



## ZMOTION PIR Motion Detection Solutions

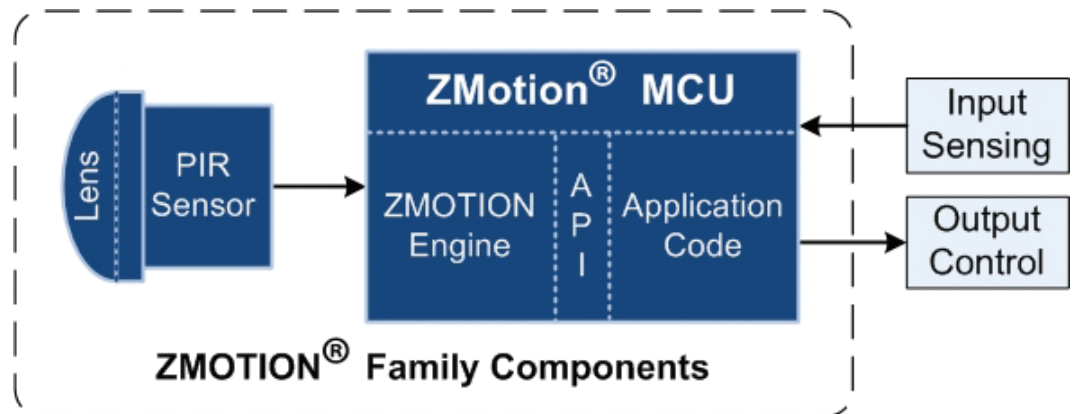
ZMOTION is a unique Microcontroller plus Software solution that greatly simplifies the task of adding motion sensing to many applications.

The ZMOTION family solution consists of the **ZMOTION Microcontroller**, the **ZMOTION Software Engine** and a selection of **Lenses** and **Pyro-Electric Sensors** all tuned to work together in a simple and flexible manner.

ZMOTION delivers a significant performance improvement over traditional PIR motion sensing solutions while reducing system component count, design complexity, and development risk.

### APPLICATIONS

- Intrusion
- Lighting Control
- Thermostats
- Access Control
- Vending
- Video Doorbells
- Smart Displays
- Proximity
- Power Management
- IP Cameras
- Occupancy Sensing
- Outdoor Detection
- IoT Sensors
- Multi-Sensor/Multi-Zone Detection



In addition to motion detection, the ZMOTION microcontroller can be used to perform additional functions such as input sensing, output control, and handling other tasks as required by the application.

The ZMOTION Engine is provided either preprogrammed in the MCU (Z8FS040/Z8FS021) or as a software library (Z8F1681/Z8F6481) and is compatible with applications requiring:

- Pet Immunity
- Low Power operation
- White Light Immunity
- Multiple PIR Sensors and multi-zone detection
- Real Time Configuration and OTA Updates
- High EMI and ESD Immunity

**ZMOTION provides the best possible performance while significantly reducing development effort, design risk, and time to market**

## The ZMOTION Engine & API

The ZMOTION Engine provides an integrated and flexible solution for Passive Infrared (PIR)-based motion detection applications. The ZMOTION Engine performs the essential PIR sensor signal processing plus additional functions such as White Light Detection and EMI Immunity.

An Application Programming Interface (API) allows the application code to configure, control, and monitor the ZMOTION Engine in real time. This allows designers to create their own application-specific software while taking advantage of Zilog's ZMOTION Motion Detection Technology.

Contact Zilog for hardware design examples and reference software, including a Serial Command interface.

## The ZMOTION MCU

ZMOTION microcontrollers are optimized for sensor applications. The application code monitors the ZMOTION Engine in real time through an API and performs other MCU functions as required by the application:

### ADVANTAGES

- Real time control of Motion Detection parameters
- Independent control of Major Motion and Minor Motion detection performance
- Pet Immunity Configuration
- Sensitivity and Range Control
- Directional Control and Status
- PIR Stability
- Frequency Response Control
- Pulse Mode and Control
- Single/Dual/Triple Pyro support
- Lens Configuration Parameters
- Low Power Modes
- White Light Detection Settings

- Switch Inputs
- TRIAC/relay control
- PWM generation
- Serial Communications (I2C, SPI, UART)
- Ambient light sensing
- Serial or RF communication protocols
- Additional sensor inputs
- DALI/DSI/DMX/1-10V control
- Real time control of motion sensitivity and Engine operation

