

Reference Manual

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VL-MPEe-U2

MiniPCle Quad Serial Interface
Module with GPIO



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VersaLogic reserves the right to revise this product and associated documentation at any time without obligation to notify anyone of such changes.

Product Revision Notes

Revision 1.00 – Commercial release.

Support

The VL-MPEe-U2 support page, at <http://www.versalogic.com/private/mpeeu2support.asp>, contains additional information and resources for this product including:

- Reference Manual (PDF format)
- Device drivers and API package
- Data sheets and manufacturers' links for chips used in this product
- Photograph of the circuit board

This is a private page for VL-MPEe-U2 users that can be accessed only by entering this address directly. It cannot be reached from the VersaLogic homepage.

The VersaTech KnowledgeBase is an invaluable resource for resolving technical issues with your VersaLogic product.

[VersaTech KnowledgeBase](#)

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Description

FEATURES AND CONSTRUCTION

The VL-MPEe-U2 is an extremely small and rugged I/O module based on the industry-standard Mini PCIe module format. It provides four serial ports, twelve general purpose I/O lines, and three indicator LEDs. The board's features include:

- Four 4-wire RS-232/RS-422/RS-485 serial ports with baud rates up to 400 Kbps
- Twelve general purpose I/O (GPIO) lines, independently configurable as inputs or outputs
- One power LED and two configurable LEDs
- Industrial temperature operation
- RoHS-compliant
- Customization available

The VL-MPEe-U2 features high reliability design and construction, including voltage sensing reset circuits and self-resetting fuses on the power supplies to the user I/O connectors.

VL-MPEe-U2 boards are subjected to 100% functional testing and are backed by a limited two-year warranty. Careful parts sourcing and US-based technical support ensure the highest possible quality, reliability, service, and product longevity for this exceptional board.

Technical Specifications

Specifications are subject to change without notification.

Board Size:

30.00 mm x 50.95 mm (Mini PCIe standard)

Storage Temperature:

-40° to +85°C

Operating Temperature:

-40° to +85°C

Power Requirements: *at +25°C running Windows 7*

3.3V ±5% @ 0.25W

(supplied from Mini PCIe socket)

Serial Ports:

Four 4-wire RS-232/422/485 serial ports, jumper selectable; 16C550 compatible; 400 Kbps max.

GPIOs:

Twelve general purpose I/O lines; configurable as input or outputs, normal or inverted level, normal HIGH or LOW state, or open drain

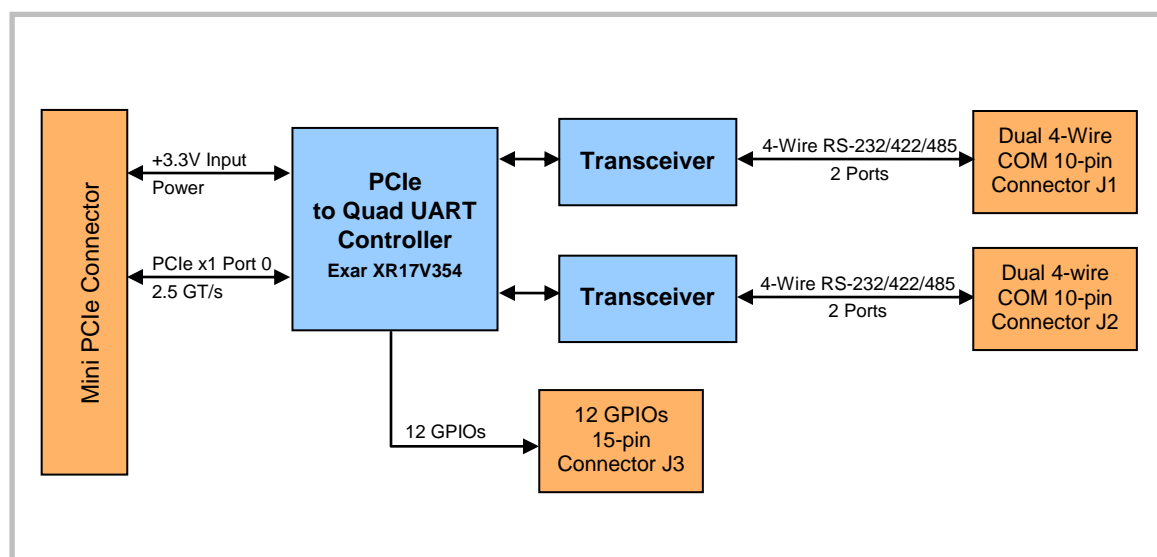
Bus Requirements:

PCIe 1.1 signals from PCIe MiniCard bus (USB and SMBus not used)

Weight:

0.012 lbs (0.006 kg)

Block Diagram



RoHS Compliance

The VL-MPEe-U2 is RoHS-compliant.

