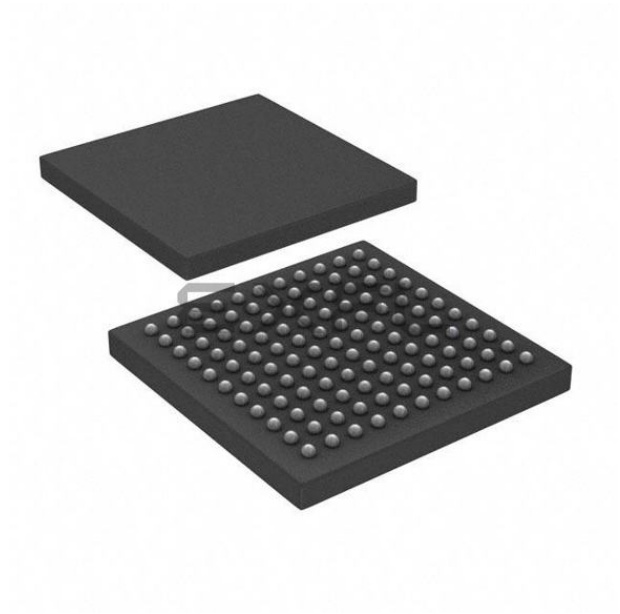

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Details	
Product Status	Active
Applications	USB Host/Peripheral Controller
Core Processor	ARM9®
Program Memory Type	External Program Memory
Controller Series	CYUSB
RAM Size	512K x 8
Interface	GPIF, I²C, I²S, MMC/SD/SDIO, SPI, UART, USB
Number of I/O	60
Voltage - Supply	1.15V ~ 1.25V
Operating Temperature	0°C ~ 70°C
Mounting Type	Surface Mount
Package / Case	121-TFBGA
Supplier Device Package	121-FBGA (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/cyusb3035-bzxc

Contents

Host Processor Interface (P-Port)

A configurable interface enables FX3S to communicate with various devices such as Sensor, FPGA, Host Processor, or a Bridge chip. FX3S supports the following P-Port interfaces.

- GPIF II (16-bit)
- Slave FIFO Interface
- 16-bit Asynchronous SRAM Interface
- 16-bit Asynchronous address/data multiplexed (ADMux) Interface
- 16-bit Synchronous address/data multiplexed (ADMux) Interface
- Processor MMC slave Interface compatible with MMC System specification, MMCA Technical Committee, Version 4.2 with eMMC 4.3 and 4.4 Pass-Through boot

The following sections describe these P-Port interfaces.

GPIF II

The high-performance GPIF II interface enables functionality similar to, but more advanced than, FX2LP's GPIF and Slave FIFO interfaces.

The GPIF II is a programmable state machine that enables a flexible interface that may function either as a master or slave in industry-standard or proprietary interfaces. Both parallel and serial interfaces may be implemented with GPIF II.

Here are a list of GPIF II features:

- Functions as master or slave
- Provides 256 firmware programmable states
- Supports 8-bit and 16-bit parallel data bus
- Enables interface frequencies up to 100 MHz
- Supports 16 configurable control pins when a 16/8 data bus is used. All control pins can be either input/output or bi-directional.

GPIF II state transitions are based on control input signals. The control output signals are driven as a result of the GPIF II state transitions. The INT# output signal can be controlled by GPIF II. Refer to the GPIFII Designer tool. The GPIF II state machine's behavior is defined by a GPIF II descriptor. The GPIF II descriptor is designed such that the required interface specifications are met. 8 kB of memory (separate from the 512 kB of embedded SRAM) is dedicated to the GPIF II waveform where the GPIF II descriptor is stored in a specific format.

Cypress's GPIF II Designer Tool enables fast development of GPIF II descriptors and includes examples for common interfaces.

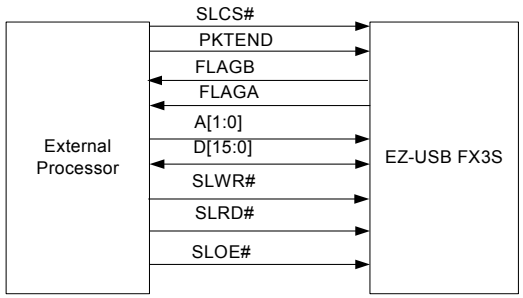
Example implementations of GPIF II are the asynchronous slave FIFO and synchronous slave FIFO interfaces.

Slave FIFO Interface

The Slave FIFO interface signals are shown in Figure 6. This interface allows an external processor to directly access up to four buffers internal to FX3S. Further details of the Slave FIFO interface are described on page 35.

Note Access to all 32 buffers is also supported over the slave FIFO interface. For details, contact Cypress Applications Support.

Figure 6. Slave FIFO Interface



Note: Multiple Flags may be configured.

Asynchronous SRAM

This interface consists of standard asynchronous SRAM interface signals as shown in Figure 7. This interface is used to access both the configuration registers and buffer memory of FX3S. Both single-cycle and burst accesses are supported by asynchronous interface signals.

The most significant address bit, A[7], determines whether the configuration registers or buffer memory are accessed. When the configuration registers are selected by asserting the address bit A[7], the address bus bits A[6:0] point to a configuration register. When A[7] is deasserted, the buffer memory is accessed as indicated by the P-Port DMA transfer register and the transfer size is determined by the P-Port DMA transfer size register.

Application processors with a DMA controller that use address auto-increment during DMA transfers, can override this by connecting any higher-order address line (such as A[15]/A[23]/A[31]) of the application processor to FX3S's A[7].

In the asynchronous SRAM mode, when reading from a buffer memory, FX3S supports two methods of reading out next data from the buffer. The next data may be read out on the rising edge of OE# or by toggling the least significant address bit A[0].

In this mode, the P-Port interface works with a 32.5-ns minimum access cycle providing an interface data rate of up to 61.5 MB per second.

CPU

FX3S has an on-chip 32-bit, 200-MHz ARM926EJ-S core CPU. The core has direct access to 16 kB of Instruction Tightly Coupled Memory (TCM) and 8 kB of Data TCM. The ARM926EJ-S core provides a JTAG interface for firmware debugging.

FX3S offers the following advantages:

- Integrates 512 KB of embedded SRAM for code and data and 8 KB of Instruction cache and Data cache.
- Implements efficient and flexible DMA connectivity between the various peripherals (such as, USB, GPIF II, I^2S, SPI, UART), requiring firmware only to configure data accesses between peripherals, which are then managed by the DMA fabric.
- Allows easy application development on industry-standard development tools for ARM926EJ-S.

Examples of the FX3S firmware are available with the Cypress EZ-USB FX3S Development Kit. Software APIs that can be ported to an external processor are available with the Cypress EZ-USB FX3S Software Development Kit.

Storage Port (S-Port)

FX3S has two independent storage ports (S0-Port and S1-Port). Both storage ports support the following specifications:

- MMC-system specification, MMCA Technical Committee, Version 4.41
- SD specification, Version 3.0
- SDIO host controller compliant with SDIO Specification Version 3.00

Both storage ports support the following features:

SD/MMC Clock Stop

FX3S supports the stop clock feature, which can save power if the internal buffer is full when receiving data from the SD/MMC/SDIO.

