



ZEPIR0AAS01SBCG

**ePIR™ Motion Detection Zdots®
SBC**

Product Specification

PS028402-1008



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Revision History

Each instance in the revision history table reflects a change to this document from its previous revision. For more details, refer to the corresponding pages or appropriate links given in the table below.

Date	Revision Level	Description	Page Number
October 2008	02	Updated Related Documents section (changed 88-pin SOIC to 28-pin SOIC for Z8FS040AHJ20SG). Removed references to GP and General Purpose.	All
October 2008	01	Original issue	All

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Chapter 1 Architectural Overview

Zilog's ePIR™ Motion Detection Zdots® Single Board Computer (SBC) is a complete, compact, and high-performance product specifically designed for the rapid development and deployment of products requiring control based on infrared motion detection.

It combines the unique features of the Z8 Encore! XP® MCU with powerful new software detection algorithms and delivers a significant performance improvement over traditional passive infrared (PIR) based solutions. Based on PIR sensor technology, it is a complete motion detector solution including PIR sensor and Fresnel lens.

Parameters for sensitivity and output timing are provided through a simple hardware interface or more advanced settings and status are available through a serial interface.

The ePIR Motion Detection Zdots SBC provides a dramatic improvement in both sensitivity and stability and is scalable to many market segments including Lighting Control, Access Control, Vending, Display, Proximity, and Power Management.

Features

Key features of the ePIR Motion Detection Zdots SBC include:

- Complete, fully functional motion detection SBC including Fresnel lens
 - Comes pre-programmed with motion detection software
- 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 serial (UART) based configuration and 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)
- Application code can also be modified to support custom solutions
- Complete development system available
- Operates from 2.7 V to 3.6 V power supply
- Simple 8-pin interface
- Standard operating temperature: 0 °C to 70 °C

ZEPIR0AAS01SBCG Block Diagram

Figure 1 displays the block diagram of ePIR™ Motion Detection Zdots® SBC.

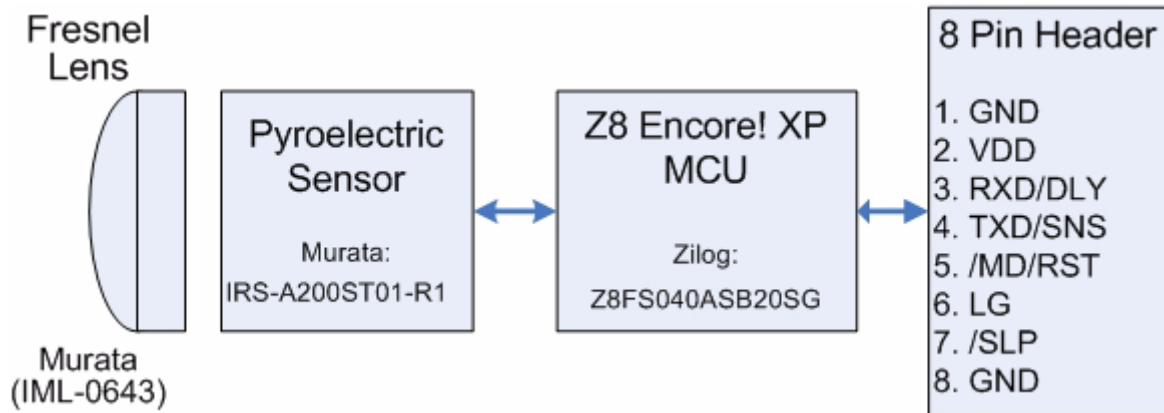


Figure 1. ePIR™ Motion Detection Zdots® SBC Block Diagram

Figure 2 displays the ePIR™ Motion Detection Zdots® SBC.

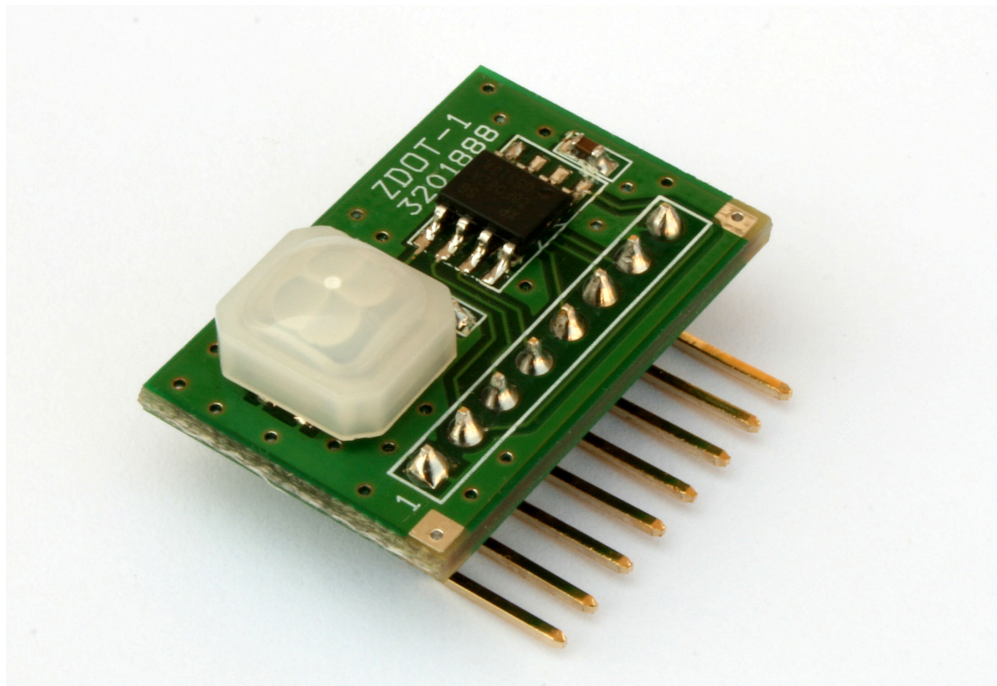


Figure 2. ePIR™ Motion Detection Zdots® SBC

Pin Description

Table 1 provides the pin and signal description for ePIR Motion Detection Zdots SBC.

Table 1. Pin Description

Pin#	Signal Name	Hardware Interface Mode	Serial Interface Mode	Comments
1	GND	Ground	Ground	—
2	VDD	Supply Voltage	Supply Voltage	—
3	RXD/DLY	DLY — Delay (analog input)	RXD — Receive Data (digital input)	—
4	TXD/SNS	SNS — Sensitivity (analog input)	TXD — Transmit Data (digital output)	Mode Select during reset
5	/MD/RST	Motion Detect (digital output)	Configurable: /RST - Reset (digital input) / MD Motion Detect (digital input)	Default is /RST (Reset) in Serial Interface Mode
6	LG	Light Gate(analog input)	Light Gate (analog input)	If unused, connect to V _{dd}
7	/SLP/DBG	/SLP — Sleep (digital input)	/SLP — Sleep (digital input)	DBG is used for programming and debug
8	GND	Ground	Ground	—

Operational Modes

The ePIR Motion Detection Zdots SBC operates in following two modes:

- [Hardware Interface Mode](#)
- [Serial Interface Mode](#)

Hardware Interface Mode

The Hardware Interface Mode is explained below:

- Basic configuration via hardware interface pins
- Allows you to adjust sensitivity and delay
- Optional ambient light input
- SLEEP mode to reduce power consumption

Serial Interface Mode

The Serial Interface Mode is explained below:

- Advanced configuration and status via serial interface
- /MD, LG and /SLP remain functional
- The serial interface runs at: 9600 bps, no parity, 8 data bits, and 1 stop bit, no flow control

Setting Operation Mode

Serial Interface Mode Selection

To select Serial Interface Mode, provide a pull up resistor from TXD/SNS to V_{dd} during power ON or when exiting SLEEP Mode (typically 100 K). The device detects that the voltage on the pin is greater than 2.5 V and enables the TXD and RXD signals. /MD, LG and /SLP remain active also. This resistor will have no effect on the transmitted data.

Hardware Interface Mode Selection

The Hardware Interface Mode is selected when TXD/SNS is between 0 V and 1.8 V during power ON or when exiting SLEEP Mode.

For examples of using the ePIR Motion Detection Zdots SBC in Hardware and Serial Interface Modes, see [Appendix A—Hardware Interface Mode](#) on page 50 and [Appendix B—Serial Interface Mode](#) on page 51.

Signal Descriptions (Hardware Interface Mode)

GND - Ground - Pin 1 and Pin 8

Both Pin 1 and Pin 8 ground signals are tied together on the ePIR Zdots single board computer PCB and are connected to power ground.

VDD - Supply Voltage - Pin 2

This provides power to the SBC. For power consumption, see [Electrical Characteristics](#) on page 47.

RXD/DLY - Delay - Pin 3

This is a high impedance analog input pin that sets the time for the /MD (Motion Detect) pin to remain active once motion has been detected. Provide a voltage between 0 and 2 V

to select a delay of 2 seconds to 15 minutes (see [Table 2](#)). Typically a simple resistor divider or trim pot is used to set the voltage.

Table 2. Delay Time and Voltage on DLY

Delay Time	Voltage on DLY
2 sec	0 V
5 sec	0.2 V
10 sec	0.4 V
30 sec	0.6 V
1 min	0.8 V
2 min	1.0 V
3 min	1.2 V
5 min	1.4 V
10 min	1.6 V
15 min	1.8 V

TXD/SNS - Sensitivity - Pin 4

This is a high impedance analog input that sets the SBC's sensitivity to motion. Provide a voltage between 0 V and 1.8 V to adjust the sensitivity to meet the application requirements. A lower voltage means higher sensitivity. Typically a simple resistor divider or trim pot is used to set the voltage.

1.8 V = Lowest Sensitivity

0 V = Highest sensitivity

This signal also determines the interface mode of the SBC. At power ON and when exiting SLEEP Mode, the signal is sampled and if it is greater than 2.5 V (for example, pulled to V_{DD} via resistor), then **Serial Interface Mode** is entered and the pin is converted to TXD. If the signal is between 0 V and 1.8 V, **Hardware Interface Mode** is selected.

/MD - Motion Detect - Pin 5

This is an active Low output that is activated when motion is detected. The time that this signal remains active is set by the DLY signal. This signal is actively driven High.

