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"[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	5MHz
Connectivity	-
Peripherals	LED, POR, WDT
Number of I/O	32
Program Memory Size	4KB (4K x 8)
Program Memory Type	ROM
EEPROM Size	-
RAM Size	188 x 8
Voltage - Supply (Vcc/Vdd)	4.5V ~ 5.5V
Data Converters	-
Oscillator Type	Internal
Operating Temperature	0°C ~ 70°C (TA)
Mounting Type	Through Hole
Package / Case	40-DIP (0.600", 15.24mm)
Supplier Device Package	40-DIP
Purchase URL	https://www.e-xfl.com/product-detail/zilog/z86k1505pscr4243



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TABLE OF CONTENTS

1.	ARCHITECTURAL OVERVIEW	1
1.1	Z86K15 KEYBOARD CONTROLLER FEATURES	1
1.2	FUNCTIONAL BLOCK DIAGRAM	2
2.	PIN DESCRIPTION	3
3.	ELECTRICAL CHARACTERISTICS	5
3.1	ABSOLUTE MAXIMUM RATINGS	5
3.2	STANDARD TEST CONDITIONS	5
3.3	CAPACITANCE	6
3.4	DC CHARACTERISTICS	6
3.5	AC ELECTRICAL CHARACTERISTICS	7
4.	PIN FUNCTIONS	8
5.	FUNCTIONAL DESCRIPTION	11
6.	CONTROL REGISTERS	20
7.	PACKAGE INFORMATION	26
8.	ORDERING INFORMATION	27
8.1	PART NUMBER DESCRIPTION	27
9.	DOCUMENT INFORMATION	28
9.1	DOCUMENT NUMBER DESCRIPTION	28
9.2	CHANGE LOG	28
	CUSTOMER FEEDBACK FORM	29
	Z86K15 KEYBOARD CONTROLLER PRODUCT SPECIFICATION	29
	CUSTOMER INFORMATION	29
	PRODUCT INFORMATION	29
	RETURN INFORMATION	29
	PROBLEM DESCRIPTION OR SUGGESTION	29



LIST OF FIGURES

FIGURE 1.	Z86K15 FUNCTIONAL BLOCK DIAGRAM	2
FIGURE 2.	40-PIN DIP CONFIGURATION	3
FIGURE 3.	44-PIN PLCC CONFIGURATION	4
FIGURE 4.	TEST LOAD DIAGRAM	5
FIGURE 5.	ADDITIONAL TIMING	7
FIGURE 6.	PORTS 0 AND 1 CONFIGURATION	8
FIGURE 7.	PORT 2 CONFIGURATION	9
FIGURE 8.	PORT 3 CONFIGURATION	10
FIGURE 9.	PROGRAM MEMORY MAP	11
FIGURE 10.	REGISTER FILE CONFIGURATION	12
FIGURE 11.	REGISTER FILE ARCHITECTURE	13
FIGURE 12.	COUNTER/TIMERS BLOCK DIAGRAM	14
FIGURE 13.	INTERRUPT BLOCK DIAGRAM	15
FIGURE 14.	RC OSCILLATOR CONFIGURATIONS	16
FIGURE 15.	WDT TURN-ON TIMING AFTER RESET	17
FIGURE 16.	STOP-MODE RECOVERY SOURCE	19
FIGURE 17.	40-PIN DIP PACKAGE DIAGRAM	26
FIGURE 18.	44-PIN PLCC PACKAGE DIAGRAM	26



LIST OF TABLES

TABLE 1.	Z86K15 KEYBOARD CONTROLLER FEATURES	1
TABLE 2.	POWER CONNECTIONS	2
TABLE 3.	40-PIN DIP PIN IDENTIFICATION.	3
TABLE 4.	44-PIN PLCC PIN IDENTIFICATION	4
TABLE 5.	ABSOLUTE MAXIMUM RATINGS.	5
TABLE 6.	CAPACITANCE	6
TABLE 7.	DC CHARACTERISTICS	6
TABLE 8.	AC ELECTRICAL CHARACTERISTICS.	7
TABLE 9.	REGISTER POINTER.	13
TABLE 10.	INTERRUPT REQUEST REGISTER	18
TABLE 11.	TIMER MODE REGISTER.	20
TABLE 12.	COUNTER/TIMER 0 REGISTER	20
TABLE 13.	PRESCALER 0 REGISTER.	21
TABLE 14.	PORT 2 MODE REGISTER.	21
TABLE 15.	PORT 2 OPEN DRAIN MODE REGISTER	21
TABLE 16.	INTERRUPT PRIORITY REGISTER.	22
TABLE 17.	INTERRUPT REQUEST REGISTER	23
TABLE 18.	INTERRUPT MASK REGISTER.	23
TABLE 19.	FLAG REGISTER.	24
TABLE 20.	REGISTER POINTER.	24
TABLE 21.	STACK POINTER	25
TABLE 22.	ORDERING INFORMATION	27
TABLE 23.	PART NUMBER DESCRIPTION	27
TABLE 24.	PACKAGE DESCRIPTION	27



