ZMOTION™

ZMOTIONL400ZCOG

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A Littelfuse Company

Z8F3224 ZMOTION Development Kit

User Manual

UM029501-0321

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Overview

Zilog's Z8F3224 ZMOTION Development Kit provides a general-purpose platform for evaluating the capabilities and operation of the ZMOTION Engine Library using the Z8F3224 Series of microcontrollers. This kit is equipped with two Z8F3224 MCUs – one configured for *Low Power* operation and one configured for *Normal Power* operation and comes complete with various lenses to test the ZMOTION Engine Library for multiple applications.

Zilog's ZMOTION Engine Library provides an integrated and flexible solution for Passive Infra-Red (PIR)-based motion detection applications. The Software library is comprised of the PIR sensor signal processing algorithms for motion detection, transient and noise detection, white light detection, and several other motion-related functions to be integrated with the user's application code.

An Application Programming Interface (API) allows the application code to configure, control, and monitor the Library in real time. API configuration parameters allow the Engine operation to be optimized for the particular lens and pyro electric sensor being used in the application. This allows the designer to create their own application-specific software while taking advantage of Zilog's ZMOTION Motion Detection technology.

For more information about the operation of the ZMOTION Library, refer to ZMOTION Engine User Manual (UM0275).

Kit Contents

The Z8F3224 ZMOTION Development Kit includes the components listed in the following table.

Item	Description	Quantity
1	Z8F3224 ZMOTION Development Board	1
2	Encore! Smart Cable or USB Smart Cable	1
3	Lenses: ZCWM05GIV1, ZNCL11, ZNCL926, ZNCL10IL, ZNCL3B, ZNCL10R, ZNCL10S	7
4	USB Cable - type A/B	1

Table 1. Kit Contents

Figure 1. ZMOTIONL400 Development Kit Contents

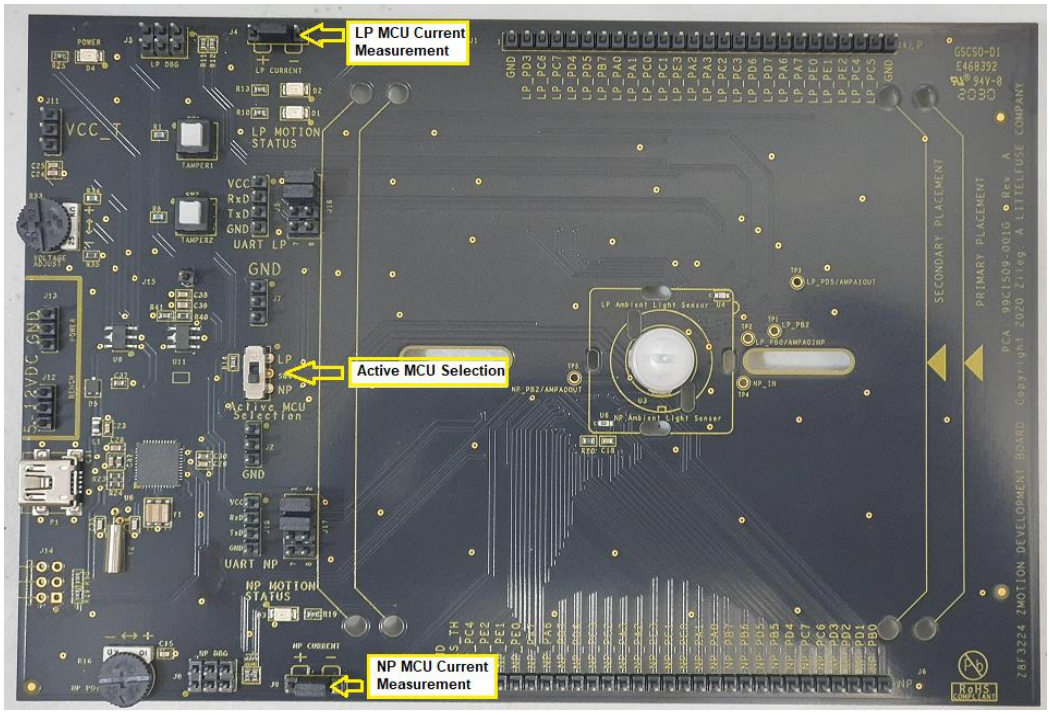

Figure 2. Development Board (top side)

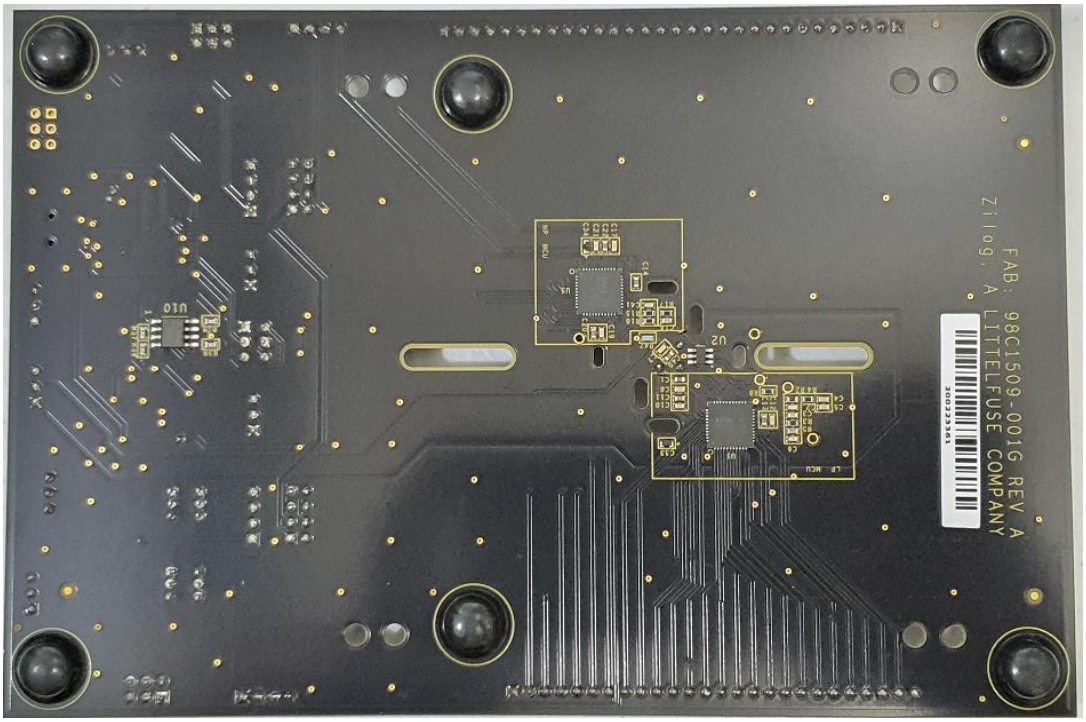

Figure 3. Development Board (bottom side)

Lenses

The Development Kit includes seven lenses. Two mounting options are supported – Clip on and PCB Mount. The following tTable 2 describes the lenses that are included with the Kit.

Part Number	Description	Typical Applications
ZNCL10IL 	9mm Wall Mount 80ºx30º Clips on to pyroelectric sensor 6 beams (X); 2 beams (Y) 7m range	Wall mount for power management • Proximity or entrance detection • Kiosks/Vending • Product display's
ZNCL3B 	9mm Wall/Ceiling Mount (60ºx60º) Clips on to pyro-electric sensor 4 beams (X); 2 beams (Y) 3m range	Proximity or entrance detection • Kiosk/Display Counters • Vending • HVAC
ZNCL10R 	9mm Wall/Ceiling Mount (circular 360º) Clips on to pyro-electric sensor 90º Cone 14 zones with dual pyro 5m range	Room Occupancy and Proximity Sensing • Lighting and HVAC Control • Kiosk/Display Control • Vending/Appliance Power Management
ZNCL10S 	9mm Wall/Ceiling Mount (15ºx15º) Clips on to pyro-electric sensor 2 beams (X); 1 beam (Y) 12m range	Barrier or entrance detection • Kiosk/Display Counters • Vending • HVAC • Directional detection
ZNCL926 	Clip-on 15mm (360º) 26 Segments 5m height, 2.1:1 Floor diameter to height ratio	Room Occupancy and Proximity Sensing • Lighting and HVAC Control • Kiosk/Display Control • Vending/Appliance Power Management
ZNCL11 	Wall/Ceiling Mount 104º(X), 37o(Y) Circuit board mount Black rectangular lens with flat front 32 detection zones 4m range	Wall or ceiling mount for power management • Room occupancy and proximity sensing • Power management • Display power management
ZCWM05GIV1 	Ceiling/Wall Mount Array (360º/180º) Circular lens with 24mm x 24mm square base Board mount clip-in 9m height/range	Wall or ceiling mount for office or meeting room lighting and HVAC control • Room Lighting Control • Local HVAC Control

