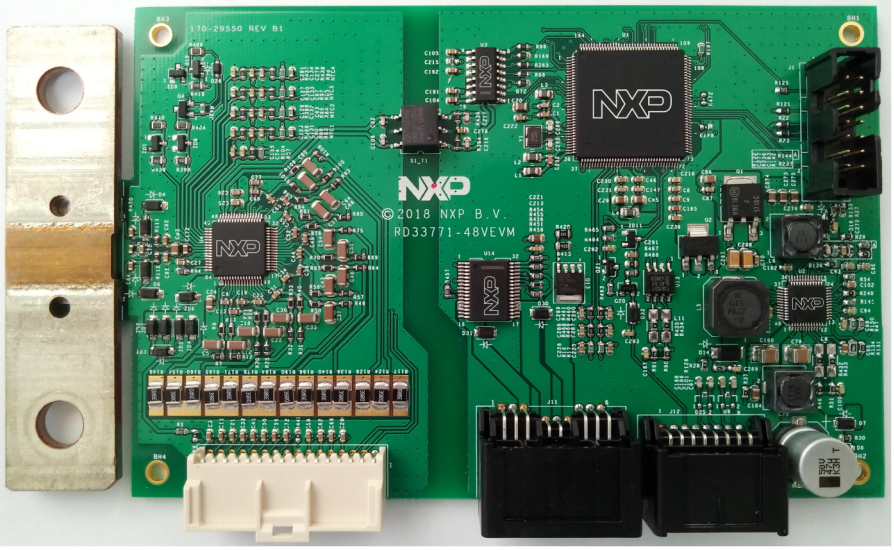
UM11300

48 V Battery management system

Rev. 3 — 19 February 2020 **User manual**



aaa-031712

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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 RD33771-48VEVM, 48 V Battery management system reference design is at http://www.nxp.com/products/:RD33771-48VEVM. 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 RD33771-48VEVM, 48 V Battery management system reference design, including the downloadable assets referenced in this document.

1.1 Collaborate in the NXP Community

The NXP Community is for sharing ideas and tips, ask and answer technical questions, and receive input on just about any embedded design topic.

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

2 Getting started

2.1 Kit contents

- Evaluation board in an antistatic bag
- CAN-bus communication cable
- Assorted cable wires

2.2 Additional hardware

In addition to the kit contents, the following hardware is necessary or beneficial when working with this kit.

- Power supply, 5 V to 28 V with current limit set initially to 1.5 A to 9.0 A
- Oscilloscope, preferably 4 channels, with current probe (optional)
- Typical loads: 48 V lithium-ion battery, battery simulator, motor, contactor, fan
- Multilink FX

2.3 Windows PC workstation

This evaluation board requires a Windows PC workstation. Meeting the minimum specifications below should produce great results when working with this evaluation board.

- Windows 10, 8 or 7 compatible PC with an available USB port

2.4 Software

Installing software is recommended to work with this evaluation board. All listed software is available on the evaluation board's information page[1].

- S32 design studio IDE for power architecture-based microcontroller unit (MCU)

3 Getting to know the hardware

3.1 General description: RD33771-48VEVM

The RD33771-48VEVM is a hardware tool for evaluation and development and is ideal for rapid prototyping of a 48 V battery management system (BMS). This board can be used to evaluate the features of the MC33771 device. The RD33771-48VEVM allows the user to connect up to 14 channels for cell voltage sensing, up to 2 channels for current sensing, and up to 6 channels for temperature sensing.

3.2 Features: RD33771-48VEVM

- Up to 14 channels for cell voltage sensing, with overvoltage (OV) and undervoltage (UV) protection
- Up to 2 channels for current sensing, with overcurrent (OC) protection
- Up to 6 channels for temperature sensing
  - 3 channels for battery cell temperature sensing
  - 1 channel for shunt resistor temperature sensing
  - 2 channels for air flow area temperature sensing executed by MCU ADC
- Main contactor status detection
- External cool fan control
- Up to 2 CAN-bus communication channels
  - 1 channel to vehicle CAN-bus
  - 1 channel is reserved
- External crash detection
- 12 V power supply input