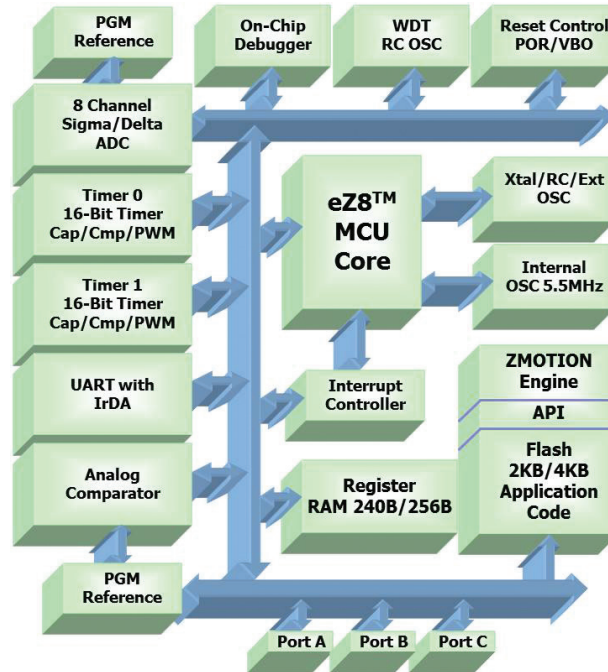
ZMOTION MCU Part Number	Package	Memory	Application Examples	Typical Power Consumption	ZMOTION Engine
Z8FS021AHH20EG	20-SSOP	2KB Flash 240 Bytes RAM	Externally Powered Indoor/Outdoor Applications Security/Intrusion Detectors, Access Control	5mA to 9mA	Pre-Programmed with ZMOTION Engine. Includes White Light Immunity
Z8FS040BSB20EG	8-SOIC	4KB Flash 256 Bytes RAM	Externally Powered Indoor/Outdoor Applications Lighting Control, General Purpose Motion Detection	1mA to 9mA	Pre-Programmed with ZMOTION Engine
Z8FS040BHH20EG	20-SSOP				
Z8F1681QK024XK2247	32-QFN	16KB Flash 2KB RAM	Battery Operated or Externally Powered Indoor/Outdoor Applications - Security/Intrusion, General Purpose, Intelligent Lighting Control (DALI, DSI, DMX), IP Cameras, Video Doorbells	<15uA - Low Power Detection 1mA - Normal Detection	ZMOTION Engine provided as S/W Library
Z8F1681QN024XK2247	44-QFN				
Z8F1681AN024XK2247	44-LQFP				
Z8F6481QN024XK2247	44-QFN	64KB Flash 3.75KB RAM	Multi-Zone Indoor/Outdoor Detector Up to 3 PIR sensors per MCU Applications - Security/Intrusion, General Purpose, Intelligent Lighting Control (DALI, DSI, DMX), IP Cameras, Video Doorbells, OTA firmware updates	<15uA - Low Power Detection 1mA - Normal Detection 3mA running 3 PIR sensors	ZMOTION Engine provided as S/W Library
Z8F6481AN024XK2247	44-LQFP				

**FEATURES**

- 4KB/2KB Flash and 256/240 Bytes of RAM available for user application code
- Integrated ZMOTION Engine performs all motion detection functions
- Z8FS021 includes White Detection and Immunity functions for intrusion applications
- All Engine parameters including sensitivity can be controlled in real time
- On-chip Debug interface for application code development
- Two 16-Bit multi-function timers with PWM outputs
- Analog Comparator with internal programmable voltage reference
- Internal 5.54MHz oscillator
- Up to 7 ADC channels and analog comparator
- Full Duplex UART
- 2.7V to 3.6V operation @ -40C to +105C

## Z8FS040/Z8FS021 MCU

The Z8FS040 and Z8FS021 ZMOTION MCUs provide all the features necessary for simple lighting control and intrusion applications.

