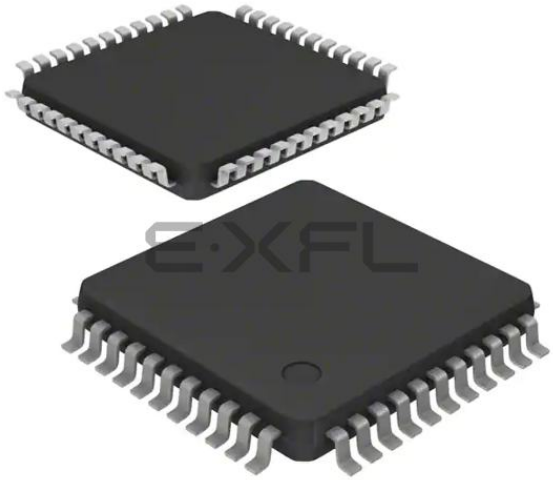


Welcome to E-XFL.COM

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	16MHz
Connectivity	UART/USART
Peripherals	-
Number of I/O	24
Program Memory Size	-
Program Memory Type	ROMless
EEPROM Size	-
RAM Size	236 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	44-LQFP
Supplier Device Package	44-LQFP (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/zilog/z86c9116fec

List of Figures

Architectural Overview

ZiLOG's large Z8® family of 8-bit ROMless microcontrollers includes the Z86C91 product with 236 bytes of RAM. Each of these devices offer fast execution, efficient use of memory, sophisticated interrupts, input/output bit manipulation capabilities, and easy hardware/software system expansion along with low cost and low power consumption.

For applications demanding powerful I/O capabilities, the Z86C91 offers 24 pins dedicated to input and output. These lines are grouped into four ports. Each port consists of eight lines and is configurable under software control to proviide timing, status signals, serial or parallel I/O with or without handshake and an address/data bus for interfacing external memory. The Z86C91 MCU features three basic address spaces to support this wide range of configurations: Program Memory, Data Memory, and 236 General Purposes Registers.

The Z86C91 operates at 16 MHz with a voltage range of 4.5 to 5.5 VDC.

To unburden the system from coping with real-time tasks such as counting/timing and data communication, the Z86C91 offers two on-chip counter/timers with a large number of user-selectable modes and a full-duplex hardware UART.

The Z86C91 is a ROMless part and offers the use of external memory, which enables this Z8® MCU to be used in high-volume applications, or where code flexibility is required.

Note: All signals with an overline are active Low. For example, B/$\overline{W}$, for which WORD is active Low, and $\overline{B}$/W, for which BYTE is active Low.

Power connections follow these conventional descriptions:

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

Z86C91 Features

- Asynchronous receiver/transmitter UART
- 40-Pin DIP and 44-Pin PLCC and QFP Packages
- 4.5- to 5.5-Volt Operating Range
- Operating Temperature Ranges:
  - Standard: 0ºC to 70ºC
  - Extended: -40ºC to 105ºC
- 24 Input/Output Lines

