AT24C01C, AT24C02C, AT24C04C, AT24C08C

I^{2}C Automotive Temperature Serial EEPROMs
1K (128 x 8), 2K (256 x 8), 4K (512 x 8), 8K (1,024 x 8)

DATASHEET

Features

- 2-Wire Serial Interface Compatible with I^{2}C
- Internally Organized 128 x 8 (1K), 256 x 8 (2K), 512 x 8 (4K), or 1,024 x 8 (8K)
- Low-voltage, Medium-voltage, and High-voltage Operation
  - Grade 1, V_{CC} = 2.5V to 5.5V
  - Grade 2[1] and 3, V_{CC} = 1.7V to 5.5V
- Extended Temperature Range (Grade 1, 2[1], and 3 as defined in AEC-Q100)
  - Grade 1 Temperature Range: -40°C to 125°C
  - Grade 2 Temperature Range[1]: -40°C to 105°C
  - Grade 3 Temperature Range: -40°C to 85°C
- Schmitt Trigger, Filtered Inputs for Noise Suppression
- Bidirectional Data Transfer Protocol
- 400kHz (2.5V) Compatibility
- Write Protect Pin for Hardware Data Protection
- 8-byte Page (1K, 2K) or 16-byte Page (4K, 8K) Write Modes
- Partial Page Writes are Allowed
- Self-timed Write Cycle (5ms Max)
- High Reliability
  - Endurance: 1,000,000 Write Cycles
  - Data Retention: 100 Years
- 8-lead JEDEC SOIC, 8-lead TSSOP, and 8-pad UDFN Packages

Note: 1.   Contact Sales for Grade 2 Availability

Description

The Atmel® AT24C01C/02C/04C/08C provides 1,024/2,048/4,096/8,192 bits of Serial Electrically Erasable and Programmable Read-Only Memory (EEPROM) organized as 128/256/512/1,024 words of eight bits each. The device is optimized for use in many automotive applications where low-power and low-voltage operation are essential. AT24C01C/02C/04C/08C is available in space-saving 8-lead JEDEC SOIC, 8-lead TSSOP, and 8-pad UDFN packages and is accessed via a 2-wire serial interface. In addition, the entire family is available in from 2.5 to 5.5V for Grade 1 or 1.7 to 5.5V) for Grade 2[1] and 3.
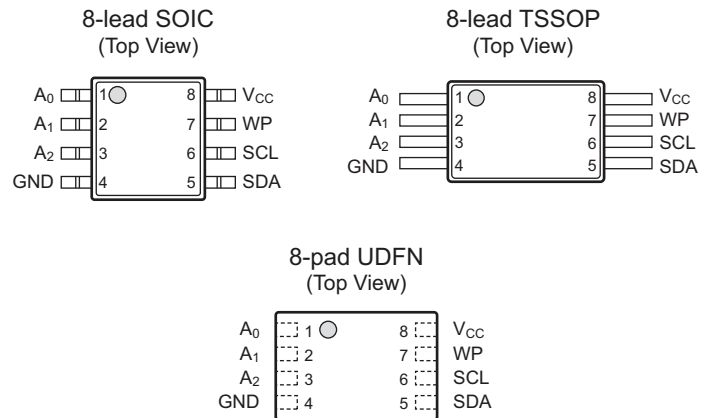
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1. Pin Configurations and Pinouts

Table 1-1.   **Pin Configurations**

Pin Name	Function
A_0	Address Input (1K and 2K)
A_1	Address Input (1K, 2K, and 4K)
A_2	Address Input (1K, 2K, 4K, and 8K)
GND	Ground
SDA	Serial Data
SCL	Serial Clock Input
WP	Write Protect
V_{CC}	Device Power Supply

8-lead SOIC (Top View)

8-lead TSSOP (Top View)

8-pad UDFN (Top 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. . . . .-1.00V to +7.00V

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 is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

3. Block Diagram

Figure 3-1. Block Diagram
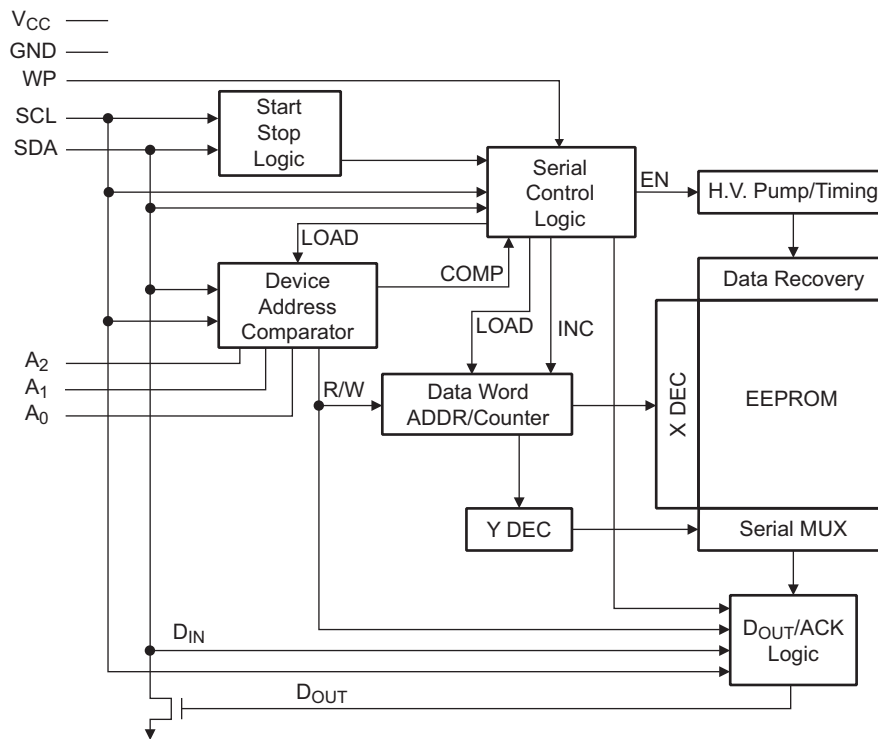
4. Pin Description

