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ZMOTION™ Detection Module Development Kit

User Manual

UM022306-1210

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Revision History

Each instance in the following Revision History table reflects a change to this document from its previous version. For more details, refer to the corresponding pages or appropriate links listed in the table below.

Table 1. History of this Document

Date	Revision	Description	Page No.
Dec 2010	06	Corrected references of Evaluation Kit to Development Kit.	All
Nov 2010	05	Updated to display the Zilog/IXYS logo.	All
Sep 2010	04	Added ZMOTION product logo.	i
Jun 2010	03	Updated references to ZMOTION Detection Module Provided clarifications and added sections	All
Oct 2008	02	Remove references to General Purpose (GP).	All
Oct 2008	01	Original Issue.	All

Safeguards

The following precautions must be observed when working with the devices described in this document.

⚠️ **Caution:** Always use a grounding strap to prevent damage resulting from electrostatic discharge (ESD).

Introduction

Zilog's ZMOTION Detection Module Development Kit includes all of the necessary components required to begin development with the ZMOTION Detection Module.

The kit includes an Development Board into which the ZMOTION Detection Module is plugged and a prototyping area to add your own custom application hardware.

The ZMOTION Detection Module Development Kit is intended for the following purposes:

1. Experiment with the ZMOTION Detection Module in hardware mode by configuring the jumpers and trim pots located on the base board to control sensitivity, range and output timing.

2. Experiment with the ZMOTION Detection Module using the built-in serial interface to gain advanced control over its settings and performance. Use the kit to tailor the settings required for your own custom application.

3. Experiment with your own hardware using the prototype area on the Development Board.

4. Using a separately-purchased USB Smart cable (debugger) and ZDS II, Zilog's Integrated Development Environment, to develop your own custom software applications on the ZMOTION Detection Module.

ZMOTION Detection Module

Zilog's ZMOTION Detection Module is a complete and fully functional motion detection solution ideal for lighting control and other occupancy and proximity detection applications. It is a board-level module that combines the unique features of Zilog's Z8FS040 ZMOTION Detection Microcontroller with a Pyroelectric Sensor and a low-profile Fresnel lens.

The ZMOTION Detection Module can operate in a simple-to-use Hardware mode, which provides an output signal when motion is detected, or in an advanced asynchronous serial mode when greater control over the motion detection performance is required. In both modes, sensitivity and delay time can be controlled to match application requirements.

The features of the ZMOTION Detection Module include:

• Complete, fully functional motion detector including lens

• Small form factor: 25.5 mm x 16.7 mm

• Wide 5 m x 5 m, 60-degree detection pattern

• Sensitivity control via simple hardware configuration

- Advanced commands and control via serial (asynchronous) interface

- Sleep mode for low power applications

- No temperature compensation required

- Input to support CDS photocell input for ambient light detection

- Minimal components ensure highest possible Mean Time Between Failures (MTBF)

- Operates from 2.7 V to 3.6 V power supply

- Simple 8-pin interface

- Standard operating temperature 0ºC to 70ºC

Kit Contents

The ZMOTION Detection Module Development Kit contains the following components:

- ZMOTION Development Board

- ZMOTION Detection Module

- RS-232 Serial Cable DB9-DB9

- 5 V DC

- Universal Power Supply

- Documentation CD

Figure 1 shows the contents of the ZMOTION Development Kit.

Figure 1. ZMOTION Detection Module Development Kit Components

Development Board

The ZMOTION Development Board provides all of the support functions required to evaluate the ZMOTION Detection Module plus a prototype area and debug interface to be used when developing your own hardware or software.