ABOUT RoHS

In 2003, the European Union issued Directive 2002/95/EC regarding the Restriction of the use of certain Hazardous Substances (RoHS) in electrical and electronic equipment.

The RoHS directive requires producers of electrical and electronic equipment to reduce to acceptable levels the presence of six environmentally sensitive substances: lead, mercury, cadmium, hexavalent chromium, and the presence of polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) flame retardants, in certain electrical and electronic products sold in the European Union (EU) beginning July 1, 2006.

VersaLogic Corp. is committed to supporting customers with high-quality products and services meeting the European Union's RoHS directive.

Warnings

ELECTROSTATIC DISCHARGE

Warning! Electrostatic discharge (ESD) can damage circuit boards, disk drives, and other components. The circuit board must only be handled at an ESD workstation. If an approved station is not available, some measure of protection can be provided by wearing a grounded antistatic wrist strap. Keep all plastic away from the board, and do not slide the board over any surface.

After removing the board from its protective wrapper, place the board on a grounded, static-free surface, component side up. Use an antistatic foam pad if available.

The board should also be protected inside a closed metallic antistatic envelope during shipment or storage.

Note: The exterior coating on some metallic antistatic bags is sufficiently conductive to cause excessive battery drain if the bag comes in contact with the bottom side of the board.

HANDLING CARE

Warning! Care must be taken when handling the board not to touch the exposed circuitry with your fingers.

Technical Support

If you are unable to solve a problem after reading this manual, please visit the VL-MPEe-U2 product support page below. This page provides links to component datasheets and device drivers.

[VL-MPEe-U2 Support Page](#)

The VersaTech KnowledgeBase contains a wealth of technical information about VersaLogic products, along with product advisories. Click the link below to see all KnowledgeBase articles related to the VL-MPEe-U2.

[VersaTech KnowledgeBase](#)

If you have further questions, contact VersaLogic Technical Support at (503) 747-2261. VersaLogic support engineers are also available via e-mail at Support@VersaLogic.com.

REPAIR SERVICE

If your product requires service, you must obtain a Returned Material Authorization (RMA) number by calling (503) 747-2261. Please provide the following information:

- Your name, the name of your company, your phone number, and your e-mail address
- The name of a technician or engineer that can be contacted if any questions arise
- Quantity of items being returned
- The model and serial number (barcode) of each item

- A detailed description of the problem
- Steps you have taken to resolve or recreate the problem
- The return shipping address

Warranty Repair All parts and labor charges are covered, including return shipping charges for UPS Ground delivery to United States addresses.

Non-warranty Repair All approved non-warranty repairs are subject to diagnosis and labor charges, parts charges, and return shipping fees. Please specify the shipping method you prefer and provide a purchase order number for invoicing the repair.

Note: Please mark the RMA number clearly on the outside of the box before returning.

Board Layout and Mounting

VL-MPEE-U2 MOUNTING

The VL-MPEE-U2 is a full size Mini PCIe card and needs to be mounted into a full size Mini PCIe site. On VersaLogic CPU boards, the module is secured using two nylon screws. VersaLogic offers 2 mm nylon screws (VL-HDW-110) and 2.5 mm nylon screws (VL-HDW-108). On non-VersaLogic CPU boards, mounting might be accomplished using a latching system.

Note: Be careful not to over tighten the nylon mounting screws. Optimum tightness is 1 lbf•in (0.1 N•m).

VL-MPEE-U2 DIMENSIONS AND CONNECTORS

The VL-MPEE-U2 complies with Mini PCIe card (full size) dimensional standards. Dimensions are given below to help with pre-production planning and layout.

