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"[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             | Active  |
| Core Processor             | Z8  |
| Core Size                  | 8-Bit   |
| Speed                      | 16MHz   |
| Connectivity               | -   |
| Peripherals                | POR, WDT  |
| Number of I/O              | 24  |
| Program Memory Size        | 4KB (4K x 8)  |
| Program Memory Type        | OTP   |
| EEPROM Size                | -   |
| RAM Size                   | 237 x 8   |
| Voltage - Supply (Vcc/Vdd) | 4.5V ~ 5.5V   |
| Data Converters            | -   |
| Oscillator Type            | Internal  |
| Operating Temperature      | -40°C ~ 105°C (TA)  |
| Mounting Type              | Through Hole  |
| Package / Case             | 28-DIP (0.600", 15.24mm)  |
| Supplier Device Package    | -   |
| Purchase URL               | <a href="https://www.e-xfl.com/product-detail/zilog/z86e3016peg">https://www.e-xfl.com/product-detail/zilog/z86e3016peg</a> |

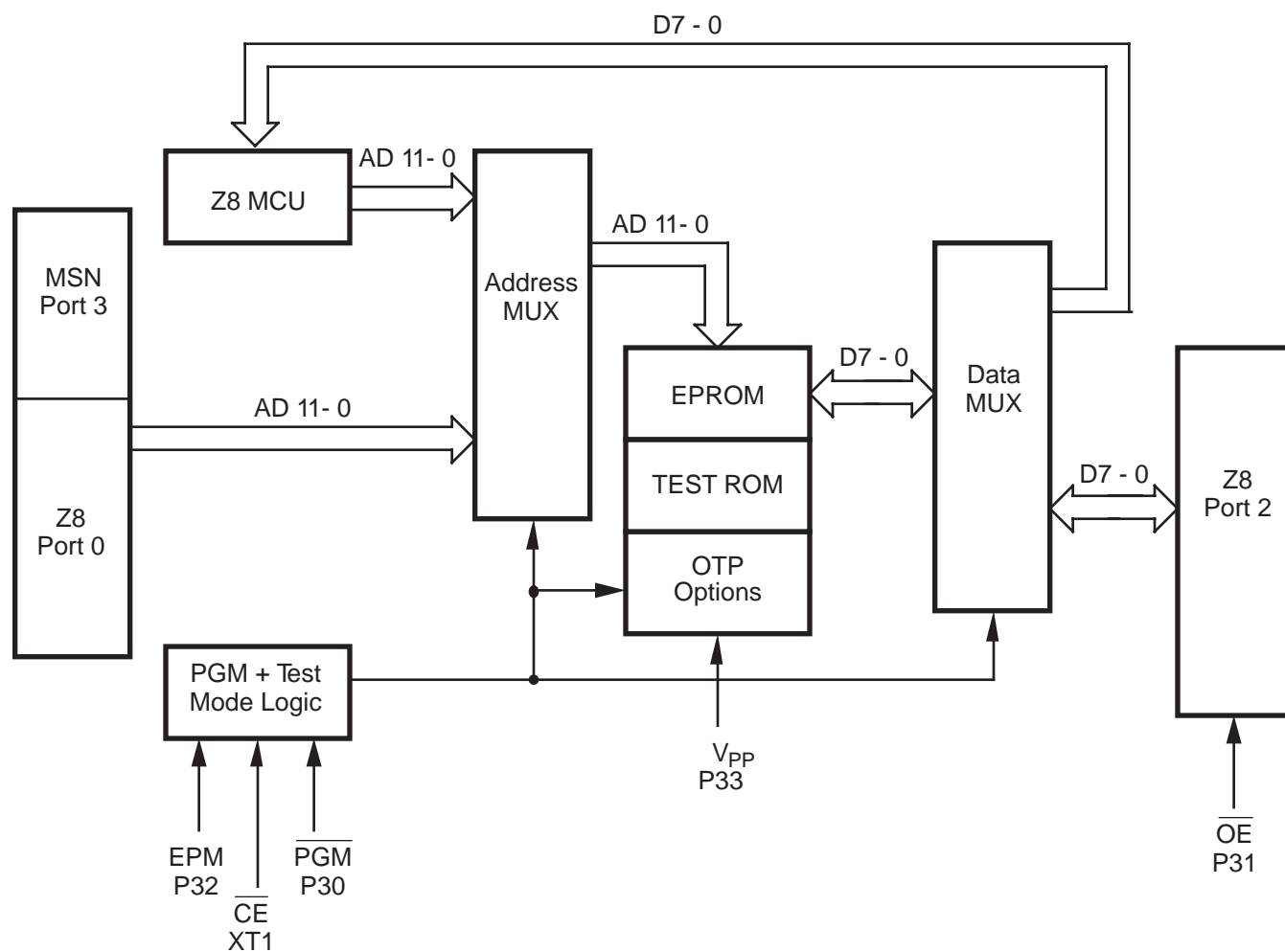


Figure 2. EPROM Programming Block Diagram

PIN IDENTIFICATION (Continued)

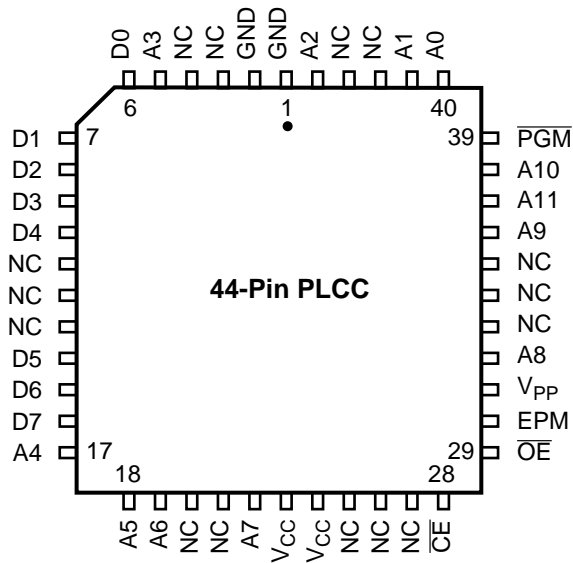


Figure 7. 44-Pin PLCC Pin Configuration  
EPROM Programming Mode

Table 5. 44-Pin PLCC Pin Configuration  
EPROM Programming Mode

| Pin # | Symbol                 | Function         | Direction |
|-------|------------------------|------------------|-----------|
| 1–2   | GND                    | Ground           |           |
| 3–4   | NC                     | No Connection    |           |
| 5     | A3                     | Address 3        | Input     |
| 6–10  | D0–D4                  | Data 0,1,2,3,4   | In/Output |
| 11–13 | NC                     | No Connection    |           |
| 14–16 | D5–D7                  | Data 5,6,7       | In/Output |
| 17–19 | A4–A6                  | Address 4,5,6    | Input     |
| 20–21 | NC                     | No Connection    |           |
| 22    | A7                     | Address 7        | Input     |
| 23–24 | V <sub>CC</sub>        | Power Supply     |           |
| 25–27 | NC                     | No Connection    |           |
| 28    | $\overline{\text{CE}}$ | Chip Select      | Input     |
| 29    | $\overline{\text{OE}}$ | Output Enable    | Input     |
| 30    | EPM                    | EPROM Prog. Mode | Input     |

Table 5. 44-Pin PLCC Pin Configuration  
EPROM Programming Mode

| Pin # | Symbol                  | Function      | Direction |
|-------|-------------------------|---------------|-----------|
| 31    | V <sub>PP</sub>         | Prog. Voltage | Input     |
| 32    | A8                      | Address 8     | Input     |
| 33–35 | NC                      | No Connection |           |
| 36    | A9                      | Address 9     | Input     |
| 37    | A11                     | Address 11    | Input     |
| 38    | A10                     | Address 10    | Input     |
| 39    | $\overline{\text{PGM}}$ | Prog. Mode    | Input     |
| 40–41 | A0,A1                   | Address 0,1   | Input     |
| 42–43 | NC                      | No Connection |           |
| 44    | A2                      | Address 2     | Input     |

PIN IDENTIFICATION (Continued)

