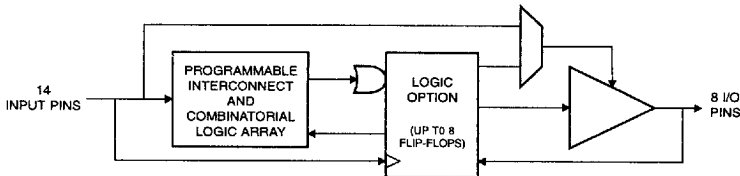


## Features

- **Industry Standard Architecture**  
**Emulates Many 24-Pin PALs®**  
**Low Cost Easy-to-Use Software Tools**
- **High Speed Electrically Erasable Programmable Logic Devices**  
**7.5 ns Maximum Pin-to-Pin Delay**
- **Low Power ATF20V8BL - 10 mA Maximum Standby**
- **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**  
**2,000 V ESD Protection**  
**200 mA Latchup Immunity**
- **Full Military, Commercial, and Industrial Temperature Ranges**
- **Dual-in-Line and Surface Mount Packages in Standard Pinouts**

### Block Diagram



### Description

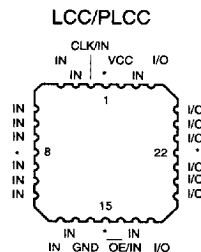
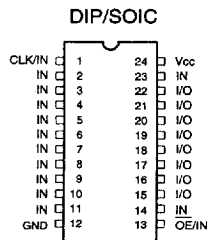
The ATF20V8B is a high performance CMOS (Electrically Erasable) Programmable Logic Device (PLD) which utilizes Atmel's proven electrically erasable Flash memory technology. Speeds down to 7.5 ns and power dissipation as low as 10 mA are offered. All speed ranges are specified over the full  $5\text{ V} \pm 10\%$  range for military and industrial temperature ranges, and  $5\text{ V} \pm 5\%$  for commercial ranges.

The ATF20V8BL provides the low power CMOS PLD solution, with low DC power (5.0 mA typical). The ATF20V8BL significantly reduces total system power and enhances system reliability

The ATF20V8Bs incorporate a superset of the generic architectures, which allows direct replacement of the 20R8 family and most 24-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.

## Pin Configurations

| Pin Name        | Function               |
|-----------------|------------------------|
| CLK             | Clock                  |
| IN              | Logic Inputs           |
| I/O             | Bidirectional Buffers  |
| $\overline{OE}$ | Output Enable          |
| *               | No Internal Connection |
| VCC             | +5 V Supply            |



## 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 <sup>(1)</sup>  |
| Voltage on Input Pins with Respect to Ground During Programming..... | -2.0 V to +14.0 V <sup>(1)</sup> |
| Programming Voltage with Respect to Ground.....                      | -2.0 V to +14.0 V <sup>(1)</sup> |

\*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 -0.6 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 overshoot to 7.0 V for pulses of less than 20 ns.

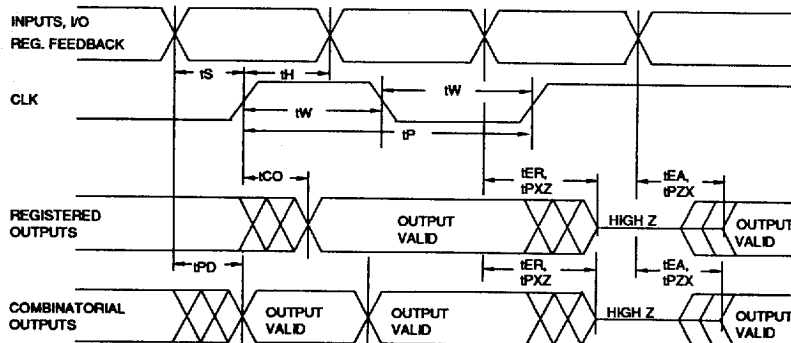
## D.C. and A.C. Operating Conditions

|                              | Commercial   | Industrial    | Military      |
|------------------------------|--------------|---------------|---------------|
| Operating Temperature (Case) | 0°C - 70°C   | -40°C - 85°C  | -55°C - 125°C |
| $V_{CC}$ Power Supply        | 5 V $\pm$ 5% | 5 V $\pm$ 10% | 5 V $\pm$ 10% |

