Features

- **Read Access Time – 150 ns**
- **Word-wide or Byte-wide Configurable**
- **Dual Voltage Range Operation**
  - **Unregulated Battery Power Supply Range, 2.7V to 3.6V or Standard 5V ± 10% Supply Range**
- **8-megabit Flash and Mask ROM-compatible Pinouts**
- **Low-power CMOS Operation**
  - **20 µA Maximum Standby**
  - **10 mA Max. Active at 5 MHz for V_{CC} = 3.6V**
- **JEDEC Standard Packages**
  - **44-lead PLCC**
  - **44-lead SOIC (SOP)**
  - **48-lead TSOP (12 mm x 20 mm)**
- **High-reliability CMOS Technology**
  - **2,000 ESD Protection**
  - **200 mA Latch-up Immunity**
- **Rapid™ Programming Algorithm – 50 µs/Word (Typical)**
- **CMOS- and TTL-compatible Inputs and Outputs**
  - **JEDEC Standard for LVTTL and LVBO**
- **Integrated Product Identification Code**
- **Commercial and Industrial Temperature Ranges**

Description

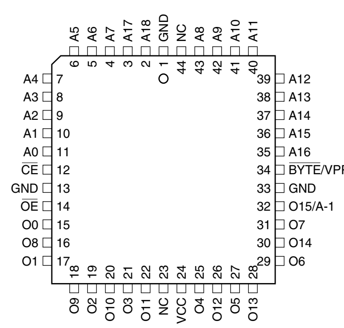
The AT27BV800 is a high-performance, low-power, low-voltage, 8,388,608-bit, one-time programmable read-only memory (OTP EPROM) organized as either 512K by 16 or 1024K by 8 bits. It requires only one supply in the range of 2.7 to 3.6V in normal

(continued)

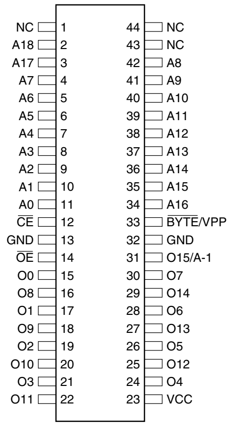
Pin Configurations

Pin Name	Function
A0 - A18	Addresses
O0 - O15	Outputs
O15/A-1	Output/Address
$\overline{BYTE}$/VPP	Byte Mode/Program Supply
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
NC	No Connect

PLCC

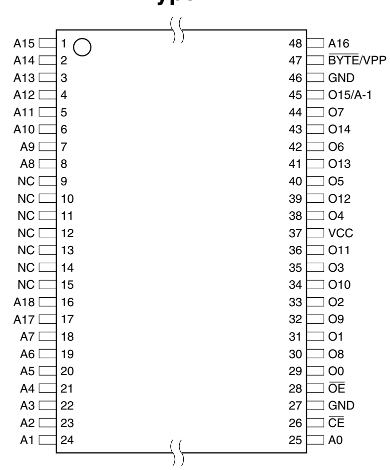


SOIC (SOP)



TSOP

Type 1



Note: PLCC Package Pin 23 is DON'T CONNECT.

8-megabit (512K x 16 or 1024K x 8) Unregulated *Battery-Voltage*™ High-speed OTP EPROM

AT27BV800

Not Recommended for New Designs

Rev. 0988D–05/00

read mode operation. The x16 organization makes this part ideal for portable and hand held 16- and 32-bit microprocessor-based systems using either regulated or unregulated battery power.

Atmel's innovative design techniques provide fast speeds that rival 5V parts while keeping the low power consumption of a 3V supply. At V_{CC} = 2.7V, any word can be accessed in less than 150 ns. With a typical power dissipation of only 10 mW at 5 MHZ and V_{CC} = 3V, the AT27BV800 consumes less than one fifth the power of a standard 5V EPROM.

Standby mode supply current is typically less than 1 mA at 3V. The AT27BV800 simplifies system design and stretches battery lifetime even further by eliminating the need for power-supply regulation.