Functional Block Diagrams

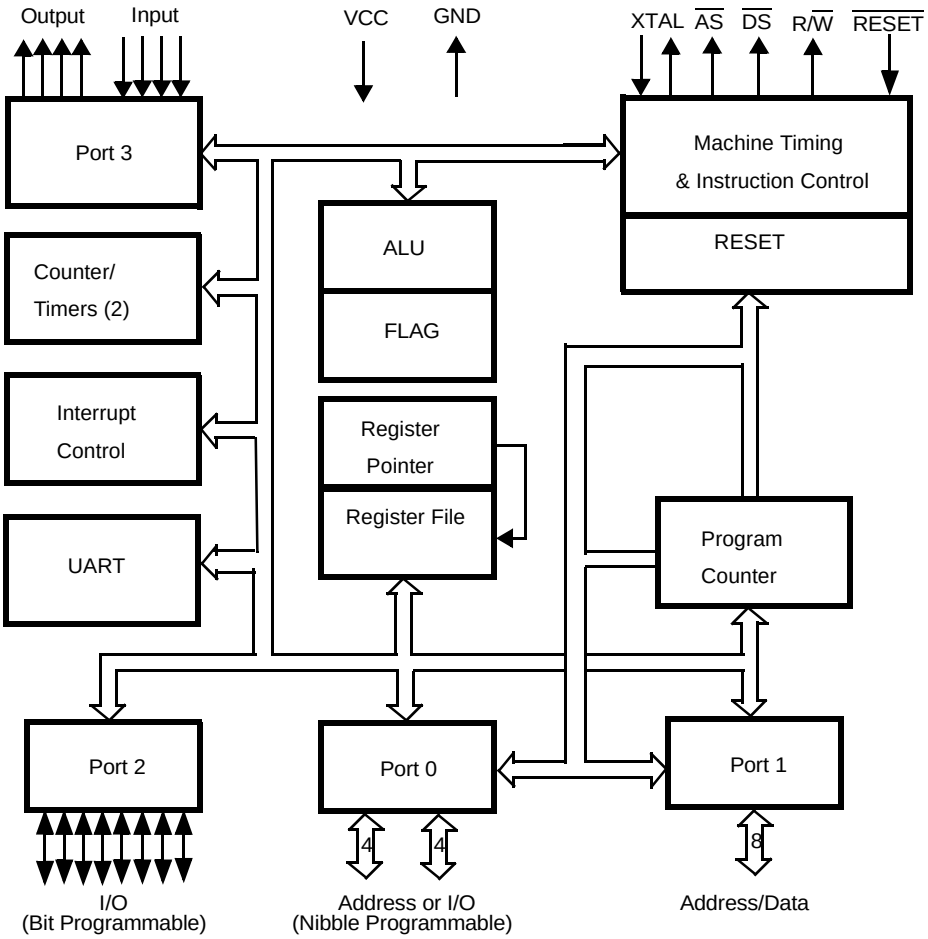


Figure 1. Z86C91 Functional Block Diagram

Table 13. 44-Pin PQFP Pin Identification (Continued)

Pin #	Symbol	Function	Direction
29	V_{CC}	Power Supply	Input
30	XTAL2	Crystal, Oscillator Clock	Output
31	XTAL1	Crystal, Oscillator Clock	Input
32	P37	Port 3, Bit 7	Output
33	P30	Port 3, Bit 0	Intput
34	$\overline{\text{RESET}}$	Reset	Input
35	R/$\overline{\text{W}}$	Read/Write	Output
36	$\overline{\text{DS}}$	Data Strobe	Output
37	$\overline{\text{AS}}$	Address Strobe	Output
38	P35	Port 3, Bit 5	Output
39	GND	Ground	Output
40	P32	Port 3, Bit 2	Input
41-43	P00-P02	Port 0, Bits 0-2	Input/Output
44	GND	Ground	Output

both nibbles are required for I/O operation, they are configured by writing to the Port 01 mode register (P01M).

After a hardware RESET, Port 0 is configured as address lines A15–A8, and extended timing is set to accommodate slow memory access. The initialization routine can include reconfiguration to eliminate this extended timing mode.

Port 0 can be placed in a high-impedance state along with Port 1, $\overline{AS}$, $\overline{DS}$ and R/$\overline{W}$, allowing the Z8 to share common resources in multiprocessor and DMA applications (Figure 5). A hardware RESET is required to exit this high-impedance state.

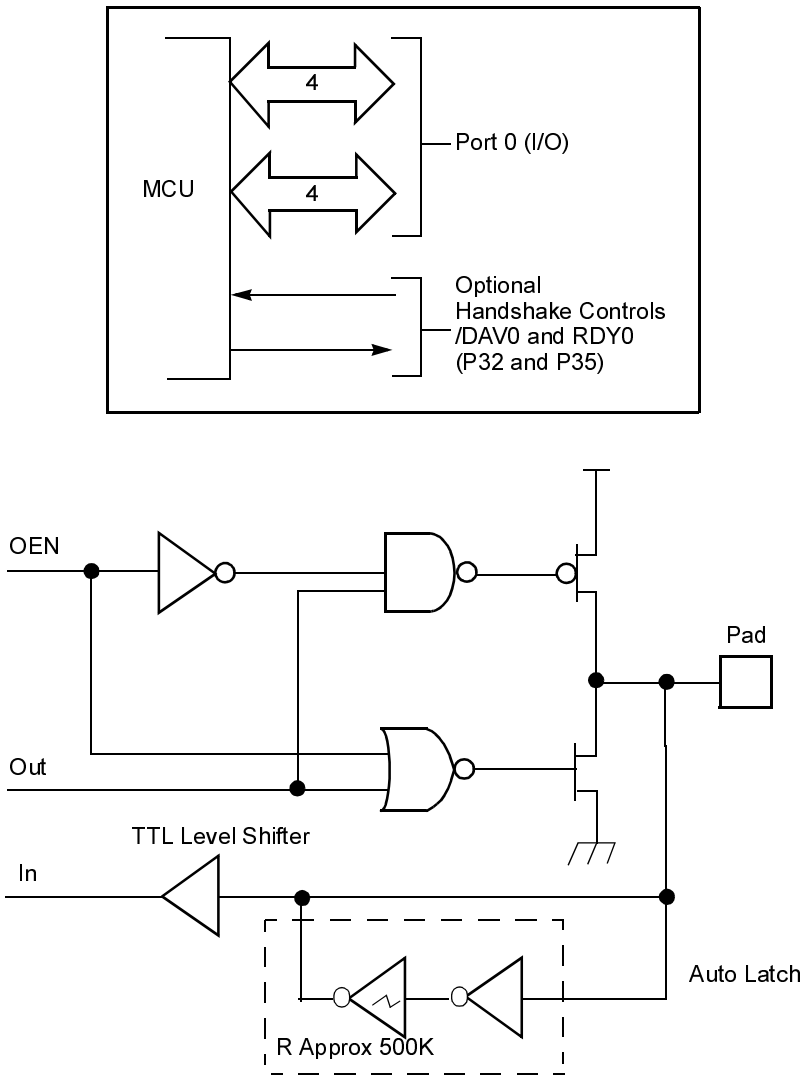


Figure 5. Port 0 Configuration

Table 15. Port 3 Pin Assignments

Pin	I/O	Control Timer	Interrupt	P0 HS	P2 HS	Ext	UART
P30	IN		IRQ3				Serial In
P31	IN	T_{IN}	IRQ2		D/R		
P32	IN		IRQ0	D/R			
P33	IN		IRQ1				
P34	OUT					$\overline{DM}$	
P35	OUT			R/D			
P36	OUT	T_{OUT}			R/D		
P37	OUT						Serial Out

