

256K SPI Bus Serial EEPROM

Device Selection Table

Part Number	Vcc Range	Page Size	Temp. Ranges	Packages
25LC256	2.5-5.5V	64 Byte	I, E	P, SN, SM, ST, MF
25AA256	1.8-5.5V	64 Byte	I	P, SN, SM, ST, MF

Features:

- Max. Clock 10 MHz
- Low-Power CMOS Technology:
 - Max. Write Current: 5 mA at 5.5V, 10 MHz
 - Read Current: 6 mA at 5.5V, 10 MHz
 - Standby Current: 1 μ A at 5.5V
- 32,768 x 8-bit Organization
- 64-Byte Page
- Self-Timed Erase and Write Cycles (5 ms max.)
- Block Write Protection:
 - Protect none, 1/4, 1/2 or all of array
- Built-In Write Protection:
 - Power-on/off data protection circuitry
 - Write enable latch
 - Write-protect pin
- Sequential Read
- High Reliability:
 - Endurance: 1,000,000 erase/write cycles
 - Data retention: > 200 years
 - ESD protection: > 4000V
- Temperature Ranges Supported:
 - Industrial (I): -40°C to +85°C
 - Automotive (E): -40°C to +125°C
- Pb-Free and RoHS Compliant

Pin Function Table

Name	Function
$\overline{\text{CS}}$	Chip Select Input
SO	Serial Data Output
$\overline{\text{WP}}$	Write-Protect
Vss	Ground
SI	Serial Data Input
SCK	Serial Clock Input
$\overline{\text{HOLD}}$	Hold Input
Vcc	Supply Voltage

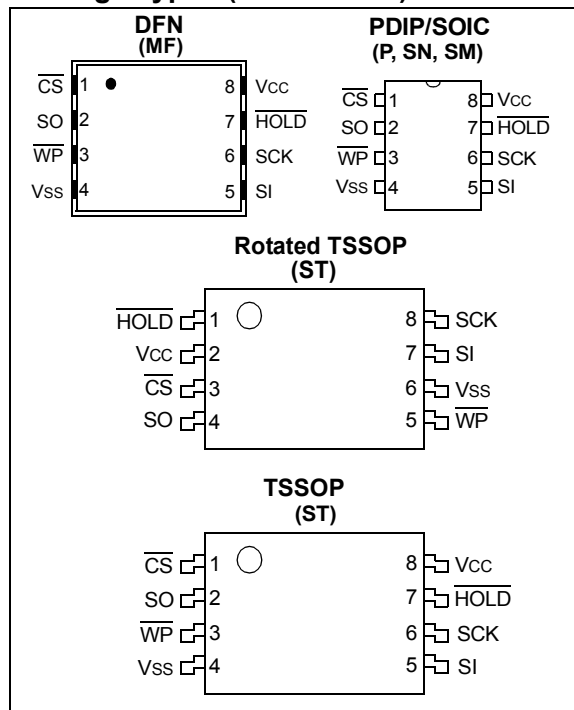
Description:

The Microchip Technology Inc. 25AA256/25LC256 (25XX256*) are 256 Kbit Serial Electrically Erasable PROMs. The memory is accessed via a simple Serial Peripheral Interface (SPI) compatible serial bus. The bus signals required are a clock input (SCK) plus separate data in (SI) and data out (SO) lines. Access to the device is controlled through a Chip Select ($\overline{\text{CS}}$) input.

Communication to the device can be paused via the hold pin ($\overline{\text{HOLD}}$). While the device is paused, transitions on its inputs will be ignored, with the exception of Chip Select, allowing the host to service higher priority interrupts.

The 25XX256 is available in standard packages including 8-lead PDIP and SOIC, and advanced packaging including 8-lead DFN and 8-lead TSSOP.

Package Types (not to scale)



* 25XX256 is used in this document as a generic part number for the 25AA256, 25LC256 devices.

25AA256/25LC256

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings (†)

V _{CC}	6.5V
All inputs and outputs w.r.t. V _{SS}	-0.6V to V _{CC} +1.0V
Storage temperature	-65°C to 150°C
Ambient temperature under bias	-40°C to 125°C
ESD protection on all pins	4 kV

† NOTICE: Stresses above 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 those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for an extended period of time may affect device reliability.

