

## 4K SPI Bus Serial EEPROM

### Device Selection Table

Part Number	Vcc Range	Page Size	Temp. Ranges	Packages
25AA040A	1.8-5.5V	16 Bytes	I	P, MS, SN, ST, MC, OT
25LC040A	2.5-5.5V	16 Bytes	I, E	P, MS, SN, ST, MC, OT

### Features:

- Max. Clock 10 MHz
- Low-Power CMOS Technology:
  - Max. Write Current: 5 mA at 5.5V, 10 MHz
  - Read Current: 5 mA at 5.5V, 10 MHz
  - Standby Current: 5  $\mu$ A at 5.5V
- 512 x 8-Bit Organization
- Write Page mode (up to 16 bytes)
- Sequential Read
- 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
- 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

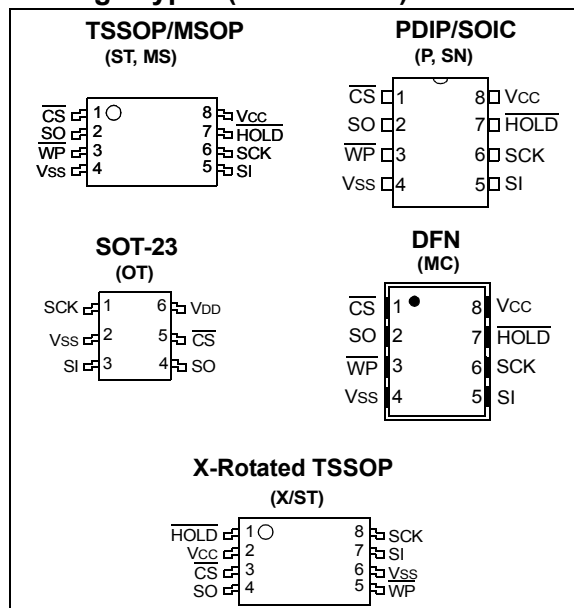
### Description:

The Microchip Technology Inc. 25XX040A\* is a 4 Kbit Serial Electrically Erasable Programmable Read-Only Memory (EEPROM). 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 25XX040A is available in standard packages including 8-lead PDIP and SOIC, and advanced packages including 8-lead MSOP, 8-lead TSSOP and rotated TSSOP, 8-lead 2x3 DFN, and 6-lead SOT-23.

### Package Types (not to scale)



\*25XX040A is used in this document as a generic part number for the 25AA040A and the 25LC040A.