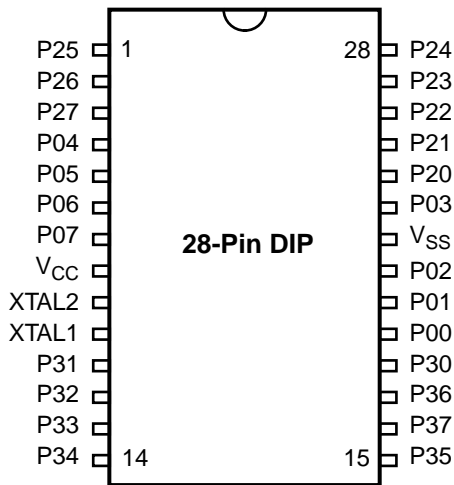


Figure 9. Standard Mode  
28-Pin DIP/SOIC Pin Configuration

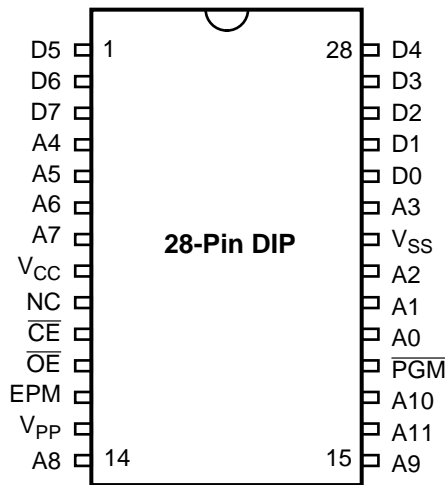


Figure 10. EPROM Programming Mode  
28-Pin DIP/SOIC Pin Configuration

Table 7. 28-Pin DIP/SOIC/PLCC  
Pin Identification\*

| Pin # | Symbol          | Function               | Direction |
|-------|-----------------|------------------------|-----------|
| 1–3   | P25–P27         | Port 2, Pins 5,6,      | In/Output |
| 4–7   | P04–P07         | Port 0, Pins 4,5,6,7   | In/Output |
| 8     | V <sub>CC</sub> | Power Supply           |           |
| 9     | XTAL2           | Crystal Oscillator     | Output    |
| 10    | XTAL1           | Crystal Oscillator     | Input     |
| 11–13 | P31–P33         | Port 3, Pins 1,2,3     | Input     |
| 14–15 | P34–P35         | Port 3, Pins 4,5       | Output    |
| 16    | P37             | Port 3, Pin 7          | Output    |
| 17    | P36             | Port 3, Pin 6          | Output    |
| 18    | P30             | Port 3, Pin 0          | Input     |
| 19–21 | P00–P02         | Port 0, Pins 0,1,2     | In/Output |
| 22    | V <sub>SS</sub> | Ground                 |           |
| 23    | P03             | Port 0, Pin 3          | In/Output |
| 24–28 | P20–P24         | Port 2, Pins 0,1,2,3,4 | In/Output |

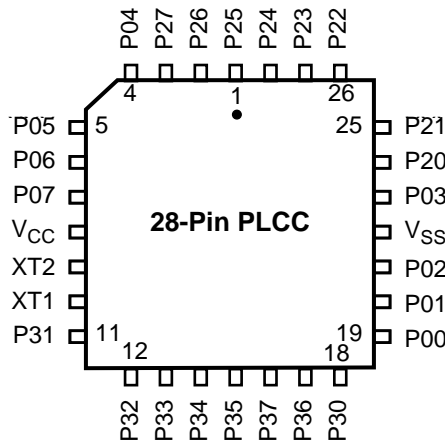


Figure 11. Standard Mode  
28-Pin PLCC Pin Configuration

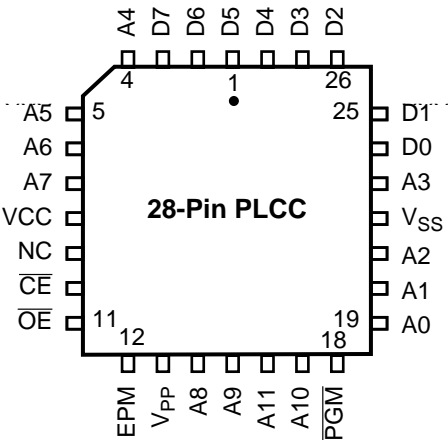


Figure 12. EPROM Programming Mode  
28-Pin PLCC Pin Configuration

Table 8. 28-Pin EPROM  
Pin Identification

| Pin # | Symbol                  | Function         | Direction |
|-------|-------------------------|------------------|-----------|
| 1–3   | D5–D7                   | Data 5,6,7       | In/Output |
| 4–7   | A4–A7                   | Address 4,5,6,7  | Input     |
| 8     | V <sub>CC</sub>         | Power Supply     |           |
| 9     | NC                      | No connection    |           |
| 10    | $\overline{\text{CE}}$  | Chip Select      | Input     |
| 11    | $\overline{\text{OE}}$  | Output Enable    | Input     |
| 12    | EPM                     | EPROM Prog. Mode | Input     |
| 13    | V <sub>PP</sub>         | Prog. Voltage    | Input     |
| 14–15 | A8–A9                   | Address 8,9      | Input     |
| 16    | A11                     | Address 11       | Input     |
| 17    | A10                     | Address 10       | Input     |
| 18    | $\overline{\text{PGM}}$ | Prog. Mode       | Input     |
| 19–21 | A0–A2                   | Address 0,1,2    | Input     |
| 22    | V <sub>SS</sub>         | Ground           |           |
| 23    | A3                      | Address 3        | Input     |
| 24–28 | D0–D4                   | Data 0,1,2,3,4   | In/Output |

## DC ELECTRICAL CHARACTERISTICS (Continued)

| $T_A = -40\text{ }^{\circ}\text{C to } +105\text{ }^{\circ}\text{C}$ |                         |                      |      |     |                   |               |                               |       |
|--|-------------------------|----------------------|------|-----|-------------------|---------------|-------------------------------|-------|
| Sym  | Parameter               | $V_{CC}$<br>Note [3] | Min  | Max | Typical<br>@ 25°C | Units         | Conditions                    | Notes |
| $I_{ALH}$  | Auto Latch High Current | 4.5V                 | -1.0 | -10 | -3.8              | $\mu\text{A}$ | $0\text{V} < V_{IN} < V_{CC}$ | 9     |
|  |                         | 5.5V                 | -1.0 | -10 | -3.8              | $\mu\text{A}$ | $0\text{V} < V_{IN} < V_{CC}$ | 9     |
| $T_{POR}$  | Power On Reset          | 4.5V                 | 2.0  | 14  | 4                 | mS            |                               |       |
|  |                         | 5.5V                 | 2.0  | 14  | 4                 | mS            |                               |       |
| $V_{LV}$   | Auto Reset Voltage      |                      | 2.0  | 3.3 | 2.9               | V             |                               | 1     |

1. Device does function down to the Auto Reset voltage.
2. GND=0V
3. The  $V_{CC}$  voltage specification of 5.5V guarantees  $5.0\text{V} \pm 0.5\text{V}$ .
4. All outputs unloaded, I/O pins floating, inputs at rail.
5. CL1= CL2 = 22 pF
6. Same as note [4] except inputs at  $V_{CC}$ .
7. Maximum temperature is 70°C
8. STD Mode (not Low EMI Mode)
9. Auto Latch (mask option) selected
10. For analog comparator inputs when analog comparators are enabled.
11. Clock must be forced Low, when XTAL1 is clock driven and XTAL2 is floating.
12. Typicals are at  $V_{CC} = 5.0\text{V}$
13. Z86E40 only
14. WDT is not running.