3.3 Block diagram: RD33771-48VEVM

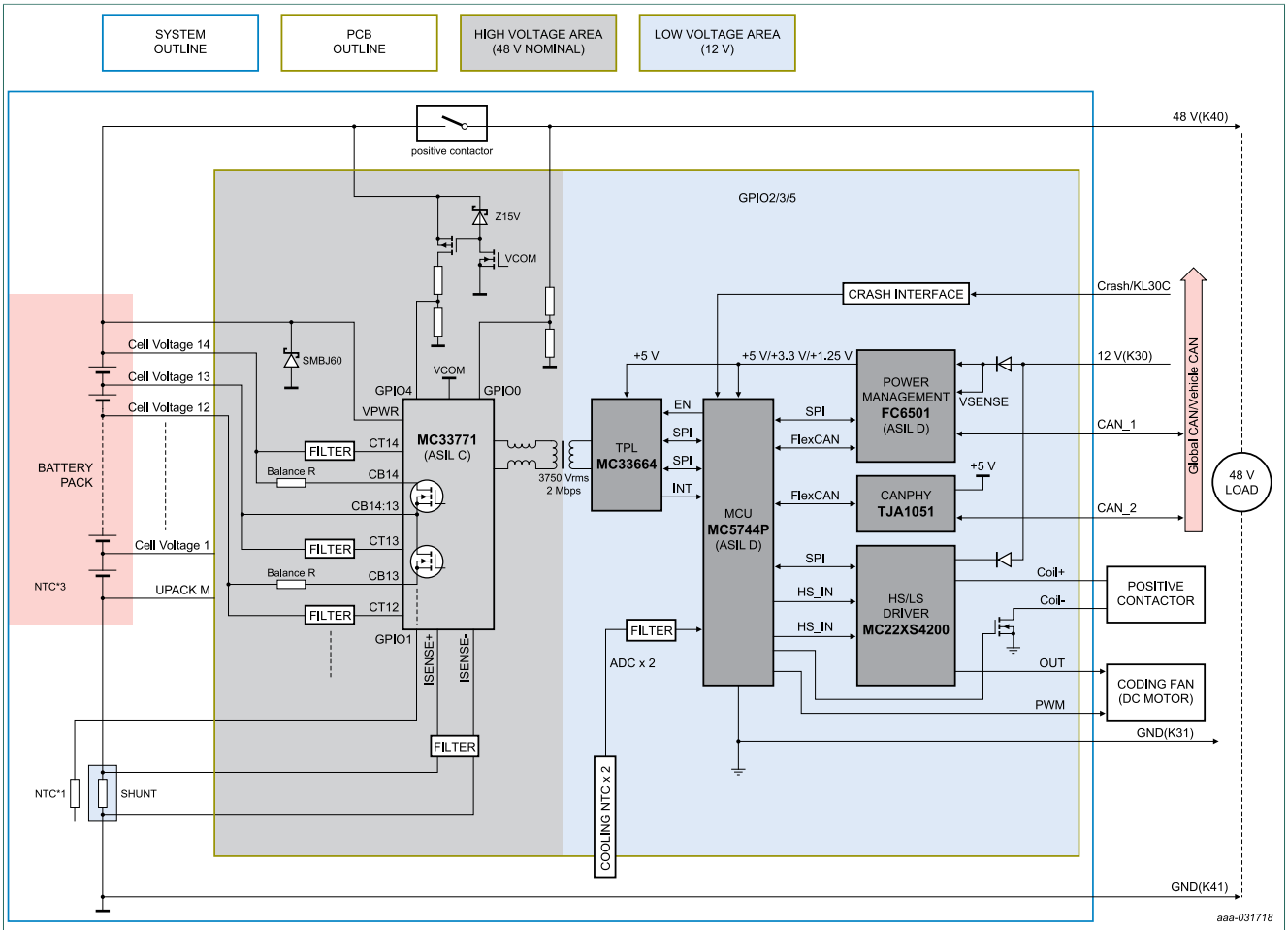


Figure 1. Block diagram: RD33771-48VEVM

3.4 Reference design featured components

The RD33771-48VEVM allows the user to exercise all the functions of the MC33771.

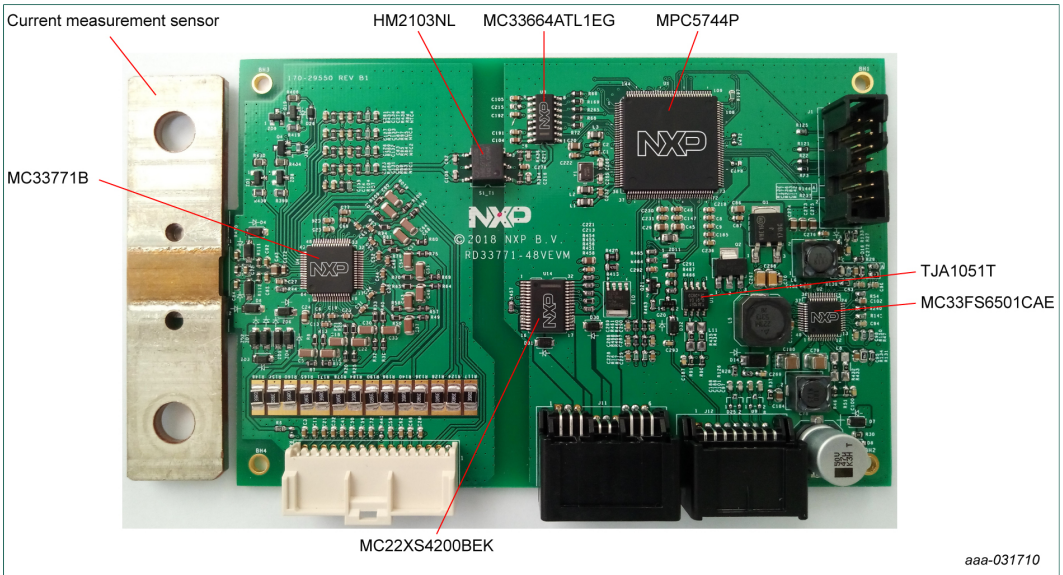


Figure 2. Board description

Table 1. Board description

Name	Description
MPC5744P	32-bit MCU 2.5 MB flash 384 kB SRAM 180 MHz 3.3 V LQFP144
MC33FS6501CAE	System basis chip 0.8 A FS1B CAN LQFP48
MC22XS4200BEK	Dual high-side switch 24 V 22 mΩ 3 V to 5.5 V SOIC32 IC to drive contactor
TJA1051T	High-speed CAN bus transceiver 1 Mbit/s 3 V to 5 V SO8
MC33664ATL1EG	Isolated communication IC
MC33771B	SMARTMOS lithium-ion battery cell controller IC
HM2103NL	Isolated transformer
12	Current measurement sensor

3.4.1 Devices and features

This reference design/evaluation board features the following NXP products.

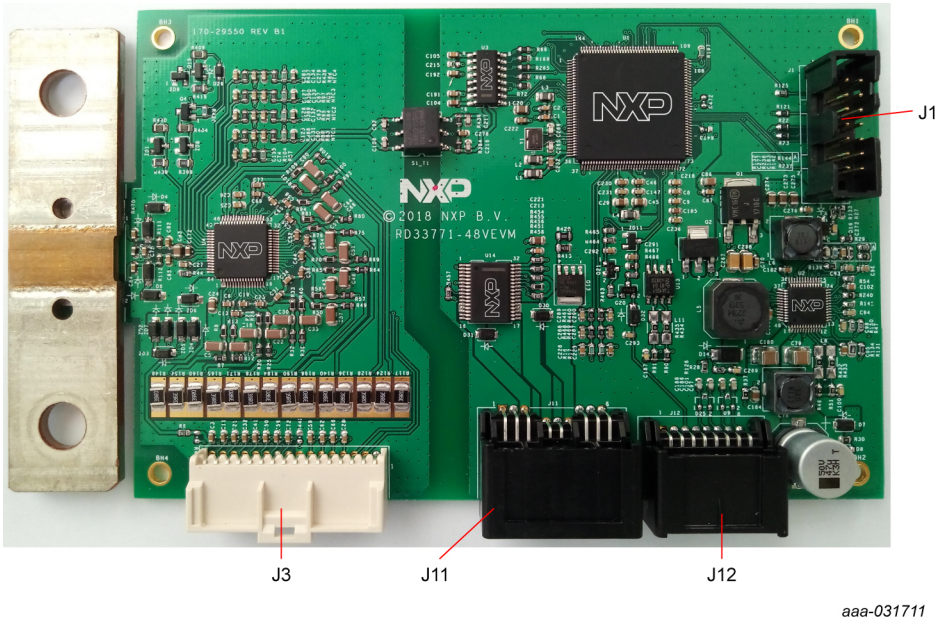
Table 2. Device features

Device	Description	Features
MC33771	Battery cell controller; 14-channel analog front end (AFE)	• 9.6 V ≤ VPWR ≤ 61.6 V operation, 75 V transient • 7 cells to 14 cells management • Isolated 2.0 Mbit/s differential communication or 4.0 Mbit/s serial peripheral interface (SPI) • Addressable on initialization • 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 overvoltage/undervoltage and temperature detection routable to fault pin • Integrated sleep mode overvoltage/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 • Single chip automotive safety integrity level (ASIL) C capable • Fully compatible with the MC33772 for a maximum of six cells
MC33664	Isolated network high-speed transceiver; transformer physical layer (TPL)	• 2.0 Mbit/s isolated network communication rate • Dual SPI architecture for message confirmation • Robust conducted and radiated immunity with wake-up • 3.3 V and 5.0 V compatible logic thresholds • Engineered for 5.0 meter, 15 node system • Low sleep mode current with automatic bus wake-up • Ultra-low radiated emissions
MC33FS65XX	System basic chip (SBC)	• Battery voltage sensing and multiplexer (MUX) output pin • Highly flexible switch mode power supply (SMPS) preregulator, allowing two topologies: non-inverting buck-boost and standard buck • Family of devices to supply MCU core from 1.0 V to 5.0 V, with SMPS (0.8 A, 1.5 A or 2.2 A) or LD0 (0.5 A) • Linear voltage regulator dedicated to auxiliary functions, or to sensor supply (VCCA tracker or independent), 5.0 V, or 3.3 V • Linear voltage regulator dedicated to MCU analog-to-digital reference voltage or I/Os supply (VCCA), 5.0 V, or 3.3 V • 3.3 V keep alive memory supply available in low-power mode • Long duration timer, counting up to 6 months with 1.0 s resolution • Multiple wake-up sources in low-power mode: controller area network bus (CAN-bus), local interconnect network (LIN), I/Os, long duration timer (LDT) • Five configurable I/Os

