Smartedge-iiot-gateway Hardware Reference

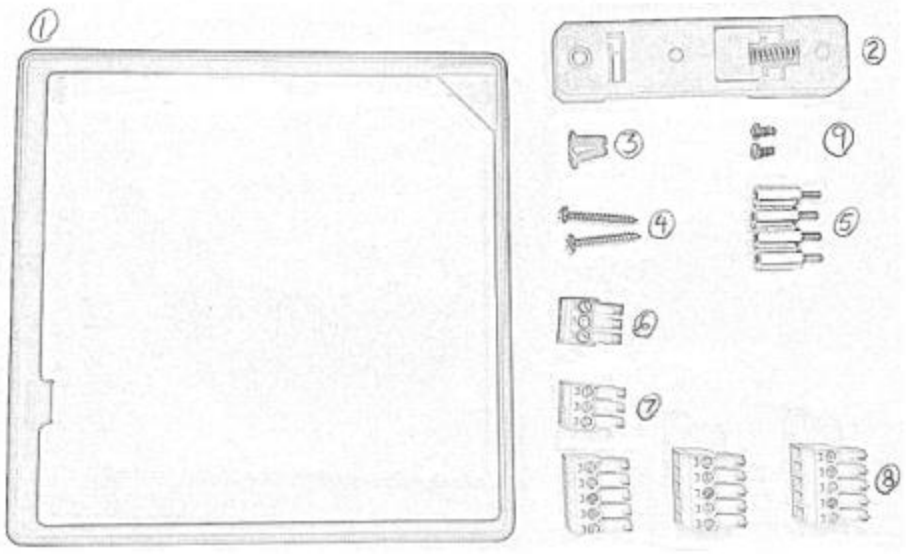
OVERVIEW

This document describes the Smartedge IIOT Gateway Hardware. This should be used in conjunction with the similar documentation available with each sensor or ioexpander.

Smartedge-iiot-gateway Hardware Reference

There are several native hardware interfaces supported by the gateway. Optionally you may need an IO Expander to support the actual sensor used. This section describes the gateway hardware. Other additional reference material will be provided with each SDK model you select.

Here is what you get out of the box.



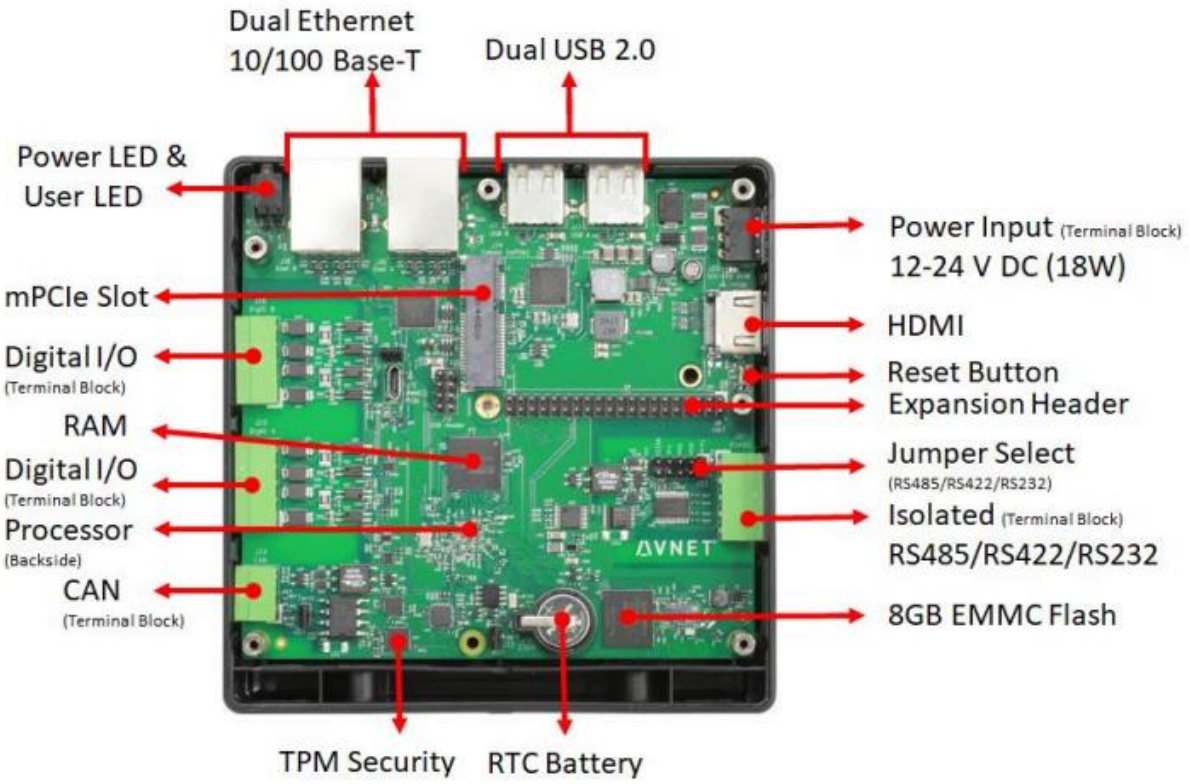
A parts kit is included in the box with the following items:

