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## What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

## Applications of "Embedded - Microcontrollers"

| Details | |
|---|---|
| Product Status | Obsolete |
| Core Processor | Z8 |
| Core Size | 8-Bit |
| Speed | 12MHz |
| Connectivity | - |
| Peripherals | POR, WDT |
| Number of I/O | 14 |
| Program Memory Size | 1KB (1K x 8) |
| Program Memory Type | OTP |
| EEPROM Size | - |
| RAM Size | 125 x 8 |
| Voltage - Supply (Vcc/Vdd) | 4.5V ~ 5.5V |
| Data Converters | - |
| Oscillator Type | Internal |
| Operating Temperature | -40°C ~ 105°C (TA) |
| Mounting Type | Surface Mount |
| Package / Case | 20-SSOP (0.209", 5.30mm Width) |
| Supplier Device Package | - |
| Purchase URL | https://www.e-xfl.com/product-detail/zilog/z86e0412hec1866tr |

## FEATURES

- 14 Input/Output Lines
- Six Vectored, Prioritized Interrupts (3 falling edge, 1 rising edge, 2 timers)
- Two Analog Comparators
- Program Options:
  - Low Noise
  - ROM Protect
  - Auto Latch
  - Watch-Dog Timer (WDT)
  - EPROM/Test Mode Disable
- Two Programmable 8-Bit Counter/Timers, Each with 6-Bit Programmable Prescaler
- WDT/ Power-On Reset (POR)
- On-Chip Oscillator that Accepts XTAL, Ceramic Resonance, LC, RC, or External Clock
- Clock-Free WDT Reset
- Low-Power Consumption (50 mw typical)
- Fast Instruction Pointer (1µs @ 12 MHz)
- RAM Bytes (125)



## PIN DESCRIPTION

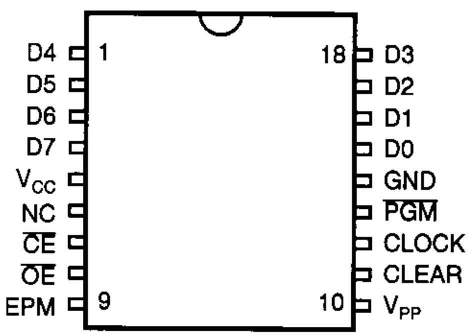



**Figure 3. 18-Pin EPROM Mode Configuration**

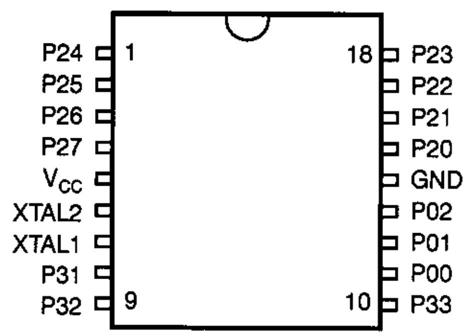



**Figure 4. 18-Pin DIP/SOIC Mode Configuration**

**Table 1. 18-Pin DIP Pin Identification**

| EPROM Programming Mode | | | |
|---|---|---|---|
| **Pin #** | **Symbol** | **Function** | **Direction** |
| 1–4 | D4–D7 | Data 4, 5, 6, 7 | In/Output |
| 5 | $V_{CC}$ | Power Supply | |
| 6 | NC | No Connection | |
| 7 | $\overline{CE}$ | Chip Enable | Input |
| 8 | $\overline{OE}$ | Output Enable | Input |
| 9 | EPM | EPROM Prog Mode | Input |
| 10 | $V_{PP}$ | Prog Voltage | Input |

