Z86E07

CMOS Z8® 2K OTP MICROCONTROLLER

GENERAL DESCRIPTION

The Z86E07 Microcontroller (MCU) introduces a new level of sophistication to single-chip architecture. The Z86E07 is a member of the Z8 single-chip microcontroller family with 2 Kbytes of one-time PROM. The device is housed in an 18-pin DIP, and 18-pin SOIC. It is manufactured in CMOS technology. The device allows easy software development and debug, prototyping, and small production runs not economically desirable with a masked ROM version.

The Z86E07 has a flexible I/O scheme, an efficient register and address space structure. Also, it has a number of ancillary features that are useful in many consumer, industrial and advanced scientific applications.

The device applications demand powerful I/O capabilities. The Z86E07 fulfills this with 14 pins dedicated to input and output. These lines are grouped into three ports, and are configurable under software control to provide I/O, timing, and status signals.

There are two basic address spaces available to support this wide range of configurations; program memory and 124 bytes of general-purpose registers.

To unburden the program from coping with real-time problems such as counting/timing and I/O data communications, the Z86E07 offers two on-chip counter/timers with a large number of user selectable modes. Included, are two on-board comparators that process analog signals with a common reference voltage.

The Z86E07 offers programmable ROM Protect and programmable Low Noise. When the part is programmed for ROM Protect, the Low Noise feature will automatically be enabled. When programmed for Low Noise, the ROM Protect feature is optional. It has the Auto Latches removed to allow operation in harsh environments.

Note: All Signals with a preceding front slash, "/", are active Low, e.g.: B/W (WORD is active Low); /B/W (BYTE is active Low, only).

Power connections follow conventional descriptions below:

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

PRODUCT RECOMMENDATIONS

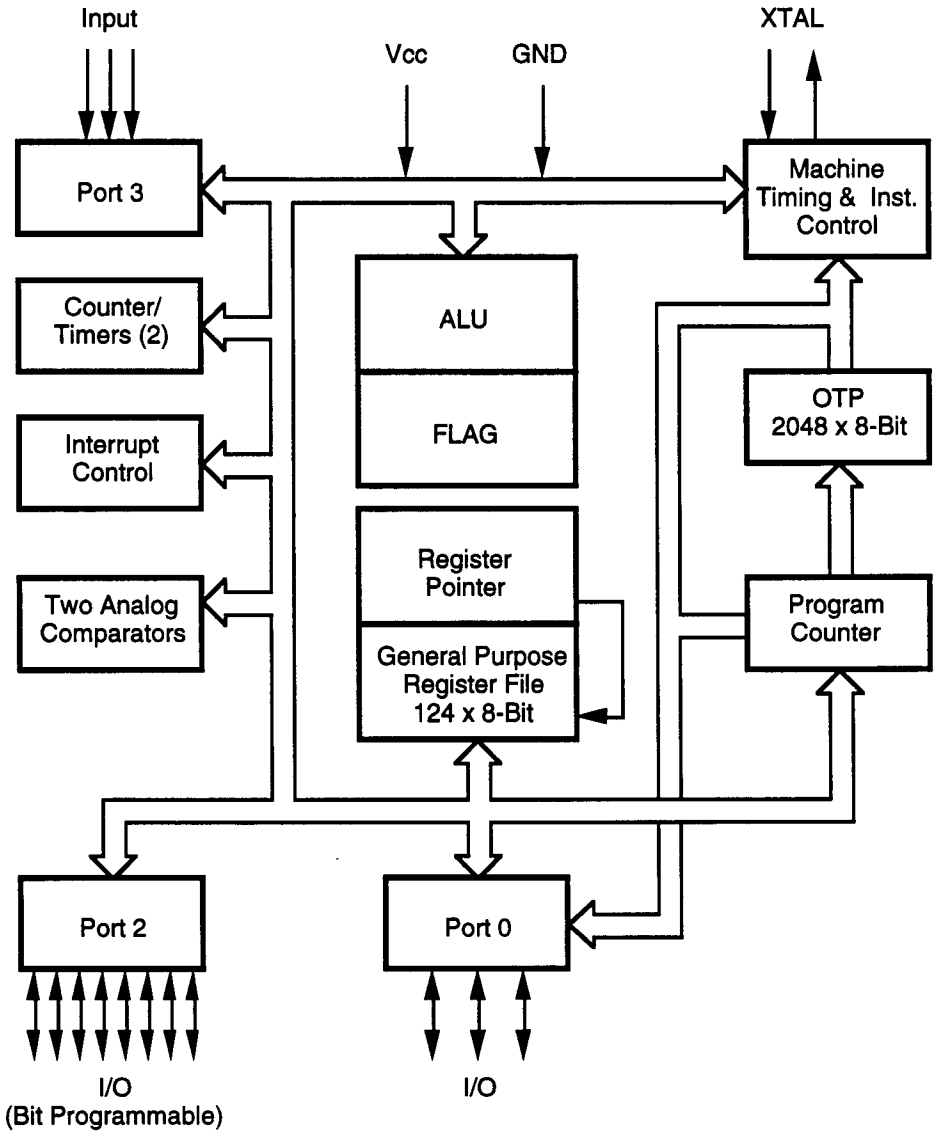
Zilog recommends the following programming equipment for use with this One-Time-Programmable product:

Device	Zilog Support Tool	Revision Level Hardware	Revision Level Software
Z86E07	Z86CCP00ZEM Z8 CCP Emulator	B	1.5
Z86E07	Z86C1200ZEM ICEBOX™ Emulator	B	1.5
Z86E07	Data I/O 3900 Programmer* (*Does not support option bits.)		1.1
Z86E07	Data I/O Unisite Programmer* (*Does not support option bits.)		3.7

Some non-Zilog programmers may have different programming waveforms, voltages and timings and not all programmers may meet the programming requirements of Zilog's One-Time-Programmable products.

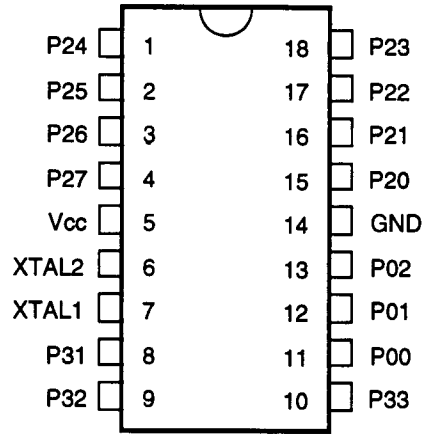
If difficulty is encountered in programming a Zilog OTP product, please contact your local Zilog sales office.

GENERAL DESCRIPTION (Continued)



Functional Block Diagram

PIN DESCRIPTION



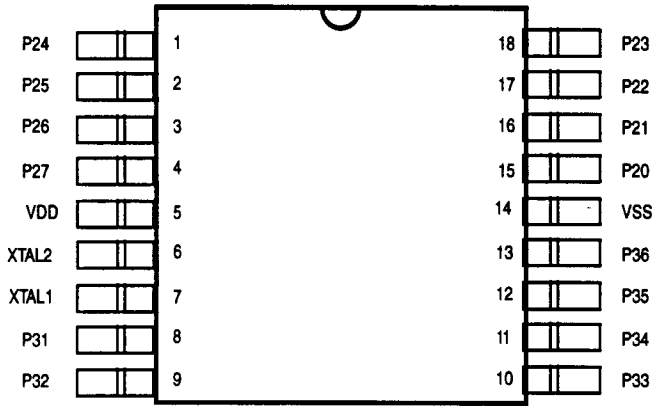
Normal Mode

18-Pin DIP Configuration

Pin Identification

Z86E07 Standard Mode

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



18-Pin SOIC Configuration

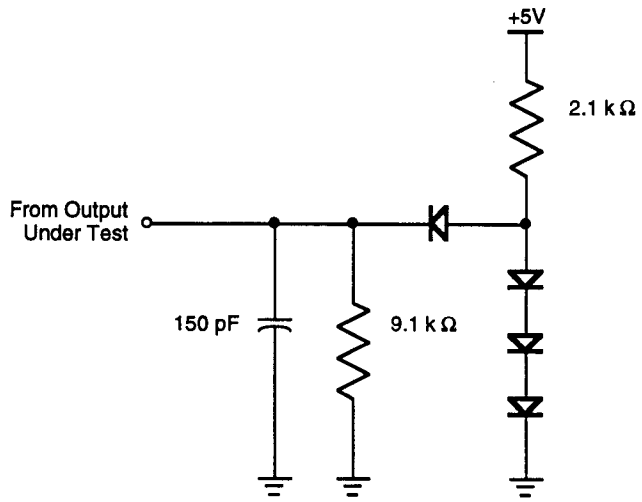
Pin Identification

Z86E07

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

STANDARD TEST CONDITIONS

The characteristics listed below apply for standard test conditions as noted. All voltages are referenced to GND. Positive current flows into the referenced pin (Test Load Diagram).



