# UM11884

## EVBMA777T2 user manual

Rev. 2.0 — 14 February 2025 User manual

**Document information**

| Information | Content |
|---|---|
| Keywords | MC33777A, EVBMA777T2 |
| Abstract | This user manual targets the EVBMA777T2 board. The EVBMA777T2 is an evaluation board for the MC33777A (battery junction box IC). |

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# 1 Introduction

The user manual describes the EVBMA777T2. The evaluation board embeds one MC33777A battery junction box controller IC.

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# 2 Getting ready

## 2.1 Kit contents

- EVBMA777T2 in an antistatic bag
- One electrical transport protocol link (ETPL) communication cable
- One power supply cable
- Four two-position connectors
- Two 12-position connectors

## 2.2 Extra hardware

- Mandatory 24 V and 100 mA power supply
- Optional voltage sources (to test the measurements)
- Optional power resistors (to test the pyrotechnic switch controller)
- Optional negative temperature coefficient (NTC) resistor (to test temperature measurement)

## 2.3 Configuring the hardware

This section describes the typical setup to configure EVBMA777T2 and evaluate the MC33777A current measurement feature.

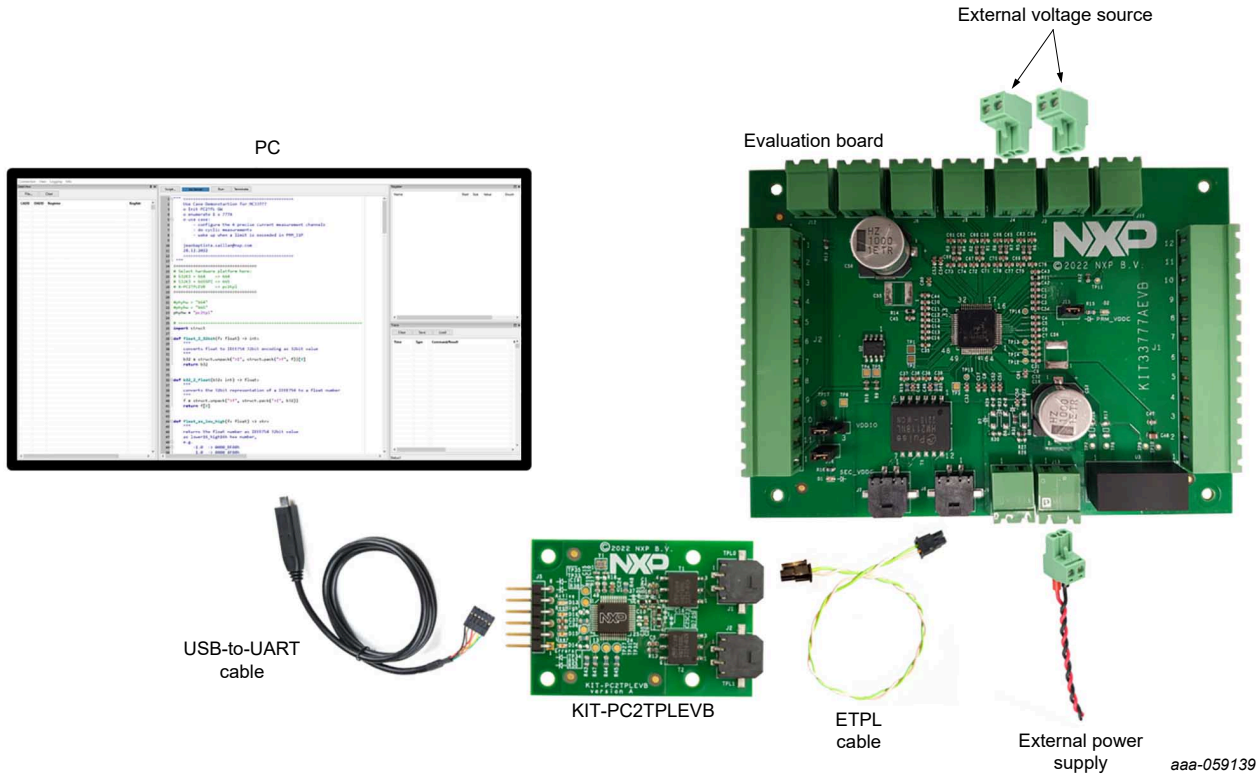


**Figure 1. Hardware setup**

Table 1 lists the material required to set up the test.

