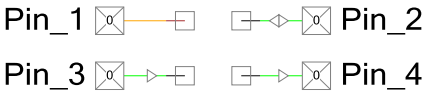
Pins
1.50

Features



- Rapid setup of all pin parameters and drive modes
- Allows PSoC Creator to automatically place and route signals
- Allows interaction with 1 or more pins simultaneously

General Description

The Pins component is the preferred way for hardware resources to connect to a physical port-pin. It provides access to external signals via an appropriately configured physical IO pin. It allows electrical characteristics to be associated with one or more pins; these characteristics are then used by PSoC Creator to automatically place and route the signals within the component.

Pins can be used with schematic wire connections and/or software. To access a Pins component from component APIs, the component must be contiguous and non-spanning. This ensures that the pins are guaranteed to be mapped into a single physical port. Pins components that span ports or are not contiguous can only be accessed from a schematic or with the global per-pin APIs.

Note There are #defines created for each pin in the Pins component to be used with global APIs.

A Pins component can be configured into any legal combination of types. For convenience the Component Catalog provides four preconfigured Pins components: Analog, Digital Bidirectional, Digital Input, and Digital Output.

When to Use a Pins Component

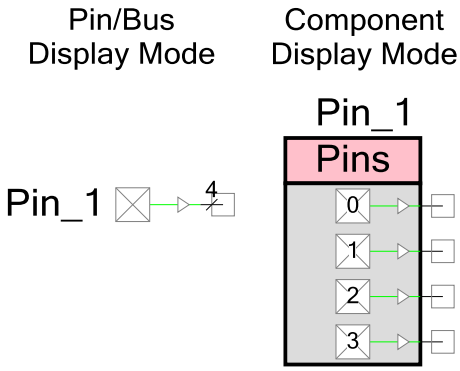
Use the Pins component when a design needs to generate or access an off-device signal through a physical IO pin. Pins are the most commonly used component in the Catalog. For example, they are used to interface with potentiometers, buttons, LEDs, peripheral sensors such as proximity detectors and accelerometers.

Input/Output Connections

This section describes the various input and output connections for the Pins component.

Display of Pins

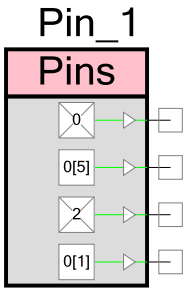
Pins can be configured into complex combinations of input, output, bidirectional, and analog. Simple configurations with less than two internal hardware connections are generally shown as single pins. More complex types of pins, arrays of pins, or buses are shown as standard components with a bounding box.



The default, and most common, configurations are shown in the following sections.

Display of Locked Pins

When you assign a Pins component to a physical GPIO or SIO pin using the PSoC Creator Design-Wide Resources Pin Editor, the tooltip for the Pins component shows the specific pin assignments. If you lock a pin assignment, the display of the component indicates the assignment, as shown in the following example:



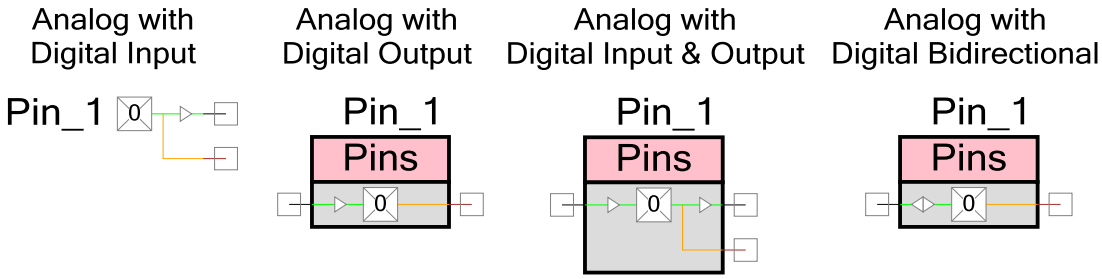
Note If the Pins component is set to "Display as Bus" then the display of the component will not display any locked pin assignments; however, the tooltip will still display this information.

Analog

A Pins component should be configured as Analog any time a connection is required between a device pin and an internal analog terminal connected together with an analog wire. When

configured as analog, the terminal is shown on the right side of the symbol with the connection drawn in the color of an analog wire.

An analog Pins component may also support digital input or output connections, or both, as well as bidirectional connections. It is possible to short together digital output and analog signals on the same pin. This can be useful in some applications; however, it is an advanced topic and should be used with care.

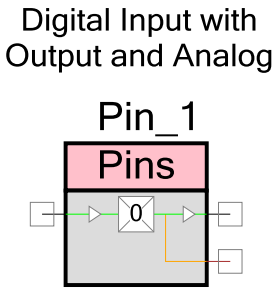


Digital Input

A Pins component should be configured as Digital Input any time a connection is required between a device pin and an internal digital input terminal, or its state is read by the CPU/DMA. In all cases, the pin state is readable by the CPU/DMA. Additionally, if the terminal is displayed it can be routed to other components in the schematic.

When visible, the terminal is shown on the right side of the symbol. The connection is drawn in the color of a digital wire with small input buffer to show signal direction.

A digital input Pins component may also support digital output and analog connections.

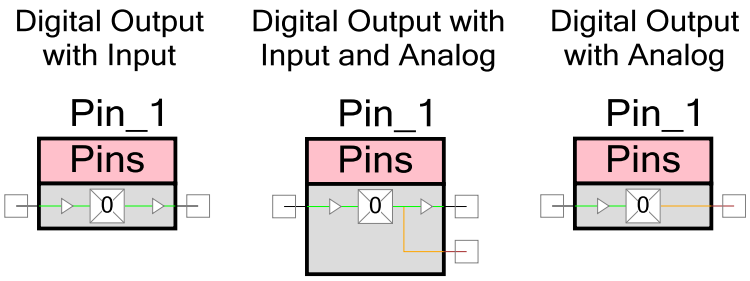


Digital Output

A Pins component should be configured as Digital Output any time a device pin is to be driven to a logic high or low. In all cases, the pin state is writeable by the CPU/DMA. Additionally, if the terminal is displayed it can be routed from other components in the schematic. When visible, the

terminal is shown on the left side of the symbol. The connection is drawn in the color of a digital wire with a small output buffer to show signal direction.