**Table 2. 18-Pin DIP/SOIC Pin Identification**

| Standard Mode | | | |
|---|---|---|---|
| **Pin #** | **Symbol** | **Function** | **Direction** |
| 1–4 | P24–P27 | Port 2, Pins 4,5,6,7 | In/Output |
| 5 | $V_{CC}$ | Power Supply | |
| 6 | XTAL2 | Crystal Osc. Clock | Output |
| 7 | XTAL1 | Crystal Osc. Clock | Input |
| 8 | P31 | Port 3, Pin 1, AN1 | Input |
| 9 | P32 | Port 3, Pin 2, AN2 | Input |

| Sym | Parameter | $V_{CC}$ [4] | $T_A$ = 0°C to +70°C Min | Max | Typical @ 25°C | Units | Conditions | Notes |
|---|---|---|---|---|---|---|---|---|



## DC ELECTRICAL CHARACTERISTICS (Continued)

| Sym | Parameter | $V_{CC}$ [4] | $T_A$ = 0°C to +70°C Min | Max | Typical @ 25°C | Units | Conditions | Notes |
|---|---|---|---|---|---|---|---|---|
| $I_{CC1}$ | Standby Current (Low Noise Mode) | 4.5V | | 4.0 | 2.5 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 1 MHz | 7 |
| | | 5.5V | | 4.0 | 2.5 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 1 MHz | 7 |
| | | 4.5V | | 4.5 | 2.8 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 2 MHz | 7 |
| | | 5.5V | | 4.5 | 2.8 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 2 MHz | 7 |
| | | 4.5V | | 5.0 | 3.0 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 4 MHz | 7 |
| | | 5.5V | | 5.0 | 3.0 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 4 MHz | 7 |
| $I_{CC2}$ | Standby Current | 4.5V | | 10.0 | 1.0 | µA | STOP Mode $V_{IN}$ = 0V, $V_{CC}$ WDT is not Running | 7,8 |
| | | 5.5V | | 10.0 | 1.0 | µA | STOP Mode $V_{IN}$ = 0V,$V_{CC}$ WDT is not Running | 7,8 |
| $I_{ALL}$ | Auto Latch Low Current | 4.5V | | 32.0 | 16 | µA | $0V < V_{IN} < V_{CC}$ | |
| | | 5.5V | | 32.0 | 16 | µA | $0V < V_{IN} < V_{CC}$ | |
| $I_{ALH}$ | Auto Latch High Current | 4.5V | | –16.0 | –8.0 | µA | $0V < V_{IN} < V_{CC}$ | |
| | | 5.5V | | –16.0 | –8.0 | µA | $0V < V_{IN} < V_{CC}$ | |

**Notes:**

1. Port 2 and Port 0 only
2. $V_{SS}$ = 0V = GND
3. The device operates down to $V_{LV}$ of the specified frequency for $V_{LV}$. The minimum operational $V_{CC}$ is determined on the value of the voltage $V_{LV}$ at the ambient temperature. The $V_{LV}$ increases as the temperature decreases.
4. $V_{CC}$ = 4.5 to 5.5V, typical values measured at $V_{CC}$ = 5.0V

## DC ELECTRICAL CHARACTERISTICS (Continued)

| Sym | Parameter | $V_{CC}$ [4] | $T_A$ = 0°C to +70°C Min | Max | Typical @ 25°C | Units | Conditions | Notes |
|---|---|---|---|---|---|---|---|---|
| $I_{CC1}$ | Standby Current (Low Noise Mode) | 4.5V | | 4.0 | 2.5 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 1 MHz | 7 |

