ZEPIR000103KITG

ZMOTION® Detection Module II Evaluation Kit

User Manual

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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 Level	Description	Page Number
Apr 2013	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 II (ZDMII) Evaluation Kit includes all of the necessary components required to begin development with ZDMII.

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

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

1. Experiment with ZDMII in hardware mode by configuring the jumpers and trim pots located on the ZDMII Evaluation Board to control sensitivity, range and output timing.
2. Experiment with ZDMII 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 Evaluation Board.
4. Using a separately-purchased USB SmartCable (debugger) and ZDSII, Zilog's Integrated Development Environment, to develop your own custom software applications on ZDMII.

ZMOTION Detection Module II

Zilog's ZMOTION Detection Module II 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 II 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 II include:

- Complete, fully functional motion detector including lens
- Small form factor: 25.5mm x 16.7mm
- 95-degree detection pattern with adjustable sensitivity and range up to 7m

- 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 2.7V to 3.6V power supply
- Simple 8-pin interface
- Standard operating temperature 0ºC to 70ºC

Kit Contents

The ZMOTION Detection Module II Evaluation Kit contains the following components:

- ZDMII Evaluation Board
- ZMOTION Detection Module II
- RS-232 Serial Cable DB9-DB9
- 5V DC
- Universal Power Supply

Figure 1 shows the contents of the ZMOTION Evaluation Kit.



Figure 1. ZMOTION Detection Module II Evaluation Kit Components

Evaluation Board

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

Figure 2 shows the ZDMII Module connected to the ZDMII Evaluation Board.