1. Extension ring (1): install to increase height of enclosure for HATs
2. DIN Rail Mount (1): install with flat head screws (2) for DIN rail mounting
3. Flat Head Screws (2): use to secure the DIN rail mount
4. Wall Mount Screws (2): install into wood or metal, placed 97mm apart vertically
5. Standoffs (4): install on top of existing standoffs when using extension ring
6. 3 Position Terminal Block (1), Black: use for DC-IN connection
7. 3 Position Terminal Block (1), Green: use for CANbus connection
8. 5 Position Terminal Block (3), Green: use for Digital I/O and RS485 connection
9. Pan Head Screws (2): use to secure a HAT onto the Gateway

POWER INPUT An external power supply is required. Rating: 12VDC to 24VDC (+/- 10%), 18W minimum, 24W recommended, LPS (Limited Power Source). Use 16-22AWG power supply wiring, stripped back 4-5mm, twisted & optionally tinned. Find the black, 3 position terminal plug in the included hardware kit (under the foam in the box). Insert the prepared wires into the terminal plug, observing proper location. The wire polarities are indicated on the enclosure and shown below. An Earth GND wire is recommended (not included). Signal DC Input Earth GND - 0V (GND) + 12-24VDC CAUTION: Verify terminal block wiring is correct, tight, and with no bare wiring exposed. CAUTION: Please use the BLACK connector on the gateway, using ANY GREEN terminal will void your warrantee.

Signal	DC Input
⏚	Earth GND
-	0V (GND)
+	12-24VDC

I NTERNAL VIEW



USB 2.0 Two USB 2.0 High-Speed ports are available to accept devices and can provide 0.5A per port.

ETHERNET Two 10/100 Ethernet peripherals are available. By default, both are configured the same and can accept connection to the customers network. Some advanced topologies could be configured by the customer (bridged, router, etc).

RESET BUTTON A pin hole reset button (labeled RST) is located next to the HDMI port. A paperclip can be used to activate it. – Short press (less than 5 seconds) initiates a reboot – Long press (between 5 and 30 seconds) re-enters Configuration state for IoTConnect Cloud Enrollment (section 3.4) – Very long press (greater than 30 seconds) performs a Factory Reset

HDMI An HDMI monitor can be used for console display. It should be connected at boot to enable the proper output.

ONBOARD DIGITAL I/O The digital inputs and outputs are available as /sys/class/gpio/gpio200 thru gpio207. GPIO200/202/204/206 are inputs and GPIO201/203/205/207 are outputs. See the schematic in the appendix for detailed connections. GPIOs must be exported in your application to use them. If they are used in the SDK (IoTConnectSDK.conf) then they are exported automatically. SmartEdge Industrial IoT Gateway User Guide http://www.element14.com/gateway Page 17

ONBOARD RS232/485 You can use the onboard RS232/485 interface as a serial console, Modbus RTU interface, or other serial usages. The RS-232/RS-485 port is configured by default for 2-wire RS-485 operation with termination enabled. On board jumpers can reconfigure the port for full duplex or RS-232 signaling. See section 3.3 for jumper configuration and connections. The port is /dev/ttySC0. Refer to the schematics in the appendix for detailed connections.