Table 2. Lenses Included with Kit

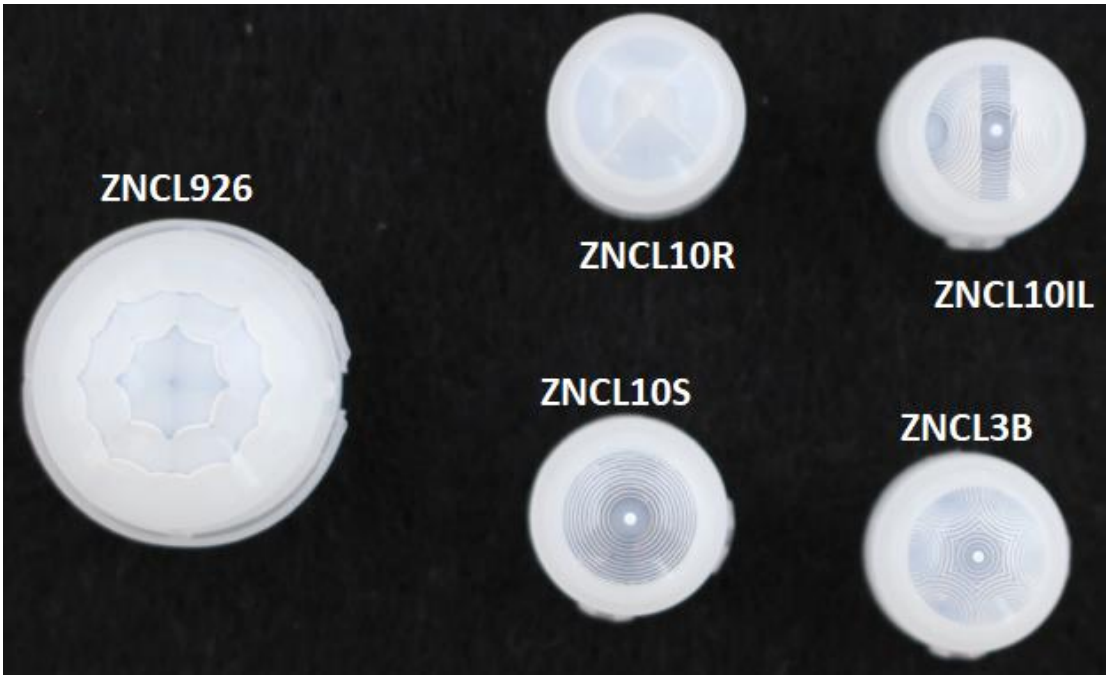

Figure 4. Clip-on Lenses

Figure 5. ZNCL11 – PCB Mount

Figure 6. ZCWM05GIV1 – PCB Mount

Z8F3224 ZMOTION Development Board

This section describes the components of the ZMOTION Development Board.

Features

- Two Z8F3224QN020XK2258 ZMOTION MCU's
  - Normal Power configuration
  - Low Power configuration
- USB Serial Interface
- Tamper switches
- Ambient Light Sensors
- Status LED's
- Variable power supply 2.0V to 3.5V

The following figure shows a block diagram of the Z8F3224 ZMOTION Development Board. Refer to Appendix A for the complete schematic diagrams.

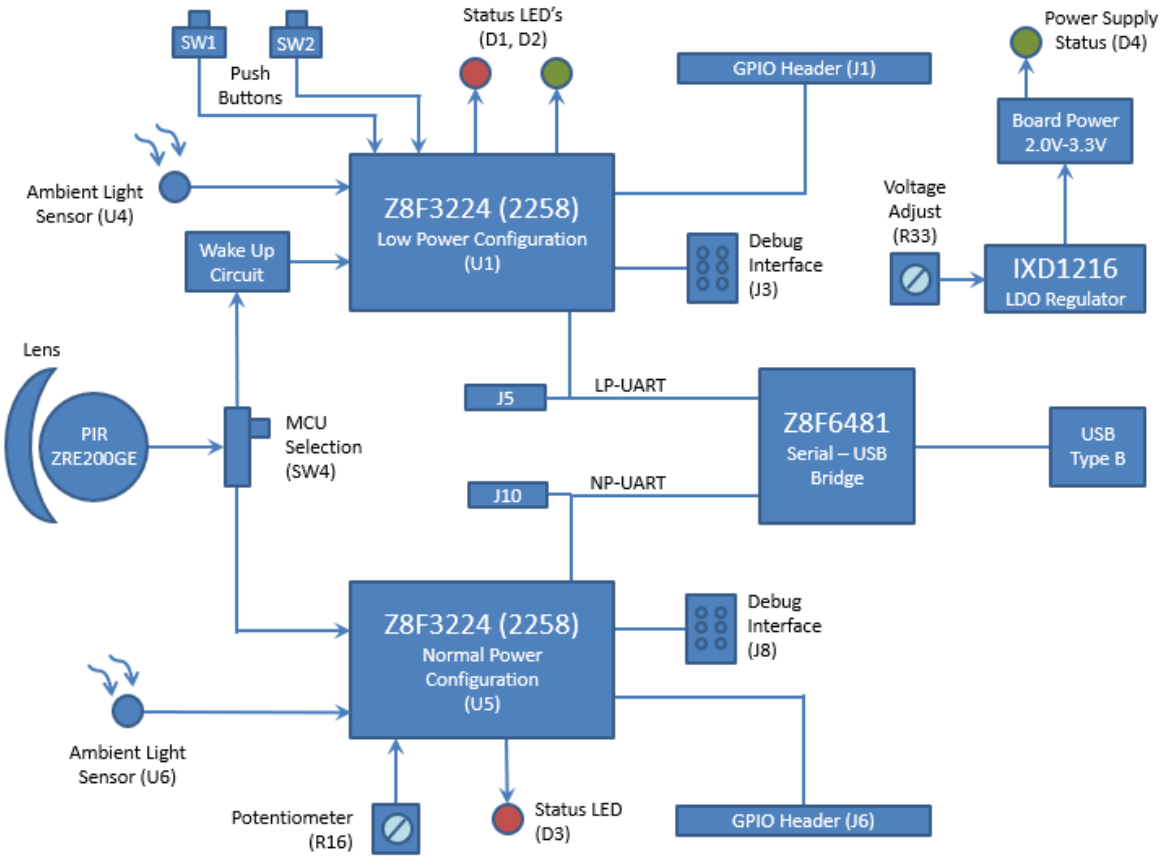

Figure 7. Z8F3224 ZMOTION Development Board Block Diagram

The Z8F3224 ZMOTION MCU

The ZMOTION Library requires a special version of the Z8F3224 Series device. Devices that support the ZMOTION Library include a 2258 suffix on the part number. There are three devices available that support the ZMOTION Library, as listed in the following table.

MCU Part Number	Package	Memory
* Z8F3224QN020XK2258	44-Pin QFN	32KB Flash, 3.75KB RAM
Z8F3224QK020XK2258	32-Pin QFN	32KB Flash, 3.75KB RAM
Z8F3224HH020XG2258	20-Pin SSOP	32KB Flash, 3.75KB RAM

Table 3. Z8F3224 Series Devices Supporting the ZMOTION Library

* The Z8F3224QN020XK2258 (44-Pin QFN) is provided with the development kit.

