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PRODUCT OVERVIEW

SAM87RI PRODUCT FAMILY

Samsung's SAM87Ri family of 8-bit single-chip CMOS microcontrollers offers a fast and efficient CPU, a wide range of integrated peripherals, and various mask-programmable ROM sizes.

A address/data bus architecture and a large number of bit-configurable I/O ports provide a flexible programming environment for applications with varied memory and I/O requirements. Timer/counters with selectable operating modes are included to support real-time operations.

KS86C4004/C4104 MICROCONTROLLER

The KS86C4004/C4104 single-chip 8-bit microcontroller is fabricated using an advanced CMOS process. It is built around the powerful SAM87Ri CPU core. The KS86C4004/C4104 is a versatile microcontroller, with its A/D converter and a zero-crossing detection capability it can be used in a wide range of general purpose applications.

Stop and Idle power-down modes were implemented to reduce power consumption. To increase on-chip register space, the size of the internal register file was logically expanded. The KS86C4004/C4104 has 4-Kbytes of program memory on-chip (ROM) and 208-bytes of general purpose register area RAM.

Using the SAM87Ri design approach, the following peripherals were integrated with the SAM87Ri core:

- Four configurable I/O ports (KS86C4004: 22 pins, KS86C4104: 16 pins)
- Six interrupt sources with one vector and one interrupt level
- Two 8-bit timer/counter with various operating modes

The KS86C4004/C4104 microcontroller is ideal for use in a wide range of electronic applications requiring simple timer/counter, PWM, ADC, ZCD and capture functions. KS86C4004 is available in a 30-pin SDIP and a 32-pin SOP package. KS86C4104 is available in a 24-pin SDIP and a 24-pin SOP package.

FEATURES

CPU

- SAM87Ri CPU core

Memory

- 4-Kbyte internal program memory (ROM)
- 208-byte general purpose register area (RAM)

Instruction Set

- 41 instructions
- IDLE and STOP instructions added for power-down modes.

Instruction Execution Time

- 600 ns at 10 MHz f_{OSC} (minimum)

Interrupts

- 6 interrupt sources with one vector and one level interrupt structure

Oscillation Frequency

- 1 MHz to 10 MHz external crystal oscillator
- Maximum 10 MHz CPU clock
- 4 MHz RC oscillator

General I/O

- Four I/O ports (22 pins for KS86C4004, 16 pins for KS86C4104)
- Bit programmable ports

A/D Converter

- Eight analog input pins
- 8-bit conversion resolution (KS86C4004)
- 10-bit conversion resolution (KS86C4104)

Timer/Counter

- One 8-bit basic timer for watchdog function
- One 8-bit timer/counter with three operating modes (10-bit PWM 1ch)
- One 8-bit timer/counter for the zero-crossing detection circuit

Zero-Crossing Detection Circuit

- Zero-crossing detection circuit that generates a digital signal in synchronism with an AC signal input

Buzzer Frequency Range

- 200 Hz to 20 kHz signal can be generated

Operating Temperature Range

- -40°C to $+85^{\circ}\text{C}$

Operating Voltage Range

- 2.7 V to 5.5 V

OTP Interface Protocol Spec

- Serial OTP

Package Types

- 30-pin SDIP, 32-pin SOP for KS86C4004/P4004
- 24-pin SDIP, 24-pin SOP for KS86C4104/P4104

