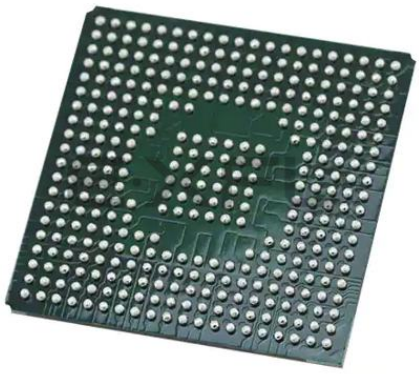

Welcome to E-XFL.COM

Understanding Embedded - Microprocessors

Embedded microprocessors are specialized computing chips designed to perform specific tasks within an embedded system. Unlike general-purpose microprocessors found in personal computers, embedded microprocessors are tailored for dedicated functions within larger systems, offering optimized performance, efficiency, and reliability. These microprocessors are integral to the operation of countless electronic devices, providing the computational power necessary for controlling processes, handling data, and managing communications.

Applications of Embedded - Microprocessors

Embedded microprocessors are utilized across a broad spectrum of applications, making them indispensable in

Details	
Product Status	Obsolete
Core Processor	ARM920T
Number of Cores/Bus Width	1 Core, 32-Bit
Speed	200MHz
Co-Processors/DSP	Math Engine; MaverickCrunch™
RAM Controllers	SDRAM
Graphics Acceleration	Yes
Display & Interface Controllers	Keypad, LCD, Touchscreen
Ethernet	1/10/100Mbps (1)
SATA	-
USB	USB 2.0 (3)
Voltage - I/O	1.8V, 3.3V
Operating Temperature	0°C ~ 70°C (TA)
Security Features	Hardware ID
Package / Case	352-BBGA
Supplier Device Package	352-PBGA (27x27)
Purchase URL	https://www.e-xfl.com/product-detail/cirrus-logic/ep9312-cbz

OVERVIEW

The EP9312 is an ARM920T-based system-on-a-chip design with a large peripheral set targeted to a variety of applications:

- Thin client computers for business and home
- Internet radio
- Internet access devices
- Industrial computers
- Specialized terminals
- Point of sale terminals
- Test and measurement equipment

The ARM920T microprocessor core with separate 16-kbyte, 64-way set-associative instruction and data caches is augmented by the MaverickCrunch™ co-processor enabling high-speed floating point calculations.

MaverickKey™ unique hardware programmed IDs are a solution to the growing concern over secure web content and commerce. With Internet security playing an important role in the delivery of digital media such as books or music, traditional software methods are quickly becoming unreliable. The MaverickKey unique IDs provide OEMs with a method of utilizing specific hardware IDs such as those assigned for SDMI (Secure Digital Music Initiative) or any other authentication mechanism.

A high-performance 1/10/100 Mbps Ethernet media access Controller (EMAC) is included along with external interfaces to SPI, I^2S audio, Raster/LCD, IDE storage peripherals, keypad, and touchscreen. A three-port USB 2.0 Full-speed Host (OHCI) (12 Mbits per second) and three UARTs are included as well.

The EP9312 is a high-performance, low-power, RISC-based, single-chip computer built around an ARM920T microprocessor core with a maximum operating clock rate of 200 MHz (184 MHz for industrial conditions). The ARM core operates from a 1.8 V supply, while the I/O operates at 3.3 V with power usage between 100 mW and 750 mW (dependent on speed).

Table A. Change History

Revision	Date	Changes
PP1	March 2001	Initial Release.
PP2	June 2001	Upgrade to revision B silicon.
PP3	August 2001	Upgrade to revision C silicon.
PP4	May 2003	Upgrade to revision D silicon.
PP5	December 2003	Update timing data.
PP6	July 2004	Update AC data. Add ADC data.
PP7	February 2005	Update with most-current characterization data.
F1	February 2010	Removed “Preliminary Data” statement from legal disclaimer. Removed lead-containing device part numbers. Increased minimum CVDD & VDD_PLL voltages from 1.65 V min. to 1.71 V min. Changed operating temperatures to 0 to 60°C commercial, -40 to 70°C industrial.
F2	March 2010	Increased commercial/industrial temperatures to 70/85 deg. C max.

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receive and a 16 byte FIFO for transmit. Interrupts are generated on Rx, Tx and modem status change.

- UART2 contains an IrDA encoder operating at either the slow (up to 115 Kbps), medium (0.576 or 1.152 Mbps), or fast (4 Mbps) IR data rates. It also has a 16 byte FIFO for receive and a 16 byte FIFO for transmit.
- UART3 supports HDLC and includes a 16 byte FIFO for receive and a 16 byte FIFO for transmit. Interrupts are generated on Rx and Tx.

Table I. Universal Asynchronous Receiver/Transmitters Pin Assignments

Pin Mnemonic	Pin Name - Description
TXD0	UART1 Transmit
RXD0	UART1 Receive
CTSn	UART1 Clear To Send / Transmit Enable
DSRn / DCDn	UART1 Data Set Ready / Data Carrier Detect
DTRn	UART1 Data Terminal Ready
RTSn	UART1 Ready To Send
EGPIO[0] / RI	UART1 Ring Indicator
TXD1 / SIROUT	UART2 Transmit / IrDA Output
RXD1 / SIRIN	UART2 Receive / IrDA Input
TXD2	UART3 Transmit
RXD2	UART3 Receive
EGPIO[3] / TENn	HDLC3 Transmit Enable

Triple-port USB Host

The USB Open Host Controller Interface (Open HCI) provides full-speed serial communications ports at a baud rate of 12 Mbits/sec. Up to 127 USB devices (printer, mouse, camera, keyboard, etc.) and USB hubs can be connected to the USB host in the USB “tiered star” topology.

This includes the following features:

- Compliance with the USB 2.0 specification
- Compliance with the Open HCI Rev 1.0 specification
- Supports both low speed (1.5 Mbps) and full speed (12 Mbps) USB device connections
- Root HUB integrated with 3 downstream USB ports
- Transceiver buffers integrated, over-current protection on ports
- Supports power management
- Operates as a master on the bus

The Open HCI host controller initializes the master DMA transfer with the AHB bus:

- Fetches endpoint descriptors and transfer descriptors
- Accesses endpoint data from system memory
- Accesses the HC communication area
- Writes status and retire transfer descriptor

Table J. Triple Port USB Host Pin Assignments

Pin Mnemonic	Pin Name - Description
USBp[2:0]	USB Positive signals
USBm[2:0]	USB Negative Signals

Two-wire Interface

The two-wire interface provides communication and control for synchronous-serial-driven devices.

Table K. Two-Wire Port with EEPROM Support Pin Assignments

Pin Mnemonic	Pin Name - Description	Alternative Usage
EECLK	Two-wire Interface Clock	General Purpose I/O
EEDATA	Two-wire Interface Data	General Purpose I/O

Real-time Clock with Software Trim

The software trim feature on the real time clock (RTC) provides software controlled digital compensation of the 32.768 kHz input clock. This compensation is accurate to ±1.24 sec/month.

Note: A real time clock must be connected to RTCXTALI or the EP9312 device will not boot.

Table L. Real-Time Clock with Pin Assignments

Pin Mnemonic	Pin Name - Description
RTCXTALI	Real-Time Clock Oscillator Input
RTCXTALO	Real-Time Clock Oscillator Output

PLL and Clocking

The Processor and the Peripheral Clocks operate from a single 14.7456 MHz crystal.

The Real Time Clock operates from a 32.768 kHz external oscillator.

DC Characteristics

(T_A = 0 to 70° C; CVDD = VDD_PLL = 1.8; RVDD = 3.3 V;
All grounds = 0 V; all voltages with respect to 0 V unless otherwise noted)

Parameter			Symbol	Min	Max	Unit
High level output voltage	Iout = -4 mA	(Note 3)	V_{oh}	0.85 × RVDD	-	V
Low level output voltage	Iout = 4 mA		V_{ol}	-	0.15 × RVDD	V
High level input voltage		(Note 4)	V_{ih}	0.65 × RVDD	VDD + 0.3	V
Low level input voltage		(Note 4)	V_{il}	-0.3	0.35 × RVDD	V
High level leakage current	Vin = 3.3 V	(Note 4)	I_{ih}	-	10	µA
Low level leakage current	Vin = 0	(Note 4)	I_{il}	-	-10	µA

Parameter		Min	Typ	Max	Unit
Power Supply Pins (Outputs Unloaded)					
Power Supply Current:	CVDD / VDD_PLL Total RVDD	- -	190 45	240 80	mA mA
Low-Power Mode Supply Current	CVDD / VDD_PLL Total RVDD	- -	2 1.0	3.5 2	mA mA

Note: 3. For open drain pins, high level output voltage is dependent on the external load.
4. All inputs that do not include internal pull-ups or pull-downs, must be externally driven for proper operation (See Table S on page 59). If an input is not driven, it should be tied to power or ground, depending on the particular function. If an I/O pin is not driven and programmed as an input, it should be tied to power or ground through its own resistor.

