AT24C32D

I²C-Compatible (2-Wire) Serial EEPROM
32-Kbit (4,096 x 8)

DATASHEET

Features

- Low-voltage and Standard-voltage Operation
  - V_{CC} = 1.7V to 5.5V
- Internally Organized as 4,096 x 8 (32K)
- I²C-compatible (2-Wire) Serial Interface
- Schmitt Trigger, Filtered Inputs for Noise Suppression
- Bidirectional Data Transfer Protocol
- 400kHz (1.7V) and 1MHz (2.5V, 2.7V, 5.0V) Compatibility
- Write Protect Pin for Hardware Protection
- 32-byte Page Write Mode
  - Partial Page Writes Allowed
- Self-timed Write cycle (5ms Max)
- High Reliability
  - Endurance: 1,000,000 Write Cycles
  - Data Retention: 100 Years
- Lead-free/Halogen-free devices Available
- Green Package Options (Pb/Halide-free/RoHS Compliant)
  - 8-lead JEDEC SOIC, 8-lead TSSOP, 8-pad UDFN, 8-pad XDFN, 5-lead SOT23, 5-ball WLCSP, and 8-ball VFBGA packages
- Die Sale Options: Wafer Form, Waffle Pack, and Bumped Wafers

Description

The Atmel® AT24C32D provides 32,768 bits of Serial Electrically Erasable and Programmable Read-Only Memory (EEPROM) organized as 4,096 words of 8 bits each. The device's cascading feature allows up to eight devices to share a common 2-wire bus. The device is optimized for use in many industrial and commercial applications where low-power and low-voltage operation are essential. The devices are available in space-saving 8-lead JEDEC SOIC, 8-lead TSSOP, 8-pad UDFN, 8-pad XDFN, 5-lead SOT23, 5-ball WLCSP, and 8-ball VFBGA packages. In addition, this device operates from 1.7V to 5.5V.

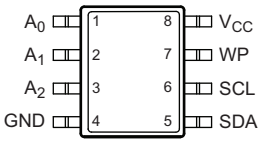
1. Pin Configurations and Pinouts

Table 1-1. Pin Configuration

Pin	Function
A_0	Address Input
A_1	Address Input
A_2	Address Input
GND	Ground
SDA	Serial Data
SCL	Serial Clock Input
WP	Write Protect
V_{CC}	Device Power Supply

Note: When using the 5-lead SOT-23 or the 5-ball WLCSP, the software bits A2, A1, and A0 must be set to Logic 0 to properly communicate with the device.

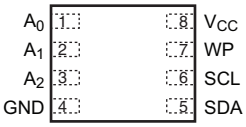
8-lead SOIC



8-lead TSSOP

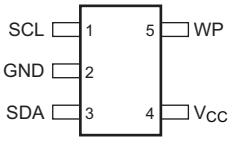
Top View

8-pad UDFN/XDFN



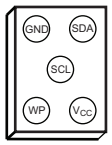
Top View

5-lead SOT23 (1)



Top View

5-ball WLCSP (1)



Ball Side View

8-ball VFBGA

Bottom View

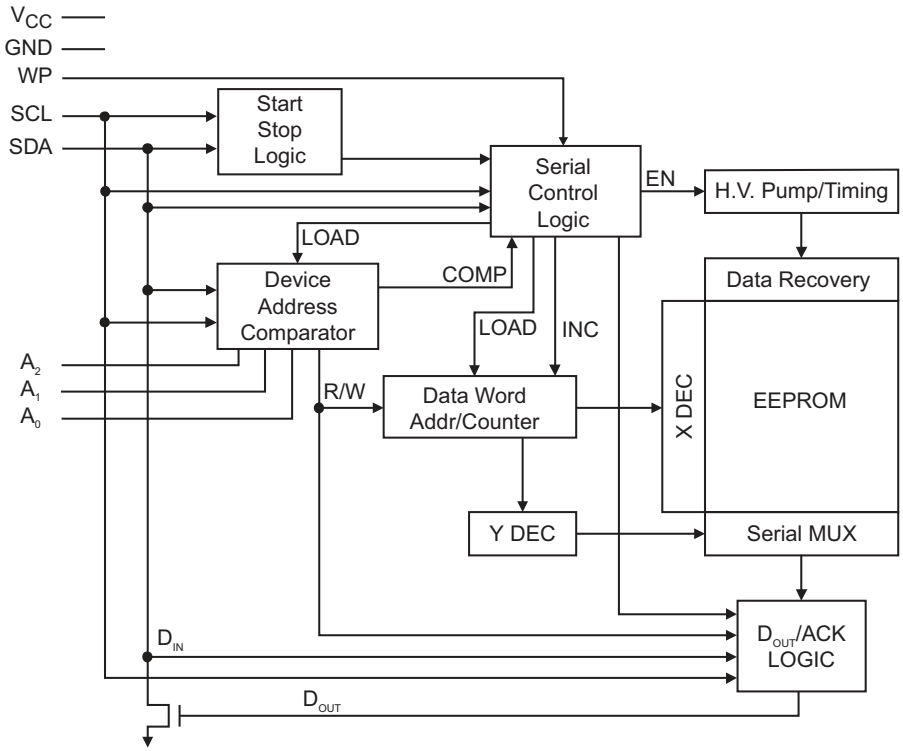
* Note: Drawings are not to scale

2. Absolute Maximum Ratings*

Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to + 150°C
Voltage on any pin with respect to ground	-1.0 V +7.0V
Maximum Operating Voltage	6.25V
DC Output Current	5.0mA

*Notice: Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

3. Block Diagram



4. Pin Descriptions

Serial Clock (SCL): The SCL input is used to positive-edge clock data into each EEPROM device and negative-edge clock data out of each device.

Serial Data (SDA): The SDA pin is bidirectional for serial data transfer. This pin is open drain driven and may be wire-ORed with any number of other open-drain or open-collector devices.

Device Addresses (A_2, A_1, A_0): The A_2, A_1, and A_0 pins are device address inputs that are hard wired (directly to GND or to V_{CC}) for compatibility with other Atmel AT24C devices. When the pins are hard wired, as many as eight 32K devices may be addressed on a single bus system. (Device addressing is discussed in detail in Section 7., "Device Addressing" on page 9). A device is selected when a corresponding hardware and software match is true. If these pins are left floating, the A_2, A_1, and A_0 pins will be internally pulled down to GND. However, due to capacitive coupling that may appear during customer applications, Atmel recommends always connecting the address pins to a known state. When using a pull-up resistor, Atmel recommends using 10kΩ or less.

Write Protect (WP): The Write Protect input, when connected to GND, allows normal write operations. When WP is connected directly to V_{CC}, all Write operations to the memory are inhibited. If the pin is left floating, the WP pin will be internally pulled down to GND; however, due to capacitive coupling that may appear during customer applications, Atmel recommends always connecting the WP pins to a known state. When using a pull-up resistor, Atmel recommends using 10kΩ or less.

Table 4-1. Write Protect

WP Pin Status	Part of the Array Protected
At V_{CC}	Full Array
At GND	Normal Read/Write Operations

5. Memory Organization

AT24C32D, 32K Serial EEPROM: The 32K is internally organized as 128 pages of 32-bytes each. Random word addressing requires a 12-bit data word address.

5.1 Pin Capacitance

Table 5-1. Pin Capacitance[1]

Applicable over recommended operating range from: T_A = 25°C, f = 1.0MHz, V_{CC} = 5.5V.

Symbol	Test Condition	Max	Units	Conditions
$C_{I/O}$	Input/Output Capacitance (SDA)	8	pF	$V_{I/O}$ = 0V
C_{IN}	Input Capacitance (A_0, A_1, A_2, and SCL)	6	pF	V_{IN} = 0V

Note: 1. This parameter is characterized and is not 100% tested.

5.2 DC Characteristics

Table 5-2. DC Characteristics

Applicable over recommended operating range from: T_{AI} = -40°C to +85°C, V_{CC} = 1.7V to 5.5V (unless otherwise noted).

