



# EP900 EPLD

## 24-Macrocell Device

June 1993, ver. 1

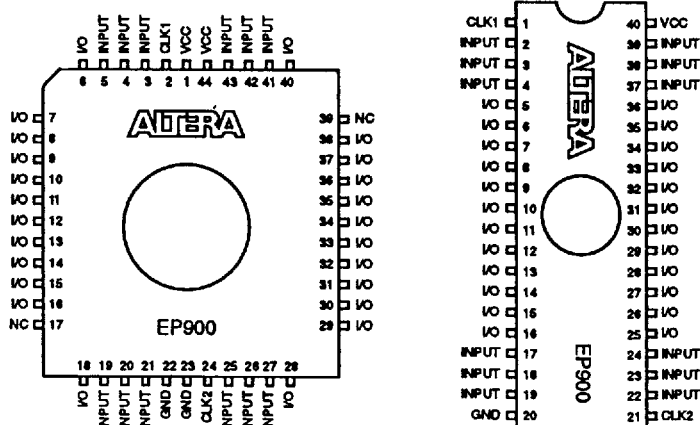
Data Sheet Supplement

## Features

- 24-macrocell Classic EPLD
  - Combinatorial speeds with  $t_{PD} = 50$  ns
  - Counter frequencies up to 20.0 MHz
  - Pipelined data rates up to 23.8 MHz
- Programmable I/O architecture with up to 36 inputs or 24 outputs
- Pin-, function-, and programming file-compatible with Altera's EP910, EP910A, and EP910T devices (see data sheets in the current data book for more information)
- 100% generically testable to provide 100% programming yield
- Programmable Clock option for independent clocking of all registers
- Programmable Security Bit to protect proprietary designs
- Macrocells individually programmable as D, T, JK, or SR flipflops, or for combinatorial operation
- Programming support with Altera's Master Programming Unit (MPU) or programming hardware from other manufacturers
- Available in windowed ceramic and one-time-programmable (OTP) plastic packages (see Figure 1):
  - 40-pin dual in-line packages (CerDIP and PDIP)
  - 44-pin J-lead chip carriers (JLCC and PLCC)

**Figure 1. EP900 Package Pin-Out Diagrams**

*Package outlines not drawn to scale. Windows in ceramic packages only.*



44-Pin J-Lead

40-Pin DIP

**Absolute Maximum Ratings** See *Operating Requirements for EPLDs* in the current data book.

| Symbol    | Parameter                  | Conditions                           | Min  | Max  | Unit |
|-----------|----------------------------|--------------------------------------|------|------|------|
| $V_{CC}$  | Supply voltage             | With respect to GND, <i>Note (1)</i> | -2.0 | 7.0  | V    |
| $V_{PP}$  | Programming supply voltage |                                      | -2.0 | 13.5 | V    |
| $V_I$     | DC input voltage           |                                      | -2.0 | 7.0  | V    |
| $I_{MAX}$ | DC $V_{CC}$ or GND current |                                      | -250 | 250  | mA   |
| $I_{OUT}$ | DC output current, per pin |                                      | -25  | 25   | mA   |
| $P_D$     | Power dissipation          |                                      |      | 1200 | mW   |
| $T_{STG}$ | Storage temperature        | No bias                              | -65  | 150  | °C   |
| $T_{AMB}$ | Ambient temperature        | Under bias                           | -65  | 135  | °C   |

**Recommended Operating Conditions** *Note (2)*

| Symbol   | Parameter             | Conditions         | Min        | Max        | Unit |
|----------|-----------------------|--------------------|------------|------------|------|
| $V_{CC}$ | Supply voltage        |                    | 4.75 (4.5) | 5.25 (5.5) | V    |
| $V_I$    | Input voltage         |                    | 0          | $V_{CC}$   | V    |
| $V_O$    | Output voltage        |                    | 0          | $V_{CC}$   | V    |
| $T_A$    | Operating temperature | For commercial use | 0          | 70         | °C   |
| $T_A$    | Operating temperature | For industrial use | -40        | 85         | °C   |
| $T_C$    | Case temperature      | For military use   | -55        | 125        | °C   |
| $t_R$    | Input rise time       |                    |            | 100 (50)   | ns   |
| $t_F$    | Input fall time       |                    |            | 100 (50)   | ns   |

