Z86233/243

CMOS Z8® 8K ROM CONSUMER CONTROLLER PROCESSOR

FEATURES

Part	ROM Kbytes	RAM bytes	I/O	Package Information
Z86233	8	237	24	28-pin DIP, SOIC, PLCC
Z86243	8	236	32	40-pin DIP, 44-pin PLCC, 44-pin QFP

- 3.0-to 5.5-Volt Operating Range
- Low-Power Consumption: 40 mW (Typical @5.0V)
- 0°C to +70°C Temperature Range (–40°C to +105°C Temperature Range Available)
- Three Expanded Register File Control Registers
- Z86C33/C43 Pin and Package Compatible Version (With Addition of 4K ROM)
- 32 Input/Output Lines (Three with Comparator Inputs) (Z86243 Only)
- Vectored, Prioritized Interrupts with Programmable Polarity
- Two Comparators
- Two Programmable 8-Bit Counter/Timers, Each with a 6-Bit Programmable Prescaler
- Watch-Dog Timer (WDT)/Power-On Reset (POR)
- On-Chip Oscillator that Accepts a Crystal, Ceramic Resonator, LC, RC, or External Clock Drive
- RAM and ROM Protect
- Clock Free Watch-Dog Timer (WDT) Reset

GENERAL DESCRIPTION

The Z86233/243 Consumer Controller Processor is a member of Zilog's Z8® single-chip microcontroller family featuring enhanced wake-up circuitry, programmable Watch-Dog timers and low-EMI options. The parts provide flexible and efficient growth paths for designers currently using the 4K ROM versions of the consumer controller devices (Z86C30/C40/C33/C43).

Four address spaces, the Program Memory, Register File, Data Memory and Expanded Register File (ERF), support a wide range of memory configurations. Through the ERF, the designer has access to two additional control registers which provide extra peripheral devices, I/O ports, and register addresses.

For applications demanding powerful I/O capabilities, the Z86243 provides 32 pins dedicated to input and output. The Z86233 provides 24 pins dedicated to input and output. These lines are grouped into four ports with eight lines each, and are configurable under software control to provide timing, status signals, or parallel I/O.

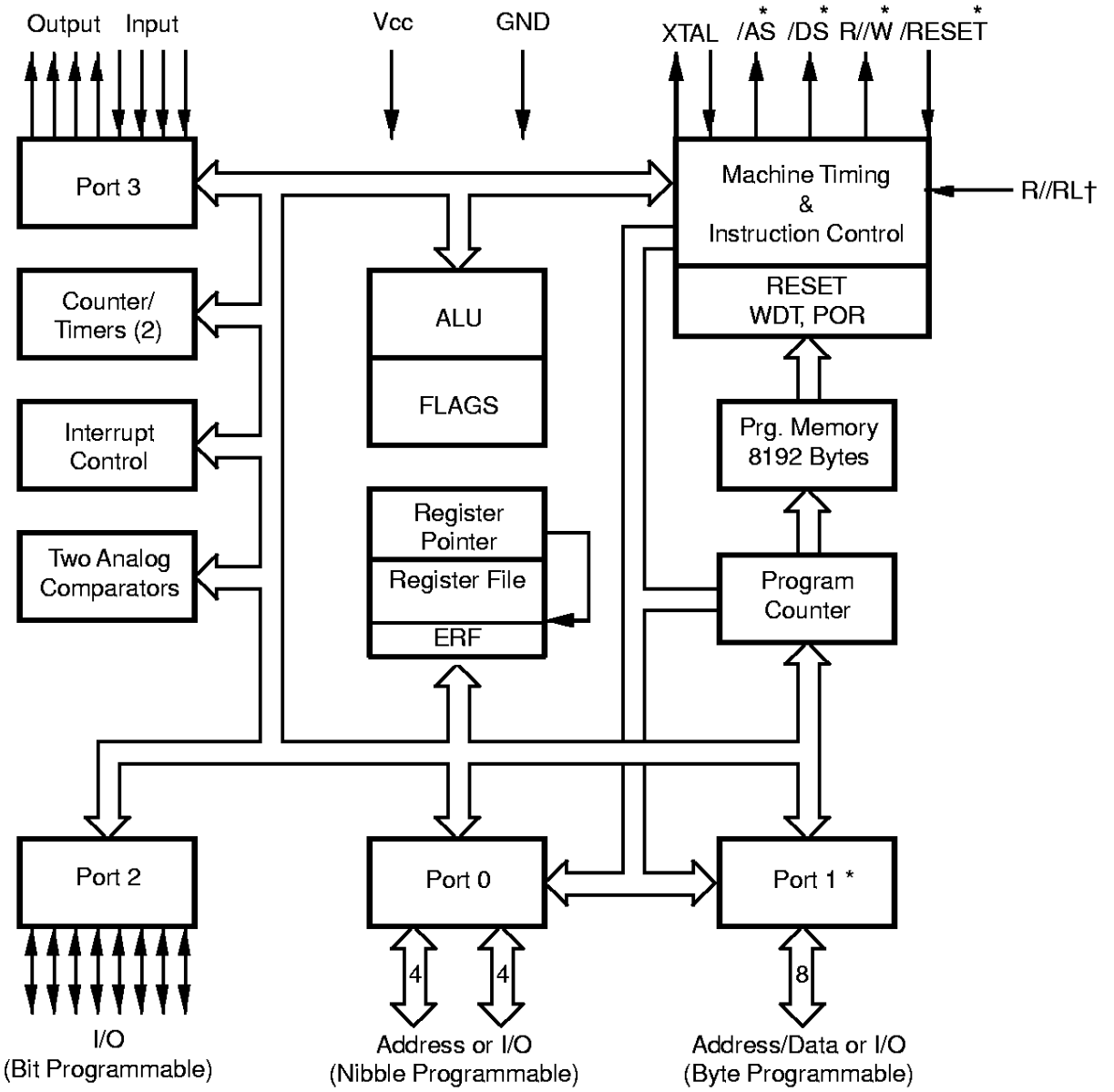
With ROM/ROMless selectivity, the Z86243 provides both external memory and pre-programmed ROM, which enables this Z8 microcontroller to be used in high-volume applications, or where code flexibility is required.

