



# MICROCHIP 24AA024/24LC024/24AA025/24LC025

## 2K I<sup>2</sup>C™ Serial EEPROM

### Device Selection Table

Part Number	Vcc Range	Max Clock	Temp. Range	Write Protect
24AA024	1.7V-5.5V	400 kHz <sup>(1)</sup>	I	Yes
24AA025	1.7V-5.5V	400 kHz <sup>(1)</sup>	I	No
24LC024	2.5V-5.5V	400 kHz	I	Yes
24LC025	2.5V-5.5V	400 kHz	I	No

**Note 1:** 100 kHz for Vcc < 2.5V

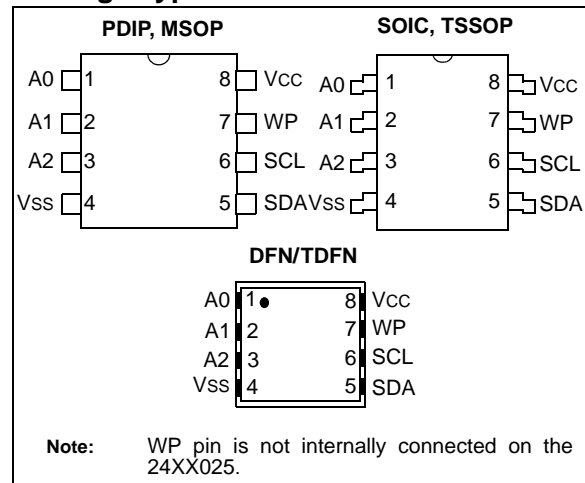
### Features:

- Single supply with operation from 1.7V to 5.5V for 24AA024/24AA025 devices, 2.5V for 24LC024/24LC025 devices
- Low-power CMOS technology:
  - Read current 1 mA, typical
  - Standby current 1  $\mu$ A, typical
- 2-wire serial interface, I<sup>2</sup>C™ compatible
- Cascadable up to eight devices
- Schmitt Trigger inputs for noise suppression
- Output slope control to eliminate ground bounce
- 100 kHz and 400 kHz clock compatibility
- Page write time 5 ms maximum
- Self-timed erase/write cycle
- 16-byte page write buffer
- Hardware write-protect on 24XX024 devices
- ESD protection >4,000V
- More than 1 million erase/write cycles
- Data retention >200 years
- Factory programming available
- Packages include 8-lead PDIP, SOIC, TSSOP, DFN, TDFN and MSOP
- Pb-free and RoHS compliant
- Temperature ranges:
  - Industrial (I): -40°C to +85°C

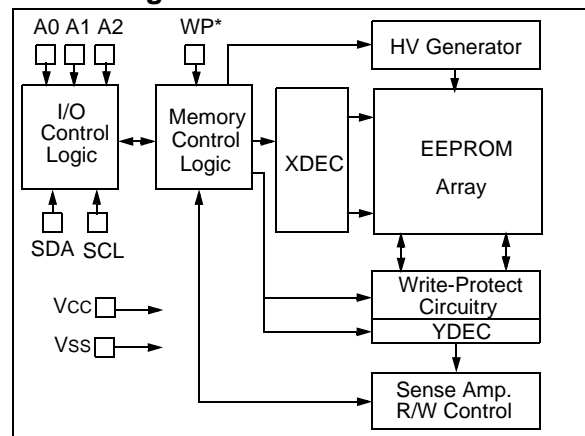
### Description:

The Microchip Technology Inc. 24AA024/24LC024/24AA025/24LC025 is a 2 Kbit Serial Electrically Erasable PROM with a voltage range of 1.7V to 5.5V. 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 typical standby and active currents of only 1  $\mu$ A and 1 mA, 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 24AA024/24LC024/24AA025/24LC025 devices on the same bus for up to 16K bits of contiguous EEPROM memory. The device is available in the standard 8-pin PDIP, 8-pin SOIC (3.90 mm), TSSOP, 2x3 DFN and TDFN and MSOP packages.

