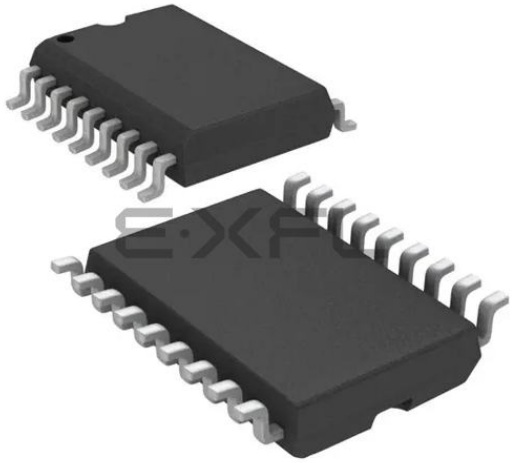

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What is "Embedded - Microcontrollers"?

"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	18-SOIC (0.295", 7.50mm Width)
Supplier Device Package	-
Purchase URL	https://www.e-xfl.com/product-detail/zilog/z86e0208ssc1925tr

Architectural Overview

ZiLOG's Z86E02 SL1925 Microcontroller (MCU) is a One-Time Programmable (OTP) member of ZiLOG's single-chip Z8® MCU family that allows easy software development, debug, prototyping, and small production runs not economically desirable with masked ROM versions.

For applications demanding powerful I/O capabilities, the Z86E02 SL1925's dedicated input and output lines are grouped into three ports, and are configurable under software control to provide timing, status signals, or parallel I/O. One on-chip counter/timer, with a large number of user-selectable modes, offload the system of administering real-time tasks such as counting/timing and I/O data communications.

Z86E02 SL1925 Features

Table 1. Z86E02 SL1925 Features

Device	OTP (KB)	RAM* (Bytes)	Speed (MHz)
Z86E02 SL1925	0.5	61	8

Note: *General-Purpose.

- 3.5V to 5.5V Operating Range @ 0°C to +70°C
- 4.5V to 5.5V Operating Range @ -40°C to +105°C
- 14 Input/Output Lines
- Six Vectored, Prioritized Interrupts (3 falling edge, 1 rising edge, 1 timer, 1 software)
- Program Options:
  - Low Noise
  - ROM Protect
  - Auto Latch
  - Watch-Dog Timer (WDT)
  - RC Oscillator
- One Programmable 8-Bit Counter/Timer, 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 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

