# Dual, 2-Wire Hall-Effect Sensor Interface with Analog and Digital Outputs

## General Description

The MAX9621 is a continuation of the Maxim family of Hall-effect sensor interfaces that already includes the MAX9921. The MAX9621 provides a single-chip solution to interface two 2-wire Hall-effect sensors to low-voltage microprocessors (µP) through either a digital output for Hall-effect switches or an analog output for linear information or both.

The MAX9621 protects the Hall sensors from supply transients up to 60V at the BAT supply. Normal operating supply voltage ranges from 5.5V to 18V. If the BAT supply rises above 18V, the MAX9621 shuts off the current to the Hall sensors. When a short-to-ground fault condition is detected, the current to the Hall input is shut off and the condition is indicated at the analog output by a zero-current level and a high digital output.

The MAX9621 provides a minimum of 50µs blanking time following Hall sensor power-up or restart. The open-drain digital outputs are compatible with logic levels up to 5.5V.

The MAX9621 is available in a 3mm x 5mm, 10-pin µMAX® package and is rated for operation in the -40°C to +125°C temperature range.

## Features

- Provides Supply Current and Interfaces to Two 2-Wire Hall-Effect Sensors
- 5.5V to 18V Operating Voltage Range
- Protects Hall Sensors Against Up to 60V Supply Transients
- Low-Power Shutdown for Power Saving
- Filtered Digital Outputs
- Analog Output Mirrors the Hall Sensor Current
- Hall Inputs Protected from Short to Ground
- Hall Sensor Blanking Following Power-Up and Restart from Shutdown and Short to Ground
- Operates with ±3V Ground Shift Between the Hall Sensor and the MAX9621
- ±2kV Human Body Model ESD and ±200V Machine Model ESD at All Pins
- 3mm x 5mm, 10-Pin µMAX Package

## Applications

- Window Lifters
- Seat Movers
- Electric Sunroofs
- Seatbelt Buckles
- Door Power Locks
- Ignition Key
- Steering Column
- Speed Sensing

## Functional Diagram

*Typical Application Circuit appears at end of data sheet.*

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For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim’s website at www.maximintegrated.com.
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ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAT Supply Range</td>
<td>VBAT</td>
<td>Guaranteed by functional test of IHI, ILI, and GEI</td>
<td>5.5</td>
<td>18</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>BAT Supply Current</td>
<td>IBAT</td>
<td>Normal mode</td>
<td>1</td>
<td>ma</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ISD</td>
<td>VSLEEP = 0V</td>
<td>1</td>
<td>10</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>Hall Input Voltage Dropout</td>
<td>VDO</td>
<td>VBAT = 5.5V, at IN1 and IN2, IIN = -14mA</td>
<td>0.59</td>
<td>1.26</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>VBAT = 5.5V, at IN1 and IN2, IIN = -20mA</td>
<td>0.86</td>
<td>1.86</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>ESD Protection</td>
<td></td>
<td>Machine Model</td>
<td>±200</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Human Body Model</td>
<td>±2000</td>
<td>V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DC ELECTRICAL CHARACTERISTICS

(VBAT = 13.6V, VSLEEP = 5V, IN1 = IN2 = no connection, RSET = 61.9kΩ to BAT, RPL = 10kΩ at DOUT1 and DOUT2, RL = 5kΩ to GND at AOUT1 and AOUT2, unless otherwise noted, TA = -40°C to +125°C. Typical values are at TA = +25°C.) (Note 1)

Continuous Power Dissipation for a Single-Layer Board
( TA = +70°C)
- 10-Pin µMAX (derate 5.6mW/°C) above +70°C........... 444.4mW
Continuous Power Dissipation for a Multilayer Board
( TA = +70°C)
- 10-Pin µMAX (derate 8.8mW/°C) above +70°C........... 707.3mW

Operating Temperature Range........................................... -40°C to +125°C
Junction Temperature.................................................... +150°C
Storage Temperature Range............................................. -65°C to +160°C
Lead Temperature (soldering, 10s)................................. +300°C
Soldering Temperature (reflow)....................................... +260°C
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DC ELECTRICAL CHARACTERISTICS (continued)