Notes:
HS = Handshake Signals
D = $\overline{DAV}$ (Data Available)
R = RDY (Ready)

Autolatch. The autolatch places valid CMOS levels on all inputs that are not externally driven. Whether this level is 0 or 1 cannot be determined. A valid CMOS level, rather than a floating node, reduces excessive supply current flow in the input buffer. Autolatches are available on Port 0, Port 1, Port 2, and P3 inputs.

$\overline{RESET}$ (input, Low). Initializes the MCU. RESET occurs through external reset only. During Power-On Reset, the externally-generated reset drives the $\overline{RESET}$ pin Low for the POR time. Pull-up is provided internally.

Caution: $\overline{RESET}$ depends on oscillator operation to achieve full reset conditions.

$\overline{RESET}$ is a Schmitt-triggered input. During the RESET cycle, $\overline{DS}$ is held active Low while $\overline{AS}$ cycles at a rate of $T_PC \div 2$. Program execution begins at location `000Ch`, after the $\overline{RESET}$ is released.

When program execution begins, $\overline{AS}$ and $\overline{DS}$ toggles only for external memory accesses. The Z8 can only exit Stop Mode by using the $\overline{RESET}$ pin.The Z8 does reset all registers on a Stop-Mode Recovery operation out of STOP mode.

Functional Description

The Z8 MCU incorporates the following functions that enhance the standard Z8® architecture and provide the user with increased design flexibility:

- Reset
- Program Memory
- Data Memory
- Working Register
- General-Purpose Registers
- Stack Pointer
- Counter/Timers
- Interrupts
- Clock
- HALT and STOP Modes
- Port Configuration Register

RESET. The device is reset in the following condition:

- External Reset

Automatic Power-On Reset circuitry is not built into this Z8. This Z8 requires an external reset circuit to reset upon power-up. The internal pull-up resistor is on the $\overline{\text{RESET}}$ pin, so a pull-up resistor is not required; however, in a high-EMI (noisy) environment, it is recommended that a low-value pull-up resistor be used.

Program Memory. The Z86C91 can address up to 64 KB of external program memory. The first 12 bytes of program memory are reserved for the interrupt vectors. These locations contain six 16-bit vectors that correspond to the six available interrupts. Program execution begins at external location `000Ch` after reset. See Figure 13.

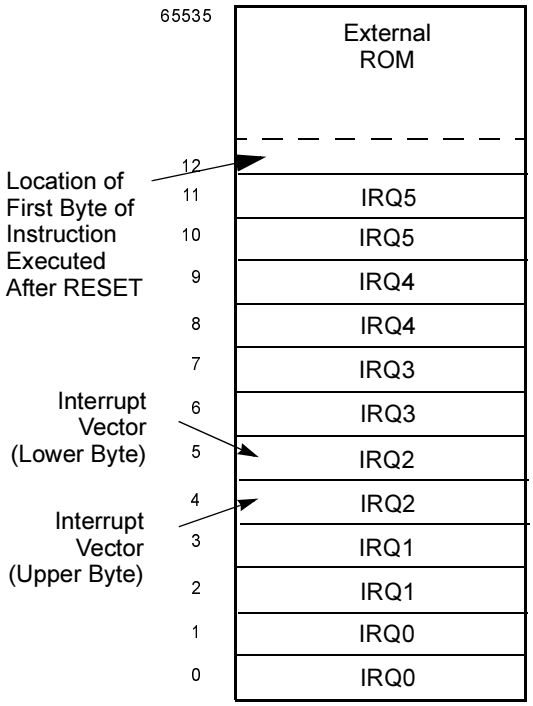


Figure 13. Program Memory Map

Data Memory ($\overline{DM}$). The Z86C91addresses up to 64 KB of external data memory. External data memory may be included with, or separated from, the external program memory space. $\overline{DM}$, an optional I/O function that is programmed to appear on pin P34, is used to distinguish between data and program memory space (Figure 14). The state of the $\overline{DM}$ signal is controlled by the type of instruction being executed. An LDC Op Code references PROGRAM ($\overline{DM}$ inactive) memory, and an LDE instruction references data ($\overline{DM}$ active Low) memory. The user must configure Port 3 Mode Register (P3M) bits D3 and D4 for this mode.

Interrupts. The Z8 has six different interrupts from eight different sources. These interrupts are maskable and prioritized. The 8 sources are divided as follows: 4 sources are claimed by Port 3 lines P33–P30, one in Serial Out, one in Serial In, and 2 are claimed by counter/timers. The Interrupt Mask Register globally or individually enables or disables the six interrupt requests.When more than one interrupt is pending, priorities are resolved by a programmable priority encoder that is controlled by the Interrupt Priority register

All interrupts are vectored through locations in Program Memory. When an interrupt request is granted, the interrupt machine cycle is activated. This resets the interrupt request flag and disables all of the subsequent interrupts, except Program Counter and Status Flags, and branches to the program memory vector location reserved for that interrupt. This memory location and the next byte contain the 16 bit 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. Software initiated interrupts are supported by setting the appropriate bit in the Interrupt Request Register (IRQ).

