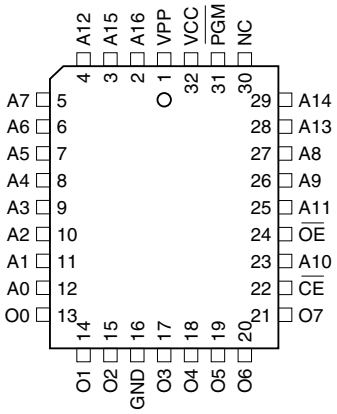
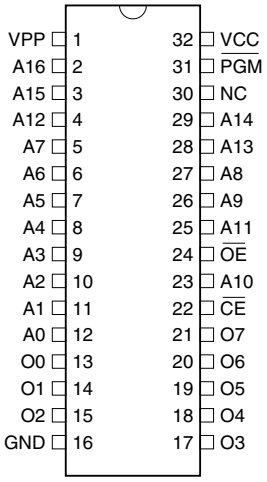
## 2. Pin configurations

| Pin name | Function |
|---|---|
| A0 - A16 | Addresses |
| O0 - O7 | Outputs |
| $\overline{CE}$ | Chip enable |
| $\overline{OE}$ | Output enable |
| $\overline{PGM}$ | Program strobe |
| NC | No connect |

32-lead PLCC
Top view



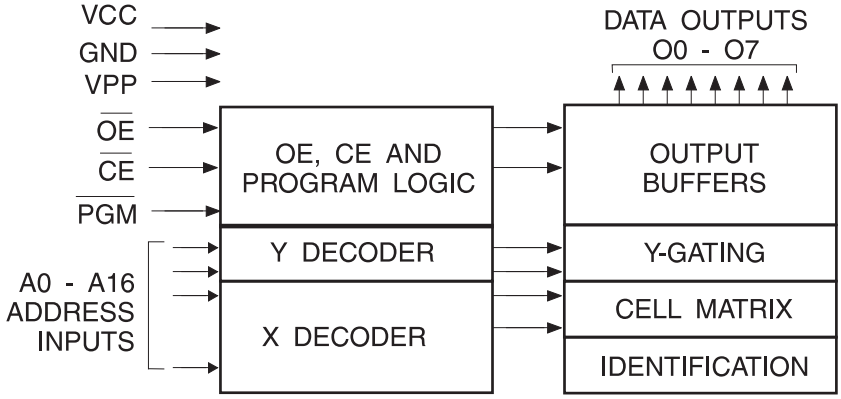

32-lead PDIP
Top view




## 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 0.1µF, 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 4.7µF 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.

Figure 3-1. Block diagram



## 4. Absolute maximum ratings*

| | |
|---|---|
| Temperature under bias | -55°C to +125°C |
| Storage temperature | -65°C to +150°C |
| Voltage on any pin with respect to ground | -2.0V to +7.0V(1) |
| Voltage on A9 with respect to ground | -2.0V to +14.0V(1) |
| $V_{PP}$ supply voltage with respect to ground | -2.0V 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 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

| Mode/Pin | $\overline{CE}$ | $\overline{OE}$ | $\overline{PGM}$ | Ai | $V_{PP}$ | Outputs |
|---|---|---|---|---|---|---|
| Read | $V_{IL}$ | $V_{IL}$ | X(1) | Ai | X | $D_{OUT}$ |
| Output disable | X | $V_{IH}$ | X | X | X | High Z |
| Standby | $V_{IH}$ | X | X | X | X | 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 | $V_{IH}$ | X | X | X | $V_{PP}$ | High Z |
| Product identification(4) | $V_{IL}$ | $V_{IL}$ | X | A9 = $V_H$(3)<br>A0 = $V_{IH}$ or $V_{IL}$<br>A1 - A16 = $V_{IL}$ | X | Identification code |

Note:
1. X can be $V_{IL}$ or $V_{IH}$.
2. Refer to programming characteristics.
3. $V_H$ = 12.0 ± 0.5V.
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

| | | Atmel AT27C010 | |
|---|---|---|---|
| | | -45 | -70 |
| Operating temp. (case) | Ind. | -40°C - 85°C | -40°C - 85°C |
| $V_{CC}$ power supply | | 5V ± 10% | 5V ± 10% |

