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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	8MHz
Connectivity	-
Peripherals	POR, WDT
Number of I/O	14
Program Memory Size	512B (512 x 8)
Program Memory Type	OTP
EEPROM Size	-
RAM Size	61 x 8
Voltage - Supply (Vcc/Vdd)	3.5V ~ 5.5V
Data Converters	-
Oscillator Type	Internal
Operating Temperature	0°C ~ 70°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/z86e0208hsc1925

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Document Disclaimer

Table of Contents

- Low-Power Consumption (50 mΩ typical)
- Fast Instruction Pointer (1.5µs @ 8 MHz)
- RAM Bytes (61)

Connection	Circuit	Device
Power	V_{CC}	V_{DD}
Ground	GND	V_{SS}

BLOCK DIAGRAMS

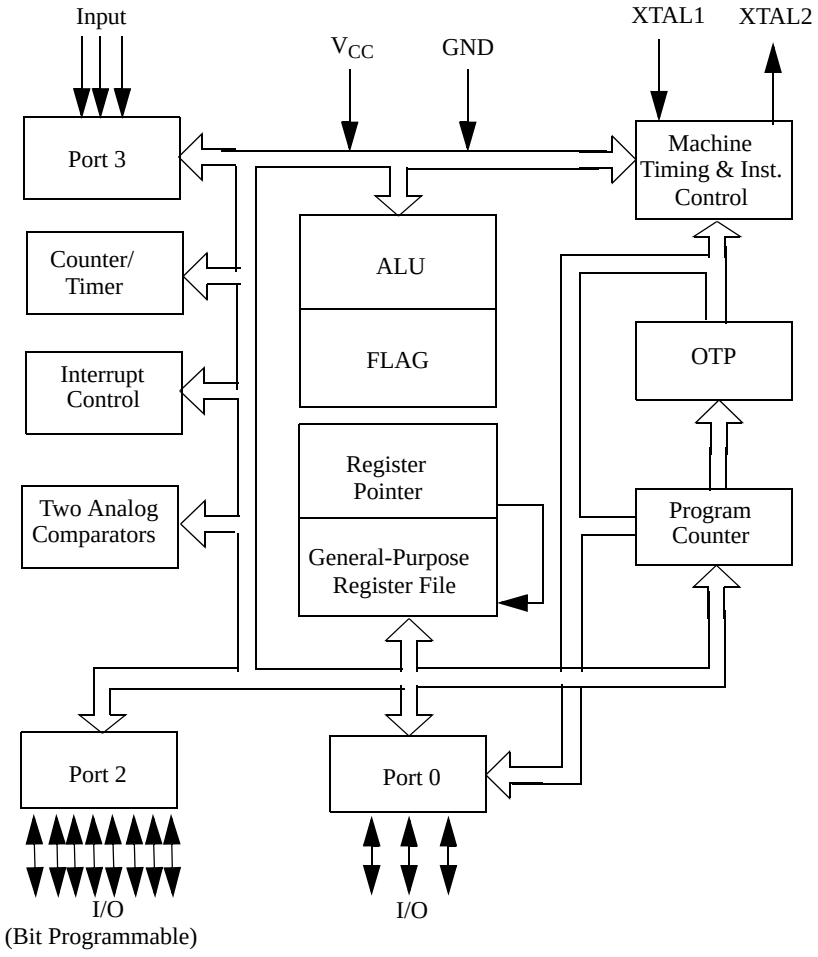


Figure 1. Functional Block Diagram

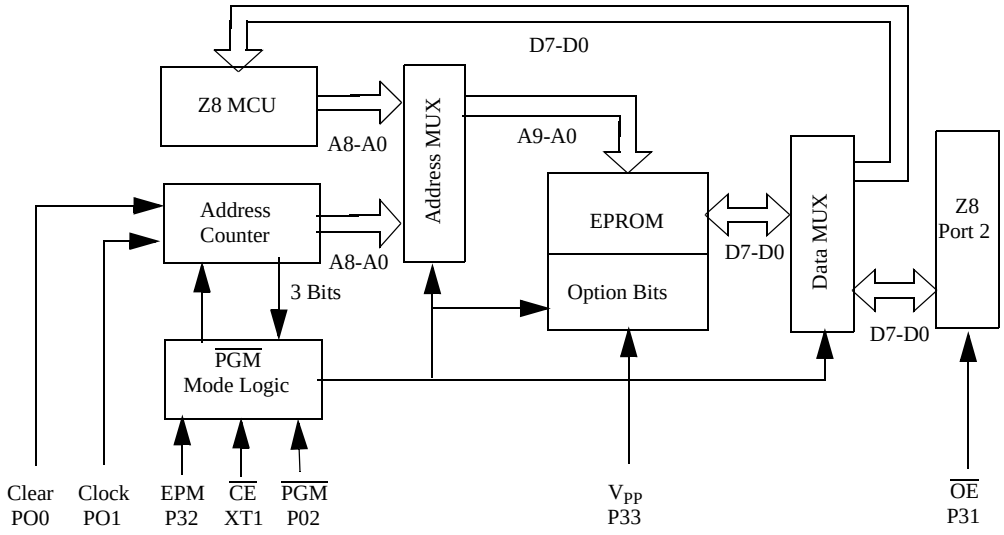


Figure 2. EPROM Programming Mode Block Diagram

PIN DESCRIPTION

Pin diagrams and identification for the device are displayed in Figure 3 through Figure 6, and in Table 2 through Table 5.

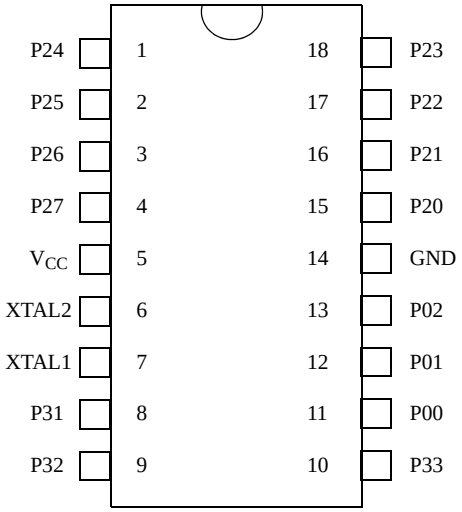


Figure 3. 18-Pin DIP/SOIC Configuration, STANDARD Mode

Table 2. 18-Pin DIP/SOIC Pin Identification, STANDARD Mode

Pin #	Symbol	Function	Direction
1-4	P24-P27	Port 2, Pins 4-7	Input/Output
5	V_{CC}	Power Supply	
