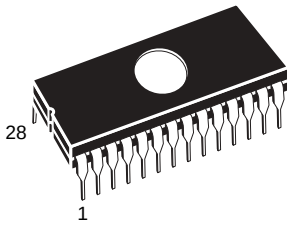
# M27C512

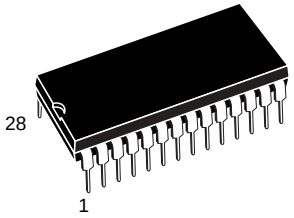
## 512 Kbit (64K x8) UV EPROM and OTP EPROM

## Features

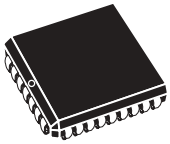
- 5V ± 10% supply voltage in read operation
- Access time: 45 ns
- Low power “CMOS” consumption:
  - Active current 30 mA
  - Standby current 100 µA
- Programming voltage: 12.75 V ± 0.25 V
- Programming time around 6 s.
- Electronic Signature
  - Manufacturer code: 20h
  - Device code: 3Dh
- Packages
  - ECOPACK® versions




FDIP28W (F)




PDIP28 (B)



PLCC32 (C)

**Table 1. Device summary**

| Package | 45 ns | 70 ns | 90 ns | 100 ns | 120 ns | 150 ns |
|---|---|---|---|---|---|---|
| PDIP28 | | | M27C512-90B6 | | | |
| PLCC32 | | M27C512-70C6 | M27C512-90C1 | M27C512-10C6 | M27C512-12C3 | |
| FDIP28W | M27C512-45XF1 | M27C512-70XF1 | M27C512-90F1<br>M27C512-90F6 | M27C512-10F1 | M27C512-12F1<br>M27C512-12F3 | M27C512-15F1<br>M27C512-15F6 |

# 1 Description

The M27C512 is a 512 Kbit EPROM offered in the two ranges UV (ultra violet erase) and OTP (one time programmable). It is ideally suited for applications where fast turn-around and pattern experimentation are important requirements and is organized as 65536 by 8 bits.

The FDIP28W (window ceramic frit-seal package) has 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 M27C512 is offered in FDIP28W, PDIP28, and PLCC32 packages. In order to meet environmental requirements, ST offers the M27C512 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**

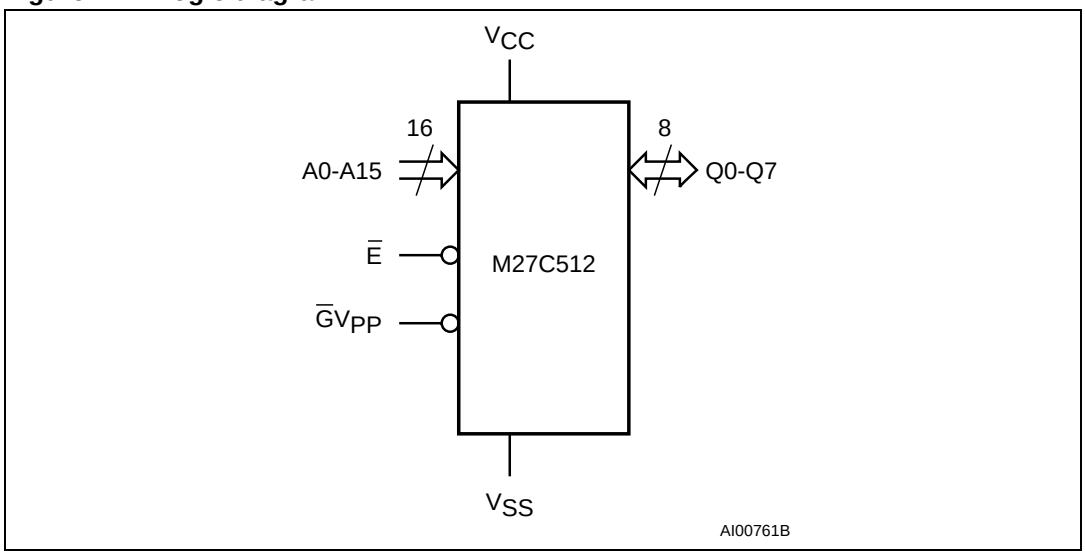



**Table 2. Signal names**

| Name | Description | Direction |
|---|---|---|
| A0-A15 | Address Inputs | Inputs |
| Q0-Q7 | Data outputs | Outputs |
| $\overline{E}$ | Chip Enable | Input |
| $\overline{G}V_{PP}$ | Output Enable / Program Supply | Input |
| $V_{CC}$ | Supply Voltage | Supply |
| $V_{SS}$ | Ground | Supply |
| NC | Not Connected Internally | - |
| DU | Don't Use | - |

