24AA32A/24LC32A

32K I²C™ Serial EEPROM

Device Selection Table

Part Number	Vcc Range	Max. Clock Frequency	Temp. Ranges
24AA32A	1.7-5.5	400 kHz(1)	I
24LC32A	2.5-5.5	400 kHz	I, E

Note 1: 100 kHz for Vcc <2.5V

Features:

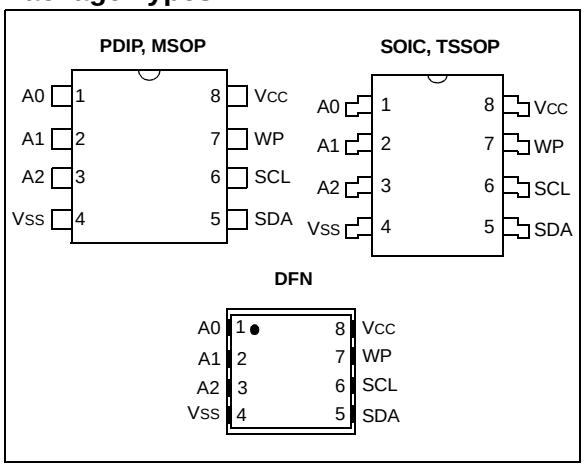
- Single supply with operation down to 1.7V for 24AA32A devices, 2.5V for 24LC32A devices
- Low-power CMOS technology:
  - Active current 1 mA, typical
  - Standby current 1 µA, typical
- 2-wire serial interface, I²C™ compatible
- Cascadable up to eight devices
- Schmitt Trigger inputs for noise suppression
- Output slope control to eliminate ground bounce
- 100 kHz and 400 kHz clock compatibility
- Page write time 5 ms max.
- Self-timed erase/write cycle
- 32-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 and DFN
- Pb-free and RoHS compliant
- Temperature ranges:
  - Industrial (I): -40°C to +85°C
  - Automotive (E): -40°C to +125°C

*24XX32A is used in this document as a generic part number for the 24AA32A/24LC32A devices.

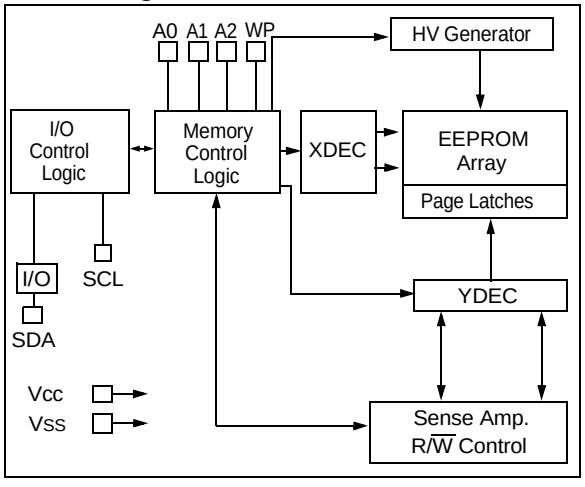
Description:

The Microchip Technology Inc. 24AA32A/24LC32A (24XX32A*) is a 32 Kbit Electrically Erasable PROM. The device is organized as a single block of 4K 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. It has been developed for advanced, low-power applications such as personal communications or data acquisition. The 24XX32A also has a page write capability for up to 32 bytes of data. Functional address lines allow up to eight devices on the same bus, for up to 256 Kbits address space. The 24XX32A is available in the standard 8-pin PDIP, surface mount SOIC, TSSOP, 2x3 DFN and MSOP packages.