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}

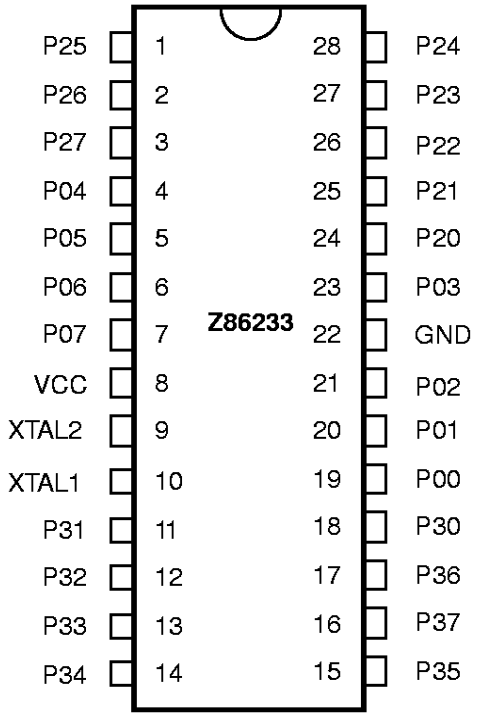
GENERAL DESCRIPTION (Continued)



*** Not available on Z86233.**
† Available on Z86243 44-Pin QFP and PLCC versions only.

Functional Block Diagram

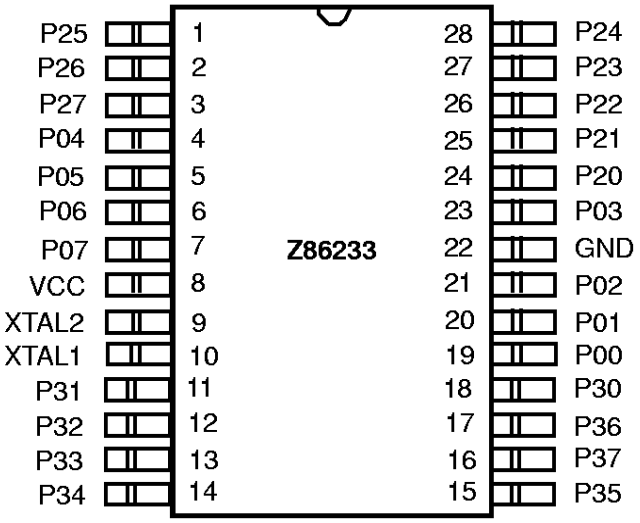
PIN DESCRIPTION



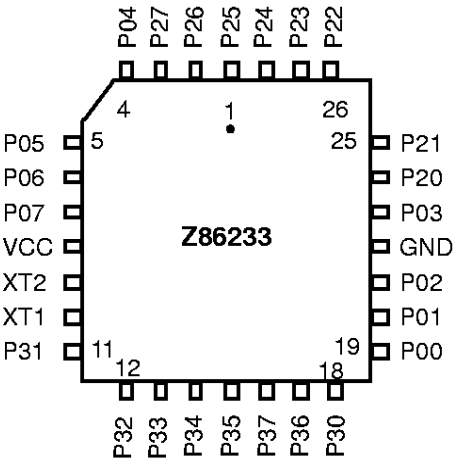
28-Pin DIP Pin Configuration

28-Pin DIP/SOIC/PLCC Pin Identification

Pin #	Symbol	Function	Direction
1-3	P25-P27	Port 2, Pins 5,6,7	In/Output
4-7	P07-P04	Port 0, Pins 4,5,6,7	In/Output
8	V_{CC}	Power Supply	
9	XTAL2	Crystal Oscillator	Output
10	XTAL1	Crystal Oscillator	Input
11-13	P33-P31	Port 3, Pins 1,2,3	Fixed Input
14-15	P35-P34	Port 3, Pins 4,5	Fixed Output
16	P37	Port 3, Pin 7	Fixed Output
17	P36	Port 3, Pin 6	Fixed Output
18	P30	Port 3, Pin 0	Fixed Input
19-21	P02-P00	Port 0, Pins 0,1,2	In/Output
22	GND	Ground	
23	P03	Port 0, Pins 3	In/Output
24-28	P24-P20	Port 2, Pins 0,1,2,3,4	In/Output

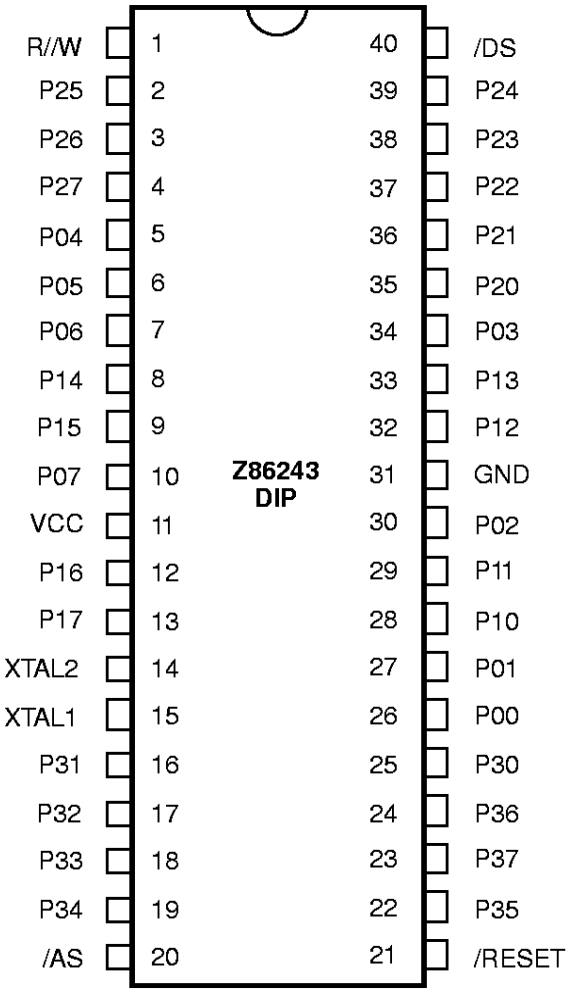


28-Pin SOIC Pin Configuration



28-Pin PLCC Pin Configuration

PIN DESCRIPTION (Continued)

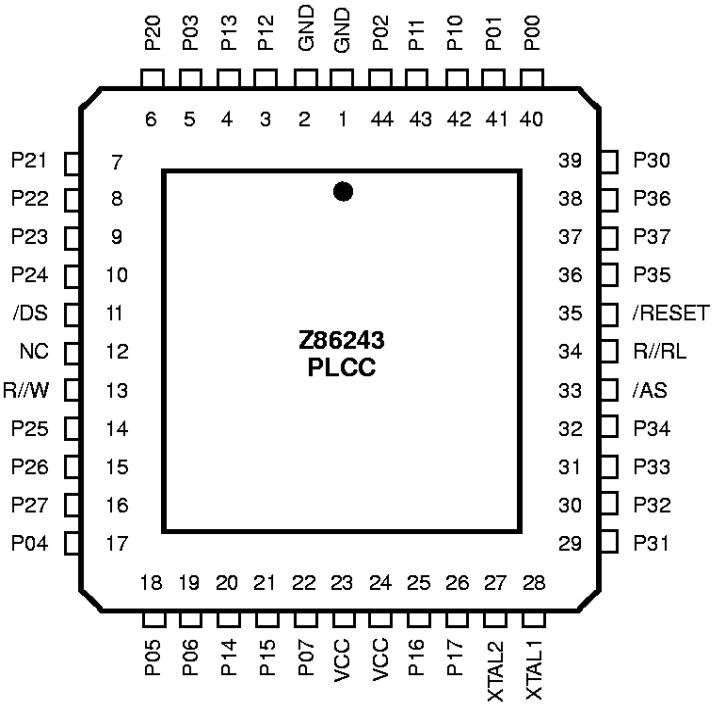


40-Pin DIP Pin Configuration

40-Pin DIP Pin Configuaration

Pin #	Symbol	Function	Direction
1	R//W	Read/Write	Output
2-4	P25-P27	Port 2, Pins 5, 6, 7	In/Output
5-7	P04-P06	Port 0, Pins 4, 5, 6	In/Output
8-9	P14-P15	Port 1, Pins 4, 5	In/Output
10	P07	Port 0, Pin 7	In/Output
11	V_{CC}	Power Supply	
12-13	P16-P17	Port 1, Pins 6, 7	In/Output
14	XTAL2	Crystal Oscillator	Output
15	XTAL1	Crystal Oscillator	Input
16-18	P31-P33	Port 3, Pins 1, 2, 3	Input
19	P34	Port 3, Pin 4	Output
20	/AS	Address Strobe	Output
21	/RESET	Reset	Input