SDRAM Burst Write Cycle

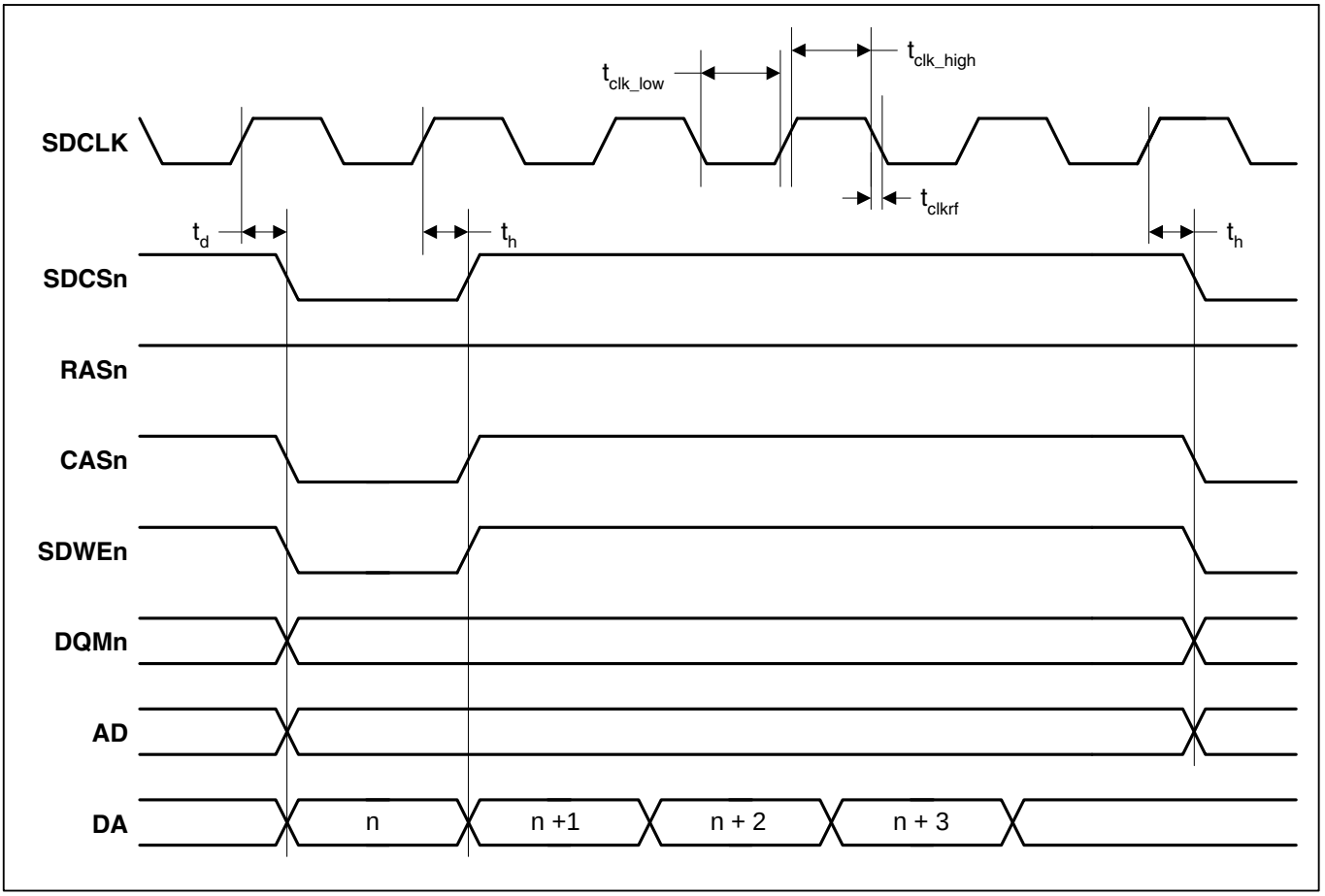
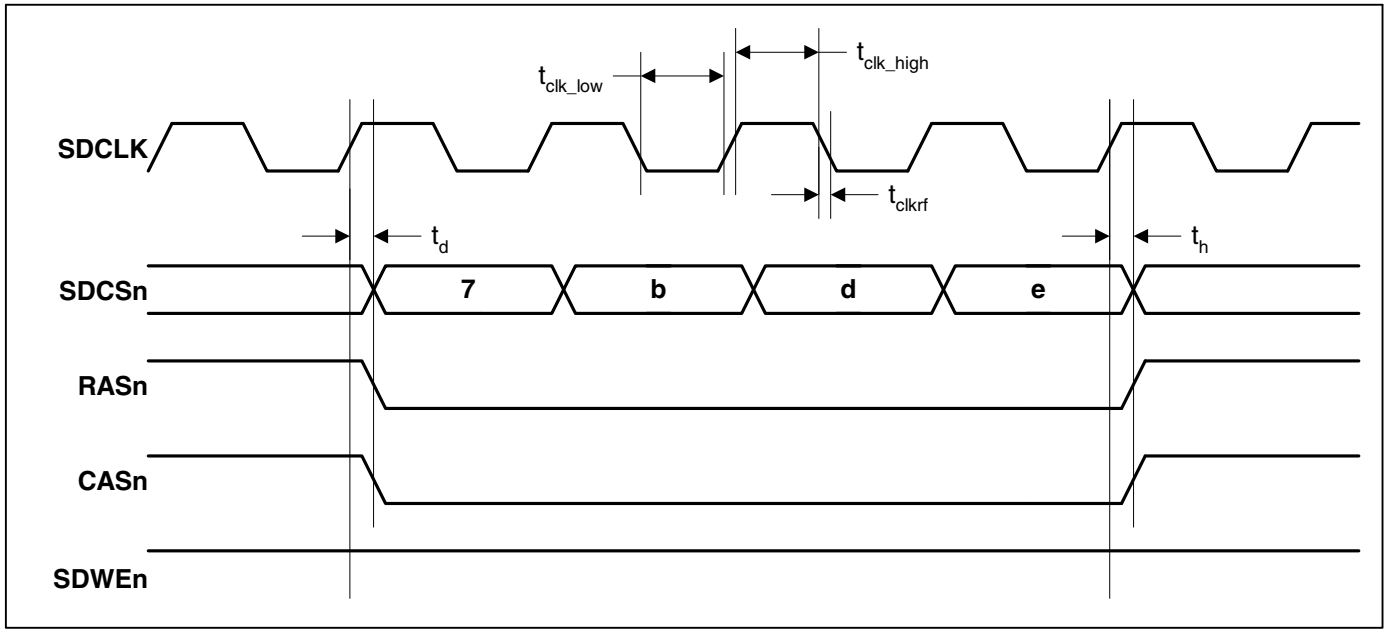


Figure 4. SDRAM Burst Write Cycle Timing Measurement

SDRAM Auto Refresh Cycle



Note: Chip select shown as bus to illustrate multiple devices being put into auto refresh in one access

Figure 5. SDRAM Auto Refresh Cycle Timing Measurement

Static Memory Single Word Read Cycle

Parameter	Symbol	Min	Typ	Max	Unit
AD setup to CSn assert time	t_{ADs}	0	-	-	ns
AD hold from CSn deassert time	t_{ADh}	t_{HCLK}	-	-	ns
RDn assert time	t_{RDpw}	-	$t_{HCLK} \times (WST1 + 2)$	-	ns
CSn to RDn delay time	t_{RDd}	-	-	3	ns
CSn assert to DQMn assert delay time	t_{DQMd}	-	-	1	ns
DA setup to RDn deassert time	t_{DAs}	$t_{HCLK} + 12$	-	-	ns
DA hold from RDn deassert time	t_{DAh}	0	-	-	ns

See “Timing Conditions” on page 14 for definition of HCLK.

