Z86C15

CMOS Z8® 8-BIT MCU KEYBOARD CONTROLLER

FEATURES

ROM (Kbytes)	RAM* (Bytes)	I/O Lines	Speed (MHz)	Pin Count / Package
4	236	32	5	40 DIP 44 PLCC 44 QFP

* General-Purpose

- 4.5- to 5.5-Volt Operating Range
- 0°C to 70°C Operating Temperature Range
- Expanded Register File
- Low-Power Consumption: 30 mW @ 5 MHz Typical
- Six Vectored, Priority Interrupts from Six Different Sources
- Two Programmable 8-Bit Counter/Timers, Each with 6-Bit Programmable Prescaler
- Power-On Reset (POR) Timer, Hardware Watch-Dog Timer (WDT)
- Digital Inputs CMOS Levels with Internal Pull-Up Resistors
- Four Direct Connect LED Drive Ports
- On-Chip RC Oscillator, 4 MHz to 5 MHz

GENERAL DESCRIPTION

The Z86C15 Keyboard Controller is a full-featured member of the Z8® microcontroller family offering a unique register-to-register architecture that avoids accumulator bottlenecks and is more code efficient than RISC processors.

For applications demanding powerful I/O capabilities, the Z86C15 provides 32 pins dedicated to input and output. These lines are grouped into four ports, each port consisting of eight lines, and are configurable under software control to provide timing, status signals, and serial or parallel I/O ports.

Two on-chip counter/timers, with a large number of user-selectable modes, are available to relieve the system of administering real-time tasks, such as counting/timing and I/O datacommunications.

Six different internal or external interrupt sources are maskable and prioritized so a vectored address is provided for efficient interrupt subroutine handling and multitasking functions.

The Z86C15 achieves low-EMI by means of several modifications in the output drivers and clock circuitry of the device.

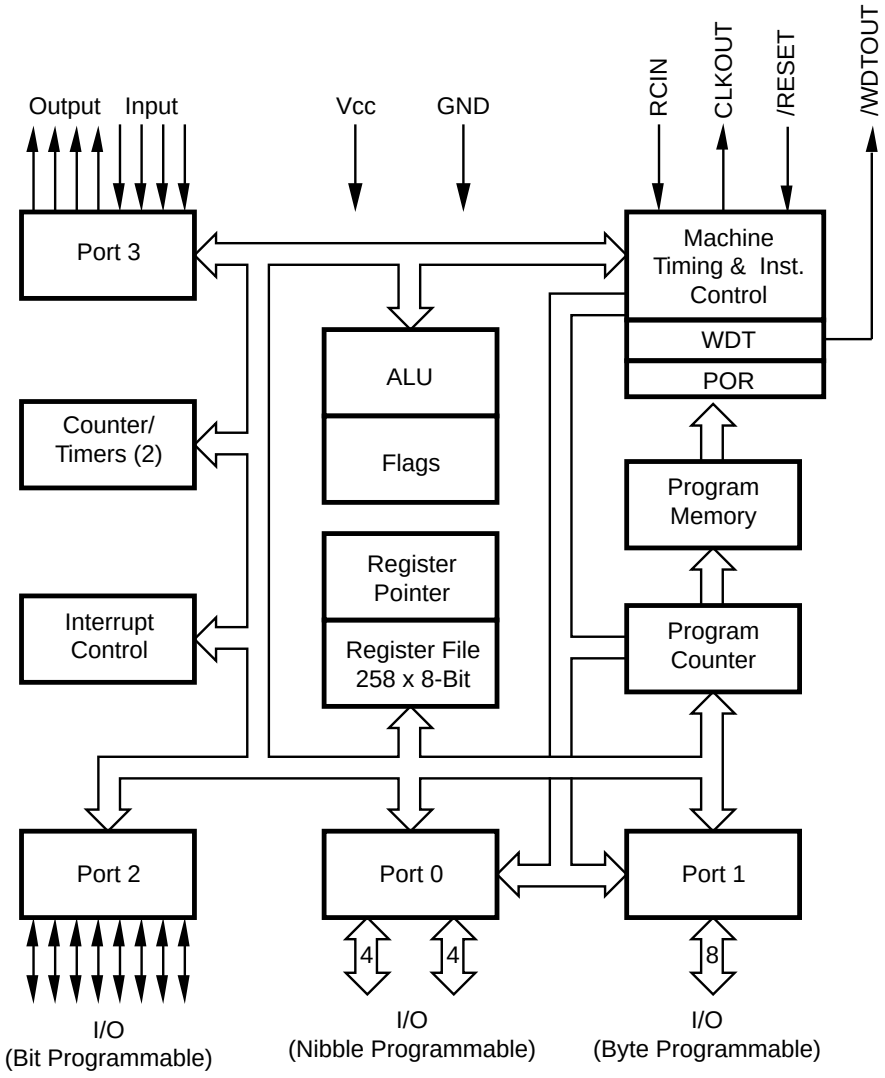
By means of an expanded register file, the designer has access to three additional system control registers that provide extra peripheral devices, I/O ports, and register addresses (see Functional Block Diagram).

