

# USB Billboard Controller

## Features

- USB 2.0-certified, Full-Speed (12 Mbps)
  - Supports native Billboard Device class driver
  - Integrated USB termination resistors
- I<sup>2</sup>C interface
  - Master up to 400 kHz
- General-purpose input/output (GPIO) pins: 9
- 2560 bytes flash for storing configuration parameters
- Billboard Device class specific descriptors
- Driver support for Billboard Device
  - Billboard Device class is natively supported by Windows 10 and Mac OS-X
  - Cypress provides drivers for
    - Windows 7 and Windows 8.x
    - Linux
- Clocking: Integrated 48-MHz clock oscillator
- Supports bus-/self-powered configurations
- USB Suspend mode for low power
- Operating voltage: 1.71 to 5.5 V
- Operating temperature:
  - Commercial: 0 °C to 70 °C
  - Industrial: -40 °C to 85 °C
- ESD protection: 2.2-kV HBM
- RoHS-compliant package
  - 24-pin QFN (4.0 mm × 4.0 mm, 0.55 mm, 0.5 mm pitch)
- Ordering part number
  - CY7C65210-24LTXI

## Applications

Any Type-C Device Container that supports Alternate Mode requires Billboard Device support such as:

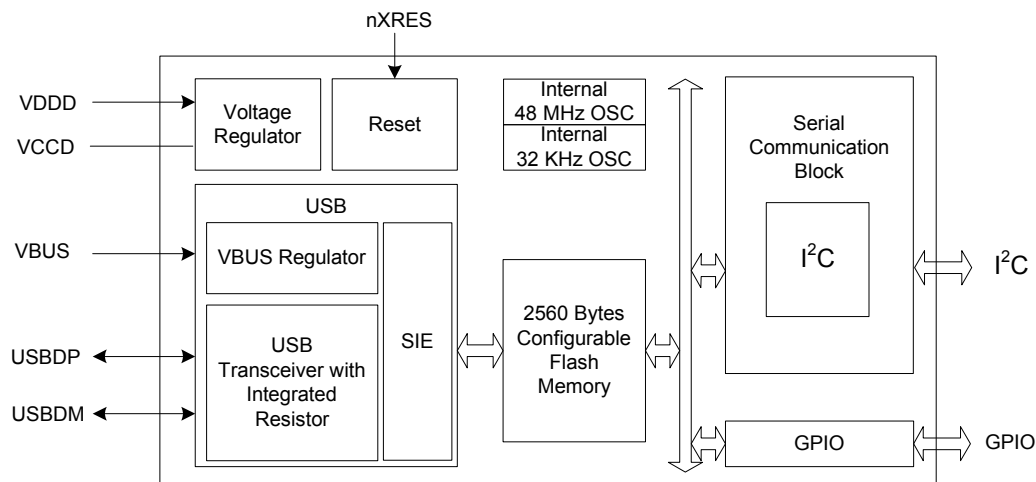
- Dongles for Type-C
- Docking Stations
- Monitors

## Functional Description

The CY7C65210 is a Full-Speed USB controller, which enumerates as Billboard Device. It integrates a voltage regulator, an oscillator, and flash memory for storing configuration parameters, offering a cost-effective solution. CY7C65210 supports bus-powered mode and enables efficient system power management with suspend and remote wake-up signals. It is available in a 24-pin QFN package.

For a complete list of related resources, click [here](#).

## Block Diagram



## More Information

Cypress provides a wealth of data at [www.cypress.com](http://www.cypress.com) to help you to select the right device for your design, and to help you to quickly and effectively integrate the device into your design.