MCU Features

- 20 MHz eZ8 CPU core
- 16 KB or 32 KB Flash memory with in-circuit programming capability
- 3.75KB internal RAM
- Up to 15-Channel, 12-bit Analog-to-Digital Converter (ADC) that can be configured for internal or external voltage reference and single-ended or differential inputs
- Two on-chip analog comparators
- Two on-chip, low-power operational amplifiers
- 8 Channel Event System provides communication between peripherals for autonomous triggering
- Full-duplex 9-bit UART port with the support of Local Interconnect Network (LIN) and Digital Addressable Lighting Interface (DALI) protocols. RS-485 Multidrop Mode up to 250 kbit/sec (DMX Support) integrated with UARTs
- Enhanced Serial Peripheral Interface (SPI) controller
- I2C controller which supports Master/Slave modes
- One 16-bit timer with 3 functional modes
- Three enhanced 16-bit timers with Capture, Compare, and PWM capability
- One additional basic 16-bit timer with interrupt (shared as UART Baud Rate Generator)
- 16-bit Multi-Channel Timer which supports four Capture/Compare/PWM modules (not available on 20, 32-pin packages)
- Watchdog Timer (WDT)
- 14 to 36 General-Purpose Input/Output (GPIO) pins, depending upon package

- Up to 30 interrupt sources with up to 23 interrupt vectors
- On-Chip Debugger (OCD)
- Power-On Reset (POR) and Voltage Brown-Out (VBO) protection
- Built-in Low-Voltage Detection (LVD) with programmable voltage threshold
- Low Frequency Crystal Oscillator (LFXO) operating at 32.768 kHz with low power consumption
- Internal clock sources and clock multiplication including: Internal Precision Oscillator (IPO), Digitally Controlled Oscillator (DCO), Watchdog Timer Oscillator (WTO) and Frequency Locked Loop (FLL)
- Wide operation voltage range: 1.8 V–3.6 V
- 20- 32-, and 44-pin packages
- –40°C to +85°C (extended) operating temperature range

Getting Started

Download and install the ZMOTIONL400ZCOG_1.0 installation file from the Zilog website located at the Software Download > Software Development Software. This will create a folder that includes the VCOM USB driver, reference schematics, sample applications, ZMOTION Engine Library, and related documentation. Version 1.0 is the latest version of the installation file when the kit was released. Later versions of the file may be available.

After installation the following folders will be created:

\Zilog\ZMOTIONL400ZCOG_1.0

Documentation

Drivers

Z8F3224 ZMOTION Library

Reference Schematics

Sample Applications

ZMOTION Engine Library

The development board comes with two Z8F3224QN020XK2258 MCUs that are pre-programmed with sample applications to demonstrate basic motion detection. These projects, and others are included in the Sample Applications folder.

- The LP MCU is pre-programmed with the ZM_LP_Basic application.
- The NP MCU is pre-programmed with the ZM_NP_Basic application.

Note: The 2258 suffix is a specific version of the Z8F3224 MCU series that supports the ZMOTION Library. Devices without the 2258 suffix do not support the ZMOTION Library

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The MCU's share the same PIR sensor, so only one device may be used at a time. SW4 (Active MCU Selection) is used to select the active MCU. The unselected MCU is powered off.

- The LP MCU is in the Low Power configuration.
- The NP MCU is in the Normal Power configuration.

For a demonstration with the pre-programmed application, perform the following steps:

1. Install the VCOM USB driver included with the ZMOTIONL400ZCOG_1.0 installation file by right-clicking on the .exe file and selecting Run as administrator. This driver is located in the Drivers folder.
    - Zilog_VCOM_Install.x64.exe: 64-bit Windows
    - Zilog_VCOM_Install.x86.exe: 32-bit Windows
    - The Device Driver will be installed as (Zilog USB Serial Device) in Device Manager under Ports (COM & LPT)
2. Set SW4 to select the active MCU configuration (LP or NP).
3. Install the ZNCL10IL lens on the PIR sensor.
4. Ensure that each jumper is installed for J4 (2:3 shunt) and J9 (2:3 shunt). Active device is enabled on SW4.
5. Ensure that R16 is adjusted on a fully clockwise direction. This shall allow NP_VDD_IN to have the same voltage level as VCC_T.
6. With the USB A (male) to Mini-B cable, connect Port P1 on the Development Board to a USB port on the development PC or other suitable power source to apply power to the Development Board.
    – Alternatively, power can be supplied from a bench type power supply using J12 and J13. An input of 5V to 12V is supported.

When power is first applied, the status LED will blink until the PIR sensor is stable. When the PIR sensor is stable, the status LED will turn off and blink when motion is detected.

If the USB interface is connected to a PC, a terminal emulation program like RealTerm or CoolTerm can be used to observe the motion status events. Set the serial interface to 57600bps, N, 8, 1.

Refer to the Sample Applications section to learn more about specific MCU operations.

MCU Current Measurement

The MCU current consumption can be easily measured by removing the shunt on J4 (LP Current) or J9 (NP Current) and connecting an ammeter on the respective positive (+) and negative (–) header pins.

Operating Voltage Adjustment

The MCU operating voltage can be adjusted from 2.0V to 3.5V by the R33 potentiometer. Turn the potentiometer clockwise to decrease the voltage. The operating voltage can be measured from the J11 header (labeled VCC_T).

UART Interface

The MCU UART can be connected to the Serial to USB converter (U8) and/or directly available as TTL signals via J10 (NP MCU) or J5 (LP MCU). Use the jumpers on J17 (NP MCU) and J16 (LP MCU) to select the desired connection.

LP UART Connection	Txd (J16)	Rxd (J16)
J5 Header	7-8	5-6
USB (U8)	3-4	1-2

Table 5. LP MCU UART Connections

NP UART Connection	Txd (J17)	Rxd (J17)
J10 Header	7-8	5-6
USB (U8)	3-4	1-2

Table 4. NP MCU UART Connections

Use caution when using a separate Serial to USB converter cable connected to J10 or J5. The Z8F3224 supply voltage (VCC_T) selected by R33 must match the drive level provided by the cable. The sample applications provided avoid this issue as follows:

- Txd: Configured as Open Drain without an internal pull up. The pull up resistor should be provided on the Rxd (cable) side.
- Rxd: Internal pull-up resistor connected to VCC_T is enabled. The Txd side (cable side) should drive using Open Drain.
- The Serial to USB chip (U8) on the ZMOTIONL400 board is configured in this manner.
- Failing to follow this precaution can cause unexpected behaviour and inaccurate current measurement reading through J9 (NP MCU) or J4 (LP MCU).

Sample Applications

Table 6 lists four sample application projects that are included with the ZMOTIONL400ZCOG_1.0 installation file. Contact Zilog Technical Support for additional sample projects.

The LP and NP MCUs on the Development Board come preloaded with the ZM_LP_Basic and ZM_NP_Basic projects. To load a different project, refer to the Using ZDS-II to Debug a Project section on page 16.

Project	Folder	MCU Configuration
ZM_LP_Basic	ZMOTION_LP_Basic	Low Power
ZM_LP_Command	ZMOTION_LP_Command	Low Power
ZM_NP_Basic	ZMOTION_NP_Basic	Normal Power
ZM_NP_Command	ZMOTION_NP_Command	Normal Power

Table 6. Sample Applications

The Z8 Encore! family of MCUs supports three operating modes:

- Run – In this mode, the CPU is running and all peripherals/clock sources can be enabled (normal running mode).
- Halt – In this mode, the CPU is not running and all peripherals/clock sources can be enabled. Exit via interrupt.
- Stop – In this mode, the CPU is not running and some peripherals/clock sources can be enabled. Exit via Stop Mode Recovery (SMR).

Stop mode provides the lowest current consumption and is used in the ZM_LP_Basic and ZM_LP_Command projects. The ZM_NP_Basic and ZM_NP_Command projects use Halt mode to reduce current consumption.

However, debugging operations are limited when using Stop mode. To use the full debugger with the ZM_LP_Basic and ZM_LP_Command projects, the following configuration definition is included in the `Sleep.h` file that enables the use of Halt mode in place of Stop mode.

```
#define USE_STOP_MODE
```

Set this definition to 0 and rebuild the project before to use Halt mode in place of Stop mode. Set this definition to 1 to use Stop mode. Current consumption will be higher when using Halt mode.

Sample Application Projects

There are four sample application projects included with the ZMOTIONL400ZCOG_1.0 installation.