**DC Operating Conditions** *Notes (2), (3), (4)*

| Symbol    | Parameter                                | Conditions                                                     | Min  | Typ | Max            | Unit |
|-----------|------------------------------------------|----------------------------------------------------------------|------|-----|----------------|------|
| $V_{IH}$  | High-level input voltage                 |                                                                | 2.0  |     | $V_{CC} + 0.3$ | V    |
| $V_{IL}$  | Low-level input voltage                  |                                                                | -0.3 |     | 0.8            | V    |
| $V_{OH}$  | High-level TTL output voltage            | $I_{OH} = -4$ mA DC                                            | 2.4  |     |                | V    |
| $V_{OH}$  | High-level CMOS output voltage           | $I_{OH} = -2$ mA DC                                            | 3.84 |     |                | V    |
| $V_{OL}$  | Low-level output voltage                 | $I_{OL} = 4$ mA DC                                             |      |     | 0.45           | V    |
| $I_I$     | Input leakage current                    | $V_I = V_{CC}$ or GND                                          | -10  |     | 10             | μA   |
| $I_{OZ}$  | Tri-state output off-state current       | $V_O = V_{CC}$ or GND                                          | -10  |     | 10             | μA   |
| $I_{CC1}$ | $V_{CC}$ supply current (standby)        | $V_I = V_{CC}$ or GND, No load, <i>Note (5)</i>                |      | 20  | 150            | μA   |
| $I_{CC2}$ | $V_{CC}$ supply current (non-turbo mode) | $V_I = V_{CC}$ or GND, No load, $f = 1.0$ MHz, <i>Note (6)</i> |      | 6   | 20             | mA   |
| $I_{CC3}$ | $V_{CC}$ supply current (turbo mode)     |                                                                |      | 45  | 80 (100)       | mA   |

**Capacitance**    *Note (7)*

| Symbol    | Parameter             | Conditions                                 | Min | Max | Unit |
|-----------|-----------------------|--------------------------------------------|-----|-----|------|
| $C_{IN}$  | Input capacitance     | $V_{IN} = 0\text{ V}, f = 1.0\text{ MHz}$  |     | 20  | pF   |
| $C_{OUT}$ | Output capacitance    | $V_{OUT} = 0\text{ V}, f = 1.0\text{ MHz}$ |     | 20  | pF   |
| $C_{CLK}$ | Clock pin capacitance | $V_{IN} = 0\text{ V}, f = 1.0\text{ MHz}$  |     | 20  | pF   |

**AC Operating Conditions**    *Note (4)*

|           |                                    |                                        | EP900-2 |     | EP900-3 |     | EP900 |     | Non-Turbo Adder |      |
|-----------|------------------------------------|----------------------------------------|---------|-----|---------|-----|-------|-----|-----------------|------|
| Symbol    | Parameter                          | Conditions                             | Min     | Max | Min     | Max | Min   | Max | <i>Note (8)</i> | Unit |
| $t_{PD1}$ | Input to non-registered output     | $C1 = 35\text{ pF}$                    |         | 45  |         | 50  |       | 55  | 25              | ns   |
| $t_{PD2}$ | I/O input to non-registered output |                                        |         | 50  |         | 55  |       | 60  | 25              | ns   |
| $t_{PZX}$ | Input to output enable             |                                        |         | 50  |         | 55  |       | 60  | 25              | ns   |
| $t_{PXZ}$ | Input to output disable            | $C1 = 5\text{ pF},$<br><i>Note (9)</i> |         | 50  |         | 55  |       | 60  | 25              | ns   |
| $t_{CLR}$ | Asynchronous output clear time     | $C1 = 35\text{ pF}$                    |         | 50  |         | 55  |       | 60  | 25              | ns   |
| $t_{IO}$  | I/O input pad and buffer delay     |                                        |         | 5   |         | 5   |       | 5   | 0               | ns   |

**Global Clock Mode**

|           |                            |                  | EP900-2 |     | EP900-3 |     | EP900 |     | Non-Turbo Adder |      |
|-----------|----------------------------|------------------|---------|-----|---------|-----|-------|-----|-----------------|------|
| Symbol    | Parameter                  | Conditions       | Min     | Max | Min     | Max | Min   | Max | <i>Note (8)</i> | Unit |
| $f_{MAX}$ | Maximum frequency          | <i>Note (10)</i> | 26.3    |     | 23.8    |     | 21.7  |     | 0               | MHz  |
| $t_{SU}$  | Input setup time           |                  | 38      |     | 42      |     | 46    |     | 25              | ns   |
| $t_H$     | Input hold time            |                  | 0       |     | 0       |     | 0     |     | 0               | ns   |
| $t_{CH}$  | Clock high time            |                  | 17.5    |     | 20      |     | 23    |     | 0               | ns   |
| $t_{CL}$  | Clock low time             |                  | 17.5    |     | 20      |     | 23    |     | 0               | ns   |
| $t_{CO1}$ | Clock to output delay      |                  |         | 23  |         | 25  |       | 28  | 0               | ns   |
| $t_{CNT}$ | Minimum clock period       |                  |         | 50  |         | 55  |       | 60  | 0               | ns   |
| $f_{CNT}$ | Internal maximum frequency | <i>Note (6)</i>  | 20.0    |     | 18.2    |     | 16.7  |     | 0               | MHz  |