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 bi-directional 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/Page Addresses (A2, A1, A0): The A_2, A_1, and A_0 pins are device address inputs that are hard wired for the AT24C01C/02C/04C/08C. As many as eight 1K/2K devices may be addressed on a single bus system (device addressing is discussed in detail in Section 6. "Device Operation").

The AT24C04C uses the A_2 and A_1 inputs for hardwire addressing and a total of four 4K devices may be addressed on a single bus system. The A_0 pin is a no connect.

The AT24C08C only uses the A_2 input for hardwire addressing and a total of two 8K devices may be addressed on a single bus system. The A_0 and A_1 pins are no connect.

Write Protect (WP): AT24C01C/02C/04C/08C has a Write Protect pin that provides hardware data protection. The Write Protect pin allows normal read/write operations when connected to ground (GND). When the Write Protect pin is connected to V_{CC}, the write protection feature is enabled and operates as shown in the following table.

Figure 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

AT24C01C, 1K Serial EEPROM: Internally organized with 16 pages of 8 bytes each, the 1K requires a 7-bit data Word Address for random word addressing.

AT24C02C, 2K Serial EEPROM: Internally organized with 32 pages of 8 bytes each, the 2K requires an 8-bit data Word Address for random word addressing.

AT24C04C, 4K Serial EEPROM: Internally organized with 32 pages of 16 bytes each, the 4K requires a 9-bit data Word Address for random word addressing.

AT24C08C, 8K Serial EEPROM: Internally organized with 64 pages of 16 bytes each, the 8K requires a 10-bit data Word Address for random word addressing.

5.1 Pin Capacitance

Table 5-1. Pin Capacitance[1]

Applicable over recommended operating range from T_A = 25°C, f = 400KHz, V_{CC} = 2.5V.

Symbol	Test Condition	Max	Units	Conditions
$C_{I/O}$	Input/Output Capacitance (SDA)	8	pF	$V_{I/O}$ = 0V
C_{IN}	Input Capacitance (A0, A1, A2, 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_A = -40°C to +125°C, V_{CC1} = 2.5V to 5.5V and T_{A2} = -40°C to 105°C, V_{CC2} = 1.7V to 5.5V.

Symbol	Parameter	Test Condition		Min	Typ	Max	Units
V_{CC1}	Supply Voltage	Grade 1		2.5		5.5	V
V_{CC2}		Grade 2[2] and 3		1.7		5.5	
I_{CC}	Supply Current	V_{CC} = 5.0V	Read at 100kHz		0.4	1.0	mA
I_{CC}			Write at 100kHz		2.0	3.0	
I_{SB1}	Standby Current	V_{CC} = 1.7V	V_{IN} = V_{CC} or V_{SS}		0.1	3.0	µA
I_{SB2}		V_{CC} = 2.5V			1.6	4.0	
I_{SB3}		V_{CC} = 5.0V			4.0	6.0	
I_{LI}	Input Leakage Current	V_{IN} = V_{CC} or V_{SS}			0.10	3.0	µA
I_{LO}	Output Leakage Current	V_{OUT} = V_{CC} or V_{SS}			0.05	3.0	
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_{OL1}	Output Low-voltage	V_{CC} = 2.5V	I_{OL} = 3.00mA			0.4	V
V_{OH1}	Output High-voltage		I_{OH} = -1.60mA	V_{CC} – 0.8			
V_{OL2}	Output Low-voltage	V_{CC} = 1.7V	I_{OL} = 0.15mA			0.2	V
V_{OH2}	Output High-voltage		I_{OH} = -100µA	V_{CC} – 0.2			

Notes: 1. V_{IL} min and V_{IH} max are reference only and are not tested.
        2. Contact Sales for Grade 2 Availability

AT24C01C/02C/04C/08C Automotive [DATASHEET]
Atmel-8819C-SEEPROM-AT24C01C-02C-04C-08C-Auto-Datasheet_092016