Pin #	Symbol	Function	Direction
22	P35	Port 3, Pin 5	Output
23	P37	Port 3, Pin 7	Output
24	P36	Port 3, Pin 6	Output
25	P30	Port 3, Pin 0	Input
26-27	P00-P01	Port 0, Pins 0,1	In/Output
28-29	P10-P11	Port 1, Pins 0,1	In/Output
30	P02	Port 0, Pin 2	In/Output
31	GND	Ground	
32-33	P12-P13	Port 1, Pins 2, 3	In/Output
34	P03	Port 0, Pin 3	In/Output
35-39	P20-P24	Port 2, Pins 0,1,2,3,4	In/Output
40	/DS	Data Strobe	Output



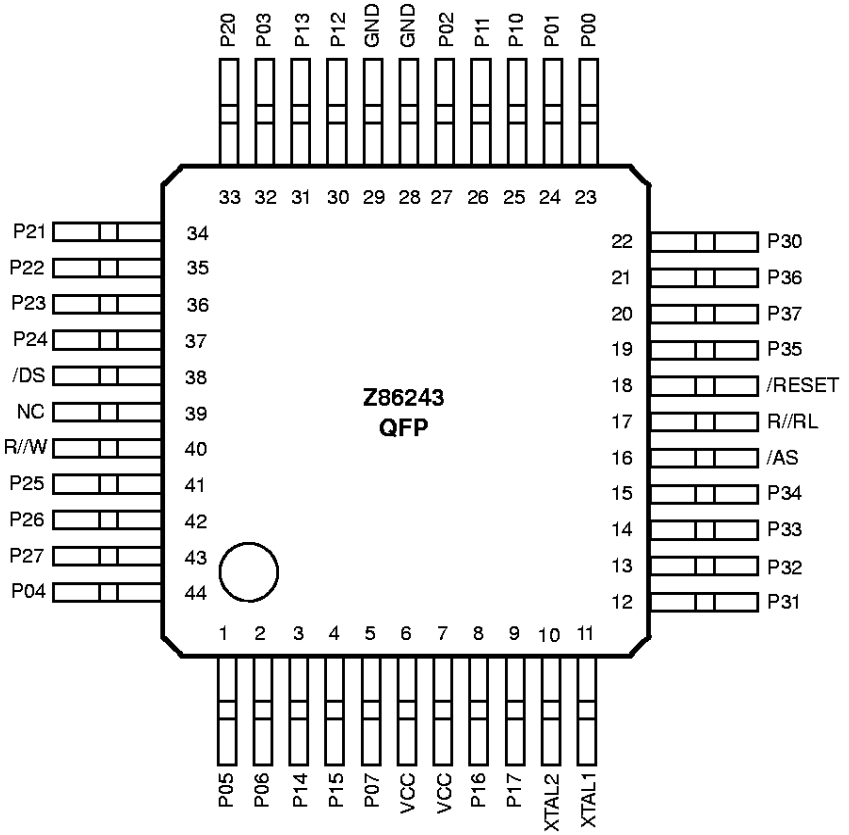
44-Pin PLCC Pin Configuration

44-Pin PLCC Pin Identification

Pin #	Symbol	Function	Direction
1	GND	Ground	
2	GND	Ground	
3-4	P12-P13	Port 1, Pins 2,3	In/Output
5	P03	Port 0, Pin 3	In/Output
6-10	P20-P24	Port 2, Pins 0,1,2,3,4	In/Output
11	/DS	Data Strobe	Output
12	N/C	Not Connected	
13	R//W	Read/Write	Output
14-16	P25-P27	Port 2, Pins 5,6,7	In/Output
17-19	P04-P06	Port 0, Pins 4,5,6	In/Output
20-21	P14-P15	Port 1, Pins 4,5	In/Output
22	P07	Port 0, Pin 7	In/Output
23	V_{CC}	Power Supply	
24	V_{CC}	Power Supply	
25-26	P16-P17	Port 1, Pins 6,7	In/Output

Pin #	Symbol	Function	Direction
27	XTAL2	Crystal Oscillator	Output
28	XTAL1	Crystal Oscillator	Input
29-31	P31-P33	Port 3, Pins 1,2,3	Input
32	P34	Port 3, Pin 4	Output
33	/AS	Address Strobe	Output
34	R//RL	ROM/ROMless select	Input
35	/RESET	Reset	Input
36	P35	Port 3, Pin 5	Output
37	P37	Port 3, Pin 7	Output
38	P36	Port 3, Pin 6	Output
39	P30	Port 3, Pin 0	Input
40-41	P00-P01	Port 0, Pins 0,1	In/Output
42-43	P10-P11	Port 1, Pins 0,1	In/Output
44	P02	Port 0, Pin 2	In/Output

PIN DESCRIPTION (Continued)



44-Pin QFP Pin Configuration

44-Pin QFP Pin Identification

Pin #	Symbol	Function	Direction
1-2	P05-P06	Port 0, Pins 5,6	In/Output
3-4	P14-P05	Port 1, Pins 4,5	In/Output
5	P07	Port 0, Pin 7	In/Output
6-7	V_{CC}	Power Supply	
8-9	P16-P17	Port 1, Pins 6,7	In/Output
10	XTAL2	Crystal Oscillator	Output
11	XTAL1	Crystal Oscillator	Input
12-14	P31-P33	Port 3, Pins 1,2,3	Input
15	P34	Port 3, Pin 4	Output
16	/AS	Address Strobe	Output
17	R//RL	ROM/ROMless select	Input
18	/RESET	Reset	Input
19	P35	Port 3, Pin 5	Output
20	P37	Port 3, Pin 7	Output

Pin #	Symbol	Function	Direction
21	P36	Port 3, Pin 6	Output
22	P30	Port 3, Pin 0	Input
23-24	P00-P01	Port 0, Pin 0,1	In/Output
25-26	P10-P11	Port 1, Pins 0,1	In/Output
27	P02	Port 0, Pin 2	In/Output
28	GND	Ground	
29	GND	Ground	
30-31	P12-P13	Port 1, Pins 2,3	In/Output
32	P03	Port 0, Pin 3	In/Output
33-37	P20-24	Port 2, Pins 0,1,2,3,4	In/Output
38	/DS	Data Strobe	Output
39	N/C	Not Connected	
40	R//W	Read/Write	Output
41-43	P25-P27	Port 2, Pins 5,6,7	In/Output
44	P04	Port 0, Pin 4	In/Output

ABSOLUTE MAXIMUM RATINGS

Parameter	Min	Max	Units
Ambient Temperature under Bias	–40	+105	C
Storage Temperature	–65	+150	C
Voltage on any Pin with Respect to V_{SS} [Note 1]	–0.6	+7	V
Voltage on V_{DD} Pin with Respect to V_{SS}	–0.3	+7	V
Voltage on XTAL1 and /RESET Pins with Respect to V_{SS} [Note 2]	–0.6	V_{DD}+1	V
Total Power Dissipation		1.21	W
Maximum Allowable Current out of V_{SS}		220	mA
Maximum Allowable Current into V_{DD}		180	mA
Maximum Allowable Current into an Input Pin [Note 3]	–600	+600	µA
Maximum Allowable Current into an Open-Drain Pin [Note 4]	–600	+600	µA
Maximum Allowable Output Current Sinked by Any I/O Pin		25	mA
Maximum Allowable Output Current Sourced by Any I/O Pin		25	mA

Notes:
[1] This applies to all pins except XTAL pins and where otherwise noted.
[2] There is no input protection diode from pin to V_{DD}.
[3] This excludes XTAL pins.
[4] Device pin is not at an output Low state.