Symbol	Parameter	Test Condition		Min	Typ	Max	Units
V_{CC1}	Supply Voltage			1.7		5.5	V
I_{CC1}	Supply Current	V_{CC} = 5.0V	Read at 400kHz		0.4	1.0	mA
I_{CC2}	Supply Current	V_{CC} = 5.0V	Write at 400kHz		2.0	3.0	mA
I_{SB1}	Standby Current	V_{CC} = 1.7V	V_{IN} = V_{CC} or V_{SS}			1.0	µA
		V_{CC} = 5.0V				6.0	µA
I_{LI}	Input Leakage Current V_{CC} = 5.0V	V_{IN} = V_{CC} or V_{SS}			0.10	3.0	µA
I_{LO}	Output Leakage Current V_{CC} = 5.0V	V_{OUT} = V_{CC} or V_{SS}			0.05	3.0	µA
V_{IL}	Input Low Level[1]			-0.6		V_{CC} x 0.3	V
V_{IH}	Input High Level[1]			V_{CC} x 0.7		V_{CC} + 0.5	V
V_{OL1}	Output Low Level	V_{CC} = 1.7V	I_{OL} = 0.15mA			0.2	V
V_{OL2}	Output Low Level	V_{CC} = 3.0V	I_{OL} = 2.1mA			0.4	V

Note: 1. V_{IL} min and V_{IH} max are reference only and are not tested.

5.3 AC Characteristics

Table 5-3. AC Characteristics (Industrial Temperature)

Applicable over recommended operating range from: T_{AI} = -40°C to +85°C, V_{CC} = 1.7V to 5.5V, CL = 100pF *(unless otherwise noted)*. Test conditions are listed in Note 2.

Symbol	Parameter	1.7V		2.5V, 5.0V		Units
		Min	Max	Min	Max	
f_{SCL}	Clock Frequency, SCL		400		1000	kHz
t_{LOW}	Clock Pulse Width Low	1300		400		ns
t_{HIGH}	Clock Pulse Width High	600		400		ns
t_I	Noise Suppression Time(1)		100		50	ns
t_{AA}	Clock Low to Data Out Valid	50	900	50	550	ns
t_{BUF}	Time the bus must be free before a new transmission can start(1)	1300		500		ns
$t_{HD.STA}$	Start Condition Hold Time	600		250		ns
$t_{SU.STA}$	Start Condition Set-up Time	600		250		ns
$t_{HD.DAT}$	Data In Hold Time	0		0		ns
$t_{SU.DAT}$	Data In Set-up Time	100		100		ns
t_R	Inputs Rise Time(1)		300		300	ns
t_F	Inputs Fall Time(1)		300		100	ns
$t_{SU.STO}$	Stop Condition Set-up Time	600		250		ns
t_{DH}	Data Out Hold Time	50		50		ns
t_{WR}	Write Cycle Time		5		5	ms
Endurance(1)	25°C, Page Mode, 3.3V	1,000,000				Write Cycles

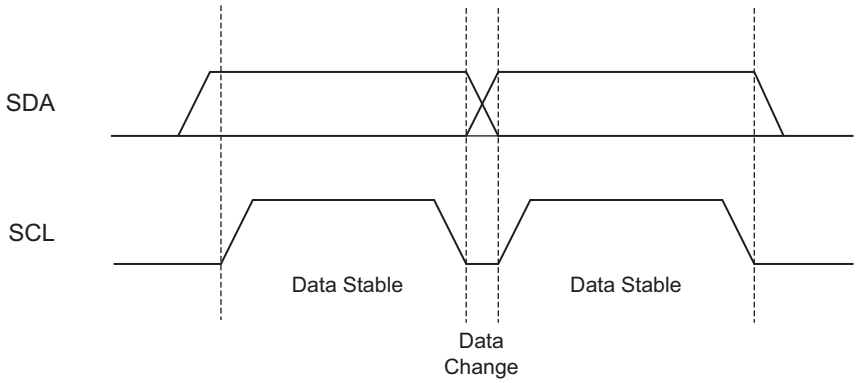
Notes: 1. This parameter is ensured by characterization and is not 100% tested.

2. AC measurement conditions:
   - R_L (connects to V_{CC}): 1.3kΩ (2.5V, 5.5V), 10kΩ (1.7V)
   - Input pulse voltages: $0.3V_{CC}$ to $0.7V_{CC}$
   - Input rise and fall times: ≤ 50ns
   - Input and output timing reference voltages: 0.5 x V_{CC}

6. Device Operation

Clock and Data Transitions: The SDA pin is normally pulled high with an external device. Data on the SDA pin may change only during SCL low time periods. Data changes during SCL high periods will indicate a Start or Stop condition as defined below.

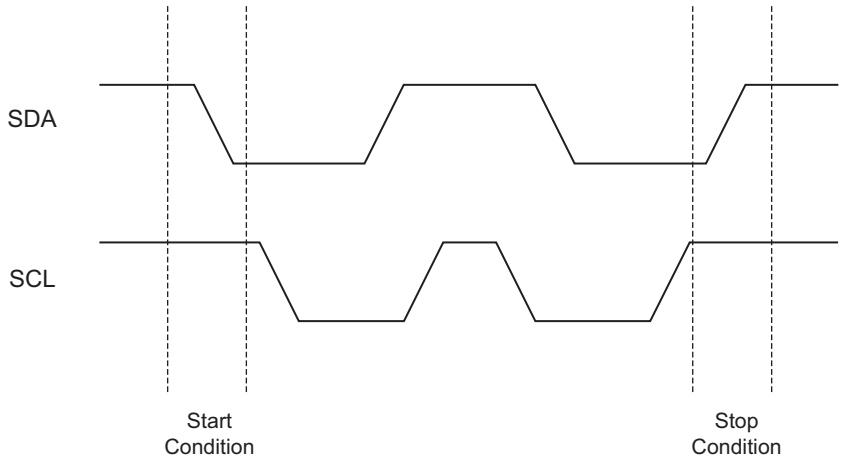
Figure 6-1. Data Validity



Start Condition: A high-to-low transition of SDA with SCL high is a Start condition that must precede every command.

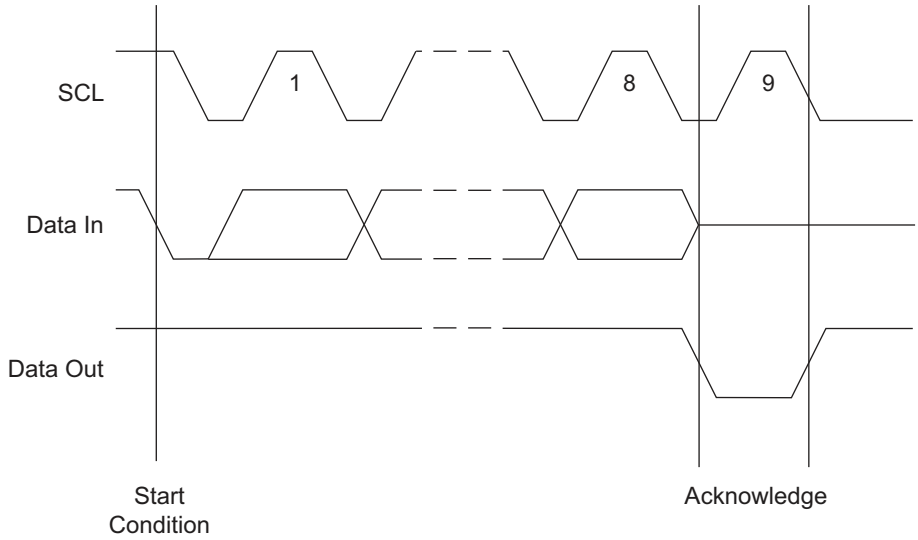
Stop Condition: A low-to-high transition of SDA with SCL high is a Stop condition. After a Read sequence, the Stop condition will place the EEPROM in a standby power mode.

Figure 6-2. Start Condition and Stop Condition Definition



Acknowledge: All addresses and data words are serially transmitted to and from the EEPROM in 8-bit words. The receiving device sends a zero during the ninth clock cycle to acknowledge that it has received each word. This zero response is referred to as an Acknowledge.

Figure 6-3. Output Acknowledge



Standby Mode: AT24C32D features a low-power standby mode that is enabled upon power-up and after the receipt of the Stop condition and the completion of any internal operations.