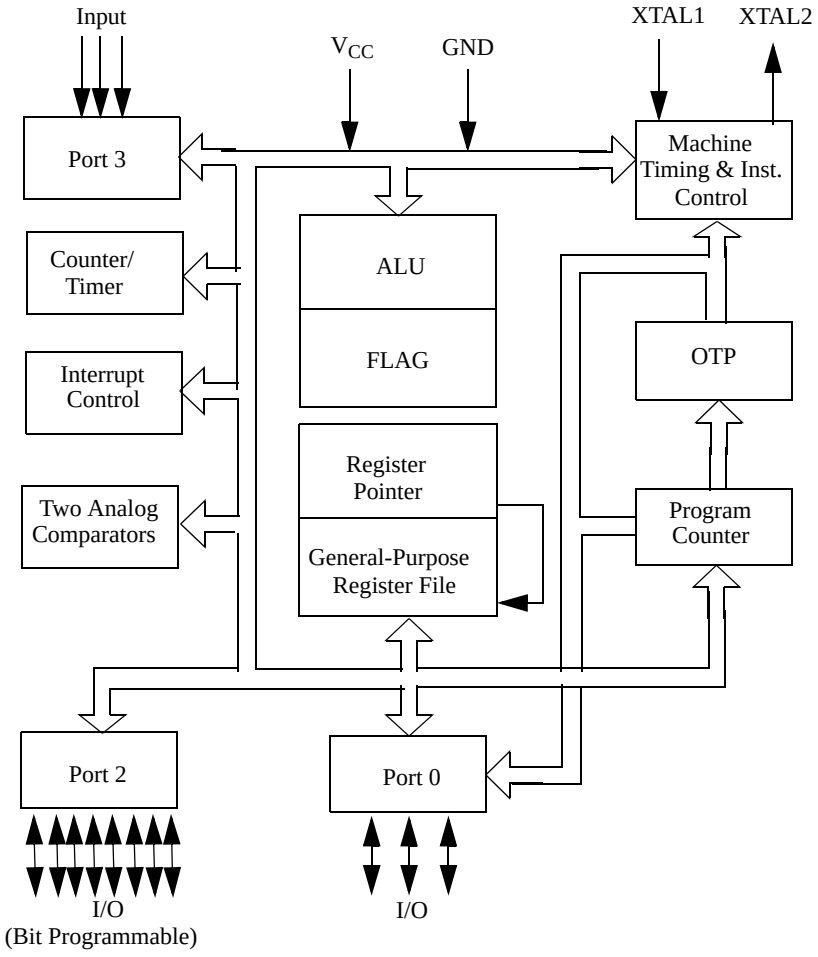

Figure 1. Functional Block Diagram

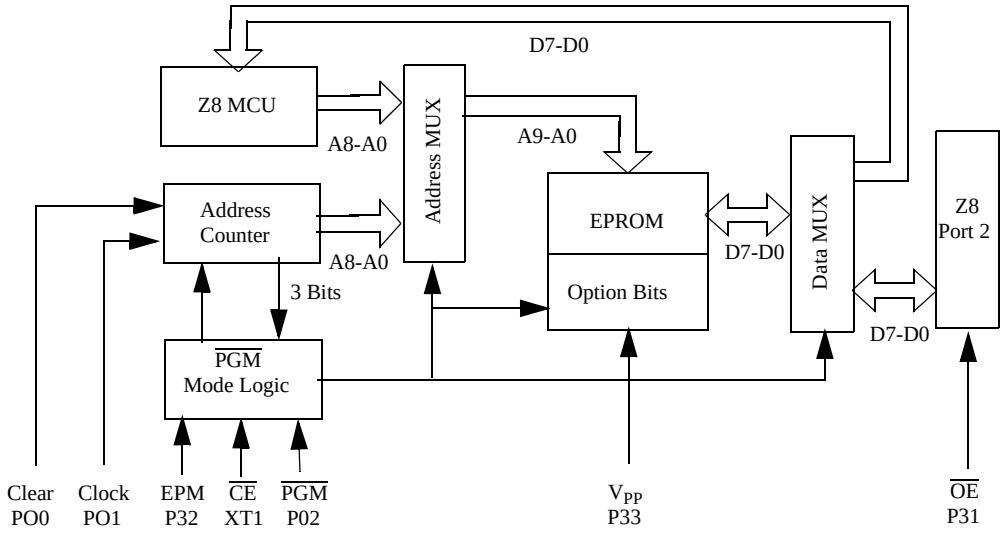

Figure 2. EPROM Programming Mode Block Diagram

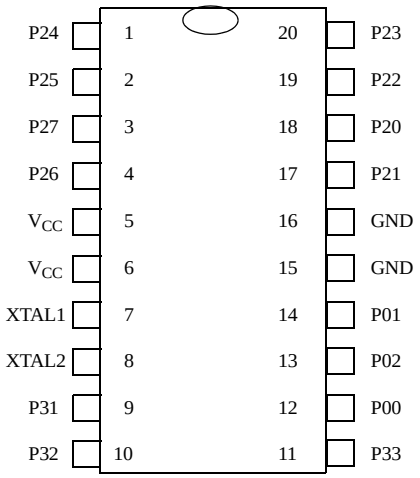

Figure 5. 20-Pin SSOP Pin Configuration, STANDARD Mode

Table 4. 20-Pin SSOP Pin Identification, STANDARD Mode

Pin #	Symbol	Function	Direction
1,2	P24-P25	Port 2, Pins 4-5	Input/Output
3	P27	Port 2, Pin 7	Input/Output
4	P26	Port 2, Pin 6	Input/Output
5	V_{CC}	Power Supply	
6	V_{CC}	Power Supply	
7	XTAL1	Crystal Oscillator Clock	Input
8	XTAL2	Crystal Oscillator Clock	Output
9	P31	Port 3, Pin 1, AN1	Input
10	P32	Port 3, Pin 2, AN2	Input
11	P33	Port 3, Pin 3, REF	Input
12	P00	Port 0, Pin 0	Input/Output
13	P02	Port 0, Pin 1	Input/Output
14	P01	Port 0, Pin 1	Input/Output
15	GND	Ground	
16	GND	Ground	
17	P21	Port 2, Pin 1	Input/Output
18	P20	Port 2, Pin 0	Input/Output
19-20	P22-P23	Port 2, Pins 2-3	Input/Output