- Overview: [USB Portfolio](#), [USB Roadmap](#)
- USB 2.0 Product Selectors: [USB-Serial Bridge Controller](#), [USB to UART Controller \(Gen I\)](#), [enCoRe II](#), [enCoRe III](#), [enCoRe V](#)
- Code Examples: [USB Full-Speed](#)
- Models: [IBIS](#)

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Pin Description

Pin <sup>[1]</sup>	Type	Name	Default	Description
1	GPIO	GPIO_6	TRISTATE	GPIO
2	GPIO	GPIO_7	TRISTATE	GPIO
3	Power	VSSD	–	Digital Ground
4	GPIO	GPIO_8	TRISTATE	GPIO
5	GPIO	GPIO_9	TRISTATE	GPIO
6	GPIO	GPIO_10	TRISTATE	GPIO
7	GPIO	GPIO_11	POWER#	GPIO
8	Output	SUSPEND	–	Indicates device in suspend mode. Can be configured as active low/high using the configuration utility
9	Input	WAKEUP	–	Wakeup device from suspend mode. Can be configured as active low/high using the configuration utility
10	USBIO	USBDP	–	USB Data Signal Plus, integrates termination resistor and a 1.5-kΩ pull-up resistor
11	USBIO	USBDM	–	USB Data Signal Minus, integrates termination resistor
12	Power	VCCD	–	This pin should be decoupled to ground using a 1-μF capacitor or by connecting a 1.8-V supply
13	Power	VSSD	–	Digital Ground
14	nXRES	nXRES	–	Chip reset, active low. Can be left unconnected or have a pull-up resistor connected if not used
15	Power	VBUS	–	VBUS Supply, 3.15 V to 5.25 V
16	Power	VSSD	–	Digital Ground
17	Power	VSSA	–	Analog Ground
18	Input	Debug I/O	–	Used for debug purpose. Should be left floating.
19	GPIO	GPIO_1	INPUT	Can be used as wakeup source to wakeup device from Suspend mode.
20	GPIO	GPIO_2	TRISTATE	GPIO
21	SCB/GPIO	SCB_1/GPIO_3	SCL	I <sup>2</sup> C SCL
22	SCB/GPIO	SCB_2/GPIO_4	SDA	I <sup>2</sup> C SDA
23	GPIO	GPIO_5	TRISTATE	GPIO
24	Power	VDDD	–	Supply to the device core and Interface, 1.71 to 5.5 V

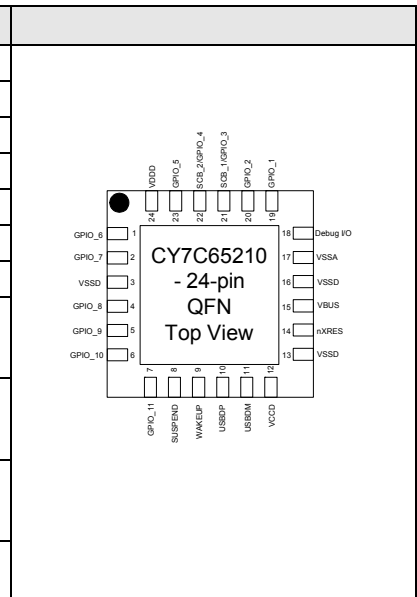


Table 1. GPIO Configuration

GPIO Configuration Option	Description
INPUT	Input GPIO
POWER#	This active low output signal is used to control power to an external logic through a switch to cut power off during an Unconfigured USB device and USB suspend. 0 - USB device in Configured state 1 - USB device in Unconfigured state or during USB suspend mode

Note

- Any pin acting as an Input pin should not be left unconnected.

## Functional Overview

### USB and Billboard Device functionality

#### USB

CY7C65210 has a built-in USB 2.0 Full-Speed transceiver. The transceiver incorporates the internal USB series termination resistors on the USB data lines and a 1.5-k $\Omega$  pull-up resistor on USBDP.

#### Billboard Device functionality

CY7C65210 is used to communicate the Alternate Modes supported by a Device Container to a USB host system. CY7C65210 sends this information through BOS descriptor and string descriptors in human readable format. CY7C65210 supports Billboard descriptor as part of complete BOS descriptor. For further details on the device class, refer to the [USB Billboard Device class specification, Rev. 1](#).

### Serial Communication

CY7C65210 has a Serial Communication block (SCB) that implements I<sup>2</sup>C interface.

#### I<sup>2</sup>C Interface

The I<sup>2</sup>C interface implements full multi-master mode and supports up to 400 kHz. For further details on the protocol, refer to the NXP I<sup>2</sup>C specification, Rev. 5.

