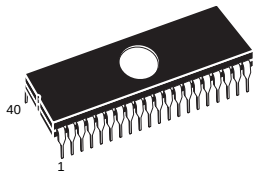
M27C4002

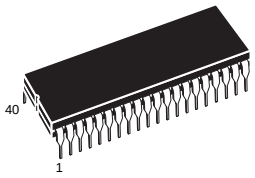
4 Mbit (256Kb x16) UV EPROM and OTP EPROM

Feature summary

- 5V ± 10% Supply voltage for Read operations
- Access time: 45ns
- Low Power consumption
  - Active Current 70mA at 10MHz
  - Standby current 100µa
- Programming Voltage: 12.75V ± 0.25V
- Programming Time: 100µs/word
- Electronic Signature
  - Manufacturer Code: 20h
  - Device Code: 44h
- ECOPACK® packages available



FDIP40W (F)



PDIP40 (B)

PLCC44 (C)

TSOP40 (N)
10 x 20 mm

1 Summary description

The M27C4002 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 organized as 262,144 words of 16 bits.

The FDIP40W (window ceramic frit-seal package) has transparent lids which allow 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.

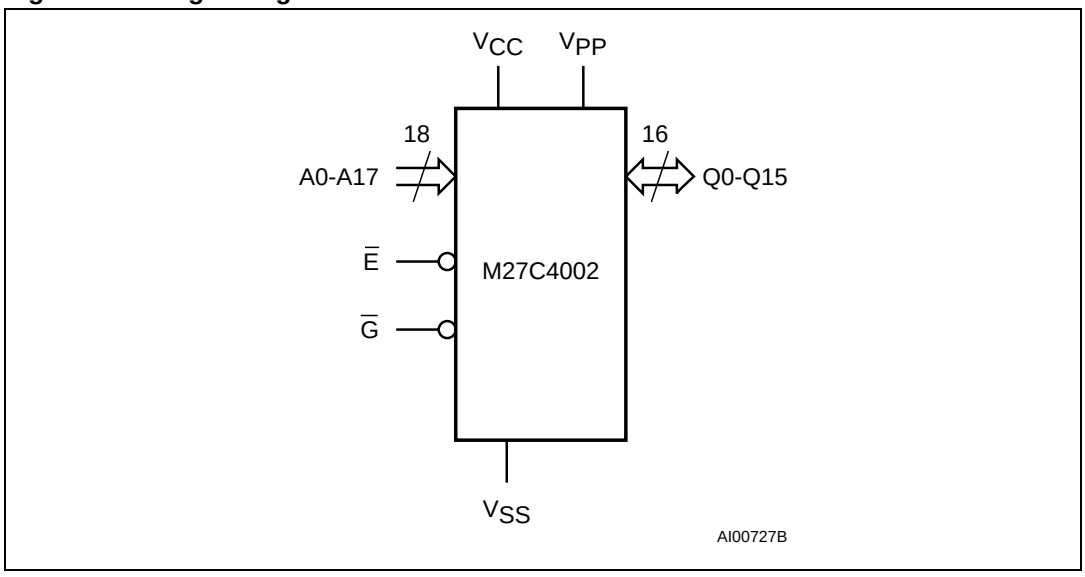
For applications where the content is programmed only one time and erasure is not required, the M27C4002 is offered in PDIP40, PLCC44 and TSOP40 (10 x 20 mm) packages.

In order to meet environmental requirements, ST offers the M27C4002 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



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

Parameter	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 6. AC Testing Input Output Waveform

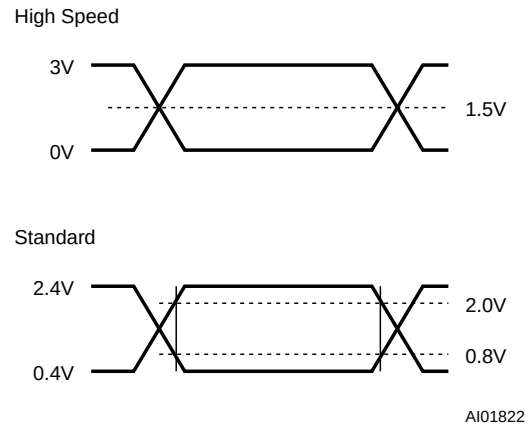


Figure 7. AC Testing Load Circuit

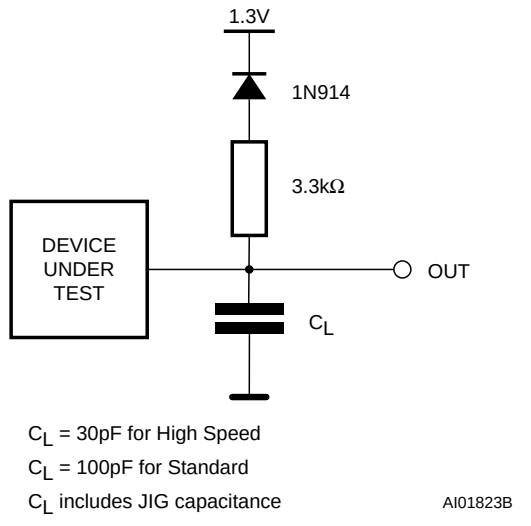


Table 6. Capacitance(1)(2)

