## Features

- Fast read access time 55ns
- Low-power CMOS operation
  - 100µA max standby
  - 25mA max active at 5MHz
- JEDEC standard packages
  - 32-lead PDIP
  - 32-lead PLCC
- $5V \pm 10\%$  supply
- High-reliability CMOS technology
  - 2,000V ESD protection
  - 200mA latchup immunity
- Rapid programming algorithm 100µs/byte (typical)
- CMOS- and TTL-compatible inputs and outputs
- Integrated product identification code
- Industrial and automotive temperature ranges
- Green (Pb/halide-free) packaging option

## 1. Description

The Atmel<sup>®</sup> AT27C020 is a low-power, high-performance, 2,097,152-bit, one-time programmable, read-only memory (OTP EPROM) organized as 256K by 8 bits. It requires only one 5V power supply in normal read mode operation. Any byte can be accessed in less than 55ns, eliminating the need for speed-reducing WAIT states on high-performance microprocessor systems.

In read mode, the AT27C020 typically consumes 8mA. Standby mode supply current is typically less than  $10\mu A.$ 

The AT27C020 is available in a choice of industry-standard, JEDEC approved, one-time programmable (OTP) PDIP and PLCC packages. All devices feature two-line control ( $\overline{CE}$ ,  $\overline{OE}$ ) to give designers the flexibility to prevent bus contention.

With 256K byte storage capability, the AT27C020 allows firmware to be stored reliably and to be accessed by the system without the delays of mass storage media.

The AT27C020 has 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 100µs/byte. 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.



2Mb (256K x 8) One-time Programmable, Read-only Memory

Atmel AT27C020

0570H-EPROM-4/11





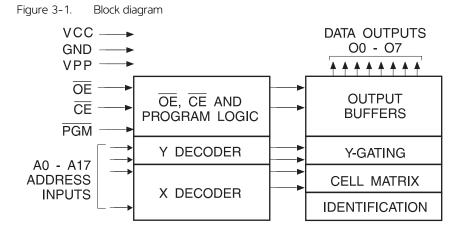
### 2. Pin configurations

Function
Addresses
Outputs
Chip enable
Output enable
Program strobe

32-lead PLCC Top view	32-lead Top v	
$\begin{array}{c} \begin{array}{c} 3 & \begin{array}{c} \begin{array}{c} \\ \\ \\ \end{array} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ $	$VPP \ \ 1$ $A16 \ \ 2$ $A15 \ \ 3$ $A12 \ \ 4$ $A7 \ \ 5$ $A6 \ \ 6$ $A5 \ \ 7$ $A4 \ \ 8$ $A3 \ \ 9$ $A2 \ \ 10$ $A1 \ \ 111$ $A0 \ \ 12$ $O0 \ \ \ 13$ $O1 \ \ \ 14$ $O2 \ \ \ 15$ $GND \ \ \ \ 16$	32 UCC 31 PGM 30 A17 29 A14 28 A13 27 A8 26 A9 25 A11 24 OE 23 A10 22 CE 21 07 20 06 19 05 18 04 17 03

#### 3. 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 datasheet limits, resulting in device nonconformance. At a minimum, a  $0.1\mu$ F, high-frequency, low inherent inductance, ceramic capacitor should be utilized for each device. This capacitor should be connected between the V<sub>CC</sub> 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  $4.7\mu$ F bulk electrolytic capacitor should be utilized, again connected between the V<sub>CC</sub> and ground terminals. This capacitor should be positioned as close as possible to the point where the power supply is connected to the array.



#### 4. 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 <sup>(1)</sup>
Voltage on A9 with respect to ground2.0V to +14.0V <sup>(1)</sup>
V <sub>PP</sub> supply voltage with respect to ground2.0V to +14.0V <sup>(1)</sup>
Note: 1 Minimum voltage is -0.6V DC which may unde

- \*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 20ns. Maximum output pin voltage is  $V_{CC}$  + 0.75V DC, which may overshoot to +7.0V for pulses of less than 20ns.