# 4 Maximum rating

Stressing the device outside the ratings listed in <Blue>Table 5. may cause permanent damage to the device. These are stress ratings only, and operation of the device at these, or any other conditions outside 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 5. 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 |
| $T_{LEAD}$ | Lead Temperature during Soldering | (note 1) | °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.

# 5 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 6. AC measurement conditions**

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

**Figure 5. Testing input/output waveform**

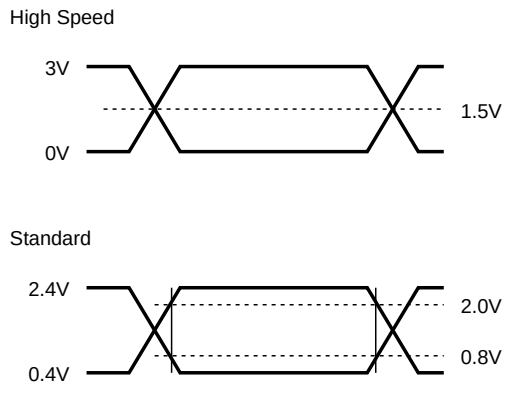



**Figure 6. AC Testing Load Circuit**

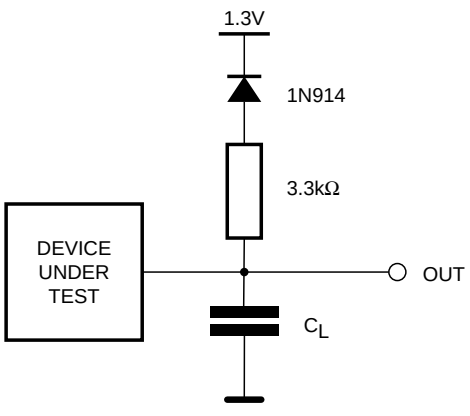


**Table 7. Capacitance**

| Symbol | Parameter | Test Condition(1)(2) | 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 = 1MHz
2. Sampled only, not 100% tested.

**Table 8. Read mode DC characteristics**

| Symbol | Parameter | Test Condition(1) | Min | Max | Unit |
|---|---|---|---|---|---|
| $I_{LI}$ | Input Leakage Current | $0V \le V_{IN} \le V_{CC}$ | | ±10 | µA |
| $I_{LO}$ | Output Leakage Current | $0V \le V_{OUT} \le V_{CC}$ | | ±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 |
| $V_{IH}$(2) | 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 | $I_{OH}$ = –1mA | 3.6 | | V |
| | Output High Voltage CMOS | $I_{OH}$ = –100µA | $V_{CC}$ – 0.7V | | V |

1. $V_{CC}$ must be applied simultaneously with or before $V_{PP}$ and removed simultaneously or after $V_{PP}$.
2. Maximum DC voltage on Output is $V_{CC}$ +0.5V.

**Table 9. Read mode AC characteristics**

| Symbol | Alt | Parameter | Test Condition(1) | M27C512 | | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | | -45(2) | | -70 | | |
| | | | | Min | Max | Min | Max | |
| $t_{AVQV}$ | $t_{ACC}$ | Address Valid to Output Valid | $\overline{E} = V_{IL}$, $\overline{G} = V_{IL}$ | | 45 | | 70 | ns |
| $t_{ELQV}$ | $t_{CE}$ | Chip Enable Low to Output Valid | $\overline{G} = V_{IL}$ | | 45 | | 70 | ns |
| $t_{GLQV}$ | $t_{OE}$ | Output Enable Low to Output Valid | $\overline{E} = V_{IL}$ | | 25 | | 35 | ns |
| $t_{EHQZ}$(3) | $t_{DF}$ | Chip Enable High to Output Hi-Z | $\overline{G} = V_{IL}$ | 0 | 25 | 0 | 30 | ns |
| $t_{GHQZ}$(3) | $t_{DF}$ | Output Enable High to Output Hi-Z | $\overline{E} = V_{IL}$ | 0 | 25 | 0 | 30 | ns |
| $t_{AXQX}$ | $t_{OH}$ | Address Transition to Output Transition | $\overline{E} = V_{IL}$, $\overline{G} = V_{IL}$ | 0 | | 0 | | ns |

1. $V_{CC}$ must be applied simultaneously with or before $V_{PP}$ and removed simultaneously or after $V_{PP}$.
2. Speed obtained with High Speed AC measurement conditions.
3. Sampled only, not 100% tested.