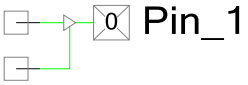
A digital output Pins component may also support digital input and analog connections.



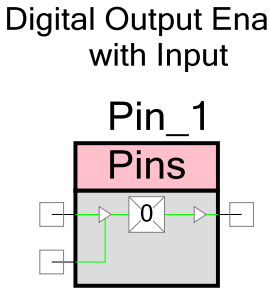
Digital Output Enable

Digital Output Enable should be selected when digital logic is to be used to quickly control the pin output driver without CPU intervention. A high logic level on this terminal enables the pin output driver as configured by the Drive Mode parameter. A logic low level on this terminal disables the pin output driver and makes the pin assume the High-Z drive mode. This terminal is shown when a component is configured with digital output using a schematic connection, and when the digital output enable has been selected. The digital output enable appears on the left side of the symbol and connects to the digital output buffer. It is drawn in the color of a digital wire.

When set to Display as Bus, only one output enable is provided regardless of the Pins component width as all the pins share the same output enable. When not displayed as a bus, individual output enables are provided per pin.



A digital output enable Pins component may also support input and analog connections.

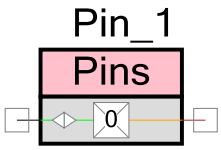


Digital Bidirectional

A Pins component should be configured as Digital Bidirectional any time a connection is required between a device pin and an internal digital bidirectional terminal. Digital Bidirectional mode is most often used with communication component like I^2C. When configured as digital bidirectional, the terminal is shown on the left side of the symbol with the connection drawn in the color of a digital wire with input and output buffers showing that the signal is bidirectional.

A bidirectional Pins component may also support analog connections.

Digital Bidirectional with Analog



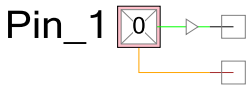
Vref

To configure a Pins component to use a Vref signal:

- use a Digital Input or Bidirectional terminal and configure the **Threshold** parameter to "Vref" on the **Input** subtab, or
- use a Digital Output or Bidirectional terminal and configure the **Drive Level** to “Vref” on the **Output** subtab

Using a Vref requires an SIO pin, indicated with a pink outline. All pins are capable of supplying their respective Vddio supply voltage. SIO pins are also able to supply a programmable or analog routed voltage for interface with devices at a different potential than the SIO’s Vddio voltage. The Vref terminal provides the analog routed voltage supplied to the SIO pin. SIO pins may also use the Vref input as the input threshold for an SIO.

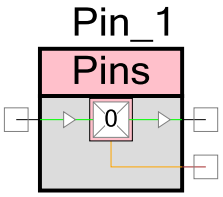
The Vref signal displays on the right side of the component, coming out of the bottom of the SIO single pin or the SIO pin pair depending on how it is configured. Each SIO pin pair shares a single Vref input.



Vref can only be used in conjunction with another digital input or output connection.

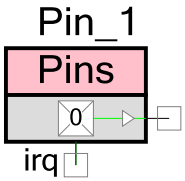
Note When using Vref, Analog cannot be used.

Vref with
Digital Input & Output



IRQ

To configure a Pins component with an interrupt, you must use a Digital Input and configure the **Interrupt** parameter on the **Input** subtab. When interrupts are used, the Pins component displays with a bounding box, and the IRQ is displayed coming out of the bottom of the component. The typical use case is to connect an Interrupt component to this terminal.



An Interrupt can be used in all configurations of the Pins component, as long as you include Digital Input.

- **Interrupt –** This parameter selects whether the pin is able to generate an interrupt and, if selected, the interrupt type. The pin interrupt may be generated with a rising edge, falling edge, as well as both edges. If set to anything but None, the component must be configured to be contiguous to ensure it is mapped into a single physical port. A single port is required because all pins in a port logically OR their interrupts together and generate a single interrupt signal and symbol terminal. The Interrupt parameter uses the dedicated pin interrupt logic which latches which pins generated interrupted events. After an interrupt occurs the Pin_1_ClearInterrupt() function must be called to clear the latched pin events to enable future events to be detected. If more than one pin in the Pins component can generate an interrupt, the Pin_1_ClearInterrupt() return value can be decoded to determine which pins generated interrupt events.

While not the preferred method, any digital input hardware connection can also be connected to an isr component providing the ability to generate a pin interrupt on high or low logic level versus on an edge event. Using the digital input connection for a level interrupt does not use the dedicated pin interrupt logic configured with this parameter.

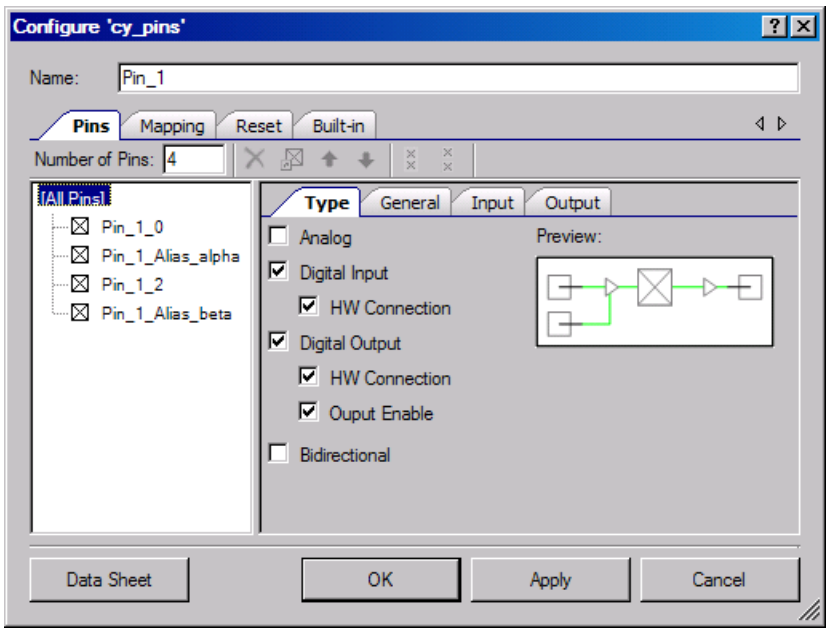
- ❑ None - Default
- ❑ Rising edge
- ❑ Falling edge
- ❑ Any edge

Component Parameters

Drag a Pin component onto the design schematic and double-click it to open the Configure dialog. This dialog is used to set component-wide parameters, such as the power-on reset state and physical pin mapping constraints. The parameters are categorized into separate tabs called subtabs.

