Features

- Fast Read Access Time 45 ns
- Low-Power CMOS Operation
 - 100 μA max. Standby
 - 30 mA max. Active at 5 MHz
- JEDEC Standard Packages
 - 40-Lead 600-mil PDIP
 - 44-Lead PLCC
 - 40-Lead VSOP (10 mm x 14 mm)
- Direct Upgrade from 512K (AT27C516) EPROM
- 5V ± 10% Power Supply
- High-Reliability CMOS Technology
 - 2000V ESD Protection
 - 200 mA Latchup Immunity
- Rapid™ Programming Algorithm 100 µs/word (typical)
- CMOS and TTL Compatible Inputs and Outputs
- Integrated Product Identification Code
- Commercial, Industrial and Automotive Temperature Ranges

Description

The AT27C1024 is a low-power, high-performance 1,048,576 bit one-time programmable read only memory (OTP EPROM) organized 64K by 16 bits. It requires only one 5V power supply in normal read mode operation. Any word can be accessed in less than 45 ns, eliminating the need for speed reducing WAIT states. The by-16 organized programmatical results of the speed reducing was also be accessed in less than 45 ns, eliminating the need for speed reducing was a speed reducing

(continued)

Pin Configurations

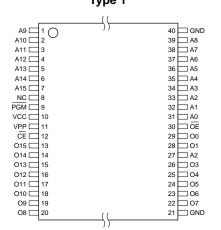
Pin Name	Function				
A0 - A15	Addresses				
O0 - O15	Outputs				
CE	Chip Enable				
ŌĒ	Output Enable				
PGM	Program Strobe				
NC	No Connect				

Note: Both GND pins must be connected.

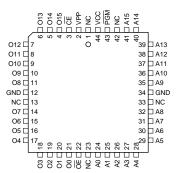
PDIP Top View

		\bigcirc		
VPP □	1		40	□ vcc
CE [2		39	PGM
015 □	3		38	□ NC
014 □	4		37	□ A15
013 □	5		36	□ A14
012 □	6		35	□ A13
011	7		34	□ A12
010 □	8		33	□ A11
O9 🗆	9		32	□ A10
08 □	10		31	□ A9
GND □	11		30	GND
07 □	12		29	□ A8
06 □	13		28	□ A7
05 □	14		27	□ A6
04 □	15		26	□ A5
03 □	16		25	□ A4
02 □	17		24	□ A3
01 □	18		23	□ A2
00 □	19		22	□ A1
OE [20		21	□ A0

VSOP Top View **Type 1**



PLCC Top View







1-Megabit (64K x 16) OTP EPROM

AT27C1024

Rev. 0019J-07/98



nization make this part ideal for high-performance 16- and 32-bit microprocessor systems.

In read mode, the AT27C1024 typically consumes 15 mA. Standby mode supply current is typically less than 10 μ A.

The AT27C1024 is available in industry standard JEDEC-approved one-time programmable (OTP) plastic PDIP, PLCC, and VSOP packages. The device features two-line control ($\overline{\text{CE}}$, $\overline{\text{OE}}$) to eliminate bus contention in high-speed systems.

With high density 64K word storage capability, the AT27C1024 allows firmware to be stored reliably and to be accessed by the system without the delays of mass storage media.

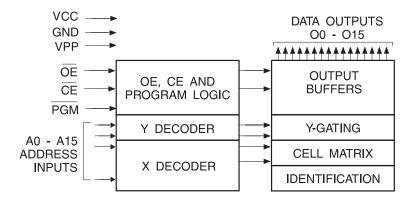
Atmel's 27C1024 have additional features to ensure high quality and efficient production use. The Rapid™ Programming Algorithm reduces the time required to program the part and guarantees reliable programming. Programming time is typically only 100 µs/word. The Integrated Product Identification Code electronically identifies the device and manufacturer. This feature is used by industry standard

programming equipment to select the proper programming algorithms and voltages.

System Considerations

Switching between active and standby conditions via the Chip Enable pin may produce transient voltage excursions. Unless accommodated by the system design, these transients may exceed data sheet limits, resulting in device non-conformance. At a minimum, a 0.1 μF high frequency, low inherent inductance, ceramic capacitor should be utilized for each device. This capacitor should be connected between the V_{CC} and Ground terminals of the device, as close to the device as possible. Additionally, to stabilize the supply voltage level on printed circuit boards with large EPROM arrays, a 4.7 μF bulk electrolytic capacitor should be utilized, again connected between the V_{CC} and Ground terminals. This capacitor should be positioned as close as possible to the point where the power supply is connected to the array.