Device	Description	Features
MPC5744P	MCU	• 32-bit MCU suitable for ISO26262 ASIL D chassis and safety applications • The MPC5744P microcontroller is based on the power architecture developed by NXP. It targets chassis and safety applications and other applications requiring a high ASIL. The MPC5744P is a SafeAssure solution. • For functional characteristics and the programming model, see the MPC5744P reference manual. • Junction temperature: The upper limit is 150 °C or 165 °C depending on the device marking.
MC22XS4200	High-side switch	• Two fully protected 22 mΩ (at 25 °C) high-side switches • Up to 3.0 A steady-state current per channel • Separate bulb and DC motor latched overcurrent handling • Individually programmable internal or external pulse width modulation (PWM) clock signals • Overcurrent, short-circuit, and overtemperature protection with programmable auto retry functions • Accurate temperature and current sensing • Open-load detection (channel in OFF and ON state), also for LED applications (7.0 mA typical) • Normal operating range: 8.0 V to 36 V, extended range: 6.0 V to 58 V • 3.3 V and 5.0 V compatible 16-bit SPI port for device control, configuration, and diagnostics at rates up to 8.0 MHz
TJA1051	High-speed CAN transceiver	• ISO 11898-2:2016 and SAE J2284/1 to SAE J2284/5 compliant • Timing guaranteed for data rates up to 5 Mbit/s in the CAN-bus FD fast phase • Suitable for 12 V and 24 V systems • Low electromagnetic emission (EME) and high electromagnetic immunity (EMI) • V_{IO} input on TJA1051T/3 and TJA1051TK/3 allows for direct interfacing with 3 V to 5 V microcontrollers (available in SO8 and very small HVSON8 package, respectively) • EN input on TJA1051T/E allows the microcontroller to switch the transceiver to a very low current OFF mode • Available in SO8 package or leadless HVSON8 package (3.0 mm x 3.0 mm) with improved automated optical inspection (AOI) capability • Dark green product (halogen free and restriction of hazardous substances (RoHS) compliant) • AEC-Q100 qualified

3.5 Connectors

Figure 3 shows the location of connectors on the board. Table 3, Table 4, Table 5, and Table 6 list the pinouts for each connector.



J1 — Joint Test Access Group (JTAG)
J3 — High voltage (HV)
J11 — Low Voltage (LV)
J12 — Low Voltage (LV)

Figure 3. Connectors

Table 3. Connector J1 description

Joint Test Access Group (JTAG)

Pin	Name	Description
1	J1_1	PTB5 TDI
2	J1_2	Ground
3	J1_3	PTB4 TDO
4	J1_4	Ground
5	J1_5	TCK
6	J1_6	Ground
7	J1_7	PTF11 NPC_WRAPPER_EVTI_IN
8	J1_8	EXT_POR_B
9	J1_9	RESET
10	J1_10	TMS
11	J1_11	VCCA
12	J1_12	Ground
13	J1_13	PTJ9 NPC_NEX_RDY_B
14	J1_14	Pulldown resistor, JCOMP

Table 4. Connector J3 description

High voltage (HV)

Pin	Name	Description
1	J3_1	Ground
2	J3_2	PORT_GPIO6
3	J3_3	Ground
4	J3_4	PORT_GPIO5
5	J3_5	Ground
6	J3_6	PORT_GPIO4
7	J3_7	Ground
8	J3_8	PORT_GPIO3
9	J3_9	Ground
10	J3_10	PORT_GPIO2
11	J3_11	Ground
12	J3_12	PORT_GPIO1
13	J3_13	Ground
14	J3_14	PORT_GPIO0
15	J3_15	Ground
16	J3_16	Ground
17	J3_17	CELL0
18	J3_18	CELL1
19	J3_19	CELL2
20	J3_20	CELL3
21	J3_21	CELL4
22	J3_22	CELL5
23	J3_23	CELL6
24	J3_24	CELL7
25	J3_25	CELL8
26	J3_26	CELL9
27	J3_27	CELL10
28	J3_28	CELL11
29	J3_29	CELL12
30	J3_30	CELL13
31	J3_31	CELL14
32	J3_32	VBAT

Table 5. Connector J11 description

Low Voltage (LV)

Pin	Name	Description
1	J11_1	Voltage supply 12 V
2	J11_2	No connection
3	J11_3	COIL_HS
4	J11_4	No connection
5	J11_5	RELAY_+
6	J11_6	No connection
7	J11_7	NTC1
8	J11_8	NTC2
9	J11_9	Ground
10	J11_10	No connection
11	J11_11	Ground
12	J11_12	No connection
13	J11_13	RELAY_–
14	J11_14	No connection
15	J11_15	Ground
16	J11_16	Ground

Table 6. Connector J12 description

Low Voltage (LV)

Pin	Name	Description
1	J12_1	Ground
2	J12_2	No connection
3	J12_3	P_CRASH
4	J12_4	No connection
5	J12_5	CAN1_L
6	J12_6	CAN1_H
7	J12_7	CAN0_L
8	J12_8	CAN0_H

3.6 Schematic, board layout and bill of materials

The schematic, board layout and bill of materials for the RD33771-48VEVM, 48 V Battery management system reference design are available the RD33771-48VEVM tool summary page[1].