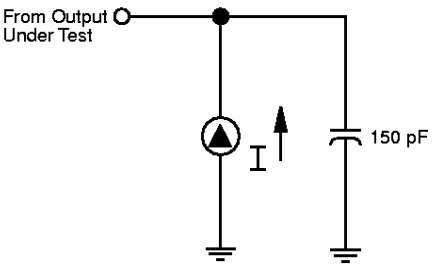
Notice:
Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at any condition above those indicated in the operational sections of these specifications is not implied. Exposure to absolute 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:

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

STANDARD TEST CONDITIONS

The characteristics listed below apply for standard test conditions as noted. All voltages are referenced to Ground. 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	Min	Max
Input capacitance	0	12 pF
Output capacitance	0	12 pF
I/O capacitance	0	12 pF

DC ELECTRICAL CHARACTERISTICS

Sym	Parameter	V_{CC} Note[3]	T_A = 0° C to +70°C Min	Max	T_A = -40°C to +105°C Min	Max	Typical[1] @25°C	Units	Conditions	Notes
V_{CH}	Clock Input High Voltage	3.0V	0.7V_{CC}	V_{CC}+0.3	0.7V_{CC}	V_{CC}+0.3	1.8	V	Driven by External Clock Generator	
		5.5V	0.7V_{CC}	V_{CC}+0.3	0.7V_{CC}	V_{CC}+0.3	2.6	V	Driven by External Clock Generator	
V_{CL}	Clock Input Low Voltage	3.0V	GND-0.3	0.2V_{CC}	GND-0.3	0.2V_{CC}	1.2	V	Driven by External Clock Generator	
		5.5V	GND-0.3	0.2V_{CC}	GND-0.3	0.2V_{CC}	2.1	V	Driven by External Clock Generator	
V_{IH}	Input High Voltage	3.0V	0.7V_{CC}	V_{CC}+0.3	0.7V_{CC}	V_{CC}+0.3	1.8	V		
		5.5V	0.7V_{CC}	V_{CC}+0.3	0.7V_{CC}	V_{CC}+0.3	2.6	V		
V_{IL}	Input Low Voltage	3.0V	GND-0.3	0.2V_{CC}	GND-0.3	0.2V_{CC}	1.1	V		
		5.5V	GND-0.3	0.2V_{CC}	GND-0.3	0.2V_{CC}	1.6	V		
V_{OH1}	Output High Voltage	3.0V	V_{CC}-0.4		V_{CC}-0.4		3.1	V	I_{OH}=-2.0mA	[8]
		5.5V	V_{CC}-0.4		V_{CC}-0.4		4.8	V	I_{OH}=-2.0mA	[8]
V_{OL1}	Output Low Voltage	3.0V		0.6		0.6	0.2	V	I_{OL}=+4.0mA	[8]
		5.5V		0.4		0.4	0.1	V	I_{OL}=+4.0mA	[8]
V_{OL2}	Output Low Voltage	3.0V		1.2		1.2	0.3	V	I_{OL}=+6mA	[8]
		5.5V		1.2		1.2	0.4	V	I_{OL}=+12mA	[8]
V_{RH}	Reset Input High Voltage	3.0V	.8V_{CC}	V_{CC}	.8V_{CC}	V_{CC}	1.8	V		[13]
		5.5V	.8V_{CC}	V_{CC}	.8V_{CC}	V_{CC}	2.6	V		[13]
V_{RI}	Reset Input Low Voltage	3.0V	GND-0.3	0.2V_{CC}	GND-0.3	0.2V_{CC}	1.1	V		[13]
		5.5V	GND-0.3	0.2V_{CC}	GND-0.3	0.2V_{CC}	1.6	V		[13]
V_{OLR}	Reset Output Low Voltage	3.0V		0.6		0.6	0.3	V	I_{OL}=+1.0mA	[13]
		5.5V		0.6		0.6	0.2	V	I_{OL}=+1.0mA	[13]
V_{OFFSET}	Comparator Input Offset Voltage	3.0V		25		25	10	mV		[10]
		5.5V		25		25	10	mV		[10]
I_{IL}	Input Leakage	3.0V	-1	1	-1	2	0.004	µA	V_{IN}=0V,V_{CC}	
		5.5V	-1	1	-1	2	0.004	µA	V_{IN}=0V,V_{CC}	
I_{OL}	Output Leakage	3.0V	-1	1	-1	2	0.004	µA	V_{IN}=0V,V_{CC}	
		5.5V	-1	1	-1	2	0.004	µA	V_{IN}=0V,V_{CC}	
I_{IR}	Reset Input Current	3.0V	-20	-130	-18	-130	-60	µA		
		5.5V	-20	-180	-18	-180	-85	µA		
I_{CC}	Supply Current	3.0V		20		20	7	mA	@16MHz	[4]
		5.5V		25		25	20	mA	@16MHz	[4]
		3.0V		15		15	5	mA	@12MHz	[4]
		5.5V		20		20	15	mA	@12MHz	[4]
I_{CC1}	Standby Current (Halt Mode)	3.0V		4.5		4.5	2.0	mA	V_{IN}=0V,V_{CC}@16MHz	[4]
		5.5V		8		8	3.7	mA	V_{IN}=0V,V_{CC}@16MHz	[4]
		3.0V		3.4		3.4	1.5	mA	Clock Divide-by-16@16MHz	[4]
		5.5V		7.0		7.0	2.9	mA	Clock Divide-by-16@16MHz	[4]
I_{CC2}	Standby Current (Stop Mode)	3.0V		8		8	2	µA	V_{IN}=0V,V_{CC} WDT is not Running	[6,11]
		5.5V		10		10	4	µA	V_{IN}=0V,V_{CC} WDT is not Running	[6,11]
		3.0V		500		600	310	µA	V_{IN}=0V,V_{CC} WDT is Running	[6,11,14]
		5.5V		800		1000	600	µA	V_{IN}=0V,V_{CC} WDT is Running	[6,11,14]

DC ELECTRICAL CHARACTERISTICS (Continued)