BLOCK DIAGRAM

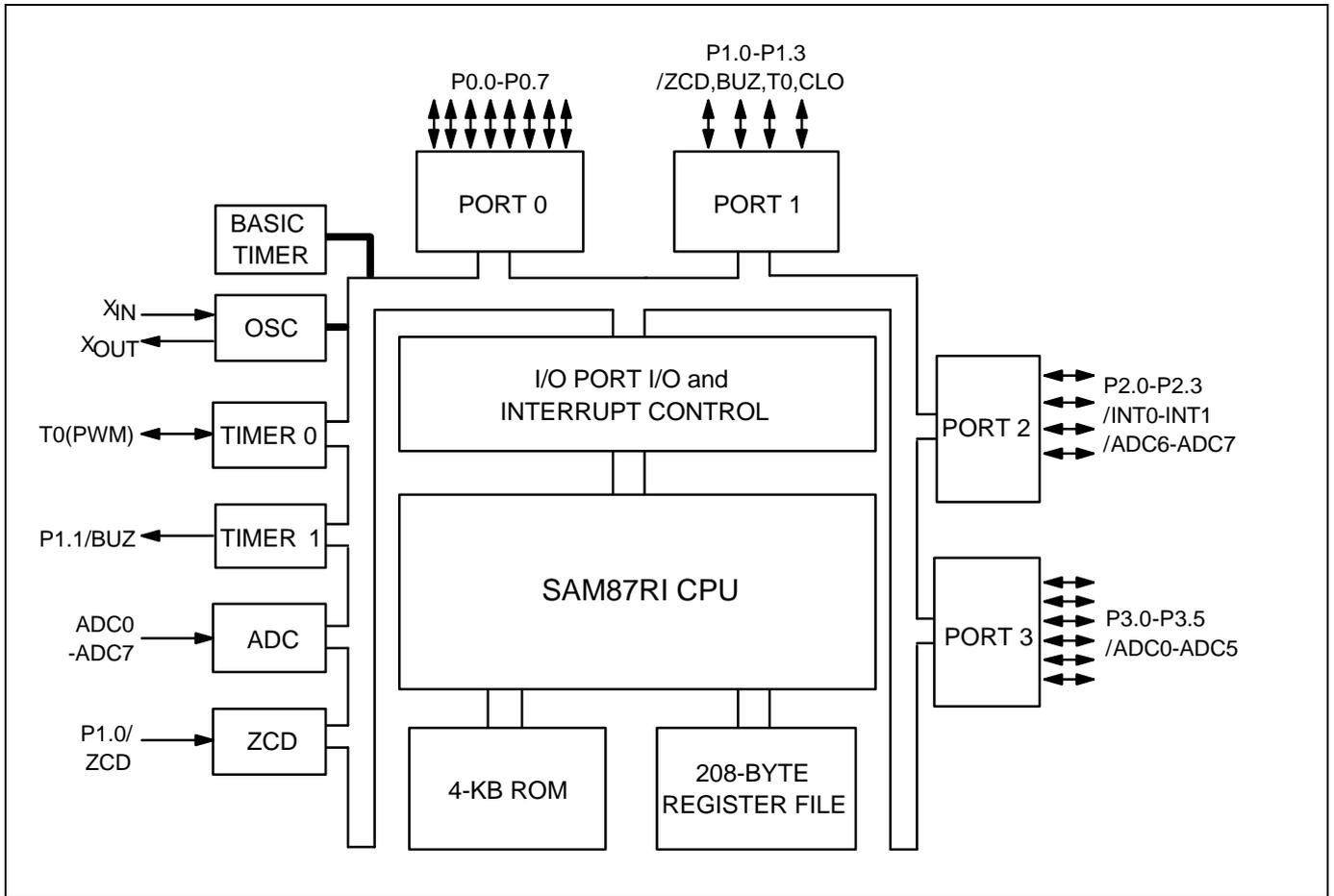


Figure 1-1. Block Diagram

PIN ASSIGNMENTS