TABLE 1-1: DC CHARACTERISTICS

DC CHARACTERISTICS			Industrial (I): TA = -40°C to +85°C		Automotive (E): TA = -40°C to +125°C		V _{CC} = 1.8V to 5.5V	V _{CC} = 2.5V to 5.5V
Param. No.	Sym.	Characteristic	Min.	Typ. ⁽²⁾	Max.	Units	Test Conditions	
D001	V _{IH}	High-level input voltage	.7 V _{CC}	—	V _{CC} +1	V		
D002	V _{IL}	Low-level input voltage	-0.3	—	0.3 V _{CC}	V	V _{CC} ≥ 2.5V	
D003	V _{IL}		-0.3	—	0.2 V _{CC}	V	V _{CC} < 2.5V	
D004	V _{OL}	Low-level output voltage	—	—	0.4	V	I _{OL} = 2.1 mA, V _{CC} = 4.5V	
D005	V _{OL}		—	—	0.2	V	I _{OL} = 1.0 mA, V _{CC} = 2.5V	
D006	V _{OH}	High-level output voltage	V _{CC} -0.5	—	—	V	I _{OH} = -400 μA	
D007	I _{LI}	Input leakage current	—	—	±1	μA	$\overline{CS} = V_{CC}$, V _{IN} = V _{SS} OR V _{CC}	
D008	I _{LO}	Output leakage current	—	—	±1	μA	$\overline{CS} = V_{CC}$, V _{OUT} = V _{SS} OR V _{CC}	
D009	C _{INT}	Internal Capacitance (all inputs and outputs)	—	—	7	pF	TA = 25°C, F _{CLK} = 1.0 MHz, V _{CC} = 5.0V (Note 1)	
D010	I _{CC} Read	Operating Current	—	2.5	6	mA	V _{CC} = 5.5V; F _{CLK} = 10.0 MHz; SO = Open	
			—	0.5	2.5	mA	V _{CC} = 2.5V; F _{CLK} = 5.0 MHz; SO = Open	
D011	I _{CC} Write		—	0.6	5	mA	V _{CC} = 5.5V	
			—	0.15	3	mA	V _{CC} = 2.5V	
D012	I _{CCS}	Standby Current	—	0.1	5	μA	$\overline{CS} = V_{CC} = 5.5V$, Inputs tied to V _{CC} or V _{SS} , 125°C	
			—		1	μA	CS = V _{CC} = 5.5V, Inputs tied to V _{CC} or V _{SS} , 85°C	

- Note 1:** This parameter is periodically sampled and not 100% tested.
Note 2: Typical measurements taken at room temperature (25°C).