SD_CLK Output Clock Stop

During the data transfer, the SD_CLK clock can be enabled (on) or disabled (stopped) at any time by the internal flow control mechanism.

SD_CLK output frequency is dynamically configurable using a clock divisor from a system clock. The clock choice for the divisor is user-configurable through a register. For example, the following frequencies may be configured:

- 400 kHz – For the SD/MMC card initialization
- 20 MHz – For a card with 0- to 20-MHz frequency
- 24 MHz – For a card with 0- to 26-MHz frequency
- 48 MHz – For a card with 0- to 52-MHz frequency (48-MHz frequency on SD_CLK is supported when the clock input to FX3S is 19.2 MHz or 38.4 MHz)
- 52 MHz – For a card with 0- to 52-MHz frequency (52-MHz frequency on SD_CLK is supported when the clock input to FX3S is 26 MHz or 52 MHz)
- 100 MHz – For a card with 0- to 100-MHz frequency

If the DDR mode is selected, data is clocked on both the rising and falling edge of the SD clock. DDR clocks run up to 52 MHz.

Card Insertion and Removal Detection

FX3S supports the two-card insertion and removal detection mechanisms.

- Use of SD_D[3] data: During system design, this signal must have an external 470-kΩ pull-down resistor connected to SD_D[3]. SD cards have an internal 10-kΩ pull-up resistor. When the card is inserted or removed from the SD/MMC connector, the voltage level at the SD_D[3] pin changes and triggers an interrupt to the CPU. The older generations of MMC cards do not support this card detection mechanism.
- Use of the S0/S1_INS pin: Some SD/MMC connectors facilitate a micro switch for card insertion/removal detection. This micro switch can be connected to S0/S1_INS. When the card is inserted or removed from the SD/MMC connector, it turns the micro switch on and off. This changes the voltage level at the pin that triggers the interrupt to the CPU. The card-detect micro switch polarity is assumed to be the same as the write-protect micro switch polarity. A low indicates that the card is inserted. This S0/S1_INS pin is shared between the two S-Ports. Register configuration determines which port gets to use this pin. This pin is mapped to the S1VDDQ power domain; if S0VDDQ and S1VDDQ are at different voltage levels, this pin cannot be used as S1_INS.

Write Protection (WP)

The S0_WP/S1_WP (SD Write Protection) on S-Port is used to connect to the WP micro switch of SD/MMC card connector. This pin internally connects to a CPU-accessible GPIO for firmware to detect the SD card write protection.

SDIO Interrupt

The SDIO interrupt functionality is supported as specified in the SDIO specification Version 2.00 (January 30, 2007).

SDIO Read-Wait Feature

FX3S supports the optional read-wait and suspend-resume features as defined in the SDIO specification Version 2.00 (January 30, 2007).

Clocking

FX3S allows either a crystal to be connected between the XTALIN and XTALOUT pins or an external clock to be connected at the CLKIN pin. The XTALIN, XTALOUT, CLKIN, and CLKIN_32 pins can be left unconnected if they are not used.

Crystal frequency supported is 19.2 MHz, while the external clock frequencies supported are 19.2, 26, 38.4, and 52 MHz.

FX3S has an on-chip oscillator circuit that uses an external 19.2-MHz (±100 ppm) crystal (when the crystal option is used). An appropriate load capacitance is required with a crystal. Refer to the specification of the crystal used to determine the appropriate load capacitance. The FSLC[2:0] pins must be configured appropriately to select the crystal- or clock-frequency option. The configuration options are shown in Table 3.

Clock inputs to FX3S must meet the phase noise and jitter requirements specified in Table 4.

The input clock frequency is independent of the clock and data rate of the FX3S core or any of the device interfaces (including P-Port and S-Port). The internal PLL applies the appropriate clock multiply option depending on the input frequency.

Table 3. Crystal/Clock Frequency Selection

FSLC[2]	FSLC[1]	FSLC[0]	Crystal/Clock Frequency
0	0	0	19.2-MHz crystal
1	0	0	19.2-MHz input CLK
1	0	1	26-MHz input CLK
1	1	0	38.4-MHz input CLK
1	1	1	52-MHz input CLK

Table 4. FX3S Input Clock Specifications

Parameter	Description	Specification		Units
		Min	Max	
Phase noise	100-Hz offset	–	–75	dB
	1- kHz offset	–	–104	dB
	10-kHz offset	–	–120	dB
	100-kHz offset	–	–128	dB
	1-MHz offset	–	–130	dB
Maximum frequency deviation		–	150	ppm
Duty cycle		30	70	%
Overshoot		–	3	%
Undershoot		–	–3	%
Rise time/fall time		–	3	ns

32-kHz Watchdog Timer Clock Input

FX3S includes a watchdog timer. The watchdog timer can be used to interrupt the ARM926EJ-S core, automatically wake up the FX3S in Standby mode, and reset the ARM926EJ-S core. The watchdog timer runs a 32-kHz clock, which may be optionally supplied from an external source on a dedicated FX3S pin.

The firmware can disable the watchdog timer.

Requirements for the optional 32-kHz clock input are listed in Table 5.

Table 5. 32-kHz Clock Input Requirements

Parameter	Min	Max	Units
Duty cycle	40	60	%
Frequency deviation	–	±200	ppm
Rise time/fall time	–	200	ns

