



Data Sheet

Reflective and slotted opto switches 2601

Gallium Arsenide infra-red emitting diodes and spectrally matched detectors housed in moulded packages mechanically designed to enable sensing in a variety of applications, i.e. limit switching, paper/tape sensing and optical encoding.

Reflective opto switch RS stock no. 307-913

Comprises a Ga As infra-red emitting diode with a silicon phototransistor in a moulded rugged package. The sensor responds to the emitted radiation from the infra-red source only when a reflective object is within the field of view of the sensor. The device is ideal for such applications as end of tape detection, mark sensing, etc. An infra-red transmitting filter eliminates ambient illumination problems.

Absolute maximum ratings at 25°C (unless stated)

Operating temp range _____ -40°C to +80°C
Storage temp range _____ -40°C to +80°C
Lead soldering temperature (5 sec) _____ 260°C

Input diode

Forward dc current _____ 40mA*
Reverse dc voltage _____ 2V
Power dissipation _____ 50mW**

Output sensor

Collector-emitter voltage _____ 15V
Emitter-collector voltage _____ 5V
Power dissipation _____ 50mW**

* Derate linearly 0.73mA/°C above 25°C

** Derate linearly 0.91mW/°C above 25°C

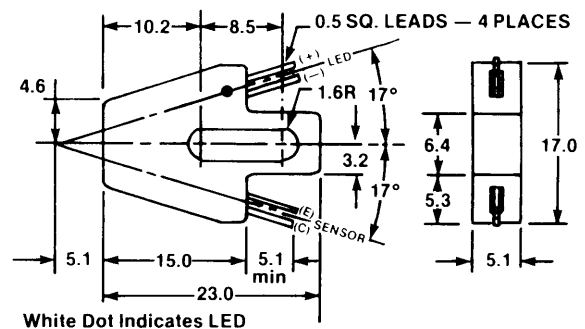
Electrical characteristics

at 25°C (unless stated)

Applications

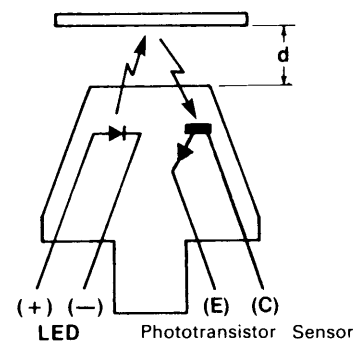
- Limit switch
- Paper sensor
- Counter
- Chopper
- Coin sensor
- Optical sensor
- Position sensor
- Level indicator.

Mechanical details



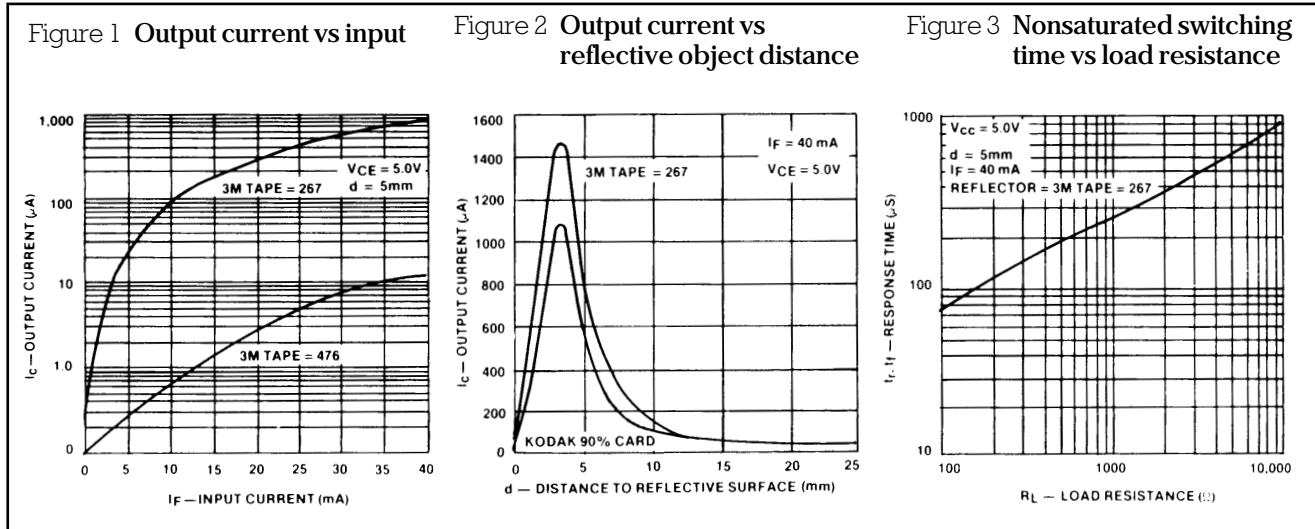
Electrical details

Reflective Surface (See Notes 1 & 2)



