25AA256/25LC256

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

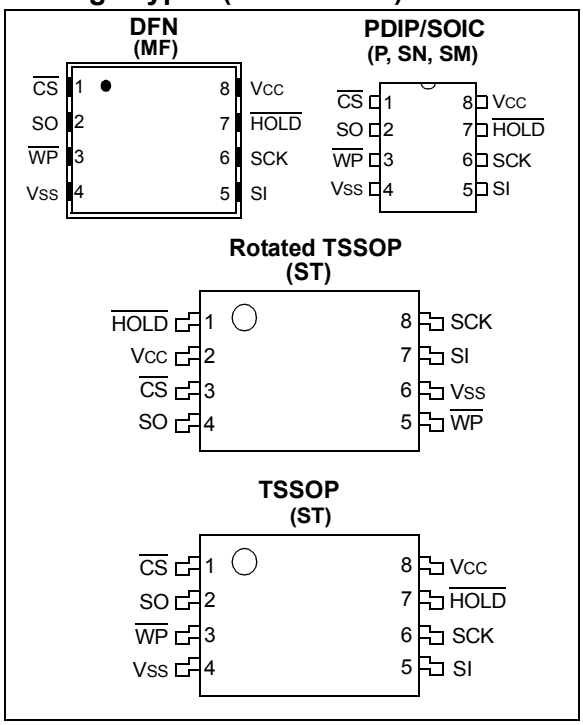
Description:

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 ($\overline{CS}$) input.

Communication to the device can be paused via the hold pin ($\overline{HOLD}$). 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.

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings (†)

VCC.....6.5V

All inputs and outputs w.r.t. VSS ..... -0.6V to VCC +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 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.**	**Typ.(2)**	**Max.**	**Units**	**Test Conditions**
D001	VIH	High-level input voltage	.7 VCC	—	VCC +1	V	
D002	VIL	Low-level input voltage	-0.3	—	0.3 VCC	V	VCC ≥ 2.5V
D003	VIL		-0.3	—	0.2 VCC	V	VCC < 2.5V
D004	VOL	Low-level output voltage	—	—	0.4	V	IOL = 2.1 mA, VCC = 4.5V
D005	VOL		—	—	0.2	V	IOL = 1.0 mA, VCC = 2.5V
D006	VOH	High-level output voltage	VCC -0.5	—	—	V	IOH = -400 µA
D007	ILI	Input leakage current	—	—	±1	µA	$\overline{CS}$ = VCC, VIN = VSS OR VCC
D008	ILO	Output leakage current	—	—	±1	µA	$\overline{CS}$ = VCC, VOUT = VSS OR VCC
D009	CINT	Internal Capacitance (all inputs and outputs)	—	—	7	pF	TA = 25°C, FCLK = 1.0 MHz, VCC = 5.0V **(Note 1)**
D010	ICC Read	Operating Current	—	2.5	6	mA	VCC = 5.5V; FCLK = 10.0 MHz; SO = Open
			—	0.5	2.5	mA	VCC = 2.5V; FCLK = 5.0 MHz; SO = Open
D011	ICC Write		—	0.6	5	mA	VCC = 5.5V
			—	0.15	3	mA	VCC = 2.5V
D012	ICCS	Standby Current	—	0.1	5	µA	$\overline{CS}$ = VCC = 5.5V, Inputs tied to VCC or VSS, 125°C
			—		1	µA	$\overline{CS}$ = VCC = 5.5V, Inputs tied to VCC or VSS, 85°C