CANBUS The internal CANbus is available but not fully enabled by default in the image. It can be enabled by removing the comments dealing with the can0 section in /etc/network/interfaces. Be sure to set the proper bitrate for your bus. Utilities cansend and candump are included and the can0 device can be used by the network stacks. A CAN termination jumper is enabled by default. Refer to section 3.3 for more information and refer to the schematics in the Appendix.

INTERNAL MPCIE SLOT This full size mPCIe slot is plug-n-play with USB based cards. PCIe cards are not supported. As with any USB device, additional drivers may need to be installed. INTERNAL RASPBERRY PI HAT EXPANSION SLOT A standard Raspberry Pi HAT expansion slot of available, and can support most off-the-shelf HAT cards. The I2C1 bus is enabled for onboard devices, so the HAT card(s) must not conflict with that usage

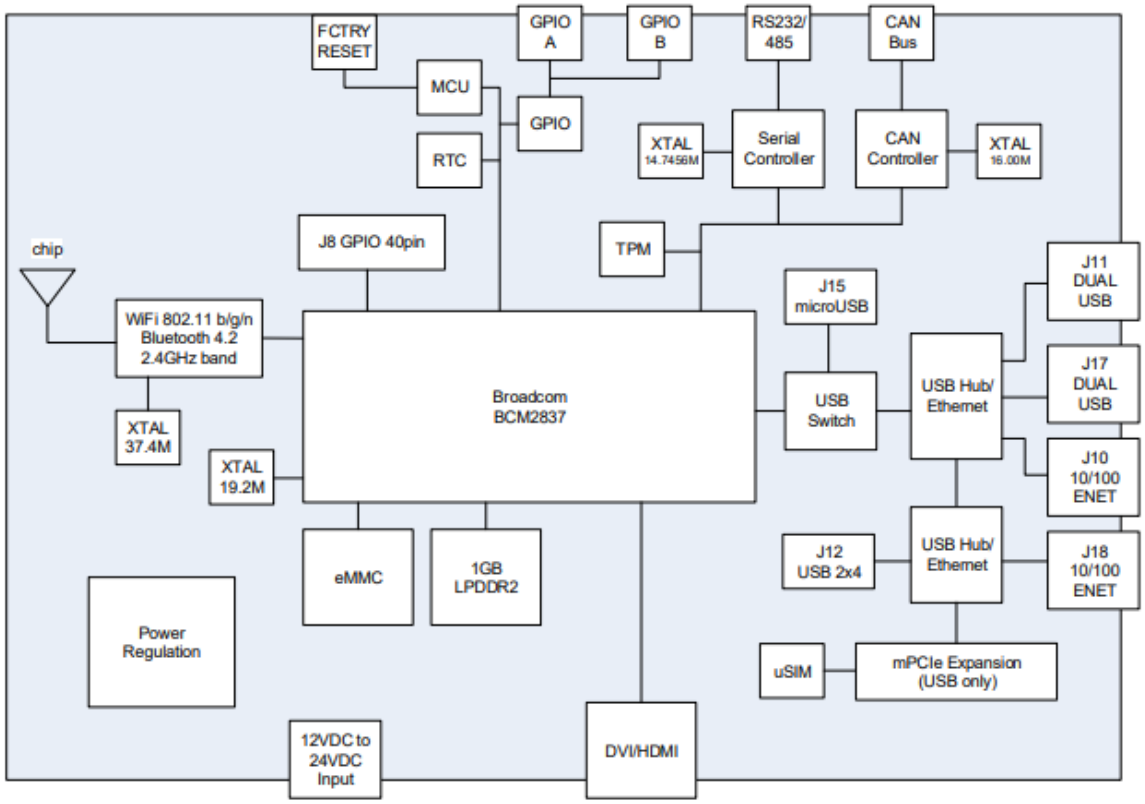
FRONT PANEL LEDS – Power / Activity LED – Green indicates valid power – Red flashing indicates disk activity by default, but configurable – User LED – Controlled from user code

HARDWARE WATCHDOG TIMER (WDT) – Selectable timeout (1-255 seconds)

TRUSTED PLATFORM MODULE (TPM) & SECURE BOOT – SLB9670 TCG 2.0 Trusted Platform Module – Secure Boot Option when used with Avnet's Image

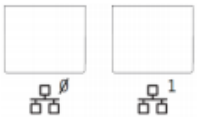
REAL-TIME CLOCK (RTC) WITH BATTERY BACKUP – PCF8563 real-time clock – BR1225 backup battery