0 = Motion detected

1 = No motion detected

LG - Light Gate - Pin 6

This is a high impedance analog input. This pin should be provided with a voltage that is proportional to the amount of ambient light in the environment (typically provided via a CDS photo cell or similar circuit). The signal is used internally to gate the /MD output signal such that it does not activate in the presence of daytime ambient light. When the voltage on this pin is lower than 1.0 V, the /MD signal will not activate even when motion is detected. If /MD is in an active state when LG transitions below 1.0 V, the current DLY time is completed before /MD is deactivated. If LG is unused, connect to V_{dd} .

GND to 1.0 V = /MD is activated when motion is detected

1.0 V to V_{dd} = /MD does not activate when motion is detected

/SLP - SLEEP Mode - Pin 7

This is an active Low digital input. When at logic '0', the SBC enters low power SLEEP mode. The SBC does not detect any motion and /MD is driven inactive. When SLP is at logic '1', the SBC exits SLEEP mode and begins detecting motion. This signal must be held at logic '1' during power ON.

0 = SBC disabled - low power SLEEP mode is active

1 = Normal operation

Signal Descriptions (Serial Interface Mode)

GND - Ground - Pin 1 and Pin 8

Both Pin 1 and Pin 8 ground signals are tied together on the ePIR Zdots Single Board Computer PCB and are connected to power ground.

VDD - Supply Voltage - Pin 2

This provides power to the SBC. For power consumption, see [Electrical Characteristics](#) on page 47.

RXD/DLY - Receive Data - Pin 3

This input is the asynchronous serial input used for sending commands and configuration to the SBC. It operates at 9600 bps, No Parity, 8 Data Bits, and 1 Stop Bit, no flow control. For a list and description of the commands supported, see [Table 3](#) on page 13.

TXD/SNS - Transmit Data - Pin 4

This output is the asynchronous serial data output from the SBC in response to commands and configuration supplied on the RXD line. It operates at 9600 bps, No Parity, 8 Data Bits, 1 Stop Bit. For more information on the serial command interface, see [Serial Interface Commands and Description](#) on page 11.

This signal also determines the interface mode of the SBC. At power ON and when exiting Sleep Mode, the signal is sampled and if it is higher than 2.5 V (for example, pulled to V_{DD} via resistor), then **Serial Interface Mode** is entered. If the signal is at a value between 0 V and 1.8 V, **Hardware Interface Mode** is selected.

/MD//RST - Motion Detect and Reset - Pin 5

This is an active Low output that is activated when motion is detected. The time that this signal remains active is set by the DLY signal. This signal is actively driven High.

0 = Motion detected

1 = No motion detected

As /RST, this pin provides an active low hardware reset signal for the SBC. The function of this pin is selected by the 'C' serial command. The default value for this pin is /RST.

LG - Light Gate - Pin 6

This is a high impedance analog input. The signal is used internally to gate the /MD signal such that it does not activate in the presence of daytime ambient light. The voltage applied to this pin should be proportional to the amount of ambient light in the environment (typically provided via a CDS photo cell or similar circuit).

- $LG > \text{Light Gate Threshold Register}$ - /MD is activated when motion is detected
- $LG < \text{Light Gate Threshold Register}$ - /MD does not activate when motion is detected

If /MD is in an active state when LG transitions above the programmed value, the current DLY time is completed before /MD is deactivated.

If LG is unused, connect to V_{dd} .

/SLP - SLEEP Mode - Pin 7

This is an active Low digital input. When at logic '0' the SBC enters low power SLEEP mode. The SBC does not detect any motion and /MD is driven inactive. When SLP is at logic '1' the SBC exits SLEEP mode and begins detecting motion. This signal must be held at logic '1' during power ON.

- 0 = SBC disabled - low power SLEEP mode is active
- 1 = Normal operation

Voltage Brownout Protection and Power-On-Reset

The ePIR™ Motion Detection Zdots® SBC contains an internal Reset Controller with a Power-on Reset circuit and Brown out Protection to ensure proper operation. When power is first applied, the POR circuit monitors the supply voltage and holds the SBC's MCU in the Reset state until the supply voltage reaches a safe operating level. After the supply voltage exceeds the POR voltage threshold (V_{POR}), the MCU is released and the SBC begins operating. A further delay of typically 20 seconds is included to allow the pyroelectric sensor to stabilize. This value varies depending on environmental conditions. After this delay, the system begins to look for motion. Prior to this delay, the /MD signal remains inactive.

Figure 3 displays Power-on Reset operation. See [Related Documents](#) on page 46 for the POR threshold voltage (V_{POR}).

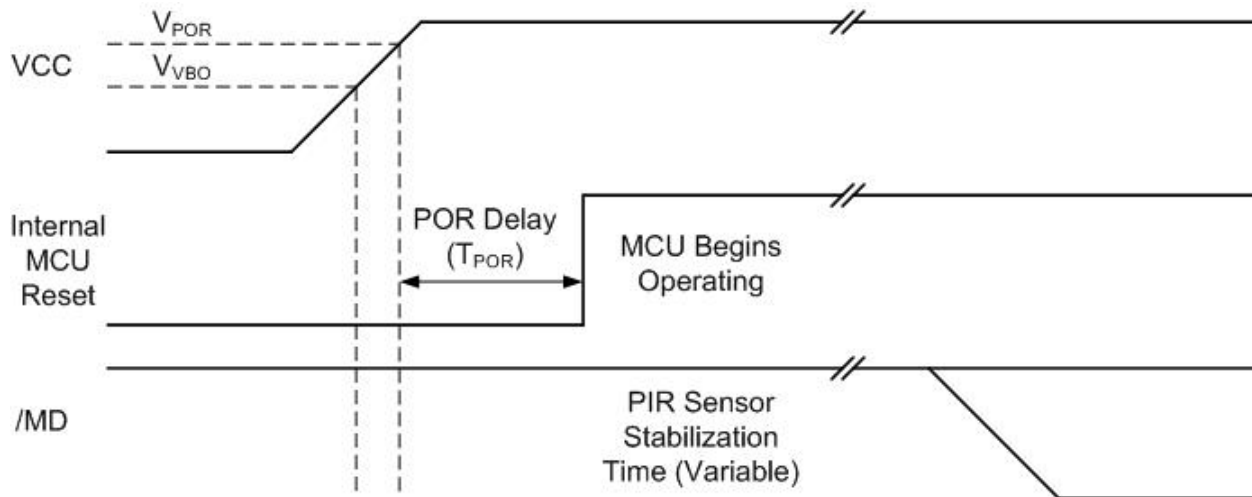


Figure 3. Power-On Reset Operation

The ePIR Motion Detection Zdots SBC provides low Voltage Brownout (VBO) protection to ensure proper operation when the supply voltage drops below an unsafe level - below the VBO threshold voltage. The VBO circuit senses this condition and forces the SBC into the Reset state. While the supply voltage remains below the POR voltage threshold (V_{POR}), the VBO block holds the SBC in the Reset.

After the supply voltage again exceeds the Power-On Reset voltage threshold, the SBC progresses through a full Power-On Reset sequence, as described in the Power-On Reset section. Figure 4 displays the Voltage Brownout operation. See Related Documents on page 46 for the VBO threshold voltage (V_{VBO}).

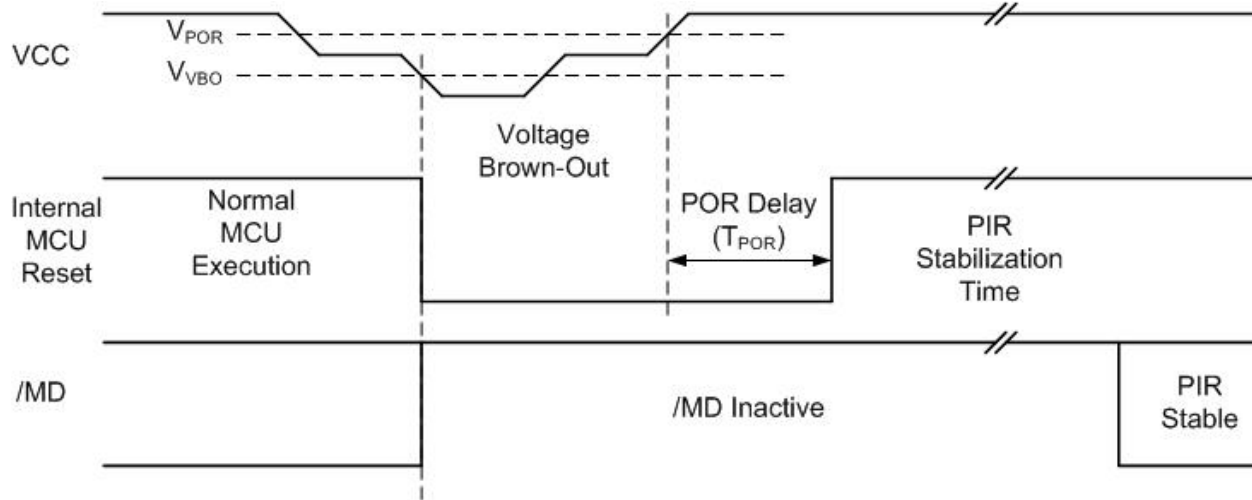


Figure 4. Voltage Brownout Reset Operation

Operation

When power is applied, the TXD/SNS pin is sampled to determine the mode of operation. If the signal is above 2.5 V, serial interface mode is entered. If the signal is between 0 V and 1.8 V hardware interface mode is entered. During this time, the pyro-electric sensor is monitored and the device waits for it to become ready. Once it is stable, the device starts normal operation in the selected mode. In hardware interface mode, the DLY, SNS, LG and /SLP signals are sampled regularly. In serial interface mode, TXD/RXD are used to communicate with the device and LG, /SLP and /MD also provide their defined functions.

Hardware Interface Mode

This mode of operation is selected when the SNS pin is at a value between 0 V and 1.8 V during power ON (or after a reset caused by V_{bo}). Once Hardware Interface mode has been established, this pin becomes the sensitivity input and accepts a voltage between 0 V and 1.8 V to set the motion detection sensitivity level.