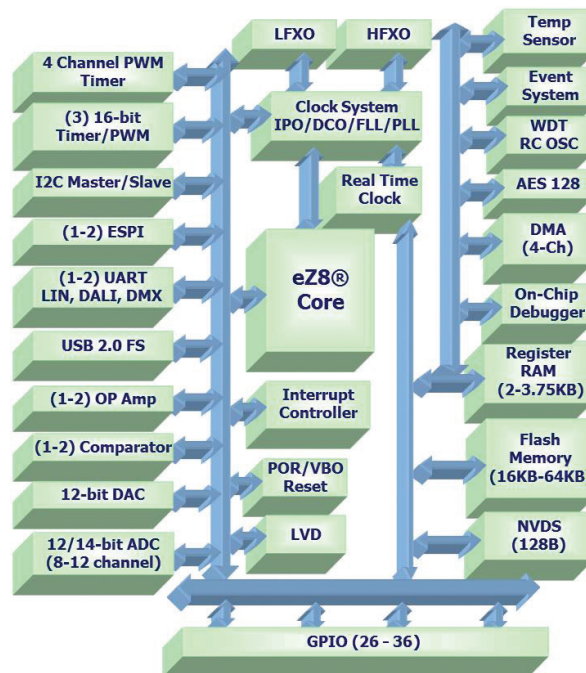


**FEATURES**

- 64KB/16KB Flash and 3.75KB /2KB RAM available for user application code and Engine
- ZMOTION Engine Library performs all motion detection functions
- All Engine parameters including sensitivity can be controlled in real time
- Three 16-Bit multi-function timers with PWM outputs
- Four channel PWM timer
- Real Time Clock
- Up to 12 ADC channels (12/14-bit)
- 12-bit DAC
- 2 Op Amps and 2 analog comparators with internal programmable voltage reference system
- 2 Full Duplex UART's with LIN, DALI and DMX
- SPI and I2C
- USB (Full Speed) with 8 End Points
- AES Encryption Block
- 1.8V to 3.6V operation @ -40C to +85C

## Z8F6481/Z81681 MCU

The Z8F6481 and Z8F1681 ZMOTION MCUs provide all the features necessary for advanced motion sensing applications.



## ZMOTION General Purpose Lenses

### ADVANTAGES

- Multiple mounting styles
- Lens detection patterns and ranges to match the application requirements
- ZMOTION can support other lens types

The ZMOTION Family includes a wide selection of general purpose PIR lenses providing the flexibility to choose the most suitable lens for the application. Several mounting options are provided for virtually any occupancy sensing application including:




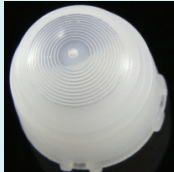

- PIR Sensor Clip-on
- PCB Mount
- 360° Circular
- Curved/Flat

API settings are provided to match the ZMOTION Engine operation to each lens, ensuring the best possible performance while significantly reducing development risk and time.

The ZMOTION Engine has the flexibility to support lenses other than those listed here.


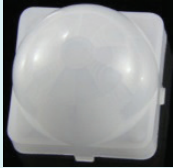
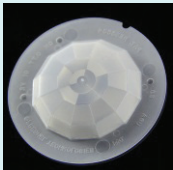
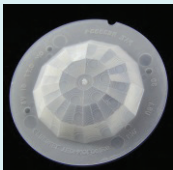



### PIR SENSOR CLIP-ON

- Clips directly on to PIR sensor ensuring correct focal length than centering
- Simple mounting method does not require special enclosure design
- 9mm and 15mm types
- Wall mount and ceiling mount types
- Excellent for lighting and other general purpose applications

Lens	Description	Typical Applications
 <p><b>ZNCL10IL</b></p>	<p>9mm Wall Mount Array (80°x30°) Clips on to pyroelectric sensor 6 beams (X); 2 beams (Y) 7m range</p>	<p><b>Wall mount for power management</b></p> <ul style="list-style-type: none"> <li>• Proximity or entrance detection</li> <li>• Kiosks</li> <li>• Vending</li> <li>• Product displays</li> </ul>
 <p><b>ZNCL3B</b></p>	<p>9mm Wall/Ceiling Mount Array (60°x60°) Clips on to pyro-electric sensor 4 beams (X); 2 beams (Y) 3m range</p>	<p><b>Proximity or entrance detection</b></p> <ul style="list-style-type: none"> <li>• Kiosk/Display counters</li> <li>• Vending</li> <li>• HVAC</li> </ul>
 <p><b>ZNCL10R</b></p>	<p>9mm Wall/Ceiling Mount Array (circular 360°) Clips on to pyro-electric sensor 90° Cone 14 zones with dual pyro 5m range</p>	<p><b>Room Occupancy and Proximity Sensing</b></p> <ul style="list-style-type: none"> <li>• Lighting and HVAC control</li> <li>• Kiosk/Display control</li> <li>• Vending/Appliance power management</li> <li>• Product displays</li> </ul>
 <p><b>ZNCL10S</b></p>	<p>9mm Wall/Ceiling Mount Array (7°x7°) Clips on to pyro-electric sensor 2 beams (X); 1 beam (Y) 12m range</p>	<p><b>Barrier or entrance detection</b></p> <ul style="list-style-type: none"> <li>• Kiosk/Display Counters</li> <li>• Vending</li> <li>• HVAC</li> <li>• Directional detection</li> </ul>
 <p><b>ZNCL926</b></p>	<p>Clip-on 15mm Array (360°) 26 Segments 5m height, 2.1:1 Floor diameter to height ratio</p>	<p><b>Room Occupancy and Proximity Sensing</b></p> <ul style="list-style-type: none"> <li>• Lighting and HVAC Control</li> <li>• Kiosk/Display Control</li> <li>• Vending/Appliance Power Management</li> </ul>

