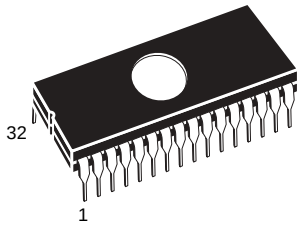
# M27C4001

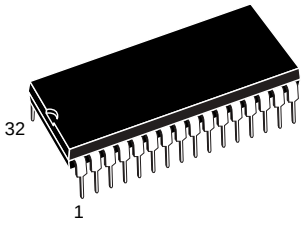
## 4 Mbit (512Kb x 8) UV EPROM and OTP EPROM

### Feature summary

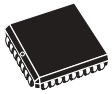
- 5V ± 10% supply voltage in Read operation
- Access time: 35ns
- Low power consumption:
  - Active Current 30mA at 5MHz
  - Standby Current 100µA
- Programming voltage: 12.75V ± 0.25V
- Programming time: 100µs/Word
- Electronic signature
  - Manufacturer Code: 20h
  - Device Code: 41h
- Packages
  - ECOPACK® compliant versions




FDIP32W (F)




PDIP32 (B)



PLCC32 (C)

TSOP32 (N) 8 x 20 mm

# 1 Summary description

The M27C4001 is a 4 Mbit EPROM offered in the two ranges UV (ultra violet erase) and OTP (one time programmable). It is ideally suited for microprocessor systems requiring large programs and is organised as 524,288 by 8 bits.

The FDIP32W (window ceramic frit-seal package) has a transparent lid which allows the user to expose the chip to ultraviolet light to erase the bit pattern. A new pattern can then be written to the device by following the programming procedure.

For applications where the content is programmed only one time and erasure is not required, the M27C4001 is offered in PDIP32, PLCC32 and TSOP32 (8 x 20 mm) packages.

In order to meet environmental requirements, ST offers the M27C4001 in ECOPACK® packages.

ECOPACK packages are Lead-free. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label.

ECOPACK is an ST trademark. ECOPACK specifications are available at: *www.st.com*.

**Figure 1. Logic Diagram**

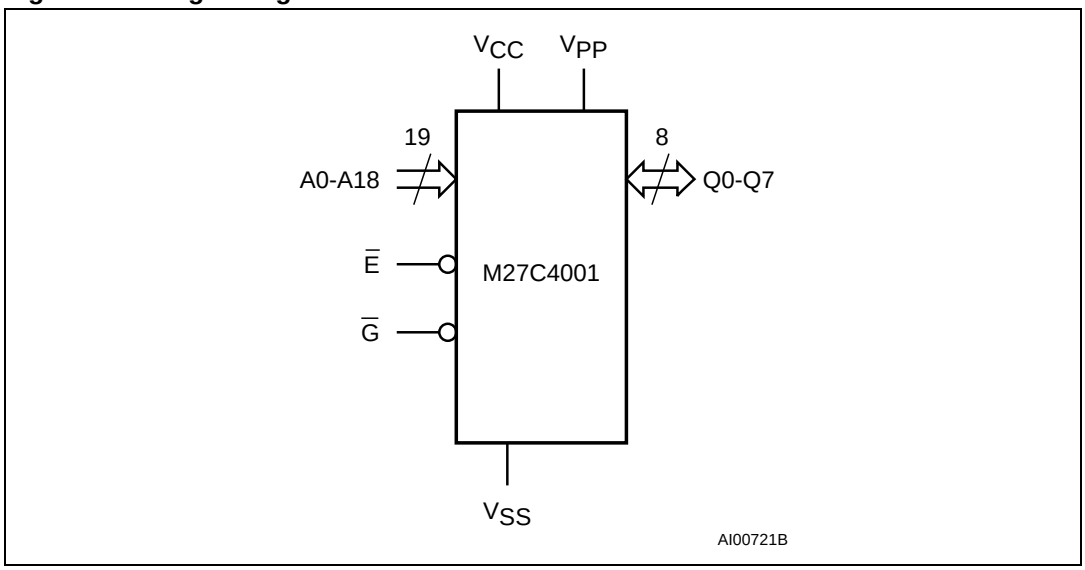



**Table 1. Signal names**

| | |
|---|---|
| A0-A18 | Address Inputs |
| Q0-Q7 | Data Outputs |
| $\overline{E}$ | Chip Enable |
| $\overline{G}$ | Output Enable |
| $V_{PP}$ | Program Supply |
| $V_{CC}$ | Supply Voltage |
| $V_{SS}$ | Ground |

