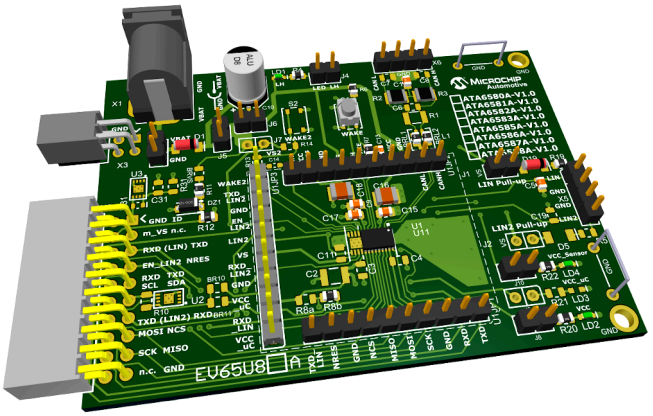
EV65U86A/EV65U88A

ATA658x CAN-LIN SBC Evaluation board User Guide

Introduction

The EV65U8xA Development Board is a hardware platform designed to evaluate the new ATA658x CAN-LIN device family and it enables users to rapidly prototype and test new CAN designs based on the ATA658x ICs.

Figure 1. ATA658x Development Board



The ATA658x device family includes eigth products:

- ATA6585/80 A CAN system basis chip (SBC): one CAN transceiver with or without CAN Partial Networking combined with a 5V, 150 mA low drop voltage regulator, a window watchdog and a 5V/3.3V, 30 mA sensor supply;
- ATA6586/80 A CAN-LIN system basis chip (SBC): one LIN transceiver, one CAN transceiver with or without Partial Networking, a 5V, 150 mA low drop voltage regulator, a window watchdog and a 5V/3.3V, 30 mA sensor supply;
- ATA6587/82 A CAN-LIN-LIN system basis chip (SBC): one CAN transceiver with or without Partial Networking, a 5V, 150 mA low drop voltage regulator, a second 5V, 85 mA low drop voltage regulator, a window watchdog, a 5V/3.3V, 30 mA sensor supply and two LIN transceivers;
- ATA6588/83 A CAN-LIN-LIN system basis chip (SBC): one CAN transceiver with or without Partial Networking, a 5V, 150 mA low drop voltage regulator, a second 3.3V, 85 mA low drop voltage regulator, a 5V/3.3V, 30 mA sensor supply and two LIN transceivers.

The high speed (up to 5Mbit/s) ISO 11898-2: 2016 compliant CAN transceiver is designed for applications in the automotive industry, providing differential transmit and receive capability to (a microcontroller with) a CAN protocol controller. It offers improved electromagnetic compatibility (EMC) and electrostatic discharge (ESD) performance, very low power consumption, as well as features such as:

- Ideal passive behavior to the CAN bus when the supply voltage is OFF
- Direct interfacing to microcontrollers with supply voltages from 3V to 5V
- Advanced low-power management with local and remote wake-up support, available all time, even when the internal supply is switched OFF

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- Protection and diagnostic functions, including bus line short-circuit detection and battery connection detection

The LIN transceiver is designed according to the LIN specification 2.0, 2.1, 2.2, 2.2A, ISO 17987-7 and SAEJ2602-2, able to handle the low-speed data communication in vehicles (for example, in convenience technologies). Improved slope control at the LIN driver ensures secure data communication up to 20 Kbaud.