TABLE 1-2: AC CHARACTERISTICS

AC CHARACTERISTICS			Industrial (I): TA = -40°C to +85°C		VCC = 1.8V to 5.5V	
			Automotive (E): TA = -40°C to +125°C		VCC = 2.5V to 5.5V	
Param. No.	Sym.	Characteristic	Min.	Max.	Units	Test Conditions
1	FCLK	Clock Frequency	—	10	MHz	$4.5V \leq V_{CC} \leq 5.5V$
			—	5	MHz	$2.5V \leq V_{CC} < 4.5V$
			—	3	MHz	$1.8V \leq V_{CC} < 2.5V$
2	T _{CS}	\overline{CS} Setup Time	50	—	ns	$4.5V \leq V_{CC} \leq 5.5V$
			100	—	ns	$2.5V \leq V_{CC} < 4.5V$
			150	—	ns	$1.8V \leq V_{CC} < 2.5V$
3	T _{CSH}	\overline{CS} Hold Time	100	—	ns	$4.5V \leq V_{CC} \leq 5.5V$
			200	—	ns	$2.5V \leq V_{CC} < 4.5V$
			250	—	ns	$1.8V \leq V_{CC} < 2.5V$
4	T _{CSD}	\overline{CS} Disable Time	50	—	ns	—
5	T _{SU}	Data Setup Time	10	—	ns	$4.5V \leq V_{CC} \leq 5.5V$
			20	—	ns	$2.5V \leq V_{CC} < 4.5V$
			30	—	ns	$1.8V \leq V_{CC} < 2.5V$
6	T _{HD}	Data Hold Time	20	—	ns	$4.5V \leq V_{CC} \leq 5.5V$
			40	—	ns	$2.5V \leq V_{CC} < 4.5V$
			50	—	ns	$1.8V \leq V_{CC} < 2.5V$
7	T _R	CLK Rise Time	—	100	ns	(Note 1)
8	T _F	CLK Fall Time	—	100	ns	(Note 1)
9	T _{HI}	Clock High Time	50	—	ns	$4.5V \leq V_{CC} \leq 5.5V$
			100	—	ns	$2.5V \leq V_{CC} < 4.5V$
			150	—	ns	$1.8V \leq V_{CC} < 2.5V$
10	T _{LO}	Clock Low Time	50	—	ns	$4.5V \leq V_{CC} \leq 5.5V$
			100	—	ns	$2.5V \leq V_{CC} < 4.5V$
			150	—	ns	$1.8V \leq V_{CC} < 2.5V$
11	T _{CLD}	Clock Delay Time	50	—	ns	—
12	T _{CLE}	Clock Enable Time	50	—	ns	—
13	T _V	Output Valid from Clock Low	—	50	ns	$4.5V \leq V_{CC} \leq 5.5V$
			—	100	ns	$2.5V \leq V_{CC} < 4.5V$
			—	160	ns	$1.8V \leq V_{CC} < 2.5V$
14	T _{HO}	Output Hold Time	0	—	ns	(Note 1)
15	T _{DIS}	Output Disable Time	—	40	ns	$4.5V \leq V_{CC} \leq 5.5V$ (Note 1)
			—	80	ns	$2.5V \leq V_{CC} < 4.5V$ (Note 1)
			—	160	ns	$1.8V \leq V_{CC} \leq 2.5V$ (Note 1)
16	T _{HS}	\overline{HOLD} Setup Time	20	—	ns	$4.5V \leq V_{CC} \leq 5.5V$
			40	—	ns	$2.5V \leq V_{CC} < 4.5V$
			80	—	ns	$1.8V \leq V_{CC} < 2.5V$
17	T _{HH}	\overline{HOLD} Hold Time	20	—	ns	$4.5V \leq V_{CC} \leq 5.5V$
			40	—	ns	$2.5V \leq V_{CC} < 4.5V$
			80	—	ns	$1.8V \leq V_{CC} < 2.5V$

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

2: T_{WC} begins on the rising edge of \overline{CS} after a valid write sequence and ends when the internal write cycle is complete.

3: This parameter is not tested but ensured by characterization. For endurance estimates in a specific application, please consult the Total Endurance™ Model which can be obtained from Microchip's web site

25AA256/25LC256

TABLE 1-2: AC CHARACTERISTICS (CONTINUED)

AC CHARACTERISTICS			Industrial (I): TA = -40°C to +85°C		VCC = 1.8V to 5.5V	
			Automotive (E): TA = -40°C to +125°C		VCC = 2.5V to 5.5V	
Param. No.	Sym.	Characteristic	Min.	Max.	Units	Test Conditions
18	THZ	$\overline{\text{HOLD}}$ Low to Output High-Z	30	—	ns	4.5V ≤ VCC ≤ 5.5V (Note 1)
			60	—	ns	2.5V ≤ VCC < 4.5V (Note 1)
			160	—	ns	1.8V ≤ VCC < 2.5V (Note 1)
19	THV	$\overline{\text{HOLD}}$ High to Output Valid	30	—	ns	4.5V ≤ VCC ≤ 5.5V
			60	—	ns	2.5V ≤ VCC < 4.5V
			160	—	ns	1.8V ≤ VCC < 2.5V
20	TWC	Internal Write Cycle Time	—	5	ms	(NOTE 2)
21	—	Endurance	1M	—	E/W Cycles	(NOTE 3)

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

2: TWC begins on the rising edge of $\overline{\text{CS}}$ after a valid write sequence and ends when the internal write cycle is complete.

3: This parameter is not tested but ensured by characterization. For endurance estimates in a specific application, please consult the Total Endurance™ Model which can be obtained from Microchip's web site at www.microchip.com.