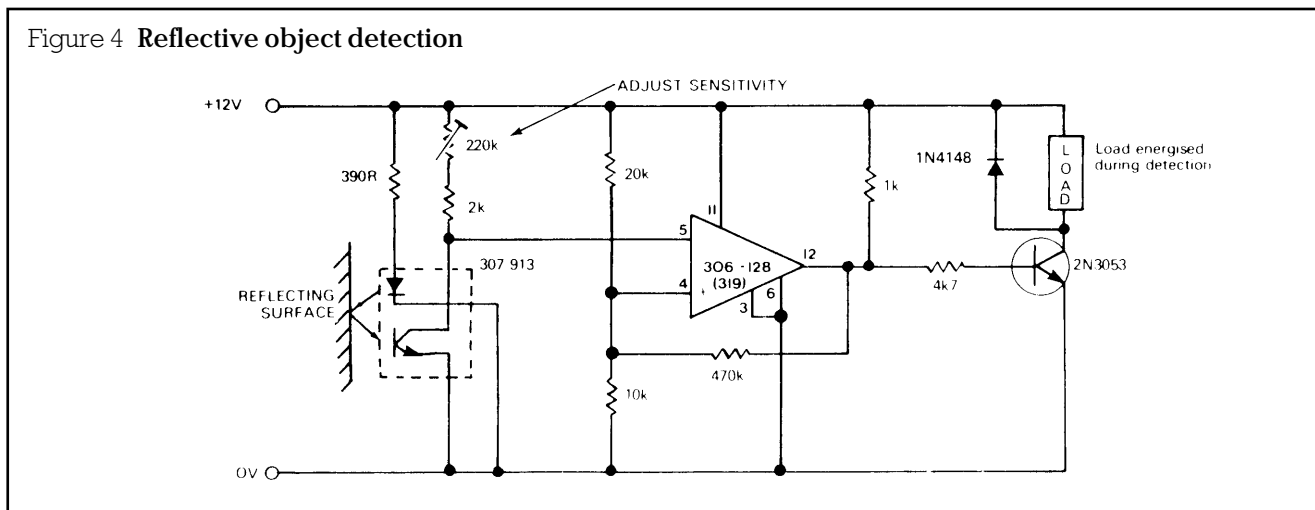
| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------------------|-------------------------------------|------|------|------|---------------|--|
| Input Diode | | | | | | |
| V_F | Forward Voltage | - | - | 1.8 | V | $I_F = 40\text{mA}$ |
| I_R | Reverse Current | - | - | 100 | μA | $V_R = 2\text{V}$ |
| P_O | Radiant Power | 0.5 | 1.5 | - | mW | $I_F = 20\text{mA}$ |
| Output Sensor | | | | | | |
| BV_{CEO} | Collector-Emitter Breakdown Voltage | 15 | - | - | V | $I_{CE} = 100\mu\text{A}$ |
| BV_{ECO} | Emitter-Collector Breakdown Voltage | 5 | - | - | V | $I_{BC} = 100\mu\text{A}$ |
| Coupled | | | | | | |
| I_C | Photocurrent (Note 1) | 200 | - | - | μA | $I_F = 40\text{mA}$, $V_{CF} = 5\text{V}$ |
| I_{CX} | Photocurrent (Note 2) | - | - | 20 | μA | $d = 5\text{mm}$ (Fig.2) |