Figure 2. DFN18 Pinning

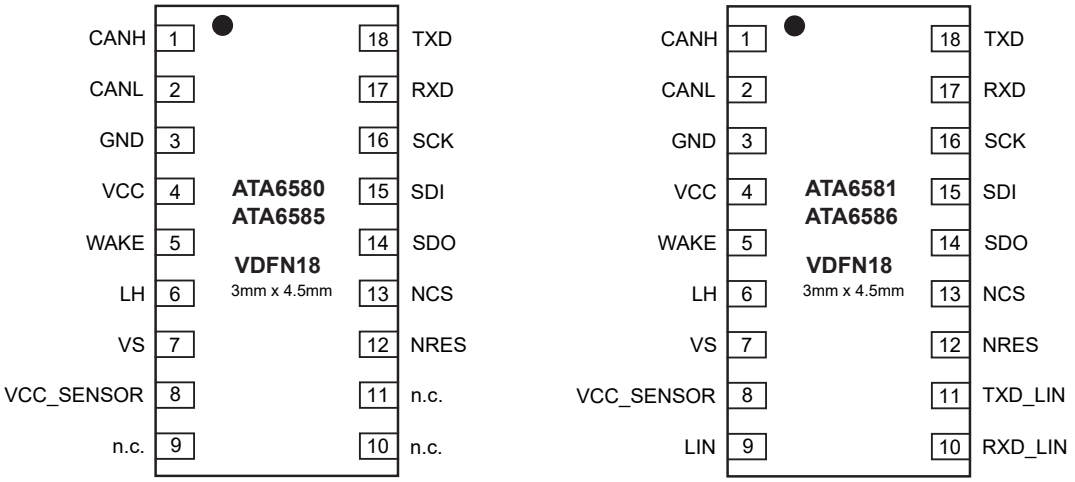
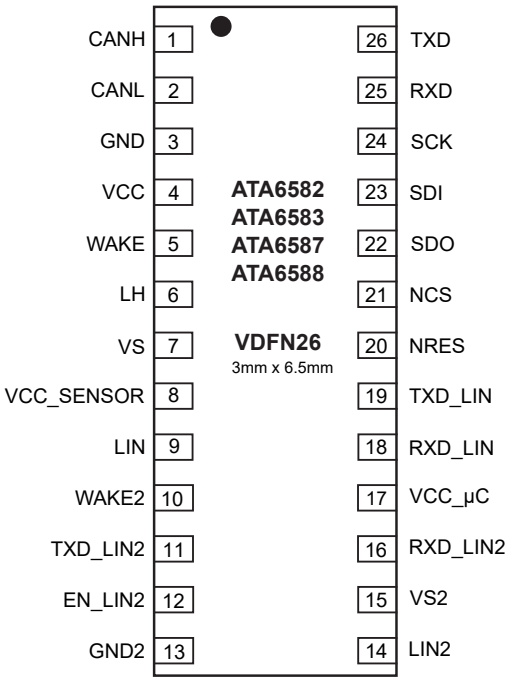


Figure 3. DFN26 Pinning



WHAT DOES THE EV65U8xA DEVELOPMENT BOARD KIT CONTAIN?

This EV65U8xA Development Board kit includes:

- The EV65U8xA Development Board
- Important Information Sheet

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1. Development Board Features

The development board EV65U8xA for the ATA658x ICs supports the following features:

- All Components Necessary to Operate the ATA658x Device are Included
- Placeholders for Some Optional Components Used in Extended Functions
- All Pins are Easily Accessible
- Push Buttons Included for Creating a Local Wake-up after Entering Sleep Mode
- LED for Indicating Operation
- Ground Coulter Clip for Easy Probe Connection while Measuring with Oscilloscope
- Connectors for Direct Plug-in with the C21-XPRO Xplained Board

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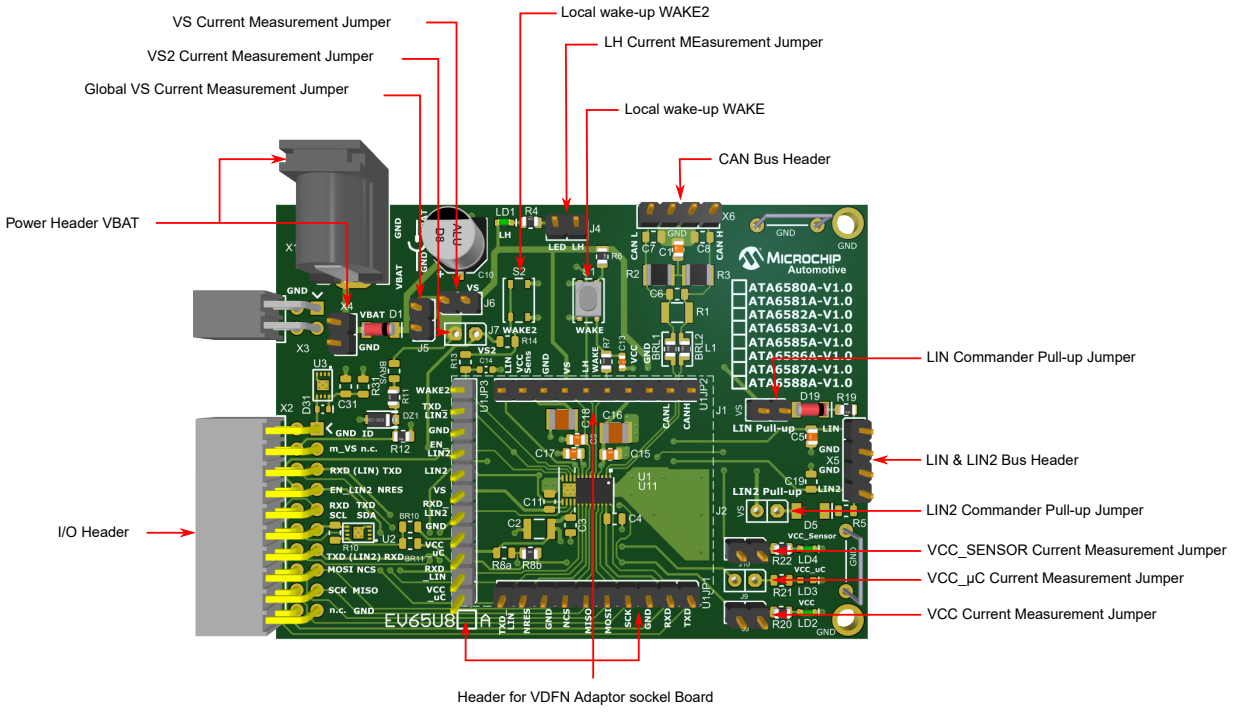
2. Hardware Description