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 = 10MHz		70	mA
		$\overline{E}$ = V_{IL}, $\overline{G}$ = V_{IL}, I_{OUT} = 0mA, f = 5MHz		50	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	V_{IL} ≤V_{IN} ≤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} = –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}.

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

Symbol	Alt	Parameter	Test Condition	M27C4002						Unit
				- 45(3)		-60 (3)		-70		
				Min	Max	Min	Max	Min	Max	
t_{AVQV}	t_{ACC}	Address Valid to Output Valid	$\overline{E}$ = V_{IL}, $\overline{G}$ = V_{IL}		45		60		70	ns
t_{ELQV}	t_{CE}	Chip Enable Low to Output Valid	$\overline{G}$ = V_{IL}		45		60		70	ns
t_{GLQV}	t_{OE}	Output Enable Low to Output Valid	$\overline{E}$ = V_{IL}		25		30		35	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 2(1)(2)

Symbol	Alt	Parameter	Test Condition	M27C4002						Unit
				-80		-90		-10		
				Min	Max	Min	Max	Min	Max	
t_{AVQV}	t_{ACC}	Address Valid to Output Valid	$\overline{E}$ = V_{IL}, $\overline{G}$ = V_{IL}		80		90		100	ns
t_{ELQV}	t_{CE}	Chip Enable Low to Output Valid	$\overline{G}$ = V_{IL}		80		90		100	ns
t_{GLQV}	t_{OE}	Output Enable Low to Output Valid	$\overline{E}$ = V_{IL}		40		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.

Table 11. Read Mode AC Characteristics 3(1)(2)

Symbol	Alt	Parameter	Test Condition	M27C4002						Unit
				-12		-15		-20		
				Min	Max	Min	Max	Min	Max	
t_{AVQV}	t_{ACC}	Address Valid to Output Valid	$\overline{E} = V_{IL}$, $\overline{G} = V_{IL}$		120		150		200	ns
t_{ELQV}	t_{CE}	Chip Enable Low to Output Valid	$\overline{G} = V_{IL}$		120		150		200	ns
t_{GLQV}	t_{OE}	Output Enable Low to Output Valid	$\overline{E} = V_{IL}$		60		60		70	ns
t_{EHQZ}(3)	t_{DF}	Chip Enable High to Output Hi-Z	$\overline{G} = V_{IL}$	0	40	0	50	0	80	ns
t_{GHQZ}(3)	t_{DF}	Output Enable High to Output Hi-Z	$\overline{E} = V_{IL}$	0	40	0	50	0	80	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 8. Read Mode AC Waveforms