FX3S Pin Description										
Pin	Power Domain	I/O	Name	S0-Port						
				8b MMC		SD+GPIO		GPIO		
K2	VIO2	I/O	GPIO[33]	S0_SD0		S0_SD0		GPIO		
J4	VIO2	I/O	GPIO[34]	S0_SD1		S0_SD1		GPIO		
K1	VIO2	I/O	GPIO[35]	S0_SD2		S0_SD2		GPIO		
J2	VIO2	I/O	GPIO[36]	S0_SD3		S0_SD3		GPIO		
J3	VIO2	I/O	GPIO[37]	S0_SD4		GPIO		GPIO		
J1	VIO2	I/O	GPIO[38]	S0_SD5		GPIO		GPIO		
H2	VIO2	I/O	GPIO[39]	S0_SD6		GPIO		GPIO		
H3	VIO2	I/O	GPIO[40]	S0_SD7		GPIO		GPIO		
F4	VIO2	I/O	GPIO[41]	S0_CMD		S0_CMD		GPIO		
G2	VIO2	I/O	GPIO[42]	S0_CLK		S0_CLK		GPIO		
G3	VIO2	I/O	GPIO[43]	S0_WP		S0_WP		GPIO		
F3	VIO2	I/O	GPIO[44]	S0S1_INS		S0S1_INS		GPIO		
F2	VIO2	I/O	GPIO[45]	MMC0_RST_OUT		GPIO		GPIO		
				S1-Port						
				8b MMC	SD+UART	SD+SPI	SD+GPIO	GPIO	GPIO+UART +I2S	SD+I2S	UART+SPI +I2S
F5	VIO3	I/O	GPIO[46]	S1_SD0	S1_SD0	S1_SD0	S1_SD0	GPIO	GPIO	S1_SD0	UART_RTS
E1	VIO3	I/O	GPIO[47]	S1_SD1	S1_SD1	S1_SD1	S1_SD1	GPIO	GPIO	S1_SD1	UART_CTS
E5	VIO3	I/O	GPIO[48]	S1_SD2	S1_SD2	S1_SD2	S1_SD2	GPIO	GPIO	S1_SD2	UART_TX
E4	VIO3	I/O	GPIO[49]	S1_SD3	S1_SD3	S1_SD3	S1_SD3	GPIO	GPIO	S1_SD3	UART_RX
D1	VIO3	I/O	GPIO[50]	S1_CMD	S1_CMD	S1_CMD	S1_CMD	GPIO	I2S_CLK	S1_CMD	I2S_CLK
D2	VIO3	I/O	GPIO[51]	S1_CLK	S1_CLK	S1_CLK	S1_CLK	GPIO	I2S_SD	S1_CLK	I2S_SD
D3	VIO3	I/O	GPIO[52]	S1_WP	S1_WP	S1_WP	S1_WP	GPIO	I2S_WS	S1_WP	I2S_WS
D4	VIO4	I/O	GPIO[53]	S1_SD4	UART_RTS	SPI_SCK	GPIO	GPIO	UART_RTS	GPIO	SPI_SCK
C1	VIO4	I/O	GPIO[54]	S1_SD5	UART_CTS	SPI_SSN	GPIO	GPIO	UART_CTS	I2S_CLK	SPI_SSN
C2	VIO4	I/O	GPIO[55]	S1_SD6	UART_TX	SPI_MISO	GPIO	GPIO	UART_TX	I2S_SD	SPI_MISO
D5	VIO4	I/O	GPIO[56]	S1_SD7	UART_RX	SPI_MOSI	GPIO	GPIO	UART_RX	I2S_WS	SPI_MOSI
C4	VIO4	I/O	GPIO[57]	MMC1_RST_OUT	GPIO	GPIO	GPIO	GPIO	I2S_MCLK	I2S_MCLK	I2S_MCLK

DC Specifications (continued)

Parameter	Description	Min	Max	Units	Notes
V_{IL}	Input LOW voltage	–0.3	0.25 × V_{CC}	V	V_{CC} is the corresponding I/O voltage supply.
V_{OH}	Output HIGH voltage	0.9 × V_{CC}	–	V	I_{OH} (max) = –100 µA tested at quarter drive strength. V_{CC} is the corresponding I/O voltage supply.
V_{OL}	Output LOW voltage	–	0.1 × VCC	V	I_{OL} (min) = +100 µA tested at quarter drive strength. V_{CC} is the corresponding I/O voltage supply.
I_{IX}	Input leakage current for all pins except SSTXP/SSXM/SSRXP/SSRXM	–1	1	µA	All I/O signals held at V_{DDQ} (For I/Os with a pull-up or pull-down resistor connected, the leakage current increases by V_{DDQ}/R_{pu} or V_{DDQ}/R_{PD}
I_{OZ}	Output High-Z leakage current for all pins except SSTXP/ SSXM/ SSRXP/SSRXM	–1	1	µA	All I/O signals held at V_{DDQ}
I_{CC} Core	Core and analog voltage operating current	–	200	mA	Total current through A_{VDD}, V_{DD}
I_{CC} USB	USB voltage supply operating current	–	60	mA	
I_{SB1}	Total suspend current during suspend mode with USB 3.0 PHY enabled (L1)	–	–	mA	Core current: 1.5 mA I/O current: 20 µA USB current: 2 mA For typical PVT (typical silicon, all power supplies at their respective nominal levels at 25 °C.)
I_{SB2}	Total suspend current during suspend mode with USB 3.0 PHY disabled (L2)	–	–	mA	Core current: 250 µA I/O current: 20 µA USB current: 1.2 mA For typical PVT (Typical silicon, all power supplies at their respective nominal levels at 25 °C.)
I_{SB3}	Total standby current during standby mode (L3)	–	–	µA	Core current: 60 µA I/O current: 20 µA USB current: 40 µA For typical PVT (typical silicon, all power supplies at their respective nominal levels at 25 °C.)
I_{SB4}	Total standby current during core power-down mode (L4)	–	–	µA	Core current: 0 µA I/O current: 20 µA USB current: 40 µA For typical PVT (typical silicon, all power supplies at their respective nominal levels at 25 °C.)
V_{RAMP}	Voltage ramp rate on core and I/O supplies	0.2	50	V/ms	Voltage ramp must be monotonic
V_N	Noise level permitted on V_{DD} and I/O supplies	–	100	mV	Max p-p noise level permitted on all supplies except A_{VDD}
V_{N_AVDD}	Noise level permitted on A_{VDD} supply	–	20	mV	Max p-p noise level permitted on A_{VDD}

