



Z86L16

CMOS Z8® LOW-VOLTAGE MICROCONTROLLER

GENERAL DESCRIPTION

The Z86L16 is a low-voltage Consumer Controller Processor (CCP™) with 1 Kbyte of ROM, and 124 bytes of General-Purpose RAM. The device is packaged in an 18-pin DIP or an 18-pin SOIC, and is manufactured in low-voltage CMOS technology. The Z86L16 offers fast execution, efficient use of memory, sophisticated interrupts, input/output bit manipulation capabilities and easy hardware/software system expansion, along with low-cost and low-power consumption. With this low-voltage process, the device may operate down to 2.0 volts.

The Z86L16 features the addition of an Expanded Register File, which allows access to register mapped peripheral and I/O circuits. The CCP offers a flexible I/O scheme, and a number of ancillary features that are useful in many consumer, industrial and automotive applications.

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

Three basic address spaces are available to support this wide range of configurations: Program Memory, Register File, and Expanded Register File. The Register File is composed of 124 bytes of General-Purpose RAM, two I/O Port registers, and 15 Control and Status registers. The Expanded Register File consists of three control registers.

With powerful peripheral features such as on-board comparators, counter/timers, watch-dog timer and serial peripheral interface, the Z86L16 meets the needs for most sophisticated controller applications. (See Functional Block Diagram.)

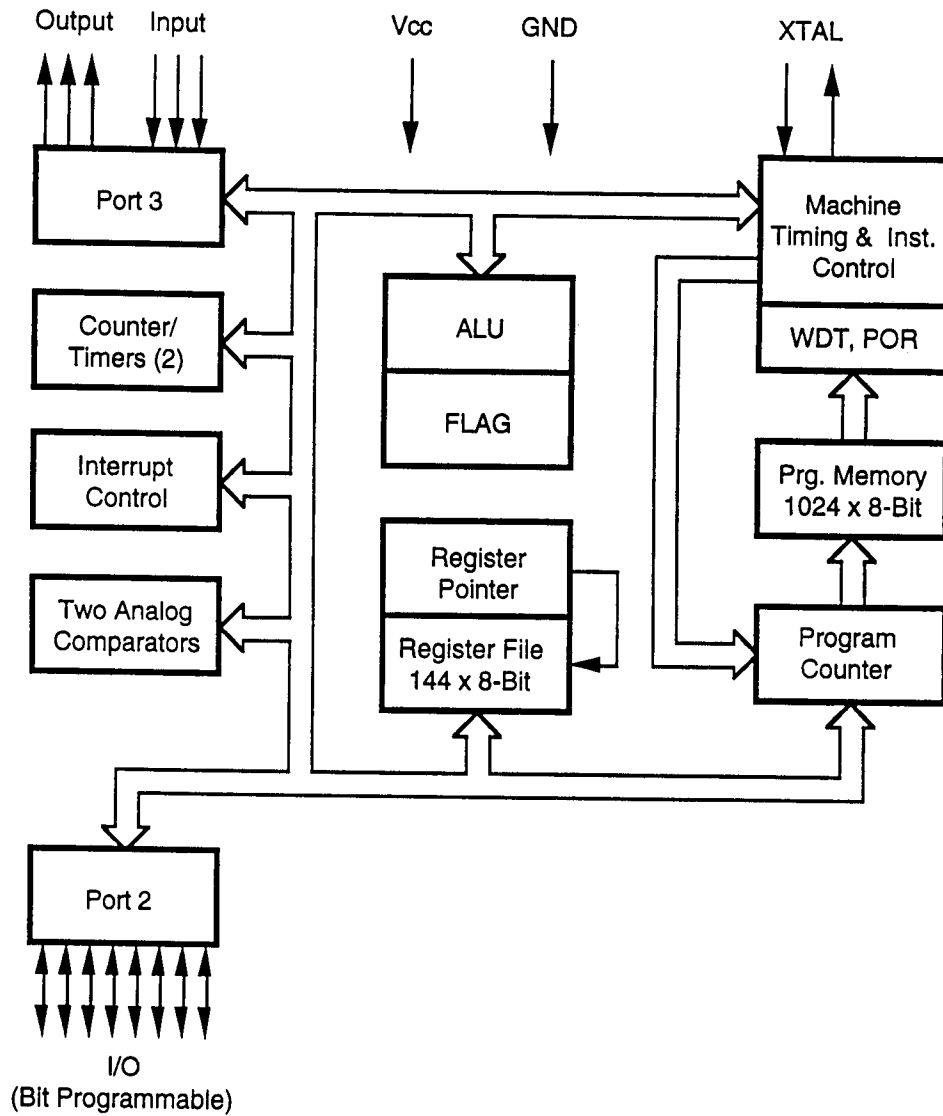
Notes:

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:

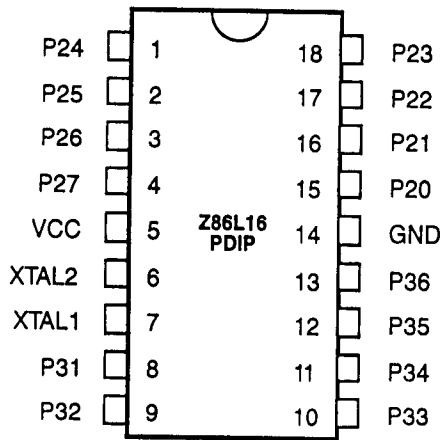
Connection	Circuit	Device
Power Ground	V _{CC} GND	V _{DD} V _{SS}

GENERAL DESCRIPTION (Continued)

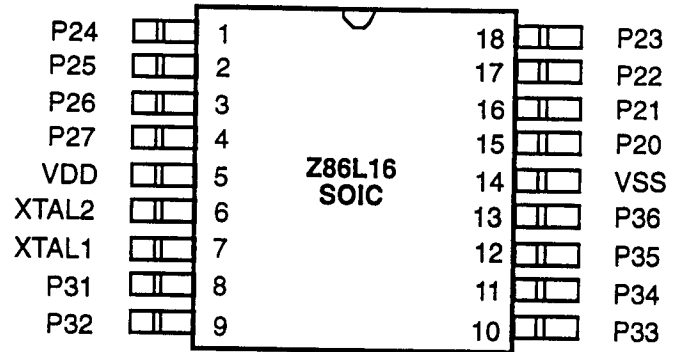


Functional Block Diagram

PIN DESCRIPTIONS



18-Pin DIP Configuration



18-Pin SOIC Configuration

ABSOLUTE MAXIMUM RATINGS

Symbol	Description	Min	Max	Units
V_{CC}	Supply Voltage*	-0.3	+7.0	V
V_{IN}	Input Voltage**	-0.3	$V_{CC}+0.3$	V
T_{STG}	Storage Temp	-65	+150	C
T_A	Oper Ambient Temp	†		C

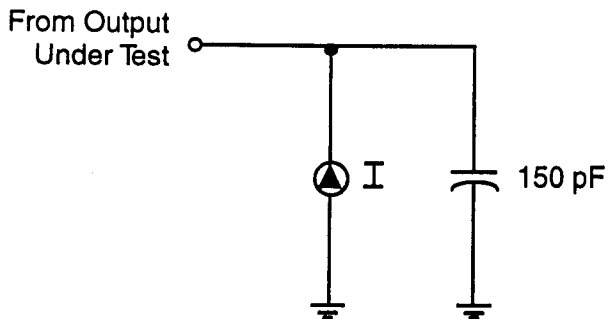
Stress greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; operation of the device at any condition above those indicated in the operational sections of these specifications is not implied. Exposure to absolute maximum rating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

Notes:

- * Voltage on V_{CC} with respect to GND/Vss.
- † See Ordering Information
- ** Voltages on all pins with respect to GND/Vss without current limitation.

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 Diagram).