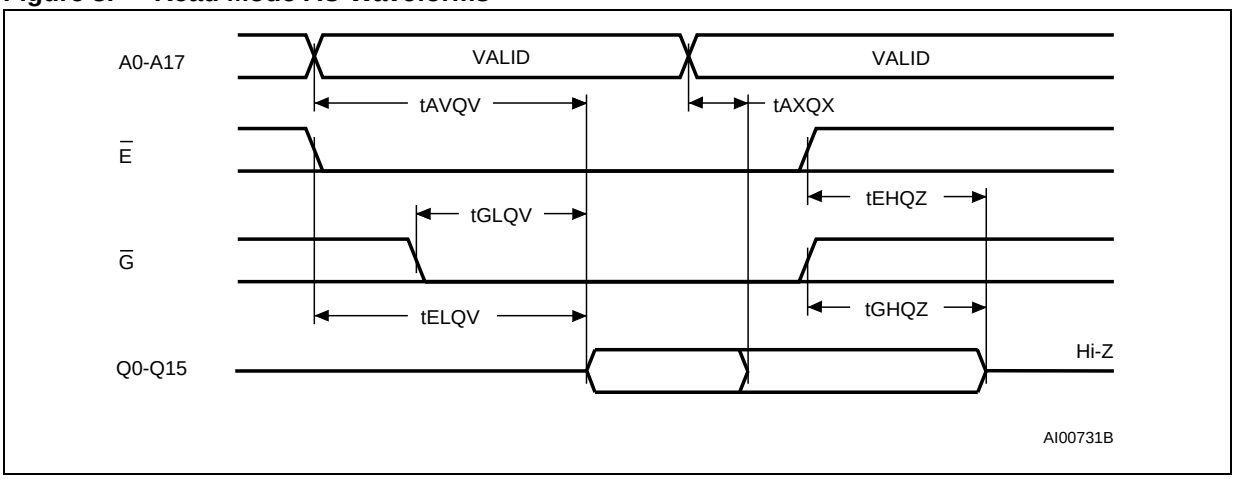
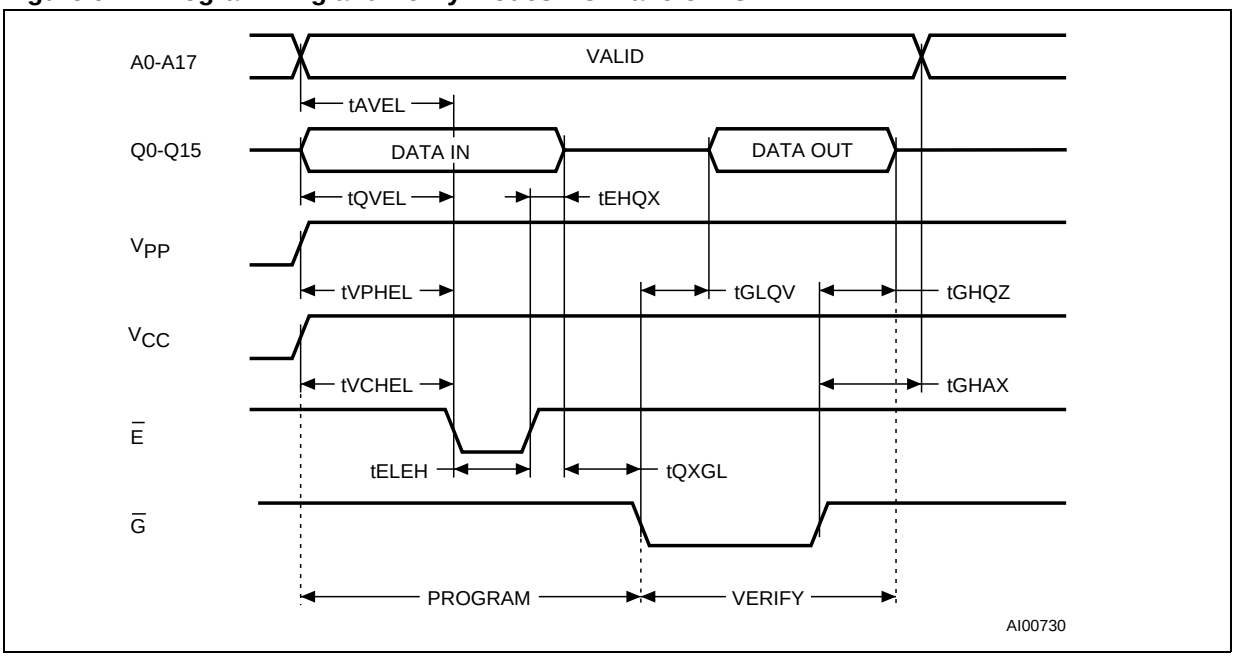


Table 12. Programming Mode AC Characteristics(1)(2)(3)

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

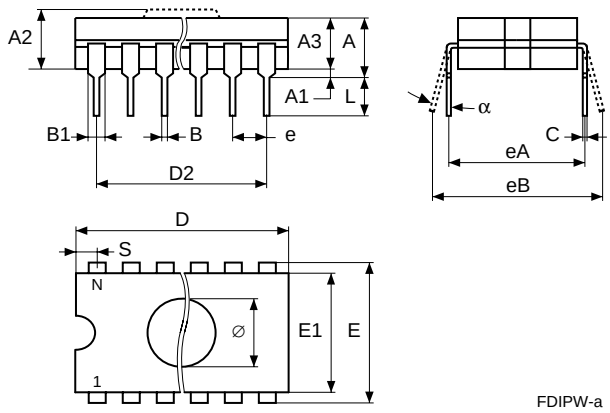
1. T_A = 25 °C; V_{CC} = 6.25V ± 0.25V; V_{PP} = 12.75V ± 0.25V.
2. V_{CC} must be applied simultaneously with or before V_{PP} and removed simultaneously or after V_{PP}.
3. Sampled only, not 100% tested.