0 V = Highest Sensitivity

1.8 V = Lowest Sensitivity

This is normally achieved with a simple resistor divider or potentiometer resistor divider.

After application of power, the PIR sensor is allowed to stabilize. At this point the MCU waits for the PIR sensor to stabilize - this typically takes 20 seconds, but varies depending on environmental conditions. The software dynamically monitors the pyro-electric sensor during power up and begins detecting motion as soon as the sensor is stable.

The /MD (Motion Detect) pin is driven active (Low) when motion is detected. The time that the signal remains active is determined by the voltage on the delay pin and can be set to a value between 2 seconds and 15 minutes. See [Table 2](#) on page 5.

The Light Gate signal acts as a disable (gate) for the /MD signal. In a typical application, this signal is a representation of the ambient light in the environment. If there is light detected, the /MD signal does not activate even in the presence of motion. For an example showing how to use the ePIR Motion Detection Zdots SBC in Hardware Interface Mode, see [Appendix A—Hardware Interface Mode](#) on page 50.

SLEEP Mode in Hardware Interface Mode

In applications where motion detection is not always required, the Sleep signal can be used to put the device into a low power mode. The advantage of this feature vs. removing power from the SBC is that the PIR stabilization time is much shorter.

If the Sleep (/SLP) input signal is driven Low, the device enters a low power SLEEP mode and is woken up by deactivating the signal (driving the signal high).

Serial Interface Mode

The Serial Interface mode is implemented as a superset of the features available in Hardware interface mode. The interfacing device (Host) has an expanded feature set and more flexibility with many of those features. The interface is designed to be simple to implement on the host processor and use as few resources as possible.

This mode of operation is selected when the SNS pin is above 2.5 V during power ON (or after a reset caused by V_{bo}). Typically this signal is tied to V_{dd} through a pull-up resistor. Once Serial Interface mode has been established, this pin becomes the Transmit Data (TXD) output and is used to send responses to commands given to the device.

The serial interface is asynchronous and is set to:

- 9600 Baud
- No Parity
- 8 Data Bits

- 1 Stop Bit
- No flow control

In Serial Interface Mode, commands are sent to the device over the RXD input pin and responses are sent from the device over the TXD output pin. The other signals on the device (/MD, LG, /SLP) remain active in Serial Interface mode.

Motion Detect (/MD) output is driven active for the time set by the "Output Activation Time" command when motion is detected. The signal is also gated by the (Light Gate) LG input. For an example showing how to use the ePIR Motion Detection Zdots SBC in Serial Interface Mode, see [Appendix A—Hardware Interface Mode](#) on page 50.

SLEEP Mode in Serial Interface Mode

In applications where motion detection is not always required, the Sleep signal can be used to put the device into a low power mode. The advantage of this feature vs. removing power from the SBC is that the PIR stabilization time is much shorter.

If the Sleep (/SLP) input signal is driven Low, the device enters a low power SLEEP mode and is woken up by either deactivating the signal (driving the signal high) or sending a character over the serial interface - the received character is ignored.

Serial Interface Commands and Description

The Serial Interface operates as a Host-Client relationship where the ePIR Zdots SBC is the client. Commands are sent from the Host and the SBC responds with the requested information or confirmation. The only exception is when the SBC is configured for "/MD Unsolicited" operation. In this mode, the SBC will send Motion Detected information without first receiving a command from the host. All commands sent to the ePIR Zdots SBC are in ASCII character format, but the data sent to and from the SBC may be ASCII or decimal.

There are 3 types of commands accepted by the SBC: **Read Commands**, **Write Commands**, and **Confirmation Commands**.

Read Command structure

Read Commands are used to request information from the SBC. Read Commands are sent from the Host and the ePIR Zdots SBC responds with the requested data.

- All read commands are initiated by single lower-case letters.
- Once received, the device will return the applicable value as described in the [ePIR Motion Detection Zdots SBC Commands](#) on page 15.

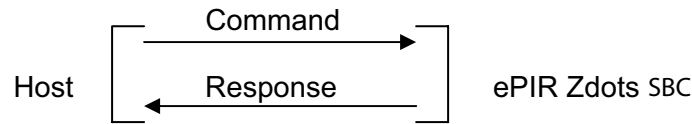


Figure 5. Read Command Structure

Write Command structure

Write Commands are used to update configuration of the ePIR Zdots SBC. The command is sent from the Host, and the SBC responds with the current value as an acknowledgment. Then the Host sends the new data and the SBC responds with an 'ACK'.

- All write commands are initiated by single upper-case letters.
- Once a write command is received the device returns the current value, and expects an appropriate single-byte data value.
- When the data value is received, the device returns an 'ACK'. If no data is received after the inactivity timeout of 2.5 seconds, the device returns a 'NACK'.

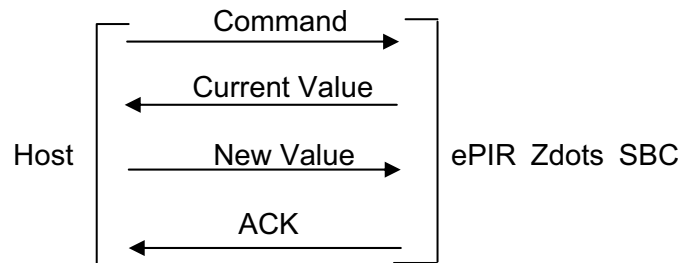


Figure 6. Write Command Structure

Confirmed Command Structure

Certain commands require a specific sequence of characters to be sent in order to help prevent accidental initiation. These commands require a 4-character confirmation sequence. Once a command requiring confirmation is received, the device returns an 'ACK'.

- If the sequence is correct, the device returns an 'ACK' and executes the command.
- If the sequence is incorrect, or there is an inactivity delay of more than 2.5 seconds between any characters of the sequence, the device immediately sends a 'NACK' and does not execute the command.

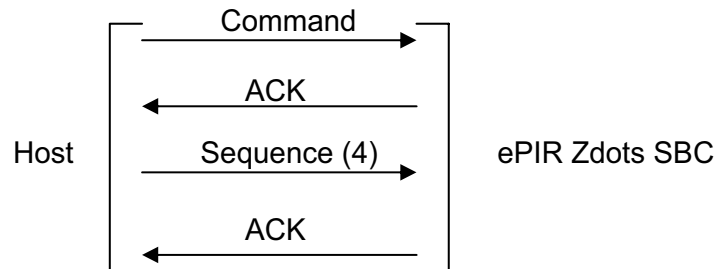


Figure 7. Confirmed Command Structure

- **Notes:** 1. *ACK = 0x06 (ASCII ACK character).*
 2. *NACK = 0x15 (ASCII NACK character). The SBC will respond with a 'NACK' on all unrecognized commands, and when command requiring data (that is, Write, Clear, and Confirmation types) does not receive the required data within the inactivity timeout period*

Table 3. Summary of Serial Interface Commands

Command	Name	Default	Command	Name	Default
0x61 - 'a'	Read Motion Status	-	0x65 - 'e'	Read Extended Range Setting	'N'
0x62 - 'b'	Read Current Light Gate Input Level	-	0x45 - 'E'	Write Extended Range Setting	'N'
0x6C - 'l'	Read Light Gate Threshold	100	0x66 - 'f'	Read Frequency Response Setting	'L'
0x4C - 'L'	Write Light Gate Threshold	100	0x46 - 'F'	Write Frequency Response Setting	'L'
0x63 - 'c'	Read /MD//RST Pin Configuration	'R'	'0x68 - 'h'	Read Motion Detection Suspend Setting	'N'
0x43 - 'C'	Write /MD//RST Pin Configuration	'R'	'0x48 - 'H'	Write Motion Detection Suspend Setting	'N'
0x64 - 'd'	Read /MD Activation Time	2	0x70 - 'p'	Read Pulse Count	'1'
0x44 - 'D'	Write /MD Activation Time	2	0x50 - 'P'	Write Pulse Count	'1'
0x6F - 'o'	Read /MD Current Output Active Time	0	0x73 - 's'	Read Sensitivity	6
0x4F - 'O'	Write /MD Output State	0	0x53 - 'S'	Write Sensitivity	6



Table 3. Summary of Serial Interface Commands (Continued)

Command	Name	Default	Command	Name	Default
0x6D - 'm'	Read Motion Detected Unsolicited Mode	'N'	0x76 - 'v'	Read Direction	'A'
0x4D - 'M'	Write Motion Detected Unsolicited Mode	'N'	'0x56 - 'V'	Write Direction	'A'
0x69 - 'l'	Read SBC S/W Version	1,1	0x58 - 'X'	SBC Reset	-
			0x5A - 'Z'	Sleep Mode	-

ePIR Motion Detection Zdots SBC Commands

Motion Status

The current status of detected motion can be read and cleared through this command. When motion has been detected the value is set to 'Y' and latched until read with the 'a' command. Once cleared, the status remains at 'N' until motion is again detected.

Command: Read Motion Status "a" (0x61)

Description

This command returns the current status of detected motion. The current status is set to 'N' when read.

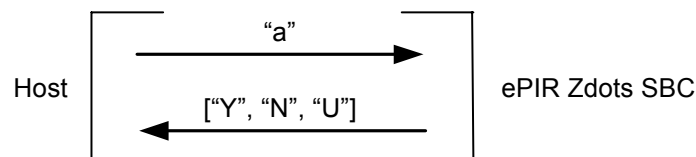
Return Values

'Y' = Motion Detected

'N' = No Motion Detected

'U' = PIR Sensor has not stabilized after power up

Normal Command Sequence



- **Note:** *This value is independent of the /MD output state or the /MD Activation Time (see commands 'o'/'O' and 'd'/'D').*

Light Gate Level

These commands control and monitor the signal associated with the LG (Light Gate) pin. This is typically relative to the ambient light detected by an externally connected CDS photocell. The range is 0 to 255, with 0 indicating maximum ambient light and, 255 indicating minimum ambient light. See [Appendix A—Hardware Interface Mode](#) on page 50 and [Appendix B—Serial Interface Mode](#) on page 51 for recommended CDS Photo Cell connections. The 'b' command reads the current signal level present on the pin.