Typical characteristics

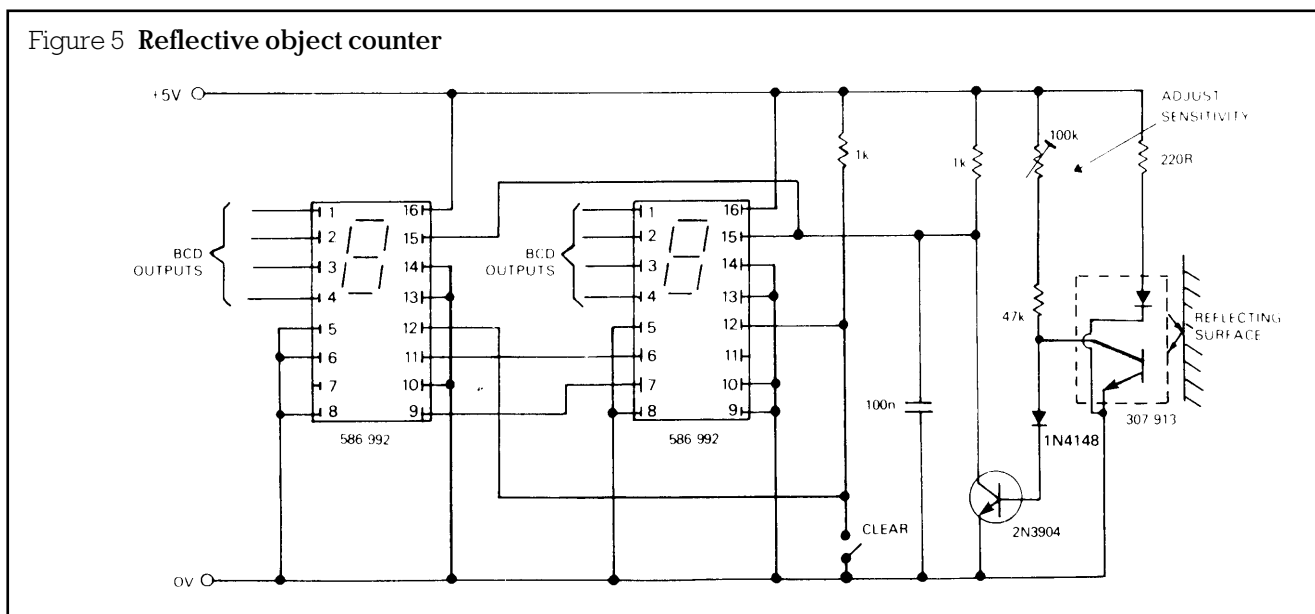


Note 1: Photocurrent (I_C) is measured using 3M tape = 267 for a reflecting surface. The reflective qualities of 3M tape = 267 are very similar to an Eastman Kodak neutral white test card having 90% diffuse reflectance.

Note 2: Photocurrent (I_{CX}) is measured using 3M tape = 476 for a reflecting surface. 3M tape = 476 has a very black dull surface with optical reflectance qualities comparable to a surface coated with carbon black printers ink.



Applications

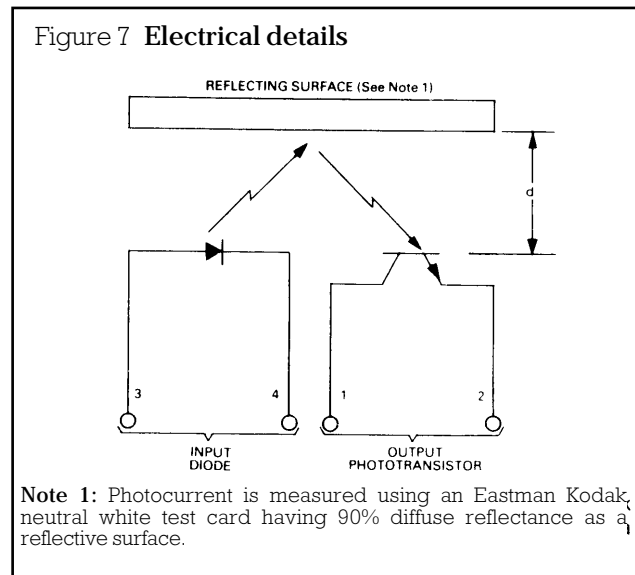
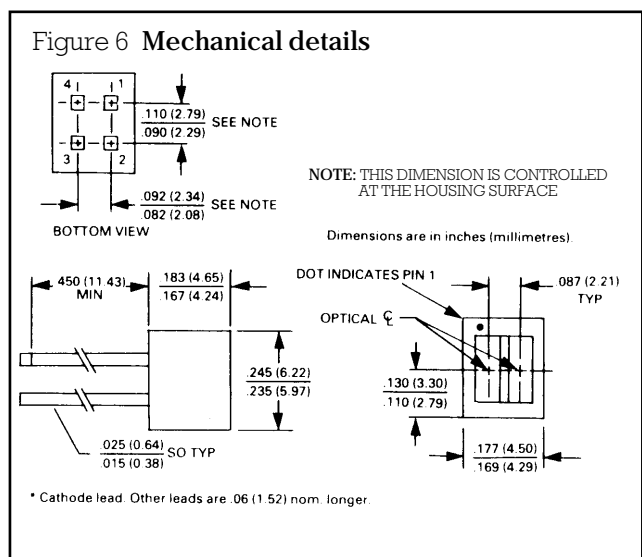