**Table 1. Bill of materials**

| Material | Comment |
|---|---|
| Personal computer | |
| KIT-PC2TPL communication board | |
| USB-to-universal asynchronous receiver/transmitter (UART) cable | included in the KIT-PC2TPL kit |
| EVBMA777T2 evaluation board | |
| ETPL cable | included in the EVBMA777T2 kit |
| Power supply cable | included in the EVBMA777T2 kit |
| Interface connectors | included in the EVBMA777T2 kit |
| External power supply | output voltage 24 V, output current 100 mA minimum |
| External voltage source (emulating the current measurement) | output voltage range is −300 mV to +300 mV |

The USB-to-UART cable interfaces the KIT-PC2TPL (connector J5) communication board with the computer (USB port).

The ETPL cable links the KIT-PC2TPLEVB (connector J1) with the EVBMA777T2 evaluation board (connector J7 or J8).

Table 2 describes the power supply connection using the power supply cable.

**Table 2. External power supply connection**

| External power supply output | Connection on the EVBMA777T2 |
|---|---|
| Positive output | J13.1 |
| Negative output | J13.2 |

Table 3 describes the connection of the external voltage source emulating the voltage drop across the shunt resistor.

**Table 3. External voltage source connection**

| External voltage source output | Connection on the EVBMA777T2 | Singal on the EVBMA777T2 |
|---|---|---|
| Positive output | J3.1 | PRM_ISENSEP |
| | J4.1 | SEC_ISENSEP |
| Negative output | J3.2 | PRM_ISENSEN |
| | J4.2 | SEC_ISENSEN |

# 3 Getting to know the hardware

## 3.1 Board description

The EVBMA777T2 allows the user to exercise all the functions of the MC33777A battery junction box controller IC. Most pins of the MC33777A are accessible via a connector. The user can configure the IC to evaluate all use cases.

## 3.2 Board features

The main features of the EVBMA777T2 are:

- Isolated power supply
- ETPL communication
- LED indicator for supply voltages and operation modes
- Four current measurement inputs
- Two external temperature measurement channels
- All inputs and outputs of the MC33777A are accessible with connectors
- Energy reservoir capacitor for pyrotechnic switch control
- EEPROM connected to the MC33777A in $I^2C$

## 3.3 Connectors

The EVBMA777T2 has multiple connectors for interfacing a power supply, a controller, or external instruments.

Figure 2 shows the location of the connectors.