# 25AA040A/25LC040A

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings<sup>(†)</sup>

V <sub>CC</sub> .....	6.5V
All inputs and outputs w.r.t. V <sub>SS</sub> .....	-0.6V to V <sub>CC</sub> +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	V <sub>CC</sub> = 1.8V to 5.5V	
			Automotive (E):	TA = -40°C to +125°C	V <sub>CC</sub> = 2.5V to 5.5V	
Param. No.	Sym.	Characteristic	Min.	Max.	Units	Test Conditions
D001	V <sub>IH1</sub>	High-level Input Voltage	0.7 V <sub>CC</sub>	V <sub>CC</sub> +1	V	
D002	V <sub>IL1</sub>	Low-level Input Voltage	-0.3	0.3 V <sub>CC</sub>	V	V <sub>CC</sub> ≥ 2.7V ( <b>Note 1</b> )
D003	V <sub>IL2</sub>		-0.3	0.2 V <sub>CC</sub>	V	V <sub>CC</sub> < 2.7V ( <b>Note 1</b> )
D004	V <sub>OL</sub>	Low-level Output Voltage	—	0.4	V	I <sub>OL</sub> = 2.1 mA
D005	V <sub>OL</sub>		—	0.2	V	I <sub>OL</sub> = 1.0 mA, V <sub>CC</sub> = 2.5V
D006	V <sub>OH</sub>	High-level Output Voltage	V <sub>CC</sub> -0.5	—	V	I <sub>OH</sub> = -400 μA
D007	I <sub>LI</sub>	Input Leakage Current	—	±1	μA	$\overline{CS} = V_{CC}$ , V <sub>IN</sub> = V <sub>SS</sub> or V <sub>CC</sub>
D008	I <sub>LO</sub>	Output Leakage Current	—	±1	μA	$\overline{CS} = V_{CC}$ , V <sub>OUT</sub> = V <sub>SS</sub> or V <sub>CC</sub>
D009	C <sub>INT</sub>	Internal Capacitance (all inputs and outputs)	—	7	pF	TA = 25°C, CLK = 1.0 MHz, V <sub>CC</sub> = 5.0V ( <b>Note 1</b> )
D010	I <sub>CC</sub> Read	Operating Current	—	5	mA	V <sub>CC</sub> = 5.5V; F <sub>CLK</sub> = 10.0 MHz; SO = Open
			—	2.5	mA	V <sub>CC</sub> = 2.5V; F <sub>CLK</sub> = 5.0 MHz; SO = Open
D011	I <sub>CC</sub> Write		—	5	mA	V <sub>CC</sub> = 5.5V
			—	3	mA	V <sub>CC</sub> = 2.5V
D012	I <sub>CCS</sub>	Standby Current	—	5	μA	$\overline{CS} = V_{CC} = 5.5V$ , Inputs tied to V <sub>CC</sub> or V <sub>SS</sub> , TA = +125°C
			—	1	μA	$\overline{CS} = V_{CC} = 2.5V$ , Inputs tied to V <sub>CC</sub> or V <sub>SS</sub> , TA = +85°C

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

**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 ≤ VCC < 5.5V
			—	5	MHz	2.5V ≤ VCC < 4.5V
			—	3	MHz	1.8V ≤ VCC < 2.5V
2	TCSS	$\overline{\text{CS}}$ Setup Time	50	—	ns	4.5V ≤ VCC < 5.5V
			100	—	ns	2.5V ≤ VCC < 4.5V
			150	—	ns	1.8V ≤ VCC < 2.5V
3	TCSH	$\overline{\text{CS}}$ Hold Time	100	—	ns	4.5V ≤ VCC < 5.5V
			200	—	ns	2.5V ≤ VCC < 4.5V
			250	—	ns	1.8V ≤ VCC < 2.5V
4	TCSD	$\overline{\text{CS}}$ Disable Time	50	—	ns	—
5	Tsu	Data Setup Time	10	—	ns	4.5V ≤ VCC < 5.5V
			20	—	ns	2.5V ≤ VCC < 4.5V
			30	—	ns	1.8V ≤ VCC < 2.5V
6	THD	Data Hold Time	20	—	ns	4.5V ≤ VCC < 5.5V
			40	—	ns	2.5V ≤ VCC < 4.5V
			50	—	ns	1.8V ≤ VCC < 2.5V
7	TR	CLK Rise Time	—	100	ns	<b>(Note 1)</b>
8	TF	CLK Fall Time	—	100	ns	<b>(Note 1)</b>
9	THI	Clock High Time	50	—	ns	4.5V ≤ VCC < 5.5V
			100	—	ns	2.5V ≤ VCC < 4.5V
			150	—	ns	1.8V ≤ VCC < 2.5V
10	TLO	Clock Low Time	50	—	ns	4.5V ≤ VCC < 5.5V
			100	—	ns	2.5V ≤ VCC < 4.5V
			150	—	ns	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	ns	4.5V ≤ VCC < 5.5V
			—	100	ns	2.5V ≤ VCC < 4.5V
			—	160	ns	1.8V ≤ VCC < 2.5V
14	THO	Output Hold Time	0	—	ns	<b>(Note 1)</b>
15	TDIS	Output Disable Time	—	40	ns	4.5V ≤ VCC < 5.5V <b>(Note 1)</b>
			—	80	ns	2.5V ≤ VCC < 4.5V <b>(Note 1)</b>
			—	160	ns	1.8V ≤ VCC < 2.5V <b>(Note 1)</b>
16	THS	$\overline{\text{HOLD}}$ Setup Time	20	—	ns	4.5V ≤ VCC < 5.5V
			40	—	ns	2.5V ≤ VCC < 4.5V
			80	—	ns	1.8V ≤ VCC < 2.5V