3.6.1 Cell voltage measurement

- The cell voltage sensing circuit follows the 33771 spec

- HF capacitor that deal with ESD, BCI, etc.
- Low pass filter between CTx and GND
- Low pass filter between CTx and CTx-1
- Cell balancing resistor
- CB capacitor to GND (optional)

3.6.1.1 Schematic

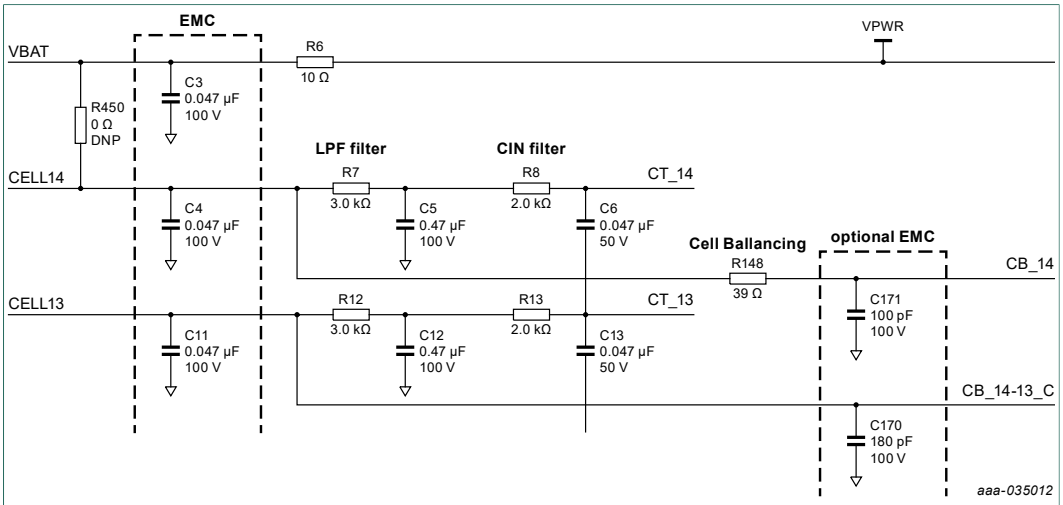


Figure 4. Cell voltage measurement

3.6.1.2 Example code

After MC33771 is initialized and configured, the MCU should send a Start of Conversion (SOC) command to the MC33771 to launch an ADC conversion. After a necessary delay time, the MCU could read back ADC data. See the example code and all the data stored in the following structure.

```
typedef struct {
      uint16_t u16ValidFlags[64];
      uint16_t u16VoltCell[64][24];
      uint16_t u16RawCell[64][24];
      uint16_t u16Temp[64];
      uint16_t u16VbgADC1[64][2];
      int32_t i32Current[64];
      uint32_t u32RawCurrent[64];
      float   u32SocCell[64][15];
      uint16_t u16SiliconRev[64];
      uint16_t u32ECCSignature[64];
      uint16_t u16CCSamples[64];
      uint32_t s32CCCounter[64];
}TYPE_BatteryPack;
```

- The u16RawCell array stores original voltage data content directly read from MC33771's register
- The u16VoltCell array stores converted cell voltages
- The u16Temp array stores converted cell temperature
- The u32RawCurrent array stores original current sensing data directly read from MC33771's register
- The i32Current array stores converted current

3.6.2 Temperature measurement

- The temperature sensing circuit follows the MC33771 routine, from left to right
- Chf capacitor for ESD, BCI, etc.
- The NTC divides voltage from VCOM by series resistor 6.8 K 0.1%
- Low pass filter #1 for onboard temperature measurement, for example, for Cell Balancing resistors area NTC
- Low pass filter #2 for off board temperature measurement, external NTC measurement, if the system requirement is allowed, this 2nd LPF could be removed.

3.6.2.1 Schematic

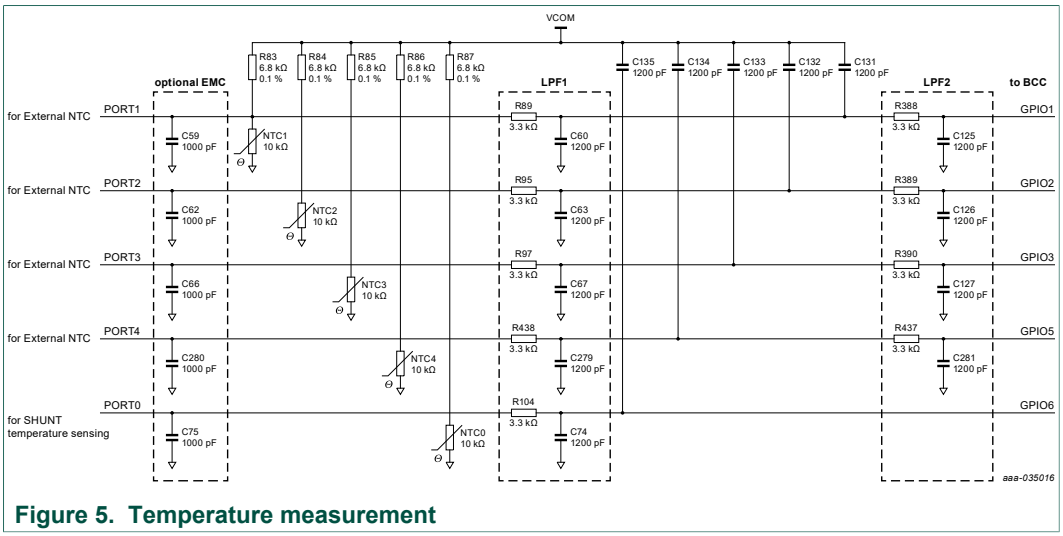


Figure 5. Temperature measurement

3.6.2.2 Example code

The example code works the same way as in Section 3.6.1.2 "Example code".

3.6.3 Current measurement

The ISENSE+,ISENSE– of MC33771 is for current measurement. A typical application schematic is shown in Figure 6.

- If ISENSE+/– cannot be used, connect them directly to GND.
- GPIO5/6 could also measure current. Noise on these pins could impact current measurement accuracy.

3.6.3.1 Schematic

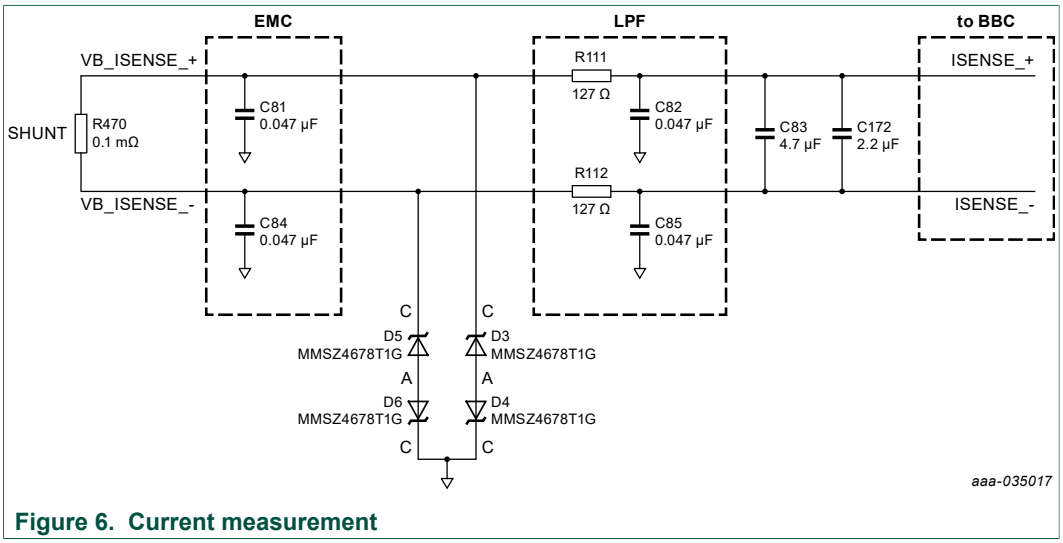


Figure 6. Current measurement

3.6.3.2 Example code

The example code works the same way as in Section 3.6.1.2 "Example code".