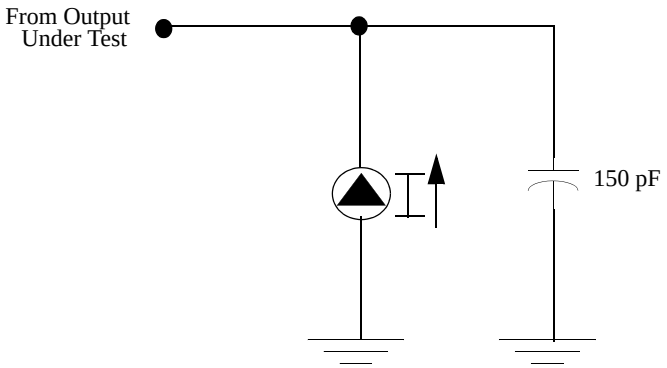

Figure 7. Test Load Diagram

Capacitance

T_A = 25°C, V_{CC} = GND = OV, f = 1.0 MHz, unmeasured pins returned to GND. See Table 7.

Table 7. Capacitance

Parameter	Min	Max
Input capacitance	0	10 pF
Output capacitance	0	20 pF
I/O capacitance	0	25 pF

DC Electrical Characteristics

Standard Temperature Range

Table 8 provides Direct Current characteristics for the Z86E02 SL1925 microcontroller, at a standard ambient temperature range of 0°C to 70°C.

Table 8. DC Characteristics, Standard Temperature Range

TA = 0°C to +70°C							
Sym	**Parameter**	**V_{CC}**	**Min**	**Max**	**Typical @ 25°C[1] Units**	**Conditions**	**Notes**
V_{INMAX}	Max Input Voltage	3.5V	-12	12	V	I_{IN} < 250 µA	2
		5.5V	-12	12	V	I_{IN} < 250 µA	2

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**
V_{ICR}	Comparator Input Common Mode Voltage Range		0	V_{CC} - 1.0		V		
I_{CC}	Supply Current	3.5V	3.5		1.5	mA	@ 2 MHz	3,6
		5.5V	7.0		6.8	mA	@ 2 MHz	3,6
		3.5V	8.0		3.0	mA	@ 8 MH	3,6
		5.5V	11.0		8.2	mA	@ 8 MHz	3,6
I_{CC1}	Standby Current (HALT Mode)	3.5V	2.5		0.7	mA	@ 2 MHz	3,6
		5.5V	4.0		2.5	mA	@ 2 MHz	3,6
		3.5V	4.0		1.0	mA	@ 8 MHz	3,6
		5.5V	5.0		3.0	mA	@ 8 MHz	3,6
I_{CC}	Supply Current (HALT and Low EMI Mode)	3.5V	3.5		1.5	mA	@ 1 MHz	6,10
		5.5V	7.0		6.8	mA	@ 1 MHz	6,10
		3.5V	5.8		2.5	mA	@ 2 MHz	6,10
		5.5V	9.0		7.5	mA	@ 2 MHz	6,10
		3.5V	8.0		3.0	mA	@ 4 MHz	6,10
		5.5V	11.0		8.2	mA	@ 4 MHz	6,10
I_{CC1}	Standby Current (Low EMI Mode)	3.5V	1.2		0.4	mA	@ 1 MHz	6,10
		5.5V	1.6		0.9	mA	@ 1 MHz	6,10
		3.5V	1.5		0.5	mA	@ 2 MHz	6,10
		5.5V	1.9		1.0	mA	@ 2 MHz	6,10
		3.5V	2.0		0.8	mA	@ 4 MHz	6,10
		5.5V	2.4		3.0	mA	@ 4 MHz	6,10
I_{CC2}	Standby Current (STOP Mode)	3.5V	10.0		1.0	µA	WDT is not Running	6,7,8
		5.5V	10.0		1.0	µA	WDT is not Running	6,7,8
I_{ALL}	Auto Latch Low Current	3.5V	12.0		3	µA	$0V < V_{IN} < V_{CC}$	9
		5.5V	32.0		16	µA	$0V < V_{IN} < V_{CC}$	9

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

AC Electrical Timing Characteristics

Figure 8 illustrates Alternating Current timing for the Z86E02 SL1925 microcontroller.