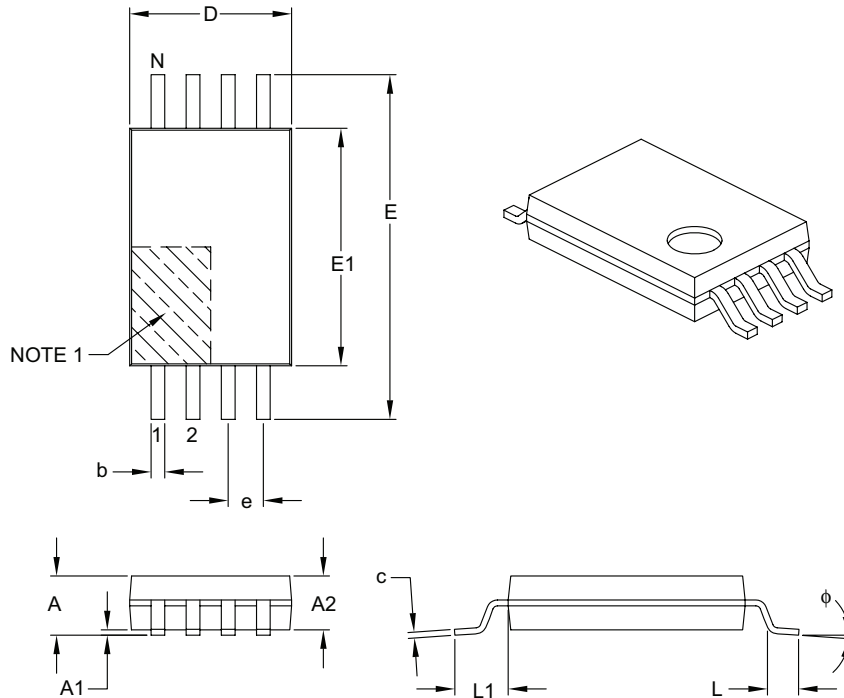
TABLE 1-3: AC TEST CONDITIONS

AC Waveform:	
VLO = 0.2V	—
VHI = VCC – 0.2V	(Note 1)
VHI = 4.0V	(Note 2)
CL = 50 pF	—
Timing Measurement Reference Level	
Input	0.5 VCC
Output	0.5 VCC

Note 1: For VCC ≤ 4.0V

2: For VCC > 4.0V

8-Lead Plastic Thin Shrink Small Outline (ST) – 4.4 mm Body [TSSOP]



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Pins	N	8		
Pitch	e	0.65 BSC		
Overall Height	A	–	–	1.20
Molded Package Thickness	A2	0.80	1.00	1.05
Standoff	A1	0.05	–	0.15
Overall Width	E	6.40 BSC		
Molded Package Width	E1	4.30	4.40	4.50
Molded Package Length	D	2.90	3.00	3.10
Foot Length	L	0.45	0.60	0.75
Footprint	L1	1.00 REF		
Foot Angle	ϕ	0°	–	8°
Lead Thickness	c	0.09	–	0.20
Lead Width	b	0.19	–	0.30

Notes:

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15 mm per side.
- Dimensioning and tolerancing per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-086B

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

<u>PART NO.</u>		<u>X</u>	-	<u>X</u>	<u>/XX</u>
Device	Tape & Reel			Temp Range	Package
Device:	25AA256			256k-bit, 1.8V, 64-Byte Page, SPI Serial EEPROM	
	25LC256			256k-bit, 2.5V, 64-Byte Page, SPI Serial EEPROM	
	25AA256X			256k-bit, 1.8V, 64-Byte Page, SPI Serial EEPROM, rotated pinout (ST only)	
	25LC256X			256k-bit, 2.5V, 64-Byte Page, SPI Serial EEPROM, rotated pinout (ST only)	
Tape & Reel:	Blank	=		Standard packaging (tube)	
	T	=		Tape & Reel	
Temperature Range:	I	=		-40°C to+85°C	
	E	=		-40°C to+125°C	
Package:	MF	=		Micro Lead Frame (6 x 5 mm body), 8-lead	
	P	=		Plastic DIP (300 mil body), 8-lead	
	SN	=		Plastic SOIC (3.90 mm body), 8-lead	
	ST	=		TSSOP, 8-lead	
	SM	=		Plastic SOIC (5.28 mm body), 8-lead	

Examples:

- a) 25AA256T-I/SN = 256k-bit, 1.8V Serial EEPROM, Industrial temp., Tape & Reel, SOIC package
- b) 25AA256T-I/ST = 256k-bit, 1.8V Serial EEPROM, Industrial temp., Tape & Reel, TSSOP package
- c) 25LC256-I/P = 256k-bit, 2.5V Serial EEPROM, Industrial temp., P-DIP package
- d) 25LC256T-E/ST = 256k-bit, 2.5V Serial EEPROM, Extended temp., Tape & Reel, TSSOP package
- e) 25LC256XT-I/ST = 256k-bit, 2.5V Serial EEPROM, Industrial temp., Tape and Reel, Rotated TSSOP package