# 3 Maximum rating

Stressing the device above the rating listed in the Absolute Maximum Ratings table may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the Operating sections of this specification is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

**Table 4. Absolute Maximum Ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $T_A$ | Ambient Operating Temperature(1) | –40 to 125 | °C |
| $T_{BIAS}$ | Temperature Under Bias | –50 to 125 | °C |
| $T_{STG}$ | Storage Temperature | –65 to 150 | °C |
| $V_{IO}$(2) | Input or Output Voltage (except A9) | –2 to 7 | V |
| $V_{CC}$ | Supply Voltage | –2 to 7 | V |
| $V_{A9}$(2) | A9 Voltage | –2 to 13.5 | V |
| $V_{PP}$ | Program Supply Voltage | –2 to 14 | V |

1. Depends on range.
2. Minimum DC voltage on Input or Output is –0.5V with possible undershoot to –2.0V for a period less than 20ns. Maximum DC voltage on Output is $V_{CC}$ +0.5V with possible overshoot to $V_{CC}$ +2V for a period less than 20ns.

# 4 DC and AC parameters

This section summarizes the operating and measurement conditions, and the DC and AC characteristics of the device. The parameters in the DC and AC Characteristic tables that follow are derived from tests performed under the Measurement Conditions summarized in the relevant tables. Designers should check that the operating conditions in their circuit match the measurement conditions when relying on the quoted parameters.

**Table 5. AC Measurement Conditions**

| | High Speed | Standard |
|---|---|---|
| Input Rise and Fall Times | ≤10ns | ≤20ns |
| Input Pulse Voltages | 0 to 3V | 0.4 to 2.4V |
| Input and Output Timing Ref. Voltages | 1.5V | 0.8 and 2V |