## DC ELECTRICAL CHARACTERISTICS (Continued)

|    |           |  |                      | $T_A = 0^{\circ}\text{C to } 70^{\circ}\text{C}$<br>16 MHz |            |          |       |
|----|-----------|--|----------------------|--|------------|----------|-------|
| No | Symbol    | Parameter  | Note [3]<br>$V_{CC}$ | Min  | Max        | Units    | Notes |
| 1  | TdA(AS)   | Address Valid to $\overline{AS}$ Rise Delay            | 3.5V<br>5.5V         | 25<br>25   |            | ns<br>ns | 2     |
| 2  | TdAS(A)   | $\overline{AS}$ Rise to Address Float Delay            | 3.5V<br>5.5V         | 35<br>35   |            | ns<br>ns | 2     |
| 3  | TdAS(DR)  | $\overline{AS}$ Rise to Read Data Req'd Valid          | 3.5V<br>5.5V         |  | 180<br>180 | ns<br>ns | 1,2   |
| 4  | TwAS      | $\overline{AS}$ Low Width                              | 3.5V<br>5.5V         | 40<br>40   |            | ns<br>ns | 2     |
| 5  | TdAS(DS)  | Address Float to $\overline{DS}$ Fall                  | 3.5V<br>5.5V         | 0<br>0   |            | ns<br>ns |       |
| 6  | TwDSR     | $\overline{DS}$ (Read) Low Width                       | 3.5V<br>5.5V         | 135<br>135   |            | ns<br>ns | 1,2   |
| 7  | TwDSW     | $\overline{DS}$ (Write) Low Width                      | 3.5V<br>5.5V         | 80<br>80   |            | ns<br>ns | 1,2   |
| 8  | TdDSR(DR) | $\overline{DS}$ Fall to Read Data Req'd Valid          | 3.5V<br>5.5V         |  | 75<br>75   | ns<br>ns | 1,2   |
| 9  | ThDR(DS)  | Read Data to $\overline{DS}$ Rise Hold Time            | 3.5V<br>5.5V         | 0<br>0   |            | ns<br>ns | 2     |
| 10 | TdDS(A)   | $\overline{DS}$ Rise to Address Active Delay           | 3.5V<br>5.5V         | 50<br>50   |            | ns<br>ns | 2     |
| 11 | TdDS(AS)  | $\overline{DS}$ Rise to $\overline{AS}$ Fall Delay     | 3.5V<br>5.5V         | 35<br>35   |            | ns<br>ns | 2     |
| 12 | TdR/W(AS) | R/ $\overline{W}$ Valid to $\overline{AS}$ Rise Delay  | 3.5V<br>5.5V         | 25<br>25   |            | ns<br>ns | 2     |
| 13 | TdDS(R/W) | $\overline{DS}$ Rise to R/ $\overline{W}$ Not Valid    | 3.5V<br>5.5V         | 35<br>35   |            | ns<br>ns | 2     |
| 14 | TdDW(DSW) | Write Data Valid to $\overline{DS}$ Fall (Write) Delay | 3.5V<br>5.5V         | 55<br>55   | 25<br>25   | ns<br>ns | 2     |
| 15 | TdDS(DW)  | $\overline{DS}$ Rise to Write Data Not Valid Delay     | 3.5V<br>5.5V         | 35<br>35   |            | ns<br>ns | 2     |
| 16 | TdA(DR)   | Address Valid to Read Data Req'd Valid                 | 3.5V<br>5.5V         |  | 230<br>230 | ns<br>ns | 1,2   |
| 17 | TdAS(DS)  | $\overline{AS}$ Rise to $\overline{DS}$ Fall Delay     | 3.5V<br>5.5V         | 45<br>45   |            | ns<br>ns | 2     |
| 18 | TdDM(AS)  | $\overline{DM}$ Valid to $\overline{AS}$ Fall Delay    | 3.5V<br>5.5V         | 30<br>30   |            | ns<br>ns | 2     |
| 20 | ThDS(AS)  | $\overline{DS}$ Valid to Address Valid Hold Time       | 3.5V<br>5.5V         | 35<br>35   |            | ns<br>ns |       |

### Notes:

1. When using extended memory timing, add 2 TpC.
2. Timing numbers given are for minimum TpC.
3. The  $V_{CC}$  voltage specification of 5.5V guarantees 5.0V  $\pm 0.5V$  and the  $V_{CC}$  voltage specification of 3.5V guarantees only 3.5V

### Standard Test Load

All timing references use 0.7  $V_{CC}$  for a logic 1 and 0.2  $V_{CC}$  for a logic 0.  
For Standard Mode (not Low-EMI Mode for outputs) with SMR D1 = 0, D0 = 0.

## Additional Timing Table

| $T_A = -40\text{ }^{\circ}\text{C to } +105\text{ }^{\circ}\text{C}$ |              |   |                      |      |      |       |            |         |
|--|--------------|---|----------------------|------|------|-------|------------|---------|
| 16 MHz   |              |   |                      |      |      |       |            |         |
| No   | Symbol       | Parameter                                 | $V_{CC}$<br>Note [6] | Min  | Max  | Units | Conditions | Notes   |
| 1  | TpC          | Input Clock Period                        | 3.5V                 | 62.5 | DC   | ns    |            | 1,7,8   |
|  |              |   | 5.5V                 | 62.5 | DC   | ns    |            | 1,7,8   |
| 2  | TrC,TfC      | Clock Input Rise & Fall Times             | 3.5V                 |      | 15   | ns    |            | 1,7,8   |
|  |              |   | 5.5V                 |      | 15   | ns    |            | 1,7,8   |
| 3  | TwC          | Input Clock Width                         | 3.5V                 | 31   |      | ns    |            | 1,7,8   |
|  |              |   | 5.5V                 | 31   |      | ns    |            | 1,7,8   |
| 4  | TwTinL       | Timer Input Low Width                     | 3.5V                 | 70   |      | ns    |            | 1,7,8   |
|  |              |   | 5.5V                 | 70   |      | ns    |            | 1,7,8   |
| 5  | TwTinH       | Timer Input High Width                    | 3.5V                 | 5TpC |      |       |            | 1,7,8   |
|  |              |   | 5.5V                 | 5TpC |      |       |            | 1,7,8   |
| 6  | TpTin        | Timer Input Period                        | 3.5V                 | 8TpC |      |       |            | 1,7,8   |
|  |              |   | 5.5V                 | 8TpC |      |       |            | 1,7,8   |
| 7  | TrTin, TfTin | Timer Input Rise & Fall Timer             | 3.5V                 |      | 100  | ns    |            | 1,7,8   |
|  |              |   | 5.5V                 |      | 100  | ns    |            | 1,7,8   |
| 8A   | TwIL         | Int. Request Low Time                     | 3.5V                 | 70   |      | ns    |            | 1,2,7,8 |
|  |              |   | 5.5V                 | 70   |      | ns    |            | 1,2,7,8 |
| 8B   | TwIL         | Int. Request Low Time                     | 3.5V                 | 5TpC |      |       |            | 1,3,7,8 |
|  |              |   | 5.5V                 | 5TpC |      |       |            | 1,3,7,8 |
| 9  | TwIH         | Int. Request Input High Time              | 3.5V                 | 5TpC |      |       |            | 1,2,7,8 |
|  |              |   | 5.5V                 |      |      |       |            |         |
| 10   | Twsm         | STOP Mode Recovery Width Spec             | 3.5V                 | 12   |      | ns    |            | 4,8     |
|  |              |   | 5.5V                 | 12   |      | ns    |            | 4,8     |
| 11   | Tost         | Oscillator Startup Time                   | 3.5V                 |      | 5TpC |       |            | 4,8     |
|  |              |   | 5.5V                 |      | 5TpC |       |            | 4,8     |
| 12   | Twdt         | Watch-Dog Timer Delay Time Before Timeout | 3.5V                 | 10   |      | ms    | D0 = 0     | 5,11    |
|  |              |   | 5.5V                 | 5    |      | ms    | D1 = 0     | 5,11    |
|  |              |   | 3.5V                 | 20   |      | ms    | D0 = 1     | 5,11    |
|  |              |   | 5.5V                 | 10   |      | ms    | D1 = 0     | 5,11    |
|  |              |   | 3.5V                 | 40   |      | ms    | D0 = 0     | 5,11    |
|  |              |   | 5.5V                 | 20   |      | ms    | D1 = 1     | 5,11    |
|  |              |   | 3.5V                 | 160  |      | ms    | D0 = 1     | 5,11    |
|  |              |   | 5.5V                 | 80   |      | ms    | D1 = 1     | 5,11    |

## Notes:

1. Timing Reference uses 0.7  $V_{CC}$  for a logic 1 and 0.2  $V_{CC}$  for a logic 0.
2. Interrupt request via Port 3 (P31–P33)
3. Interrupt request via Port 3 (P30)
4. SMR-D5 = 1, POR STOP Mode Delay is on
5. Reg. WDTMR
6. The  $V_{CC}$  voltage spec. of 5.5V guarantees 5.0V  $\pm$  0.5V.
7. SMR D1 = 0
8. Maximum frequency for internal system clock is 4 MHz when using XTAL divide-by-one mode.
9. For RC and LC oscillator, and for oscillator driven by clock driver.
10. Standard Mode (not Low EMI output ports)
11. Using internal RC



## PIN FUNCTIONS (Continued)

**Port 1** (P17–P10). Port 1 is an 8-bit, bidirectional, CMOS-compatible port with multiplexed Address (A7–A0) and Data (D7–D0) ports. These eight I/O lines can be programmed as inputs or outputs or can be configured under software control as an Address/Data port for interfacing external memory. The input buffers are Schmitt-triggered and the output buffers can be globally programmed as either push-pull or open-drain. Low EMI output buffers can be globally programmed by the software. Port 1 can be placed under handshake control. In this configuration, Port 3, lines P33 and P34 are used as the handshake controls

RDY1 and /DAV1 (Ready and Data Available). To interface external memory, Port 1 must be programmed for the multiplexed Address/Data mode. If more than 256 external locations are required, Port 0 outputs the additional lines (Figure 19).