The AT27BV800 can be organized as either word-wide or byte-wide. The organization is selected via the $\overline{BYTE}/V_{PP}$ pin. When $\overline{BYTE}/V_{PP}$ is asserted high (V_{IH}), the word-wide organization is selected and the O15/A-1 pin is used for O15 data output. When $\overline{BYTE}/V_{PP}$ is asserted low (V_{IL}), the byte-wide organization is selected and the O15/A-1 pin is used for the address pin A-1. When the AT27BV800 is logically regarded as x16 (word-wide), but read in the byte-wide mode, then with A-1 = V_{IL}, the lower eight bits of the 16 bit word are selected; with A-1 = V_{IH}, the upper eight bits of the 16-bit word are selected.

The AT27BV800 is available in industry-standard, JEDEC-approved, one-time programmable (OTP) PLCC, SOIC (SOP) and TSOP packages. The device features two-line control ($\overline{CE}$,$\overline{OE}$) to eliminate bus contention in high-speed systems.

With high-density 512K-word or 1024K-bit storage capability, the AT27BV800 allows firmware to be to be stored reliably and to be accessed by the system without the delays of mass storage media.

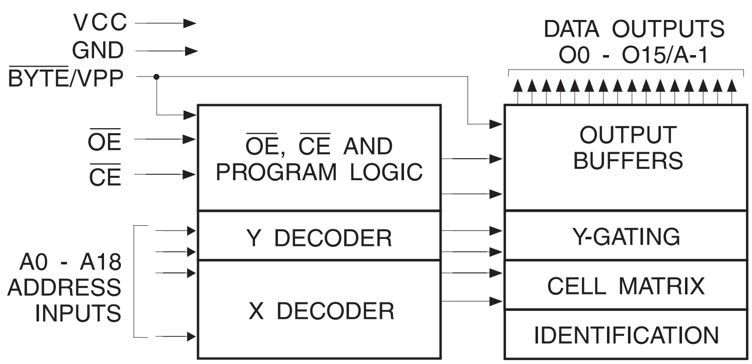
The AT27BV800 operating with V_{CC} at 3.0V produces TTL-level outputs that are compatible with standard TTL logic devices operating at V_{CC} = 5V. At V_{CC} = 2.7V, the part is compatible with JEDEC-approved low-voltage battery operation (LVBO) interface specifications. The device is also capable of standard 5-volt operation making it ideally suited for dual supply range systems or card products that are pluggable in both 3-volt and 5-volt hosts.

Atmel's AT27BV800 has additional features that 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 equipment and voltages. The AT27BV800 programs exactly the same way as a standard 5V AT27C800 and uses the same programming equipment.

System Considerations

Switching between active and standby conditions via the Chip Enable pin may produce transient voltage excursions. Unless accommodated by the system design, these transients may exceed datasheet limits, resulting in device nonconformance. At a minimum, a 0.1 µF high-frequency, low inherent inductance, ceramic capacitor should be utilized for each device. This capacitor should be connected between the V_{CC} and Ground terminals of the device, as close to the device as possible. Additionally, to stabilize the supply voltage level on printed circuit boards with large EPROM arrays, a 4.7 µF bulk electrolytic capacitor should be utilized, again connected between the V_{CC} and Ground terminals. This capacitor should be positioned as close as possible to the point where the power supply is connected to the array.

Block Diagram



Absolute Maximum Ratings*

Temperature under Bias	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Voltage on Any Pin with 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)

*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.

Note: 1. Minimum voltage is -0.6V DC, which may undershoot to -2.0V for pulses of less than 20 ns. Maximum output pin voltage is V_{CC} + 0.75V DC, which may overshoot to + 7.0V for pulses of less than 20 ns.