6	XTAL2	Crystal Oscillator Clock	Output
7	XTAL1	Crystal Oscillator Clock	Input
8	P31	Port 3, Pin 1 AN1	Input
9	P32	Port 3, Pin 1 AN2	Input
10	P33	Port 3, Pin 3, REF	Input
11-13	P00-P02	Port 0, Pins 0-2	Input/Output
14	GND	Ground	
15-18	P20-P23	Port 2, Pins 0-3	Input/Output

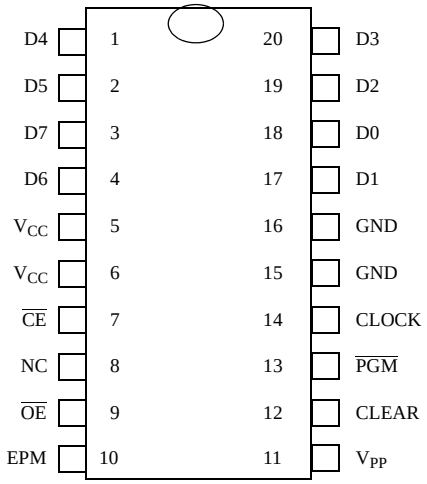


Figure 6. 20-Pin SSOP Pin Configuration, EPROM Mode

Table 5. 20-Pin SSOP Pin Identification, EPROM Mode

Pin #	Symbol	Function	Direction
1-2	D4-D5	Data 4-5	Input/Output
3	D7	Data 7	Input/Output
4	D6	Data 6	Input/Output
5	V_{CC}	Power Supply	
6	V_{CC}	Power Supply	
7	$\overline{CE}$	Chip Enable	Input
8	NC	No Connection	
9	$\overline{OE}$	Output Enable	Input
10	EPM	EPROM Program Mode	Input
11	V_{PP}	Program Voltage	Input
12	CLEAR	Clear Clock	Input
13	$\overline{PGM}$	Program Mode	Input
14	CLOCK	Address	Input
15	GND	Ground	
16	GND	Ground	
17	D1	Data 1	Input/Output
18	D0	Data 0	Input/Output
19-20	D2-D3	Data 2-3	Input/Output

Table 8. DC Characteristics, Standard Temperature Range (Continued)

TA = 0°C to +70°C								
Sym	**Parameter**	**V_{CC}**	**Min**	**Max**	**Typical @ 25°C[1]**	**Units**	**Conditions**	**Notes**
I_{ALH}	Auto Latch High Current	3.5V	-8.0		-1.5	µA	$0V < V_{IN} < V_{CC}$	9
		5.5V	-16.0		-8.0	µA	$0V < V_{IN} < V_{CC}$	9