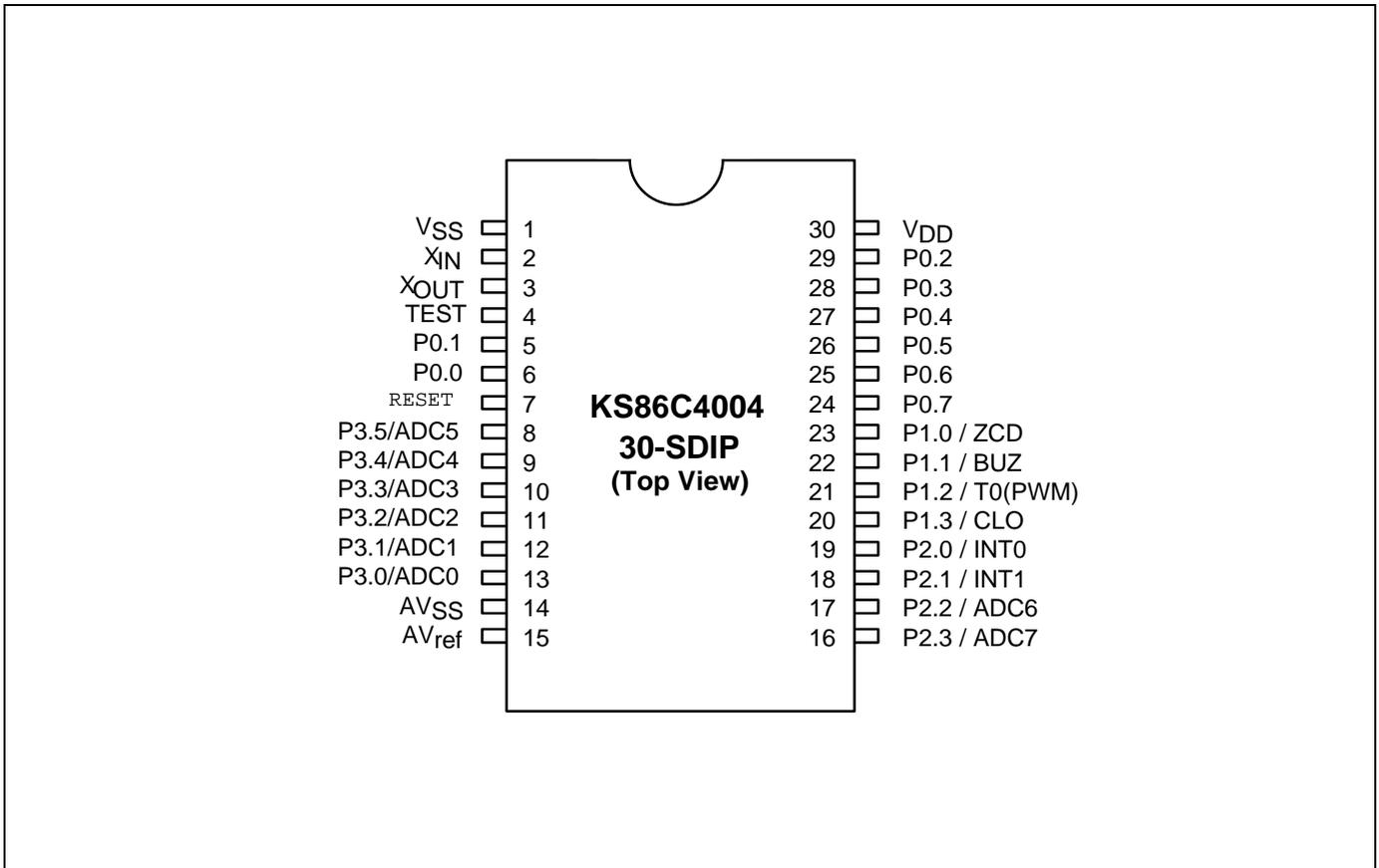


Figure 1-2. Pin Assignment Diagram (30-Pin SDIP Package)