- ZM_LP_Basic
  - Basic motion detection operation in Low Power Mode
- ZM_LP_Command
  - Advanced motion detection operation in Low Power Mode
  - Refer to “Serial Command Functions LP Rev x.pdf” included in the project folder
- ZM_NP_Basic
  - Basic motion detection operation in Normal Power Mode
- ZM_NP_Command
  - Advanced motion detection operation in Normal Power Mode
  - Refer to “Serial Command Functions NP Rev x.pdf” included in the project folder

ZM_LP_Basic

This project uses the Low Power MCU configuration to provide motion detection with ZMOTION Digital PIR validation.

The MCU stays in Low Power Stop mode until a motion event is detected by the analog PIR interface. When the MCU wakes up it runs the ZMOTION Engine on the PIR signal to validate the motion event.

When the motion event is validated, the status LED is flashed, and a message is sent via the VCOM USB serial interface (connected to UART0 on the LP MCU).

Typical current consumption is <15uA @ 3.3V

Sliding SW4 to the LP position causes the NP MCU to be powered off and powers on the LP MCU. The following status messages will be displayed on the terminal after power on.

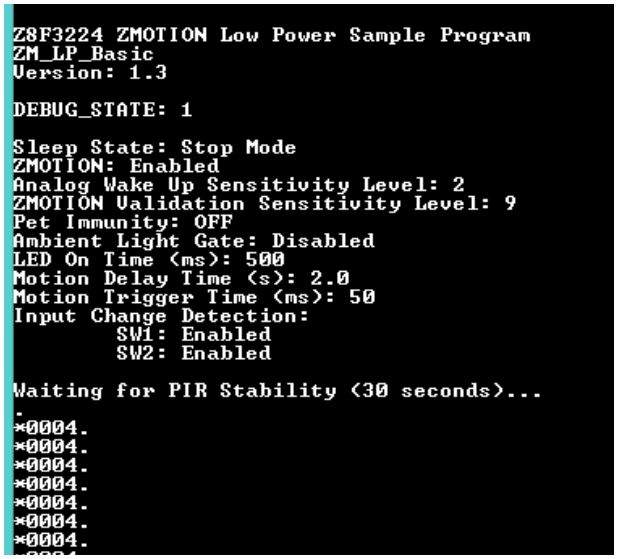


Figure 8. ZM_LP_Basic Power on Messages

The MCU normally stays in Stop mode to conserve power. Each time it wakes up, a status message is sent to indicate the reason for the wake up. Table 7 lists these status message descriptions.

Status Code	Description
*0004	Wake up from Power-on Stability Delay timer.
*0002	Wake up from Ignore Motion Timer
*0001	Wake up due to analog PIR motion event
*0010	Wake up to drive Motion Trigger Output inactive
PIR Stable	PIR sensor is stable – Power on stability delay complete.
Motion Detected	The ZMOTION Engine validated the motion event.
EM	Motion detection enabled – Ignore Motion time is complete
SW1 Pressed	Indicates that Tamper1/SW1 is pressed down
SW1 Released	Indicates that Tamper1/SW1 is pressed to release the switch up
SW2 Pressed	Indicates that Tamper2/SW2 is pressed down
SW2 Released	Indicates that Tamper2/SW2 is pressed to release the switch up
.	MCU has entered Sleep mode

Table 7. Status Messages

Note: In Table 7, '*' indicates MCU wake up and '.' indicates MCU returning to Stop mode. When Motion Detected status is sent, an ASCII BELL character (0x07) is also sent. Some terminal applications can interpret this and provide an audible indication of motion detection

ZM_LP_Command

This project uses the Low Power MCU configuration to provide motion detection with ZMOTION Digital PIR validation.

The MCU stays in Low Power Stop mode until a motion event is detected by the analog PIR interface. When the MCU wakes up it runs the ZMOTION Engine on the PIR signal to validate the motion event.

When the motion event is validated, the status LED is flashed, motion trigger output is pulsed, and a message can be sent via Serial interface.

Typical current consumption is <15uA @ 3.0V.

The serial command interface has the following features that help adjust system operations and performance:

- Pet Immunity mode
- Programmable Digital and Analog sensitivity
- Programmable LED, trigger, and motion delay time
- Ambient light levels and threshold
- Temperature Compensation – adjusts Analog PIR thresholds based on ambient temperature
- Temperature Change Protection – Ignores motion events generated by temperature changes
- Vdd Shift Protection – Ignores motion events generated by shifts in supply voltage
- Smart Sense Mode – Intelligent micro motion
- Pass Through Mode – Intelligent motion delay time
- Boot Loader

Refer to the “Serial Command Functions LP” file included with the project for a full description of operation and list of functions and features.

ZM_NP_Basic

This project demonstrates the use of the ZMOTION Library and API to detect motion. In Normal Power mode, the MCU is continuously sampling and processing the PIR sensor signal.

When motion is detected, an LED is turned on, output is driven active, and a message is sent via the VCOM USB serial interface (connected to UART0 on the NP MCU).

Typical current consumption is <1mA @ 3.0V

Move SW4 from the LP position to the NP position. The LP MCU will be powered off. The NP MCU will start running and display the following messages:

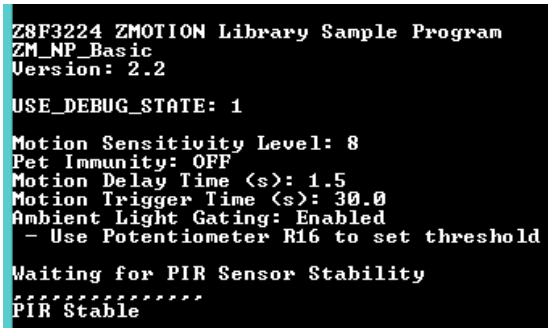


Figure 9. ZM_NP_Basic Power on Messages

Each time the MCU wakes up from a motion event it will display the following status message:

Figure 10. ZM_NP_Basic Motion Detection Messages

ZM_NP_Command

This project demonstrates the use of the ZMOTION Library and API to detect motion with ambient light detection and a serial command interface. When a motion event is detected, the status LED is flashed, motion trigger output is pulsed, and a message can be sent via Serial interface.

Typical current consumption is <1mA @ 3.0V

The serial command interface includes the following features that help adjust system operations and performance:

- Pet Immunity mode
- Programmable Digital sensitivity
- Programmable LED, trigger, and motion delay time
- Ambient light levels and threshold
- Temperature Compensation – adjusts Analog PIR thresholds based on ambient temperature
- Temperature Change Protection – Ignores motion events generated by temperature changes
- Vdd Shift Protection – Ignores motion events generated by shifts in supply voltage
- Smart Sense Mode – Intelligent micro motion
- Pass Through Mode – Intelligent motion delay time
- Boot Loader

Refer to the Serial Command Functions NP file included with the project for a full list of functions and features.

Using ZDS-II to Debug a Project

Zilog Developer Studio II (ZDS II) Integrated Development Environment is a complete standalone system that provides a state-of-the-art development environment. Based on standard Windows user interfaces, ZDS II integrates a language-sensitive editor, project manager, C-compiler, assembler, linker, librarian, and source-level symbolic debugger to provide a development solution specifically tailored to the Z8 Encore! Family of microcontrollers.

1. Download and install ZDS II using the procedure outlined in Appendix B. IDE- Zilog Developer Studio II.
2. If not already installed, install the VCOM USB driver included with the ZMOTIONL400ZCOG_1.0 installation file by right-clicking on the .exe file and selecting **Run as administrator**. This driver is located in the Drivers folder.
   - Zilog_VCOM_Install.x64.exe: 64-bit Windows
   - Zilog_VCOM_Install.x86.exe: 32-bit Windows
   - The Device Driver will be installed as (Zilog USB Serial Device) in Device Manager under Ports (COM & LPT)

Connect ZMOTIONL400 Dev Board and PC

Observe the following procedure to connect the ZMOTIONL400 Development Board to your PC. We will use the ZM_NP_Command project for this example.

Caution: Disconnect or turn off the power to the ZMOTIONL400 Development Board before connecting or disconnecting the Encore! SmartCable or the USB Smart Cable.

1. Ensure that the NP Current Jumper is installed on J9. It should be installed across the centre two pins, as shown in the following figure.