Notes:
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:

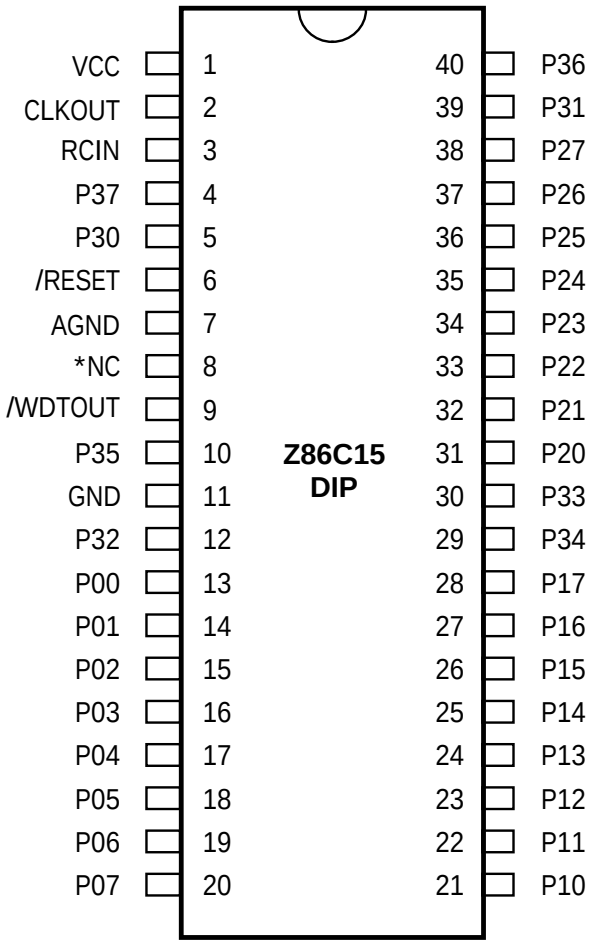
Connection	Circuit	Device
Power	V_{CC}	V_{DD}
Ground	GND	V_{SS}

GENERAL DESCRIPTION (Continued)



Z86C15 Functional Block Diagram

PIN IDENTIFICATION



Note:** Pin 8 is connected to the chip, although it is used only for testing. This pin ***must float.