Test Load Diagram

DC ELECTRICAL CHARACTERISTICS

Sym	Parameter Note [2]	V_{CC}	$T_A = 0^\circ\text{C to } +70^\circ\text{C}$		Typical [7] @ +25°C	Units	Conditions	Notes
			Min	Max				
	Max Input Voltage	2.0V 3.6V	$V_{SS}-0.3$ $V_{SS}-0.3$	$V_{CC}+0.3$ $V_{CC}+0.3$		V V		
V_{CH}	Clock Input High Voltage	2.0V 3.6V	$0.9 V_{CC}$ $0.9 V_{CC}$	$V_{CC}+0.3$ $V_{CC}+0.3$	0.9 2.0	V V	Driven by External Clock Generator Driven by External Clock Generator	
V_{CL}	Clock Input Low Voltage	2.0V 3.6V	$V_{SS}-0.3$ $V_{SS}-0.3$	$0.1 V_{CC}$ $0.1 V_{CC}$	0.9 1.8	V V	Driven by External Clock Generator Driven by External Clock Generator	
V_{IH}	Input High Voltage Port 2	2.0V 3.6V	$0.9 V_{CC}$ $0.9 V_{CC}$	$V_{CC}+0.3$ $V_{CC}+0.3$	1.2 1.9	V V		
V_{IH}	Input High Voltage Port 3	2.0V 3.6V	$0.7 V_{CC}$ $0.7 V_{CC}$	$V_{CC}+0.3$ $V_{CC}+0.3$	0.9 1.9	V V		
V_{IL}	Input Low Voltage Port 2	2.0V 3.6V	$V_{SS}-0.3$ $V_{SS}-0.3$	$0.1 V_{CC}$ $0.1 V_{CC}$	0.6 1.2	V V		
V_{IL}	Input Low Voltage Port 3	2.0V 3.6V	$V_{SS}-0.3$ $V_{SS}-0.3$	$0.2 V_{CC}$ $0.2 V_{CC}$	0.9 1.7	V V		
V_{OH1}	Output High Voltage	2.0V 3.6V	$V_{CC}-0.4$ $V_{CC}-0.4$		1.9 3.5	V V	$I_{OH} = 500 \mu\text{A}$ $I_{OH} = 500 \mu\text{A}$	[6] [6]
V_{OH}	Output High Voltage Low EMI Mode	2.0V 3.6V	$V_{CC}-0.4$ $V_{CC}-0.4$		1.9 3.5	V V	$I_{OH} = -125 \mu\text{A}$ $I_{OH} = -125 \mu\text{A}$	
V_{OL}	Output Low Voltage Low EM Mode	2.0V 3.6V		0.4 0.4	0.1 0.04	V V	$I_{OL} = 250 \mu\text{A}$ $I_{OL} = 250 \mu\text{A}$	
V_{OL1}	Output Low Voltage	2.0V 3.6V		0.4 0.4	0.1 0.04	V V	$I_{OL} = 1.0 \text{ mA}$ $I_{OL} = 1.0 \text{ mA}$	[6] [6]
V_{OL2}	Output Low Voltage	2.0V 3.6V		1.0 1.0	0.5 0.3	V V	$I_{OL} = 3 \text{ mA}$, 3 Pin Max $I_{OL} = 3 \text{ mA}$, 3 Pin Max	[6] [6]
V_{OFFSET}	Comparator Input Offset Voltage	2.0V 3.6V		25 25	6 6	mV mV		
I_{IL}	Input Leakage (Input bias current of comparator)	2.0V 3.6V	-1.0 -1.0	1.0 1.0	.001 .001	μA μA	$V_{IN} = 0\text{V}, V_{CC}$ $V_{IN} = 0\text{V}, V_{CC}$	[8] [8]
I_{OL}	Output Leakage	2.0V 3.6V	-1.0 -1.0	1.0 1.0	.001 .001	μA μA	$V_{IN} = 0\text{V}, V_{CC}$ $V_{IN} = 0\text{V}, V_{CC}$	
I_{CC}	Supply Current	2.0V 3.6V		6 11.0	1.2 6	mA mA	@ 8 MHz @ 8 MHz	[3,4] [9] [10] [3,4] [9] [10]