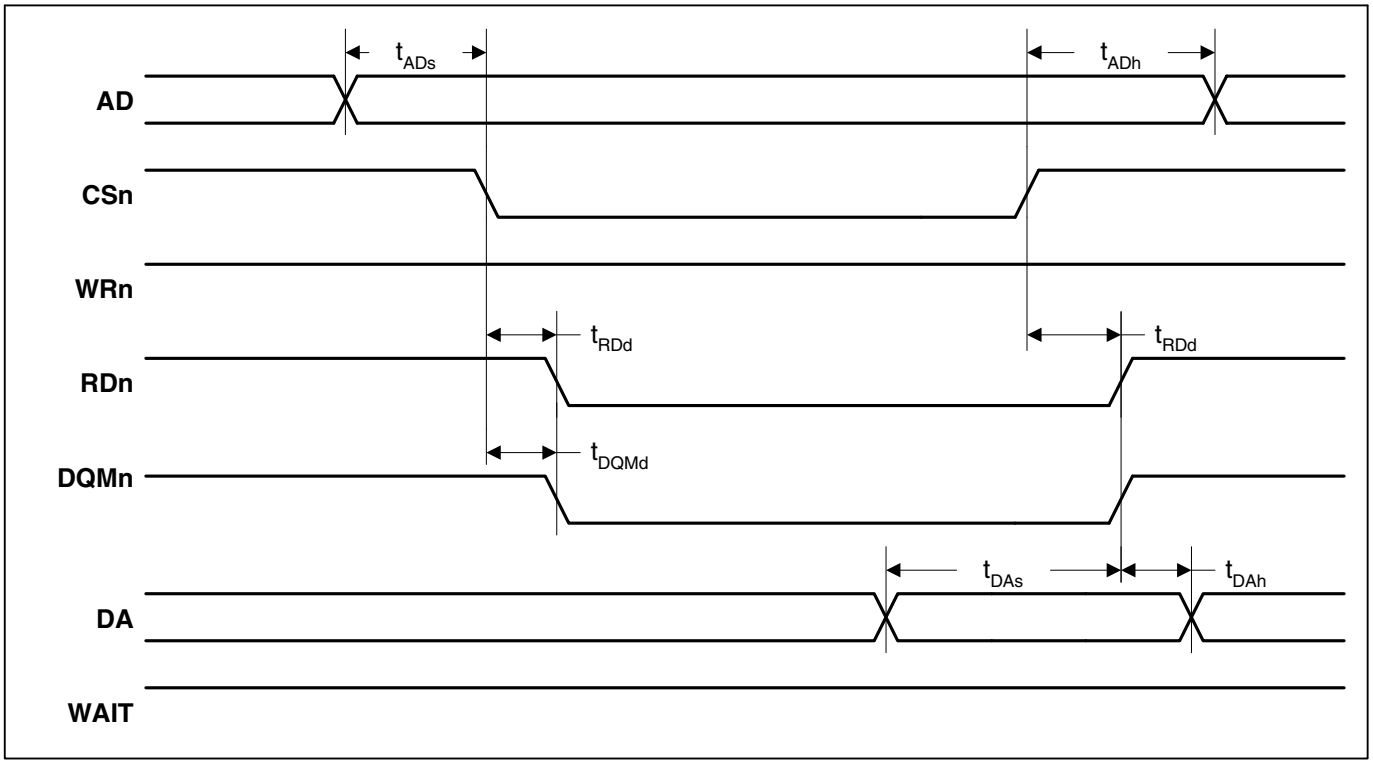


Figure 6. Static Memory Single Word Read Cycle Timing Measurement

Static Memory 32-bit Read on 8-bit External Bus

Parameter	Symbol	Min	Typ	Max	Unit
AD setup to CSn assert time	t_{ADs}	t_{HCLK}	-	-	ns
CSn assert to Address transition time	t_{AD1}	-	$t_{HCLK} \times (WST1 + 1)$	-	ns
Address assert time	t_{AD2}	-	$t_{HCLK} \times (WST1 + 1)$	-	ns
AD transition to CSn deassert time	t_{AD3}	-	$t_{HCLK} \times (WST1 + 2)$	-	ns
AD hold from CSn deassert time	t_{ADh}	t_{HCLK}	-	-	ns
RDn assert time	t_{RDpwL}	-	$t_{HCLK} \times (4 \times WST1 + 5)$	-	ns
CSn to RDn delay time	t_{RDd}	-	-	3	ns
CSn assert to DQMn assert delay time	t_{DQMd}	-	-	1	ns
DA setup to AD transition time	t_{DAs1}	15	-	-	ns
DA setup to RDn deassert time	t_{DAs2}	$t_{HCLK} + 12$	-	-	ns
DA hold from AD transition time	t_{DAh1}	0	-	-	ns
DA hold from RDn deassert time	t_{DAh2}	0	-	-	ns

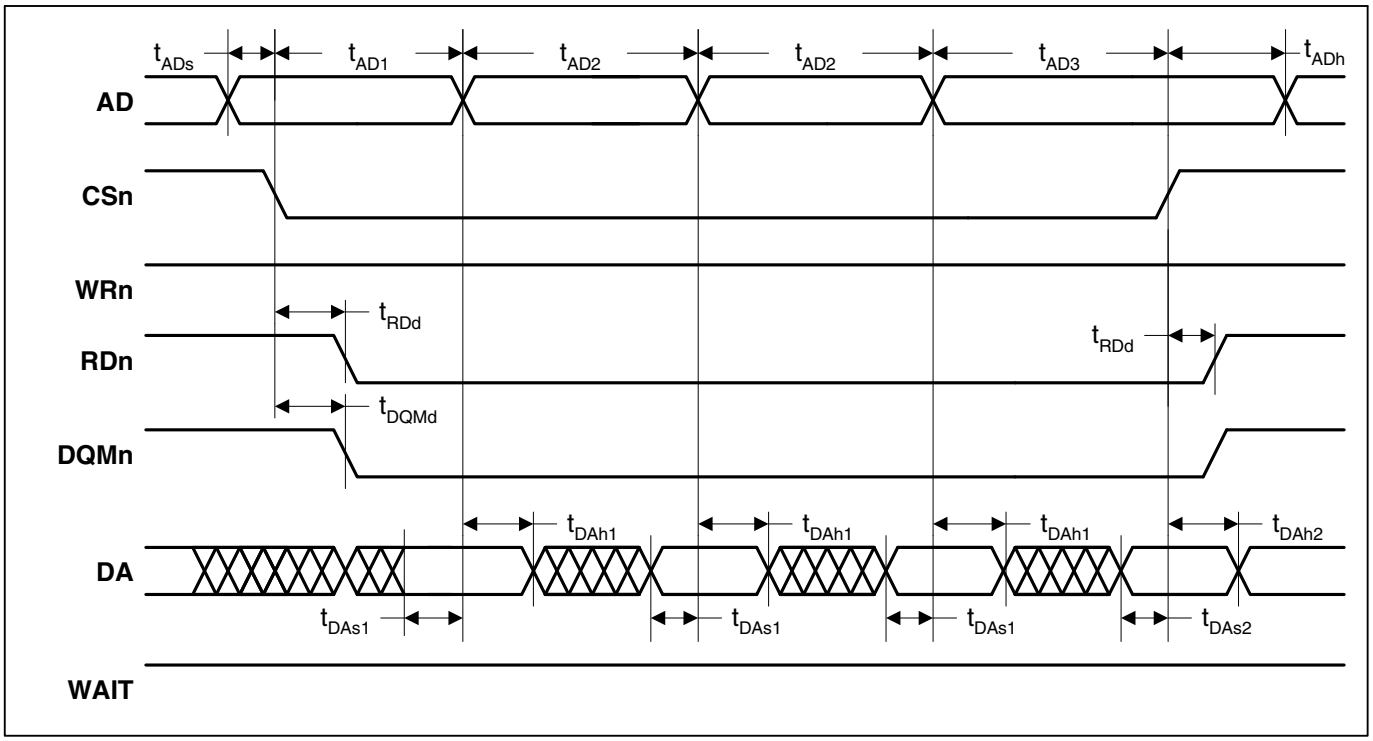


Figure 8. Static Memory Multiple Word Read 8-bit Cycle Timing Measurement

Static Memory 32-bit Write on 8-bit External Bus

Parameter	Symbol	Min	Typ	Max	Unit
AD setup to WRn assert time	t_{ADs}	$t_{HCLK} - 3$	-	-	ns
WRn/DQMn deassert to AD transition time	t_{ADd}	-	-	$t_{HCLK} + 6$	ns
AD hold from WRn deassert time	t_{ADh}	$t_{HCLK} \times 2$	-	-	ns
CSn hold from WRn deassert time	t_{CSh}	7	-	-	ns
CSn to WRn assert delay time	t_{WRd}	-	-	2	ns
WRn assert time	t_{WRpwL}	-	$t_{HCLK} \times (WST1 + 1)$	-	ns
WRn deassert time	t_{WRpwH}	-	$t_{HCLK} \times 2$	$(t_{HCLK} \times 2) + 14$	ns
CSn to DQMn assert delay time	t_{DQMd}	-	-	1	ns
DQMn assert time	t_{DQMpwL}	-	$t_{HCLK} \times (WST1 + 1)$	-	ns
DQMn deassert time	t_{DQMpwH}	-	-	$(t_{HCLK} \times 2) + 7$	ns
WRn / DQMn deassert to DA transition time	t_{DAh}	t_{HCLK}	-	-	ns
WRn / DQMn assert to DA valid time	t_{DAV}	-	-	8	ns