Pins Tab

The **Pins** tab has three areas: a toolbar, pin tree, and another set of subtabs. The toolbar is used to determine how many physical pins are managed by the component and determine their order. The subtabs are used to set the pin-specific attributes, such as type, direction, drive mode, and initial state. The pin tree works with the subtabs to allow you to choose the specific pin(s) to which these attributes are applied.



Toolbar

Contains these commands:

- **Number of Pins** – The number of device pins controlled by the component. Valid values are between 1 and 64. Default Value: 1.

  Note Some configurations can only be placed into a single physical port; therefore, the default maximum number of pins is limited to 8 or less. When the component is configured as noncontiguous and spanning, the maximum number of pins can be set up to 64 as they are no longer required to be placed into a single physical port.

- **Delete Pin –** Deletes selected pin(s) from the tree.

- **Add / Change Alias –** Opens a dialog to add or change the alias name for a selected pin in the tree. You can also double-click a pin or press [**F2**] to open the dialog.
- **Move Up / Down –** Moves the selected pin(s) up or down in the tree.
- **Pair / Unpair SIOs –** Pairs or unpairs selected SIO pins (denoted by a pink outline) in the tree.

  This control specifies whether or not pins that require SIO should be placed in the same SIO pair on the device. Pairing pins results in fewer physical SIO pins being "wasted." This is because an unpaired pin that requires SIO cannot share its SIO pair on the device with another pin that requires SIO. For pins to share an SIO pair on the device, they must have their per-pair settings configured the same way and be adjacent.

  A pin requires SIO if **Hot Swap** is set to true, **Threshold Level** is set to anything but LVTTL or CMOS, **Drive Level** set to Vref, and/or **Drive Current** is set to 25mA sink.

Pin Tree

This area displays all of the pins for the component. You can individually select one or more pins to use with the toolbar commands and subtabs. Each pin displays its name which is comprised of the Pins component name + '_' + individual pin alias.

Type Subtab

This is the default subtab displayed for the **Pins** tab. This is where you choose the type of pins for your component using the checkboxes. The preview area shows what the selected Pin(s) component symbol will look like with various options selected for that specific pin.

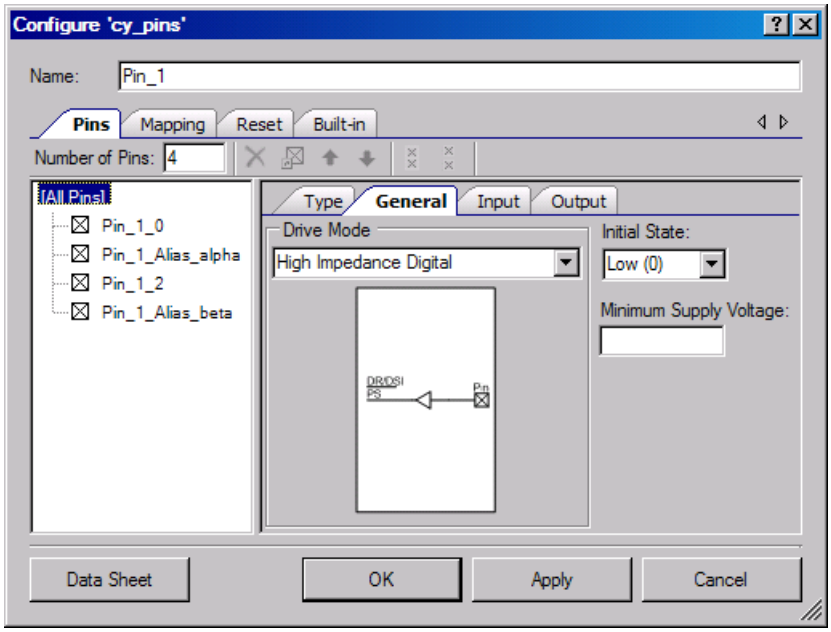
- Analog – Select Analog to enable the analog pin terminal to allow analog signal routing to other components. Selecting analog forces the pin to be physically placed on a GPIO pin and not an SIO pin.
- Digital Input – Select Digital Input to enable the digital input pin terminal (optional) as well as enable the Input subtab for additional configuration opens related to inputs.
  - HW Connection – This parameter determines whether or not the digital input terminal for an input pin is displayed in the schematic. If displayed, the pin provides a digital signal to the Digital System Interconnect (DSI) for use with hardware components. Independent of this selection, all pins may always be read by the CPU through registers or APIs. If this option is unchecked, the terminal is not displayed and it is controlled only by software APIs.
- Digital Output - Select Digital Output to enable the digital output pin terminal (optional) as well as enable the Output subtab for additional configuration opens related to outputs.
  - HW Connection – This parameter determines whether or not the digital output terminal for a given output pin is displayed in the schematic. If displayed, the pin outputs the digital signal supplied by hardware components through the DSI. If not displayed, the

output logic level is determined by CPU register or API writes. If this option is unchecked, the terminal is not displayed and it is controlled only by software APIs.