**Figure 6. AC Testing Input Output Waveform**

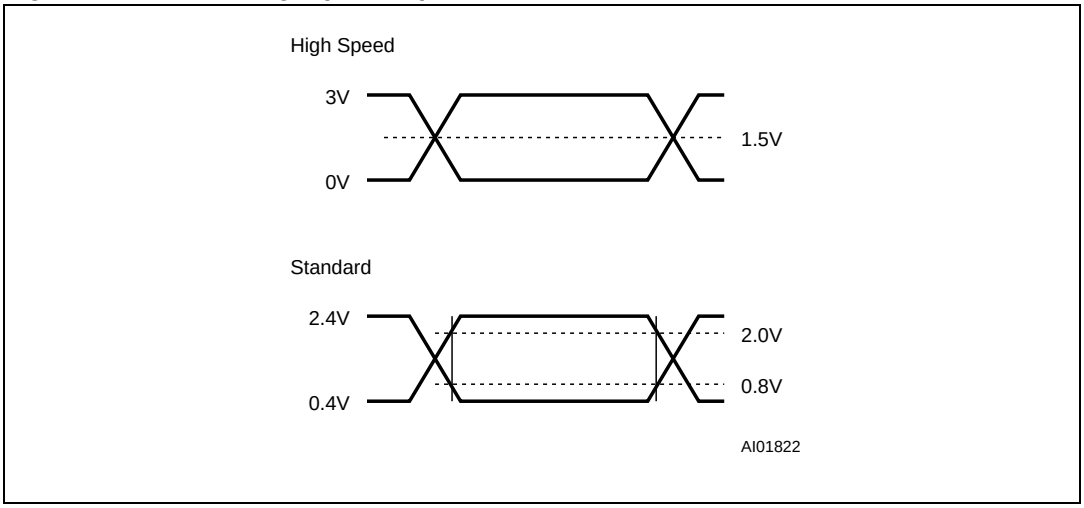



**Figure 7. AC Testing Load Circuit**

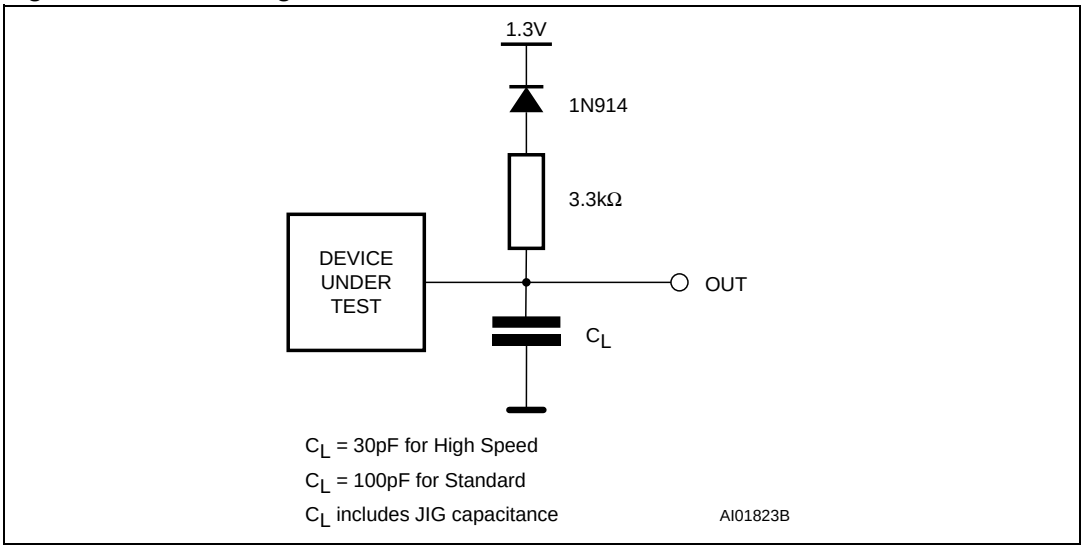


**Table 6. Capacitance (1) (2)**

| Symbol | Parameter | Test Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{IN}$ = 0V | | 6 | pF |
| $C_{OUT}$ | Output Capacitance | $V_{OUT}$ = 0V | | 12 | pF |

1. $T_A$ = 25 °C, f = 1 MHz.
2. Sampled only, not 100% tested.

**Table 7. Read Mode DC Characteristics(1) (2)**

| Symbol | Parameter | Test Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| $I_{LI}$ | Input Leakage Current | 0V ≤$V_{IN}$ ≤$V_{CC}$ | | ±10 | µA |
| $I_{LO}$ | Output Leakage Current | 0V ≤$V_{OUT}$ ≤$V_{CC}$ | | ±10 | µA |
| $I_{CC}$ | Supply Current | $\overline{E}$ = $V_{IL}$, $\overline{G}$ = $V_{IL}$, $I_{OUT}$ = 0mA, f = 5MHz | | 30 | mA |
| $I_{CC1}$ | Supply Current (Standby) TTL | $\overline{E}$ = $V_{IH}$ | | 1 | mA |
| $I_{CC2}$ | Supply Current (Standby) CMOS | $\overline{E}$ > $V_{CC}$ – 0.2V | | 100 | µA |
| $I_{PP}$ | Program Current | $V_{PP}$ = $V_{CC}$ | | 10 | µA |
| $V_{IL}$ | Input Low Voltage | | –0.3 | 0.8 | V |
| $V_{IH}$(3) | Input High Voltage | | 2 | $V_{CC}$ + 1 | V |
| $V_{OL}$ | Output Low Voltage | $I_{OL}$ = 2.1mA | | 0.4 | V |
| $V_{OH}$ | Output High Voltage TTL | $I_{OH}$ = –400µA | 2.4 | | V |
| | Output High Voltage CMOS | $I_{OH}$ = –100µA | $V_{CC}$ – 0.7V | | V |

