AT27CL010

T-46-13-29
*T-46-13-25*

Features

- **Very Low Power CMOS Operation**
  - 100 µA max. Standby
  - 20 mA max. Active at 5 MHz
- **Fast Read Access Time - 150ns**
- **Compatible with JEDEC standard AT27C010**
- **Wide Selection of JEDEC Standard Packages Including OTP**
  - 32-Lead 600 mil Cerdip and OTP Plastic DIP
  - 32-Pad LCC
  - 32-Lead JLCC and OTP PLCC
- **5V±10% Supply**
- **High Reliability CMOS Technology**
  - 2000V ESD Protection
  - 200mA Latchup Immunity
- **Rapid Programming - 100µs/byte (typical)**
- **Two-line Control**
- **CMOS and TTL Compatible Inputs and Outputs**
- **Integrated Product Identification Code**
- **Full Military, Commercial and Industrial Temperature Ranges**
- **Fully Compatible with AT27C010/L**

1 Megabit (128K x 8) Low Power UV Erasable CMOS EPROM

Preliminary

Block Diagram
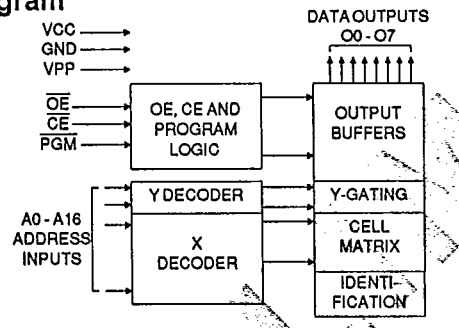
Description

The AT27CL010 chip is a very low-power, high performance 1,048,576 bit Ultraviolet Erasable and Electrically Programmable Read Only Memory (EPROM) organized as 128K x 8 bits. It requires only one 5V power supply in normal read mode operation. Any byte can be accessed in less than 150ns, eliminating the need for speed reducing WAIT states on high performance microprocessor systems.

In read mode, the AT27CL010 typically consumes 6mA. Standby mode supply current is typically less than 5µA.

Pin Configurations

Pin Name	Function
A0-A16	Addresses
O0-O7	Outputs
CE	Chip Enable
OE	Output Enable
PGM	Program Strobe
NC	No Connect
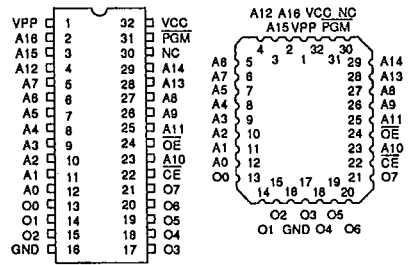
Description (Continued)

The AT27CL010 comes in a choice of industry standard JEDEC-approved packages including; 32-pin DIP in ceramic or one time programmable (OTP) plastic, 32-pad ceramic leadless chip carrier (LCC), and 32-lead ceramic (JLCC) or OTP plastic (PLCC) J-leaded chip carrier. All devices feature two line control ($\overline{CE}$, $\overline{OE}$) to give designers the flexibility to prevent bus contention.

With high density 128K byte storage capability, the AT27CL010 allows firmware to be stored reliably and to be accessed by the system without the delays of mass storage media.

Atmel's 27CL010 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. The AT27CL010 programs identically to an AT27C010/L.

Erasure Characteristics

The entire memory array of the AT27CL010 is erased (all outputs read as V_{OH}) after exposure to ultraviolet light at a wavelength of 2537Å. Complete erasure is assured after a minimum of 20 minutes exposure using 12,000 µW/cm² intensity lamps spaced one inch away from the chip. Minimum erase time for lamps at other intensity ratings can be calculated from the minimum integrated erasure dose of 15W·sec/cm². To prevent unintentional erasure, an opaque label is recommended to cover the clear window on any UV erasable EPROM which will be subjected to continuous fluorescent indoor lighting or sunlight.

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]
Integrated UV Erase Dose	7258 W·sec/cm²

*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.

Notes:
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.