#### Notes

- I<sup>2</sup>C ports are not tolerant to higher voltages. Therefore, they cannot be hot-swapped or powered up independently when chip is not powered.
- The minimum fall time of the SCL is met (as per NXP I<sup>2</sup>C specification Rev5) when V<sub>DD</sub> is between 1.71 V and 3.0 V. When V<sub>DD</sub> is within the range of 3.0 V to 3.6 V, it is recommended to add a 50 pF capacitor on the SCL signal.

### GPIO Interface

CY7C65210 has nine configurable GPIOs. The configurable options are as follows:

- INPUT: Input GPIO
- POWER#: Power control

### Memory

CY7C65210 has a 2560 bytes configurable flash. Flash is used to store USB parameters, such as VID/PID, serial number, product and manufacturer descriptors, and Billboard Device class specific descriptors.

## System Resources

#### Power System

CY7C65210 supports the USB Suspend mode to control power usage. CY7C65210 operates in bus-powered or self-powered modes over a range of 3.15 to 5.5 V.

#### Clock System

CY7C65210 has a fully integrated clock with no external components required. The clock system is responsible for providing clocks to all subsystems.

#### Internal 48-MHz Oscillator

The internal 48-MHz oscillator is the primary source of internal clocking in CY7C65210.

#### Internal 32-kHz Oscillator

The internal 32-kHz oscillator is primarily used to generate clocks for peripheral operation in the USB Suspend mode.

#### Reset

The reset block provides reliable power-on reset and brings the device back to the default known state. The nXRES (active low) pin can be used by the external devices to reset the CY7C65210.

### Suspend and Resume

The CY7C65210 device asserts the SUSPEND pin when the USB bus enters the suspend state. This helps in meeting the stringent suspend current requirement of the USB 2.0 specification, while using the device in bus-powered mode. The device resumes from the suspend state under either of the two following conditions:

1. Any activity is detected on the USB bus
2. The WAKEUP pin is asserted to generate remote wakeup to the host

### WAKEUP

The WAKEUP pin is used to generate the remote wakeup signal on the USB bus. The remote wakeup signal is sent only if the host enables this feature through the SET\_FEATURE request. The device communicates support for the remote wakeup to the host through the configuration descriptor during the USB enumeration process.

## Internal Flash Configuration

The internal flash memory can be used to store the configuration parameters provided in [Table 2](#).

**Table 2. Internal Flash Configuration**

Parameter	Default Value	Description
USB Configuration		
USB Vendor ID (VID)	0x04B4	Default Cypress VID. Can be configured to customer VID.
USB Product ID (PID)	0x5210	Default Cypress PID. Can be configured to customer PID.
Manufacturer string	Cypress Semiconductor	Can be configured with any string up-to 126 characters <sup>[2]</sup> .
Product string	Billboard Device	Can be configured with any string up-to 126 characters <sup>[2]</sup> .
Serial string	0001	Can be configured with any string up-to 126 characters <sup>[2]</sup> .
Power mode	Bus powered	Can be configured to bus-powered or self-powered mode.
Max current draw	100 mA	Can be configured to any value from 0 to 500 mA. The configuration descriptor will be updated based on this.
Remote wakeup	Enabled	Can be disabled. Remote wakeup is initiated by asserting the WAKEUP or GPIO_1 pin.
bcdDevice	0x00	Can be configured with specific binary coded decimal number.
GPIO Configuration		
GPIO_1	Input	GPIO can be configured as shown in <a href="#">Table 1 on page 4</a> .
GPIO_2	Tristate	
GPIO_3	Tristate	
GPIO_4	Tristate	
GPIO_5	Tristate	
GPIO_6	Tristate	
GPIO_7	Tristate	
GPIO_8	Tristate	
GPIO_9	Tristate	
GPIO_10	Tristate	
GPIO_11	POWER#	
Billboard Device class Descriptor Configuration		
iAdditionalInfoURL	<a href="http://www.cypress.com/Type-C">www.cypress.com/Type-C</a>	Can be configured with any string up-to 126 characters <sup>[2]</sup> .
bNumberOfAlternateModes	0x01	Can be configured with any value from 0x01 to 0x08.
bPreferredAlternateMode	0x00	Can be configured with any value from 0x00 to 0x07.
VCONN Power	0x0000	Can be configured with any value from 0x0000 to 0x0006 or it can be configured with value 0x8000.
SVID	0xFF01	Can be configured to specific SVID.
bAlternateMode	0x01	Can be configured with any value from 0x01 to 0x08.
iAlternateModeString	Type-C to Display adapter. For further assistance, see <a href="http://help.vesa.org/dp-usb-type-c">http://help.vesa.org/dp-usb-type-c</a>	Can be configured with any string up-to 126 characters <sup>[2]</sup> .

