LSI/CSI

A3800

LS6511

PIR SENSOR INTERFACE

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FEATURES:
- Direct Interface with PIR Sensor
- Two-Stage Differential Amplifier
- Amplifier Gain and Bandwidth externally controlled
- True and Complementary Output Drives
- Separate digital filters for processing positive and negative input signals
- Single Pulse/Dual Pulse/ Concurrent Pulse Detection
- Adjustable Output Pulse Width
- Optional 5V Shunt Regulator Output
- 50 µA Typical Supply Current
- Undervoltage Detection
- LS6511 (14-Pin DIP)
  LS6511-S (14-Pin SOIC) - See Figure 1

PIN ASSIGNMENT - TOP VIEW

Pin	Name		Pin	Name
1	DIFF. AMP. 1 OUTPUT		14	DIFF. AMP 1 INPUT (-)
2	DIFF. AMP. 2 INPUT (-)		13	DIFF. AMP 1 INPUT (+)
3	DIFF. AMP. 2 OUTPUT		12	5V REGULATOR OUTPUT
4	DIGITAL FILTER RC		11	VDD (+V)
5	ONE-SHOT/WINDOW TIMER RC		10	VSS (- V)
6	DURATION TIMER RC		9	LED/RELAY OUTPUT
7	MODE SELECT		8	LED/RELAY OUTPUT

FIGURE 1

DESCRIPTION:
The LS6511 is a CMOS Silicon Gate integrated circuit, designed for detecting motion from a PIR Sensor and initiating appropriate responses. Referring to Figure 2, the detailed description of the functional blocks are as follows:

DIFFERENTIAL AMPLIFIER
Each stage of the two stage Differential Amplifier can be set to have its own amplification and bandwidth. The two inputs to the first stage allow for single-ended or differential connection to PIR Sensors. This stage can be biased anywhere in its dynamic range. The second stage is internally biased so that the Window Comparator's lower and higher thresholds can be fixed relative to this bias. Signal levels as low as 100µV can be detected.

WINDOW COMPARATOR
The Window Comparator provides noise filtering by enabling only those signals equal to or greater than a fixed threshold at the output of the Differential Amplifier to appear at the 2 outputs of the Window Comparator. One output detects positive input signals while the other output detects negative input signals.

COMPARATOR DIGITAL FILTER
The outputs of the Window Comparator are filtered so that motion must be present for a certain duration before it can be recognized and appear as pulses at the Digital Filter outputs. An external RC network sets the duration time. Nominal duration is 50ms.

MODE SELECT
A tristate input pin selects how the detected signals are processed. When the input is a logic 0, detection from either a positive or negative input signal at the Digital Filter outputs will cause an LED/RELAY output to occur (Single Pulse Mode). When the input is floating, detection from a positive and negative input signal must occur within a specific time before an output will occur (Concurrent Pulse Mode). When the input is a logic 1, any two detections within a specific time will cause an output to occur (Dual Pulse Mode).
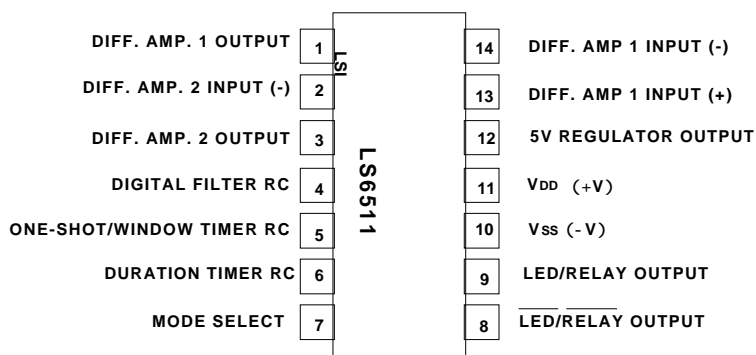
PROGRAMMABLE RETRIGGERABLE ONE-SHOTS
Positive and negative input signals at the digital filter outputs will generate retriggerable one-shot pulses. In the Concurrent Pulse Mode, outputs from each one-shot must occur together at some point in time to cause an output to occur. The one-shot pulse width is programmable using an external RC network. Typical pulse widths used vary between 1 and 12 seconds.

WINDOW TIMER
In the Dual Pulse Mode any two detections must occur within a timing window to cause an output to occur. The timing window is programmable using an external RC network. Typical windows are between 1 and 5 seconds.

OUTPUT DURATION TIMER
The duration timer is retriggerable and programmable using an external RC network. Typical duration times are between 0.5 and 15 seconds. Successive input detections will restart the timer.