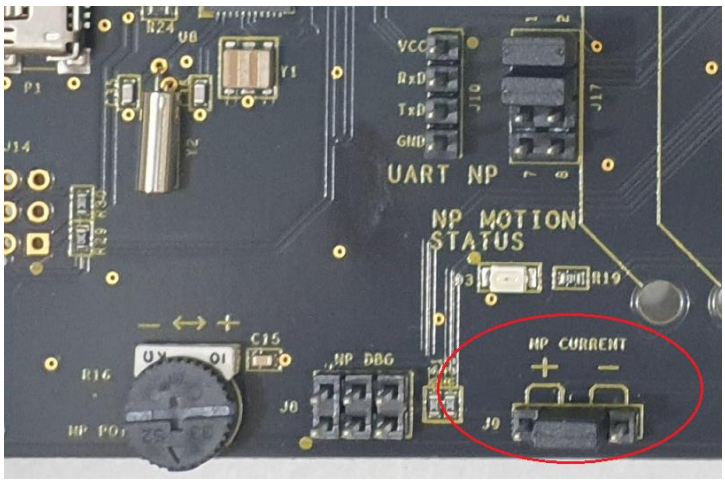


Figure 11. NP Current Jumper Installed on J9

2. Place switch SW4 into the NP position.
3. Connect one end of the 6-circuit ribbon cable provided in your Kit to the SmartCable debugger, ensuring that the ribbon's male connector is aligned correctly with the female connector on the unit, as indicated by the red stripe in the following figure.

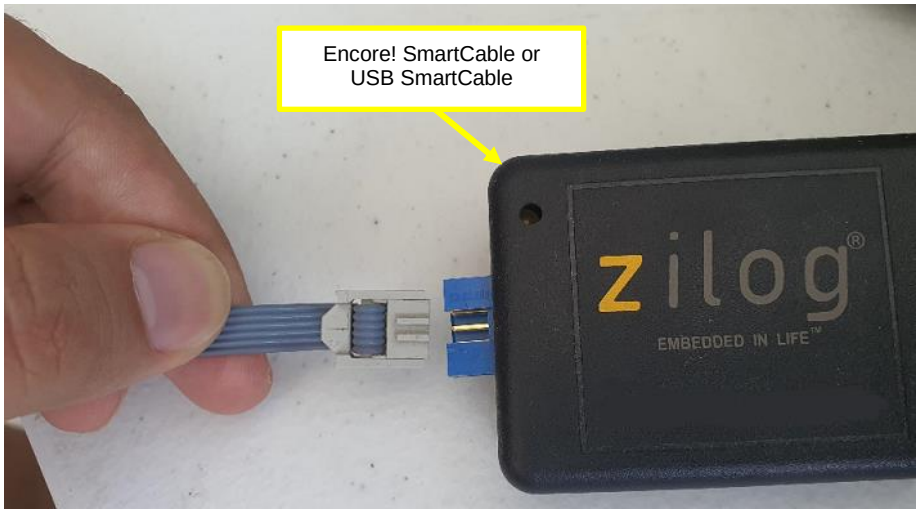


Figure 12. Connecting the 6-Circuit Ribbon Cable to the SmartCable

4. Connect the other end of the ribbon cable to NP Debug Connector J8 on the Development Board. Ensure that Pin 1 on the ribbon cable is aligned with Pin 1 on the target connector, as shown in the following figure.

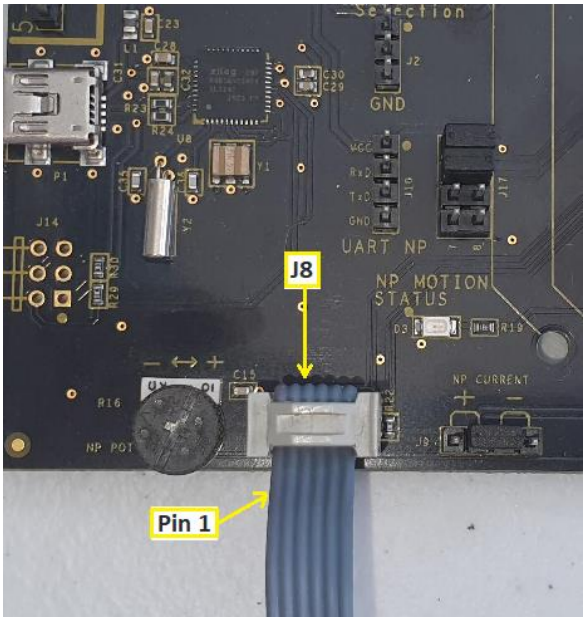


Figure 13. Connecting Ribbon Cable to NP Debug Connector J8

5. With the USB A (male) to Mini-B cable, connect Port P1 on the ZMOTIONL400 Development Board to a USB port on the development PC to apply power and provide a serial interface for the Development Board. Refer to the following figure.

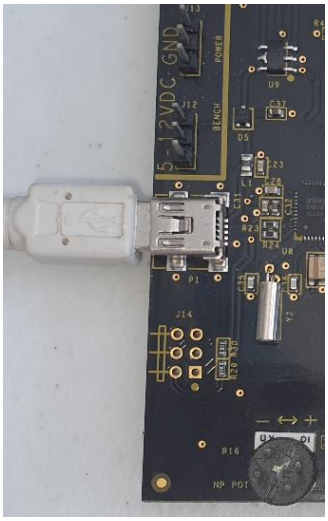


Figure 14. Mini-USB Cable connection to ZMOTIONL400 Development Board

6. Open a serial terminal application like Teraterm, CoolTerm, or RealTerm and connect to the Zilog USB Serial Device at 57,600 bps, No Parity, 1 Stop bit. The USB serial port from the will be identified as USBSER000 (000 is the port instance) in the terminal application. If needed, open **Device Manager** and look under **Ports (COM & LPT)** to identify the COM port assigned to the Zilog USB Serial Device connected to the ZMOTIONL400 Development Board.
7. Start ZDS II and open the NP Serial Command project (ZM_NP_Command.zdsproj). This can be done by starting ZDS II and opening the project by clicking **File → Open Project** from the menu or by navigating to the folder in Windows File Explorer and double-clicking the project file located in:

   ```
   ZMOTIONL400ZCOG_x.x\Z8F3224 ZMOTION Library\Sample
   Applications\ZMOTION_3224_NP_Command_Rx_x
   ```

   The Rx_x suffix indicates the project revision.

   Four projects are provided. The projects share the same source code:

Project	Device Package	Bootloader
ZM_NP_Command_32.zdsproj	32-QFN	No
ZM_NP_Command_44.zdsproj	44-QFN	No
ZM_NP_Command_BL_32.zdsproj	32-QFN	Yes
ZM_NP_Command_BL_44.zdsproj	44-QFN	Yes

Table 8. NP_Command Project Options

Note: When using the project with Bootloader, care must be taken not to set Breakpoints in the application code area when starting the application. Setting a Breakpoint modifies the Flash memory location to a Break instruction which will cause the Bootloader's checksum test performed after reset to fail.

8. If using an Encore! SmartCable, set your Target VDD to “By External Source”
9. If the Debug icons are not displayed, as in the following figure, right-click in the empty grey area under the icons and select **Debug** and **Workbook Mode**.

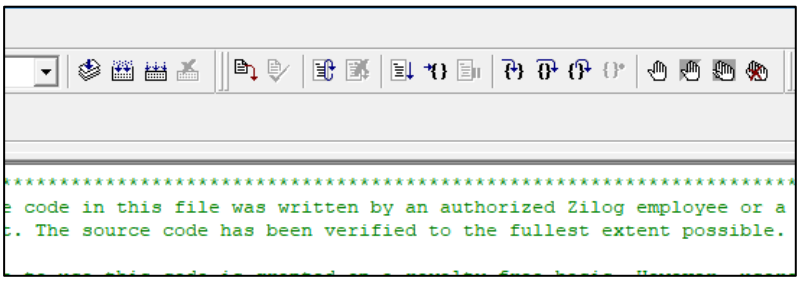


Figure 15. Debug Icons

10. Hover the mouse over each icon to display its function. Click the Rebuild All icon. ZDS II will build the project using the current versions of all source files and generate the necessary output files. If there were no errors detected during the build, a message similar to the one in the following figure will be displayed.

```
Space                    Base          Top         Size       Used     Unused
------------------- ---------- ---------- ---------- ---------- ----------
EDATA                  E:0100     E:0467       D00H       368H       998H
                                                (     3328        872       2456)
RDATA                    R:30       R:8C        C0H        5DH        63H
                                                (      192         93         99)
ROM                    C:0000     C:3FED      8000H      3FEEH      4012H
                                                (    32768      16366      16402)

OUTPUT CHECKSUM
===============
ZM_NP_Command_44_Pin.hex 87F2
ZM_NP_Command_44_Pin.lod 87F2

0 warning(s)
0 error(s)
Build succeeded.
```