\((V_{BAT} = 13.6V, V_{SLEEP} = 5V, I_{IN1} = I_{IN2} = \text{no connection}, R_{SET} = 61.9k\Omega \text{ to BAT}, R_{Pu} = 10k\Omega \text{ at DOUT1 and DOUT2}, R_{L} = 5k\Omega \text{ to GND at AOUT1 and AOUT2}, \text{unless otherwise noted}, T_{A} = -40^\circ\text{C} \text{ to } +125^\circ\text{C}. \text{Typical values are at } T_{A} = +25^\circ\text{C}.\) (Note 1)

<table>
<thead>
<tr>
<th>PARAMETER</th>
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<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Referred Current Offset</td>
<td>(I_{OS})</td>
<td>Inferred from measurements at (I_{IN} = -5\text{mA} \text{ to } -14\text{mA})</td>
<td>-120</td>
<td>+120</td>
<td></td>
<td>(\mu\text{A})</td>
</tr>
<tr>
<td>AOUT(_1) Dropout Voltage</td>
<td></td>
<td>(V_{BAT} = 5.5V, \text{for } 5% \text{ current reduction})</td>
<td>(I_{IN} = -14\text{mA})</td>
<td>0.85</td>
<td>1.6</td>
<td>(V)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(I_{IN} = -20\text{mA})</td>
<td>1.09</td>
<td>1.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AOUT(_2) Output Impedance</td>
<td></td>
<td></td>
<td>500</td>
<td></td>
<td></td>
<td>(\text{M}\Omega)</td>
</tr>
<tr>
<td>LOGIC I/O (DOUT1, DOUT2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output-Voltage Low DOUT1, DOUT2</td>
<td>(V_{OL})</td>
<td>Sink current (= 1\text{mA})</td>
<td>0.4</td>
<td></td>
<td></td>
<td>(V)</td>
</tr>
<tr>
<td>Three-State Output Current DOUT1, DOUT2</td>
<td>(I_{OZ})</td>
<td>(V_{SLEEP} = 0V, 0V \leq V_{DOUT} \leq 5V)</td>
<td>(\pm 1)</td>
<td></td>
<td></td>
<td>(\mu\text{A})</td>
</tr>
<tr>
<td>SLEEP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input-Voltage High</td>
<td>(V_{IH})</td>
<td></td>
<td>2.0</td>
<td></td>
<td></td>
<td>(V)</td>
</tr>
<tr>
<td>Input-Voltage Low</td>
<td>(V_{IL})</td>
<td></td>
<td>0.8</td>
<td></td>
<td></td>
<td>(V)</td>
</tr>
<tr>
<td>Input Resistance to GND</td>
<td>(R_{IN})</td>
<td></td>
<td>50</td>
<td>100</td>
<td></td>
<td>(k\Omega)</td>
</tr>
</tbody>
</table>