1. Typical values are read at a V_{CC} of 5.0V and V_{CC} of 3.5V.
2. Port 2, Port 3, and Port 0 only.
3. STANDARD mode (not low EMI mode).
4. These values apply while operating in RUN mode or HALT mode.
5. These values apply while operating in STOP mode.
6. All outputs are unloaded and all inputs are at the V_{CC} or V_{SS} level.
7. If the analog comparator is selected, then the comparator inputs must be at the V_{CC} level.
8. A 10-M pull-up resistor is required in the circuit between the X_{IN} pin to the V_{CC} pin.
9. Auto latches are enabled.
10. Low EMI Mode (not Standard Mode)

Extended Temperature Range

Table 9 provides Direct Current characteristics for the Z86E02 SL1925 microcontroller, at an extended ambient temperature range of -40°C to 105°C.

Table 9. DC Characteristics, Extended Temperature Range

			TA = -40°C to +105°C					
Sym	**Parameter**	**V_{CC}**	**Min**	**Max**	**Typical @ 25°C[1]**	**Units**	**Conditions**	**Notes**
V_{INMAX}	Max Input Voltage	4.5V		12.0		V	$I_{IN} < 250$ µA	2
		5.5V		12.0		V	$I_{IN} < 250$ µA	2
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	
V_{CL}	Clock Input Low Voltage	4.5V	V_{SS}-0.3	0.2 V_{CC}	1.7	V	Driven by External Clock Generator	
		5.5V	V_{SS}-0.3	0.2 V_{CC}	1.7	V	Driven by External Clock Generator	

Table 9. DC Characteristics, Extended Temperature Range (Continued)

			TA = -40°C to +105°C					
Sym	**Parameter**	**V_{CC}**	**Min**	**Max**	**Typical @ 25°C[1]**	**Units**	**Conditions**	**Notes**
I_{CC}	Supply Current	4.5V		7.0	6.8	mA	@ 2 MHz	3,6
		5.5V		7.0	6.8	mA	@ 2 MHz	3,6
		4.5V		11.0	8.2	mA	@ 8 MHz	3,6
		5.5V		11.0	8.2	mA	@ 8 MHz	3,6
I_{CC1}	Standby Current (HALT Mode)	4.5V		3.0	2.5	mA	@ 2 MHz	3,6
		5.5V		3.0	2.5	mA	@ 2 MHz	3,6
		4.5V		5.0	3.0	mA	@ 8 MHz	3,6
		5.5V		5.0	3.0	mA	@ 8 MHz	3,6
I_{CC}	Supply Current (Low EMI Mode)	4.5V		7.0	6.8	mA	@ 1 MHz	6,10
		5.5V		7.0	6.8	mA	@ 1 MHz	6,10
		4.5V		9.0	7.5	mA	@ 2 MHz	6,10
		5.5V		9.0	7.5	mA	@ 2 MHz	6,10
		4.5V		11.0	8.2	mA	@ 4 MHz	6,10
		5.5V		11.0	8.2	mA	@ 4 MHz	6,10
I_{CC1}	Standby Current (HALT and Low EMI Mode)	4.5V		1.6	0.9	mA	@ 1 MHz	6,10
		5.5V		1.6	0.9	mA	@ 1 MHz	6,10
		4.5V		1.9	1.0	mA	@ 2 MHz	6,10
		5,5V		1.9	1.0	mA	@ 2 MHz	6,10
		4.5V		2.4	3.0	mA	@ 4 MHz	6,10
		5.5V		2.4	3.0	mA	@ 4 MHz	6,10
I_{CC2}	Standby Current (Stop mode)	4.5V		20	1.0	µA	WDT is not Running	6,7,8
		5.5V		20	1.0	µA	WDT is not Running	6,7,8
I_{ALL}	Auto Latch Low Current	4.5V		40	16	µA	$0V < V_{IN} < V_{CC}$	9
		5.5V		40	16	µA	$0V < V_{IN} < V_{CC}$	9

Table 10. AC Electrical Characteristics, Standard Mode and Temperature (Continued)

			TA = 0°C to +70°C				
			8MHz				
No	**Symbol**	**Parameter**	**V_{CC}**	**Min**	**Max**	**Units**	**Notes**
4	$T_WT_{IN}L$	Timer Input Low Width	3.5V	100		ns	1
			5.5V	70		ns	1
5	$T_WT_{IN}H$	Timer Input High Width	3.5V	5TpC			1
			5.5V	5TpC			1
6	T_PT_{IN}	Timer Input Period	3.5V	8TpC			1
			5.5V	8TpC			1
7	T_RT_{IN}, T_TT_{IN}	Timer Input Rise and Fall Time	3.5V		100	ns	1
			5.5V		100	ns	1
8	T_WIL	Interrupt Request Input Low Time	3.5V	100		ns	1,2
			5.5V	70		ns	1,2
9	T_WIH	Interrupt Request Input High Time	3.5V	5TpC			1,2
			5.5V	5TpC			1,2
10	T_{WDT}	Watch-Dog Timer Delay Time before Time-out	3.5V	10		ms	
			5.5V	5		ms	
11	T_{POR}	Power-On Reset Time	3.5V	4	36	ms	
			5.5V	2	18	ms	