The "L" command sets the Light Gate Threshold value. This value is used in conjunction with the signal on the LG pin to internally "Gate" the /MD signal such that it does not activate in the presence of ambient light. When the signal on the LG (Light Gate) pin is below this value, the /MD output signal remains inactive even when motion has been detected. When the signal on the LG (Light Gate) pin is above this value, the /MD signal activates normally when motion has been detected.

Command: Read Current Light Gate Input Level "b" (0x62)

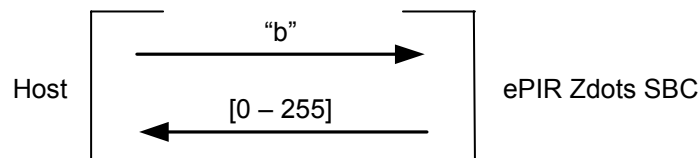
Description

The "b" command returns the current signal level present on the LG (Light Gate) pin.

Return Values

0 - 255 (decimal)

Normal Command Sequence



Command: Read Light Gate Threshold "l" (0x6C)

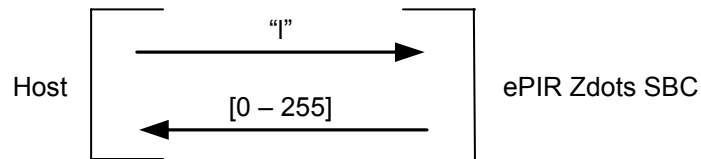
Description

The "l" command Returns the current Light Gate threshold value set by the "Write Light Gate Threshold command.

Return Values

0 - 255 (decimal)

Normal Command Sequence



Command: Write Light Gate Threshold "L" (0x4C)

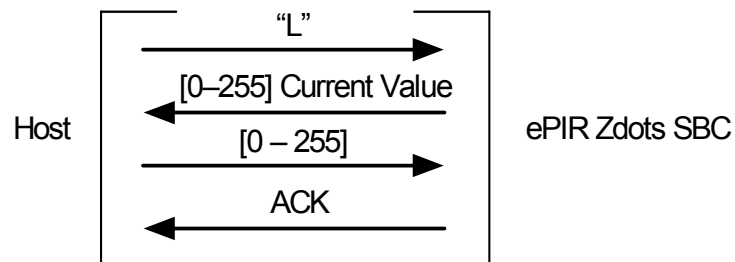
Description

The "L" command sets the Light Gate Threshold value.

Input Values

0 - 255 (decimal)

Normal Command Sequence



/MD/RST Pin Configuration

The /MD//RST pin can be configured to function as either the Motion Detect output or the SBC Reset input. This command selects between the two modes. As /RST, a low on this pin causes the ePIR Zdots SBC to perform a full hardware reset. See [Signal Descriptions \(Serial Interface Mode\)](#) on page 6 for more information.

Command: Read /MD//RST Pin Configuration "c" (0x63)

Description

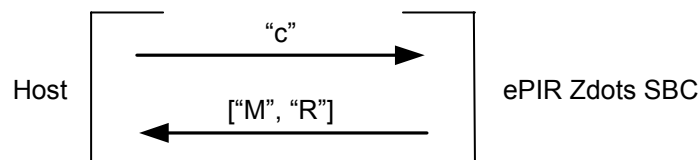
This Read command returns the configuration mode of the /MD//RST pin as set by the "C" command.

Return Values

'M' = /MD//RST pin configured as /MD

'R' = /MD//RST pin configured as /RST

Normal Command Sequence



Command: Write /MD//RST Pin Configuration "C" (0x43)

Description

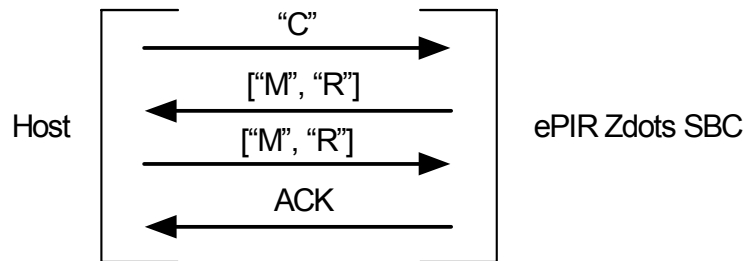
Configures the /MD//RST pin as either /MD (Motion Detect output) or /RST (SBC Reset).

Input Values

'M' = Configure /MD//RST pin as /MD

'R' = Configure /MD//RST pin as /RST

Normal Command Sequence



/MD Activation Time

The length of time that the /MD pin is held active when motion is detected is configured by this command. See [Table 4](#) on page 41 for corresponding values.

Command: Read /MD Activation Time "d" (0x64)

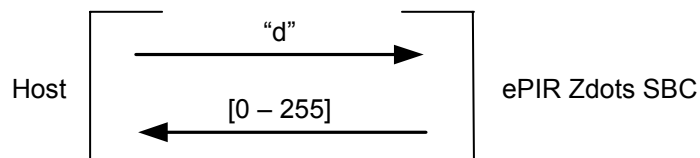
Description

Reads the currently configured /MD pin output activation time value used when motion is detected.

Input Values

0 - 255 (decimal) — See [Table 4](#) on page 41.

Normal Command Sequence



Command: Write /MD Activation Time "D" (0x44)

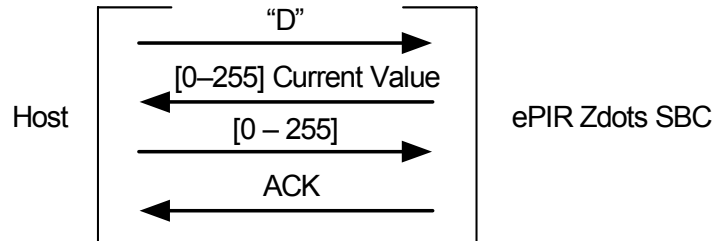
Description

Selects the /MD pin output activation time value used when motion is detected.

Input Values

0 - 255 (decimal) - See [Table 4](#) on page 41.

Normal Command Sequence



/MD Current Active Output Time

This command directly controls the /MD output pin. The "O" command activates the /MD output pin for the specified amount of time. This is a "manual override" of the current state of /MD and is independent of motion detection. The valid range is given in [Table 4](#) on page 41. The "o" command is used to read the remaining time that /MD will be held active - as initiated by this command or by detected motion.

Command: Read /MD Current Output Active Time "o" (0x6F)

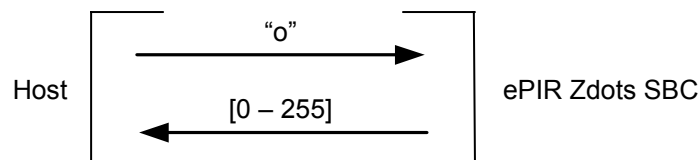
Description

Returns the remaining time that the /MD output pin will be held active.

Return Values

0 - 255 (decimal) - See [Table 4](#) on page 41.

Normal Command Sequence



- **Note:** *This command is still valid if the /MD pin is configured for /RST. The command returns the state of /MD pin as if it was configured to indicate motion.*

Command: Write /MD Output State "O" (0x4F)

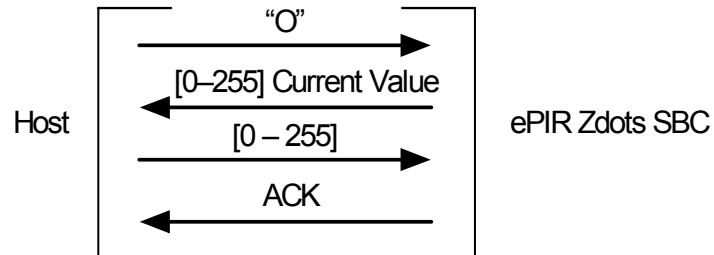
Description

Activates the /MD output pin for the amount of activation time desired.

Input Values

0 - 255 (decimal) - /MD activated for the selected amount of time. See [Table 4](#) on page 41.

Normal Command Sequence:



- **Notes:**
1. *This command has no effect on the Read Motion Status command ('a').*
 2. *If the /MD pin is configured as Reset, the value is saved as if the /MD pin is configured to indicate motion.*

Motion Detected Unsolicited Mode

This mode allows the ePIR Zdots SBC to send motion detection status to the Host unsolicited (without first sending the 'a' command). The ePIR Zdots SBC will send an 'M' to the Host every time motion is detected. When disabled, the Host must poll using the 'a' command to determine motion detection status or monitor the /MD output signal or read the Current Output Active Time "o".

Command: Read Motion Detected Unsolicited Mode "m" (0x6D)

Description

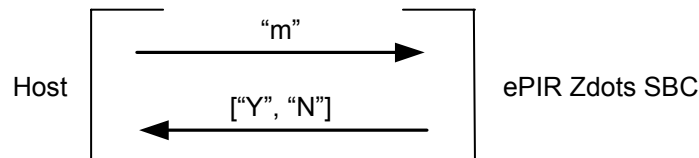
This read command returns the Motion Detected Unsolicited Mode currently selected.

Return Values

'Y' = Unsolicited mode is enabled. SBC sends an 'M' each time motion is detected.

'N' = Unsolicited mode is disabled.

Normal Command Sequence



Command: Write Motion Detected Unsolicited Mode "M" (0x4D)

Description

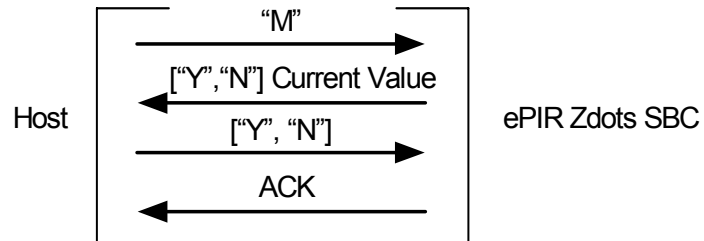
Enables/disable Motion Detected Unsolicited Mode

Input Values

'Y' = Unsolicited mode is enabled. SBC sends an 'M' each time motion is detected.

'N' = Unsolicited mode is disabled.