Asynchronous SRAM Timing

Figure 15. Non-multiplexed Asynchronous SRAM Read Timing

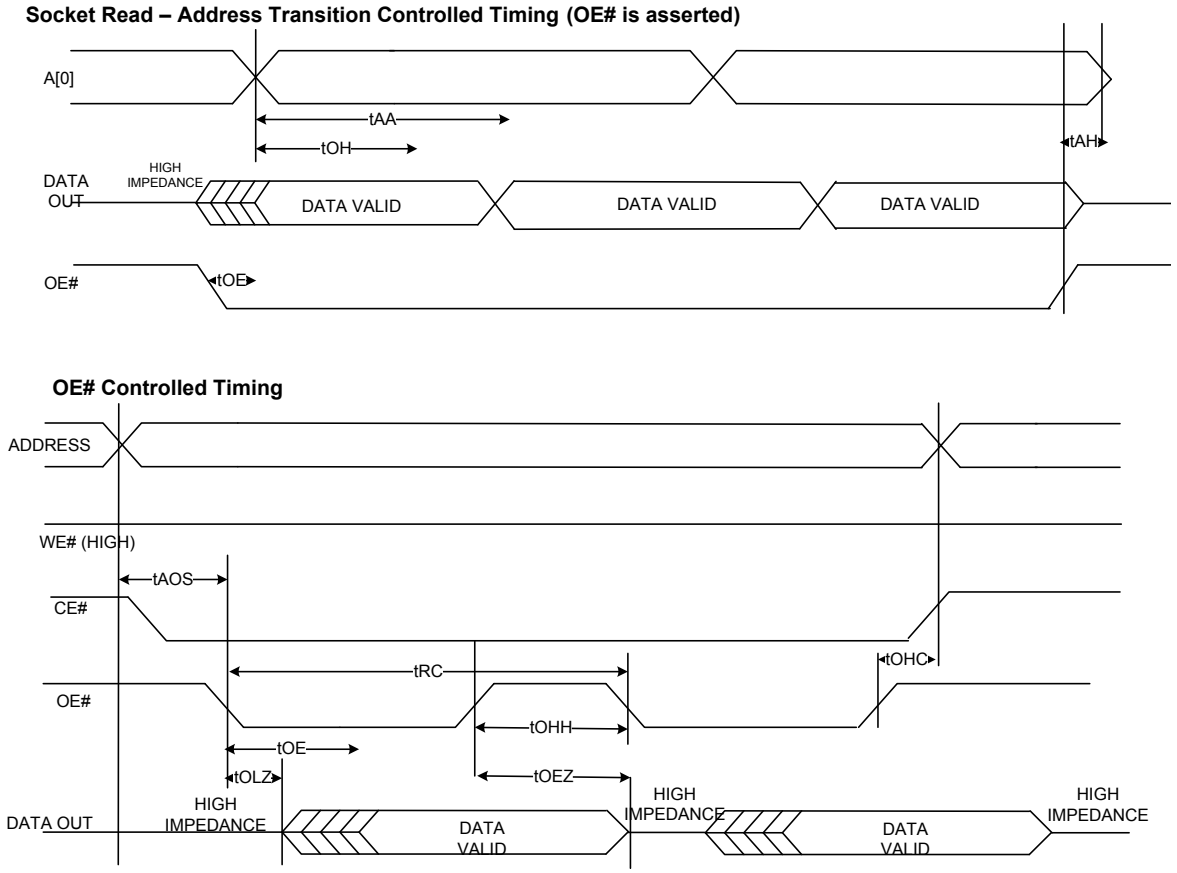


Figure 16. Non-multiplexed Asynchronous SRAM Write Timing (WE# and CE# Controlled)

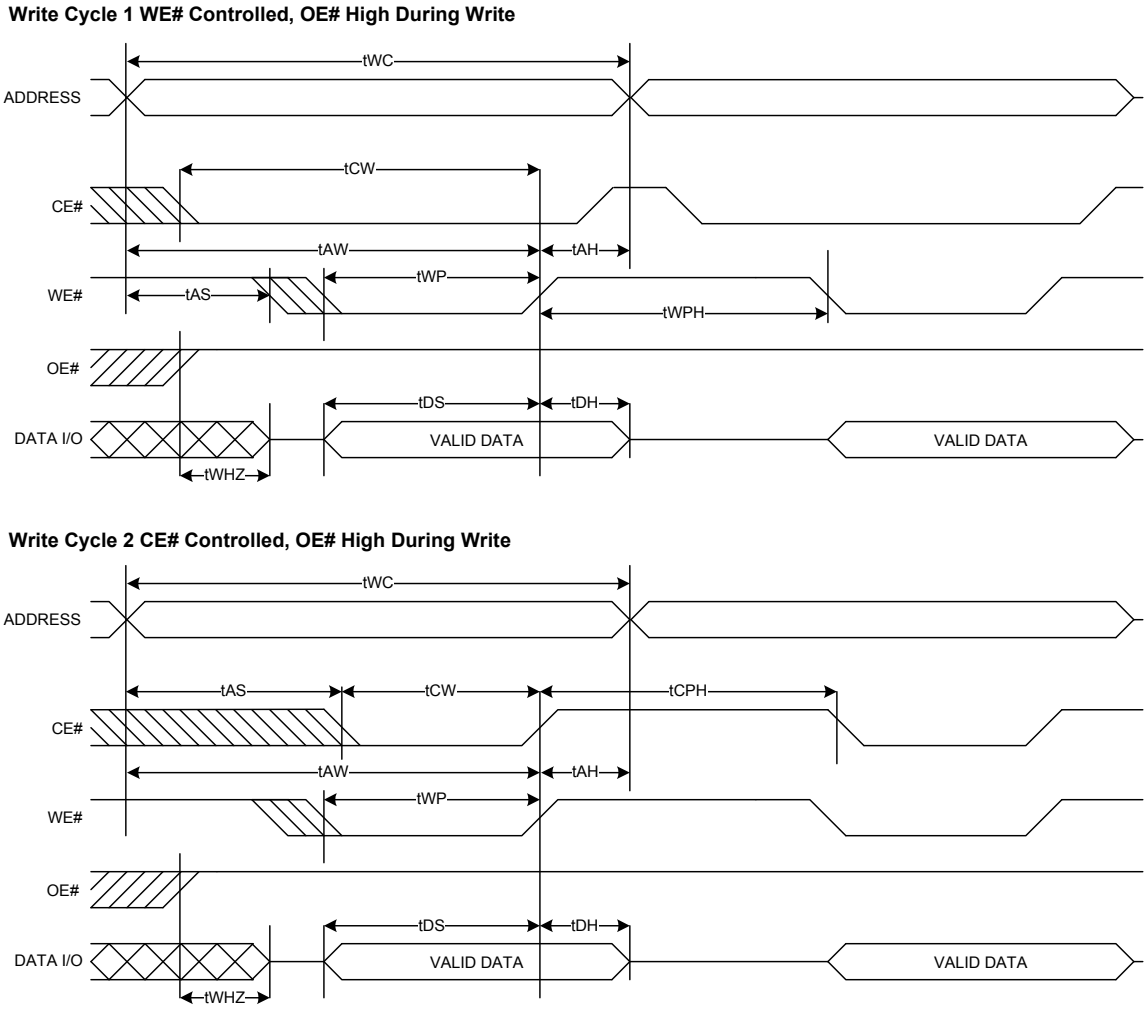
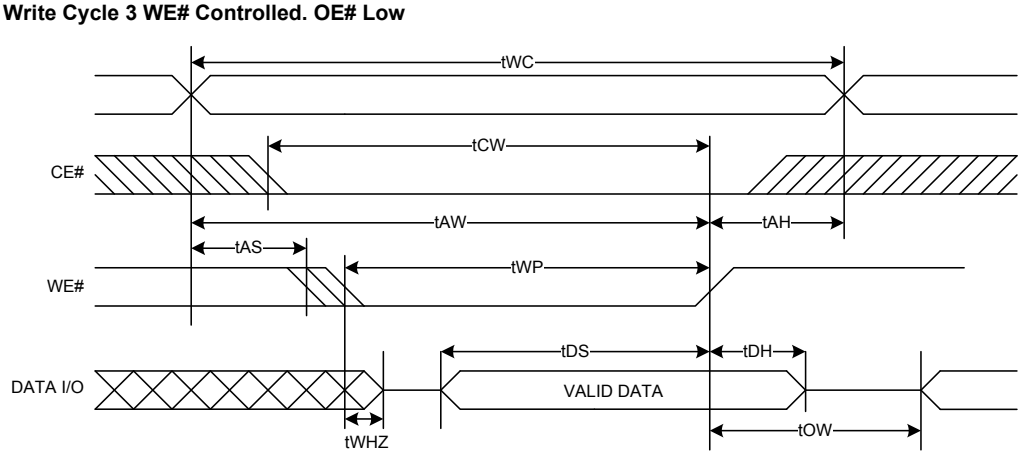


Figure 17. Non-multiplexed Asynchronous SRAM Write Timing (WE# Controlled, OE# LOW)



Note: tWP must be adjusted such that tWP > tWHZ + tDS

Table 11. Synchronous ADMux Timing Parameters[7]

Parameter	Description	Min	Max	Unit
FREQ	Interface clock frequency	–	100	MHz
tCLK	Clock period	10	–	ns
tCLKH	Clock HIGH time	4	–	ns
tCLKL	Clock LOW time	4	–	ns
tS	CE#/WE#/DQ setup time	2	–	ns
tH	CE#/WE#/DQ hold time	0.5	–	ns
tCH	Clock to data output hold time	0	–	ns
tDS	Data input setup time	2	–	ns
tDH	Clock to data input hold	0.5	–	ns
tAVDOE	ADV# HIGH to OE# LOW	0	–	ns
tAVDWE	ADV# HIGH to WE# LOW	0	–	ns
tHZ	CE# HIGH to Data HIGH-Z	–	8	ns
tOHZ	OE# HIGH to Data HIGH-Z	–	8	ns
tOLZ	OE# LOW to Data LOW-Z	0	–	ns
tKW	Clock to RDY valid	–	8	ns

Note
7. All parameters guaranteed by design and validated through characterization.