**Table 10. Read mode AC characteristics**

| Symbol | Alt | Parameter | Test Condition(1) | M27C512 | | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | -90 | | -10 | | -12 | | -15 | | |
| | | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| $t_{AVQV}$ | $t_{ACC}$ | Address Valid to Output Valid | $\overline{E} = V_{IL}$, $\overline{G} = V_{IL}$ | | 90 | | 100 | | 120 | | 150 | ns |
| $t_{ELQV}$ | $t_{CE}$ | Chip Enable Low to Output Valid | $\overline{G} = V_{IL}$ | | 90 | | 100 | | 120 | | 150 | ns |
| $t_{GLQV}$ | $t_{OE}$ | Output Enable Low to Output Valid | $\overline{E} = V_{IL}$ | | 40 | | 40 | | 50 | | 60 | ns |
| $t_{EHQZ}$ (2) | $t_{DF}$ | Chip Enable High to Output Hi-Z | $\overline{G} = V_{IL}$ | 0 | 30 | 0 | 30 | 0 | 40 | 0 | 50 | ns |
| $t_{GHQZ}$(2) | $t_{DF}$ | Output Enable High to Output Hi-Z | $\overline{E} = V_{IL}$ | 0 | 30 | 0 | 30 | 0 | 40 | 0 | 50 | ns |
| $t_{AXQX}$ | $t_{OH}$ | Address Transition to Output Transition | $\overline{E} = V_{IL}$, $\overline{G} = V_{IL}$ | 0 | | 0 | | 0 | | 0 | | ns |

1. $V_{CC}$ must be applied simultaneously with or before $V_{PP}$ and removed simultaneously or after $V_{PP}$.
2. Sampled only, not 100% tested.

**Figure 7. Read mode AC waveforms**

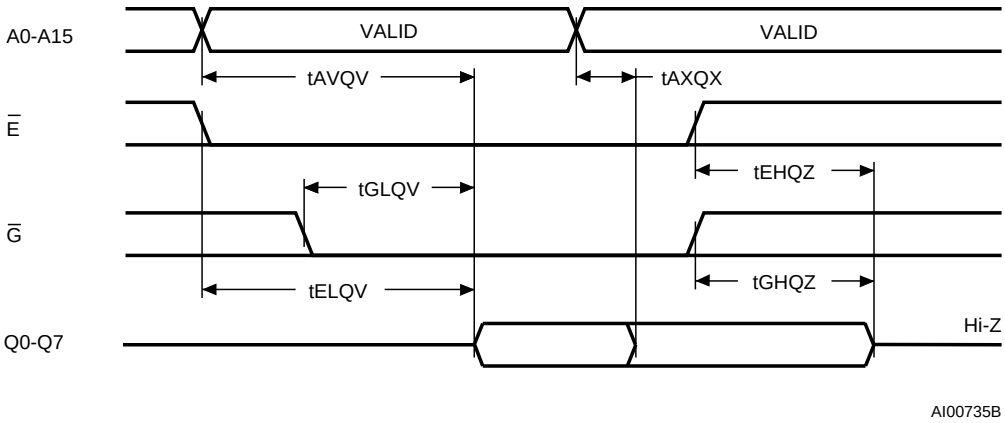



**Table 11. Programming mode DC characteristics**

| Symbol | Parameter | Test Condition(1)(2) | Min | Max | Unit |
|---|---|---|---|---|---|
| $I_{LI}$ | Input Leakage Current | $V_{IL} \le V_{IN} \le V_{IH}$ | | ±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 | $I_{OH}$ = –1mA | 3.6 | | 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 $V_{PP}$.

