Features

- Wide Power Supply Range, 3.0 V to 5.5 V
- Fast Read Access Time - 150 ns
- Compatible with JEDEC Standard AT27C4096
- Low Power 3.3-Volt CMOS Operation
  - 20 µA max. Standby
  - 36 mW max. Active at 5 MHz for V_{CC} = 3.6 V
  - 165 mW max. Active at 5 MHz for V_{CC} = 5.5 V
- Wide Selection of JEDEC Standard Packages
  - 40-Lead 600-mil PDIP and Cerdip
  - 44-Pad PLCC and LCC
  - 40-Lead TSOP
- High Reliability CMOS Technology
  - 2000 V ESD Protection
  - 200 mA Latchup Immunity
- Rapid Programming - 50 µs/byte (typical)
- Two-line Control
- CMOS and TTL Compatible Inputs and Outputs
- Integrated Product Identification Code
- Commercial and Industrial Temperature Ranges

Description

The AT27LV4096 chip is a low power, low voltage 4,194,304 bit ultraviolet erasable and electrically programmable read only memory (EPROM) organized as 256K x 16 bits. It requires only one supply in the range of 3.0 to 5.5 V in normal read mode operation, making it ideal for portable systems.

With a typical power draw of only 15 mW at 1 MHz and V_{CC} at 3.3 V, the AT27LV4096 draws less than one-fifth the power of a standard 5-V EPROM. Standby mode supply current is typically less than 1 µA at 3.3 V.

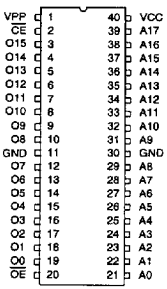
(continued)

Pin Configurations

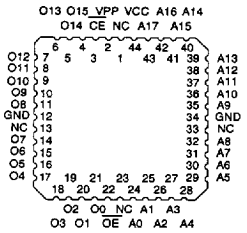
Pin Name	Function
A0-A17	Addresses
O0-O15	Outputs
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
NC	No Connect

Note: Both GND pins must be connected.

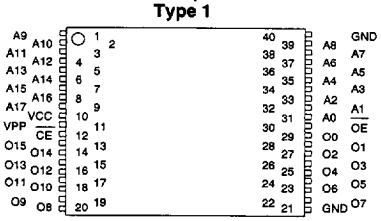
CDIP, PDIP Top View



LCC, JLCC, PLCC Top View



TSOP Top View
Type 1



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4 Megabit (256K x 16) Low Voltage UV Erasable CMOS EPROM

Preliminary

Description (Continued)

The AT27LV4096 comes in a choice of industry standard JEDEC-approved packages, including: one-time programmable (OTP) plastic PDIP, PLCC, and TSOP, as well as windowed ceramic Cerdip and LCC. All devices feature two-line control ($\overline{CE}$, $\overline{OE}$) to give designers the flexibility to prevent bus contention.

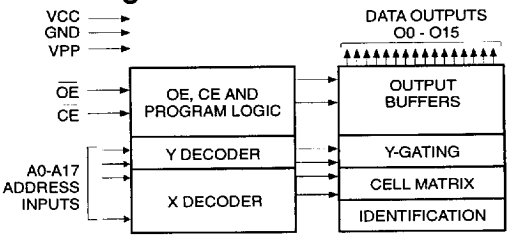
The AT27LV4096 operating with V_{CC} at 3.0 V produces TTL level outputs that are compatible with standard TTL logic devices operating at V_{CC} = 5.0 V.

Atmel's 27LV4096 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 50 µs/word. 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 AT27LV4096 programs identically as an AT27C4096.