1. $T_A$ = 0 to 70 °C or –40 to 85 °C; $V_{CC}$ = 5V ± 5% or 5V ± 10%; $V_{PP}$ = $V_{CC}$
2. $V_{CC}$ must be applied simultaneously with or before $V_{PP}$ and removed simultaneously or after $V_{PP}$.
3. Maximum DC voltage on Output is $V_{CC}$ +0.5V.

**Table 8. Programming Mode DC Characteristics (1) (2)**

| Symbol | Parameter | Test Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| $I_{LI}$ | Input Leakage Current | 0 ≤$V_{IN}$ ≤$V_{CC}$ | | ±10 | µA |
| $I_{CC}$ | Supply Current | | | 50 | mA |
| $I_{PP}$ | Program Current | $\overline{E}$ = $V_{IL}$ | | 50 | mA |
| $V_{IL}$ | Input Low Voltage | | –0.3 | 0.8 | V |
| $V_{IH}$ | Input High Voltage | | 2 | $V_{CC}$ + 0.5 | V |
| $V_{OL}$ | Output Low Voltage | $I_{OL}$ = 2.1mA | | 0.4 | V |
| $V_{OH}$ | Output High Voltage TTL | $I_{OH}$ = –400µA | 2.4 | | V |
| $V_{ID}$ | A9 Voltage | | 11.5 | 12.5 | V |

1. $T_A$ = 25 °C; $V_{CC}$ = 6.25V ± 0.25V; $V_{PP}$ = 12.75V ± 0.25V.
2. $V_{CC}$ must be applied simultaneously with or before $V_{PP}$ and removed simultaneously or after $V_{PP}$.