## DC ELECTRICAL CHARACTERISTICS
Extended Temperature

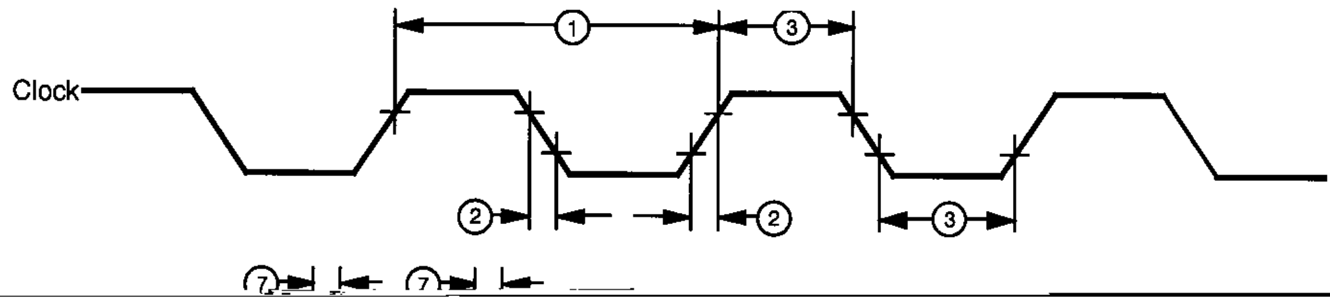
| Sym | Parameter | $V_{CC}$ [4] | $T_A$ = –40°C to +105°C Min | Max | Typical @ 25°C | Units | Conditions | Notes |
|---|---|---|---|---|---|---|---|---|
| $V_{INMAX}$ | Max Input Voltage | 4.5V | | 12.0 | | V | $I_{IN} < 250\ \mu A$ | 1 |
| | | 5.5V | | 12.0 | | V | $I_{IN} < 250\ \mu A$ | 1 |
| $V_{CH}$ | Clock Input High Voltage | 4.5V | 0.8 $V_{CC}$ | $V_{CC}$+0.3 | 2.8 | V | Driven by External Clock Generator | |
| | | 5.5V | 0.8 $V_{CC}$ | $V_{CC}$+0.3 | 2.8 | V | Driven by External Clock Generator | |



## DC ELECTRICAL CHARACTERISTICS (Continued)

| Sym | Parameter | $V_{CC}$ [4] | $T_A$ = –40°C to +105°C Min | Max | Typical @ 25°C | Units | Conditions | Notes |
|---|---|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply Current | 4.5V | | 11.0 | 6.8 | mA | All Output and I/O Pins Floating @ 2 MHz | 5,7 |
| | | 5.5V | | 11.0 | 6.8 | mA | All Output and I/O Pins Floating @ 2 MHz | 5,7 |
| | | 4.5V | | 15.0 | 8.2 | mA | All Output and I/O Pins Floating @ 8 MHz | 5,7 |
| | | 5.5V | | 15.0 | 8.2 | mA | All Output and I/O Pins Floating @ 8 MHz | 5,7 |
| | | 4.5V | | 20.0 | 12.0 | mA | All Output and I/O Pins Floating @ 12 MHz | 5,7 |
| | | 5.5V | | 20.0 | 12.0 | mA | All Output and I/O Pins Floating @ 12 MHz | 5,7 |
| $I_{CC1}$ | Standby Current | 4.5V | | 5.0 | 2.5 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 2 MHz | 5,7 |
| | | 5.5V | | 5.0 | 2.5 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 2 MHz | 5,7 |
| | | 4.5V | | 5.0 | 3.0 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 8 MHz | 5,7 |
| | | 5.5V | | 5.0 | 3.0 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 8 MHz | 5,7 |
| | | 4.5V | | 7.0 | 4.0 | mA | HALT Mode $V_{IN}$ = 0V, $V_{CC}$ @ 12 MHz | 5,7 |
| | | 5.5V | | 7.0 | 4.0 | mA | HALT Mode $V_{IN}$ = 0V, | 5,7 |