OUTPUTS
The LED/RELAY Output is an open drain output that will sink current when an input signal is detected and processed and when the Power Supply drops below 3.7V (Typical) (Undervoltage Detection). The Undervoltage Detection will be removed when the Power Supply rises above 3.9V (Typical). The LED/RELAY Output performs identically but is opposite in polarity. The output can sink current from a relay coil returned to a positive voltage (VDD to 9.5V maximum).

SHUNT REGULATOR
The LS6511 includes a 5V Shunt Regulator Output which can be tied to the VDD Pin so that the circuit can be powered from a higher voltage power supply.

ABSOLUTE MAXIMUM RATINGS:

PARAMETER	SYMBOL	VALUE	UNIT
DC supply voltage	V_{DD}-V_{SS}	+7	V
Any input voltage	V_{IN}	V_{SS}-0.3 to V_{DD} + 0.3	V
Operating temperature	T_A	-40 to +85	°C
Storage temperature	T_{STG}	-65 to +150	°C

ELECTRICAL CHARACTERISTICS:
(All voltages referenced to V_{SS}, T_A = -40°C to +55°C, 4.5V V_{DD} 6.5V, unless otherwise specified.)

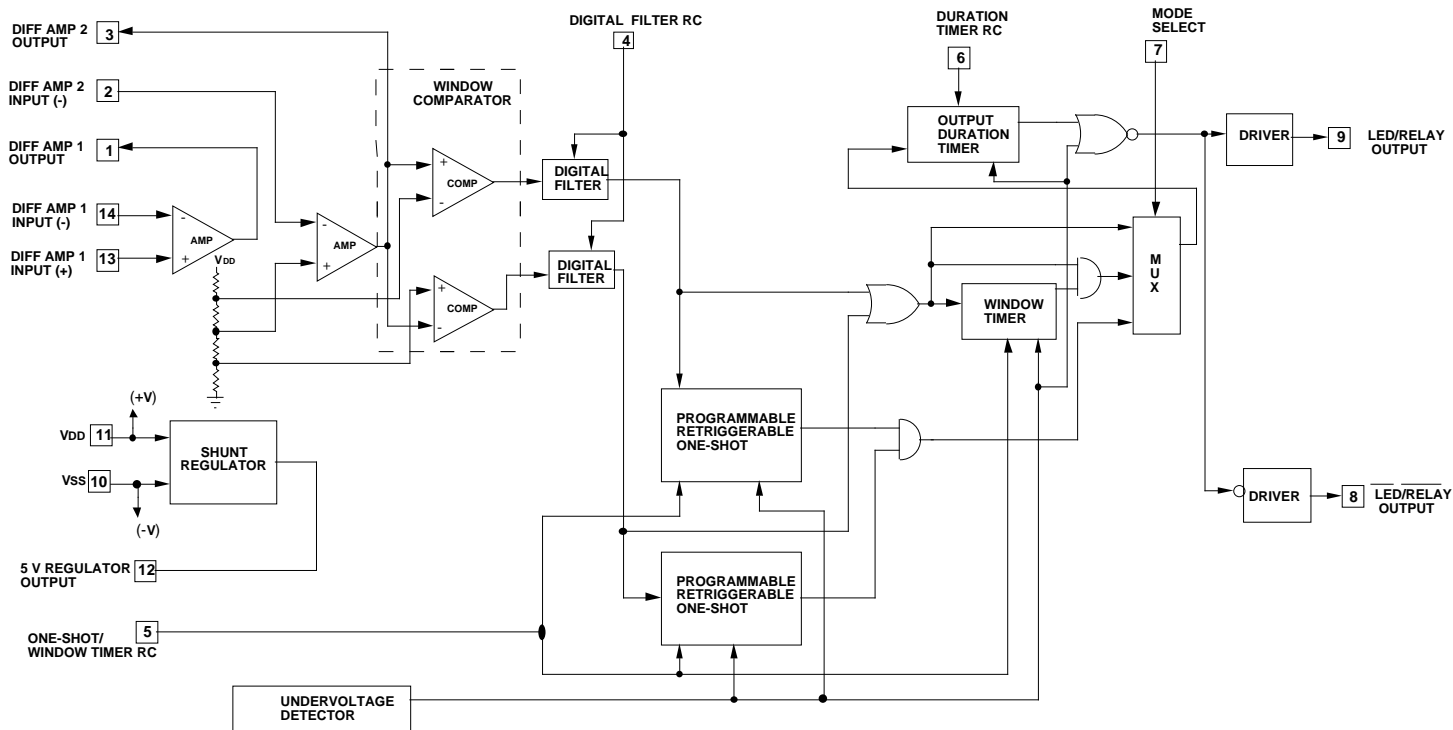| PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	CONDITIONS
SUPPLY CURRENT:						
V_{DD} = 5V	I_{DD}	-	50	75	µA	$\overline{\text{LED/RELAY}}$, $\overline{\overline{\text{LED/RELAY}}}$
V_{DD} = 4.5V-6.5V	I_{DD}	-	65	125	µA	and REGULATOR
						outputs not loaded
REGULATOR:						
Voltage	V_R	5.00	5.75	6.25	V	-
Current	I_R	-	-	10	mA	-
DIFFERENTIAL AMPLIFIERS:						
Open Loop Gain, Each Stage	G	70	-	-	dB	-
Common Mode Rejection Ratio	C_{MRR}	60	-	-	dB	-
Power Supply Rejection Ratio	P_{SRR}	60	-	-	dB	-
Input Sensitivity (Minimum Detectable Voltage to first amplifier when both amplifiers are cascaded for a net gain of 8,000)	V_S	100	-	-	µVp-p	T_A = 25°C, with Amplifier Bandpass configuration as shown in Figure 3
Input Dynamic Range	-	0	-	1.75	V	-
Diff. Amp 2 Internal Reference	V_{IR}	-	0.3V_{DD}	-	V	-
COMPARATOR:						
Lower Reference	V_{THL}	-	V_{IR}-0.8V	-	V	At V_{DD} = 5.75V
Higher Reference	V_{THH}	-	V_{IR}+0.8V	-	V	At V_{DD} = 5.75V
DIGITAL FILTER:						
For 50ms Filter Time	R_{DF}	-	2.2	-	M	-
	C_{DF}	-	0.01	-	µF	-
ONE SHOT	R_{OS}	-	2.2	-	M	-
(1 Second)	C_{OS}	-	0.22	-	µF	-
WINDOW TIMER	R_{WT}	-	2.2	-	M	-
(2.5 Second)	C_{WT}	-	0.68	-	µF	-
DURATION TIMER	R_{DT}	-	2.2	-	M	-
(5 Seconds)	C_{DT}	-	0.68	-	µF	-
OUTPUT DRIVE CURRENT	I_O	-20	-	-	mA	V_{DD} = 5V
(Vo = 0.5V Max.)						