Port 1 can be placed in the high-impedance state along with Port 0,  $\overline{AS}$ ,  $\overline{DS}$ , and  $R/\overline{W}$ , allowing the Z86E40 to share common resources in multiprocessor and DMA applications.

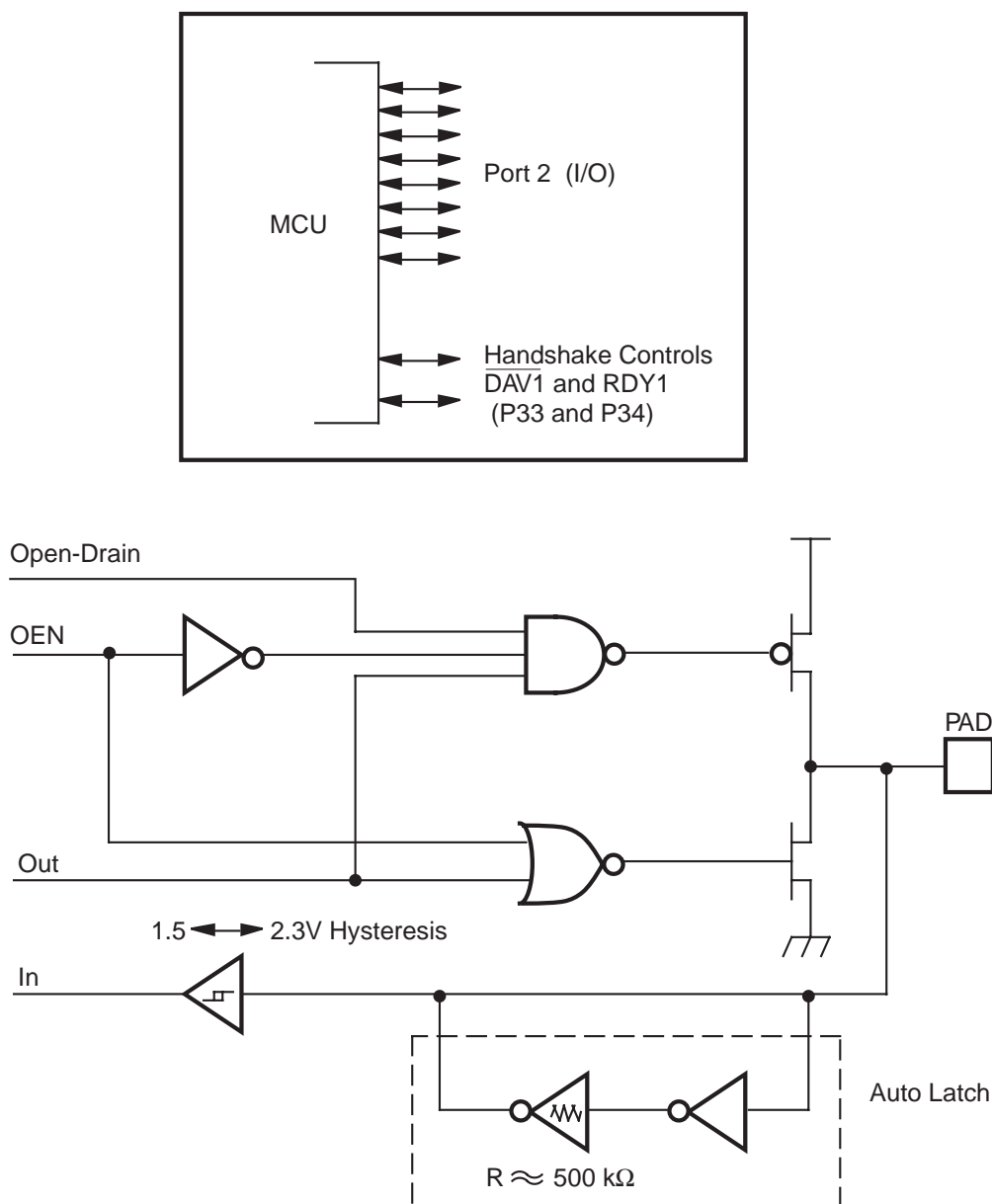


Figure 19. Port 1 Configuration (Z86E40 Only)

**Register File.** The register file consists of three I/O port registers, 236/125 general-purpose registers, 15 control and status registers, and three system configuration registers in the expanded register group. The instructions can access registers directly or indirectly through an 8-bit address field. This allows a short 4-bit register address using the Register Pointer (Figure 24). In the 4-bit mode, the register file is divided into 16 working register groups, each

occupying 16 continuous locations. The Register Pointer addresses the starting location of the active working-register group.

**Note:** Register Bank E0–EF can only be accessed through working register and indirect addressing modes. (This bank is available in Z86E30/E40 only.)

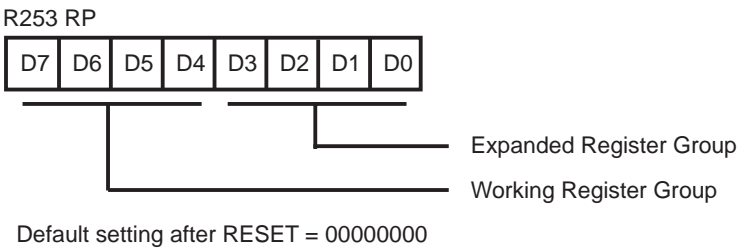


Figure 24. Register Pointer Register

**Expanded Register File (ERF).** The register file has been expanded to allow for additional system control registers, mapping of additional peripheral devices and input/output ports into the register address area. The Z8 register address space R0 through R15 is implemented as 16 groups of 16 registers per group (Figure 26). These register groups are known as the Expanded Register File (ERF).

The low nibble (D3–D0) of the Register Pointer (RP) select the active ERF group, and the high nibble (D7–D4) of register RP select the working register group. Three system configuration registers reside in the Expanded Register File at bank FH: PCON, SMR, and WDTMR. The rest of the Expanded Register is not physically implemented and is reserved for future expansion.

FUNCTIONAL DESCRIPTION (Continued)

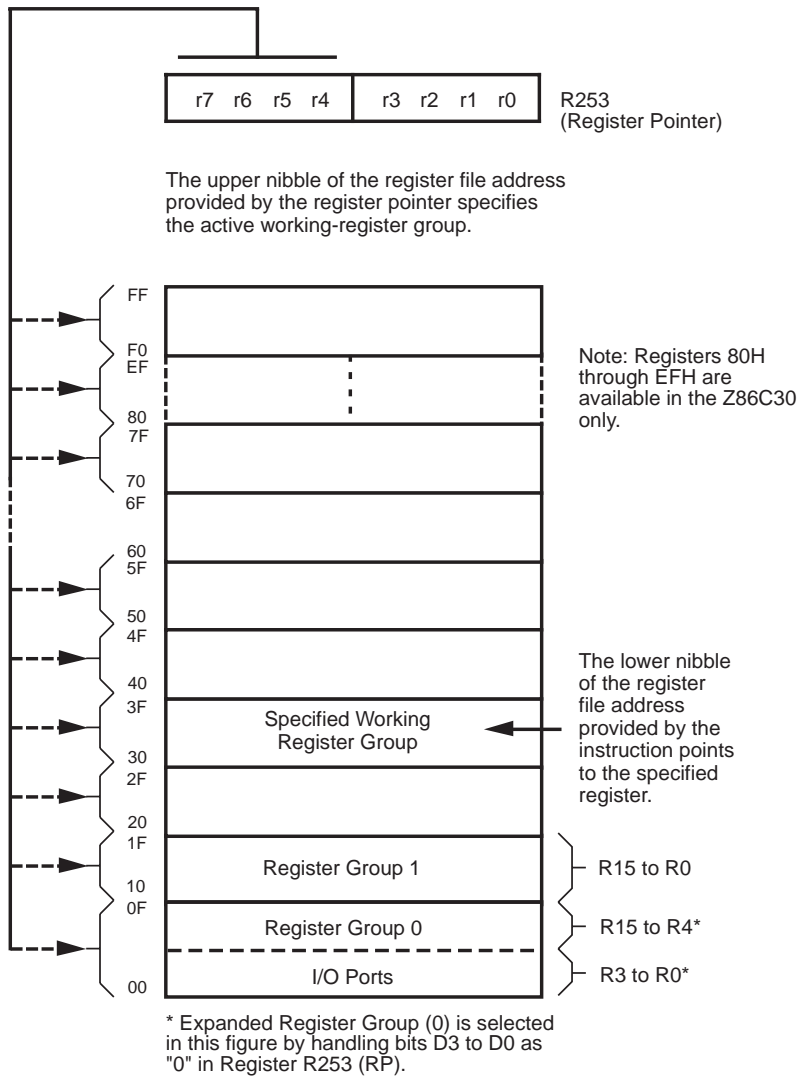


Figure 25. Register Pointer

## FUNCTIONAL DESCRIPTION (Continued)

**General-Purpose Registers (GPR).** These registers are undefined after the device is powered up. The registers keep their last value after any reset, as long as the reset occurs in the  $V_{CC}$  voltage-specified operating range. The register R254 is general-purpose on Z86E30/E31. R254 and R255 are set to 00H after any reset or STOP-Mode Recovery.