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

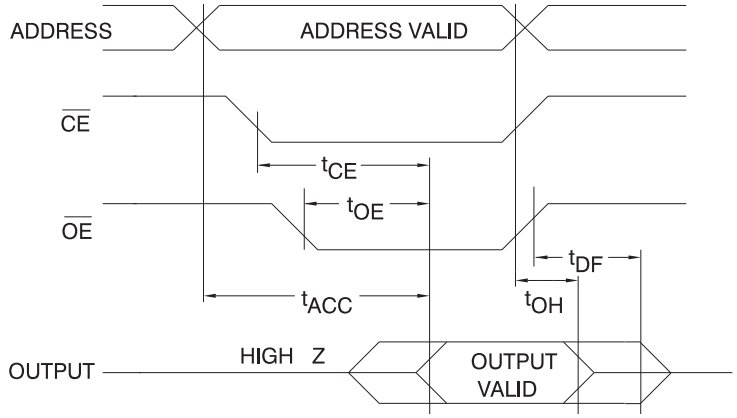
| Symbol | Parameter | Condition | | Min | Max | Units |
|---|---|---|---|---|---|---|
| $I_{LI}$ | Input load current | $V_{IN}$ = 0V to $V_{CC}$ | Ind. | | ± 1 | µA |
| $I_{LO}$ | Output leakage current | $V_{OUT}$ = 0V to $V_{CC}$ | Ind. | | ± 5 | µA |
| IPP1[2] | $V_{PP}$[1] read/standby current | $V_{PP}$ = $V_{CC}$ | | | 10 | µA |
| $I_{SB}$ | $V_{CC}$[1] standby current | $I_{SB1}$ (CMOS), $\overline{CE}$ = $V_{CC}$ ± 0.3V | | | 100 | µA |
| | | $I_{SB2}$ (TTL), $\overline{CE}$ = 2.0 to $V_{CC}$ + 0.5V | | | 1 | mA |
| $I_{CC}$ | $V_{CC}$ active current | f = 5MHz, $I_{OUT}$ = 0mA, $\overline{CE}$ = $V_{IL}$ | | | 25 | 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 | $I_{OL}$ = 2.1mA | | | 0.4 | V |
| $V_{OH}$ | Output high voltage | $I_{OH}$ = -400µA | | 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 $I_{PP}$.

Table 5-4. AC characteristics for read operation

| | | | Atmel AT27C010 | | | | |
|---|---|---|---|---|---|---|---|
| | | | -45 | | -70 | | |
| Symbol | Parameter | Condition | Min | Max | Min | Max | Units |
| $t_{ACC}$[3] | Address to output delay | $\overline{CE}$ = $\overline{OE}$ = $V_{IL}$ | | 45 | | 70 | ns |
| $t_{CE}$[2] | $\overline{CE}$ to output delay | $\overline{OE}$ = $V_{IL}$ | | 45 | | 70 | ns |
| $t_{OE}$[2][3] | $\overline{OE}$ to output delay | $\overline{CE}$ = $V_{IL}$ | | 20 | | 30 | ns |
| $t_{DF}$[4][5] | $\overline{OE}$ or $\overline{CE}$ high to output float, whichever occurred first | | | 20 | | 25 | ns |
| $t_{OH}$ | Output hold from address, $\overline{CE}$ or $\overline{OE}$, whichever occurred first | | 7 | | 7 | | ns |

Figure 5-1. AC waveforms for read operation[1]




Notes: 1. Timing measurement reference level is 1.5V for -45 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. $\overline{OE}$ may be delayed up to $t_{CE}$ - $t_{OE}$ after the falling edge of $\overline{CE}$ without impact on $t_{CE}$.
3. $\overline{OE}$ 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

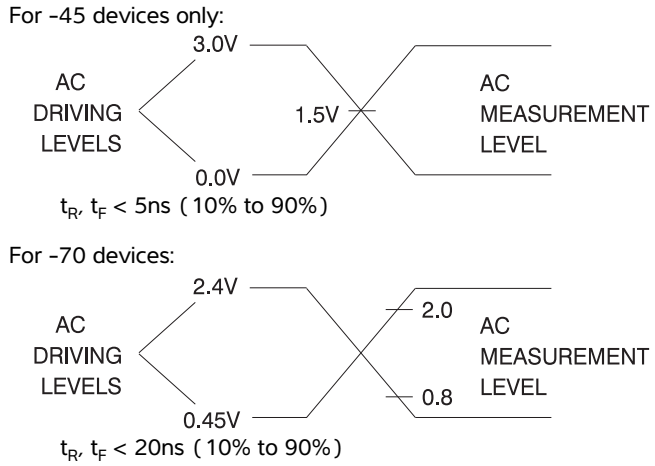
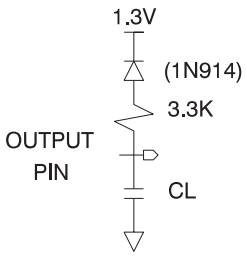