Figure 2 shows the ZMOTION Detection Module connected to the ZMOTION Development Board.
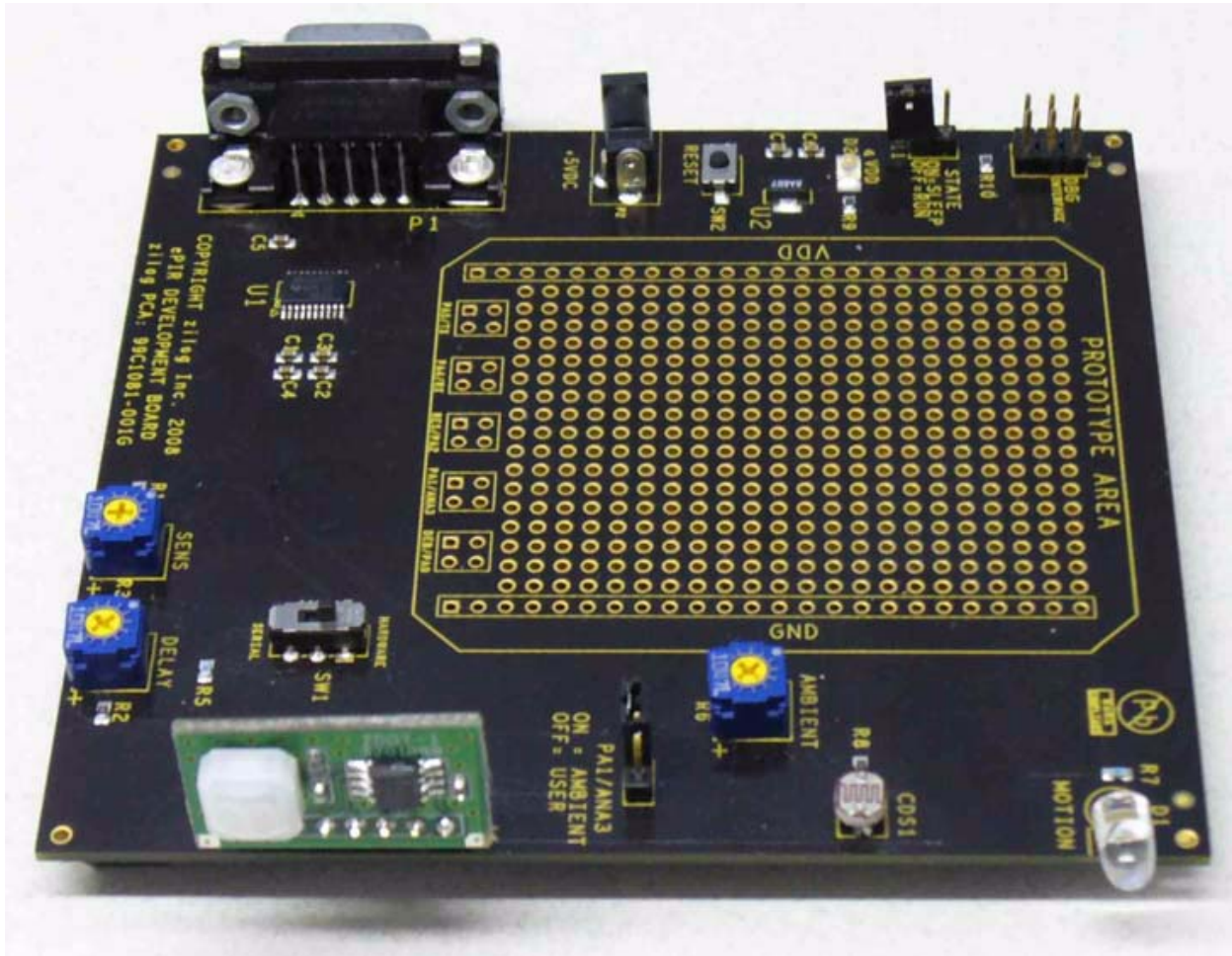
Figure 2. The ZMOTION Detection Development Board and ZMOTION Detection Module

The Development Board provides the following features:

- 8-pin connector for the ZMOTION Detection Module

- 3.3 V regulated power supply for the ZMOTION Detection Module

- Trim pots for motion sensitivity, ambient light sensitivity and output delay timing

- Switch selection for hardware or serial interface modes

- Reset button

- CDS photocell for ambient light detection

- Red LED for power indication

- Blue LED for *motion detected* status

- RS-232 interface with DB-9 connector to support serial interface mode

- On-Chip Debugger (OCD) interface

- Prototype area for custom hardware

Operation

The ZMOTION Detection Module Development Kit provides various features to control its overall operation. It operates in two basic modes:

- Hardware Interface Mode

- Serial Interface Mode

Each of these modes is described in this section.