**RAM Protect.** The upper portion of the RAM's address spaces 80H to EFH (excluding the control registers) can be protected from reading and writing. This option can be selected during the EPROM Programming Mode. After this option is selected, the user can activate this feature from the internal EPROM. D6 of the IMR control register (R251) is used to turn off/on the RAM protect by loading a 0 or 1, respectively. A "1" in D6 indicates RAM Protect enabled. RAM Protect is not available on the Z86E31.

**Stack.** The Z86E40 external data memory or the internal register file can be used for the stack. The 16-bit Stack Pointer (R254–R255) is used for the external stack, which can reside anywhere in the data memory for ROMless mode, but only from 4096 to 65535 in ROM mode. An 8-bit Stack Pointer (R255) is used for the internal stack on the Z86E30/E31/E40 that resides within the 236 general-purpose registers (R4–R239). SPH (R254) can be used as a general-purpose register when using internal stack only. R254 and R255 are set to 00H after any reset or Stop-Mode Recovery.

**Counter/Timers.** There are two 8-bit programmable counter/timers (T0 and T1), each driven by its own 6-bit programmable prescaler. The T1 prescaler is driven by internal or external clock sources; however, the T0 prescaler is driven by the internal clock only (Figure 27).

The 6-bit prescalers can divide the input frequency of the clock source by any integer number from 1 to 64. Each prescaler drives its counter, which decrements the value (1 to 256), that has been loaded into the counter. When the counter reaches the end of count, a timer interrupt request, IRQ4 (T0) or IRQ5 (T1), is generated.

The counters can be programmed to start, stop, restart to continue, or restart from the initial value. The counters can also be programmed to stop upon reaching zero (single pass mode) or to automatically reload the initial value and continue counting (modulo-n continuous mode).

The counters, but not the prescalers, can be read at any time without disturbing their value or count mode. The clock source for T1 is user-definable and can be either the internal microprocessor clock divided by four, or an external signal input through Port 3. The Timer Mode register configures the external timer input (P31) as an external clock, a trigger input that can be retriggerable or non-retriggerable, or as a gate input for the internal clock. Port 3 line P36 serves as a timer output ( $T_{OUT}$ ) through which T0, T1, or the internal clock can be output. The counter/timers can be cascaded by connecting the T0 output to the input of T1.

FUNCTIONAL DESCRIPTION (Continued)

**Interrupts.** The MCU has six different interrupts from six different sources. The interrupts are maskable and prioritized (Figure 28). The six sources are divided as follows: four sources are claimed by Port 3 lines P33–P30) and two

in counter/timers. The Interrupt Mask Register globally or individually enables or disables the six interrupt requests (Table 10).

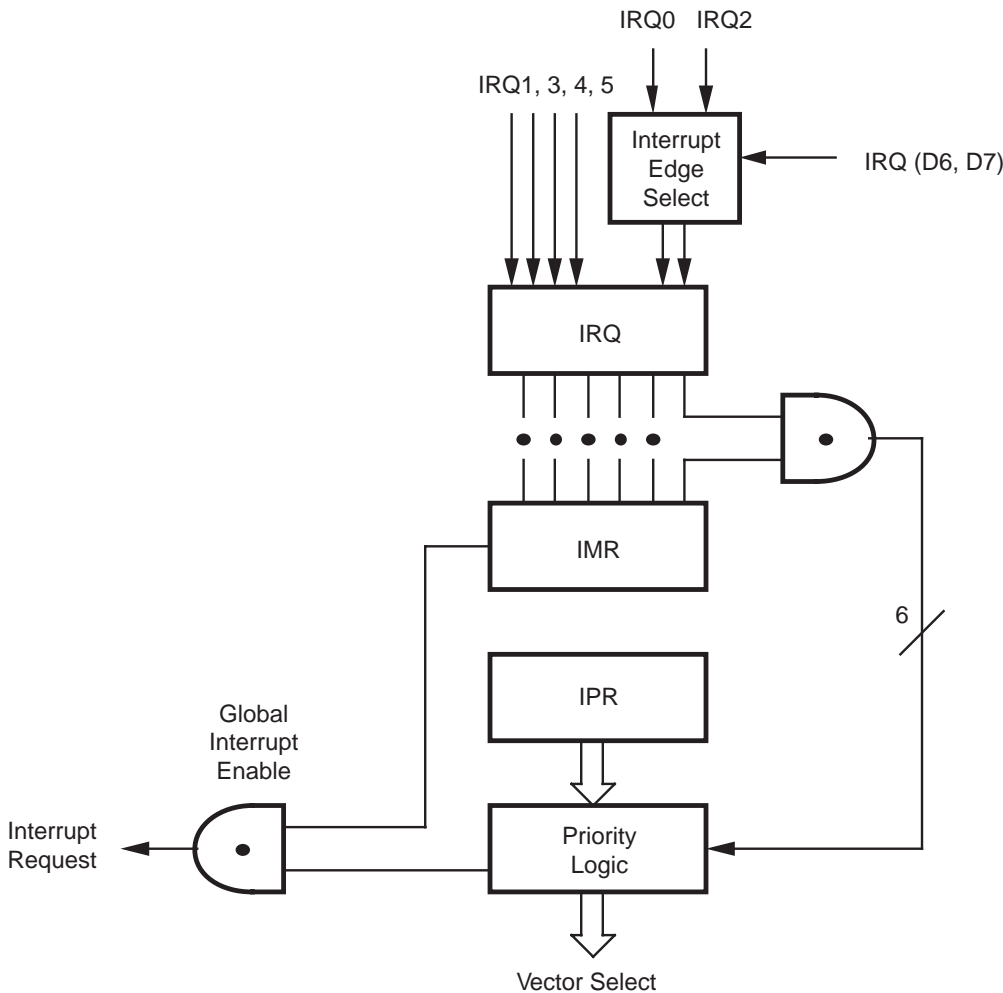


Figure 28. Interrupt Block Diagram

Table 10. Interrupt Types, Sources, and Vectors

| Name | Source                      | Vector Location | Comments                                      |
|------|-----------------------------|-----------------|---|
| IRQ0 | DAV0, IRQ0                  | 0, 1            | External (P32), Rising/Falling Edge Triggered |
| IRQ1 | IRQ1                        | 2, 3            | External (P33), Falling Edge Triggered        |
| IRQ2 | DAV2, IRQ2, T <sub>IN</sub> | 4, 5            | External (P31), Rising/Falling Edge Triggered |
| IRQ3 | IRQ3                        | 6, 7            | External (P30), Falling Edge Triggered        |
| IRQ4 | T0                          | 8, 9            | Internal                                      |
| IRQ5 | T1                          | 10, 11          | Internal                                      |

When more than one interrupt is pending, priorities are resolved by a programmable priority encoder that is controlled by the Interrupt Priority Register (IPR). An interrupt machine cycle is activated when an interrupt request is granted. Thus, disabling all subsequent interrupts, saves the Program Counter and Status Flags, and then branches to the program memory vector location reserved for that interrupt. All interrupts are vectored through locations in the program memory. This memory location and the next byte contain the 16-bit starting address of the interrupt service routine for that particular interrupt request.

To accommodate polled interrupt systems, interrupt inputs are masked and the interrupt request register is polled to determine which of the interrupt requests need service.

An interrupt resulting from AN1 is mapped into IRQ2, and an interrupt from AN2 is mapped into IRQ0. Interrupts IRQ2 and IRQ0 may be rising, falling or both edge triggered, and are programmable by the user. The software may poll to identify the state of the pin.

Programming bits for the Interrupt Edge Select are located in bits D7 and D6 of the IRQ Register (R250). The configuration is shown in Table 11.