FIGURE 2. LS6511 BLOCK DIAGRAM

FIGURE 3. TYPICAL RELAY APPLICATION

NOTE 1: The relay coil is normally energized and the LED is off. When an alarm occurs, the relay coil becomes de-energized and the LED is turned on.
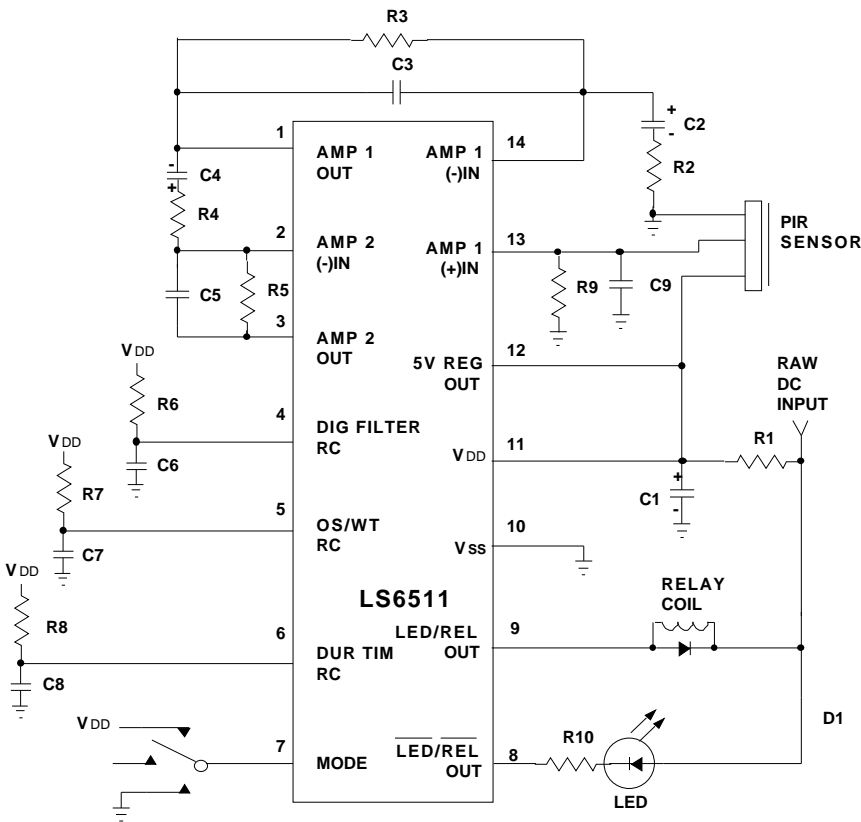
R1 = See NOTE 2
R2 = 36K
R3 = 2.7M
R4 = 36K
R5 = 2.7M

