

## 2K 5.0V I<sup>2</sup>C™ Serial EEPROM

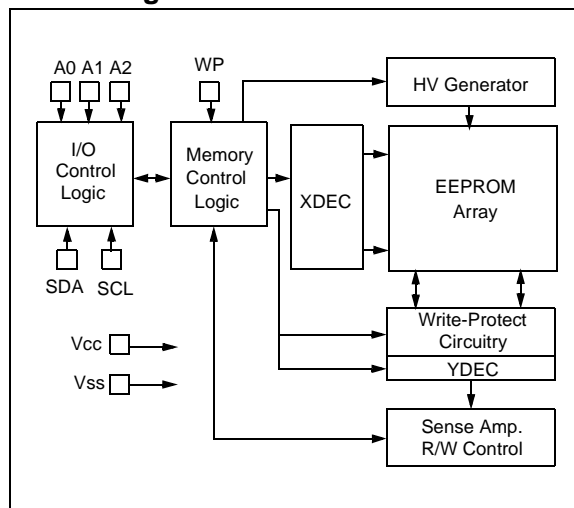
### Features:

- Single-Supply with Operation from 4.5V to 5.5V
- Low-Power CMOS Technology:
  - Read current 1 mA, max.
  - Standby current 5  $\mu$ A, max.
- 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
- Fast Page or Byte Write Time 1 ms, typical
- Self-Timed Erase/Write Cycle
- 16-Byte Page Write Buffer
- Hardware Write-Protect for Upper Half of the Array (80h-FFh)
- 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
  - Automotive (E): -40°C to +125°C

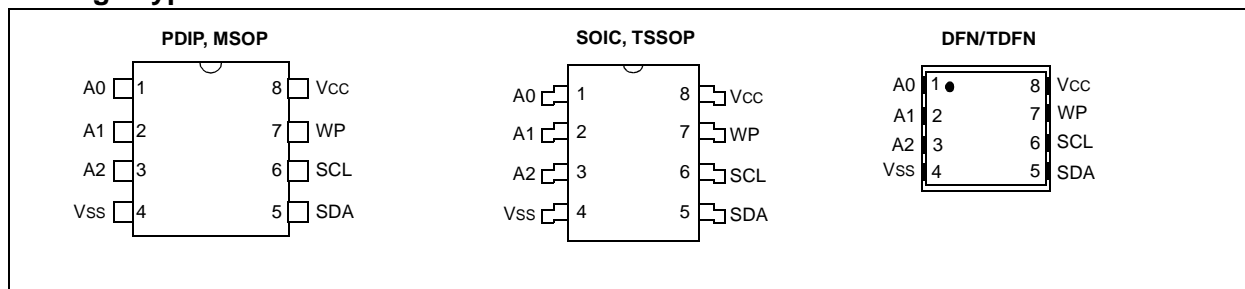
### Description:

The Microchip Technology Inc. 24C02C is a 2K bit Serial Electrically Erasable PROM with a voltage range of 4.5V 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 max. standby and active currents of only 5  $\mu$ A and 1 mA, respectively. The device has a page write capability for up to 16 bytes of data and has fast write cycle times of only 1 ms for both byte and page writes. Functional address lines allow the connection of up to eight 24C02C 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), 8-pin 2x3 DFN and TDFN, 8-pin MSOP and TSSOP packages.

### Block Diagram



### Package Types



# 24C02C

## 1.0 ELECTRICAL CHARACTERISTICS

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

V <sub>CC</sub> .....	7.0V
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 these or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to Absolute 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> = +4.5V to 5.5V		T <sub>A</sub> = -40°C to +85°C	
			Automotive (E): V <sub>CC</sub> = +4.5V 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
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	—	1	mA	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	—	5	μA	V <sub>CC</sub> = 5.5V SCL = SDA = V <sub>CC</sub> WP = V <sub>SS</sub>