**Figure 8. Read Mode AC Waveforms**

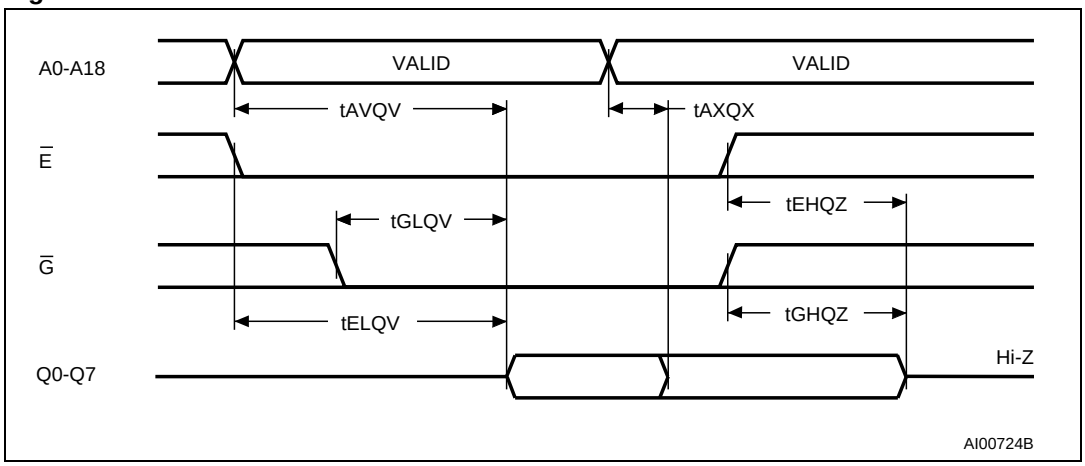



**Table 9. Read Mode AC Characteristics(1) (2)**

| Symbol | Alt | Parameter | Test Condition | M27C4001 | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | -35(3) | | -45(3) | | -55(3) | | |
| | | | | Min | Max | Min | Max | Min | Max | |
| $t_{AVQV}$ | $t_{ACC}$ | Address Valid to Output Valid | $\overline{E} = V_{IL}$, $\overline{G} = V_{IL}$ | | 35 | | 45 | | 55 | ns |
| $t_{ELQV}$ | $t_{CE}$ | Chip Enable Low to Output Valid | $\overline{G} = V_{IL}$ | | 35 | | 45 | | 55 | ns |
| $t_{GLQV}$ | $t_{OE}$ | Output Enable Low to Output Valid | $\overline{E} = V_{IL}$ | | 20 | | 25 | | 30 | ns |
| $t_{EHQZ}$(4) | $t_{DF}$ | Chip Enable High to Output Hi-Z | $\overline{G} = V_{IL}$ | 0 | 30 | 0 | 30 | 0 | 30 | ns |
| $t_{GHQZ}$(4) | $t_{DF}$ | Output Enable High to Output Hi-Z | $\overline{E} = V_{IL}$ | 0 | 30 | 0 | 30 | 0 | 30 | ns |
| $t_{AXQX}$ | $t_{OH}$ | Address Transition to Output Transition | $\overline{E} = V_{IL}$, $\overline{G} = V_{IL}$ | 0 | | 0 | | 0 | | ns |

1. $T_A$ = 0 to 70 °C or –40 to 85 °C; $V_{CC}$ = 5V ± 5% or 5V ± 10%; $V_{PP} = V_{CC}$
2. $V_{CC}$ must be applied simultaneously with or before $V_{PP}$ and removed simultaneously or after $V_{PP}$
3. Speed obtained with High Speed AC measurement conditions.
4. Sampled only, not 100% tested.

**Table 10. Read Mode AC Characteristics(1) (2)**

| Symbol | Alt | Parameter | Test Condition | M27C4001 | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | -70 | | -80/-90 | | -10/-12/-15 | | |
| | | | | Min | Max | Min | Max | Min | Max | |
| $t_{AVQV}$ | $t_{ACC}$ | Address Valid to Output Valid | $\overline{E} = V_{IL}$, $\overline{G} = V_{IL}$ | | 70 | | 80 | | 100 | ns |
| $t_{ELQV}$ | $t_{CE}$ | Chip Enable Low to Output Valid | $\overline{G} = V_{IL}$ | | 70 | | 80 | | 100 | ns |
| $t_{GLQV}$ | $t_{OE}$ | Output Enable Low to Output Valid | $\overline{E} = V_{IL}$ | | 35 | | 40 | | 50 | ns |
| $t_{EHQZ}$(3) | $t_{DF}$ | Chip Enable High to Output Hi-Z | $\overline{G} = V_{IL}$ | 0 | 30 | 0 | 30 | 0 | 30 | ns |
| $t_{GHQZ}$(3) | $t_{DF}$ | Output Enable High to Output Hi-Z | $\overline{E} = V_{IL}$ | 0 | 30 | 0 | 30 | 0 | 30 | ns |
| $t_{AXQX}$ | $t_{OH}$ | Address Transition to Output Transition | $\overline{E} = V_{IL}$, $\overline{G} = V_{IL}$ | 0 | | 0 | | 0 | | ns |

1. $T_A$ = 0 to 70 °C or –40 to 85 °C; $V_{CC}$ = 5V ± 5% or 5V ± 10%; $V_{PP} = V_{CC}$
2. $V_{CC}$ must be applied simultaneously with or before $V_{PP}$ and removed simultaneously or after $V_{PP}$.
3. Sampled only, not 100% tested.