Software Reset: After an interruption in protocol, power loss or system reset, any 2-wire part can be protocol reset by following these steps:

1. Create a Start condition (if possible).
2. Clock nine cycles.
3. Create another Start condition followed by Stop condition as shown below.

The device should be ready for the next communication after above steps have been completed. In the event that the device is still non-responsive or remains active on the SDA bus, a power cycle must be used to reset the device.

Figure 6-4. Software Reset

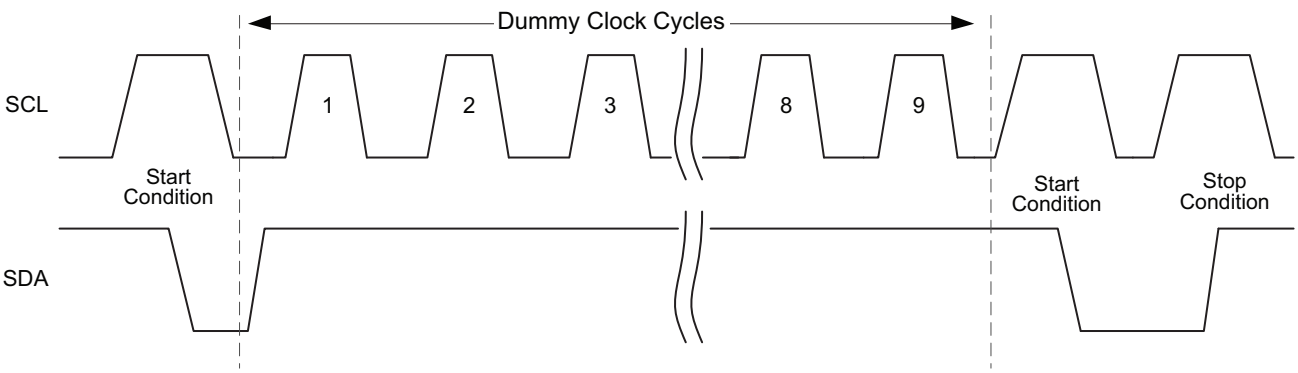


Figure 6-5. Bus Timing

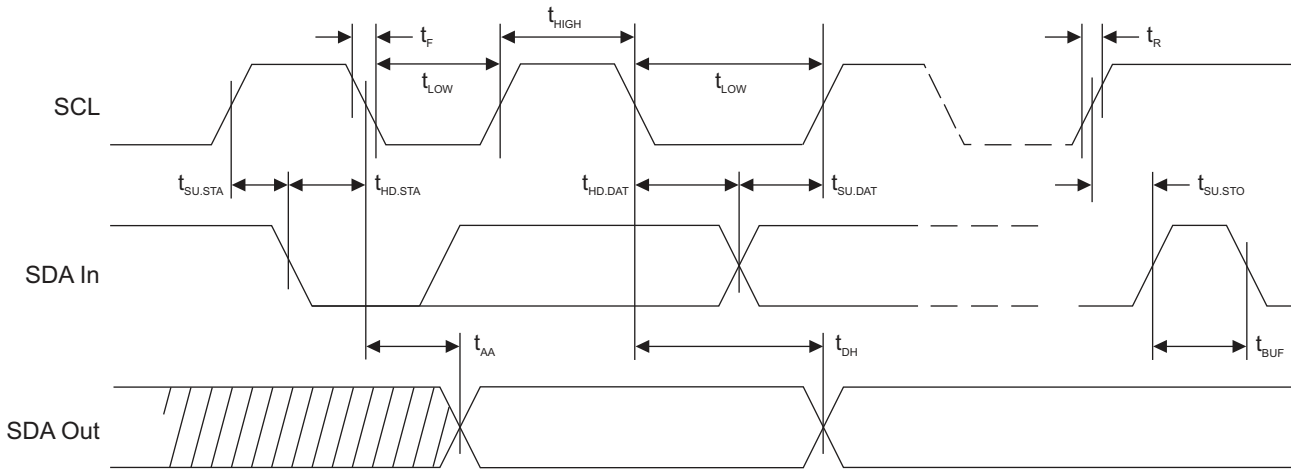
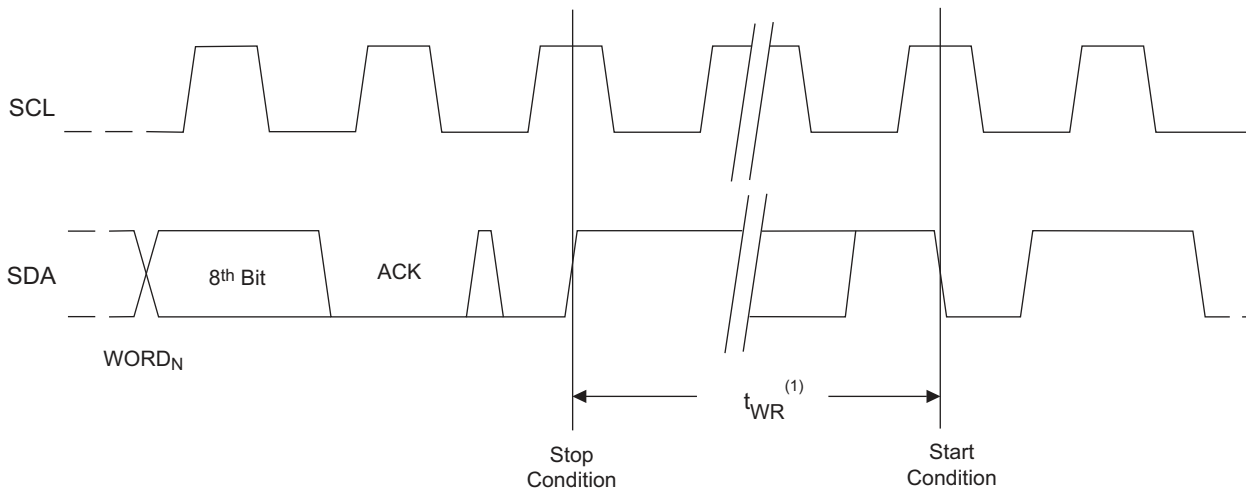


Figure 6-6. Write Cycle Timing



Note: 1. The Write cycle time t_{WR} is the time from a valid Stop condition of a Write sequence to the end of the internal Clear/Write cycle.

7. Device Addressing

The 32K EEPROM requires an 8-bit device address word following a Start condition to enable the chip for a Read or Write operation. The device address word consists of a mandatory '1010' sequence for the first four most significant bits which is known as the device type identifier. These four bits are bit 7, bit 6, bit 5, and bit 4 as seen in Figure 7-1. This is common to all 2-wire Serial EEPROM devices.

The next three bits are the A2, A1, and A0 hardware address select bits which allow as many as eight devices on the same bus. These bits must compare to their corresponding hard wired input pins, A_2, A_1, and A_0. The A_2, A_1, and A_0 pins use an internal proprietary circuit that biases them to a logic low condition if the pins are allowed to float.

When utilizing the 5-ball WLCSP or the 5-lead SOT-23 packages, the A_2, A_1, and A_0 pins are not available. The A_2, A_1, and A_0 pins are internally pulled to ground and thus the A2, A1, and A0 device address bits must always be set to a Logic 0 to communicate with the device. This condition is depicted in Figure 7-1 below.

The eighth bit of the device address is the Read/write operation select bit. A Read operation is initiated if this bit is a Logic 1, and a Write operation is initiated if this bit is a Logic 0.

Upon a successful comparison of the device address, the EEPROM will output a zero during the following clock cycle. If a compare is not made, the device will not acknowledge and will instead return to a standby state.

