MICROCHIP®

24AA16/24LC16B

16K I^{2}C™ Serial EEPROM

Device Selection Table

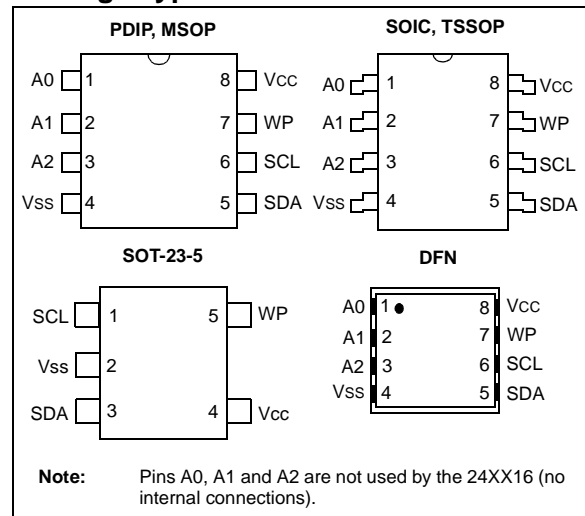| Part Number	Vcc Range	Max. Clock Frequency	Temp. Ranges
24AA16	1.7-5.5	400 kHz[1]	I
24LC16B	2.5-5.5	400 kHz	I, E

Note 1: 100 kHz for $V_{CC} <2.5V$

Features:

- Single supply with operation down to 1.7V 24AA16 devices, 2.5V for 24LC16B devices
- Low-power CMOS technology:
  - Active current 1 mA, typical
  - Standby current, 1 μa, typical
- 2-wire serial interface, I^{2}C™ compatible
- Schmitt Trigger inputs for noise suppression
- Output slope control to eliminate ground bounce
- 100 kHz (2.5V) and 400 kHz clock compatibility
- Page write time 5 ms max.
- Self-timed erase/write cycle
- 16-byte page write buffer
- Hardware write-protect
- 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, MSOP, DFN and SOT-23-5
- Pb-free and RoHS compliant
- Temperature ranges:
  - Industrial (I):   -40°C to +85°C
  - Automotive (E): -40°C to +125°C

*24XX16 is used in this document as a generic part number for the 24AA16/24LC16B devices.
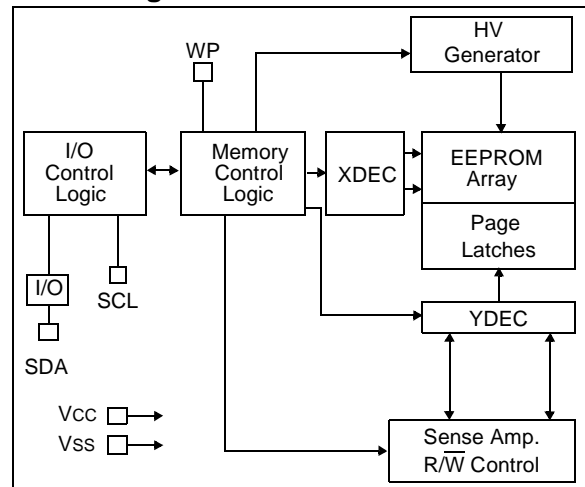
Description:

The Microchip Technology Inc. 24AA16/24LC16B (24XX16*) is a 16 Kbit Electrically Erasable PROM. The device is organized as eight blocks of 256 x 8-bit memory with a 2-wire serial interface. Low-voltage design permits operation down to 1.7V with standby and active currents of only 1 μA and 1 mA, respectively. The 24XX16 also has a page write capability for up to 16 bytes of data. The 24XX16 is available in the standard 8-pin PDIP, surface mount SOIC, TSSOP, 2x3 DFN and MSOP packages, and is also available in the 5-lead SOT-23 package.

Package Types

Note: Pins A0, A1 and A2 are not used by the 24XX16 (no internal connections).

