PSoC® Creator™
Project Datasheet for P4_SpiSlave_CapSense

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Table of Contents

1 Overview

The Cypress PSoC 4 is a family of 32-bit devices with the following characteristics:

- High-performance 32-bit ARM Cortex-M0 core with a nested vectored interrupt controller (NVIC)
- Digital system that includes configurable Universal Digital Blocks (UDBs) and specific function peripherals, such as UART, SPI and I2C
- Analog subsystem that includes 12-bit SAR ADC, PWMs, comparators, op amps, CapSense, LCD drive and more
- Several types of memory elements, including SRAM and flash
- Programming and debug system through Serial Wire Debug (SWD)
- Flexible routing to all pins

Figure 1 shows the major components of a typical CY8C42 family member PSoC 4 device. For details on all the systems listed above, please refer to the PSoC 4 Technical Reference Manual .

Figure 1. CY8C42 Device Family Block Diagram

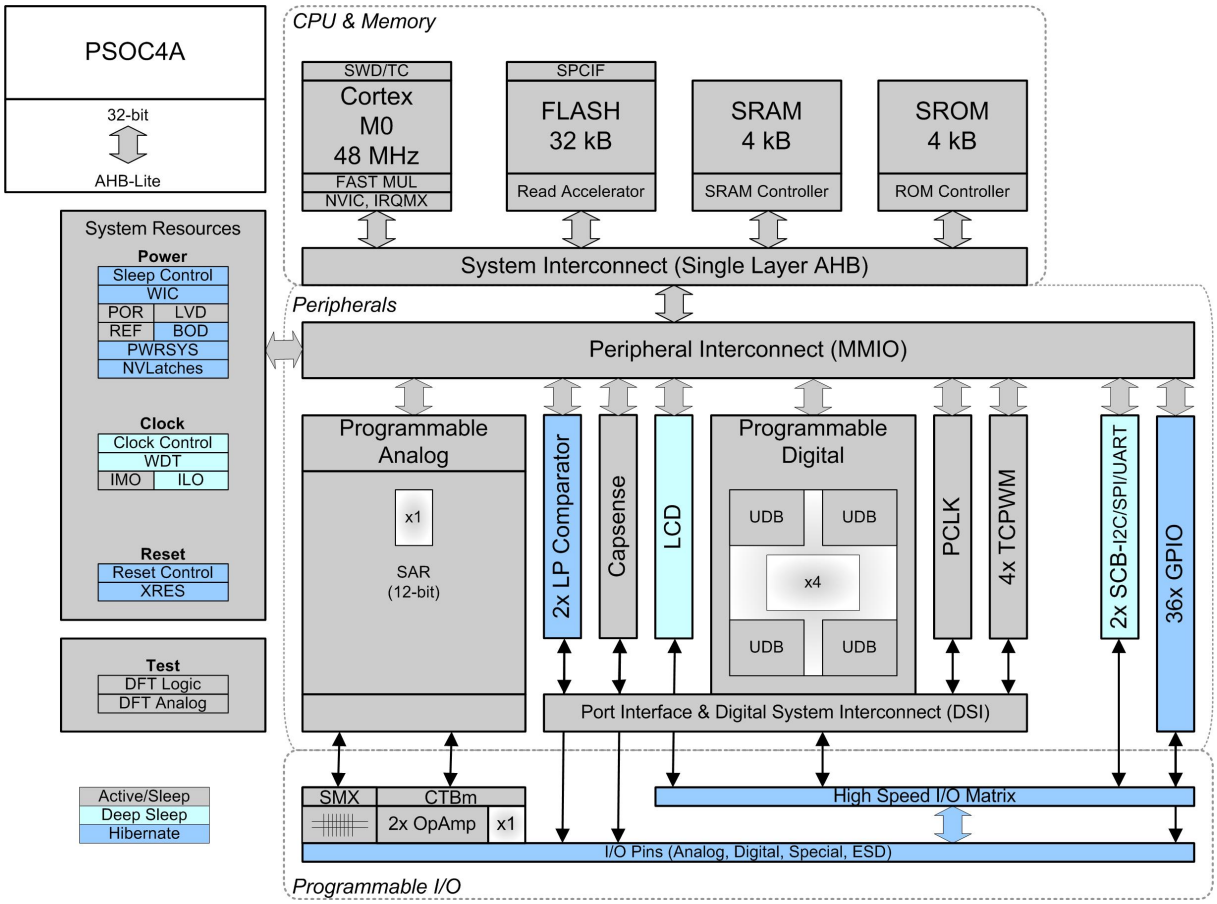


Table 1 lists the key characteristics of this device.

Table 1. Device Characteristics

Name	Value
Architecture	PSoC 4
Family	CY8C42
CPU speed (MHz)	48
Flash size (kBytes)	32
SRAM size (kBytes)	4
Vdd range (V)	1.71 to 5.5
Automotive qualified	No (Industrial Grade Only)

NOTE: The CPU speed noted above is the maximum available speed. The CPU is clocked by HFCLK, listed in the System Clocks section below.

Table 2 lists the device resources that this design uses:

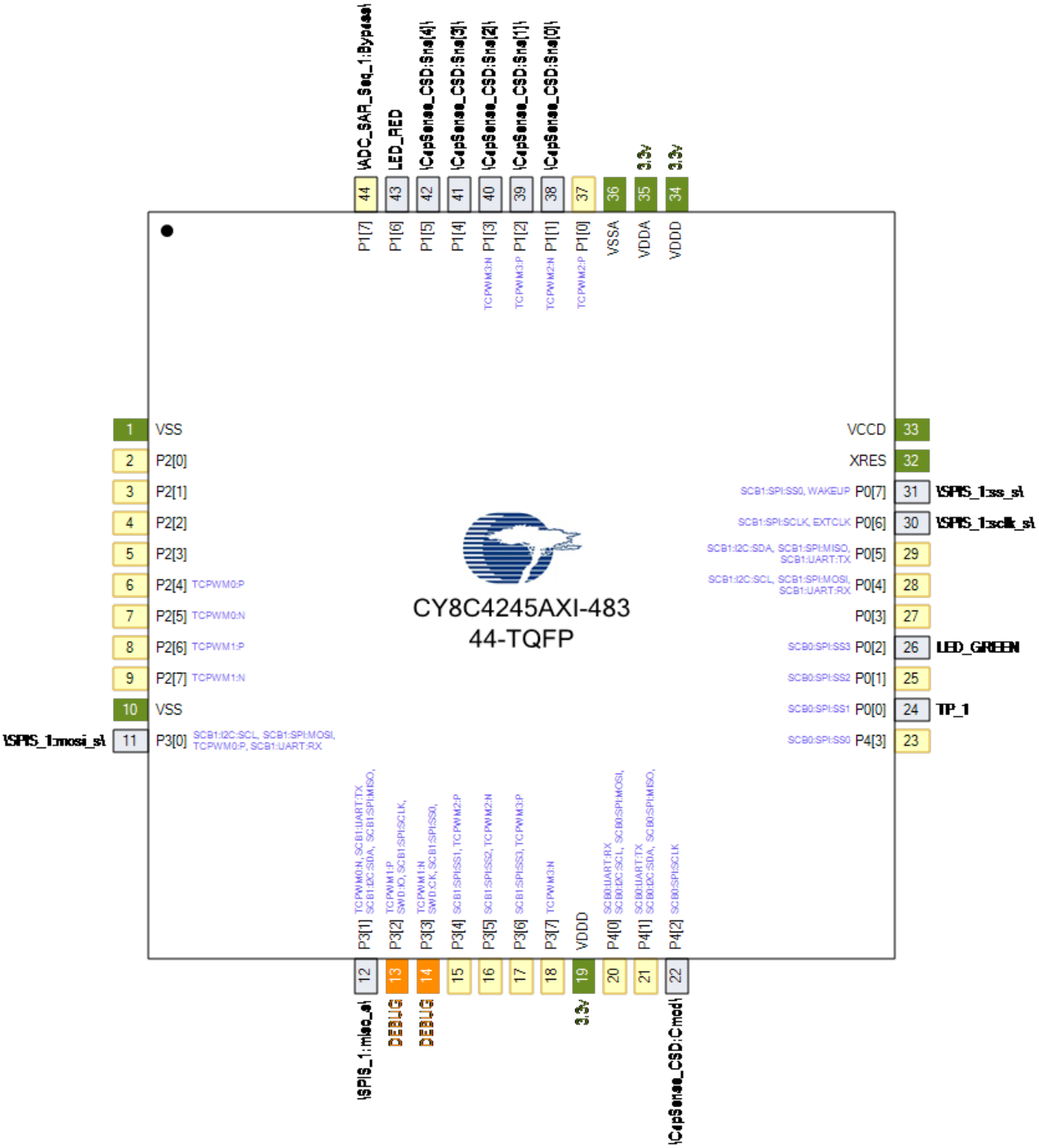
Table 2. Device Resources

Name	Resources in Use	Total Resources Available
Digital clock dividers	0 (0.0%)	4
Pins	16 (44.4%)	36
UDB Macrocells	1 (3.1%)	32
UDB Unique Pterms	0 (0.0%)	64
UDB Datapath Cells	0 (0.0%)	4
UDB Status Cells	0 (0.0%)	4
UDB Control Cells	0 (0.0%)	4
Interrupts	3 (9.4%)	32
Comparator/Opamp Fixed Blocks	0 (0.0%)	2
SAR Fixed Blocks	1 (100.0%)	1
CSD Fixed Blocks	1 (100.0%)	1
8-bit CapSense IDACs	1 (100.0%)	1
7-bit CapSense IDACs	1 (100.0%)	1
Temperature Sensor	1 (100.0%)	1
Low Power Comparator	0 (0.0%)	2
TCPWM Blocks	1 (25.0%)	4
Serial Communication Blocks	1 (50.0%)	2
Segment LCD Blocks	0 (0.0%)	1

2 Pins

Figure 2 shows the pin layout of this device.

Figure 2. Device Pin Layout



2.1 Hardware Pins

Table 3 contains information about the pins on this device in device pin order. (No connection ["n/c"] pins have been omitted.)

Table 3. Device Pins

Pin	Port	Name	Type	Drive Mode	Reset State
1	VSS	VSS	Power		
2	P2[0]	GPIO [unused]			HiZ Analog Unb
3	P2[1]	GPIO [unused]			HiZ Analog Unb
4	P2[2]	GPIO [unused]			HiZ Analog Unb
5	P2[3]	GPIO [unused]			HiZ Analog Unb
6	P2[4]	GPIO [unused]			HiZ Analog Unb
7	P2[5]	GPIO [unused]			HiZ Analog Unb
8	P2[6]	GPIO [unused]			HiZ Analog Unb
9	P2[7]	GPIO [unused]			HiZ Analog Unb
10	VSS	VSS	Power		
11	P3[0]	\SPIS_1:mosi_s\	Dgtl In	HiZ digital	HiZ Analog Unb
12	P3[1]	\SPIS_1:miso_s\	Dgtl Out	Strong drive	HiZ Analog Unb
13	P3[2]	GPIO [unused]			HiZ Analog Unb
14	P3[3]	GPIO [unused]			HiZ Analog Unb
15	P3[4]	GPIO [unused]			HiZ Analog Unb
16	P3[5]	GPIO [unused]			HiZ Analog Unb
17	P3[6]	GPIO [unused]			HiZ Analog Unb
18	P3[7]	GPIO [unused]			HiZ Analog Unb
19	VDDD	VDDD	Power		
20	P4[0]	GPIO [unused]			HiZ Analog Unb
21	P4[1]	GPIO [unused]			HiZ Analog Unb
22	P4[2]	\CapSense_CSD:Cmod\	A/D Out	HiZ analog	HiZ Analog Unb
23	P4[3]	GPIO [unused]			HiZ Analog Unb
24	P0[0]	TP_1		Strong drive	HiZ Analog Unb
25	P0[1]	GPIO [unused]			HiZ Analog Unb
26	P0[2]	LED_GREEN	Dgtl Out	Strong drive	HiZ Analog Unb
27	P0[3]	GPIO [unused]			HiZ Analog Unb
28	P0[4]	GPIO [unused]			HiZ Analog Unb
29	P0[5]	GPIO [unused]			HiZ Analog Unb
30	P0[6]	\SPIS_1:sclk_s\	Dgtl In	HiZ digital	HiZ Analog Unb
31	P0[7]	\SPIS_1:ss_s\	Dgtl In	HiZ digital	HiZ Analog Unb
32	XRES	XRES	Power		
33	VCCD	VCCD	Power		
34	VDDD	VDDD	Power		
35	VDDA	VDDA	Power		
36	VSSA	VSSA	Power		
37	P1[0]	GPIO [unused]			HiZ Analog Unb
38	P1[1]	\CapSense_CSD:Sns[0]\	Analog	HiZ analog	HiZ Analog Unb
39	P1[2]	\CapSense_CSD:Sns[1]\	Analog	HiZ analog	HiZ Analog Unb
40	P1[3]	\CapSense_CSD:Sns[2]\	Analog	HiZ analog	HiZ Analog Unb
41	P1[4]	\CapSense_CSD:Sns[3]\	Analog	HiZ analog	HiZ Analog Unb
42	P1[5]	\CapSense_CSD:Sns[4]\	Analog	HiZ analog	HiZ Analog Unb
43	P1[6]	LED_RED	Dgtl Out	Strong drive	HiZ Analog Unb
44	P1[7]	\ADC_SAR_Seq_1:Bypass\	Analog	HiZ analog	HiZ Analog Unb

Abbreviations used in Table 3 have the following meanings:

- HiZ Analog Unb = Hi-Z Analog Unbuffered
- Dgtl In = Digital Input
- HiZ digital = High impedance digital
- Dgtl Out = Digital Output
- A/D Out = Analog / Digital Output
- HiZ analog = High impedance analog

2.2 Software Pins

Table 4 contains information about the software pins on this device in alphabetical order. (Only software-accessible pins are shown.)

Table 4. Software Pins

Name	Port	Type	Reset State
\ADC_SAR_Seq_1:Bypass\	P1[7]	Analog	HiZ Analog Unb
\CapSense_CSD:Cmod\	P4[2]	A/D Out	HiZ Analog Unb
\CapSense_CSD:Sns[0]\	P1[1]	Analog	HiZ Analog Unb
\CapSense_CSD:Sns[1]\	P1[2]	Analog	HiZ Analog Unb
\CapSense_CSD:Sns[2]\	P1[3]	Analog	HiZ Analog Unb
\CapSense_CSD:Sns[3]\	P1[4]	Analog	HiZ Analog Unb
\CapSense_CSD:Sns[4]\	P1[5]	Analog	HiZ Analog Unb
\SPIS_1:miso_s\	P3[1]	Dgtl Out	HiZ Analog Unb
\SPIS_1:mosi_s\	P3[0]	Dgtl In	HiZ Analog Unb
\SPIS_1:sclk_s\	P0[6]	Dgtl In	HiZ Analog Unb
\SPIS_1:ss_s\	P0[7]	Dgtl In	HiZ Analog Unb
LED_GREEN	P0[2]	Dgtl Out	HiZ Analog Unb
LED_RED	P1[6]	Dgtl Out	HiZ Analog Unb
TP_1	P0[0]		HiZ Analog Unb

Abbreviations used in Table 4 have the following meanings:

- HiZ Analog Unb = Hi-Z Analog Unbuffered
- A/D Out = Analog / Digital Output
- Dgtl Out = Digital Output
- Dgtl In = Digital Input

For more information on reading, writing and configuring pins, please refer to:

- Pins chapter in the System Reference Guide
  - CyPins API routines
- Programming Application Interface section in the cy_pins component datasheet

3 System Settings

3.1 System Configuration

Table 5. System Configuration Settings

Name	Value
Device Configuration Mode	Compressed
Unused Bonded IO	Allow but warn
Heap Size (bytes)	0x0100
Stack Size (bytes)	0x0400
Include CMSIS Core Peripheral Library Files	True

