

Features

- Wide Power Supply Range, 3.0 VDC to 5.5 VDC
- Compatible with JEDEC Standard AT27C010
- Low Power 3-Volt CMOS Operation
 - 100 μ A max. Standby
 - 26 mW max. Active at 1 MHz for $V_{CC} = 3.3$ VDC
 - 138 mW max. Active at 5 MHz for $V_{CC} = 5.5$ VDC
- Read Access Time - 250 ns
- Wide Selection of JEDEC Standard Packages Including OTP
 - 32-Lead 600-mil Cerdip and OTP Plastic DIP and SOIC
 - 32-Pad LCC, 32-Lead JLCC, OTP PLCC and TSOP
- High Reliability CMOS Technology
 - 2000 V ESD Protection
 - 200 mA Latchup Immunity
- Rapid Programming - 100 μ s/byte (typical)
- Two-line Control
- CMOS and TTL Compatible Inputs and Outputs
- Integrated Product Identification Code
- Commercial and Industrial Temperature Ranges

Description

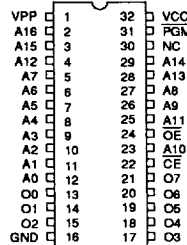
The AT27LV010 chip is a low power, low voltage 1,048,576 bit Ultraviolet Erasable and Electrically Programmable Read Only Memory (EPROM) organized as 128K x 8 bits. It requires only one supply in the range of 3.0 to 5.5 VDC in normal read mode operation, making it ideal for battery powered systems.

With a typical power draw of only 18mW at 1 MHz and V_{CC} at 3.3 VDC, the AT27LV010 will draw less than one-fifth the power of a standard 5-volt EPROM. Standby mode supply current is typically less than 10 μ A.

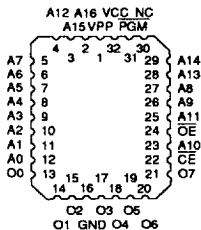
Pin Configurations

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

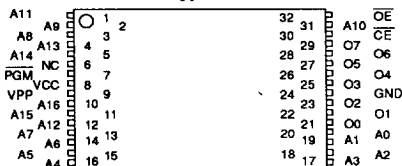
CDIP, PDIP, SOIC Top View



LCC, JLCC, PLCC Top View



TSOP Top View
Type 1



Description (Continued)

The AT27LV010 comes in a choice of industry standard JEDEC-approved through hole and surface mount packages including windowed and one time programmable (OTP) packages, such as the OTP thin small outline package (TSOP). All devices feature two line control (\overline{CE} , \overline{OE}) to give designers the flexibility to prevent bus contention.

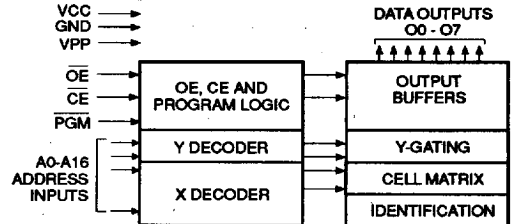
The AT27LV010 operating with V_{CC} at 3.0 VDC produces TTL level outputs that are compatible with standard TTL logic devices operating at $V_{CC} = 5.0$ VDC.

Atmel's 27LV010 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 100 μ s/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 AT27LV010 programs identically as an AT27C010.

Erase Characteristics

The entire memory array of the AT27LV010 is erased (all outputs read as V_{OH}) after exposure to ultraviolet light at a wavelength of 2537 Å. Complete erasure is assured after a minimum of 20 minutes exposure using 12,000 μ W/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 15 W-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.

