

Features

- Industry-standard Architecture
 - Emulates Many 20-pin PALs®
 - Low-cost Easy-to-use Software Tools
- High-speed Electrically-erasable Programmable Logic Devices
 - 10 ns Maximum Pin-to-pin Delay
- Several Power Saving Options

Device	I _{CC} , Standby	I _{CC} , Active
ATF16V8B	50 mA	55 mA
ATF16V8BQ	35 mA	40 mA
ATF16V8BQL	5 mA	20 mA

- CMOS and TTL Compatible Inputs and Outputs
 - Input and I/O Pull-up Resistors
- Advanced Flash Technology
 - Reprogrammable
 - 100% Tested
- High-reliability CMOS Process
 - 20 Year Data Retention
 - 100 Erase/Write Cycles
 - 2,000V ESD Protection
 - 200 mA Latchup Immunity
- Commercial, and Industrial Temperature Ranges
- Dual-in-line and Surface Mount Packages in Standard Pinouts
- PCI-compliant
- Green Package Options (Pb/Halide-free/RoHS Compliant) Available

1. Description

The ATF16V8B is a high-performance CMOS (electricallyerasable) programmable logic device (PLD) that utilizes Atmel's proven electrically-erasable Flash memory technology. All speed ranges are specified over the full 5V ± 10% range for industrial temperature ranges, and 5V ± 5% for commercial temperature ranges.

Several low-power options allow selection of the best solution for various types of power-limited applications. Each of these options significantly reduces total system power and enhances system reliability.

The ATF16V8Bs incorporate a superset of the generic architectures, which allows direct replacement of the 16R8 family and most 20-pin combinatorial PLDs. Eight outputs are each allocated eight product terms. Three different modes of operation, configured automatically with software, allow highly complex logic functions to be realized.



**High-
performance
EE PLD**

**ATF16V8B
ATF16V8BQ
ATF16V8BQL**



3. 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	-2.0 V to +7.0 V ⁽¹⁾
Voltage on Input Pins with Respect to Ground During Programming.....	-2.0 V to +14.0 V ⁽¹⁾
Programming Voltage with Respect to Ground	-2.0 V to +14.0 V ⁽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.

4. DC and AC Operating Conditions

	Commercial	Industrial
Operating Temperature (Ambient)	0°C - 70°C	-40°C - 85°C
V_{CC} Power Supply	5V ± 5%	5V ± 10%