Block Diagram



Absolute Maximum Ratings*

Temperature Under Bias55°C to + 125°C
Storage Temperature65°C to + 150°C
Voltage on Any Pin with Respect to Ground2.0V to + 7.0V ⁽¹⁾
Voltage on A9 with Respect to Ground2.0V to + 14.0V ⁽¹⁾
V _{PP} Supply Voltage with Respect to Ground2.0V to + 14.0V ⁽¹⁾

*NOTICE:

Stresses beyond 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 beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note:

1. Minimum voltage is -0.6V dc which may undershoot to -2.0V for pulses of less than 20 ns. Maximum output pin voltage is V_{CC} + 0.75V dc which may overshoot to +7.0V for pulses of less than 20 ns.

Operating Modes

Mode/Pin	CE	ŌĒ	PGM	Ai	V _{PP}	Outputs
Read	V _{IL}	V_{IL}	X ⁽¹⁾	Ai	Х	D _{OUT}
Output Disable	Х	V _{IH}	Х	X	Х	High Z
Standby	V _{IH}	Х	Х	X	X ⁽⁵⁾	High Z
Rapid Program ⁽²⁾	V _{IL}	V _{IH}	V _{IL}	Ai	V _{PP}	D _{IN}
PGM Verify	V _{IL}	V _{IL}	V _{IH}	Ai	V _{PP}	D _{OUT}
PGM Inhibit	V _{IH}	Х	Х	X	V _{PP}	High Z
Product Identification ⁽⁴⁾	V _{IL}	V _{IL}	Х	$A9 = V_{H}^{(3)}$ $A0 = V_{IH} \text{ or } V_{IL}$ $A1 - A15 = V_{IL}$	V _{cc}	Identification Code

- Notes: 1. X can be V_{IL} or V_{IH} .
 - 2. Refer to Programming Characteristics.
 - 3. $V_H = 12.0 \pm 0.5 V$.
 - 4. Two identifier words may be selected. All Ai inputs are held low (V_{IL}) , except A9 which is set to V_H and A0 which is toggled low (V_{IL}) to select the Manufacturer's Identification word and high (V_{IH}) to select the Device Code word.
 - 5. Standby V_{CC} current (I_{SB}) is specified with $V_{PP} = V_{CC}$. $V_{CC} > V_{PP}$ will cause a slight increase in I_{SB} .





DC and AC Operating Conditions for Read Operation

				AT270	C1024		
		-45	-55	-70	-90	-12	-15
	Com.	0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C
Operating Temp. (Case)	Ind.	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C
Tomp. (Gass)	Auto.				-40°C - 125°C	-40°C - 125°C	-40°C - 125°C
V _{CC} Power Supply		5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%

DC and Operating Characteristics for Read Operation

Symbol	Parameter	Condition		Min	Max	Units
	Innut Lood Current	\/ 0\/ to \/	Com., Ind.		±1	μΑ
ILI	Input Load Current	$V_{IN} = 0V \text{ to } V_{CC}$	Auto.		±5	μΑ
	Outrat Lealing Comment)/ 0)/4=)/	Com., Ind.		±5	μΑ
I _{LO}	Output Leakage Current	$V_{OUT} = 0V \text{ to } V_{CC}$	Auto.		±10	μΑ
I _{PP1} ⁽²⁾	V _{PP} ⁽¹⁾⁾ Read/Standby Current	$V_{PP} = V_{CC}$	$V_{PP} = V_{CC}$			μΑ
	V (1) O = 11 = 0 = = 1	I_{SB1} (CMOS), $\overline{CE} = V_{CC} \pm$		100	μΑ	
I _{SB}	V _{CC} ⁽¹⁾ Standby Current	I_{SB2} (TTL), \overline{CE} = 2.0 to V_C		1	mA	
I _{CC}	V _{CC} Active Current	$f = 5 \text{ MHz}, I_{OUT} = 0 \text{ mA}, \overline{C}$	E = V _{IL}		30	mA
V _{IL}	Input Low Voltage			-0.6	0.8	V
V _{IH}	Input High Voltage			2.0	V _{CC} + 0.5	V
V _{OL}	Output Low Voltage	I _{OL} = 2.1 mA			0.4	V
V _{OH}	Output High Voltage	I _{OH} = -400 μA		2.4		V

Notes: 1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP} .