- Output Enable – This parameter allows the use of the Output Enable feature of pins and displays the Output Enable input terminal. The Output Enable feature allows a hardware signal to control the pins output drivers without requiring the CPU to write registers. A high logic level configures the output drivers as set in the Drive Mode parameter. A low logic level disables the output drivers and places the pin into the High-Z drive mode.

- Bidirectional – Enabling the Bidirectional parameter is functionally equivalent to Enabling the Digital Input with HW Connection and the Digital Output with HW Connection parameters. The difference is that only a single bidirectional terminal is displayed on the component symbol rather than separate input and output terminals. Both Input and Output subtabs are enabled for further configuration.

General Subtab

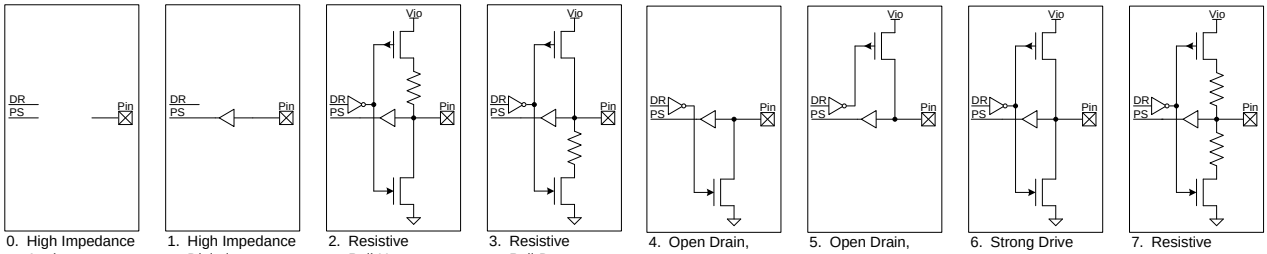


The General subtab allows you to set up parameters that apply to all pins such as the drive move, initial state, and minimum supply voltage of the selected pin. The settings on this subtab include:

- **Drive Mode –** This parameter configures the pin to provide one of the eight available pin drive modes. The defaults and legal choices are influenced from the selections on the **Type** subtab. Refer to the device data sheet for more details on each drive mode. A diagram shows the circuit representation for each drive mode as they are selected.
  - If the type is Digital Input or Digital Input/Analog, the default is High Impedance Digital.
  - If the pin type is Analog, the default is High Impedance Analog.

- If the pin type is Bidirectional or Bidirectional/Analog, the default is Open Drain, Drives Low.
- All other pin types default to Strong Drive.

The diagram for each drive mode is as follows:



0. High Impedance Analog
1. High Impedance Digital
2. Resistive Pull-Up
3. Resistive Pull-Down
4. Open Drain, Drives Low
5. Open Drain, Drives High
6. Strong Drive
7. Resistive Pull-Up & Down

Note If any of the three drive modes (resistive pull-up, resistive pull down, resistive pull-up & down) is used, choosing the output drive level to be Vref will not work.

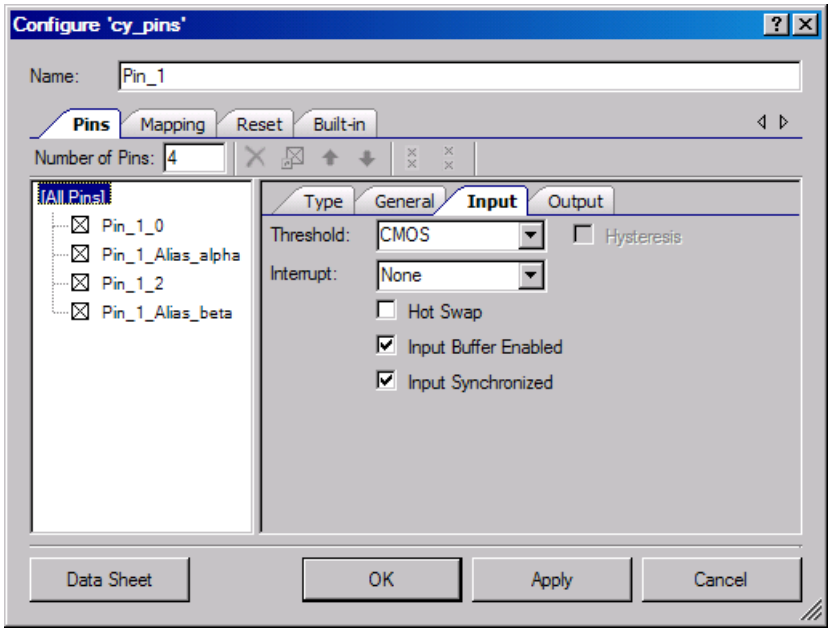
- **Initial State –** This parameter specifies the pin specific initial value written to the pin's Data Register after Power-On Reset (POR). All pins default to a logic low (0) in hardware at POR. The Initial State is written to the pin just after the Drive Mode is configured, which occurs as part of the configuration of the entire device. The Initial State is configured high by default only for the "Resistive Pull Up" and "Resistive Pull Up/Down" drive-modes to ensure the pull up resistor is active.

  Note This should not be confused with the reset state under the main **Reset** tab. That attribute affects the state of the whole port that the pin is a member of, from the moment of reset, before any other device configuration.

- **Minimum Supply Voltage –** This parameter selects the requested minimum high logic level output voltage. The requested voltage must be provided by one of the Vddio supply inputs. This selection ensures that the Pins component will be mapped onto pins that can support its required output voltage. If left blank, the component has no voltage requirements, allowing placement to a pin supplied by any of the available Vddio voltages.

  Valid values are determined by the settings in the **System** tab of the *<project>.cydwr* file for Vio0/Vio1/Vio2/Vio3 Vio3 and to a lesser extent Vddd. Depending on the selected device, you may have two USB pins that will use Vddd as their voltage available for placement. The pin will not be placeable if this value is not less than or equal to the maximum value set for those settings. This range check is performed outside this dialog; the results will appear in the Notice List window if the check fails.

