Z8615
NMOS Z8® 8-BIT MCU
KEYBOARD CONTROLLER

DESCRIPTION

The Z8615 Keyboard Controller (KBC) is a member of the Z8® single-chip microcontroller family with 4 Kbytes of ROM. The device is housed in a 40-pin DIP and 44-pin PLCC package, and is manufactured in NMOS technology. The Z8615 KBC microcontroller offers fast execution, efficient use of memory, sophisticated interrupt, input/output bit-manipulation capabilities, and easy hardware/software system expansion along with low cost and low power consumption.

The Z8615 KBC architecture is characterized by a flexible I/O scheme, an efficient register, I/O, and a number of ancillary features that are useful in many industrial and advanced scientific applications.

For applications which demand powerful I/O capabilities, the KBC provides 32 pins dedicated to input and output. These lines are grouped into four ports, each port consists of 8 lines, and are configurable under software control to provide timing, status signals, and serial or parallel I/O ports.

The Z8615 KBC offers low EMI emission which is achieved by means of several modifications in the output drivers and clock circuitry of the device.

There are two basic address spaces which are available to support this wide range of configurations: Program Memory and 124 General-Purpose Registers.

The Z8615 KBC offers two on-chip counter/timers with a large number of user-selectable modes. This unburdens the program from coping with real-time problems such as counting/timing (Block Diagram).
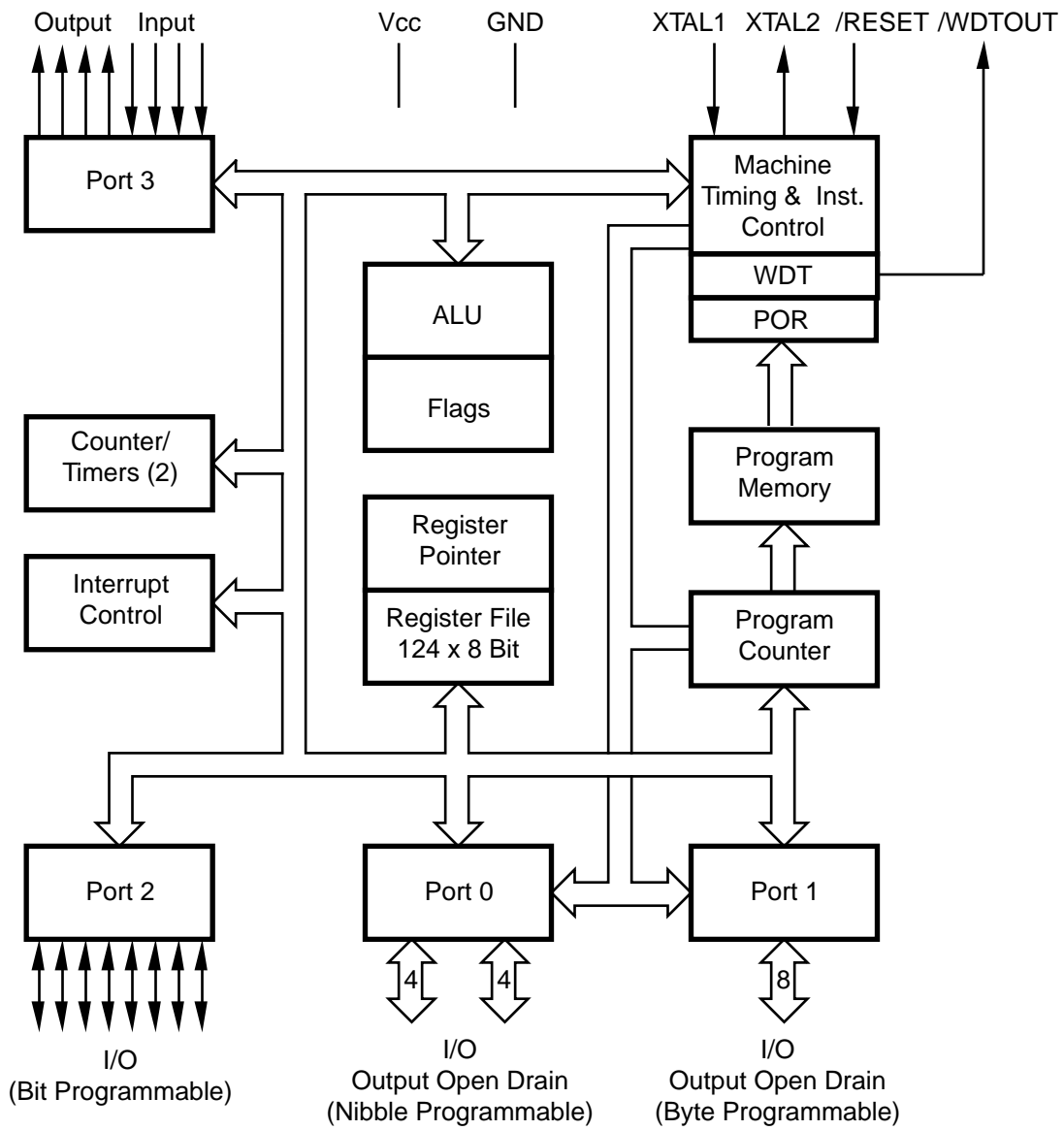
Notes:
All Signals with a preceding front slash, "/", are active Low, e.g., B//W (WORD is active Low); /B/W (BYTE is active Low, only).
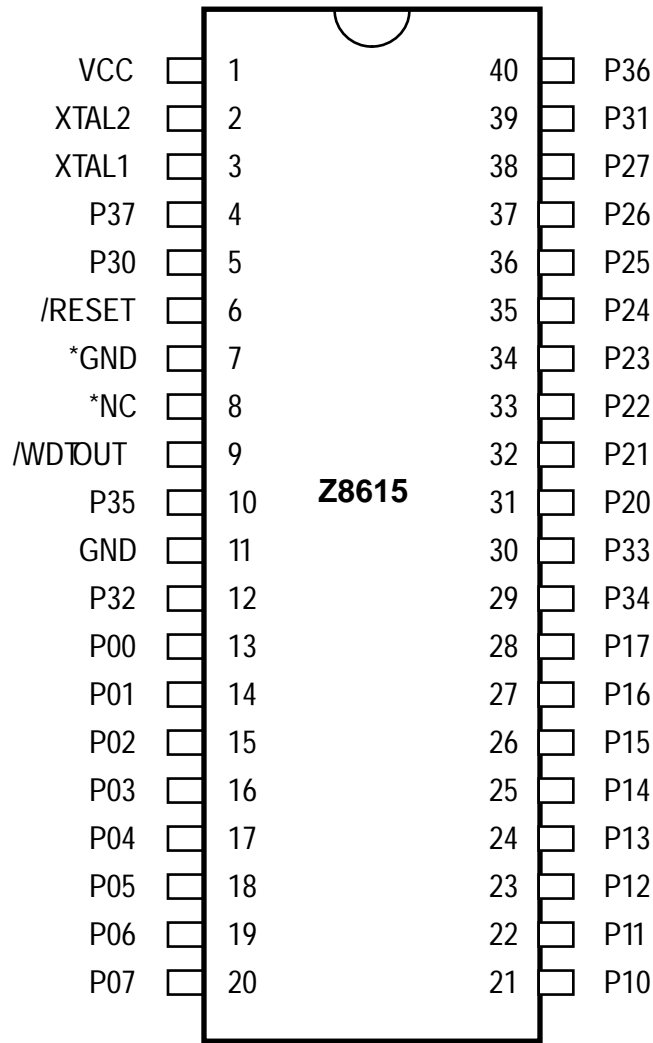
Power connections follow conventional descriptions below:

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

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GENERAL DESCRIPTION (Continued)

Output Input   Vcc   GND   XTAL1 XTAL2 /RESET /WDTOUT

| Port 3 |

| Machine Timing & Inst. Control |
| WDT |
| POR |

| ALU |
| Flags |

| Counter/ Timers (2) |

| Interrupt Control |

| Register Pointer |
| Register File 124 x 8 Bit |

| Program Memory |

| Program Counter |

| Port 2 |
| Port 0 |
| Port 1 |

I/O
(Bit Programmable)

I/O
Output Open Drain
(Nibble Programmable)

I/O
Output Open Drain
(Byte Programmable)

4   4   8

Functional Block Diagram

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PIN IDENTIFICATION

VCC	1	40	P36
XTAL2	2	39	P31
XTAL1	3	38	P27
P37	4	37	P26
P30	5	36	P25
/RESET	6	35	P24
*GND	7	34	P23
*NC	8	33	P22
/WDTOUT	9	32	P21
P35	10	31	P20
GND	11	30	P33
P32	12	29	P34
P00	13	28	P17
P01	14	27	P16
P02	15	26	P15
P03	16	25	P14
P04	17	24	P13
P05	18	23	P12
P06	19	22	P11
P07	20	21	P10

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40-Pin Configuration

*Note:
Pin 8 is connected to the chip, although used only for testing. This pin *must float.* Pin 7 is a test pin and must be grounded.