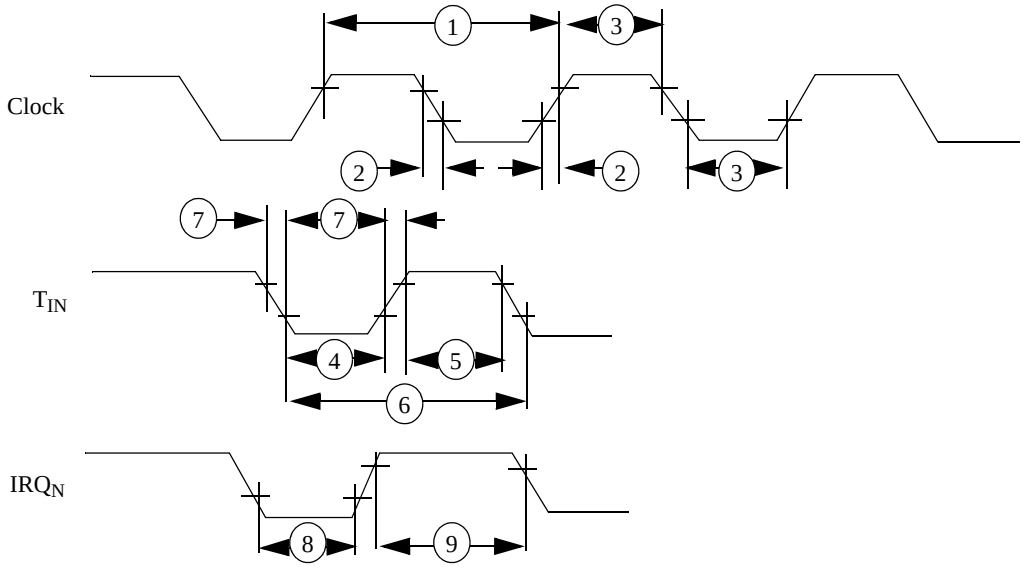

Figure 8. AC Electrical Timing

STANDARD Mode at Standard Temperature

Table 10 describes timing characteristics in STANDARD mode at standard temperature for the timing diagram noted in Figure 8.

Table 10. AC Electrical Characteristics, Standard Mode and Temperature

			TA = 0°C to +70°C				
			8MHz				
No	**Symbol**	**Parameter**	**V_{CC}**	**Min**	**Max**	**Units**	**Notes**
1	T_PC	Input Clock Period	3.5V	125	DC	ns	1
			5.5V	125	DC	ns	1
2	T_RC,T_FC	Clock Input Rise and Fall Times	3.5V		25	ns	1
			5.5V		25	ns	1
3	T_WC	Input Clock Width	3.5V	62		ns	1
			5.5V	62		ns	1

STANDARD Mode at Extended Temperature

Table 11 describes timing characteristics in STANDARD mode at extended temperature for the timing diagram noted in Figure 8.

Table 11. AC Electrical Timing, Standard Mode at Extended Temperature

			TA = -40°C to +105°C				
				8MHz			
No	Symbol	Parameter	V_{CC}	Min	Max	Units	Notes
1	T_PC	Input Clock Period	4.5V	125	DC	ns	1
			5.5V	125	DC	ns	1
2	T_RC,T_FC	Clock Input Rise and Fall Times	4.5V		25	ns	1
			5.5V		25	ns	1
3	T_WC	Input Clock Width	4.5V		62	ns	1
			5.5V		62	ns	1
4	$T_WT_{IN}L$	Timer Input Low Width	4.5V	70		ns	1
			5.5V	70		ns	1
5	$T_WT_{IN}H$	Timer Input High Width	4.5V	5TpC			1
			5.5V	5TpC			1
6	T_PT_{IN}	Timer Input Period	4.5V	8TpC			1
			5.5V	8TpC			1
7	T_RT_{IN}, T_TT_{IN}	Timer Input Rise and Fall Time	4.5V		100	ns	1
			5.5V		100	ns	1
8	T_WIL	Interrupt Request Input Low Time	4.5V	70		ns	1,2
			5.5V	70		ns	1,2
9	T_WIH	Interrupt Request Input High Time	4.5V	5TpC			1,2
			5.5V	5TpC			1,2
10	T_{WDT}	Watch-Dog Timer Delay Time before Time-out	4.5V	5		ms	
			5.5V	5		ms	
11	T_{POR}	Power-On Reset Time	4.5V	1	20	ms	
			5.5V	1	20	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)

Recommendations for dampening voltage surges in both test and OTP mode include the following:

- Using a clamping diode to V_{CC}.
- Adding a capacitor to the affected pin.

Note: Programming the EPROM/Test Mode Disable option prevents accidental entry into EPROM Mode or Test Mode.

STANDARD Mode

XTAL1, XTAL2. Crystal In, Crystal Out (time-based input and output, respectively). These pins connect an external parallel-resonant crystal, resonator, RC, LC, or an external single-phase clock (8 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 9).

Auto Latch. The Auto Latch places 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 sets the ports to an undetermined state of 0 or 1. The default condition is AUTO LATCH ENABLED. The Auto Latch can be disabled by programming the AUTO LATCH DISABLE option bit.