Miniature reflective opto-switch RS stock no. 301-606

Comprises a Ga As infra-red emitting diode and an npn silicon phototransistor mounted side by side on parallel axes and housed in a black plastic moulding to reduce ambient light noise. The photosensor responds to radiation only when a reflective object passes within its field of view.

Applications

- B.O.T.-E.O.T. Sensors
- Line finders
- Batch counters
- Object sensors
- Level indicators



Absolute maximum ratings

at 25°C (unless stated)

Operating temp. range _____ -55°C to +80°C
 Storage temp. range _____ -55°C to +80°C
 Lead soldering temperature (3 secs) _____ 240°C

Input diode

Forward dc current _____ 50mA
 Peak forward current _____
 (pulse width = 1 μ S, 300p.p.s.) _____ 3A
 Reverse dc voltage _____ 3V
 Power dissipation _____ 75mW*

Phototransistor

Collector-emitter voltage _____ 30V
 Emitter-collector voltage _____ 5V
 Collector dc current _____ 25mA
 Power dissipation _____ 75mW*

* derate linearly 1.36mW/°C above 25°C

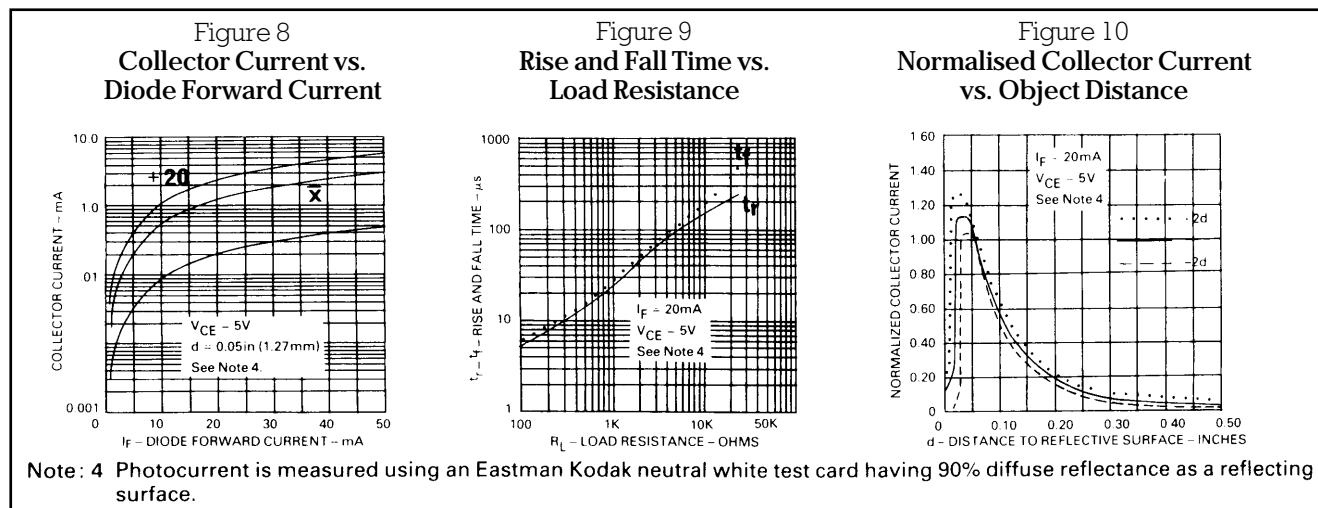
Electrical characteristics at 25°C (unless stated)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|--|--|--------------|-------------|---------------|--------------|--|
| Input Diode V_F I_R | Forward Voltage Reverse Current | - | - | 1.7 | V μA | $I_F = 20mA$ $V_R = 3V$ |
| Photo Transistor $V(BR)_{CEO}$ $V(BR)_{ECO}$ I_{CEO} | Collector-Emitter Breakdown Voltage Emitter-Collector Breakdown Voltage Collector Dark Current | 30 5 - | - - - | - - 100 | V V nA | $I_C = 100\mu A$ $I_E = 100\mu A$ $V_{CE} = 5 I_F = 0$ |
| Coupled $I_C(On)$ | On-State Collector Current | 350 | 700 | - | μA | $I_F = 20mA$ $V_{CE} = 5V$ $d = 1.27 mm$ (Note 2) |
| I_{CX} | Photocurrent (Note 3) | - | - | 0.20 | μA | $I_F = 20mA$ $V_{CE} = 5V$ No reflecting surface |