3.2 System Debug Settings

Table 6. System Debug Settings

Name	Value
Chip Protection	Open
Debug Select	SWD (serial wire debug)

3.3 System Operating Conditions

Table 7. System Operating Conditions

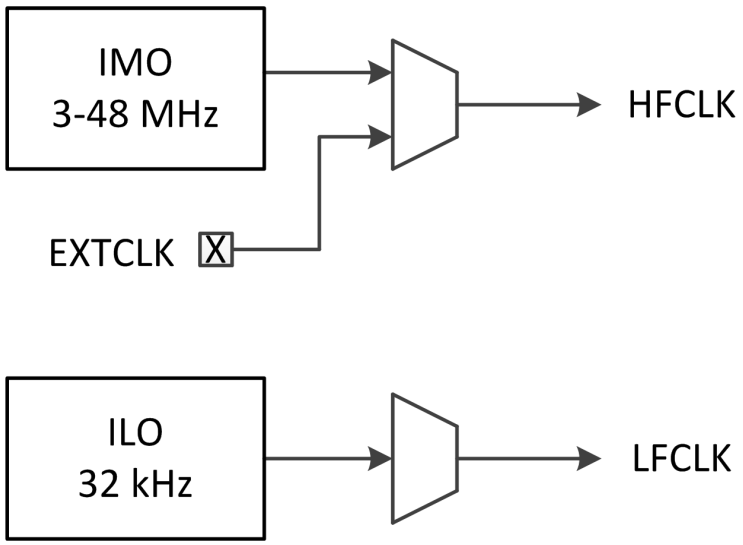
Name	Value
Vddd (V)	3.3
Vdda (V)	3.3
Variable Vdda	True
Temperature Range	-40C - 85C

4 Clocks

The clock system includes these clock resources:

- Two internal clock sources:
  - 3 to 48 MHz Internal Main Oscillator (IMO) ±2% at 3 MHz
  - 32 kHz Internal Low Speed Oscillator (ILO) output
- HFCLK can be generated using an external signal from EXTCLK pin
- Twelve clock dividers, each with 16-bit divide capability:
  - Eight can be used for fixed-function blocks
  - Four can be used for the UDBs

Figure 3. System Clock Configuration



4.1 System Clocks

Table 8 lists the system clocks used in this design.

Table 8. System Clocks

Name	Domain	Source	Desired Freq (MHz)	Nominal Freq (MHz)	Accuracy (%)	Start at Reset	Enabled
LFCLK	NONE	ILO	0	0.032	±30	True	True
ILO	NONE		0.032	0.032	±30	True	True
SYSCLK	NONE	HFCLK	0	24	±2	True	True
EXTCLK	NONE		24	0	±0	False	False
IMO	NONE		24	24	±2	True	True
HFCLK	NONE	Direct_Sel	24	24	±2	True	True

4.2 Local and Design Wide Clocks

Local clocks drive individual analog and digital blocks. Design wide clocks are a user-defined optimization, where two or more analog or digital blocks that share a common clock profile (frequency, etc) can be driven from the same clock divider output source.

Figure 4. Local and Design Wide Clock Configuration

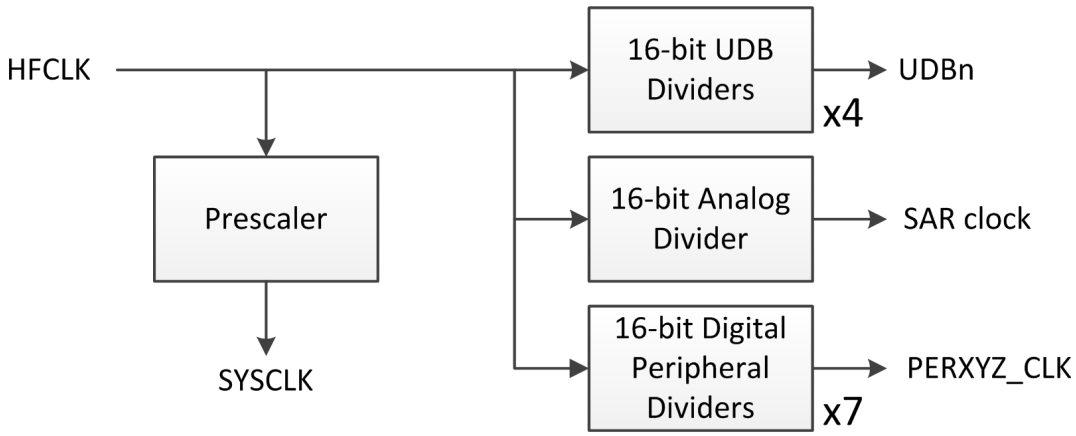


Table 9 lists the local clocks used in this design.

Table 9. Local Clocks

Name	Domain	Source	Desired Freq (MHz)	Nominal Freq (MHz)	Accuracy (%)	Start at Reset	Enabled
CapSense_CSD_SenseClk	FIXED_FUNCTION	HFCLK	1	1	±2	True	True
CapSense_CSD_SampleClk	FIXED_FUNCTION	HFCLK	0	12	±2	True	True
Clock_PWM	FIXED_FUNCTION	HFCLK	12	12	±2	True	True

Name	Domain	Source	Desired Freq (MHz)	Nominal Freq (MHz)	Accuracy (%)	Start at Reset	Enabled
SPIS_1_SC-BCLK	FIXED_-FUNCT-ION	HFCLK	12	12	±2	True	True
ADC_SAR_S-eq_1_intClock	FIXED_-FUNCT-ION	HFCLK	1	1	±2	True	True

For more information on clocking resources, please refer to:

- Clocking System chapter in the PSoC 4 Technical Reference Manual
- Clocking chapter in the System Reference Guide
  - CyIMO API routines
  - CyILO API routines

5 Interrupts

5.1 Interrupts

This design contains the following interrupt components: (0 is the highest priority)

Table 10. Interrupts

Name	Priority	Vector
ADC_SAR_Seq_1_IRQ	3	14
CapSense_CSD_ISR	3	15
SPIS_1_SCB_IRQ	3	11

For more information on interrupts, please refer to:

- Interrupt Controller chapter in the PSoC 4 Technical Reference Manual
- Interrupts chapter in the System Reference Guide
  - CyInt API routines and related registers
- Datasheet for cy_isr component

6 Flash Memory

PSoC 4 devices offer a host of Flash protection options and device security features that you can leverage to meet the security and protection requirements of an application. These requirements range from protecting configuration settings or Flash data to locking the entire device from external access.

Table 11 lists the Flash protection settings for your design.

Table 11. Flash Protection Settings

Start Address	End Address	Protection Level
0x0	0x7FFF	U - Unprotected

Flash memory is organized as rows with each row of flash having 128 bytes. Each flash row can be assigned one of four protection levels:

- U - Unprotected
- F - External read protect (Factory upgrade)
- R - External write protect (Field upgrade)
- W - Full Protection

For more information on Flash memory and protection, please refer to:

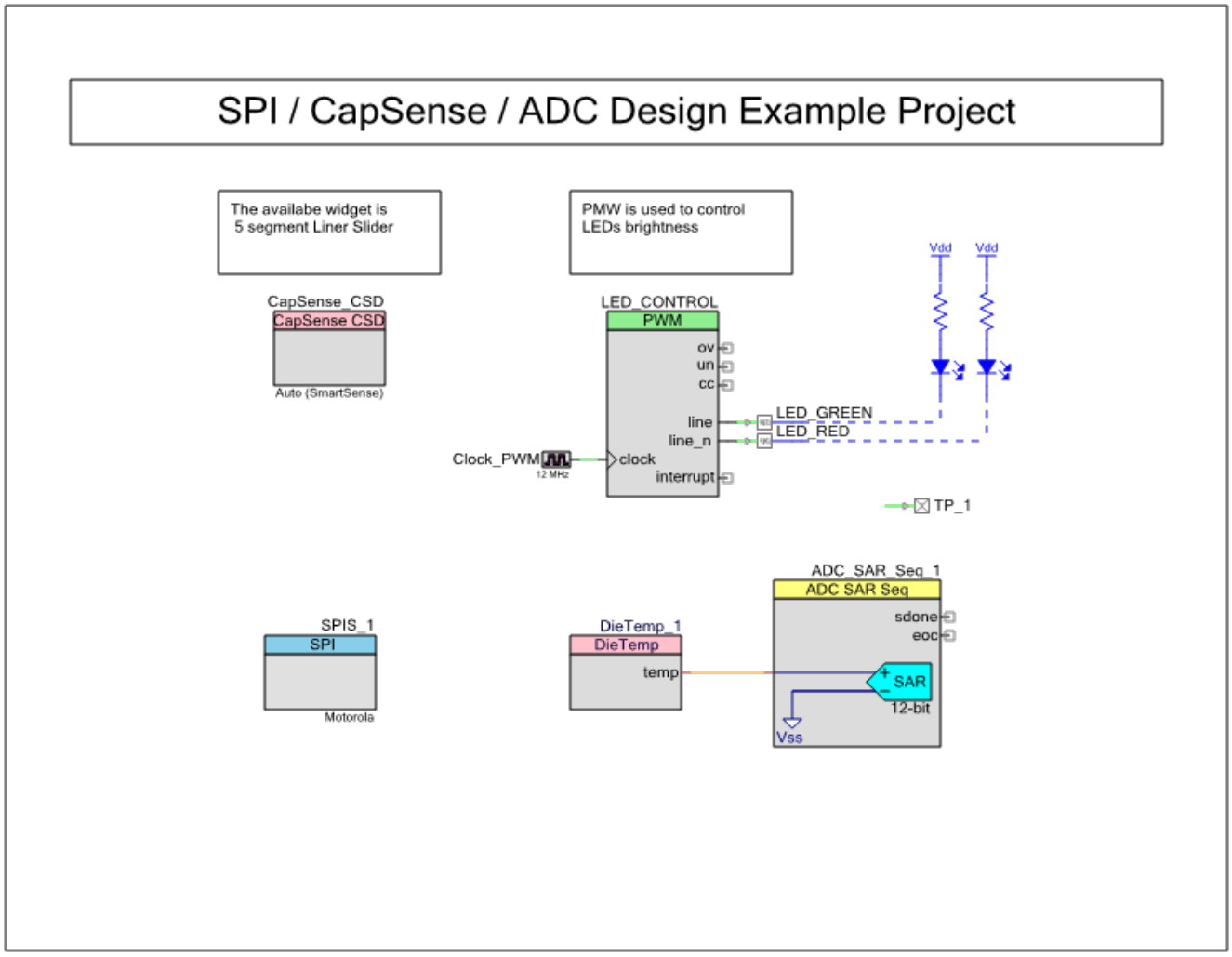
- Flash Protection chapter in the PSoC 4 Technical Reference Manual
- Flash and EEPROM chapter in the System Reference Guide
  - CyFlash API routines
  - CyWrite API routines

7 Design Contents

This design's schematic content consists of the following 2 schematic sheets:

7.1 Schematic Sheet: Schematic

Figure 5. Schematic Sheet: Schematic

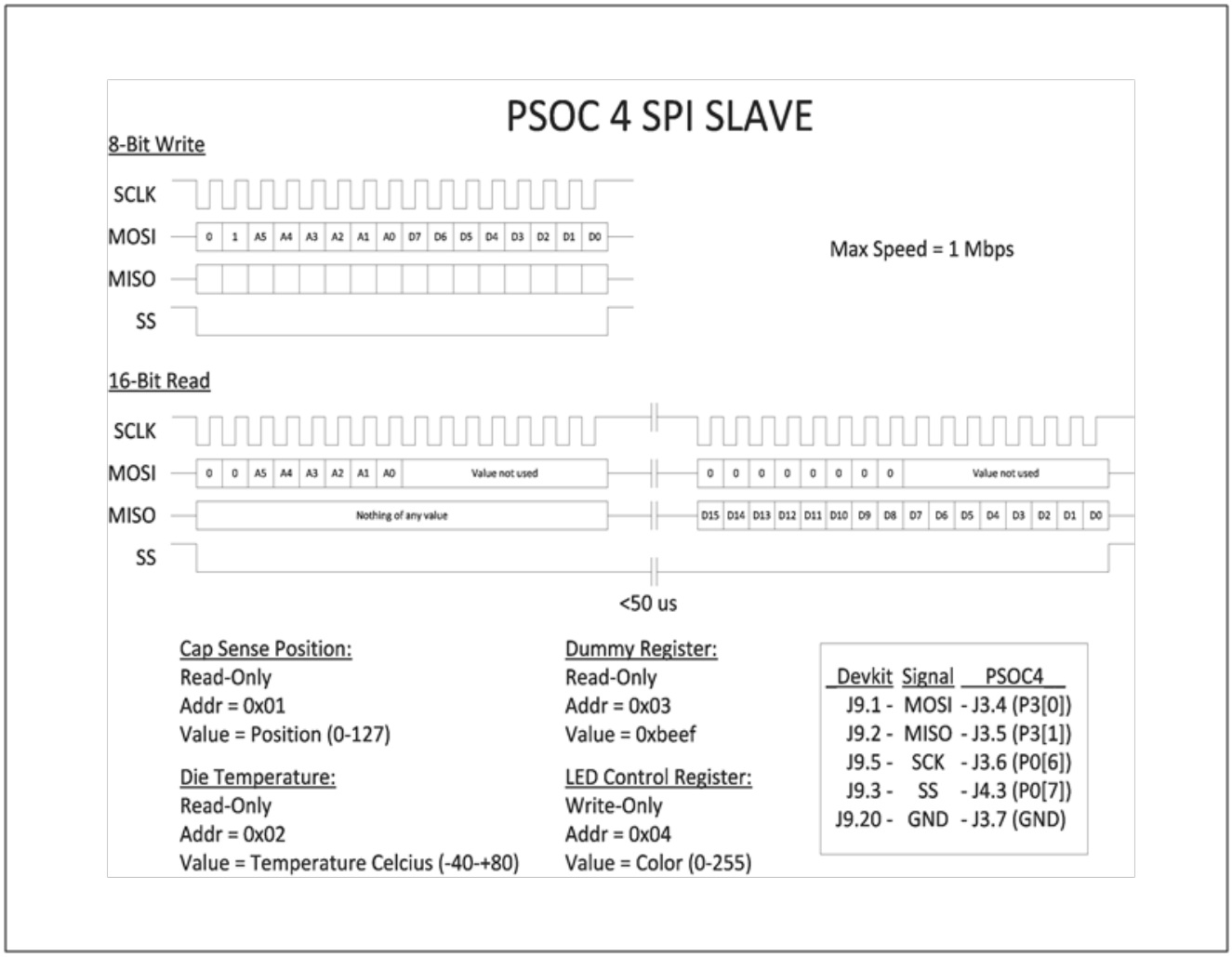


This schematic sheet contains the following component instances:

- Instance ADC_SAR_Seq_1 (type: ADC_SAR_SEQ_P4_v1_10)
- Instance CapSense_CSD (type: CapSense_CSD_P4_v1_11)
- Instance DieTemp_1 (type: DieTemp_P4_v1_0)
- Instance LED_CONTROL (type: TCPWM_P4_v1_0)
- Instance SPIS_1 (type: SCB_P4_v1_10)

7.2 Schematic Sheet: SPI Communication

Figure 6. Schematic Sheet: SPI Communication



8 Components

8.1 Component type: ADC_SAR_SEQ_P4 [v1.10]

8.1.1 Instance ADC_SAR_Seq_1

Description: PSoC 4 Sequencing Successive Approximation ADC
Instance type: ADC_SAR_SEQ_P4 [v1.10]
Datasheet: online component datasheet for ADC_SAR_SEQ_P4

Table 12. Component Parameters for ADC_SAR_Seq_1

Parameter Name	Value	Description
AdcAClock	4	Acquisition time in clock cycles for configuration A.
AdcAdjust	ClockFreq	Timing parameter adjustable by the user.
AdcAlternateResolution	8	This parameter sets the alternate ADC resolution to either 8 or 10 bits.
AdcAvgMode	Fixed Resolution	This parameter sets how the averaging mode operates.
AdcAvgSamplesNum	256	This parameter sets the averaging rate for any channel that has its averaging option enabled.
AdcBClock	4	Acquisition time in clock cycles for configuration B.
AdcCClock	4	Acquisition time in clock cycles for configuration C.
AdcChannelsEnConf	1	This bitmask is intended to enable the channels for scanning during runtime.
AdcChannelsModeConf	0	Mode configuration for the channels (0 - Single, 1 - Differential)
AdcClock	Internal	Clock source type.
AdcClockFrequency	1000000	Specifies the internal clock frequency in Hz.
AdcCompareMode	Low_Limit <= Result < High_Limit	This parameter sets the condition in which the limit condition will occur.
AdcDataFormatJustification	Right	This parameter sets whether the output data is left or right justified for a 16-bit word. For signed values, the result will be sign extended when configured in right justification mode.
AdcDClock	4	Acquisition time in clock cycles for configuration D.
AdcDifferentialResultFormat	Signed	This parameter sets the whether the result from a differential measurement is Signed or Unsigned.
AdcHighLimit	4095	This parameter sets the high limit for a limit compare.