Test Load Diagram

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min	Max	Units
V_{CC}	Supply Voltage*	-0.3	+7	V
T_{STG}	Storage Temp	-65	+150	°C
T_A	Oper Ambient Temp	†	†	°C

Notes:
* Voltages on all pins with respect to GND.
† See Ordering Information

Stress greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; operation of the device at any condition above those indicated in the operational sections of these specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

CAPACITANCE

T_A = 25°C, V_{CC} = GND = 0V, f =1.0 MHz, unmeasured pins to GND.

Parameter	Max
Input Capacitance	10 pF
Output Capacitance	20 pF
I/O Capacitance	25 pF

V_{CC} SPECIFICATION

4.5V to 5.0V ± 0.5V

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V_{CC}	T_A = 0°C to +70°C Min	Max	Typical @ 25°C	Units	Conditions
	Max Input Voltage	4.5V		12		V	V_{IN} = 250 µA
		5.5V		12		V	V_{IN} = 250 µA
V_{CH}	Clock Input High Voltage	4.5V	0.8 V_{CC}	V_{CC}+0.3	2.4	V	Driven by External Clock Generator
		5.5V	0.8 V_{CC}	V_{CC}+0.3	2.6	V	Driven by External Clock Generator
V_{CL}	Clock Input Low Voltage	4.5V	V_{SS}–0.3	0.2 V_{CC}	1.6		Driven by External Clock Generator
		5.5V	V_{SS}–0.3	0.2 V_{CC}	2.3	V	Driven by External Clock Generator
V_{IH}	Input High Voltage	4.5V	0.7 V_{CC}	V_{CC}+0.3	2.1	V	
		5.5V	0.7 V_{CC}	V_{CC}+0.3	2.7	V	
V_{IL}	Input Low Voltage	4.5V	V_{SS}–0.3	0.2 V_{CC}	1.2	V	
		5.5V	V_{SS}–0.3	0.2 V_{CC}	1.7	V	
V_{OH}	Output High Voltge	4.5V	V_{CC}–0.4		3.9	V	I_{OH} = -2.0 mA
		5.5V	V_{CC}–0.4		5.4	V	I_{OH} = -2.0 mA
V_{OH}	Output High Voltage	4.5V	V_{CC}–0.4			V	Low Noise @ I_{OH} = –0.5 mA
		5.5V	V_{CC}–0.4			V	Low Noise @ I_{OH} = –0.5 mA
V_{OL1}	Output Low Voltage	4.5V		0.8	0.2	V	I_{OL} = +4.0 mA
		5.5V		0.4	0.2	V	I_{OL} = +4.0 mA
V_{OL2}	Output Low Voltage	4.5V	TBD		0.7	V	I_{OL} = +12 mA, 3 Pin Max
		5.5V	0.8		0.5	V	I_{OL} = +12 mA, 3 Pin Max
V_{OFFSET}	Comparator Input Offset Voltage	4.5V		10	6	mV	
		5.5V		25	7	mV	
V_{RST}	Auto Reset Voltage		1.55	2.7	2.4	V	
I_{IL}	Input Leakage (Input Bias Current of Comparator)	4.5V	–1.0	1.0	1.0	µA	V_{IN} = 0V, V_{CC}
		5.5V	–1.0	1.0	1.0	µA	V_{IN} = 0V, V_{CC}
I_{OL}	Output Leakage	4.5V	–1.0	1.0	1.0	µA	V_{IN} = 0V, V_{CC}
		5.5V	–1.0	1.0	1.0	µA	V_{IN} = 0V, V_{CC}
V_{ICR}	Input Common Mode Voltage Range		0	V_{CC}–1.0		V	

Symbol	Parameter	V_{CC}	T_A = 0°C to +70°C Min	Max	Typical @ 25°C	Units	Conditions
I_{CC}	Supply Current (Standard Mode)	4.5V		4.0	2.2	mA	All Output and I/O Pins Floating @ 2 MHz
		5.5V		7.0	5.0	mA	All Output and I/O Pins Floating @ 2 MHz
		4.5V		9.0	4.5	mA	All Output and I/O Pins Floating @ 8 MHz
		5.5V		11.0	8.3	mA	All Output and I/O Pins Floating @ 8 MHz
		4.5V		10	6.1	mA	All Output and I/O Pins Floating @ 12 MHz
		5.5V		15	10.8	mA	All Output and I/O Pins Floating @ 12 MHz
I_{CC1}	Standby Current (Standard Mode)	4.5V		2.5	0.5	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 2 MHz
		5.5V		4.0	1.0	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 2 MHz
		4.5V		4.0	1.0	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 8 MHz
		5.5V		5.0	2.0	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 8 MHz
		4.5V		5.0	1.3	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 12 MHz
		5.5V		7.0	2.3	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 12 MHz
I_{CC}	Supply Current (Low Noise Mode)	4.5V		4.0	2.2	mA	All Output and I/O Pins Floating @ 1 MHz
		5.5V		7.0	4.2	mA	All Output and I/O Pins Floating @ 1 MHz
		4.5V		6.0	2.9	mA	All Output and I/O Pins Floating @ 2 MHz
		5.5V		9.0	5.5	mA	All Output and I/O Pins Floating @ 2 MHz
		4.5V		8.0	4.4	mA	All Output and I/O Pins Floating @ 4 MHz
		5.5V		11.0	7.9	mA	All Output and I/O Pins Floating @ 4 MHz