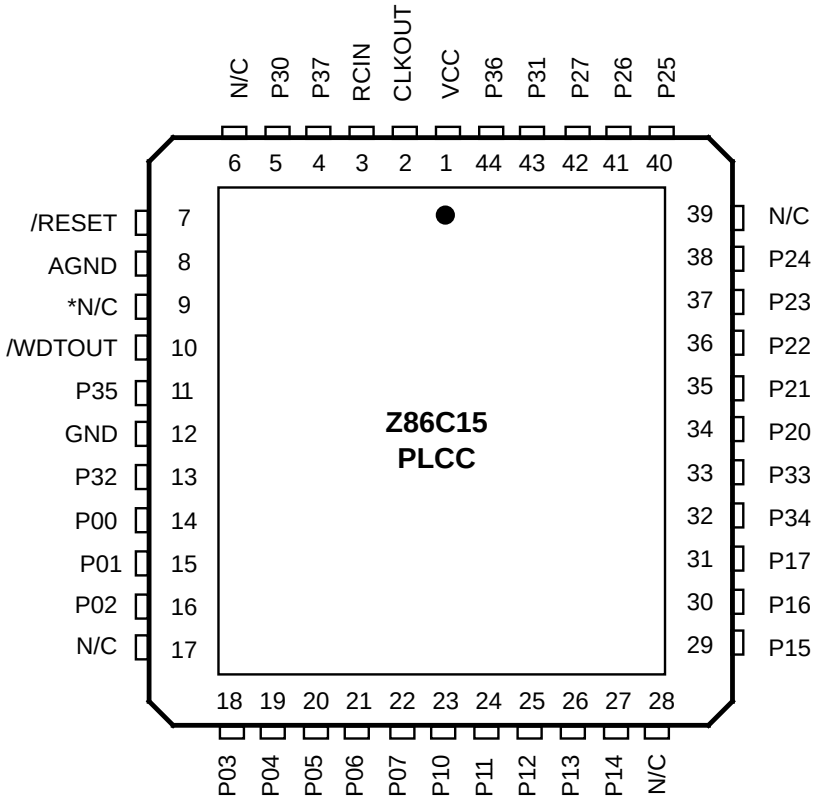
40-Pin DIP Pin Configuration

40-Pin DIP Pin Identification

Pin #	Symbol	Function	Direction
1	V_{CC}	Power Supply	Input
2	CLKOUT	Z8 System Clock	Output
3	RCIN	RC Oscillator Clock	Input
4	P37	Port 3, Pin 7	Output
5	P30	Port 3, Pin 0	Input
6	/RESET	Reset	Input
7	AGND	Analog Ground	
*8	NC	Not Connected	
9	/WDTOUT	Watch-Dog Timer	Output
10	P35	Port 3, Pin 5	Output

Pin #	Symbol	Function	Direction
11	GND	Ground	
12	P32	Port 3, Pin 2	Input
13-20	P00-P07	Port 0, Pins 0,1,2,3,4,5,6,7	In/Output
21-28	P10-P17	Port 1, Pins 0,1,2,3,4,5,6,7	In/Output
29	P34	Port 3, Pin 4	Output
30	P33	Port 3, Pin 3	Input
31-38	P20-P27	Port 2, Pins 0,1,2,3,4,5,6,7	In/Output
39	P31	Port 3, Pin 1	Input
40	P36	Port 3, Pin 6	Output

PIN IDENTIFICATION (Continued)



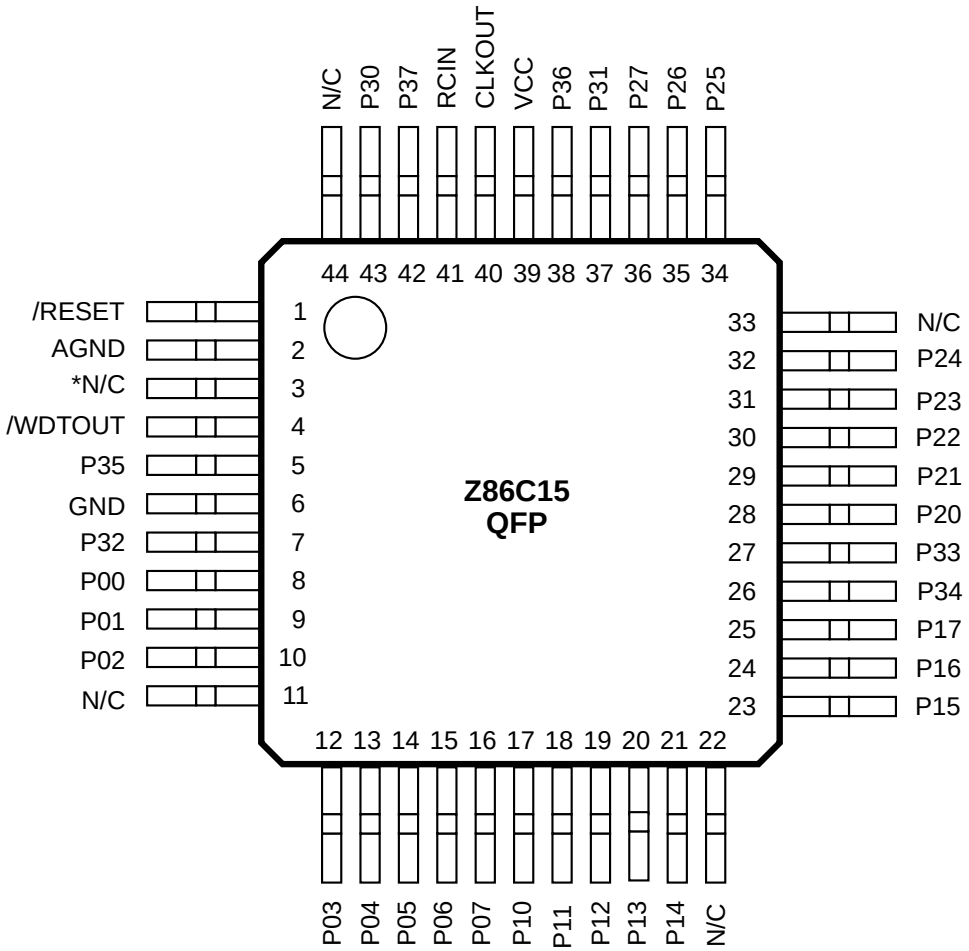
Note:** Pin 9 is connected to the chip, although it is used only for testing. This pin ***must float.