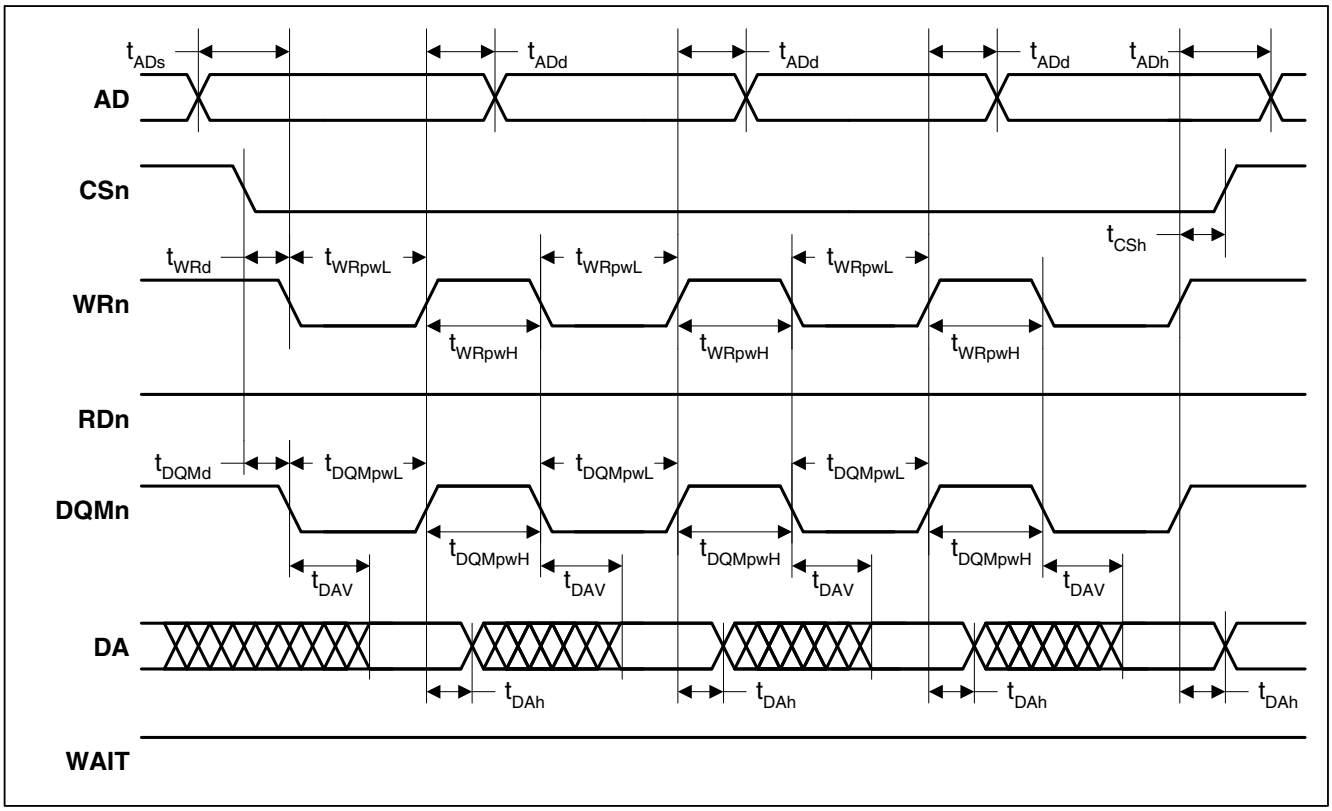


Figure 9. Static Memory Multiple Word Write 8-bit Cycle Timing Measurement

Static Memory Single Read Wait Cycle

Parameter	Symbol	Min	Typ	Max	Unit
CSn assert to WAIT time	t_{WAITd}	-	-	$t_{HCLK} \times (WST1-2)$	ns
WAIT assert time	t_{WAITpw}	$t_{HCLK} \times 2$	-	$t_{HCLK} \times 510$	ns
WAIT to CSn deassert delay time	t_{CSnd}	$t_{HCLK} \times 3$	-	$t_{HCLK} \times 5$	ns

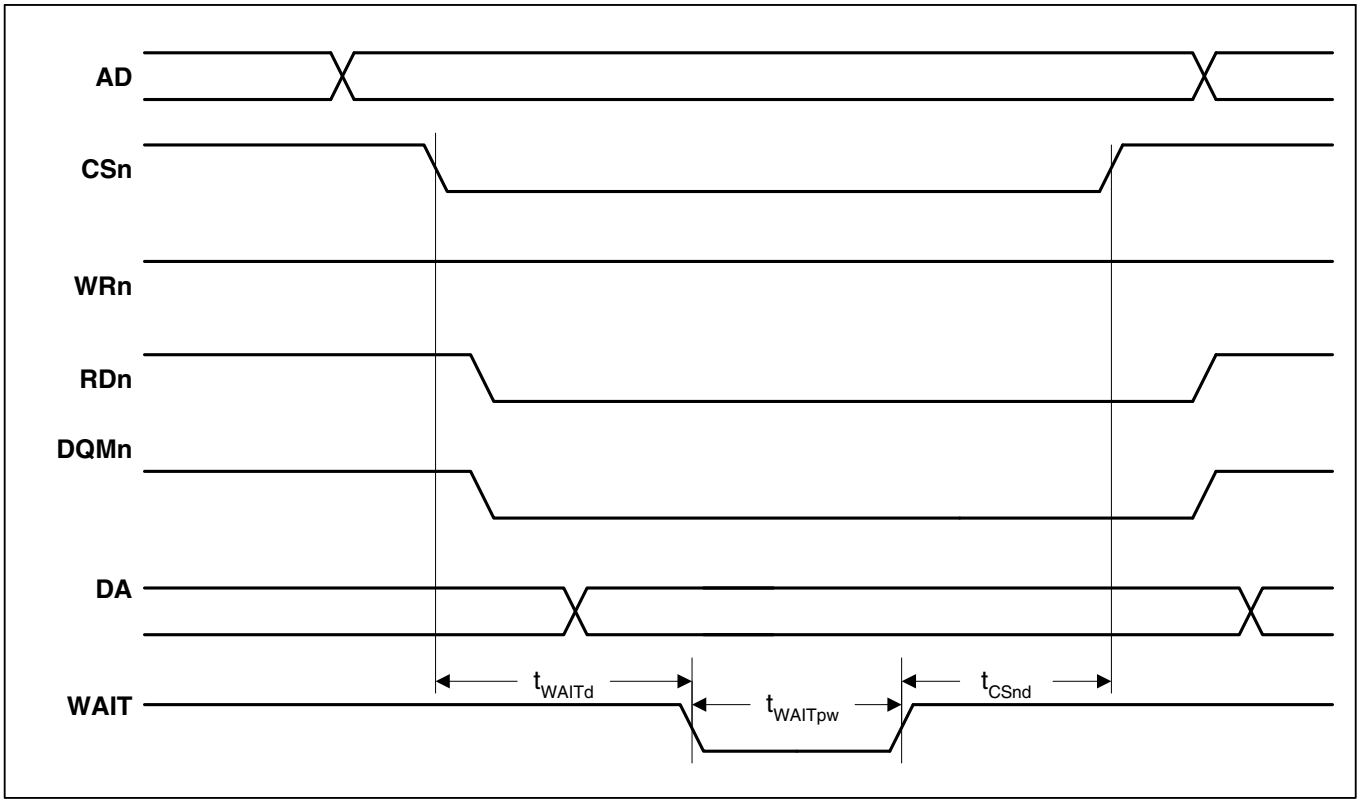


Figure 14. Static Memory Single Read Wait Cycle Timing Measurement

Static Memory Single Write Wait Cycle

Parameter	Symbol	Min	Typ	Max	Unit
WAIT to WRn deassert delay time	t_{WRd}	$t_{HCLK} \times 2$	-	$t_{HCLK} \times 4$	ns
CSn assert to WAIT time	t_{WAITd}	-	-	$t_{HCLK} \times$ (WST1-2)	ns
WAIT assert time	t_{WAITpw}	$t_{HCLK} \times 2$	-	$t_{HCLK} \times 510$	ns
WAIT to CSn deassert delay time	t_{CSnd}	$t_{HCLK} \times 3$	-	$t_{HCLK} \times 5$	ns

