Features

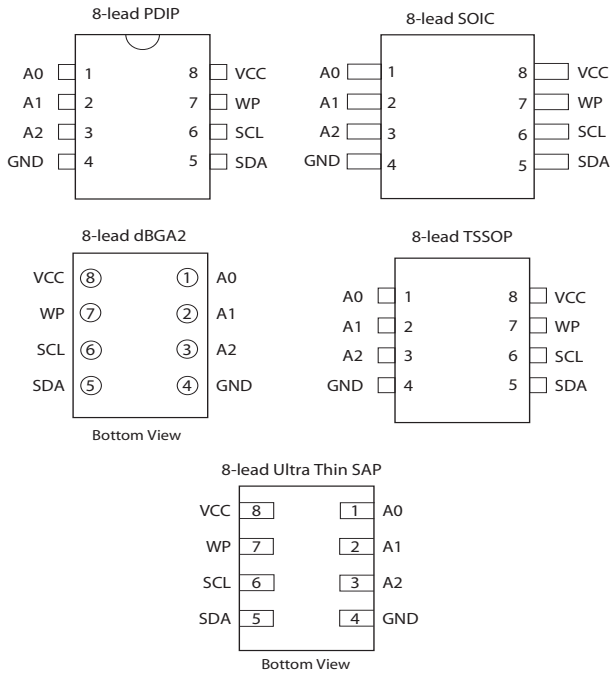
- Low-voltage and Standard-voltage Operation
  - 1.8 (V_{CC} = 1.8V to 5.5V)
- Internally Organized as 32,768 x 8
- Two-wire Serial Interface
- Schmitt Trigger, Filtered Inputs for Noise Suppression
- Bidirectional Data Transfer Protocol
- 1 MHz (5.0V, 2.7V, 2.5V), and 400 kHz (1.8V) Compatibility
- Write Protect Pin for Hardware and Software Data Protection
- 64-byte Page Write Mode (Partial Page Writes Allowed)
- Self-timed Write Cycle (5 ms Max)
- High Reliability
  - Endurance: One Million Write Cycles
  - Data Retention: 40 Years
- Lead-free/Halogen-free Devices Available
- 8-lead JEDEC PDIP, 8-lead JEDEC SOIC, EIAJ SOIC, 8-lead Ultra Thin Small Array Package (SAP), 8-lead TSSOP, and 8-ball dBGA2 Packages
- Die Sales: Wafer Form, Waffle Pack and Bumped Wafers

Description

The AT24C256B provides 262,144 bits of serial electrically erasable and programmable read-only memory (EEPROM) organized as 32,768 words of 8 bits each. The device's cascadable feature allows up to eight devices to share a common two-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 PDIP, 8-lead JEDEC SOIC, 8-lead Ultra Thin SAP, 8-lead TSSOP, and 8-ball dBGA2 packages. In addition, the entire family is available in a 1.8V (1.8V to 5.5V) version.

Pin Configurations

Pin Name	Function
A0–A2	Address Inputs
SDA	Serial Data
SCL	Serial Clock Input
WP	Write Protect
GND	Ground



Two-wire Serial EEPROM

256K (32,768 x 8)