## D.C. Characteristics

| Symbol                         | Parameter                         | Condition                                                                       | Min                       | Typ.       | Max                   | Units                 |    |
|--------------------------------|-----------------------------------|---------------------------------------------------------------------------------|---------------------------|------------|-----------------------|-----------------------|----|
| I <sub>IL</sub>                | Input or I/O Low Leakage Current  | 0 ≤ V <sub>IN</sub> ≤ V <sub>IL</sub> (MAX)                                     | -35                       |            | -100                  | μA                    |    |
| I <sub>IH</sub>                | Input or I/O High Leakage Current | 3.5 ≤ V <sub>IN</sub> ≤ V <sub>CC</sub>                                         |                           |            | 10                    | μA                    |    |
| I <sub>CC</sub>                | Power Supply Current, Standby     | V <sub>CC</sub> = MAX,<br>V <sub>IN</sub> = MAX,<br>Outputs Open                | B-7, -10                  | Com.       | 60                    | 90                    | mA |
|                                |                                   |                                                                                 |                           | Ind., Mil. | 60                    | 100                   | mA |
|                                |                                   |                                                                                 | B-15, -25                 | Com.       | 55                    | 80                    | mA |
|                                |                                   |                                                                                 |                           | Ind., Mil. | 55                    | 90                    | mA |
|                                |                                   |                                                                                 | BL-15                     | Com.       | 5                     | 10                    | mA |
|                                |                                   |                                                                                 |                           | Ind., Mil. | 5                     | 15                    | mA |
| I <sub>CC2</sub>               | Clocked Power Supply Current      | V <sub>CC</sub> = MAX,<br>Outputs Open                                          | ATF20V8BL-15              | Com.       | 1                     | mA/MHz <sup>(2)</sup> |    |
| I <sub>CC3</sub>               | Clocked Power Supply Current      | V <sub>CC</sub> = MAX,<br>Outputs Open,<br>f=25 MHz                             | B-7, -10                  | Com.       | 80                    | 110                   | mA |
|                                |                                   |                                                                                 |                           | Ind., Mil. | 80                    | 125                   | mA |
|                                |                                   |                                                                                 | B-15, -25                 | Com.       | 60                    | 90                    | mA |
|                                |                                   |                                                                                 |                           | Ind., Mil. | 60                    | 105                   | mA |
|                                |                                   |                                                                                 | BL-15                     | Com.       | 30                    | 40                    | mA |
|                                |                                   |                                                                                 |                           | Ind., Mil. | 30                    | 50                    | mA |
| I <sub>OS</sub> <sup>(1)</sup> | Output Short Circuit Current      | V <sub>OUT</sub> = 0.5 V                                                        |                           |            | -130                  | mA                    |    |
| V <sub>IL</sub>                | Input Low Voltage                 |                                                                                 | -0.5                      | -0.5       | 0.8                   | V                     |    |
| V <sub>IH</sub>                | Input High Voltage                |                                                                                 | 2.0                       | 2.0        | V <sub>CC</sub> +0.75 | V                     |    |
| V <sub>OL</sub>                | Output Low Voltage                | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br>V <sub>CC</sub> = MIN | I <sub>OL</sub> = 24 mA   | Com., Ind. | 0.5                   | V                     |    |
|                                |                                   |                                                                                 | I <sub>OL</sub> = 16 mA   | Mil.       | 0.5                   | V                     |    |
| V <sub>OH</sub>                | Output High Voltage               | V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> ,<br>V <sub>CC</sub> =MIN   | I <sub>OH</sub> = -4.0 mA | 2.4        | 2.4                   | V                     |    |

- Notes: 1. Not more than one output at a time should be shorted. Duration of short circuit test should not exceed 30 sec.  
2. Low frequency only, contact factory for  $I_{CC}$  versus frequency characterization curves.

A.C. Waveforms <sup>(1)</sup>

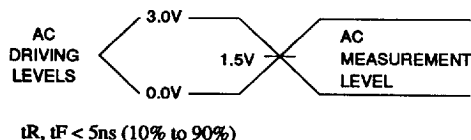
Note: 1. Timing measurement reference is 1.5 V. Input AC driving levels are 0.0 V and 3.0 V, unless otherwise specified.