Block Diagram

24AA16/24LC16B

1.0   ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings [†]

VCC..6.5V

All inputs and outputs w.r.t. VSS .... -0.3V to VCC +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			Industrial (I): TA = -40°C to +85°C, VCC = +1.7V to +5.5V Automotive (E): TA = -40°C to +125°C, VCC = +2.5V to +5.5V				
Param. No.	Symbol	Characteristic	Min.	Typ.	Max.	Units	Conditions
D1	VIH	**WP, SCL and SDA pins**	—	—	—	—	—
D2	—	High-level input voltage	0.7 VCC	—	—	V	—
D3	VIL	Low-level input voltage	—	—	0.3 VCC	V	—
D4	VHYS	Hysteresis of Schmitt Trigger inputs	.05 VCC	—	—	V	**(Note 1)**
D5	VOL	Low-level output voltage	—	—	0.40	V	IOL = 3.0 mA, VCC = 2.5V
D6	ILI	**Input leakage current**	—	—	±1	µA	VIN = VSS or VCC
D7	ILO	**Output leakage current**	—	—	±1	µA	VOUT = VSS or VCC
D8	CIN, COUT	Pin capacitance (all inputs/outputs)	—	—	10	pF	VCC = 5.0V **(Note 1)** TA = 25°C, FCLK = 1 MHz
D9	ICC write	**Operating current**	—	—	3	mA	VCC = 5.5V, SCL = 400 kHz
D10	ICC read		—	0.01	1	mA	—
D11	ICCS	**Standby current**	—	0.3	1	µA	Industrial
			—	.01	5	µA	Automotive SDA = SCL = VCC WP = VSS

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

2:   Typical measurements taken at room temperature.

TABLE 1-2: AC CHARACTERISTICS

AC CHARACTERISTICS			Industrial (I): TA = -40°C to +85°C, VCC = +1.7V to +5.5V Automotive (E): TA = -40°C to +125°C, VCC = +2.5V to +5.5V			
Param. No.	Symbol	Characteristic	Min.	Max.	Units	Conditions
1	FCLK	Clock frequency	— —	400 100	kHz	2.5V ≤ VCC ≤ 5.5V 1.7V ≤ VCC < 2.5V **(24AA16)**
2	THIGH	Clock high time	600 4000	— —	ns	2.5V ≤ VCC ≤ 5.5V 1.7V ≤ VCC < 2.5V **(24AA16)**
3	TLOW	Clock low time	1300 4700	— —	ns	2.5V ≤ VCC ≤ 5.5V 1.7V ≤ VCC < 2.5V **(24AA16)**
4	TR	SDA and SCL rise time **(Note 1)**	— —	300 1000	ns	2.5V ≤ VCC ≤ 5.5V **(Note 1)** 1.7V ≤ VCC < 2.5V **(24AA16)** **(Note 1)**
5	TF	SDA and SCL fall time	—	300	ns	**(Note 1)**
6	THD:STA	Start condition hold time	600 4000	— —	ns	2.5V ≤ VCC ≤ 5.5V 1.7V ≤ VCC < 2.5V **(24AA16)**
7	TSU:STA	Start condition setup time	600 4700	— —	ns	2.5V ≤ VCC ≤ 5.5V 1.7V ≤ VCC < 2.5V **(24AA16)**
8	THD:DAT	Data input hold time	0	—	ns	**(Note 2)**
9	TSU:DAT	Data input setup time	100 250	— —	ns	2.5V ≤ VCC ≤ 5.5V 1.7V ≤ VCC < 2.5V **(24AA16)**
10	TSU:STO	Stop condition setup time	600 4000	— —	ns	2.5V ≤ VCC ≤ 5.5V 1.7V ≤ VCC < 2.5V **(24AA16)**
11	TAA	Output valid from clock **(Note 2)**	— —	900 3500	ns	2.5V ≤ VCC ≤ 5.5V 1.7V ≤ VCC < 2.5V **(24AA16)**
12	TBUF	Bus free time: Time the bus must be free before a new transmission can start	1300 4700	— —	ns	2.5V ≤ VCC ≤ 5.5V 1.7V ≤ VCC < 2.5V **(24AA16)**
13	TOF	Output fall time from VIH minimum to VIL maximum	20+0.1CB —	250 250	ns	2.5V ≤ VCC ≤ 5.5V 1.7V ≤ VCC <2.5V **(24AA16)**
14	TSP	Input filter spike suppression (SDA and SCL pins)	—	50	ns	**(Notes 1 and 3)**
15	TWC	Write cycle time (byte or page)	—	5	ms	—
16	—	Endurance	1M	—	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