AC TIMING CHARACTERISTICS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shutdown Delay from SLEEP Low to IN(_n) Shutoff</td>
<td>(t_{SHDN})</td>
<td>(I_{IH} = -14\text{mA} \text{ to GND, time from SLEEP low to IN(<em>n) drop } 500\text{mV}, C</em>{L} = 20\text{pF})</td>
<td>33</td>
<td>40</td>
<td>46</td>
<td>(\mu\text{s})</td>
</tr>
<tr>
<td>IN(_n) Blanking Time at Hall Sensor Power-Up</td>
<td>(t_{BL})</td>
<td>(I_{IH} = -14\text{mA} \text{ to GND, time from } V_{IN} = 500\text{mV until DOUT(<em>n) high, } C</em>{L} = 20\text{pF}) (Notes 2, 3)</td>
<td>76</td>
<td>89</td>
<td>103</td>
<td>(\mu\text{s})</td>
</tr>
<tr>
<td>IN(_n) Current Ramp Rate After Turn-On</td>
<td>(t_{RAMP})</td>
<td>(I_{IN} = \text{GND} \text{ (Note 2)})</td>
<td>3.6</td>
<td>5</td>
<td>6.7</td>
<td>(\text{mA/\mu\text{s}})</td>
</tr>
<tr>
<td>Delay from IN(_n) to DOUT(_n) (Filter Delay)</td>
<td>(t_{DEL})</td>
<td>From (I_{IH}) to (I_{IL}) or from (I_{IL}) to (I_{IH}), (C_{L} = 20\text{pF}), Figure 1 (Note 2)</td>
<td>10.8</td>
<td>13.5</td>
<td>16</td>
<td>(\mu\text{s})</td>
</tr>
<tr>
<td>Delay Difference Between Rising and Falling Edges of Both Channels</td>
<td>(t_{DM})</td>
<td>(C_{HALL-BYPASS} = 0.01\mu\text{F}, I_{IH} = -11.5\text{mA} \text{ and } I_{IL} = -7.5\text{mA}, C_{L} = 20\text{pF})</td>
<td>1</td>
<td></td>
<td></td>
<td>(\mu\text{s})</td>
</tr>
<tr>
<td>Delay Difference Between Channels</td>
<td>(t_{CC})</td>
<td>(C_{HALL-BYPASS} = 0.01\mu\text{F}, I_{IH} = -11.5\text{mA} \text{ and } I_{IL} = -7.5\text{mA}, C_{L} = 20\text{pF})</td>
<td>500</td>
<td></td>
<td></td>
<td>(\text{ns})</td>
</tr>
<tr>
<td>Maximum Frequency on Hall Inputs</td>
<td>(f_{MAX})</td>
<td>(C_{HALL-BYPASS} = 0.01\mu\text{F}, I_{IH} = -11.5\text{mA} \text{ and } I_{IL} = -7.5\text{mA}, C_{L} = 20\text{pF}) (Note 2)</td>
<td>34</td>
<td>39</td>
<td></td>
<td>(\text{kHz})</td>
</tr>
<tr>
<td>Maximum Analog Output Current During Short-to-GND Fault</td>
<td>(I_{MAO})</td>
<td>(C_{HALL-BYPASS} = 0.01\mu\text{F}, I_{IH} = -11.5\text{mA} \text{ and } I_{IL} = -7.5\text{mA}, C_{L} = 20\text{pF}) (Note 2)</td>
<td></td>
<td></td>
<td>-1.4</td>
<td>(\text{mA})</td>
</tr>
<tr>
<td>IN(_n) Pulse Length Rejected by Filter to DOUT(_n)</td>
<td>(P_{R})</td>
<td>Figure 2 (Note 2)</td>
<td>7.8</td>
<td>11.5</td>
<td>14.6</td>
<td>(\mu\text{s})</td>
</tr>
</tbody>
</table>

Note 1: All DC specifications are 100% production tested at \(T_{A} = +25^\circ\text{C}.\) AC specifications are guaranteed by design at \(T_{A} = +25^\circ\text{C}.\)

Note 2: Parameters that change with the value of the \(R_{SET}\) resistor: \(I_{IH}, I_{IL}, I_{IN-HYS}, I_{SC}, t_{BL}, t_{RAMP}, t_{DEL}, f_{MAX}, \text{and } P_{R}.

Note 3: Following power-up or startup from sleep mode, the start of the blanking period is delayed 20\(\mu\text{s}\).
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Timing Diagrams

Figure 1. Timing Diagram

Figure 2. Hall Input Pulse Rejection
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Typical Operating Characteristics

(V_{BAT} = 13.6V, R_{SET} = 61.9kΩ, R_L = 5kΩ to GND at AOUT_, V_{SLEEP} = 5V, T_A = +25°C, unless otherwise noted.)
Typical Operating Characteristics (continued)

$V_{BAT} = 13.6\text{V}$, $R_{SET} = 61.9k\Omega$, $R_L = 5k\Omega$ to GND at AOUT, $V_{SLEEP} = 5\text{V}$, $T_A = +25^\circ\text{C}$, unless otherwise noted.