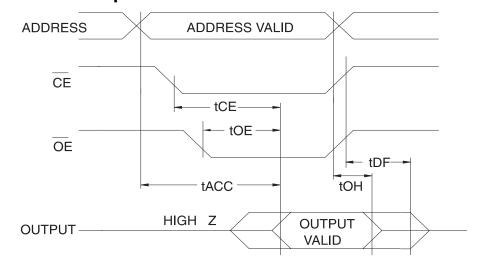
2. V_{PP} may be connected directly to V_{CC} , except during programming. The supply current would then be the sum of I_{CC} and I_{PP} .

AC Characteristics for Read Operation

								AT27	C1024						
			-	-45 -55		-	70	-90		-12		-15			
Symbol	Parameter	Condition	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Units
t _{ACC} ⁽³⁾	Address to Output Delay	$\overline{CE} = \overline{OE} = V_{IL}$		45		55		70		90		120		150	ns
t _{CE} ⁽²⁾	CE to Output Delay	OE = V _{IL}		45		55		70		90		120		150	ns
t _{OE} ⁽²⁾⁽³⁾	OE to Output Delay	CE = V _{IL}		20		25		25		30		35		50	ns
t _{DF} ⁽⁴⁾⁽⁵⁾	OE or CE High to Output F	Float, whichever		20		25		25		30		30		40	ns
t _{OH}	Output Hold from Address whichever occurred first	, CE or OE,	7		7		7		0		0		0		ns

Note: 2, 3, 4, 5. - see AC Waveforms for Read Operation.

AC Waveforms for Read Operation(1)



- Notes: 1.
- 1. Timing measurement reference level is 1.5V for -45 and -55 devices. Input AC drive levels are $V_{IL} = 0.0V$ and $V_{IH} = 3.0V$. Timing measurement reference levels for all other speed grades are $V_{OL} = 0.8V$ and $V_{OH} = 2.0V$. Input AC drive levels are $V_{IL} = 0.45V$ and $V_{IH} = 2.4V$.
 - 2. $\overline{\text{OE}}$ may be delayed up to t_{CE} t_{OE} after the falling edge of $\overline{\text{CE}}$ without impact on t_{CE} .
 - 3. $\overline{\text{OE}}$ may be delayed up to t_{ACC} t_{OE} after the address is valid without impact on t_{ACC} .
 - 4. This parameter is only sampled and is not 100% tested.
 - 5. Output float is defined as the point when data is no longer driven.

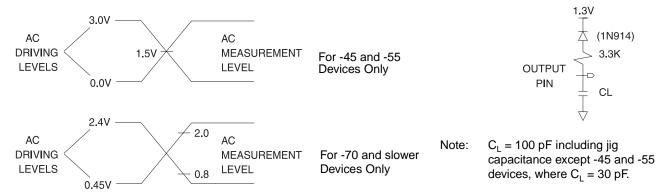
Pin Capacitance

f = 1 MHz. $T = 25^{\circ}C^{(1)}$

Symbol	Тур	Max	Units	Conditions
C _{IN}	4	10	pF	$V_{IN} = 0V$
C _{OUT}	8	12	pF	V _{OUT} = 0V

Note: 1. Typical values for nominal supply voltage. This parameter is only sampled and is not 100% tested.

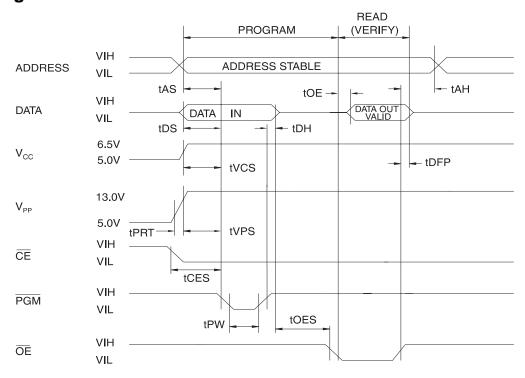
Input Test Waveforms and Measurement Levels Output Test Load







Programming Waveforms⁽¹⁾



Notes: 1. The Input Timing Reference is 0.8V for $V_{\rm IL}$ and 2.0V for $V_{\rm IH}$.

- 2. t_{OE} and t_{DFP} are characteristics of the device but must be accommodated by the programmer.
- 3. When programming the AT27C1024 a 0.1 μ F capacitor is required across V_{PP} and ground to suppress sputious voltage transients.