Normal Command Sequence



Extended Range Setting

Extended Range increases the distance that the ePIR Zdots SBC can "see". It also allows it to detect a greater range of target speeds - both faster and slower. See detection patterns in [Figure 8](#) on page 42 and [Figure 9](#) on page 43.

Command: Read Extended Range Setting "e" (0x65)

Description

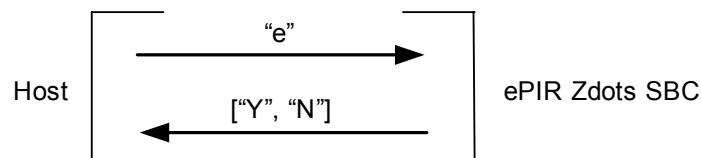
This read command returns the current Extended Range setting.

Return Values

Y = Extended Range Enabled

N = Extended Range Disabled

Normal Command Sequence



Command: Write Extended Range Setting "E" (0x45)

Description

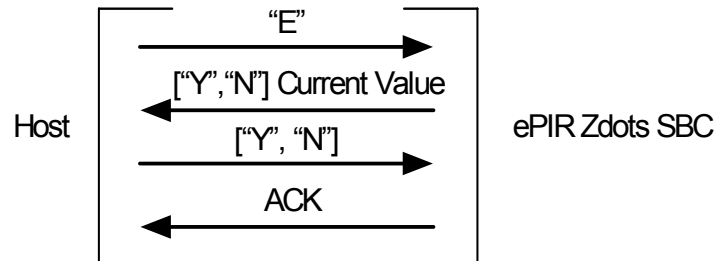
This write command enables/disables the Extended Range feature.

Input Values

Y = Extended Range Enabled

N = Extended Range Disabled

Normal Command Sequence



Frequency Response Setting

The Frequency Response setting controls sensitivity to targets producing lower frequencies. When set to "H", sensitivity to targets producing lower frequencies is reduced. These targets typically include horizontally oriented objects such as pets. This also has the effect of reducing the distance that the ePIR Zdots SBC can "see".

Command: Read Frequency Response Setting "f" (0x66)

Description

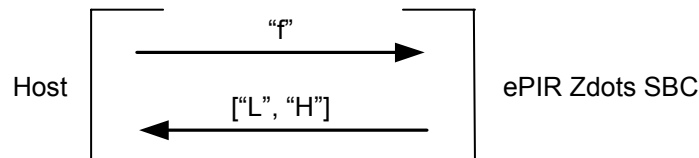
This read command returns the current Frequency Response setting of the ePIR Zdots SBC.

Return Values

L = Low and High frequency targets detected

H = Low frequency target sensitivity reduced

Normal Command Sequence



Command: Write Frequency Response Setting "F" (0x46)

Description

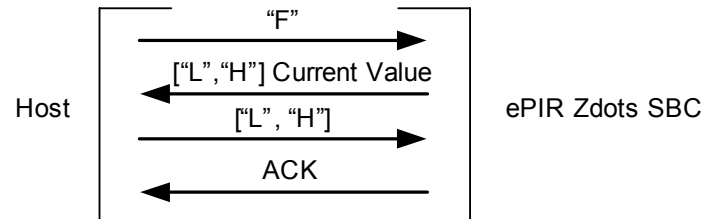
This write command sets the Frequency Response of the ePIR Zdots SBC.

Input Values

L = Low and High frequency targets detected

H = Low frequency target sensitivity reduced

Normal Command Sequence



Motion Detection Suspend

This command enables and disables motion detection by the ePIR Zdots SBC. When set to 'N', the ePIR Zdots SBC detects motion. When set to "Y", motion detection is suspended. This is a method to temporarily disable motion detection, but the /MD pin may still be "manually" driven active/inactive via the "O" (Write /MD Output State) command.

Command: Read Motion Detection Suspend Setting "h" (0x68)

Description

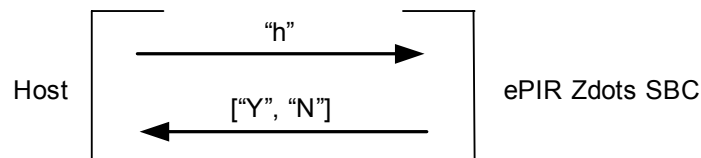
This read command returns the current Motion Detection Suspend setting.

Return Values

Y = Motion Detection is suspended

N = Motion Detection is active

Normal Command Sequence



Command: Write Motion Detection Suspend Setting "H" (0x48)

Description

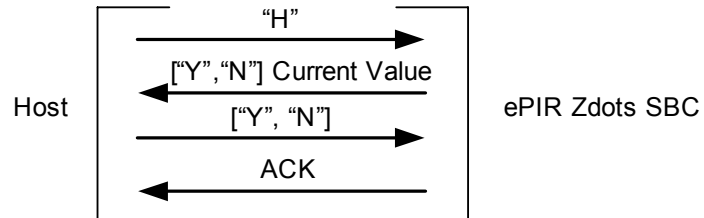
This write command enables and disables motion detection by the ePIR Zdots SBC

Input Values

Y = Motion Detection is suspended

N = Motion Detection is active

Normal Command Sequence



Pulse Count

This command sets the Pulse Count mode for the ePIR Zdots SBC. Values can be either 1 or 2. A motion pulse is created when the target passes across the beams created by the Fresnel lens. A Pulse Count of 1 means that only one motion pulse from the target is required to qualify as valid motion. A Pulse Count of 2 means that two motion pulses are required from the target to qualify as valid motion. A Pulse Count of 2 is typically used in harsher environmental conditions to decrease the chances of false triggers from sources such as fast heating and cooling.

Command: Read Pulse Count "p" (0x70)

Description

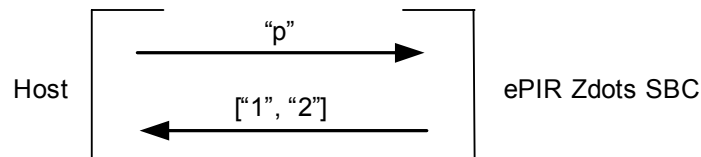
This command returns the current Pulse Count setting.

Return Values

1 = Pulse Count set to 1

2 = Pulse Count set to 2

Normal Command Sequence



Command: Write Pulse Count "P" (0x50)

Description

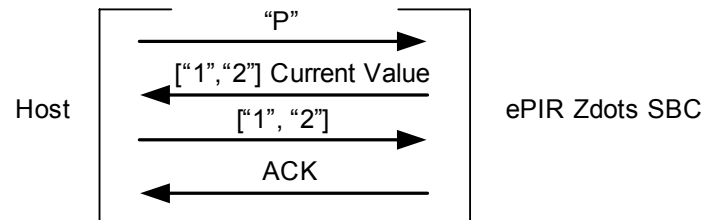
This write command sets the Pulse Count mode for the ePIR Zdots SBC. Values can be either 1 or 2.

Input Values

1 = Pulse Count is set to 1

2 = Pulse Count is set to 2

Normal Command Sequence



Sensitivity

This command controls the sensitivity of the ePIR Zdots SBC to motion. Larger values provide lower sensitivity and also have the effect of reducing the range. Smaller values provide higher sensitivity.

Command: Read Sensitivity "s" (0x73)

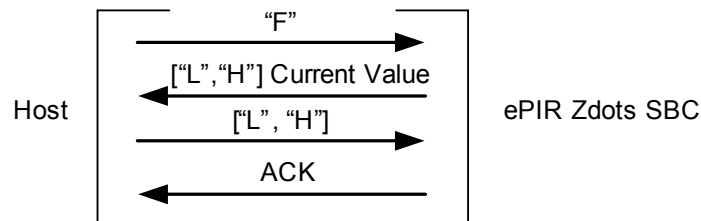
Description

The "s" command returns the current motion detection sensitivity setting.

Return Values

0 - 255 (decimal)

Normal Command Sequence



Command: Write Sensitivity "S" (0x53)

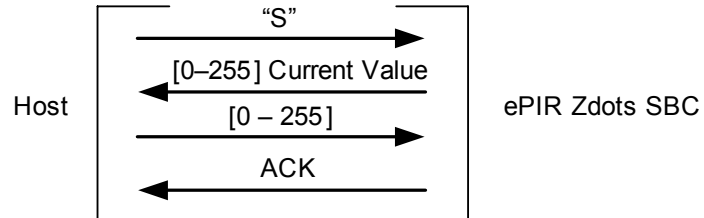
Description

This command sets the motion detection sensitivity.

Input Values

0 - 255 (decimal)

Normal Command Sequence



Motion Direction

The ePIR Motion Detection Zdots SBC detects motion in any and all directions. However, it is also capable of discriminating between "left to right" and "right to left" motion. This command controls the direction of motion to be detected.

The signal generated by the pyro-electric sensor used to discern direction can vary from device to device, but is consistent for a particular device. Therefore, in an application, the "+" and "-" direction settings can mean either left to right or right to left motion, but will always be the same for that particular device. Each device can be calibrated simply by setting it to detect motion in the "+" or "-" direction, then creating motion in one or both directions and observing the results.

Command: Read Direction "v" (0x76)

Description

The 'v' command returns the current Motion Direction setting.

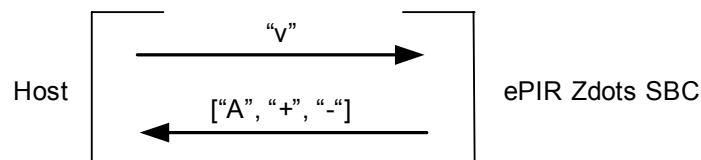
Return Values

'A' = Detect motion in all directions

'+' = Detect motion only in the "+" direction

'-' = Detect motion only in the "-" direction

Normal Command Sequence



Command: Write Direction "V" (0x56)

Description

The 'V' command selects the direction of motion to be detected. The ePIR Zdots SBC can be configured to detect motion occurring in one or both directions.