**PCB MOUNT**

- Clips in to PCB ensuring correct focal length and centering
- Simple mounting method does not require special enclosure design

Lens	Description	Typical Applications
<p><b>ZNCL11</b></p> 	<p>Wall/Ceiling Mount Array 104°(X), 37°(Y) Circuit board mount Black rectangular lens with flat front 32 detection zones 4 meter range</p>	<p><i>Wall or ceiling mount for power management</i></p> <ul style="list-style-type: none"> <li>• Room occupancy sensing</li> <li>• Appliance power management</li> <li>• Display/keypad power management</li> <li>• TV auto shut-off</li> </ul>
<p><b>ZCWM05GIV1</b></p> 	<p>Ceiling/Wall Mount Array (180°) Circular lens with 24mm square base Board mount clip-in 9m height/range</p>	<p><i>Wall or ceiling mount for office or meeting rooms</i></p> <ul style="list-style-type: none"> <li>• Mid Bay Lighting Control</li> <li>• Room Lighting Control</li> <li>• Local HVAC Control</li> </ul>
<p><b>ZCM077GIV2</b></p> 	<p>Ceiling Mount Array (360°) 37mm diameter circular, 19.6mm focal 3.7m height, 4:1 floor diameter to height ratio</p>	<p><i>Ceiling Mount for large coverage areas</i></p> <ul style="list-style-type: none"> <li>• Parking garages</li> <li>• Large indoor areas</li> <li>• Low ceilings</li> </ul>
<p><b>ZCM077GIV3</b></p> 	<p>Ceiling Mount Array (360°) 37mm diameter circular, 19.6mm focal 3.7m height, 3:1 floor diameter to height ratio</p>	<p><i>Ceiling Mount for standard commercial heights</i></p> <ul style="list-style-type: none"> <li>• Lighting and HVAC Control</li> <li>• Meeting rooms</li> <li>• Office space</li> </ul>
<p><b>ZCM077GIV5</b></p> 	<p>Ceiling Mount Array (360°) 37mm diameter circular lens, 19.6mm focal 12.2m height, 2:1 floor diameter to height ratio</p>	<p><i>High Ceiling mount for commercial and industrial applications</i></p> <ul style="list-style-type: none"> <li>• Commercial Lighting Control (Mid bay)</li> <li>• Commercial HVAC Control</li> <li>• Warehouse lighting</li> </ul>
<p><b>ZEWA03GIV2</b></p> 	<p>Extra Wide Angle (180°) Flat Lens 14mm x 28mm Flat Fresnel 7.6mm Focal Length 5 Meter Range, 16 equal segments</p>	<p><i>Room Occupancy/Entrance Sensing</i></p> <ul style="list-style-type: none"> <li>• Wall mount lighting Control</li> <li>• Light switch replacements</li> <li>• Intelligent thermostats</li> <li>• HVAC</li> </ul>
<p><b>ZAA09GIT1</b></p> 	<p>Long Range (88°) 35.6mm x 49.9mm Flat Fresnel 22.9mm Focal Length 25 Meter Range, 22 equal segments</p>	<p><i>Corner wall mount or very high ceiling with rectangular floor pattern</i></p> <ul style="list-style-type: none"> <li>• Warehouse Lighting (Bay Light)</li> <li>• Combined Intrusion and Lighting Control</li> <li>• Local HVAC Control</li> </ul>

**360° CIRCULAR**

- Excellent for ceiling mount applications
- 2:1 to 4:1 floor to height ratio
- Lenses are interchangeable

**CURVED/FLAT - LIGHTING CONTROL**

- Large coverage area
- Can be used as ceiling mount with rectangular floor pattern

## ZMOTION Security/Intrusion Lenses

The following lenses are intended for security and intrusion applications.