1 ARCHITECTURAL OVERVIEW

The Z86K15 Keyboard Controller is a full-featured member of the Z8[®] MCU family, offering a unique register-to-register architecture that avoids accumulator bottlenecks. The Z86K15 is more code-efficient than RISC processors.

For keyboard applications demanding powerful I/O capabilities, the Z86K15 provides 32 pins dedicated to input and output for row, column, clock, data, and LEDs.

An on-chip counter/timer is available to relieve the system of administering real-time tasks.

5 different internal or external interrupt sources are maskable and prioritized to provide a vectored address for efficient interrupt subroutine handling and multi-tasking functions.

The Z86K15 achieves low EMI by means of several modifications in the clock circuitry and output drivers.

1.1 Z86K15 KEYBOARD CONTROLLER FEATURES

Table 1 lists the features of the Z86K15 Keyboard Controller.

TABLE 1. Z86K15 KEYBOARD CONTROLLER FEATURES

Device	ROM (KB)	I/O Lines	Speed (MHz)	Pin Count/Package
Z86K15	4	32	3–5	40-Pin DIP, 44-Pin PLCC, Chip On Board

- 4.5 V to 5.5 V Operating Range
- 0°C to +70°C Operating Temperature Range
- 188 Bytes of RAM
- Low Power Consumption: 40 mW @ 5 MHz
- 5 Vectored, Priority Interrupts from 5 Different Sources
- Programmable 8-Bit Counter/Timer, with 6-Bit Programmable Prescaler
- Power-On Reset (POR) Timer, Hardware Watch-Dog Timer (WDT)
- Digital-Input CMOS Levels with Internal Pull-Up Resistors
- 4 Direct-Connect LED Drive Ports
- On-Chip RC Oscillator
- Low System EMI Emission
- Z86E15 Emulation OTP

Power connections follow the conventional descriptions outlined in Table 2.