# AC ELECTRICAL CHARACTERISTICS



## AC ELECTRICAL CHARACTERISTICS

Timing Table (Standard Mode for SCLK/TCLK = XTAL/2)
Standard Temperature

| 15 | | | | $T_A$ = 0 °C to +70 °C | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 8 MHz | | 12 MHz | | | |
| No | Symbol | Parameter | $V_{CC}$ | Min | Max | Min | Max | Units | Notes |
| 1 | TpC | Input Clock Period | 4.5V | 125 | DC | 83 | DC | ns | 1 |
| | | | 5.5V | 125 | DC | 83 | DC | ns | 1 |
| 2 | TrC,TfC | Clock Input Rise and Fall Times | 4.5V | | 25 | | 15 | ns | 1 |
| | | | 5.5V | | 25 | | 15 | ns | 1 |
| 3 | TwC | Input Clock Width | 4.5V | 62 | | 41 | | ns | 1 |
| | | | 5.5V | 62 | | 41 | | ns | 1 |
| 4 | TwTinL | Timer Input Low Width | 4.5V | 100 | | 100 | | ns | 1 |
| | | | 5.5V | 70 | | 70 | | ns | 1 |
| 5 | TwTinH | Timer Input High Width | 4.5V | 5TpC | | 5TpC | | | 1 |
| | | | 5.5V | 5TpC | | 5TpC | | | 1 |
| 6 | TpTin | Timer Input Period | 4.5V | | 8TpC | 8TpC | | | 1 |
| | | | 5.5V | | 8TpC | 8TpC | | | 1 |
| 7 | TrTin, TtTin | Timer Input Rise and Fall Time | 4.5V | | 100 | | 100 | ns | 1 |
| | | | 5.5V | | 100 | | 100 | ns | 1 |
| 8 | TwIL | Int. Request Input Low Time | 4.5V | 70 | | 70 | | ns | 1,2 |
| | | | 5.5V | 70 | | 70 | | ns | 1,2 |
| 9 | TwIH | Int. Request Input High Time | 4.5V | | 5TpC | 5TpC | | | 1,2 |
| | | | 5.5V | | 5TpC | 5TpC | | | 1,2 |
| 10 | Twdt | Watch-Dog Timer Delay Time for Timeout | 4.5V | 12 | | 12 | | ms | 1 |
| | | | 5.5V | 12 | | 12 | | ms | 1 |
| 11 | Tpor | Power-On Reset Time | 4.5V | 20 | 80 | 20 | 80 | ms | 1 |
| | | | 5.5V | 20 | 80 | 20 | 80 | ms | 1 |

**Notes:**

## LOW NOISE VERSION

### Low EMI Emission

The Z86E04/E08 can be programmed to operate in a Low EMI Emission Mode by means of a mask ROM bit option. Use of this feature results in:

- All pre-driver slew rates reduced to 10 ns typical.
- Internal SCLK/TCLK operation limited to a maximum of 4 MHz–250 ns cycle time.
- Output drivers have resistances of 500 Ohms (typical).
- Oscillator divide-by-two circuitry eliminated.

The Low EMI Mode is mask-programmable to be selected by the customer at the time the ROM code is submitted.

## PIN FUNCTIONS

### OTP Programming Mode

**D7–D0** *Data Bus.* Data can be read from, or written to, the EPROM through this data bus.

**$V_{CC}$** *Power Supply.* It is typically 5V during EPROM Read Mode and 6.4V during the other modes (Program, Program Verify, and so on).

**Clock** *Address Clock.* This pin is a clock input. The internal address counter increases by one with one clock cycle.

**$\overline{PGM}$** *Program Mode* (active Low). A Low level at this pin programs the data to the EPROM through the Data Bus.

### Application Precaution

The production test-mode environment may be enabled

## PIN FUNCTIONS (Continued)

**XTAL1, XTAL2** *Crystal In, Crystal Out* (time-based input and output, respectively). These pins connect a parallel-resonant crystal, LC, or an external single-phase clock (8 MHz or 12 MHz max) to the on-chip clock oscillator and buffer.

**Port 0, P02–P00.** Port 0 is a 3-bit bidirectional, Schmitt-triggered CMOS-compatible I/O port. These three I/O lines can be globally configured under software control to be inputs or outputs (Figure 7).

**Auto Latch.** The Auto Latch puts valid CMOS levels on all CMOS inputs (except P33, P32, P31) that are not externally driven. A valid CMOS level, rather than a floating node, reduces excessive supply current flow in the input buffer. On Power-up and Reset, the Auto Latch will set the ports to an undetermined state of 0 or 1. Default condition is Auto Latches enabled.