Hardware Interface Mode

Hardware Interface Mode provides the simplest mode of operation and allows basic control of the ZMOTION Detection Module with hardware jumpers and potentiometers. In this mode, the serial interface is disabled and the trim pots on the Development Board (Sensitivity, Delay and Ambient Light Threshold) are used to control operation.

To enable Hardware Interface Mode and test its basic operation, observe the following steps.

1. Place SW1 in the HARDWARE position.

2. Turn the AMBIENT potentiometer fully clockwise (towards '+') to set the ambient light threshold to maximum. Essentially, the maximum amount of ambient light will be required to disable the Motion Detection output (LED). For details about the AMBIENT pot, see Ambient Light Threshold on page 7.

3. Turn the DELAY potentiometer fully counterclockwise (towards '–') to select the minimum LED "on" time (2 seconds). For details about the DELAY pot, see /MD Output Delay Time on page 8.

4. Turn the SENSITIVITY potentiometer fully clockwise (towards '+') to select the maximum motion-detection sensitivity. For details about the SENSITIVITY pot, see Sensitivity on page 8.

5. Press Reset or apply power.

At this point, the ZMOTION Detection Module will power-up and check the voltage applied to the TXD/SNS pin to determine its Interface Mode. With SW1 in the

HARDWARE position, the voltage on this pin will be between 0 V and 1.8 V and determine its selection to be **Hardware Interface Mode**. This interface mode is detected once, and only after reset, while the ambient light threshold, delay and sensitivity are monitored continuously.

After power-on, the ZMOTION Detection Module waits for the pyroelectric sensor to stabilize before it begins detecting motion. This power-up delay can take as little as a few seconds to a maximum of about 30 seconds.

6. Wave your hand in front of the ZMOTION Detection Module's lens to create motion and observe that the Blue LED turns on for 2 seconds.

Controlling Operation in Hardware Interface Mode

1. Slowly rotate the AMBIENT potentiometer while creating motion in front of the lens until the LED no longer illuminates. This point, then, is the threshold of the ambient light in your room. In lighting control applications, this method allows you to adjust the amount of ambient light allowed in the room without turning the lights on when motion is detected; i.e., the lights are not turned on when it is already bright enough in the room.

2. Return the AMBIENT potentiometer to its fully clockwise position.

3. Rotate the DELAY potentiometer *slightly* clockwise to increase the amount of time the LED stays on after motion is detected.

4. Return the DELAY potentiometer to its fully counterclockwise position.

5. Decrease sensitivity by rotating the SENS Potentiometer counterclockwise and observe that additional motion is required to turn on the LED or that the range/distance of detection is decreased.

Serial Interface Mode

Serial Interface Mode provides more control over the operation of the ZMOTION Detection Module by providing a serial command interface to monitor and control the device. In Serial Interface Mode, commands are sent over the provided DB9 RS-232 interface. Refer to the ZMOTION Detection Module Product Specification (PS0284) for a complete list and description of the supported commands.

To enable Serial Interface Mode and test its basic operation, observe the following steps.

1. Connect the provided serial cable between the DB9 connector on the Development Board and a serial port on your PC.

2. Launch Hyperterminal or other serial terminal program and configure it to the following settings:

```
9600 bps, No Parity, 8 Data bits, 1 Stop bit, No Flow Control
```

3. Place SW1 in the SERIAL position.

4. Turn the AMBIENT pot fully clockwise (towards '+') to set the ambient light threshold to maximum. Essentially, the maximum amount of ambient will be required to disable the Motion Detection output (LED). For details about the AMBIENT pot, see Ambient Light Threshold.

> **Note:** The DELAY and SENS potentiometers are not used in Serial Interface Mode.

5. Press Reset or apply power.

   At this point, the ZMOTION Detection Module will power-up and check the voltage applied to the TXD/SNS pin to determine the interface mode. With SW1 in the SERIAL position, the voltage on this pin will be greater than 2.5 V when selecting **Serial Interface Mode**. The interface mode is detected once, and only after reset, while the ambient light threshold is monitored continuously.

   After power-on, the ZMOTION Detection Module waits for the pyroelectric sensor to stabilize before it begins detecting motion. This power-up delay can take as little as a few seconds to a maximum of about 30 seconds. During this stabilization time, the module will still accept commands over the serial interface.