A.C. Characteristics <sup>(1)</sup>

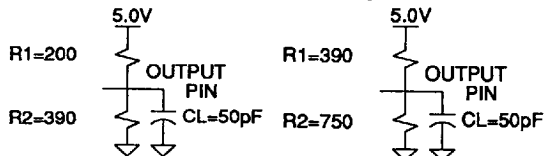
| Symbol           | Parameter                                               | -7  |     | -10 |     | -15 |     | -25 |     | Units |
|------------------|---------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-------|
|                  |                                                         | Min | Max | Min | Max | Min | Max | Min | Max |       |
| t <sub>PD</sub>  | Input or Feedback to Non-Registered Output              | 3   | 7.5 | 3   | 10  | 3   | 15  | 3   | 25  | ns    |
| t <sub>CF</sub>  | Clock to Feedback                                       |     | 3   |     | 6   |     | 8   |     | 10  | ns    |
| t <sub>CO</sub>  | Clock to Output                                         | 2   | 5   | 2   | 7   | 2   | 10  | 2   | 12  | ns    |
| t <sub>S</sub>   | Input or Feedback Setup Time                            | 5   |     | 7.5 |     | 12  |     | 15  |     | ns    |
| t <sub>H</sub>   | Hold Time                                               | 0   |     | 0   |     | 0   |     | 0   |     | ns    |
| t <sub>P</sub>   | Clock Period                                            | 8   |     | 12  |     | 16  |     | 24  |     | ns    |
| t <sub>W</sub>   | Clock Width                                             | 4   |     | 6   |     | 8   |     | 12  |     | ns    |
| F <sub>MAX</sub> | External Feedback 1/(t <sub>S</sub> +t <sub>CO</sub> )  |     | 100 |     | 68  |     | 45  |     | 37  | MHz   |
|                  | Internal Feedback 1/(t <sub>S</sub> + t <sub>CF</sub> ) |     | 125 |     | 74  |     | 50  |     | 40  | MHz   |
|                  | No Feedback 1/(t <sub>P</sub> )                         |     | 125 |     | 83  |     | 62  |     | 41  | MHz   |
| t <sub>EA</sub>  | Input to Output Enable — Product Term                   | 3   | 9   | 3   | 10  | 3   | 15  | 3   | 25  | ns    |
| t <sub>ER</sub>  | Input to Output Disable — Product Term                  | 2   | 9   | 2   | 10  | 2   | 15  | 2   | 25  | ns    |
| t <sub>PZX</sub> | OE pin to Output Enable                                 | 2   | 6   | 2   | 10  | 2   | 15  | 2   | 20  | ns    |
| t <sub>PXZ</sub> | OE pin to Output Disable                                | 1.5 | 6   | 1.5 | 10  | 1.5 | 15  | 1.5 | 20  | ns    |

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

## Input Test Waveforms and Measurement Levels:



## Output Test Loads:



## Pin Capacitance (f = 1 MHz, T = 25°C) <sup>(1)</sup>

|                  | Typ | Max | Units | Conditions             |
|------------------|-----|-----|-------|------------------------|
| C <sub>IN</sub>  | 5   | 8   | pF    | V <sub>IN</sub> = 0 V  |
| C <sub>OUT</sub> | 6   | 8   | pF    | V <sub>OUT</sub> = 0 V |

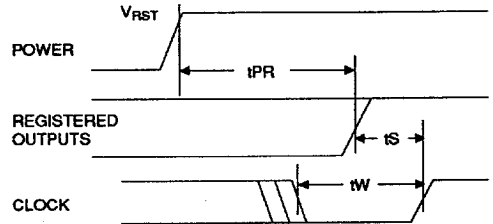
Note: 1. Typical values for nominal supply voltage. This parameter is only sampled and is not 100% tested.

## Power Up Reset

The registers in the ATF20V8Bs are designed to reset during power up. At a point delayed slightly from V<sub>CC</sub> crossing V<sub>RST</sub>, 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<sub>CC</sub> actually rises in the system, the following conditions are required:

- 1) The V<sub>CC</sub> rise must be monotonic,
- 2) After reset occurs, all input and feedback setup times must be met before driving the clock term high, and
- 3) The signals from which the clock is derived must remain stable during t<sub>PR</sub>.



| Parameter        | Description            | Typ | Max   | Units |
|------------------|------------------------|-----|-------|-------|
| t <sub>PR</sub>  | Power-Up Reset Time    | 600 | 1,000 | ns    |
| V <sub>RST</sub> | Power-Up Reset Voltage | 3.8 | 4.5   | V     |

## Preload of Registered Outputs

The ATF20V8B'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.

## Security Fuse Usage

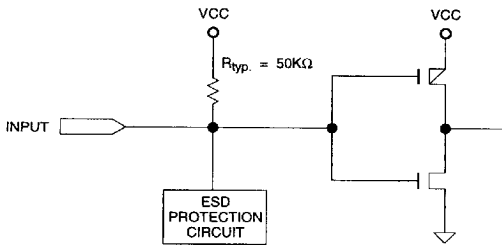
A single fuse is provided to prevent unauthorized copying of the ATF20V8B fuse patterns. Once programmed, fuse verify and preload are inhibited. However, the 64-bit User Signature remains accessible.

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

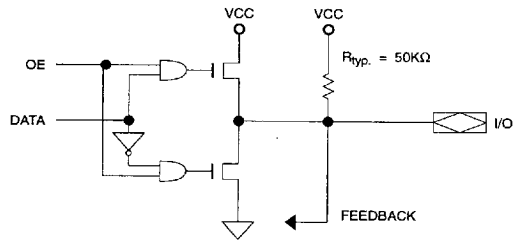
## Input and I/O Pull-Ups

The ATF20V8B and ATF20V8BL have internal input and I/O pull-up resistors. Therefore, whenever inputs or I/Os are not being driven externally, they will float to Vcc. This ensures that all logic array inputs are at known states. These are relatively weak active pull-ups that can easily be overdriven by TTL-compatible drivers (see input and I/O diagrams below).