#### 5. DC and AC characteristics

Table 5-1.	Operating modes
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Mode/Pin	CE	ŌĒ	PGM	Ai	V <sub>PP</sub>	Outputs
Read	VIL	V <sub>IL</sub>	X <sup>(1)</sup>	Ai	Х	D <sub>OUT</sub>
Output disable	X	V <sub>IH</sub>	Х	Х	X	High-Z
Standby	V <sub>IH</sub>	Х	Х	Х	Х	High-Z
Rapid program <sup>(2)</sup>	VIL	V <sub>IH</sub>	V <sub>IL</sub>	Ai	V <sub>PP</sub>	D <sub>IN</sub>
PGM verify	VIL	V <sub>IL</sub>	VIH	Ai	V <sub>PP</sub>	D <sub>OUT</sub>
PGM inhibit	V <sub>IH</sub>	Х	Х	Х	V <sub>PP</sub>	High-Z
Product identification <sup>(4)</sup>	V <sub>IL</sub>	V <sub>IL</sub>	×	$A9 = V_{H}^{(3)}$ $A0 = V_{H} \text{ or } V_{L}$ $A1 - A17 = V_{L}$	×	Identification code

Notes: 1. X can be  $V_{IL}$  or  $V_{IH}$ .

2. Refer to programming characteristics.

3.  $V_{\rm H} = 12.0 \pm 0.5 V.$ 

4. Two identifier bytes 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 byte and high  $(V_{IH})$  to select the device code byte.

Table 5-2.	DC and AC operating conditions for read operation
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_		Atmel AT27C020		
		-55	-90	
Operating temperature (case)	Ind.	-40°C - 85°C	-40°C - 85°C	
	Auto.		-40°C - 125°C	
V <sub>CC</sub> power supply		5V ± 10%	5V ± 10%	





Symbol	Parameter	Condition	Min	Max	Units
ILI	Input load current	$V_{IN} = 0V$ to $V_{CC}$ (Com., Ind.)		±1.0	μA
I <sub>LO</sub>	Output leakage current	$V_{OUT} = 0V$ to $V_{CC}$ (Com., Ind.)		±5.0	μA
I <sub>PP</sub> <sup>(2)</sup>	V <sub>PP</sub> <sup>(1)</sup> read/standby current	$V_{PP} = V_{CC}$		±10	μA
	V (1) · · · ·	$I_{SB1}$ (CMOS), $\overline{CE} = V_{CC} \pm 0.3V$		100	μA
I <sub>SB</sub>	V <sub>CC</sub> <sup>(1)</sup> standby current	$I_{SB2}$ (TTL), $\overline{CE} = 2.0$ to $V_{CC} + 0.5V$		1.0	mA
I <sub>CC</sub>	V <sub>CC</sub> active current	$f = 5MHz$ , $I_{OUT} = 0mA$ , $\overline{CE} = V_{IL}$		25	mA
V <sub>IL</sub>	Input low voltage		-0.6	0.8	V
V <sub>IH</sub>	Input high voltage		2.0	V <sub>CC</sub> + 0.5	V
V <sub>OL</sub>	Output low voltage	I <sub>OL</sub> = 2.1mA		0.4	V
V <sub>OH</sub>	Output high voltage	I <sub>OH</sub> = -400μA	2.4		V

#### Table 5-3. DC and operating characteristics for read operation

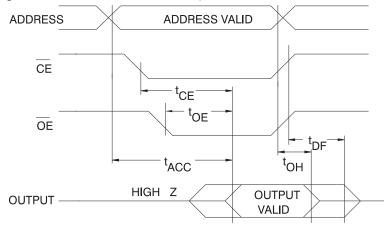
Notes: 1.  $V_{CC}$  must be applied simultaneously or before  $V_{PP}$ , and removed simultaneously or after  $V_{PP}$ 

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  $I_{PP}$ .