### Package Types



### Block Diagram



# 24AA024/24LC024/24AA025/24LC025

## 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**

All parameters apply across the specified operating ranges unless otherwise noted.		V <sub>CC</sub> = 1.7V to 5.5V Industrial (I): T <sub>A</sub> = -40°C to +85°C			
Parameter	Symbol	Min.	Max.	Units	Conditions
SCL and SDA pins:					
High-level input voltage	V <sub>IH</sub>	0.7 V <sub>CC</sub>	—	V	—
Low-level input voltage	V <sub>IL</sub>	—	0.3 V <sub>CC</sub>	V	—
Hysteresis of Schmitt Trigger inputs	V <sub>HYS</sub>	0.05 V <sub>CC</sub>	—	V	<b>(Note)</b>
Low-level output voltage	V <sub>OL</sub>	—	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
Input leakage current	I <sub>LI</sub>	—	±1	μA	V <sub>IN</sub> = V <sub>SS</sub> or V <sub>CC</sub>
Output leakage current	I <sub>LO</sub>	—	±1	μA	V <sub>OUT</sub> = V <sub>SS</sub> or V <sub>CC</sub>
Pin capacitance (all inputs/outputs)	C <sub>IN</sub> , C <sub>OUT</sub>	—	10	pF	V <sub>CC</sub> = 5.0V <b>(Note)</b> T <sub>A</sub> = 25°C, F <sub>CLK</sub> = 1 MHz
Operating current	I <sub>CC</sub> Read	—	1	mA	V <sub>CC</sub> = 5.5V, SCL = 400 kHz
	I <sub>CC</sub> Write	—	3	mA	V <sub>CC</sub> = 5.5V
Standby current	I <sub>CCS</sub>	—	1	μA	V <sub>CC</sub> = 5.5V, SDA = SCL = 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.

# 24AA024/24LC024/24AA025/24LC025

**TABLE 1-2: AC CHARACTERISTICS**

All parameters apply across the specified operating ranges unless otherwise noted.			V <sub>CC</sub> = 1.7V to 5.5V Industrial (I): T <sub>A</sub> = -40°C to +85°C				
Parameter	Symbol	STD MODE		V <sub>CC</sub> = 2.5V - 5.5V FAST MODE		Units	Remarks
		Min.	Max.	Min.	Max.		
Clock frequency	FCLK	—	100	—	400	kHz	—
Clock high time	THIGH	4000	—	600	—	ns	—
Clock low time	TLOW	4700	—	1300	—	ns	—
SDA and SCL rise time	TR	—	1000	—	300	ns	<b>(Note 1)</b>
SDA and SCL fall time	TF	—	300	—	300	ns	<b>(Note 1)</b>
Start condition hold time	THD:STA	4000	—	600	—	ns	After this period the first clock pulse is generated
Start condition setup time	TSU:STA	4700	—	600	—	ns	Only relevant for repeated Start condition
Data input hold time	THD:DAT	0	—	0	—	ns	<b>(Note 2)</b>
Data input setup time	TSU:DAT	250	—	100	—	ns	—
Stop condition setup time	TSU:STO	4000	—	600	—	ns	—
Output valid from clock	TAA	—	3500	—	900	ns	<b>(Note 2)</b>
Bus free time	TBUF	4700	—	1300	—	ns	Time the bus must be free before a new transmission can start
Output fall time from V <sub>IH</sub> minimum to V <sub>IL</sub> maximum	TOF	—	250	20 +0.1 C <sub>B</sub>	250	ns	<b>(Note 1)</b> , C <sub>B</sub> ≤ 100 pF
Input filter spike suppression (SDA and SCL pins)	TSP	—	50	—	50	ns	<b>(Note 3)</b>
Write cycle time	TWC	—	5	—	5	ms	Byte or Page mode
Endurance		1M	—	1M	—	cycles	25°C, <b>(Note 4)</b>