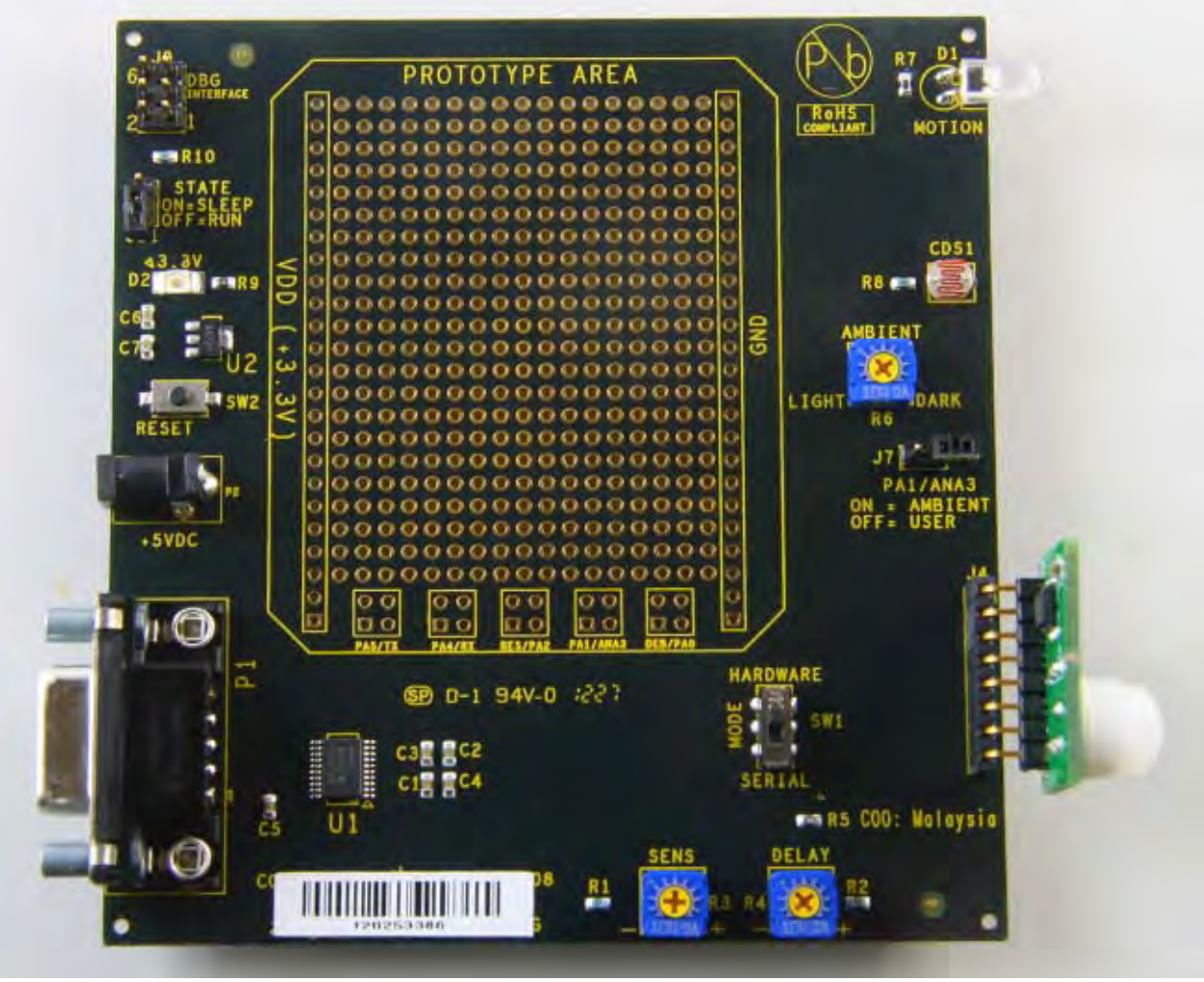


Figure 2. Overhead View of the ZDMII Evaluation Board Showing the ZDMII Module and the AMBIENT, SENS and DELAY Pots

The Evaluation Board provides the following features:

- 8-pin connector for ZDMII
- 3.3V regulated power supply for ZDMII
- 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

- Green 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 II Evaluation Board provides a number of 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 II with hardware jumpers and potentiometers. In this mode, the serial interface is disabled and the trim pots on the Evaluation 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 counterclockwise, towards `Light`, to set the ambient light threshold to its maximum brightness, as shown in Figure 2 on page 4. Essentially, the maximum amount of ambient light will be required to disable the Motion Detection output (LED). For details about the AMBIENT pot, see the Ambient Light Threshold section on page 8.
3. Turn the DELAY potentiometer fully counterclockwise, towards '–', to select the minimum LED "on" time (2 seconds). For details about the DELAY pot, see the /MD Output Delay Time section on page 9.
4. Turn the SENSITIVITY potentiometer fully clockwise, towards '+', to select the maximum motion-detection sensitivity. For details about the SENSITIVITY pot, see the Sensitivity section on page 9.
5. Press Reset or apply power.

   At this point, ZDMII 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 0V and 1.8V 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, ZDMII 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 II'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 ZDMII 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 II Product Specification (PS0305) 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 Evaluation 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 potentiometer fully counterclockwise, towards Light, to set the ambient light threshold to its maximum brightness, as shown in Figure 2 on page 4. Essentially, the maximum amount of ambient will be required to disable the Motion

Detection output (LED). For details about the AMBIENT pot, see the Ambient Light Threshold section on page 8.

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

5. Press Reset or apply power.

   At this point, ZDMII 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 2.5V 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, ZDMII 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.

Note: The following commands are case-sensitive; additionally, do not include 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 II'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 II Product Specification (PS0305) 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 II. When the module detects this voltage to be below 1.0V 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 0V and 1.8V to the TXD/SNS signal on ZDMII. 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 ($\overline{\text{MD}}$ 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 0V and 1.8V to the RXD/DELAY input on the ZMOTION Detection Module II. A higher voltage yields a longer activation time.

Hardware and Software Development Support

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

Software development is supported on the ZDMII Evaluation Board by using the Debug connector (J9) with a separately available USB SmartCable and ZDSII. ZDSII is Zilog's Integrated Development Environment (IDE) and is available free from the Zilog website. The USB SmartCable provides a means to download and debug the software developed on ZDSII.

To learn more about developing your own ZDMII hardware and software, refer to the Schematic Diagrams section on page 12; also see the ZMOTION Detection Module II Product Specification (PS0305). For a description of the ZDMII software operation, see the ZMOTION Detection Module II Reference Design (RD0026).