44-Pin PLCC Pin Assignments

44-Pin PLCC Pin Identification

Pin #	Symbol	Function	Direction
1	V_{CC}	Power Supply	Input
2	CLKOUT	Z8 System Clock	Output
3	RCIN	RC Oscillator Clock	Input
4	P37	Port 3, Pin 7	Output
5	P30	Port 3, Pin 0	Input
6	N/C	Not Connected	
7	/RESET	Reset	Input
8	AGND	Analog Ground	
*9	N/C	Not Connected	
10	/WDTOUT	Watch-Dog Timer	Output
11	P35	Port 3, Pin 5	Output
12	GND	Ground	
13	P32	Port 3, Pin 2	Input

Pin #	Symbol	Function	Direction
14-16	P00-P02	Port 0, Pins 0, 1, 2	In/Output
17	N/C	Not Connected	
18-22	P03-P07	Port 0, Pins 3, 4, 5, 6, 7	In/Output
23-27	P10-P14	Port 1, Pins 0, 1, 2, 3, 4	In/Output
28	N/C	Not Connected	
29-31	P15-P17	Port 1, Pins 5, 6, 7	In/Output
32	P34	Port 3, Pin 4	Output
33	P33	Port 3, Pin 3	Input
34-38	P20-P24	Port 2, Pins 0, 1, 2, 3, 4	In/Output
39	N/C	Not Connected	
40-42	P25-P27	Port 2, Pins 5, 6, 7	In/Output
43	P31	Port 3, Pin 1	Input
44	P36	Port 3, Pin 6	Output



Note:** Pin 3 is connected to the chip, although it is used only for testing. This pin ***must float.

44-Pin QFP Pin Assignments

44-Pin QFP Pin Identification

Pin #	Symbol	Function	Direction
1	/RESET	Reset	Input
2	AGND	Analog Ground	
*3	N/C	Not Connected	
4	/WDTOUT	Watch-Dog Timer	Output
5	P35	Port 3, Pin 5	Output
6	GND	Ground	
7	P32	Port 3, Pin 2	Input
8-10	P00-P02	Port 0, Pins 0, 1, 2	In/Output
11	N/C	Not Connected	Input
12-16	P03-P07	Port 0, Pins 3,4,5,6,7	In/Output
17-21	P10-P14	Port 1, Pins 0,1,2,3,4	In/Output
22	N/C	Not Connected	
23-25	P15-P17	Port 1, Pins 5, 6,7	In/Output

Pin #	Symbol	Function	Direction
26	P34	Port 3, Pin 4	Output
27	P33	Port 3, Pin 3	Input
28-32	P20-P24	Port 2, Pins 0, 1, 2, 3, 4	In/Output
33	N/C	Not Connected	
34-36	P25-P27	Port 2, Pins 5, 6, 7	In/Output
37	P31	Port 3, Pin 1	Input
38	P36	Port 36	Output
39	V_{CC}	Power Supply	
40	CLKOUT	Z8 System Clock	Output
41	RCIN	RC Oscillator Clock	Input
42	P37	Port 3, Pin 7	Output
43	P30	Port 3, Pin 0	Input
44	N/C	Not Connected	

ABSOLUTE MAXIMUM RATINGS

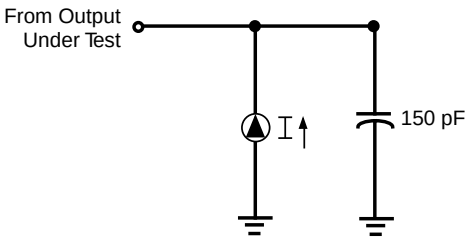
Symbol	Description	Min	Max	Units
V_{CC}	Supply Voltage*	–0.3	+7.0	V
T_{STG}	Storage Temp	–65	+150	°C
T_A	Oper Ambient Temp	0	+105	°C

Notes:
* 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 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.