- **Hall Input Current Thresholds vs. ISET Resistor**
- **Input Blanking Time at Restart from Sleep Mode (or Power-Up) vs. Temperature**
- **In-Current Ramp Rate After Turn-On vs. Temperature**
- **Delay from IN to DOUT (Filter Delay) vs. Temperature**
- **Delay Difference Between Channels vs. Temperature**
- **In-CURRENT RAMP RATE AFTER TURN-ON vs. TEMPERATURE**
- **Input Dropout Voltage vs. Temperature**
- **Input Dropout Voltage vs. $V_{BAT}$**
- **In-Current Ramp Rate After Turn-On vs. Temperature**
- **In-CURRENT RAMP RATE AFTER TURN-ON vs. TEMPERATURE**
Typical Operating Characteristics (continued)

(\(V_{\text{BAT}} = 13.6V, R_{\text{SET}} = 61.9k\Omega, R_{\text{L}} = 5k\Omega\) to GND at AOUT, \(V_{\text{SLEEP}} = 5V, T_{\text{A}} = +25^\circ\text{C}\), unless otherwise noted.)
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**Pin Configuration**

---

**Pin Description**

<table>
<thead>
<tr>
<th>PIN</th>
<th>NAME</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BAT</td>
<td>Battery Power Supply. Connect to the positive supply through an external reverse-polarity diode. Bypassed to GND with a 0.1µF capacitor.</td>
</tr>
<tr>
<td>2</td>
<td>ISET</td>
<td>Current Setting Input. Place a 1% resistor (RSET) between BAT and ISET to set the desired input current threshold range for the DOUT outputs. See the Typical Operating Characteristics section for the correct value of RSET for the desired range. Make no other connections to this pin. All routing must have low parasitic capacitance. See the Input Current Thresholds and Short to Ground section.</td>
</tr>
<tr>
<td>3</td>
<td>IN1</td>
<td>Hall-Effect Sensor Input 1. Supplies current to the Hall sensor and monitors the current level drawn to determine the high/low state of the sensor. Bypass to GND with a 0.01µF capacitor. Connect an unused input to BAT pin.</td>
</tr>
<tr>
<td>4</td>
<td>IN2</td>
<td>Hall-Effect Sensor Input 2. Supplies current to the Hall sensor and monitors the current level drawn to determine the high/low state of the sensor. Bypass to GND with a 0.01µF capacitor. Connect an unused input to BAT pin.</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>
**Pin Description (continued)**

<table>
<thead>
<tr>
<th>PIN</th>
<th>NAME</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>DOUT2</td>
<td>Open-Drain Output. Signal translated from Hall sensor 2. DOUT2 is high when the current flowing out of IN2 exceeds the input current threshold high, and is low when less than the input current threshold low. See Table 1 for output response to operating conditions.</td>
</tr>
<tr>
<td>7</td>
<td>AOUT2</td>
<td>Analog Current Output. Mirrors the current to the corresponding Hall sensor at IN2. When IN2 has been shut down due to a short to GND a current of zero is supplied to AOUT2. See Table 1 for output response to operating conditions. To obtain a voltage output, connect a resistor from AOUT_ to ground.</td>
</tr>
<tr>
<td>8</td>
<td>DOUT1</td>
<td>Open-Drain Output. Signal translated from Hall sensor 1. DOUT1 is high when the current flowing out of IN1 exceeds the input current threshold high, and is low when less than the input current threshold low. See Table 1 for output response to operating conditions.</td>
</tr>
<tr>
<td>9</td>
<td>AOUT1</td>
<td>Analog Current Output. Mirrors the current to the corresponding Hall sensor at IN1. When IN1 has been shut down due to a short to GND a current of zero is supplied to AOUT1. See Table 1 for output response to operating conditions. To obtain a voltage output, connect a resistor from AOUT_ to ground.</td>
</tr>
<tr>
<td>10</td>
<td>SLEEP</td>
<td>Sleep Mode Input. The part is placed in sleep mode when the SLEEP input is low for more than 40μs. If the SLEEP input is low for less than 20μs and then goes high, the part restarts any Hall input that has been shut off due to a detected short to GND. Any Hall input that is operational is not affected when SLEEP is cycled low for less than 20μs. There is an internal 100kΩ pulldown resistance to GND.</td>
</tr>
</tbody>
</table>