PIN IDENTIFICATION (Continued)

44-Pin PLCC Pin Assignments
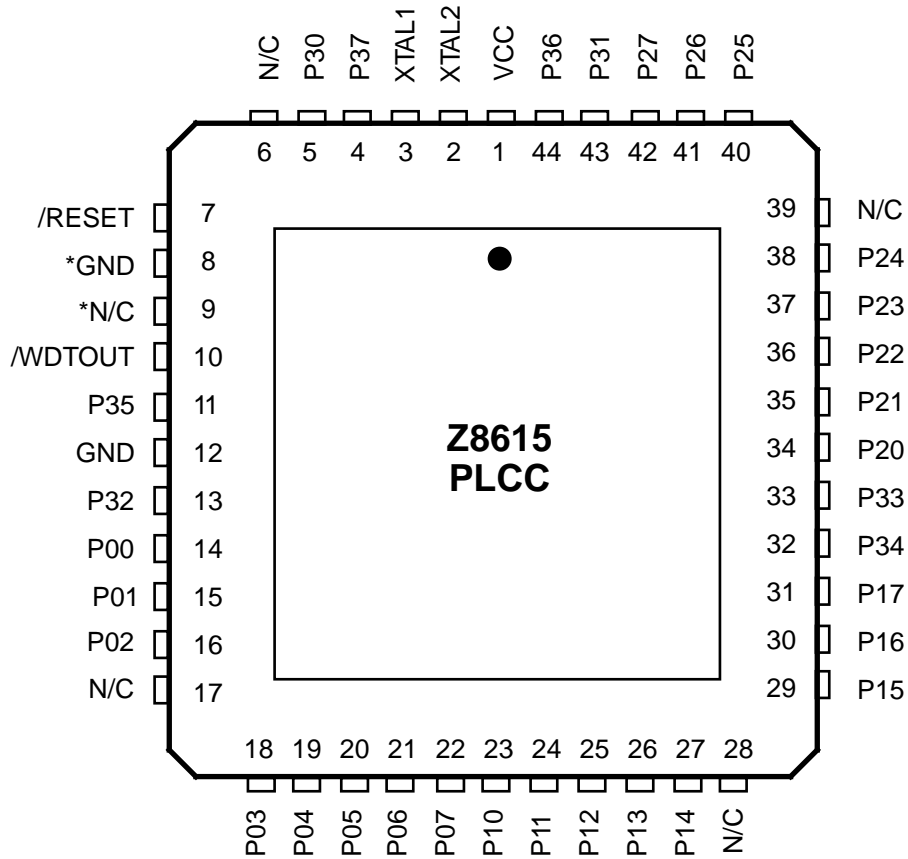
Note:

* Pin 9 is connected to the chip, although used only for testing. This pin **must** float. Pin 8 is a test pin and **must** be grounded.

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	†	†	

Notes:

* Voltage on all pins with respect to GND.

† See ordering information

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

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).
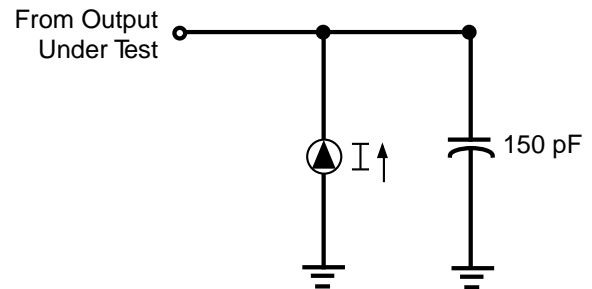
Test Load Diagram