5.3 AC Characteristics

Table 5-3. **AC Characteristics**

Applicable over recommended operating range from T_A = -40°C to +125°C, V_{CC} = +1.7V to +5.5V, CL = 1 TTL Gate and 100pF unless otherwise noted or restricted by grade. Test conditions are listed in Note 3.

| Symbol	Parameter	Min	Max	Units
f_{SCL}	Clock Frequency, SCL		400	kHz
t_{LOW}	Clock Pulse Width Low	1200		ns
t_{HIGH}	Clock Pulse Width High	600		ns
t_I	Noise Suppression Time[1]		50	ns
t_{AA}	Clock Low to Data Out Valid	100	900	ns
t_{BUF}	Time the bus must be free before a new transmission can start[2]	1200		ns
$t_{HD.STA}$	Start Hold Time	600		ns
$t_{SU.STA}$	Start Set-up Time	600		ns
$t_{HD.DAT}$	Data In Hold Time	0		ns
$t_{SU.DAT}$	Data In Set-up Time	100		ns
t_R	Inputs Rise Time[2]		300	ns
t_F	Inputs Fall Time[2]		300	ns
$t_{SU.STO}$	Stop Set-up Time	600		ns
t_{DH}	Data Out Hold Time	50		ns
t_{WR}	Write Cycle Time		5	ms
Endurance[1]	5.0V, 25°C, Page Mode	1,000,000		Write Cycles

Notes: 1. This parameter is characterized and is not 100% tested (T_A = 25°C).
2. This parameter is characterized only.
3. AC measurement conditions:
- RL (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.
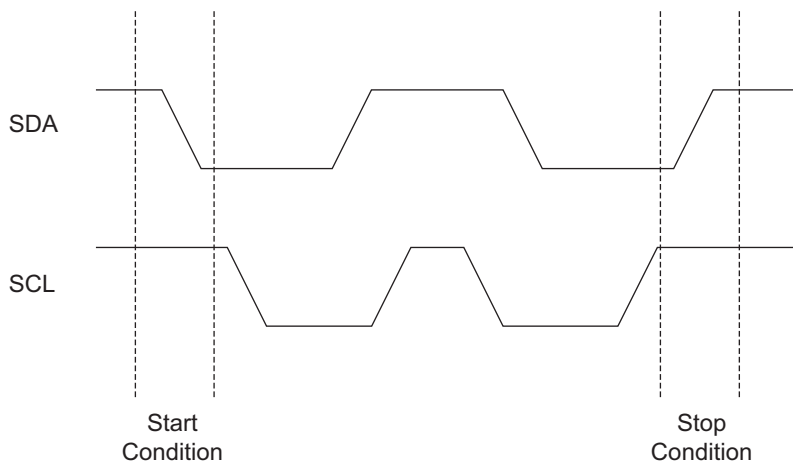
Figure 6-1.   Data Validity
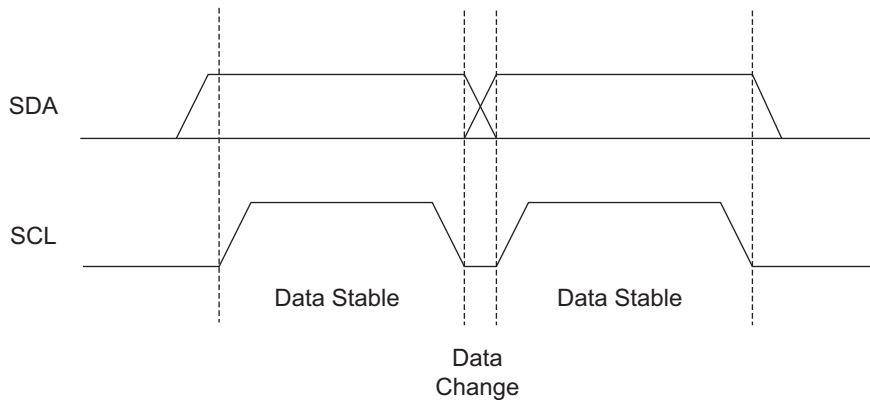
Start Condition: A high-to-low transition of SDA with SCL high is a Start condition which must precede any other command.

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 and Stop Condition

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Acknowledge: All addresses and data words are serially transmitted to and from the EEPROM in 8-bit words. The EEPROM sends a zero to acknowledge that it has received each word. When the EEPROM is reading data out, the host will transmit an ACK after each data word to indicate that the next word can be transmitted.This happens during the ninth clock cycle.