**Note**

2. Maximum available configuration space for all string descriptors is 1920 bytes. Each string descriptor can be configured up to 126 characters.

## Electrical Specifications

### Absolute Maximum Ratings

Exceeding maximum ratings<sup>[3]</sup> may shorten the useful life of the device.

Storage temperature .....	-55 °C to +100 °C
Ambient temperature with power supplied (Industrial) .....	-40 °C to +85 °C
Supply voltage to ground potential	
V <sub>DDD</sub> .....	6.0 V
V <sub>BUS</sub> .....	6.0 V
V <sub>CCD</sub> .....	1.95 V
V <sub>GPIO</sub> .....	V <sub>DDD</sub> + 0.5 V

Static discharge voltage ESD protection levels:

■ 2.2-KV HBM per JESD22-A114

Latch-up current .....	140 mA
Current per GPIO .....	25 mA

### Operating Conditions

T <sub>A</sub> (ambient temperature under bias)	
Commercial .....	0 °C to 70 °C
Industrial .....	-40 °C to +85 °C
V <sub>BUS</sub> supply voltage .....	3.15 V to 5.50 V
V <sub>DDD</sub> supply voltage .....	1.71 V to 5.50 V
V <sub>CCD</sub> supply voltage .....	1.71 V to 1.89 V

### Device-Level Specifications

All specifications are valid for -40 °C ≤ T<sub>A</sub> ≤ 85 °C, T<sub>J</sub> ≤ 100 °C, and 1.71 V to 5.50 V, except where noted.

Table 3. DC Specifications

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
V <sub>BUS</sub>	V <sub>BUS</sub> supply voltage	3.15	3.30	3.45	V	Set and configure the correct voltage range using a configuration utility for V <sub>BUS</sub> . Default 5 V.
		4.35	5.00	5.5	V	
V <sub>DDD</sub>	V <sub>DDD</sub> supply voltage	1.71	1.80	1.89	V	Used to set I/O and core voltage. Set and configure the correct voltage range using a configuration utility for V <sub>DDD</sub> . Default 3.3 V.
		2.0	3.3	5.5	V	
V <sub>CCD</sub>	Output voltage (for core logic)	-	1.80	-	V	Do not use this supply to drive the external device. <ul style="list-style-type: none"> <li>1.71 V ≤ V<sub>DDD</sub> ≤ 1.89 V: Short the V<sub>CCD</sub> pin with the V<sub>DDD</sub> pin</li> <li>V<sub>DDD</sub> &gt; 2 V – Connect a 1-μF capacitor (Cefc) between the V<sub>CCD</sub> pin and ground</li> </ul>
Cefc	External regulator voltage bypass	1.00	1.30	1.60	μF	X5R ceramic or better
I <sub>DD1</sub>	Operating supply current	-	20	-	mA	USB 2.0 FS, UART at 1-Mbps single channel, no GPIO switching.
I <sub>DD2</sub>	USB Suspend supply current	-	5	-	μA	Does not include current through a pull-up resistor on USBDP.

**Note**

3. Usage above the Absolute Maximum conditions may cause permanent damage to the device. Exposure to Absolute Maximum conditions for extended periods of time may affect device reliability. When used below Absolute Maximum conditions but above normal operating conditions, the device may not operate to specification.