**Figure 9. Programming and Verify Modes AC Waveforms**

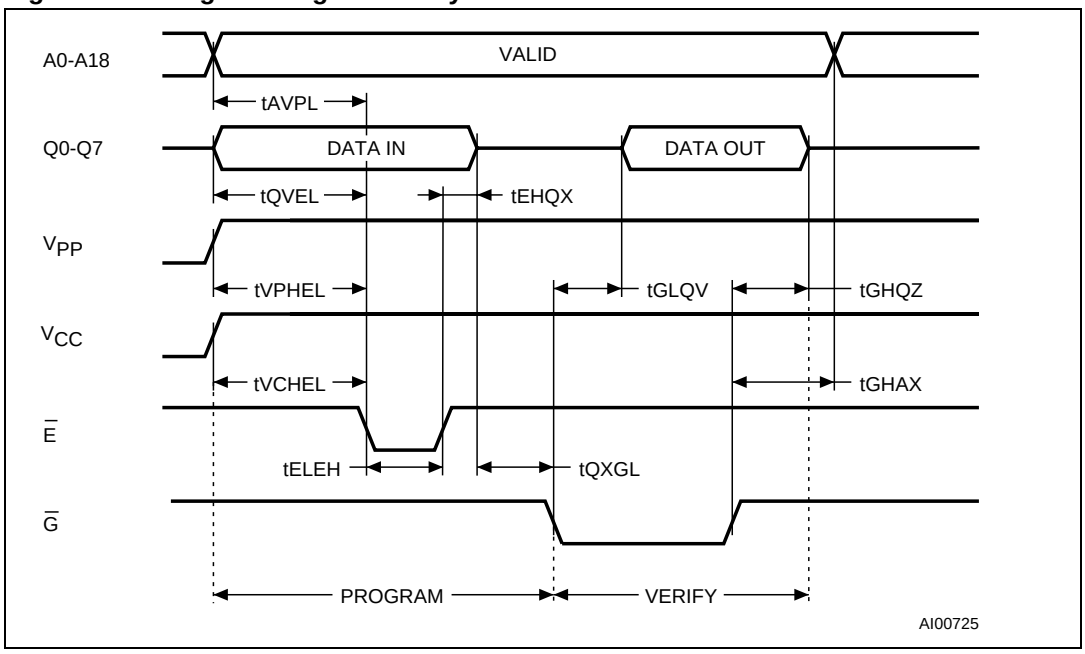
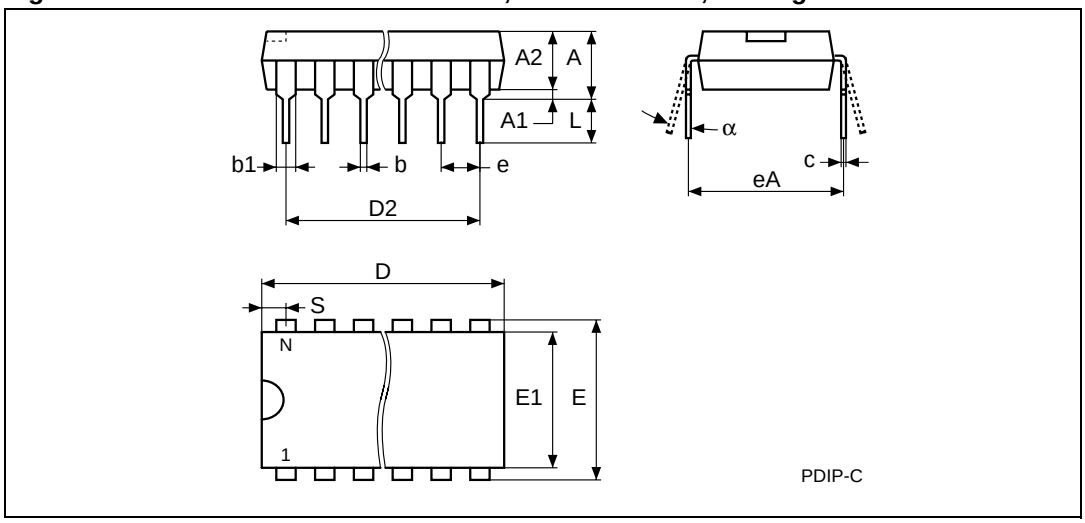