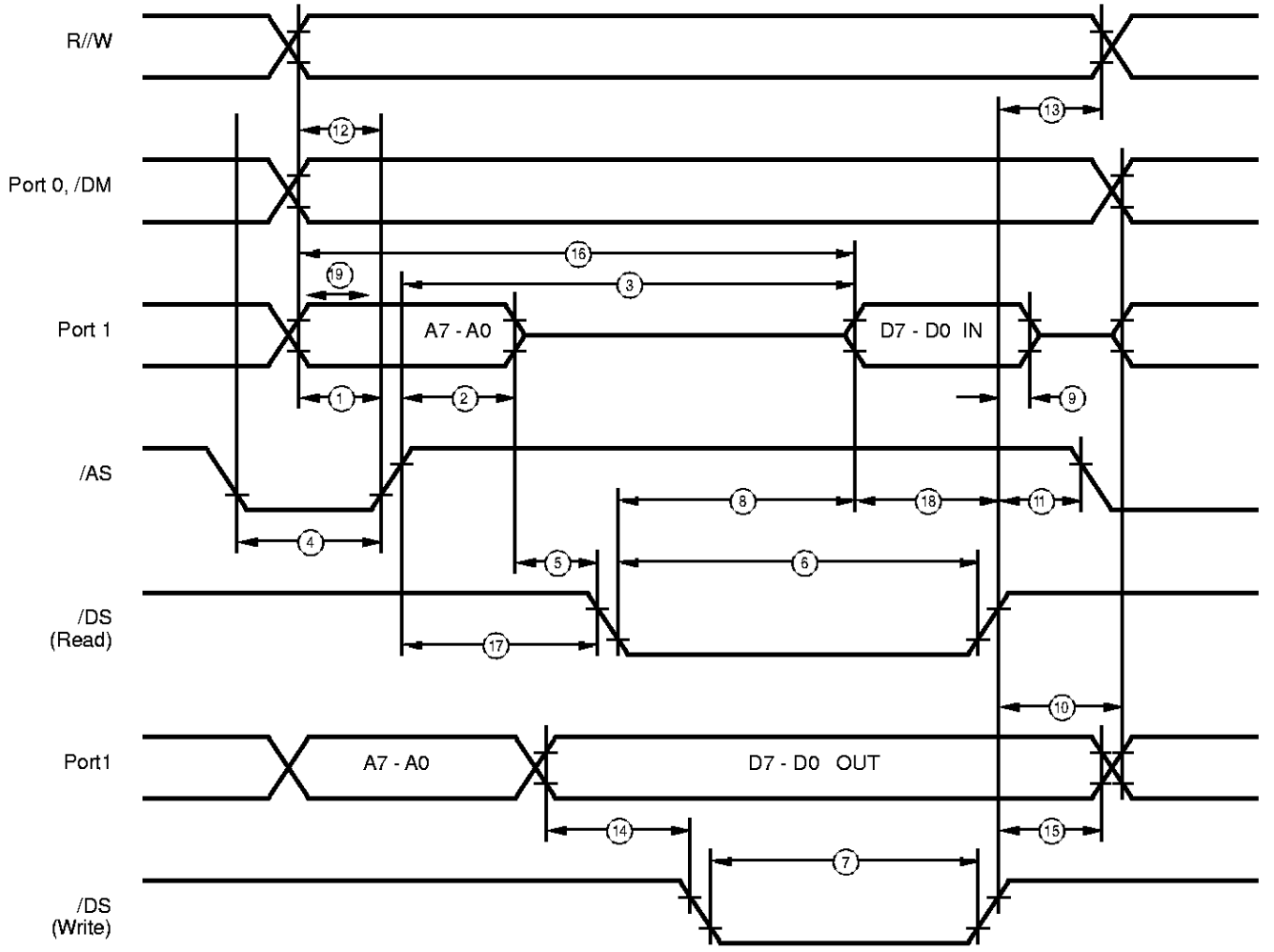
Sym	Parameter	V_{CC} Note[3]	T_A = 0° C to +70°C Min	Max	T_A = -40°C to +105°C Min	Max	Typical[1] @25°C	Units	Conditions	Notes
V_{CR}	Input Common Mode Voltage Range	3.0 5.5	GND-0.3 GND-0.3	V_{CC}-1.0V V_{CC}-1.0V	GND-0.3 GND-0.3	V_{CC}-1.5V V_{CC}-1.5V		V V		[10] [10]
I_{ALL}	Auto Latch Low Current	3.0V 5.5V		8 15		10 20	3 5	µA µA	$0V<V_{IN}<V_{CC}$ $0V<V_{IN}<V_{CC}$	[9] [9]
I_{ALH}	Auto Latch High Current	3.0V 5.5V		-5 -8		-7 -10	-3 -6	µA µA	$0V<V_{IN}<V_{CC}$ $0V<V_{IN}<V_{CC}$	[9] [9]
V_{LV}	V_{CC} Low Voltage Protection Voltage		2.4	3.1	2.1	3.3	2.8 2.8	V	4MHz max Int. CLK Freq. 6MHz max Int. CLK Freq.	[7,15] [7,14]
V_{OH}	Output High Voltage (Low EMI Mode)	3.3V 5.0V	V_{CC}-0.4 V_{CC}-0.4		V_{CC}-0.4 V_{CC}-0.4		3.1 4.8	V V	I_{OH}=-0.5mA I_{OH}=-0.5mA	
V_{OL}	Output Low Voltage (Low EMI Mode)	3.3V 5.0V		0.6 0.4		0.6 0.4	0.2 0.1	V V	I_{OL}=1.0mA I_{OL}=1.0mA	

Notes:

[1] Typicals are at V_{CC} = 5.0V and 3.3V.
[2] GND = 0V.
[3] The V_{DD} voltage specification of 3.0V guarantees 3.3V ±0.3V, and the V_{DD} voltage specification of 5.5V guarantees 5.0V ±0.5V.
[4] All outputs unloaded, I/O pins floating, inputs at rail.
[5] CL1 = CL2 = 100 pF.
[6] Same as note [4] except inputs at V_{CC}.
[7] The V_{LV} increases as the temperature decreases.
[8] Standard Mode (not Low EMI).
[9] Auto Latch (Mask Option) selected.
[10] For analog comparator, inputs when analog comparators are enabled.
[11] Clock must be forced Low, when XTAL 1 is clock-driven and XTAL2 is floating.
[12] Excludes clock pins.
[13] Z86243 Only.
[14] 0°C to 70°C (standard temperature).
[14] –40°C to 105°C (extended temperature).