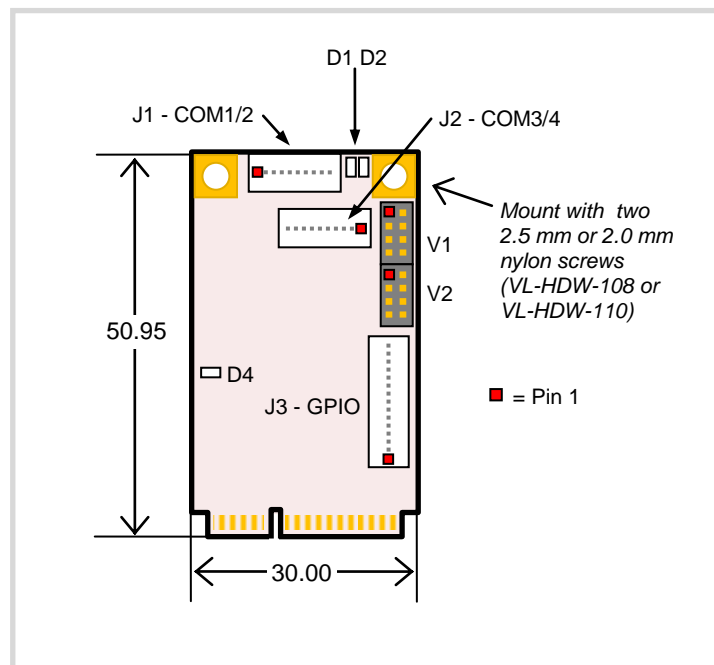


Figure 1. VL-MPEE-U2 Dimensions and Connectors

(Not to scale. All dimensions in millimeters.)

Table 1 provides information about the function, mating connectors, and transition cables for VL-MPEe-U2 connectors. Page numbers indicate where a detailed pinout or further information is available.

Table 1: Connector Functions and Interface Cables

Connector	Function	Mating Connector	Transition Cable	Cable Description	Page
J1	COM 1/2	Molex 501330-1000 vertical 1x10 1 mm "Pico-clasp"	VL-CBR-1014	12" dual-channel serial cable; latching 10-pin connector to dual D-sub (9-pin)	13
J2	COM 3/4	Molex 501330-1000 vertical 1x10 1 mm "Pico-clasp"	VL-CBR-1014	12" dual-channel serial cable; latching 10-pin connector to dual D-sub (9-pin)	13
J3	GPIO	Molex 501330-1500 vertical 1x15 1 mm "Pico-clasp"	VL-CBR-1502	12" GPIO 15-pin VL-CBR-1502A cable to VL-CBR-2004B 20-pin screw terminal paddleboard	15

VL-CBR-2004B DIMENSIONS AND CONNECTORS

The VL-CBR-1502 cable assembly consists of the VL-CBR-1502A cable and the VL-CBR-2004B paddleboard. The paddleboard provides a 20-pin screw terminal interface for all GPIO lines.

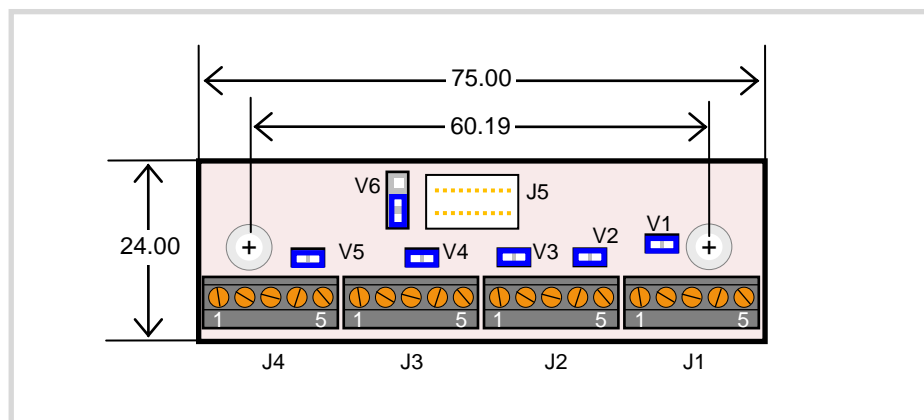


Figure 2. VL-CBR-2004B Dimensions, Connectors, Jumper Blocks

Note: The jumpers on the VL-CBR-2004B must not be removed or moved. Leave all jumpers in the positions shown in the above figure.

Table 2 provides information about the function, mating connectors, and transition cables for VL-MPEe-A1/A2 connectors. Page numbers indicate where a detailed pinout or further information is available.