Operating Modes

MODE \ PIN	$\overline{CE}$	$\overline{OE}$	$\overline{PGM}$	Ai	V_{PP}	V_{CC}	Outputs
Read	V_{IL}	V_{IL}	$X^{(1)}$	Ai	X	V_{CC}	D_{OUT}
Output Disable	X	V_{IH}	X	X	X	V_{CC}	High Z
Standby	V_{IH}	X	X	X	X	V_{CC}	High Z
Fast Program[2]	V_{IL}	V_{IH}	V_{IL}	Ai	V_{PP}	V_{CC}	D_{IN}
PGM Verify	V_{IL}	V_{IL}	V_{IH}	Ai	V_{PP}	V_{CC}	D_{OUT}
PGM Inhibit	V_{IH}	X	X	X	V_{PP}	V_{CC}	High Z
Product Identification[4]	V_{IL}	V_{IL}	X	A9=V_H [3] A0=V_{IH} or V_{IL} A1-A16=V_{IL}	X	V_{CC}	Identification Code

Notes: 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.

D.C. and A.C. Operating Conditions for Read Operation

		AT27CL010			
		-15	-17	-20	-25
Operating Temperature (Case)	Com.	0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C
	Ind.		-40°C - 85°C	-40°C - 85°C	-40°C - 85°C
	Mil.		-55°C - 125°C	-55°C - 125°C	-55°C - 125°C
Vcc Power Supply		5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%

D.C. and Operating Characteristics for Read Operation

Symbol	Parameter	Condition	Min	Max	Units
I_{LI}	Input Load Current	V_{IN}=-0.1V to V_{CC}+1V		5	μA
I_{LO}	Output Leakage Current	V_{OUT}=-0.1V to V_{CC}+0.1V		10	μA
I_{PP1} [2]	V_{PP} [1] Read/Standby Current	V_{PP}=3.8 to V_{CC}+0.3V		10	μA
I_{SB}	V_{CC} [1] Standby Current	I_{SB1} (CMOS), $\overline{CE}$=V_{CC}-0.3 to V_{CC}+1.0V		100	μA
		I_{SB2} (TTL), $\overline{CE}$=2.0 to V_{CC}+1.0V		1	mA
I_{CC}	V_{CC} Active Current	f=5MHz,I_{OUT}=0mA, $\overline{CE}$=V_{IL}		20	mA
V_{IL}	Input Low Voltage		-0.6	0.8	V
V_{IH}	Input High Voltage		2.0	V_{CC}+1	V
V_{OL}	Output Low Voltage	I_{OL}=2.1mA		.45	V
V_{OH}	Output High Voltage	I_{OH}=-100μA	V_{CC}-0.3		V
		I_{OH}=-2.5mA	3.5		V
		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}.

A.C. Characteristics for Read Operation

| Symbol	Parameter	Condition		AT27CL010 -15 Min	-15 Max	-17 Min	-17 Max	-20 Min	-20 Max	-25 Min	-25 Max	Units
t_{ACC} [3]	Address to Output Delay	$\overline{CE}$=$\overline{OE}$ =V_{IL}	Com.		150		170		200		250	ns
			Ind.,Mil.				170		200		250	ns
t_{CE} [2]	$\overline{CE}$ to Output Delay	$\overline{OE}$=V_{IL}			150		170		200		250	ns
t_{OE} [2,3]	$\overline{OE}$ to Output Delay	$\overline{CE}$=V_{IL}			40		65		75		100	ns
t_{DF} [4,5]	$\overline{OE}$ High to Output Float	$\overline{CE}$=V_{IL}			40		50		55		60	ns
t_{OH}	Output Hold from Address, $\overline{CE}$ or $\overline{OE}$, whichever occurred first	$\overline{CE}$=$\overline{OE}$ =V_{IL}		0		0		0		0		ns

Notes: 2, 3, 4, 5. - see AC Waveforms for Read Operation.

A.C. Waveforms for Read Operation [1]
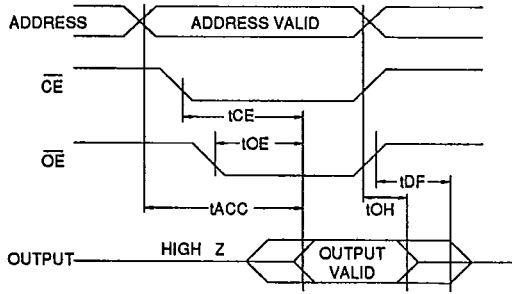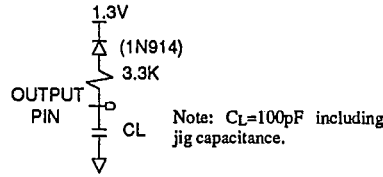

Notes:
1. Timing measurement references are 0.8V and 2.0V. Input AC driving levels are 0.45V and 2.4V, unless otherwise specified.
2. $\overline{OE}$ may be delayed up to t_{CE}-t_{OE} after the falling edge of $\overline{CE}$ without impact on t_{CE}.
3. $\overline{OE}$ may be delayed up to t_{ACC}-t_{OE} 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.