Block Diagram



Absolute Maximum Ratings*

Temperature Under Bias	-40°C to +85°C
Storage Temperature	-65°C to +125°C
Voltage on Any Pin with Respect to Ground	-2.0 V to +7.0 V ⁽¹⁾
Voltage on A9 with Respect to Ground	-2.0 V to +14.0 V ⁽¹⁾
V _{PP} Supply Voltage with Respect to Ground	-2.0 V to +14.0 V ⁽¹⁾
Integrated UV Erase Dose	7258 W-sec/cm ²

*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 -0.6 V dc which may undershoot to -2.0 V for pulses of less than 20 ns. Maximum output pin voltage is $V_{CC} + 0.75$ V dc which may be exceeded if certain precautions are observed (consult application notes) and which may overshoot to +7.0 V for pulses of less than 20 ns.

Operating Modes

Mode \ Pin	\overline{CE}	\overline{OE}	PGM	Ai	V _{PP}	V _{CC}	Outputs
Read	V _{IL}	V _{IL}	X ⁽¹⁾	Ai	X	V _{CC}	DOUT
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} ⁽²⁾	DIN
PGM Verify ⁽²⁾	V _{IL}	V _{IL}	V _{IH}	Ai	V _{PP}	V _{CC} ⁽²⁾	DOUT
PGM Inhibit ⁽²⁾	V _{IH}	X	X	X	V _{PP}	V _{CC} ⁽²⁾	High Z
Product Identification ^{(2),(4)}	V _{IL}	V _{IL}	X	A9=V _{IH} ⁽³⁾ A0=V _{IH} or V _{IL} A1-A16=V _{IL}	X	V _{CC} ⁽²⁾	Identification Code

- Notes:
1. X can be V_{IL} or V_{IH}.
 2. Refer to Programming characteristics. Programming modes require $V_{CC} > 4.5$ V.
 3. $V_{IH} = 12.0 \pm 0.5$ V.

4. Two identifier bytes may be selected. All Ai inputs are held low (V_{IL}), except A9 which is set to V_{IH} 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

AT27LV010		
		-25
		-30
Operating Temperature (Case)	Com.	0°C - 70°C
	Ind.	-40°C - 85°C
V _{CC} Power Supply		3.0 V to 5.5 V

D.C. and Operating Characteristics for Read Operation

(V_{CC} = 3.0 V to 5.5 V unless otherwise specified)

Symbol	Parameter	Condition	Min	Max	Units
I _{LI}	Input Load Current	V _{IN} = -0.1 V to V _{CC} +1 V		5	μA
I _{LO}	Output Leakage Current	V _{OUT} = -0.1 V to V _{CC} +0.1 V		10	μA
I _{PP1} ⁽²⁾	V _{PP} ⁽¹⁾ Read/Standby Current	V _{PP} = V _{CC} -0.7 V to V _{CC} +0.3 V		10	μA
I _{SB}	V _{CC} ⁽¹⁾ Standby Current	I _{SB1} (CMOS), CE = V _{CC} -0.3 to V _{CC} +1.0 V		100	μA
		I _{SB2} (TTL), CE=2.0 to V _{CC} +1.0 V		1	mA
I _{CC}	V _{CC} Active Current	I _{CC1} f = 5 MHz, I _{OUT} = 0 mA, CE = V _{IL} , V _{CC} = 5.5 V	Com.	25	mA
			Ind.	30	mA
		I _{CC2} f = 1 MHz, I _{OUT} = 0 mA CE = V _{IL} , V _{CC} = 3.3 V	Com.	8	mA
			Ind.	10	mA
V _{IL}	Input Low Voltage		-0.6	0.8	V
V _{IH}	Input High Voltage		2.0	V _{CC} +0.75	V
V _{OL}	Output Low Voltage	I _{OL} = 2.1 mA		.45	V
V _{OH}	Output High Voltage	I _{OH} = -100 μA		V _{CC} -0.3	V
		I _{OH} = -400 μA		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}.