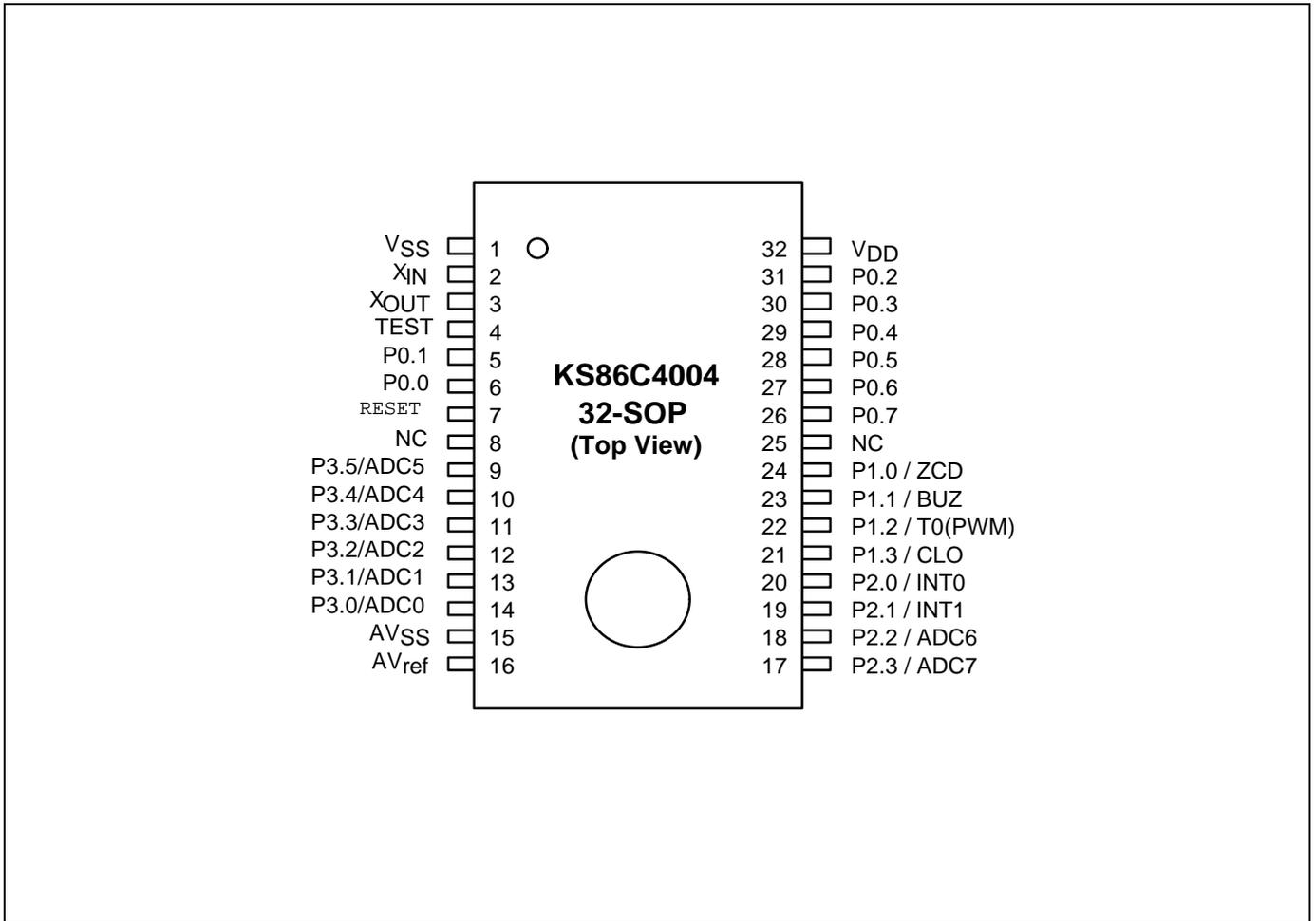


Figure 1-3. Pin Assignment Diagram (32-Pin SOP Package)