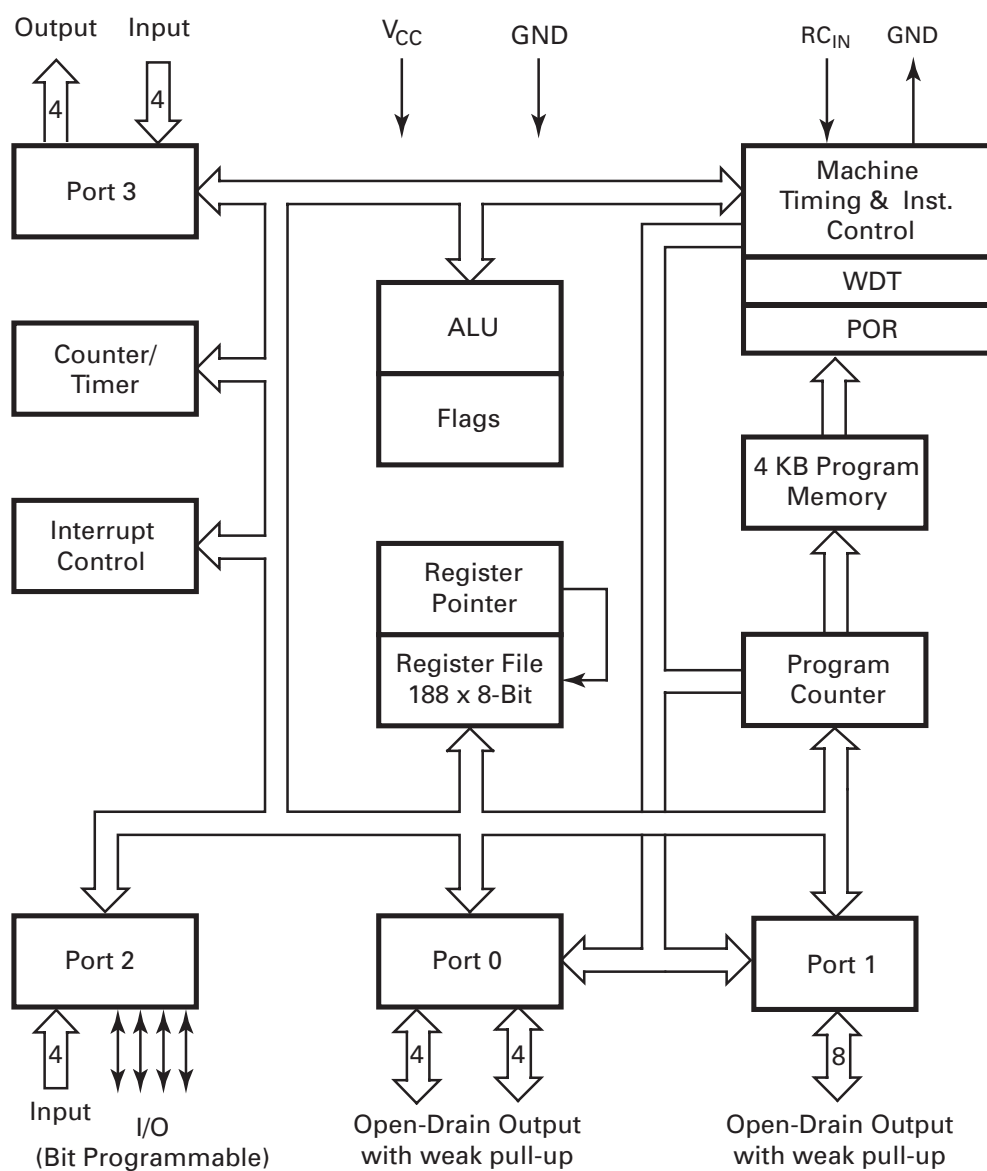
TABLE 2. POWER CONNECTIONS

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

1.2 FUNCTIONAL BLOCK DIAGRAM

Figure 1 illustrates the functional block layout of the Z86K15 Keyboard Controller.

FIGURE 1. Z86K15 FUNCTIONAL BLOCK DIAGRAM



3 ELECTRICAL CHARACTERISTICS

3.1 ABSOLUTE MAXIMUM RATINGS

Table 5 provides Absolute Maximum Ratings for the Z86K15 Keyboard Controller.

TABLE 5. ABSOLUTE MAXIMUM RATINGS

Symbol	Description	Min	Max	Units
V_{CC}	Supply Voltage*	-0.3	+7.0	V
T_{STG}	Storage Temp	-65	+150	°C
I_A	Operating Ambient Temperature	0	+105	°C

NOTE: *Voltage on all pins with respect to GND.

Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This rating is a stress rating only. Functional 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 an extended period may affect device reliability.

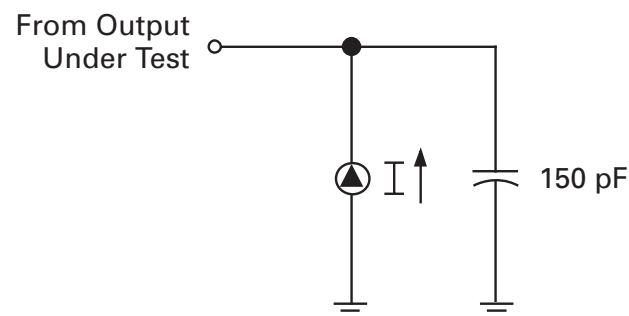
Total power dissipation should not exceed 1.21 W for the package. Power dissipation is calculated as follows:

$$\begin{aligned} \text{Total Power Dissipation} = & V_{DD} \times [I_{DD} - (\text{sum of } I_{OH}), \\ & + \text{sum of } [(V_{DD} - V_{OH}) \times I_{OH}] \\ & + \text{sum of } (V_{OL} \times I_{OL}) \end{aligned}$$

3.2 STANDARD TEST CONDITIONS

The characteristics listed here apply for standard test conditions as noted. All voltages are referenced to GND. Positive current flows into the referenced pin (Figure 4).