Synchronous Slave FIFO Write Sequence Description

- FIFO address is stable and the signal SLCS# is asserted
- External master or peripheral outputs the data to the data bus
- SLWR# is asserted
- While the SLWR# is asserted, data is written to the FIFO and on the rising edge of the PCLK, the FIFO pointer is incremented
- The FIFO flag is updated after a delay of t_{WFLG} from the rising edge of the clock

The same sequence of events is also shown for burst write

Note For the burst mode, SLWR# and SLCS# are asserted for the entire duration, during which all the required data values are written. In this burst write mode, after the SLWR# is asserted, the data on the FIFO data bus is written to the FIFO on every rising edge of PCLK. The FIFO pointer is updated on each rising edge of PCLK.

Short Packet: A short packet can be committed to the USB host by using the PKTEND#. The external device or processor should be designed to assert the PKTEND# along with the last word of data and SLWR# pulse corresponding to the last word. The FIFOADDR lines must be held constant during the PKTEND# assertion.

Zero-Length Packet: The external device or processor can signal a Zero-Length Packet (ZLP) to FX3S simply by asserting PKTEND#, without asserting SLWR#. SLCS# and address must be driven as shown in Figure 25.

Figure 25. Synchronous Slave FIFO Write Mode

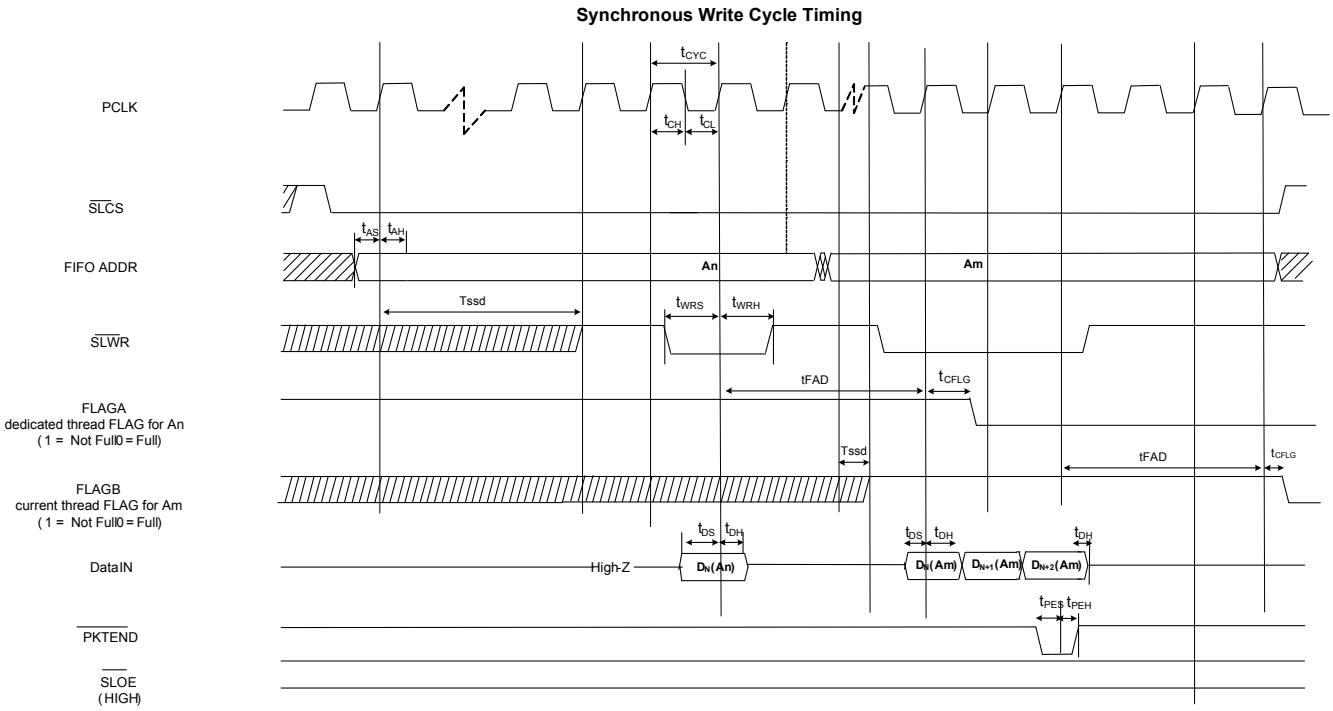
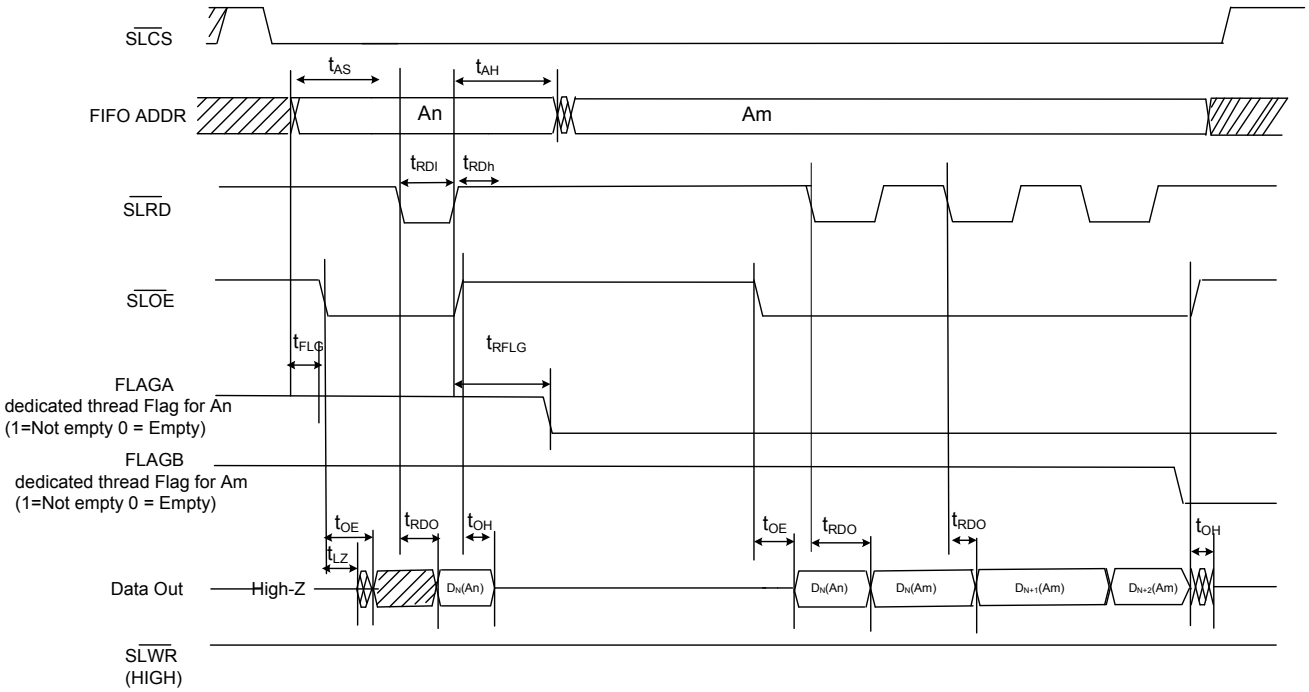