1. Timing reference is 0.7 V_{CC} for a logic 1 and 0.2 V_{CC} for a logic 0
2. Interrupt request through Port 3 (P33-P31)

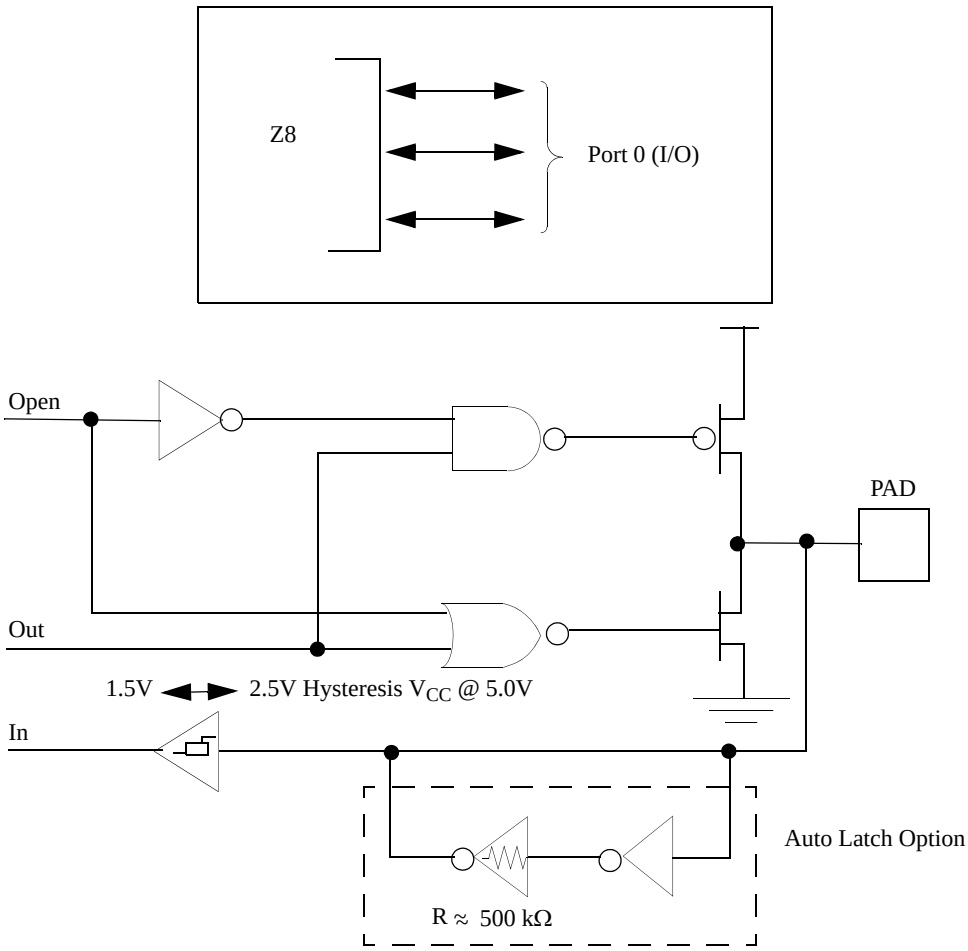


Figure 9. Port 0 Configuration

Port 2, P27–P20. Port 2 is an 8-bit, bit programmable, bidirectional, Schmitt-triggered CMOS-compatible I/O port. These eight I/O lines can be configured under software control to be inputs or outputs, independently. Bits programmed as outputs can be globally programmed as either push-pull or open-drain (Figure 10).