**Table 4. AC Specifications**

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
Fall Time_FS	FS USB Fall Time	–	7.815	–	ns	90% to 10% of full swing, 50pF load
Rise Time_FS	FS USB Rise Time	–	8.367	–	ns	10% to 90% of full swing, 50pF load
TRFM_FS	FS Rise/Fall Matching	–	107.024	–	%	–
VCRS_FS	FS Crossover Voltage	–	1.797	–	V	–
TDJ1	FS Driver Jitter (next)	–	–0.339	–	ns	–
TDJ2	FS Driver Jitter (paired)	–	–0.285	–	ns	–
TFDEOP	FS Differential to EOP Skew	–	–0.076	–	ns	–
F1	Frequency	47.04	48	48.96	MHz	Non-USB mode
F2		47.88	48	48.12	MHz	USB mode
Zout	USB driver output impedance	28	–	44	Ω	–
Twakeup	Wakeup from USB Suspend mode	–	25	–	μs	–

**GPIO**
**Table 5. GPIO DC Specification**

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
$V_{IH}^{[4]}$	Input voltage high threshold	$0.7 \times V_{DDD}$	–	–	V	CMOS Input
$V_{IL}$	Input voltage low threshold	–	–	$0.3 \times V_{DDD}$	V	CMOS Input
$V_{IH}^{[4]}$	LVTTL input, $V_{DDD} < 2.7$ V	$0.7 \times V_{DDD}$	–	–	V	–
$V_{IL}$	LVTTL input, $V_{DDD} < 2.7$ V	–	–	$0.3 \times V_{DDD}$	V	–
$V_{IH}^{[4]}$	LVTTL input, $V_{DDD} \geq 2.7$ V	2	–	–	V	–
$V_{IL}$	LVTTL input, $V_{DDD} \geq 2.7$ V	–	–	0.8	V	–
$V_{OH}$	CMOS output voltage high level	$V_{DDD} - 0.4$	–	–	V	$I_{OH} = 4$ mA, $V_{DDD} = 5$ V +/- 10%
$V_{OH}$	CMOS output voltage high level	$V_{DDD} - 0.6$	–	–	V	$I_{OH} = 4$ mA, $V_{DDD} = 3.3$ V +/- 10%
$V_{OH}$	CMOS output voltage high level	$V_{DDD} - 0.5$	–	–	V	$I_{OH} = 1$ mA, $V_{DDD} = 1.8$ V +/- 5%
$V_{OL}$	CMOS output voltage low level	–	–	0.4	V	$I_{OL} = 8$ mA, $V_{DDD} = 5$ V +/- 10%
$V_{OL}$	CMOS output voltage low level	–	–	0.6	V	$I_{OL} = 8$ mA, $V_{DDD} = 3.3$ V +/- 10%
$V_{OL}$	CMOS output voltage low level	–	–	0.6	V	$I_{OL} = 4$ mA, $V_{DDD} = 1.8$ V +/- 5%
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)	–	–	2	nA	25 °C, $V_{DDD} = 3.0$ V
$C_{IN}$	Input capacitance	–	–	7	pF	–
Vhysttl	Input hysteresis LVTTL; $V_{DDD} > 2.7$ V	25	40	C	mV	–
Vhyscmos	Input hysteresis CMOS	$0.05 \times V_{DDD}$	–	–	mV	–

**Note**

4.  $V_{IH}$  must not exceed  $V_{DDD} + 0.2$  V.



**Table 6. GPIO AC Specification**

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
T <sub>RiseFast1</sub>	Rise Time in Fast mode	2	–	12	ns	V <sub>DDD</sub> = 3.3 V/ 5.5 V, Load = 25 pF
T <sub>FallFast1</sub>	Fall Time in Fast mode	2	–	12	ns	V <sub>DDD</sub> = 3.3 V/ 5.5 V, Load = 25 pF
T <sub>RiseSlow1</sub>	Rise Time in Slow mode	10	–	60	ns	V <sub>DDD</sub> = 3.3 V/ 5.5 V, Load = 25 pF
T <sub>FallSlow1</sub>	Fall Time in Slow mode	10	–	60	ns	V <sub>DDD</sub> = 3.3 V/ 5.5 V, Load = 25 pF
T <sub>RiseFast2</sub>	Rise Time in Fast mode	2	–	20	ns	V <sub>DDD</sub> = 1.8 V, Load = 25 pF
T <sub>FallFast2</sub>	Fall Time in Fast mode	20	–	100	ns	V <sub>DDD</sub> = 1.8 V, Load = 25 pF
T <sub>RiseSlow2</sub>	Rise Time in Slow mode	2	–	20	ns	V <sub>DDD</sub> = 1.8 V, Load = 25 pF
T <sub>FallSlow2</sub>	Fall Time in Slow mode	20	–	100	ns	V <sub>DDD</sub> = 1.8 V, Load = 25 pF