Nested interrupts are supported by enabling interrupts in the interrupt service routine.

Internal interrupt requests are sampled on the falling edge of the last cycle of every instruction, and the interrupt request must be valid 5TpC before the falling edge of the last clock cycle of the currently executing instruction.

When the device samples a valid interrupt request, the next 48TpC (external XTAL clock cycles) are used to prioritize the interrupt, and push the two PC bytes and the FLAG register on the stack. The following nine cycles are used to fetch the interrupt vector from external memory. The first byte of the interrupt service routine is fetched beginning on the 58th TpC cycle following the internal sample point, which corresponds to the 63rd TpC cycle following the external interrupt sample point.

Timer Mode Register

The Timer Mode Register, TMR, controls timing and counter functions and shown.in Figure 22.

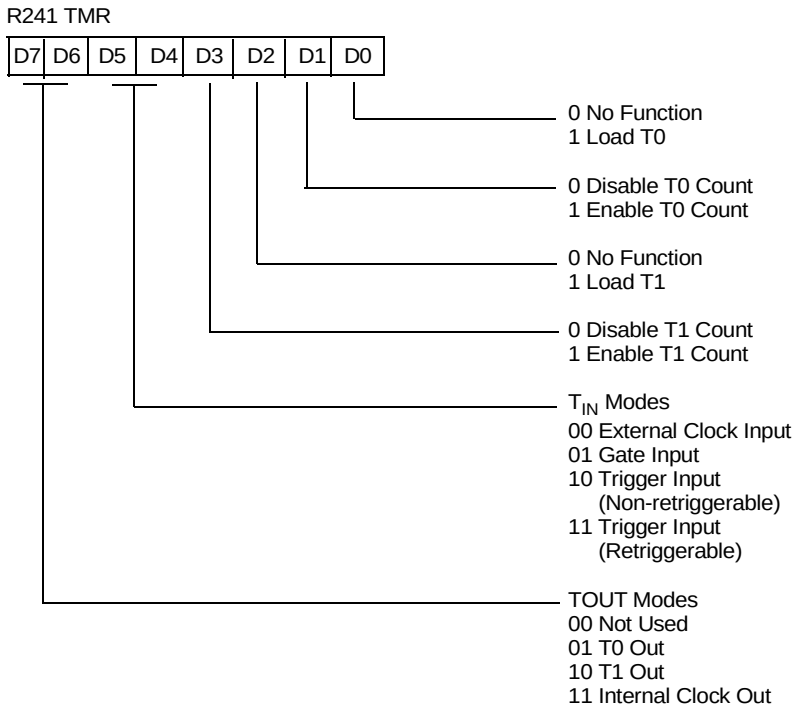


Figure 22. Timer Mode Register (F1h: Read/Write)

Counter/Timer 1 Register

The Counter/Timer 1 Register, T1 is shown in Figure 23.

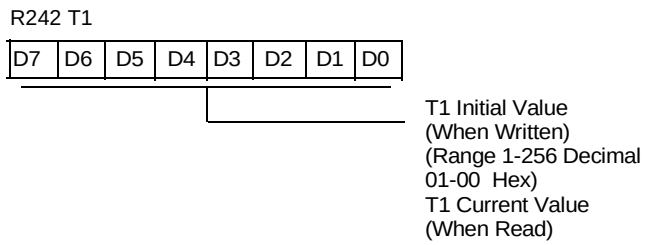


Figure 23. Counter Timer 1 Register (F2h: Read/Write)

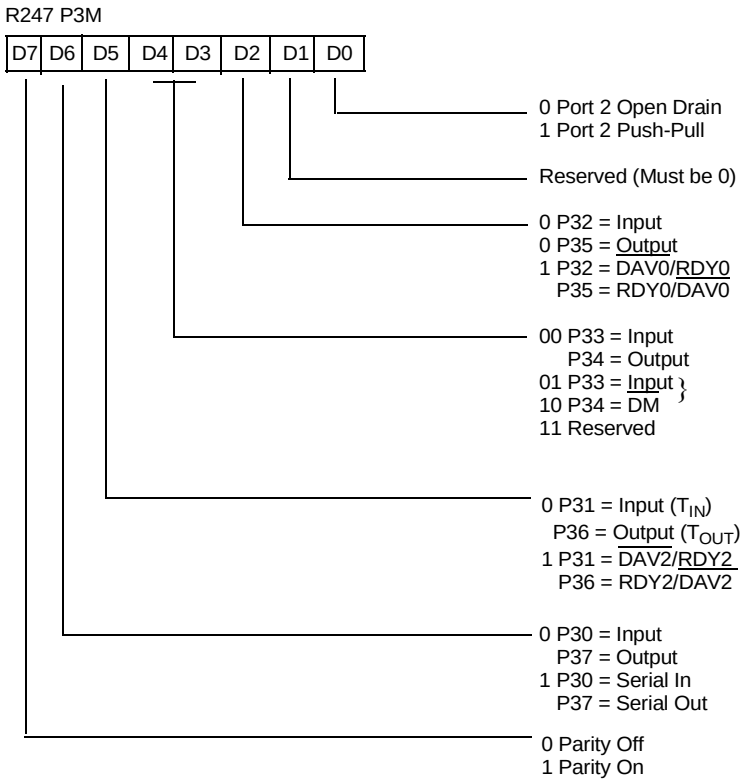


Figure 28. Port 3 Mode Register (F7h: Write Only)

