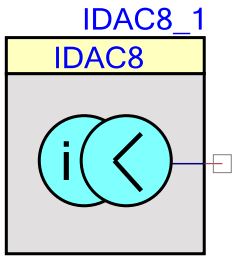
8-Bit Current Digital to Analog Converter (IDAC8)

1.0

Features

- Three ranges 2040uA, 255uA, and 32.875uA
- Software or clock driven output strobe.
- Data source may be CPU, DMA, or UDB.
- Current sink or source selectable.



General Description

The IDAC8 component is an 8-bit current output DAC (Digital to Analog Converter). You may configure the IDAC8 component a number of ways depending on your needs. The IDAC8 may be controlled by hardware, software or with a combination of both hardware and software. The IDAC8 is also easily configured as a current sink or source.

When to use a IDAC8

Use the IDAC8 when a fixed or programmable current source is required in an application.

Input/Output Connections

This section describes the various input and output connections for the IDAC8. An asterisk (*) in the list of I/O's states that the I/O may be hidden on the symbol under the conditions listed in the description of that I/O.

iOut – Analog

The iOut terminal is the connection to the current source/sink. It may be routed to any analog compatible pin on the PSoC. When the highest current range is selected (2048 uA) the output should only be routed to a specific set of pins that provide a direct low resistive path. These port pins are P06, P07, P30, or P31.

Data[7:0] – Input *

This 8-bit wide data signal connects the IDAC8 directly to the DAC Bus. The DAC Bus may be driven by UDB based components, control registers, or routed directly from GPIO pins. This

input is enabled by setting the “Data_Source” parameter to “DAC_Bus”. If the “DMA_or_CPU” option is selected instead, the bus connection will disappear from the component symbol.

You would use the Data[7:0] input when hardware is capable of setting the proper value without CPU intervention. When using this option, the Strobe option should be enabled as well.

For many applications this input is not required, but instead the CPU or DMA will write a value directly to the data register. In firmware you may use the SetRange() function or directly write a value to the IDAC8_1_Data register (assuming an instance name of “IDAC8_1”.).

Strobe – Input *

The Strobe input is an optional signal input and is selected with the “Strobe_Mode” parameter. If Strobe_Mode is set to “External”, the pin will be visible and must be connected to a valid digital source. In this mode the data is transferred from the IDAC8 register to the DAC on the next positive edge of the Strobe signal.

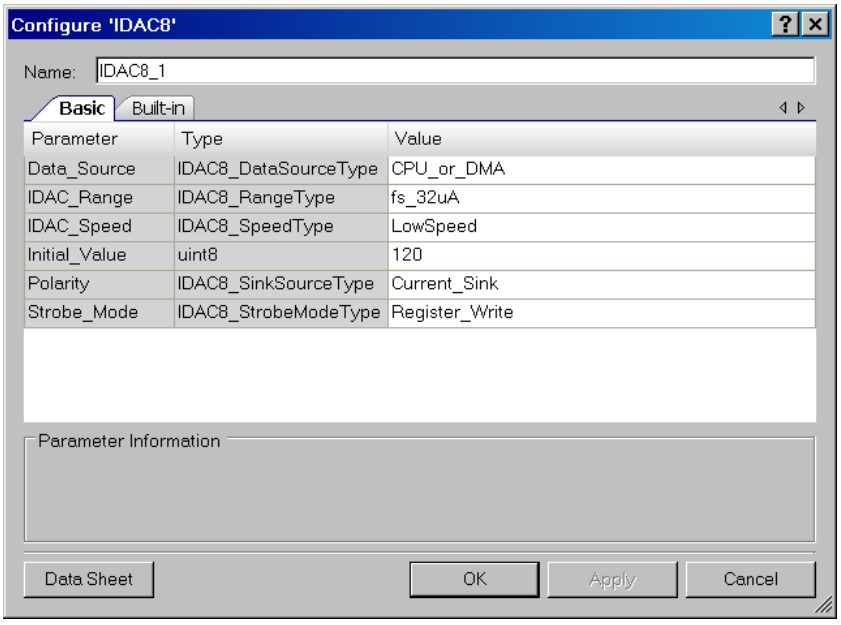
If this parameter is set to “Register_Write” the pin will disappear from the symbol and any write to the data registers will be immediately transferred to the DAC.

For audio or periodic sampling applications, the same clock used to clock the data into the DAC could also be used to generate an interrupt. Each rising edge of the clock would transfer data to the DAC and cause an interrupt to get the next value loaded into the DAC register.

Parameters and Setup

Drag an IDAC8 component onto your design and double-click it to open the Configure dialog.

Figure 1 Configure IDAC8 Dialog



The IDAC8 component provides the following parameters.

Data_Source

This parameter selects the source of the data to be written into the DAC register. If the CPU (firmware) or the DMA will write data to the IDAC8, then select “DMA_or_CPU”. It data is written directly from the UDBs or UDB based component, then the “DAC_BUS” should be selected. There is only one DAC Bus

IDAC_Range

This parameter enables the designer to set one of three current ranges as the default value. The range may be changed at anytime during runtime with the setRange() function. If the highest current range, “fs_2040uA” is selected, the output should be routed to one of the special pins that provide a low resistive path. These pins are P06, P07, P30, and P31.

Range	Lowest Value	Highest Value	Step Size
fs_2040uA	0.0 uA	2040 uA	8 uA
fs_255uA	0.0 uA	255 uA	1 uA
fs_32uA	0.0 uA	31.875 uA	0.125 uA

IDAC_Speed

This parameter provides two settings for the designer, LowSpeed and HighSpeed. In the LowSpeed mode, the settling time is slower but it consumes less operating current. In the HighSpeed mode, the current settle much faster, but at a cost of more operating current.