### Input Diagram



### I/O Diagram



## Functional Logic Diagram Description

The Logic Option and Functional Diagrams describe the ATF20V8B architecture. Eight configurable macrocells can be configured as a registered output, combinatorial I/O, combinatorial output, or dedicated input.

The ATF20V8B can be configured in one of three different modes. Each mode makes the ATF20V8B look like a different device. Most PLD compilers can choose the right mode automatically. The user can also force the selection by supplying the compiler with a mode selection. The determining factors would be the usage of register versus combinatorial outputs and dedicated outputs versus outputs with output enable control.

The ATF20V8B universal architecture can be programmed to emulate many 24-pin PAL devices. These architectural subsets

can be found in each of the configuration modes described in the following pages. The user can download the listed subset device JEDEC programming file to the PLD programmer, and the ATF20V8B can be configured to act like the chosen device. Check with your programmer manufacturer for this capability.

Unused product terms are automatically disabled by the compiler to decrease power consumption. A Security Fuse, when programmed, protects the content of the ATF20V8B. Eight bytes (64 fuses) of User Signature are accessible to the user for purposes such as storing project name, part number, revision, or date. The User Signature is accessible regardless of the state of the Security Fuse.

## Compiler Mode Selection

|                  | Registered               | Complex                   | Simple                    | Auto Select |
|------------------|--------------------------|---------------------------|---------------------------|-------------|
| ABEL, Atmel-ABEL | P20V8R                   | P20V8C                    | P20V8AS                   | P20V8       |
| CUPL             | G20V8MS                  | G20V8MA                   | G20V8AS                   | G20V8       |
| LOG/IC           | GAL20V8_R <sup>(1)</sup> | GAL20V8_C7 <sup>(1)</sup> | GAL20V8_C8 <sup>(1)</sup> | GAL20V8     |
| OrCAD-PLD        | "Registered"             | "Complex"                 | "Simple"                  | GAL20V8A    |
| PLDesigner       | P20V8R                   | P20V8C                    | P20V8C                    | P20V8A      |
| Tango-PLD        | G20V8R                   | G20V8C                    | G20V8AS                   | G20V8       |

Note: 1. Only applicable for version 3.4 or lower.



## ATF20V8B Registered Mode

### PAL Device Emulation / PAL Replacement

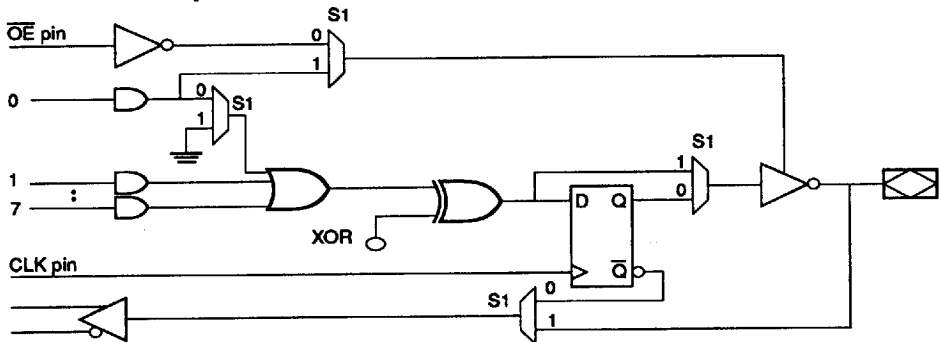
The registered mode is used if one or more registers are required. Each macrocell can be configured as either a registered or combinational output or I/O, or as an input. For a registered output or I/O, the output is enabled by the OE pin, and the register is clocked by the CLK pin. Eight product terms are allocated to the sum term. For a combinational output or I/O, the output enable is controlled by a product term, and seven product

terms are allocated to the sum term. When the macrocell is configured as an input, the output enable is permanently disabled.

