

## 2K I<sup>2</sup>C™ Serial EEPROM with Half-Array Write Protect

### Device Selection Table

Part Number	Vcc Range	Max. Clock	Temp. Range
24AA024H	1.7V-5.5V	400 kHz <sup>(1)</sup>	I
24LC024H	2.5V-5.5V	1 MHz	I, E

**Note 1:** 100 kHz for Vcc < 1.8V

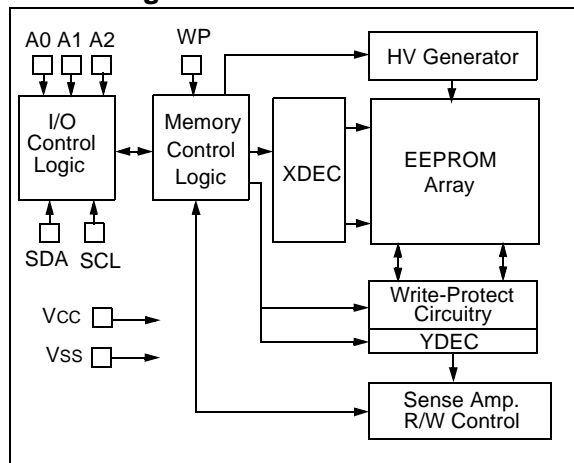
### Features:

- Single-Supply with Operation Down to 1.7V
- Low-Power CMOS Technology:
  - 400  $\mu$ A active current, max.
  - 1  $\mu$ A standby current, max.
- Organized as a Single Block of 256 Bytes (256 x 8)
- 2-Wire Serial Interface Bus, I<sup>2</sup>C™ Compatible
- Schmitt Trigger Inputs for Noise Suppression
- Output Slope Control to Eliminate Ground Bounce
- 100 kHz and 400 kHz Compatibility
- 1 MHz Compatibility (LC)
- Page Write Buffer for up to 16 Bytes
- Self-Timed Write Cycle (including Auto-Erase)
- Hardware Write Protection for Half Array (80h-FFh)
- Address Lines Allow up to Eight Devices on Bus
- 1 Million Erase/Write Cycles
- ESD Protection > 4,000V
- Data Retention > 200 Years
- Factory Programming (QTP) Available
- 8-pin PDIP, SOIC, TSSOP, TDFN and MSOP Packages
- Available for Extended Temperature Ranges:
  - Industrial (I): -40°C to +85°C
  - Automotive (E): -40°C to +125°C
- Pb-Free and RoHS compliant

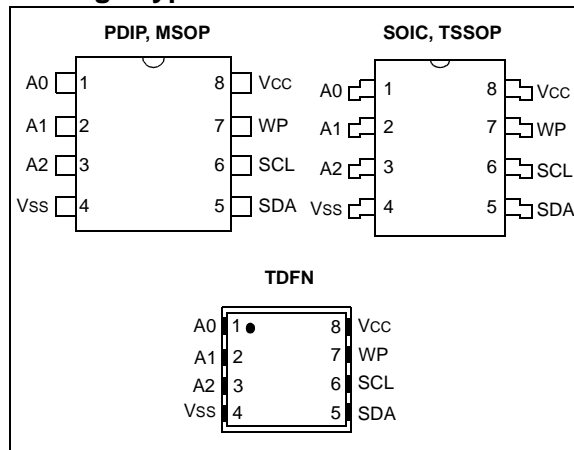
### Description:

The Microchip Technology Inc. 24AA024H/24LC024H is a 2 Kbit Serial Electrically Erasable PROM with operation down to 1.7V. The device is organized as a single block of 256 x 8-bit memory with a 2-wire serial interface. Low-current design permits operation with maximum standby and active currents of only 1  $\mu$ A and 400  $\mu$ A, respectively. The device has a page write capability for up to 16 bytes of data. Functional address lines allow the connection of up to eight 24AA024H/24LC024H devices on the same bus for up to 16 Kbits of contiguous EEPROM memory. The device is available in the standard 8-pin PDIP, 8-pin SOIC (150 mil), TSSOP, 2x3 TDFN and MSOP packages.

### Block Diagram



### Package Types



# 24AA024H/24LC024H

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings (†)

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 with power applied.....	-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 extended periods may affect device reliability.