Table 5-4. AC characteristics for read operation

			Atmel AT27C020				
			-55		-90		
Symbol	Parameter	Condition	Min	Max	Min	Max	Units
t <sub>ACC</sub> <sup>(3)</sup>	Address to output delay	$\overline{CE} = \overline{OE} = V_{IL}$		55		90	ns
t <sub>CE</sub> <sup>(2)</sup>	CE to output delay	$\overline{OE} = V_{IL}$		55		90	ns
t <sub>OE</sub> <sup>(2)(3)</sup>	OE to output delay	$\overline{CE} = V_{IL}$		20		35	ns
t <sub>DF</sub> <sup>(4)(5)</sup>	OE or CE high to outputfloat, Whichever occurred first			18		20	ns
t <sub>он</sub>	Output hold from address, CE or OE, Whichever occurred first	,	7		0		ns

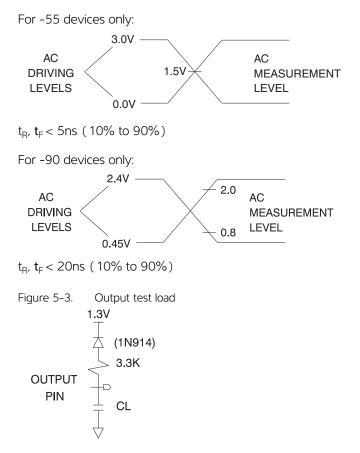
Figure 5-1. AC waveforms for read operation<sup>(1)</sup>



Notes: 1. Timing measurement references are 0.8V and 2.0V. Input AC drive levels are 0.45V and 2.4V, unless otherwise specified.

- 2.  $\overline{OE}$  may be delayed up to  $t_{CE}$   $t_{OE}$  after the falling edge of  $\overline{CE}$  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.

Figure 5-2. Input test waveforms and measurement levels



Note: CL = 100pF including jig capacitance, except -55 devices, where CL = 30pF



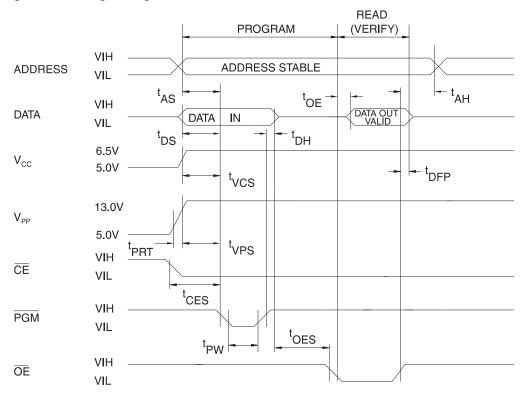


## Table 5-5.Pin capacitance

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

Symbol	Тур	Max	Units	Conditions
C <sub>IN</sub>	4	8	pF	$V_{IN} = OV$
C <sub>OUT</sub>	8	12	pF	$V_{OUT} = 0V$

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



#### Figure 5-4. Programming waveforms <sup>(1)</sup>

Note: 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 Atmel AT27C020, a 0.1 $\mu$ F capacitor is required across V<sub>PP</sub> and ground to suppress voltage transients

Table 5-6.	DC programming characteristics	
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			Lin		
Symbol	Parameter	Test conditions	Min	Max	Units
ILI	Input load current	$V_{IN} = V_{IL'} V_{IH}$		±10	μA
V <sub>IL</sub>	Input low level		-0.6	0.8	V
V <sub>IH</sub>	Input high level		2.0	V <sub>CC</sub> + 1.0	V
V <sub>OL</sub>	Output low voltage	$I_{OL} = 2.1 mA$		0.4	V
V <sub>OH</sub>	Output high voltage	I <sub>OH</sub> = -400μA	2.4		V
I <sub>CC2</sub>	$V_{CC}$ supply current (program and verify)			40	mA
I <sub>PP2</sub>	V <sub>PP</sub> supply current	$\overline{CE} = \overline{PGM} = V_{ L}$		20	mA
V <sub>ID</sub>	A9 product identification voltage		11.5	12.5	V