Input Subtab

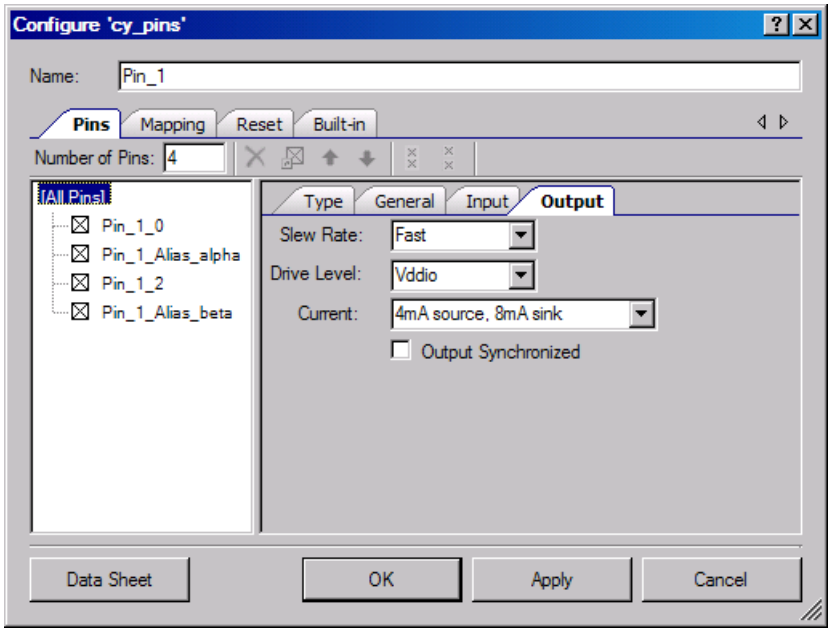


The Input subtab is used to specify input settings. If the pin type does not enable Input or Bidirectional in the Type subtab, this subtab is disabled as no input information needs to be specified.

- **Threshold –** This parameter selects the threshold levels that define a logic high level (1) and a logic low level (0). CMOS is the default and should be used for the vast majority of application connections. The other threshold levels allow for easy interconnect with devices with custom interface requirements that differ from that of CMOS. Thresholds that are derived from Vddio or Vref require the use of an SIO pin.
  - CMOS – Default
  - LVTTL
  - CMOS or LVTTL
  - 0.5 x Vddio – Requires SIO
  - 0.4 x Vddio – Requires SIO
  - 0.5 x Vref – Requires SIO
  - Vref – Requires SIO
- **Hysteresis –** Enables or Disables the SIO differential hysteresis for the pin. This feature is disabled if the Threshold is CMOS or LVTTL. Hysteresis control requires the use of an SIO pin. GPIO pins always have hysteresis enabled.
  - Disabled – Default
  - Enabled

- **Interrupt –** This parameter selects whether the pin is able to generate an interrupt and, if selected, the interrupt type. The pin interrupt may be generated with a rising edge, falling edge, as well as both edges. If set to anything but None, the component must be configured to be contiguous to ensure it is mapped into a single physical port. A single port is required because all pins in a port logically OR their interrupts together and generate a single interrupt signal and symbol terminal.
  - None - Default
  - Rising edge
  - Falling edge
  - Any edge
- **Hot Swap –** A pin configured for hot swap capability will be mapped to an SIO pin supporting this capability in hardware. Hot Swap capability allows the voltage present on the pin to rise above the pin's Vddio voltage, up to 6.0V. Hot Swap also does not allow a pin with any voltage up to 6.0V present not leak current into the PSoC device even when the PSoC device is not powered. Hot swap is useful for connecting the PSoC device when unpowered to a communications bus like I^2C without shorting the bus or back powering the PSoC device.
  - No - Default
  - Yes – Requires SIO
- **Input Buffer Enabled –** This parameter determines if the pin's digital input buffer is enabled. The digital buffer is required to read or use the logic level present on a pin through DSI routing or a CPU read. The input buffer is required to use the pin as a digital input. Analog pins disable the digital input buffer by default to reduce pin leakage in low power modes. If the pin type is Analog, the default is Disabled. All other pin types including combinations that include Analog default to Enabled. The input buffers should be disabled to reduce current when not needed especially with analog signals.
  - Enabled
  - Disabled
- **Input Synchronized –** Input Synchronization occurs at pins to ensure all signals entering the device are synchronized to bus_clk. Input synchronization may be optionally disabled at the pin in limited cases where an asynchronous signal is required for application performance and does not violate device operational requirements. Refer to the TRM or device data sheet for use details.
  - Yes - Default
  - No

Output Subtab



The Output subtab is used to specify output settings. If the type is not Output or Bidirectional this tab is disabled because no output information needs to be specified.

- **Slew Rate –** The slew rate parameter determines the rise and fall ramp rate for the pin as it changes output logic levels. Fast mode is required for signals that switch at greater than 1 MHz Slow mode may be selected for signals less than 1 MHz switching rate and benefit from slower transition edge rates reducing radiated EMI and coupling with neighboring signals.
  - ❑ Fast – Default
  - ❑ Slow
- **Drive Level –** Selects the output drive voltage supplied sourced by the pin. All pins are capable of supplying their respective Vddio supply voltage. SIO pins are also able to supply a programmable or analog routed voltage for interface with devices at a different potential than the SIOs Vddio voltage.
  - ❑ Vddio – Default
  - ❑ Vref – Requires SIO