DC Programming Characteristics

 $T_A = 25 \pm 5^{\circ}C, \ V_{CC} = 6.5 \pm 0.25V, \ V_{PP} = 13.0 \pm 0.25V$

			Lir	mits	
Symbol	Parameter	Test Conditions	Min	Max	Units
ILI	Input Load Current	$V_{IN} = V_{IL}, V_{IH}$		±10	μA
V_{IL}	Input Low Level		-0.6	0.8	V
V _{IH}	Input High Level		2.0	V _{CC} + 0.1	V
V _{OL}	Output Low Voltage	I _{OL} = 2.1 mA		0.4	V
V _{OH}	Output High Voltage	I _{OH} = -400 μA	2.4		V
I _{CC2}	V _{CC} Supply Current (Program and Verify)			50	mA
I _{PP2}	V _{PP} Supply Current	CE = PGM = V _{IL}		30	mA
V _{ID}	A9 Product Identification Voltage		11.5	12.5	V

AC Programming Characteristics

 $T_A = 25 \pm 5^{\circ}C, \ V_{CC} = 6.5 \pm 0.25V, \ V_{PP} = 13.0 \pm 0.25V$

			Lir	nits		
Symbol	Parameter	Test Conditions ⁽¹⁾	Min	Max	Units	
t _{AS}	Address Setup Time		2		μs	
t _{CES}	CE Setup Time		2		μs	
t _{OES}	OE Setup Time	Input Rise and Fall Times	2		μs	
t _{DS}	Data Setup Time	(10% to 90%) 20ns	2		μs	
t _{AH}	Address Hold Time	Input Pulse Levels	0		μs	
t _{DH}	Data Hold Time	0.45V to 2.4V	2		μs	
t _{DFP}	OE High to Output Float Delay ⁽²⁾	T	0	130	ns	
t _{VPS}	V _{PP} Setup Time	Input Timing Reference Level 0.8V to 2.0V	2		μs	
t _{VCS}	V _{CC} Setup Time	0.00 10 2.00	2		μs	
t _{PW}	PGM Program Pulse Width ⁽³⁾	Output Timing Reference Level	95	105	μs	
t _{OE}	Data Valid from OE	0.8V to 2.0V		150	ns	
t _{PRT}	V _{PP} Pulse Rise Time During Programming		50		ns	

Notes: 1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP}

3. Program Pulse width tolerance is 100 $\mu sec \pm 5\%.$

Atmel's 27C1024 Integrated Product Identification Code

	Pins						Hex				
Codes	Α0	015-08	07	O 6	O5	04	О3	O2	01	00	Data
Manufacturer	0	0	0	0	0	1	1	1	1	0	001E
Device Type	1	0	1	1	1	1	0	0	0	1	00F1



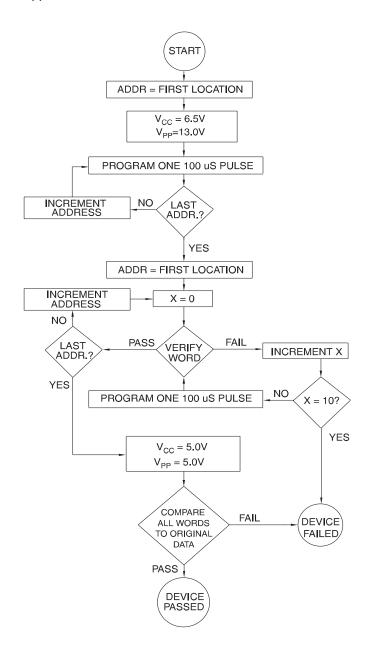
^{2.} This parameter is only sampled and is not 100% tested. Output Float is defined as the point where data is no longer driven—see timing diagram.



Rapid Programming Algorithm

A 100 μ s \overline{PGM} pulse width is used to program. The address is set to the first location. V_{CC} is raised to 6.5V and V_{PP} is raised to 13.0V. Each address is first programmed with one 100 μ s \overline{PGM} pulse without verification. Then a verification / reprogramming loop is executed for each address. In the event a word fails to pass verification, up to 10 successive 100 μ s pulses are applied with a verification

after each pulse. If the word fails to verify after 10 pulses have been applied, the part is considered failed. After the word verifies properly, the next address is selected until all have been checked. V_{PP} is then lowered to 5.0V and V_{CC} to 5.0V. All words are read again and compared with the original data to determine if the device passes or fails.



