

Mar 2013

BATTERY POWERED LOW-POWER PIR SENSOR INTERFACE

FEATURES:

- Power derived from 3.0V Lithium battery
- V_{DD} operating range 2.3V to 3.6V
- 25 μ A maximum quiescent current (LS6525)
- 30 μ A maximum quiescent current (LS6526)
- Direct interface with PIR sensor
- Analog signal and digital interrupt signal outputs for interfacing with a MCU
- 2.175V regulated output
- Low battery indicator output (LS6526)
- LS6525 (DIP), LS6525-S (SOIC)
LS6526 (DIP), LS6526-S (SOIC)

APPLICATIONS:

The low operating voltage and low current drain make the LS6525 / LS6526 ideal for microcontroller based portable applications such as battery operated motion detectors and photographic equipment, automatic doors, intrusion detection, and anywhere electric outlets are not available.

DESCRIPTION:

The LS6525 / LS6526 is a CMOS integrated circuit designed for detecting motion from a PIR sensor and is microcontroller interface ready. It uses a 3.0V Li battery as a source of energy for its operation. The detailed description of the functional blocks is as follows (refer to Figure 2).

AMPLIFIERS

The input PIR preamplifier, AMP1, has a nominal gain set at 29V/V using internal resistors. An internal bias is used so that AMP10 output has a quiescent voltage of 1.1V. The output of the PIR amplifier is AC coupled to a second amplifier (AMP2) which uses external components to set the gain. This second stage is internally biased and applied to a window comparator which has lower and higher trip levels set with respect to that bias. External components are used to set a typical gain of 22V/V. Amplified signals greater in magnitude than the trip levels will cause an interrupt signal to be generated at the INT open drain output, pin 12. The INT output can be pulled to a voltage higher than V_{DD} (pin 13).

The output of the PIR amplifier is also AC coupled to an additional amplifier (MCU amplifier) which uses external components to set the gain. An internal bias sets the MCO output at 0.5V and external resistors set a typical gain = 10V/V, the MCO output signal can be applied to a microcontroller input for processing.

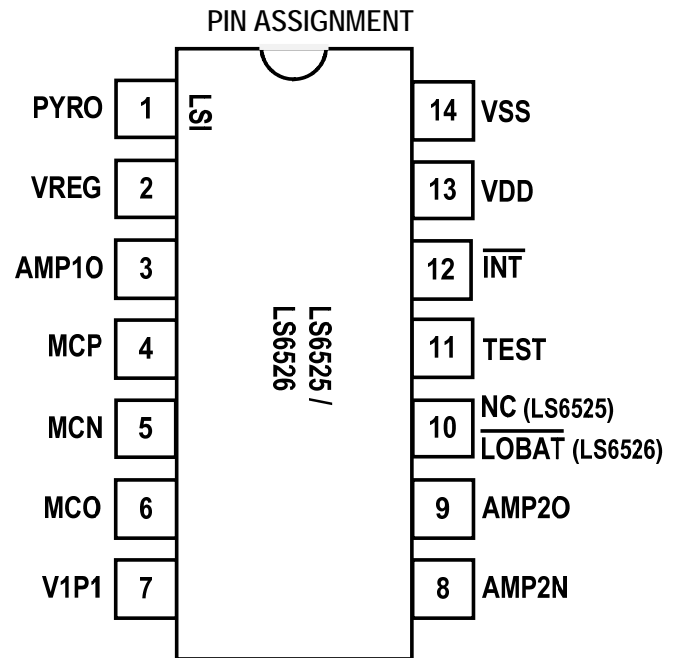


Figure 1

INPUT / OUTPUT DESCRIPTION

PIN1 – PYRO Input – Non-inverting input of PIR amplifier AC coupled to source of PIR signal.

PIN2 – VREG Output – This output provides power to the PIR Sensor circuit and for all the internal amplifier circuitry.

PIN3 – AMP10 Output – Output terminal of the PIR amplifier

PIN4 – MCP – 0.5V internal bias. (Internal use only. No external components.)

PIN5 – MCN Input – Inverting input to the MCU amplifier.

PIN6 – MCO Output – Output of the MCU amplifier.

PIN7 – V1P1 – Internally biased to 1.1V and applied to non-inverting input of AMP2. Requires an external bypass capacitor.

PIN8 – AMP2N – Inverting input of AMP2 amplifier.