2.1. BLOCK DIAGRAM



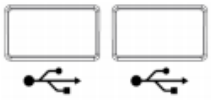
DUAL ETHERNET PORTS

- 10/100 Base-T
- Link / Activity LEDs



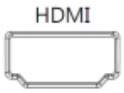
DUAL USB PORTS

- USB 2.0 High-Speed
- 5V @ 1.2A Output, shared among all USB ports



DISPLAY CONNECTOR

- HDMI / DVI Compatible

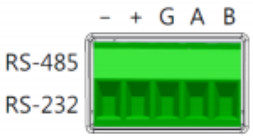


ISOLATED RS-485 / RS-422 / RS232

- SC16IS740 UART (16C550 compatible)
- Jumper selection (see section 3.3)
  - Term: Enable RS485 termination [installed by default, 120ohm termination]
  - Shdn: Port Shutdown [not installed by default, port enabled]
  - Slew: Slow Slew Rate [not installed by default, fast slew rate]
  - Full: Full duplex (4-wire) [not installed by default, RS485 half duplex]
  - RS232: Use RS232 signaling [not installed by default, RS485 mode]

RS-485/RS-422/RS-232 Terminal Block Connections

Signal	2-Wire RS485 (half)	4-Wire RS485 (full) RS-422	RS-232
-	(n/c)	RD (A) -	CTS
+	(n/c)	RD (B) +	RXD
G	GND	GND	GND
A	DATA (A) -	TD (A) -	TXD
B	DATA (B) +	TD (B) +	RTS

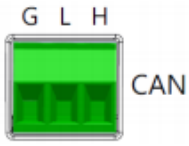


WARNING! DO NOT INSTALL DCIN PLUG INTO CANBUS PORT! THIS WILL DESTROY THE CANBUS DRIVER AND TERMINATION RESISTOR!

- MCP2515 CAN Controller
- Recommended Cable: Shielded Twisted Pair, 120ohm impedance (Belden 3105A)
- Route multiple device connections as daisy chain, with termination only at endpoints
- Jumper selection for: CAN termination (see section 3.3)

CAN Terminal Block Connections

Signal	CANbus signal
G	GND
L	CANL
H	CANH

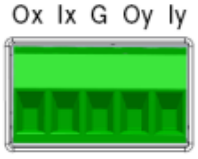


ISOLATED DIGITAL I/O

- Dual individually isolated blocks A & B, with each block having two (2) inputs and two (2) outputs
- Digital Outputs:
  - Outputs are open drain
  - High Level: up to 60V can be applied to Digital Output
  - Low Level: 1.5V max @ 500mA
- Digital Inputs:
  - Inputs have internal pull-down of 6.8kOhm.
  - High Level: minimum of 5V @ 1mA at the input terminal, 60V @ 10mA max
  - Low Level: maximum of 1V at the input terminal

Digital I/O Terminal Block Connections

Label	Digital I/O Signal
Ox	Output x
Ix	Input x
G	Ground
Oy	Output y
Iy	Input y



USB HEADER

- 2x4 header with two USB ports for optional internal USB devices
- Specially designed HATs can use USB

USB Header (J12)

Pin	Signal Name	Signal Name	Pin
1	Vbus	Vbus	2
3	USB1-	USB2-	4
5	USB1+	USB2+	6
7	GND	GND	8

HAT EXPANSION SLOT

- Support for standard Raspberry Pi HAT boards
- Both HAT and mPCIe card can be installed (check for any interference)
- Standard device-tree overlays can be used
- Enclosure expansion ring can increase the enclosure height
- Orient the expansion ring with the tab facing the PCB near the coin battery
- Install the four standoffs in the parts kit to the four locations shown in below picture
- HATs have access to full 40pin HAT I/O and alternate functions*