**Detailed Description**

The MAX9621, an interface between two 2-wire Hall-effect sensors and a low-voltage microprocessor, supplies and monitors current through IN1 and IN2 to two Hall sensors.

The MAX9621 complements Maxim’s existing family of Hall-effect sensor interfaces that includes the MAX9921.

The MAX9621 provides two independent channels with two outputs for each channel, a digital output, and an analog output. The digital outputs (DOUT1 and DOUT2) are open-drain and indicate a logic level that corresponds to the Hall sensor status. DOUT1 or DOUT2 outputs high when the current out of IN1 or IN2, respectively, exceeds the high-input current threshold. DOUT1 or DOUT2 outputs low when the current flowing out of IN1 or IN2, respectively, is lower than the low-input current threshold. DOUT1 and DOUT2 provide a time domain output filter for robust noise immunity. See Figure 2.

The analog outputs (AOUT1 and AOUT2) mirror the current flowing out to the corresponding inputs IN1 and IN2 with a nominal gain of 0.05mA/mA.

**Hall Sensor Protection from Supply Transients**

The MAX9621 protects the hall sensors from supply transients by shutting off current at IN1 and IN2 when the BAT voltage is 18V. The digital outputs go low and analog outputs have zero output current. When VBAT returns to the proper operating range, both inputs restart following a blanking cycle.
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Table 1. AOUT_/DOUT_ Truth Table

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>AOUT</th>
<th>DOUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN_ Short to GND</td>
<td>0</td>
<td>High-Z</td>
</tr>
<tr>
<td>IN_ Short to BAT</td>
<td>0</td>
<td>Low*</td>
</tr>
<tr>
<td>IN_ Open</td>
<td>0</td>
<td>High-Z</td>
</tr>
<tr>
<td>SLEEP Low</td>
<td>0</td>
<td>Low*</td>
</tr>
<tr>
<td>VBAT &gt; 18V</td>
<td>0</td>
<td>Low*</td>
</tr>
</tbody>
</table>

*If IN_ is already shorted to BAT or open during power-up, DOUT_ goes to high-Z until IN_ is loaded.

Hall Input Short-to-Battery Condition

The MAX9621 interprets a short to battery when the voltage at IN1 or IN2 is higher than VBAT - 100mV. The digital outputs go low and the analog outputs are set to zero output current. If IN1 or IN2 is more than 1V above VBAT, it back-drives current into BAT. The MAX9621 restarts the Hall inputs when the Hall input is loaded again.

Hall Input Short to Ground

The Hall input short-to-ground fault is effectively a latched condition if the input remains loaded by the Hall switch. The current required to power the Hall switch is shut off and only a 50µA pullup current remains. The Hall input can be manually reenergized or it can be reenergized by the µP. A 10µs to 20µs negative pulse at SLEEP restarts with a blanking cycle any Hall input that has been shut down due to the short-to-ground condition. During startup or restart, it is possible for a Hall input to charge up an external capacitance of 0.02µF without tripping into a short-to-ground latched state. During the short-to-ground fault, DOUT1 and DOUT2 are high impedance (pulled high by the pullup resistors), while AOUT1 and AOUT2 are set to zero-output current.

Manual Method for Reenergizing Hall Sensor and Means for Diagnosing an Intermittent Hall Sensor Connection

Figure 3 shows the behavior of the MAX9621 when a Hall input is open. Figure 4 shows the behavior of the MAX9621 when the open input is reconnected to a Hall sensor. Figures 3 and 4 demonstrate how a short-to-ground Hall input can be reset. Resetting a short-to-ground Hall input involves three steps:

1) Relieve the short to ground at the Hall sensor.
2) Disconnect the Hall input from the Hall sensor (open-input fault condition).
3) Reconnect the Hall input to the Hall sensor.