Parameter Name	Value	Description
AdcInjChannelEnabled	false	Determines whether the symbol will display the injection channel.
AdcInputBufGain	Disable	Sets the input buffer gain or disables it.
AdcLowLimit	0	This parameter sets the low limit for a limit compare.
AdcMaxResolution	12	Sets the maximum resolution of the ADC in bits.
AdcSampleMode	FreeRunning	Sampling mode.
AdcSarMuxChannelConfig	0	Channels mode configuration for the multiplexer (0 - Single, 1 - Differential)
AdcSequencedChannels	1	Number of input signals that will be scanned. This excludes the injection channel.
AdcSingleEndedNegativeInput	Vss	Negative input source for single ended operation.
AdcSingleResultFormat	Signed	This parameter sets whether the result from a single ended measurement is Signed or Unsigned.
AdcSymbolHasSingleEn-dedInputChannel	false	Determines whether the configuration contains an external negative input.
AdcVrefSelect	Internal 1.024 volts, bypassed	The reference voltage that is used for the SAR ADC.
AdcVrefVoltage_mV	1024	The reference voltage value.
rm_int	false	Removes the internal interrupt

8.2 Component type: CapSense_CSD_P4 [v1.11]

8.2.1 Instance CapSense_CSD

Description: CapSense_CSD
Instance type: CapSense_CSD_P4 [v1.11]
Datasheet: online component datasheet for CapSense_CSD_P4

Table 13. Component Parameters for CapSense_CSD

Parameter Name	Value	Description
AnalogSwitchDivider	12	Defines the clock divider for analog switches source.
CmodPrecharge	Precharge byVref buffer	Defines the pre-charge option for Cmod capacitor.
ConnectInactiveSensors	Ground	Defines the sensor inactive state.
Csh_tankPrecharge	Precharge by IO buffer	Defines the pre-charge option for Csh_tank capacitor.
CurrentSource	IDAC Sourcing	Defines the IDAC mode.
CustomEzI2CInstanceName	SCB	Default instance name of Tuner communication component.
EnableTuneHelper	false	Allows generation of tuner APIs.
GuardSensorEnable	false	Enables Guard sensor. This type of sensor typically required for water proof applications.

Parameter Name	Value	Description
IDACRange	4x	Defines Idac Range for all sensors.
IDACsCount	2	Sets IDACs count.
InputClkFreq	3	Defines the signal frequency used to drive the comparator latch and period counter.
LowBaselineReset	5	Defines the number of samples with raw counts less than baseline needed to make baseline snap down to the raw count level.
MeasureType	Self capacitance	Defines the type of capacitance measurement type.
ModulatorClkDivider	12	Defines the modulator clock divider.
NegativeNoiseThreshold	20	Defines the negative difference between the raw count and baseline levels for baseline resting to the raw count level.
PrechargeClkDivider	12	Defines the clock divider for analog switches source
PrechargeClkFreq	3	Defines the precharge signal frequency
PrsOptions	12bits	Defines the source of sensors switching controlling signal
RawDataFilterType	First Order IIR 1/4	Defines the filter applied to raw data values.
SensorAutoReset	false	Enabling auto reset causes baseline to always update regardless of whether the difference counts are above or below the noise threshold. When auto reset is disabled, Baseline only updates when difference counts are within the plus/minus noise threshold (the noise threshold is mirrored.)
SensorNumber	5	Total sensors count
SensorsFreqSettingsInd	true	Select individual frequency settings for each sensor or common for all sensors.
ShieldDelay	None	Defines shield signal delay relative to the switches controlling signal.
ShieldEnable	false	Defines using of shield output.
ShieldTankEnable	false	Enables external shield tank capacitor.
SnsAlias	LinearSlider0_e0__LS, LinearSlider0_e1__LS, LinearSlider0_e2__LS, LinearSlider0_e3__LS, LinearSlider0_e4__LS	Contains all aliases for sensors.
TunerIntfAddress	8	This parameter specifies the I2C 7-bits slave address (MSB ignored).

Parameter Name	Value	Description
TunerIntfDataRate	400	This parameter specifies the I2C Data rate in kbps. The standard data rates are: 50, 100, 400 kbps.
TunerProperties		Contains additional parameters required for tuner
TuningMethod	Auto	Defines tuning method for capsense system.
WaterProofingEnabled	false	Enables special capsense system settings to use in water proof designs.
WidgetResolution	8	Defines Signal resolution as uint8 or uint16. Valid values are 8 and 16.

8.3 Component type: DieTemp_P4 [v1.0]

8.3.1 Instance DieTemp_1

Description: Die temperature sensor interface
Instance type: DieTemp_P4 [v1.0]
Datasheet: online component datasheet for DieTemp_P4

8.4 Component type: SCB_P4 [v1.10]

8.4.1 Instance SPIS_1

Description: Serial Communication Block (SCB)
Instance type: SCB_P4 [v1.10]
Datasheet: online component datasheet for SCB_P4

Table 14. Component Parameters for SPIS_1

Parameter Name	Value	Description
EzI2cClockFromTerm	false	When the SCB mode is EZI2C, this parameter provides a clock terminal to connect a clock outside the component.
EzI2cClockStretching	true	When the SCB mode is EZI2C, this parameter specifies whether the SCL is stretched while in EZI2C operation.
EzI2cDataRate	100	When the SCB mode is EZI2C, this parameter defines EZI2C Data rate in kbps. The standard data rates are: 50, 100, 400 and 1000 kbps.
EzI2cIsPrimarySlaveA-ddressHex	true	When the SCB mode is EZI2C, this parameter notifies that the EZI2C slave primary address was entered in hexadecimal. This parameter is used only by the component customizer.

Parameter Name	Value	Description
EzI2cIsSecondarySlav-eAddressHex	true	When the SCB mode is EZI2C, this parameter notifies that the EZI2C slave secondary address was entered in hexadecimal. This parameter is used only by the component customizer.
EzI2cMedianFilterEnable	true	When the SCB mode is EZI2C, this parameter applies a digital 3 tap median filter to the EZI2C input lines.
EzI2cNumberOfAddresses	1	When the SCB mode is EZI2C, this parameter defines the number of I2C slave addresses that device respond to.
EzI2cOvsFactor	16	When the SCB mode is EZI2C, this parameter defines the oversampling factor of the SCBCLK.
EzI2cPrimarySlaveAddress	8	When the SCB mode is EZI2C, this parameter specifies EZI2C primary 7-bits slave address (MSB ignored).
EzI2cSecondarySlaveAddress	9	When the SCB mode is EZI2C, this parameter specifies EZI2C secondary 7-bits slave address (MSB ignored). Only applicable when EZI2C clock stretching option is set.
EzI2cSubAddressSize	8	When the SCB mode is EZI2C, this parameter specifies the maximum size of the slave buffer that is exposed to the master: 8bits – maximum buffer size is 256 bytes, 16 bits – maximum buffer size is 65536 bytes.
EzI2cWakeEnable	false	When the SCB mode is EZI2C, this parameter enables wakeup from Deep Sleep on I2C address match event.
I2cAcceptAddress	false	When the SCB mode is I2C, this parameter specifies whether to accept a match I2C slave address in the RX FIFO or not. This option could be used for software address matching.
I2cClockFromTerm	false	When the SCB mode is I2C, this parameter allows the provision of a clock terminal to connect a clock from outside the component.
I2cDataRate	100	When the SCB mode is I2C, this parameter specifies the data rate in kbps. The standard data rates are: 50, 100, 400 and 1000 kbps.