Figure 7-1. Device Addressing

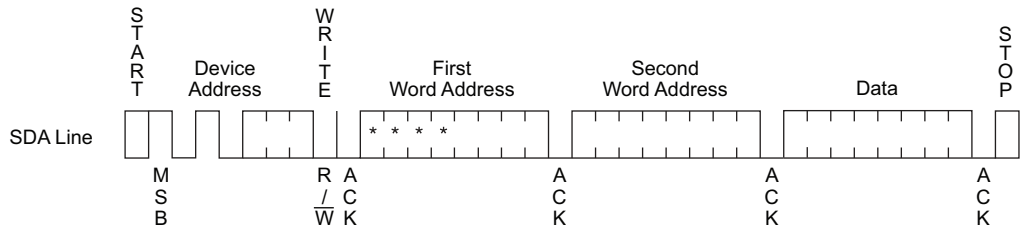
Package	Device Type Identifier				Hardware Address Select Bits			R/W Select
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
SOIC, TSSOP, UDFN, XDFN, and VFBGA	1	0	1	0	A2	A1	A0	R/$\overline{W}$
SOT-23 and WLCSP	1	0	1	0	0	0	0	R/$\overline{W}$
	MSB							LSB

Data Security: The AT24C32D has a hardware data protection scheme that allows the user to write protect the whole memory when the WP pin is at V_{CC}.

8. Write Operations

Byte Write: A Write operation requires two 8-bit data word addresses following the device address word and acknowledgment. Upon receipt of this address, the EEPROM will again respond with a zero then clock in the first 8-bit data word. Following receipt of the 8-bit data word, the EEPROM will output a zero. The addressing device, such as a microcontroller, must then terminate the write sequence with a Stop condition. At this time, the EEPROM enters an internally-timed Write cycle, t_{WR}, to the nonvolatile memory (See Figure 6-6). All inputs are disabled during this Write cycle and the EEPROM will not respond until the Write is complete.

Figure 8-1. Byte Write



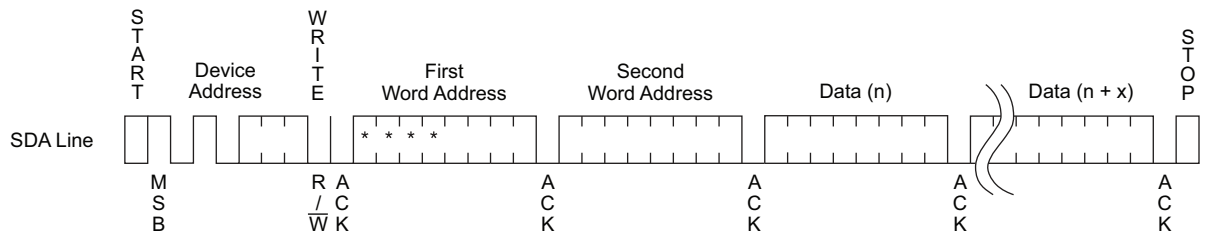
Note: * = Don't care bit.

Page Write: The 32K EEPROM is capable of 32-byte Page Writes.

A Page Write is initiated the same way as a Byte Write, but the microcontroller does not send a Stop condition after the first data word is clocked in. Instead, after the EEPROM acknowledges receipt of the first data word, the microcontroller can transmit up to 31 more data words. The EEPROM will respond with a zero after each data word received. The microcontroller must terminate the Page Write sequence with a Stop condition.

The data word address lower five bits are internally incremented following the receipt of each data word. The higher data word address bits are not incremented, retaining the memory page row location. When the word address, internally generated, reaches the page boundary, the following byte is placed at the beginning of the same page. If more than 32 data words are transmitted to the EEPROM, the data word address will roll-over and the previously loaded data will be altered. The address roll-over during Write is from the last byte of the current page to the first byte of the same page.

Figure 8-2. Page Write



Note: * = Don't care bit.

Acknowledge Polling: Once the internally-timed Write cycle has started and the EEPROM inputs are disabled, acknowledge polling can be initiated. This involves sending a Start condition followed by the device address word. The Read/Write bit is representative of the operation desired. Only if the internal Write cycle has completed will the EEPROM respond with a zero, allowing the Read or Write sequence to continue.

9. Read Operations

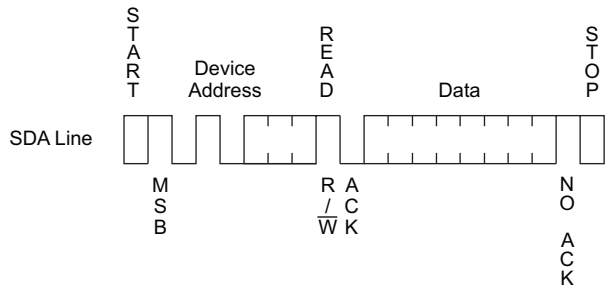
Read operations are initiated the same way as Write operations with the exception that the Read/Write select bit in the device address word is set to one. There are three Read operations:

- Current Address Read
- Random Address Read
- Sequential Read

Current Address Read: The internal data word address counter maintains the last address accessed during the last Read or Write operation, incremented by one. This address stays valid between operations as long as the chip power is maintained. The address roll-over during read is from the last byte of the last memory page, to the first byte of the first page.

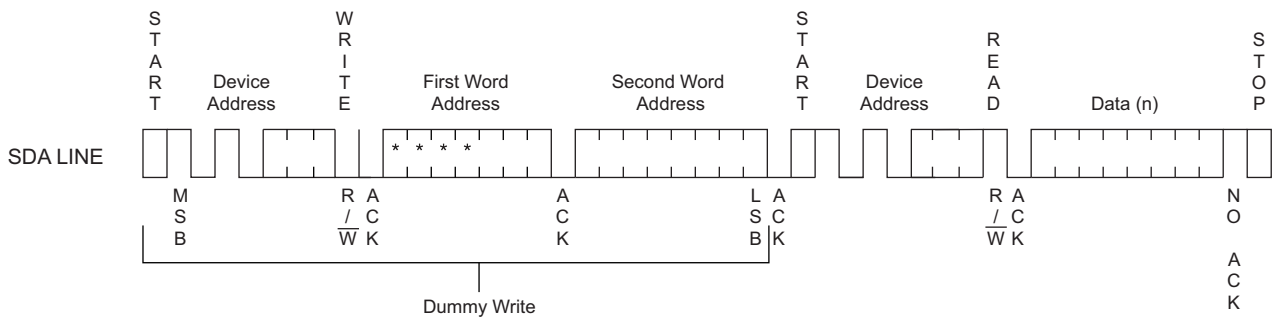
Once the device address with the Read/Write select bit set to one is clocked in and acknowledged by the EEPROM, the current address data word is serially clocked out. The microcontroller does not respond with an zero but does generate a Stop condition.

Figure 9-1. Current Address Read



Random Read: A Random Read requires a dummy Byte Write sequence to load in the data word address. Once the device address word and data word address are clocked in and acknowledged by the EEPROM, the microcontroller must generate another Start condition. The microcontroller now initiates a Current Address Read by sending a device address with the Read/write select bit high. The EEPROM acknowledges the device address and serially clocks out the data word. The microcontroller does not respond with a zero but does generate a Stop condition.

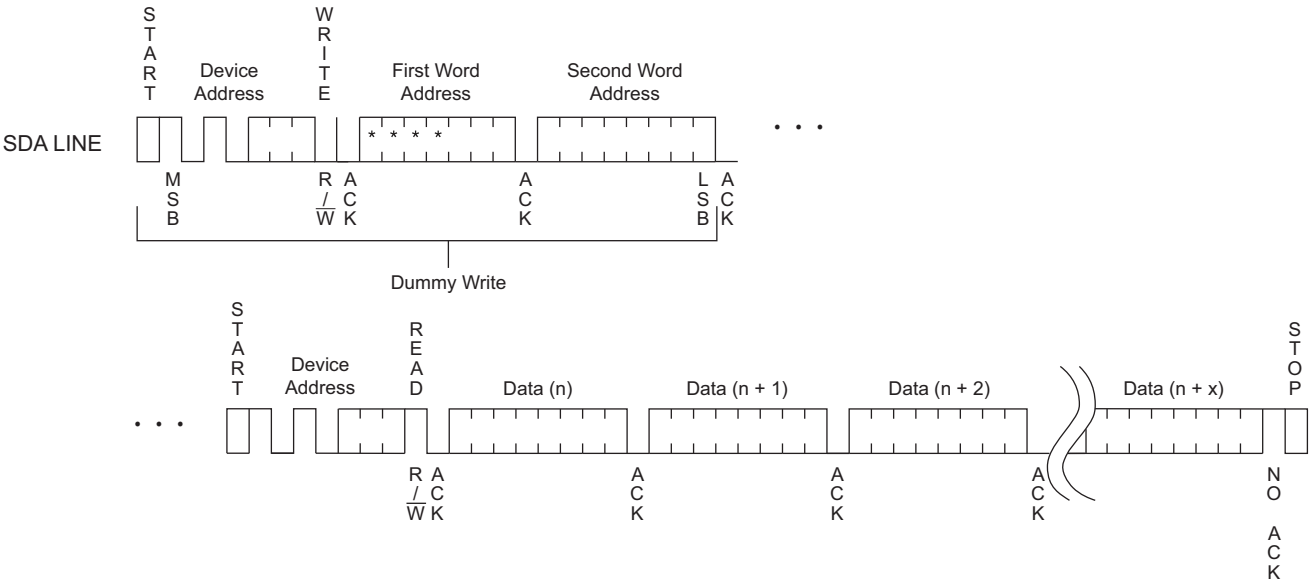
Figure 9-2. Random Read



Note: * = Don't care bit.