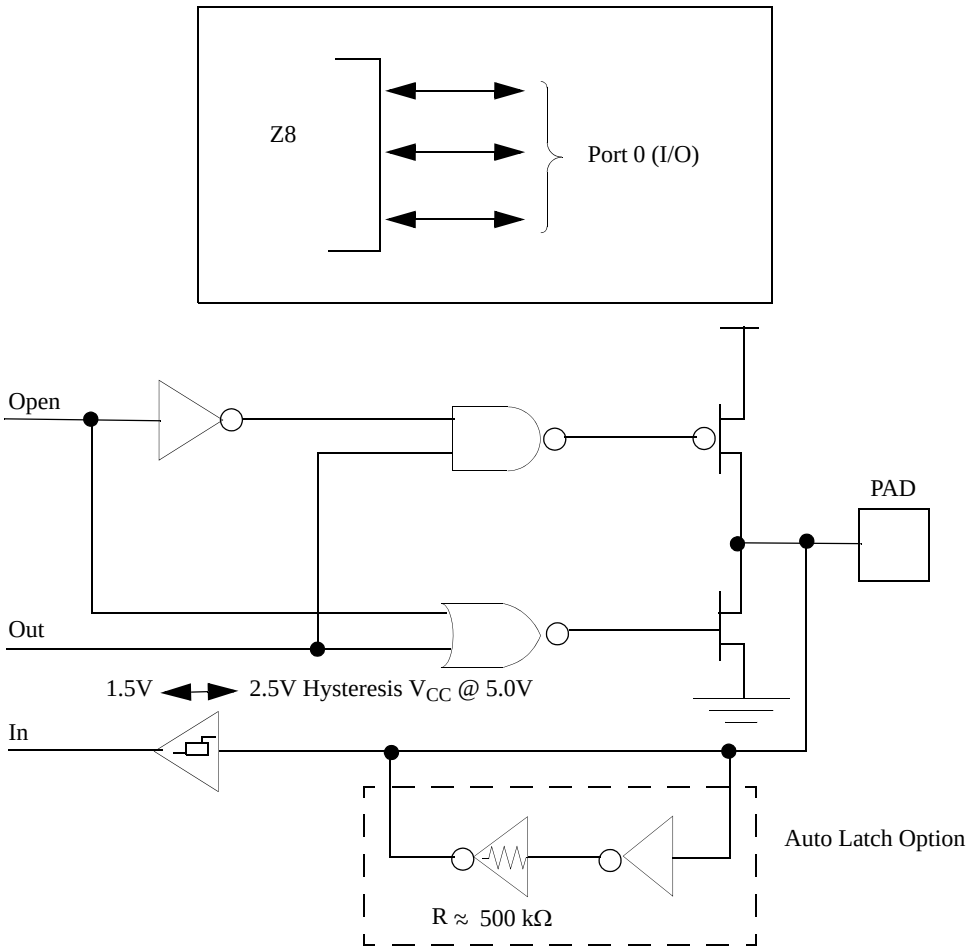

Figure 9. Port 0 Configuration

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).