Operating Modes

Mode/Pin	$\overline{CE}$	$\overline{OE}$	Ai	$\overline{BYTE}/V_{PP}$	Outputs O_0 - O_7	Outputs O_8 - O_{14}	Outputs O_{15}/A-1
Read Word-wide	V_{IL}	V_{IL}	X(1)	V_{IH}	D_{OUT}	D_{OUT}	D_{OUT}
Read Byte-wide Upper	V_{IL}	V_{IL}	X(1)	V_{IL}	D_{OUT}	High-Z	V_{IH}
Read Byte-wide Lower	V_{IL}	V_{IL}	X(1)	V_{IL}	D_{OUT}	High-Z	V_{IL}
Output Disable	X(1)	V_{IH}	X(1)	X		High-Z	
Standby	V_{IH}	X(1)	X(1)	X(6)		High-Z	
Rapid Program(3)	V_{IL}	V_{IH}	Ai	V_{PP}		D_{IN}	
PGM Verify	X	V_{IL}	Ai	V_{PP}		D_{OUT}	
PGM Inhibit	V_{IH}	V_{IH}	X(1)	V_{PP}		High-Z	
Product Identification(5)	V_{IL}	V_{IL}	A9 = V_H(4) A0 = V_{IH} or V_{IL} A1 - A18 = V_{IL}	V_{IH}	Identification Code		

Notes: 1. X can be V_{IL} or V_{IH}.

2. Read, output disable and standby modes require 2.7V ≤ V_{CC} ≤ 3.6V or 4.5V ≤ V_{CC} ≤ 5.5V.
3. Refer to the programming characteristics tables in this datasheet.
4. V_H = 12.0 ± 0.5V.
5. Two identifier words 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 word and high (V_{IH}) to select the Device Code word.
6. Standby V_{CC} current (I_{SB}) is specified with V_{PP} = V_{CC}. V_{CC} > V_{PP} will cause a slight increase in I_{SB}.

DC and AC Operating Conditions for Read Operation

		AT27BV800-15
Operating Temperature (Case)	Com.	0°C - 70°C
	Ind.	-40°C - 85°C
V_{CC} Power Supply		2.7V to 3.6V
		5V ± 10%

DC and Operating Characteristics for Read Operation

Symbol	Parameter	Condition	Min	Max	Units
V_{CC} = 2.7V to 3.6V					
I_{LI}	Input Load Current	V_{IN} = 0V to V_{CC}		±1	µA
I_{LO}	Output Leakage Current	V_{OUT} = 0V 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} ± 0.3V		20	µA
		I_{SB2} (TTL), $\overline{CE}$ = 2.0 to V_{CC} + 0.5V		100	mA
I_{CC}	V_{CC} Active Current	f = 5 MHz, I_{OUT} = 0 mA, $\overline{CE}$ = V_{IL}, V_{CC} = 3.6V		10	mA
V_{IL}	Input Low Voltage	V_{CC} = 3.0 to 3.6V	-0.6	0.8	V
		V_{CC} = 2.7 to 3.6V	-0.6	0.2 x V_{CC}	V
V_{IH}	Input High Voltage	V_{CC} = 3.0 to 3.6V	2.0	V_{CC} + 0.5	V
		V_{CC} = 2.7 to 3.6V	0.7 x V_{CC}	V_{CC} + 0.5	V
V_{OL}	Output Low Voltage	I_{OL} = 2.0 mA		0.4	V
		I_{OL} = 100 µA		0.2	V
		I_{OL} = 20 µA		0.1	V
V_{OH}	Output High Voltage	I_{OH} = -2.0 mA	2.4		V
		I_{OH} = -100 µA	V_{CC} - 0.2		V
		I_{OH} = -20 µA	V_{CC} - 0.1		V
V_{CC} = 4.5V to 5.5V					
I_{LI}	Input Load Current	V_{IN} = 0V to V_{CC}		±1.0	µA
I_{LO}	Output Leakage Current	V_{OUT} = 0V to V_{CC}		±5.0	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} ± 0.3V		100	µA
		I_{SB2} (TTL), $\overline{CE}$ = 2.0 to V_{CC} + 0.5V		1	mA
I_{CC}	V_{CC} Active Current	f = 5MHz, I_{OUT} = 0 mA, $\overline{CE}$ = V_{IL}		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_{OH} = -2.1 mA		0.4	V
V_{OH}	Output High Voltage	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}.