Figure 6-3.   Output Acknowledge
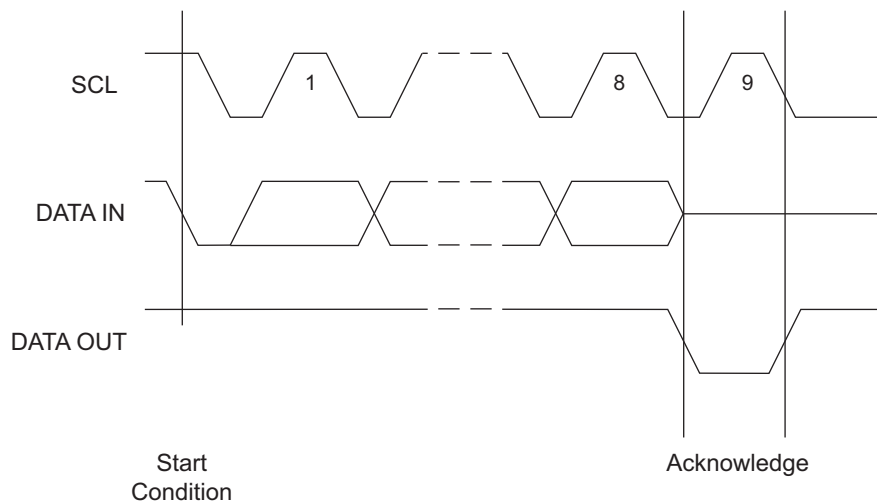
Standby Mode: AT24C01C/02C/04C/08C features a low-power standby mode which is enabled:

- Upon power-up.
- After the receipt of the Stop condition and the completion of any internal operations.

2-wire 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 in the following figures.

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
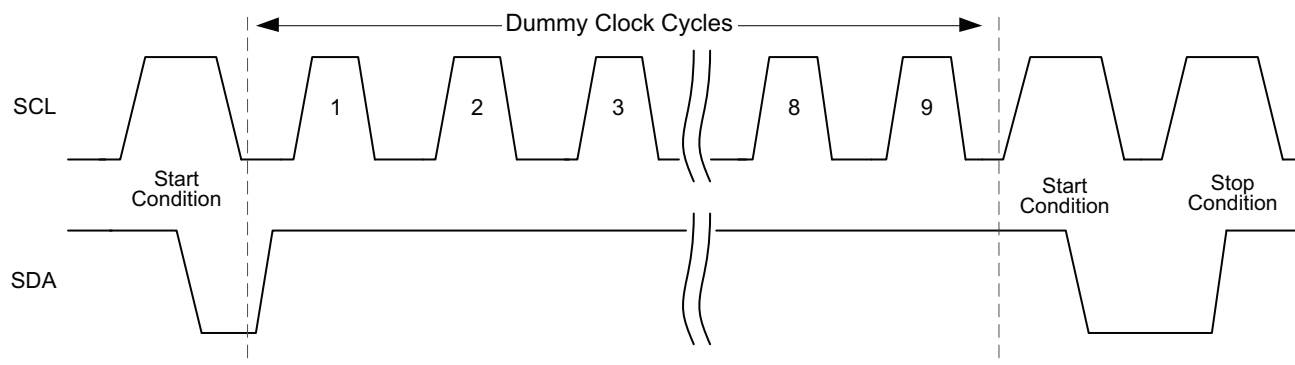
Figure 6-5.   Bus Timing

SCL: Serial Clock, SDA: Serial Data I/O
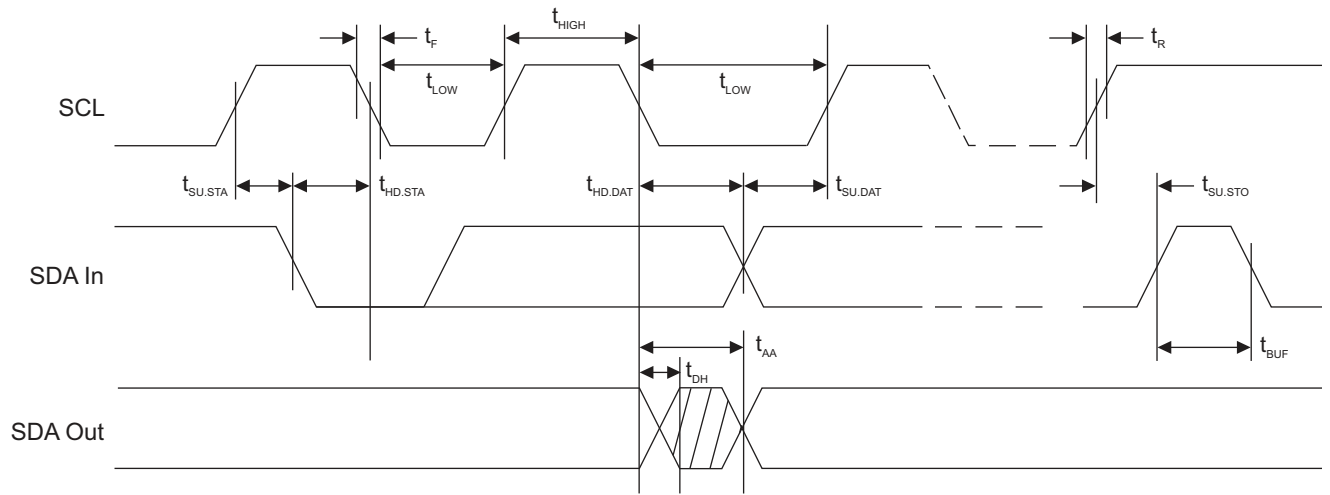
Figure 6-6.   Write Cycle Timing