Ports 0 and 1 Mode Register

The Ports 0 and 1 Mode Register, P01M, controls port and timing functions for Ports 0 and 1 and is shown in Figure 29.

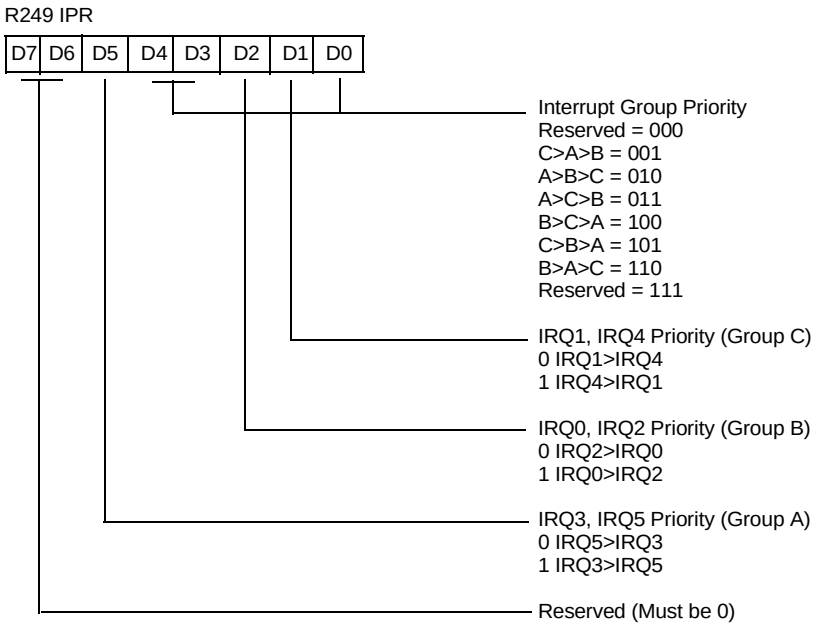


Figure 30. Interrupt Priority Register (F9h: Write Only)

Interrupt Request Register

The Interrupt Request Register, IRQ, controls interrupt functions and is shown in Figure 31.

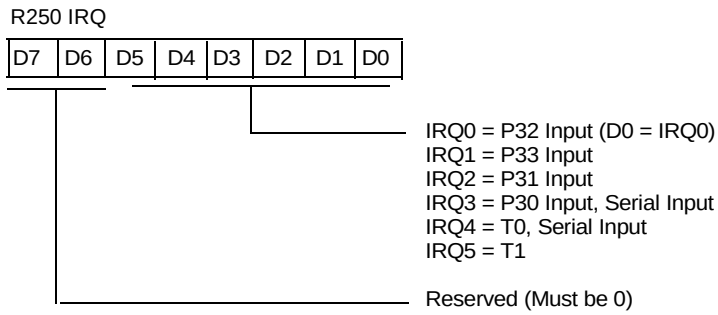


Figure 31. Interrupt Request Register (FAh: Read/Write)

Interrupt Mask Register

The Interrupt Mask Register, IMR, controls interrupt functions and is shown in Figure 32.

Table 17. DC Electrical Characteristics at Standard and External Temperatures (Continued)

		T_A = 0°C to +70°C		T_A = -40°C to +105°C		Typical[2]		
Sym	**Parameter**	**Min**	**Max**	**Min**	**Max**	**@25°C**	**Units**	**Conditions**
V_{CL}	Clock Input Low Voltage	-0.3	0.8	-0.3	0.8		V	Driven by External Clock Generator
V_{IH}	Input High Voltage	2.0	V_{CC}	2.0	V_{CC}		V	
V_{IL}	Input Low Voltage	–0.3	0.8	-0.3	0.8		V	
V_{OH}	Output High Voltage	2.4		2.4			V	I_{OH} = -2.0 mA
V_{OH}	Output High Voltage	V_{CC}–100mV		V_{CC}–100mV			V	I_{OH} = -100 µA
V_{OL}	Output Low Voltage		0.4		0.4		V	I_{OH} = +2 mA
V_{RH}	Reset Input High Voltage	3.8	V_{CC}	3.8	V_{CC}		V	
V_{RL}	Reset Input Low Voltage	–0.3	0.8	-0.3	0.8		V	
I_{IL}	Input Leakage	–2	2	-2	2		µA	Test at 0 V, V_{CC}
I_{OL}	Output Leakage	–2	2	-2	2		µA	Test at 0 V, V_{CC}
I_{IR}	Reset Input Current		–80		-80		µA	V_{RL}=0V
I_{CC}	Supply Current		35		35	24	mA	@ 16 MHz([1])
I_{CC1}	Standby Current		7		7	4.5	mA	HALT Mode V_{IN} = 0 V, V_{CC} @ 16 MHz
I_{CC2}	Standby Current		10		10	1	µA	STOP Mode V_{IN} = 0 V, V_{CC} ([1])
I_{ALL}	Autolatch Low Current	-10	10	-14	14		µA	