PIN9 – AMP2O – Output of the AMP2 amplifier.

PIN10 – NC – For LS6525.

PIN10 – $\overline{\text{LOBAT}}$ Output – For LS6526 only. Open drain output requiring an external pull-up resistor to a power-supply that can be higher than V_{DD} . An active low at the output signifies that a low battery condition exists.

PIN11 – TEST – This pin is not used and must be tied to ground.

PIN12 – $\overline{\text{INT}}$ Output – Open drain output requiring an external pull-up resistor to a power supply that can be higher than V_{DD} . A recognized Interrupt signal will be an active low at this output.

PIN13 – VDD – Power Supply Voltage

PIN14 – VSS – Power Supply Ground

| ABSOLUTE MAXIMUM RATINGS: | | | | | | |
|---|-----------------------------------|----------------------------------|-------|------|------------------|--|
| PARAMETER | SYMBOL | VALUE | | | UNIT | |
| DC Supply Voltage | V_{DD} | +7 | | | | V |
| Input Voltage | V_{IN} | $V_{SS} - 0.3$ to $V_{DD} + 0.3$ | | | | V |
| Operating Temperature | T_A | -40 to +70 | | | | °C |
| Storage Temperature | T_{STG} | -65 to +150 | | | | °C |
| | | | | | | |
| ELECTRICAL CHARACTERISTICS: | | | | | | |
| (All voltages referenced to V_{SS} , $T_A = 25^\circ\text{C}$, $V_{DD} = 2.3\text{V} - 3.6\text{V}$, unless otherwise specified.) | | | | | | |
| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT | CONDITIONS |
| SUPPLY CURRENT: | | | | | | |
| $V_{DD} = 2.3\text{V} - 3.6\text{V}$ | I_{DD} | - | - | 25 | μA | LS6525, No Load@VREG |
| | I_{DD} | | | 30 | μA | LS6526, No Load@VREG |
| REGULATOR: | | | | | | |
| Voltage V | V_R 2.13 | | 2.175 | 2.22 | V | |
| Source Current Capability | I_R | - | - | 25 | μA | |
| AMPLIFIERS: | | | | | | |
| PIR Amplifier | | | | | | |
| Gain G | G_P 28 | | 29.5 | 32 | V/V | V_{ip} 1mV _{P-P} , 10Hz $R_L = \text{No Load to } 3\text{M}\Omega$ |
| Input Impedance | R_P | | 2 | | $\text{M}\Omega$ | |
| MCU amplifier / AMP2 | | | | | | |
| Open Loop Gain | G_M 70 | | | | dB | |
| MCO Output Quiescent Voltage | V_Q | 0.48 | 0.5 | 0.52 | V | |
| AMP2 Internal Reference | V_{IR} | | 1.1 | | V | |
| Window -Comparator amplifier | | | | | | |
| Input Sensitivity to $\overline{\text{INT}}$ Output | V_S 120 | | | | μV_P | AMP1 and AMP2 cascaded for net gain = 675V/V |
| Comparator | | | | | | |
| | $V_{LO, \text{THRESHOLD}}$ | | 1.02 | | V | |
| | $V_{HI, \text{THRESHOLD}}$ | 1.18 | | | V | |
| $\overline{\text{INT}}$ Output | | | | | | |
| | $V_{OL, \overline{\text{INT}}}$ | | | 0.1 | V | $R_{PULL-UP} = 2\text{M}\Omega$, $V_{PULL-UP} = 3.6\text{V}$ |
| | $V_{PULL-UP}$ | | | 5.5 | V | |
| $\overline{\text{Lobat}}$ | | | | | | |
| Trip Voltage | V_{TRIP} | 2.45 | | | V | |
| Hysteresis | H_{ys} | 0.1 | | | V | |
| | $V_{OL, \overline{\text{LOBAT}}}$ | | | 0.1 | V | $R_{PULL-UP} = 2\text{M}\Omega$, $V_{PULL-UP} = 3.6\text{V}$ |
| | $V_{PULL-UP}$ | | | 5.5 | V | |