SCL: Serial Clock, SDA: Serial Data I/O
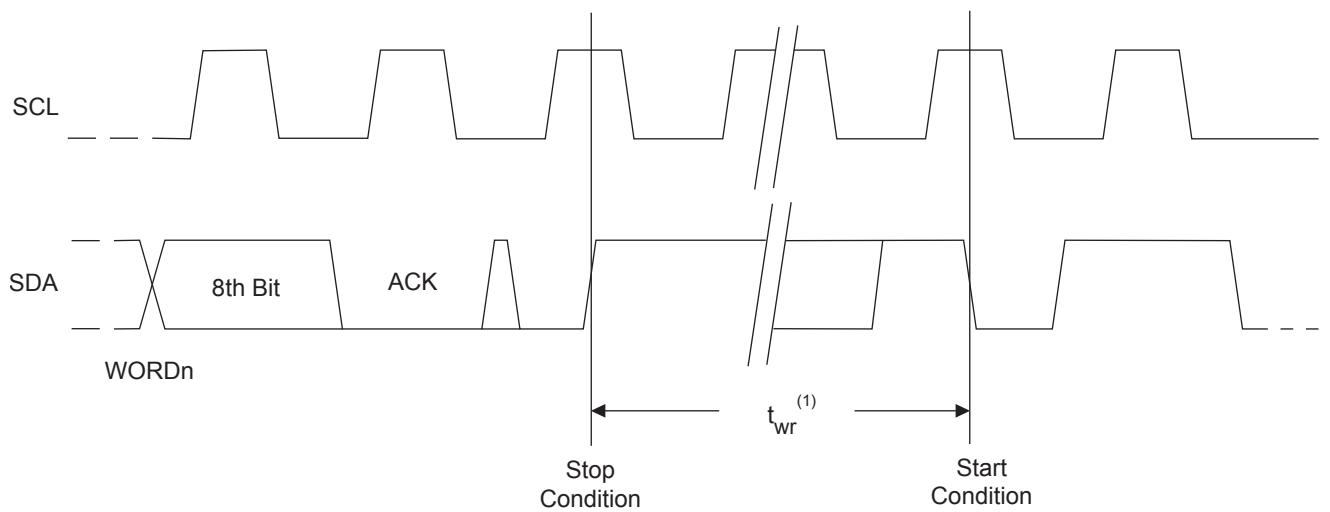
Note: 1.   The length of the self timed write cycle, or t_{WR}, is defined as the amount of time from the Stop condition that begins the internal write operation, to the Start condition of the first Device Address byte sent to the device that it subsequently responds to with an ACK.

7. Device Addressing

The 1K/2K/4K/8K EEPROM devices require an 8-bit device address word following a Start condition to enable the device for a read or write operation.

The device address word consists of a mandatory `'1010'` sequence for the first four Most Significant Bits (MSB). This is common to all the Serial EEPROM devices.

For the 1K/2K EEPROM, the next three bits are the A2, A1, and A0 device address bits. These three bits must compare to their corresponding hardwired input A_2, A_1, and A_0 pins.

The 4K EEPROM only uses the A2 and A1 device address bits with the A0 bit being a memory address bit (P0). The two device address bits must compare to their corresponding hardwired input A_2 and A_1 pins. The A_0 pin is not connected.

The 8K EEPROM only uses the A2 device address bit with the next two bits (P1, P0) being for memory page addressing. The A2 bit must compare to its corresponding hardwired input pin. The A_1 and A_0 pins are not connected.

The eighth bit of the device address is the read/write operation select bit. A read operation is initiated if this bit is high and a write operation is initiated if this bit is low.

After a valid comparison of the device address, the EEPROM will output a zero. If the comparison is invalid, the device will return to a standby state.

Figure 7-1.   Device Address

1K/2K	1	0	1	0	A2	A1	A0	R/W

MSB   LSB

4K	1	0	1	0	A2	A1	P0	R/W

8K	1	0	1	0	A2	P1	P0	R/W

8. Write Operations

Byte Write: A write operation requires an 8-bit data Word Address following the device address word and acknowledgment. Upon receipt of this address, the EEPROM will again respond with a zero and then clock in the first 8-bit data word. Following receipt of the 8-bit data word, the EEPROM will output a zero and the addressing device, such as a microcontroller, must 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. All inputs are disabled during this write cycle, and the EEPROM will not respond until the write is complete.

Figure 8-1.   Byte Write
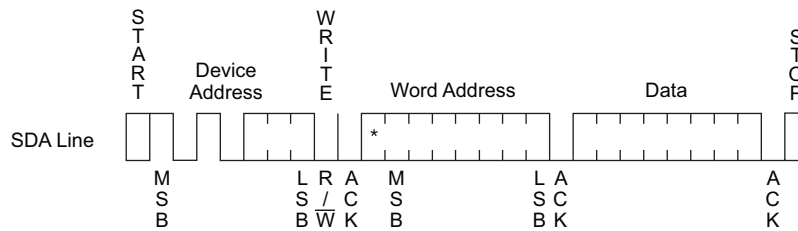
* = Don't care bit for 1K

Page Write: The 1K/2K EEPROM are capable of an 8-byte Page Write. The 4K/8K EEPROM devices are capable of 16-byte Page Writes.