The MAX9621 restarts the Hall input with a blanking cycle. If the Hall input is disconnected from the Hall sensor for 10ms, it allows the Hall input to be pulled up by the 50µA pullup current to register the open-input fault condition. Reconnecting the Hall input to the Hall sensor restarts the Hall input with a blanking cycle. This provides a manual means of reenergizing a Hall input without having to resort to the µP to restart it. This also demonstrates the behavior of an intermittent connection to a Hall sensor.

Figure 3. Hall Input Ramps to Open-Circuit Fault When a Short to Ground Is Relieved
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**Sleep Mode Input (SLEEP)**
The MAX9621 features an active-low SLEEP input. Pull SLEEP low for more than 40μs to put the device into sleep mode for power saving. In sleep mode, the DOUT1 and DOUT2 outputs are high impedance and are pulled high by pullup resistors. AOUT1 and AOUT2 are set to zero-output current.

**Hall Input Restart**
When an input has been shut down due to a short to ground, cycle SLEEP for 10μs to 20μs to restart the input. If the other input is operational it is not affected. The restart happens on the rising edge of SLEEP.

**Input Current Thresholds and Short to Ground**
The input current high and low thresholds that determine the logic level of the digital outputs are adjusted by changing the RSET value. When the RSET value changes, the following parameters change as well: I\text{IN\_HYS}, I\text{SC}, I\text{BL}, I\text{RAMP}, I\text{DEL}, I\text{MAX}, and PR.

IIH, IIL, I\text{IN\_HYS}, I\text{SC}, I\text{RAMP}, and I\text{MAX} are inversely proportional to RSET and decrease as RSET increases. This inverse relationship is linear. For example, a 10% change in (1/RSET) results in a 10% change in current parameters. Conversely, time and delay parameters are linear and directly proportional to RSET, and a 10% change in RSET results in an 10% change in time parameters.

The difference between the maximum and minimum threshold current limits is the min/max limit spread, which is greater than the threshold hysteresis. The min/max spread and the hysteresis both change by the same percentage as the mean of the threshold current limits. The following equation is useful for finding the mean of the threshold current limits given a value of RSET resistance:

\[
I = I_0 + \frac{1}{R \times m} \quad (I < 0)
\]

I is the mean of the threshold current limits, R is the value of the RSET resistance in kΩ, the constant I_0 = 0.03717mA, and the constant m = -0.001668 (1/(kΩ x mA)).

The following equation is useful for finding the value of RSET resistance given a mean of the threshold current limits:

\[
Y = Y_0 + m \times I \quad (I < 0)
\]

\[
R = \frac{1}{Y}
\]

\[
Y_0 = 6.2013 \times 10^{-5} \text{ units of } (1/kΩ)
\]

To compute the typical input current thresholds from the mean input current, it is necessary to obtain the hysteresis. The following equation finds the hysteresis given the mean threshold current, I:

\[
H = H_0 + k \times I \quad (I < 0)
\]

where H_0 = -0.033463 in mA, and k = -0.08414 in mA/mA.

**Application Information**

**Use of Digital and Analog Outputs**
The digital output can be used to provide the μP with an interrupt signal that can represent a Hall sensor change of status. DOUT1 and DOUT2 provide a time domain output filter for robust noise immunity. See Figure 2. The analog output can be connected to an ADC with an appropriate load resistor, and can be used to perform custom diagnostics.
MAX9621

**Dual, 2-Wire Hall-Effect Sensor Interface with Analog and Digital Outputs**

![Diagram](image)

**Sleep Mode**
Sleep mode can be used in applications that do not continuously require the polling of the Hall sensors. In such cases, the µP can enable the MAX9621 for a short time, check the sensor status, and then put the MAX9621 back to sleep. A blanking period follows upon exiting sleep mode.