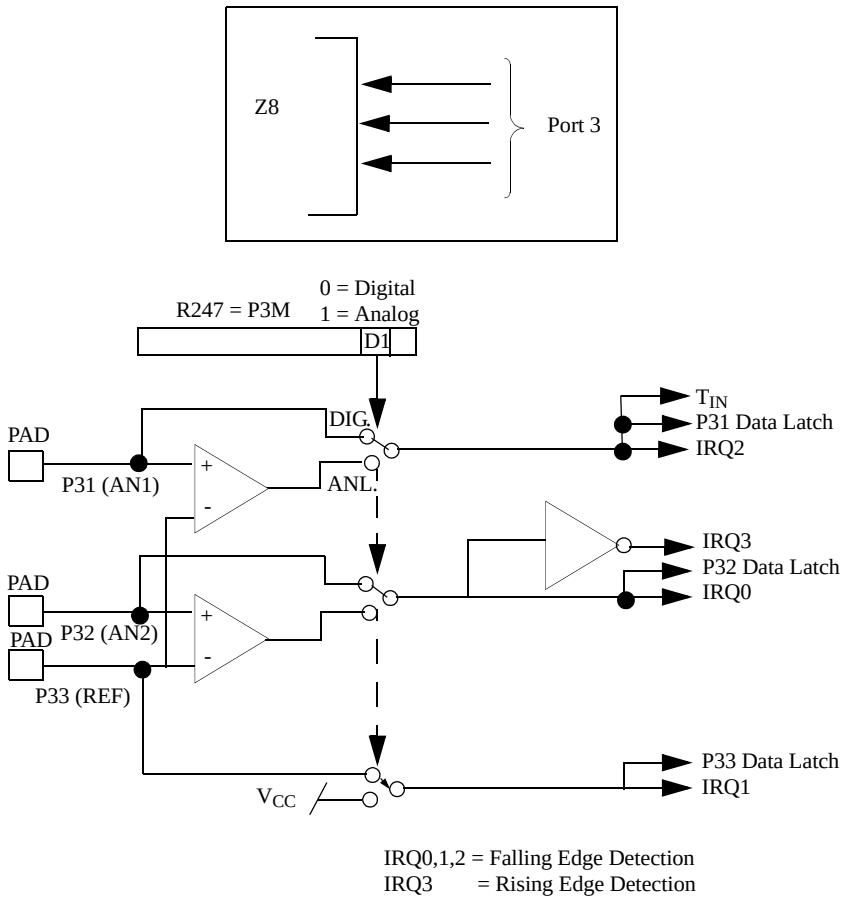


Figure 11. Port 3 Configuration

Comparator Inputs. Two analog comparators are added to input of Port 3, P31, and P32, for interface flexibility. The comparators reference voltage P33 (REF) is common to both comparators.

Typical applications for the on-board comparators; Zero crossing detection, AID conversion, voltage scaling, and threshold detection. In Analog Mode, P33 input functions serve as a reference voltage to the comparators.

The dual comparator (common inverting terminal) features a single power supply which discontinues power in STOP Mode. The common voltage range is 0-4 V when the V_{CC} is 5.0V; the power supply and common mode rejection ratios are 90 dB and 60 dB, respectively.

Interrupts are generated on either edge of Comparator 2's output, or on the falling edge of Comparator 1's output. The comparator output is used for interrupt gener-

ation, Port 3 data inputs, or T_{IN} through P31. Alternatively, the comparators can be disabled, freeing the reference input (P33) for use as IRQ1 and/or P33 input.

The comparator requires two NOPs to be stable after setting the enable bit. ZiLOG recommends that interrupts IRQ0, IRQ1, and IRQ2 be disabled before setting the enable bit. After enabling the comparator, IRQ0, IRQ1, and IRQ2 should be cleared prior to re-enabling the interrupts. ZiLOG also recommends clearing these interrupts when disabling the comparator.

Hardware Work Around on the on the Z86CCP01ZEM Emulator to P32 Rising Edge Digital Interrupt

To emulate the P32 rising edge digital interrupt the emulator must be modified in the following way:

1. Connect P32 by soldering a wire jumper from either emulation socket (P3, pin 17) or (P2, pin 12) to 74HCT04 U27 pin 1.
2. Connect 74HCT04 U27 pin 2 by soldering a wire jumper from U27 pin 2 to P30 on either emulator socket (P3, pin 25) or (P2, pin 18).

Hardware Work Around on the on the Z86CCP01ZEM Emulator to P32 Rising Edge Analog Interrupt

To emulate the P32 rising edge analog interrupt the emulator must be modified in the following way:

1. Connect P32 by soldering a wire jumper from either emulation socket (P2, pin 16) or (P1, pin 23) to 74HCT04 U27 pin 1.
2. Connect 74HCT04 U27 pin 2 by soldering a wire jumper from U27 pin 2 to P30 on either emulator socket (P3, pin 25) or (P2, pin 18).