Note:
1. All inputs driven to 0V, V_{CC} and outputs floating.
2. V_{CC} = 5.0V

AC Electrical Characteristics

Figure 38 illustrates the timing characteristics of the Z86C91MCU with respect to external input/output sources. See Table 18 for descriptions of the numbered timing parameters in the figure.

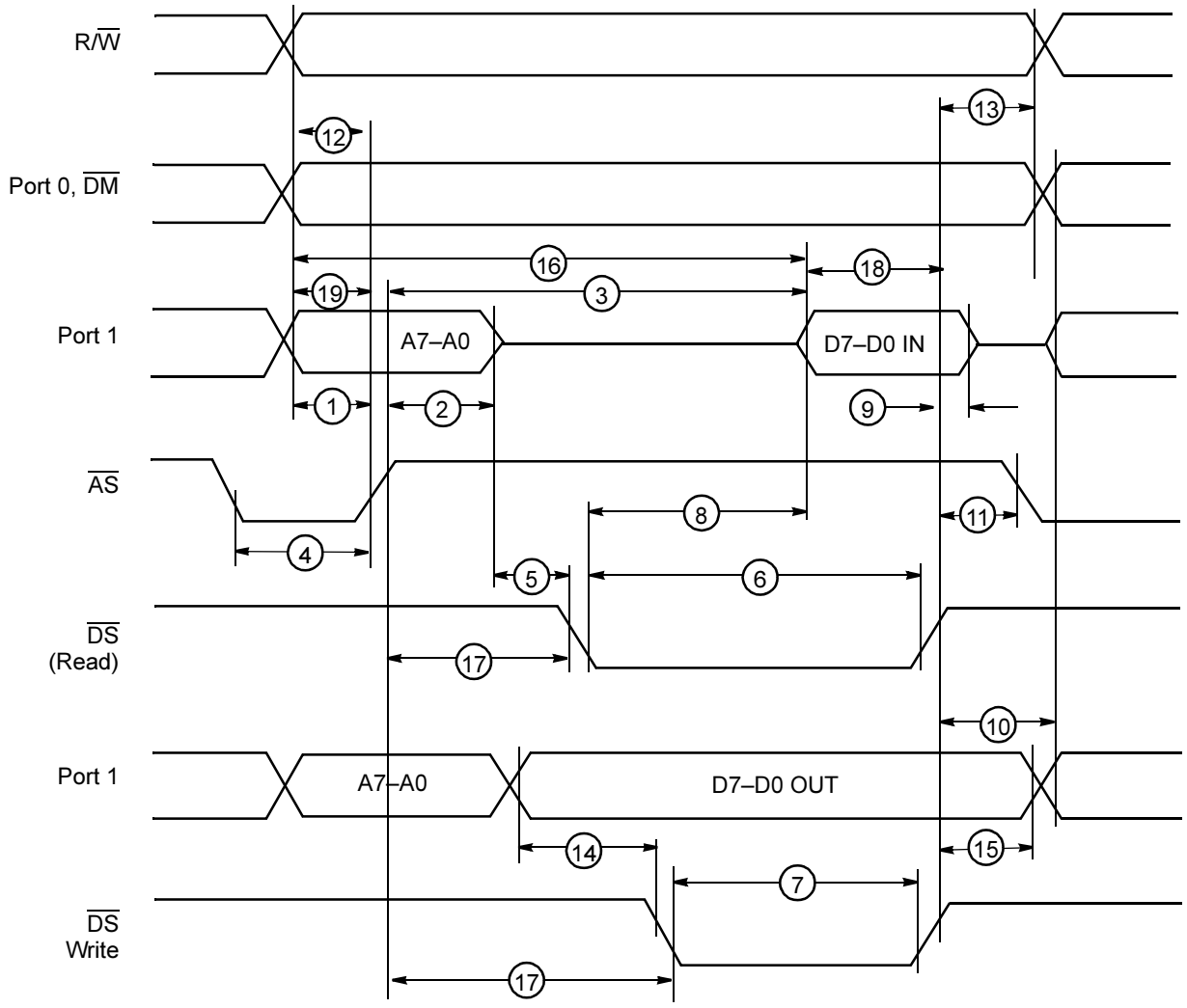


Figure 38. External I/O or Memory READ and WRITE Timing

Table 20. Additional Timing (Standard and Extended Temperature) (Continued)

			T_A = 0°C to +70°C 16 MHz		T_A =-4 0°C to +105°C 16 MHz			
No	**Sym**	**Parameter**	**Min**	**Max**	**Min**	**Max**	**Units**	**Notes**
6	T_PT_{IN}	Timer Input Period	$8T_PC$		$8T_PC$			2
7	T_RT_{IN},T_FT_{IN}	Timer Input Rise & Fall Timer	100		100		ns	2
8A	T_WIL	Interrupt Request Low Time	70		70		ns	2,4
8B	T_WIL	Interrupt Request Low Time	$3T_PC$		$3T_PC$			2,5
9	T_WIH	Interrupt Request Input High Time	$3T_PC$		$3T_PC$			2,3

Notes:
1. Clock timing references use 3.8V for a logic one and 0.8V for a logic 0.
2. Timing references use 2.0V for a logic 1 and 0.8V for a logic 0.
3. Interrupt references request via Port 3.
4. The interrupt request via Port 3 (P31–P33).
5. The interrupt request via Port 3 (P30).