Evaluation Board Hardware Functions

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

Table 1. ZMOTION Detection Module II Functions

	Operational Mode (SW1—MODE)			
Feature	**Evaluation Board Name**	**Function Type**	**Hardware Mode**	**Serial Mode**
System Reset	RESET (SW2)	Push Button	Reset ZDMII 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 II'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 ZDMII 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 SmartCable (debugger) when developing software on ZDMII.	

Schematic Diagrams

Figures 4 and 5 show schematics for the ZMOTION Detection Module II and the ZDM II Evaluation Board, respectively.

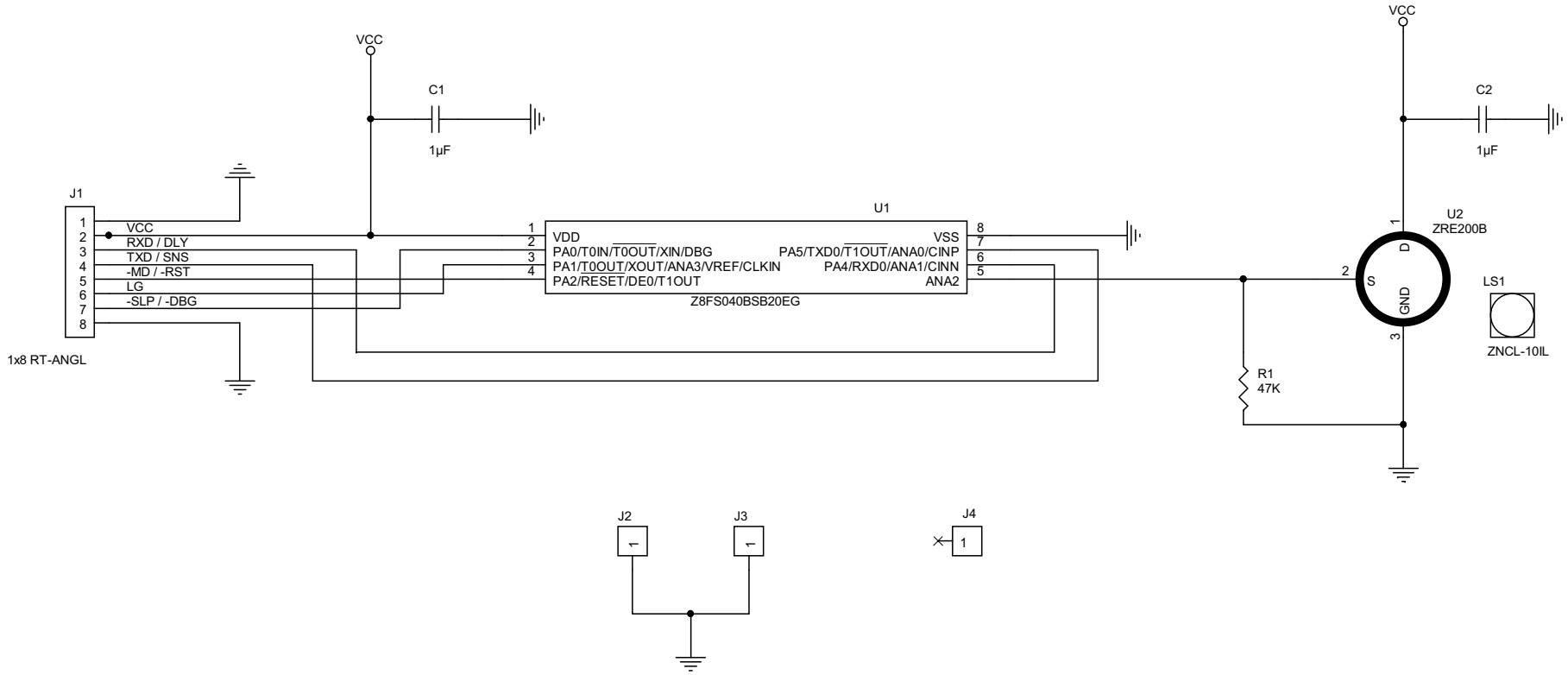


Figure 4. Schematic Diagram of the ZMOTION Detection Module II

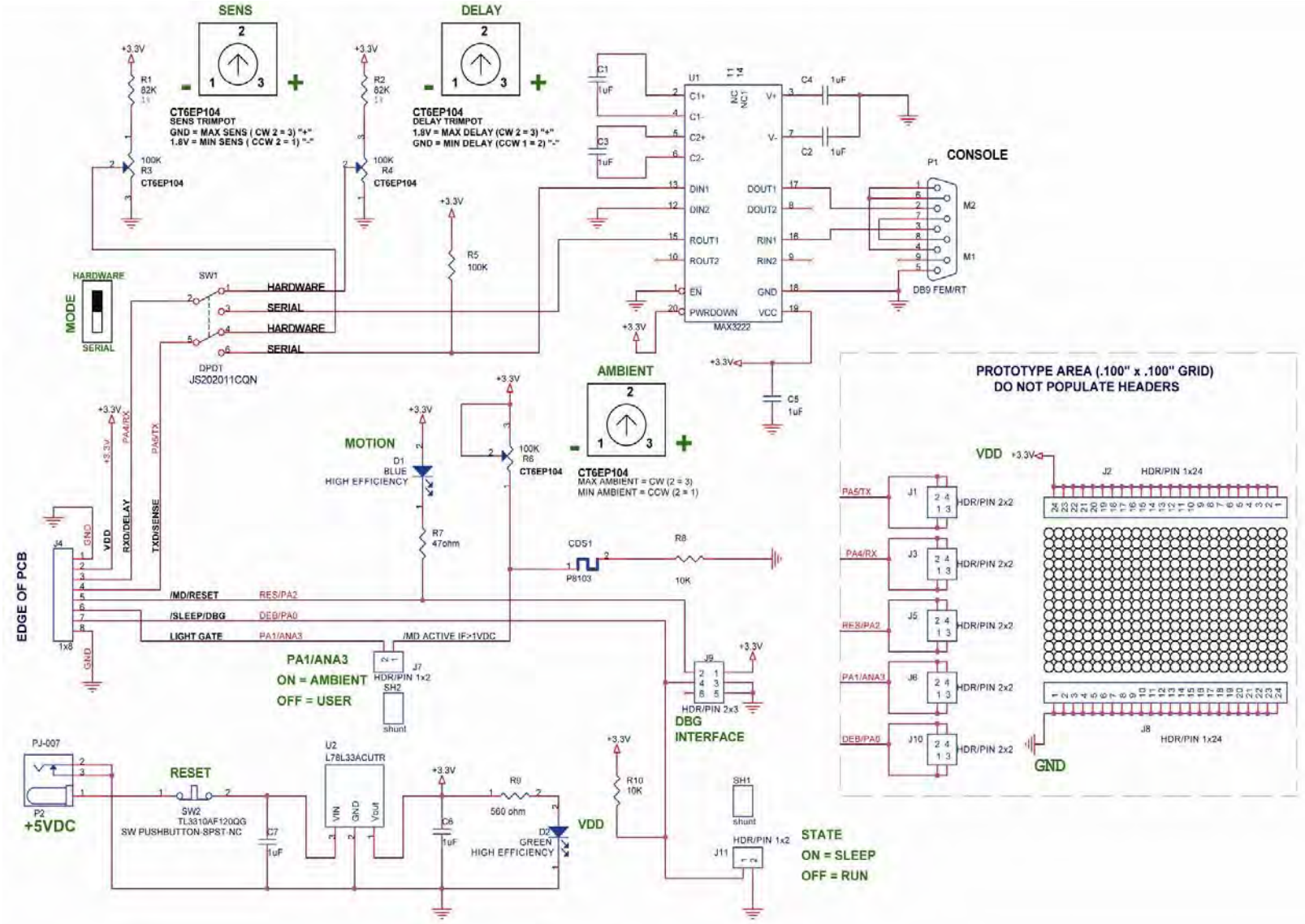


Figure 5. Schematic Diagram of the ZDMII Evaluation Board

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