The development board of the ATA658x is shipped with all the components necessary to start with the development of a CAN or a CAN-LIN node immediately. However, commands, data and status information are transferred to and from the ATA658x via SPI. This is how the ATA658x device can be configured and operated.

Microchip offers an Xplained Pro board (ATSAMC21-XPRO Xplained board), which can be used as interface, together with the ATA658x GUI, to operate and control the ATA658x. This Xplained Pro board has to be ordered separately, as the EV65U8xA board comes as a standalone board. The ATA658x GUI can be downloaded directly from Microchip's homepage: www.microchip.com/ata6588.

Figure 2-1. ATA658x Evaluation Board Overview



After correctly connecting an external 12V DC power supply (Power Header VS) to the power connector of the EV65U8xA board, and connecting the Xplained Pro interface board to the PC via the USB cable, the kit is ready to use. To start working with the kit, execute the "ata65xx.exe" file. The ATA658x IC starts in Standby mode, the window watchdog is switched on. A quick check to determine if everything is working properly can be done by executing the following:

CAN Communication Check:

- Configure the WDT to be triggered. On the default WDT settings it is sufficient to configure a WDT period of 100 ms and activate the "Trigger On" checkbox.
- Click the **Normal Mode** button in the **Operating mode** section.
- Click the **Normal Mode** button in the **CAN transceiver** section.
- Set "TXD Pulsed".
- Choose 250 kHz as "Frequency" and press the **Set** button. A 250 kHz signal should be visible on the CANH and CANL pins, when you put oscilloscope probes on those pins.

Sleep/Wake-up Check:

- Select **Falling edge** or **Rising edge** in the **Wake-up settings** section.

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- Click the **Sleep Mode** button in the **Operating mode** section. Please keep in mind that at least one wake-up source should be selected prior putting the ATA658x device into Sleep mode (to avoid deadlock). Otherwise, the “go to sleep” command will be ignored and the device will switch to Standby mode.
- The INH will be switched OFF and, if the jumper J4 is set, the LED “LD1” will be switched OFF.
- Press the local wake-up button (ATA658x board) -> the LED LD1 will be switched ON (the ATA658x device switches from Sleep to Standby mode and the INH becomes active).

Watchdog Check:

- Deselect the “Trigger On”.
- Select “Window mode”
- The LED “LD1” should turn ON – Watchdog failure/resets, because the watchdog is not triggered
- Set the “Trigger On” again. LD1 should turn OFF

2.1 Power Supply

The EV65U8xA board can be powered by an external power source (4.5V to 28V) through the X1 connector or the 2-pin power header X4.

2.1.1 Measuring the ATA658x Current Consumption

As part of an evaluation of the ATA658x device, it can be of interest to measure its current consumption. Because the device has different power supplies (VS and VS2), it is possible to measure the current consumption via separate jumpers. By replacing the jumper J5 with an ampere meter it is possible to determine the current consumption of the entire device (VS+VS2). By replacing the jumper J6 or J7 with an ampere meter it is possible to determine the current consumption on VS or VS2 respectively. Please keep in mind, if the intention is to measure the current consumed only by the ATA658x device, the jumpers J4, J8 and J9 have to be removed in order exclude the current flowing through the LEDs.