Package Types



Block Diagram



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	—	**A0, A1, A2, WP, SCL and SDA pins**	—	—	—	—	—
D2	VIH	High-level input voltage	0.7 VCC	—	—	V	—
D3	VIL	Low-level input voltage	—	—	0.3 VCC 0.2 VCC	V V	VCC ≥ 2.5V VCC < 2.5V
D4	VHYS	Hysteresis of Schmitt Trigger inputs (SDA, SCL pins)	0.05 VCC	—	—	V	VCC ≥ 2.5V **(Note 1)**
D5	VOL	Low-level output voltage	—	—	0.40	V	IOL = 3.0 mA, VCC = 4.5V IOL = 2.1 mA, Vcc = 2.5V
D6	ILI	**Input leakage current**	—	—	±1	µA	VIN = VSS or VCC, WP = VSS VIN = VSS or VCC, WP = 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**	—	0.1	3	mA	VCC = 5.5V, SCL = 400 kHz
D10	ICC read		—	0.05	400	µA	
D11	ICCS	**Standby current**	— —	0.01 —	1 5	µA µA	Industrial Automotive SDA = SCL = VCC = 5.5V A0, A1, A2, 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): T_A = -40°C to +85°C, V_{CC} = +1.7V to +5.5V Automotive (E): T_A = -40°C to +125°C, V_{CC} = +2.5V to +5.5V			
Param. No.	**Symbol**	**Characteristic**	**Min.**	**Max.**	**Units**	**Conditions**
1	F_{CLK}	Clock Frequency	— —	400 100	kHz	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
2	T_{HIGH}	Clock High Time	600 4000	— —	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
3	T_{LOW}	Clock Low Time	1300 4700	— —	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
4	T_R	SDA and SCL Rise Time **(Note 1)**	— —	300 1000	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
5	T_F	SDA and SCL Fall Time	—	300	ns	**(Note 1)**
6	$T_{HD:STA}$	Start Condition Hold Time	600 4000	— —	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
7	$T_{SU:STA}$	Start Condition Setup Time	600 4700	— —	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
8	$T_{HD:DAT}$	Data Input Hold Time	0	—	ns	**(Note 2)**
9	$T_{SU:DAT}$	Data Input Setup Time	100 250	— —	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
10	$T_{SU:STO}$	Stop Condition Setup Time	600 4000	— —	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
11	$T_{SU:WP}$	WP Setup Time	600 4000	— —	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
12	$T_{HD:WP}$	WP Hold Time	1300 4700	— —	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
13	T_{AA}	Output Valid from Clock **(Note 2)**	— —	900 3500	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
14	T_{BUF}	Bus free time: Time the bus must be free before a new transmission can start	1300 4700	— —	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
15	T_{OF}	Output Fall Time from V_{IH} Minimum to V_{IL} Maximum	20+0.1C_B —	250 250	ns	2.5V ≤ V_{CC} ≤ 5.5V 1.7V ≤ V_{CC} < 2.5V **(24AA32A)**
16	T_{SP}	Input Filter Spike Suppression (SDA and SCL pins)	—	50	ns	**(Notes 1 and 3)**
17	T_{WC}	Write Cycle Time (byte or page)	—	5	ms	—
18	—	Endurance	1M	—	cycles	25°C, **(Note 4)**