6. From your keyboard, send the following commands to the module to place it into a convenient testing mode (without the comma):

C, M	Configure the MD/RST pin as MD (causes the Blue LED to turn on when motion is detected.
K, A	Enable ASCII command mode.
M, Y	Send motion status automatically over the serial interface (without polling).

7. Wave your hand in front of the ZMOTION Detection Module's lens to create motion and observe that the Blue LED turns on for 2 seconds. Also notice that an uppercase *M* is transmitted from the module.

8. Refer once again to the ZMOTION Detection Module Product Specification (PS0284) to test other commands and status responses. This document contains a complete list and description of all supported commands.

Ambient Light Threshold

In various lighting control applications, the decision of when to turn the lights on can depend on current ambient light levels in addition to detecting motion. A CDS photocell is

provided in the kit to demonstrate this function. When light shines on the photocell, its resistance decreases, thereby providing a lower voltage to the light gate (LG) signal on the ZMOTION Detection Module. When the module detects this voltage to be below 1.0 V in Hardware Mode or the programmed threshold in Serial Mode, the MOTION LED (/MD signal) will not activate when motion is detected. The AMBIENT potentiometer (R6) sets the amount of ambient light required to cross the threshold.

Sensitivity

The amount of motion required to trigger the MOTION LED (/MD signal) can be adjusted using the SENS potentiometer (R3). This adjustment also has the effect of controlling the range that the detector can *see*—lower sensitivity reduces the range of the detection pattern. The SENS potentiometer provides a voltage between 0 V and 1.8 V to the TXD/SNS signal on the ZMOTION Detection Module. A higher voltage means lower sensitivity. The SENS potentiometer is used only in Hardware Interface Mode. In Serial Interface Mode, the sensitivity is set via commands sent over the serial interface.

/MD Output Delay Time

The amount of time that the MOTION LED (/MD signal) is activated can be controlled by the DELAY (R4) potentiometer. You can set this range between 2 seconds and 15 minutes. This feature is typically used in power control applications in which the amount of time that a device is activated must be controlled. The potentiometer provides a voltage between 0 V and 1.8 V to the RXD/DELAY input on the ZMOTION Detection Module. A higher voltage yields a longer activation time.

Hardware and Software Development Support

The ZMOTION Detection Module Development Kit provides support for developing hardware and software for the module. Signals from the ZMOTION Detection Module are available to the prototype area as four through-hole connections. 3.3 V (VDD) and ground are also provided to this area. Do not exceed 90 mA of current draw from the 3.3 V supply.

Software development is supported on the ZMOTION Development Board by using the Debug connector (J9) with a separately available USB Smart Cable and ZDS II. ZDS II is Zilog's integrated development environment (IDE) and is available free from the Zilog website. The USB Smart Cable provides a means to download and debug the software developed on ZDS II.

See the Schematics section of this User Manual and refer to the ZMOTION Detection Module Product Specification (PS0284) for more information about developing your own hardware and software.

Development Board Hardware Functions

Table 1 describes the functions provided by the ZMOTION Detection Module Development Kit hardware.

Table 1. ZMOTION Detection Module Functions

| Feature	Development Board Name	Function Type	Operational Mode (SW1—MODE)	
			Hardware Mode	Serial Mode
System Reset	RESET (SW2)	Push Button	Reset the ZMOTION Detection Module by momentarily interrupting power.	
Ambient Light Threshold	AMBIENT (R6)	Potentiometer	Sets the amount of ambient light required to prohibit the MOTION LED from activating. Turn clockwise to increase the amount of light required.	
Sensitivity	SENS (R3)	Potentiometer	Controls the ZMOTION Detection Module's sensitivity to motion. It provides an adjustable voltage between 0 V and 1.8 V to the SBC's TXD/SNS input. Turn clockwise to increase sensitivity.	No effect. Use the serial interface to control sensitivity.
/MD Output Delay Time	DELAY (R4)	Potentiometer	Controls the amount of time that the MOTION LED is activated after motion has been detected. Turn clockwise to increase the time.	No effect. Use the serial interface to control /MD output delay time.
SBC State	STATE (J11)	Jumper	Places the ZMOTION Detection Module into a low power sleep mode.	
CDS Enable	CDS ENABLE (J7)	Jumper	When this jumper is installed, the CDS Photo Cell is used. When this jumper is not installed, you can control the LG signal from the prototype area.	
OCD Interface	DBG INTERFACE (J9)	6-pin Header	This 6-pin header provides the interface to the USB Smart Cable (debugger) when developing software on the ZMOTION Detection Module.	