#### Table 5-7. AC programming characteristics

 $T_{A} = 25 \pm 5^{\circ}\text{C}, V_{CC} = 6.5 \pm 0.25 \text{V}, V_{pp} = 13.0 \pm 0.25 \text{V}$ 

			Lin	Limits		
Symbol	Parameter	Test condition <sup>(1)</sup>	Min	Max	Units	
t <sub>AS</sub>	Address setup time		2		μs	
t <sub>CES</sub>	CE setup time		2		μs	
t <sub>OES</sub>	OE setup time	Input rise and fall times:	2		μs	
t <sub>DS</sub>	Data setup time	2		μs		
t <sub>AH</sub>	Address hold time	Input pulse levels:	0		μs	
t <sub>DH</sub>	Data hold time	0.45V to 2.4V	2		μs	
t <sub>DFP</sub>	$\overline{\text{OE}}$ high to output float delay <sup>(2)</sup>		0	130	ns	
t <sub>VPS</sub>	V <sub>PP</sub> setup time	Input timing reference level: 0.8V to 2.0V	2		μs	
t <sub>VCS</sub>	V <sub>CC</sub> setup time		2		μs	
t <sub>PW</sub>	PGM program pulse width <sup>(3)</sup>	Output timing reference level:	95	105	μs	
t <sub>OE</sub>	Data valid from $\overline{OE}$	0.8V to 2.0V		150	ns	
t <sub>PRT</sub>	V <sub>PP</sub> pulse rise time during programming		50		ns	

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

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.

3. Program pulse width tolerance is  $100\mu s \pm 5\%$ .



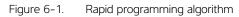


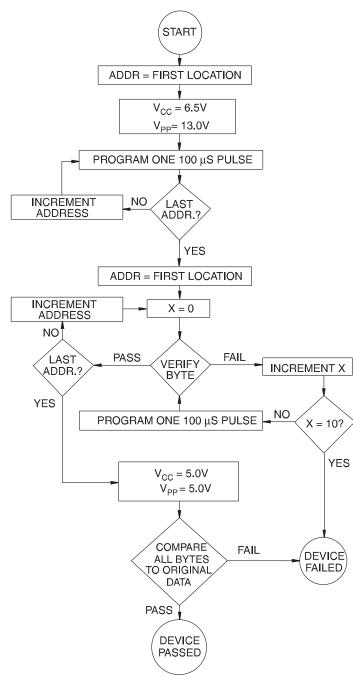
Table 5-8.	The Atmel AT27C020 integrated product identification code
10010 0 01	The Fame Field and the state of

		Pins								
Codes	AO	07	O6	O5	04	O3	02	01	00	Hex data
Manufacturer	0	0	0	0	1	1	1	1	0	1E
Device type	1	1	0	0	0	0	1	1	0	86

#### 6. Rapid programming algorithm

A 100µs  $\overrightarrow{PGM}$  pulse width is used to program. The address is set to the first location. V<sub>CC</sub> is raised to 6.5V and V<sub>PP</sub> is raised to 13.0V. Each address is first programmed with one 100µs  $\overrightarrow{PGM}$  pulse without verification. Then a verification/reprogramming loop is executed for each address. In the event a byte fails to pass verification, up to 10 successive 100µs pulses are applied with a verification after each pulse. If the byte fails to verify after 10 pulses have been applied, the part is considered failed. After the byte verifies properly, the next address is selected until all have been checked. V<sub>PP</sub> is then lowered to 5.0V and V<sub>CC</sub> to 5.0V. All bytes are read again and compared with the original data to determine if the device passes or fails.