**Table 12. Margin Mode AC Characteristics**

| Symbol | Alt | Parameter | Test Condition(1)(2) | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{A9HVPH}$ | $t_{AS9}$ | $V_{A9}$ High to $V_{PP}$ High | | 2 | | µs |
| $t_{VPHEL}$ | $t_{VPS}$ | $V_{PP}$ High to Chip Enable Low | | 2 | | µs |
| $t_{A10HEH}$ | $t_{AS10}$ | $V_{A10}$ High to Chip Enable High (Set) | | 1 | | µs |
| $t_{A10LEH}$ | $t_{AS10}$ | $V_{A10}$ Low to Chip Enable High (Reset) | | 1 | | µs |
| $t_{EXA10X}$ | $t_{AH10}$ | Chip Enable Transition to $V_{A10}$ Transition | | 1 | | µs |
| $t_{EXVPX}$ | $t_{VPH}$ | Chip Enable Transition to $V_{PP}$ Transition | | 2 | | µs |
| $t_{VPXA9X}$ | $t_{AH9}$ | $V_{PP}$ Transition to $V_{A9}$ Transition | | 2 | | µs |

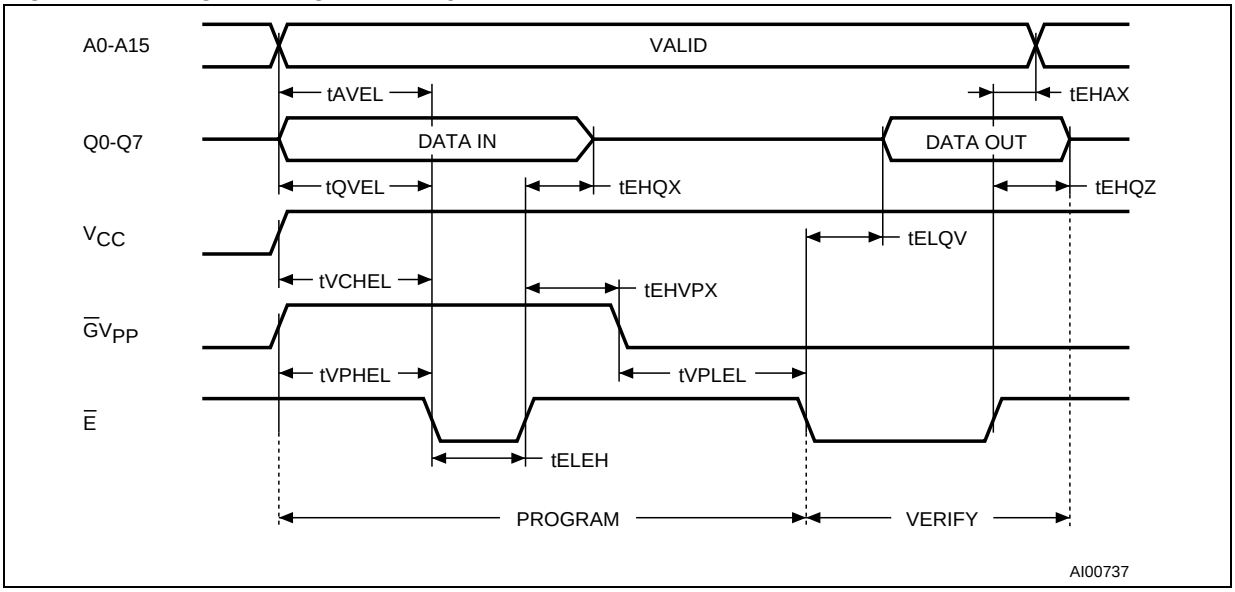
1. $T_A$ = 25 °C; $V_{CC}$ = 6.25V ± 0.25V; $V_{PP}$ = 12.75V ± 0.25V
2. $V_{CC}$ must be applied simultaneously with or before $V_{PP}$ and removed simultaneously or after $V_{PP}$.

**Table 13. Programming mode AC characteristics**

| Symbol | Alt | Parameter | Test Condition(1)(2) | 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 |
| $t_{VCHEL}$ | $t_{VCS}$ | $V_{CC}$ High to Chip Enable Low | | 2 | | µs |
| $t_{VPHEL}$ | $t_{OES}$ | $V_{PP}$ High to Chip Enable Low | | 2 | | µs |
| $t_{VPLVPH}$ | $t_{PRT}$ | $V_{PP}$ Rise Time | | 50 | | ns |
| $t_{ELEH}$ | $t_{PW}$ | Chip Enable Program Pulse Width (Initial) | | 95 | 105 | µs |
| $t_{EHQX}$ | $t_{DH}$ | Chip Enable High to Input Transition | | 2 | | µs |
| $t_{EHVPX}$ | $t_{OEH}$ | Chip Enable High to $V_{PP}$ Transition | | 2 | | µs |
| $t_{VPLEL}$ | $t_{VR}$ | $V_{PP}$ Low to Chip Enable Low | | 2 | | µs |
| $t_{ELQV}$ | $t_{DV}$ | Chip Enable Low to Output Valid | | | 1 | µs |
| $t_{EHQZ}$(3) | $t_{DFP}$ | Chip Enable High to Output Hi-Z | | 0 | 130 | ns |
| $t_{EHAX}$ | $t_{AH}$ | Chip Enable High to Address Transition | | 0 | | ns |