3.6.4 Isolation communication

This reference design board uses the isolation TPL communication between MC33771 and MCU(MPC5744P) + MC33664. For other non-Isolation low-cost applications, MC33771 supports direct SPI communication with general MCU.

3.6.4.1 Schematic

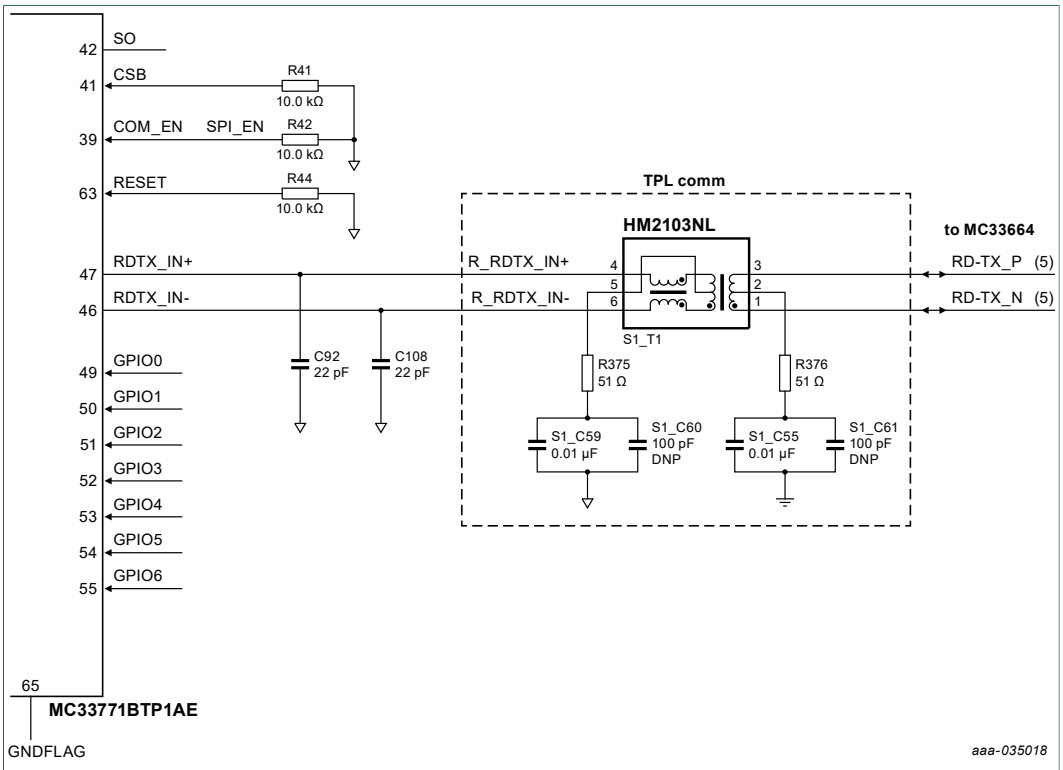


Figure 7. Isolation communication

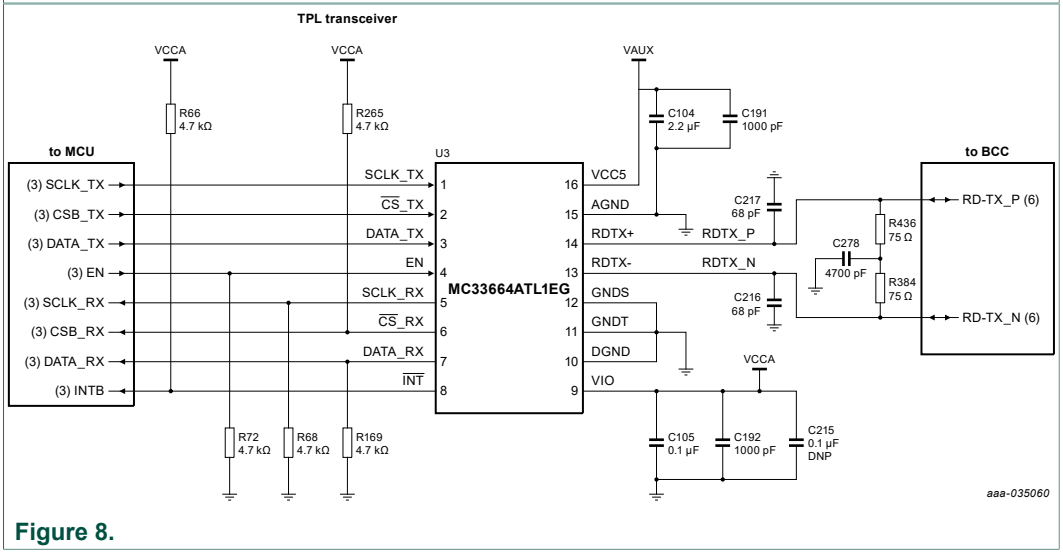


Figure 8.

3.6.5 Relay/Coil Control

This reference design board provides an example for Relay/Coil device control. The high-side device driven by NXP ESwitch device MC22XS4200, which meets ISO26262 ASIL-B level, has diagnostic OC, OL, current sensing, PWM output, etc functions. For more details, see Section 8 "References".

- High-side driver for fans. Connection: COIL_HS, GND
- High-side + low-side driver for relay control. Connection: RELAY+, RELAY–