Figure 26. Asynchronous Slave FIFO Read Mode



Asynchronous Slave FIFO Write Sequence Description

- FIFO address is driven and SLCS# is asserted
- SLWR# is asserted. SLCS# must be asserted with SLWR# or before SLWR# is asserted
- Data must be present on the tWRS bus before the deasserting edge of SLWR#
- Deassertion of SLWR# causes the data to be written from the data bus to the FIFO, and then the FIFO pointer is incremented
- The FIFO flag is updated after the tWFLG from the deasserting edge of SLWR.

The same sequence of events is shown for a burst write.

Note that in the burst write mode, after SLWR# deassertion, the data is written to the FIFO, and then the FIFO pointer is incremented.

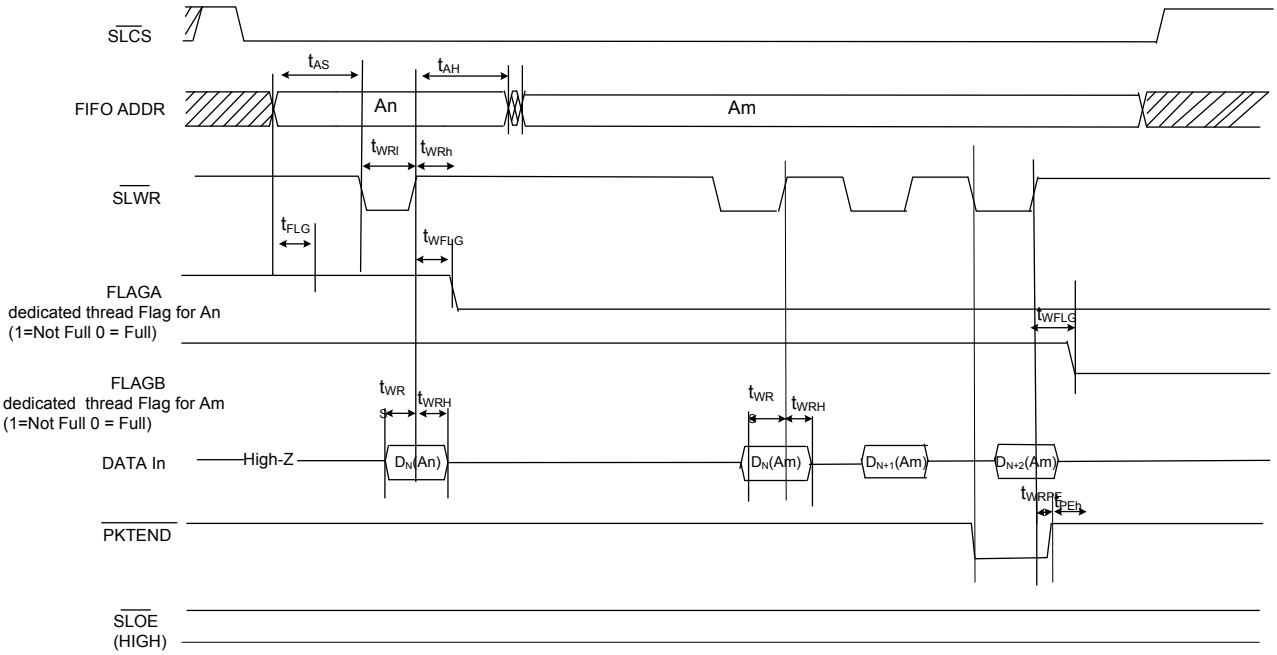
Short Packet: A short packet can be committed to the USB host by using the PKTEND#. The external device or processor should be designed to assert the PKTEND# along with the last word of data and SLWR# pulse corresponding to the last word. The FIFOADDR lines must be held constant during the PKTEND# assertion.

Zero-Length Packet: The external device or processor can signal a zero-length packet (ZLP) to FX3S simply by asserting PKTEND#, without asserting SLWR#. SLCS# and the address must be driven as shown in Figure 27 on page 39.

FLAG Usage: The FLAG signals are monitored by the external processor for flow control. FLAG signals are FX3S outputs that can be configured to show empty, full, and partial status for a dedicated address or the current address.

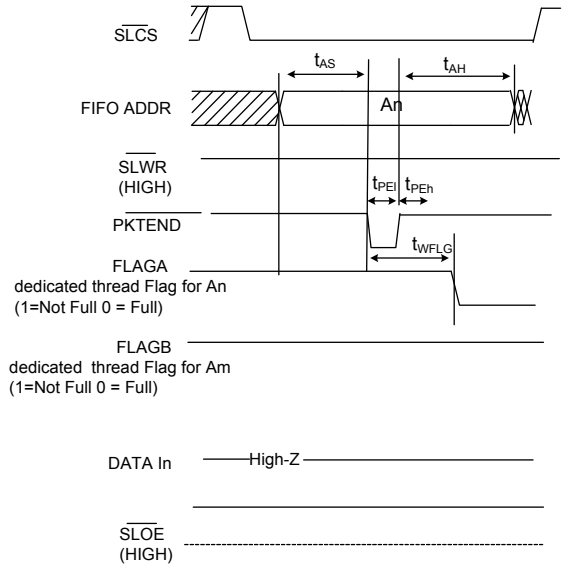
Figure 27. Asynchronous Slave FIFO Write Mode

Asynchronous Write Cycle Timing



tWRPE: SLWR# de-assert to PKTEND deassert = 2ns min (This means that PKTEND should not be be deasserted before SLWR#)
Note: PKTEND must be asserted at the same time as SLWR#.

Asynchronous ZLP Write Cycle Timing



Storage Port Timing

The S0-Port and S1-Port support the MMC Specification Version 4.41 and SD Specification Version 3.0. Table 14 lists the timing parameters for S-Port of the FX3S device.