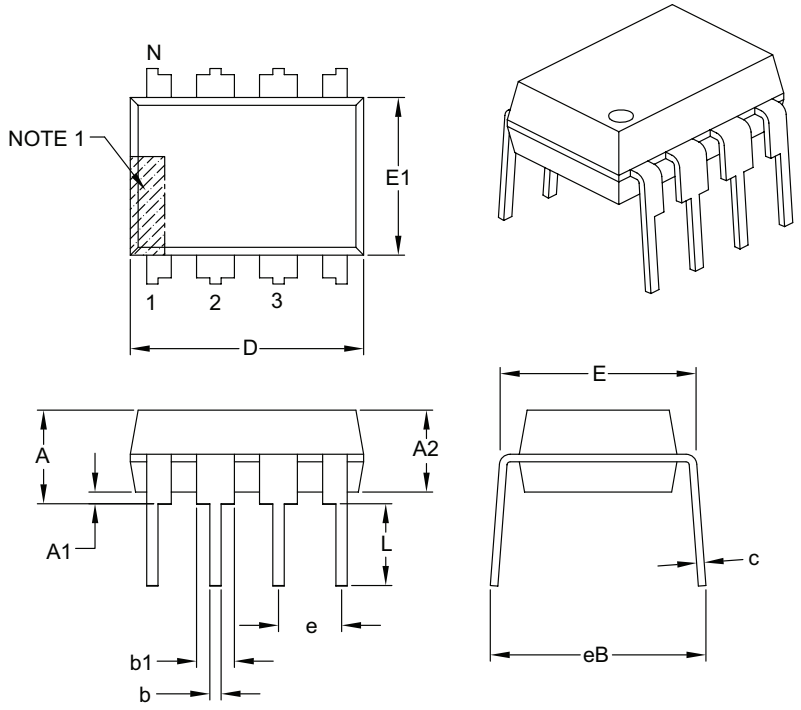
Note 1: Not 100% tested. C_B = total capacitance of one bus line in pF.

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 T_{SP} and V_{HYS} specifications are due to new Schmitt Trigger inputs which provide improved noise spike suppression. This eliminates the need for a T_I 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 on Microchip's web site at

8-Lead Plastic Dual In-Line (P or PA) – 300 mil Body [PDIP]



Units		INCHES		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		.100 BSC	
Top to Seating Plane	A	–	–	.210
Molded Package Thickness	A2	.115	.130	.195
Base to Seating Plane	A1	.015	–	–
Shoulder to Shoulder Width	E	.290	.310	.325
Molded Package Width	E1	.240	.250	.280
Overall Length	D	.348	.365	.400
Tip to Seating Plane	L	.115	.130	.150
Lead Thickness	c	.008	.010	.015
Upper Lead Width	b1	.040	.060	.070
Lower Lead Width	b	.014	.018	.022
Overall Row Spacing §	eB	–	–	.430

Notes:

1. Pin 1 visual index feature may vary, but must be located with the hatched area.
2. § Significant Characteristic.
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
4. Dimensioning and tolerancing per ASME Y14.5M.

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

Microchip Technology Drawing C04-018B

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 Range	Package

Device:	24AA32A:	1.7V, 32 Kbit I^2C Serial EEPROM
	24AA32AT:	1.7V, 32 Kbit I^2C Serial EEPROM (Tape and Reel)
	24LC32A:	2.5V, 32 Kbit I^2C Serial EEPROM
	24LC32AT:	2.5V, 32 Kbit I^2C Serial EEPROM (Tape and Reel)
Temperature Range:	I =	-40°C to +85°C
	E =	-40°C to +125°C
Package:	P =	Plastic DIP (300 mil body), 8-lead
	SN =	Plastic SOIC (3.90 mm body), 8-lead
	SM =	Plastic SOIC (5.28 mm body), 8-lead
	ST =	Plastic TSSOP (4.4 mm), 8-lead
	MS =	Plastic Micro Small Outline (MSOP), 8-lead
	MC =	2x3 DFN, 8-lead

Examples:

a) 24AA32A-I/P: Industrial Temperature,1.7V, PDIP package

b) 24AA32A-I/SN: Industrial Temperature,1.7V, SOIC package

c) 24AA32A-I/SM: Industrial Temperature.,1.7V, SOIC (5.28 mm) package

d) 24AA32A-I/ST: Industrial Temperature.,1.7V, TSSOP package

e) 24LC32A-I/P: Industrial Temperature, 2.5V, PDIP package

f) 24LC32A-E/SN: Automotive Temperature, 2.5V SOIC package

g) 24LC32A-E/SM: Automotive Temperature, 2.5V SOIC (5.28 mm) package

h) 24LC32AT-I/ST: Industrial Temperature, 2.5V, TSSOP package, Tape and Reel