Initial_Value

This is the initial value the IDAC8 will present after the Start() command is executed. The SetValue() function or a direct write to the DAC register will override the default value at anytime. Legal values are between 0 and 255 inclusive.

Polarity

The Polarity parameter allows the designer to select whether the IDAC8 sinks or sources current to its load. When the “Current_Source” option is selected, the output of the DAC will source current to a load that is connected to Vss. In the “Current_Sink” mode, it will supply current to a load that is connected to Vdd.

Strobe_Mode

This parameter selects whether the data is immediately written to the DAC as soon as the data is written into the IDAC8 data register. This mode is selected when the “Register_Write” option is

selected. When the “External” option is selected, a clock or signal from UDBs controls when the data is written from the DAC register to the actual DAC.

Resources

The IDAC8 uses one vIDAC8 analog block.

Application Programming Interface

Application Programming Interface (API) routines allow you to configure the component using software. The following table lists and describes the interface to each function. The subsequent sections cover each function in more detail.

By default, PSoC Creator assigns the instance name "IDAC8_1" to the first instance of a component in a given design. You can rename the instance 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. For readability, the instance name used in the following table is "IDAC8".

Function	Description
void IDAC8_Start(void)	Configure and enable power of DAC.
void IDAC8_Stop(void)	Disables the IDAC8 and sets it to the lowest power state.
Void IDAC8_SetSpeed(uint8 speed)	Set DAC speed.
void IDAC8_SetPolarity(uint8 polarity)	Sets the output mode to current sink or source.
void IDAC8_SetRange(uint8 range)	Sets full scale range for IDAC8.
void IDAC8_SetValue(uint8 value)	Sets value between 0 and 255 with the given range.

void IDAC8_Start(void)

Description: The start function initializes the IDAC8 with the default values, and sets the power to the given level. A power level of 0 is the same as executing the stop function.

Parameters: None

Return Value: None

Side Effects: None

void IDAC8_Stop(void)

Description: Powers down IDAC8 to lowest power state and disables output.

Parameters: None

Return Value: None

Side Effects: None

void IDAC8_SetSpeed(uint8 speed)

Description: Set DAC speed.

Parameters: (uint8) speed: Sets DAC speed, see table below for valid parameters.

Option	Description
IDAC8_LOWSPEED	Low speed (low power)
IDAC8_HIGHSPEED	High speed (high power)

Return Value: None

Side Effects: None

void IDAC8_SetPolarity(uint8 polarity)

Description: Sets output polarity to sink or source.

Parameters: (uint8) polarity: Sets current sink or source functionality, see table below.

Option	Description
IDAC8_IDIR_SRC	Set mode as current source.
IDAC8_IDIR_SINK	Set mode to current sink.

Return Value: None

Side Effects: None

void IDAC8_SetRange(uint8 range)

Description: Sets full scale range for IDAC8

Parameters: (uint8) range: Sets full scale range for IDAC8. See table below for ranges.

Option	Description
IDAC8_RANGE_32uA	Set full scale range to 31.875 uA
IDAC8_RANGE_255uA	Set full scale range to 255 uA
IDAC8_RANGE_2mA	Set full scale range to 2.040 mA

Return Value: None

Side Effects: None

void IDAC8_SetValue(uint8 value)

Description: Sets value to output on IDAC8. Valid values are between 0 and 255.

Parameters: (uint8) value: Value between 0 and 255. A value of 0 is the lowest (zero) and a value of 255 is the full scale value. The full scale value is dependent on the range which is selectable with the SetRange API.

Return Value: None

Side Effects: None

Sample Firmware Source Code

The following is a C language example demonstrating the basic functionality of the IDAC8 component. This example assumes the component has been placed in a design with the default name "IDAC8_1."

Note If you rename your component you must also edit the example code as appropriate to match the component name you specify.

```
#include <device.h>

void main()
{
    IDAC8_1_Start();                        // Enable IDAC8
    IDAC8_1_SetRange(IDAC8_1_RANGE_255uA);  // Set full scale range to 255uA
    IDAC8_1_SetValue(100);                  // Set value to 100uA
}
```

User Registers

The functions provided support most of the common runtime functions that are required for most applications. The register reference below provides a brief description for the advanced user. The IDAC8_Data register may be used to write data directly to the DAC without using the API. This may be useful for either the CPU or DMA.

Table 1 IDAC8_CR0

Bits	7	6	5	4	3	2	1	0
Value	RSVD			mode	Range[1:0]		hs	RSVD

- mode: Sets DAC to either voltage or current mode.
- range[1:0]: DAC range settings.
- hs: Use to set data speed.

Table 2 IDAC8_CR1

Bits	7	6	5	4	3	2	1	0
Value	RSVD		mx_data	reset_udb_en	mx_idir	idirbit	Mx_ioff	ioffbit

- mx_data: Select data source.
- reset_udb_en: DAC reset enable.
- mx_idir: Mux selection for DAC current direction control.
- idirbit: Register source for DAC current direction.
- mx_off: Mux selection for DAC current off control.
- ioffbit: Register source for DAC current off

Table 3 IDAC8_DATA

Bits	7	6	5	4	3	2	1	0
Value	Data[7:0]							

- Data[7:0]: DAC data register.

DC and AC Electrical Characteristics

5.0V/3.3V DC and AC Electrical Characteristics

Parameter	Typical	Min	Max	Units	Conditions and Notes
Resolution		8	8	bits	
Linearity					
DNL	---		---	LSB	
INL	---		---	LSB	
Monotonic	YES				
V_{os}, Offset Current				uA	
Output Noise				uA rms	X to y MHz
fclock					
Fast mode				MHz	
Slow mode				MHz	
Operating Current					
Fast mode				uA	
Slow mode				uA	

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