FIGURE 4. TEST LOAD DIAGRAM



3.5 AC ELECTRICAL CHARACTERISTICS

The ambient temperature (T_A) range for the Z86K15 Keyboard Controller's alternating current (AC) characteristics is 0°C to 70°C, at 5 MHz (Table 8).

TABLE 8. AC ELECTRICAL CHARACTERISTICS

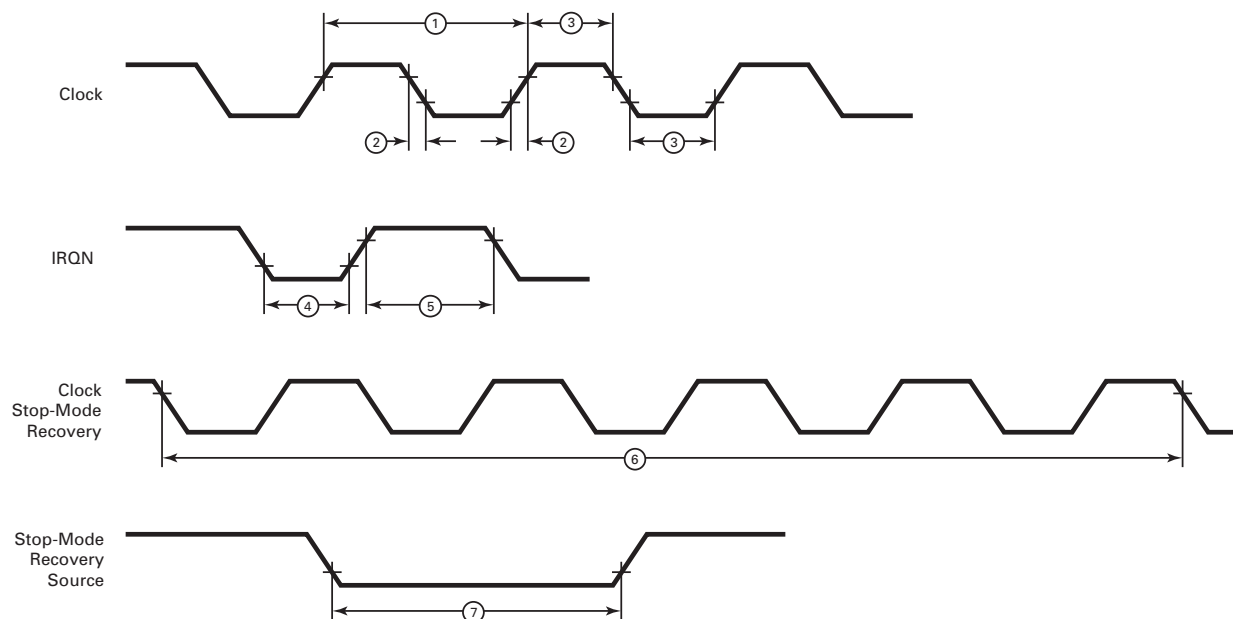
No	Symbol	Parameter	V _{CC}	Min	Max	Units	Notes
1	TpC	Input Clock Period	5.0 V	200	333	ns	1
2	TrC, TfC	Clock Input Rise & Fall Times	5.0 V		25	ns	1
3	TwC	Input Clock Width	5.0 V	37		ns	1
4	TwIL	Interrupt Request Low Time	5.0 V	3TpC			1,2
5	TwIH	Interrupt Request Input High Time	5.0 V	3TpC			1,3
6	Tost	Oscillator Start-Up Time	5.0 V		5TpC		4
7	Twsm	Stop-Mode Recovery Width Spec	5.0 V	5TpC		ns	
8	Twdt	Watch-Dog Timer Delay Time	5.0 V	53		ms	
9	Tpor	Power-On Reset	5.0 V	50	200	ms	

NOTES:

1. Timing Reference uses 0.7 V_{CC} for a logic 1 and 0.2 V_{CC} for a logic 0.
2. Interrupt request through Port 3 (P30).
3. Interrupt request through Port 3 (P31–P33).
4. After Stop-Mode Recovery.

Additional timing characteristics of the Z86K15 are illustrated in Figure 5.