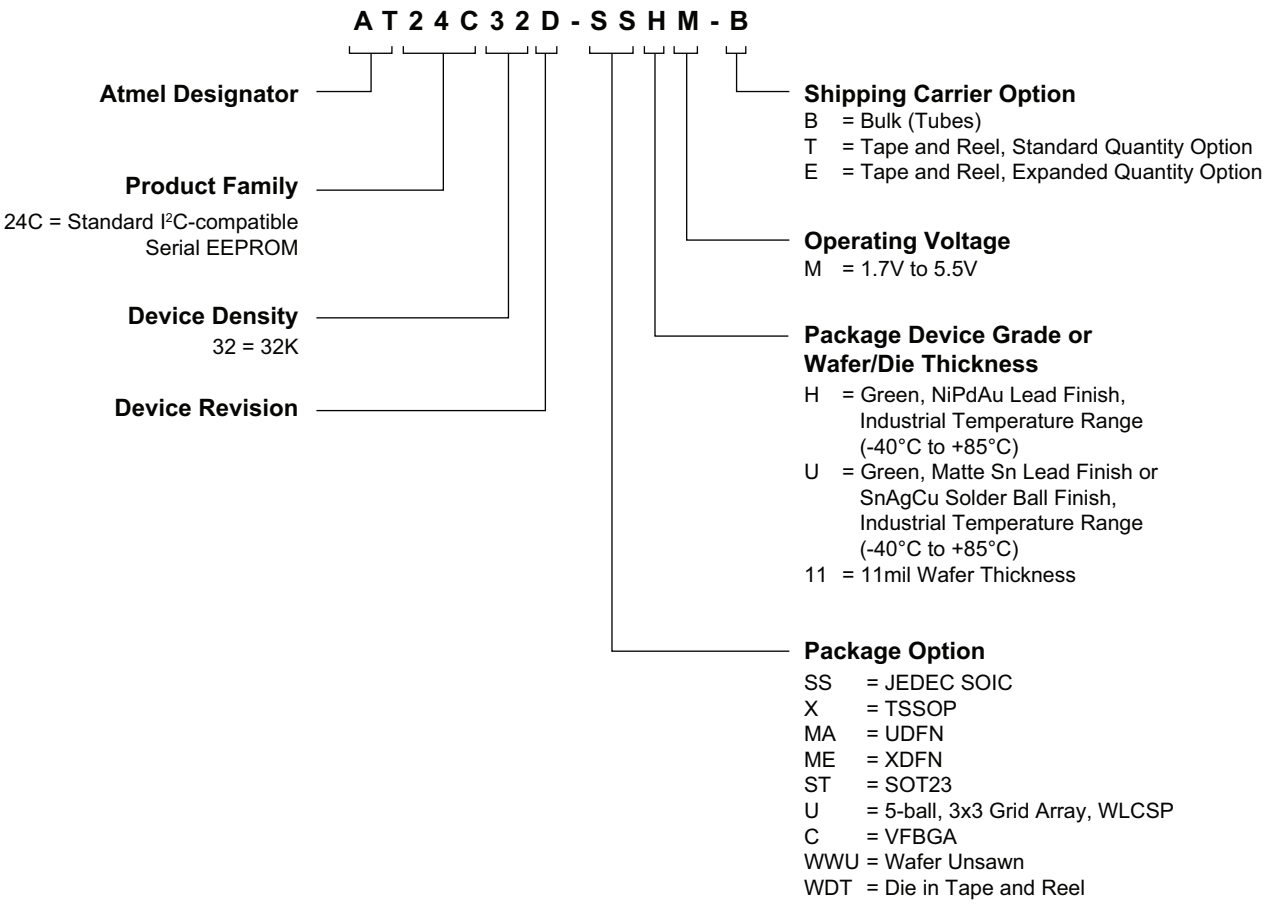
Sequential Read: Sequential Reads are initiated by either a Current Address Read or a Random Address Read. After the microcontroller receives a data word, it responds with an acknowledge. As long as the EEPROM receives an acknowledge, it will continue to increment the data word address and serially clock out sequential data words. When the memory address maximum address is reached, the data word address will roll-over and the Sequential Read will continue from the beginning of the array. The Sequential Read operation is terminated when the microcontroller does not respond with a zero but does generate a Stop condition.

Figure 9-3. Sequential Read



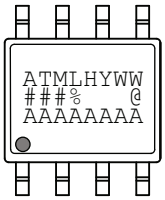
Note: * = Don’t care bit.

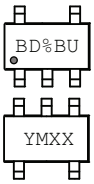
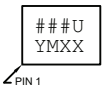
10. Ordering Code Detail



11. Part Markings

AT24C32D: Package Marking Information

8-lead SOIC	8-lead TSSOP	8-pad UDFN	8-pad XDFN
		2.0 x 3.0 mm Body 	1.8 x 2.2 mm Body 

5-lead SOT-23	5-ball WLCSP	8-ball VFBGA
 Top Mark Bottom Mark		1.5 x 2.0 mm Body 

Note 1: ● designates pin 1
Note 2: Package drawings are not to scale

Catalog Number Truncation			
AT24C32D		Truncation Code ###: 32D	
Date Codes			**Voltages**
Y = Year	M = Month	WW = Work Week of Assembly	% = Minimum Voltage
4: 2014 8: 2018 5: 2015 9: 2019 6: 2016 0: 2020 7: 2017 1: 2021	A: January B: February ... L: December	02: Week 2 04: Week 4 ... 52: Week 52	M: 1.7V min
Country of Assembly	**Lot Number**		**Grade/Lead Finish Material**
@ = Country of Assembly	AAA...A = Atmel Wafer Lot Number		U: Industrial/Matte Tin/SnAgCu H: Industrial/NiPdAu
Trace Code			**Atmel Truncation**
XX = Trace Code (Atmel Lot Numbers Correspond to Code) Example: AA, AB.... YZ, ZZ			AT: Atmel ATM: Atmel ATML: Atmel

10/31/14

Atmel Package Mark Contact: DL-CSO-Assy_eng@atmel.com	**TITLE** **24C32DSM**, AT24C32D Package Marking Information	**DRAWING NO.** 24C32DSM	**REV.** B