Figure 16. Build Succeeded Message

11. Click the **Go** icon. ZDS II will connect to the target MCU through the Encore! SmartCable or USB SmartCable, download the project to its Flash memory, reset the MCU, and start running the application. A message similar to the one shown in the following figure is displayed.

```
Connected to target ZMOTIONL400ZCOG
Starting debug session [project:ZM_NP_Command_44, configuration:ZM_NP_COMMAND]...
Cpu Z8F3224xN_2258 Rev AC,
Encore! SmartCable FW v1.0, DFU Boot Loader v1.0
SN #2102180001
Loading file C:\From T440 Laptop\Projects2\ZMOTIONL400ZCOG\TPT\Z8F3224 Normal Power\ZMOTION_3224_NP_Command_R
Loading file C:\From T440 Laptop\Projects2\ZMOTIONL400ZCOG\TPT\Z8F3224 Normal Power\ZMOTION_3224_NP_Command_R
Checksum(NOT including pad bytes): 0x87F2
```

Figure 17. Message Displayed upon Connecting to Target MCU

12. The red LED (D3) should start flashing 1 second on, 1 second off while the application waits for the PIR sensor to stabilize.
13. If a serial terminal application is running and connected to the Zilog USB Serial Device, the messages similar to those shown in the following figure will be displayed.

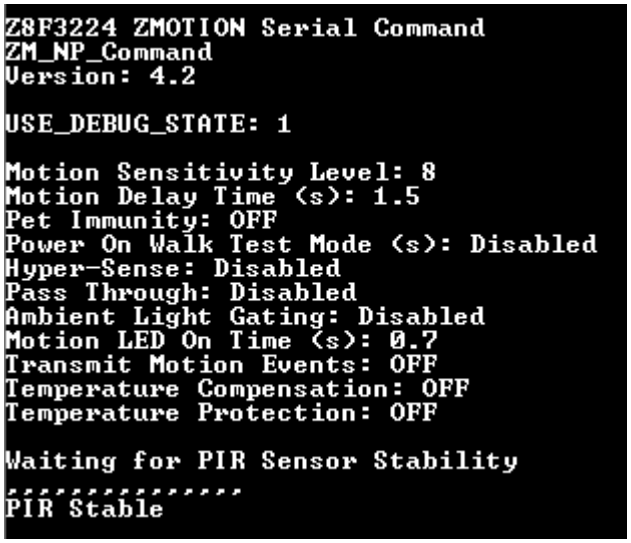


Figure 18. Messages Displayed on Tera Term Serial Capture Program

14. Each time motion is detected, the terminal will display "**Motion Detected**".
15. Other status messages are sent out the serial port. The amount of status information sent can be selected by setting USE_DEBUG_STATE to 0, 1, 2 or 3 in ProjectConfig.h.

Documentation

Additional information can be found in the following documents. These are available free for download from the Zilog website. They are also included with the ZDS II installation or the ZMOTIONL400ZCOG_1.0 installation.

Description	Document ID	Installed Location
F3224 Series Product Specification	PS0381	Documentation\Chip_Documentation
F6482 Series Product Specification	PS0294	Documentation\Chip_Documentation
eZ8 CPU User Manual	UM0128	Documentation\Chip_Documentation
Z8 Encore! Design for Debug	TN0036	Documentation\Tools_Documentation
Encore! Smart Cable User Manual	UM0294	Documentation\Tools_Documentation
USB SmartCable User Manual	UM0181	Documentation\Tools_Documentation
Opto-Isolated USB SmartCable User Manual	UM0195	Documentation\Tools_Documentation
Ethernet SmartCable User Manual	UM0207	Documentation\Tools_Documentation
Documents included in the ZMOTIONL400ZCOG_1.0 Installation		
Description	**Document ID**	**Installed Location**
Z8F3224 ZMOTION Development Kit Quick Start Guide	QS0097	Documentation
Z8F3224 ZMOTION Development Kit User Manual	UM0295	Documentation\Tools_Documentation
ZMOTION Engine Library User Manual	UM0275	Documentation
ZMOTION Product Brief	PB0258	Documentation

Table 9. Z8F3224 ZMOTION Development Kit Documentation

Appendix A

Schematic Diagrams

The schematic diagram for the Z8F3224 ZMOTION Development Board is shown in the figures on the following pages.

LP_VDD_IN
R1 100K ohm
SW1
ON-ON
SW2
R6 100K ohm
ON-ON
TAMPER 1
TAMPER 2
LP_PC0
LP_PC1
C1
1uF
LP_PB5_AMPA1OUT
LP_PB4_VREF+
LP_PB3_VREF-
LP_PC6
LP_PD3
PET
LP_PC7
LP_PD4
LP_PD5
LP_PB2
TP1
LP_PB2_AMPA0OUT
LP_PB6_AMPA1INN
LP_PB1
LP_PB5_AMPA1OUT
LP_PB5
TP3
R5
3.3M
C6
4700pF
R3
47K
C3
10uF
C2
6800pF
R2 2.2M ohm
R4
33K
C4
PET
C5 10uF
10uF
LP_PB1_AMPA0INN
U1
33 32 31 30 29 28 27 26 25 24 23
PD5/T2OUT/ESOUT2
PB5/ANA5/C1OUT/AMPA1OUT
PD4/T2IN/T2OUT/ESOUT1
PB4/VREF+
PB3/VREF-
PB2/ANA4/C0OUT/AMPA0OUT
PC7/ANA11/C1IN1N/ESOUT3
PC6/ANA10/C1IN1P/ESOUT2
PB1/ANA3/C0IN0N/AMPA0INN
PD3/ANA14
PD2/ANA13
J1
1 LP_PD3
2 LP_PC6
3 LP_PC7
4 LP_PD4
5 LP_PD5
6 LP_PB7
7 LP_PA0
8 LP_PA1
9 LP_PC0
10 LP_PC1
11 LP_PE3
12 LP_PA2
13 LP_PA3
14 LP_PC2
15 LP_PC3
16 LP_PD6
17 LP_PD7
18 LP_PA6
19 LP_PA7
20 LP_PE0
21 LP_PE1
22 LP_PE2
23 LP_PC4
24 LP_PC5
HDR/PIN 1x24
LP_PB6_AMPA1INN 34
LP_PB7 35
LP_VCORE 36
LP_VDD 37
LP_PA0 38
LP_PA1 39
40
LP_DBG 41
LP_PC0 42
LP_PC1 43
LP_PE3 44
45 EP GND
PB6/ANA6/C1IN0N/AMPA1INN/ESOUT2
PB7/ANA7/C1IN0P/AMPA1INP/ESOUT3
VCORE
VDD
PA0/T0IN/T0OUT/CLKIN
PA1/T0OUT/SCKOUT
VSS
DBG
PC0/T0IN/T0OUT/DE/MISO/SCL
PC1/T0OUT/CTS/SS/SDA
PE3/ESOUT3
Z8F3224QN
22 PD1/ANA12
21 LP_PB0_AMPA0INP
20 PB0/ANA2/C0IN0P/AMPA0INP
19 VSS
18 AVSS
17 AVDD
16 VDD
15 PD0/RESET
14 PC5/ANA9/C0IN1N
13 PC4/ANA8/C0IN1P
12 PE2/T4IN
11 PE1/T4CHD/T0OUT
10 PE0/T4CHC/T0IN/T0OUT
9 PA7/T1OUT/SDA/ANA1/VBIAS
8 PA6/T1IN/T1OUT/SCL/ANA0
7 PA5/TXD/SCK/ESOUT2
6 PA4/RXD/MOSI/ESOUT1
5 PD7/T4CHB/C0OUT
4 PD6/T4CHA
3 PC3/T2OUT/SCK/ESOUT1
2 PC2/T2IN/T2OUT/MOSI/ESOUT0
1 PA3/X2OUT/CTS/MISO/ESOUT0
PA2/X2IN/DE/CLK2IN/SS
TP2
LP_PB0
R8
470K
LP_PB0_AMPA0INP
LP_VDD
LP_PC4
LP_PA7
U4
ALS-PT19
R9
7.5K
C9
0.1uF
LP-NP
U2
LP_IN 1
NO 6
IN 5
GND
VCC
NP_IN 3
NC
COM 4
TS5A3159
SNS 2
VCC_USB
NP_IN
VCC_T
R42
2.21K
U3
ZRE200GE
D 1
S 2
GND 3
C7
0.1uF
C40
1uF
LP_PE0
LP_VCORE
C8
4.7uF
D1
RED
LP MOTION
STATUS
R10
330 ohm
D2
GREEN
LP_PE3
R13
330 ohm
LP_VDD_IN
LP_PA2
LP_PA3
LP_PC2
LP_PC3
LP_PD6
LP_PD7
LP_PA6
LP_PA7
LP_PE0
LP_TXD
LP_RXD
J16
2 4 6 8
1 3 5 7
LP_RXDU
LP_TXDU
LP_RXDB
LP_TXDB
J16 SHUNTS
1-2, 3-4 USB
5-6, 7-8 J5
LP_VDD_IN
J5
1
2
3
4
HDR 4-CKT
LP_RXDB
LP_TXDB
LP UART
LP_VDD_IN
R11
10K
R12
10K
J3
1 2
3 4
5 6
HDR/PIN 2x3
LP_-RST
LP_DBG
LP_DBG
J2
1
2
3
GND
LP_VDD_IN
LP_VDD
J4
+
1
2
3
4
−
HDR 4-CKT
C10
0.015uF
C11
1uF
C12
0.015uF
C13
1uF
C33
10uF
GND
For normal operations place SH1
on pins 2 and 3 of J4.
TO MEASURE CURRENT:
1. Remove SH1
2. Connect Ampmeter to
Pin 2 and 3 of J4
3. Polarity indicated
4. DO NOT USE DEVICES WITH
CONNECTION TO GND(EARTH)
LP-NP CONTROL, SW4