**Remote Ground**
The MAX9621 targets applications with 2-wire Hall-effect sensors. 2-wire sensors have connections for supply and ground. The output level is signaled by means of modulation of the current drawn by the Hall sensor from its supply. The two threshold currents for high/low are generally in the range of 5mA to 14mA. Thus, the interfacing of a 2-wire sensor is not simply a matter of detecting two voltage thresholds, but requires a coarse current-sense function.

Because of the high-side current-sense structure of the MAX9621, the device is immune to shifts between the sensor ground, the ground of the MAX9621 and µP. This ground-shift immunity eliminates the need for a ground-connection wire, allowing a single-wire interface to the Hall sensor.

**Hall-Effect Sensor Selection**
The MAX9621 is optimized for use with 2-wire Hall-effect switches or with 3-wire Hall-effect switches connected as 2-wire (Figure 5). When using a 3-wire Hall sensor the resistor R is chosen so that the current drawn by the Hall sensor crosses the MAX9621 current threshold when the magnetic threshold of the Hall sensor is exceeded. A partial list of Hall switches that can be used with the MAX9621 is given in Table 2.

**Input Current Threshold Precision**
To get the best input current threshold precision, it is recommended that the $R_{\text{SET}}$ resistor be directly connected to the BAT pin. A true Kelvin type connection is best.

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**Table 2. A Partial List of Compatible Hall Switches**

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>MANUFACTURER</th>
<th>WEBSITE</th>
<th>COMMENTS</th>
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<tbody>
<tr>
<td>HAL573-6</td>
<td>Micronas</td>
<td><a href="http://www.micronas.com">www.micronas.com</a></td>
<td>2-wire</td>
</tr>
<tr>
<td>HAL556/560/566</td>
<td>Micronas</td>
<td><a href="http://www.micronas.com">www.micronas.com</a></td>
<td>2-wire</td>
</tr>
<tr>
<td>HAL579/581/584</td>
<td>Micronas</td>
<td><a href="http://www.micronas.com">www.micronas.com</a></td>
<td>2-wire</td>
</tr>
<tr>
<td>A1140/1/2/3</td>
<td>Allegro</td>
<td><a href="http://www.allegromicro.com">www.allegromicro.com</a></td>
<td>2-wire</td>
</tr>
<tr>
<td>A3161</td>
<td>Allegro</td>
<td><a href="http://www.allegromicro.com">www.allegromicro.com</a></td>
<td>3-wire, optimized for 2-wire use without added resistor</td>
</tr>
<tr>
<td>TLE4941/C</td>
<td>Infineon</td>
<td><a href="http://www.infineon.com">www.infineon.com</a></td>
<td>2-wire</td>
</tr>
</tbody>
</table>
MAX9621

Dual, 2-Wire Hall-Effect Sensor Interface with Analog and Digital Outputs

Typical Application Circuit

Chip Information

PROCESS: BICMOS
MAX9621

Dual, 2-Wire Hall-Effect Sensor Interface with Analog and Digital Outputs

Package Information

For the latest package outline information and land patterns (footprints), go to www.maximintegrated.com/packages. Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

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<th>PACKAGE TYPE</th>
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<th>LAND PATTERN NO.</th>
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<td>10 μMAX</td>
<td>U10+2</td>
<td>21-0061</td>
<td>90-0330</td>
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PACKAGE OUTLINE, 10L uMAX/uSOP

Maxim Integrated
# MAX9621

## Dual, 2-Wire Hall-Effect Sensor Interface with Analog and Digital Outputs

### Revision History

<table>
<thead>
<tr>
<th>REVISION NUMBER</th>
<th>REVISION DATE</th>
<th>DESCRIPTION</th>
<th>PAGES CHANGED</th>
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<tbody>
<tr>
<td>0</td>
<td>11/09</td>
<td>Initial release</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>9/11</td>
<td>Added automotive qualified part</td>
<td>1</td>
</tr>
</tbody>
</table>

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