Figure 5-3. Output test load




$C_L$ = 100pF including jig capacitance, except for the -45 devices, where $C_L$ = 30pF

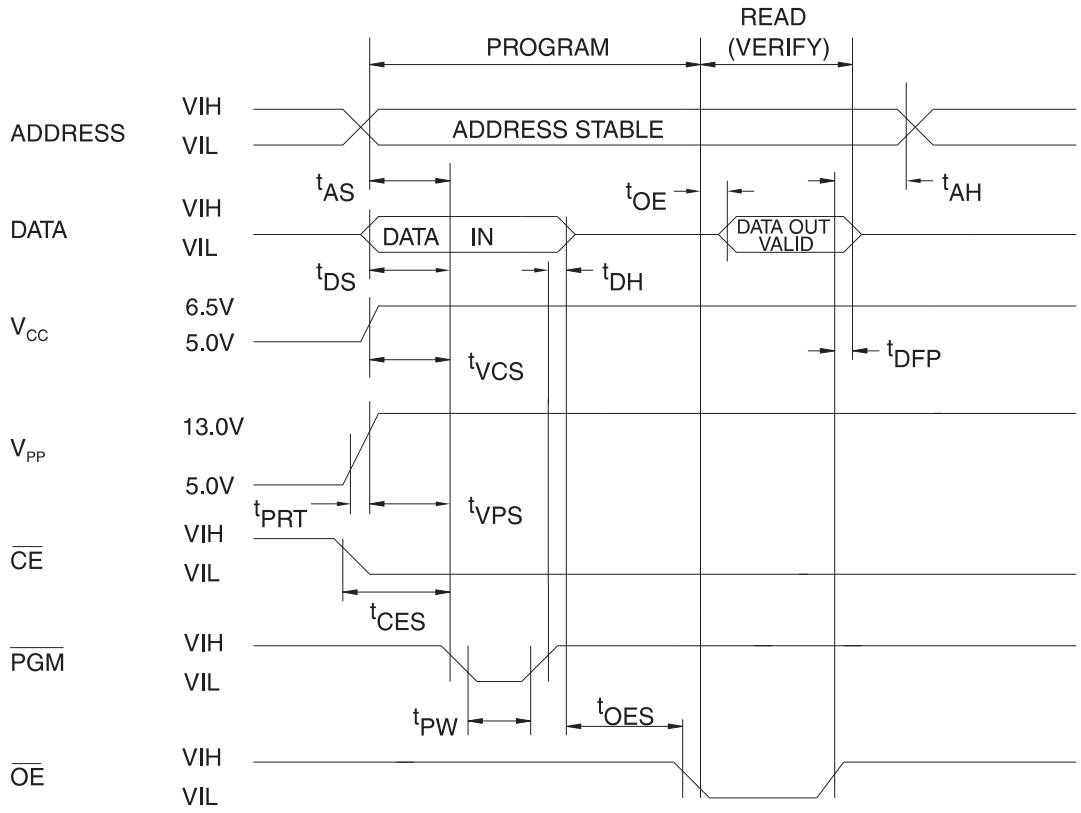
Table 5-5. Pin capacitance

f = 1MHz, T = 25°C[1]

| Symbol | Typ | Max | Units | Conditions |
|---|---|---|---|---|
| $C_{IN}$ | 4 | 8 | 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.

Figure 5-4. Programming Waveforms[1]




Notes:
1. The input timing reference is 0.8V for $V_{IL}$ and 2.0V for $V_{IH}$.
2. $t_{OE}$ and $t_{DFP}$ are characteristics of the device, but must be accommodated by the programmer.
3. When programming the Atmel AT27C010, a 0.1µF capacitor is required across $V_{PP}$ and ground to suppress spurious voltage transients.