5-Lead Plastic Small Outline Transistor (OT or CT) [SOT-23]
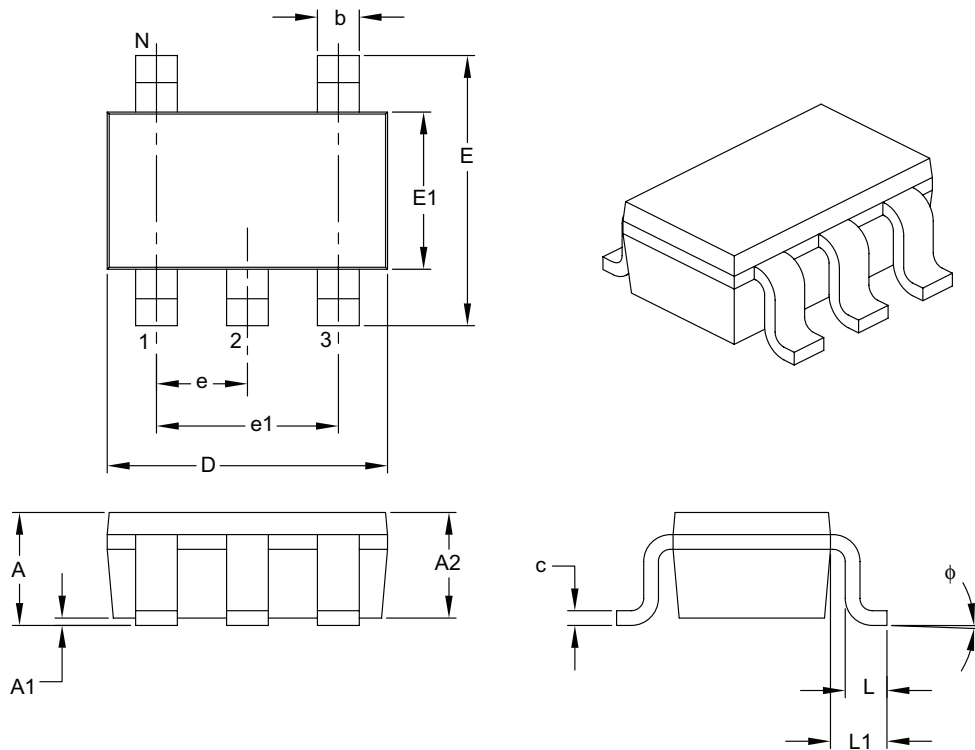
	Units		MILLIMETERS		
	Dimension Limits		MIN	NOM	MAX
Number of Pins		N		5	
Lead Pitch		e		0.95 BSC	
Outside Lead Pitch		e1		1.90 BSC	
Overall Height		A	0.90	–	1.45
Molded Package Thickness		A2	0.89	–	1.30
Standoff		A1	0.00	–	0.15
Overall Width		E	2.20	–	3.20
Molded Package Width		E1	1.30	–	1.80
Overall Length		D	2.70	–	3.10
Foot Length		L	0.10	–	0.60
Footprint		L1	0.35	–	0.80
Foot Angle		φ	0°	–	30°
Lead Thickness		c	0.08	–	0.26
Lead Width		b	0.20	–	0.51

Notes:

1. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.127 mm per side.
2. Dimensioning and tolerancing per ASME Y14.5M.
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-091B

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   /XX

Device   Temperature   Package
           Range

24AA16:	=	1.7V, 16 Kbit I^{2}C Serial EEPROM
24AA16T:	=	1.7V, 16 Kbit I^{2}C Serial EEPROM (Tape and Reel)
24LC16B:	=	2.5V, 16 Kbit I^{2}C Serial EEPROM
24LC16BT:	=	2.5V, 16 Kbit I^{2}C Serial EEPROM (Tape and Reel)

Temperature Range:	I	= -40°C to +85°C
	E	= -40°C to +125°C

Package:	MC	=	2x3 DFN, 8-lead
	P	=	Plastic DIP (300 mil body), 8-lead
	SN	=	Plastic SOIC (3.90 mm body), 8-lead
	ST	=	Plastic TSSOP (4.4 mm), 8-lead
	MS	=	Plastic Micro Small Outline (MSOP), 8-lead
	OT	=	SOT-23, 5-lead (Tape and Reel only)

Examples:

a) 24AA16-I/P: Industrial Temperature,1.7V, PDIP package

b) 24AA16-I/SN: Industrial Temperature,1.7V, SOIC package

c) 24AA16T-I/OT: Industrial Temperature, 1.7V, SOT-23 package, Tape and Reel

d) 24LC16B-I/P: Industrial Temperature, 2.5V, PDIP package

e) 24LC16B-E/SN: Automotive Temp.,2.5V SOIC package

f) 24LC16BT-I/OT: Industrial Temperature, 2.5V, SOT-23 package, Tape and Reel