12. Ordering Information

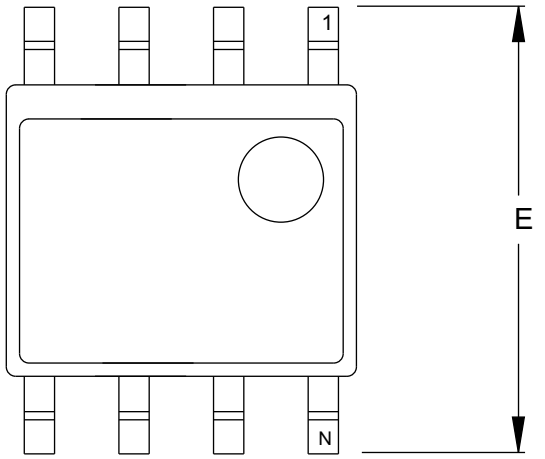
Atmel Ordering Code	Lead Finish	Package	Delivery Information		Operating Range
			Form	Quantity	
AT24C32D-SSHM-B	NiPdAu (Lead-free/Halogen-free)	8S1	Bulk (Tubes)	100 per Tube	Industrial Temperature (-40°C to 85°C)
AT24C32D-SSHM-T			Tape and Reel	4,000 per Reel	
AT24C32D-XHM-B		8X	Bulk (Tubes)	100 per Tube	
AT24C32D-XHM-T			Tape and Reel	5,000 per Reel	
AT24C32D-MAHM-T		8MA2	Tape and Reel	5,000 per Reel	
AT24C32D-MAHM-E			Tape and Reel	15,000 per Reel	
AT24C32D-MEHM-T		8ME1	Tape and Reel	5,000 per Reel	
AT24C32D-STUM-T	Matte Tin (Lead-free/Halogen-free)	5TS1	Tape and Reel	5,000 per Reel	
AT24C32D-UUM-T(1)	SnAgCu (Lead-free/Halogen-free)	5U-3	Tape and Reel	5,000 per Reel	
AT24C32D-CUM-T		8U2-1	Tape and Reel	5,000 per Reel	
AT24C32D-WWU11M(2)	N/A	Wafer Sale	Note 2		

Notes:
1. WLCSP Package: **CAUTION**: Exposure to ultraviolet (UV) light can degrade the data stored in the EEPROM cells. Therefore, customers who use a WLCSP product must ensure that exposure to ultraviolet light does ***not*** occur.
2. Contact Atmel Sales for Wafer sales.

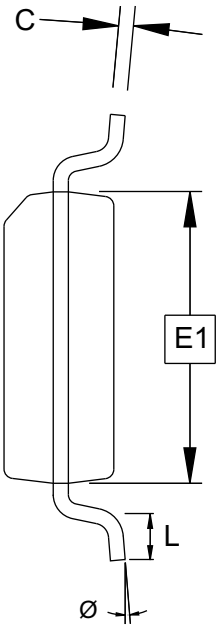
Package Type	
8S1	8-lead, 0.150” wide, Plastic Gull Wing Small Outline (JEDEC SOIC)
8X	8-lead, 4.40mm body, Plastic Thin Shrink Small Outline Package (TSSOP)
8MA2	8-pad, 2.00mm x 3.00mm body, 0.50mm pitch, Dual No Lead (UDFN)
8ME1	8-pad, 1.80mm x 2.20mm body, 0.40mm pitch, Extra Thin DFN (XDFN)
5TS1	5-lead, 2.90mm x 1.60mm Plastic Think Shrink Small Outline (SOT23)
5U-3	5-ball, 3x3 Grid Array, Wafer Level Chip Scale Package (WLCSP)
8U2-1	8-ball, Die Ball Grid Array (VFBGA)

13. Packaging Information

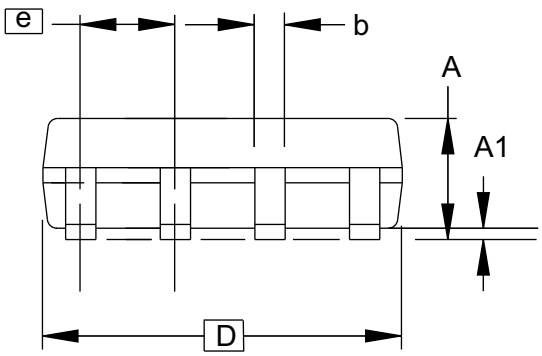
13.1 8S1 — 8-lead JEDEC SOIC



TOP VIEW



END VIEW



SIDE VIEW

Notes: This drawing is for general information only.
Refer to JEDEC Drawing MS-012, Variation AA
for proper dimensions, tolerances, datums, etc.

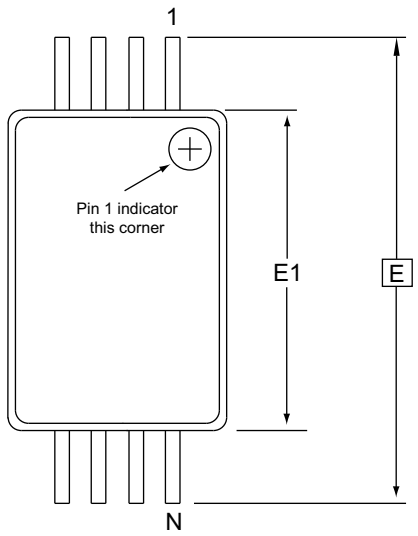
COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	1.35	–	1.75	
A1	0.10	–	0.25	
b	0.31	–	0.51	
C	0.17	–	0.25	
D	4.80	–	5.05	
E1	3.81	–	3.99	
E	5.79	–	6.20	
e	1.27 BSC			
L	0.40	–	1.27	
Ø	0°	–	8°	

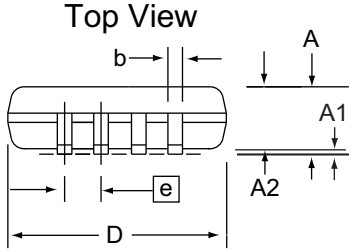
6/22/11

Atmel Package Drawing Contact: packagedrawings@atmel.com	**TITLE** 8S1, 8-lead (0.150” Wide Body), Plastic Gull Wing Small Outline (JEDEC SOIC)	**GPC** SWB	**DRAWING NO.** 8S1	**REV.** G

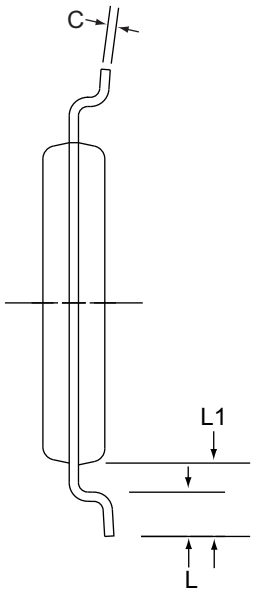
13.2 8X — 8-lead TSSOP



Top View



Side View



End View

Notes:
1. This drawing is for general information only. Refer to JEDEC Drawing MO-153, Variation AA, for proper dimensions, tolerances, datums, etc.
2. Dimension D does not include mold Flash, protrusions or gate burrs. Mold Flash, protrusions and gate burrs shall not exceed 0.15mm (0.006in) per side.
3. Dimension E1 does not include inter-lead Flash or protrusions. Inter-lead Flash and protrusions shall not exceed 0.25mm (0.010in) per side.
4. Dimension b does not include Dambar protrusion. Allowable Dambar protrusion shall be 0.08mm total in excess of the b dimension at maximum material condition. Dambar cannot be located on the lower radius of the foot. Minimum space between protrusion and adjacent lead is 0.07mm.
5. Dimension D and E1 to be determined at Datum Plane H.

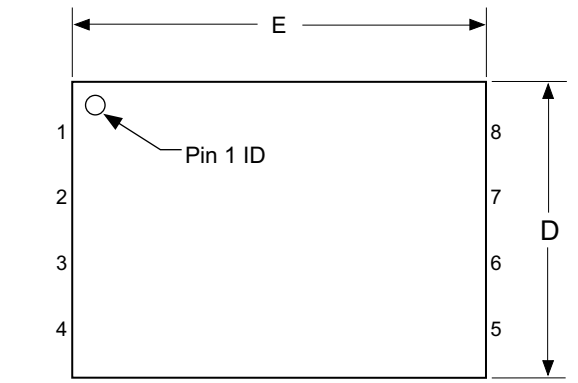
COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	-	-	1.20	
A1	0.05	-	0.15	
A2	0.80	1.00	1.05	
D	2.90	3.00	3.10	2, 5
E		6.40 BSC		
E1	4.30	4.40	4.50	3, 5
b	0.19	0.25	0.30	4
e		0.65 BSC		
L	0.45	0.60	0.75	
L1		1.00 REF		
C	0.09	-	0.20	