LP-NP	-NP_ON	-LP_ON	SNS CNCT
0	LOW	HIGH	NP
1	HIGH	LOW	LP

SW4 NORMAL POWER (NP)
LP_NP
LP-NP
2
1
3
R14
10K
VCC_T
4
-NP_ON
5
6
-LP_ON
DPDT
LOW POWER (LP)
Active MCU Selection

C14
1uF

NP_PB2
NP_PD2
NP_PD3
NP_PC6
NP_PC7
NP_PD4
NP_PB5
NP_PD5

NP_PB1_AMPA0INN

J6
HDR/PIN 1x30
1 NP_PB0
2 NP_PD1
3 NP_PB2
4 NP_PD2
5 NP_PD3
6 NP_PC6
7 NP_PC7
8 NP_PD4
9 NP_PB5
10 NP_PD5
11 NP_PB6_AMPA1INN
12 NP_PB7_AMPA1INP
13 NP_PA0
14 NP_PA1
15 NP_PC0
16 NP_PC1
17 NP_PE3
18 NP_PA2
19 NP_PA3
20 NP_PC2
21 NP_PC3
22 NP_PD6
23 NP_PD7
24 NP_PA6
25 NP_PA7
26 NP_PE0
27 NP_PE1
28 NP_PE2
29 NP_PC4
30 NP_PC5

U5
Z8F3224QN

33 PD5/T2OUT/ESOUT2
32 PB5/ANA5/C1OUT/AMPA1OUT
31 PD4/T2IN/T2OUT/ESOUT1
30 PB4/VREF+
29 PB3/VREF-
28 PB2/ANA4/C0OUT/AMPA0OUT
27 PC7/ANA11/C1IN1N/ESOUT3
26 PC6/ANA10/C1IN1P/ESOUT2
25 PB1/ANA3/C0IN0N/AMPA0INN
24 PD3/ANA14
23 PD2/ANA13

NP_PB6_AMPA1INN 34 PB6/ANA6/C1IN0N/AMPA1INN/ESOUT2
NP_PB7_AMPA1INP 35 PB7/ANA7/C1IN0P/AMPA1INP/ESOUT3
NP_VCORE 36 VCORE
NP_VDD 37 VDD
NP_PA0 38 PA0/T0IN/T0OUT/CLKIN
NP_PA1 39 PA1/T0OUT/SCKOUT
40 VSS
NP_DBG 41 DBG
NP_PC0 42 PC0/T0IN/T0OUT/DE/MISO/SCL
NP_PC1 43 PC1/T0OUT/CTS/SS/SDA
NP_PE3 44 PE3/ESOUT3
45 EP GND

22 PD1/ANA12 NP_PD1
21 PB0/ANA2/C0IN0P/AMPA0INP NP_PB0
20 VSS
19 AVSS
18 AVDD NP_VDD
17 VDD NP_-RST
16 PD0/RESET NP_PC5
15 PC5/ANA9/C0IN1N
14 PC4/ANA8/C0IN1P NP_PC4
13 PE2/T4IN NP_PE2
12 PE1/T4CHD/T0OUT NP_PE1

1 PA2/X2IN/DE/CLK2IN/SS
2 PA3/X2OUT/CTS/MISO/ESOUT0
3 PC2/T2IN/T2OUT/MOSI/ESOUT0
4 PC3/T2OUT/SCK/ESOUT1
5 PD6/T4CHA
6 PD7/T4CHB/C0OUT
7 PA4/RXD/MOSI/ESOUT1
8 PA5/TXD/SCK/ESOUT2
9 PA6/T1IN/T1OUT/SCL/ANA0
10 PA7/T1OUT/SDA/ANA1/VBIAS
11 PE0/T4CHC/T0IN/T0OUT

NP_PA2
NP_PA3
NP_PC2
NP_PC3
NP_PD6
NP_PD7
NP_PA6
NP_PA7
NP_PE0

NP_TXD
NP_RXD

J17 SHUNTS
1-2, 3-4 USB
5-6, 7-8 J10

J17
HDR/PIN 2x4
2 4 6 8
1 3 5 7
NP_RXDU
NP_TXDU
NP_TXDB
NP_RXDB

C16
10uF
R18
47K
C41
4700pF
TP4
NP_IN
NP_IN

NP_PC5
ALS_TH (ANA3)
NP_VDD_IN
C15
0.1uF
R16
25K

NP_VDD_IN
U6
ALS-PT19
R20
7.5K
C18
0.1uF

NP_PB7_AMPA1INP
R19
330 ohm
D3
RED
NP MOTION
STATUS

J7
GND
NP_VCORE
C17
4.7uF

NP_VDD_IN
J8
HDR/PIN 2x3
R21
10K
R22
10K
NP_-RST
NP_DBG
NP_-RST
DBG

NP_VDD_IN
J9
HDR 4-CKT
NP_VDD
+
-
C19
0.015uF
C20
1uF
GND
C21
0.015uF
C22
1uF
C34
10uF

For normal operation place SH2 on
pins 2 and 3 of J9

TO MEASURE CURRENT:
1. Remove SH2
2. Connect Ampmeter to Pin 1 and 4 of J9
3. Polarity indicated
4. DO NOT USE DEVICES WITH
CONNECTION TO GND(EARTH)

