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**

High-performance EE PLD

ATF16V8B
ATF16V8BQ
ATF16V8BQL

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.

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

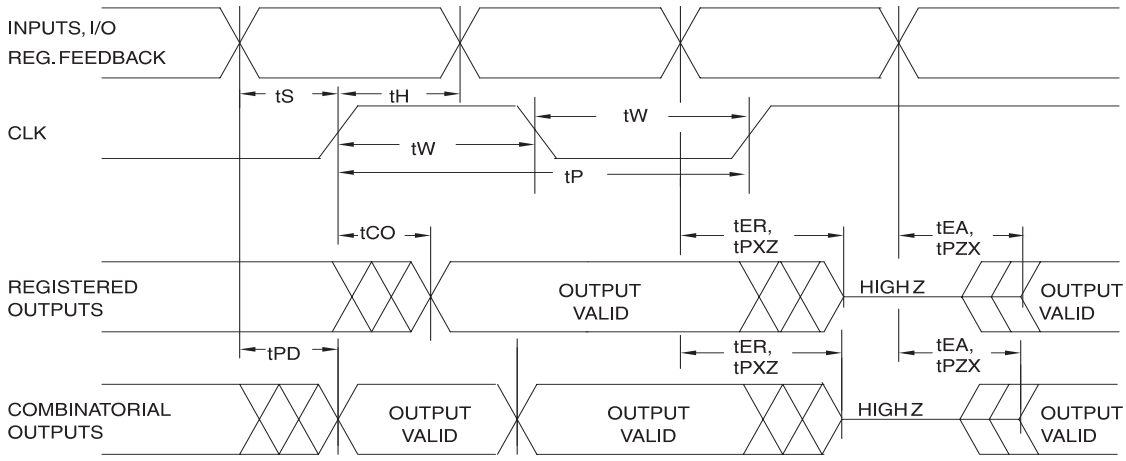
	Commercial	Industrial
Operating Temperature (Ambient)	0°C - 70°C	-40°C - 85°C
V_{CC} Power Supply	5V ± 5%	5V ± 10%

4.1 DC Characteristics

Symbol	Parameter	Condition			Min	Typ	Max	Units
I_{IL}	Input or I/O Low Leakage Current	$0 \le V_{IN} \le V_{IL}$(Max)				-35	-100	µA
I_{IH}	Input or I/O High Leakage Current	$3.5 \le V_{IN} \le V_{CC}$					10	µA
I_{CC}	Power Supply Current, Standby	V_{CC} = Max, V_{IN} = Max, Outputs Open	B-10	Com.		55	85	mA
				Ind.		55	95	mA
			B-15	Com.		50	75	mA
			B-15	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} = Max, Outputs Open, f = 15 MHz	B-10	Com.		60	90	mA
				Ind.		60	100	mA
			B-15	Com.		55	85	mA
			B-15	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 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	$V_{IN} = V_{IH}$ or V_{IL}, V_{CC} = Min	I_{OL} = -24 mA Com., Ind.				0.5	V
V_{OH}	Output High Voltage	$V_{IN} = V_{IH}$ or V_{IL}, V_{CC} = Min	I_{OH} = -4.0 mA		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.

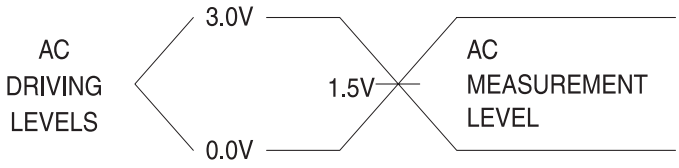
4.3 AC Characteristics[1]

Symbol	Parameter		-10 Min	-10 Max	-15 Min	-15 Max	Units
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.