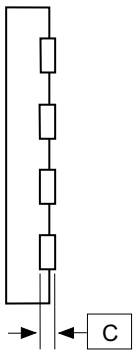
2/27/14

Atmel Package Drawing Contact: packagedrawings@atmel.com	TITLE 8X, 8-lead 4.4mm Body, Plastic Thin Shrink Small Outline Package (TSSOP)	GPC TNR	DRAWING NO. 8X	REV. E

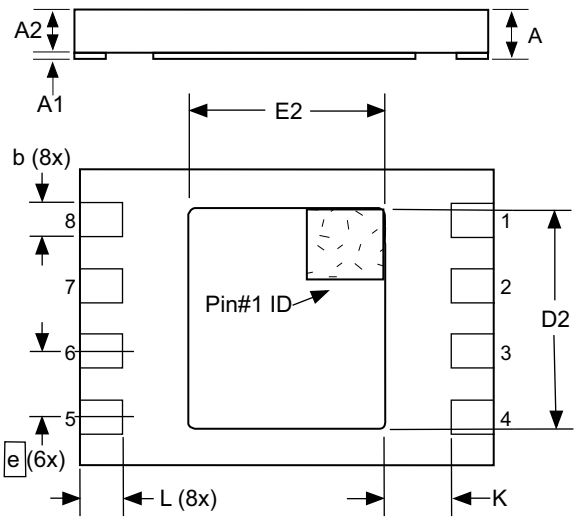
13.3 8MA2 — 8-pad UDFN



TOP VIEW



SIDE VIEW



BOTTOM VIEW

Notes:
1. This drawing is for general information only. Refer to Drawing MO-229, for proper dimensions, tolerances, datums, etc.
2. The Pin #1 ID is a laser-marked feature on Top View.
3. Dimensions b applies to metallized terminal and is measured between 0.15 mm and 0.30 mm from the terminal tip. If the terminal has the optional radius on the other end of the terminal, the dimension should not be measured in that radius area.
4. The Pin #1 ID on the Bottom View is an orientation feature on the thermal pad.

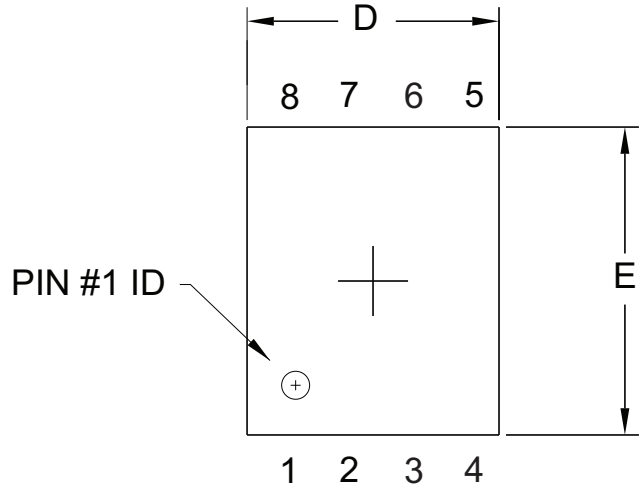
COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	0.50	0.55	0.60	
A1	0.0	0.02	0.05	
A2	-	-	0.55	
D	1.90	2.00	2.10	
D2	1.40	1.50	1.60	
E	2.90	3.00	3.10	
E2	1.20	1.30	1.40	
b	0.18	0.25	0.30	3
C	1.52 REF			
L	0.30	0.35	0.40	
e	0.50 BSC			
K	0.20	-	-	

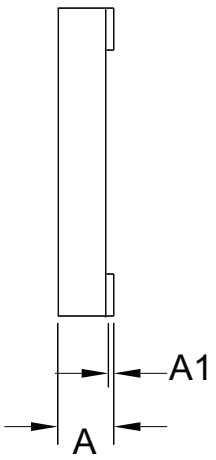
11/26/14

Atmel Package Drawing Contact: packagedrawings@atmel.com	**TITLE** 8MA2, 8-pad 2 x 3 x 0.6mm Body, Thermally Enhanced Plastic Ultra Thin Dual Flat No-Lead Package (UDFN)	**GPC** YNZ	**DRAWING NO.** 8MA2	**REV.** G

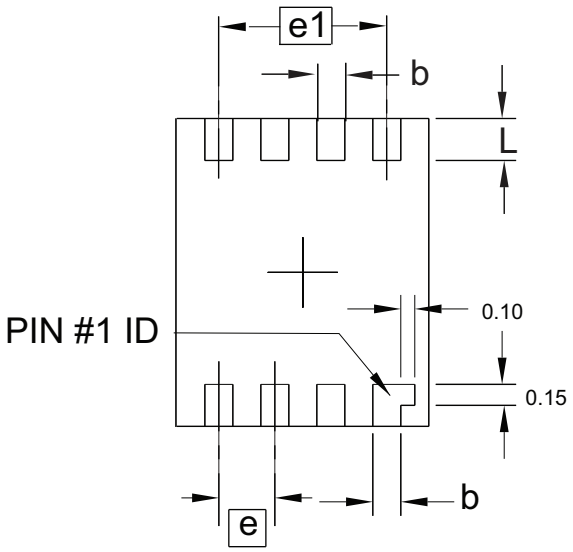
13.4 8ME1 — 8-pad XDFN



Top View



Side View



End View

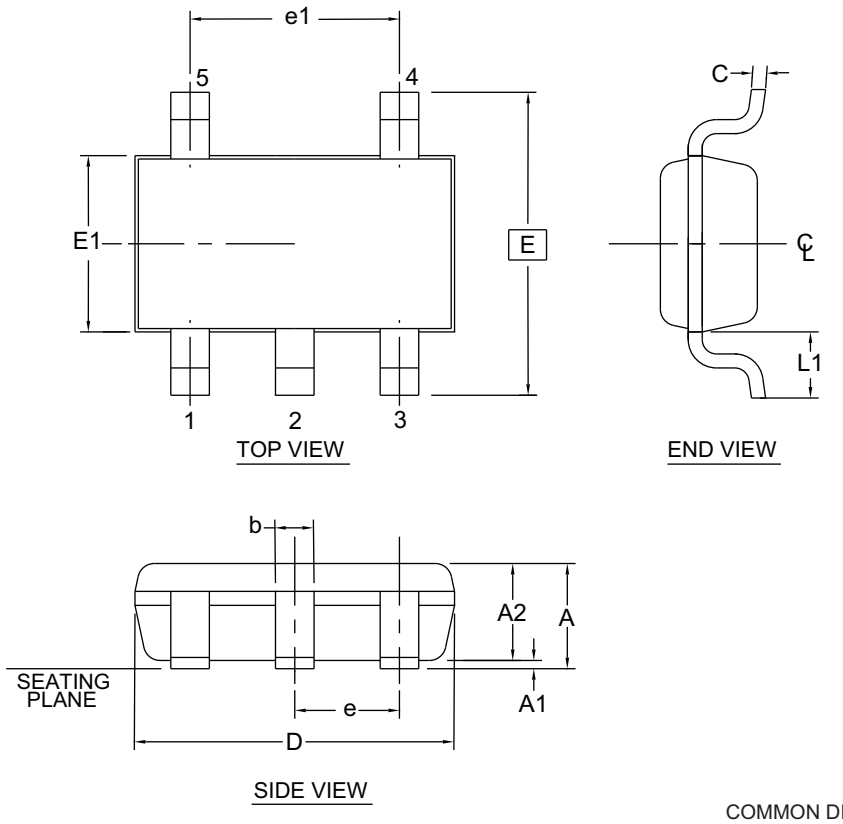
COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	0.40	
A1	0.00	–	0.05	
D	1.70	1.80	1.90	
E	2.10	2.20	2.30	
b	0.15	0.20	0.25	
e	0.40 TYP			
e1	1.20 REF			
L	0.26	0.30	0.35	

9/10/2012

Atmel Package Drawing Contact: packagedrawings@atmel.com	TITLE **8ME1**, 8-pad (1.80mm x 2.20mm body) Extra Thin DFN (XDFN)	GPC DTP	DRAWING NO. 8ME1	REV. B

13.5 5TS1 — 5-lead SOT23



1. Dimension D does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.15 mm per end. Dimension E1 does not include interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.15 mm per side.
2. The package top may be smaller than the package bottom. Dimensions D and E1 are determined at the outermost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body.
3. These dimensions apply to the flat section of the lead between 0.08 mm and 0.15 mm from the lead tip.
4. Dimension "b" does not include dambar protrusion. Allowable dambar protrusion shall be 0.08 mm total in excess of the "b" dimension at maximum material condition. The dambar cannot be located on the lower radius of the foot. Minimum space between protrusion and an adjacent lead shall not be less than 0.07 mm.