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

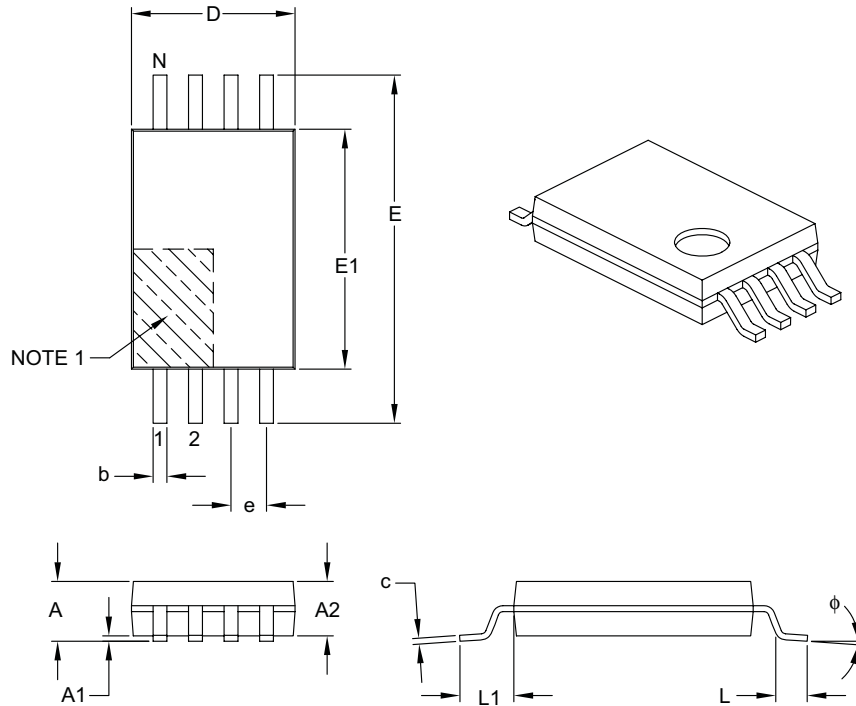
**2:** As a transmitter, the device must provide an internal minimum delay time to bridge the undefined region (minimum 300 ns) of the falling edge of SCL to avoid unintended generation of Start or Stop conditions.

**3:** The combined TSP and V<sub>HYS</sub> specifications are due to Schmitt Trigger inputs which provide improved noise spike suppression. This eliminates the need for a TI specification for standard operation.

**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 downloaded at

# 24AA024/24LC024/24AA025/24LC025

## 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	$\phi$	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

# 24AA024/24LC024/24AA025/24LC025

## 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>		
24AA024:	1.7V, 2 Kbit Addressable Serial EEPROM with WP pin.	
24AA024T:	1.7V, 2 Kbit Addressable Serial EEPROM (Tape and Reel) with WP pin.	
24LC024:	2.5V, 2 Kbit Addressable Serial EEPROM with WP pin.	
24LC024T:	2.5V, 2 Kbit Addressable Serial EEPROM (Tape and Reel) with WP pin.	
24AA025:	1.7V, 2 Kbit Addressable Serial EEPROM with no WP pin.	
24AA025T:	1.7V, 2 Kbit Addressable Serial EEPROM (Tape and Reel) with no WP pin.	
24LC025:	2.5V, 2 Kbit Addressable Serial EEPROM (Tape and Reel) with no WP pin.	
24LC025T:	2.5V, 2 Kbit Addressable Serial EEPROM (Tape and Reel) with no WP pin.	
<b>Temperature Range:</b>	I = -40°C to +85°C	
<b>Package:</b>		
P	= Plastic DIP, (300 mil Body), 8-lead	
SN	= Plastic SOIC, (3.90 mm Body)	
ST	= TSSOP, 8-lead	
MS	= MSOP, 8-lead	
MC	= 2x3 DFN, 8-lead	
MNY <sup>(1)</sup>	= Plastic Dual Flat (TDFN), No lead package, 2x3 mm body, 8-lead	
<b>Note 1:</b> "Y" indicates a Nickel, Palladium, Gold (NiPdAu) finish.		

**Examples:**

- a) 24AA024-I/P: Industrial Temperature, 1.7V, PDIP Package
- b) 24AA024-I/SN: Industrial Temperature, 1.7V, SOIC Package
- c) 24AA025T-I/ST: Industrial Temperature, 1.7V, TSSOP Package, Tape and Reel, no WP
- d) 24LC024-I/P: Industrial Temperature, 2.5V, PDIP Package
- e) 24LC024-I/MS: Industrial Temperature, 2.5V, MSOP Package, Tape and Reel
- f) 24LC025-T-I/SN: Industrial Temperature, 2.5V, SOIC Package, Tape and Reel, No WP