H21A1 / H21A2 / H21A3
PHOTOTRANSISTOR
OPTICAL INTERRUPTER SWITCH

DESCRIPTION
The H21A1, H21A2 and H21A3 consist of a gallium arsenide infrared emitting diode coupled with a silicon phototransistor in a plastic housing. The packaging system is designed to optimize the mechanical resolution, coupling efficiency, ambient light rejection, cost and reliability. The gap in the housing provides a means of interrupting the signal with an opaque material, switching the output from an “ON” to an “OFF” state.

FEATURES
• Opaque housing
• Low cost
• .035” apertures
• High IC(ON)

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)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>T.OPR</td>
<td>-55 to +100</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>T.STG</td>
<td>-55 to +100</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering Temperature (Iron)(2,3 and 4)</td>
<td>T.SOL-I</td>
<td>240 for 5 sec</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering Temperature (Flow)(2 and 3)</td>
<td>T.SOL-F</td>
<td>260 for 10 sec</td>
<td>°C</td>
</tr>
</tbody>
</table>

INPUT (EMITTER)
Continuous Forward Current | IF | 50 | mA |
Reverse Voltage | V.R | 6 | V |
Power Dissipation (1) | P.D | 100 | mW |

OUTPUT (SENSOR)
Collector to Emitter Voltage | V.CEO | 30 | V |
Emitter to Collector Voltage | V.ECO | 4.5 | V |
Collector Current | I.C | 20 | mA |
Power Dissipation (T.C = 25°C)(1) | P.D | 150 | mW |

© 2001 Fairchild Semiconductor Corporation
www.fairchildsemi.com
## ELECTRICAL / OPTICAL CHARACTERISTICS

(Ta = 25°C) (All measurements made under pulse condition)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>SYMBOL</th>
<th>DEVICES</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT (EMITTER)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward Voltage</td>
<td>IF = 60 mA</td>
<td>VF</td>
<td>All</td>
<td>—</td>
<td>—</td>
<td>1.7</td>
<td>V</td>
</tr>
<tr>
<td>Reverse Breakdown Voltage</td>
<td>IR = 10 µA</td>
<td>VR</td>
<td>All</td>
<td>6.0</td>
<td>—</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>Reverse Leakage Current</td>
<td>VR = 3 V</td>
<td>IR</td>
<td>All</td>
<td>—</td>
<td>—</td>
<td>1.0</td>
<td>µA</td>
</tr>
<tr>
<td>OUTPUT (SENSOR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emitter to Collector Breakdown</td>
<td>IF = 100 µA, Ee = 0</td>
<td>BVECO</td>
<td>All</td>
<td>6.0</td>
<td>—</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>Collector to Emitter Breakdown</td>
<td>IC = 1 mA, Ee = 0</td>
<td>BVECO</td>
<td>All</td>
<td>30</td>
<td>—</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>Collector to Emitter Leakage</td>
<td>VCE = 25 V, Ee = 0</td>
<td>ICEO</td>
<td>All</td>
<td>—</td>
<td>—</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>COUPLED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-State Collector Current</td>
<td>IF = 5 mA, VCE = 5 V</td>
<td>IC(ON)</td>
<td>H21A1</td>
<td>0.15</td>
<td>—</td>
<td>—</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>IF = 20 mA, VCE = 5 V</td>
<td></td>
<td>H21A2</td>
<td>0.30</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IF = 30 mA, VCE = 5 V</td>
<td></td>
<td>H21A3</td>
<td>0.60</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VCE(SAT)</td>
<td>H21A2/3</td>
<td></td>
<td>—</td>
<td>—</td>
<td>0.40</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>VCE(SAT)</td>
<td>H21A1</td>
<td></td>
<td>—</td>
<td>—</td>
<td>0.40</td>
<td>V</td>
</tr>
<tr>
<td>Turn-On Time</td>
<td>IC = 30 mA, VCE = 5 V</td>
<td>ton</td>
<td>All</td>
<td>—</td>
<td>8</td>
<td>—</td>
<td>µs</td>
</tr>
<tr>
<td>Turn-Off Time</td>
<td>IC = 30 mA, VCE = 5 V</td>
<td>toff</td>
<td>All</td>
<td>—</td>
<td>50</td>
<td>—</td>
<td>µs</td>
</tr>
</tbody>
</table>
Figure 1. Output Current vs. Input Current

- Normalized to $V_{CE} = 5\, V$, $I_F = 20\, mA$, $P_W = 100\, \mu\, sec$
- Pulsed
- $P_R = 100\, pps$

Figure 2. Output Current vs. Temperature $T_A$, Ambient Temperature ($^\circ C$)

- Normalized to $V_{CE} = 5\, V$, $I_F = 20\, mA$, $T_A = 25\, ^\circ C$
- Input Pulsed

Figure 3. $V_{CE(SAT)}$ vs. Temperature $T_A$, Ambient Temperature ($^\circ C$)

- Normalized to $I_C = 1.8\, mA$, $T_A = 25\, ^\circ C$
- Pulsed
- $P_W = 100\, \mu\, sec$, $P_R = 100\, pps$
Figure 4. Leakage Current vs. Temperature

**DETECTOR**

- Normalized Dark Current
- $V_{CE} = 25 \text{ V}$
- $T_A = 25 \degree \text{C}$
- $V_{CE} = 10 \text{ V}$
- $T_A = 25 \degree \text{C}$

**EMITTER**

- Normalized Leakage Current
- $V_R = 5 \text{ V}$
- $T_A = 25 \degree \text{C}$

Figure 5. Switching Speed vs. $R_L$

- $t_{ON}$ and $t_{OFF}$ Normalized
- $R_L$ Load Resistance ($\Omega$)
- $P_{W} = 300 \mu\text{s}$
- $P_{RR} = 100 \text{ pps}$
- $I_F = 75 \text{ AMPS, } V_{CC} = 5 \text{ V}$
- Normalized to $R_L = 2.5 \text{ K}\Omega$

Figure 6. Output Current vs. Distance

- $I_{CE(on)}$ Normalized Output Current
- $d$, Distance (mils)
- Normalized to Value with Shield Removed
- BLACK SHIELD
- $D + E + d$
- $78.7, 157.5, 236.2, 315, 393.7$

www.fairchildsemi.com
DISCLAIMER
FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY
FAIRCHILD’S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in labeling, can be reasonably expected to result in a significant injury of the user.

2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.