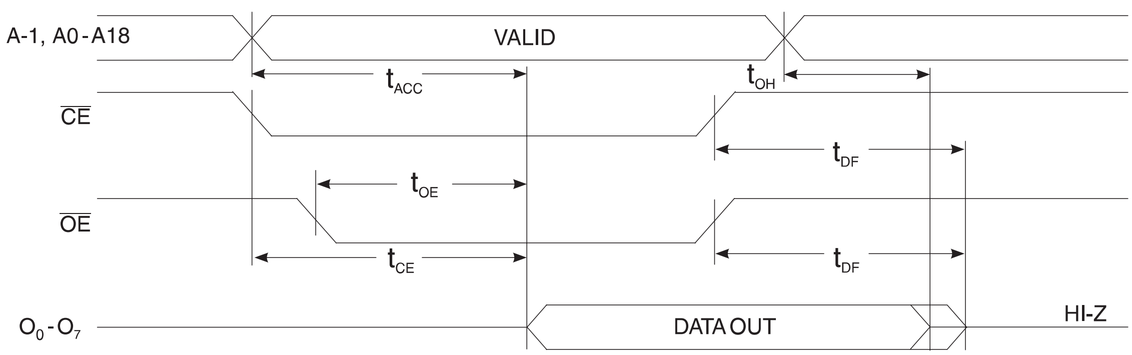
AC Characteristics for Read Operation

V_{CC} = 2.7V to 3.6V and 4.5V to 5.5V

Symbol	Parameter	Condition	AT27BV800-15		Units
			Min	Max	
t_{ACC}(3)	Address to Output Delay	$\overline{CE}$ = $\overline{OE}$ = V_{IL}		150	ns
t_{CE}(2)	$\overline{CE}$ to Output Delay	$\overline{OE}$ = V_{IL}		150	ns
t_{OE}(2,3)	$\overline{OE}$ to Output Delay	$\overline{CE}$ = V_{IL}		50	ns
t_{DF}(4,5)	$\overline{OE}$ or $\overline{CE}$ High to Output Float, whichever occurred first			40	ns
t_{OH}(4)	Output Hold from Address $\overline{CE}$ or $\overline{OE}$, whichever occurred first		5.0		ns
t_{ST}	$\overline{BYTE}$ High to Output Valid			150	ns
t_{STD}	$\overline{BYTE}$ Low to Output Transition			60	ns

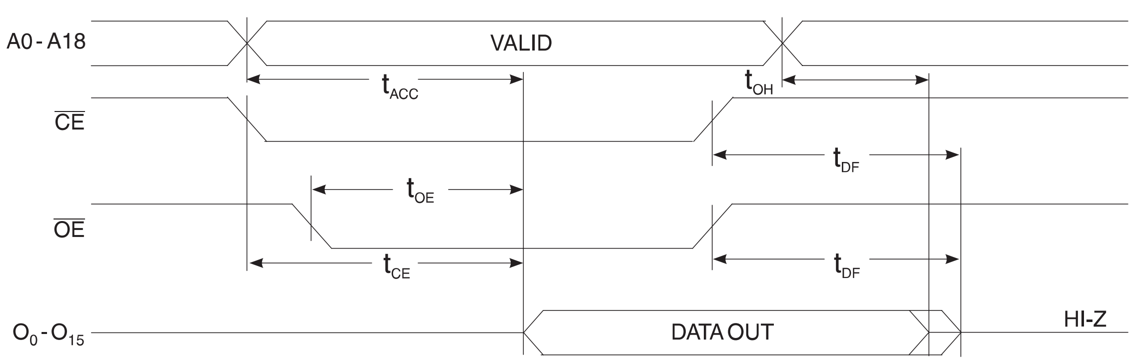
Notes: 1. 2,3,4,5. See the AC Waveforms for Read Operation diagram.