**TABLE 1-1: DC CHARACTERISTICS**

DC CHARACTERISTICS			Electrical Characteristics:			
			Industrial (I): V <sub>CC</sub> = +1.7V to 5.5V		T <sub>A</sub> = -40°C to +85°C	
			Automotive (E): V <sub>CC</sub> = +2.5V to 5.5V		T <sub>A</sub> = -40°C to +125°C	
Param. No.	Sym.	Characteristic	Min.	Max.	Units	Conditions
D1	—	A0, A1, A2, SCL, SDA and WP pins:	—	—	—	—
D2	V <sub>IH</sub>	High-level input voltage	0.7 V <sub>CC</sub>	—	V	—
D3	V <sub>IL</sub>	Low-level input voltage	—	0.3 V <sub>CC</sub>	V	—
D4	V <sub>HYS</sub>	Hysteresis of Schmitt Trigger inputs (SDA, SCL pins)	0.05 V <sub>CC</sub>	—	V	<b>(Note)</b>
D5	V <sub>OL</sub>	Low-level output voltage	—	0.40	V	I <sub>OL</sub> = 3.0 ma @ V <sub>CC</sub> = 4.5V I <sub>OL</sub> = 2.1 ma @ V <sub>CC</sub> = 2.5V
D6	I <sub>LI</sub>	Input leakage current	—	±1	μA	V <sub>IN</sub> = V <sub>SS</sub> or V <sub>CC</sub> , WP = V <sub>SS</sub>
D7	I <sub>LO</sub>	Output leakage current	—	±1	μA	V <sub>OUT</sub> = V <sub>SS</sub> or V <sub>CC</sub>
D8	C <sub>IN</sub> , C <sub>OUT</sub>	Pin capacitance (all inputs/outputs)	—	10	pF	V <sub>CC</sub> = 5.0V <b>(Note)</b> T <sub>A</sub> = 25°C, f = 1 MHz
D9	I <sub>CC</sub> Read	Operating current	—	400	μA	V <sub>CC</sub> = 5.5V, SCL = 400 kHz
	I <sub>CC</sub> Write		—	3	mA	V <sub>CC</sub> = 5.5V
D10	I <sub>CCS</sub>	Standby current	—	1	μA	V <sub>CC</sub> = 5.5V, SCL = SDA = V <sub>CC</sub> WP = V <sub>SS</sub> , A0, A1, A2 = V <sub>SS</sub>

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

# 24AA024H/24LC024H

**TABLE 1-2: AC CHARACTERISTICS**

AC CHARACTERISTICS			Electrical Characteristics:			
			Industrial (I):	V <sub>CC</sub> = +1.7V to 5.5V	T <sub>A</sub> = -40°C to +85°C	
			Automotive (E):	V <sub>CC</sub> = +2.5V to 5.5V	T <sub>A</sub> = -40°C to +125°C	
Param. No.	Symbol	Characteristic	Min.	Max.	Units	Conditions
1	FCLK	Clock frequency	— — —	100 400 1000	kHz	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
2	THIGH	Clock high time	4000 600 500	— — —	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
3	TLOW	Clock low time	4700 1300 500	— — —	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
4	TR	SDA and SCL rise time ( <b>Note 1</b> )	— — —	1000 300 300	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
5	TF	SDA and SCL fall time ( <b>Note 1</b> )	— — —	1000 300 300	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
6	THD:STA	Start condition hold time	4000 600 250	— — —	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
7	TSU:STA	Start condition setup time	4700 600 250	— — —	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
8	THD:DAT	Data input hold time	0	—	ns	<b>(Note 2)</b>
9	TSU:DAT	Data input setup time	250 100 100	— — —	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
10	TSU:STO	Stop condition setup time	4000 600 250	— — —	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
11	TSU:WP	WP setup time	4000 600 600	— — —	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
12	THD:WP	WP hold time	4700 600 600	— — —	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
13	TAA	Output valid from clock ( <b>Note 2</b> )	— — —	3500 900 400	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
14	TBUF	Bus free time: Time the bus must be free before a new transmission can start	1300 4700 4700	— — —	ns	1.7V ≤ V <sub>CC</sub> < 1.8V 1.8V ≤ V <sub>CC</sub> ≤ 5.5V 2.5V ≤ V <sub>CC</sub> ≤ 5.5V (24LC024H)
16	TSP	Input filter spike suppression (SDA and SCL pins)	—	50	ns	24AA024H <b>(Note 1 and Note 3)</b>
17	TWC	Write cycle time (byte or page)	—	5	ms	—
18	—	Endurance	1M	—	cycles	25°C, V <sub>CC</sub> = 5.5V, Block mode <b>(Note 4)</b>