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

**2:** 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 our web site:

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

# 25AA040A/25LC040A

**TABLE 1-2: AC CHARACTERISTICS (CONTINUED)**

AC CHARACTERISTICS			Industrial (I): $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ $V_{CC} = 1.8\text{V}$ to $5.5\text{V}$ Automotive (E): $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ $V_{CC} = 2.5\text{V}$ to $5.5\text{V}$			
Param. No.	Sym.	Characteristic	Min.	Max.	Units	Test Conditions
17	THH	$\overline{\text{HOLD}}$ Hold Time	20	—	ns	$4.5\text{V} \leq V_{CC} < 5.5\text{V}$
			40	—	ns	$2.5\text{V} \leq V_{CC} < 4.5\text{V}$
			80	—	ns	$1.8\text{V} \leq V_{CC} < 2.5\text{V}$
18	THZ	$\overline{\text{HOLD}}$ Low to Output High-Z	30	—	ns	$4.5\text{V} \leq V_{CC} < 5.5\text{V}$ <b>(Note 1)</b>
			60	—	ns	$2.5\text{V} \leq V_{CC} < 4.5\text{V}$ <b>(Note 1)</b>
			160	—	ns	$1.8\text{V} \leq V_{CC} < 2.5\text{V}$ <b>(Note 1)</b>
19	THV	$\overline{\text{HOLD}}$ High to Output Valid	30	—	ns	$4.5\text{V} \leq V_{CC} < 5.5\text{V}$
			60	—	ns	$2.5\text{V} \leq V_{CC} < 4.5\text{V}$
			160	—	ns	$1.8\text{V} \leq V_{CC} < 2.5\text{V}$
20	Twc	Internal Write Cycle Time (byte or page)	—	5	ms	<b>(NOTE 3)</b>
21	—	Endurance	1M	—	E/W Cycles	<b>(NOTE 2)</b>

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

**2:** 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 our web site:

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

**TABLE 1-3: AC TEST CONDITIONS**

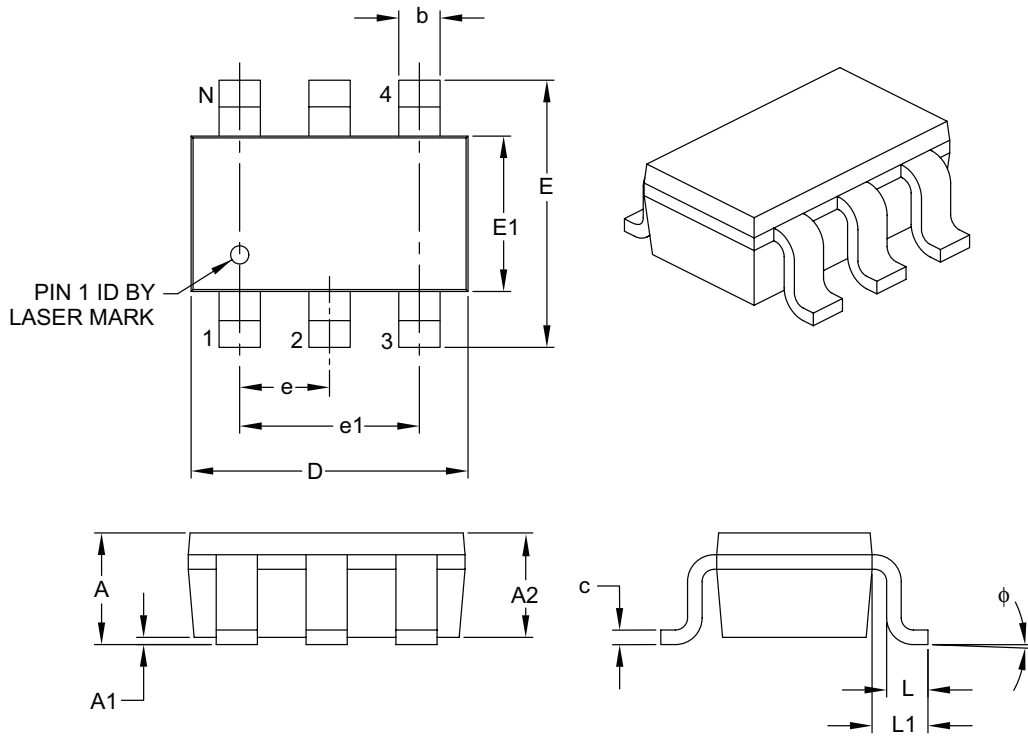
AC Waveform:	
$V_{LO} = 0.2\text{V}$	—
$V_{HI} = V_{CC} - 0.2\text{V}$	<b>(Note 1)</b>
$V_{HI} = 4.0\text{V}$	<b>(Note 2)</b>
$C_L = 100\text{ pF}$	—
Timing Measurement Reference Level	
Input	0.5 $V_{CC}$
Output	0.5 $V_{CC}$