AC CHARACTERISTICS

External I/O or Memory Read and Write Timing Diagram



External I/O or Memory Read/Write Timing

AC CHARACTERISTICS

External I/O or Memory Read and Write Timing Table
(SCLK/TCLK = XTAL/2)

				T_A = 0°C to +70°C				T_A = -40°C to +105°C					
			Note[3]	12MHz		16MHz		12MHz		16MHz			
No	Symbol	Parameter	V_{CC}	Min	Max	Min	Max	Min	Max	Min	Max	Units	Notes
1	TdA(AS)	Address Valid to /AS Rise Delay	3.0	35		25		35		25		ns	[2]
			5.5	35		25		35		25			
2	TdAS(A)	/AS Rise to Address Float Delay	3.0	45		35		45		35		ns	[2]
			5.5	45		35		45		35		ns	
3	TdAS(DR)	/AS Rise to Read Data Req'd Valid	3.0		250		180		250		180	ns	[1,2]
			5.5		250		180		250		180	ns	
4	TwAS	/AS Low Width	3.0	55		40		55		40		ns	[2]
			5.5	55		40		55		40		ns	
5	Td	Address Float to /DS Fall	3.0	0		0		0		0		ns	
			5.5	0		0		0		0		ns	
6	TwDSR	/DS (Read) Low Width	3.0	200		135		200		135		ns	[1,2]
			5.5	200		135		200		135		ns	
7	TwDSW	/DS (Write) Low Width	3.0	110		80		110		80		ns	[1,2]
			5.5	110		80		110		80		ns	
8	TdDSR(DR)	/DS Fall to Read Data Req'd Valid	3.0		150		75		150		75	ns	[1,2]
			5.5		150		75		150		75	ns	
9	ThDR(DS)	Read Data to /DS Rise Hold Time	3.0	0		0		0		0		ns	[2]
			5.5	0		0		0		0		ns	
10	TdDS(A)	/DS Rise to Address Active Delay	3.0	45		50		45		50		ns	[2]
			5.5	55		50		55		50		ns	
11	TdDS(AS)	/DS Rise to /AS Fall Delay	3.0	30		35		30		35		ns	[2]
			5.5	45		35		45		55		ns	
12	TdRW(AS)	R/W Valid to /AS Rise Delay	3.0	45		25		45		25		ns	[2]
			5.5	45		25		45		25		ns	
13	TdDS(RW)	/DS Rise to R/W Not Valid	3.0	45		35		45		35		ns	[2]
			5.5	45		35		45		35		ns	
14	TdDW(DSW)	Write Data Valid to /DS Fall (Write) Delay	3.0	55		25		55		25		ns	[2]
			5.5	55		25		55		25		ns	
15	TdDS(DW)	/DS Rise to Write Data Not Valid Delay	3.0	45		35		45		35		ns	[2]
			5.5	55		35		55		35		ns	
16	TdA(DR)	Address Valid to Read Data Req'd Valid	3.0		310		230		310		230	ns	[1,2]
			5.5		310		230		310		230	ns	
17	TdAS(DS)	/AS Rise to /DS Fall Delay	3.0	65		45		65		45		ns	[2]
			5.5	65		45		65		45		ns	
18	TdDI(DS)	Data Input Setup to /DS Rise	3.0	115		60		115		60		ns	[1,2]
			5.5	75		60		75		60		ns	
19	TdDM(AS)	/DM Valid to /AS Rise Delay	3.0	35		30		35		30		ns	[2]
			5.5	35		30		35		30		ns	

Notes:

[1] When using extended memory timing add 2 TpC.

[2] Timing numbers given are for minimum TpC.

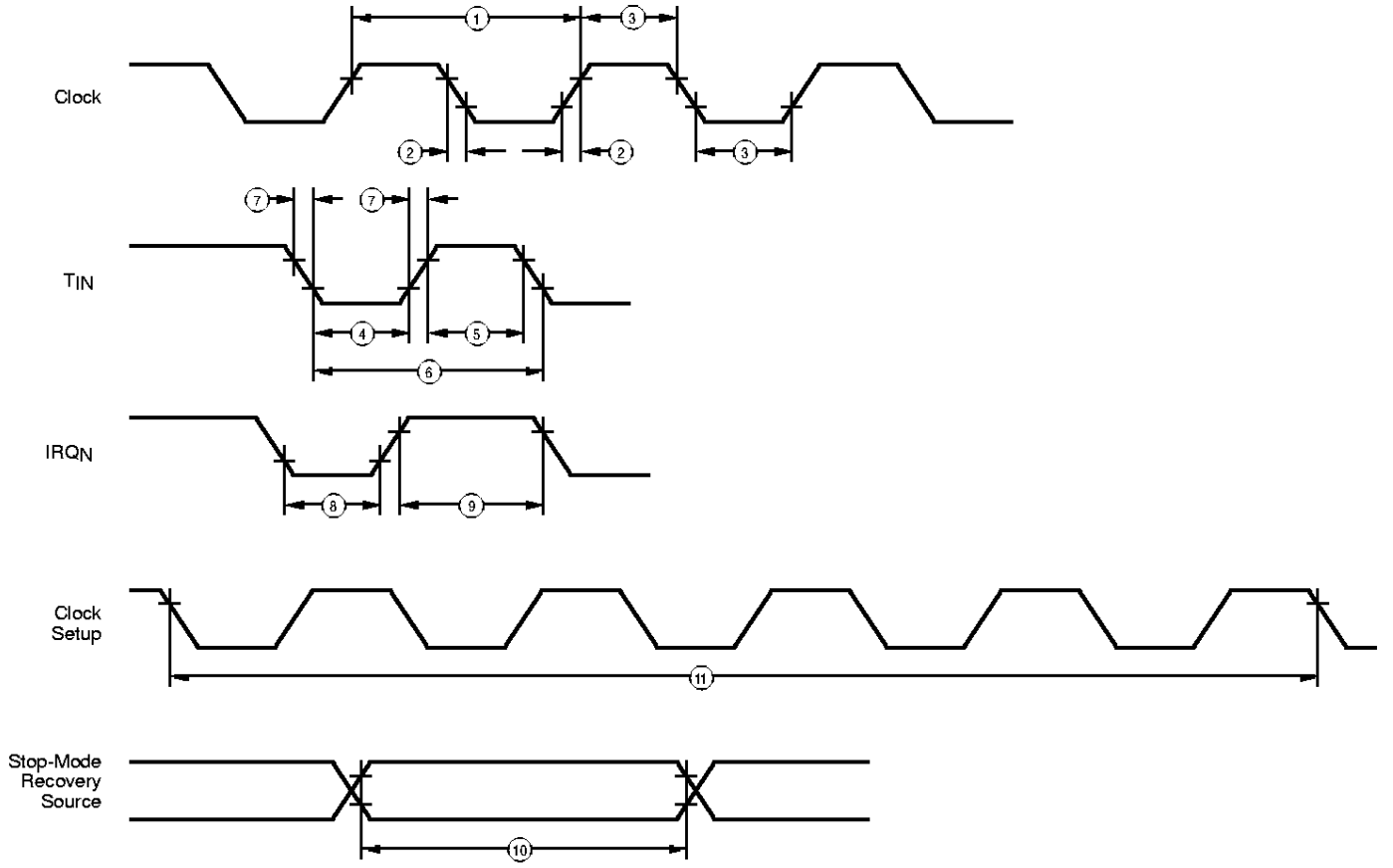
[3] The V_{DD} voltage specification of 3.0V guarantees 3.3V ±0.3V, and the V_{DD} voltage specification of 5.5V guarantees 5.0V ±0.5V.

Standard Test Load

All timing references use 0.7 V_{CC} for a logic 1 and 0.2 V_{CC} for a logic 0.