A Page Write is initiated the same 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 seven (1K/2K) or fifteen (4K/ 8K) 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 three (1K/2K) or four (4K/8K) 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 next byte sent will be written to the beginning address on the same page. In order words, if more than eight (1K/2K) or sixteen (4K/8K) data words are transmitted to the EEPROM, the data Word Address will "roll over" and the data previously sent to the device at the beginning of the page write sequence will be altered.

Figure 8-2.   Page Write
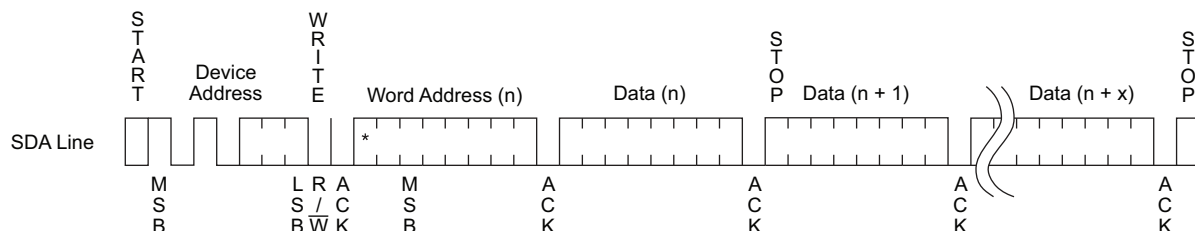
* = Don't care bit for 1K

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 state 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.

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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. The address roll-over during write is from the last byte of the current page to the first byte of the same 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. To end the command, the microcontroller does not respond with a zero but does generate a Stop condition in the subsequent clock cycle.

Figure 9-1.   Current Address Read
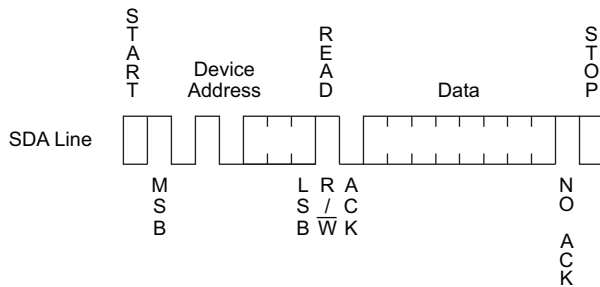
Random Read: A Random Read requires a dummy byte write sequence to load in the data Word Address. Once the device address word and data Word Address are clocked in and acknowledged by the EEPROM, the microcontroller must generate another Start condition. The microcontroller now initiates a Current Address 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. To end the command, the microcontroller does not respond with a zero but does generate a Stop condition in the subsequent clock cycle.

Figure 9-2.   Random Read
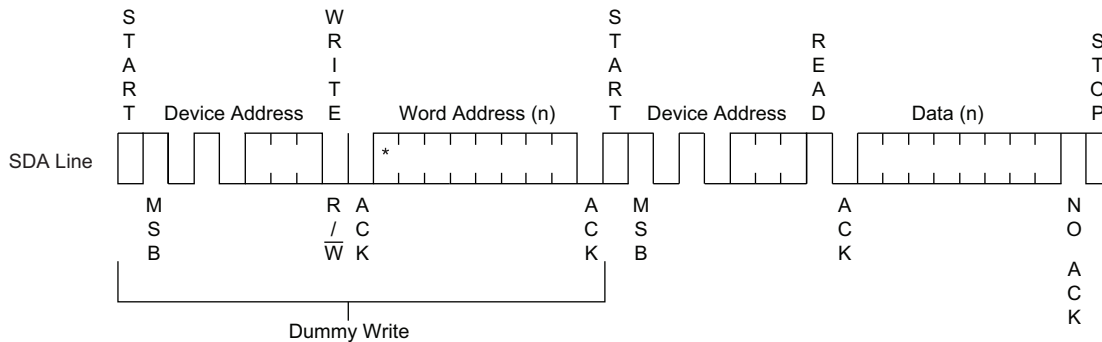
* = Don't care bit for 1K

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 limit is reached, the data Word Address will "roll over" and the Sequential Read will continue. To end the command, the microcontroller does not respond with a zero but does generate a Stop condition in the subsequent clock cycle.