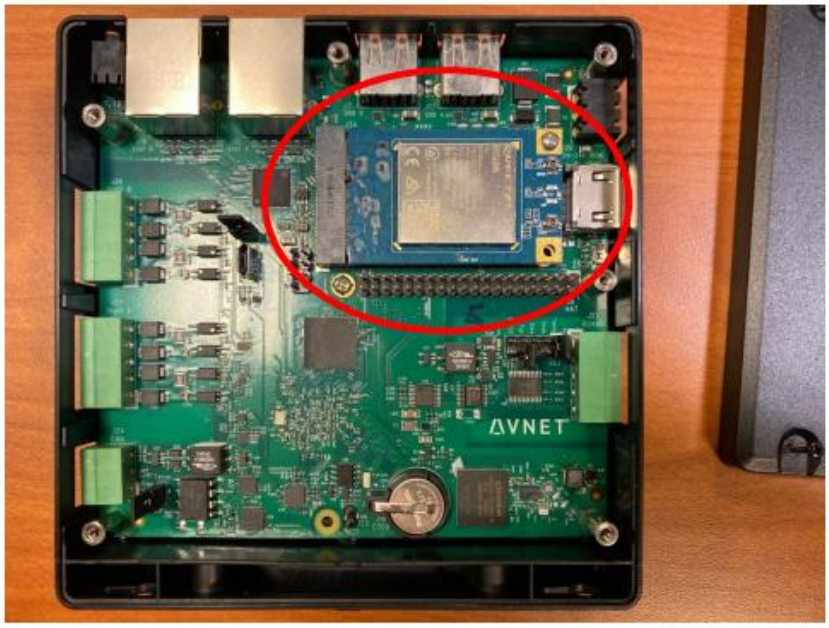
**NOTE: I2C1 Bus (GPIO2/GPIO3) is shared with onboard devices. I2C addresses: 0x33, 0x43, 0x44, 0x51 are reserved.*

HAT Expansion card location

MINI-PCIE SLOT (J34)

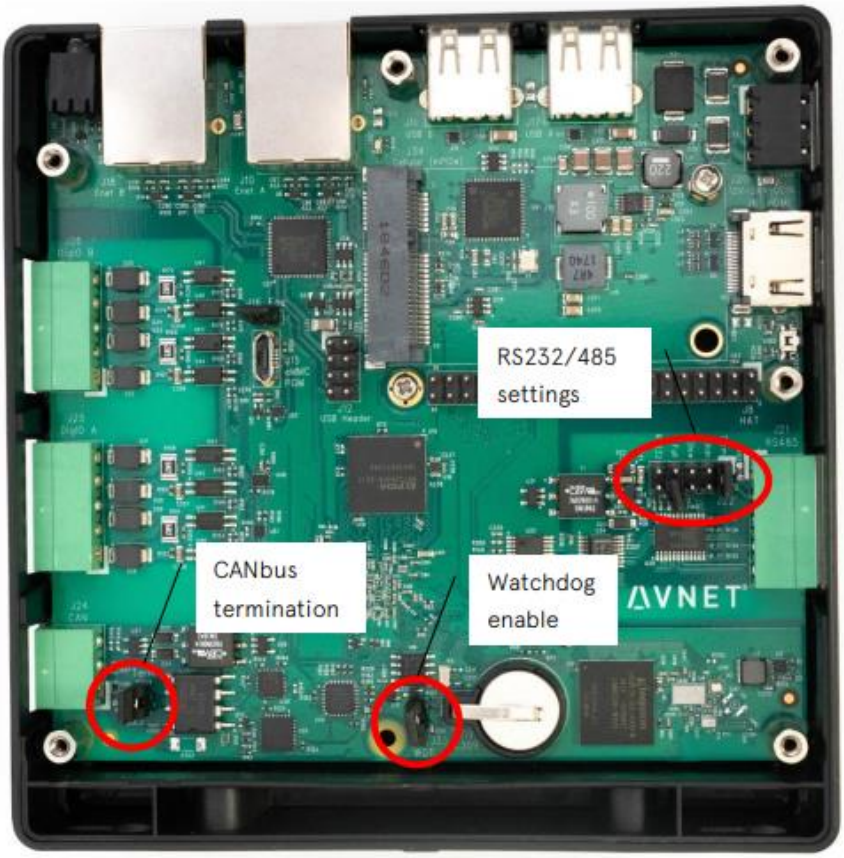
- Full size mPCIe slot for USB devices only (PCIe bus is not connected)
- Supports USB, SIM, and WWAN LED for optional cellular modem
- MicroSIM socket for modem is located on the bottom side of the PCBA (remove the four corner standoffs and the middle screw to lift out the PCBA)
- The included enclosure extension ring has two knockouts for SMA bulkhead antenna cables. The knockouts may need to be removed using a drill/router bit.