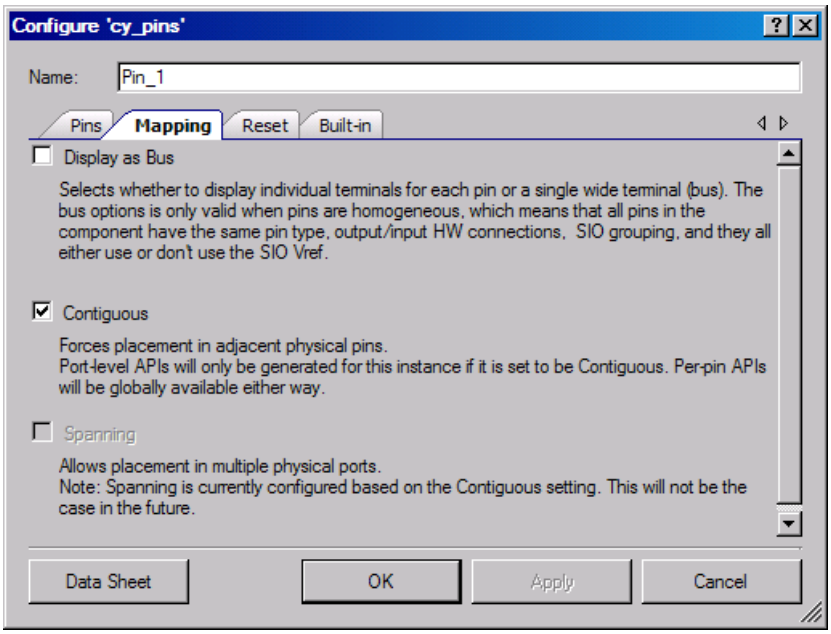
  Note If any of the three drive modes (resistive pull-up, resistive pull-down, resistive pull-up & down) is used, choosing the output drive level to be Vref will not work.
- **Drive Current –** The drive current selection determines the maximum nominal logic level current required for a specific pin. Pins may supply more current at the cost of logic level compliance or may have a maximum value that is less than listed, based on system voltages. Refer to the device data sheet for more details on drive currents.
  - ❑ 4mA source, 8mA sink – Default

- 4mA source, 25mA sink – Requires SIO

- **Output Synchronized –** Output Synchronization can be enabled to reduce pin to pin output signal skew in high speed signals requiring minimal signal skew. The output signal is synchronized to bus_clk. Please see the TRM or device data sheet for use details.
  - Disabled - Default
  - Enabled

Mapping Tab

The Mapping tab contains parameters that define how the Pins component is displayed in the schematic view and mapped on to physical pins.



Display as Bus

Selects whether to display individual terminals for each pin or a single wide terminal (bus). The bus option is only valid when pins are homogeneous. That means all pins in the component have the same pin type, output/input HW connections, and SIO grouping. They also all must either use or not use the SIO Vref. Displaying as a bus is useful when many of the same type of pin are required. This saves schematic space and time to configure and route.

Contiguous

Check box to force placement in adjacent physical pins within a port. Actual pin placement is package dependent according to the device datasheet. This option has the following restrictions:

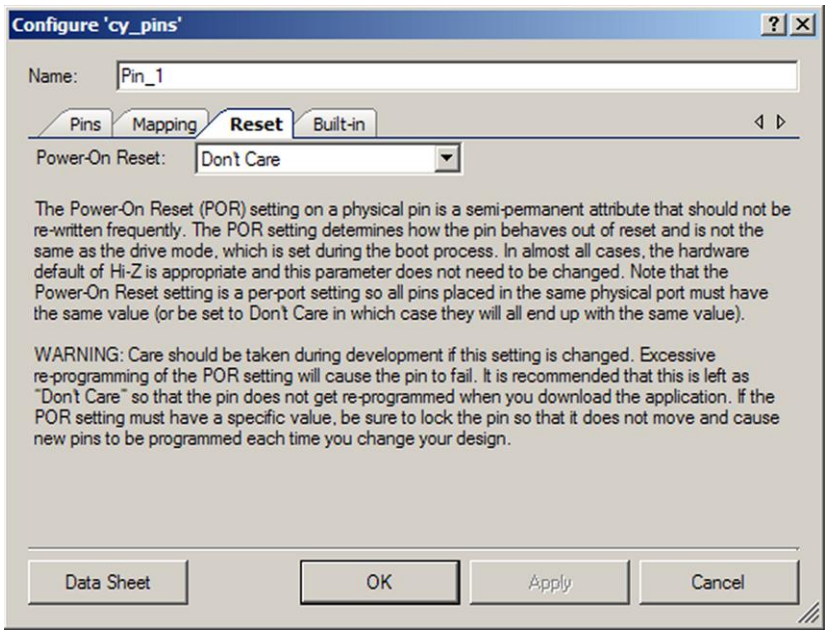
- If contiguous, port level APIs will be generated for the component. If noncontiguous, port level APIs will not be generated.

- If contiguous, the number of pins in the component needs to be less than or equal to 8.

Spanning

Check box to allow placement in multiple physical ports. This is currently controlled by the contiguous selection, where contiguous implies nonspanning and noncontiguous implies spanning. A future release of the software will support separate control of the Spanning parameter.

Reset Tab



Power-On Reset

The Power-On Reset (POR) setting on a physical pin is a semi-permanent attribute that should not be re-written frequently. The POR setting determines how the pin behaves out of reset and is not the same as the drive mode, which is set during the boot process. In almost all cases, the hardware default of Hi-Z is appropriate and this parameter does not need to be changed. Note that the Power-On Reset setting is a per-port setting so all pins placed in the same physical port must have the same value (or be set to Don't Care in which case they will all end up with the same value).

Warning: Care should be taken during development if this setting is changed. Excessive re-programming of the POR setting will cause the pin to fail. See the device datasheet for the maximum number of NVL write cycles. It is recommended that this is left as “Don't Care” so that the pin is not reprogrammed when you download the application. If the POR setting must have a

specific value, be sure to lock the pin so that it does not move and cause new pins to be programmed each time you change your design.

- Don't Care – Default. When left set to Don't Care, the POR will be determined by the physical port in which this component is placed. If all the placed pins in the port are set to Don't Care, the default POR of the part will be used. Otherwise, whatever POR is specified for the other pins placed in that physical port (they must all match) will be used for the ones set to Don't Care.
- High-Z analog
- Pulled-up
- Pulled-down

Placement

There is no placement specific information.

Resources

Each Pins component consumes one physical pin per bit of the **Number of Pins** parameter.