**Note 1:** For  $V_{CC} \leq 4.0\text{V}$

**2:** For  $V_{CC} \geq 4.0\text{V}$

# 25AA040A/25LC040A

## 6-Lead Plastic Small Outline Transistor (CH) [SOT-23]



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Pins	N	6		
Pitch	e	0.95 BSC		
Outside Lead Pitch	e1	1.90 BSC		
Overall Height	A	0.90	–	1.45
Molded Package Thickness	A2	0.89	–	1.30
Standoff	A1	0.00	–	0.15
Overall Width	E	2.20	–	3.20
Molded Package Width	E1	1.30	–	1.80
Overall Length	D	2.70	–	3.10
Foot Length	L	0.10	–	0.60
Footprint	L1	0.35	–	0.80
Foot Angle	$\phi$	0°	–	30°
Lead Thickness	c	0.08	–	0.26
Lead Width	b	0.20	–	0.51

### Notes:

- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.127 mm per side.
- Dimensioning and tolerancing per ASME Y14.5M.

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

Microchip Technology Drawing C04-028B

# 25AA040A/25LC040A

## 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		Temperature	Package
<b>Device:</b>	25AA040A				
	25LC040A				
	25AA040AX				
	25LC040AX				
<b>Tape &amp; Reel:</b>	Blank	=			
	T	=			
<b>Temperature Range:</b>	I	=			
	E	=			
<b>Package:</b>	MS	=			
	P	=			
	SN	=			
	ST	=			
	MC	=			
	OT	=			

Examples:	
a)	25AA040A-I/MS = 4k-bit, 16-byte page, 1.8V Serial EEPROM, Industrial temp., MSOP package
b)	25AA040AT-I/SN = 4k-bit, 16-byte page, 1.8V Serial EEPROM, Industrial temp., Tape & Reel, SOIC package
c)	25LC040AT-I/SN = 4k-bit, 16-byte page, 2.5V Serial EEPROM, Industrial temp., Tape & Reel, SOIC package
d)	25LC040AT-I/ST = 4k-bit, 16-byte page, 2.5V Serial EEPROM, Industrial temp., Tape & Reel, TSSOP package
e)	25LC040AT-E/SN = 4k-bit, 16-byte page, 2.5V Serial EEPROM, Extended temp., Tape & Reel, SOIC package
f)	25LC040AX-E/ST = 4k-bit, 16-byte page, 2.5V Serial EEPROM, Extended temp., rotated pinout, TSSOP package