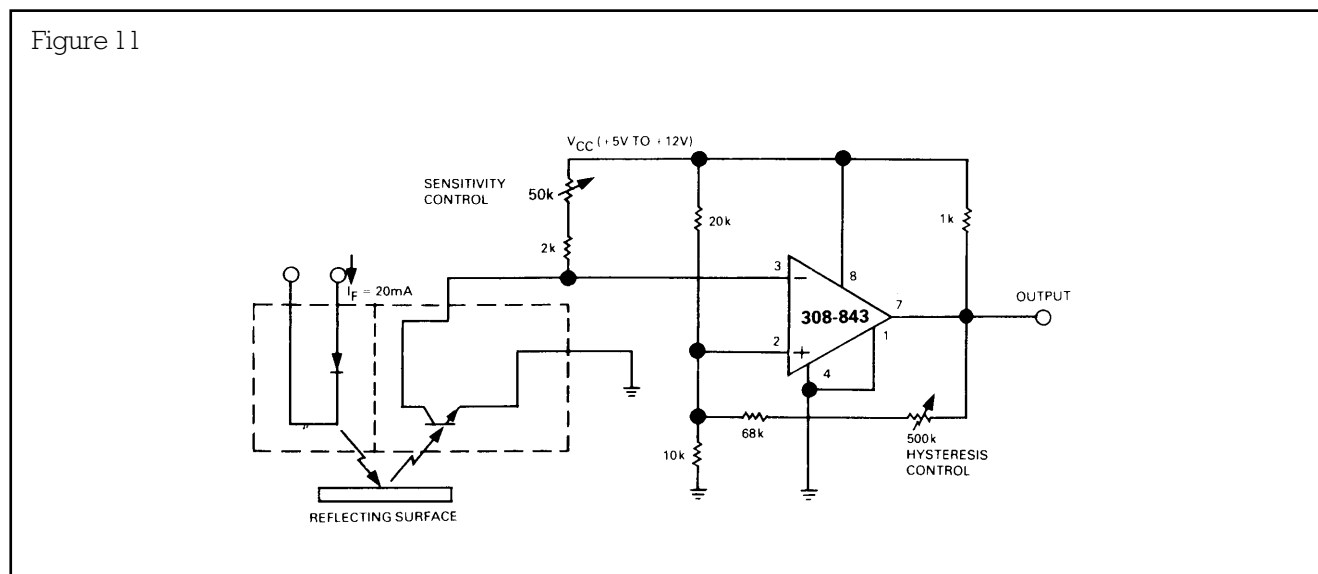
Note 2: d is the distance in mm from the assembly face to the reflective surface.

Note 3: Photocurrent (I_{CX}) is the collector current measured with the indicated current in the input diode and no reflecting surface.