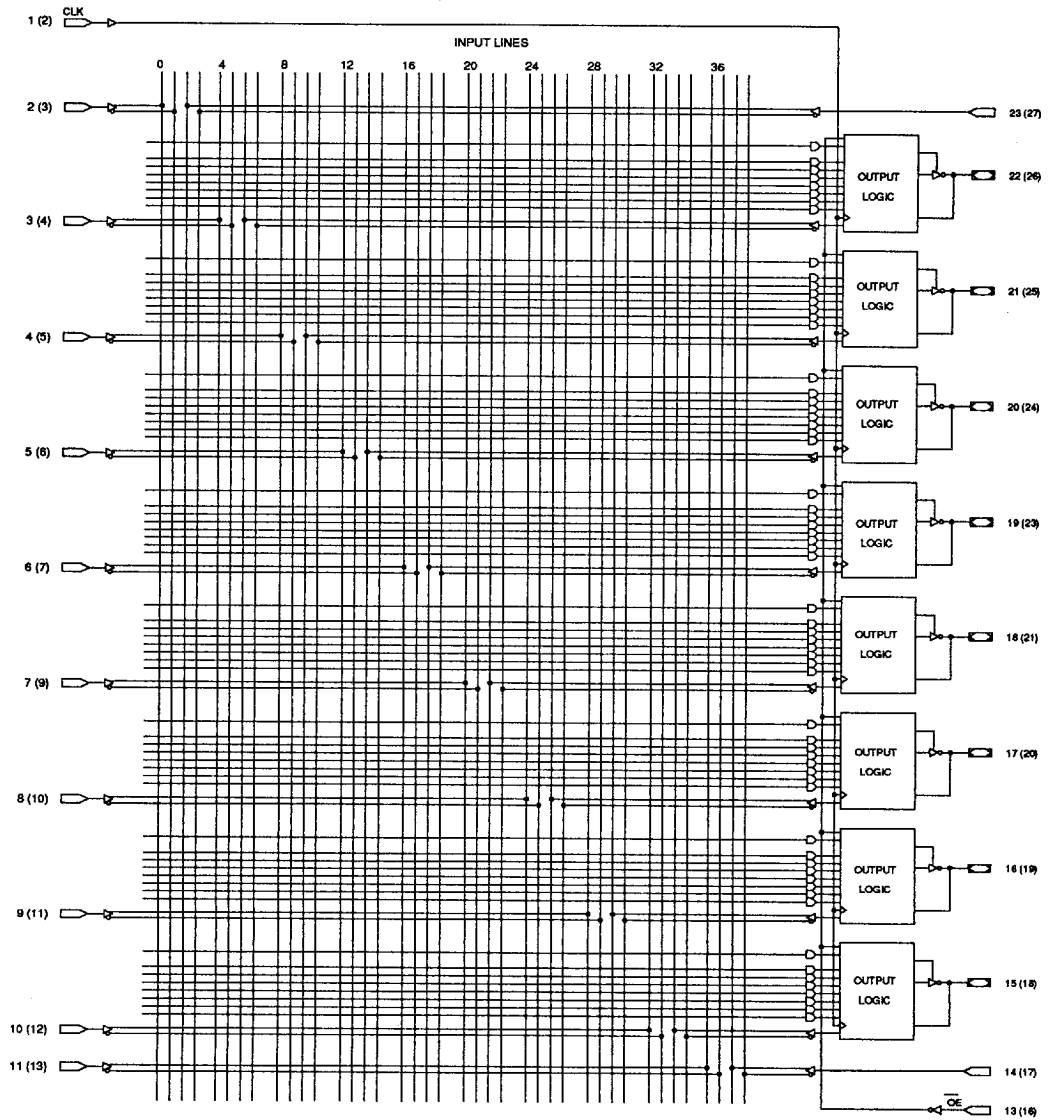
Any register usage will make the compiler select this mode. The following registered devices can be emulated using this mode:

|      |       |
|------|-------|
| 20R8 | 20RP8 |
| 20R6 | 20RP6 |
| 20R4 | 20RP4 |

### Registered Mode Option



## Registered Mode Logic Diagram



## ATF20V8B Complex Mode

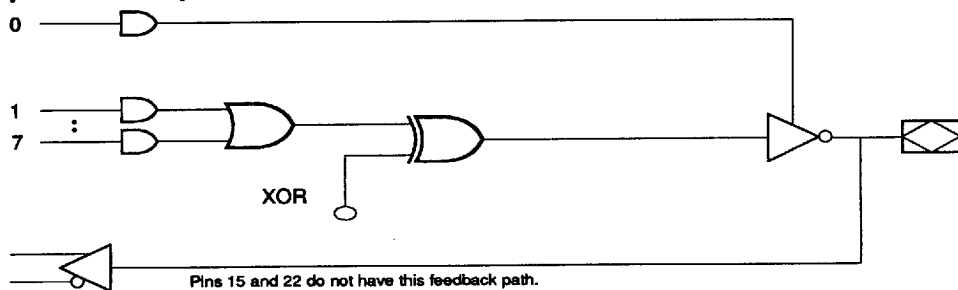
### PAL Device Emulation/PAL Replacement

In the Complex Mode, combinatorial output and I/O functions are possible. Pins 1 and 13 are regular inputs to the array. Pins 16 through 21 have pin feedback paths back to the AND-array, which makes full I/O capability possible. Pins 15 and 22 (outer-most macrocells) are outputs only. They do not have input capability. In this mode, each macrocell has seven product terms going to the sum term and one product term enabling the output.