Input Test Waveforms and Measurement Levels
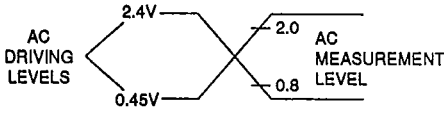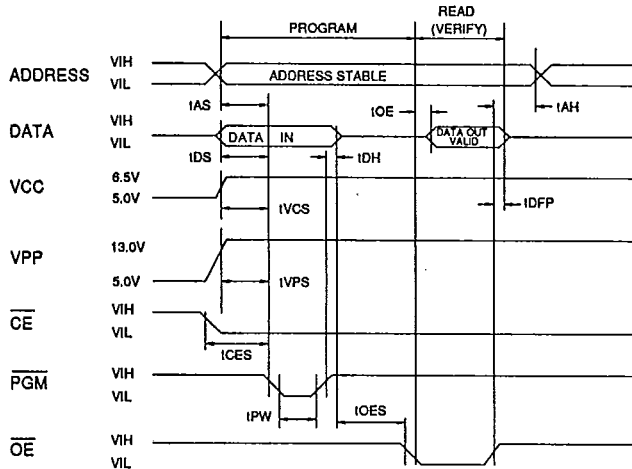

t_R, t_F < 20ns (10% to 90%)

Output Test Load

Note: C_L=100pF including jig capacitance.

Pin Capacitance (f=1MHz T=25°C) [1]

	Typ	Max	Units	Conditions
C_{IN}	4	8	pF	V_{IN} = 0V
C_{OUT}	8	12	pF	V_{OUT} = 0V

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

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 AT27CL010 a 0.1μF capacitor is required across V_{PP} and ground to suppress spurious voltage transients.

AT27CL010

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D.C. Programming Characteristics

$T_A=25\pm5°C$, $V_{CC}=6.5\pm0.25V$, $V_{PP}=13.0\pm0.25V$

Symbol	Parameter	Test Conditions	Min	Max	Units
I_{LI}	Input Load Current	$V_{IN}=V_{IL},V_{IH}$		10	µA
V_{IL}	Input Low Level	(All Inputs)	-0.6	0.8	V
V_{IH}	Input High Level		2.0	$V_{CC}+1$	V
V_{OL}	Output Low Volt.	$I_{OL}=2.1mA$		.45	V
V_{OH}	Output High Volt.	$I_{OH}=-400µA$	2.4		V
I_{CC2}	Vcc Supply Current (Program and Verify)			40	mA
I_{PP2}	Vpp Supply Current	$\overline{CE}=\overline{PGM}=V_{IL}$		20	mA
V_{ID}	A9 Product Identification Voltage		11.5	12.5	V

A.C. Programming Characteristics

$T_A=25\pm5°C$, $V_{CC}=6.5\pm0.25V$, $V_{PP}=13.0\pm0.25V$

Symbol	Parameter	Test Conditions* (see Note 1)	Min	Max	Units
t_{AS}	Address Setup Time		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	(Note 2)	0	130	ns
t_{VPS}	Vpp Setup Time		2		µs
t_{VCS}	Vcc Setup Time		2		µs
t_{PW}	$\overline{PGM}$ Program Pulse Width	(Note 3)	95	105	µs
t_{OE}	Data Valid from $\overline{OE}$			150	ns

*A.C. Conditions of Test:
Input Rise and Fall Times (10% to 90%) 20ns
Input Pulse Levels . . . . .0.45V to 2.4V
Input Timing Reference Level . . . . .0.8V to 2.0V
Output Timing Reference Level . . . . .0.8V to 2.0V

Notes:
1. Vcc must be applied simultaneously or before Vpp and removed simultaneously or after Vpp.
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%.

Atmel's 27CL010 Integrated Product Identification Code[1]

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	O5

Note: 1. The AT27CL010 has the same Product Identification Code as the AT27C010/L. Both are programming compatible.