### CURVED/FLAT - SECURITY

- Lens patterns optimized for Intrusion/Security applications

Lens	Description	Typical Applications
<p>ZWA12GI12V4</p> 	<p>Wide Angle Array (88°) 18m Range 1.2" Focal Length</p>	<ul style="list-style-type: none"> <li>• 18m wide area Intrusion detector</li> </ul>
<p>ZWP12GI12V1</p> 	<p>Vertical Barrier Array 15m x 7m Curtain 1.2" Focal Length</p>	<ul style="list-style-type: none"> <li>• Wall or ceiling mount curtain or vertical barrier intrusion detector</li> </ul>
<p>ZLR12GI12V3</p> 	<p>Long Range Array 30m Range 1.2" Focal Length</p>	<ul style="list-style-type: none"> <li>• Wall mount long rang corridor/hall way 30m Intrusion detector</li> </ul>

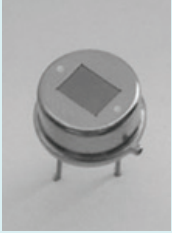
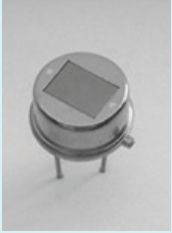
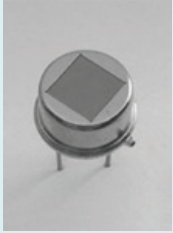
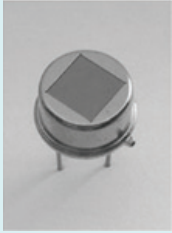
## ZMOTION PIR Sensors

The ZMOTION Family includes a selection of pyro-electric sensors validated to operate well with the ZMOTION MCUs and Lenses.

Dual Element sensors are ideal for wall mount lenses while the quad element sensor can optimize the performance of 360° lenses and improve walk-up detection for wall-mount applications.

### ADVANTAGES

- Suitable for general purpose or Security/Intrusion applications
- EMI compensated PIR sensors for wireless applications

ZRE200GE	ZSBG323671 ZSBG323611PP	ZSBG446671	ZSFG469711
 <p>Basic Dual Element</p>	 <p>EMC Compensated Dual Element (ZSBG323671) and EMC Compensated Dual Element with Common Polarity (ZSBG323611PP)</p>	 <p>EMC Compensated Quad Element</p>	 <p>EMC Compensated Circular Dual Element</p>

## Development Support

To simplify your design process, Zilog provides development kits, reference designs, sample applications, and full technical support from concept to production.

Zilog Application Engineers have extensive experience with PIR motion sensing applications.

## ZMOTION Development Kits

Everything you need to evaluate and begin development of your ZMOTION project.



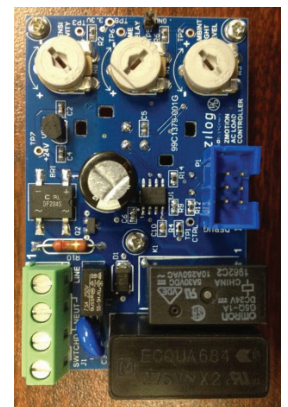
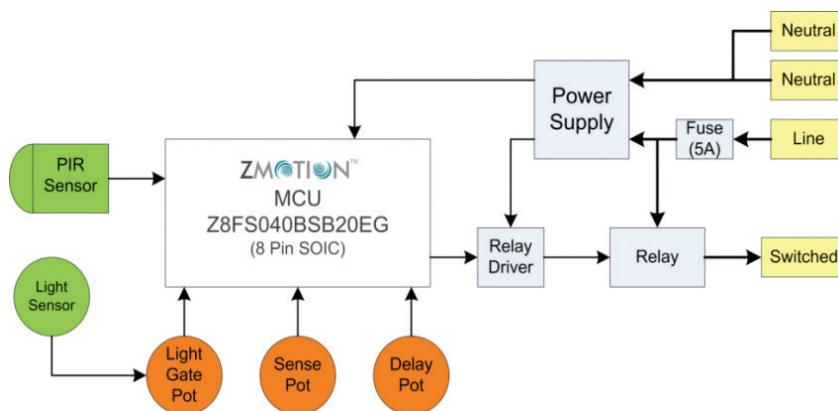
- Development board with ZMOTION MCU programmed with sample S/W
- 3 additional PIR Sensors and 9 Lenses with holders
- USB Smart Cable (Debugger/Programmer)
- ZDS-II (IDE including C-Compiler & Debugger)
- Sample applications
- ZMOTIONL100ZCOG - 8 Pin MCU (Z8FS040)
- ZMOTIONL200ZCOG - 20 Pin MCU (Z8FS040)
- ZMOTIONL300ZCOG - (Z8F6481 + Library)