Table 5-6. DC programming characteristics

$T_A$ = 25 ± 5°C, $V_{CC}$ = 6.5 ± 0.25V, $V_{PP}$ = 13.0 ± 0.25V

| Symbol | Parameter | Test conditions | Limits | | Units |
|---|---|---|---|---|---|
| | | | Min | Max | |
| $I_{LI}$ | 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 | $V_{CC}$ + 1 | V |
| $V_{OL}$ | Output low voltage | $I_{OL}$ = 2.1mA | | 0.4 | V |
| $V_{OH}$ | Output high voltage | $I_{OH}$ = -400µA | 2.4 | | V |
| $I_{CC2}$ | $V_{CC}$ supply current (program and verify) | | | 40 | mA |
| $I_{PP2}$ | $V_{PP}$ supply current | $\overline{CE} = \overline{PGM} = V_{IL}$ | | 20 | mA |
| $V_{ID}$ | A9 product identification voltage | | 11.5 | 12.5 | V |

Table 5-7. AC programming characteristics

$T_A$ = 25 ± 5°C, $V_{CC}$ = 6.5 ± 0.25 V, $V_{PP}$ = 13.0 ± 0.25V

| Symbol | Parameter | Test conditions[1] | Limits | | Units |
|---|---|---|---|---|---|
| | | | Min | Max | |
| $t_{AS}$ | Address setup time | Input rise and fall times (10% to 90%) 20ns<br>Input pulse levels 0.45V to 2.4V<br>Input timing reference level 0.8V to 2.0V<br>Output timing reference level 0.8V to 2.0V | 2 | | µs |
| $t_{CES}$ | $\overline{CE}$ setup time | | 2 | | µs |
| $t_{OES}$ | $\overline{OE}$ setup time | | 2 | | µs |
| $t_{DS}$ | Data setup time | | 2 | | µs |
| $t_{AH}$ | Address hold time | | 0 | | µs |
| $t_{DH}$ | Data hold time | | 2 | | µs |
| $t_{DFP}$ | $\overline{OE}$ high to output float delay[2] | | 0 | 130 | ns |
| $t_{VPS}$ | $V_{PP}$ setup time | | 2 | | µs |
| $t_{VCS}$ | $V_{CC}$ setup time | | 2 | | µs |
| $t_{PW}$ | $\overline{PGM}$ program pulse width[3] | | 95 | 105 | µs |
| $t_{OE}$ | Data valid from $\overline{OE}$ | | | 150 | ns |
| $t_{PRT}$ | $V_{PP}$ 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 100µsec ± 5%.

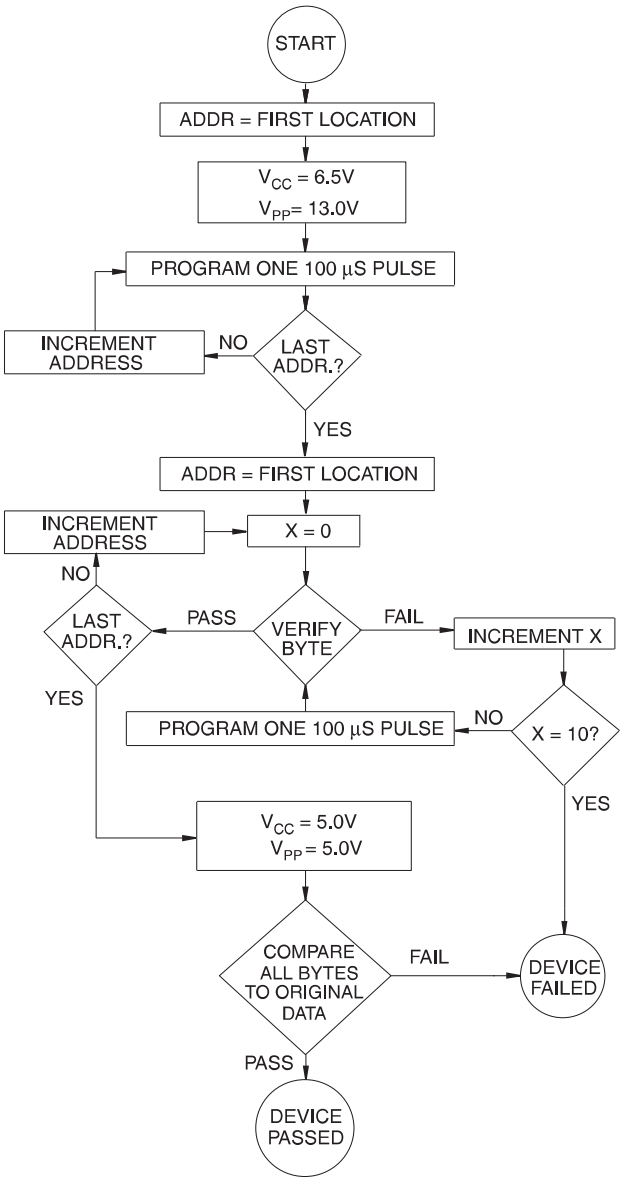
Table 5-8. The Atmel AT27C010 integrated product identification code

| Codes | Pins | | | | | | | | | Hex data |
|---|---|---|---|---|---|---|---|---|---|---|
| | A0 | O7 | O6 | O5 | O4 | O3 | O2 | O1 | O0 | |
| Manufacturer | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1E |
| Device type | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 05 |