Parameter Name	Value	Description
I2cIsSlaveAddressHex	true	When the SCB mode is I2C, this parameter notifies that the I2C slave address was entered in hexadecimal. This parameter is used only by the component customizer.
I2cIsSlaveAddressMaskHex	true	When the SCB mode is I2C, this parameter notifies that the I2C slave address mask was entered in hexadecimal. This parameter is used only by the component customizer.
I2cMedianFilterEnable	true	When the SCB mode is I2C, this parameter applies a digital 3 tap median filter to the I2C lines.
I2cMode	Slave	When the SCB mode is I2C, this parameter defines the I2C operation mode as: Slave, Master, Multi-Master or Multi-Master--Slave.
I2cOvsFactor	16	When the SCB mode is I2C, this parameter defines the oversampling factor of SCBCLK.
I2cOvsFactorHigh	8	When the SCB mode is I2C, this parameter defines the high oversampling factor of SCBCLK. Only applicable for I2C Master modes.
I2cOvsFactorLow	8	When the SCB mode is I2C, this parameter defines the low oversampling factor of SCBCLK. Only applicable for I2C Master modes.
I2cSlaveAddress	8	When the SCB mode is I2C, this parameter specifies the I2C 7-bits slave address (MSB ignored).
I2cSlaveAddressMask	254	When the SCB mode is I2C, this parameter specifies the I2C Slave address mask. Bit value 0 – excludes bit from address comparison. Bit value 1 – the bit needs to match with the corresponding bit of the I2C slave address.
I2cWakeEnable	false	When the SCB mode is I2C, this parameter enables wakeup from Deep Sleep on an I2C address match event.
ScbMisoSdaTxEnable	true	This parameter defines the availability of the spi_miso_i2c_-sda_uart_tx pin.
ScbMode	SPI	This parameter defines the mode of operation for the SCB component.

Parameter Name	Value	Description
ScbMosiSclRxEnable	true	This parameter defines the availability of the spi_mosi_i2c_-scl_uart_rx pin.
ScbRxWakeIrqEnable	false	This parameter defines the availability of the spi_mosi_i2c_-scl_uart_rx_wake pin.
ScbSclkEnable	false	This parameter defines the availability of the sclk pin.
ScbSs0Enable	false	This parameter defines the availability of the ss0 pin.
ScbSs1Enable	false	This parameter defines the availability of the ss1 pin.
ScbSs2Enable	false	This parameter defines the availability of the ss2 pin.
ScbSs3Enable	false	This parameter defines the availability of the ss3 pin.
SpiBitRate	1000	When the SCB mode is SPI, this parameter specifies the SPI Bit rate in kbps. The standard bit rates are: 500, 1000-16000 kbps.
SpiBitsOrder	MSB First	When the SCB mode is SPI, this parameter defines the bit order as: MSB first or LSB first.
SpiClockFromTerm	false	When the SCB mode is SPI, this parameter provides a clock terminal to connect a clock outside the component in SPI mode.
SpiInterruptMode	Internal	When the SCB mode is SPI, this parameter specifies the interrupt mode: None: Removes all interrupt -support. Internal: Leaves the interrupt SCBIRQ inside the component-the interrupt terminal becomes invisible. External: Provides an interrupt terminal to connect an interrupt outside the component.
SpiIntrMasterSpiDone	false	When the SCB mode is SPI, this parameter enables the SCB.INTR_M. SPI_DONE inte-rrupt source. SCB.INTR_M. SPI_DONE: all data are sent into TX FIFO and the TX FIFO and the shifter register are emptied. Only applicable for SPI Master mode.
SpiIntrRxFull	true	When the SCB mode is SPI, this parameter enables the SCB.INTR_RX.FULL interrupt source. SCB.INTR_RX.FULL: RX FIFO is full.

Parameter Name	Value	Description
SpiIntrRxNotEmpty	true	When the SCB mode is SPI, this parameter enables the SCB.INTR_RX.NOT_EMPTY interrupt source. SCB.INTR_RX.NOT_EMPTY: RX FIFO is not empty. There is at least one entry to get data from.
SpiIntrRxOverflow	false	When the SCB mode is SPI, this parameter enables the SCB.INTR_RX.OVERFLOW interrupt source. SCB.INTR_RX.OVERFLOW: attempt to write to a full RX FIFO.
SpiIntrRxTrigger	false	When the SCB mode is SPI, this parameter enables the SCB.INTR_RX.TRIGGER interrupt source. SCB.INTR_RX.TRIGGER: RX FIFO has more entries than the value specified by SpiRxTriggerLevel.
SpiIntrRxUnderflow	false	When the SCB mode is SPI, this parameter enables the SCB.INTR_RX.UNDERFLOW interrupt source. SCB.INTR_RX.UNDERFLOW: attempt to read from an empty RX FIFO.
SpiIntrSlaveBusError	false	When the SCB mode is SPI, this parameter enables the SCB.INTR_SLAVE.BUS_ERROR interrupt source. SCB.INTR_SLAVE.BUS_ERROR: slave select line is deselected at an unexpected time in the SPI transfer. Only applicable for SPI Slave mode.
SpiIntrTxEmpty	false	When the SCB mode is SPI, this parameter enables the SCB.INTR_TX.EMPTY interrupt source. SCB.INTR_TX.EMPTY: TX FIFO is empty.
SpiIntrTxNotFull	false	When the SCB mode is SPI, this parameter enables the SCB.INTR_TX.NOT_FULL interrupt source. SCB.INTR_TX.NOT_FULL: TX FIFO is not full. There is at least one entry to put data.

Parameter Name	Value	Description
SpiIntrTxOverflow	false	When the SCB mode is SPI, this parameter enables the SCB.INTR_TX.OVERFLOW interrupt source. SCB.INTR_TX.OVERFLOW: attempt to write to a full TX FIFO.
SpiIntrTxTrigger	false	When the SCB mode is SPI, this parameter enables the SCB.INTR_TX.TRIGGER interrupt source. SCB.INTR_TX.TRIGGER: TX FIFO has fewer entries than the value specified by SpiTxTriggerLevel.
SpiIntrTxUnderflow	false	When the SCB mode is SPI, this parameter enables the SCB.INTR_TX.UNDERFLOW interrupt source. SCB.INTR_TX.UNDERFLOW: attempt to read from an empty TX FIFO.
SpiLateMisoSampleEnable	false	When the SCB mode is SPI, this parameter enables late sampling of the MISO line.
SpiMedianFilterEnable	false	When the SCB mode is SPI, this parameter applies a digital 3 tap median filter to the SPI input line.
SpiMode	Slave	When the SCB mode is SPI, this parameter selects SPI mode of operation as: Slave or Master.
SpiNumberOfRxDataBits	16	When the SCB mode is SPI, this parameter specifies the number of data bits inside the SPI byte/word for RX direction.
SpiNumberOfSelectLines	1	When the SCB mode is SPI, this parameter defines the number of slave select lines. The SPI Slave has only one slave select line. The SPI Master has up to 4 lines.
SpiNumberOfTxDataBits	16	When the SCB mode is SPI, this parameter define the number of data bits inside the SPI byte/word for TX direction.
SpiOvsFactor	12	When the SCB mode is SPI, this parameter defines the oversampling factor of SCBCLK.
SpiRxBufferSize	8	When the SCB mode is SPI, this parameter defines the size of the RX buffer. The value 8 implies usage of hardware RX FIFO. Greater values imply usage of internal software buffer along with RX FIFO.