**nXRES**
**Table 7. nXRES DC Specifications**

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
V <sub>IH</sub>	Input voltage high threshold	0.7 × V <sub>DDD</sub>	–	–	V	–
V <sub>IL</sub>	Input voltage low threshold	–	–	0.3 × V <sub>DDD</sub>	V	–
R <sub>pullup</sub>	Pull-up resistor	3.5	5.6	8.5	kΩ	–
C <sub>IN</sub>	Input capacitance	–	5	–	pF	–
V <sub>hysxres</sub>	Input voltage hysteresis	–	100	–	mV	–

**Table 8. nXRES AC Specifications**

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
T <sub>resetwidth</sub>	Reset pulse width	1	–	–	μs	–

**I<sup>2</sup>C Specifications**
**Table 9. I<sup>2</sup>C AC Specifications**

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
F <sub>I2C</sub>	I <sup>2</sup> C frequency	1	–	400	kHz	–

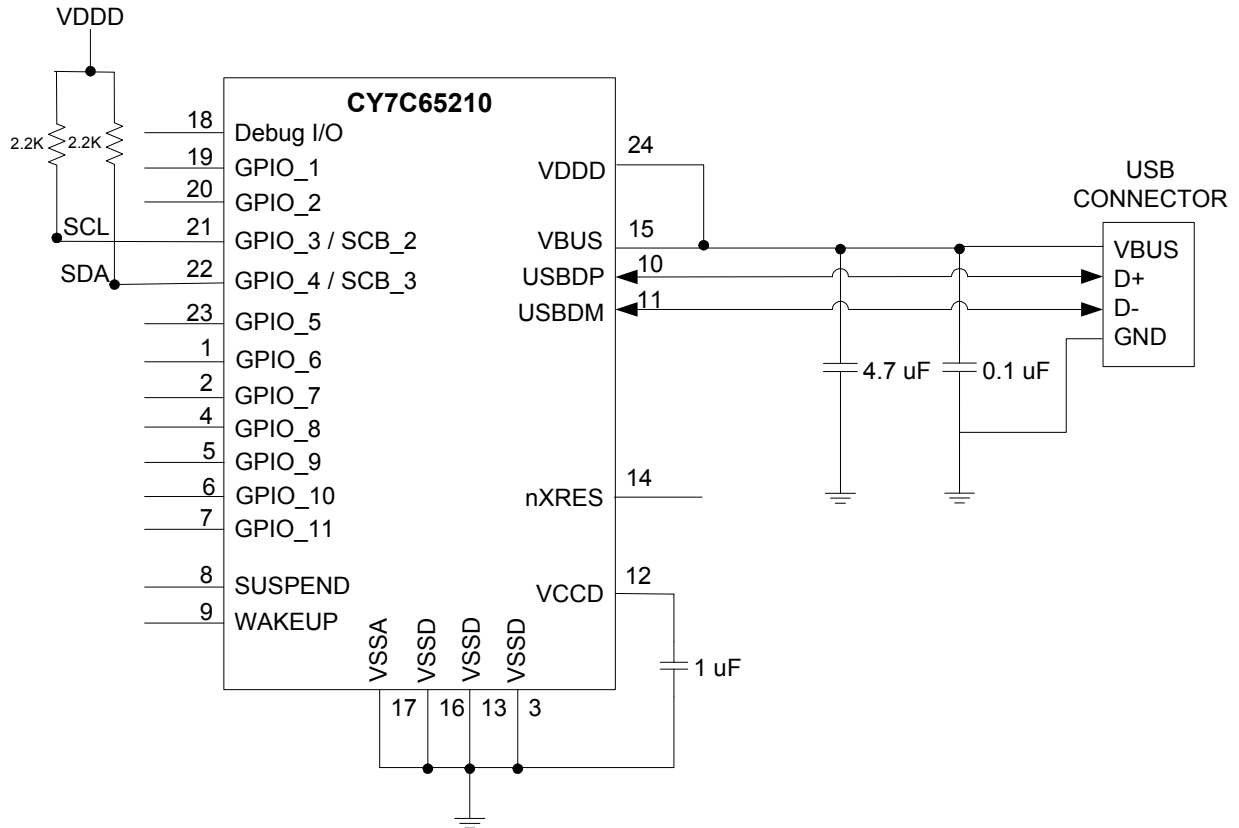
**Flash Memory Specifications**
**Table 10. Flash Memory Specifications**