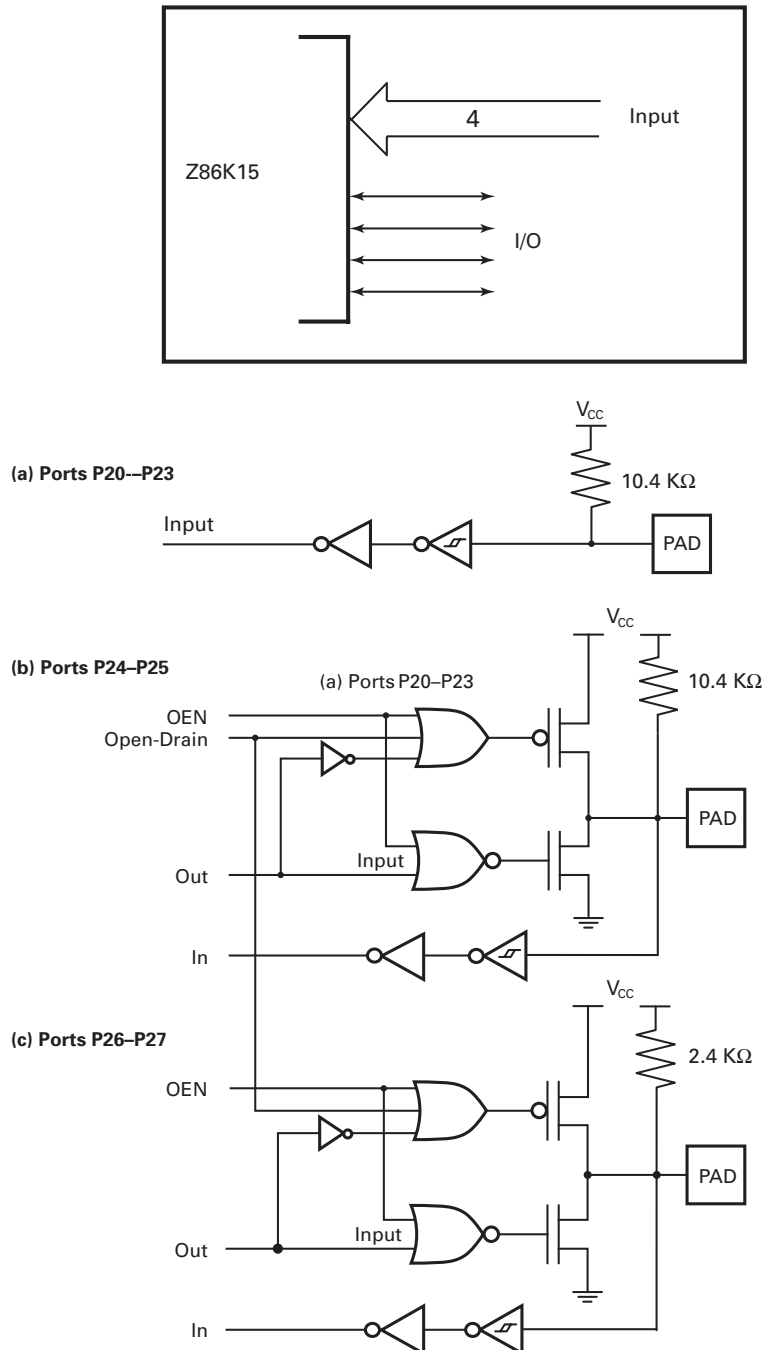
FIGURE 5. ADDITIONAL TIMING



Port 2 (P27–P20). Port 2 is an 8-bit CMOS-compatible Port with 4-bit input and 4-bit programmable I/O (Figure 7). P20–P25 feature 10.4-K Ω ($\pm 35\%$) pull-up resistors. P26–P27 feature 2.4-K Ω ($\pm 25\%$) pull-up resistors.

NOTE: Only 1 bit is used to program all 4 bits of P2_{OUT} (P24–P27; Open-Drain/Push-Pull). To meet keyboard application requirements, all 4 bits are open-drain.