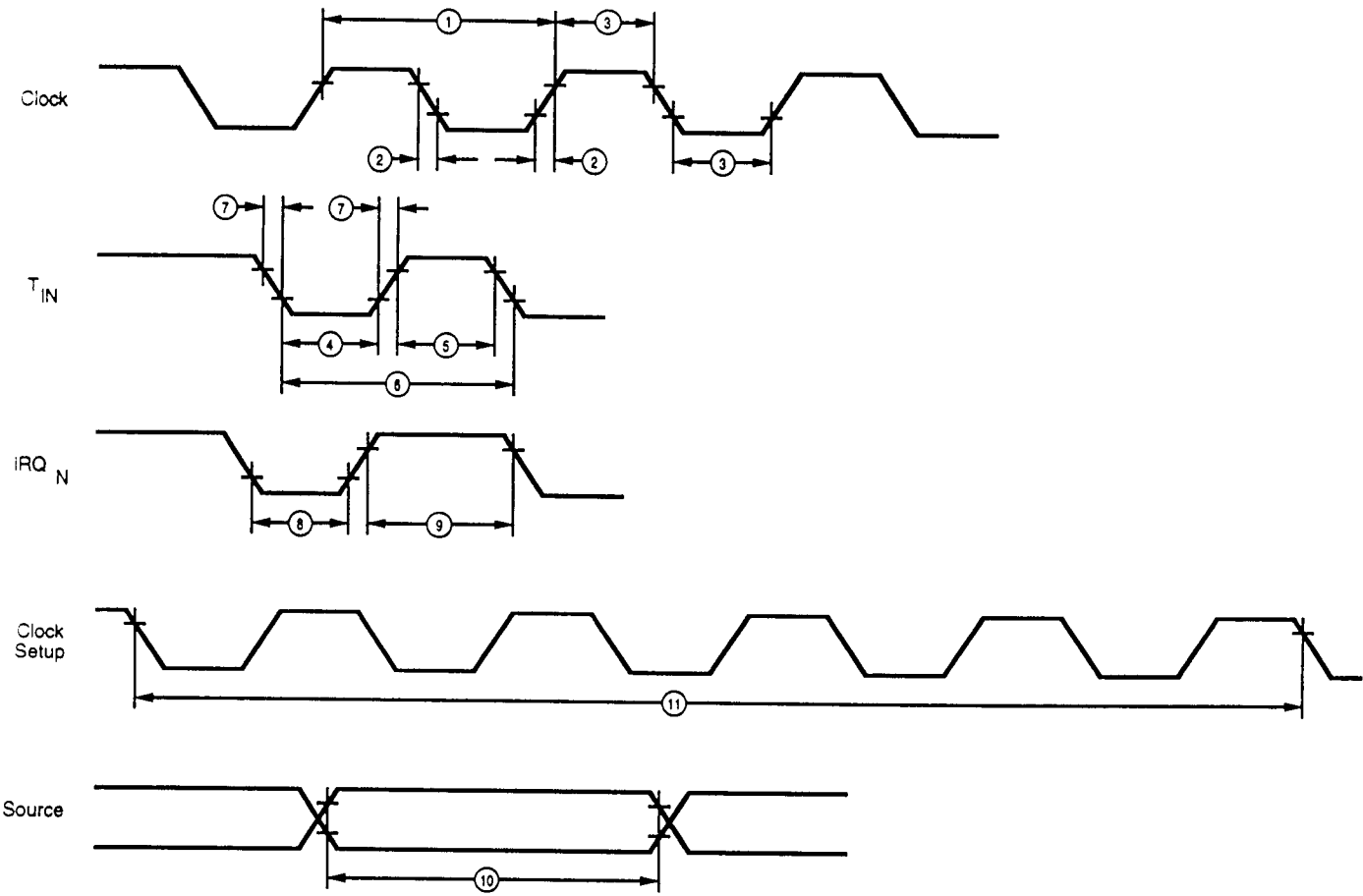
DC ELECTRICAL CHARACTERISTICS (Continued)