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
F <sub>end</sub>	Flash endurance	100K	–	–	cycles	–
F <sub>ret</sub>	Flash retention. T <sub>A</sub> ≤ 85 °C, 10 K program/erase cycles	10	–	–	years	–

### Application Schematic

Figure 1 shows the application schematic for CY7C65210. Refer to the [Pin Description on page 4](#) for signal details.

Figure 1. Application Schematic



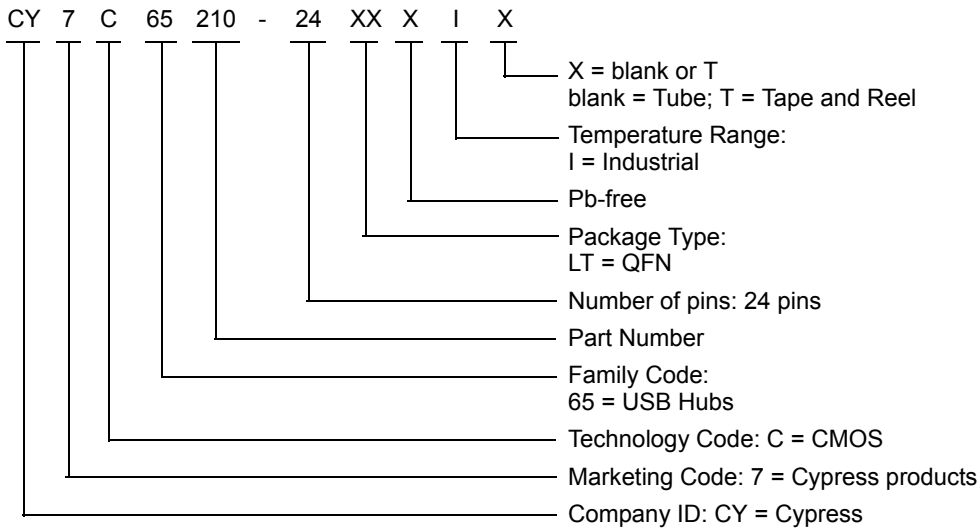
## Ordering Information

Table 11 lists the key package features and ordering codes of the CY7C65210. For more information, contact your local sales representative.