This drawing is for general information only. Refer to JEDEC Drawing MO-193, Variation AB for additional information.

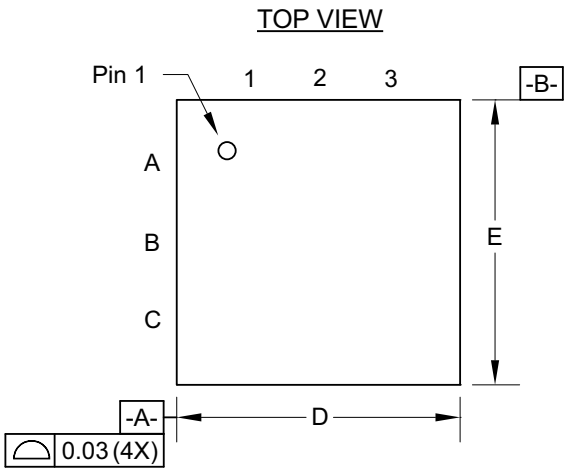
COMMON DIMENSIONS
(Unit of Measure = mm)

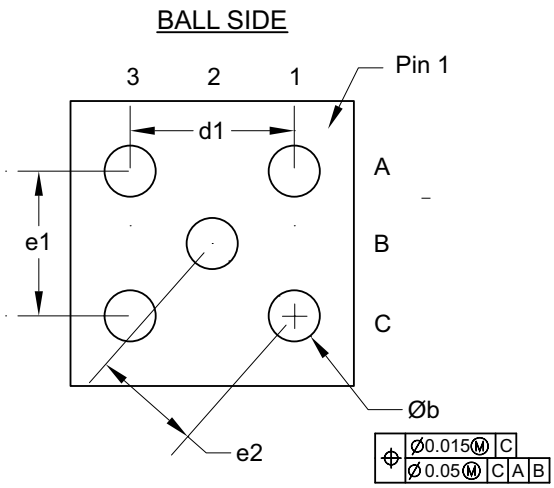
SYMBOL	MIN	NOM	MAX	NOTE
A	-	-	1.00	
A1	0.00	-	0.10	
A2	0.70	0.90	1.00	
c	0.08	-	0.20	3
D	2.90 BSC			1,2
E	2.80 BSC			1,2
E1	1.60 BSC			1,2
L1	0.60 REF			
e	0.95 BSC			
e1	1.90 BSC			
b	0.30	-	0.50	3,4

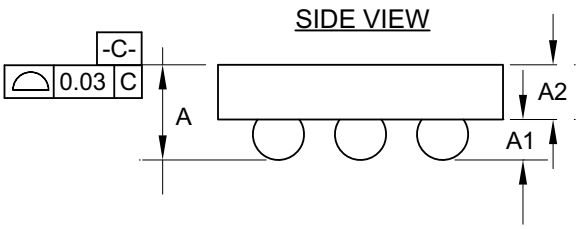
5/31/12

Atmel Package Drawing Contact: packagedrawings@atmel.com	TITLE 5TS1, 5-lead 1.60mm Body, Plastic Thin Shrink Small Outline Package (Shrink SOT)	GPC TSZ	DRAWING NO. 5TS1	REV. D

13.6 5U-3 — 5-ball, WLCSP







PIN ASSIGNMENT MATRIX

	1	2	3
A	GND	n/a	SDA
B	n/a	SCL	n/a
C	WP	n/a	V_{CC}

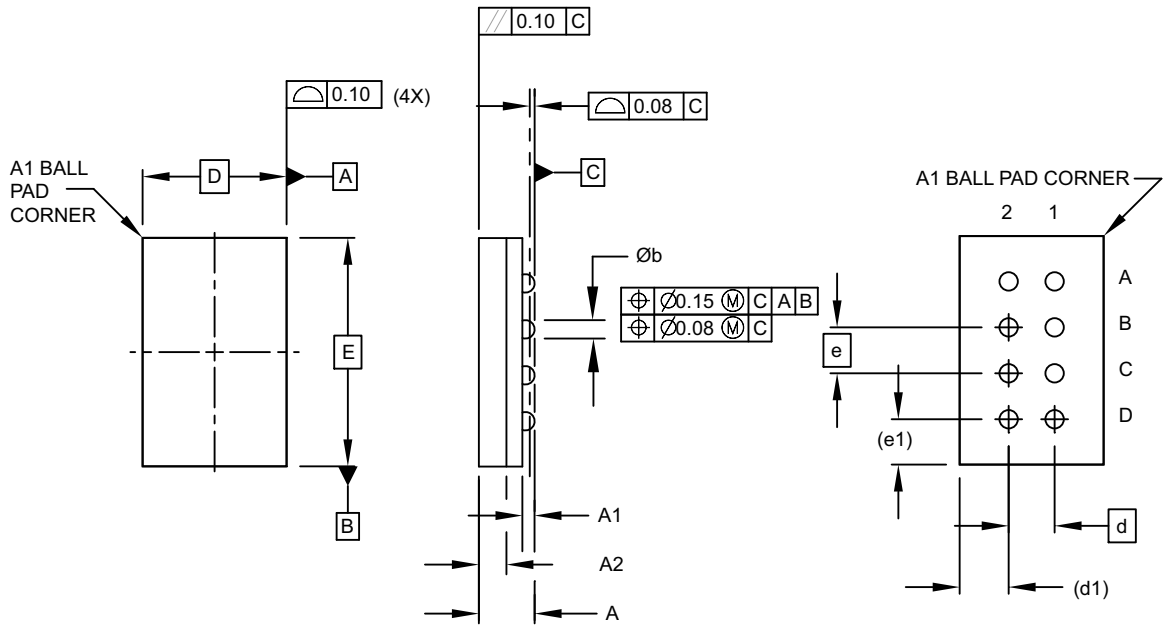
COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	TYP	MAX	NOTE
A	0.270	0.309	0.348	
A1	0.078	-	0.139	
A2	0.175	0.200	0.225	
E	Contact Atmel for details			
e1	0.529			
e2	0.400			
D	Contact Atmel for details			
d1	0.600			
b	0.148	0.168	0.188	

7/25/13

Atmel Package Drawing Contact: packagedrawings@atmel.com	TITLE 5U-3, 5-ball Wafer Level Chip Scale Package (WLCSP) - AT24C32D	GPC GCQ	DRAWING NO. 5U-3	REV. A

13.7 8U2-1 — 8-ball VFBGA



COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	0.81	0.91	1.00	
A1	0.15	0.20	0.25	
A2	0.40	0.45	0.50	
b	0.25	0.30	0.35	
D	2.35 BSC			
E	3.73 BSC			
e	0.75 BSC			
e1	0.74 REF			
d	0.75 BSC			
d1	0.80 REF			

Notes:

1. This drawing is for general
2. Dimension 'b' is measured at the maximum solder ball diameter.
3. Solder ball composition shall be 95.5Sn-4.0Ag-.5Cu.

6/11/13

Atmel Package Drawing Contact: packagedrawings@atmel.com	TITLE 8U2-1, 8-ball, 2.35 x 3.73 mm Body, 0.75 mm pitch, Very Thin, Fine-Pitch Ball Grid Array Package (VFBGA)	GPC GWW	DRAWING NO. 8U2-1	REV. G

14. Revision History

Doc. Rev.	Date	Comments
8866B	01/2015	Add the UDFN Expanded Quantity Option. Update the 8X and 8MA2 package outline drawings, the part markings page, and the ordering information section.
8866A	08/2013	Split AT24C32D from AT24C64D due to growing differences in package offerings. Add 5-ball WLCSP package. Update template and Atmel logos.

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