Sym	Parameter Note [2]	V _{cc}	T _A = 0°C to +70°C		Typical @ + 25°C	Units	Conditions	Notes
			Min	Max				
I _{cc}	Standby Current	2.0V		2.0	0.5	mA	HALT Mode V _{IN} = 0V, V _{cc} @ 8 MHz	[3,4] [9] [10]
		3.6V		4	1.5	mA	HALT Mode V _{IN} = 0V, V _{cc} @ 8 MHz	[3,4] [9] [10]
		2.0V		1.0	0.4	mA	Clock Divide by 16 @ 8 MHz	[3,4] [9] [10]
		3.6V		3.0	1.0	mA	Clock Divide by 16 @ 8 MHz	[3,4] [9] [10]
I _{cc}	Standby Current	2.0V		15	1.0	μA	STOP Mode V _{IN} = 0V, V _{cc} WDT is not Running	[5]
		3.6V		15	3.0	μA	STOP Mode V _{IN} = 0V, V _{cc} WDT is not Running	[5]
		2.0V		115	30	μA	STOP Mode V _{IN} = 0V, V _{cc} WDT is Running	[5] [9]
		3.6V		350	180	μA	STOP Mode V _{IN} = 0V, V _{cc} WDT is Running	[5] [9]
V _{ca}	Comparator Input Common Mode Voltage Range			V _{cc} - 1.5V				
V _{sc}	Low-Voltage Protection			2.6V	2.3V			

Notes:

- [1] V_{ss} = 0V = GND
- [2] V_{cc} range 3.6V to 2.0V
- [3] All outputs unloaded, I/O pins floating, inputs at rail.
- [4] C_{L1} = C_{L2} = 47 pF
- [5] Same as note [4] except inputs at V_{cc}
- [6] STD MODE (not low noise)
- [7] Typical are at V_{cc} = 3.6V and 2.0V.
- [8] Input bias currents for comparator inputs P31, P32, P33.
- [9] Internal on-board RC is driving WDT.
- [10] System clock is external XTAL frequency divided by 2.

AC ELECTRICAL CHARACTERISTICS



Additional Timing

AC ELECTRICAL CHARACTERISTICS

(Reference Additional Timing)

No	Symbol	Parameter	V _{cc} Note[3]	T _A = 0°C to +70°C 8 MHz		Units	Notes
				Min	Max		
1	TpC	Input Clock Period	2.0V	125	DC	ns	[1] [7]
			3.6V	125	DC	ns	[1] [7]
2	TrC,TfC	Clock Input Rise and Fall Times	2.0V		25	ns	[1]
			3.6V		25	ns	[1]
3	TwC	Input Clock Width	2.0V	37		ns	[1] [7]
			3.6V	37		ns	[1] [7]
4	TwTinL	Timer Input Low Width	2.0V	250		ns	[1] [7]
			3.6V	250		ns	[1] [7]
5	TwTinH	Timer Input High Width	2.2V	5TpC			[1] [7]
			3.6V	5TpC			[1] [7]
6	TpTin	Timer Input Period	2.0V	8TpC			[1] [7]
			3.6V	8TpC			[1] [7]
7	TrTin, TtTin	Timer Input Rise and Fall Timer	2.0V		100	ns	[1]
			3.6V		100	ns	[1]
8	TwIL	Int. Request Input Low Time	2.0V	100		ns	[1,2]
			3.6V	70		ns	[1,2]
9	TwIH	Int. Request Input High Time	2.0V	5TpC			[1,2] [7]
			3.6V	5TpC			[1,2] [7]
10	Twsm	STOP Mode Recovery Width Spec	2.0V	70		ns	
			3.6V	70		ns	
11	Tost	Oscillator Startup Time	2.0V	5TpC			Reg.
			3.6V	5TpC		ns	[4] [7]
12	Twdt	Watchdog Timer Refresh Time	2.0V	30	150		[5]
			3.6V	10	40	ms	D0 = 0 [6] D1 = 0 [6]
			2.0V	60	300	ms	D0 = 1 [6]
			3.6V	20	80	ms	D1 = 0 [6]
			2.0V	120	600	ms	D0 = 0 [6]
			3.6V	40	160	ms	D1 = 1 [6]
			2.0V	480	2400	ms	D0 = 1 [6]
			3.6V	160	610	ms	D1 = 1 [6]
13	T _{POR}	Power On Reset Time	2.0V	15	75	ms	[5]
			3.6V	4	20	ms	D0 = 0 [6]

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)

 [3] V_{cc} range 3.6V to 2.0V

[4] SMR-D5 = 0

[5] Reg. WDTMR

[6] Internal RC Oscillator only.

[7] System clock is XTAL frequency divided by 2.

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Zilog, Inc. 210 East Hacienda Ave.
Campbell, CA 95008-6600
Telephone (408) 370-8000
Telex 910-338-7621
FAX 408 370-8056