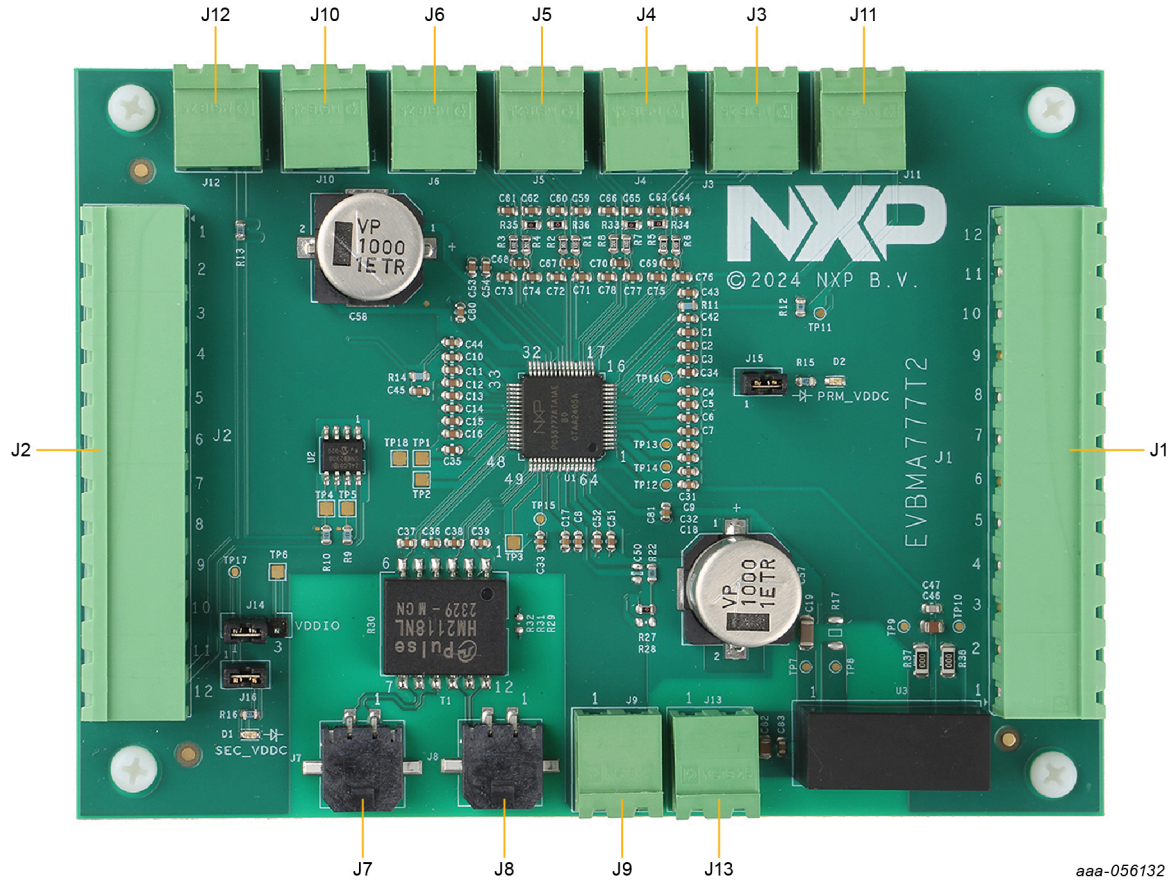


**Figure 2. Connector location**

Table 4 lists the connectors.

**Table 4. Connector description**

| Pin | Connection | Description |
|---|---|---|
| Power supply (J13) | | |
| J13.1 | 24V+ | positive power supply terminal |
| J13.2 | 24V- | power supply isolated ground |
| ETPL communication (J7) | | |
| J7.1 | TPL1P | ETPL positive input/output from/to lower node |
| J7.2 | TPL1N | ETPL negative input/output from/to lower node |
| ETPL communication (J8) | | |
| J8.1 | TPL2P | ETPL positive input/output from/to upper node |
| J8.2 | TPL2N | ETPL negative input/output from/to upper node |
| Primary ISENSE inputs (J3) | | |
| J3.1 | PRM_ISENSEP | primary positive current measurement input |
| J3.2 | PRM_ISENSEN | primary negative current measurement input |

**Table 4. Connector description**...*continued*

| Pin | Connection | Description |
|---|---|---|
| Secondary ISENSE inputs (J4) | | |
| J4.1 | SEC_ISENSEP | secondary positive current measurement input |
| J4.2 | SEC_ISENSEN | secondary negative current measurement input |
| Primary VISENSE inputs (J5) | | |
| J5.1 | PRM_VISENSEP | primary positive current/voltage measurement input |
| J5.2 | PRM_VISENSEN | primary negative current/voltage measurement input |
| Secondary VISENSE inputs (J6) | | |
| J6.1 | SEC_VISENSEP | secondary positive current/voltage measurement input |
| J6.2 | SEC_VISENSEN | secondary negative current/voltage measurement input |
| Primary external temperature measurement (J11) | | |
| J11.1 | PRM_IO7 | primary external NTC terminal |
| J11.2 | GND | primary external NTC terminal |
| Secondary external temperature measurement (J12) | | |
| J12.1 | SEC_IO7 | secondary external NTC terminal |
| J12.2 | GND | secondary external NTC terminal |
| Primary I/O and reference voltage (J1) | | |
| J1.1 | PRM_IO6 | primary input/output 6 |
| J1.2 | PRM_IO5 | primary input/output 5 |
| J1.3 | GND | ground |
| J1.4 | PRM_IO4 | primary input/output 4 |
| J1.5 | PRM_IO3 | primary input/output 3 |
| J1.6 | GND | ground |
| J1.7 | PRM_IO2 | primary input/output 2 |
| J1.8 | PRM_IO1 | primary input/output 1 |
| J1.9 | GND | ground |
| J1.10 | PRM_IO0 | primary input/output 0 |
| J1.11 | PRM_VREF2V5 | primary 2.5 V reference |
| J1.12 | PRM_VREF5V0 | primary 5 V reference |
| Secondary I/O and reference voltage (J2) | | |
| J2.1 | SEC_IO6 | secondary input/output 6 |
| J2.2 | SEC_IO5 | secondary input/output 5 |
| J2.3 | GND | ground |
| J2.4 | SEC_IO4 | secondary input/output 4 |
| J2.5 | SEC_IO3 | secondary input/output 3 |
| J2.6 | GND | ground |
| J2.7 | SEC_IO2 | secondary input/output 2 |