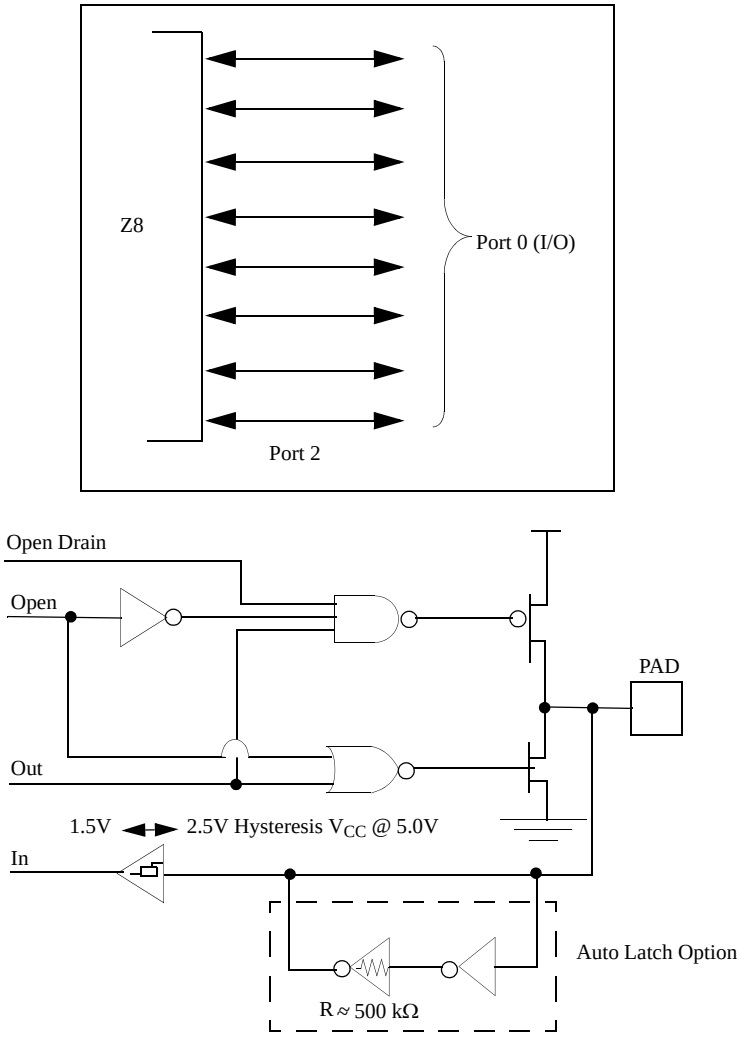

Figure 10. Port 2 Configuration

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.

These three input lines are also used as the interrupt sources IRQ0–IRQ3, and as the timer input signal T_{IN} (Figure 11).

Location		Identifiers
255(FFh)	Stack Pointer (Bits 7-0)	SPL
254(FEh)	General-Purpose Register	GPR
253(FDh)	Register Pointer	RP
252(FCh)	Program Control Flags	Flags
251(FBh)	Interrupt Mask Register	IMR
250(FBh)	Interrupt Request Register	IRQ
249(FAh)	Interrupt Priority Register	IRP
248(F8h)	Ports 0-1 Mode	P01M
247(F7h)	Port 3 Mode	P3M
246(F6h)	Port 2 Mode	P2M
245(F5h)	Reserved	Reserved
244(F4h)	Reserved	Reserved
243(F3h)	T1 Prescaler	PRE1
242(F2h)	TimerCounter1	T1
241(F1h)	Timer Mode	TMR
240(F0h) 64(40h)	Not Implemented	
63(30h) 4(04h)	General-Purpose Registers	
3(03h)	Port 3	P3
2(02h)	Port 2	P2
1(01h)	Reserved	Reserved
0(00h)	Port 0	P0

Figure 14. Register File

The Z8® instructions can access registers directly or indirectly through an 8-bit address field, thereby allowing short 4-bit register addressing mode using the Register Pointer.

In the 4-bit address mode, the register file is divided into eight working register groups, each occupying 16 continuous locations. The Register Pointer (Figure 15) addresses the starting location of the active working-register group.

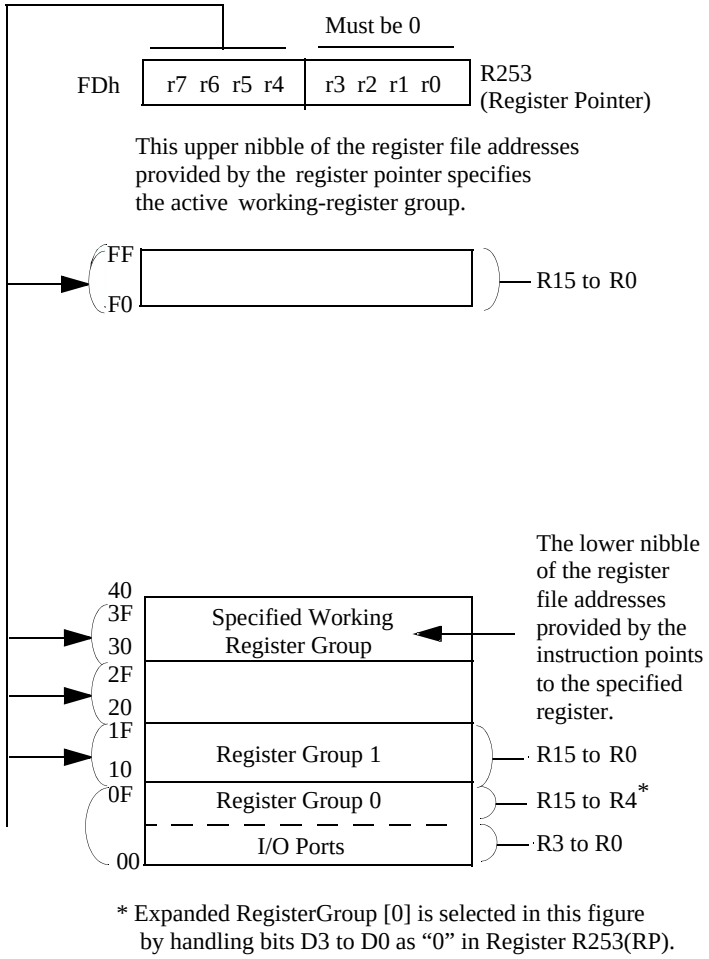

Figure 15. Register Pointer

Stack Pointer

The Z8® features an 8-bit Stack Pointer (R255) used for the internal stack that resides within the 60 general-purpose registers from 04h to 3Fh.