## ZMOTION Reference Designs

Zilog offers several reference designs to help speed your evaluation and design process. Each reference design comes with schematics, BOMs, layout files, and software.

### ZMOTION AC Load Controller Reference Design - RD10027

The ZMOTION AC Load Controller Reference Design provides an example of how to use the ZMOTION MCU in a Motion Detector to control power to an AC load such as Lighting Systems or HVAC equipment. The design uses the Z8FS040 8-pin ZMOTION MCU to control a mechanical relay and provides user adjustments for motion sensitivity, delay time and ambient light level. Several other unique features such as Pass-through mode for small rooms & offices and Delayed Detection for harsh environments are also included.

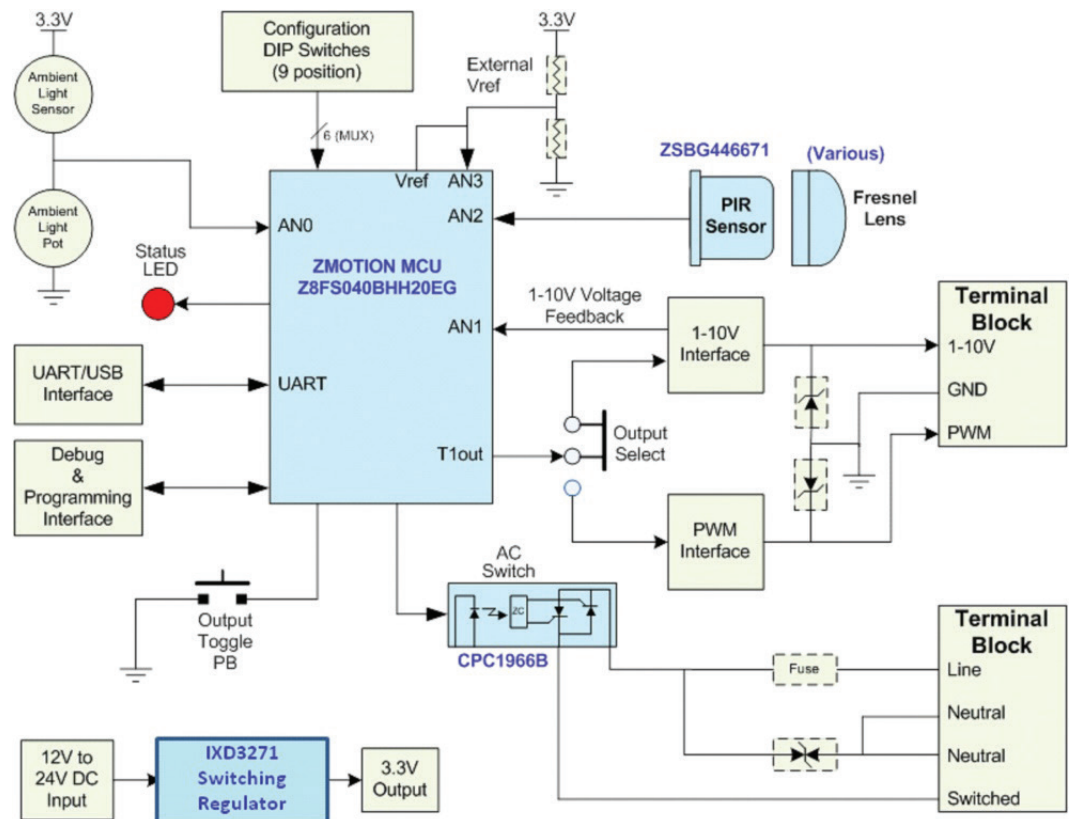
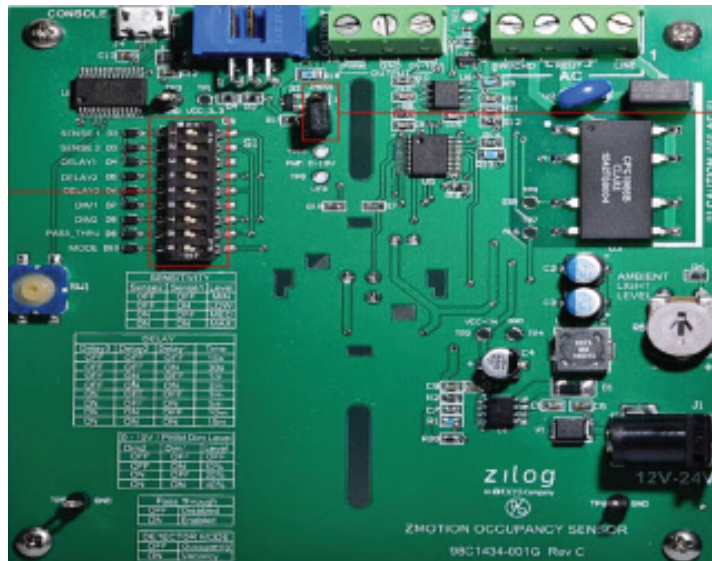