2.2 Headers, Connectors and Jumpers

The following table describes the implementation of the relevant connectors, headers and jumpers on the ATA658X development board.

Table 2-1. Headers, Connectors and Jumpers

Type	Name	Description
Jumper	J1	Commander pull-up for LIN1
Jumper	J2	Commander pull-up for LIN2
Jumper	J4	Disconnect the LED LD1 from the LH (Limp Home) pin. Connection for external circuitry. During current consumption measurements of the device this jumper has to be removed.
Jumper	J5	When replacing the jumper J5 with an ampere meter it is possible to determine the allover current consumption of the device. When measuring the current consumption of the device the jumpers J1, J2, J4, J8, J9 and J10 have to be removed.
Jumper	J6	When replacing the jumper J6 with an ampere meter it is possible to determine the current consumption of VS. When measuring the current consumption at VS the jumpers J1, J2, J4, J7, J8, J9 and J10 have to be removed.
Jumper	J7	When replacing the jumper J7 with an ampere meter it is possible to determine the allover current consumption of VS2. When measuring the current consumption of VS2 the jumpers J1, J2, J4, J6, J8, J9 and J10 have to be removed.
Jumper	J8	Disconnect the LED LD2 from the VCC pin. Connection for external circuitry. During current consumption measurements of the device this jumper has to be removed.

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.....continued		
Type	Name	Description
Jumper	J9	Disconnect the LED LD3 from the VCC_µC pin. Connection for external circuitry. During current consumption measurements of the device this jumper has to be removed.
Jumper	J10	Disconnect the LED LD4 from the VCC_SENSOR pin. Connection for external circuitry. During current consumption measurements of the device this jumper has to be removed.
Connector	X1	Main power supply connector – VBAT
Header	X2	Interface header to C21-XPRO Xplained board
Header	X3	Mechanical connector; no electrical function
Header	X4	Optional main power supply connector – VBAT
Header	X5	LINx bus connection header
Header	X6	CANx bus connection header
Header	U1JP1	By default not mounted. Direct access to the device pins.
Header	U1JP2	By default not mounted. Direct access to the device pins.
Header	U1JP3	By default not mounted. Direct access to the device pins.

2.3 Mechanical Buttons

There are two mechanical buttons on the EV65U8xA development board. They are used to generate a local wake-up :

- S1 button generates a local wake-up at pin WAKE
- S2 button generates a local wake-up at pin WAKE2

2.4 LEDs

There are four LEDs available on the EV65U8xA development board (LD1-LD4) indicating activity on LH pin, VCC pin, VCC_µC pin and VCC_SENSOR pin respectively. Via the jumpers J4, J8, J9 and J10 the LEDs can be deactivated if necessary (for example for current measurements on the device, or if an external circuitry should be connected to the corresponding pins).

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3. Mode Control

The ATA658x devices offer various operation modes.

The desired operating mode of the ATA658x device can be set via the SPI interface. With the dedicated GUI and the connected Xplained Pro interface board (C21-XPRO), configuring the ATA658x can be easily done (for more information please see section Graphical User Interface (GUI) and the datasheet of the ATA658x device).

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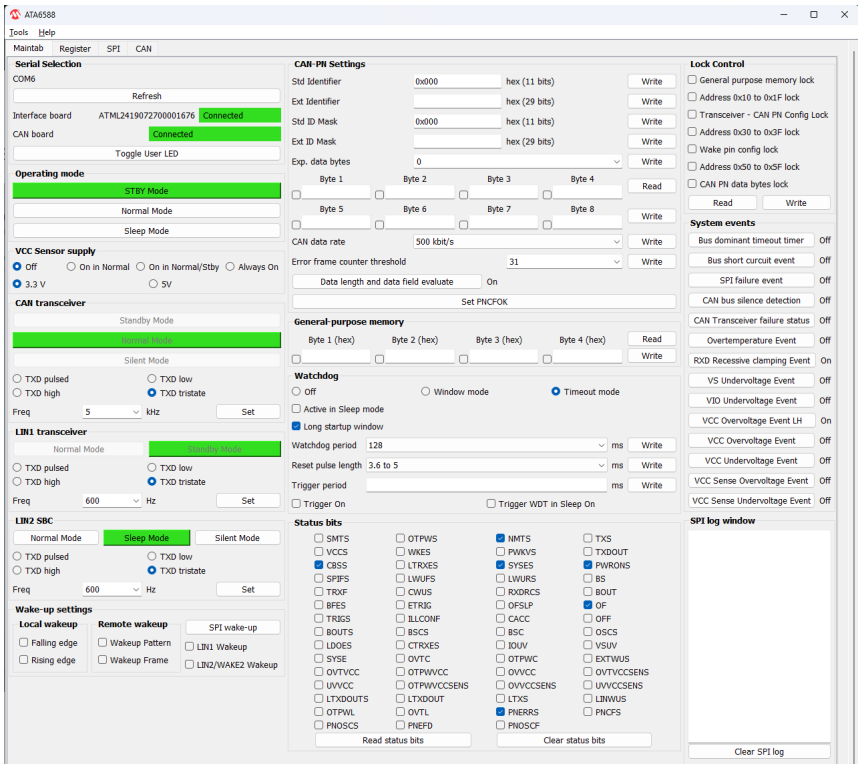
4. Graphical User Interface (GUI)