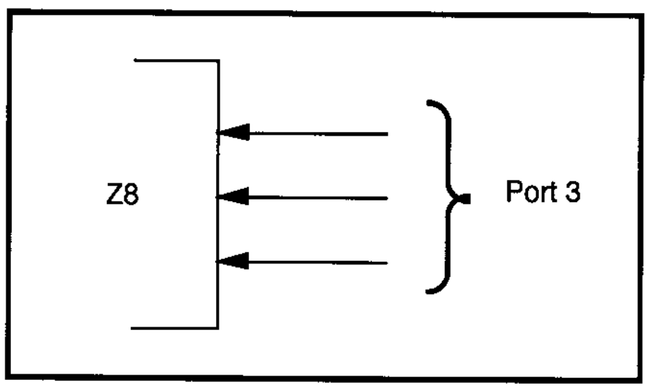
## PIN FUNCTIONS (Continued)

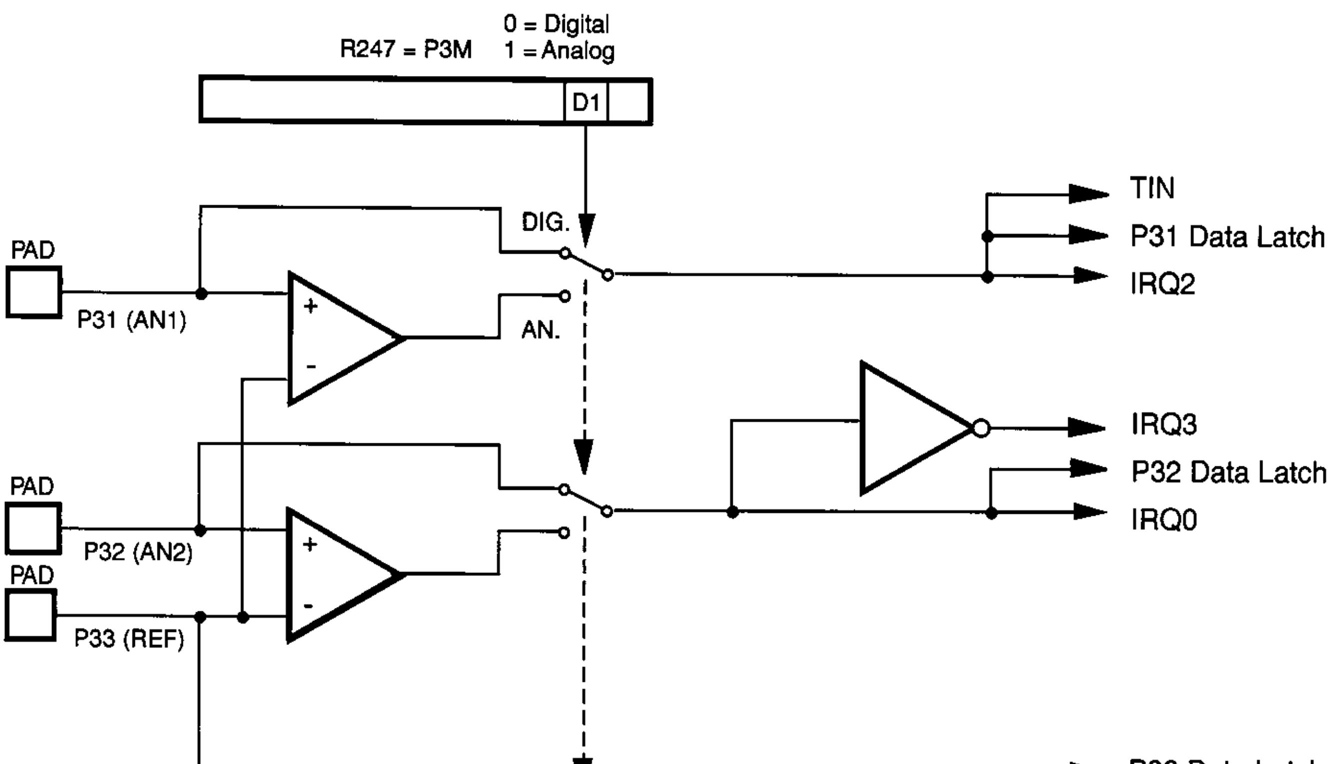
Z86E04/E08
CMOS Z8 OTP Microcontrollers
Zilog