FIGURE 7. PORT 2 CONFIGURATION

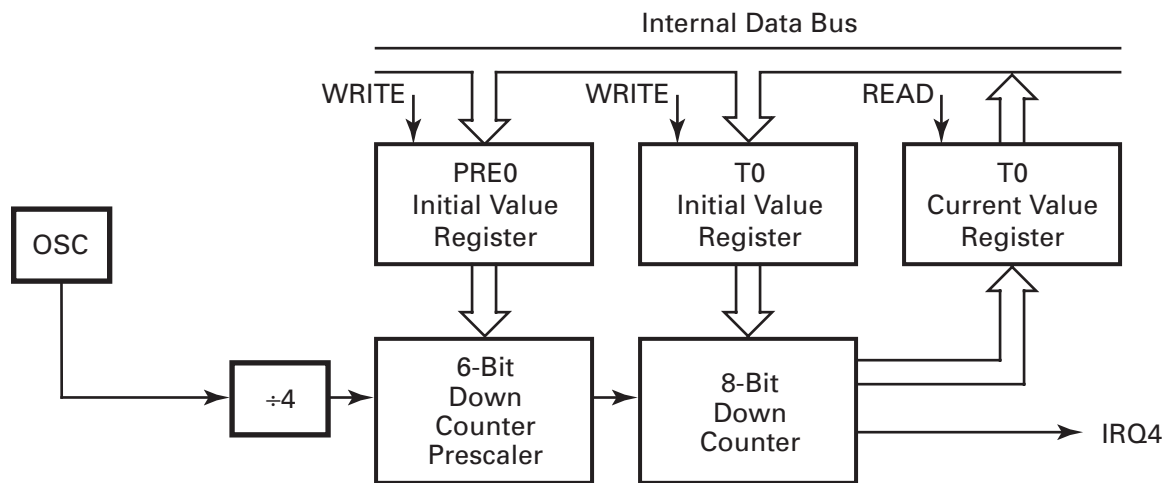


Counter/Timers. There is an 8-bit programmable counter/timer (T0) driven by its own 6-bit programmable prescaler (Figure 12).

The 6-bit prescaler can divide the input frequency of the clock by any integer number from 1 to 64. The prescaler drives its counter, which decrements the value (1 to 256) on the prescaler overflow. When both the counter and prescaler reach the end of count, a timer interrupt request, IRQ4, is generated.

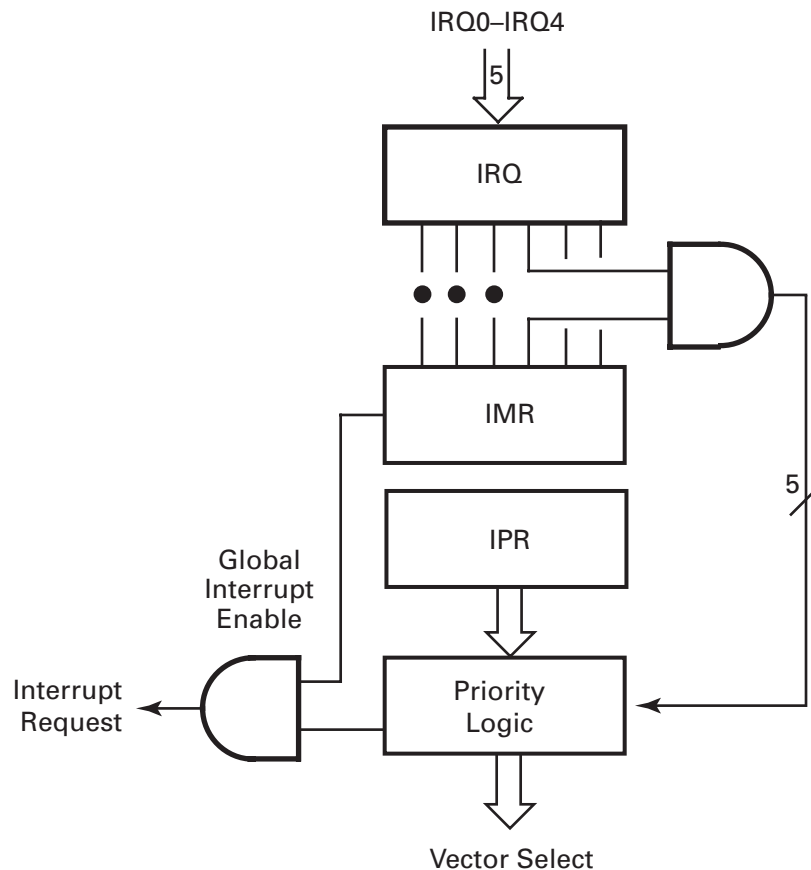
The counter can be programmed to start, stop, restart to continue, or restart from the initial value. The counter can also be programmed to stop upon reaching zero (SINGLE PASS mode) or to automatically reload the initial value and continue counting (MODULO-N CONTINUOUS mode) The counter, but not the prescaler, can be read at any time without disturbing its value or COUNT mode.