**Table 4. Connector description**...*continued*

| Pin | Connection | Description |
|---|---|---|
| J2.8 | SEC_IO1 | secondary input/output 1 |
| J2.9 | GND | ground |
| J2.10 | SEC_IO0 | secondary input/output 0 |
| J2.11 | SEC_VREF2V5 | secondary 2.5 V reference |
| J2.12 | SEC_VREF5V0 | secondary 5 V reference |
| Primary pyrotechnic switch controller (J9) | | |
| J9.1 | PRM_PSCHS | primary high side output of PSC |
| J9.2 | PRM_PSCLS | primary low side output of PSC |
| Secondary pyrotechnic switch controller (J10) | | |
| J10.1 | SEC_PSCHS | secondary high side output of PSC |
| J10.2 | SEC_PSCLS | secondary low side output of PSC |

Table 5 lists the reference of all connectors and their mating part number.

**Table 5. Connector part number**

| Connector | Manufacturer | Part number | Mating connector |
|---|---|---|---|
| J1, J2 | Phoenix | 1754630 | 1757116 |
| J7, J8 | Molex | 43650-0213 | 43645-0200 |
| J3, J4, J5, J6, J9, J10, J11, J12, J13 | Phoenix | 1754436 | 1757019 |

## 3.4 Test points

The EVBMA777T2 offers multiple test points to access signals close to the MC33777A.

Figure 3 shows the location of the test points.

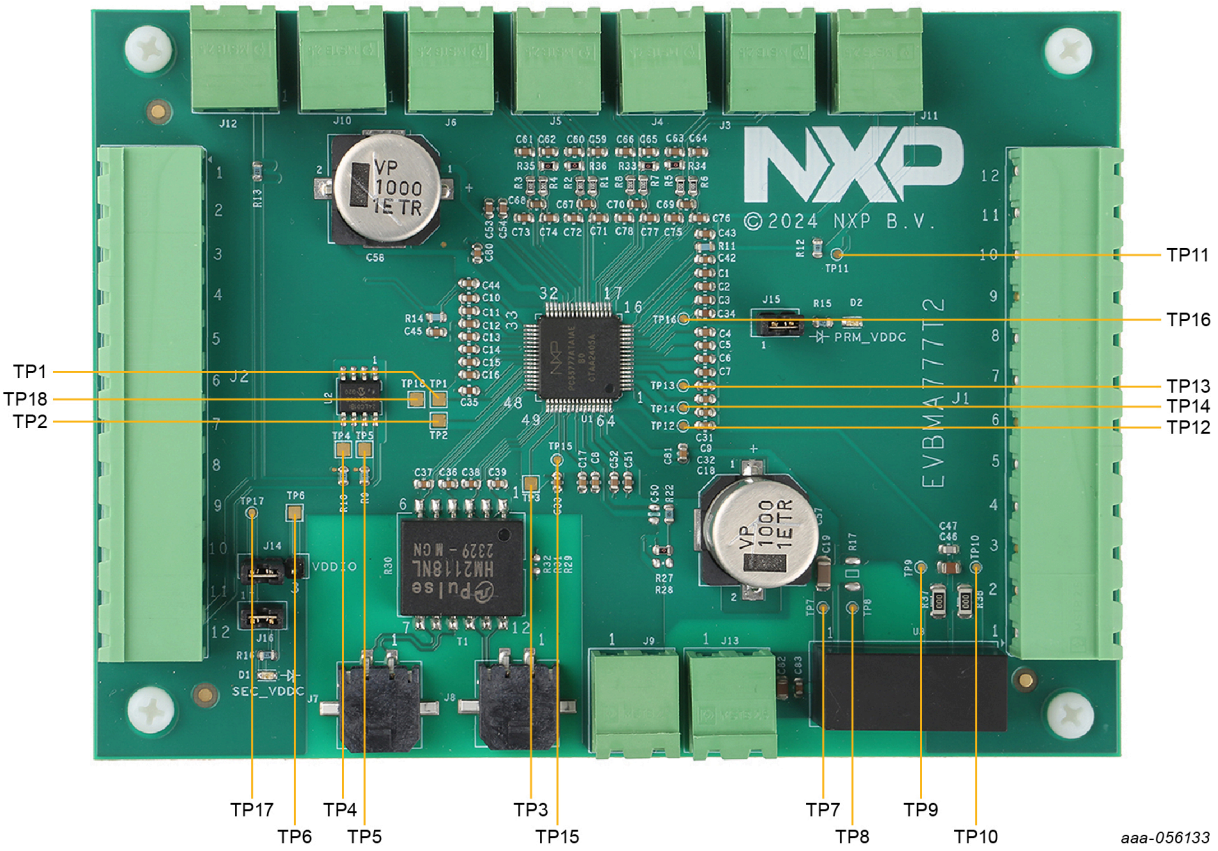


**Figure 3. Test point location**

Table 6 lists the test points.