Byte-wide Read Mode AC Waveforms[1]



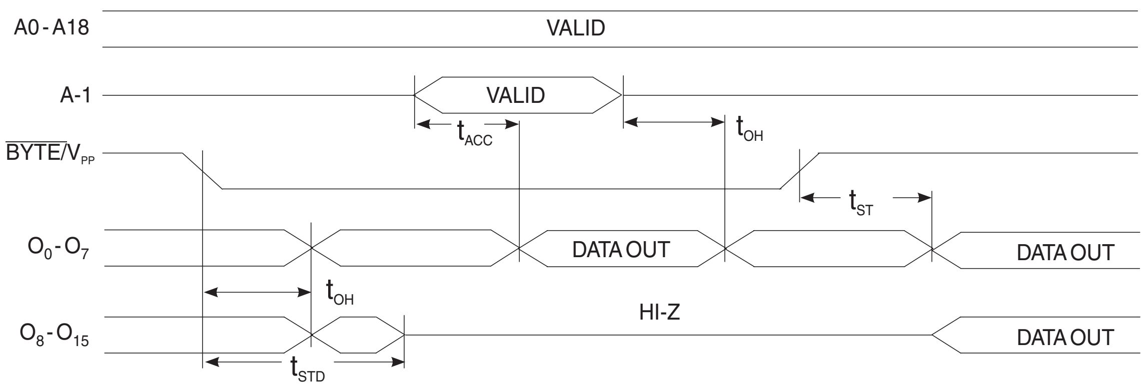
Note: 1. $\overline{BYTE}/V_{PP}$ = V_{IL}

Word-wide Read Mode AC Waveforms[1]



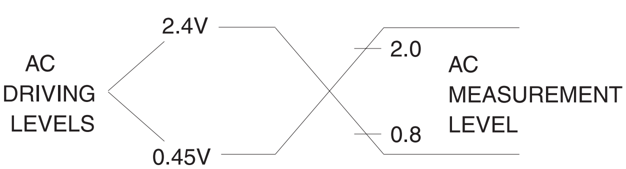
Note: 1. $\overline{BYTE}/V_{PP}$ = V_{IH}

$\overline{\text{BYTE}}$ Transition AC Waveforms



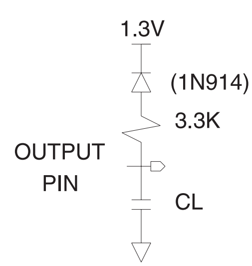
Notes:
1. Timing measurement references are 0.8V and 2.0V. Input AC drive levels are 0.45V and 2.4V, unless otherwise specified.
2. $\overline{OE}$ may be delayed up to t_{CE} - t_{OE} after the falling edge of $\overline{CE}$ without impact on t_{CE}.
3. $\overline{OE}$ may be delayed up to t_{ACC}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

Output Test Load



Note: CL = 100 pF including jig capacitance.