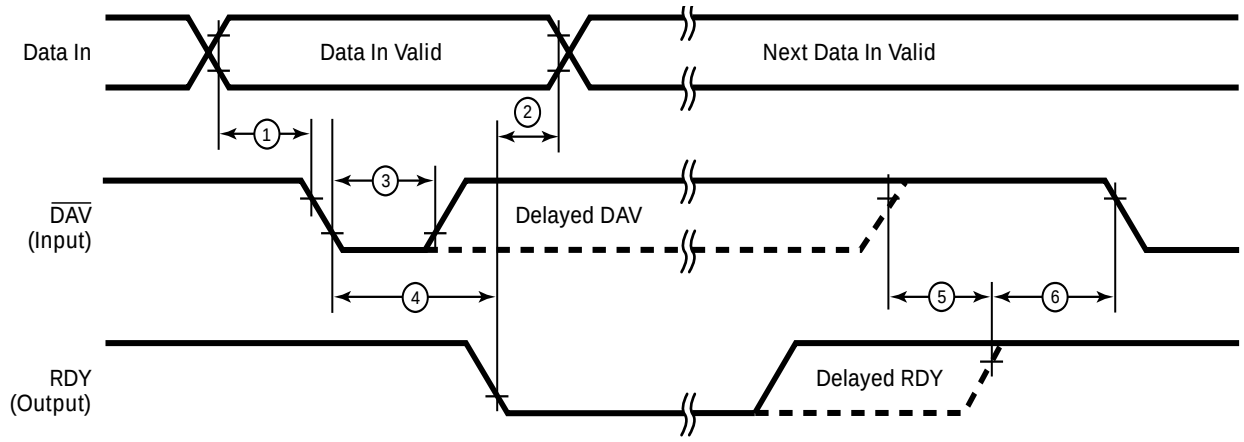


Figure 40. Input Handshake Timing

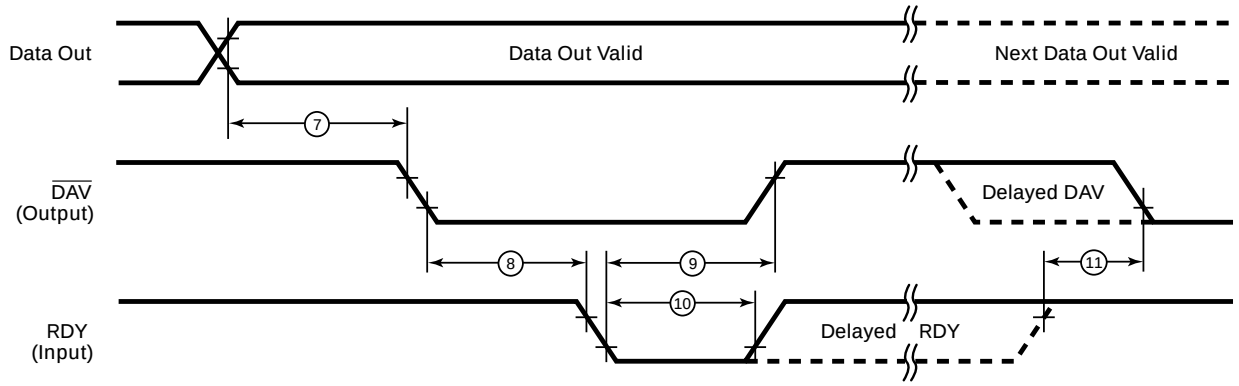


Figure 41. Output Handshake Timing

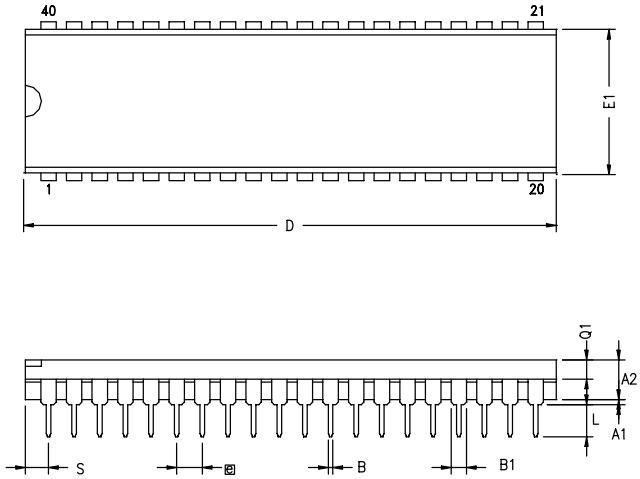
Table 21. Handshake Timing (Standard and Extended Temperatures)