Schematics
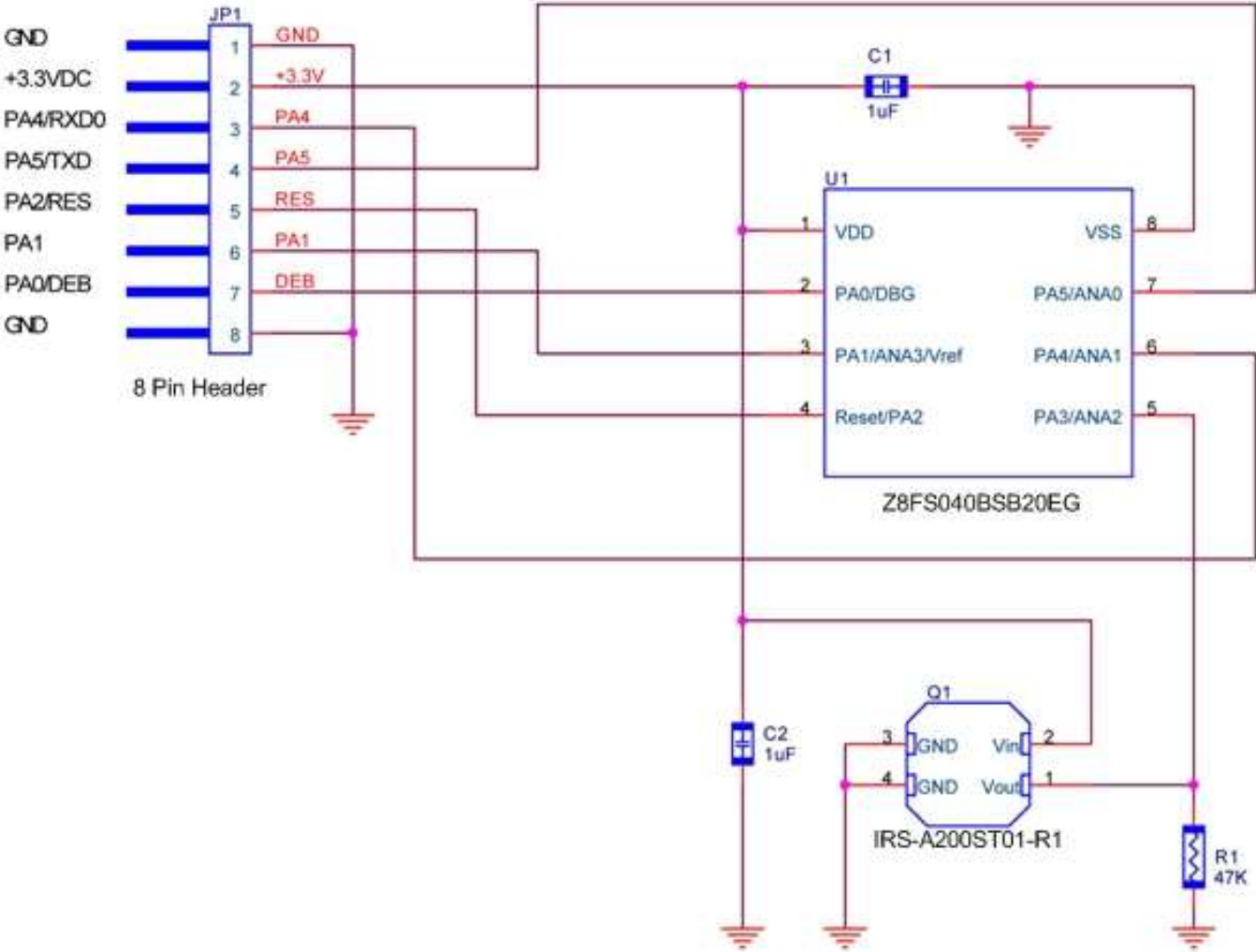
Figure 1. Schematic Diagram of the ZMOTION Detection Module
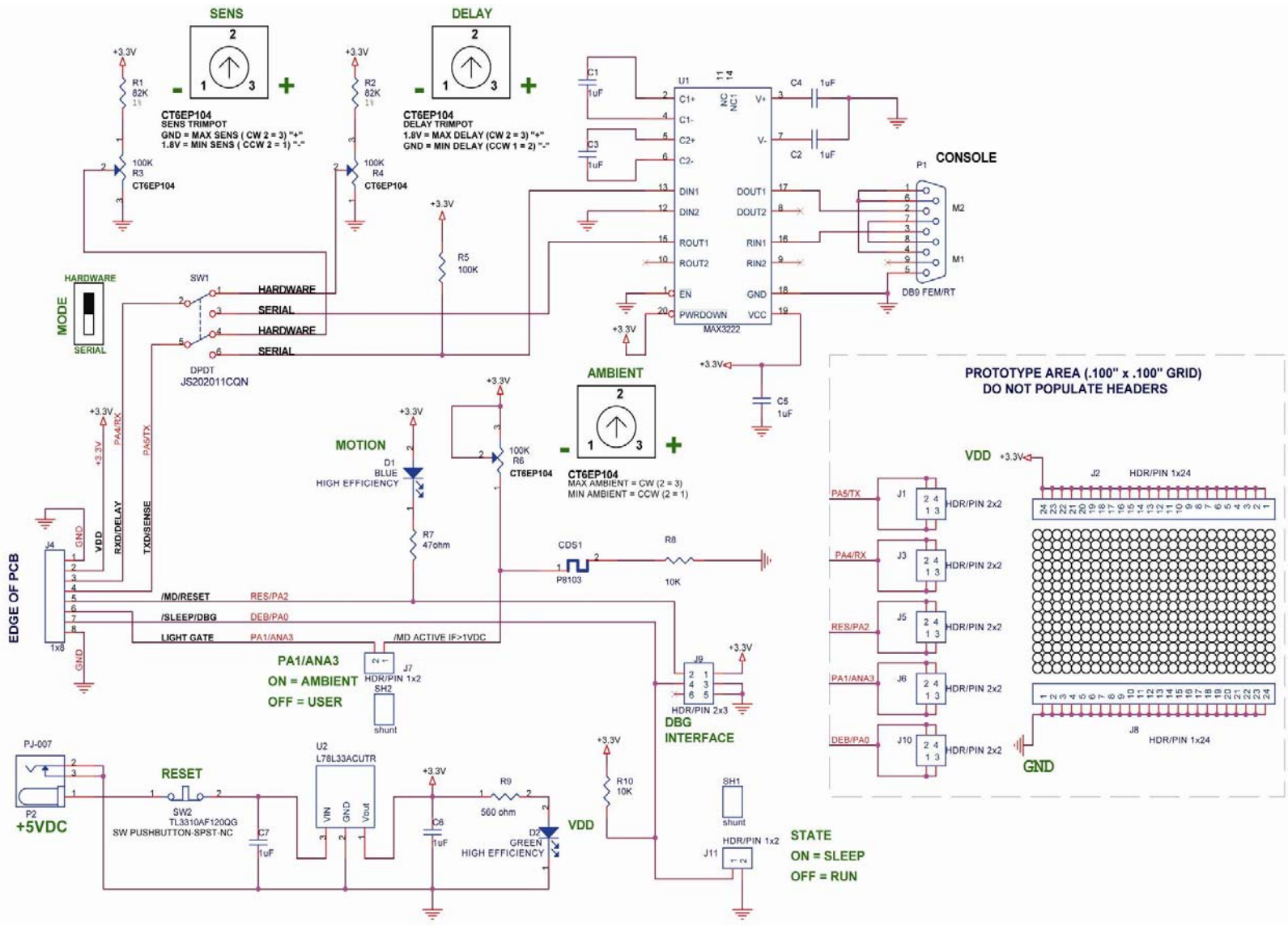
Figure 2. Schematic Diagram of the ZMOTION Development Board

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To learn more about this product, find additional documentation, or to discover other facets about Zilog product offerings, please visit the Zilog Knowledge Base at http://zilog.com/kb or consider participating in the Zilog Forum at http://zilog.com/forum.

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