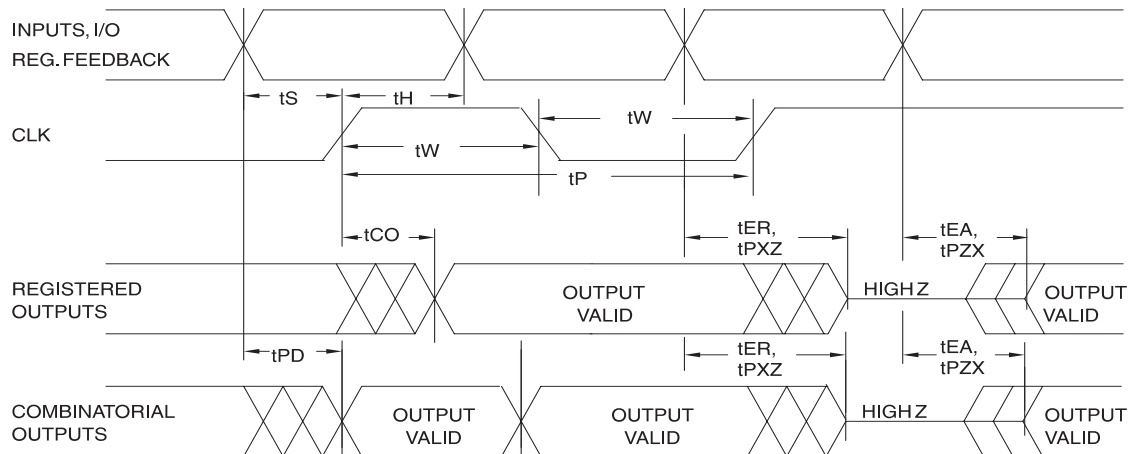


4.1 DC Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Units	
I_{IL}	Input or I/O Low Leakage Current	$0 \leq V_{IN} \leq V_{IL}(\text{Max})$		-35	-100	μA	
I_{IH}	Input or I/O High Leakage Current	$3.5 \leq V_{IN} \leq V_{CC}$			10	μA	
I_{CC}	Power Supply Current, Standby	$V_{CC} = \text{Max},$ $V_{IN} = \text{Max},$ Outputs Open	B-10	Com.	55	85	mA
				Ind.	55	95	mA
			B-15	Com.	50	75	mA
				Ind.	50	80	mA
			BQ-10	Com.	35	55	mA
			BQL-15	Com.	5	10	mA
			BQL-15	Ind.	5	15	mA
I_{CC2}	Clocked Power Supply Current	$V_{CC} = \text{Max},$ Outputs Open, $f = 15 \text{ MHz}$	B-10	Com.	60	90	mA
				Ind.	60	100	mA
			B-15	Com.	55	85	mA
				Ind.	55	95	mA
			BQ-10	Com.	40	55	mA
			BQL-15	Com.	20	35	mA
			BQL-15	Ind.	20	40	mA
$I_{OS}^{(1)}$	Output Short Circuit Current	$V_{OUT} = 0.5 \text{ V}$			-130	mA	
V_{IL}	Input Low Voltage		-0.5		0.8	V	
V_{IH}	Input High Voltage		2.0		$V_{CC}+0.75$	V	
V_{OL}	Output High Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL},$ $V_{CC} = \text{Min}$			0.5	V	
V_{OH}	Output High Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL},$ $V_{CC} = \text{Min}$		2.4		V	

Note: 1. Not more than one output at a time should be shorted. Duration of short circuit test should not exceed 30 sec.

4.2 AC Waveforms⁽¹⁾



Note: 1. Timing measurement reference is 1.5V. Input AC driving levels are 0.0V 3.0V, unless otherwise specified.

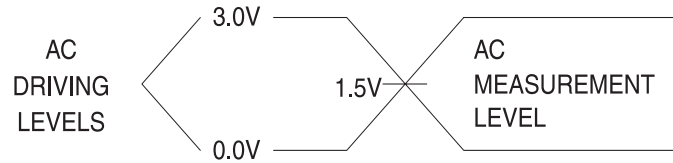
4.3 AC Characteristics⁽¹⁾

Symbol	Parameter	-10		-15		Units		
		Min	Max	Min	Max			
t _{PD}	Input or Feedback to Non-Registered Output	8 outputs switching		3	10	3	15	ns
t _{CF}	Clock to Feedback		6		8			ns
t _{CO}	Clock to Output	2	7	2	10			ns
t _S	Input or Feedback Setup Time	7.5		12				ns
t _H	Hold Time	0		0				ns
t _P	Clock Period	12		16				ns
t _W	Clock Width	6		8				ns
f _{MAX}	External Feedback 1/(t _S + t _{CO})		68		45			MHz
	Internal Feedback 1/(t _S + t _{CF})		74		50			MHz
	No Feedback 1/(t _P)		83		62			MHz
t _{EA}	Input to Output Enable — Product Term	3	10	3	15			ns
t _{ER}	Input to Output Disable — Product Term	2	10	2	15			ns
t _{PZX}	\overline{OE} pin to Output Enable	2	10	2	15			ns
t _{PXZ}	\overline{OE} pin to Output Disable	1.5	10	1.5	15			ns

Note: 1. See ordering information for valid part numbers and speed grades.

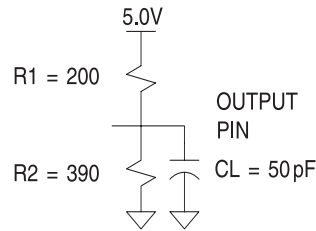
4.4 Input Test Waveforms

4.4.1 Input Test Waveforms and Measurement Levels



$$t_R, t_F < 5 \text{ ns (10\% to 90\%)}$$

4.4.2 Output Test Loads (Commercial)



C_L includes Test fixture and Probe capacitance

4.5 Pin Capacitance

Table 4-1. Pin Capacitance ($f = 1 \text{ MHz}$, $T = 25^\circ\text{C}^{(1)}$)

	Typ	Max	Units	Conditions
C_{IN}	5	8	pF	$V_{IN} = 0V$
C_{OUT}	6	8	pF	$V_{OUT} = 0V$

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

4.6 Power-up Reset

The registers in the ATF16V8Bs are designed to reset during power-up. At a point delayed slightly from V_{CC} crossing V_{RST} , all registers will be reset to the low state. As a result, the registered output state will always be high on power-up.