STANDARD TEST CONDITIONS

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

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

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DC CHARACTERISTICS

V_{CC} = 4.75V to 5.25V @ 0°C to -55°C

Sym	Parameter	Min	Max	Typ*	Unit	Condition
V_{CH}	Clock Input High Voltage	3.8	V_{CC}		V	Driven by External Clock Generator
V_{CL}	Clock Input Low Voltage	−0.3	0.8		V	Driven by External Clock Generator
V_{IH}	Input High Voltage	2.0	V_{CC}		V	
V_{IL}	Input Low Voltage	−0.3	0.8		V	
V_{RH}	Reset Input High Voltage	3.8	V_{CC}		V	
V_{RL}	Reset Input Low Voltage	−0.3	0.8		V	
V_{OH}	Output High Voltage	2.0			V	I_{OH} = −250 µA (Port 2 only)
	Output High Voltage	2.4			V	I_{OH} = −250 µA (Port 3 only)
V_{OL}	Output Low Voltage		0.8		V	I_{OL} = 10.0 mA (See note [1] below.)
I_{IL}	Input Leakage	−10	10		µA	V_{IN} = 0V, 5.25V (See note [3] below.)
I_{OL}	Output Leakage	−10	10		µA	V_{IN} = 0V, 5.25V (See note [2] below.)
I_{IR}	Reset Input Current	−335	−775	−477	µA	V_{IN} = 0V
I_{R1}	Input Current	−335	−775		µA	Pull-up resistor=10.4 Kohms, V_{IN}=0.0V
I_{R2}	Input Current	−1.6	−2.9		mA	Pull-up resistor = 2.4 Kohms, V_{IN}=0.0V
I_{CC}	V_{CC} Supply Current		150		mA	
WDT	Watch-Dog Timer		2.0		mA	V_{OL}=0.4 Volt

Notes:

* Typical @ 25°C

[1] Ports P37-P34 may be used to sink 12 mA at 2.8V. These may be used for LEDs or as general-purpose outputs requiring high sink current.

[2] P00-P07, P10-P17, P20-P25, P30-P33 as output mode open-drain as a logic one.

[3] P04-P07, P10-P17, P20-P23, P30-P33 as input mode.

TOLERANCE VALUES

The Z8615 provides internal pull-up resistors. Tolerances for these resistors consists of the following:

Resistor	Tolerance
2.4K	± 25%
10.4K	± 35%

The RC Oscillator option provided on the Z8615 requires an external 1% precision resistor. Tolerance for the oscillator consists of the following:

Frequency:	4 MHz to 5 MHz
Tolerance:	+ 10%, − 10%

Note:

1) All Characteristics stated above are specified according to the following:

V_{CC} = 4.75 to 5.25
Temperature = 15°C to 55°C

2) To measure the RC oscillator's frequency, use only a high-impedance probe (10 Mohms, 2 pf) to probe XTAL2 (Pin 2). Other probes with higher capacitance loading can create strong ground bounces which shift the frequency reading at XTAL2. Also, do not probe XTAL1 when measuring the RC frequency. Refer to the procedure for Test Conditions and Methodology.

3) To measure the POR delay, apply a square wave (amplitude = 4 volts, frequency ~ .5 Hertz) to RESET (Pin 6) then measure the time it takes for Data Strobe (Pin 8) to go high after RESET goes high. Refer to the procedure for Test Conditions and Methodology.

TEST CONDITIONS AND METHODOLOGY

1. Title:
    Z08615CA UTB Frequency-POR Measurement Procedure.

2. Objective:
    To provide instructions for making frequency and POR measurements.

3. Scope:
    All products containing on-board RC oscillator.

4. Applicable Documents:

    4.1 Instruction manuals for H-P 8012B Pulse Generator, H-P 1661A Logic Analyzer, Tektronix DC 503A Universal Counter/Timer.

    4.2 Data Sheet for device under test.

5. Equipment, Materials, and Supplies:

    5.1 One UTB (agreed upon by customer).

    5.2 One DIN-5 (female) connector or PC (IBM® or clone) to power the keyboard.

    5.3 H-P 8012B Pulse Generator.

    5.4 H-P 1661A Logic Analyzer.

    5.5 Tektronix DC 503A Universal Counter/Timer and Tektronix P6202A DC to 500 MHz 10 meg–2 pico probe.

    5.6 H-P 6115A Precision Power Supply.

    5.7 A temperature forcing unit (Temptronic Corporation), or equivalent.

    5.8 Golden correlation units.

6. Important Notes:

    6.1 The oscillator input/output is sensitive to external loading, e.g., stray capacitance or inductance. When making frequency measurement, make sure the meter probe is on the oscillator output (Pin 2) only (as close as possible). Any slight loading on the oscillator input (Pin 3) will cause drastic changes to the oscillator frequency. Therefore, it is recommended that the RC resistor be connected as close as possible to the oscillator input (Pin 3); and that nothing is hanging on the oscillator input.

    6.2 During frequency measurement, oscillator input (Pin 3) should not be probed. The internal circuitry requires that the external impedance on this node be purely resistive. This is why the input of the oscillator (Pin 3) is very sensitive to external loading, then the frequency of the oscillator will be unstable due to resonance (of loading) excited by external, as well as internal noise.

    To make a frequency reading, connect the scope probe only to the oscillator out (Pin 2). Even though this output is well buffered from the oscillator, loading on this node will affect the period of oscillation. So use a high-impedance probe to measure the frequency at this node. The high-impedance probe serves to minimize waveform distortion.