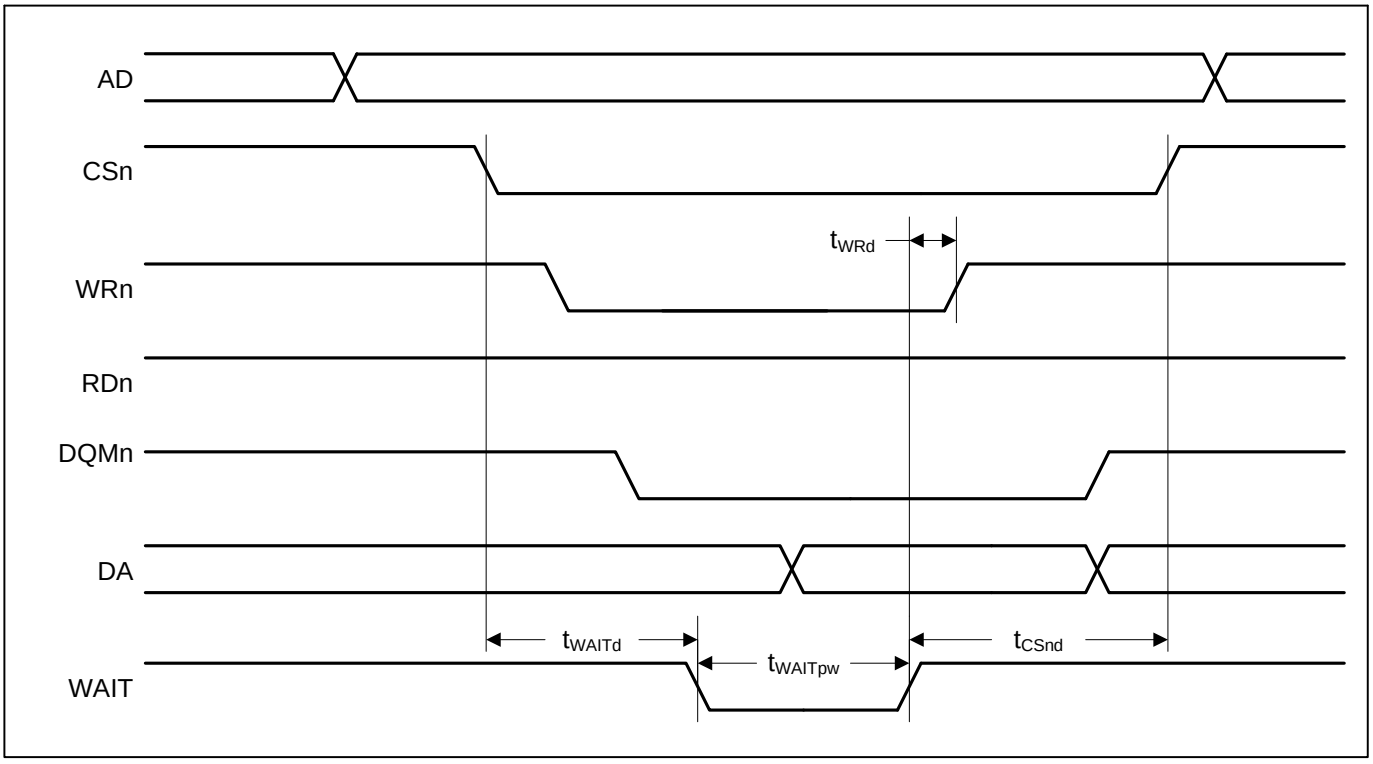
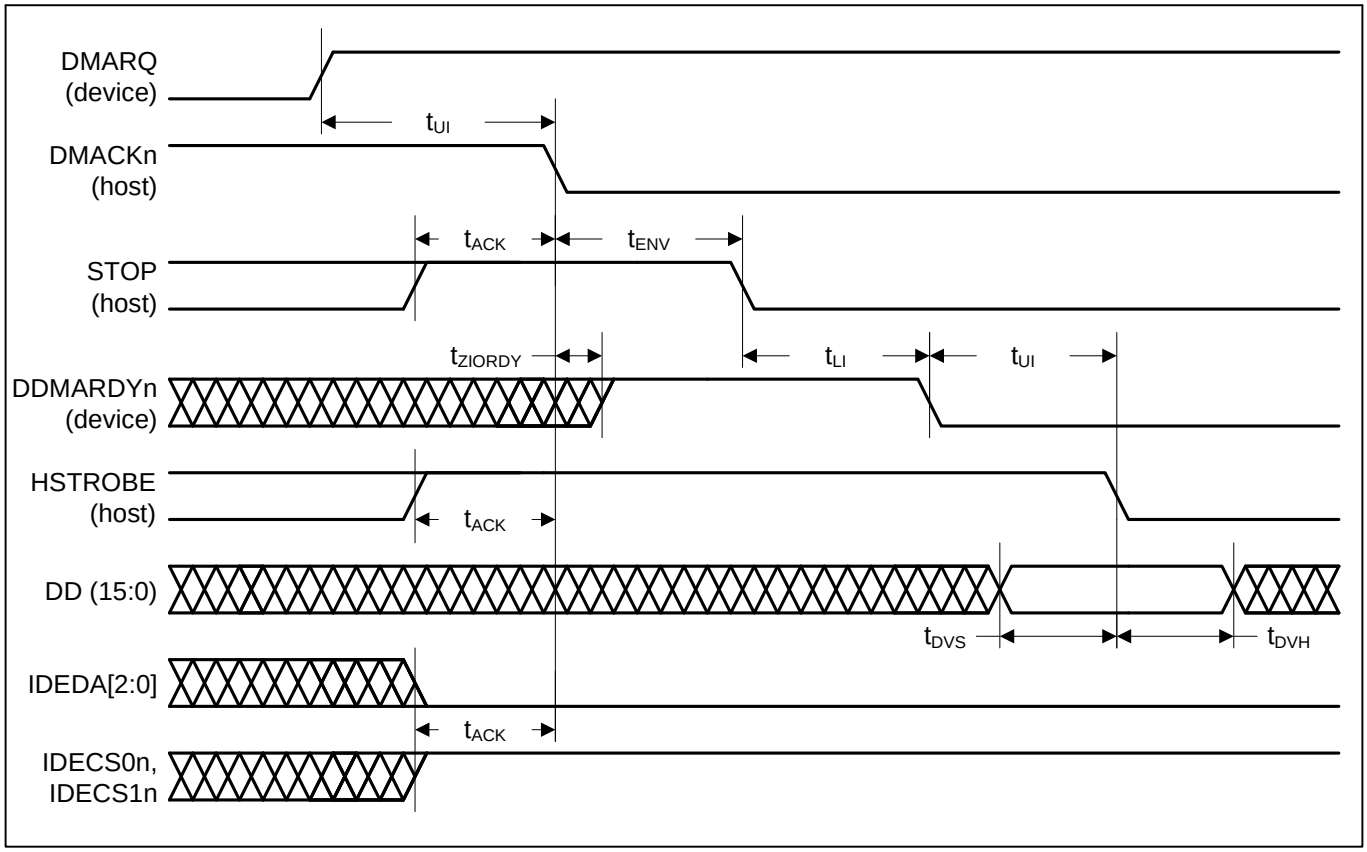
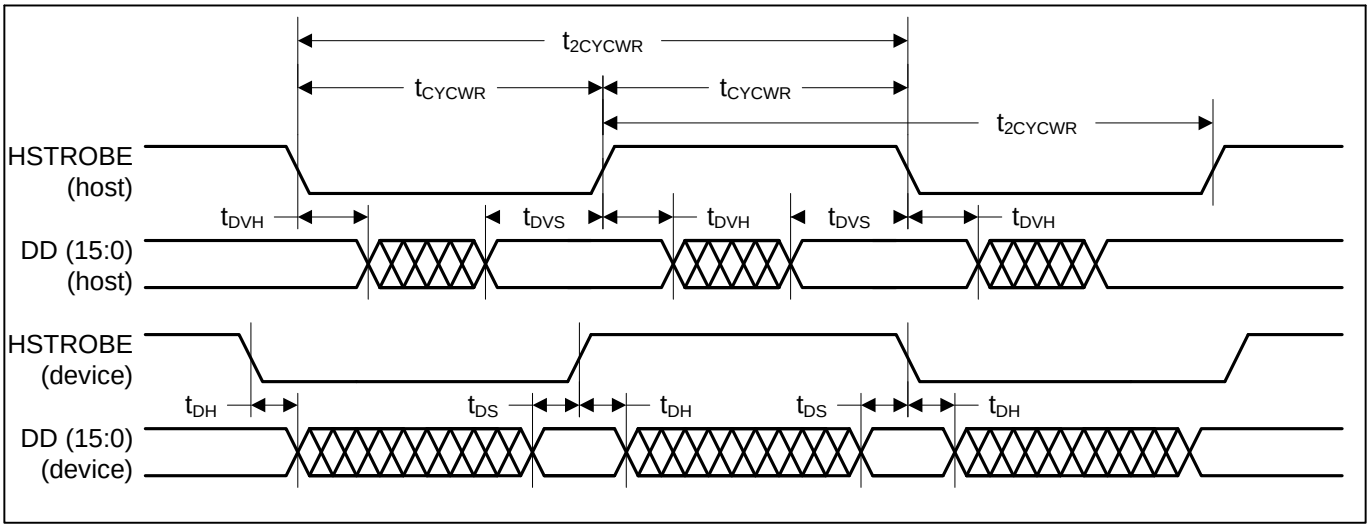