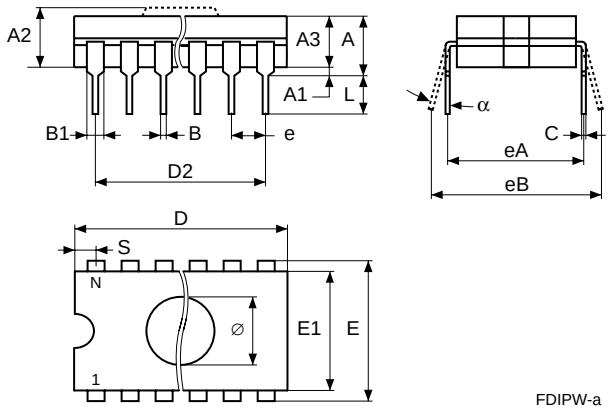
1. $T_A$ = 25 °C; $V_{CC}$ = 6.25V ± 0.25V; $V_{PP}$ = 12.75V ± 0.25V
2. $V_{CC}$ must be applied simultaneously with or before $V_{PP}$ and removed simultaneously or after $V_{PP}$.
3. Sampled only, not 100% tested.

**Figure 9. Programming and Verify modes AC waveforms**



# 6 Package mechanical

**Figure 10. FDIP28W - 28 pin Ceramic Frit-seal DIP, with window, Package Outline**




1. Drawing is not to scale.

**Table 14. FDIP28W - 28 pin Ceramic Frit-seal DIP, with window, Package Mechanical Data**

| Symbol | millimeters | | | inches | | |
|---|---|---|---|---|---|---|
| | Typ | Min | Max | Typ | Min | Max |
| A | | | 5.72 | | | 0.225 |
| A1 | | 0.51 | 1.40 | | 0.020 | 0.055 |
| A2 | | 3.91 | 4.57 | | 0.154 | 0.180 |
| A3 | | 3.89 | 4.50 | | 0.153 | 0.177 |
| B | | 0.41 | 0.56 | | 0.016 | 0.022 |
| B1 | 1.45 | – | – | 0.057 | – | – |
| C | | 0.23 | 0.30 | | 0.009 | 0.012 |
| D | | 36.50 | 37.34 | | 1.437 | 1.470 |
| D2 | 33.02 | – | – | 1.300 | – | – |
| E | 15.24 | – | – | 0.600 | – | – |
| E1 | | 13.06 | 13.36 | | 0.514 | 0.526 |
| e | 2.54 | – | – | 0.100 | – | – |
| eA | 14.99 | – | – | 0.590 | – | – |
| eB | | 16.18 | 18.03 | | 0.637 | 0.710 |
| L | | 3.18 | 4.10 | | 0.125 | 0.161 |
| S | | 1.52 | 2.49 | | 0.060 | 0.098 |
| ∅ | 7.11 | – | – | 0.280 | – | – |
| α | | 4° | 11° | | 4° | 11° |
| N | 28 | | | 28 | | |

# 7 Part numbering

**Table 17. Ordering Information Scheme**

Example: M27C512 -70 X C 1

**Device Type**

M27

**Supply Voltage**

C = 5V

**Device Function**

512 = 512 Kbit (64Kb x8)

**Speed**

-45 = 45 ns(1)

-70 = 70 ns

-90 = 90 ns

-10 = 100 ns

-12 = 120 ns

-15 = 150 ns

**$V_{CC}$ Tolerance**

blank = ± 10%

X = ± 5%

**Package**

F = FDIP28W

B = PDIP28

C = PLCC32

**Temperature Range**

1 = 0 to 70 °C

3 = –40 to 125 °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 your nearest ST Sales Office.