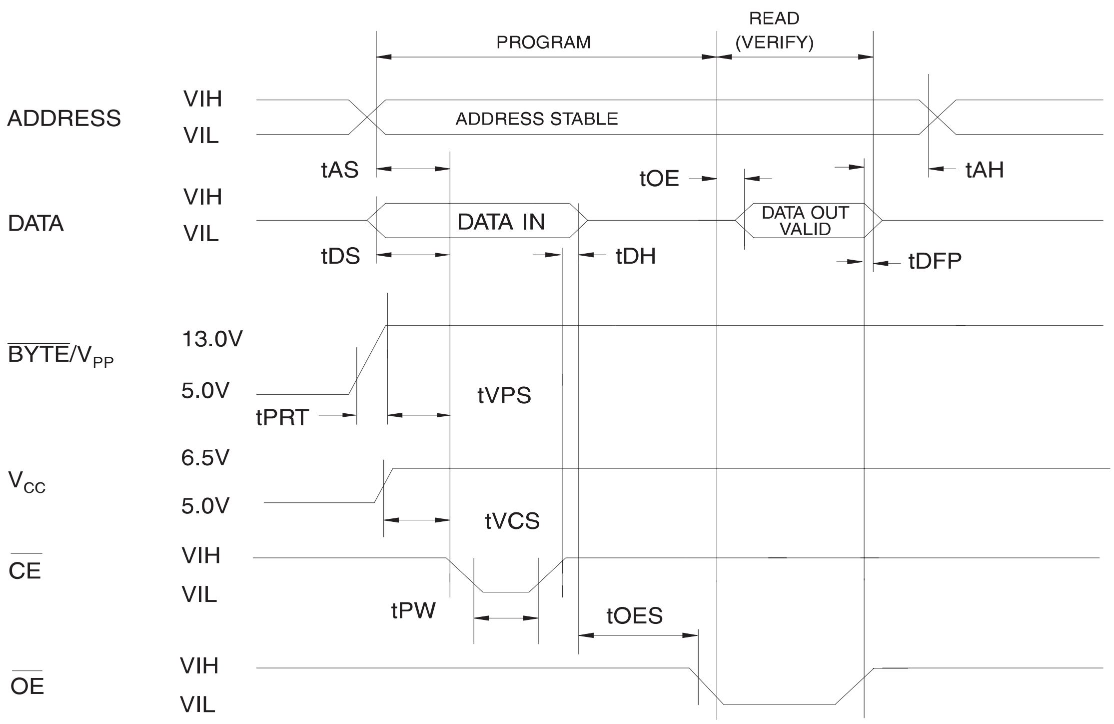
Pin Capacitance

f = 1 MHz, T = 25°C[(1)]

Symbol	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 0.8V 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 AT27BV800, a 0.1 µF capacitor is required across V_{PP} and ground to suppress voltage transients.

DC Programming Characteristics

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

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		-0.6	0.8	V
V_{IH}	Input High Level		2.0	V_{CC} + 0.5	V
V_{OL}	Output Low Voltage	I_{OL} = 2.1 mA		0.4	V
V_{OH}	Output High Voltage	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

AC Programming Characteristics

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

Symbol	Parameter	Test Conditions[1]	Limits Min	Limits Max	Units
t_{AS}	Address Setup Time	Input Rise and Fall Times: (10% to 90%) 20 ns	2		µs
t_{OES}	$\overline{OE}$ Setup Time		2		µs
t_{DS}	Data Setup Time	Input Pulse Levels: 0.45V to 2.4V	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[2]	Input Pulse Levels: 0.8V to 2.0V	0	130	ns
t_{VPS}	V_{PP} Setup Time		2		µs
t_{VCS}	V_{CC} Setup Time	Input Timing Reference Level: 0.8V to 2.0V	2		µs
t_{PW}	$\overline{CE}$ Program Pulse Width[3]		47.5	52.5	µs
t_{OE}	Data Valid from $\overline{OE}$	Output Timing Reference Level: 0.8V to 2.0V		150	ns
t_{PRT}	$\overline{BYTE}/V_{PP}$ Pulse Rise Time During Programming		50		ns

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 µs ± 5%.