This feature is critical for state machine initialization. However, due to the asynchronous nature of reset and the uncertainty of how V_{CC} actually rises in the system, the following conditions are required:

1. The V_{CC} rise must be monotonic,
2. After reset occurs, all input and feedback setup times must be met before driving the clock pin high, and
3. The clock must remain stable during t_{PR} .

Figure 4-1. Power-up Reset Waveforms

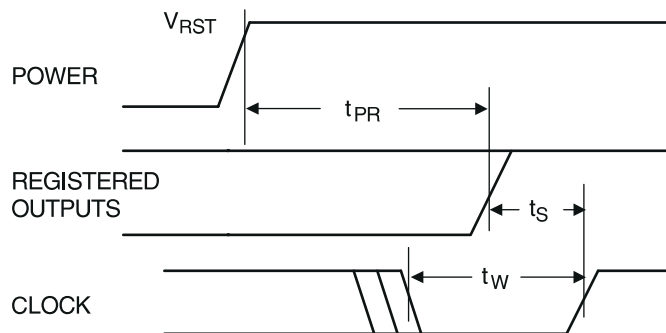


Table 4-2. Power-up Reset Parameters

Parameter	Description	Typ	Max	Units
t_{PR}	Power-up Reset Time	600	1,000	ns
V_{RST}	Power-up Reset Voltage	3.8	4.5	V

4.7 Preload of Registered Outputs

The ATF16V8B's registers are provided with circuitry to allow loading of each register with either a high or a low. This feature will simplify testing since any state can be forced into the registers to control test sequencing. A JEDEC file with preload is generated when a source file with vectors is compiled. Once downloaded, the JEDEC file preload sequence will be done automatically by most of the approved programmers after the programming.

5. Security Fuse Usage

A single fuse is provided to prevent unauthorized copying of the ATF16V8B fuse patterns. Once programmed, fuse verify and preload are inhibited. However, the 64-bit User Signature remains accessible.

The security fuse should be programmed last, as its effect is immediate.

13. ATF16V8B Ordering Information

13.1 ATF16V8B Standard Package Options

t_{PD} (ns)	t_S (ns)	t_{CO} (ns)	Ordering Code	Package	Operation Range
10	7.5	7	ATF16V8B-10JC	20J	Commercial (0°C to 70°C)
			ATF16V8B-10PC	20P3	
			ATF16V8B-10SC	20S	
			ATF16V8B-10XC	20X	
			ATF16V8B-10JI	20J	Industrial (-40°C to 85°C)
			ATF16V8B-10PI	20P3	
			ATF16V8B-10SI	20S	
			ATF16V8B-10XI	20X	
15	12	10	ATF16V8B-15JC	20J	Commercial (0°C to 70°C)
			ATF16V8B-15PC	20P3	
			ATF16V8B-15SC	20S	
			ATF16V8B-15XC	20X	
			ATF16V8B-15JI	20J	Industrial (-40°C to 85°C)
			ATF16V8B-15PI	20P3	
			ATF16V8B-15SI	20S	
			ATF16V8B-15XI	20X	

Note: The last time buy date is Sept. 30, 2005 for shaded parts.

13.2 ATF16V8B Green Package Options (Pb/Halide-free/RoHS Compliant)

t_{PD} (ns)	t_S (ns)	t_{CO} (ns)	Ordering Code	Package	Operation Range
10	7.5	7	ATF16V8B-10JU	20J	Industrial (-40°C to 85°C)
15	12	10	ATF16V8B-15JU	20J	
			ATF16V8B-15PU	20P3	
			ATF16V8B-15SU	20S	
			ATF16V8B-15XU	20X	

13.3 Using “C” Product for Industrial

To use commercial product for Industrial temperature ranges, down-grade one speed grade from the “I” to the “C” device (7 ns “C” = 10 ns “I”) and de-rate power by 30%.