Table 14. S-Port Timing Parameters[10]

Parameter	Description	Min	Max	Units
MMC-20				
tSDIS CMD	Host input setup time for CMD	4.8	–	ns
tSDIS DAT	Host input setup time for DAT	4.8	–	ns
tSDIH CMD	Host input hold time for CMD	4.4	–	ns
tSDIH DAT	Host input hold time for DAT	4.4	–	ns
tSDOS CMD	Host output setup time for CMD	5	–	ns
tSDOS DAT	Host output setup time for DAT	5	–	ns
tSDOH CMD	Host output hold time for CMD	5	–	ns
tSDOH DAT	Host output hold time for DAT	5	–	ns
tSCLKR	Clock rise time	–	2	ns
tSCLKF	Clock fall time	–	2	ns
tSDCK	Clock cycle time	50	–	ns
SDFREQ	Clock frequency	–	20	MHz
tSDCLKOD	Clock duty cycle	40	60	%
MMC-26				
tSDIS CMD	Host input setup time for CMD	10	–	ns
tSDIS DAT	Host input setup time for DAT	10	–	ns
tSDIH CMD	Host input hold time for CMD	9	–	ns
tSDIH DAT	Host input hold time for DAT	9	–	ns
tSDOS CMD	Host output setup time for CMD	3	–	ns
tSDOS DAT	Host output setup time for DAT	3	–	ns
tSDOH CMD	Host output hold time for CMD	3	–	ns
tSDOH DAT	Host output hold time for DAT	3	–	ns
tSCLKR	Clock rise time	–	2	ns
tSCLKF	Clock fall time	–	2	ns
tSDCK	Clock cycle time	38.5	–	ns
SDFREQ	Clock frequency	–	26	MHz
tSDCLKOD	Clock duty cycle	40	60	%
MC-HS				
tSDIS CMD	Host input setup time for CMD	4	–	ns
tSDIS DAT	Host input setup time for DAT	4	–	ns
tSDIH CMD	Host input hold time for CMD	3	–	ns
tSDIH DAT	Host input hold time for DAT	3	–	ns
tSDOS CMD	Host output setup time for CMD	3	–	ns
tSDOS DAT	Host output setup time for DAT	3	–	ns
tSDOH CMD	Host output hold time for CMD	3	–	ns
tSDOH DAT	Host output hold time for DAT	3	–	ns

Note
10. All parameters guaranteed by design and validated through characterization.

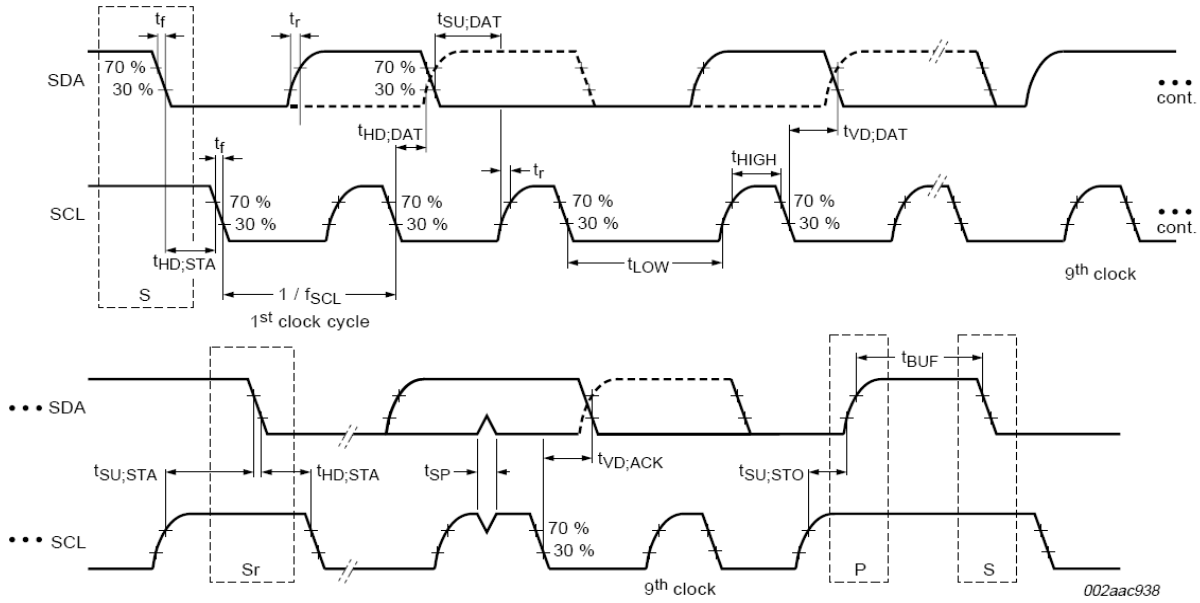
Table 14. S-Port Timing Parameters[10] (continued)

Parameter	Description	Min	Max	Units
tSCLKR	Clock rise time	–	2	ns
tSCLKF	Clock fall time	–	2	ns
tSDCK	Clock cycle time	20	–	ns
SDFREQ	Clock frequency	–	50	MHz
tSDCLKOD	Clock duty cycle	40	60	%
SD-SDR50				
tSDIS CMD	Host input setup time for CMD	1.5	–	ns
tSDIS DAT	Host input setup time for DAT	1.5	–	ns
tSDIH CMD	Host input hold time for CMD	2.5	–	ns
tSDIH DAT	Host input hold time for DAT	2.5	–	ns
tSDOS CMD	Host output setup time for CMD	3	–	ns
tSDOS DAT	Host output setup time for DAT	3	–	ns
tSDOH CMD	Host output hold time for CMD	0.8	–	ns
tSDOH DAT	Host output hold time for DAT	0.8	–	ns
tSCLKR	Clock rise time	–	2	ns
tSCLKF	Clock fall time	–	2	ns
tSDCK	Clock cycle time	10	–	ns
SDFREQ	Clock frequency		100	MHz
tSDCLKOD	Clock duty cycle	40	60	%
SD-DDR50				
tSDIS CMD	Host input setup time for CMD	4	–	ns
tSDIS DAT	Host input setup time for DAT	0.92	–	ns
tSDIH CMD	Host input hold time for CMD	2.5	–	ns
tSDIH DAT	Host input hold time for DAT	2.5	–	ns
tSDOS CMD	Host output setup time for CMD	6	–	ns
tSDOS DAT	Host output setup time for DAT	3	–	ns
tSDOH CMD	Host output hold time for CMD	0.8	–	ns
tSDOH DAT	Host output hold time for DAT	0.8	–	ns
tSCLKR	Clock rise time	–	2	ns
tSCLKF	Clock fall time	–	2	ns
tSDCK	Clock cycle time	20	–	ns
SDFREQ	Clock frequency	–	50	MHz
tSDCLKOD	Clock duty cycle	45	55	%