Typical characteristics



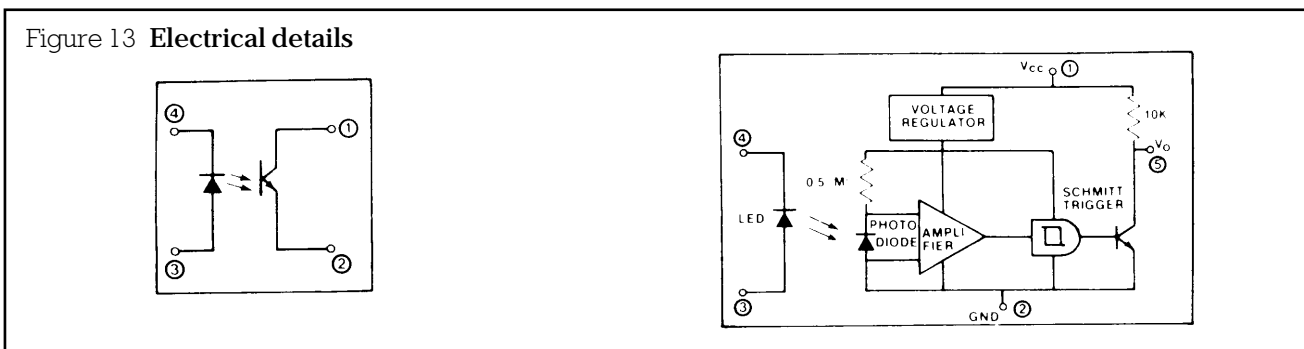
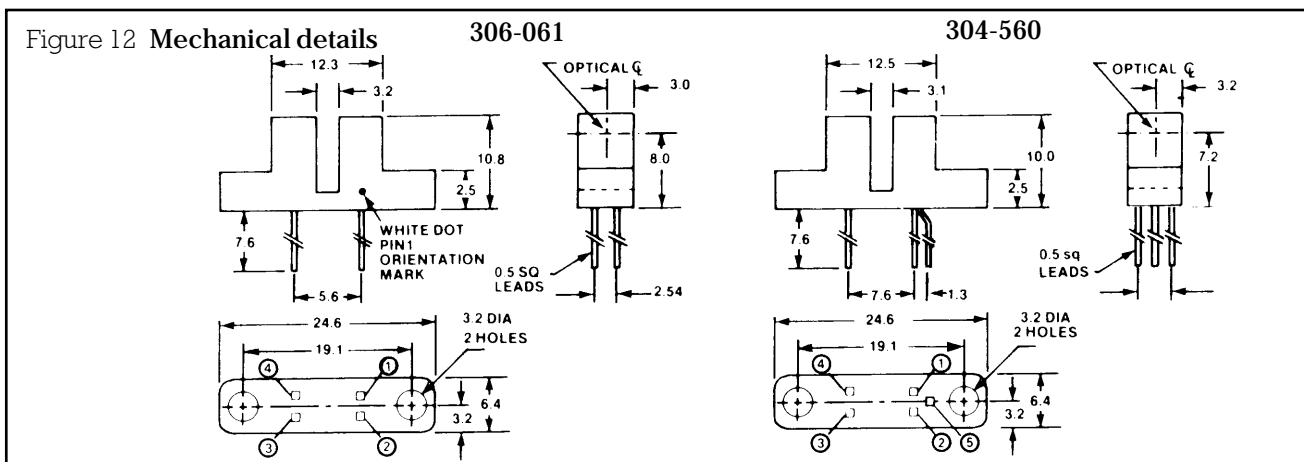
Applications



Slotted opto switches (RS stock numbers 306-061, 304-560)

Two versions are available. 306-061 comprises a Ga As infra-red LED coupled with an npn silicon photo-transistor housed in a plastic package with infra-red transmitting filter for high ambient light application and dust protection. 304-560 is a similar device but the detector is an integrated circuit

consisting of a Schmitt trigger, voltage regulator, differential amplifier and photodiode. The on-chip voltage regulator gives a wide operating voltage range and ensures output compatibility with TTL/LSTTL/CMOS logic.



Absolute maximum ratings at 25°C (unless stated)

| | 306-061 | 304-560 |
|----------------------------------|----------------|----------------|
| Operating temperature range | -55°C to 100°C | -40°C to 100°C |
| Storage temperature range | -55°C to 125°C | -55°C to 115°C |
| Lead soldering temperature (10s) | 260°C | 260°C |

Input diode (306-061 and 304-560)

| | |
|---|-------|
| Forward dc current | 50mA |
| Peak forward current (1 μs p.w. 300pps) | 3A |
| Reverse dc voltage | 3V |
| Power dissipation | 100mW |

Output Sensors

| | 306-061 | 304-560 |
|-------------------------------|---------|---------|
| Collector-emitter voltage | 30V | - |
| Emitter-collector voltage | 5V | - |
| Max allowable V _{CC} | - | 20V |
| Collector dc current | 30mA | 50mA |
| Power dissipation | 150mW** | 250mW |