### ZMOTION Occupancy Sensor Reference Design – RD10035

The ZMOTION Occupancy Sensor Reference Design demonstrates the use of Zilog’s Z8FS040 ZMOTION microcontroller as a passive infrared (PIR) sensor based motion detector for controlling lighting systems. It can operate in two modes – Occupancy Mode and Vacancy Mode. Both modes provide PWM and 1–10 V interfaces to control dimmable lighting ballasts. These ballasts typically drive fluorescent/compact fluorescent (CFL), High Intensity Discharge (HID), or High Power LED lighting.

#### KEY FEATURES

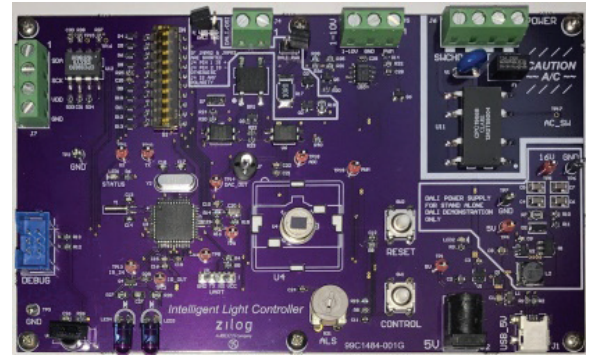
- Uses the ZMOTION MCU (part number Z8FS040BHH20EG) to perform all motion detection and output control
- 1–10V output with voltage feedback and fault detection (can support up to 25 ballasts)
- PWM output
- AC switch supporting 3 A/220 VAC load
- Ambient light sensor with light gate adjustment
- Occupancy and Vacancy modes
- Pass Through and Hyper Sense detection
- Programmable output level for unoccupied state
- Dimming control of light output level
- LED indicator (for motion detection and external wiring fault detection)
- Push button to toggle light output (manual override)
- 9-position DIP switch for configuration of parameters
- Supports ZMOTION L200 development kit lenses