Figure 4-1. ATA658x Graphical User Interface



Note: The root directory of the GUI contains installers for the Visual C# runtime from Microsoft and for the Microchip USB drivers. Both are necessary to run the GUI and must be run before the GUI is launched. `vc_redist.x86.exe` should be installed for x86/x64 based systems. For the USB driver the correct installer should be chosen depending on the host computer.

4.1 Features

- Configuration of Functions
  - Operating mode
  - CAN Transceiver mode
  - LIN1/LIN2 Transceiver mode
  - Watchdog
  - System events
  - Wake-up settings
  - CAN-PN settings
  - LIN1/LIN2 wake-up
  - General-purpose memory
  - Status bits
  - Lock Control
- Direct Read/Write to All Registers
- Configuration for Xplained Pro

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  - Watchdog trigger
  - CAN TXD pin static/pulsed/data
  - LIN1/LIN2 static/pulsed
- SPI Commands

The ATA658x GUI is a PC software application that graphically displays configuration of an ATA658x device received through the PC's USB connection. The received data is shown in different tabs.

4.2 Maintab

This tab gives access to most of the functionality needed for its features. The device can be configured without accessing the registers directly. Register accesses (read and write) will happen in the background and will be printed on the SPI log window.

This tab is not refreshed periodically. Instead, relevant parts are refreshed when performing an action. For example, when configuring the operating mode, the mode is read back and updated accordingly. There are two ways to refresh the complete tab:

- Switch from a different tab
- Select a different SAMC21 Xplained Pro board in the **Serial Selection** section and press **Refresh**

Both methods will refresh the entire **Maintab**.

4.2.1 Serial Selection

The GUI supports connecting to multiple SAMC21 Xplained Pro boards, hence it is necessary to select which one to send the command to. In the drop-down menu, all boards with a suitable firmware are shown. Commands are sent to the currently selected one. The board can be identified by the Serial number that is also shown in this window. This serial number is printed on a sticker on the bottom of the PCB. To help identifying the board the LED0 close to the SW0 can be toggled by the GUI.

4.2.2 Operating Mode

The operating mode of the device can be chosen in this section. Available modes are Standby, Normal and Sleep, as described in the data sheet. Additionally, the state of the INH pin is continuously monitored and shown in a check box. The switch to Normal and Standby mode can always be executed by issuing the corresponding write to the DCMR register. To enter Sleep mode, certain conditions must be fulfilled, which are described in the data sheet. The GUI checks for these conditions and, if they are not fulfilled, logs an error in the SPI log window. The mode in use will remain unchanged. A write attempt to DCMR will not happen.

4.2.3 CAN Transceiver

In this section, the transceiver part can be configured. For the CAN Transceiver, the following modes are accessible

- Standby mode
- Normal mode
- Normal mode with undervoltage detection active
- Silent mode

Note: To use the transceiver, the device operating mode has to be Normal mode. This mode can be changed as described in 4.2.2. Operating Mode

In this section it is also possible to control an output of the SAMC21 connected to the TXD input. Available options are

- TXD pulsed - this will pulse the TXD with a 50% duty cycle

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- TXD static low
- TXD static high
- TXD tristate - if selected, the internal pull-up on the ATA658x will pull the pin high

When the pulse option is selected, the nearest possible value for the frequency will be selected and the “Freq” cell will be updated accordingly.