Mini-PCIe Slot



The RS232/485, CANBUS, and WATCHDOG have internal jumpers to set bus signaling, termination, function, etc. The lid must be removed to access these jumpers.

Jumper locations



RS232/485 JUMPER

- Term [default installed]: Install to enable RS422/485 bus termination (bus should be terminated on both ends only)
- Shdn: Install to shutdown the transceiver (disable)
- Slew: Install to use slow slew rate. This reduces EMI emissions but limits maximum bandwidth
- Full: Install to enable RS422/485 full duplex (4-wire)
- RS232: Install to use RS232 signaling instead of RS422/485 (Full & Term jumpers should be removed)

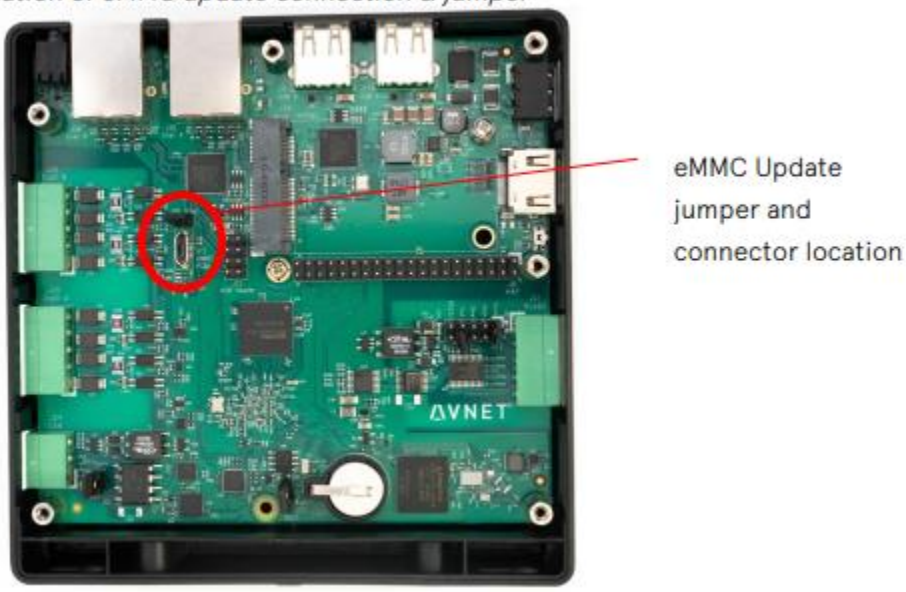
CANBUS JUMPER

- Term [default installed]: Install to enable CANbus termination (bus should be terminated on both ends only)

WATCHDOG JUMPER

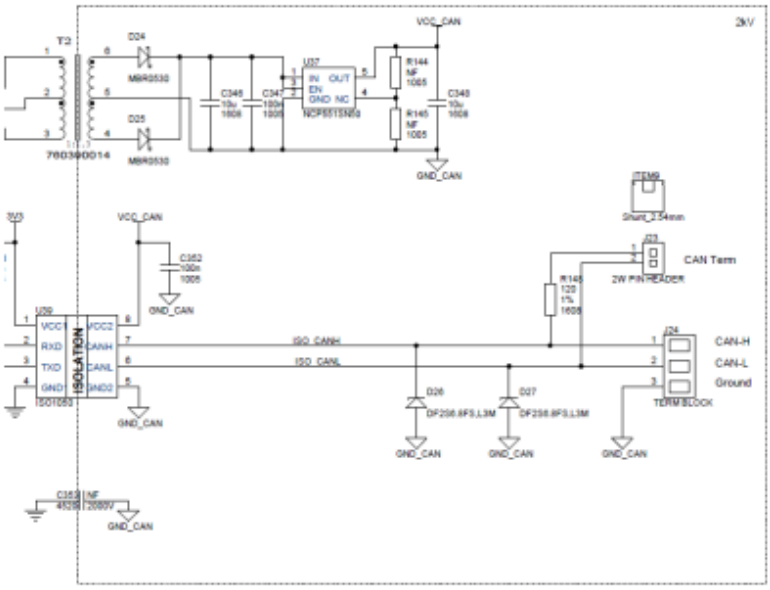
- WDT: If this jumper is installed, the hardware watchdog timer is enabled at power-on. It must be disabled or toggled before power-on timeout (approximately 4 minutes) else the system will reset.