Erasure Characteristics

The entire memory array of the AT27LV4096 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 µW/cm^2 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/cm^2. 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	$\overline{CE}$	$\overline{OE}$	Ai	V_{PP}	V_{CC}	Outputs
Read	V_{IL}	V_{IL}	Ai	X(1)	V_{CC}	D_{OUT}
Output Disable	X	V_{IH}	X	X	V_{CC}	High Z
Standby	V_{IH}	X	X	X	V_{CC}	High Z
Rapid Program(2)	V_{IL}	V_{IH}	Ai	V_{PP}	V_{CC} (2)	D_{IN}
PGM Verify(2)	V_{IH}	V_{IL}	Ai	V_{PP}	V_{CC} (2)	D_{OUT}
PGM Inhibit(2)	V_{IH}	V_{IH}	X	V_{PP}	V_{CC} (2)	High Z
Product Identification(2,4)	V_{IL}	V_{IL}	A9=V_H (3) A0=V_{IH} or V_{IL} A1-A17=V_{IL}	V_{CC}	V_{CC} (2)	Identification Code

Notes: 1. X can be V_{IL} or V_{IH}.
2. Refer to Programming characteristics. Programming modes require $V_{CC} \geq 4.5$ V.
3. $V_H = 12.0 \pm 0.5$ V.
4. Two identifier bytes may be selected. All Ai inputs are held low (V_{IL}), except A9 which is set to V_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

		AT27LV4096		
		-15	-20	-25
Operating Temperature (Case)	Com.	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
V_{CC} Power Supply		3.0 V to 5.5 V	3.0 V to 5.5 V	3.0 V to 5.5 V

= Advance Information

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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 V to V_{CC}			±1	µA
I_{LO}	Output Leakage Current	V_{OUT} = 0 V to V_{CC}			±5	µA
I_{PP1} (2)	V_{PP} (1) Read/Standby Current	V_{PP} = V_{CC}			10	µA
I_{SB}	V_{CC} (1) Standby Current	I_{SB1} (CMOS), $\overline{CE}$ = V_{CC} ± 0.3 V	V_{CC} = 3.6 V		20	µA
			V_{CC} = 5.5 V		100	µA
		I_{SB2} (TTL), $\overline{CE}$ = 2.0 to V_{CC} + 0.5 V	V_{CC} = 3.6 V		100	µA
			V_{CC} = 5.5 V		1	mA
I_{CC}	V_{CC} Active Current	I_{CC1} f = 5 MHz, I_{OUT} = 0 mA, $\overline{CE}$ = V_{IL}, V_{CC} = 3.6 V	Com.		10	mA
			Ind.		12	mA
		I_{CC2} f = 5 MHz, I_{OUT} = 0 mA $\overline{CE}$ = V_{IL}, V_{CC} = 5.5 V	Com.		30	mA
			Ind.		40	mA
V_{IL}	Input Low Voltage			-0.6	0.8	V
V_{IH}	Input High Voltage			2.0	V_{CC}+0.5	V
V_{OL}	Output Low Voltage	I_{OL} = 2.0 mA			.4	V
		I_{OL} = 100 µA			.2	V
V_{OH}	Output High Voltage	I_{OH} = -2.0 mA		2.4		V
		I_{OH} = -100 µA		V_{CC}-0.2		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)

				AT27LV4096						
				-15		-20		-25		
Symbol	Parameter	Condition		Min	Max	Min	Max	Min	Max	Units
t_{ACC} (3)	Address to Output Delay	$\overline{CE}$ = $\overline{OE}$ = V_{IL}	Com.		150		200		250	ns
			Ind.		150		200		250	ns
t_{CE} (2)	$\overline{CE}$ to Output Delay	$\overline{OE}$ = V_{IL}			150		200		250	ns
t_{OE} (2,3)	$\overline{OE}$ to Output Delay	$\overline{CE}$ = V_{IL}			60		70		100	ns
t_{DF} (4,5)	$\overline{OE}$ or $\overline{CE}$ High to Output Float				50		50		50	ns
t_{OH}	Output Hold from Address, $\overline{CE}$ or $\overline{OE}$, whichever occurred first			0		0		0		ns