R6 = 2.2M   (Typical)
R7 = 2.2M   (Typical)
R8 = 2.2M   (Typical)
R9 = 24K
R10 = 5.1K   (Typical)

C1 = 100µF
C2 = 33µF
C3 = 0.01µF
C4 = 33µF
C5 = 0.01µF
C6 = 0.01µF (Typical)
C7 = 0.22µF(O.S. MODE) (Typical)
C7 = 0.68µF(W.T. MODE) (Typical)
C8 = 0.01µF (Typical)
C9 = 0.1µF
D1 = 1N4001
RELAY = No typical P/N

PIR = HEIMANN LHi 954, 958, 978, 874 or 878 (Typical)

All Resistors 1/4W   All Capacitors 10V

NOTE 2: R1 is selected to provide sufficient current to drive the LS6511 and PIR Sensor. Any surplus current is available to drive additional loads applied to the 5V Shunt Regulator output or is absorbed by the 5V Shunt Regulator. Refer to specifications for current limits.

FIGURE 4. DIFFERENTIAL INTERFACE TO PIR SENSOR PAIR
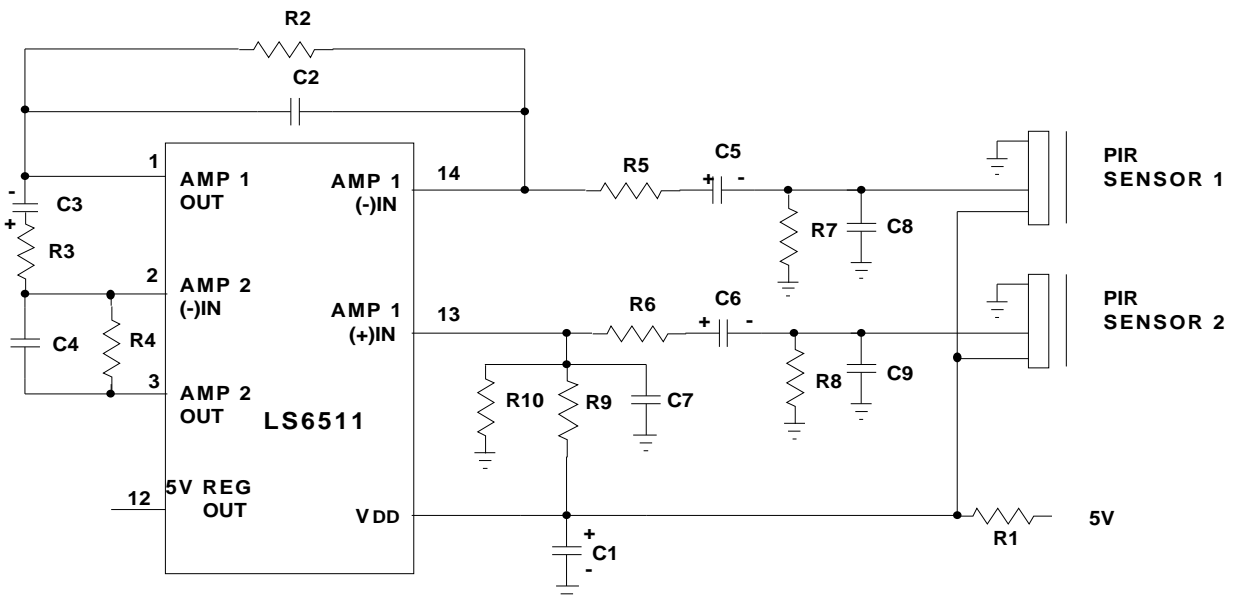
R1 = 1K
R2 = 2.7M
R3 = 36K
R4 = 2.7M
R5 = 36K

R6 = 36K
R7 = 36K
R8 = 36K
R9 = 5.6M
R10 = 2.4M

C1 = 100µF
C2 = 0.01µF
C3 = 33µF
C4 = 0.01µF
C5 = 33µF

C6 = 33µF
C7 = 0.01µF
C8 = 0.1µF
C9 = 0.1µF

PIRs = HEIMANN LHi 954, 958, 978, 874 or 878 (Typical)

All Resistors 1/4 W. All Capacitors 10V
NOTES: 1) A pair of PIR Sensors may be used in applications where a wider optical field of view is needed.
2) External 5V Regulator drives the LS6511 and PIR sensor.