Analog Blocks	Digital Blocks					API Memory (Bytes)		Pins (per External I/O)
	Datapaths	Macro cells	Status Registers	Control Registers	Counter7	Flash	RAM	
N/A	N/A	N/A	N/A	N/A	N/A	110	0	N/A

Application Programming Interface

Application Programming Interface (API) routines allow you to configure and use the component using software. The Pins component enables access on a per-pin and component-wide basis.

Per-Pin APIs

You can access individual pins in the component by using the global APIs defined in the *cypins.h* generated file (in the cy_boot directory). These APIs are documented in the System Reference Guide (Help > Documentation) and include:

- CyPins_ReadPin()

- CyPins_SetPin()
- CyPins_ClearPin()
- CyPins_SetPinDriveMode()
- CyPins_ReadPinDriveMode()

These APIs can be used with either physical pin register names or the pin alias from the component. Accessing physical pins directly from software is not recommended because there is no safeguard against the same pins being allocated to other functions by the tool. Even if a pin is only ever accessed from software, Cypress strongly recommends the use of a Pins component. You can use the generated aliases from the component with the above APIs to safely access individual pins without a performance or memory penalty.

To use the above APIs, the component generates aliases for the pin registers in the *CyPins_aliases.h* file. By default the alias is the component name with the pin number appended to it:

CyPins_x - x is the pin within the component (0 based)

If you provide an alias name in the Pins configuration dialog, then an additional #define is created with the form:

CyPins_<AliasName>

Component APIs

These APIs access all pins in the component in a single function call. Efficient implementation of component-wide APIs is only possible if all pins are placed in a single physical port on the device. They are only generated if the component is configured to be contiguous. Non-contiguous Pins components only allow access on the per-pin basis described above.

By default, PSoC Creator assigns the instance name "Pin_1" to the first instance of a Pins component in a given design. You can rename it to any unique value that follows the syntactic rules for identifiers. The instance name becomes the prefix of every global function name, variable, and constant symbol.

The following table lists and describes the interface to each function. The subsequent sections cover each function in more detail.

Function	Description
uint8 Pin_1_Read(void)	Reads the physical port and returns the current value for all pins in the component.
void Pin_1_Write(uint8 value)	Writes the value to the component pins while protecting other pins in the physical port if shared by multiple Pins components.

Function	Description
uint8 Pin_1_ReadDataReg(void)	Reads the current value of the port's data output register and returns the current value for all pins in the component.
void Pin_1_SetDriveMode(uint8 mode)	Sets the drive mode for each of the Pins component's pins.
uint8 Pin_1_ClearInterrupt(void)	Clears any active interrupts on the port into which the component is mapped. Returns value of interrupt status register.

uint8 Pin_1_Read(void)

Description: Reads the associated physical port (pin status register) and masks the required bits according to the width and bit position of the component instance. The pin's status register returns the current logic level present on the physical pin.

Parameters: None

Return Value: The current value for the pins in the component as a right justified number.

Side Effects: None

void Pin_1_Write(uint8 value)

Description: Writes the value to the physical port (data output register), masking and shifting the bits appropriately. The data output register controls the signal applied to the physical pin in conjunction with the drive mode parameter. This function avoids changing other bits in the port by using the appropriate method (read-modify-write or bit banding).

Parameters: uint8 value: Value to write to the component instance.

Return Value: None

Side Effects: Due to the use of read-modify write operations that are not atomic; it is possible for Interrupt Service Routines (ISR) to cause corruption of this API. An ISR that interrupts this API and performs writes to the Pins component Data register may cause corrupted port data. To avoid this issue it is recommended to either use the Per-Pin APIs (primary method) or disable interrupts around this API.

uint8 Pin_1_ReadDataReg(void)

Description: Reads the associated physical port's data output register and masks the correct bits according to the width and bit position of the component instance. The data output register controls the signal applied to the physical pin in conjunction with the drive mode parameter. This is not the same as the preferred Pin_1_Read() API because the Pin_1_ReadDataReg() reads the data register instead of the status register. For output pins this is a useful API to determine the value just written to the pin.

Parameters: None

Return Value: The current value of the data register masked and shifted into a right justified number for the component instance.

Side Effects: None

void Pin_1_SetDriveMode(uint8 mode)

Description: Sets the drive mode for each of the Pins component's pins.

Parameters: uint8 mode: mode for the selected signals. Defined legal options are:

Pin_1_DM_STRONG	(Strong Drive)
Pin_1_DM_OD_HI	(Open Drain, Drives High)
Pin_1_DM_OD_LO	(Open Drain, Drives Low)
Pin_1_DM_RES_UP	(Resistive Pull Up)
Pin_1_DM_RES_DWN	(Resistive Pull Down)
Pin_1_DM_RES_UPDWN	(Resistive Pull Up / Down)
Pin_1_DM_DIG_HIZ	(High Impedance Digital)
Pin_1_DM_ALG_HIZ	(High Impedance Analog)

Return Value: None

Side Effects: Due to the use of read-modify write operations that are not atomic it is possible for Interrupt Service Routines (ISR) to cause corruption of this API. An ISR that interrupts this API and performs writes to the Pins component Drive Mode registers may cause corrupted port data. To avoid this issue it is recommended to either use the Per-Pin APIs (primary method) or disable interrupts around this API.

uint8 Pin_1_ClearInterrupt(void)

Description: Clears any active interrupts attached with the component and returns the value of the interrupt status register allowing determination of which pins generated an interrupt event.

Parameters: None

Return Value: uint8: The right shifted current value of the interrupt status register. Each pin has one bit set if it generated an interrupt event. For example bit 0 is for pin 0 and bit 1 is for pin 1 of the Pin component.

Side Effects: Clears **all** bits of the physical port's interrupt status register, not just those associated with the Pins component.

Sample Firmware Source Code

PSoC Creator provides numerous example projects that include schematics and example code in the Find Example Project dialog. For component-specific examples, open the dialog from the Component Catalog or an instance of the component in a schematic. For general examples, open the dialog from the Start Page or **File** menu. As needed, use the **Filter Options** in the dialog to narrow the list of projects available to select.