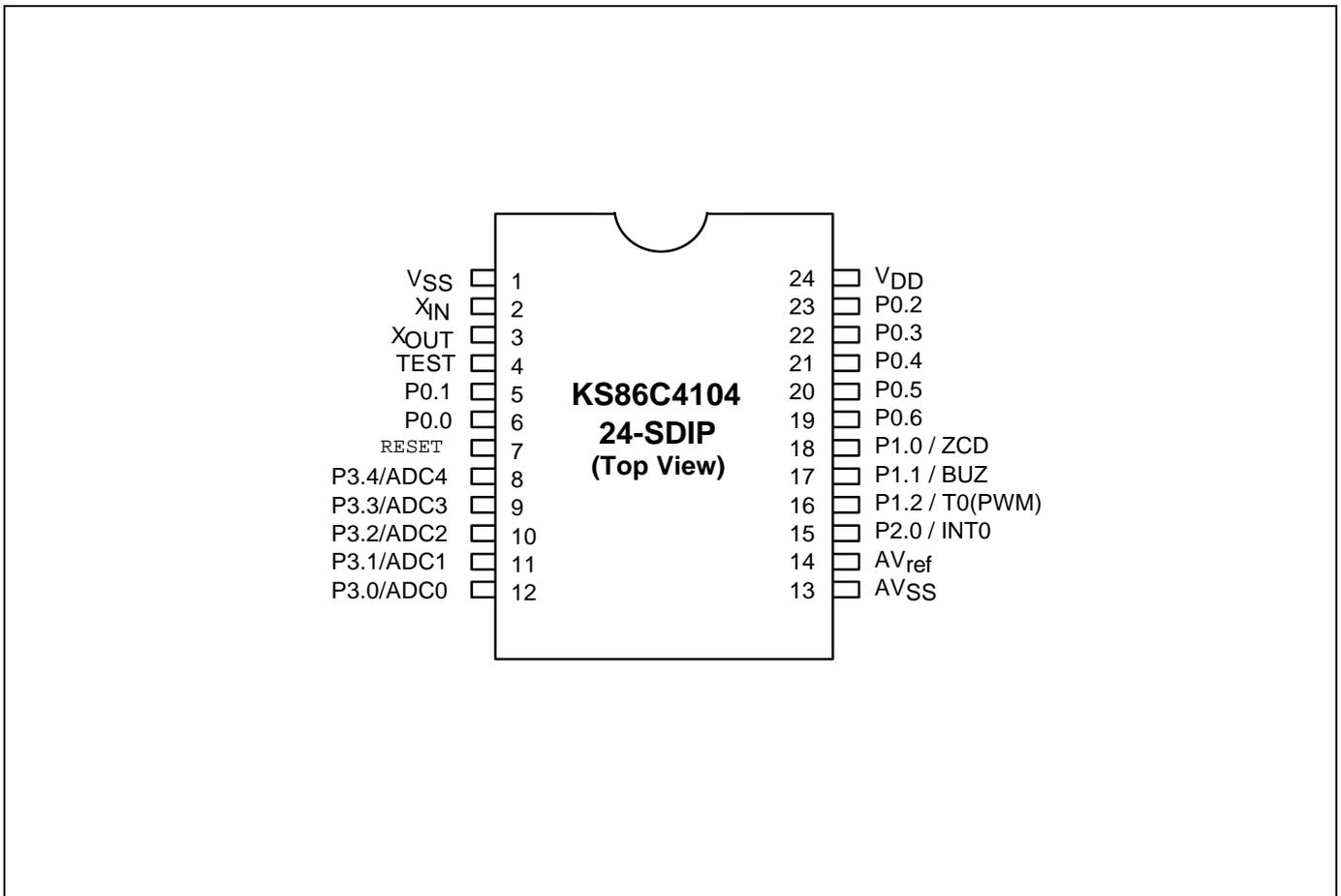


Figure 1-4. Pin Assignment Diagram (24-Pin SDIP Package)