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

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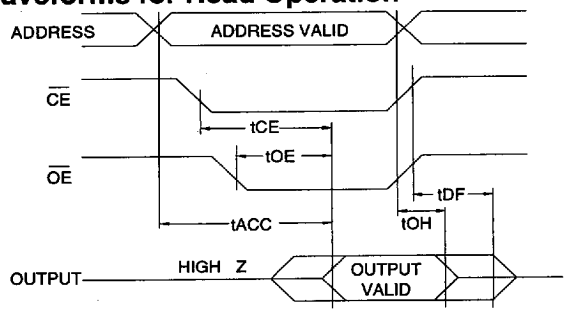
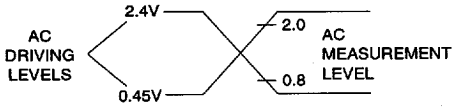
A.C. Waveforms for Read Operation [1]



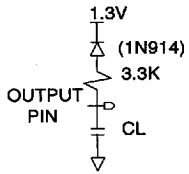
Notes:
1. Timing measurement references are 0.8 V and 2.0 V. Input AC driving levels are 0.45 V and 2.4 V, unless otherwise specified.
2. $\overline{OE}$ may be delayed up to t_{CE}-t_{OE} after the falling edge of $\overline{CE}$ without impact on t_{CE}.
3. $\overline{OE}$ may be delayed up to t_{ACC}-t_{OE} 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 < 20 ns (10% to 90%)

Output Test Load



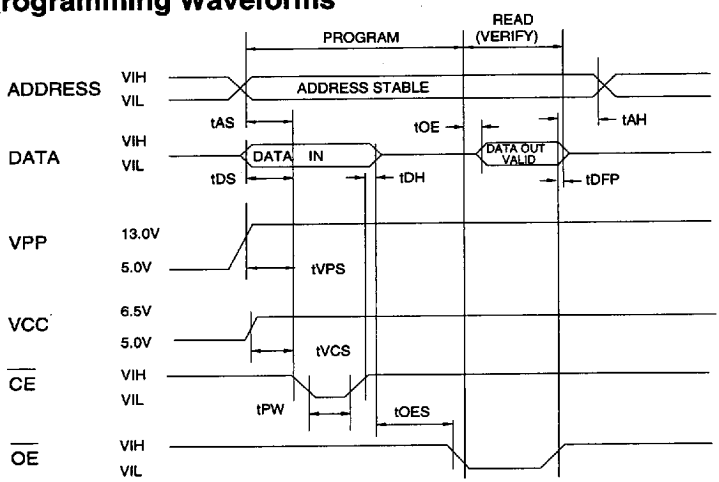
Note: C_L = 100 pF including jig capacitance.

Pin Capacitance (f = 1 MHz T = 25°C) [1]

	Typ	Max	Units	Conditions
C_{IN}	4	10	pF	V_{IN} = 0V
C_{OUT}	8	12	pF	V_{OUT} = 0V

Note: 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 0.8 V for V_{IL} and 2.0 V 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 AT27LV4096, a 0.1-µF capacitor is required across V_{PP} and ground to suppress spurious voltage transients.

D.C. Programming Characteristics

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

Symbol	Parameter	Test Conditions	Limits Min	Limits 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	$V_{CC}+0.7$	V
V_{OL}	Output Low Volt.	$I_{OL}=2.1$ mA		.45	V
V_{OH}	Output High Volt.	$I_{OH}=-400$ µA	2.4		V
I_{CC2}	V_{CC} Supply Current (Program and Verify)			50	mA
I_{PP2}	V_{PP} Supply Current	$\overline{CE}=V_{IL}$		30	mA
V_{ID}	A9 Product Identification Voltage		11.5	12.5	V

A.C. Programming Characteristics

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

Symbol	Parameter	Test Conditions* (see Note 1)	Limits Min	Limits Max	Units
t_{AS}	Address 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}	$\overline{CE}$ Program Pulse Width	(Note 3)	47.5	52.5	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:

1. V_{CC} must be applied simultaneously or before V_{PP} and removed simultaneously or after V_{PP}.
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 50 µsec ± 5%.