Table 11. IRQ Register Configuration

| IRQ |    | Interrupt Edge |     |
|-----|----|----------------|-----|
| D7  | D6 | P31            | P32 |
| 0   | 0  | F              | F   |
| 0   | 1  | F              | R   |
| 1   | 0  | R              | F   |
| 1   | 1  | R/F            | R/F |

Notes:  
F = Falling Edge  
R = Rising Edge

**Clock.** The on-chip oscillator has a high-gain, parallel-resonant amplifier for connection to a crystal, RC, ceramic resonator, or any suitable external clock source (XTAL1 = Input, XTAL2 = Output). The crystal should be AT cut, 10 KHz to 16 MHz max, with a series resistance (RS) less than or equal to 100 Ohms.

The crystal should be connected across XTAL1 and XTAL2 using the vendor's recommended capacitor values from each pin directly to device pin Ground. The RC oscillator option can be selected in the programming mode. The RC oscillator configuration must be an external resistor connected from XTAL1 to XTAL2, with a frequency-setting capacitor from XTAL1 to Ground (Figure 29).

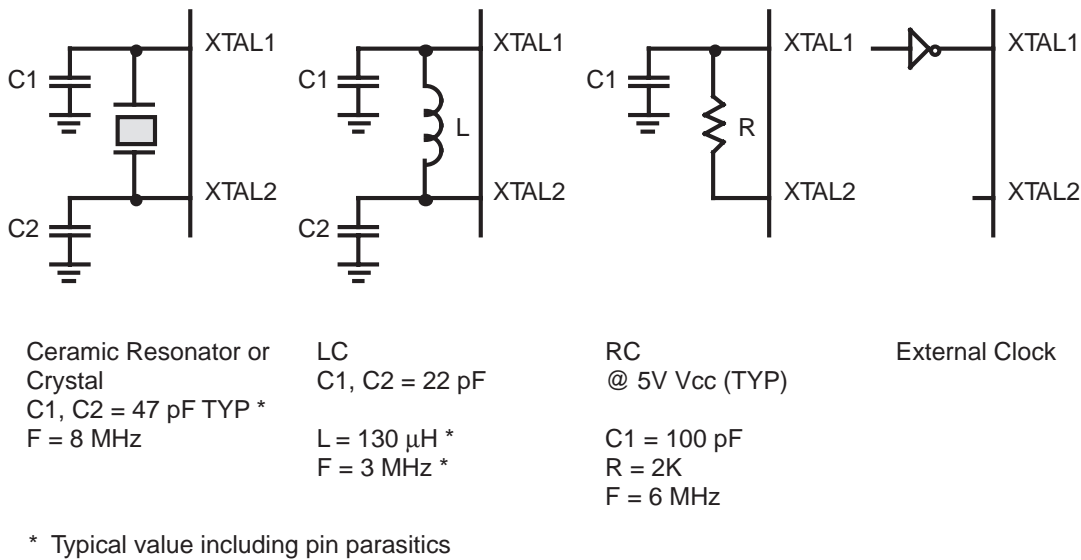


Figure 29. Oscillator Configuration

**Comparator Output Port 3 (D0).** Bit 0 controls the comparator output in Port 3. A “1” in this location brings the comparator outputs to P34 and P37, and a “0” releases the Port to its standard I/O configuration. The default value is 0.

**Port 1 Open-Drain (D1).** Port 1 can be configured as an open-drain by resetting this bit (D1=0) or configured as push-pull active by setting this bit (D1=1). The default value is 1.

**Port 0 Open-Drain (D2).** Port 0 can be configured as an open-drain by resetting this bit (D2=0) or configured as push-pull active by setting this bit (D2=1). The default value is 1.

**Low EMI Port 0 (D3).** Port 0 can be configured as a Low EMI Port by resetting this bit (D3=0) or configured as a Standard Port by setting this bit (D3=1). The default value is 1.

**Low EMI Port 1 (D4).** Port 1 can be configured as a Low EMI Port by resetting this bit (D4=0) or configured as a Standard Port by setting this bit (D4=1). The default value is 1. **Note:** The emulator does not support Port 1 low EMI mode and must be set D4 = 1.

**Low EMI Port 2 (D5).** Port 2 can be configured as a Low EMI Port by resetting this bit (D5=0) or configured as a Standard Port by setting this bit (D5=1). The default value is 1.

**Low EMI Port 3 (D6).** Port 3 can be configured as a Low EMI Port by resetting this bit (D6=0) or configured as a Standard Port by setting this bit (D6=1). The default value is 1.

**Low EMI OSC (D7).** This bit of the PCON Register controls the low EMI noise oscillator. A “1” in this location configures the oscillator with standard drive. While a “0” configures the oscillator with low noise drive, however, it does not affect the relationship of SCLK and XTAL. The low EMI mode will reduce the drive of the oscillator (OSC). The default value is 1. **Note:** 4 MHz is the maximum external clock frequency when running in the low EMI oscillator mode.

**Stop-Mode Recovery Register (SMR).** This register selects the clock divide value and determines the mode of Stop-Mode Recovery (Figure 31). All bits are Write Only except bit 7 which is a Read Only. Bit 7 is a flag bit that is hardware set on the condition of STOP Recovery and reset by a power-on cycle. Bit 6 controls whether a low or high level is required from the recovery source. Bit 5 controls the reset delay after recovery. Bits 2, 3, and 4 of the SMR register specify the Stop-Mode Recovery Source. The SMR is located in Bank F of the Expanded Register Group at address 0BH.

**SCLK/TCLK Divide-by-16 Select (D0).** This bit of the SMR controls a divide-by-16 prescaler of SCLK/TCLK. The purpose of this control is to selectively reduce device power consumption during normal processor execution (SCLK control) and/or HALT mode (where TCLK sources counter/timers and interrupt logic).

**External Clock Divide-by-Two (D1).** This bit can eliminate the oscillator divide-by-two circuitry. When this bit is 0, the System Clock (SCLK) and Timer Clock (TCLK) are equal to the external clock frequency divided by two. The SCLK/TCLK is equal to the external clock frequency when this bit is set (D1=1). Using this bit together with D7 of

PCON further helps lower EMI (i.e., D7 (PCON) = 0, D1 (SMR) = 1). The default setting is zero.

**STOP-Mode Recovery Source (D2, D3, and D4).** These three bits of the SMR register specify the wake up source of the STOP-Mode Recovery (Figure 32). Table 12 shows the SMR source selected with the setting of D2 to D4. P33–P31 cannot be used to wake up from STOP mode when programmed as analog inputs. When the STOP-Mode Recovery sources are selected in this register then SMR2 register bits D0, D1 must be set to zero.