Figure 9-3.   Sequential Read
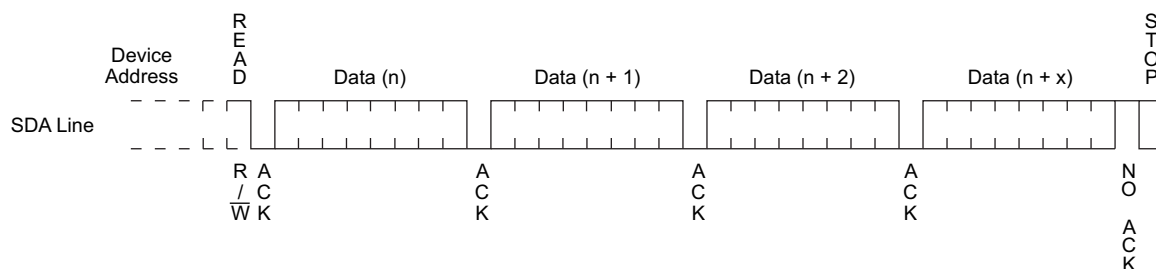
10.   Power Recommendation

The device internal POR (Power-On Reset) threshold is just below the minimum operating voltage of the device. Power shall rise monotonically from 0.0Vdc to full V_{CC} in less than 1ms. Hold at full V_{CC} for at least 100μs before the first operation. Power shall drop from full V_{CC} to 0.0Vdc in less than 1ms. Power dropping to a non-zero level and then slowly going to zero is not recommended. Power shall remain off (0.0Vdc) for 0.5s minimum. Please consult Atmel if your power conditions do not meet the above recommendations.

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11. Ordering Information

11.1 Ordering Code Detail

A T 2 4 C 0 1 C - S S P D - T

Atmel Designator

Product Family
24C = Standard I²C-compatible
Serial EEPROM

Device Density
01 = 1 kilobit
02 = 2 kilobit
04 = 4 kilobit
08 = 8 kilobit

Device Revision

Shipping Carrier Option
T = Tape and Reel, Standard Quantity Option
E = Tape and Reel, Expanded Quantity Option

Operating Voltage
M = 1.7V to 5.5V
D = 2.5V to 5.5V

Package Device Grade or Wafer/Die Thickness
9 = Lead-free / Halogen-free
     Automotive (-40°C to +85°C)
K[1]= Lead-free / Halogen-free
     Automotive (-40°C to +105°C)
P = Lead-free / Halogen-free
     Automotive (-40°C to +125°C)

Package Option
SS = JEDEC SOIC
X   = TSSOP
MA = UDFN

Notes: 1.   Contact Sales for Grade 2 Availability

11.2 Ordering Code Information

11.2.1 Automotive Grade 1, V_{CC} = 2.5V to 5.5V

| Atmel Ordering Code | Lead Finish | Package | Delivery Information | | Operation Range |
			Form	Quantity	
AT24C01C-SSPD-T	NiPdAu (Lead-free/Halogen-free)	8S1	Tape and Reel	4,000 per Reel	Automotive Temperature (-40°C to 125°C)
AT24C01C-XPD-T		8X		5,000 per Reel	
AT24C01C-MAPD-T		8MA2		5,000 per Reel	
AT24C01C-MAPD-E				15,000 per Reel	
AT24C02C-SSPD-T	NiPdAu (Lead-free/Halogen-free)	8S1	Tape and Reel	4,000 per Reel	Automotive Temperature (-40°C to 125°C)
AT24C02C-XPD-T		8X		5,000 per Reel	
AT24C02C-MAPD-T		8MA2		5,000 per Reel	
AT24C02C-MAPD-E				15,000 per Reel	
AT24C04C-SSPD-T	NiPdAu (Lead-free/Halogen-free)	8S1	Tape and Reel	4,000 per Reel	Automotive Temperature (-40°C to 125°C)
AT24C04C-XPD-T		8X		5,000 per Reel	
AT24C04C-MAPD-T		8MA2		5,000 per Reel	
AT24C04C-MAPD-E				15,000 per Reel	
AT24C08C-SSPD-T	NiPdAu (Lead-free/Halogen-free)	8S1	Tape and Reel	4,000 per Reel	Automotive Temperature (-40°C to 125°C)
AT24C08C-XPD-T		8X		5,000 per Reel	
AT24C08C-MAPD-T		8MA2		5,000 per Reel	
AT24C08C-MAPD-E				15,000 per Reel	

Package Type	
8S1	8-lead, 0.150" wide, Plastic Gull Wing Small Outline (JEDEC SOIC)
8X	8-lead, 4.4mm body, Plastic Thin Shrink Small Outline Package (TSSOP)
8MA2	8-pad, 2.00mm x 3.00mm body, 0.50mm pitch, Ultra Thin, Dual No Lead (UDFN)

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11.2.2 Automotive Grade 3, V_{CC} = 1.7V to 5.5V