The following routine must be added to the initialization of the device:

```
HSWP32AFIX      Push RP
                LD RP, #0Fh
                LD R0, #0FFh
                POP RP
```

Table 14. Z8® Control Registers Reset Values*

		Reset Condition								
Address	**Register**	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**Dl**	**D0**	**Comments**
FFh	SPL	0	0	0	0	0	0	0	0	
FDh	RP	0	0	0	0	0	0	0	0	
FCh	FLAGS	U	U	U	U	U	U	U	U	
FBh	IMR	0	U	U	U	U	U	U	U	
FAh	IRQ	U	U	0	0	0	0	0	0	IRQ3 is used for positive edge detection
F9h	IPR	U	U	U	U	U	U	U	U	
F8h*	P01M	U	U	U	0	U	1	0	1	
F7h*	P3M	U	U	U	0	U	U	0	0	
F6h*	P2M	1	1	1	1	1	1	1	1	Inputs after reset
F3h	PRE1	U	U	U	0	U	U	0	0	
F2h	T1	U	U	U	0	U	U	U	U	
F1h	TMR	0	0	0	0	0	0	0	0	

Note: Registers are not reset after a Stop-Mode Recovery using P27 pin. A subsequent reset causes these control registers to be reconfigured as indicated in Table 14 and the user must avoid bus contention on the port pins or it may affect device reliability

A timer circuit clocked by a dedicated on-board RC oscillator is used for a POR timer function. The POR time allows V_{CC} and the oscillator circuit to stabilize before instruction execution begins. The POR timer circuit is a one-shot timer triggered by one of the four following conditions:

- Power-bad to power-good status
- Stop-Mode Recovery
- WDT time-out
- WDH time-out (in Halt mode)

Watch-Dog Timer Reset

The WDT is a retriggerable one-shot timer that resets the Z8® if it reaches its terminal count. The WDT is initially enabled by executing the WDT instruction and is retriggered on subsequent execution of the WDT instruction. The timer circuit is driven by an on-board RC oscillator.

Counter/Timer

There is one 8-bit programmable counter/timer (T1), driven by its own 6-bit programmable prescaler. The T1 prescaler is driven by internal or external clock sources (Figure 16).

The 6-bit prescaler 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 is loaded into the counter. When both counter and prescaler reach the end of count, a timer interrupt request IRQ5 (T1) is generated.

The counter can be programmed to start, stop, restart to continue, or restart from the initial value. The counters are also programmed to stop upon reaching zero (SINGLE-PASS mode) or to automatically reload the initial value and continue counting (MODULO-N CONTINUOUS mode).

The counter, but not the prescaler, are read at any time without disturbing their value or count mode. The clock source for T1 is user-definable and is 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 is retriggerable or non-retriggerable, or used as a gate input for the internal clock.

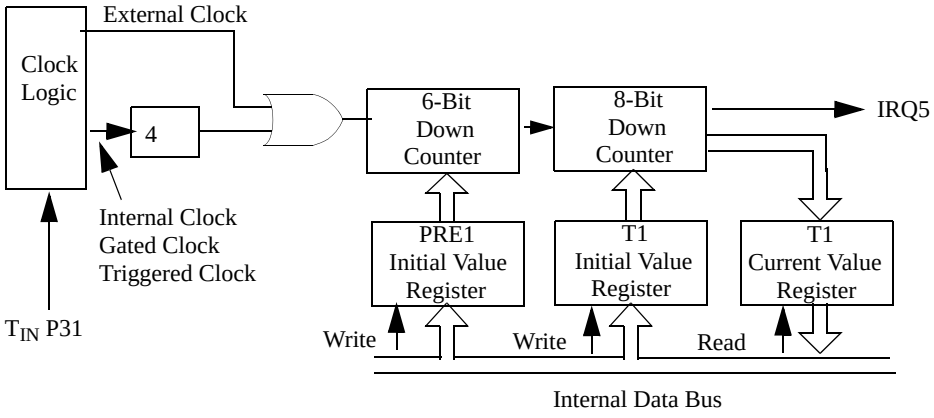


Figure 16. Counter/Timer Block Diagram

Interrupts

The Z8® features six interrupts from six different sources. These interrupts are maskable and prioritized (Figure 17). The sources are divided as follows: the falling edge of P31 (AN 1), P32 (AN2), P33 (REF), the rising edge of P32 (AN2), by software, and one counter/timer. The Interrupt Mask Register globally or individually enables or disables the six interrupt requests (Interrupt Types, Sources, and Vectors).