Figure 15. Static Memory Single Write Wait Cycle Timing Measurement



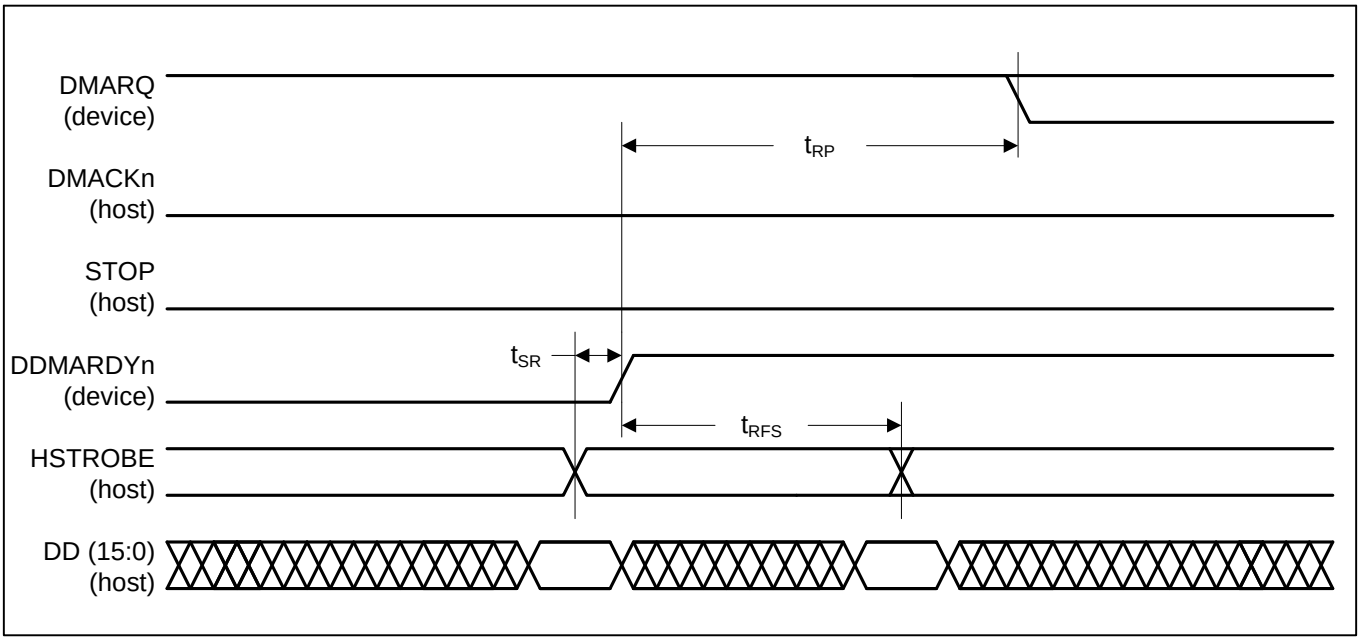
Note: The definitions for the DIOWn:STOP, DIORn:HDMARDYn:HSTROBE and IORDY:DDMARDYn:DSTROBE signal lines are not in effect until DMARQ and DMACKn are asserted.

Figure 24. Initiating an Ultra DMA data-out Burst



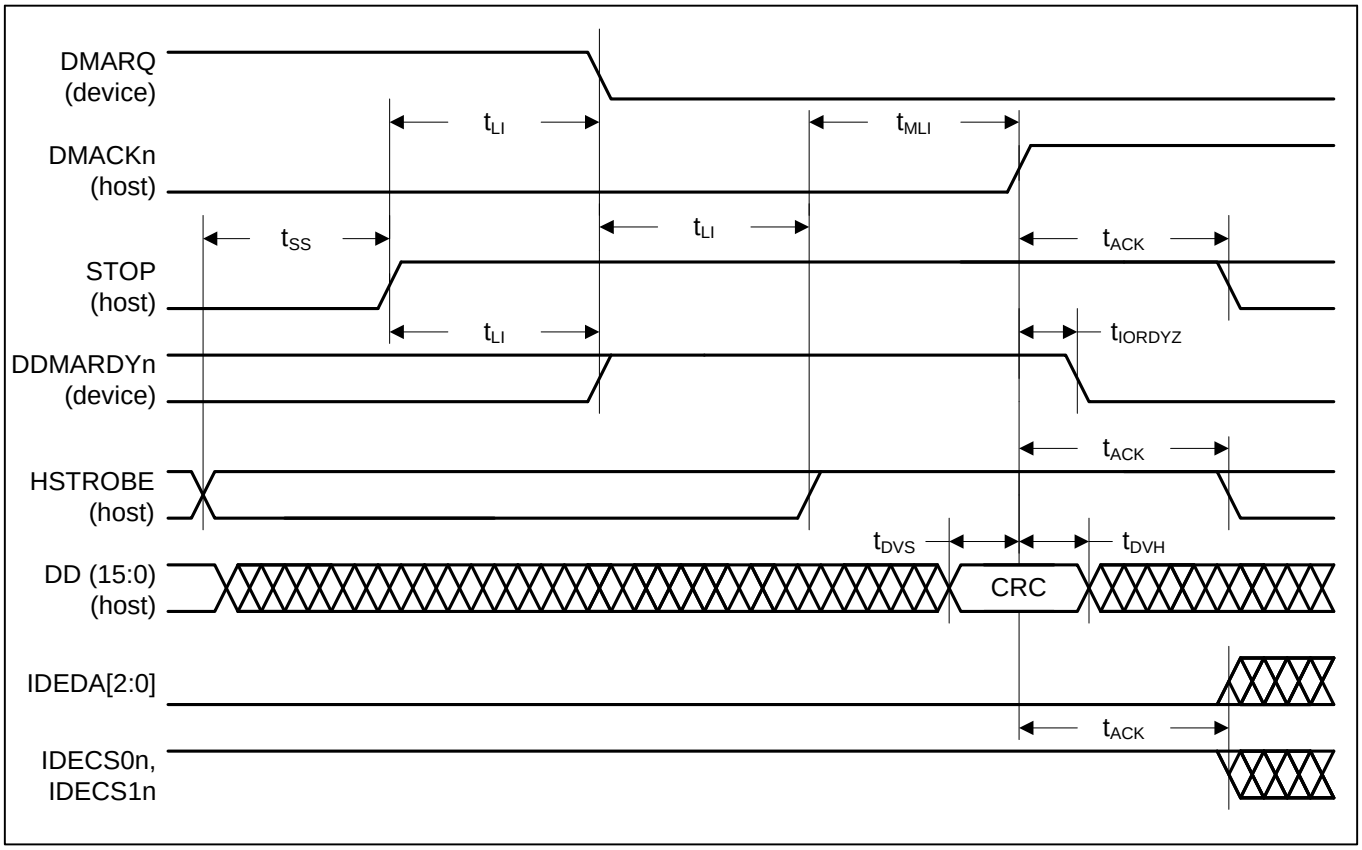
Note: DD (15:0) and HSTROBE signals are shown at both the device and the host to emphasize that cable settling time as well as cable propagation delay shall not allow the data signals to be considered stable at the device until some time after they are driven by the host.