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

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 5 3	MHz MHz MHz	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 1.8V ≤ Vcc < 2.5V
2	TCSS	$\overline{CS}$ Setup Time	50 100 150	— — —	ns ns ns	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 1.8V ≤ Vcc < 2.5V
3	TCSH	$\overline{CS}$ Hold Time	100 200 250	— — —	ns ns ns	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 1.8V ≤ Vcc < 2.5V
4	TCSD	$\overline{CS}$ Disable Time	50	—	ns	—
5	Tsu	Data Setup Time	10 20 30	— — —	ns ns ns	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 1.8V ≤ Vcc < 2.5V
6	THD	Data Hold Time	20 40 50	— — —	ns ns ns	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 1.8V ≤ Vcc < 2.5V
7	TR	CLK Rise Time	—	100	ns	**(Note 1)**
8	TF	CLK Fall Time	—	100	ns	**(Note 1)**
9	THI	Clock High Time	50 100 150	— — —	ns ns ns	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 1.8V ≤ Vcc < 2.5V
10	TLO	Clock Low Time	50 100 150	— — —	ns ns ns	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 1.8V ≤ Vcc < 2.5V
11	TCLD	Clock Delay Time	50	—	ns	—
12	TCLE	Clock Enable Time	50	—	ns	—
13	TV	Output Valid from Clock Low	— — —	50 100 160	ns ns ns	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 1.8V ≤ Vcc < 2.5V
14	THO	Output Hold Time	0	—	ns	**(Note 1)**
15	TDIS	Output Disable Time	— — —	40 80 160	ns ns ns	4.5V ≤ Vcc ≤ 5.5V **(Note 1)** 2.5V ≤ Vcc ≤ 4.5V **(Note 1)** 1.8V ≤ Vcc ≤ 2.5V **(Note 1)**
16	THS	$\overline{HOLD}$ Setup Time	20 40 80	— — —	ns ns ns	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 1.8V ≤ Vcc < 2.5V
17	THH	$\overline{HOLD}$ Hold Time	20 40 80	— — —	ns ns ns	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 1.8V ≤ Vcc < 2.5V

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

2: TWC 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

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	$\overline{HOLD}$ Low to Output High-Z	30 60 160	— — —	ns ns ns	4.5V ≤ Vcc ≤ 5.5V **(Note 1)** 2.5V ≤ Vcc < 4.5V **(Note 1)** 1.8V ≤ Vcc < 2.5V **(Note 1)**
19	THV	$\overline{HOLD}$ High to Output Valid	30 60 160	— — —	ns ns ns	4.5V ≤ Vcc ≤ 5.5V 2.5V ≤ Vcc < 4.5V 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 $\overline{CS}$ 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

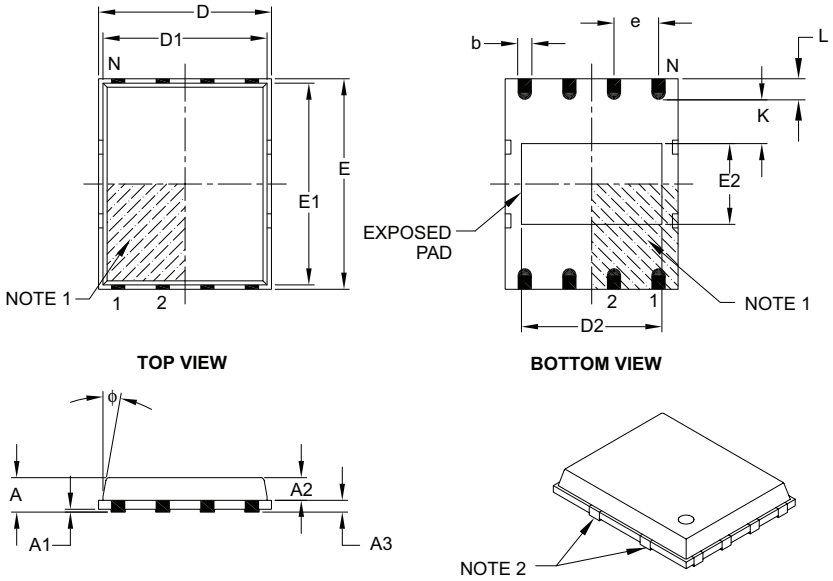
TABLE 1-3: AC TEST CONDITIONS

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 Dual Flat, No Lead Package (MF) – 6x5 mm Body [DFN-S] PUNCH SINGULATED



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		1.27 BSC	
Overall Height	A	–	0.85	1.00
Molded Package Thickness	A2	–	0.65	0.80
Standoff	A1	0.00	0.01	0.05
Base Thickness	A3		0.20 REF	
Overall Length	D		4.92 BSC	
Molded Package Length	D1		4.67 BSC	
Exposed Pad Length	D2	3.85	4.00	4.15
Overall Width	E		5.99 BSC	
Molded Package Width	E1		5.74 BSC	
Exposed Pad Width	E2	2.16	2.31	2.46
Contact Width	b	0.35	0.40	0.47
Contact Length	L	0.50	0.60	0.75
Contact-to-Exposed Pad	K	0.20	–	–
Model Draft Angle Top	ϕ	–	–	12°

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package may have one or more exposed tie bars at ends.
3. 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 C04-113B

PRODUCT IDENTIFICATION SYSTEM

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

PART NO.	X	–	X	/XX
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 mml 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