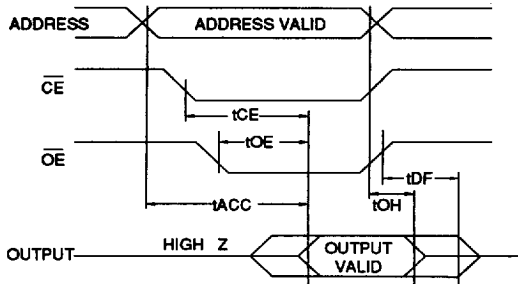
A.C. Characteristics for Read Operation (V_{CC} = 3.0V to 5.5V)

					AT27LV010				Units
					-25		-30		
Symbol	Parameter	Condition			Min	Max	Min	Max	
t _{ACC} ⁽³⁾	Address to Output Delay	$\overline{CE} = \overline{OE} = V_{IL}$	Com.		250		270	ns	
			Ind.		250		270	ns	
t _{CE} ⁽²⁾	\overline{CE} to Output Delay	$\overline{OE} = V_{IL}$			250		300	ns	
t _{OE} ^(2,3)	\overline{OE} to Output Delay	$\overline{CE} = V_{IL}$			100		150	ns	
t _{DF} ^(4,5)	\overline{OE} High to Output Float	$\overline{CE} = V_{IL}$			50		50	ns	
t _{OH}	Output Hold from Address, \overline{CE} or \overline{OE} , whichever occurred first	$\overline{CE} = \overline{OE} = V_{IL}$			0		0	ns	

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



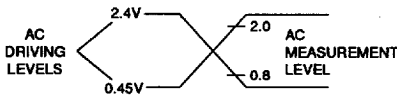
A.C. Waveforms for Read Operation ⁽¹⁾



Notes:

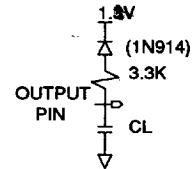
1. Timing measurement references are 0.8 V and 2.0 V. Input AC driving levels are 0.45 V and 2.4 V. See Input Test Waveforms and Measurement Levels.
2. \overline{OE} may be delayed up to t_{CE-tOE} after the falling edge of \overline{CE} without impact on t_{CE} .
3. \overline{OE} may be delayed up to $t_{ACC-tOE}$ 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 Waveform and Measurement Level



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

Output Test Load



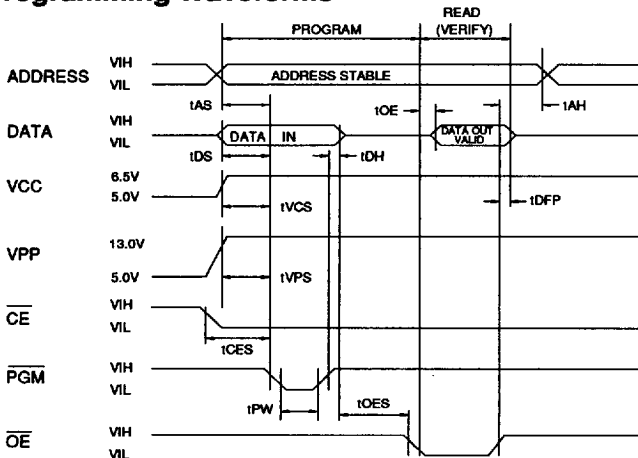
Note: $C_L = 100$ pF including jig capacitance.

Pin Capacitance ($f = 1$ MHz, $T = 25^\circ\text{C}$) ⁽¹⁾

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

Notes: 1. Typical values for 5-V supply voltage. This parameter is only sampled and is not 100% tested.

Programming Waveforms ⁽¹⁾



Notes:

1. The Input Timing Reference is 0.8 V for V_{IL} and 2.0 V for V_{IH} .
2. t_{OE} and t_{PES} are characteristics of the device but must be accommodated by the programmer.
3. When programming the AT27LV010 a 0.1- μF capacitor is required across V_{PP} and ground to suppress spurious voltage transients.