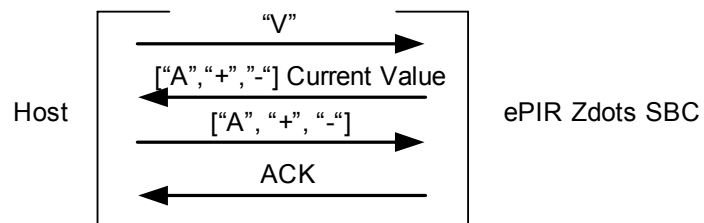
Input Values

'A' = Detect motion in all directions

'+' = Detect motion only in the "+" direction

'-' = Detect motion only in the "-" direction

Normal Command Sequence



SBC Reset

This command forces the ePIR Zdots SBC to reset. All configuration and status are returned to default values — see [Table 3](#) on page 13.

This is a special command that requires confirmation. Once the "X" is received, the ePIR Zdots SBC sends an 'ACK' and expects the 4-digit confirmation sequence ("1", "2", "3", "4").

Once this sequence is received the device sends an 'ACK' and performs a reset. If the confirm sequence is incorrect or the inactivity timeout is exceeded, the device will send a 'NACK' and ignore the reset request.

Command: SBC Reset "X" (0x58)

Description

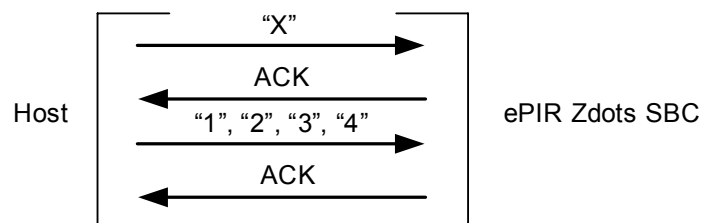
Reset the ePIR Zdots SBC

Return Values

ACK = Reset command accepted

NACK = Reset command not accepted

Normal Command Sequence



Sleep Mode

This command places ePIR Zdots SBC into Sleep Mode. This is a special command that requires confirmation. Once the "Z" is received, the ePIR Zdots SBC sends an 'ACK' and expects the 4-digit confirmation sequence ("1", "2", "3", "4").

Once this sequence is received the device sends an 'ACK' and performs and enters low power Sleep Mode. If the confirm sequence is incorrect or the inactivity timeout is exceeded, the device will send a 'NACK' and ignore the reset request.

Wake up is initiated by a transition on the /SLP pin or by sending a character over the serial interface - this character is ignored.

Command: Sleep Mode "Z" (0x5A)

Description:

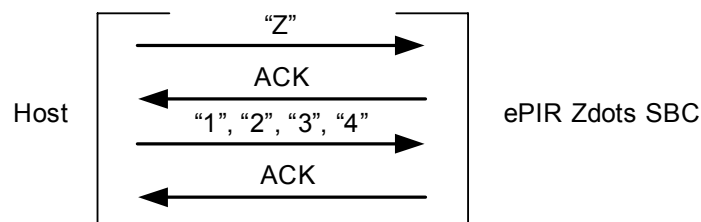
The 'Z' command places the ePIR Zdots SBC into low power Sleep mode.

Return Values

ACK = Sleep command accepted

NACK = Sleep command not accepted

Normal Command Sequence



S/W Revision

The S/W in the ePIR Motion Detection Zdots SBC is made up of two parts: The ePIR S/W Engine and the Application S/W. The S/W Revision command returns the revisions of this software.

The ePIR S/W Engine is locked into the device and can not be changed. This S/W provides all of the algorithms and processing functions needed for motion detection - See the product specification for the Z8FS040ASB20SG IC for more details on the operation of this S/W.

The Application S/W provides the Serial and H/W Interface Mode functionality. It uses the services provided by the ePIR S/W Engine for all of the motion detection functions. This application S/W is available for download and can be modified for custom applications. Please see the Zilog Web Site to obtain the Application S/W project.

See [Appendix C](#) on page 52 for version information.

Command: S/W Revision "i" (0x69)

Description

The 'i' command returns the revision of the S/W programmed into the ePIR Motion Detection Zdots SBC. The first value returned is the Application S/W revision. The second value returned is the ePIR S/W Engine revision.

Return Values

VAL1 = 0 - 255 (decimal) - Application S/W Version

VAL2 = 0 - 255 (decimal) - ePIR S/W Engine Version

Normal Command Sequence

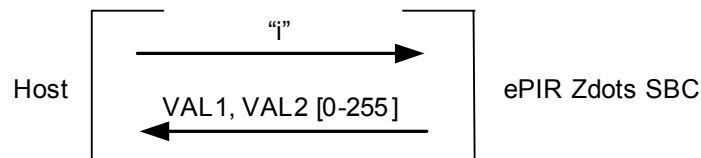


Table 4. /MD Output Activation Time Values

Command Value	/MD Output Activation Time
0	Output does not activate on motion
1–127	1–127 seconds
128	Output does not activate on motion
129–255	1–128 minutes

Detection Pattern

The Fresnel lens directs the infrared energy on to the pyro-electric sensor. The area covered by the lens is called the range and the ePIR Motion Detection Zdots SBC can be used in either a Standard Range mode or Extended Range mode. In Standard Range Mode (Command “E” set to “N”) the typical range is 3 meters by 3 meters with a 60 degree angle (See [Figure 8](#)). In Extended Range Mode (Command “E” set to “Y”) the typical range is 5 meters by 5 meters with a 60 degree angle (See [Figure 9](#) on page 43). The actual distance is dependent on the sensitivity setting of the ePIR Motion Detection Zdots SBC.