Location of eMMC update connection & jumper



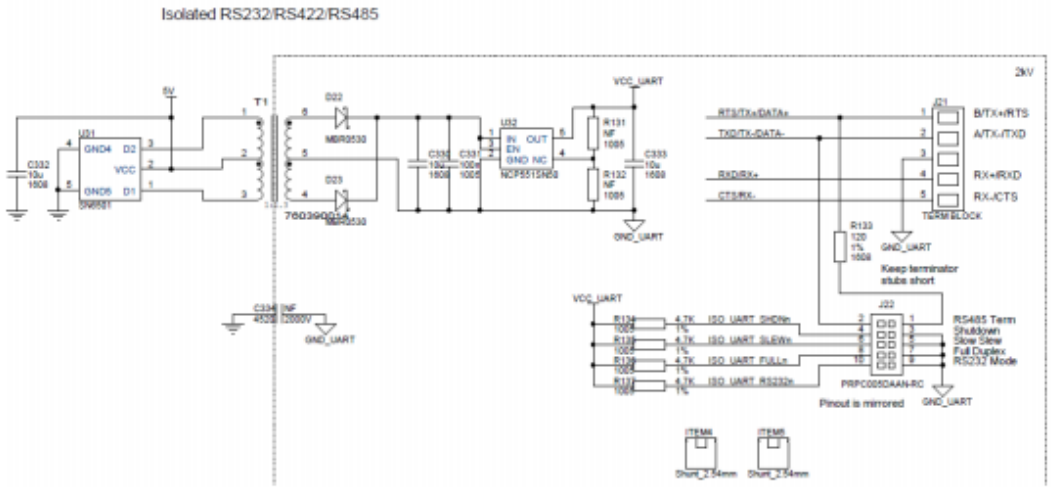
CANBUS

Isolated CANbus

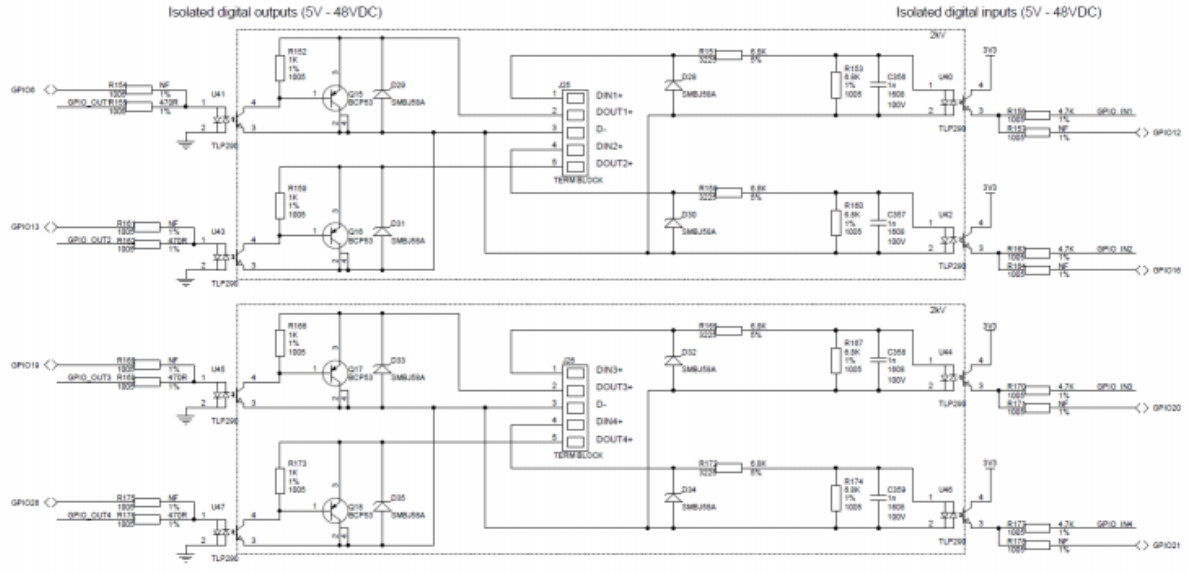


RS232/RS485

Isolated RS232/RS422/RS485



DIGITAL I/O



Gateway XYZ Hardware Reference