Combinatorial applications with an OE requirement will make the compiler select this mode. The following devices can be emulated using this mode:

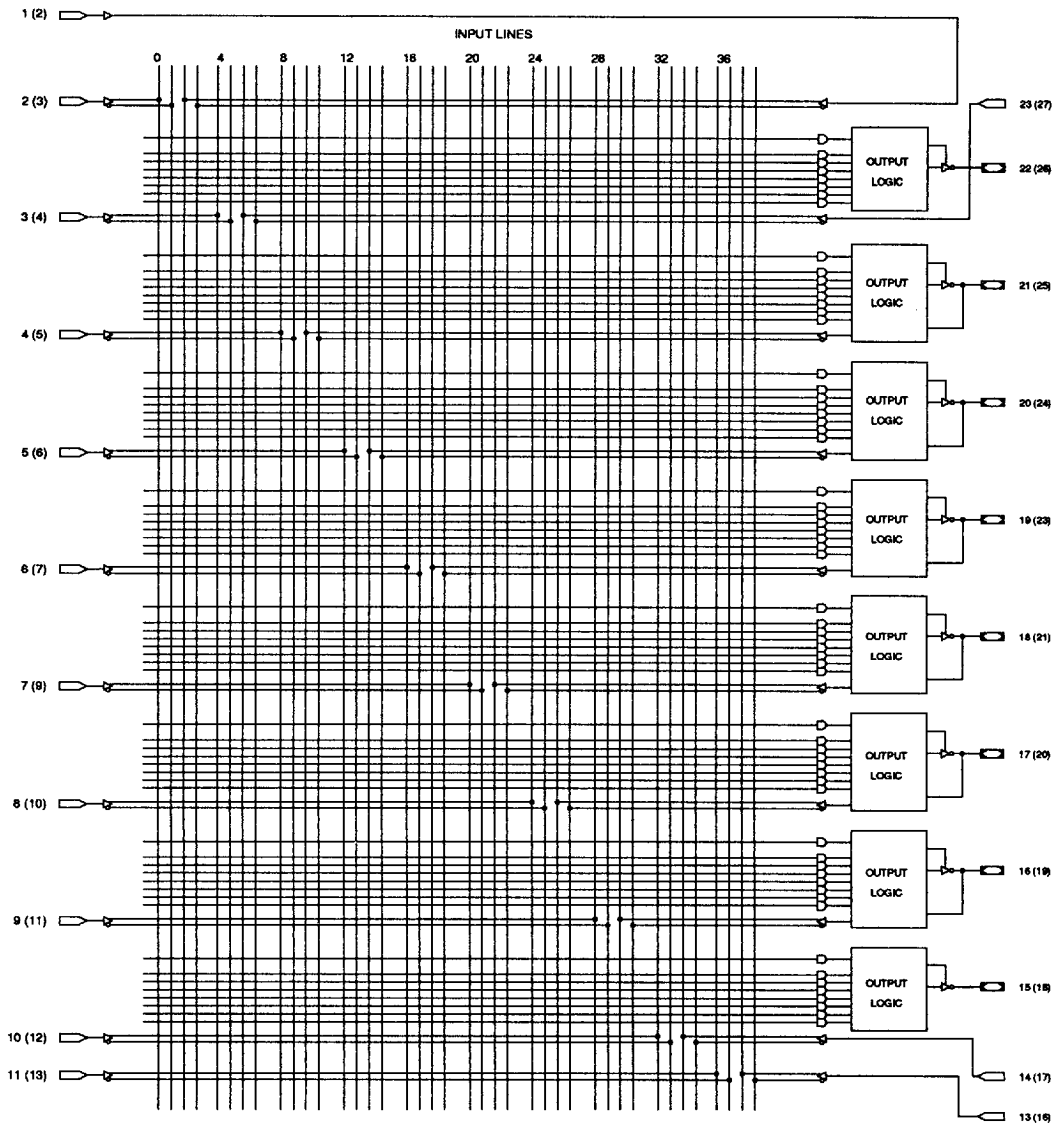
20L8  
20H8  
20P8

### Complex Mode Option





## Complex Mode Logic Diagram



## ATF20V8B Simple Mode

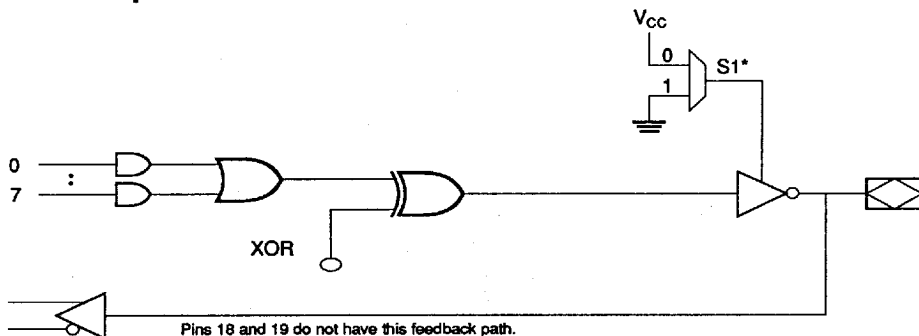
### PAL Device Emulation / PAL Replacement

In the Simple Mode, 8 product terms are allocated to the sum term. Pins 18 and 19 (center macrocells) are permanently configured as combinatorial outputs. Other macrocells can be either inputs or combinatorial outputs with pin feedback to the AND-array. Pins 1 and 13 are regular inputs.