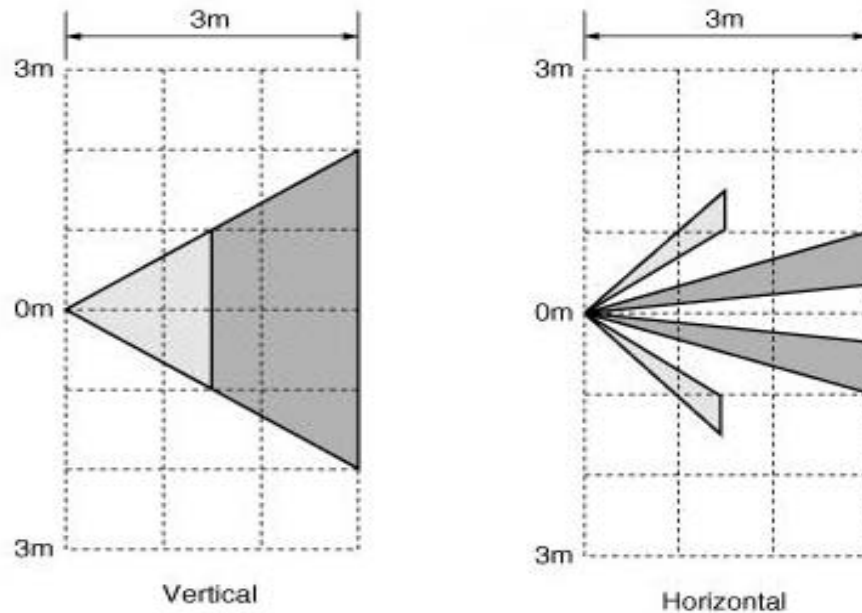


Figure 8. Detection Pattern—Standard Range

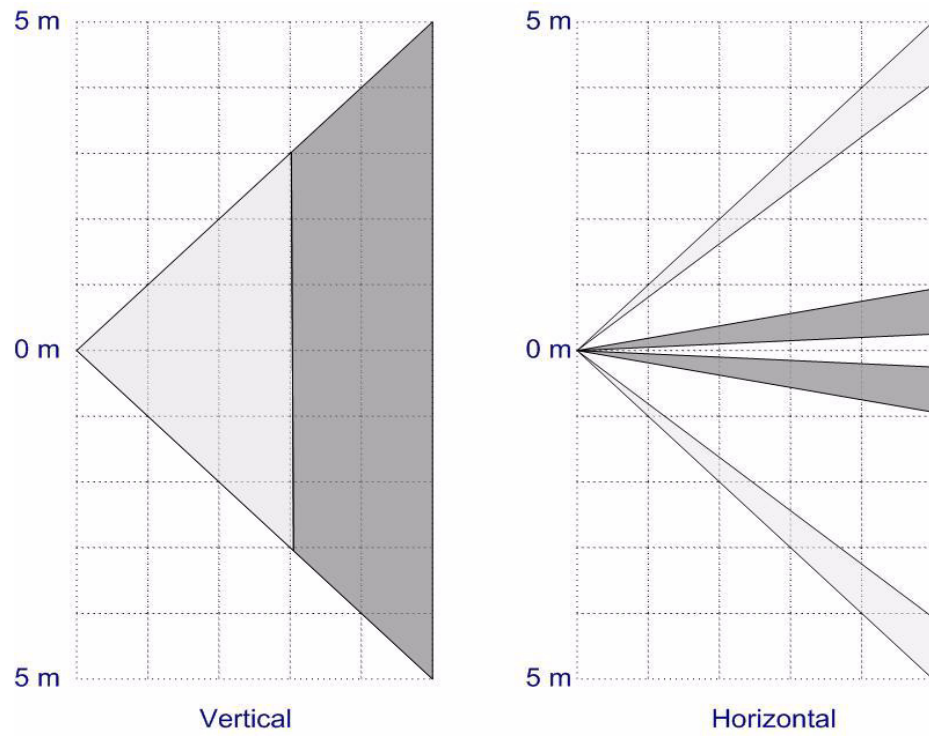


Figure 9. Detection Pattern—Extended Range

Mechanical Information - Physical Description

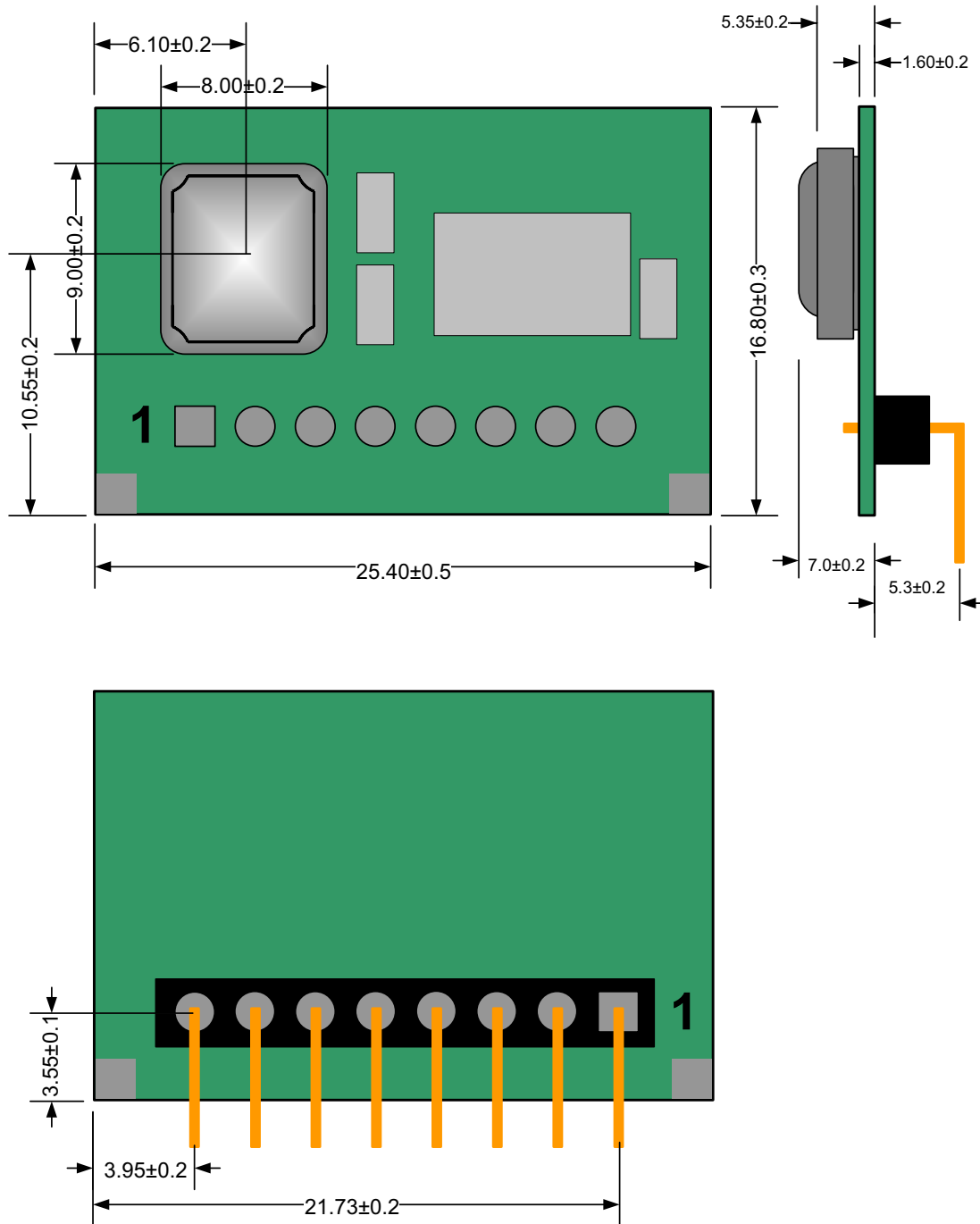


Figure 10. Mechanical Drawing of ePIR Zdots

ePIR Zdots SBC Schematic

Figure 11 displays the schematic of ePIR™ Motion Detection Zdots® SBC.

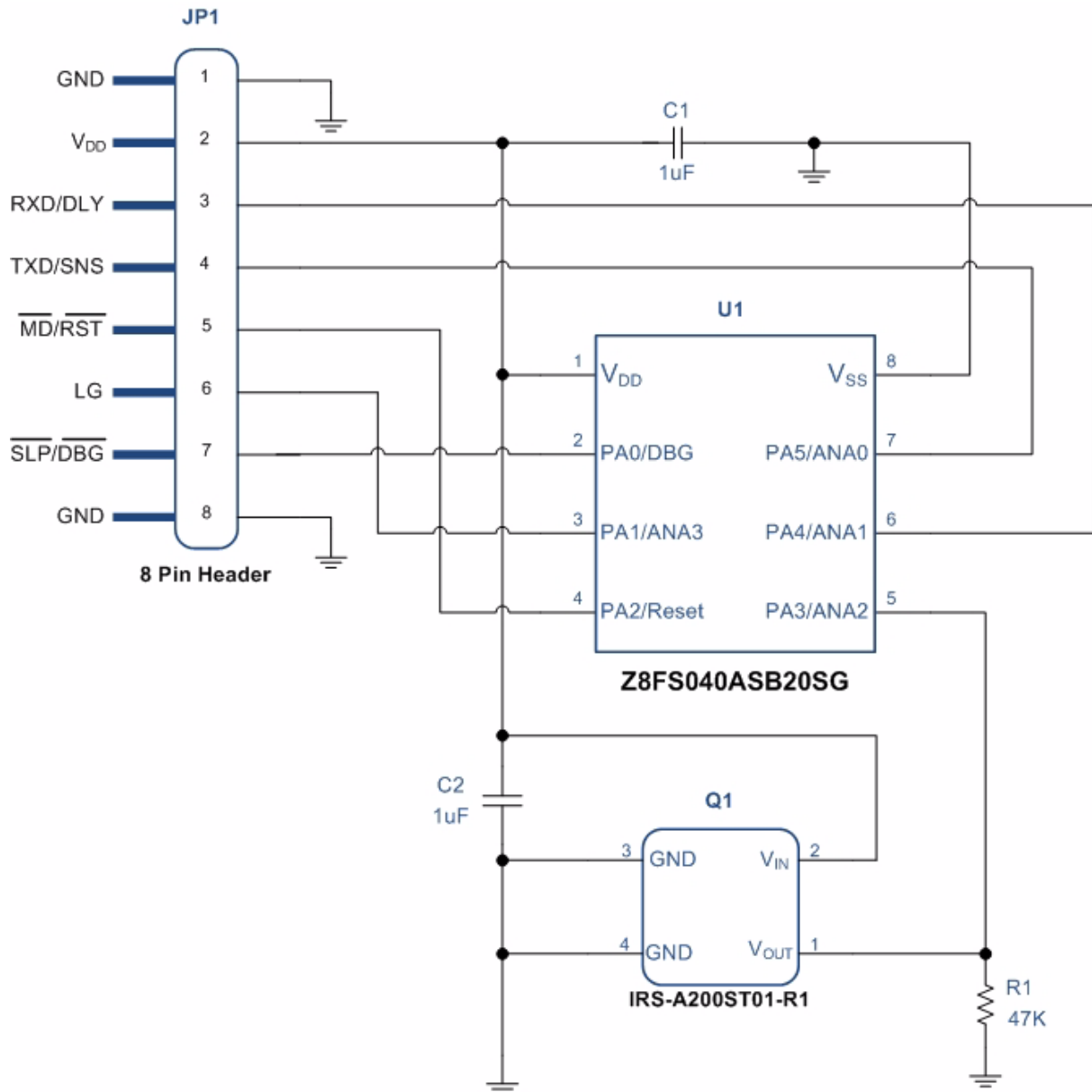


Figure 11. Schematic of ePIR™ Motion Detection Zdots® SBC

Related Documents

The related documents for ePIR™ Motion Detection Zdots® Single Board Computer include:

- ePIR™ Motion Detection IC Series Product Specification (to be released)
- ePIR™ Motion Detection Zdots® SBC Development Kit User Manual (UM0223)
- Z8 Encore! XP® F082A Series Product Specification (PS0228)

Related Products

Below table lists the products related with ePIR Motion Detection Zdots SBC.

Product Number	Product Description
Z8FS040ASB20SG	ePIR™ Motion Detection IC (8 pin SOIC)
Z8FS040AHH20SG	ePIR™ Motion Detection IC (20 pin SOIC)
Z8FS040AHJ20SG	ePIR™ Motion Detection IC (28 pin SOIC)
ZEPIR000101ZCOG	ePIR™ Motion Detection Zdots Single Board Computer Development Kit

Chapter 2 Electrical Characteristics

The data in this chapter is pre-qualification and pre-characterization and is subject to change. For additional electrical characteristics, refer to *Z8 Encore! XP® F082A Series Product Specification (PS0228)*.

Table 5. Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Units	Conditions
V _{POR}	Power-on Reset Voltage Threshold	2.20	2.45	2.70	V	V _{DD} = V _{POR}
V _{VBO}	Voltage Brownout Reset Voltage Threshold	2.15	2.40	2.65	V	V _{DD} = V _{POR}
T _{RAMP}	Time for V _{DD} to transition from V _{SS} to V _{POR} to ensure valid Reset	0.10	—	100	ms	—
T _{POR}	Power-on Reset Digital Delay	—	1.0	—	ms	—
V _{DD}	Supply Voltage	2.7	—	3.6	V	—
V _{IL1}	Low Level Input Voltage	-0.3	—	0.3*V _{DD}	V	RXD, /RST, /SLP
V _{IH1}	High Level Input Voltage	0.7*V _{DD}	—	5.5	V	RXD, /RST, /SLP
V _{OL1}	Low Level Output Voltage	—	—	0.4	V	I _{OL} = 2 mA; V _{DD} = 3.0 V TXD, /MD
V _{OL2}	Low Level Output Voltage	—	—	0.6	V	I _{OL} = 20 mA; V _{DD} = 3.3 V TXD, /MD
V _{OH1}	High Level Output Voltage	2.4	—	—	V	I _{OH} = -2 mA; V _{DD} = 3.0 V TXD, /MD
V _{OH2}	High Level Output Voltage	2.4	—	—	V	I _{OH} = -20 mA; V _{DD} = 3.3 V TXD, /MD
I _{DD} Active	Supply Current in Active Mode	—	8.9 mA	—	—	V _{DD} = 3.3 V
I _{DD} Sleep	Supply Current in Sleep Mode	—	2.3 mA	—	—	V _{DD} = 3.3 V
T _{PIR}	PIR Stabilization Time	—	20	—	seconds	—

Table 5. Electrical Characteristics (Continued)

Symbol	Parameter	Min	Typ	Max	Units	Conditions
Z _{IN}	Analog Pin Input Impedance	—	550	—	kΩ	DLY, SNS, LG
	Serial Interface Inactivity Timeout	—	2.5	—	seconds	—

Absolute Maximum Ratings

Stresses greater than those listed in [Table 6](#) can cause permanent damage to the device. These ratings are stress ratings only. Operation of the device at any condition outside 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. For improved reliability, unused inputs should be tied to one of the supply voltages (V_{DD} or V_{SS}).