Package Type	
20J	20-lead, Plastic J-leaded Chip Carrier (PLCC)
20P3	20-lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
20S	20-lead, 0.300" Wide, Plastic Gull-wing Small Outline (SOIC)
20X	20-lead, 4.4 mm Wide, Plastic Thin Shrink Small Outline (TSSOP)

14. ATF16V8BQ/BQL Ordering Information

14.1 ATF16V8BQ and ATF16V8BQL Ordering Information

t_{PD} (ns)	t_S (ns)	t_{CO} (ns)	Ordering Code	Package	Operation Range
10	7.5	7	ATF16V8BQ-10JC	20J	Commercial (0°C to 70°C)
			ATF16V8BQ-10PC	20P3	
			ATF16V8BQ-10SC	20S	
			ATF16V8BQ-10XC	20X	
15	12	10	ATF16V8BQL-15JC	20J	Commercial (0°C to 70°C)
			ATF16V8BQL-15PC	20P3	
			ATF16V8BQL-15SC	20S	
			ATF16V8BQL-15XC	20X	
		ATF16V8BQL-15JI	20J	Industrial (-40°C to 85°C)	
		ATF16V8BQL-15PI	20P3		
		ATF16V8BQL-15SI	20S		
		ATF16V8BQL-15XI	20X		

Note: The last time buy date is Sept. 30, 2005 for shaded parts.

14.2 ATF16V8BQ and ATF16V8BQL Green Package Options (Pb/Halide-free/RoHS Compliant)

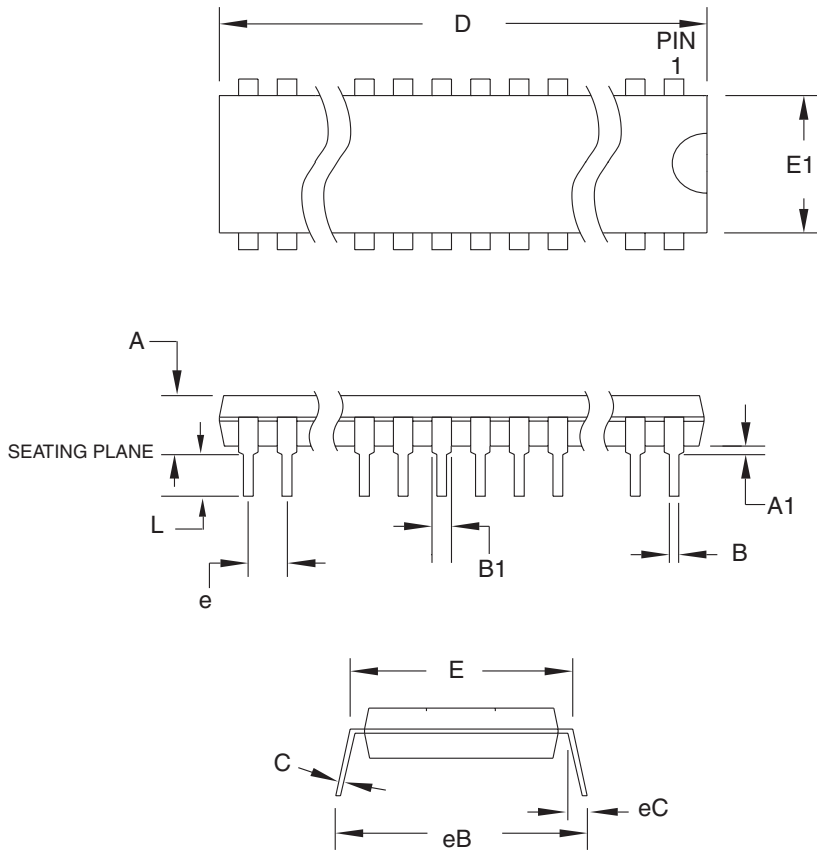
t_{PD} (ns)	t_S (ns)	t_{CO} (ns)	Ordering Code	Package	Operation Range
15	12	10	ATF16V8BQL-15JU	20J	Industrial (-40°C to 85°C)
			ATF16V8BQL-15PU	20P3	
			ATF16V8BQL-15SU	20S	
			ATF16V8BQL-15XU	20X	

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15.2 20P3 – PDIP



COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	5.334	
A1	0.381	–	–	
D	24.892	–	26.924	Note 2
E	7.620	–	8.255	
E1	6.096	–	7.112	Note 2
B	0.356	–	0.559	
B1	1.270	–	1.551	
L	2.921	–	3.810	
C	0.203	–	0.356	
eB	–	–	10.922	
eC	0.000	–	1.524	
e	2.540 TYP			

- Notes:
1. This package conforms to JEDEC reference MS-001, Variation AD.
 2. Dimensions D and E1 do not include mold Flash or Protrusion. Mold Flash or Protrusion shall not exceed 0.25 mm (0.010").