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.
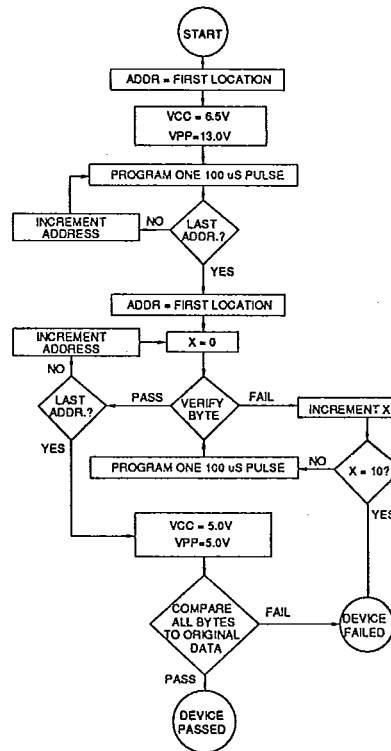
Ordering Information

tACC (ns)	Icc (mA) Active	Icc (mA) Standby	Ordering Code	Package	Operation Range
150	20	0.1	AT27CL010-15DC AT27CL010-15JC AT27CL010-15KC AT27CL010-15LC AT27CL010-15PC	32DW6 32J 32KW 32LW 32P6	Commercial (0°C to 70°C)
170	20	0.1	AT27CL010-17DC AT27CL010-17JC AT27CL010-17KC AT27CL010-17LC AT27CL010-17PC	32DW6 32J 32KW 32LW 32P6	Commercial (0°C to 70°C)
			AT27CL010-17DI AT27CL010-17JI AT27CL010-17KI AT27CL010-17LI AT27CL010-17PI	32DW6 32J 32KW 32LW 32P6	Industrial (-40°C to 85°C)
			AT27CL010-17DM AT27CL010-17KM AT27CL010-17LM	32DW6 32KW 32LW	Military (-55°C to 125°C)
			AT27CL010-17DM/883 AT27CL010-17KM/883 AT27CL010-17LM/883	32DW6 32KW 32LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
200	20	0.1	AT27CL010-20DC AT27CL010-20JC AT27CL010-20KC AT27CL010-20LC AT27CL010-20PC	32DW6 32J 32KW 32LW 32P6	Commercial (0°C to 70°C)
			AT27CL010-20DI AT27CL010-20JI AT27CL010-20KI AT27CL010-20LI AT27CL010-20PI	32DW6 32J 32KW 32LW 32P6	Industrial (-40°C to 85°C)
			AT27CL010-20DM AT27CL010-20KM AT27CL010-20LM	32DW6 32KW 32LW	Military (-55°C to 125°C)
			AT27CL010-20DM/883 AT27CL010-20KM/883 AT27CL010-20LM/883	32DW6 32KW 32LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)
250	20	0.1	AT27CL010-25DC AT27CL010-25JC AT27CL010-25KC AT27CL010-25LC AT27CL010-25PC	32DW6 32J 32KW 32LW 32P6	Commercial (0°C to 70°C)
			AT27CL010-25DI AT27CL010-25JI AT27CL010-25KI AT27CL010-25LI AT27CL010-25PI	32DW6 32J 32KW 32LW 32P6	Industrial (-40°C to 85°C)

Ordering Information

tACC (ns)	ICC (mA) Active	ICC (mA) Standby	Ordering Code	Package	Operation Range
250	20	0.1	AT27CL010-25DM AT27CL010-25KM AT27CL010-25LM	32DW6 32KW 32LW	Military (-55°C to 125°C)
			AT27CL010-25DM/883 AT27CL010-25KM/883 AT27CL010-25LM/883	32DW6 32KW 32LW	Military/883C Class B, Fully Compliant (-55°C to 125°C)

Package Type	
32DW6	32 Lead, 0.600" Wide, Windowed, Ceramic Dual Inline Package (Cerdip)
32J	32 Lead, Plastic J-Leaded Chip Carrier OTP (PLCC)
32KW	32 Lead, Windowed, Ceramic J-Leaded Chip Carrier (JLCC)
32LW	32 Pad, Windowed, Ceramic Leadless Chip Carrier (LCC)
32P6	32 Lead, 0.600" Wide, Plastic Dual Inline Package OTP (PDIP)