**Table 6. Test point description**

| Test point | Signal | Description |
|---|---|---|
| TP1 | GPIO0 | |
| TP2 | GPIO1 | |
| TP3 | GPIO4 | |
| TP4 | GPIO3_SDA | $I^2C$ data line to the external EEPROM |
| TP5 | GPIO2_SCL | $I^2C$ clock line to the external EEPROM |
| TP6 | - | VDDIO alternative voltage |
| TP7 | 24V- | power supply isolated ground |
| TP8 | 24V+ | positive power supply terminal |
| TP9 | VBAT | |
| TP10 | GND | |
| TP11 | PRM_VREF5V0 | |
| TP12 | SEC_VREF5V0 | |
| TP13 | PRM_VDDA | |
| TP14 | SEC_VDDA | |

Table 6. Test point description...*continued*

| Test point | Signal | Description |
|---|---|---|
| TP15 | VDDIO | |
| TP16 | PRM_VDDC | |
| TP17 | SEC_VDDC | |
| TP18 | GND | |

## 3.5 Jumpers

The EVBMA777T2 has jumpers to configure MC33777A signals.

Figure 4 shows the location of the jumpers.

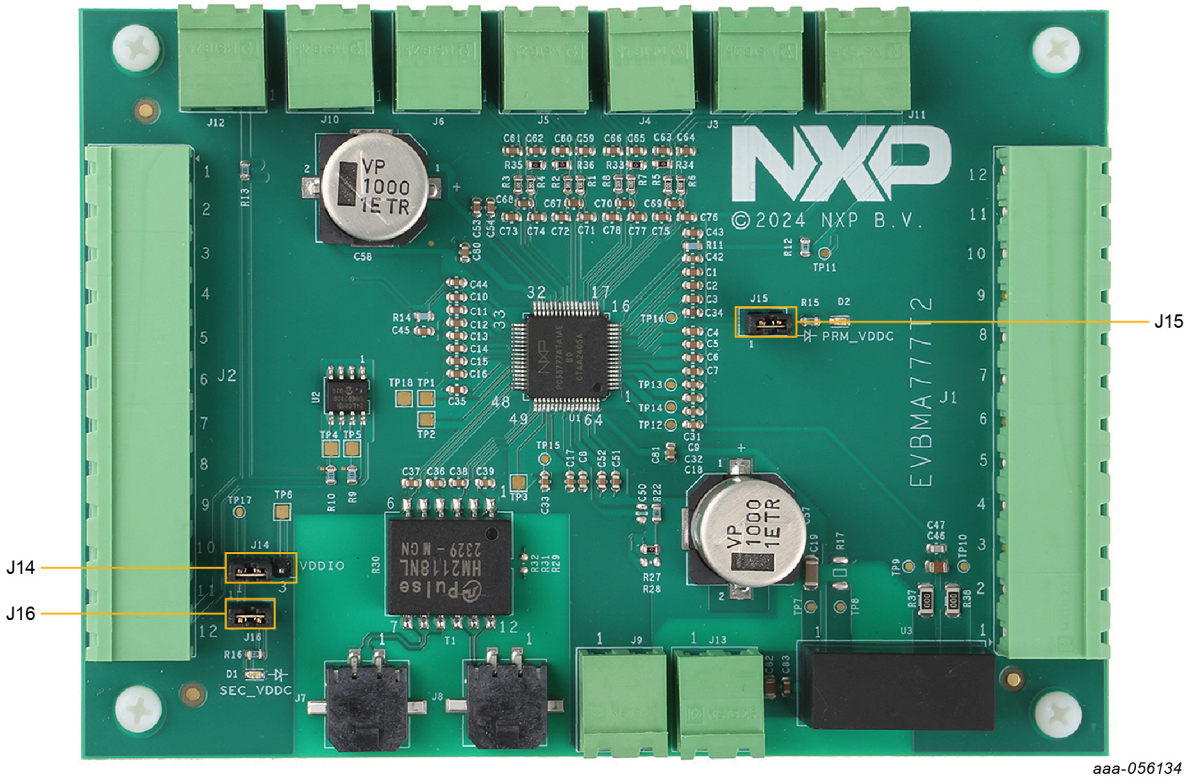


**Figure 4. Jumper location**

J15 connects an LED to PRM_VDDC of the MC33777A. The LED signals that the device is in active mode. Removing the jumper disables the feature.