3.6.5.1 Schematic

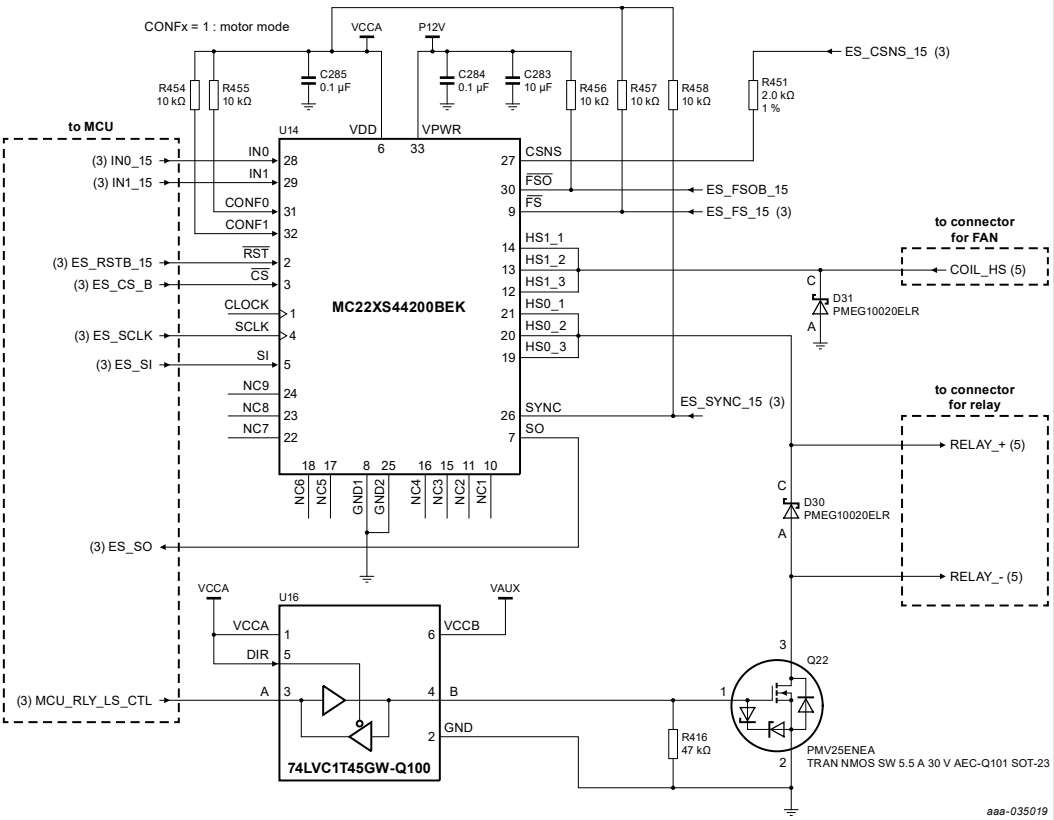


Figure 9. High-side/low-side driver for external load (relay, etc.)

Note: *Figure 9 shows F457 and R458 pulling up to VCCA. The product might not reflect this design.*

3.6.5.2 Example code

The ESwitch supports direct GPIO or SPI control for the output ON/OFF switch.

```
case 0xC8: //PC configure restore
    if ((u8Data>>0)&0xF) {
    SIUL_SetPad (SIUL_PD2);
    }
    else{
    SIUL_ClearPad(SIUL_PD2);
    }
    Delayms(10);
    /*PC control Eswitch*/
    ES_SetOutput_SPI(((u8Data>>0)&0xF)*100, ((u8Data>>4)&0xF)*100);
    break;
```

3.6.6 Relay status detection

This reference design board provides an example for relay status detection.

3.6.6.1 Schematic

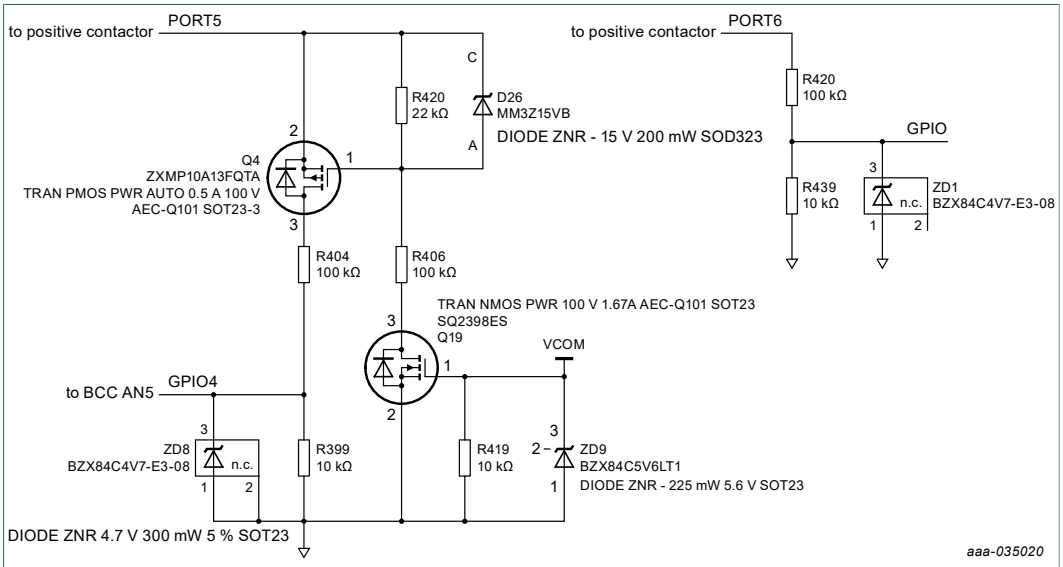


Figure 10. Relay sensing measurement

3.6.6.2 Example code

Because the hardware uses MC33771 GPIO0/4 to detect high voltage, the example code works same way as in Section 3.6.1.2 "Example code".

3.6.7 Crash detection

This reference design board provide a crash signal detection and diagnostic method. This board supports 0 to 12 V crash signal and PWM signal. Normally, the MCU uses GPIO to drive MCU_DIAG_CRASH high. Because MCU_AD_CRASH is linked to an ADC pin of MCU, the MCU could detect crash signals. If MCU_DIAG_CRASH was turned low, that could crash detection functions.

3.6.7.1 Schematic

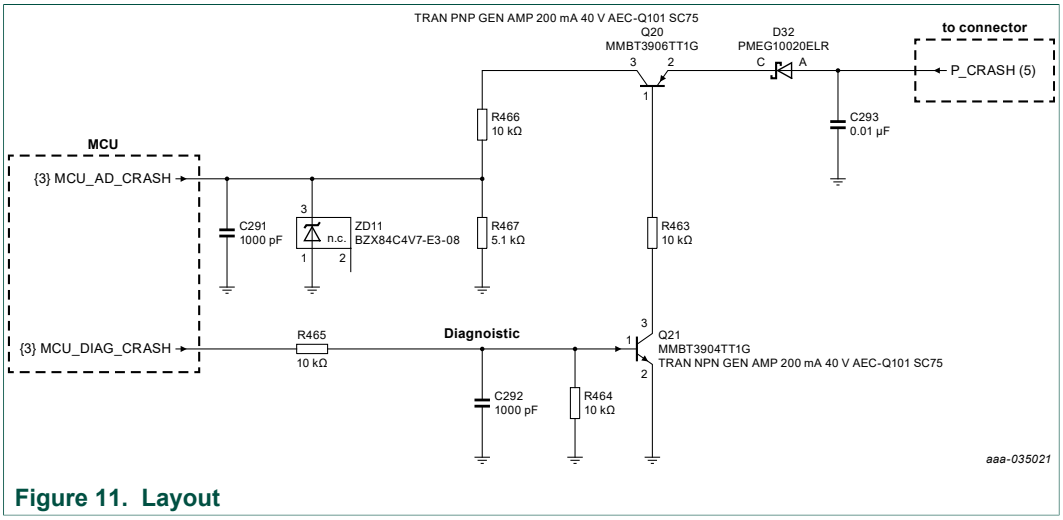


Figure 11. Layout

3.6.7.2 Example code

Software could use GPIO to pull down MCU_DIAG_CRASH and launch a diagnostic function.

```
case 0xC7: /*Crash Diag */
    if(u8Data == 0x01) {
        SIUL_ClearPad(DIUL_PD3);
    }
    else if(u8Data == 0x00) {
        SIUL_SetPad(SIUL_PD3);
    }
    break;
```

3.6.8 External temperature

This reference design board provides an extended temperature measurement from the MCU by an external NTC.