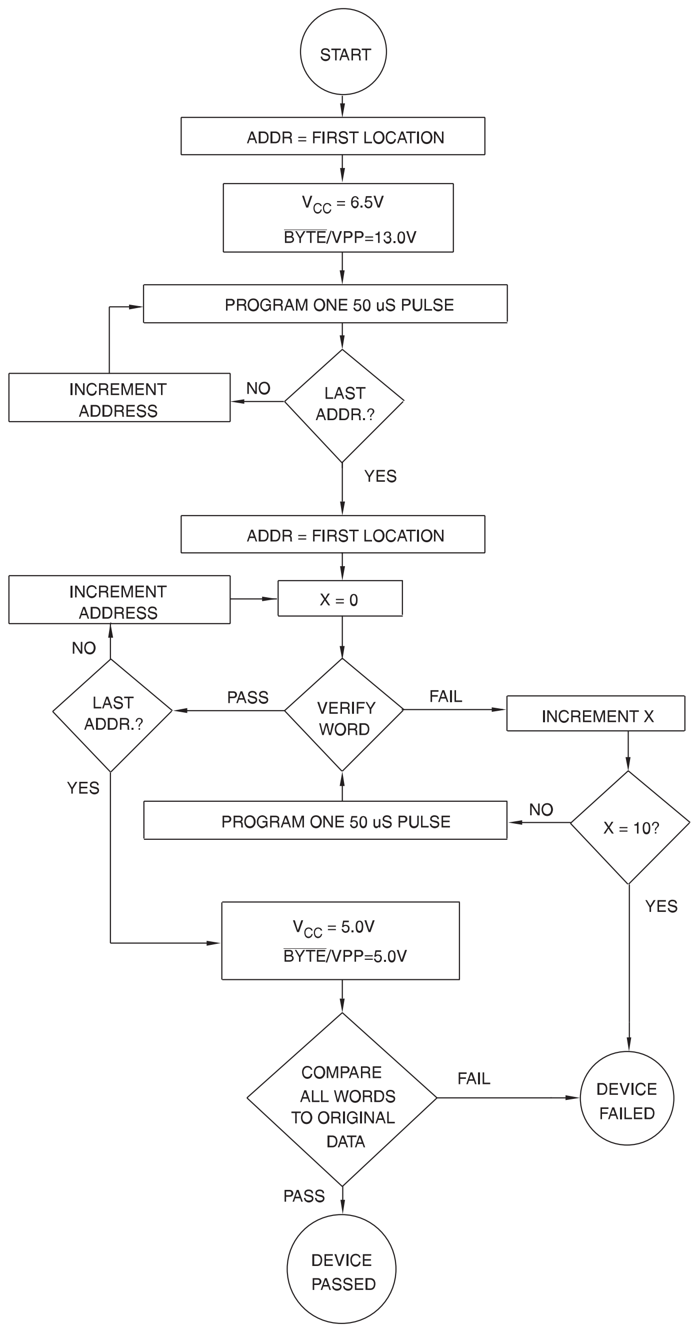
Atmel's 27BV800 Integrated Product Identification Code[1]

Codes	Pins A0	O15 / O7	O14 / O6	O13 / O5	O12 / O4	O11 / O3	O10 / O2	O9 / O1	O8 / O0	Hex Data
Manufacturer	0	0	0	0	1	1	1	1	0	1E1E
Device Type	1	1	1	1	1	1	0	0	0	F8F8

Note: 1. The AT27BV800 has the same Product Identification Code as the AT27C800. 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 6.5V and $\overline{BYTE}/V_{PP}$ is raised to 13.0V. 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 5.0V and V_{CC} to 5.0V. All words are read again and compared with the original data to determine if the device passes or fails.



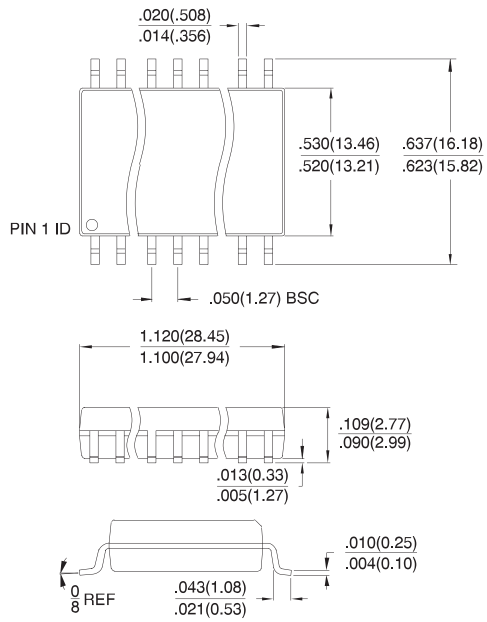
Ordering Information

t_{ACC} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
150	10	0.02	AT27BV800-15JC AT27BV800-15RC AT27BV800-15TC	44J 44R 48T	Commercial (0°C to 70°C)
	10	0.02	AT27BV800-15JI AT27BV800-15RI AT27BV800-15TI	44J 44R 48T	Industrial (-40°C to 85°C)