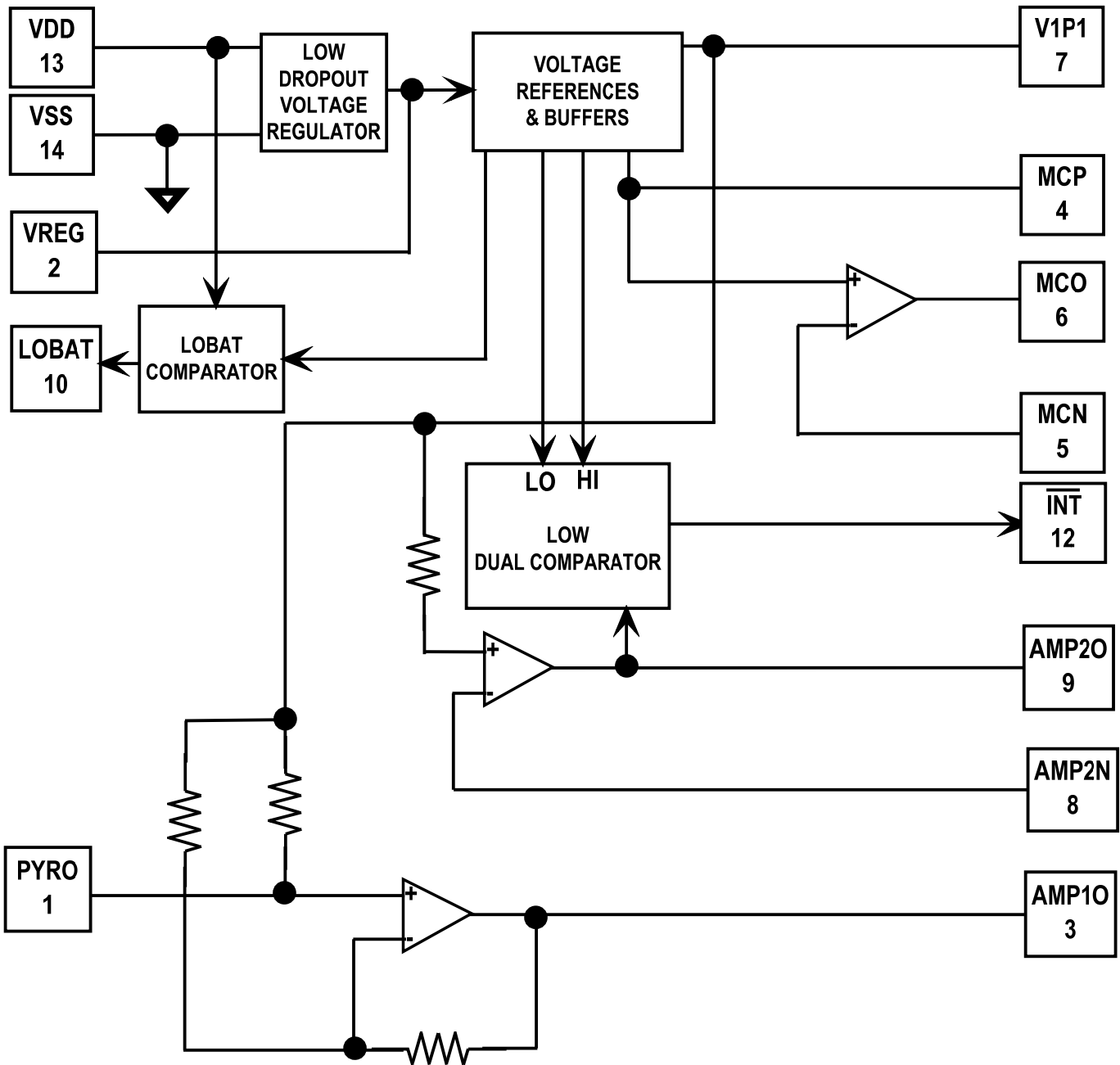
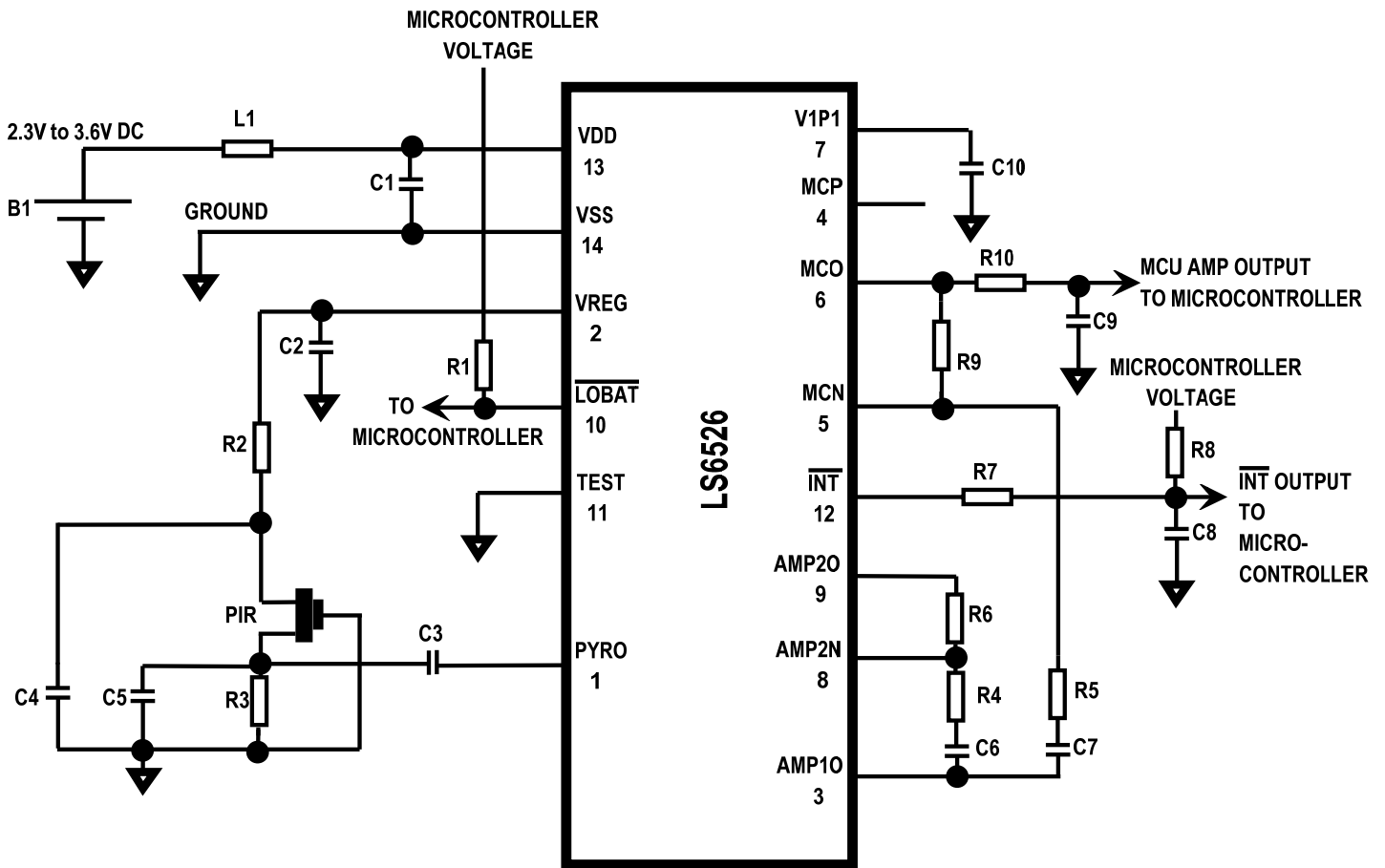


Figure 2 Block Diagram



C

| | | | |
|-----|---------------|-----|---|
| L1 | 68nH | C1 | 1 μ F |
| | | 2 | 1 μ F |
| R1 | 2M Ω | C3 | 1 μ F |
| R2 | 10k Ω | C4 | 47pF |
| R3 | 4.7M Ω | C5 | 47pF |
| R4 | 442k Ω | C6 | 3.3 μ F |
| R5 | 1M Ω | C7 | 1 μ F |
| R6 | 10M Ω | C8 | 3.3nF |
| R7 | 100k Ω | C9 | 0.16 μ F |
| R8 | 2M Ω | C10 | 10 μ F |
| R9 | 10M Ω | | |
| R10 | 100k Ω | B1 | Typical battery used: 3V CR123A Lithium |
| | | PIR | Excelitas LHI968 Pyro (Typical) |

Figure 3 Application schematic for LS6526.

For the LS6525, pin 10 has no connection. The gain of AMP2 is set using R6 and R4 to a nominal gain of 22V/V. The MCU amplifier gain is set to 10V/V using R9 and R5. R10-C9 and R7-C8 are additional filter stages for the MCO and INT outputs when applied to the microcontroller.