No	Symbol	Parameter	T_A = 0ºC to +70ºC Min	T_A = 0ºC to +70ºC Max	T_A = -40ºC to +105ºC Min	T_A = -40ºC to +105ºC Max	Data Direction
1	T_SDI(DAV)	Data In Setup Time	0		0		Input
2	T_HDI(RDY)	Data In Hold Time	145		145		Input
3	T_WDAV	Data Available Width	110		110		Input
4	T_DDAVI(RDY)	DAV Fall to RDY Fall Delay		115		115	Input
5	T_DDAVId(RDY)	DAV Out to DAV Fall Delay		115		115	Input
6	RDY0$_D$(DAV)	RDY Rise to DAV Fall Delay	0		0		Input
7	T_DD0(DAV)	Data Out to DAV Fall Delay		TpC		TpC	Output
8	T_DDAV0(RDY)	DAV Fall to RDY Fall Delay	0		0		Output
9	T_DRDY0(DAV)	RDY Fall to DAV Rise Delay		115		115	Output
10	T_WRDY	RDY Width	110		110		Output
11	T_DRDY0$_D$(DAV)	RDY Rise to DAV Fall Delay		115		115	Output

Note: All timing references use 2.0V for a logic 1 and 0.8V for a logic 0.

Packaging

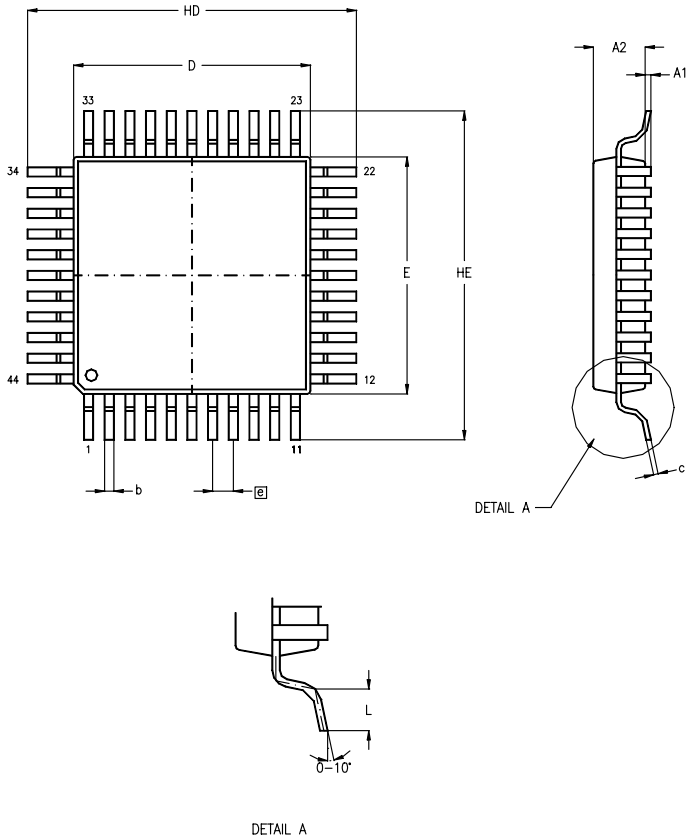
Figure 42 illustrates the 40-pin DIP package for the microcontroller devices.



SYMBOL	MILLIMETER		INCH	
	MIN	MAX	MIN	MAX
A1	0.51	1.02	.020	.040
A2	3.18	3.94	.125	.155
B	0.38	0.53	.015	.021
B1	1.02	1.52	.040	.060
C	0.23	0.38	.009	.015
D	52.07	52.58	2.050	2.070
E	15.24	15.75	.600	.620
E1	13.59	14.22	.535	.560
e	2.54 TYP		.100 TYP	
eA	15.49	16.76	.610	.660
L	3.05	3.81	.120	.150
Q1	1.40	1.91	.055	.075
S	1.52	2.29	.060	.090

CONTROLLING DIMENSIONS : INCH

Figure 42. 40-Pin DIP Package Diagram



SYMBOL	MILLIMETER		INCH	
	MIN	MAX	MIN	MAX
A1	0.05	0.25	.002	.010
A2	2.00	2.25	.078	.089
b	0.25	0.45	.010	.018
c	0.13	0.20	.005	.008
HD	13.70	14.15	.539	.557
D	9.90	10.10	.390	.398
HE	13.70	14.15	.539	.557
E	9.90	10.10	.390	.398
e	0.80 BSC		.0315 BSC	
L	0.60	1.20	.024	.047

NOTES:
1. CONTROLLING DIMENSIONS : MILLIMETER
2. LEAD COPLANARITY : MAX .10 / .004"

Figure 44. 44-Pin PQFP Package Diagram

Customer Feedback Form

Z86C91 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
System Test/Customer Support
532 Race Street
San Jose, CA 95126-3432
Fax: (408) 558-8536
Email: zservice@zilog.com

Problem Description or Suggestion

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

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