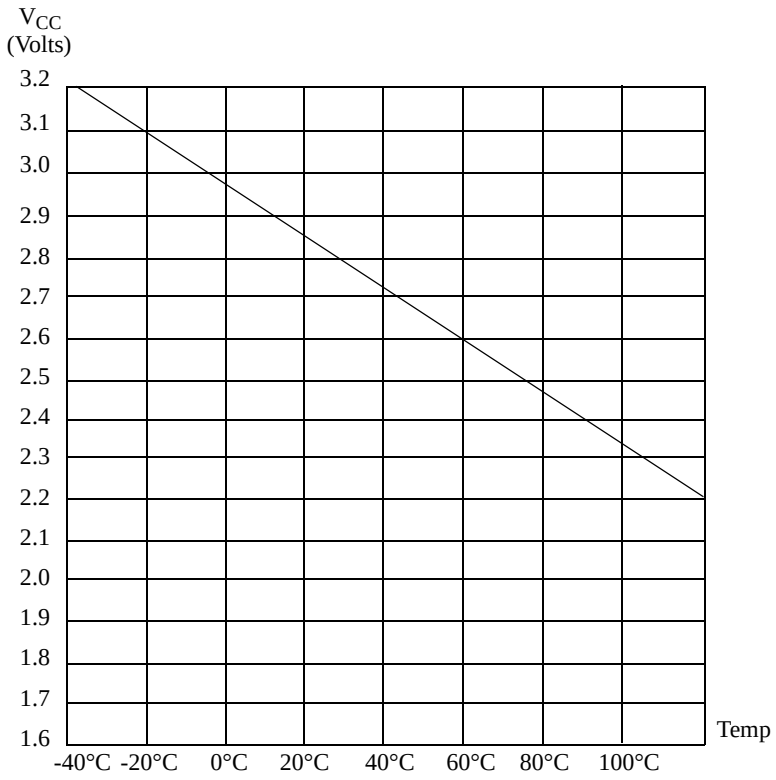


Figure 19. Typical Auto Reset Voltage (V_{LV}) vs. Temperature

OTP Option Bit Description

One-Time Programmable EPROM option bits for the device are described in this section. The Z86E02 SL1925 must be power-cycled to fully implement the selected option after programming.

Low-EMI Emission. The Low EMI option bit, when programmed, enables the Z8 to operate in a low-EMI emission (low-noise) mode. Use of this feature results in:

- All pre-driver slew rates are typically reduced to 10 ns
- Internal SCLK /TCLK operation limited to a maximum of 4 MHz–250 ns cycle time
- Output drivers typically exhibit resistances of 200 ohms
- Oscillator divide-by-two circuitry eliminated

RC Oscillator. The RC Oscillator option bit, when programmed, enables the internal RC oscillator to connect to the XTAL2 and XTAL1 pins while disabling the internal crystal oscillator to XTAL2 and XTAL1.

Table 19. Prescaler 1 Register, R243 PRE1 F3h Bank 0h: WRITE ONLY

Bit	7	6	5	4	3	2	1	0
R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Reset	X	X	X	X	X	X	X	X
Note: R = Read, W = Write, X = Indeterminate								

Bit Position	Bit Field	R/W	Reset Value	Description
7-2	Prescaler	W	X	**Prescaler Modulo** Range = 1-64 decimal; 01h-00h
1	Clock	W	0	**Clock Source** 0: T1 External Timing Input (T_{IN}) Mode 1: Internal
0	Count	W	0	**TI Count Mode** 0: Single Pass 1: Modulo N

Table 20. Port 2 Mode Register, R246 P2M F6h Bank 0h: WRITE ONLY

Bit	7	6	5	4	3	2	1	0
R/W	W	W	W	W	W	W	W	W
Reset	1	1	1	1	1	1	1	1
Note: W = Write,								

Bit Position	Bit Field	R/W	Reset Value	Description
7-0	P20-P27	W	1	**P20-P27 I/O Definition** 0: Defines bit as Output 1: Defines bit as Input

Table 21. Port 3 Mode Register, R247 P3M F7h Bank 0h: WRITE ONLY

Bit	7	6	5	4	3	2	1	0
R/W	W	W	W	W	W	W	W	W
Reset	X	X	X	X	X	X	X	X
Note: W = Write, X = Indeterminate								

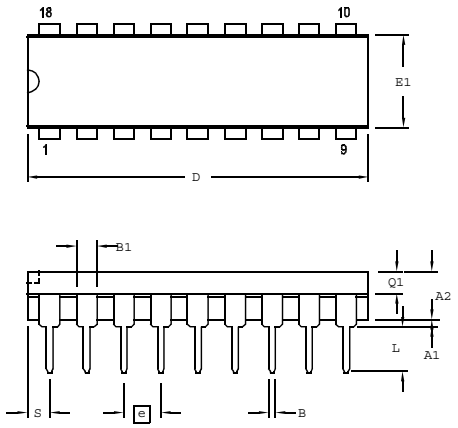
Bit Position	Bit Field	R/W	Reset Value	Description
7-2	Reserved	W	X	Reserved-must be 0
1	Port 3	W	0	**Port 3 Outputs** 0: DIGITAL Mode 1: ANALOG Mode
0	Port 2	W	0	**Port 2 Outputs** 0: Open-Drain 1: Push-Pull