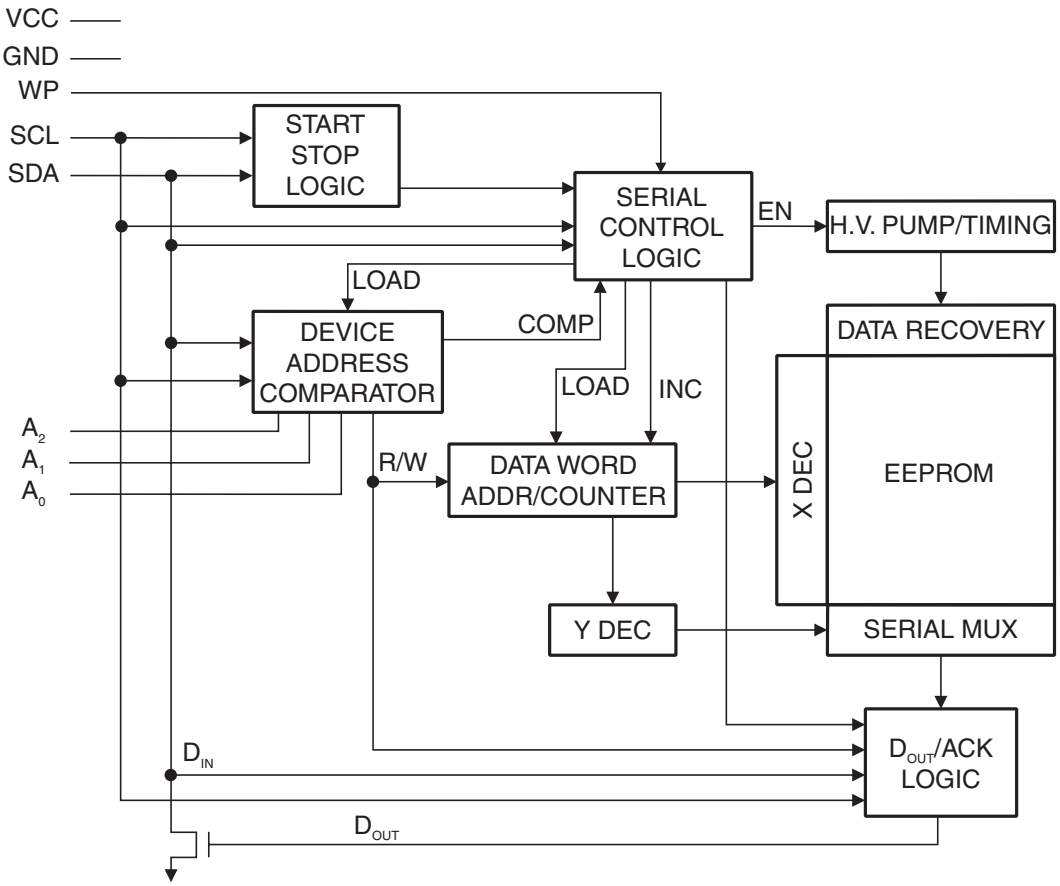
AT24C256B

1. 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	– 1.0V to +7.0V
Maximum Operating Voltage	6.25V
DC Output Current	5.0 mA

*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only; 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.

Figure 1-1. Block Diagram



2. 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 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/PAGE ADDRESSES (A2, A1, A0): The A2, A1, and A0 pins are device address inputs that are hardwired (directly to GND or to Vcc) for compatibility with other AT24Cxx devices. When the pins are hardwired, as many as eight 256K devices may be addressed on a single bus system. (Device addressing is discussed in detail under “Device Addressing,” page 9.) A device is selected when a corresponding hardware and software match is true. If these pins are left floating, the A2, A1, and A0 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 Vcc, 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.

3. Memory Organization

AT24C256B, 256K SERIAL EEPROM: The 256K is internally organized as 512 pages of 64 bytes each. Random word addressing requires a 15-bit data word address.

Table 3-1. Pin Capacitance[1]

Applicable over recommended operating range from T_A = 25°C, f = 1.0 MHz, V_{CC} = +1.8V

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, SCL)	6	pF	V_{IN} = 0V

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

Table 3-2. DC Characteristics

Applicable over recommended operating range from: T_{AI} = – 40°C to +85°C, V_{CC} = +1.8V to +5.5V (unless otherwise noted)

Symbol	Parameter	Test Condition		Min	Typ	Max	Units
V_{CC1}	Supply Voltage			1.8		5.5	V
I_{CC1}	Supply Current	V_{CC} = 5.0V	READ at 400 kHz		1.0	2.0	mA
I_{CC2}	Supply Current	V_{CC} = 5.0V	WRITE at 400 kHz		2.0	3.0	mA
I_{SB1}	Standby Current (1.8V option)	V_{CC} = 1.8V	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_{OL2}	Output Low Level	V_{CC} = 3.0V	I_{OL} = 2.1 mA			0.4	V
V_{OL1}	Output Low Level	V_{CC} = 1.8V	I_{OL} = 0.15 mA			0.2	V

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

Table 3-3. AC Characteristics (Industrial Temperature)

Applicable over recommended operating range from T_{AI} = – 40°C to +85°C, V_{CC} = +1.8V to +5.5V, CL = 100 pF (unless otherwise noted). Test conditions are listed in Note 2.

Symbol	Parameter	1.8-volt		2.5, 5.0-volt		Units
		Min	Max	Min	Max	
f_{SCL}	Clock Frequency, SCL		400		1000	kHz
t_{LOW}	Clock Pulse Width Low	1.3		0.4		µs
t_{HIGH}	Clock Pulse Width High	0.6		0.4		µs
t_i	Noise Suppression Time(1)		100		50	ns
t_{AA}	Clock Low to Data Out Valid	0.05	0.9	0.05	0.55	µs
t_{BUF}	Time the bus must be free before a new transmission can start(1)	1.3		0.5		µs
$t_{HD.STA}$	Start Hold Time	0.6		0.25		µs
$t_{SU.STA}$	Start Set-up Time	0.6		0.25		µs
$t_{HD.DAT}$	Data In Hold Time	0		0		µs
$t_{SU.DAT}$	Data In Set-up Time	100		100		ns
t_R	Inputs Rise Time(1)		0.3		0.3	µs
t_F	Inputs Fall Time(1)		300		100	ns
$t_{SU.STO}$	Stop Set-up Time	0.6		0.25		µs
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}): 1.3 kΩ (2.5V, 5.5V), 10 kΩ (1.8V)
   Input pulse voltages: 0.3 V_{CC} to 0.7 V_{CC}
   Input rise and fall times: ≤ 50 ns
   Input and output timing reference voltages: 0.5 V_{CC}