Figure 25. Sustained Ultra DMA data-out Burst



Note: 1. The device may negate DMARQ to request termination of the Ultra DMA burst no sooner than t_{RP} after DDMARDYn is negated.
2. If the t_{SR} timing is not satisfied, the device may receive zero, one, or two more data words from the host.

Figure 26. Device Pausing an Ultra DMA data-out Burst



Note: The definitions for the DIOWn:STOP, IORDY:DDMARDYn:DSTROBE and DIORn:HDMARDYn:HSTROBE signal lines are no longer in effect after DMARQ and DMACKn are negated.

Figure 27. Host Terminating an Ultra DMA data-out Burst

Ethernet MAC Interface

Parameter	Symbol	Min		Typ		Max		Unit
		10 Mbit mode	100 Mbit mode	10 Mbit mode	100 Mbit mode	10 Mbit mode	100 Mbit mode	
TXCLK cycle time	t_{TX_per}	-	-	400	40	-	-	ns
TXCLK high time	t_{TX_high}	140	14	200	20	260	26	ns
TXCLK low time	t_{TX_low}	140	14	200	20	260	26	ns
TXCLK to signal transition delay time	t_{TXd}	0	0	10	10	25	25	ns
TXCLK rise/fall time	t_{TXrf}	-	-	-	-	5	5	ns
RXCLK cycle time	t_{RX_per}	-	-	400	40	-	-	ns
RXCLK high time	t_{RX_high}	140	14	200	20	260	26	ns
RXCLK low time	t_{RX_low}	140	14	200	20	260	26	ns
RXDVAL / RXERR setup time	t_{RXs}	10	10	-	-	-	-	ns
RXDVAL / RXERR hold time	t_{RXh}	10	10	-	-	-	-	ns
RXCLK rise/fall time	t_{RXrf}	-	-	-	-	5	5	ns
MDC cycle time	t_{MDC_per}	-	-	400	400	-	-	ns
MDC high time	t_{MDC_high}	160	160	-	-	-	-	ns
MDC low time	t_{MDC_low}	160	160	-	-	-	-	ns
MDC rise/fall time	t_{MDCrf}	-	-	-	-	5	5	ns
MDIO setup time (STA sourced)	t_{MDIOs}	10	10	-	-	-	-	ns
MDIO hold time (STA sourced)	t_{MDIOh}	10	10	-	-	-	-	ns
MDC to MDIO signal transition delay time (PHY sourced)	t_{MDIOd}	-	-	-	-	300	300	ns

STA - Station - Any device that contains an IEEE 802.11 conforming Medium Access Control (MAC) and physical layer (PHY) interface to the wireless medium.

PHY - Ethernet physical layer interface.

Texas Instruments' Synchronous Serial Format

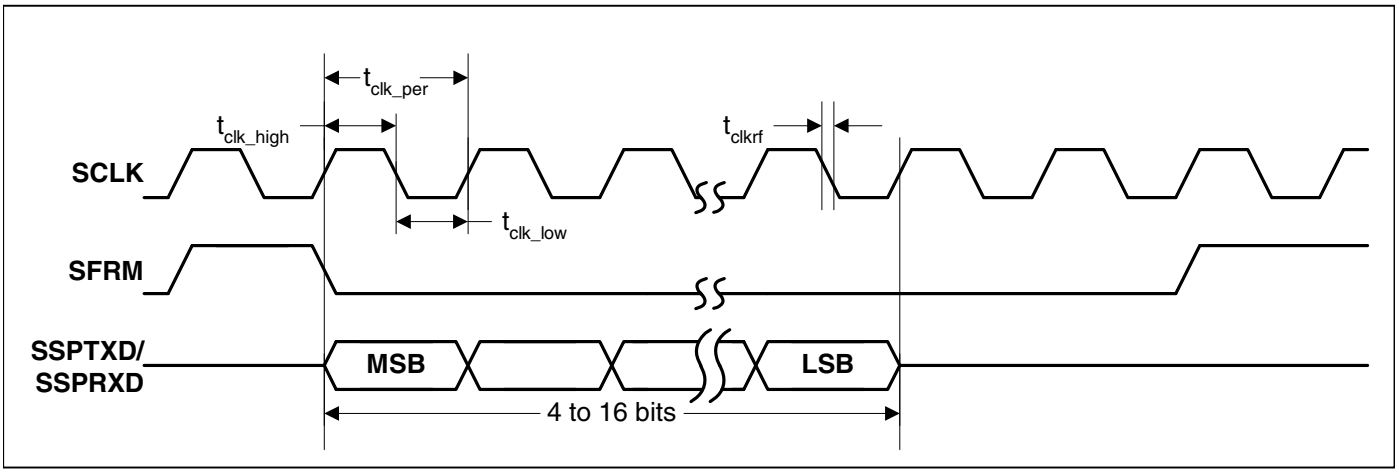


Figure 30. *TI* Single Transfer Timing Measurement

Microwire

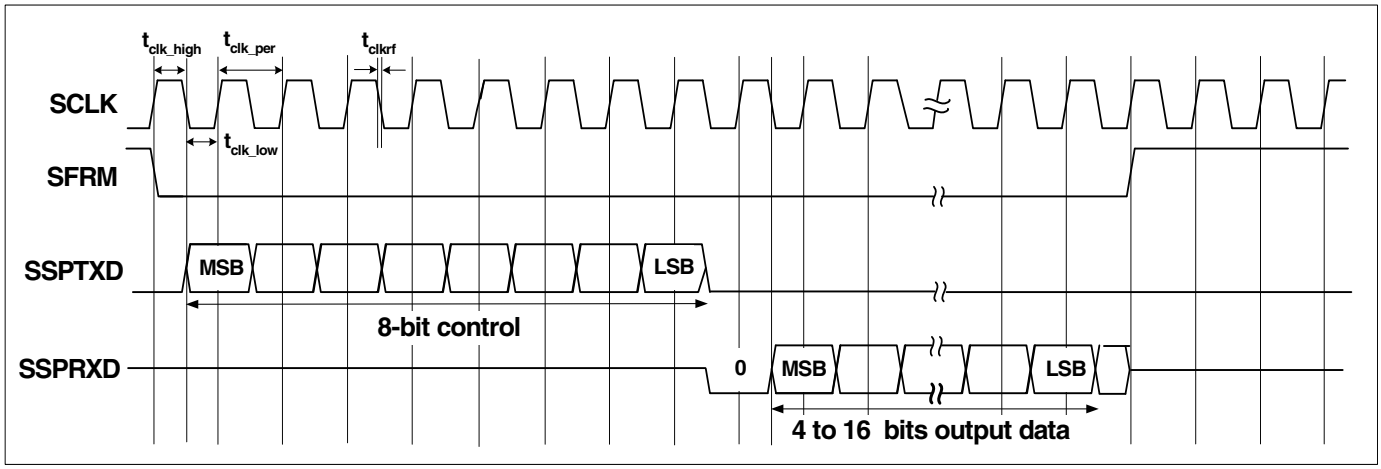


Figure 31. Microwire Frame Format, Single Transfer

AC'97

Parameter	Symbol	Min	Typ	Max	Unit
ABITCLK input cycle time	t_{clk_per}	-	81.4	-	ns
ABITCLK input high time	t_{clk_high}	36	-	45	ns
ABITCLK input low time	t_{clk_low}	36	-	45	ns
ABITCLK input rise/fall time	t_{clkrf}	2	-	6	ns
ASDI setup to ABITCLK falling	t_s	10	-	-	ns
ASDI hold after ABITCLK falling	t_h	10	-	-	ns
ASDI input rise/fall time	t_{rfin}	2	-	6	ns
ABITCLK rising to ASDO / ASYNC valid, C_L = 55 pF	t_{co}	2	-	15	ns
ASYNC / ASDO rise/fall time, C_L = 55 pF	t_{rfout}	2	-	6	ns