Ordering Information

t _{ACC}	I _{cc}	; (mA)				
(ns)	Active	Standby	Ordering Code	Package	Operation Range	
45	30	0.1	AT27C1024-45JC	44J	Commercial	
			AT27C1024-45PC	40P6	(0°C to 70°C)	
			AT27C1024-45VC	40V		
	30	0.1	AT27C1024-45JI	44J	Industrial	
			AT27C1024-45PI	40P6	(-40°C to 85°C)	
			AT27C1024-45VI	40V		
55	30 0.1		AT27C1024-55JC	44J	Commercial	
			AT27C1024-55PC	40P6	(0°C to 70°C)	
			AT27C1024-55VC	40V		
	30	0.1	AT27C1024-55JI	44J	Industrial	
			AT27C1024-55PI	40P6	(-40°C to 85°C)	
			AT27C1024-55VI	40V		
70	30	0.1	AT27C1024-70JC	44J	Commercial	
			AT27C1024-70PC	40P6	(0°C to 70°C)	
			AT27C1024-70VC	40V		
	30	0.1	AT27C1024-70JI	44J	Industrial	
			AT27C1024-70PI	40P6	(-40°C to 85°C)	
			AT27C1024-70VI	40V		

(continued)

Package Type		
44J	44-Lead, Plastic J-Leaded Chip Carrier (PLCC)	
40P6	40-Lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)	
40V	40-Lead, Plastic Thin Small Outline Package (VSOP) 10 x 14 mm	





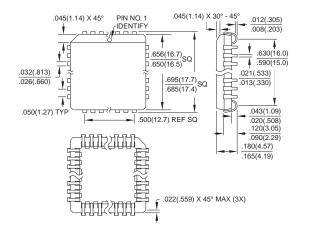
Ordering Information (Continued)

t _{ACC} (ns)	I _{CC} (mA)				
	Active	Standby	Ordering Code	Package	Operation Range
90	30	0.1	AT27C1024-90JC	44J	Commercial
			AT27C1024-90PC	40P6	(0°C to 70°C)
			AT27C1024-90VC	40V	
	30	0.1	AT27C1024-90JI	44J	Industrial
			AT27C1024-90PI	40P6	(-40°C to 85°C)
			AT27C1024-90VI	40V	
	30	0.1	AT27C1024-90JA	44J	Automotive
			AT27C1024-90PA	40P6	(-40°C to 125°C)
120	30	0.1	AT27C1024-12JC	44J	Commercial
			AT27C1024-12PC	40P6	(0°C to 70°C)
			AT27C1024-12VC	40V	
	30	0.1	AT27C1024-12JI	44J	Industrial
			AT27C1024-12PI	40P6	(-40°C to 85°C)
			AT27C1024-12VI	40V	
	30	0.1	AT27C1024-12JA	44J	Automotive
			AT27C1024-12PA	40P6	(-40°C to 125°C)
150	30	0.1	AT27C1024-15JC	44J	Commercial
			AT27C1024-15PC	40P6	(0°C to 70°C)
			AT27C1024-15VC	40V	
	30	0.1	AT27C1024-15JI	44J	Industrial
			AT27C1024-15PI	40P6	(-40°C to 85°C)
			AT27C1024-15VI	40V	
	30	0.1	AT27C1024-15JA	44J	Automotive
			AT27C1024-15PA	40P6	(-40°C to 125°C)

Package Type		
44J	44-Lead, Plastic J-Leaded Chip Carrier (PLCC)	
40P6	40-Lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)	
40V	40-Lead, Plastic Thin Small Outline Package (VSOP) 10 x 14 mm	

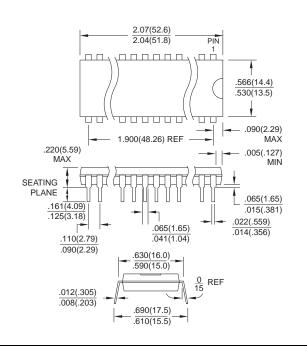
Packaging Information

44J, 44-Lead, Plastic J-Leaded Chip Carrier (PLCC) Dimensions in Inches and (Millimeters)
JEDEC STANDARD MS-018 AC



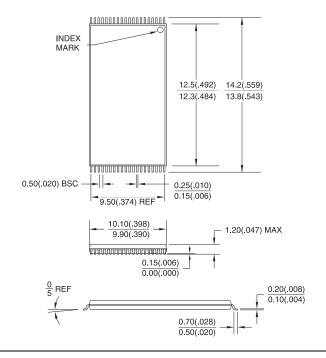
40P6, 40-Lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)

Dimensions in Inches and (Millimeters) JEDEC STANDARD MS-011 AC



40V, 40-Lead, Plastic Thin Small Outline Package (TSOP)

Dimensions in Millimeters and (Inches) JEDEC OUTLINE MO-142 CA







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