Table 6. Absolute Maximum Ratings

Parameter	Min	Max	Units
Ambient Temperature Under Bias	0	70	°C
Storage Temperature	-65	+150	°C
Voltage on Any Pin with respect to V_{SS}	-0.3	+5.5	V
Voltage on V_{DD} Pin with respect to V_{SS}	-0.3	+3.6	V
Maximum Output Current from Active Output Pin	-25	+25	mA

Chapter 3 Ordering Information

You can order the ePIR Motion Detection Zdots SBC from Zilog® or any of our authorized distributors using the following part numbers. For more information on ordering, please consult your local Zilog sales office. The Zilog website www.zilog.com lists all regional offices and provides additional ePIR Motion Detection Zdots SBC product information.

Part Numbers

Table 7 lists the part numbers for ePIR Motion Detection Zdots SBC and a brief description of each part.

Table 7. Part Numbers

Part Number	Description
ZEPIR0AAS01SBCG	Zdots - ePIR Motion Detection Zdots Single Board Computer
ZEPIR000101ZCOG	Zdots - ePIR Motion Detection Zdots Single Board Computer Development Kit

Appendix A—Hardware Interface Mode

The schematic in Figure 12 shows a typical application example of how to use the SBC in Hardware Interface Mode.

Hardware Interface Mode is selected because the Sense pin is between 0V and 1.8V. In this example, the DLY and SNS signals are connected to trim pots for control of the /MD output activation time and the Motion Detection sensitivity respectively. These connections can also be replaced with fixed resistor values in an application where adjustments are not necessary. The Sleep feature is not being used so the /SLP input is left unconnected as there is an internal pull-up resistor to ensure this pin remains inactive. It is also acceptable to tie this pin to Vdd. The /MD signal directly drives a solid state relay and is active low. The LG (Light Gate) signal is connected to a CDS photo cell in a divider configuration with a potentiometer to adjust the light level. The signal is used by the SBC to gate the /MD signal such that it does not activate in the presence of daytime ambient light. When the voltage on this pin is lower than 1.0 V, the /MD signal will not activate even when motion is detected.

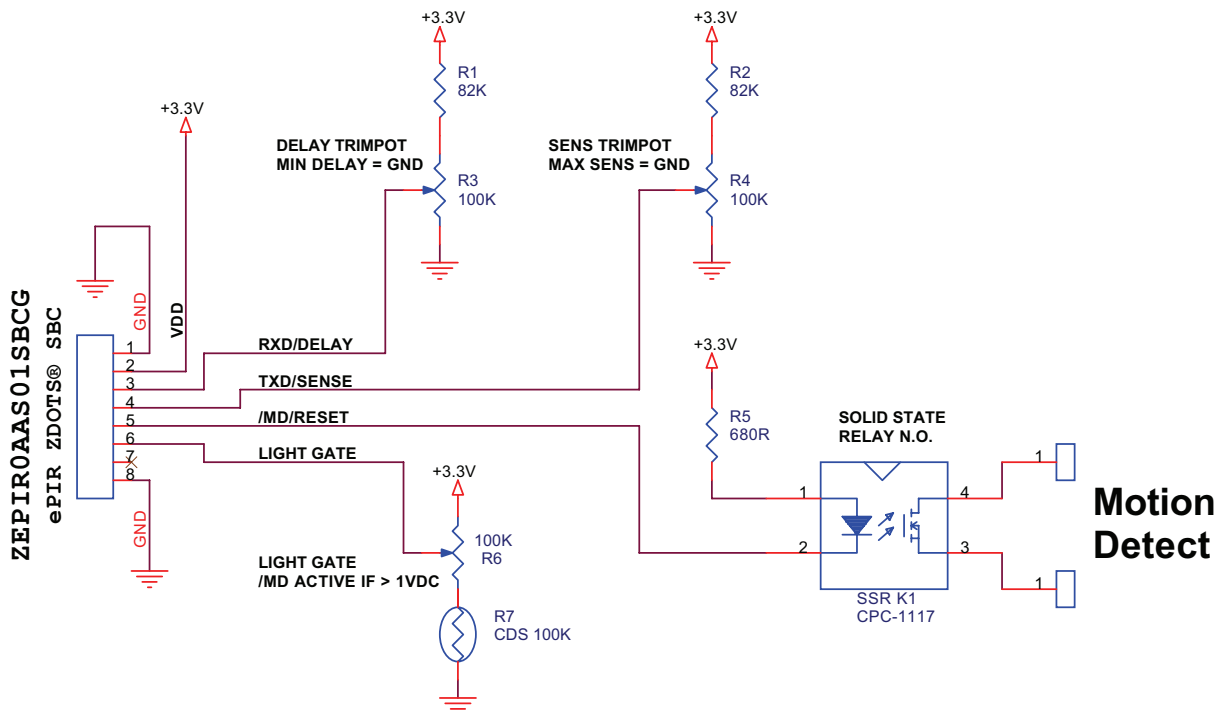


Figure 12. Application Example - Hardware Interface Mode

Appendix B—Serial Interface Mode

The schematic in Figure 13 shows a typical application example of how to use the SBC in Serial Interface Mode.

Serial Interface Mode is selected because the TXD pin is pulled high via the 10K ohm resistor R1. This state need only be guaranteed during power up. In this example, the RXD and TXD signals are connected to the TXD and RXD signals (respectively) of the Z8F1680. Since the /MD and /SLP signals are still active in the Serial Interface Mode, they are also connected to the host MCU. If they were not connected to the MCU, /MD would typically drive the control circuitry similar the Hardware Interface Mode and /SLP either left unconnected or tied high. /SLP has an internal pull-up to ensure proper operation. The LG (Light Gate) signal is connected to a CDS photo cell in a divider configuration with a potentiometer to adjust the light level. The signal is used by the SBC to gate the /MD signal such that it does not activate in the presence of daytime ambient light. When the signal on this pin is lower than lower than the value programmed into the Light Gate Threshold register, the /MD signal will not activate even when motion is detected.

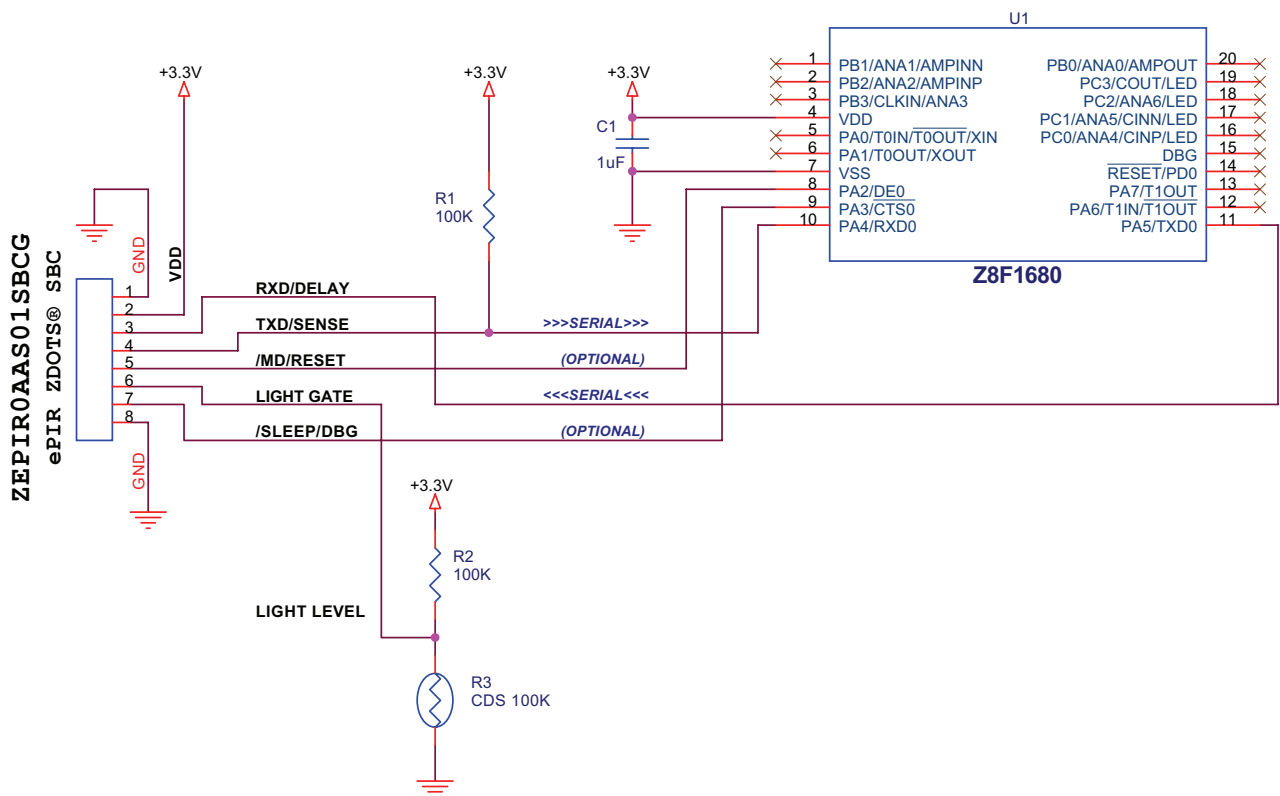


Figure 13. Application Example - Serial Interface Mode

Appendix C

Table 8. ePIR Motion Detection Zdots SBC S/W Revision (Application S/W)

Returned Value (‘i’ command)	S/W Revision	Changes/Updates
1	1.0	Initial Production Release

Table 9. ePIR S/W Engine Revision

Returned Value (‘i’ command)	S/W Revision	Changes/Updates
1	1.0	Initial Production Release

Customer Support

For answers to technical questions about the product, documentation, or any other issues with Zilog's offerings, please visit Zilog's Knowledge Base at: <http://www.zilog.com/kb>.

For any comments, detail technical questions, or reporting problems, please visit Zilog's Technical Support at: <http://support.zilog.com>.