Parameter Name	Value	Description
SpiRxTriggerLevel	7	When the SCB mode is SPI, this parameter defines the number of entries in the RX FIFO to trigger the SCB.INTR_-RX.TRIGGER interrupt event.
SpiSclkMode	CPHA = 1, CPOL = 1	When the SCB mode is SPI, this parameter defines the serial clock phase (CPHA) and polarity (CPOL).
SpiSubMode	Motorola	When the SCB mode is SPI, this parameter defines the sub mode of the SPI as: Motorola, TI, or Microwire.
SpiTransferSeparation	Continuous	When the SCB mode is SPI, this parameter defines the type of SPI transfers separation as: continuous or separated.
SpiTxBufferSize	8	When the SCB mode is SPI, this parameter defines the size of the TX buffer. The value 8 implies usage of hardware TX FIFO. Greater values imply usage of an internal software buffer along with TX FIFO.
SpiTxTriggerLevel	0	When the SCB mode is SPI, this parameter defines the number of entries in TX FIFO to trigger the INTR_TX.TRIGGER interrupt event.
SpiWakeEnable	false	When the SCB mode is SPI, this parameter enables wakeup from Deep Sleep on slave select event.
UartClockFromTerm	false	When the SCB mode is UART, this parameter provides a clock terminal to connect a clock outside the component.
UartDataRate	115200	When the SCB mode is UART, this parameter defines the UART baud rate in kbps. The standard baud rates are provided.
UartDirection	TX + RX	When the SCB mode is UART, this parameter enables RX or TX direction or both simultaneously.
UartDropOnFrameErr	false	When the SCB mode is UART, this parameter defines whether the data is dropped from RX FIFO on a frame error event.
UartDropOnParityErr	false	When the SCB mode is UART, this parameter determines whether the data is dropped from RX FIFO on a parity error event.

Parameter Name	Value	Description
UartInterruptMode	None	When the SCB mode is UART, this parameter specifies the interrupt mode: None: Removes all interrupt support. Internal: Leaves the interrupt SCBIRQ inside the component- the interrupt terminal becomes invisible. External: Provides an interrupt terminal to connect an interrupt outside component.
UartIntrRxFrameErr	false	When the SCB mode is UART, this parameter enables the SCB.INTR_RX.FRAME_-ERROR interrupt source. SCB.INTR_RX.FRAME_E-RROR: frame error in received data frame.
UartIntrRxFull	false	When the SCB mode is UART, this parameter enables the SCB.INTR_RX.FULL interrupt source. SCB.INTR_RX.FULL: RX FIFO is full.
UartIntrRxNotEmpty	true	When the SCB mode is UART, this parameter enables the SCB.INTR_RX.NOT_EMPTY interrupt source. SCB.INTR_RX.NOT_EMPTY: RX FIFO is not empty. There is at least one entry to get data from.
UartIntrRxOverflow	false	When the SCB mode is UART, this parameter enables the SCB.INTR_RX.OVERFLOW interrupt source. SCB.INTR_RX.OVERFLOW: at-tempt to write to a full RX FIFO.
UartIntrRxParityErr	false	When the SCB mode is UART, this parameter enables the SCB.INTR_RX.PARITY_-ERROR interrupt source. SCB.INTR_RX.PARITY_-ERROR: parity error in received data frame.
UartIntrRxTrigger	false	When the SCB mode is UART, this parameter enables the SCB.INTR_RX.TRIGGER inter-rupt source. SCB.INTR_RX.TRIGGER: RX FIFO has more entries than the value specified by UartRxTrigg-erLevel.

Parameter Name	Value	Description
UartIntrRxUnderflow	false	When the SCB mode is UART, this parameter enables the SCB.INTR_RX.UNDERFLOW interrupt source. SCB.INTR_RX.UNDERFLOW: - attempt to read from an empty RX FIFO.
UartIntrTxEmpty	false	When the SCB mode is UART, this parameter enables the SCB.INTR_TX.EMPTY interrupt source. SCB.INTR_TX.EMPTY: TX FIFO is empty.
UartIntrTxNotFull	false	When the SCB mode is UART, this parameter enables the SCB.INTR_TX.NOT_FULL interrupt source. SCB.INTR_TX.NOT_FULL: TX FIFO is not full. There is at least one entry to put data.
UartIntrTxOverflow	false	When the SCB mode is UART, this parameter enables the SCB.INTR_TX.OVERFLOW interrupt source. SCB.INTR_TX.OVERFLOW: attempt to write to a full TX FIFO.
UartIntrTxTrigger	false	When the SCB mode is UART, this parameter enables the SCB.INTR_TX.TRIGGER interrupt source. SCB.INTR_TX.TRIGGER: TX FIFO has fewer entries than the value specified by UartTxTriggerLevel.
UartIntrTxUartDone	false	When the SCB mode is UART, this parameter enables the SCB.INTR_TX.UART_DONE interrupt source. SCB.INTR_TX.UART_DONE: all data are sent in to TX FIFO and the transmit FIFO and the shifter register are emptied.
UartIntrTxUartLostArb	false	When the SCB mode is UART, this parameter enables the SCB.INTR_TX.UART_ARB_LOST interrupt source. SCB.INTR_TX.UART_ARB_LOST: UART lost arbitration- the value driven on the TX line is not the same as the value observed on the RX line. This event is useful when the transmitter and the receiver share a TX/RX line. Only applicable for UART SmartCard mode.

Parameter Name	Value	Description
UartIntrTxUartNack	false	When the SCB mode is UART, this parameter enables the SCB.INTR_TX.UART_NACK interrupt source. SCB.INTR_TX.UART_NACK: UART transmitter received a negative acknowledgement. Only applicable for UART SmartCard mode.
UartIntrTxUnderflow	false	When the SCB mode is UART, this parameter enables the SCB.INTR_TX.UNDERFLOW interrupt source. SCB.INTR_TX.UNDERFLOW: - attempt to read from an empty TX FIFO.
UartIrdaLowPower	false	When the SCB mode is UART, this parameter enables the low power receiver option. Only applicable for UART IrDA mode.
UartIrdaPolarity	Non-Inverting	When the SCB mode is UART, this parameter inverts the incoming RX line signal. Only applicable for UART IrDA mode.
UartMedianFilterEnable	false	When the SCB mode is UART, this parameter applies a digital 3 tap median filter to the UART input line.
UartMpEnable	false	When the SCB mode is UART, this parameter enables the UART multi-processor mode. Only applicable for UART Standard mode.
UartMpRxAcceptAddress	false	When the SCB mode is UART, this parameter define whether to put the matched UART address into RX FIFO. Only applicable for UART multi-processor mode.
UartMpRxAddress	2	When the SCB mode is UART, this parameter defines the UART address. Only applicable for UART multi-processor mode.
UartMpRxAddressMask	255	When the SCB mode is UART, this parameter defines the address mask in multi-processor operation mode. Bit value 0 – excludes bit from address comparison. Bit value 1 – the bit needs to match with the corresponding bit of the UART address. Only applicable for UART multi-processor mode.

Parameter Name	Value	Description
UartNumberOfDataBits	8 bits	When the SCB mode is UART, this parameter defines the number of data bits inside the UART byte/word.
UartNumberOfStopBits	1 bit	When the SCB mode is UART, this parameter defines the number of Stop bits.
UartOvsFactor	12	When the SCB mode is UART, this parameter defines the oversampling factor of SCBCLK.
UartParityType	None	When the SCB mode is UART, this parameter applies UART parity check as Odd or Even or discards the parity entirely.
UartRxBufferSize	8	When the SCB mode is UART, this parameter defines the size of the RX buffer. The value 8 implies the usage of hardware RX FIFO. Greater values imply usage of internal software buffer along with RX FIFO.
UartRxTriggerLevel	7	When the SCB mode is UART, this parameter defines the number of entries in the RX FIFO to trigger the SCB.INTR_-RX.TRIGGER interrupt event.
UartSmCardRetryOnNack	false	When the SCB mode is UART, this parameter defines whether to send a message again when a NACK response is received. Only applicable for UART SmartCard mode.
UartSubMode	Standard	When the SCB mode is UART, this parameter defines the sub mode of UART as: Standard, SmartCard or IrDA.
UartTxBufferSize	8	When the SCB mode is UART, this parameter defines the size of the TX buffer. The value 8 implies usage of hardware TX FIFO. Greater values imply the usage of internal software buffer along with TX FIFO.
UartTxTriggerLevel	0	When the SCB mode is UART, this parameter defines the number of entries in the TX FIFO to trigger the SCB.INTR_-TX.TRIGGER interrupt event.
UartWakeEnable	false	When the SCB mode is UART, this parameter enables the wakeup from Deep Sleep on start bit event. The actual wakeup source is RX GPIO. The skip start UART feature allows it to continue receiving bytes.