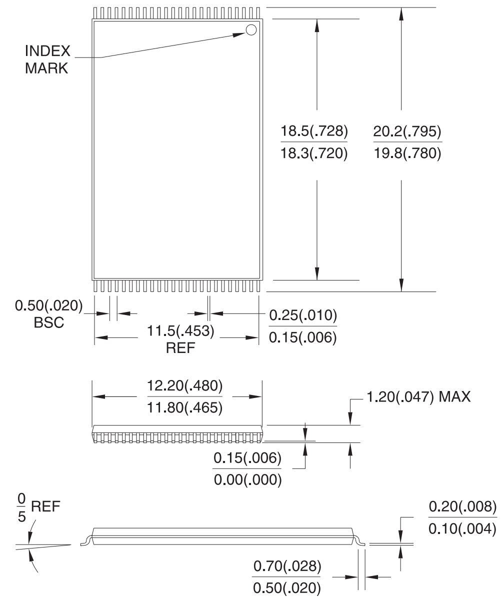
Package Type	
44J	44-lead, Plastic J-leaded Chip Carrier (PLCC)
44R	44-lead, 0.525" Wide, Plastic Gull Wing Small Outline Package (SOIC/SOP)
48T	48-lead, Plastic Thin Small Outline Package (TSOP) 12 x 20 mm

Packaging Information

44R, 44-lead, 0.525" Wide,
Plastic Gull Wing Small Outline Package (SOIC/SOP)
Dimensions in Inches and (Millimeters)

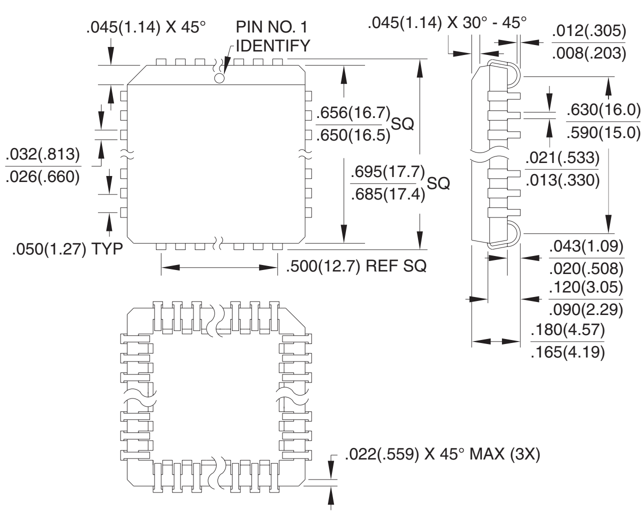


48T, 48-lead, 12 x 20 mm,
Plastic Thin Small Outline Package (TSOP)
Dimensions in Millimeters and (Inches)*
JEDEC OUTLINE MO-142 BD



*Controlling dimension: millimeters

44J, 44-lead, Plastic J-leaded Chip Carrier (PLCC)
Dimensions in Inches and (Millimeters)
JEDEC STANDARD MS-018 AC



Atmel Headquarters

Corporate Headquarters
2325 Orchard Parkway
San Jose, CA 95131
TEL (408) 441-0311
FAX (408) 487-2600

Europe
Atmel U.K., Ltd.
Coliseum Business Centre
Riverside Way
Camberley, Surrey GU15 3YL
England
TEL (44) 1276-686-677
FAX (44) 1276-686-697

Asia
Atmel Asia, Ltd.
Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimhatsui
East Kowloon
Hong Kong
TEL (852) 2721-9778
FAX (852) 2722-1369

Japan
Atmel Japan K.K.
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
TEL (81) 3-3523-3551
FAX (81) 3-3523-7581

Atmel Operations

Atmel Colorado Springs
1150 E. Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
TEL (719) 576-3300
FAX (719) 540-1759

Atmel Rousset
Zone Industrielle
13106 Rousset Cedex
France
TEL (33) 4-4253-6000
FAX (33) 4-4253-6001

Fax-on-Demand
North America:
1-(800) 292-8635
International:
1-(408) 441-0732

e-mail
literature@atmel.com

Web Site
http://www.atmel.com

BBS
1-(408) 436-4309

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