3.6.8.1 Schematic

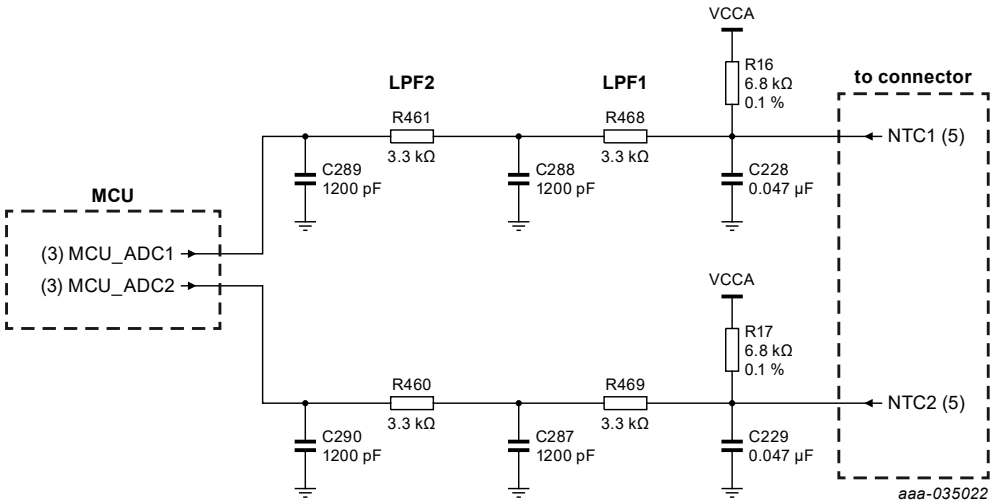


Figure 12. Current measurement

3.6.8.2 Example code

```
ADC_result[0] = ADC_GetChannelValue(ADC_nb0, 4);
ADC_result[1] = ADC_GetChannelValue(ADC_nb0, 6);
ADC_result[2] = ADC_GetChannelValue(ADC_nb0, 5);
CAN_SendLVSig2GUI(ADC_result);
```

4 Installing software and tools

4.1 Installing S32 Design Studio IDE for Power Architecture

The S32 Design Studio IDE is a complimentary integrated development environment for automotive and ultra-Reliable MCUs that enables editing, compiling and debugging of designs.

1. Download the S32 Design Studio IDE for Power Architecture installer, available on the RD33771-48VEVM tool summary page[1]. Version 2017.R1 is recommended.
   Note: Registration is required.
2. Open the installer, then follow the instructions in the setup wizard.

5 Configuring the hardware

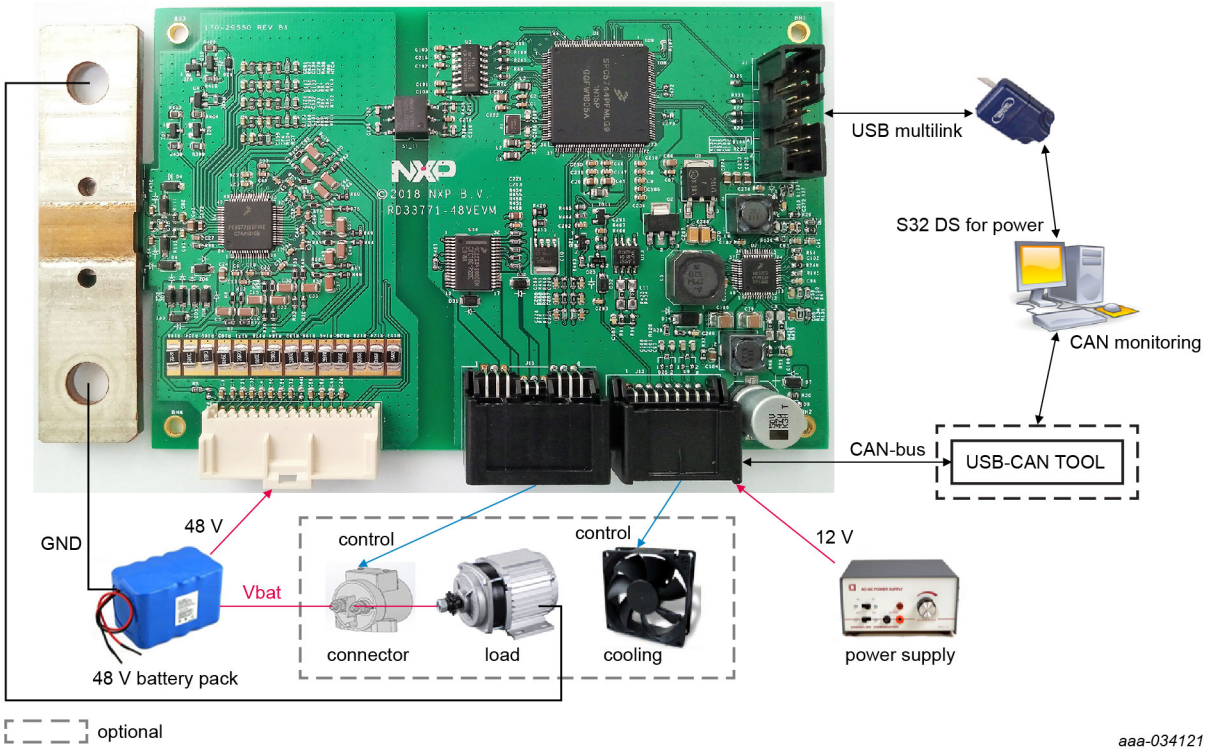


Figure 13. Typical system configuration

The RD33771-48VEVM is used in a standalone configuration. There are no connectors to add a daughter board. All required cables are included in the kit.

1. Turn off the power supply.
2. Connect the power supply output to J11 using the power supply cable.
3. (Optional) Connect the load and connector to the battery pack or battery simulator.
4. Connect a battery simulation device or a real battery to the J3 connector.
5. Connect the debug tool to J1 and the Windows PC workstation.
6. Connect the CAN-bus communication cable; one end to J12. other end to the CAN card of the Windows PC workstation.

6 Import and debug embedded software

After configuring the hardware, users must set up software to perform the examples. Use the following procedure to perform the initial software setup.

1. Install S32 Design Studio for Power Architecture (Version 2017.R1 is recommended). See Section 4 "Installing software and tools".