Table 2: Connector Functions and Interface Cables

Connector	Function	Mating Connector	Transition Cable	Cable Description	Page
J1	GPIO0-2	Bare wire, 18–30 AWG	—	—	15
J2	GPIO3-5	Bare wire, 18–30 AWG	—	—	15
J3	GPIO6-9	Bare wire, 18–30 AWG	—	—	15
J4	GPIO10-11	Bare wire, 18–30 AWG	—	—	15
J5	Interface to MPEe-U2 board	Molex 501189-2010 2x10 1 mm Pico-Clasp receptacle	VL-CBR-1502A	20 position screw terminal, 12" latching cable to VL-CBR-2004B I/O board	—

Jumper Blocks

VL-MPEE-U2 JUMPERS AS-SHIPPED CONFIGURATION

All jumpers on the VL-MPEe-U2 are shipped in the out (or "storage") position, as shown in the figure below.

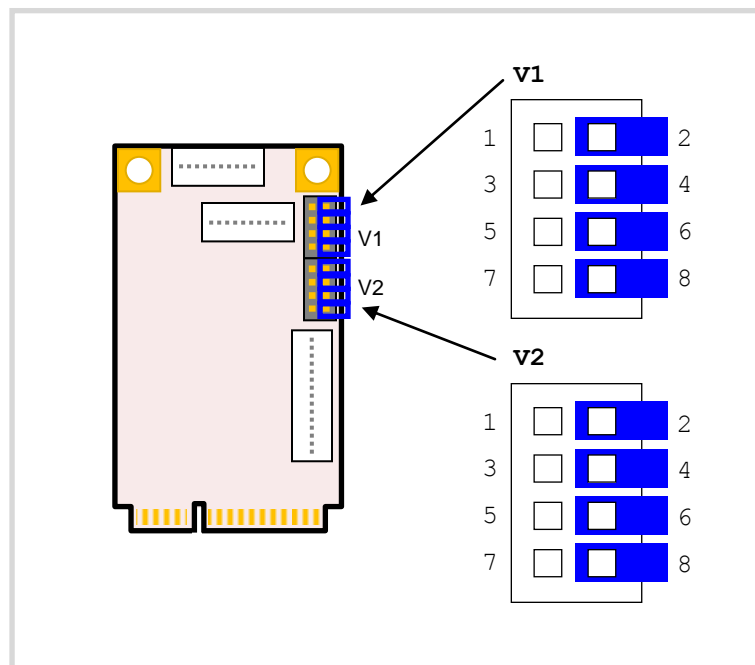


Figure 3. VL-MPEe-U2 Jumper As-shipped Configuration

JUMPER SUMMARY**Table 3: Jumper Summary**

Jumper Block	Description	As Shipped
V1[1-2]	COM1 RS-422 Rx or RS-485 Termination In – 120 Ohm terminated Out – Not terminated	Out
V1[3-4]	COM2 RS-422 Rx or RS-485 Termination In – 120 Ohm terminated Out – Not terminated	Out
V1[5-6]	COM3 RS-422 Rx or RS-485 Termination In – 120 Ohm terminated Out – Not terminated	Out
V1[7-8]	COM4 RS-422 Rx or RS-485 Termination In – 120 Ohm terminated Out – Not terminated	Out
V2[1-2]	COM1 Mode In – RS-422/485 Mode Out – RS-232 Mode	Out
V2[3-4]	COM2 Mode In – RS-422/485 Mode Out – RS-232 Mode	Out
V2[5-6]	COM3 Mode In – RS-422/485 Mode Out – RS-232 Mode	Out
V2[7-8]	COM4 Mode In – RS-422/485 Mode Out – RS-232 Mode	Out

Serial Ports

The VL-MPEe-U2 features four on-board 16550-based serial channels. All four channels are 4-wire RS-232/RS-422/RS-485 ports with baud rates up to 400 Kbps.

Connector J1 provides an interface to the COM1 and COM2 ports. Connector J2 provides an interface to the COM3 and COM4 ports. The VL-CBR-1014 cables each provide two DB9 connectors and can be connected to both J1 and J2 for a total of four DB9 connectors.

COM PORT CONFIGURATION

All serial ports can be operated in RS-232, RS-422, or RS-485 modes. Jumper block V2 selects the mode of each port independently. Jumper block V1 enables the RS-422/485 termination resistor for each port independently. The termination resistor should be enabled for RS-422 and the RS-485 endpoint station. It should be disabled for RS-232 and for RS-485 intermediate stations.