**Table 11. Programming Mode AC Characteristics(1) (2) (3)**

| Symbol | Alt | Parameter | Test Condition | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{AVEL}$ | $t_{AS}$ | Address Valid to Chip Enable Low | | 2 | | µs |
| $t_{QVEL}$ | $t_{DS}$ | Input Valid to Chip Enable Low | | 2 | | µs |
| $t_{VPHEL}$ | $t_{VPS}$ | $V_{PP}$ High to Chip Enable Low | | 2 | | µs |
| $t_{VCHEL}$ | $t_{VCS}$ | $V_{CC}$ High to Chip Enable Low | | 2 | | µs |
| $t_{ELEH}$ | $t_{PW}$ | Chip Enable Program Pulse Width | | 95 | 105 | µs |
| $t_{EHQX}$ | $t_{DH}$ | Chip Enable High to Input Transition | | 2 | | µs |
| $t_{QXGL}$ | $t_{OES}$ | Input Transition to Output Enable Low | | 2 | | µs |
| $t_{GLQV}$ | $t_{OE}$ | Output Enable Low to Output Valid | | | 100 | ns |
| $t_{GHQZ}$ | $t_{DFP}$ | Output Enable High to Output Hi-Z | | 0 | 130 | ns |
| $t_{GHAX}$ | $t_{AH}$ | Output Enable High to Address Transition | | 0 | | ns |

1. $T_A$ = 25 °C; $V_{CC}$ = 6.25V ± 0.25V; $V_{PP}$ = 12.75V ± 0.25V
2. $V_{CC}$ must be applied simultaneously with or before $V_{PP}$ and removed simultaneously or after $V_{PP}$.
3. Sampled only, not 100% tested.