NP_VDD_IN
J10
HDR 4-CKT
VCC
RxD
TxD
GND
NP_RXDB
NP_TXDB
UART NP

D4
GREEN
POWER
R25
330 ohm
VCC_USB
P1
USB, mini B
L1 FERRITE BEAD
R23 27
R24 27
C23
0.01uF
USB_DM
USB_DP
D5
PMEG3020
VCC
C37
1uF
J12
5-12 VDC
BENCH POWER
J13
GND
C28
4.7uF
VCC_USB
Y1
16MHZ
U8
Z8F6481QN
PE2/T4IN
VCORE
AVDD
VDD
PA0/T0IN/T0OUT-/CLKIN/XIN
PA1/T0OUT/XOUT
VSS
AVSS
PD7/C0OUT
PE1/DM/T0OUT
PE0/DP/T0IN/T0OUT-
EP
GND
PE6/T4CHD/ESOUT3
PE5/T4CHC/ESOUT2
PB3/VREF-
PB4/VREF+
PB2/ANA2/AMPAINP
PB1/ANA1/AMPAINN
PB0/ANA0/AMPAOUT
PD1/C1INN/AMPBINN/ANA7
PD2/C1INP/AMPBINP/ANA6
PC3/MISO0/ANA11/DAC
PC2/ANA3/SS0-
PC1/ANA5/C0INN/MISO0
PC0/ANA4/VBIAS/C0INP
PE4/T4CHB/ESOUT1
VSS
PD3/C1OUT/AMPBOUT/ANA8
DBG
PD0/RESET
VDD
PC7/T2OUT/CTS1-/ESOUT1
PC6/T2IN/T2OUT-/SCKOUT/ESOUT0
PD4/RXD1
PA2/DE0/CLK2IN/X2IN
PA3/CTS0-/X2OUT
PE3/T4CHA/ESOUT0
PD6/DE1
PA4/RXD0/MOSI0
PA5/TXD0/SCK0
PD5/TXD1
PA6/T1IN/T1OUT-/SCL
PC4/MOSI0/T0IN/T0OUT-/SCL/DE0
PC5/SCK0/T0OUT/SDA/CTS0-
PA7/T1OUT/SDA
LP_NP
GND
U_DBG
U_-RST
NP_TXDU
C35
18pF
C36
18pF
Y2
32.768KHZ
NP_RXDU
LP_RXDU
LP_TXDU
C29
0.015uF
C30
1uF
C31
0.015uF
C32
1uF
GND
VCC_USB
U9
IXD1216C
VIN
VOUT
GND
VOFB
CE
U11
R40
6.49K
R41
10K
C39
4.7uF
C38
0.1uF
J15
VCC_USB
J11
VCC_T
2V - 3.3V
R34
1K
25K
R33
R35
40.2K
C24
4.7uF
C25
0.1uF
R38
10K
U10
FPF2302MX
GND
FLTA
IN
OUTA
ONA
OUTB
ONB
FLTB
LP_VDD_IN
NP_VDD_IN
R36
10K
R37
10K
R39
10K
-LP_ON
-NP_ON
J14
DBG
R29
10K
R30
10K
U_-RST
U_DBG

Appendix B

IDE-Zilog Developer Studio II

Observe the following steps to download and install the ZDS II software package.

Note: If you have already installed ZDS II – Z8 Encore! Version 5.6.0 or later and have downloaded the sample applications and documentation by following the procedure on the paper insert in your kit (FL0198), you're ready for Appendix D. Installing the Encore! SmartCable Driver or Appendix C. Installing the USB SmartCable Driver

---

1. Prior to connecting the Z8F3224 ZMOTION Development Board to your development PC, download ZDS II for Z8 Encore! v5.6.0 (or later) from the Zilog website.
    - Select the most recent version of ZDS II – Z8 Encore!
2. When your download is complete, double-click the installation file named `ZDS2_Z8Encore!<version>.exe`, and follow the on-screen instructions.

Supported Operating Systems

ZDS-II is supported for the following operating systems:

- Microsoft Windows 10 (32-bit/64-bit)
- Microsoft Windows 8 (32-bit/64-bit)
- Microsoft Windows 7 (32-bit/64-bit)

Appendix C

Installing the USB SmartCable Driver

1. Connect the USB Smart Cable to the host PC. A Windows message appears, stating *Driver Software Installation*.
2. Windows automatically searches for the driver. This process can take a while to complete. However, because there is no option to terminate this process immediately, Zilog advises waiting for the search to complete. If the driver was previously installed on your system, Windows automatically installs the USB Smart Cable driver. If this is the case, skip ahead to Step 8. If the driver was not found, close the Search dialog and proceed to Step 3.
3. Go to the Windows Start menu and, in the Search programs and files field, enter Device Manager. The Windows Device Manager should appear in the list of returned items in your search; click this item to launch the Device Manager.
4. A selection label as **Other devices** should appear in the list of hardware devices currently running in the Device Manager. Click the arrow to the left of Other Devices to display these additional devices.
5. Right-click USB Smart Cable to select Update Driver Software, which will display the Update Driver Software - USB Smart Cable dialog.
6. Select the Browse my computer for driver software option in this dialog, then browse to one of the following driver directories:

   32-bit systems:

   <ZDS II Installation Directory>\device drivers\USB\x32

   64-bit systems:

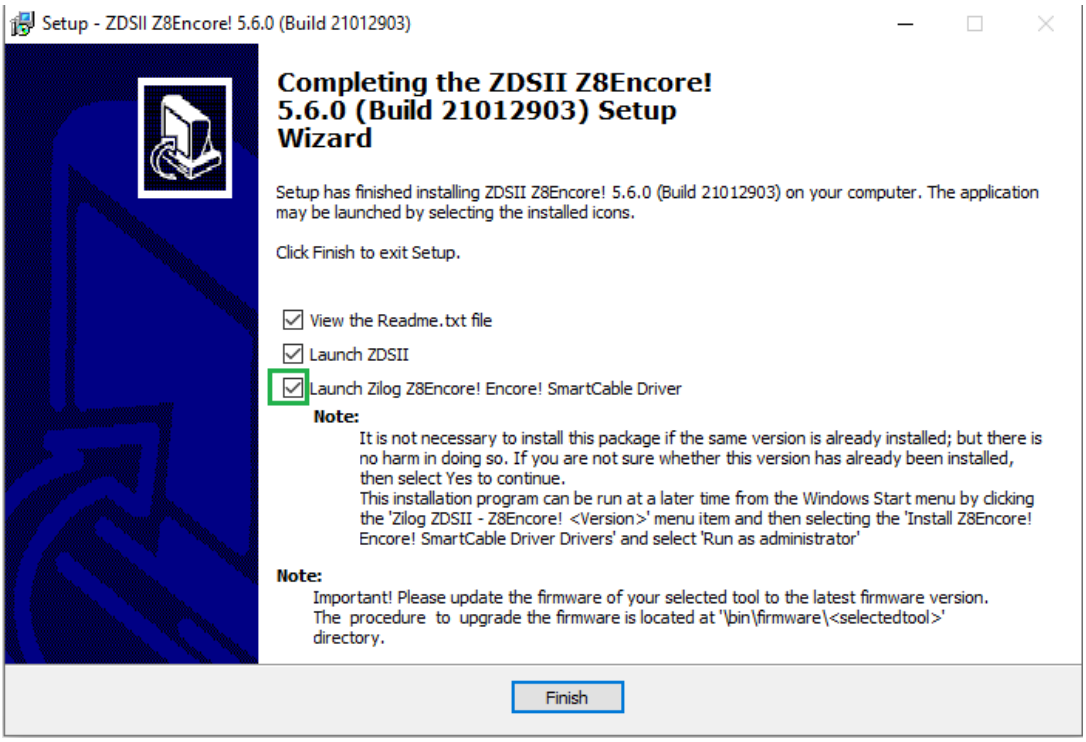
   <ZDS II Installation Directory>\device drivers\USB\x64

7. Click Next to install the driver. In 32-bit systems, the Windows Security dialog will appear: click Install this driver software anyway.
8. Click Close after the Wizard finishes the installation.

Appendix D

Installing the Encore! SmartCable Driver

Note: You might have done the driver installation on ZDSII – Z8 Encore! 5.6.0 installation, when the check box is selected on below screen shot and clicked **Finish**. If so, you don't need to do the following below steps, but there is no harm proceeding



1. Navigate to Start >All Programs >ZiLOG ZDSII – Z8 Encore! 5.6.0
2. Right click on Install Encore! SmartCable Driver and select Run as administrator
3. Click on **Yes** button on the User Account Control prompt that appears
4. Click on **Yes** button on the Encore! SmartCable Driver Installation prompt to install the driver software
5. Select **Next** button that appears
6. Select the **Finish** button

Revision History

Each instance in this document's revision history reflects a change from its previous edition. For more details, refer to the corresponding page(s) or appropriate links furnished in the table below.

Date	Revision Level	Description	Page
March 2021	01	Original issue.	All

Customer Support

To share comments, get your technical questions answered, or report issues you may be experiencing with our products, please visit Zilog's Technical Support page at support.zilog.com.

To learn more about this product, find additional documentation, or to discover other facets about Zilog product offerings, please visit the Zilog Knowledge Base.

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