STANDARD TEST CONDITIONS

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 (Test Load).



Test Load Diagram

CAPACITANCE

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

Parameter	Max
Input Capacitance	12 pF
Output Capacitance	12 pF
I/O Capacitance	12 pF

FREQUENCY

Frequency 4 MHz – 5 MHz
Tolerance ±10%

Frequency tolerance limit only applies to the packaged device and not die or wafer.

DC CHARACTERISTICS (Z86C15)

V_{CC} = 5.0V ±10% @ 0°C to +70°C

Sym	Parameter	Min	Max	Typical @ 25°C	Unit	Condition
V_{CH}	Clock Input High Voltage	0.7 V_{CC}	V_{CC} to +0.3V	2.5	V	Driven by External Clock Generator
V_{CL}	Clock Input Low Voltage	GND –0.3	0.2 V_{CC}	1.5	V	Driven by External Clock Generator
V_{IH}	Input High Voltage	0.7 V_{CC}	V_{CC} + 0.3	2.5	V	
V_{IL}	Input Low Voltage	GND –0.3	0.2V_{CC}	1.5	V	
V_{RH}	Reset Input High Voltage	0.8 V_{CC}	V_{CC}	2.1	V	
V_{RL}	Reset Input Low Voltage	GND –0.3	0.2 V_{CC}	1.7	V	
V_{OH}	Output High Voltage	V_{CC} –0.4		3.1	V	I_{OH} = –2.0 mA
V_{OH}	Output High Voltage	V_{CC} 0.6			V	I_{OH} = –2.0 mA (See note [1] below.)
V_{OL}	Output Low Voltage		0.8		V	I_{OL} = 4 mA (See note [1] below.)
V_{OL}	Output Low Voltage		.4		V	I_{OL}= 4 mA
I_{OL}	Output Low	8	20		mA	V_{OL}= V_{CC} –2.2 V (See note [1] below.)
I_{IL}	Input Leakage	–1	1	<1	µA	V_{IN} = 0V, 5.25V (See note [2] beow.)
I_{OL}	Output Leakage	–1	1	<1	µA	V_{IN} = 0V, 5.25V
I_{CC}	V_{CC} Supply Current		12	6	mA	@ 5.0 MHz
POR	Power On Reset	84	196	140	ms	
I_{CC1}	Standby Current		4	2.0	mA	HALT mode V_{IN} = 0V, V_{CC} @ 5 MHz
I_{CC2}	Standby Current		20		µA	STOP mode V_{IN} = 0V
R_P	Pull Up Resistor	6.76	14.04	10.4	Kohm	
R_P	Pull Up Resistor (P26-P27)	1.8	3	2.4	Kohm	
R_P	Pull Up Resistor (Reset)	40	80	60	Kohm	

Note:

[1] Ports P37-P34. These may be used for LEDs or as general-purpose outputs requiring high sink current.

[2] Input pin without pull-up resistor.

AC ELECTRICAL CHARACTERISTICS (Z86C15)