DC ELECTRICAL CHARACTERISTICS (Continued)

Symbol	Parameter	V_{CC}	T_A = 0°C to +70°C Min	Max	Typical @ 25°C	Units	Conditions
I_{CC1}	Standby Current (Low Noise Mode)	4.5V		1.2	0.4	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 1 MHz
		5.5V		1.6	0.9	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 1 MHz
		4.5V		1.5	0.5	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 2 MHz
		5.5V		1.9	1	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 2 MHz
		4.5V		2.0	0.8	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 4 MHz
		5.5V		2.4	1.3	mA	HALT Mode V_{IN} = 0V, V_{CC} @ 4 MHz
I_{CC2}	Standby Current	4.5V		10	1.0	µA	STOP Mode V_{IN} = 0V, V_{CC} WDT is not Running
		5.5V		10	1.0	µA	STOP Mode V_{IN} = 0V, V_{CC} WDT is not Running
I_{ALL}	Auto Latch Low Current	4.5V		10	6.0	µA	$0V < V_{IN} < V_{CC}$
		5.5V		15	11.5	µA	$0V < V_{IN} < V_{CC}$
I_{ALH}	Auto Latch High Current	4.5V		–7.0	–3.3	µA	$0V < V_{IN} < V_{CC}$
		5.5V		–7.0	–6.5	µA	$0V < V_{IN} < V_{CC}$

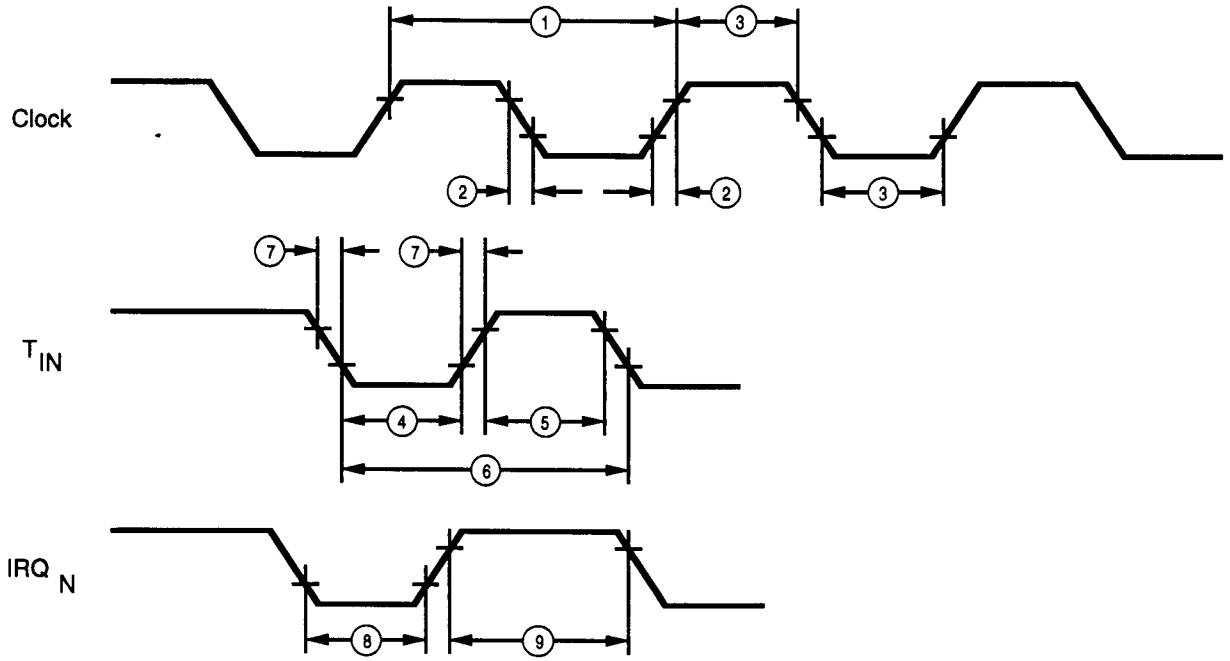
Notes:

[1] I_{CC1}

	Typ	Max	Unit	Freq
Clock Driven on Crystal	3.0	5.0	mA	8 MHz
or XTAL Resonator	0.3	5.0	mA	8 MHz

[2] V_{SS} = 0V = GND

AC ELECTRICAL CHARACTERISTICS



Electrical Timing Diagram

AC ELECTRICAL CHARACTERISTICS
Low Noise Mode

				T_A = 0°C to +70°C					
				1 MHz		4 MHz			
No	Symbol	Parameter	V_{CC}	Min	Max	Min	Max	Units	Notes
1	TpC	Input Clock Period	4.5V	1000	DC	250	DC	ns	[1]
			5.5V	1000	DC	250	DC	ns	[1]
2	TrC,TfC	Clock Input Rise and Fall Times	4.5V		25		25	ns	[1]
			5.5V		25		25	ns	
3	TwC	Input Clock Width	4.5V	500		125		ns	[1]
			5.5V	500		125		ns	[1]
4	TwTinL	Timer Input Low Width	4.5V	100		100		ns	[1]
			5.5V	70		70		ns	[1]
5	TwTinH	Timer Input High Width	4.5V	2.5TpC		2.5TpC			[1]
			5.5V	2.5TpC		2.5TpC			[1]
6	TpTin	Timer Input Period	4.5V	4TpC		4TpC			[1]
			5.5V	4TpC		4TpC			[1]
7	TrTin, TtTin	Timer Input Rise and Fall Timer	4.5V		100		100	ns	[1]
			5.5V		100		100	ns	[1]
8	TwIL	Int. Request Input Low Time	4.5V	100		100		ns	[1,2]
			5.5V	70		70		ns	[1,2]
9	TwIH	Int. Request Input High Time	4.5V	2.5TpC		2.5TpC			[1]
			5.5V	2.5TpC		2.5TpC			[1,2]
10	Twdt	Watchdog Timer Delay Time	4.5V		15		15	ms	[1]
			5.5V		10		10	ms	[1]
11	TPOR	Power On Reset Time	4.5V		15		10	ms	[1]
			5.5V		15		10	ms	[1]

Notes:
[1] Timing Reference uses 0.9 V_{CC} for a logic 1 and 0.1 V_{CC} for a logic 0.
[2] Interrupt request via Port 3 (P31-P33)

AC ELECTRICAL CHARACTERISTICS

Standard Mode, Standard Temperature

				T_A = 0°C to +70°C					
				8 MHz		12 MHz			
No	Symbol	Parameter	V_{cc}	Min	Max	Min	Max	Units	Notes
1	TpC	Input Clock Period	4.5V	125	DC	83	DC	ns	[1]
			5.5V	125	DC	83	DC	ns	[1]
2	TrC,TfC	Clock Input Rise and Fall Times	4.5V		25		15	ns	[1]
			5.5V		25		15	ns	
3	TwC	Input Clock Width	4.5V	62		41		ns	[1]
			5.5V	62		41		ns	[1]
4	TwTinL	Timer Input Low Width	4.5V	100		100		ns	[1]
			5.5V	70		70		ns	[1]
5	TwTinH	Timer Input High Width	4.5V	5TpC		5TpC			[1]
			5.5V	5TpC		5TpC			[1]
6	TpTin	Timer Input Period	4.5V	8TpC		8TpC			[1]
			5.5V	8TpC		8TpC			[1]
7	TrTin, TtTin	Timer Input Rise and Fall Timer	4.5V		100		100	ns	[1]
			5.5V		100		100	ns	[1]
8	TwIL	Int. Request Input Low Time	4.5V	100		100		ns	[1,2]
			5.5V	70		70		ns	[1,2]
9	TwIH	Int. Request Input High Time	4.5V	5TpC		5TpC			[1]
			5.5V	5TpC		5TpC			[1,2]
10	Twdt	Watchdog Timer Delay Time	4.5V		15		15	ms	[1]
			5.5V		10		10	ms	[1]
11	TPOR	Power On Reset Time	4.5V		60		60	ms	[1]
			5.5V		45		45	ms	[1]

Notes:

[1] Timing Reference uses 0.9 V_{cc} for a logic 1 and 0.1 V_{cc} for a logic 0.

[2] Interrupt request via Port 3 (P31-P33)

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