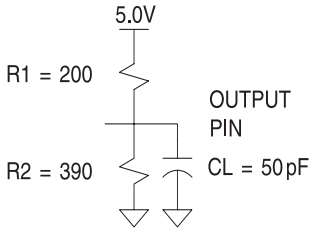
4.4 Input Test Waveforms

4.4.1 Input Test Waveforms and Measurement Levels



t_R, t_F < 5 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 MHz, T = 25°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

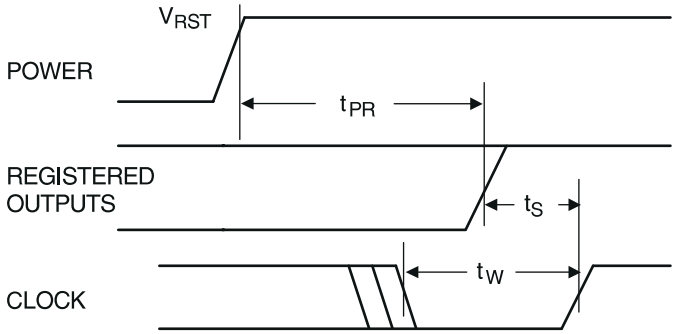


Table 4-2. Power-up Reset Parameters

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.

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 ATF16V8BQ-10PC ATF16V8BQ-10SC ATF16V8BQ-10XC	20J 20P3 20S 20X	Commercial (0°C to 70°C)
15	12	10	ATF16V8BQL-15JC ATF16V8BQL-15PC ATF16V8BQL-15SC ATF16V8BQL-15XC	20J 20P3 20S 20X	Commercial (0°C to 70°C)
			ATF16V8BQL-15JI ATF16V8BQL-15PI ATF16V8BQL-15SI ATF16V8BQL-15XI	20J 20P3 20S 20X	Industrial (-40°C to 85°C)

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 ATF16V8BQL-15PU ATF16V8BQL-15SU ATF16V8BQL-15XU	20J 20P3 20S 20X	Industrial (-40°C to 85°C)

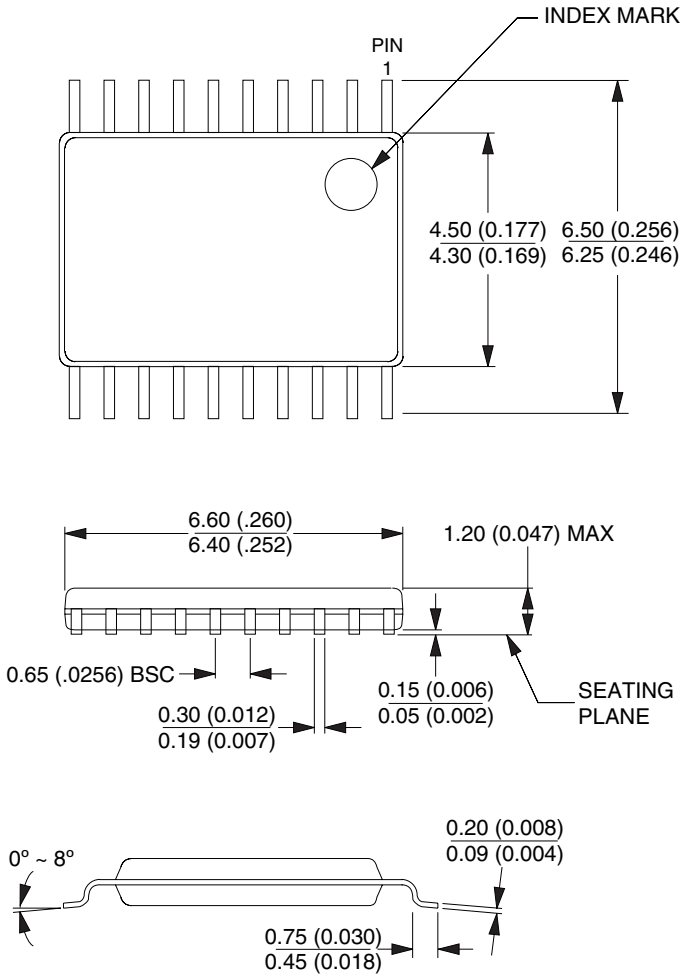
14.3 Using “C” Product for Industrial

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)

15.4 20X – TSSOP

Dimensions in Millimeters and (Inches).
Controlling dimension: Millimeters.
JEDEC Standard MO-153 AC



TITLE	DRAWING NO.
20X, (Formerly 20T), 20-lead, 4.4 mm Body Width, Plastic Thin Shrink Small Outline Package (TSSOP)	20X