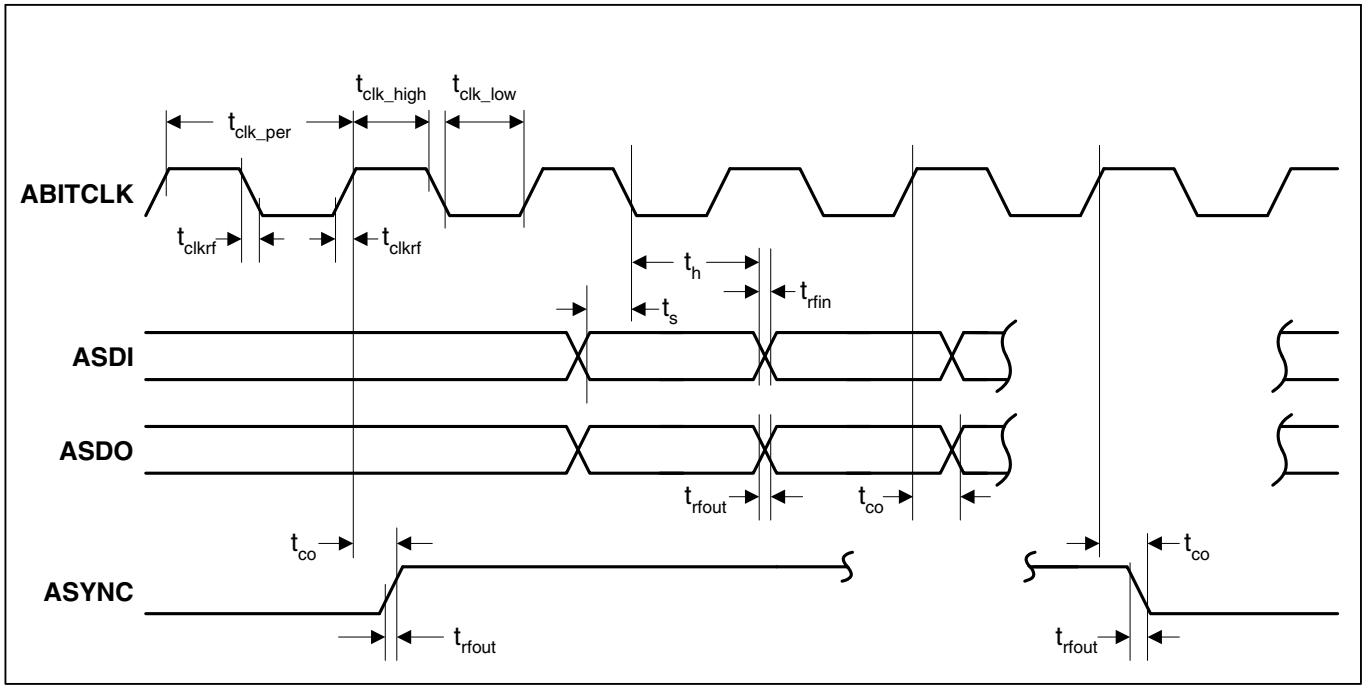
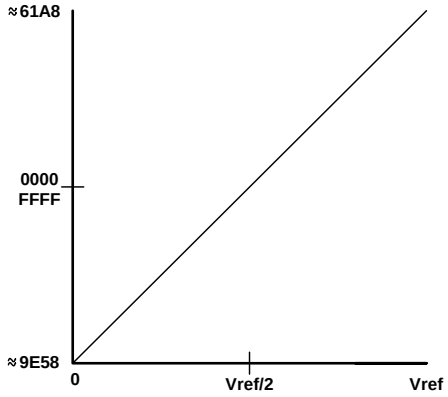


Figure 34. AC '97 Configuration Timing Measurement

ADC

Parameter	Comment	Value	Units
Resolution	No missing codes Range of 0 to 3.3 V	50K counts (approximate)	
Integral non-linearity		0.01%	
Offset error		±15	mV
Full scale error		0.2%	
Maximum sample rate	ADIV = 0 ADIV = 1	3750 925	Samples per second Samples per second
Channel switch settling time	ADIV = 0 ADIV = 1	500 2	µs ms
Noise (RMS) - typical		120	µV

Note: ADIV refers to bit 16 in the KeyTchClkDiv register.
ADIV = 0 means the input clock to the ADC module is equal to the external 14.7456 MHz clock divided by 4.
ADIV = 1 means the input clock to the ADC module is equal to the external 14.7456 MHz clock divided by 16.



A/D Converter Transfer Function
(approximately ±25,000 counts)

Figure 36. ADC Transfer Function

Using the ADC:

This ADC has a state-machine based conversion engine that automates the conversion process. The initiator for a conversion is the read access of the TSXYResult register by the CPU. The data returned from reading this register contains the result as well as the status bit indicating the state of the ADC. However, this peripheral requires a delay between each successful conversion and the issue of the next conversion command, or else the returned value of successive samples may not reflect the analog input. Since the state of the ADC state machine is returned through the same channel used to initiate the conversion process, there must be a delay inserted after every complete conversion. Note that reading TSXYResult during a conversion will not affect the result of the ongoing process.

The following is a recommended procedure for safely polling the ADC from software:

1. Read the TSXYResult register into a local variable to initiate a conversion.
2. If the value of bit 31 of the local variable is '0' then repeat step 1.
3. Delay long enough to meet the maximum sample rate as shown above.
4. Mask the local variable with 0xFFFF to remove extraneous data.
5. If signed mode is used, do a sign extend of the lower halfword.
6. Return the sampled value.

Acronyms and Abbreviations

The following tables list abbreviations and acronyms used in this data sheet.

Term	Definition
ADC	Analog-to-Digital Converter
ALT	Alternative
AMBA	Advanced Micro-controller Bus Architecture
ATAPI	ATA Packet Interface
CODEC	COder / DECoder
CRC	Cyclic Redundancy Check
DAC	Digital-to-Analog Converter
DMA	Direct-Memory Access
EBUS	External Memory Bus
EEPROM	Electronically Erasable Programmable Read Only Memory
EMAC	Ethernet Media Access Controller
FIFO	First In / First Out
FIQ	Fast Interrupt Request
FLASH	Flash memory
GPIO	General Purpose I/O
HDLC	High-level Data Link Control
I/F	Interface
I^2S	Inter-IC Sound
IC	Integrated Circuit
ICE	In-Circuit Emulator
IDE	Integrated Drive Electronics
IEEE	Institute of Electronics and Electrical Engineers
IrDA	Infrared Data Association
IRQ	Standard Interrupt Request
ISO	International Standards Organization
JTAG	Joint Test Action Group
LFSR	Linear Feedback Shift Register
MII	Media Independent Interface
MMU	Memory Management Unit
OHCI	Open Host Controller Interface
PHY	Ethernet PHYsical layer interface
PIO	Programmed I/O
RISC	Reduced Instruction Set Computer
SDMI	Secure Digital Music Initiative
SDRAM	Synchronous Dynamic RAM
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory
STA	Station - Any device that contains an IEEE 802.11 conforming Medium Access Control (MAC) and physical layer (PHY) interface to the wireless medium
TFT	Thin Film Transistor
TLB	Translation Lookaside Buffer
USB	Universal Serial Bus

Units of Measurement

Symbol	Unit of Measure
$^{\circ}C$	degree Celsius
Hz	Hertz = cycle per second
Kbps	Kilobits per second
kbyte	Kilobyte
kHz	KiloHertz = 1000 Hz
Mbps	Megabits per second
MHz	MegaHertz = 1,000 kHz
µA	microAmpere = 10^{-6} Ampere
µs	microsecond = 1,000 nanoseconds = 10^{-6} seconds
mA	milliAmpere = 10^{-3} Ampere
ms	millisecond = 1,000 microseconds = 10^{-3} seconds
mW	milliWatt = 10^{-3} Watts
ns	nanosecond = 10^{-9} seconds
pF	picoFarad = 10^{-12} Farads
V	Volt
W	Watt