# 7. Ordering information

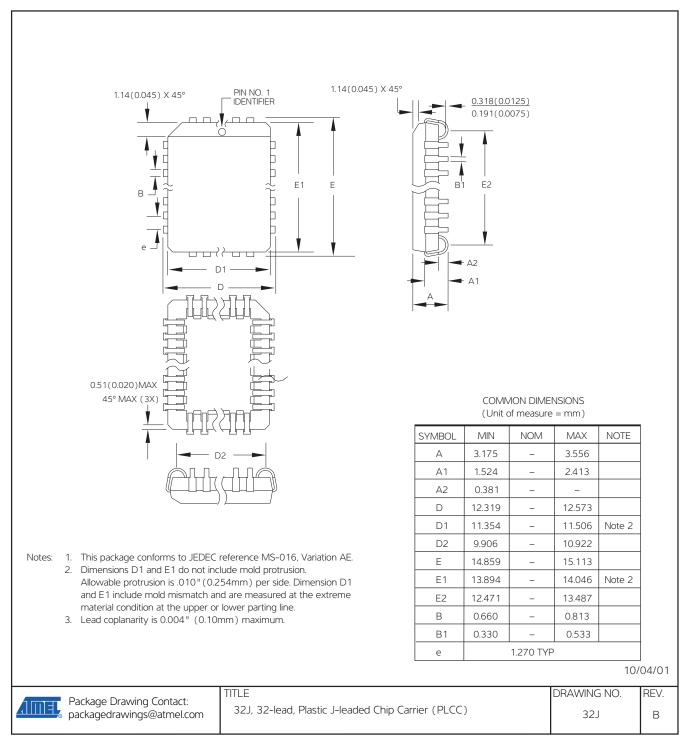
# Green package (Pb/halide-free)

t <sub>ACC</sub>	I <sub>CC</sub> (mA)					
(ns)	Active	Standby	Atmel ordering code	Package	Lead finish	Operation range
55	25	0.1	<b>AT27C020-</b> 55JU AT27C <b>020-</b> 55PU	32J 32P6	Matte tin Matte Tin	Industrial (-40°C to 85°C)
90	25	0.1	AT27C <b>020-90</b> JU AT27C <b>020-90</b> PU	32J 32P6	Matte tin Matte tin	Industrial (-40°C to 85°C)

Package type					
32J	32-lead, plastic, J-leaded chip carrier (PLCC)				
32P6 32-lead, 0.600" wide, plastic, dual inline package (PDIP)					

### 8. Packaging information

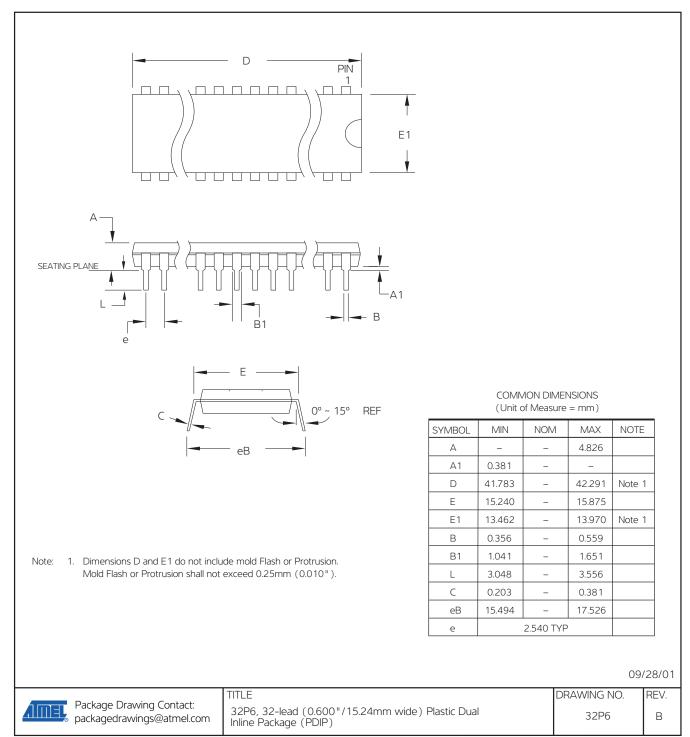
## 32J – PLCC







#### 32P6 - PDIP



# 9. Revision history

Doc. Rev.	Date	Comments
0570H	04/2011	Remove TSOP package Add lead finish to ordering information
0570G	12/2007	





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