4.2.4 Watchdog

In this section, the watchdog can be configured. Available modes are:

- “Off”
- “Window mode”
- “Time-Out mode”

Additionally, all the configuration bits for the watchdog can be controlled.

The following bits can be set/cleared:

- “Active in Sleep mode” - sets/clears the WDSLP bit in the WDCR1 register
- “Long startup window” - sets/clears the WDLW bit in the WDCR1 register

“Watchdog period” and “Reset pulse length” control the settings in WDCR1 and WDCR2.

Note: In order to avoid unwanted configuration of the window watchdog (WWD), the ATA658x only allows users to configure the WWD (write access to WDCR1 register and WDCR2) when the device is in Standby mode. For more information, please see the data sheet.

An appropriate trigger setup should be made, that configures the SAMC21 Xplained Pro to generate a SPI trigger command with the configured frequency. Activating the trigger will first update the frequency on the SAMC21 Xplained Pro and then activate the continuous triggering.

4.2.5 System Events

This section allows the user to enable/disable the capturing of all events distributed across the different registers. The current status is indicated next to the button that toggles the status. The following bits can be configured:

- BOUTE - **Bus dominant time-out timer**
- BSCE - **Bus short circuit event**
- SPIFE - **SPI failure event**
- BSE - **CAN bus status detection**
- TRXFE - **TXD failure status**
- OTPWE - **Overtemperature event**
- RXDRCD - **RXD recessive clamping event**
- VSUVE - **VS undervoltage event**
- IOUVE - **IO undervoltage event**
- VCCOVLHE - **VCC overvoltage LH event**
- VCCOVE - **VCC overvoltage event**
- VCCUVE - **VCC undervoltage event**
- VCCSENSOVE - **VCC Sensor overvoltage event**
- VCCSENSUVE - **VCC Sensor undervoltage event**

The displayed status is not a live-view and only updates when the corresponding button is pressed or the complete tab is updated as described in Section 4.2. Maintab.

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4.2.6 Wake-up Settings

In this section, all wake-up sources supported by the ATA658x device can be activated. For the Local wake-up on pin Wake, falling, rising or both edges can be configured as a valid wake-up source. For the Remote wake-up, either wake-up pattern, wake-up frame or none has to be configured. If “Wake-Up Frame” is selected, the frame must be configured as described in section 4.2.7. CAN PN Settings. The LIN wake-up sources can only be activated or deactivated. The SPI wake-up button will wake up the device by setting the device into Standby mode. This is only possible for the 26-pin variants and only if VCC_µC is present. The checkboxes are updated when a full refresh of the **Maintab** is performed.

4.2.7 CAN PN Settings

This section allows the user to configure the CAN-PN functionality available in the ATA658x. The wake-up frame can be configured with either a STD identifier or an extended one, and, if necessary, a data byte mask can be activated, as well. A description of how CAN PN can be configured can be found in the appnote available here: ww1.microchip.com/downloads/aemDocuments/documents/APID/ApplicationNotes/ApplicationNotes/AN3176-ATA6570-DS00003176.pdf

Note: It should be noted that the data bytes are a mask of bits expected to be 1, i.e., a data byte of 0xAA on the bus will generate a wake-up for devices configured for 0x01, 0x0A and 0xAA and others where all bits selected in the mask are fulfilled.

Note: It should be noted that the configuration for the CAN PN only becomes valid and active after the PNCFOK flag has been set. This can be done by pressing the "Set PNCFOK" button in this section.

4.2.8 General Purpose Memory

This section gives access to the 4 bytes of general purpose memory available on the ATA658x (available at addresses 0x6-0x9). The bytes read/written are selected with the check boxes. The displayed values are not a live-view and only update when the corresponding button is pressed or the entire tab is updated as described in section 4.2. Maintab.

4.2.9 Status bits

This section gives an overview of all status bits of the device. The display is not updated continuously and must be refreshed manually by clicking the “**Read Status bits**” button.