Serial Peripherals Timing

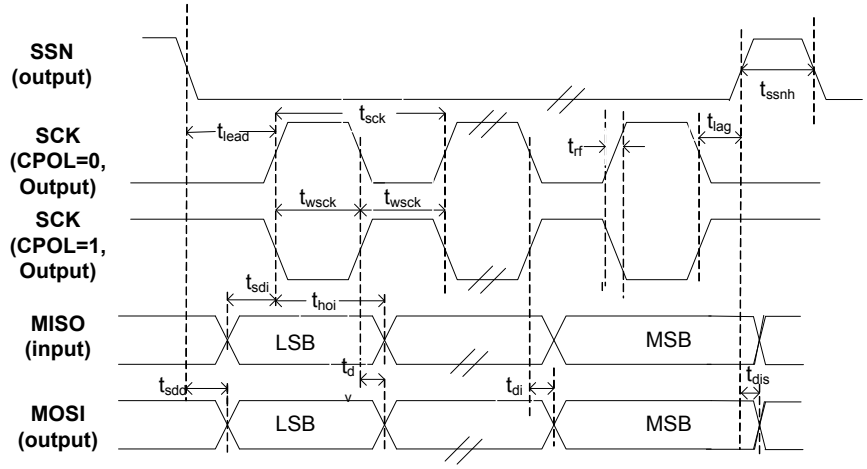
I^2C Timing

Figure 28. I^2C Timing Definition

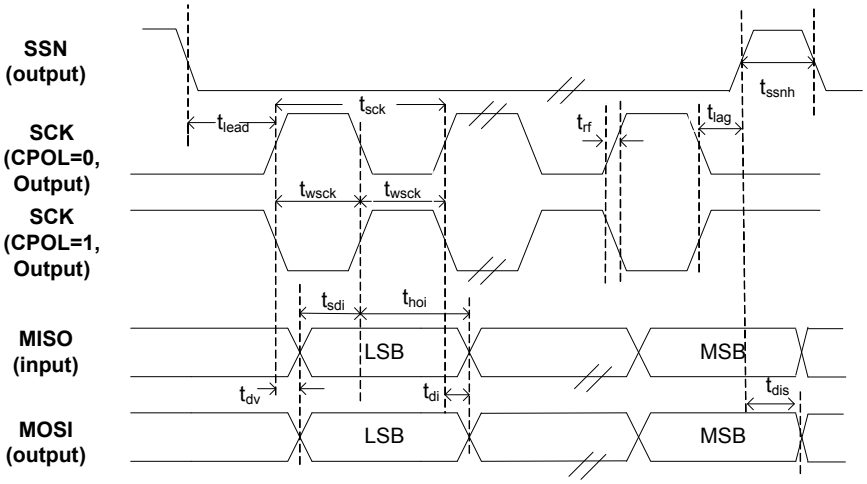


SPI Timing Specification

Figure 30. SPI Timing



SPI Master Timing for CPHA = 0



SPI Master Timing for CPHA = 1

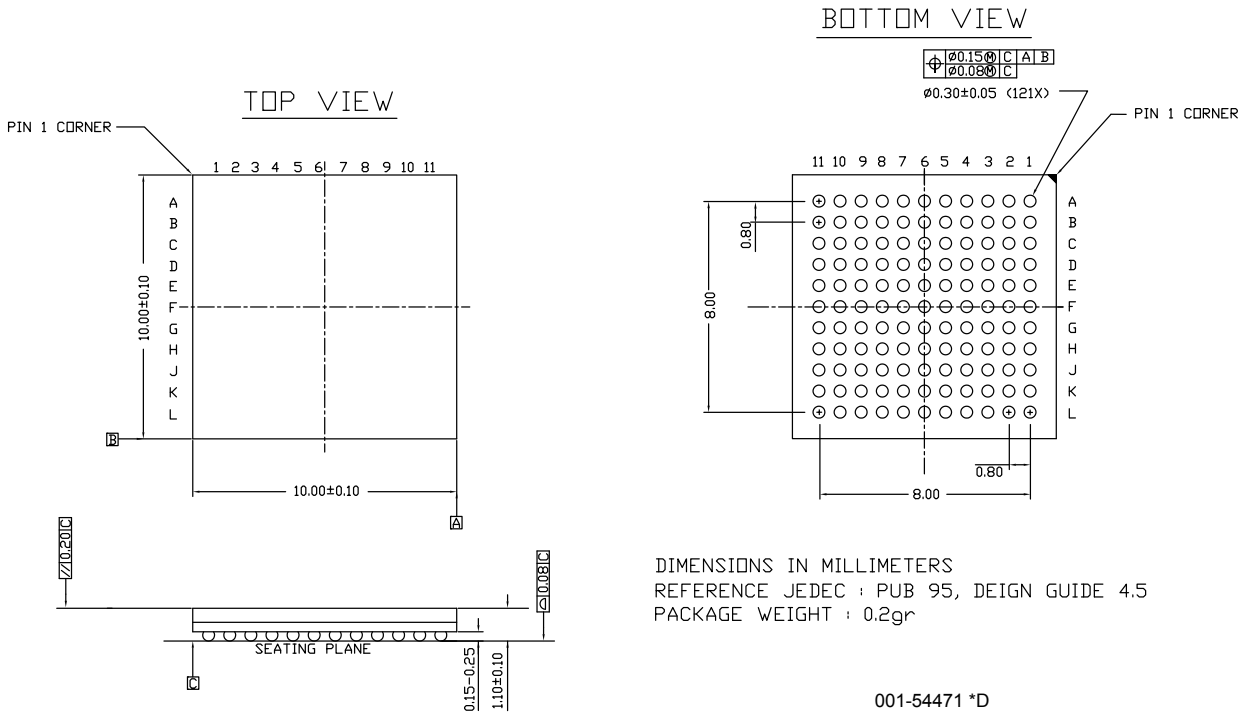
Table 17. SPI Timing Parameters[13]

Parameter	Description	Min	Max	Units
fop	Operating frequency	0	33	MHz
tsck	Cycle time	30	–	ns
twsck	Clock high/low time	13.5	–	ns
tlead	SSN-SCK lead time	1/2 tsck[14]-5	1.5 tsck[14]+ 5	ns
tlag	Enable lag time	0.5	1.5 tsck[14]+5	ns
trf	Rise/fall time	–	8	ns
tsdd	Output SSN to valid data delay time	–	5	ns
tdv	Output data valid time	–	5	ns
tdi	Output data invalid	0	–	ns
tssnh	Minimum SSN high time	10	–	ns
tsdi	Data setup time input	8	–	ns
thoi	Data hold time input	0	–	ns
tdis	Disable data output on SSN high	0	–	ns

Notes
13. All parameters guaranteed by design and validated through characterization.
14. Depends on LAG and LEAD setting in the SPI_CONFIG register.

Package Diagram

Figure 32. 121-ball FBGA (10 × 10 × 1.2 mm (0.30 mm Ball Diameter)) Package Outline, 001-54471



Acronyms

Acronym	Description
DMA	Direct Memory Access
HNP	Host Negotiation Protocol
MMC	Multimedia Card
MTP	Media Transfer Protocol
PLL	Phase Locked Loop
PMIC	Power Management IC
SD	Secure Digital
SDIO	Secure Digital Input/Output
SLC	Single-Level Cell
SLCS	Slave Chip Select
SLOE	Slave Output Enable
SLRD	Slave Read
SLWR	Slave Write
SPI	Serial Peripheral Interface
SRP	Session Request Protocol
USB	Universal Serial Bus
WLCSP	Wafer Level Chip Scale Package

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
Mbps	megabits per second
MBps	megabytes per second
MHz	megahertz
µA	microampere
µs	microsecond
mA	milliampere
ms	millisecond
ns	nanosecond
Ω	ohm
pF	picofarad
V	volt

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