The compiler selects this mode when all outputs are combinatorial without OE control. The following simple PALs can be emulated using this mode:

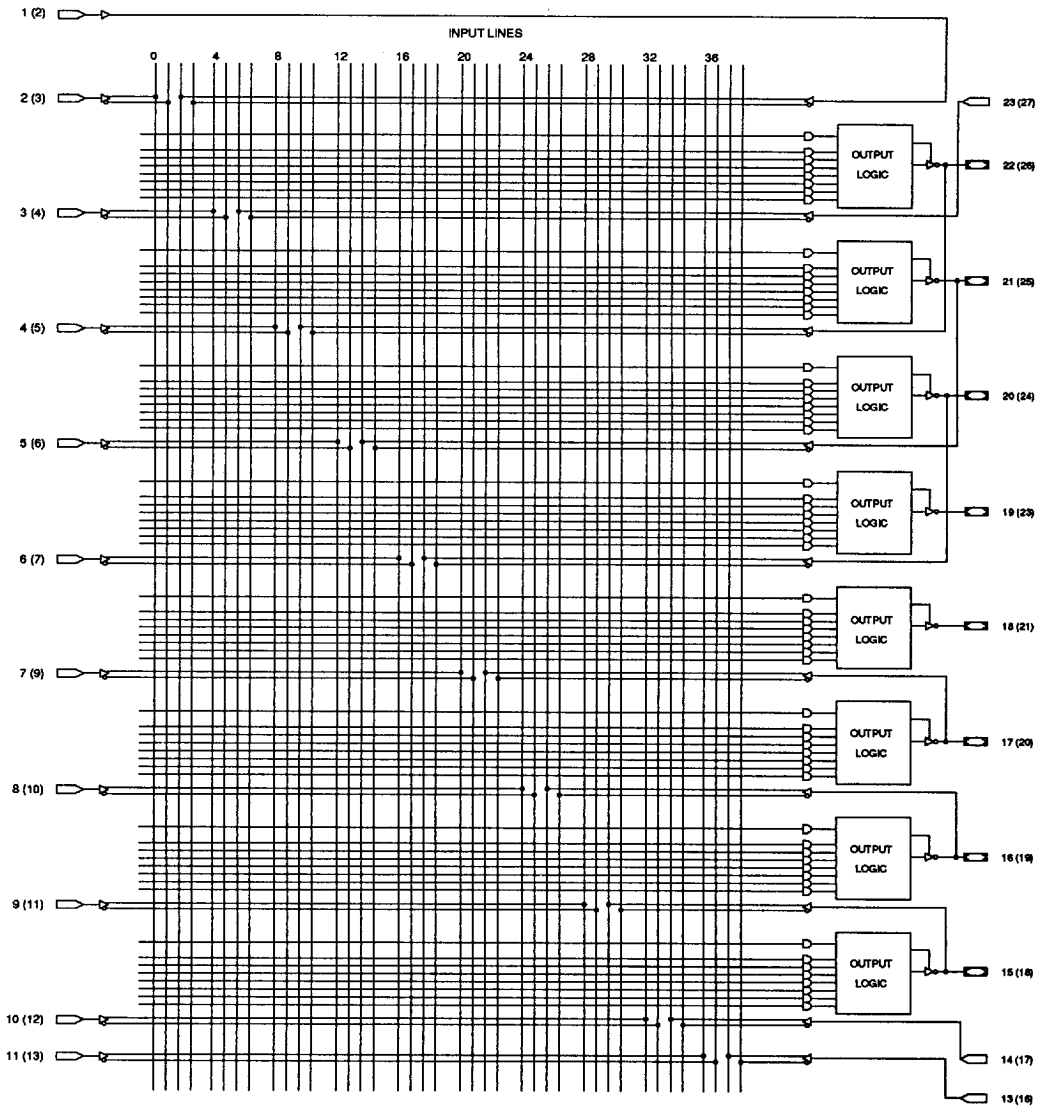
|      |      |      |
|------|------|------|
| 14L8 | 14H8 | 14P8 |
| 16L6 | 16H6 | 16P6 |
| 18L4 | 18H4 | 18P4 |
| 20L2 | 20H2 | 20P2 |

## Simple Mode Option



\* - Pins 18 and 19 are always enabled.