# 6. Rapid programming algorithm

A 100µs $\overline{PGM}$ 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 100µs $\overline{PGM}$ 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. $V_{PP}$ is then lowered to 5.0V and $V_{CC}$ to 5.0V. All bytes are read again and compared with the original data to determine if the device passes or fails.

Figure 6-1. Rapid programming algorithm



# 7. Ordering information

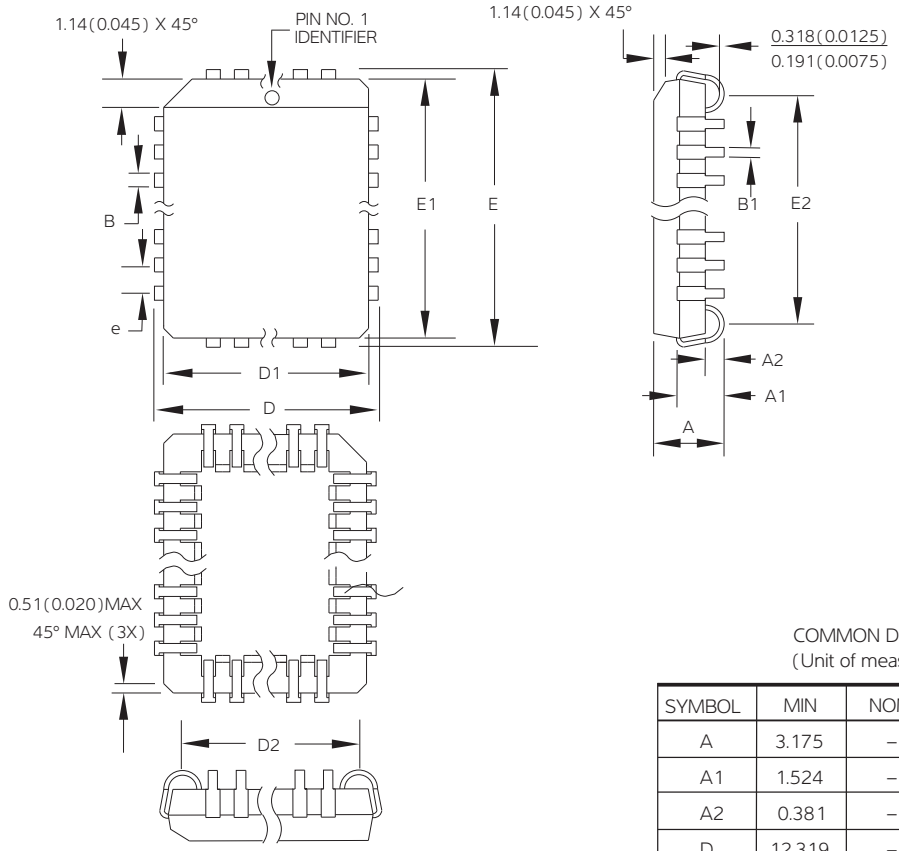
## Green package option (Pb/halide-free)

| $t_{ACC}$ (ns) | $I_{CC}$ (mA) | | Atmel ordering code | Package | Lead finish | Operation range |
|---|---|---|---|---|---|---|
| | Active | Standby | | | | |
| 45 | 25 | 0.1 | AT27C010-45JU | 32J | Matte tin | Industrial (-40°C to 85°C) |
| 70 | 25 | 0.1 | AT27C010-70JU<br>AT27C010-70PU | 32J<br>32P6 | Matte tin<br>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. Package Information

## 32J – PLCC




COMMON DIMENSIONS
(Unit of measure = mm)