**Table 11. Key Features and Ordering Information**

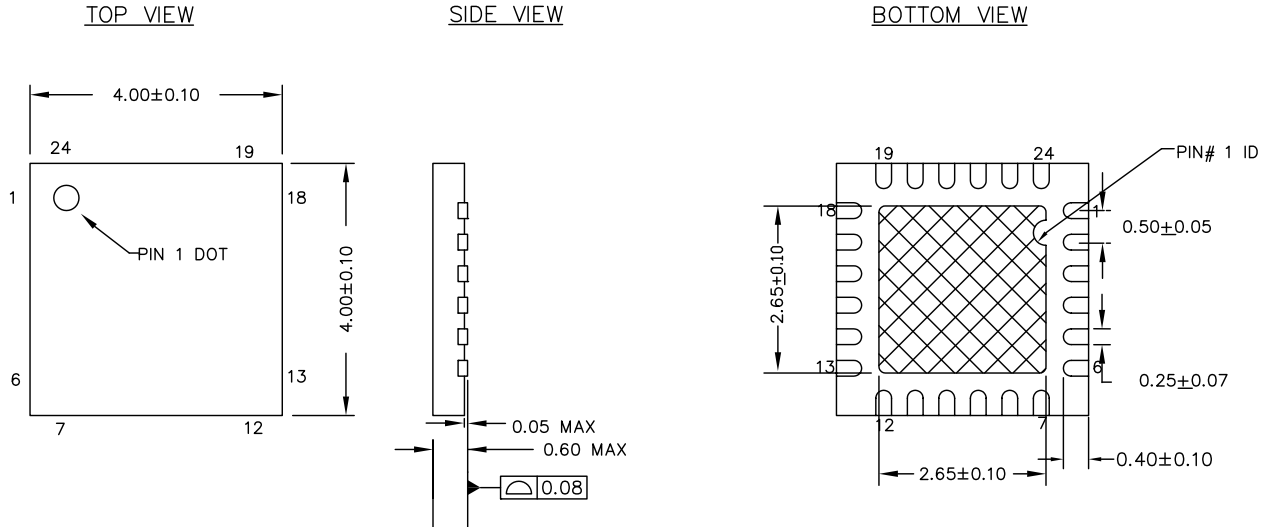
Package	Ordering Code	Operating Range
24-pin QFN (4.00 × 4.00 × 0.55 mm, 0.5 mm pitch) (Pb-free)	CY7C65210-24LTXI	Industrial
24-pin QFN (4.00 × 4.00 × 0.55 mm, 0.5 mm pitch) (Pb-free) – Tape and Reel	CY7C65210-24LTXIT	Industrial

### Ordering Code Definitions




Package Information

Figure 2. 24-pin QFN 4 mm × 4 mm × 0.55 mm LQ24A 2.65 × 2.65 EPAD (Sawn)



NOTES :

1.  HATCH IS SOLDERABLE EXPOSED METAL.
2. REFERENCE JEDEC # MO-248
3. PACKAGE WEIGHT : 29 ± 3 mg
4. ALL DIMENSIONS ARE IN MILLIMETERS

001-13937 \*F

Table 12. Package Characteristics

Parameter	Description	Min	Typ	Max	Units
T <sub>A</sub>	Operating ambient temperature	-40	25	85	°C
THJ	Package θ <sub>JA</sub>	-	18.4	-	°C/W

Table 13. Solder Reflow Peak Temperature

Package	Maximum Peak Temperature	Maximum Time at Peak Temperature
24-pin QFN	260 °C	30 seconds

Table 14. Package Moisture Sensitivity Level (MSL), IPC/JEDEC J-STD-2

Package	MSL
24-pin QFN	MSL 3

## Acronyms

**Table 15. Acronyms Used in this Document**

Acronym	Description
BOS	binary device object store
ESD	electrostatic discharge
GPIO	general purpose input/output
HBM	human-body model
I <sup>2</sup> C	inter-integrated circuit
MCU	microcontroller unit
OSC	oscillator
PID	product identification
SCB	serial communication block
SCL	I <sup>2</sup> C serial clock
SDA	I <sup>2</sup> C serial data
SIE	serial interface engine
SVID	standard or vendor ID
USB	Universal Serial Bus
VID	vendor identification

## Document Conventions

### Units of Measure

**Table 16. Units of Measure**

Symbol	Unit of Measure
°C	degree Celsius
DMIPS	Dhrystone million instructions per second
kΩ	kilo-ohm
KB	kilobyte
kHz	kilohertz
kV	kilovolt
Mbps	megabits per second
MHz	megahertz
mm	millimeter
V	volt

### Document History Page

Document Title: CY7C65210, USB Billboard Controller Document Number: 001-97082				
Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	4715309	MVTA	04/10/2015	New datasheet.
*A	4839996	MVTA	07/22/2015	Updated <a href="#">Features</a> , <a href="#">Block Diagram</a> , <a href="#">Pin Description</a> , <a href="#">GPIO Interface</a> , and <a href="#">Memory</a> . Updated <a href="#">Table 2</a> . Updated <a href="#">Figure 2</a> (spec 001-13937 *E to *F) in <a href="#">Package Information</a> .

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