Table 22. Port 0 and 1 Mode Register, R248 P01 F8h Bank 0h: WRITE ONLY

Bit	7	6	5	4	3	2	1	0
R/W	W	W	W	W	W	W	W	W
Reset	X	X	X	0	X	1	0	1
Note: W = Write, X = Indeterminate								

Bit Position	Bit Field	R/W	Reset Value	Description
7-5, 3	Reserved	W	X	Reserved-must be 0
4	Reserved	W	0	Reserved-must be 0
2	Reserved	W	X	Reserved-must be 1
1-0	P02-P00	W	01	**P02-P00 Mode** 0: Output 1: Input

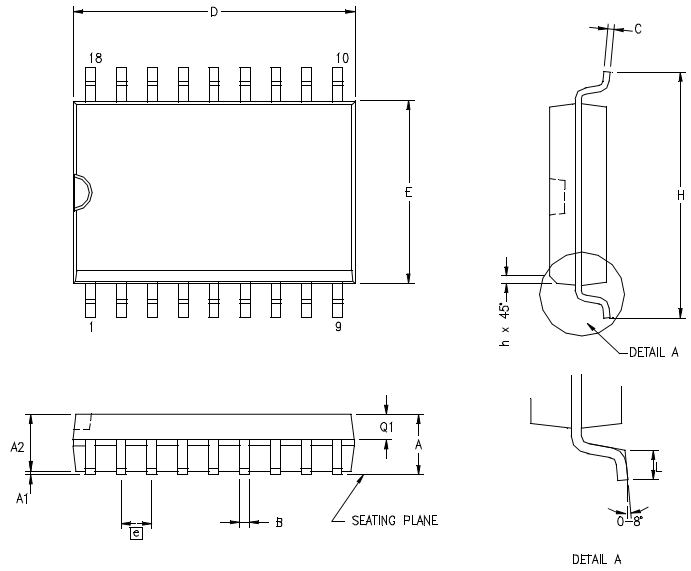
Package Information



SYMBOL	MILLIMETER		INCH	
	MIN	MAX	MIN	MAX
A1	0.51	0.81	.020	.032
A2	3.25	3.43	.128	.135
B	0.38	0.53	.015	.021
B1	1.14	1.65	.045	.065
C	0.23	0.38	.009	.015
D	22.35	23.37	.880	.920
E	7.62	8.13	.300	.320
E1	6.22	6.48	.245	.255
e	2.54 BSC		.100 BSC	
eA	7.87	9.40	.310	0.370
L	3.18	3.81	.125	.150
Q1	1.47	1.65	.058	.065
S	0.89	1.65	.035	.065

CONTROLLING DIMENSIONS : INCH

Figure 20. 18-Pin DIP Package Diagram



SYMBOL	MILLIMETER		INCH	
	MIN	MAX	MIN	MAX
A	2.40	2.65	0.094	0.104
A1	0.10	0.30	0.004	0.012
A2	2.24	2.44	0.088	0.096
B	0.36	0.46	0.014	0.018
C	0.23	0.30	0.009	0.012
D	11.40	11.75	0.449	0.463
E	7.40	7.60	0.291	0.299
e	1.27 BSC		0.050 BSC	
H	10.00	10.65	0.394	0.419
h	0.30	0.50	0.012	0.020
L	0.60	1.00	0.024	0.039
Q1	0.97	1.07	0.038	0.042

CONTROLLING DIMENSIONS : MM
LEADS ARE COPLANAR WITHIN .004 INCH.

Figure 21. 18-Pin SOIC Package Diagram

For fast results, contact your local ZiLOG Sales offices for assistance in ordering the part(s) required. Contact your local ZiLOG Sales office by navigating to Sales Office on

Part Number Description

ZiLOG part numbers consist of a number of components. For example, part number Z86E0208PSC1925 is a 8-MHz 18-pin DIP that operates in the -0°C to +70°C temperature range, with Plastic Standard Flow. The Z86E0208PSC1925 part number corresponds to the code segments indicated in the following table.

Z	ZiLOG Prefix
86	Z8 Product
E	OTP Product
02	Product Number
08	Speed (MHz)
P	Dual In-line Processor
S	Standard Temperature
C	Environmental Flow

Document Information

Document Number Description

The Document Control Number that appears in the footer of each page of this document contains unique identifying attributes, as indicated in the following table:

PS	Product Specification
0148	Unique Document Number
02	Revision Number
0903	Month and Year Published