### ZMOTION Intelligent Lighting Control Reference Design – RD10038

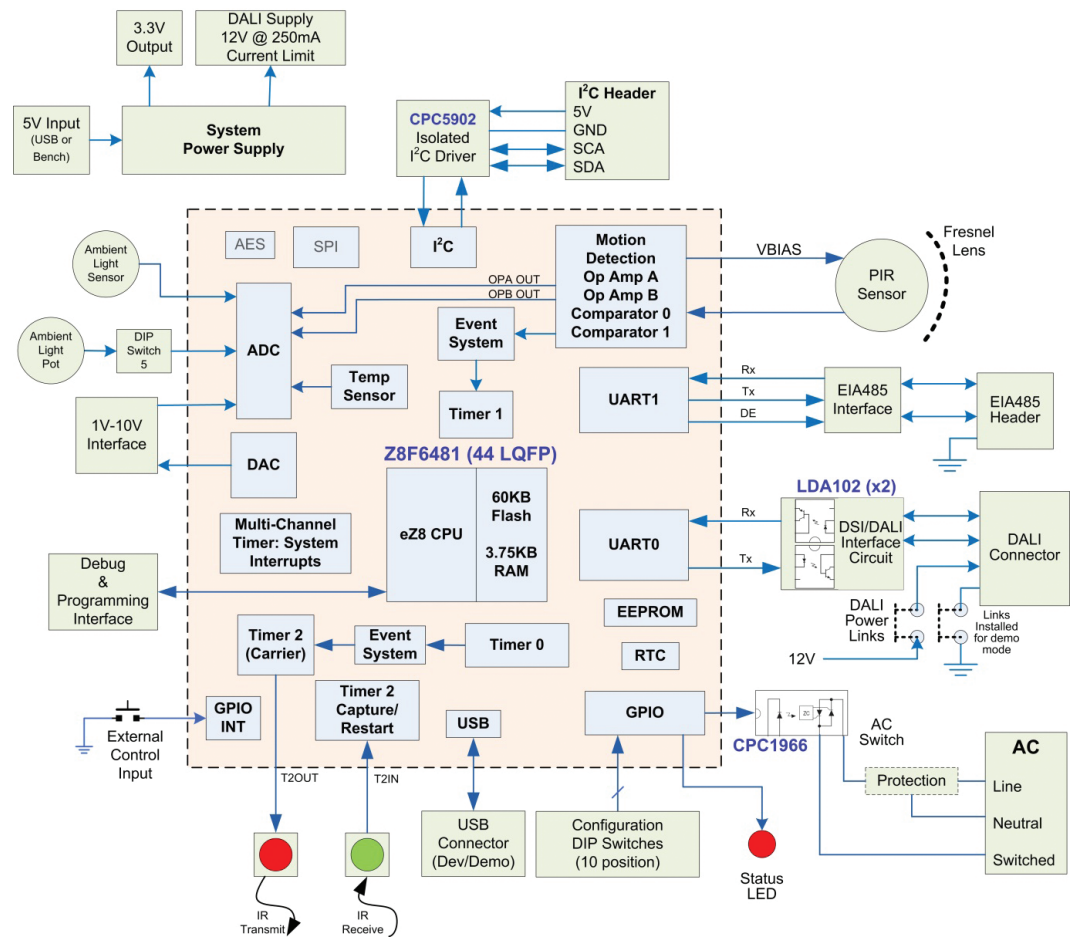
This ZMOTION Intelligent Lighting Control Reference Design provides a complete multi-protocol Lighting Control application with PIR Motion Sensing using the Z8F6481 MCU. Multiple communication interfaces are provided including DALI, DSI, and 1V-10V. A UART and isolated I2C interface is also supported in the hardware. Operational control is provided via DIP switch or bi-directional IR interface.



The software and hardware are designed modularly to allow customers to easily include or exclude functions as desired.

#### FEATURES

- Z8F6481 44-pin ZMOTION MCU in an Intelligent Motion Detector
- Communication interfaces: DALI, DSI, 1V-10V, I2C, UART, USB
- Lighting control modes: Occupancy, Vacancy, and Occupancy Pass-Through
- Lighting Control Profile: Dual or Multi-State (ON, Pre-OFF, OFF)
- Switched AC Control
- PIR Motion Detection with ZMOTION Digital Processing
- Hyper-sense mode for micro-motion detection
- Ambient Light Sensor for Light Gating
- Local Configuration via DIP Switches
- IR interface for remote configuration



### ZMOTION Intrusion Reference Design – RD10001

The ZMOTION Intrusion Reference Design demonstrates the use of Zilog's ZMOTION Intrusion Motion Detection solution in a PIR-based intrusion motion detector. Using the Z8FS021 ZMOTION MCU, it also highlights the implementation of additional functions such as anti-mask and power supply supervisory features.

Key features of this reference design include:

- Complete Intrusion Motion Detection design supporting three lens types:
  - WA 1.2 GI 12 V4: 18 meter, wide angle (installed)
  - LR 1.2 GI 12 V3: 30 meter, corridor
  - VB 1.2 GI V1: 15 meter, vertical barrier
- Automatic temperature compensation
- 12 kg/30 kg selectable pet immunity
- Selectable NORMAL and PULSE modes
- Auto LED feature
- Anti-mask demonstration
- Power supply supervisory
- White light immunity > 12,000 LUX
- Uses low-cost ZRE200GE dual-element pyroelectric sensor
- Independently verified to meet EN-50131 EMC susceptibility requirements