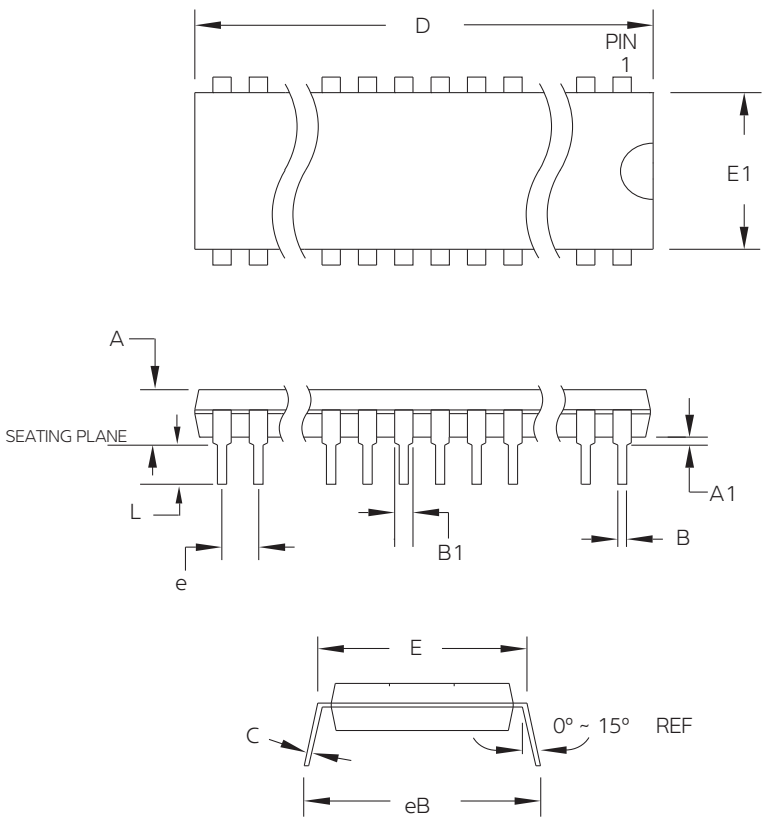
| SYMBOL | MIN | NOM | MAX | NOTE |
|---|---|---|---|---|
| A | 3.175 | – | 3.556 | |
| A1 | 1.524 | – | 2.413 | |
| A2 | 0.381 | – | – | |
| D | 12.319 | – | 12.573 | |
| D1 | 11.354 | – | 11.506 | Note 2 |
| D2 | 9.906 | – | 10.922 | |
| E | 14.859 | – | 15.113 | |
| E1 | 13.894 | – | 14.046 | Note 2 |
| E2 | 12.471 | – | 13.487 | |
| B | 0.660 | – | 0.813 | |
| B1 | 0.330 | – | 0.533 | |
| e | 1.270 TYP | | | |

Notes:
1. This package conforms to JEDEC reference MS-016, Variation AE.
2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is .010"(0.254mm) per side. Dimension D1 and E1 include mold mismatch and are measured at the extreme material condition at the upper or lower parting line.
3. Lead coplanarity is 0.004" (0.10mm) maximum.

10/04/01

| Package Drawing Contact: packagedrawings@atmel.com | TITLE | DRAWING NO. | REV. |
|---|---|---|---|
| | 32J, 32-lead, Plastic J-leaded Chip Carrier (PLCC) | 32J | B |

## 32P6 – PDIP




COMMON DIMENSIONS
(Unit of Measure = mm)

| SYMBOL | MIN | NOM | MAX | NOTE |
|---|---|---|---|---|
| A | – | – | 4.826 | |
| A1 | 0.381 | – | – | |
| D | 41.783 | – | 42.291 | Note 1 |
| E | 15.240 | – | 15.875 | |
| E1 | 13.462 | – | 13.970 | Note 1 |
| B | 0.356 | – | 0.559 | |
| B1 | 1.041 | – | 1.651 | |
| L | 3.048 | – | 3.556 | |
| C | 0.203 | – | 0.381 | |
| eB | 15.494 | – | 17.526 | |
| e | 2.540 TYP | | | |

Note: 1. Dimensions D and E1 do not include mold Flash or Protrusion. Mold Flash or Protrusion shall not exceed 0.25mm (0.010").

09/28/01

| | TITLE | DRAWING NO. | REV. |
|---|---|---|---|
| Package Drawing Contact: packagedrawings@atmel.com | 32P6, 32-lead (0.600"/15.24mm wide) Plastic Dual Inline Package (PDIP) | 32P6 | B |

# 9. Revision history

| Doc. Rev. | Date | Comments |
|---|---|---|
| 0321N | 04/2011 | Remove TSOP package<br>Add lead finish to ordering information |
| 0321M | 12/2007 | |

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