FIGURE 12. COUNTER/TIMERS BLOCK DIAGRAM



Interrupts. The Z86K15 features 5 different interrupts from 5 different sources. These interrupts are maskable and prioritized (Figure 13). The 5 sources are divided as follows: 4 sources are claimed by Port 3 lines P33–P30, and the other is claimed by the counter/timer. The Interrupt Mask Register globally or individually enables or disables the 5 interrupt requests.

FIGURE 13. INTERRUPT BLOCK DIAGRAM



When more than 1 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 the program memory. When an interrupt machine cycle is activated, an interrupt request is granted, thus disabling all of the subsequent interrupts. The program counter and status flags are saved. The interrupt machine cycle then branches to the program memory vector location reserved for the interrupt. This memory location and the next byte contain the 16-bit address of the interrupt service routine for this particular interrupt request.

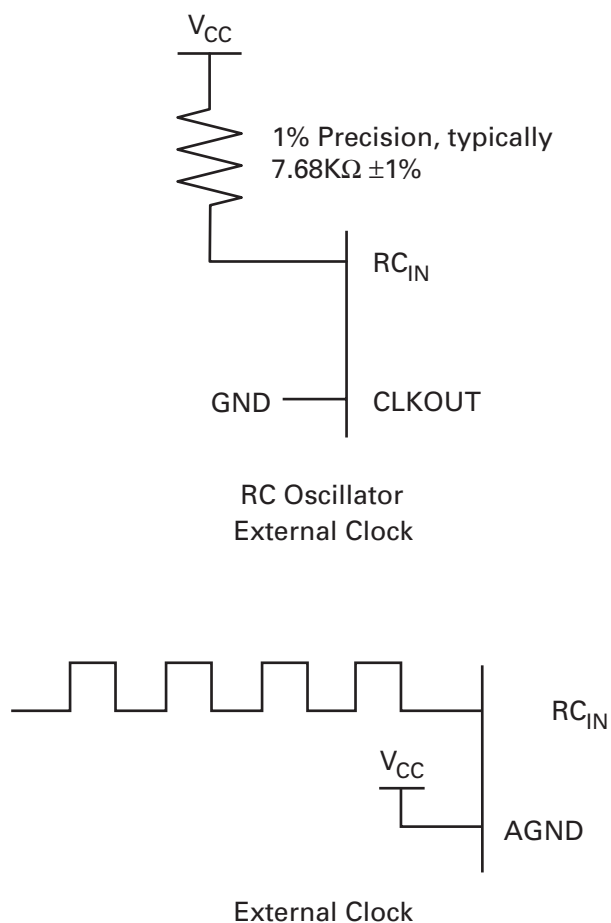
To accommodate polled interrupt systems, interrupt inputs are masked and the interrupt request register is polled to determine which of the interrupt request requires service.

RC Oscillator. The Z86K15 provides an internal capacitor to accommodate an RC oscillator configuration. A 1% precision resistor is necessary to achieve $\pm 10\%$ accurate frequency oscillation. For a nominal 4-MHz signal, use a $7.68\text{ K}\Omega$ resistor.

RC_{IN}. A precision resistor is connected between this pin and the power supply to form the RC oscillator.

The Z86K15 also accepts an external clock from (RC_{IN}) with AGND connected to V_{CC} (Figure 14).

FIGURE 14. RC OSCILLATOR CONFIGURATIONS



Cold or Warm Start (D6). This bit is set upon entering STOP mode. A 0 (cold) indicates that the device is awakened by a POR/WDT RESET. A 1 (warm) indicates that the device is awakened by a SMR source. This bit is reset when read.

A negative transition on the host data line or any of the designated row input pins recover the Z86K15 from STOP mode. See Figure 16.