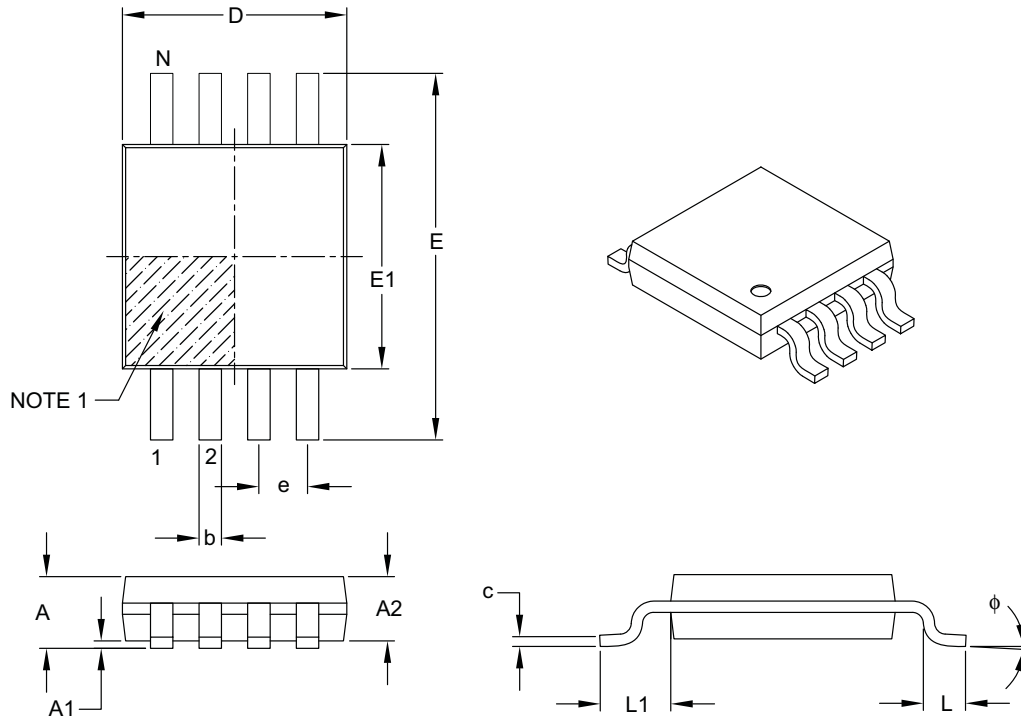
**Note 1:** Not 100% tested. C<sub>B</sub> = total capacitance of one bus line in pF.

**Note 2:** As a transmitter, the device must provide an internal minimum delay time to bridge the undefined region (minimum 300 ns) of the falling edge of SCL to avoid unintended generation of Start or Stop conditions.

**Note 3:** The combined TSP and VHYS specifications are due to new Schmitt Trigger inputs, which provide improved noise spike suppression. This eliminates the need for a TI specification for standard operation.

**Note 4:** 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

## 8-Lead Plastic Micro Small Outline Package (MS) [MSOP]



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Pins	N	8		
Pitch	e	0.65 BSC		
Overall Height	A	–	–	1.10
Molded Package Thickness	A2	0.75	0.85	0.95
Standoff	A1	0.00	–	0.15
Overall Width	E	4.90 BSC		
Molded Package Width	E1	3.00 BSC		
Overall Length	D	3.00 BSC		
Foot Length	L	0.40	0.60	0.80
Footprint	L1	0.95 REF		
Foot Angle	$\phi$	0°	–	8°
Lead Thickness	c	0.08	–	0.23
Lead Width	b	0.22	–	0.40

### 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 C04-111B

# 24AA024H/24LC024H

## 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>/XX</u>
Device	Temperature Range	Package
<b>Device:</b>		
24AA024H:	1.7V, 2 Kbit Addressable Serial EEPROM	
24AA024HT:	1.7V, 2 Kbit Addressable Serial EEPROM (Tape and Reel)	
24LC024H:	2.5V, 2 Kbit Addressable Serial EEPROM	
24LC024HT:	2.5V, 2 Kbit Addressable Serial EEPROM (Tape and Reel)	
<b>Temperature Range:</b>	I = -40°C to +85°C	
	E = -40°C to +125°C	
<b>Package:</b>		
	P = Plastic DIP, (300 mil Body), 8-lead	
	SN = Plastic SOIC, (3.90 mm Body)	
	ST = TSSOP, (4.4 mm Body), 8-lead	
	MS = MSOP, (Plastic Micro Small Outline), 8-lead	
	MNY <sup>(1)</sup> = TDFN, (2x3x0.75 mm Body), 8-lead	
<b>Note 1:</b>	"Y" indicates a Nickel Palladium Gold (NiPdAu) finish.	

**Examples:**

- a) 24AA024H-I/P: Industrial Temperature, 1.7V, PDIP package.
- b) 24AA024H-I/SN: Industrial Temperature, 1.7V, SOIC Package.
- c) 24AA024HT-I/ST: Industrial Temperature, 1.7V, TSSOP Package, Tape and Reel

- a) 24LC024H-I/P: Industrial Temperature, 2.5V, PDIP Package.
- b) 24LC024HT-E/SN: Automotive Temperature, 2.5V, SOIC Package, Tape and Reel
- c) 24LC024HT-I/MS: Industrial Temperature, 2.5V, MSOP Package, Tape and Reel.