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

TABLE 1-2: AC CHARACTERISTICS

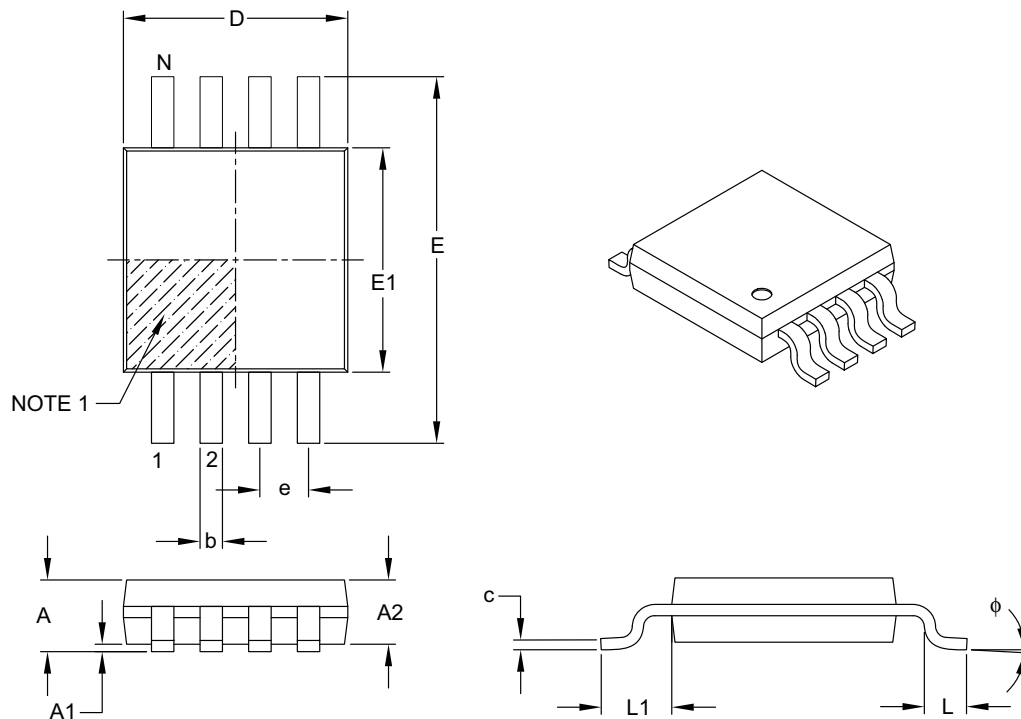
AC CHARACTERISTICS			Electrical Characteristics:			
			Industrial (I): VCC = +4.5V to 5.5V		TA = -40°C to +85°C	
			Automotive (E): VCC = +4.5V to 5.5V		TA = -40°C to +125°C	
Param. No.	Sym.	Characteristic	Min.	Max.	Units	Conditions
1	FCLK	Clock frequency	— —	100 400	kHz	— (I-temp)
2	THIGH	Clock high time	4000 600	— —	ns	— (I-temp)
3	TLOW	Clock low time	4700 1300	— —	ns	— (I-temp)
4	TR	SDA and SCL rise time (Note 1)	— —	1000 300	ns	— (I-temp)
5	TF	SDA and SCL fall time (Note 1)	—	300	ns	— (I-temp)
6	THD:STA	Start condition hold time	4000 600	— —	ns	— (I-temp)
7	TSU:STA	Start condition setup time	4700 600	— —	ns	— (I-temp)
8	THD:DAT	Data input hold time	0	—	ns	(Note 2)
9	TSU:DAT	Data input setup time	250 100	— —	ns	— (I-temp)
10	TSU:STO	Stop condition setup time	4000 600	— —	ns	— (I-temp)
11	TAA	Output valid from clock (Note 2)	— —	3500 900	ns	— (I-temp)
12	TBUF	Bus free time: Time the bus must be free before a new transmission can start	4700 1300	— —	ns	— (I-temp)
13	TOF	Output fall time from VIH minimum to VIL maximum CB ≤ 100 pF	10 + 0.1CB	250	ns	(Note 1)
14	TSP	Input filter spike suppression (SDA and SCL pins)	—	50	ns	(Note 3)
15	TWC	Write cycle time (byte or page)	—	1.5 1	ms	— (I-temp)
16	—	Endurance	1,000,000	—	cycles	25°C (Note 4)

**Note 1:** Not 100% tested. CB = 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 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.
- 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

# 24C02C

## 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

## 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
<p><b>Device:</b></p> <p>24C02C: 2K I<sup>2</sup>C™ Serial EEPROM            24C02CT: 2K I<sup>2</sup>C™ Serial EEPROM (Tape and Reel)</p> <p><b>Temperature Range:</b></p> <p>I = -40°C to +85°C            E = -40°C to +125°C</p> <p><b>Package:</b></p> <p>P = Plastic DIP (300 mil Body), 8-lead            SN = Plastic SOIC, (3.90 mm Body), 8-lead            ST = TSSOP (4.4 mm Body), 8-lead            MS = Plastic Micro Small Outline (MSOP), 8-lead            MC = Plastic Dual Flat (DFN), No lead package, 2x3 mm body, 8-lead            MNY<sup>(1)</sup> = Plastic Dual Flat (TDFN), No lead package, 2x3 mm body, 8-lead</p> <p><b>Note 1:</b> "Y" indicates a Nickel, Palladium, Gold (NiPdAu) finish.</p>		<p><b>Examples:</b></p> <p>a) 24C02C-I/P: Industrial Temperature, PDIP Package</p> <p>b) 24C02C-E/SN: Extended Temperature, SOIC Package</p> <p>c) 24C02C-I/MNY: Industrial Temperature, 2x3 TDFN Package</p>