**Array Clock Mode**

|            |                            |                  | EP900-2 |     | EP900-3 |     | EP900 |     | Non-Turbo Adder |      |
|------------|----------------------------|------------------|---------|-----|---------|-----|-------|-----|-----------------|------|
| Symbol     | Parameter                  | Conditions       | Min     | Max | Min     | Max | Min   | Max | <i>Note (8)</i> | Unit |
| $f_{MAX}$  | Maximum frequency          | <i>Note (10)</i> | 26.3    |     | 23.8    |     | 21.7  |     | 0               | MHz  |
| $t_{ASU}$  | Input setup time           |                  | 13      |     | 14      |     | 15    |     | 25              | ns   |
| $t_{AH}$   | Input hold time            |                  | 15      |     | 15      |     | 15    |     | 0               | ns   |
| $t_{ACH}$  | Clock high time            |                  | 17.5    |     | 20      |     | 23    |     | 0               | ns   |
| $t_{ACL}$  | Clock low time             |                  | 17.5    |     | 20      |     | 23    |     | 0               | ns   |
| $t_{ACO1}$ | Clock to output delay      |                  |         | 48  |         | 53  |       | 59  | 25              | ns   |
| $t_{ACNT}$ | Minimum clock period       |                  |         | 50  |         | 55  |       | 60  | 0               | ns   |
| $f_{ACNT}$ | Internal maximum frequency | <i>Note (6)</i>  | 20.0    |     | 18.2    |     | 16.7  |     | 0               | MHz  |

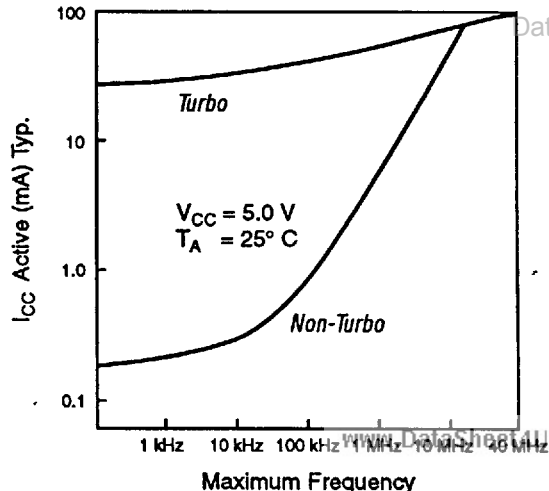
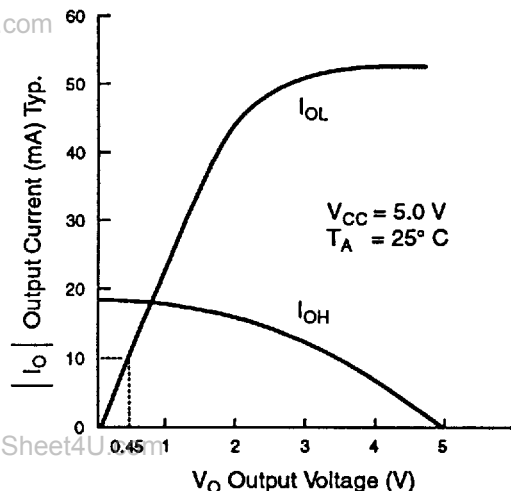
**Notes to tables:**

- (1) The minimum DC input is  $-0.3$  V. During transitions, the inputs may undershoot to  $-2.0$  V or overshoot to  $7.0$  V for periods less than  $20$  ns under no-load conditions.
- (2) Numbers in parentheses are for military- and industrial-temperature-range versions.
- (3) Typical values are for  $T_A = 25^\circ\text{C}$  and  $V_{CC} = 5$  V.
- (4) Operating conditions:  $V_{CC} = 5\text{ V} \pm 5\%$ ,  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$  for commercial use;  
 $V_{CC} = 5\text{ V} \pm 10\%$ ,  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$  for industrial use;  
 $V_{CC} = 5\text{ V} \pm 10\%$ ,  $T_C = -55^\circ\text{C}$  to  $125^\circ\text{C}$  for military use.
- (5) When in non-turbo mode, an EPLD will automatically enter standby mode if logic transitions do not occur approximately  $100$  ns after the last transition.
- (6) Measured with a device programmed as a 24-bit counter.  $I_{CC}$  measured at  $0^\circ\text{C}$ .
- (7) Capacitance measured at  $25^\circ\text{C}$ . Sample-tested only. Clock-pin capacitance for dedicated clock inputs only. Pin CLK2 (high-voltage pin during programming) has a maximum capacitance of  $60$  pF.
- (8) See "Turbo Bit" in the EP910 EPLDs: High Performance, 24-Macrocell Device Data Sheet in the current data book for more information.
- (9) Sample-tested only for an output change of  $500$  mV.
- (10) The  $f_{MAX}$  values represent the highest frequency for pipelined data.

Figure 2 shows the output drive characteristics of EP900 I/O pins and typical supply current ( $I_{CC}$ ) versus frequency for the EP900 EPLD.

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**Figure 2. EP900 Maximum Output Drive Characteristics and  $I_{CC}$  vs. Frequency**



**Data Sheet Supplement****EP900 EPLD: 24-Macrocell Device****Product  
Availability**

| <b>Device Qualification</b>        | <b>Availability</b>     |
|------------------------------------|-------------------------|
| Commercial Temp. (0° C to 70° C)   | EP900-2, EP900-3, EP900 |
| Industrial Temp. (–40° C to 85° C) | Consult factory         |
| Military Temp. (–55° C to 125° C)  | Consult factory         |