**Figure 11. PDIP32 - 32 lead Plastic DIP, 600 mils width, Package Outline**

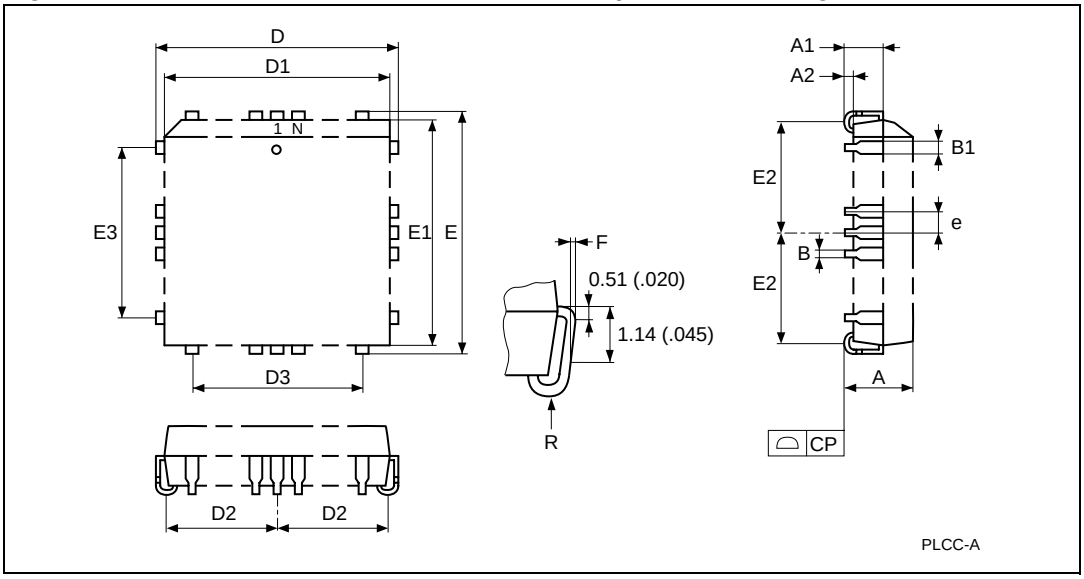



1. Drawing is not to scale.

**Table 13. PDIP32 - 32 lead Plastic DIP, 600 mils width, package mechanical data**

| Symbol | millimeters | | | inches | | |
|---|---|---|---|---|---|---|
| | Typ | Min | Max | Typ | Min | Max |
| A | | | 4.83 | | | 0.190 |
| A1 | | 0.38 | | | 0.015 | |
| A2 | 3.81 | | | 0.150 | | |
| b | | 0.41 | 0.53 | | 0.016 | 0.021 |
| b1 | | 1.14 | 1.65 | | 0.045 | 0.065 |
| c | | 0.23 | 0.38 | | 0.009 | 0.015 |
| D | | 41.78 | 42.29 | | 1.645 | 1.665 |
| eA | 15.24 | – | – | 0.600 | – | – |
| e | 2.54 | – | – | 0.100 | – | – |
| E | | 15.24 | 15.88 | | 0.600 | 0.625 |
| E1 | | 13.46 | 13.97 | | 0.530 | 0.550 |
| S | | 1.65 | 2.21 | | 0.065 | 0.087 |
| L | | 3.05 | 3.56 | | 0.120 | 0.140 |
| α | | 0° | 15° | | 0° | 15° |
| N | 32 | | | 32 | | |

**Figure 12. PLCC32 - 32 lead Plastic Leaded Chip Carrier, Package Outline**




1. Drawing is not to scale.

**Table 14. PLCC32 - 32 lead Plastic Leaded Chip Carrier, package mechanical data**

| Symbol | millimeters | | | inches | | |
|---|---|---|---|---|---|---|
| | Typ | Min | Max | Typ | Min | Max |
| A | | 3.18 | 3.56 | | 0.125 | 0.140 |
| A1 | | 1.53 | 2.41 | | 0.060 | 0.095 |
| A2 | | 0.38 | – | | 0.015 | – |
| B | | 0.33 | 0.53 | | 0.013 | 0.021 |
| B1 | | 0.66 | 0.81 | | 0.026 | 0.032 |
| CP | | | 0.10 | | | 0.004 |
| D | | 12.32 | 12.57 | | 0.485 | 0.495 |
| D1 | | 11.35 | 11.51 | | 0.447 | 0.453 |
| D2 | | 4.78 | 5.66 | | 0.188 | 0.223 |
| D3 | 7.62 | – | – | 0.300 | – | – |
| E | | 14.86 | 15.11 | | 0.585 | 0.595 |
| E1 | | 13.89 | 14.05 | | 0.547 | 0.553 |
| E2 | | 6.05 | 6.93 | | 0.238 | 0.273 |
| E3 | 10.16 | – | – | 0.400 | – | – |
| e | 1.27 | – | – | 0.050 | – | – |
| F | | 0.00 | 0.13 | | 0.000 | 0.005 |
| R | 0.89 | – | – | 0.035 | – | – |
| N | 32 | | | 32 | | |

# 6 Part numbering

**Table 16. Ordering Information Scheme**

Example: M27C4001 -45 X C 1

**Device Type**
M27

**Supply Voltage**
C = 5V

**Device Function**
4001 = 4 Mbit (512Kb x 8)

**Speed**
-35(1) = 35 ns
-45(1) = 45 ns
-55(1) = 55 ns
-70 = 70 ns
-80 = 80 ns
-90 = 90 ns
-10 = 100 ns
-12 = 120 ns
-15 = 150 ns

**$V_{CC}$ Tolerance**
blank = ± 10%
X = ± 5%

**Package**
F = FDIP32W
B = PDIP32
C = PLCC32
N = TSOP32: 8 x 20 mm

**Temperature Range**
1 = 0 to 70 °C
6 = –40 to 85 °C

1. High Speed, see AC Characteristics section for further information.

For a list of available options (Speed, Package, etc...) or for further information on any aspect of this device, please contact the STMicroelectronics Sales Office nearest to you.