If RS-485 mode is used, the half-duplex differential twisted pair (TxD+/RxD+ and TxD-/RxD-) is formed by connecting both transmit and receive pairs together. For example with COM1 on VL-CBR-1014 connector DB9b, the TxD+/RxD+ signal is formed by connecting pins 7 and 8, and the TxD-/RxD- signal is formed by connecting pins 2 and 3.

SERIAL PORT CONNECTORS

The following tables show the function of each pin of the J1 and J2 connectors, and how the signals are routed to the DB9 connectors on the VL-CBR-1014 cable.

Table 4: J1 Serial Port Connector Pinout

VL-MPEe-U2 J1 Pin	VL-CBR-1014 Connector	Pin*	Signal	
			RS-232	RS-422/485
1	COM1 DB9b	7	RTS	TxD+
2		3	TXD	TxD-
3		8	CTS	RxD+
4		2	RXD	RxD-
5		5	Ground	Ground
6	COM2 DB9a	7	RTS	TxD+
7		3	TXD	TxD-
8		8	CTS	RxD+
9		2	RXD	RxD-
10		5	Ground	Ground

Note: Pins 1, 4, 6, and 9 of each DB9 connector are not connected.

Table 5: J2 Serial Port Connector Pinout

VL-MPEe-U2 J2 Pin	VL-CBR-1014		Signal	
	Connector	Pin*	RS-232	RS-422/485
1	COM3 DB9b	7	RTS	TxD+
2		3	TXD	TxD-
3		8	CTS	RxD+
4		2	RXD	RxD-
5		5	Ground	Ground
6	COM4 DB9a	7	RTS	TxD+
7		3	TXD	TxD-
8		8	CTS	RxD+
9		2	RXD	RxD-
10		5	Ground	Ground

Note: Pins 1, 4, 6, and 9 of each DB9 connector are not connected.

General Purpose I/O (GPIO) Lines

The VL-MPEe-U2 provides twelve GPIO (digital I/O) lines that are independently configurable as an input or output. GPIO inputs can be set for normal or inverted level, and optionally set to generate an interrupt. GPIO outputs can be set to be normal HIGH or LOW state, or open drain. There are 10K pull-up resistors to +3.3V on all GPIO lines.

VersaLogic provides a set of API calls for managing the GPIO lines. See Application Programming Interface (API) for information.

Note: Accesses to the GPIO functions are physically made using the Exar COM port interface driver. Under Windows, this driver can only be opened by one application at a time, so care should be taken that any systems wishing to use the serial port interface and GPIO interface simultaneously synchronize their access to this COM port resource through a single application.

GPIO CONNECTOR

Connector J3 provides a vertical 1x15 1 mm Pico-Clasp connector for the GPIO interface. The VersaLogic VL-CBR-1502 cable assembly (consisting of the VL-CBR-1502A cable and the VL-CBR-2004B paddleboard) attaches to connector J3 to provide a 20-pin screw terminal interface for GPIO.

Table 6 shows the pinout of the J3 connector.

Table 6: J3 GPIO Connector Pinout

J3 Pin	Signal Name	Function
1	UART_MPIO0	GPIO0
2	UART_MPIO1	GPIO1
3	UART_MPIO2	GPIO2
4	UART_MPIO3	GPIO3
5	GND	Ground
6	UART_MPIO4	GPIO4
7	UART_MPIO5	GPIO5
8	UART_MPIO6	GPIO6
9	UART_MPIO7	GPIO7
10	GND	Ground
11	UART_MPIO8	GPIO8
12	UART_MPIO9	GPIO9
13	UART_MPIO10	GPIO10
14	UART_MPIO11	GPIO11
15	GND *	Ground

* Ground on standard products. Custom products can be designed to make pin 15 UART_MPIO15.

Table 7 shows how the GPIO signals are routed to the VL-CBR-2004B paddleboard screw terminals.

Table 7: VL-CBR-2004B Terminal Block Pinouts

VL-CBR-2004B J1 Pin	Signal Name	Function
5	DGND1	Ground
4	DIO1	GPIO0
3	DIO2	GPIO1
2	DGND1	Ground
1	DIO3	GPIO2
J2 Pin		
5	DIO4	GPIO3
4	DGND1	Ground
3	DIO5	GPIO4
2	DIO6	GPIO5
1	DGND2	Ground
J3 Pin		
5	DIO7	GPIO6
4	DIO8	GPIO7
3	DGND2	Ground
2	DIO9	GPIO8
1	DIO10	GPIO9
J4 Pin		
5	DGND2	Ground
4	DIO11	GPIO10
3	DIO12	GPIO11
2	DGND2	Ground
1	DIO13	Ground

LEDs

There are two blue LEDs (D1 and D2) that can be enabled by driving the active low XR17V354 MPIO 12 (D2) and MPIO 13 (D1).

