H21L Series
OPTOLOGIC® Optical Interrupter Switch

Features
- Low cost
- 0.035" apertures
- Black plastic opaque housing
- Mounting tabs on housing
- Choice of inverter or buffer output functions
- Choice of open-collector or totem-pole output configuration
- TTL/CMOS compatible output functions

Description
The H21L series are slotted optical switches designed for multipurpose non contact sensing. They consist of a GaAs LED and a silicon OPTOLOGIC® sensor packaged in an injection molded housing and facing each other across a .124" (3.15 mm) gap. The output is either inverting or non-inverting, with a choice of totem-pole or open-collector configuration for TTL/CMOS compatibility.

Part Number Definitions
H21LTB, Totem-pole, buffer output
H21LTI, Totem-pole, inverter output
H21LOB, Open-collector, buffer output
H21LOI, Open-collector, inverter output

Package Dimensions

Notes:
1. Dimensions for all drawings are in inches (mm).
2. Tolerance of ± .010 (.25) on all non-nominal dimensions unless otherwise specified.
Absolute Maximum Ratings (\(T_A = 25°C\) Unless otherwise specified)

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Rating</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>(T_{OPR})</td>
<td>Operating Temperature</td>
<td>-40 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>(T_{STG})</td>
<td>Storage Temperature</td>
<td>-40 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>(T_{SOL-I})</td>
<td>Soldering Temperature (Iron)(^{(5)(6)(7)(8)})</td>
<td>240 for 5 sec</td>
<td>°C</td>
</tr>
<tr>
<td>(T_{SOL-F})</td>
<td>Soldering Temperature (Flow)(^{(5)(6)(8)})</td>
<td>260 for 10 sec</td>
<td>°C</td>
</tr>
</tbody>
</table>

**INPUT (Emitter)**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Rating</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I_F)</td>
<td>Continuous Forward Current</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>(V_R)</td>
<td>Reverse Voltage</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>(P_D)</td>
<td>Power Dissipation(^{(3)})</td>
<td>100</td>
<td>mW</td>
</tr>
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</table>

**OUTPUT (Sensor)**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Rating</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I_O)</td>
<td>Output Current</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>(V_{CC})</td>
<td>Supply Voltage</td>
<td>4.0 to 16</td>
<td>V</td>
</tr>
<tr>
<td>(V_O)</td>
<td>Output Voltage</td>
<td>30</td>
<td>V</td>
</tr>
<tr>
<td>(P_D)</td>
<td>Power Dissipation(^{(4)})</td>
<td>150</td>
<td>mW</td>
</tr>
</tbody>
</table>

Notes:

3. Derate power dissipation linearly 1.67mW/°C above 25°C.
4. Derate power dissipation linearly 2.50mW/°C above 25°C.
5. RMA flux is recommended.
6. Methanol or isopropyl alcohols are recommended as cleaning agents.
7. Soldering iron 1/16" (1.6mm) from housing.
8. As long as leads are not under any stress or spring tension.
### Electrical/Optical Characteristics \( (T_A = 25^\circ C) \)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
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<tr>
<td><strong>INPUT (Emitter)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_F )</td>
<td>Forward Voltage</td>
<td>( I_F = 20mA )</td>
<td></td>
<td>1.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( I_R )</td>
<td>Reverse Leakage Current</td>
<td>( V_R = 5 ) V</td>
<td></td>
<td>10</td>
<td></td>
<td>( \mu A )</td>
</tr>
<tr>
<td><strong>OUTPUT (Sensor)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_{CC} )</td>
<td>Supply Current</td>
<td>( V_{CC} = 5 ) V</td>
<td></td>
<td>5</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td><strong>COUPLED</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>( V_{OL} )</td>
<td>Low Level Output Voltage H21LTB, H21LOB</td>
<td>( I_F = 0mA, V_{CC} = 5V, I_{OL} = 16mA )</td>
<td></td>
<td>0.4</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Low Level Output Voltage H21LTI, H21LOI</td>
<td>( I_F = 15mA, V_{CC} = 5V, I_{OL} = 16mA )</td>
<td></td>
<td>0.4</td>
<td></td>
<td></td>
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<tr>
<td>( V_{OH} )</td>
<td>High Level Output Voltage H21LTB</td>
<td>( I_F = 15mA, V_{CC} = 5V, I_{OH} = -1mA )</td>
<td></td>
<td>2.4</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>High Level Output Voltage H21LTI</td>
<td>( I_F = 0mA, V_{CC} = 5V, I_{OH} = -1mA )</td>
<td></td>
<td>2.4</td>
<td></td>
<td></td>
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<tr>
<td>( I_{OH} )</td>
<td>High Level Output Current H21LOB</td>
<td>( I_F = 15mA, V_{CC} = 5V, V_{OH} = 30V )</td>
<td></td>
<td>100</td>
<td></td>
<td>( \mu A )</td>
</tr>
<tr>
<td></td>
<td>High Level Output Current H21LOI</td>
<td>( I_F = 0mA, V_{CC} = 5V, V_{OH} = 30V )</td>
<td></td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_F(+) )</td>
<td>Turn on Threshold Current</td>
<td>( V_{CC} = 5V )</td>
<td></td>
<td>15</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>( I_F(-) )</td>
<td>Turn off Threshold Current</td>
<td>( V_{CC} = 5V )</td>
<td></td>
<td>0.50</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>( I_F(+) / I_F(-) )</td>
<td>Hysteresis Ratio</td>
<td></td>
<td></td>
<td>1.2</td>
<td></td>
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<td>( t_{PLH}, t_{PHL} )</td>
<td>Propagation Delay, H21LOI, H21LOB</td>
<td>( V_{CC} = 5V, R_L = 300\Omega ) (Fig. 9)</td>
<td></td>
<td>6</td>
<td></td>
<td>( \mu s )</td>
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<tr>
<td></td>
<td>Propagation Delay, H21LTI, H21LTB</td>
<td>( V_{CC} = 5V, R_L = 300\Omega ) (Fig. 9)</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
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<tr>
<td>( t_r, t_f )</td>
<td>Output Rise and Fall Time, H21LOI, H21LOB</td>
<td>( V_{CC} = 5V, R_L = 300\Omega ) (Fig. 9)</td>
<td></td>
<td>100</td>
<td></td>
<td>ns</td>
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<td></td>
<td>Output Rise and Fall Time, H21LTI, H21LTB</td>
<td>( V_{CC} = 5V, R_L = 300\Omega ) (Fig. 9)</td>
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<td>70</td>
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### Input/Output Table