- OFF - Watchdog is off
- CACC - Corrupted write access to the watchdog configuration registers
- ILLCONF - An attempt is made to reconfigure the watchdog control register while the device is not in Standby mode
- TRIGS - The device set the bit to 1 if window watchdog is in first half of window and set the bit to 0 if window watchdog is in second half of window. If the WD is not in window mode, the bit is always be set to 0.
- OF - Watchdog overflow
- OFSLP - Watchdog overflow in Sleep mode
- ETRIG - Watchdog triggered too early
- OTPWS - overtemperature pre-warning status
- NMTS - Normal mode transition status
- VCCS - VVCC status
- TXS - CAN transmitter status
- PNERRS - Partial networking error detection status
- PNCFS - Partial networking configuration status
- PNOSCS - Partial networking oscillator nominal

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- CBSS - CAN Bus status
- TXDOUT - TXD time out status
- BOUT - CAN bus dominant timeout event indicator
- BSC - CAN bus short-circuit event capture indicator+
- RXDRCS - RXD recessive clamping status
- LTXDOUTS - TXD_LIN time out status+
- LTXS - LIN transceiver status
- PWKVS - Pin WAKE voltage status
- OSCS - System oscillator status
- BFES - Bus failure event status
- LTRXES - LIN Transceiver event status
- WKES - WAKE event status
- CTRXES - CAN Transceiver event status
- LDOES - Low drop voltage regulators event status
- SYSES - System event status
- SYSE - Internal system error
- VSUV - VS undervoltage status
- PWRONS - Power on status
- SPIFS - SPI failure status
- IOUV - IO supply voltage undervoltage event
- OVTL -LIN transceiver overtemperature shutdown event
- OTPWL - LIN transceiver overtemperature pre-warning status
- LINWUS - LIN bus wake-up status
- PNOSCF - Partial networking oscillator hardware failure
- PNEFD - Partial networking frame detection status
- BS - Bus status
- OTPWC - CAN overtemperature pre-warning status
- OVTC - CAN transceiver overtemperature shutdown event
- TRXF - CAN transceiver failure status
- CWUS - CAN wake-up status
- EXTWUS - signals a wake-up event from the ATA663232/55 die in ATA6582/3/7/8
- LWURS - Local Wake-up Rising Edge Status
- LWUFS - Local Wake-up Falling Edge Status
- BOUTS - CAN bus dominant timeout event status
- BSCS - device CAN bus short-circuit event status
- OVTVCC - VCC regulator overtemperature shutdown event
- OTPWVCC - VCC regulator overtemperature pre-warning status
- OVVCC - VCC supply voltage overvoltage event
- UVVCC - VCC supply voltage undervoltage event
- OVTVCCSENS - VCC sensor supply overtemperature shutdown event
- OTPWVCCSENS - VCC sensor supply overtemperature pre-warning event

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- OVVCCSENS - Sensor supply voltage overvoltage event
- UVVCCSENS - Sensor supply voltage undervoltage event

Bits can not be manipulated individually but it is possible to clear all status-bits that are writable at once. The following bits are cleared when clicking the "**Clear status bits**" button:

- "BOUTS" - Bus dominant timeout status
- "BS" - Bus silence
- "BSCS" - Bus short circuit
- "CACC" - Corrupted write access to watchdog configuration registers
- "CWUS" - CAN wake-up status
- "ETRIG" - Early watchdog trigger
- "ILLCONF" - Watchdog configuration was written while the device is not in Standby mode
- "LWUFS" - Local wake-up falling edge detected
- "LWURS" - Local wake-up rising edge detected
- "OF" - Watchdog overflow
- "OFSLP" - Watchdog overflow in Sleep mode
- "OTPW" - Overtemperature pre-warning
- "PNEFD" - Partial networking frame detection status
- "PWRONS" - Power-on Reset
- "SPIFS" - SPI failure status
- "TRXF" - Transceiver failure

A list of all status-bits and their descriptions can be found in the data sheet www.microchip.com/wwwproducts/en/ATA6588.

4.2.10 Lock Control

In this section, it is possible to control the bits locking specific parts of the device memories. All seven lock bits can be configured. The configuration is only written/read when pressing the write/read button. Ticking the check boxes will not update the value on the ATA658x. The displayed status is not a live-view and only updates when the corresponding button is pressed or the entire tab is updated as described in section 4.2. Maintab.

4.2.11 SPI Log Window

In this section, all SPI communication with the ATA658x will be logged and possible errors are displayed. The log can be cleared by pressing the "**Clear SPI**" log button below it. The log entry will be made as soon as an action in the GUI is performed. The SPI log does not check if the command was accepted by the ATA658x (failed commands are logged). As more data is written in the log file, the GUI navigation speed might be affected. In such cases, please try clearing the log.

4.3 Registers

This tab allows the user to manipulate the registers directly. Each column shows the name of the register, the address, the last read value and gives the option to read from the register or write to it.

