab. 10.	Jumper setting to work with FRDM-KL25Z (default)	12	Tab. 20.	Revision history	18

Figures

Fig. 1.	Block diagram	5	Fig. 5.	Connectors	8
Fig. 2.	Board description	6	Fig. 6.	FRDM33771BSPIEBV mounted to a FRDM-KL25Z	17
Fig. 3.	VCOM LED	7			
Fig. 4.	Test points	7			

Contents

1	FRDM33771BSPIEBV	1
2	Important notice	2
3	Getting started	3
3.1	Kit contents/packing list	3
3.2	Required equipment	3
4	Getting to know the hardware	3
4.1	Board overview	3
4.2	Board features	4
4.3	Block diagram	5
4.4	Device features	5
4.5	Board description	6
4.6	VCOM LED	7
4.7	Test-point definitions	7
4.8	Connectors	8
4.9	External EEPROM	11
4.10	GPIO configuration	11
4.11	Cell terminal voltage measurement	11
4.12	Current sensing	11
4.13	SPI communication interface	11
5	Configuring the hardware	12
5.1	Compatible NXP MCU development platforms	12
5.2	Freedom board configuration	16
5.3	Off-board NTC configuration	17
6	Available accessories	17
7	References	18
8	Revision history	18
9	Legal information	19

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP B.V. 2018.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 29 June 2018

Document identifier: FRDM33771BSPIEBVUG