A third blue LED (D4) is a power good output driven when the XR17V354 internal 1.2V regulator is powered up.

About VersaAPI

The VersaLogic Application Programming Interface (VersaAPI) is a shared library of API calls for reading and controlling on-board devices on certain VersaLogic products. In Microsoft Windows they are presented as a dynamically linked library interface plus associated header file, and under Linux as a shared library with an associated header file.

Visit the [VL-MPEe-U2 support page](#) to download the VersaAPI package.

Open and Close Calls

The library interface must be opened by every application that wishes to make calls into the API and also must be closed by that same application when exiting.

VSL_Open();

Opens the VersaAPI library.

Syntax: VL_OSALIB_API **unsigned long** VSL_Open();

Inputs: none

Outputs: unsigned long

This call returns 0 if the open was a success and nonzero if no useable drivers were found by the DLL. For the VL-MPEe-U2, the useable driver is the Exar serial port driver.

VSL_Close();

Closes the VersaAPI library.

Syntax: VL_OSALIB_API **void** VSL_Close();

Inputs: none

Outputs: none

VSL_GetVersion()

Gets the version number of the VersaAPI library

Syntax: VL_OSALIB_API void VSL_GetVersion(unsigned char *Major, unsigned char *Minor, unsigned char *Revision);

Inputs: unsigned char *Major
A pointer to the unsigned character to receive the Version Major number.

unsigned char *Minor
A pointer to the unsigned character to receive the Version Minor number.

unsigned char *Revision
A pointer to the unsigned character to receive the Version Revision number.

Outputs: none
While this function is void, the Major, Minor, and Revision versions are returned in their respective input fields.

Digital I/O (DIO) Calls

API calls can be made to control or interrogate specific DIO channels. The following table lists the channel, level, and direction parameter definitions used in DIO calls.

Table 8: DIO API Parameter Definitions

Parameters	Value
Channel	DIO_U2_CHANNEL_1 0xA0
	DIO_U2_CHANNEL_2 0xA1
	DIO_U2_CHANNEL_3 0xA2
	DIO_U2_CHANNEL_4 0xA3
	DIO_U2_CHANNEL_5 0xA4
	DIO_U2_CHANNEL_6 0xA5
	DIO_U2_CHANNEL_7 0xA6
	DIO_U2_CHANNEL_8 0xA7
	DIO_U2_CHANNEL_9 0xA8
	DIO_U2_CHANNEL_10 0xA9
	DIO_U2_CHANNEL_11 0xAA
	DIO_U2_CHANNEL_12 0xAB
Level*	DIO_CHANNEL_LOW 0x00
	DIO_CHANNEL_HIGH 0x01
Direction	DIO_INPUT 0x01
	DIO_OUTPUT 0x00

*Level values are also the return results for VSL_DIOGetChannelLevel.

VSL_DIOGetChannelLevel

Reads the signal level of the specified channel.

Syntax: VL_OSALIB_API unsigned char VSL_DIOGetChannelLevel(unsigned char Channel);

Inputs: unsigned char Channel
The DIO channel number to be interrogated.

Outputs: unsigned char
Returns the state of the channel as either high (DIO_CHANNEL_HIGH) or low (DIO_CHANNEL_LOW).

VSL_DIOSetChannelLevel

Sets the signal level of the specified channel.

Syntax: VL_OSALIB_API void VSL_DIOSetChannelLevel(unsigned char Channel, unsigned char Level);

Inputs: unsigned char Channel
The DIO channel number to be set.

unsigned char Level
The DIO level to be set: DIO_CHANNEL_HIGH or DIO_CHANNEL_LOW.

Outputs: none

VSL_DIOSetChannelDirection

Sets the signal direction of the specified channel.

Syntax: VL_OSALIB_API void VSL_DIOSetChannelDirection(unsigned char Channel, unsigned char Direction);

Inputs: unsigned char Channel
The DIO channel number to be set.

unsigned char Direction
The DIO direction to be set: DIO_INPUT or DIO_OUTPUT.

Outputs: none