## Simple Mode Logic Diagram



## Ordering Information

| t <sub>PD</sub><br>(ns) | t <sub>s</sub><br>(ns) | t <sub>CO</sub><br>(ns) | Ordering Code                                                    | Package                    | Operation Range                                               |
|-------------------------|------------------------|-------------------------|------------------------------------------------------------------|----------------------------|---------------------------------------------------------------|
| 7.5                     | 5                      | 5                       | ATF20V8B-7GC<br>ATF20V8B-7JC<br>ATF20V8B-7PC                     | 24D3<br>28J<br>24P3        | Commercial<br>(0°C to 70°C)                                   |
| 10                      | 7.5                    | 7                       | ATF20V8B-10GC<br>ATF20V8B-10JC<br>ATF20V8B-10PC<br>ATF20V8B-10SC | 24D3<br>28J<br>24P3<br>24S | Commercial<br>(0°C to 70°C)                                   |
|                         |                        |                         | ATF20V8B-10GI<br>ATF20V8B-10JI<br>ATF20V8B-10PI<br>ATF20V8B-10SI | 24D3<br>28J<br>24P3<br>24S | Industrial<br>(-40°C to 85°C)                                 |
|                         |                        |                         | ATF20V8B-10GM<br>ATF20V8B-10NM                                   | 24D3<br>28L                | Military<br>(-55°C to 125°C)                                  |
|                         |                        |                         | ATF20V8B-10GM/883<br>ATF20V8B-10NM/883                           | 24D3<br>28L                | Military/883C<br>(-55°C to 125°C)<br>Class B, Fully Compliant |
| 15                      | 12                     | 10                      | ATF20V8B-15GC<br>ATF20V8B-15JC<br>ATF20V8B-15PC<br>ATF20V8B-15SC | 24D3<br>28J<br>24P3<br>24S | Commercial<br>(0°C to 70°C)                                   |
|                         |                        |                         | ATF20V8B-15GI<br>ATF20V8B-15JI<br>ATF20V8B-15PI<br>ATF20V8B-15SI | 24D3<br>28J<br>24P3<br>24S | Industrial<br>(-40°C to 85°C)                                 |
|                         |                        |                         | ATF20V8B-15GM<br>ATF20V8B-15NM                                   | 24D3<br>28L                | Military<br>(-55°C to 125°C)                                  |
|                         |                        |                         | ATF20V8B-15GM/883<br>ATF20V8B-15NM/883                           | 24D3<br>28L                | Military/883C<br>(-55°C to 125°C)<br>Class B, Fully Compliant |
| 25                      | 15                     | 12                      | ATF20V8B-25GC<br>ATF20V8B-25JC<br>ATF20V8B-25PC<br>ATF20V8B-25SC | 24D3<br>28J<br>24P3<br>24S | Commercial<br>(0°C to 70°C)                                   |
|                         |                        |                         | ATF20V8B-25GI<br>ATF20V8B-25JI<br>ATF20V8B-25PI<br>ATF20V8B-25SI | 24D3<br>28J<br>24P3<br>24S | Industrial<br>(-40°C to 85°C)                                 |

# Ordering Information

| tPD<br>(ns)              | tS<br>(ns) | tCO<br>(ns)                       | Ordering Code  | Package | Operation Range               |
|--------------------------|------------|-----------------------------------|----------------|---------|-------------------------------|
| 15                       | 12         | 10                                | ATF20V8BL-15GC | 24D3    | Commercial<br>(0°C to 70°C)   |
|                          |            |                                   | ATF20V8BL-15JC | 28J     |                               |
|                          |            |                                   | ATF20V8BL-15PC | 24P3    |                               |
|                          |            |                                   | ATF20V8BL-15SC | 24S     |                               |
|                          |            |                                   | ATF20V8BL-15GI | 24D3    | Industrial<br>(-40°C to 85°C) |
|                          |            |                                   | ATF20V8BL-15JI | 28J     |                               |
|                          |            |                                   | ATF20V8BL-15PI | 24P3    |                               |
|                          |            |                                   | ATF20V8BL-15SI | 24S     |                               |
| ATF20V8BL-15GM           | 24D3       | Military<br>(-55°C to 125°C)      |                |         |                               |
| ATF20V8BL-15NM           | 28L        |                                   |                |         |                               |
| ATF20V8BL-15GM/883       | 24D3       | Military/883C<br>(-55°C to 125°C) |                |         |                               |
| ATF20V8BL-15NM/883       | 28L        |                                   |                |         |                               |
| Class B, Fully Compliant |            |                                   |                |         |                               |

| Package Type |                                                              |
|--------------|--------------------------------------------------------------|
| <b>24D3</b>  | 24 Lead, 0.300" Wide, Ceramic Dual Inline Package (Cerdip)   |
| <b>28J</b>   | 28 Lead, Plastic J-Leaded Chip Carrier (PLCC)                |
| <b>28L</b>   | 28 Pad, Ceramic Leadless Chip Carrier (LCC)                  |
| <b>24P3</b>  | 24 Lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)     |
| <b>24S</b>   | 24 Lead, 0.300" Wide, Plastic Gull Wing Small Outline (SOIC) |