Figure 9. Programming and Verify Modes AC Waveforms



5 Package mechanical data

Figure 10. FDIP40W - 40 pin Ceramic Frit-seal DIP with window, Package Outline

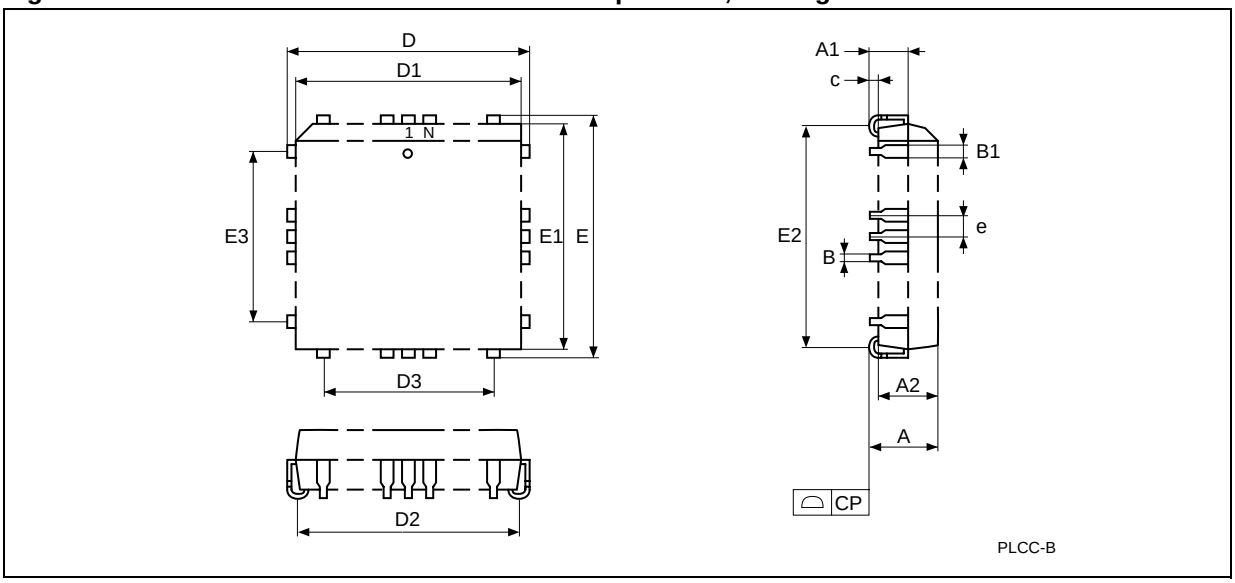


1. Drawing is not to scale.

Table 13. FDIP40W - 40 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		51.79	52.60		2.039	2.071
D2	48.26	–	–	1.900	–	–
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			0.125	
S		1.52	2.49		0.060	0.098
∅	7.62	–	–	0.300	–	–
α		4°	11°		4°	11°
N	40			40		

Figure 12. PLCC44 - 44 lead Plastic Leaded Chip Carrier, Package Outline



1. Drawing is not to scale.

Table 15. PLCC44 - 44 lead Plastic Leaded Chip Carrier, Package Mechanical Data

Symbol	millimeters			inches		
	Typ	Min	Max	Typ	Min	Max
A		4.200	4.570		0.1654	0.1799
A1		2.290	3.040		0.0902	0.1197
A2		3.650	3.700		0.1437	0.1457
B		0.331	0.533		0.0130	0.0210
B1		0.661	0.812		0.0260	0.0320
CP			0.101			0.0040
c	0.510			0.0201		
D		17.400	17.650		0.6850	0.6949
D1		16.510	16.662		0.6500	0.6560
D2		14.990	16.000		0.5902	0.6299
D3	12.700	–	–	0.5000	–	–
E		17.400	17.650		0.6850	0.6949
E1		16.510	16.660		0.6500	0.6559
E2		14.990	16.000		0.5902	0.6299
E3	12.700	–	–	0.5000	–	–
e	1.270	–	–	0.0500	–	–
N	44			44		

6 Part numbering

Table 17. Ordering Information Scheme

Example: M27C4002 -80 X C 1 TR

Device Type
M27

Supply Voltage
C = 5V

Device Function
4002 = 4 Mbit (256Kb x16)

Speed
-45 = 45 ns (1)
-60 (1) = 60 ns
-70 = 70 ns
-80 = 80 ns
-90 = 90 ns
-10 = 100 ns
-12 = 120 ns
-15 = 150 ns
-20 = 200 ns

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

Package
F = FDIP40W
B = PDIP40
C = PLCC44
N = TSOP40: 10 x 20 mm

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

Options
TR = Tape & Reel Packing

1. High Speed, see *Section 4: DC and AC parameters* 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.