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<th>Part Number</th>
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<th>Output</th>
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<tbody>
<tr>
<td>H21LTB</td>
<td>On</td>
<td>High</td>
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<tr>
<td>H21LTB</td>
<td>Off</td>
<td>Low</td>
</tr>
<tr>
<td>H21LTI</td>
<td>On</td>
<td>Low</td>
</tr>
<tr>
<td>H21LTI</td>
<td>Off</td>
<td>High</td>
</tr>
<tr>
<td>H21LOB</td>
<td>On</td>
<td>High</td>
</tr>
<tr>
<td>H21LOB</td>
<td>Off</td>
<td>Low</td>
</tr>
<tr>
<td>H21LOI</td>
<td>On</td>
<td>Low</td>
</tr>
<tr>
<td>H21LOI</td>
<td>Off</td>
<td>High</td>
</tr>
</tbody>
</table>
H21L Series — OPTOLOGIC® Optical Interrupt Switch

Circuit Schematics

H21LTB
Totem-Pole Output Buffer

H21LTI
Totem-Pole Output inverter

H21LOB
Open-Collector Output Buffer

H21LOI
Open-Collector Output Inverter
Typical Performance Characteristics

**Figure 1. Output Voltage vs. Input Current (Inverters)**

**Figure 2. Output Voltage vs. Input Current (Buffers)**

**Figure 3. Normalized Threshold Current vs. Shield Distance**

**Figure 4. Normalized Threshold Current vs. Supply Voltage**
Typical Performance Characteristics (Continued)

Figure 5. Normalized Threshold Current vs. Ambient Temperature

Figure 6. Forward Current vs. Forward Voltage

Figure 7. Low Output Voltage vs. Output Current

Figure 8. Response Time vs. Forward Current
Figure 9. Switching Speed Test Circuit

![Switching Speed Test Circuit Diagram](image)

- Pulse Generator
- $V_O = 5V$
- $f = 10$ KHz
- d.c. = 50%

- $R_1 = 300\Omega$
- $R_2 = 180\Omega$
- $C_1 = 15pF$
- $C_2 = 20pF$
- $C_1$ and $C_2$ include probe and stray wire capacitance

Figure 10. Typical Operating Circuit

![Typical Operating Circuit Diagram](image)

- $R_{OL}$
- $V_{IN}$
- $V_{CC}$
- $V_O$
- $GND$

- $V_{OH}$
- $V_{OL}$

Figure 11. Switching Times Definition for Buffer

![Switching Times Definition for Buffer Diagram](image)

- $0 mA$
- $V_{OH}$
- $V_{OL}$
- $t_{PLH}$
- $t_{PHL}$

- 90%
- 10%
- 50%

Figure 12. Switching Times Definitions for Inverters

![Switching Times Definitions for Inverters Diagram](image)

- $0 mA$
- $V_{OH}$
- $V_{OL}$
- $t_{PLH}$
- $t_{PHL}$

- 90%
- 10%
- 50%
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<th>Definition</th>
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