Additional Timing Table

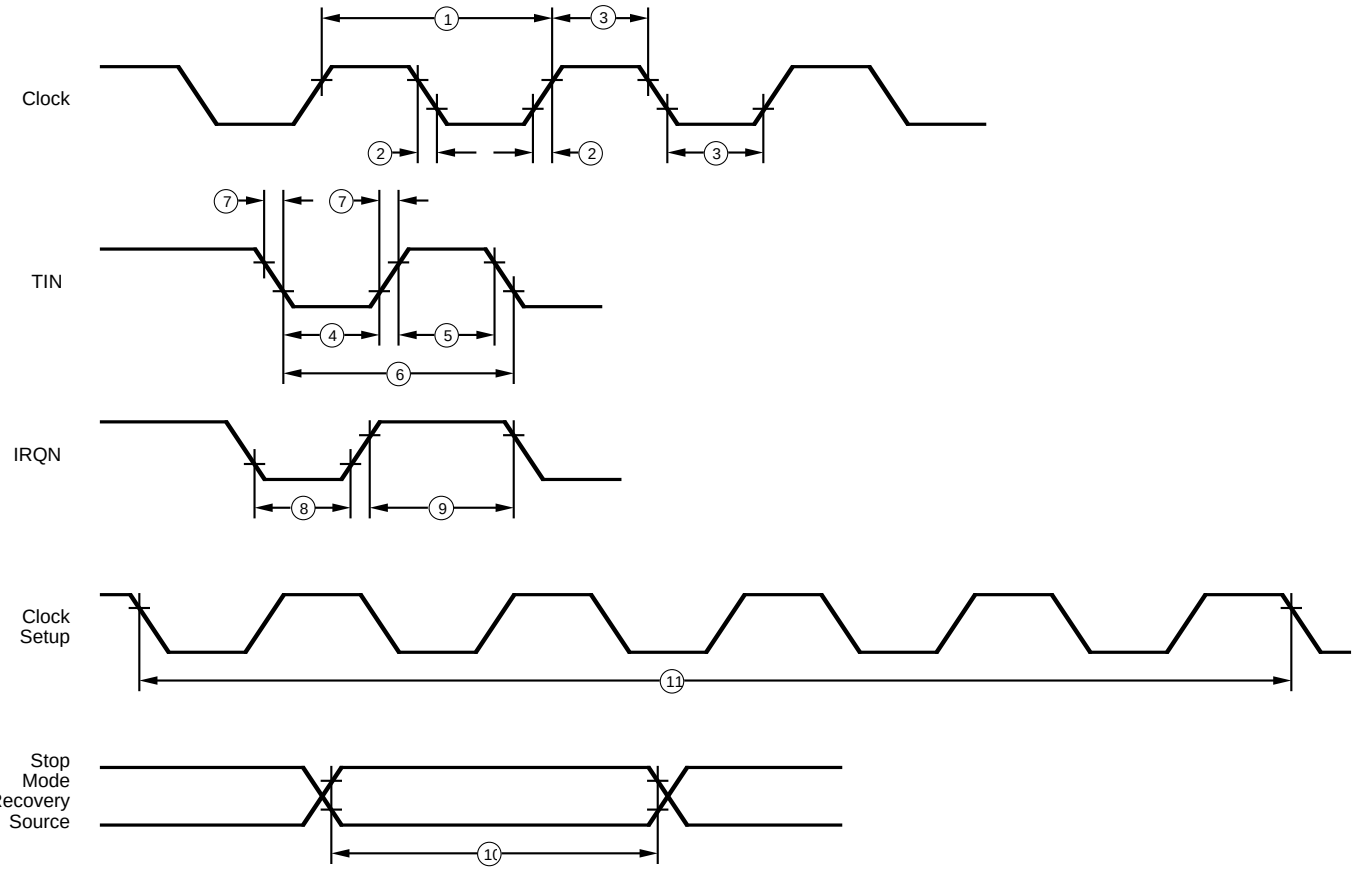
No	Symbol	Parameter	V_{CC} Note [4]	T_A = 0°C to +70°C 5 MHz Min	Max	Units	Notes
1	TpC	Input Clock Period	5.0V	125	100000	ns	[1]
2	TrC,TfC	Clock Input Rise & Fall Times	5.0V		25	ns	[1]
3	TwC	Input Clock Width	5.0V	37		ns	[1]
4	TwTinL	Timer Input Low Width	5.0V	70		ns	[1]
5	TwTinH	Timer Input High Width	5.0V	2.5TpC			[1]
6	TpTin	Timer Input Period	5.0V	4TpC			[1]
7	TrTin	Timer Input Rise & Fall Timer	5.0V		100	ns	[1]
8A	TwIL	Int. Request Low Time	5.0V	70		ns	[1,2]
8B	TwIL	Int. Request Low Time	5.0V	3TpC			[1,3]
9	TwIH	Int. Request Input High Time	5.0V	3TpC			[1,2]
10	Twsm	STOP Mode Recovery Width Spec	5.0V	20		ns	Reg. SMR - D5=0
			5.0V	5TpC			Reg. SMR - D5=1
11	Tost	Oscillator Startup Time	5.0V		5TpC		[4]
12	Twdt	Watch-Dog Timer Delay Time	5.0V	2		ms	[5]
			5.0V	4		ms	[6]
			5.0V	8		ms	[7]
			5.0V	32		ms	[8]

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 via Port 3 (P31-P33).
[3] Interrupt request via Port 3 (P30).
[4] SMR-D5 = 0.
[5] D1 = 0, D0 = 0.{Reg. WDTMR)
[6] D1 = 0, D0 = 1.{Reg. WDTMR)
[7] D1 = 1, D0 = 0.{Reg. WDTMR)
[8] D1 = 1, D0 = 1.{Reg. WDTMR)

AC ELECTRICAL CHARACTERISTICS

Additional Timing Diagram



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