2. Download the desired demo software from the RD33771-48VEVM product information page[1] and extract the project to a local drive.
3. In S32 Design Studio for Power Architecture, import the software project.
   a. From the **File** menu, select **Import**.
   b. Choose **General** > **Existing Project into Workspace**, and then click **Next**.
   c. Select **Select root directory**. Click **Browse**, then locate project from step 2. Select **Eval_MC3377X_New48V** project, and then click **Finish**.
4. Select **Eval_MC3377X_New48V** project, and then click **Project** > **Build Project** to build the project.
5. Debug the software project.
   a. Go to **Run** > **Debug Configurations**.
   b. Choose **Main** page, click **Search Project**, then choose *Eval_MC3377X_New48V.elf*, and then click **OK**.
   c. Choose **Debugger** page, make sure USB Multilink is connected correctly, then click **Device Name**, and then choose **MPC5744P**.
   d. Click **Debug**.

Upon completion, the software is downloaded and users are able to debug demo functions. The data or variables can be monitored in the S32K DS tool.

7 Set up evaluation GUI (optional)

RD33771-48VEVM evaluation board hardware provides CAN bus interface and embedded software integration with CAN communication protocol. Using a Graphical User Interface (GUI) on a PC workstation can help users perform functions more clearly and more easily than using a debug tool (S32 Design Studio IDE).

Users can develop a GUI by following the communication protocol and with the help of the third party USB-CAN tool and GUI development tool. The CAN0 port in J12 is used as an evaluation communication interface. Users must connect CAN0_high and CAN0_low to USB-CAN tool correctly. The CAN communication protocol is shown in Table 7.

Notes:

- *Host is the device that sends the CAN message.*
- *All voltage, current and temperature data are raw values from MC33771 registers. Users need to convert them to actual values by multiplying by the resolution, which can be found in the MC33771 product data sheet.*

Table 7. CAN communication protocol

Host	Extended ID	Data							
		Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 4	Byte 5	Byte 6
Evaluation board	0x18801100	Stack voltage		Cell14 voltage		Cell13 voltage		Cell12 voltage	
Evaluation board	0x18801104	Cell11 voltage		Cell10 voltage		Cell9 voltage		Cell8 voltage	
Evaluation board	0x18801108	Cell7 voltage		Cell6 voltage		Cell5 voltage		Cell4 voltage	
Evaluation board	0x1880110C	Cell3 voltage		Cell2 voltage		Cell1 voltage		AN6 voltage	
Evaluation board	0x18801110	AN5 voltage		AN4 voltage		AN3 voltage		AN2 voltage	
Evaluation board	0x18801114	AN1 voltage		AN0 voltage		IC temperature		n.a.	
Evaluation board	0x18802100	Current measurement				n.a.		n.a.	
Evaluation board	0x18804100	MC33771 FAULT1_STATUS		MC33771 FAULT2_STATUS		MC33771 FAULT3_STATUS		MC33771 COM_STATUS	
Evaluation board	0x18803100	Communication result		n.a.		n.a.		n.a.	
PC GUI	0x18800000	Command	Parameter	n.a.		n.a.		n.a.	
		0xC1 Reset MC33771	n.a.						
		0xC2 Initialize MC33771	1						
		0xC4 MC33771 Go to sleep	n.a.						
		0xC5 MC33771 Wake up	n.a.						
		0xC7 Crash signal control	0x01:generate 0x00:cancel						
		0xC8 High-side switch control	0x11: Relay & Fan on 0x10:Fan on 0x01:Relay on 0x00:off						

8 References

[1] **Product summary page for RD33771-48VEVM: 48 V Battery management system reference design** — https://www.nxp.com/design/designs/rd33771-48vevm-reference-design:RD33771-48VEVM

[2] **Product summary page for MC33664: Isolated Network High-Speed Transceiver** — https://www.nxp.com/products/interfaces/other-interfaces/isolated-network-high-speed-transceiver:MC33664?&tid=vanMC33664

[3] **Product summary page for MC33771: 14-Channel Li-ion Battery Cell Controller IC** — https://www.nxp.com/products/power-management/battery-management/battery-cell-controllers/14-channel-li-ion-battery-cell-controller-ic:MC33771B

[4] **Product summary page for FS6500: Grade 1 and Grade 0 safety power system basis chip with CAN flexible data transceiver** — https://www.nxp.com/products/power-management/system-basis-chips/functional-safety-sbcs/grade-1-and-grade-0-safety-power-system-basis-chip-with-can-flexible-data-transceiver:FS6500

[5] **Product summary page for MPC5744P: Ultra-Reliable MPC574xP MCU for Automotive & Industrial Safety Applications** — https://www.nxp.com/products/processors-and-microcontrollers/power-architecture/mpc55xx-5xxx-mcus/ultra-reliable-mpc57xx-mcus/ultra-reliable-mpc574xp-mcu-for-automotive-industrial-safety-applications:MPC574xP

[6] **Product summary page for MC22XS4200: Dual 24 V, 22 mΩ high-side switch** — https://www.nxp.com/products/power-management/smart-switches-and-drivers/high-side-switches/24-v-multipurpose-low-rsubdson-sub-extreme-switch:MC24XS4

[7] **Product summary page for TJA1051: High-speed CAN transceiver** — https://www.nxp.com/products/interfaces/can-transceivers/can-with-flexible-data-rate/high-speed-can-transceiver:TJA1051

[8] **Support page for S32DS-PA: S32 Design Studio IDE for Power Architecture based MCUs** — https://www.nxp.com/design/software/development-software/s32-design-studio-ide/s32-design-studio-for-arm:S32DS-ARM

[9] **NXP DocStore** — docstore.nxp.com

9 Revision history

Revision history

Revision number	Date	Description
3	20200219	• Section 2.2: Changed to "Typical loads: 48 V lithium-ion battery, battery simulator, motor, contactor, fan" from "Typical loads: battery simulator" • Section 3.6.1: Changed to "...circuit follows the 33771 spec" from "...circuit follows the MC33771 routine, from left to right" • Section 3.6.4: Changed to "For other non-Isolation low-cost applications..." from "For other non-Isolation low applications..." • Section 3.6.5: Changed to "The high-side device driven by NXP ESwitch..." from "The high-side device drive by NXP ESwitch..." • Figure 9: Added note • Section 8: Updated links
2	20190903	• Changed document id from RD33771-48VEVM to UM11300 • Added Section 1 "Finding kit resources and information on the NXP web site" and Section 1.1 "Collaborate in the NXP Community" • Moved contents of Section 2 "Getting started" to Section 1 "Finding kit resources and information on the NXP web site" and modified to align with nxp.com page format • Revised Section 2 "Getting started" subsections to align with NXP format • Added Section 3.6 "Schematic, board layout and bill of materials" • Added Section 4 "Installing software and tools" • Section 5 "Configuring the hardware": Added Figure 13 • Added Section 6 "Import and debug embedded software" • Added Section 7 "Set up evaluation GUI (optional)" • Section 8 "References": Added references to list and reformatted to current NXP standards
1	20181127	Initial release

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