AC ELECTRICAL CHARACTERISTICS

Additional Timing Diagram



Additional Timing

AC ELECTRICAL CHARACTERISTICS

Additional Timing Table (SCLK/TCLK = XTAL/2)

No	Symbol	Parameter	V_{CC} Note[6]	T_A=0°C to +70°C 12MHz Min	12MHz Max	16MHz Min	16MHz Max	T_A=-40°C to +105°C 12MHz Min	12MHz Max	16MHz Min	16MHz Max	Units	Notes
1	TpC	Input Clock Period	3.0V	83	DC	62.5	DC	83	DC	62.5	DC	ns	[1]
			5.5V	83	DC	62.5	DC	83	DC	62.5	DC	ns	[1]
2	TrC,TfC	Clock Input Rise & Fall Times	3.0V		15		15		15		15	ns	[1]
			5.5V		15		15		15		15	ns	[1]
3	TwC	Input Clock Width	3.0V	41		31		41		31		ns	[1]
			5.5V	41		31		41		31		ns	[1]
4	TwTinL	Timer Input Low Width	3.0V	100		100		100		100		ns	[1]
			5.5V	70		70		70		70		ns	[1]
5	TwTinH	Timer Input High Width	3.0V	5TpC		5TpC		5TpC		5TpC			[1]
			5.5V	5TpC		5TpC		5TpC		5TpC			[1]
6	TpTin	Timer Input Period	3.0V	8TpC		8TpC		8TpC		8TpC			[1]
			5.5V	8TpC		8TpC		8TpC		8TpC			[1]
7	TrTin,	Timer Input Rise & Fall Timer	3.0V		100		100		100		100	ns	[1]
	TfTin		5.5V		100		100		100		100	ns	[1]
8A	TwIL	Int. Request Low Time	3.0V	100		100		100		100		ns	[1,2]
			5.5V	70		70		70		70		ns	[1,2]
8B	TwIL	Int. Request Low Time	3.0V	5TpC		5TpC		5TpC		5TpC			[1,3]
			5.5V	5TpC		5TpC		5TpC		5TpC			[1,3]
9	TwIH	Int. Request Input High Time	3.0V	5TpC		5TpC		5TpC		5TpC			[1,2]
			5.5V	5TpC		5TpC		5TpC		5TpC			[1,2]
10	Twsm	STOP-Mode Recovery Width Spec	3.0V	12		12		12		12		ns	
			5.5V	12		12		12		12		ns	
11	Tost	Oscillator Startup Time	3.0V		5TpC		5TpC		5TpC		5TpC		[4]
			5.5V		5TpC		5TpC		5TpC		5TpC		[4]
12	Twdt	Watch-Dog Timer Delay Time											D1 D0
		Before Time-Out	3.0V	10		10		10		10		ms	0 0 [5]
			5.5V	5		5		5		5		ms	0 0 [5]
			3.0V	20		20		20		20		ms	0 1 [5]
			5.5V	10		10		10		10		ms	0 1 [5]
			3.0V	40		40		40		40		ms	1 0 [5]
			5.5V	20		20		20		20		ms	1 0 [5]
			3.0V	160		160		160		160		ms	1 1 [5]
			5.5V	80		80		80		80		ms	1 1 [5]
13	T_{PCR}	Power On Reset Delay	3.0V	7	24	7	24	7	25	7	25	ms	
			5.5V	3	13	3	13	3	14	3	14	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 via Port 3 (P31-P33).

[3] Interrupt request via Port 3 (P30).

[4] SMR-D5 = 0.

[5] Reg. WDTMR, internal RC used.

[6] The V_{DD} voltage specification of 3.0V guarantees 3.3V ±0.3V, and the V_{DD} voltage specification of 5.5V guarantees 5.0V ±0.5V.

AC ELECTRICAL CHARACTERISTICS

Additional Timing Table (Divide-By-One Mode, SCLK/TCLK = XTAL)

No	Symbol	Parameter	V_{CC} Note[6]	T_A=0°C to +70°C 4MHz Min	Max	T_A=-40°C to +105°C 4MHz Min	Max	Units	Notes
1	TpC	Input Clock Period	3.0V	250	DC	250	DC	ns	[1,7,8]
			5.5V	250	DC	250	DC	ns	[1,7,8]
2	TrC,TfC	Clock Input Rise & Fall Times	3.0V		25		25	ns	[1,7,8]
			5.5V		25		25	ns	[1,7,8]
3	TwC	Input Clock Width	3.0V	125		125		ns	[1,7,8]
			5.5V	125		125		ns	[1,7,8]
4	TwTinL	Timer Input Low Width	3.0V	100		100		ns	[1,7,8]
			5.5V	70		70		ns	[1,7,8]
5	TwTinH	Timer Input High Width	3.0V	3TpC		3TpC			[1,7,8]
			5.5V	3TpC		3TpC			[1,7,8]
6	TpTin	Timer Input Period	3.0V	4TpC		4TpC			[1,7,8]
			5.5V	4TpC		4TpC			[1,7,8]
7	TrTin,	Timer Input Rise & Fall Timer	3.0V		100		100	ns	[1,7,8]
	TfTin		5.5V		100		100	ns	[1,7,8]
8A	TwIL	Int. Request Low Time	3.0V	100		100		ns	[1,2,7,8]
			5.5V	70		70		ns	[1,2,7,8]
8B	TwIL	Int. Request Low Time	3.0V	3TpC		3TpC			[1,3,7,8]
			5.5V	3TpC		3TpC			[1,3,7,8]
9	TwIH	Int. Request Input High Time	3.0V	3TpC		3TpC			[1,2,7,8]
			5.5V	3TpC		2TpC			[1,2,7,8]
10	Twsm	STOP-Mode Recovery Width Spec	3.0V	12		12		ns	[4,8]
			5.5V	12		12		ns	[4,8]
11	Tost	Oscillator Startup Time	3.0V		5TpC		5TpC		[4,8,9]
			5.5V		5TpC		5TpC		[4,8,9]

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 (P33-P31).

[3] Interrupt request via Port 3 (P30).

[4] SMR-D5 = 1, POR STOP mode delay is on.

[5] Reg. WDTMR.

[6] The V_{DD} voltage specification of 3.0V guarantees 3.3V ±0.3V, and the V_{DD} voltage specification of 5.5V guarantees 5.5V ±0.5V.

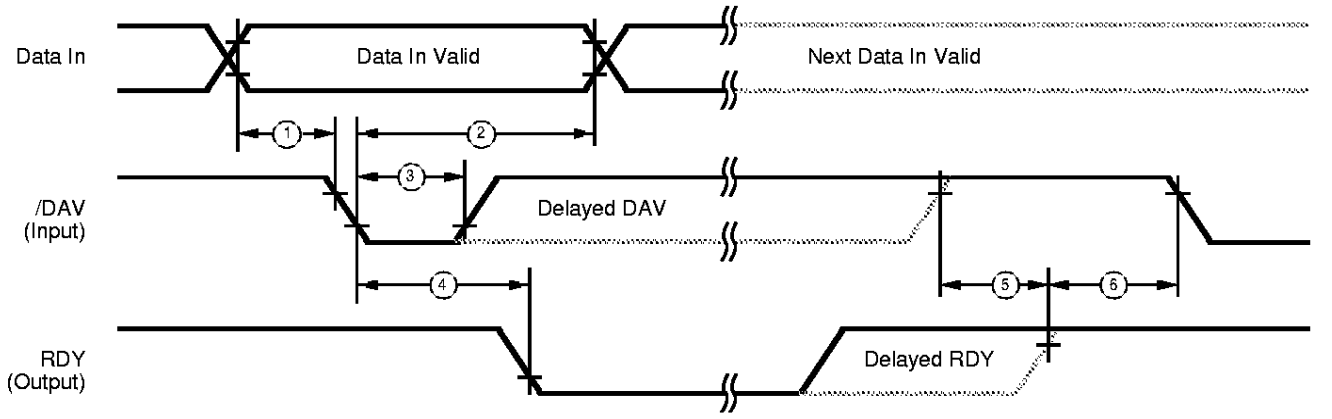
[7] SMR D1 = 0.