PIN FUNCTIONS (Continued)

**Port 3, P33–P31.** Port 3 is a 3-bit, CMOS-compatible port with three fixed input (P33–P31) lines. These three input lines can be configured under software control as digital Schmitt-trigger inputs or analog inputs.

These three input lines are also used as the interrupt sources IRQ0–IRQ3, and as the timer input signal $T_{IN}$ (Figure 9).



# Z8 CONTROL REGISTERS

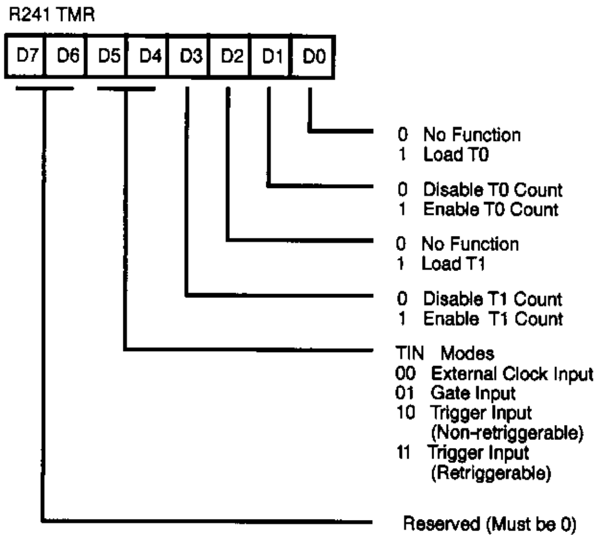
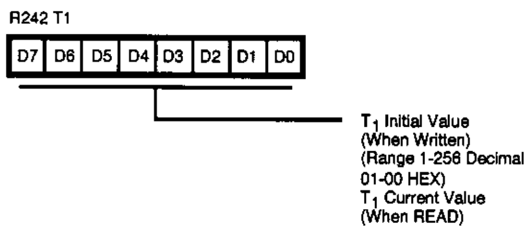



**Figure 24. Timer Mode Register (F1$_H$: Read/Write)**



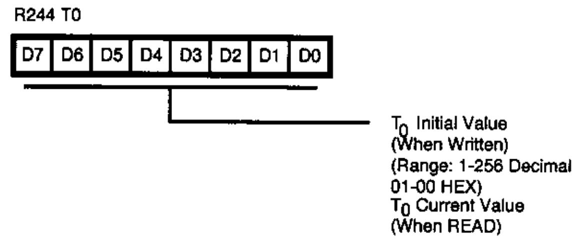




**Figure 27. Counter/Timer 0 Register (F4$_H$: Read/Write)**

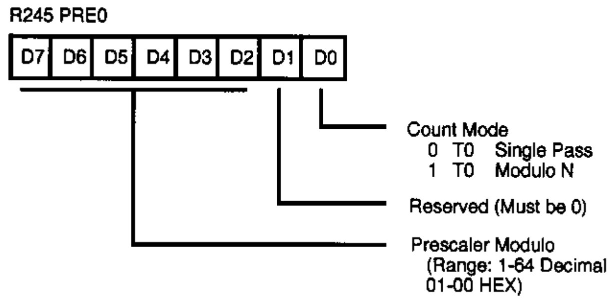



**Figure 28. Prescaler 0 Register (F5$_H$: Write Only)**

**Pre-Characterization Product:**

The product represented by this CPS is newly introduced and Zilog has not completed the full characterization of the found, either by Zilog or its customers in the course of further application and characterization work. In addition