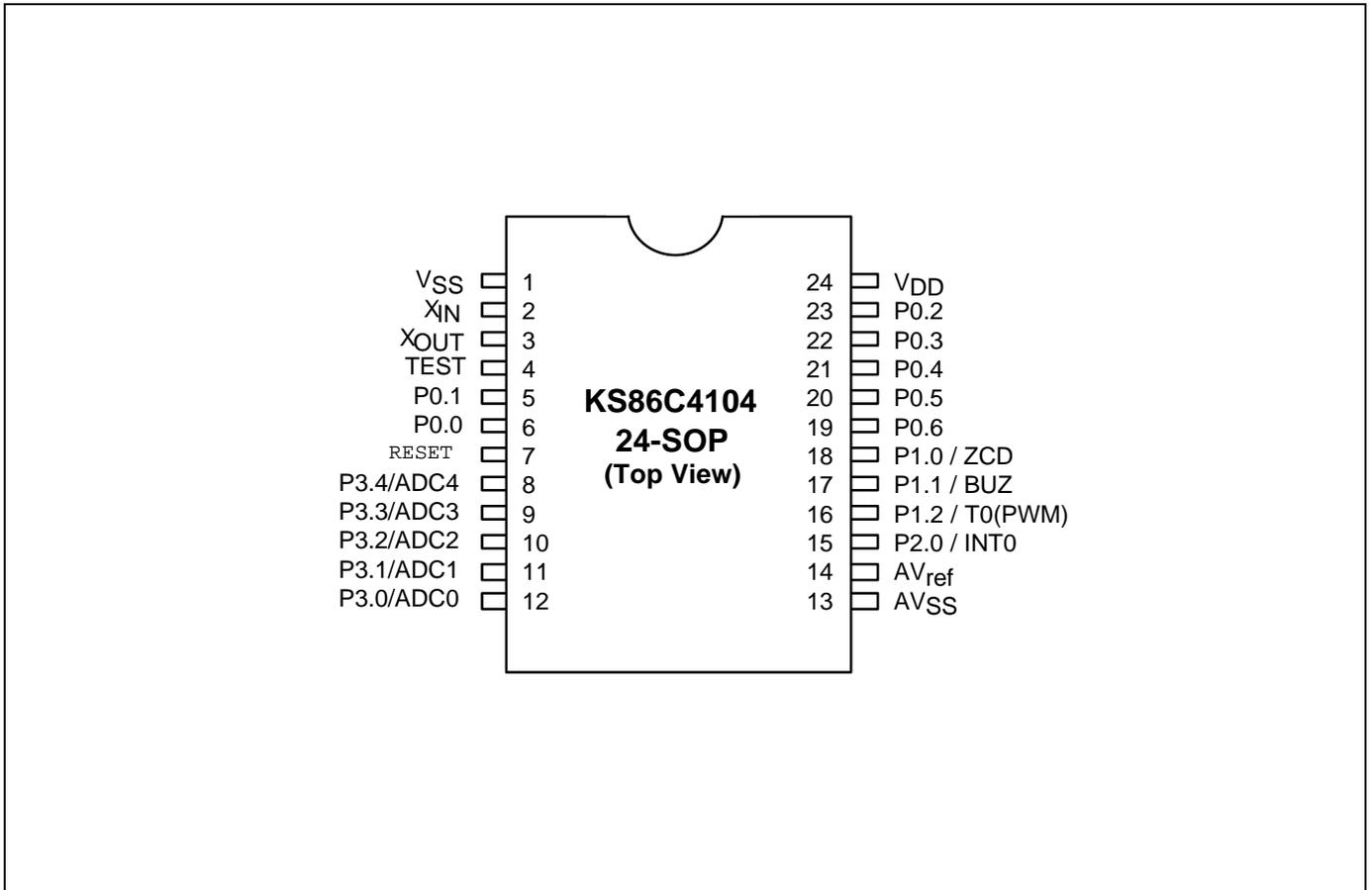


Figure 1-5. Pin Assignment Diagram (24-Pin SOP Package)

PIN DESCRIPTIONS

Table 1-1. KS86C4004/C4104 Pin Descriptions

Pin Names	Pin Type	Pin Description	Circuit Type	Share Pins
P0.0-P0.7	I/O	Bit-programmable I/O port for normal input or push-pull, open-drain output. Pull-up resistors are assignable by software.	E-2	
P1.0-P1.3	I/O	Bit-programmable I/O port for Schmitt trigger input or push-pull output. Pull-up resistors are assignable by software. Port 1 pins can also be used as alternative functions.	F D D D	ZCD BUZ T0(PWM) CLO
P2.0-P2.3	I/O	Bit-programmable I/O port for Schmitt trigger input or push-pull, open drain output. Pull up resistors are assignable by software. Port 2 can also be used as external interrupt, A/D input.	E E-1	INT0-INT1 ADC6-ADC7
P3.0-P3.5	I/O	Bit-programmable I/O port for Schmitt trigger input or push-pull output. Pull-up resistors are assignable by software. Port 3 pins can also be used as A/D converter input.	F	ADC0-ADC5
X _{IN} , X _{OUT}	-	Crystal/ceramic, or RC oscillator signal for system clock.	-	-
INT0-INT1	I	External interrupt input.	E	P2.0-P2.1
RESET	I	System RESET signal input pin.	B	-
TEST	I	Test signal input pin (for factory use only: must be connected to V _{SS})	-	-
V _{DD} , V _{SS}	-	Voltage input pin and ground	-	-
A _V _{REF} , A _V _{SS}	-	A/D converter reference voltage input and ground	-	-
ZCD	I	Zero crossing detector input	F	P1.0
BUZ	O	200 Hz-20 kHz frequency output for buzzer sound	D	P1.1
T0	I/O	Timer 0 capture input or 10-bit PWM output	D	P1.2
CLO	O	System clock output port	D	P1.3
ADC0-ADC7	I	A/D converter input	F E-1	P3.0-P3.5 P2.2-P2.3

NOTE: Port 0.7, P1.3, P2.1-P2.3 and P3.5 is not available in KS86C4104/P4104 .