FIGURE 16. STOP-MODE RECOVERY SOURCE



TABLE 17. INTERRUPT REQUEST REGISTER—R250 IRQ (FAH: READ/WRITE)

Bit	D7	D6	D5	D4	D3	D2	D1	D0
R/W	R	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
D7	WDT	R	0	Watch-Dog Timer Hot Bit 0: POR* 1: WDT Time-out
D6	STOP	R/W	0	Stop Flag 0: POR/WDT 1: Stop-Mode Recovery
D5	STOP	R/W	0	Stop Delay 0: OFF* 1: ON
D4–D0	IRQ4–IRQ0	R/W	0	IRQ0 = P32 Input IRQ1 = P33 Input IRQ2 = P31 Input IRQ3 = P30 Input IRQ4 = T0

NOTE: Upon Reset.

TABLE 18. INTERRUPT MASK REGISTER—R251 IMR (FBH: READ/WRITE)

Bit	D7	D6	D5	D4	D3	D2	D1	D0
R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Reset	0	X	X	0	0	0	0	0

NOTE: R = Read, W = Write, X = Indeterminate.

Bit Position	Bit Field	R/W	Reset Value	Description
D7	Interrupt	R/W	0	1: Enables Interrupts
D6–D5	Reserved	R/W	X	Reserved; must be 0
D4–D0	IRQ4–IRQ0	R/W	0	1: Enables IRQ0–IRQ4; D0 = IRQ0

TABLE 19. FLAG REGISTER—R252 (FCH: READ/WRITE)

Bit	D7	D6	D5	D4	D3	D2	D1	D0
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
D7		R/W	0	Carry Flag
D6		R/W	0	Zero Flag
D5		R/W	0	Sign Flag
D4		R/W	0	Overflow Flag
D3		R/W	0	Decimal Adjust Flag
D2		R/W	0	Half Carry Flag
D1		R/W	0	User Flag F2
D0		R/W	0	User Flag F1

TABLE 20. REGISTER POINTER—R253 (FDH: READ/WRITE)

Bit	D7	D6	D5	D4	D3	D2	D1	D0
R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Reset	0	0	0	0	X	X	X	X

NOTE: R = Read, W = Write, X = Indeterminate.

Bit Position	Bit Field	R/W	Reset Value	Description
D7	r7	R/W	0	Register Pointer
D6	r6	R/W	0	Register Pointer
D5	r5	R/W	0	Register Pointer
D4	r4	R/W	0	Register Pointer
D3–D0	Reserved	R/W	X	Reserved; must be 0



INDEX

NUMERICS

40-Pin DIP Configuration	3
40-Pin DIP Pin Identification	3
44-Pin PLCC Configuration	4
44-Pin PLCC Pin Identification	4
4-bit mode	12

A

Absolute Maximum Ratings	5
AC Electrical Characteristics	7
alternating current	7
ambient temperature range	7
Architectural Overview	1

B

bit definitions	20
-----------------------	----

C

Capacitance	6
Change Log	28
clock circuitry	1
cold start	19
Control Registers	20
Counter/Timer	14-15, 18
Counter/Timer 0 Register	20
Customer Feedback Form	29
Customer Information	29

D

DC Characteristics	6
Direct Current	6
Document Information	28
Document Number Description	28

E

Electrical Characteristics	5
external interrupt request	10
external interrupts	18

F

Functional Block Diagram	2
Functional Description	11

G

GND	2
-----------	---

H

host data line	19
----------------------	----

I

input frequency	14
internal CPU clock	18
Interrupt Mask Register	15, 23
Interrupt Priority Register	15, 22
Interrupt Request	7, 14-15, 17
Register	18, 23
interrupt sources	1
interrupt subroutine handling	1
interrupt vector	11, 18
Interrupts	1, 11, 15, 23
IRQ0	10, 18, 22, 23
IRQ1	18, 22, 23
IRQ2	18, 22, 23
IRQ3	10, 18, 23
IRQ4	14, 18, 22, 23

L

Low Power Consumption	1
-----------------------------	---

M

modulo-n continuous mode	14
multitasking	1

N

NOP	18
-----------	----

O

on-chip counter/timer	1
Op Code	18
Open-Drain	9, 21
Operating Range	1
Operating Temperature	1
Ordering Information	27
output drivers	1

P

P2OUT	9
-------------	---