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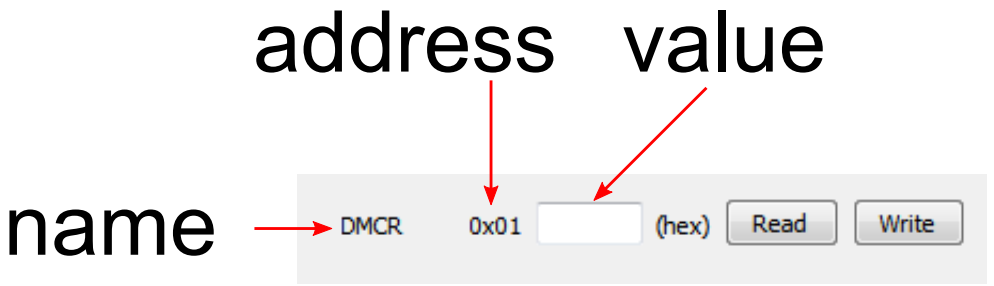
Figure 4-2. Registers



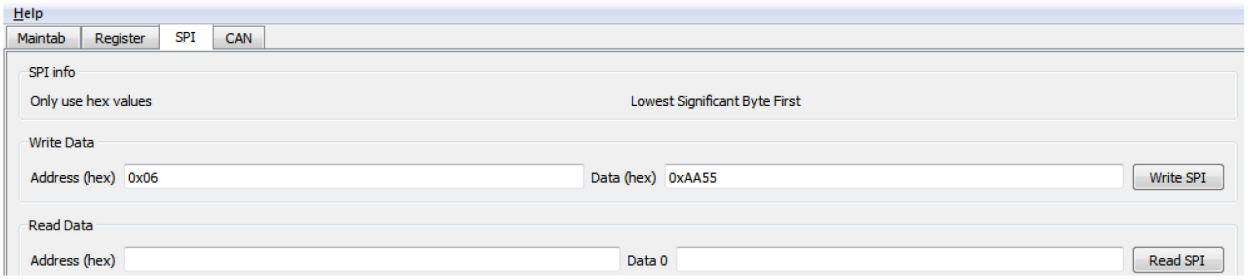
It is also possible to read all registers at once. When writing registers, it is possible to automatically verify the value afterward. This is selectable using the checkbox “Verify after write”. Until a value is verified, it will be shown in a red font.

Note: The displayed values are not a live-view and only updates when the corresponding button is pressed or the entire tab is updated by a tab switch.

4.4 SPI

This tab allows sending SPI commands to the ATA658x device directly. This can be useful for writing multiple registers at the same time or for debugging purposes. To read an address, a valid hex value must be entered in the Address (hex) field.

Figure 4-3. SPI



Note: The data is sent out starting from the lowest significant byte. The order in which the bytes are sent is from right to left. Writing address 0x06 and data 0xAA55 will write 0x55 to 0x06 and 0xAA to 0x07.

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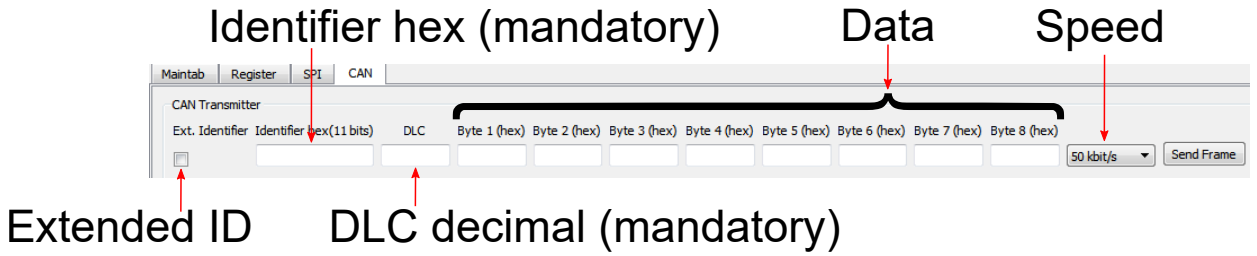
4.5 CAN

This tab allows limited sending of CAN messages for testing. Only “singleshot” messages are supported.

Figure 4-4. CAN



To initiate a transmission, the identifier, the DLC and at least the number of bytes specified in the DLC must be given. After clicking “Send Frame”, the frame will be sent one time if the configuration is valid. It is not possible to receive CAN data.

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5. Revision History

Revision A (February 2024)

Initial release of this document.

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