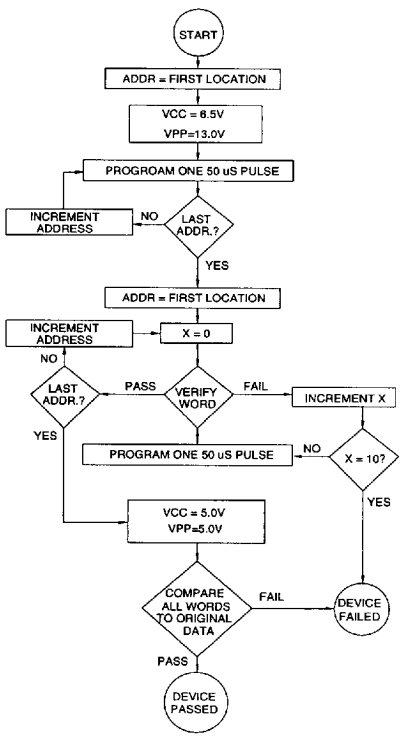
Atmel's 27LV4096 Integrated Product Identification Code (1)

Codes	Pins A0	015-08	O7	O6	O5	O4	O3	O2	O1	O0	Hex Data
Manufacturer	0	0	0	0	0	1	1	1	1	0	001E
Device Type	1	0	1	1	1	1	0	1	0	0	00F4

Note: 1. The AT27LV4096 has the same Product Indentification Code as the AT27C4096. Both are programming compatible.

Rapid Programming Algorithm

A 50 µs $\overline{CE}$ 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 50 µs $\overline{CE}$ pulse without verification. Then a verification/reprogramming loop is executed for each address. In the event a word fails to pass verification, up to 10 successive 50 µs pulses are applied with a verification after each pulse. If the word fails to verify after 10 pulses have been applied, the part is considered failed. After the word 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 words are read again and compared with the original data to determine if the device passes or fails.



Ordering Information

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t_{ACC} (ns)	I_{CC} (mA) V_{CC} = 3.6 V Active	Standby	Ordering Code	Package	Operation Range
150	10	0.02	AT27LV4096-15DC AT27LV4096-15JC AT27LV4096-15LC AT27LV4096-15PC AT27LV4096-15VC	40DW6 44J 44LW 40P6 40V	Commercial (0°C to 70°C)
150	12	0.02	AT27LV4096-15DI AT27LV4096-15JI AT27LV4096-15LI AT27LV4096-15PI AT27LV4096-15VI	40DW6 44J 44LW 40P6 40V	Industrial (-40°C to 85°C)
200	10	0.02	AT27LV4096-20DC AT27LV4096-20JC AT27LV4096-20LC AT27LV4096-20PC AT27LV4096-20VC	40DW6 44J 44LW 40P6 40V	Commercial (0°C to 70°C)
200	12	0.02	AT27LV4096-20DI AT27LV4096-20JI AT27LV4096-20LI AT27LV4096-20PI AT27LV4096-20VI	40DW6 44J 44LW 40P6 40V	Industrial (-40°C to 85°C)
250	10	0.02	AT27LV4096-25DC AT27LV4096-25JC AT27LV4096-25LC AT27LV4096-25PC AT27LV4096-25VC	40DW6 44J 44LW 40P6 40V	Commercial (0°C to 70°C)
250	12	0.02	AT27LV4096-25DI AT27LV4096-25JI AT27LV4096-25LI AT27LV4096-25PI AT27LV4096-25VI	40DW6 44J 44LW 40P6 40V	Industrial (-40°C to 85°C)

Package Type	
40DW6	40 Lead, 0.600" Wide, Windowed, Ceramic Dual In-Line Package (Cerdip)
44J	44 Lead, Plastic J-Leaded Chip Carrier OTP (PLCC)
44LW	44 Pad, Windowed, Ceramic Leadless Chip Carrier (LCC)
40P6	40 Lead, 0.600" Wide, Plastic Dual Inline Package OTP (PDIP)
40V	40 Lead, Plastic Thin Small Outline Package OTP (TSOP) 10 x 14 mm