J16 connects an LED to SEC_VDDC of the MC33777A. The LED signals that the device is in active mode. Removing the jumper disables the feature.

J14 connects by default VDDIO to SEC_VDDC (jumper between pin 1 and pin 2). The user can power VDDIO with another voltage by moving the jumper (between pin 2 and pin 3) and by applying a voltage on TP6.

## 3.6 Power supply

The EVBMA777T2 integrates an isolated DC-DC converter (TMR 4-2415, from Traco). It generates an isolated supply voltage for the MC33777A ($V_{BAT}$). The user must connect a power supply to J13 with characteristics shown in Table 7.

**Table 7. Power supply**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | TMR 4-2415 active | 18 | 24 | 36 | V |
| $I_{CC}$ | supply current | TMR 4-2415 active; MC33777A fully operational | 200 | - | - | mA |

## 3.7 Temperature measurement (IO7)

The EVBMA777T2 dedicates two IOs for temperature measurement with an external NTC resistor. The board includes the associated circuitry (antialiasing filter, voltage reference).

The user can connect an NTC resistor on J11 or J12 to measure a temperature on PRM_IO7 or SEC_IO7 of the MC33777A.

**Table 8. Temperature measurement characteristic**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $R_{NTC(ext)}$ | external NTC resistor | $T_{amb}$ = 25 °C | - | 10 | - | kΩ |
| $R_{div}$ | divider resistor | high-side voltage | - | 10 | - | kΩ |

## 3.8 Current measurement (ISENSE, VISENSE)

The MC33777A offers four current measurement inputs (PRM_ISENSE, SEC_ISENSE, PRM_VISENSE, and SEC_VISENSE).

Figure 5 describes the ISENSE/VISENSE input circuitry.

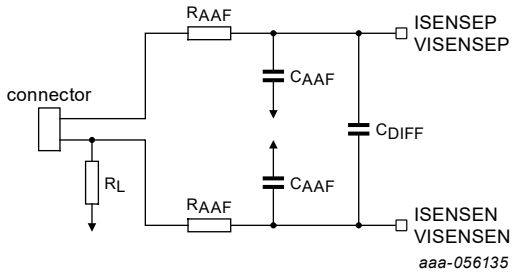


**Figure 5. ISENSE/VISENSE input circuitry**

The current measurement lines are linked to connectors (see Section 3.3) and embed the recommended filters for current measurement ($C_{AAF}$, $R_{AAF}$, and $C_{DIFF}$).

A 0 Ω resistor ($R_L$) links the negative measurement line to the ground. The user can remove this resistor, but must ensure that the common mode voltage meets the MC33777A specifications.

The user can connect the EVBMA777T2 to various instruments (voltage source, current source in series with a shunt resistor, and so forth).

### 3.9 Inputs/outputs (IO)

All primary and secondary IOs are accessible with connectors (see Section 3.3). As these pins have several functions (analog measurement, digital input, digital output, and so forth), there is no circuitry on the EVBMA777T2. It only embeds capacitors for electrostatic discharge (ESD) protection.

The user has to provide external circuitry depending on the use case to evaluate.

### 3.10 Pyrotechnic switch control (PSC)

The EVBMA777T2 embeds circuitry to test the pyrotechnic switch controller.

For each channel, a 1 mF capacitor acts as an energy reservoir (MAL215099614E3).

The resistor R22 (linked to PSC_CFG) configures the capacitor charge current. By default, R1 = 300 kΩ and the charge current equals 60 mA.

Each driver output (PRM_PSC and SEC_PSC) is linked to a connector (see Section 3.3). A real pyrotechnic switch or a power resistor can be connected to evaluate the feature.

### 3.11 Communication

The MC33777A provides two ETPL communication ports accessible on connectors (see Section 3.3).

The user can link any port to a controller or other NXP devices. A transformer isolates the EVBMA777T2 from other devices.

## 4 References

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

The information page for the MC33777A is http://nxp.com/mc33777. This page provides overview information, documentation, software and tools, parametrics, ordering information and a getting started tab.

## 5 Revision history

**Table 9. Revision history**

| Document ID | Release date | Description |
|---|---|---|
| UM11884 v.2.0 | 14 February 2025 | • Update documentation with the latest board name; all information on the EVBMA8420T has been removed |
| UM11884 v.1.0 | 6 June 2024 | • Initial version |

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## Figures

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