D.C. Programming Characteristics

$T_A = 25 \pm 5^\circ\text{C}$, $V_{CC} = 6.5 \pm 0.25\text{ V}$, $V_{PP} = 13.0 \pm 0.25\text{ V}$

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	(All Inputs)	-0.6	0.8	V
V_{IH}	Input High Level		2.0	$V_{CC}+1$	V
V_{OL}	Output Low Volt.	$I_{OL}=2.1\text{ mA}$.45	V
V_{OH}	Output High Volt.	$I_{OH}=400\text{ }\mu\text{A}$	2.4		V
I_{CC2}	V_{CC} Supply Current (Program and Verify)			40	mA
I_{PP2}	V_{PP} Supply Current	$\overline{CE}=\text{PGM}=V_{IL}$	20		mA
V_{ID}	A9 Product Identification Voltage		11.5	12.5	V

A.C. Programming Characteristics

$T_A = 25 \pm 5^\circ\text{C}$, $V_{CC} = 6.5 \pm 0.25\text{ V}$, $V_{PP} = 13.0 \pm 0.25\text{ V}$

Symbol	Parameter	Test Conditions* (see Note 1)	Limits		Units
			Min	Max	
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}	V_{PP} Setup Time		2		μs
t_{VCS}	V_{CC} Setup Time		2		μs
t_{PW}	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%) 20 ns
 Input Pulse Levels 0.45 V to 2.4 V
 Input Timing Reference Level 0.8 V to 2.0 V
 Output Timing Reference Level 0.8 V to 2.0 V

Notes:

- V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP} .
- 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.
- Program Pulse width tolerance is 100 $\mu\text{sec} \pm 5\%$.

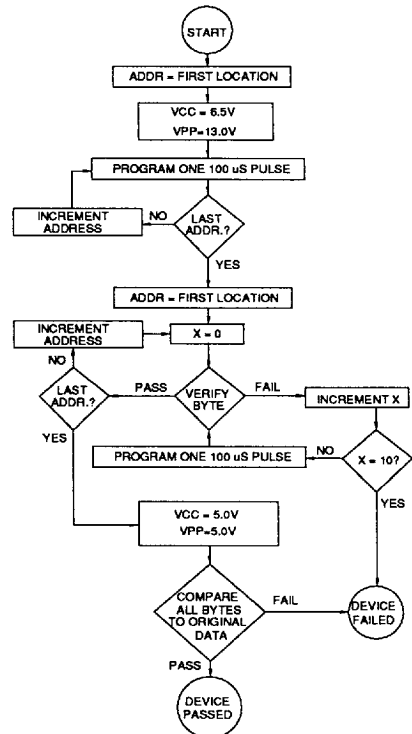
Atmel's 27LV010 Integrated Product Identification Code⁽¹⁾

Codes	Pins								Hex Data
	A0	O7	O6	O5	O4	O3	O2	O1	O0
Manufacturer	0	0	0	0	1	1	1	1	0
Device Type	1	0	0	0	0	0	1	0	1

Note: 1. The AT27LV010 has the same Product Identification Code as the AT27C010/L. Both are programming compatible.

Rapid Programming Algorithm

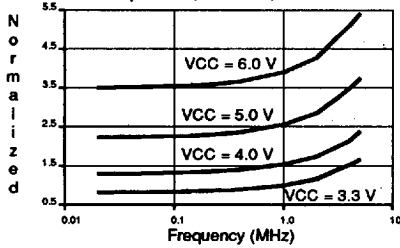
A 100 μs PGM pulse width is used to program. The address is set to the first location. V_{CC} is raised to 6.5 V and V_{PP} is raised to 13.0 V. Each address is first programmed with one 100 μs PGM pulse without verification. Then a verification/ reprogramming loop is executed for each address. In the event a byte fails to pass verification, up to 10 successive 100 μs 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 5.0 V and V_{CC} to 5.0 V. All bytes are read again and compared with the original data to determine if the device passes or fails.