    6.3 Be consistent in the reading times, e.g., allow the unit two minutes to warm up before making the frequency reading. Apply this timing on all parts tested. Erratic readings will result if the unit's temperature is not stabilized.

7. Frequency Measurement:

    7.1 Solder a half-centimeter piece of wire to the UTB at the oscillator out (Pin 2), then hook the probe to the wire. Also solder a lesser-than 4" wire to the device ground (Pin 11), then clip the counter ground to this. To begin measurement, connect a 5 volt power supply to the UTB. Even though this output is well buffered from the oscillator, loading on this node will affect THE FREQUENCY READOUTS ON THE FREQUENCY COUNTER. So use the high-impedance probe to properly read the frequency on the oscillator out.

    7.2 Set the temperature forcing unit (at 25°C) directly above the device. Before taking a reading, give the part two minutes after power-on to stabilize under a controlled ambient temperature. Then take the reading at that instant. Note, if this timing is not kept consistent from reading to reading, the frequency reading of a given part can vary as much as 5% relative to the center frequency. If a part is still warm from previous measurement, give it a minute or two to cool to room temperature before making another measurement. Here, consistency in cooling time is also important to minimize drifts in the readings. This drift is caused by the accumulation of head from the immediate runs.

TEST CONDITIONS AND METHODOLOGY

7.3 A socket can be soldered into the keyboard to expedite measurements of different units. But initial correlation of how much shift (relative to directly soldering) the socket induces must be done on a reference unit. It is desireable to use a unit that operates at the center of the frequency range when directly soldered on the UTB.

8. Analyzer Set-Up for Timing Measurements:

8.1 In order for the analyzer to work, the analyzer channels must first be defined/formatted. To begin this process, depress the <Format> button, then perform the following sequence:

1. Move the cursor down to the last position on the left of LABEL, then depress <Select>.

2. Type in the appropriate name for this entry, then depress <Done>.

3. Move the cursor to the POD A1 group which is to the right of the entry just defined, then depress <Select>.

4. Move the cursor to the right until the cursor is located on the desired channel number, then depress <Done>.

5. To define another channel, repeat the sequence.

8.2 To properly get the analyzer to display, a trigger edge needs to be defined. To do this, depress <Trigger>, then continue the following sequence.

1. If the analyzer is just powered-up, this menu will indicate that trigger edge "a" is selected. Move the cursor down to label "a," then depress <Select> to define its logic.

2. Move the cursor to the right beneath RESET (one of the signals used to pull the reset pin low on the 8615), depress <Select>, type "1," then depress <Done>.

3. Move the cursor to the right beneath POR (another signal which goes low when RESET goes low and goes high ~ 120 ms after RESET goes high), depress <Select>, type "1," then depress <Done>.

4. To define the logic for another trigger edge, follow the above sequence for another trigger label.

8.3 The last remaining step to do before viewing a set of signals is to define the display sequence for the channels defined in step 8.1. To get into the display window, depress <Wave-Form>, then do the following sequence:

1. Move the cursor to the left side of the screen, then move it down as far as it will go, then depress <Select>.

2. Select the signal to display by moving the cursor up/down the list of defined signals. Once the desired signal is highlighted, press <Done>.

3. To start the display, move the cursor to the RUN option (upper right corner of the screen), then depress <Select>. Move the cursor to highlight SINGLE or REPETITION for a single trigger or a recurrent trigger, then depress <Done>.

9.0 POR Measurement:

9.1 Apply a square wave (amplitude = 4 volts), frequency ~ .5 Hertz, and rise/fall times greater than 8V/usec) to RESET (Pin 6).

9.2 Connect one of the analyzer probes to data strobe (Pin 8) and another to RESET (Pin 6) goes high to when data strobe (Pin 8) goes high.

9.3 To get a consistent image on the analyzer, it should be triggered on an edge of the signal driving reset terminal. The POR delay is defined as the time when reset (Pin 6) goes high to when data strobe (Pin 8) goes high.

9.4 Remember to connect the analyzer ground to the UTB ground.

Standard Product:

Product acknowledged by Zilog to ship within thirty (30) days cannot be cancelled or rescheduled. This order will be invoiced for the full amount for all product cancelled or rescheduled within the thirty (30) days of the scheduled ship date.

Zilog's products are not authorized for use as critical components in life support devices or systems unless a specific written agreement pertaining to such intended use is executed between the customer and Zilog prior to use. Life support devices or systems are those which are intended for surgical implantation into the body, or which sustains life whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.