**Note:** If the Port2 pin is configured as an output, this output level will be read by the SMR circuitry.

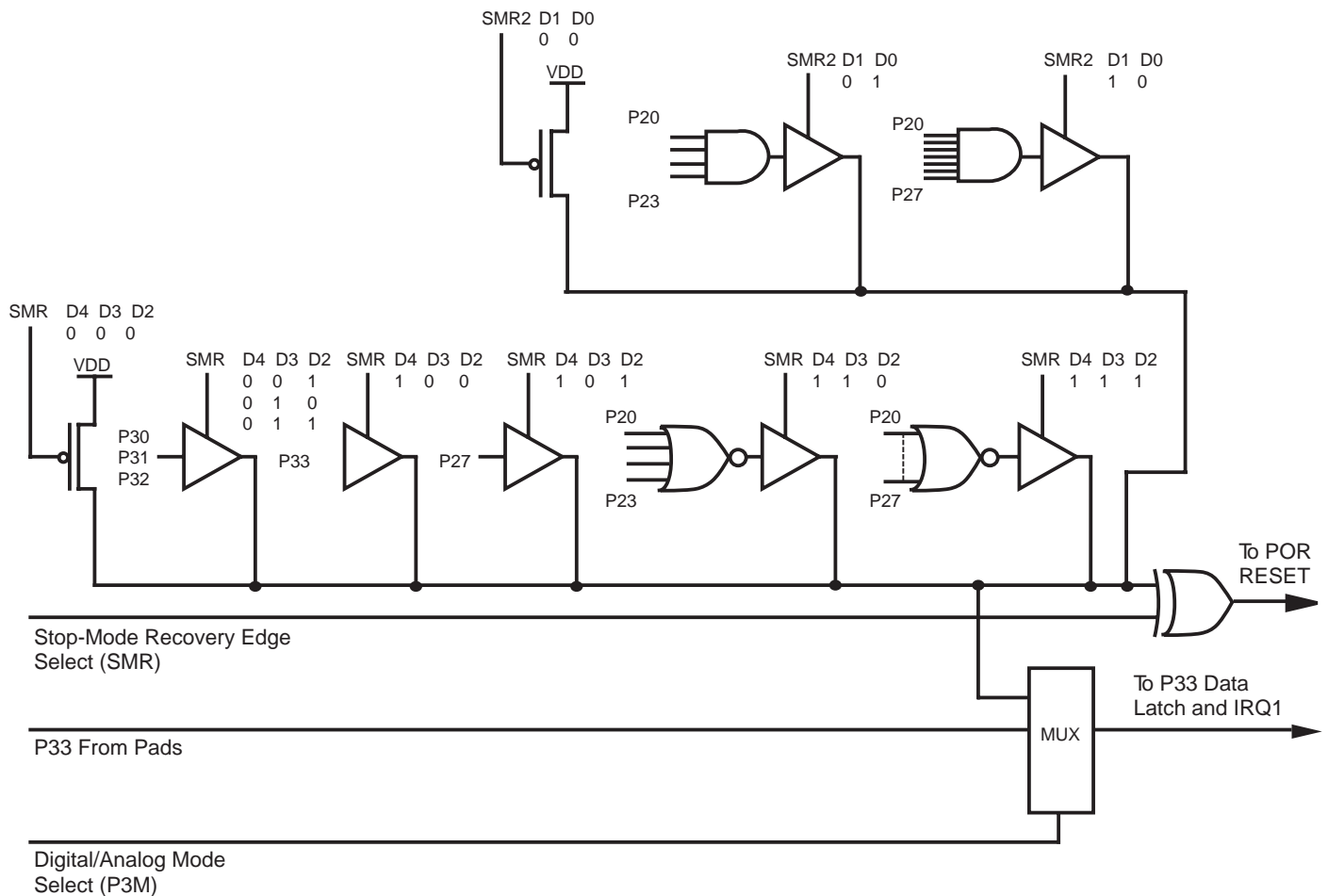
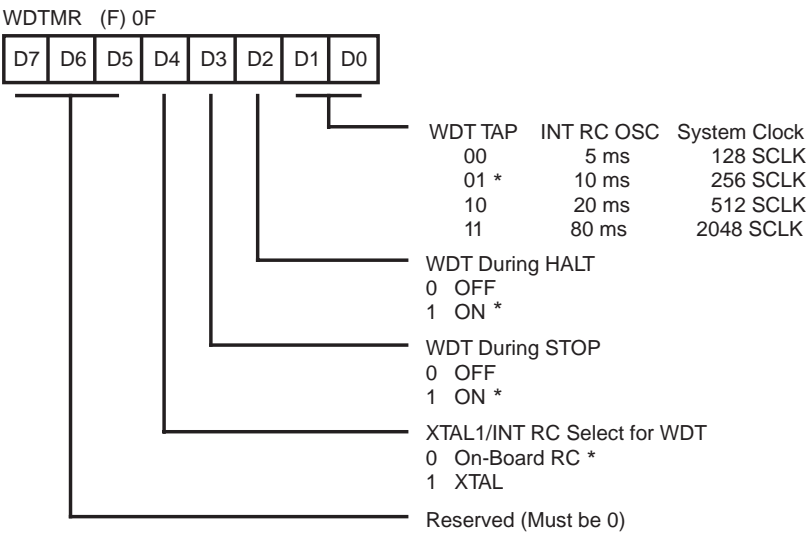


Figure 32. Stop-Mode Recovery Source



cycles from the execution of the first instruction after Power-On Reset, Watch-Dog reset or a STOP-Mode Recovery (Figures 33 and 34). After this point, the register cannot be modified by any means, intentional or

otherwise. The WDTMR cannot be read and is located in Bank F of the Expanded Register Group at address location 0FH.



\* Default setting after RESET

Figure 33. Watch-Dog Timer Mode Register  
Write Only

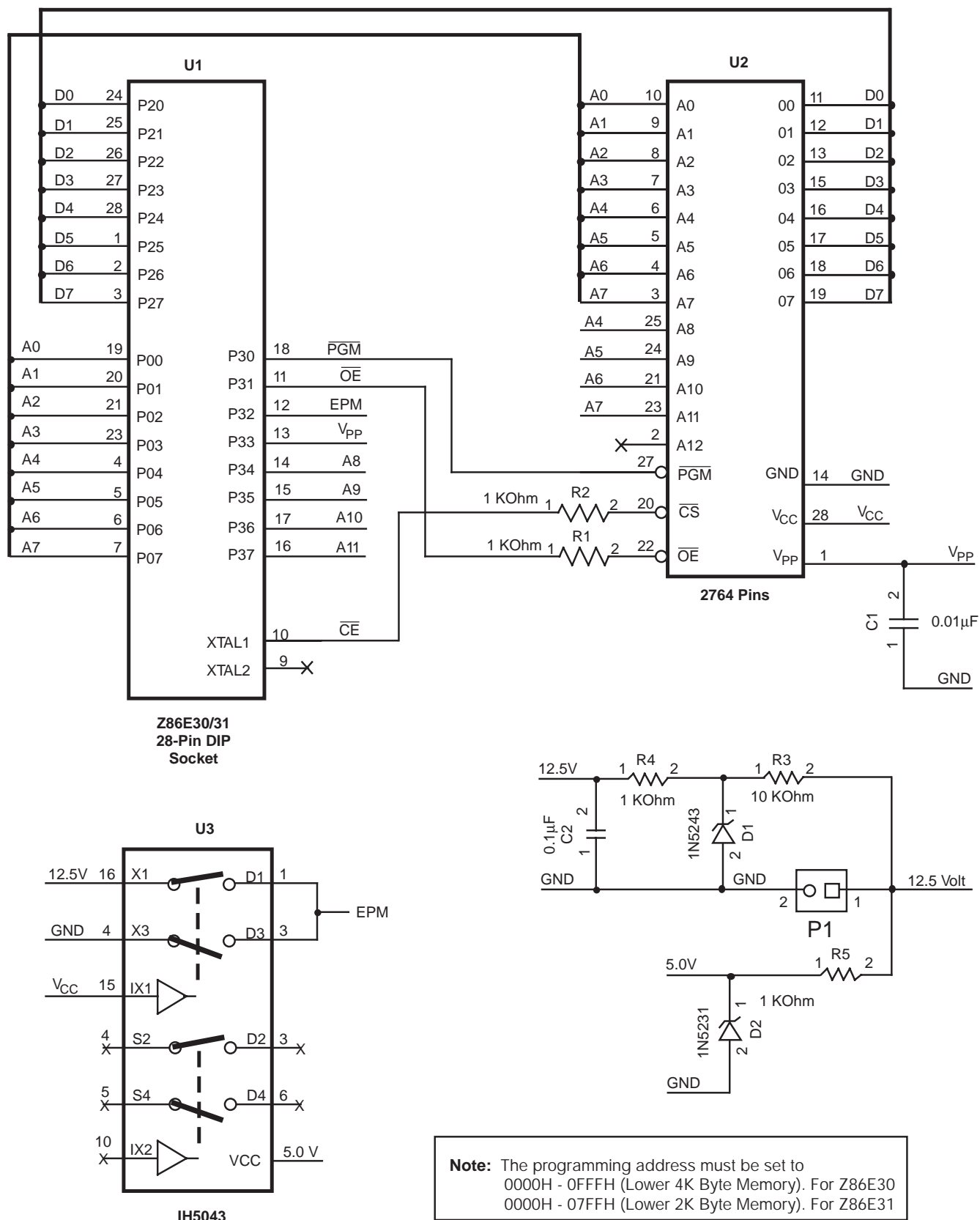


Figure 39. Z86E30/E31 Programming Adapter Circuitry

Z8 CONTROL REGISTER DIAGRAMS (Continued)