LV EPROM Product Characteristics

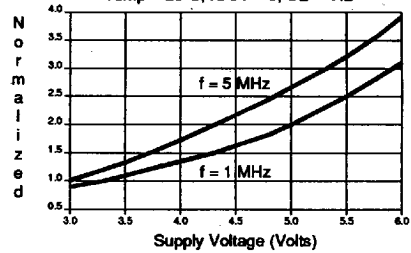
NORMALIZED SUPPLY CURRENT vs. FREQUENCY

Temp = 25°C, IOUT = 0, CE = VIL

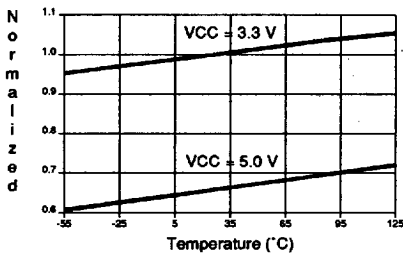


NORMALIZED SUPPLY CURRENT vs. VOLTAGE

Temp = 25°C, IOUT = 0, CE = VIL

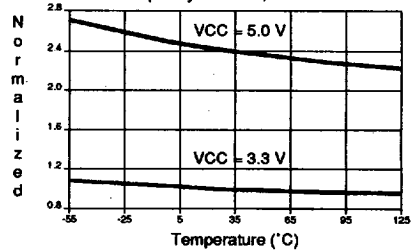


NORMALIZED ACCESS TIME vs. TEMPERATURE



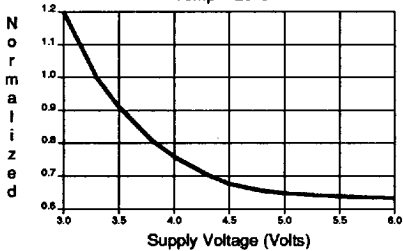
NORMALIZED SUPPLY CURRENT vs. TEMP.

Frequency = 1 MHz, IOUT = 0



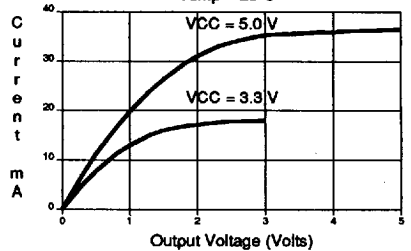
NORMALIZED ACCESS TIME vs. SUPPLY VOLTAGE

Temp = 25°C



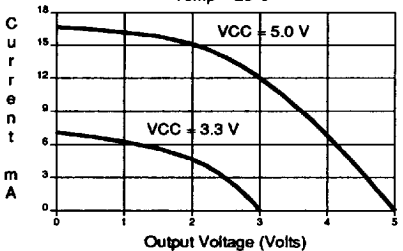
OUTPUT SINK CURRENT vs. OUTPUT VOLTAGE

Temp = 25°C



OUTPUT SOURCE CURRENT vs. OUTPUT VOLTAGE

Temp = 25°C



Ordering Information

t _{ACC} (ns)	I _{CC} (mA) V _{CC} = 3.3 V		Ordering Code	Package	Operation Range
	Active	Standby			
250	8	0.1	AT27LV010-25DC AT27LV010-25KC AT27LV010-25LC	32DW6 32KW 32LW	Commercial (0°C to 70°C)
250	10	0.1	AT27LV010-25DI AT27LV010-25LI	32DW6 32LW	Industrial (-40°C to 85°C)
300	8	0.1	AT27LV010-30DC AT27LV010-30JC AT27LV010-30KC AT27LV010-30LC AT27LV010-30PC AT27LV010-30RC	32DW6 32J 32KW 32LW 32P6 32R	Commercial (0°C to 70°C)
300	10	0.1	AT27LV010-30DI AT27LV010-30LI	32DW6 32LW	Industrial (-40°C to 85°C)

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t _{ACC} (ns)	I _{CC} (mA) V _{CC} = 3.3 V		Ordering Code	Package	Operation Range
	Active	Standby			
250	8	0.1	AT27LV010-25TC	32T	Commercial (0°C to 70°C)
300	8	0.1	AT27LV010-30TC	32T	Commercial (0°C to 70°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)
32R	32 Lead, 0.450" Wide, Plastic Gull Wing Small Outline OTP (SOIC)
32T	32 Lead, Plastic Thin Small Outline Package OTP (TSOP)