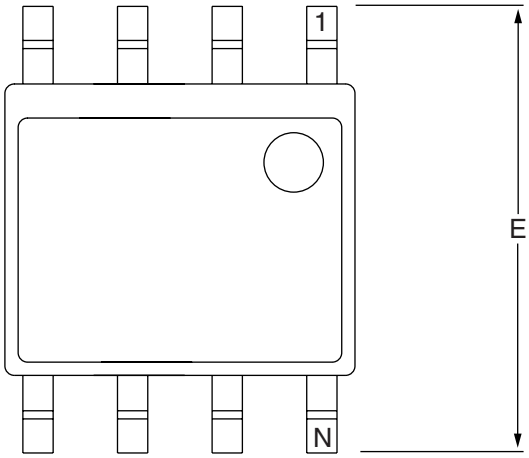
8. AT24C256B Ordering Codes

Ordering Code	Voltage	Package	Operation Range
AT24C256B-PU (Bulk Form Only)	1.8	8P3	Lead-free/Halogen-free Industrial Temperature (–40°C to 85°C)
AT24C256BN-SH-B[1] (NiPdAu Lead Finish)	1.8	8S1	
AT24C256BN-SH-T[2] (NiPdAu Lead Finish)	1.8	8S1	
AT24C256BW-SH-B[1] (NiPdAu Lead Finish)	1.8	8S2	
AT24C256BW-SH-T[2] (NiPdAu Lead Finish)	1.8	8S2	
AT24C256B-TH-B[1] (NiPdAu Lead Finish)	1.8	8A2	
AT24C256B-TH-T[2] (NiPdAu Lead Finish)	1.8	8A2	
AT24C256BY7-YH-T[2] (NiPdAu Lead Finish)	1.8	8Y7	
AT24C256BU2-UU-T[2]	1.8	8U2-1	
AT24C256B-W-11	1.8	Die Sale	Industrial Temperature (–40°C to 85°C)

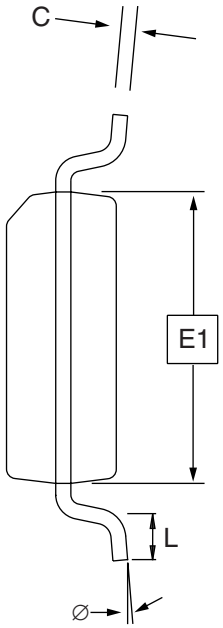
Notes:
1. "-B" denotes bulk.
2. "-T" denotes tape and reel. SOIC = 4K per reel. TSSOP and dBGA2 = 5K per reel. SAP = 3K per reel. EIAJ = 2K per reel.
3. Available in tape & reel and wafer form; order as SL788 for inkless wafer form. Bumped die available upon request. Please contact Serial Interface Marketing.

Package Type	
8P3	8-lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
8S1	8-lead, 0.150" Wide, Plastic Gull Wing Small Outline Package (JEDEC SOIC)
8S2	8-lead, 0.200" Wide, Plastic Gull Wing Small Outline Package (EIAJ SOIC)
8U2-1	8-ball, die Ball Grid Array Package (dBGA2)
8A2	8-lead, 4.40 mm Body, Plastic Thin Shrink Small Outline Package (TSSOP)
8Y7	8-lead, 6.00 mm x 4.90 mm Body, Ultra Thin, Dual Footprint, Non-leaded, Small Array Package (SAP)
Options	
–1.8	Low-voltage (1.8V to 5.5V)

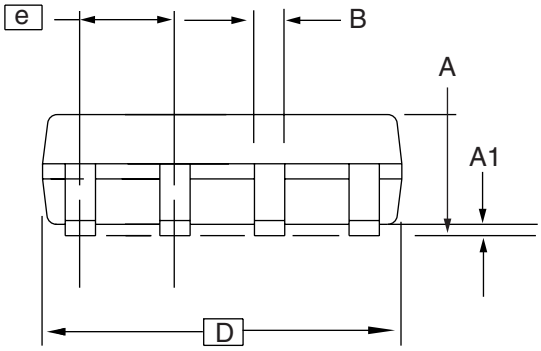
8S1 – JEDEC SOIC



Top View



End View



Side View

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	–	5.00	
E1	3.81	–	3.99	
E	5.79	–	6.20	
e	1.27 BSC			
L	0.40	–	1.27	
∅	0°	–	8°	

Note: These drawings are for general information only. Refer to JEDEC Drawing MS-012, Variation AA for proper dimensions, tolerances, datums, etc.

1150 E. Cheyenne Mtn. Blvd. Colorado Springs, CO 80906	**TITLE** **8S1**, 8-lead (0.150" Wide Body), Plastic Gull Wing Small Outline (JEDEC SOIC)	**DRAWING NO.** 8S1	**REV.** B