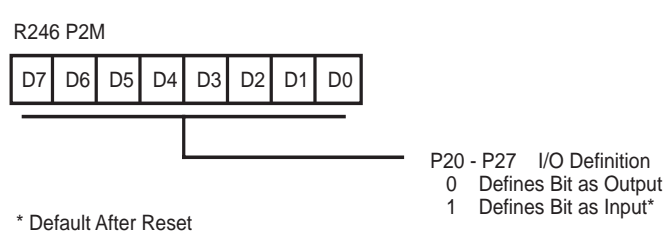


Figure 51. Port 2 Mode Register  
F6H: Write Only

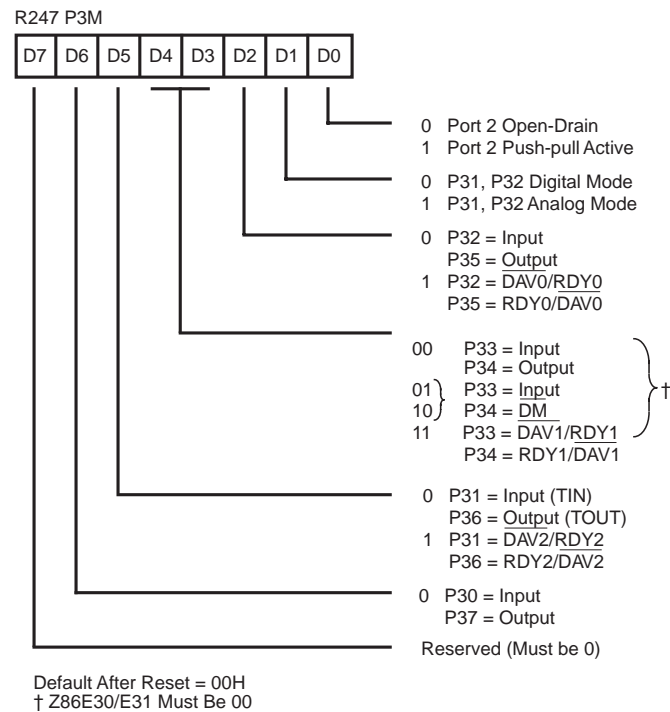


Figure 52. Port 3 Mode Register  
F7H: Write Only

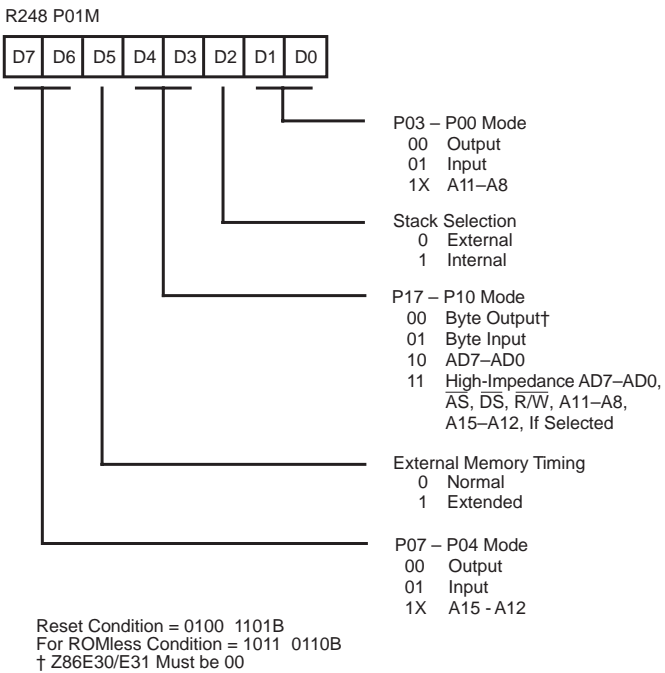


Figure 53. Port 0 and 1 Mode Register  
F8H: Write Only  
Z86E30/E31 Only

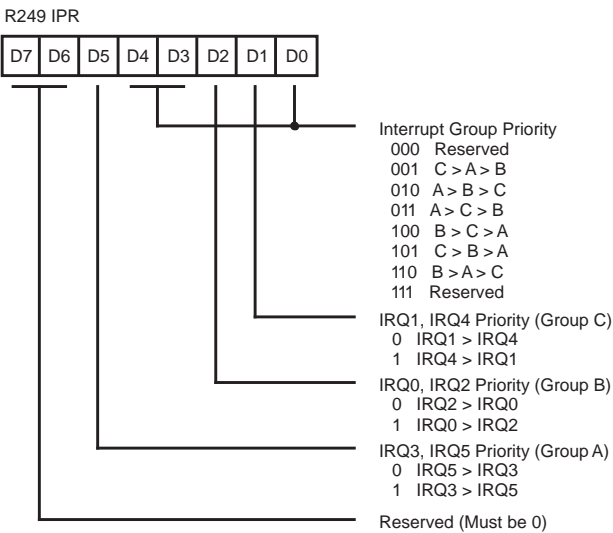
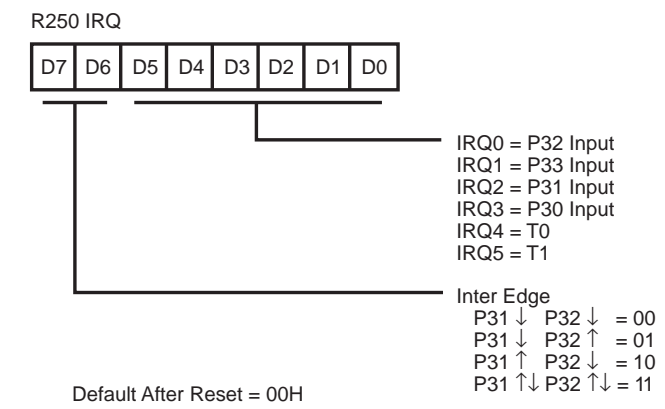
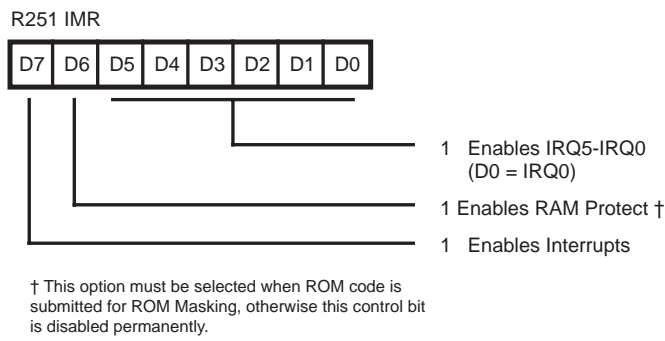


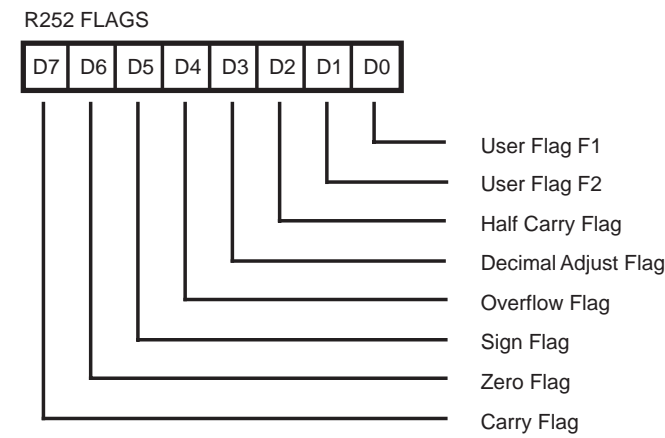
Figure 54. Interrupt Priority Register  
F9H: Write Only



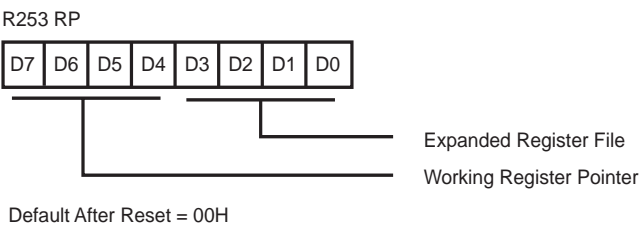
**Figure 55. Interrupt Request Register**  
**FAH: Read/Write**



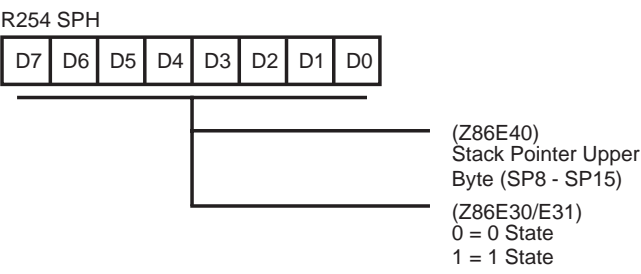
**Figure 56. Interrupt Mask Register**  
**FBH: Read/Write**



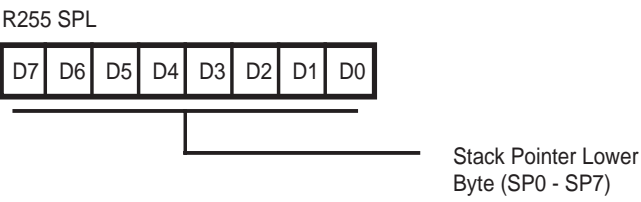
**Figure 57. Flag Register**  
**FCH: Read/Write**



**Figure 58. Register Pointer**  
**FDH: Read/Write**



**Figure 59. Stack Pointer High**  
**FEH: Read/Write**



**Figure 60. Stack Pointer Low**  
**FFH: Read/Write**

## Customer Support

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