Atmel Ordering Code	Lead Finish	Package	Delivery Information		Operation Range
			Form	Quantity	
AT24C01C-SS9M-T	NiPdAu (Lead-free/Halogen-free)	8S1	Tape and Reel	4,000 per Reel	Automotive Temperature (-40°C to 85°C)
AT24C01C-X9M-T		8X		5,000 per Reel	
AT24C01C-MA9M-T		8MA2		5,000 per Reel	
AT24C01C-MA9M-E				15,000 per Reel	
AT24C02C-SS9M-T	NiPdAu (Lead-free/Halogen-free)	8S1	Tape and Reel	4,000 per Reel	Automotive Temperature (-40°C to 85°C)
AT24C02C-X9M-T		8X		5,000 per Reel	
AT24C02C-MA9M-T		8MA2		5,000 per Reel	
AT24C02C-MA9M-E				15,000 per Reel	
AT24C04C-SS9M-T	NiPdAu (Lead-free/Halogen-free)	8S1	Tape and Reel	4,000 per Reel	Automotive Temperature (-40°C to 85°C)
AT24C04C-X9M-T		8X		5,000 per Reel	
AT24C04C-MA9M-T		8MA2		5,000 per Reel	
AT24C04C-MA9M-E				15,000 per Reel	
AT24C08C-SS9M-T	NiPdAu (Lead-free/Halogen-free)	8S1	Tape and Reel	4,000 per Reel	Automotive Temperature (-40°C to 85°C)
AT24C08C-X9M-T		8X		5,000 per Reel	
AT24C08C-MA9M-T		8MA2		5,000 per Reel	
AT24C08C-MA9M-E				15,000 per Reel	

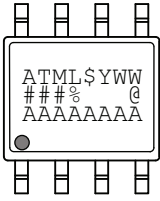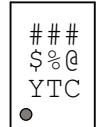| Package Type	
8S1	8-lead, 0.150" wide, Plastic Gull Wing Small Outline (JEDEC SOIC)
8X	8-lead, 4.4mm body, Plastic Thin Shrink Small Outline Package (TSSOP)
8MA2	8-pad, 2.00mm x 3.00mm body, 0.50mm pitch, Ultra Thin, Dual No Lead (UDFN)

11.3   Product Markings

AT24C01C, AT24C02C, AT24C04C and AT24C08C: Package Marking Information

8-lead SOIC	8-lead TSSOP	8-pad UDFN
ATML$YWW ###% @ AAAAAAAA	AT$YWW ###% @ AAAAAAA	2.0 x 3.0 mm Body ### $%@ YTC

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

Catalog Number Truncation	
AT24C01C	Truncation Code ###: 01C
AT24C02C	Truncation Code ###: 02C
AT24C04C	Truncation Code ###: 04C
AT24C08C	Truncation Code ###: 08C

Date Codes		Voltages
Y = Year	WW = Work Week of Assembly	% = Minimum Voltage
6: 2016 0: 2020 7: 2017 1: 2021 8: 2018 2: 2022 9: 2019 3: 2023	02:Week 2 04:Week 4 ... 52:Week 52	M: 1.7V minimum D: 2.5V minimum

Country of Assembly	Lot Number	$ = Grade/Lead Finish Material
@ = Country of Assembly	AAA...A = Atmel Wafer Lot Number	P: Automotive Grade 1/NiPdAu K: Automotive Grade 2/NiPdAu 9: Automotive Grade 3/NiPdAu
		Atmel Truncation
		AT: Atmel ATM: Atmel ATML: Atmel

3/14/2016

	TITLE	DRAWING NO.	REV.
Atmel Package Mark Contact: DL-CSO-Assy_eng@atmel.com	**24C01-02-04-08CAM**, AT24C01C, AT24C02C, AT24C04C, and AT24C08C Automotive Package Marking Information	24C01-02-04-08CAM	C

12. Packaging Information

12.1 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	–	–	1.75	
A1	0.10	–	0.25	
b	0.31	–	0.51	
C	0.17	–	0.25	
D	4.90 BSC			
E	6.00 BSC			
E1	3.90 BSC			
e	1.27 BSC			
L	0.40	–	1.27	
Ø	0°	–	8°	

3/6/2015

Atmel
Package Drawing Contact:
packagedrawings@atmel.com

TITLE	**GPC**	**DRAWING NO.**	**REV.**
8S1, 8-lead (0.150" Wide Body), Plastic Gull Wing Small Outline (JEDEC SOIC)	SWB	8S1	H

12.2   8X — 8-lead TSSOP


```
            1
      Pin 1 indicator
      this corner

        E1        E                        C

                                      L1


        N                                       L

      Top View                 End View

            A
   b
            A1

   e   A2

        D

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

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12.3   8MA2 — 8-pad UDFN

TOP VIEW

Pin 1 ID

E

D

1
2
3
4

8
7
6
5

SIDE VIEW

C

A2

A1

A

C

BOTTOM VIEW

E2

b (8x)

8
7
6
5

1
2
3
4

Pin#1 ID

D2

e (6x)

L (8x)

K

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	0.152 REF			
L	0.35	0.40	0.45	
e	0.50 BSC			
K	0.20	-	-	

11/2/15

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

13. Revision History

Doc. Rev.	Date	Comments
8819C	09/2016	Added the Automotive Grade 2 and 3 options, UDFN package options, ordering code detail, and table of contents. Updated the "Software Reset" section, part marking, and the 8S1 package drawing.
8819B	08/2014	Increased t_{AA} maximum from 90ns to 900ns. Updated the 8X package drawing, footers, and the disclaimer page.
8819A	12/2012	Initial document release.

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