8.5 Component type: TCPWM_P4 [v1.0]

8.5.1 Instance LED_CONTROL

Description: 16-bit Timer Counter PWM (TCPWM)
Instance type: TCPWM_P4 [v1.0]
Datasheet: online component datasheet for TCPWM_P4

Table 15. Component Parameters for LED_CONTROL

Parameter Name	Value	Description
PWMCompare	1	Initial value for the comparison register when in PWM mode
PWMCompareBuf	65535	Initial value for the second comparison register when in PWM mode
PWMCompareSwap	Disable swap	Determines whether the PWM swap check box is enabled or disabled
PWMCountMode	Level	Determines whether the PWM counter counts at a level detect or at various modes of edge detection
PWMCountPresent	false	Determines if the PWM count signal is present and controls the visibility of the count pin
PWMDeadTimeCycle	0	Sets the number of cycles of dead time insertion
PWMInterruptMask	None	Mask used for enabling the interrupt bit in PWM mode
PWMKillEvent	Asynchronous	Selects whether a PWM kill event is synchronous or asynchronous to the input clock
PWMLinenSignal	Direct Output	Selects whether the PWM line_n signal is inverted or is directly output
PWMLineSignal	Direct Output	Selects whether the PWM line signal is inverted or is directly output
PWMMode	PWM	Selects one of the three PWM modes - PWM, PWM with dead time insertion, or Pseudo random PWM
PWMPeriod	65535	Initial value for the period register when in PWM mode
PWMPeriodBuf	65535	Initial value for the second period register when in PWM mode
PWMPeriodSwap	Disable swap	Enables swap between PWM period and period_buf registers
PWMPrescaler	0	Defines the prescaler used to divide the TCPWM clock to create the counter clock
PWMReloadMode	Rising edge	Determines whether the PWM reload signal is accepted at a level detect or at various modes of edge detection

Parameter Name	Value	Description
PWMReloadPresent	false	Determines whether the PWM reload signal is present, and controls its pin visibility
PWMRunMode	Continuous	Selects between continuous and one shot run mode for the PWM
PWMSetAlign	Left align	Selects the alignment of the PWM waveform to be either left, right, center or asymmetrically aligned
PWMStartMode	Rising edge	Determines whether the PWM start signal is accepted at a level detect or at various modes of edge detection
PWMStartPresent	false	Determines whether the PWM start signal is present and controls its pin visibility
PWMStopEvent	Don't stop on Kill	Selects whether to kill the PWM on a stop signal or not
PWMStopMode	Rising edge	Determines whether the PWM stop signal is accepted at a level detect or at various modes of edge detection
PWMStopPresent	false	Determines whether the PWM stop signal is present, and controls its pin visibility
PWMSwitchMode	Rising edge	Determines whether the PWM switch signal is accepted at a level detect or at various modes of edge detection
PWMSwitchPresent	false	Determines whether the PWM switch signal is present, and controls its pin visibility
QuadEncodingModes	x1 Encoding mode	Selects one of the three quadrature decoder modes – x1, x2, or x4 encoding mode
QuadIndexMode	Rising edge	Determines whether the Quadrature Decoder index signal is accepted at a level detect or at various modes of edge detection
QuadIndexPresent	false	Determines whether the Quadrature Decoder index signal is present, and controls its pin visibility
QuadInterruptMask	Terminal count mask	Mask used to configure which Quadrature Decoder event causes an interrupt
QuadPhiAMode	Level	Determines whether the Quadrature Decoder PhiA signal is accepted at a level detect or at various modes of edge detection
QuadPhiBMode	Level	Determines whether the Quadrature Decoder PhiB signal is accepted at a level detect or at various modes of edge detection

Parameter Name	Value	Description
QuadStopMode	Rising edge	Determines whether the Quadrature Decoder stop signal is accepted at a level detect or at various modes of edge detection
QuadStopPresent	false	Determines whether the Quadrature Decoder stop signal is present, and controls its pin visibility
TCCaptureMode	Rising edge	Determines whether the Timer/Counter capture signal is accepted at a level detect or at various modes of edge detection
TCCapturePresent	false	Determines whether the Timer/Counter capture signal is present, and controls its pin visibility
TCCompare	65535	Initial value for the comparison register when in Timer/Counter mode
TCCompareBuf	65535	Initial value for the second comparison register when in Timer/Counter mode
TCCompareSwap	Disable swap	Determine whether the Timer/Counter swap check box is enabled or disabled
TCCompCapMode	Capture Mode	Selects whether the Timer/Counter capture or the compare mode is enabled
TCCountingModes	Counts up	Selects the count direction of the counter
TCCountMode	Level	Determines whether the Timer/Counter count signal is accepted at a level detect or at various modes of edge detection
TCCountPresent	false	Determines whether the Timer/Counter count signal is present, and controls its pin visibility
TCInterruptMask	Terminal count mask	Mask used to determine which Timer/Counter event causes an interrupt
TCPeriod	65535	Initial value for the Timer/Counter period register
TCPrescaler	0	Selects the prescaler value to apply to the Timer/Counter clock
TCPWMCapturePresent	false	Determines whether the Unconfigured capture signal is present, and controls its pin visibility
TCPWMConfig	PWM	Selects the TCPWM mode - Unconfigured, Timer/Counter, PWM, or Quadrature Decoder

Parameter Name	Value	Description
TCPWMCountPresent	false	Determines whether the Unconfigured count signal is present, and controls its pin visibility
TCPWMReloadPresent	false	Determines whether the Unconfigured reload signal is present, and controls its pin visibility
TCPWMStartPresent	false	Determines whether the Unconfigured start signal is present, and controls its pin visibility
TCPWMStopPresent	false	Determines whether the Unconfigured stop signal is present, and controls its pin visibility
TCReloadMode	Rising edge	Determines whether the Timer/Counter reload signal is accepted at a level detect or at various modes of edge detection
TCReloadPresent	false	Determines whether the Timer/Counter reload signal is present, and controls its pin visibility
TCRunMode	Continuous	Selects whether the counter runs continuously or one shot
TCStartMode	Rising edge	Determines whether the start signal is accepted at a level detect or at various modes of edge detection
TCStartPresent	false	Determines whether the Timer/Counter start signal is present, and controls its pin visibility
TCStopMode	Rising edge	Determines whether the Timer/Counter stop signal is accepted at a level detect or at various modes of edge detection
TCStopPresent	false	Determines whether the Timer/Counter stop signal is present, and controls its pin visibility

9 Other Resources

The following documents contain important information on Cypress software APIs that might be relevant to this design:

- Standard Types and Defines chapter in the System Reference Guide
  - Software base types
  - Hardware register types
  - Compiler defines
  - Cypress API return codes
  - Interrupt types and macros
- Registers
  - The full PSoC 4 register map is covered in the PSoC 4 Registers Technical Reference Manual
  - Register Access chapter in the System Reference Guide
    - CY_GET API routines
    - CY_SET API routines
- System Functions chapter in the System Reference Guide
  - General API routines
  - CyDelay API routines
  - CyVd Voltage Detect API routines
- Power Management
  - Power Supply and Monitoring chapter in the PSoC 4 Technical Reference Manual
  - Low Power Modes chapter in the PSoC 4 Technical Reference Manual
  - Power Management chapter in the System Reference Guide
    - CyPm API routines
- Watchdog Timer chapter in the System Reference Guide
  - CyWdt API routines