Refer to the "Find Example Project" topic in the PSoC Creator Help for more information.

DC and AC Electrical Characteristics

The following values are indicative of expected performance and based on initial characterization data.

Pins DC Specifications

Parameter	Description	Conditions	Min	Typ	Max	Units
Vinmax	Maximum input voltage	All allowed values of Vddio and Vddd	–	–	5.5	V
Vinref	Input voltage reference (Differential input mode)		0.5	–	0.52 × V_{DDIO}	V
Voutref	Output voltage reference (Regulated output mode)					
		V_{DDIO} > 3.7	1	–	V_{DDIO} – 1	V
		V_{DDIO} < 3.7	1	–	V_{DDIO} – 0.5	V

Parameter	Description	Conditions	Min	Typ	Max	Units
V_{IH}	Input voltage high threshold					
	GPIO mode	CMOS input	0.7 × V_{DDIO}	–	–	V
	Differential input mode	Hysteresis disabled	SIO_ref + 0.2	–	–	V
V_{IL}	Input voltage low threshold					
	GPIO mode	CMOS input	–	–	0.3 × V_{DDIO}	V
	Differential input mode	Hysteresis disabled	–	–	SIO_ref – 0.2	V
V_{OH}	Output voltage high					
	Unregulated mode	I_{OH} = 4 mA, V_{DDIO} = 3.3 V	V_{DDIO} – 0.4	–	–	V
	Regulated mode	I_{OH} = 1 mA	SIO_ref – 0.65	–	SIO_ref + 0.2	V
	Regulated mode	I_{OH} = 0.1 mA	SIO_ref – 0.3	–	SIO_ref + 0.2	V
V_{OL}	Output voltage low					
		V_{DDIO} = 3.30 V, I_{OL} = 25 mA	–	–	0.8	V
		V_{DDIO} = 1.80 V, I_{OL} = 4 mA	–	–	0.4	V
Rpullup	Pull-up resistor		3.5	5.6	8.5	kΩ
Rpulldown	Pull-down resistor		3.5	5.6	8.5	kΩ
I_{IL}	Input leakage current (Absolute value) [1]					
	$V_{IH} \leq$ Vddsio	25 °C, Vddsio = 3.0 V, V_{IH} = 3.0 V	–	–	14	nA
	V_{IH} > Vddsio	25 °C, Vddsio = 0 V, V_{IH} = 3.0 V	–	–	10	µA
C_{IN}	Input Capacitance [1]		–	–	7	pF

[1] Based on device characterization (Not production tested).

Parameter	Description	Conditions	Min	Typ	Max	Units
V_H	Input voltage hysteresis (Schmitt-Trigger) [1]	Single ended mode (GPIO mode)	–	40	–	mV
		Differential mode	–	35	–	mV
Idiode	Current through protection diode to V_{SSIO}		–	–	100	µA

Pins AC Specifications

Parameter	Description	Conditions	Min	Typ	Max	Units
TriseF	Rise time in fast strong mode (90/10%)[1]	Cload = 25 pF, V_{DDIO} = 3.3 V	–	–	12	ns
TfallF	Fall time in fast strong mode (90/10%)[1]	Cload = 25 pF, V_{DDIO} = 3.3 V	–	–	12	ns
TriseS	Rise time in slow strong mode (90/10%)[1]	Cload = 25 pF, V_{DDIO} = 3.0 V	–	–	75	ns
TfallS	Fall time in slow strong mode (90/10%)[1]	Cload = 25 pF, V_{DDIO} = 3.0 V	–	–	60	ns
Fsioout	SIO output operating frequency					
	3.3 V < V_{DDIO} < 5.5 V, Unregulated output (GPIO) mode, fast strong drive mode	90/10% V_{DDIO} into 25 pF	–	–	33	MHz
	1.71 V < V_{DDIO} < 3.3 V, Unregulated output (GPIO) mode, fast strong drive mode	90/10% V_{DDIO} into 25 pF	–	–	16	MHz
	3.3 V < V_{DDIO} < 5.5 V, Unregulated output (GPIO) mode, slow strong drive mode	90/10% V_{DDIO} into 25 pF	–	–	5	MHz
	1.71 V < V_{DDIO} < 3.3 V, Unregulated output (GPIO) mode, slow strong drive mode	90/10% V_{DDIO} into 25 pF	–	–	4	MHz
	3.3 V < V_{DDIO} < 5.5 V, Regulated output mode, fast strong drive mode	Output continuously switching into 25 pF	–	–	20	MHz

	1.71 V < V_{DDIO} < 3.3 V, Regulated output mode, fast strong drive mode	Output continuously switching into 25 pF	–	–	10	MHz
	1.71 V < V_{DDIO} < 5.5 V, Regulated output mode, slow strong drive mode	Output continuously switching into 25 pF	–	–	2.5	MHz
Fsioin	SIO input operating frequency					
	1.71 V < V_{DDIO} < 5.5 V	90/10% V_{DDIO}	–	–	66	MHz

Component Changes

This section lists the major changes in the component from the previous version.

Version	Description of Changes	Reason for Changes / Impact
1.50.c	Minor datasheet edit.	
1.50.b	Minor datasheet edit.	
1.50.a	The summary has been changed for each of the four pin macros.	Improved readability.
	Added characterization data to datasheet	
	Improved interrupt information in datasheet	
	Added note regarding Vref drive level to datasheet	
	Minor datasheet edits and updates	
1.50	Added Keil function reentrancy support to the APIs.	Add the capability for customers to specify individual generated functions as reentrant.
	Added a sentence to the Reset tab in the Configure dialog clarifying that Power-On Reset applies to an entire physical port.	Clarification.
1.20	Display as Bus now gives an error if checked and the Pins component is not homogeneous. The homogeneous check has been extended to include the HW connections settings. The only changes needed to go from the older version to the new would come from having 'Display as Bus' checked and having some HW connections unchecked.	