General-Purpose Registers (GPR)

These registers are undefined after the device is powered up. The registers keep their most recent value after any reset, as long as the reset occurs in the V_{CC} volt-age-specified operating range.

Note: Register R254 is designated as a general-purpose register and is set to 00h after any reset or Stop-Mode Recovery.

Table 15. Interrupt Types, Sources, and Vectors

Name	Source	Vector Location	Comments
IRQ0	AN2(P32)	0,1	External (F) Edge
IRQ1	REF(P33)	2,3	External (F) Edge
IRQ2	AN1 (P31)	4,5	External (F) Edge
IRQ3	AN2 (P32)	6,7	External (R) Edge
IRQ4	Software	8,9	Internal
IRQ5	T1	10,11	Internal
Note: Note: F = Falling edge triggered: R = Rising edge triggered			

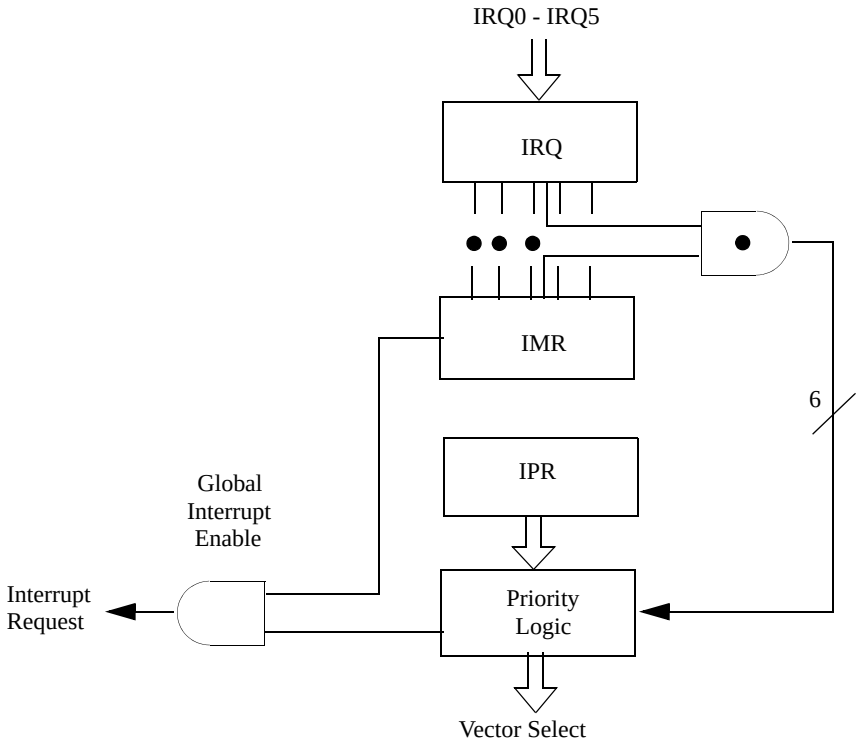

Figure 17. Interrupt Block Diagram

Table 16. Typical Frequency (MHz) vs. RC Values V_{CC} = 5.0 V @ 25°C (Continued)

	Load Capacitor							
	33 pF		56 pF		100 pF		0.001 µF	
Resistor (R)	A	B	A	B	A	B	A	B
5 KΩ	7.6	1.6	3.6	1.0	2.3	0.7	0.28	0.14
2 KΩ	12.5	2.3	8.5	1.7	4.1	1.3	0.66	0.27
1 KΩ	17	3.1	13	2.5	9.5	1.8	1.2	0.42

1. A = Standard mode frequency
2. B = Low EMI mode frequency

HALT Mode

This instruction turns off the internal CPU clock but not the crystal oscillation. The counter/timers and external interrupts IRQ0, IRQ1, IRQ2 and IRQ3 remain active. The device is recovered by interrupts, either externally or internally generated. An interrupt request must be executed (enabled) to exit HALT mode. After the interrupt service routine, the program continues from the instruction after the HALT.

Note: On the C12 ICEBOX, the IRQ3 does not wake the device out of HALT Mode.