[8] Maximum frequency for internal system clock is 4 MHz when using XTAL divide-by-one mode.

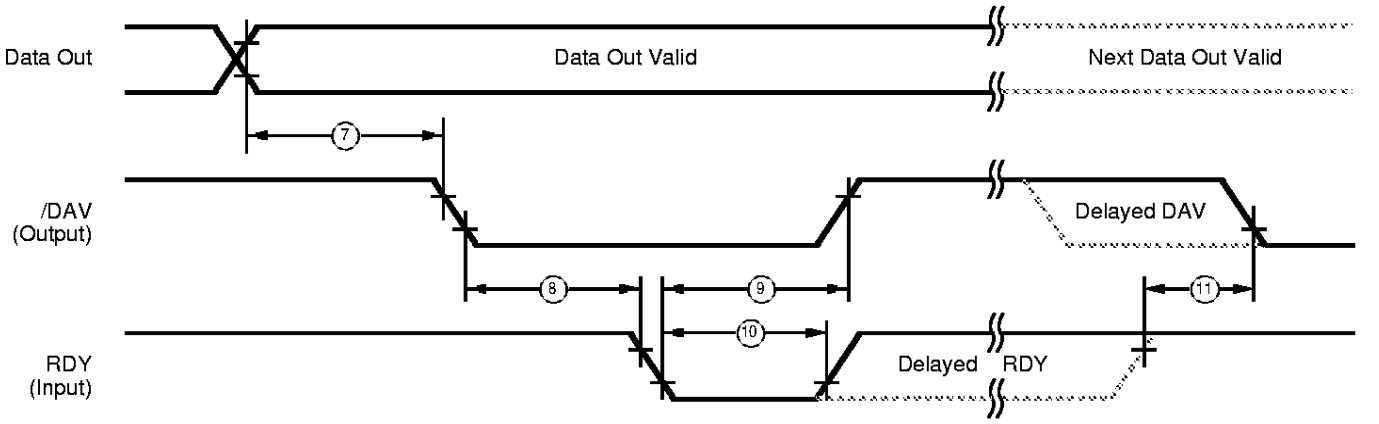
[9] For RC and LC oscillator, and for oscillator driven by clock driver.

AC ELECTRICAL CHARACTERISTICS

Handshake Timing Diagrams



Input Handshake Timing



Output Handshake Timing

AC ELECTRICAL CHARACTERISTICS

Handshake Timing Table

				T_A = 0°C to +70°C				T_A = –40°C to +105°C				
			V_{CC}	12MHz		16MHz		12MHz		16MHz		Data
No	Symbol	Parameter	Note[1,2]	Min	Max	Min	Max	Min	Max	Min	Max	Direction
1	TsDI(DAV)	DataInSetupTime	3.0V	0		0		0		0		IN
			5.5V	0		0		0		0		IN
2	ThDI(DAV)	DataInHoldTime	3.0V	160		160		160		160		IN
			5.5V	115		115		115		115		IN
3	TwDAV	DataAvailableWidth	3.0V	155		155		155		155		IN
			5.5V	110		110		110		110		IN
4	TdDAVf(RDY)	DAVFalltoRDYFallDelay	3.0V		160		160		160		160	IN
			5.5V		115		115		115		115	IN
5	TdDAVr(RDY)	DAVRisetoRDYRiseDelay	3.0V		120		120		120		120	IN
			5.5V		80		80		80		80	IN
6	TdRDY0(DAV)	RDYRisetoDAVFallDelay	3.0V	0		0		0		0		IN
			5.5V	0		0		0		0		IN
7	TdD0(DAV)	DataOuttoDAVFallDelay	3.0V	42		31		42		31		OUT
			5.5V	42		31		42		31		OUT
8	TdDAV0(RDY)	DAVFalltoRDYFallDelay	3.0V	0		0		0		0		OUT
			5.5V	0		0		0		0		OUT
9	TdRDY0(DAV)	RDYFalltoDAVRiseDelay	3.0V		160		160		160		160	OUT
			5.5V		115		115		115		115	OUT
10	TwRDY	RDYWdth	3.0V	110		110		110		110		OUT
			5.5V	80		80		80		80		OUT
11	TdRDY0d(DAV)	RDYRisetoDAVFallDelay	3.0V		110		110		110		110	OUT
			5.5V		80		80		80		80	OUT

Notes:

[1] Timing Reference uses 0.7 V_{CC} for a logic 1 and 0.2 V_{CC} for a logic 0.

[2] The V_{DD} voltage specification of 3.0V guarantees 3.3V ±0.3V and the V_{DD} voltage specification of 5.5V guarantees 5.0V ±0.5V.

PRECAUTIONS

(1) When in ROM Protect Mode, and executing out of *External Program Memory* , instructions LDC, LDCI, LDE, and LDEI *cannot* read Internal Program Memory.

When in ROM Protect Mode, and executing out of *Internal Program Memory* , instructions LDC, LDCI, LDE, and LDEI *can* read Internal Program Memory.

(2) The device has an oscillator-free reset for the device pins. When the device is reset from a WDT timeout, POR, or V_{BO}, the reset will force the device pins to their reset default state even if the oscillator is not running.

(3) The Port 3 outputs are reset to High State after Reset, except after Stop-Mode Recovery, at which the outputs remain in the last state.

(4) Extended timing is operable.

(5) P0/P1/P2/P3 is Low-EMI software programmable.

(6) P0/P1/P2 is software programmable for open-drain.

(7) Expanded register PCON is Write Only.

(8) WDTMR is writeable only within the first 60 internal system clocks after Reset. Afterward, the WDTMR is write protected.

(9) Device functions down to the V_{LV} threshold. At temperatures less than 25°C, the V_{LV} threshold will rise to a maximum V_{DD} of 3.6V.

(10) Low EMI is 25 percent of standard pull-down output driver and 25 percent of standard pull-up output driver.

(11) There is no clock filter on Reset pin.

(12) Registers FE Hex (SPH) and FF Hex (SPL) are set to 00Hex after any reset.

(13) When Low EMI OSC is selscted (PCONReg Bit D7=0), the output drive of /DS, /AS, and R//W will also be in low emi mode.

(14) P01M Reg Bit D4,D3 must be set to 00Hex for Z86233.

Zilog, Inc. 210 East Hacienda Ave.
Campbell, CA 95008-6600
Telephone (408) 370-8000
FAX 408 370-8056
Internet: http://www.zilog.com