Note: The device can be recovered by a WDT timeout. The WDT reset in HALT Mode generates a full reset similar to the Normal run mode (not STOP Mode).

STOP Mode

This instruction turns off the internal clock and external crystal oscillation and reduces the standby current to 10 A. The STOP mode is released by a RESET through a Stop-Mode Recovery (pin P27). A LOW INPUT condition on P27 releases the STOP mode. Program execution begins at location 000C (Hex). Refer to the Watch Dog Timer (WDT) section for information relating to WDT wakeup out of Stop Mode. However, when P27 is used to release STOP mode, the I/O port mode registers are not reconfigured to their default POWER-ON conditions. Thus the I/O, configured as output when the STOP instruction was executed, is prevented from glitching to an unknown state. To use the P27 release approach with STOP mode, use the following instruction:

```
LD      P2M, #1XXX XXXXB
NOP
STOP
```

Note: X = Dependent on user's application.

Control Registers

Table 17. Timer Mode Register, R241 TMR F1h Bank 0h: READ/WRITE

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	0	0	0	0	0	0	0	0
Note: R = Read, W = Write								

Bit Position	Bit Field	R/W	Reset Value	Description
7-6	Reserved	R/W	00	Reserved-must be 0
5-4	T_{IN} Mode	R/W	0	**T_{IN} Mode** 00: External Clock Input 01: Gate Input 10: Trigger Input (non retriggerable) 11: Trigger Input (retriggerable)
3	T1 Count	R/W	0	**TI Count** 0: Disable 1: Enable
2	T1	R/W	0	**TI** 0: No Function 1: Load T1
1-0	Reserved	R/W	0	Reserved - must be 0

Table 18. Counter/Timer 1 Register, R242 T1 F2h Bank 0h: READ/WRITE

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
7-0	T1	R	X	**T1 Current Value**
		W	X	**T1 Initial Value** Range = 1-256 decimal; 01h-00h

Table 24. Interrupt Request Register, R250 IPR FAh Bank 0h: READ/WRITE

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	0	0	0	0	0	0	0	0
Note: R = Read, W = Write								

Bit Position	Bit Field	R/W	Reset Value	Description
7-6	Reserved	R/W	00	Reserved-must be 0
5	IRQ5	R/W	0	**Interrupt** IRQ5 = T1 0: No interrupt pending 1: Interrupt pending
4	IRQ4	R/W	**0**	**Interrupt** RQ4 = Software generated 0: No interrupt pending 1: Interrupt pending
3	IRQ3	R/W	**0**	**Interrupt** RQ3 = P32 Input (rising edge) 0: No interrupt pending 1: Interrupt pending
2	IRQ2	R/W	**0**	**Interrupt** RQ2 = P31 Input 0: No interrupt pending 1: Interrupt pending
1	IRQ1,	R/W	**0**	**Interrupt** RQ1 = P33 Input 0: No interrupt pending 1: Interrupt pending
0	IRQ0	R/W	**0**	**Interrupt** RQ0 = P32 Input 0: No interrupt pending 1: Interrupt pending
Note: *Selecting a Reserved mode causes an undefined operation.				

Table 27. Register Pointer, R253 RP FDh Bank 0h: READ/WRITE

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	0	0	0	0	0	0	0	0
Note: R = Read, W= Write								

Bit Position	Bit Field	R/W	Reset Value	Description
7-4	Working Register Pointer	R/W	0	Working Register Pointer
3-0	Reserved	R/W	X	Reserved-must be 0

Table 28. General-Purpose Register, R254 GPR FEh Bank 0h: READ/WRITE

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	0	0	0	0	0	0	0	0
Note: R = Read, W= Write								

Bit Position	Bit Field	R/W	Reset Value	Description
7-0	Stack	R/W	0	General-Purpose Register

Customer Feedback Form

Z86E02 SL1925 Product Specification

If you experience any problems while operating this product, or if you note any inaccuracies while reading this Product Specification, please copy and complete this form, then mail or fax it to ZiLOG (see Return Information, below). We also welcome your suggestions!

Customer Information

Name	Country
Company	Phone
Address	Fax
City/State/Zip	E-Mail

Product Information

Serial # or Board Fab #/Rev. #
Software Version
Document Number
Host Computer Description/Type

Return Information

ZiLOG
532 Race Street
Campbell, CA 95126-3432
Fax: (408) 558-8536
www.zilog.com

Problem Description or Suggestion

Please provide a complete description of the problem or suggestion. If you are reporting a specific problem, include all steps leading up to the occurrence of the problem. Attach additional pages as necessary.