* Derate linearly 1.33mW/°C above 25°C

** Derate linearly 3.3mW/°C above 25°C

Electrical characteristics at 25°C (unless stated)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------------------|-------------------------------------|------|------|------|-------|--|
| Input Diode | | | | | | |
| V _F | Forward Voltage | - | 1.2 | 1.7 | V | I _F = 20mA |
| I _R | Reverse Current | - | - | 100 | μA | V _R = 3V |
| Output Sensor | | | | | | |
| BV _{CEO} | Collector-Emitter Breakdown Voltage | 30 | 60 | - | V | I _C = 1.0mA |
| BV _{EBO} | Emitter-Collector Breakdown Voltage | 5 | 8 | - | V | I _E = 100μA |
| I _D | Collector Dark Current | - | 10 | 100 | nA | V _{CE} = 10V, I _F = 0, H = 0 |
| Coupled | | | | | | |
| V _{CE(SAT)} | Collector-Emitter Sat. Voltage | - | 0.2 | 0.4 | V | I _F = 10mA, I _C = 250μA |
| I _{C(ON)} | On-state Collector Current | 1000 | 3000 | - | μA | I _F = 10mA, V _{CE} = 5V |
| t _R | Response Time | - | 5 | - | μS | |

Figure 14 On-state collector current vis input diode forward current

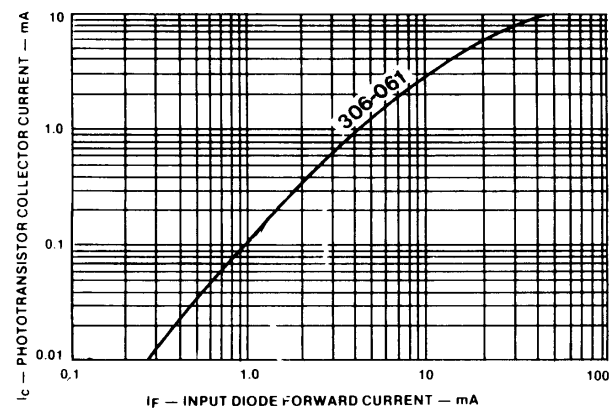
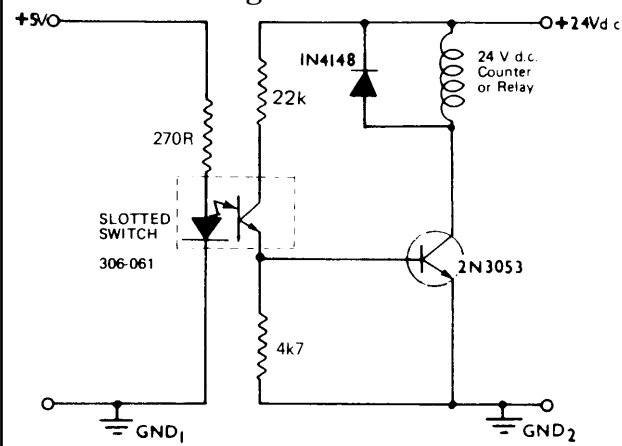


Figure 15 Application: Event counting or limit switching



Opto Schmitt switch (RS stock number 304-560)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------------------------------|--------------------------------|------|----------|------|---------------|--|
| Input Diode V_F | Forward Voltage | - | - | 1.5 | V | $I_F = 20\text{mA}$ |
| I_R | Reverse Current | - | - | 10 | μA | $V_R = 3\text{V}$ |
| Output Sensor V_{CC} | Operating Supply Voltage Range | 4.5 | - | 16 | V | |
| | Output Voltage (Low) | - | - | 0.4 | V | $-40^\circ\text{C} < T_A < 100^\circ\text{C}$. $I_O = 16\text{mA}$ |
| | Output Voltage (High) | - | V_{CC} | - | - | NB. Output tied to V_{CC} through 10K resistor |
| I_{CC} | Operating Current | - | - | 15 | mA | $V_{CC} = 16\text{V}$ |
| t_p | Propagation Delay Time | 1 | - | 5 | μs | $I_F = 10\text{mA}$ |
| t_r | Output Rise Time | - | 150 | 180 | nS | $C_L = 50\text{pF}$, $R_L = 390\text{R}$ $V_{CC} = 5\text{V}$ |
| t_f | Output Fall Time | - | 23 | 50 | nS | $C_L = 50\text{pF}$, $R_L = 390\text{R}$ - $V_{CC} = 5\text{V}$ |
| | Hysteresis | | 10 | - | 30 | % Note 2 |
| I_{FT} | Required LED Current | - | - | 10 | mA | Note 1. $-40^\circ\text{C} < T_A < 75^\circ\text{C}$ |
| f_{max} | Maximum Operating Frequency | - | - | 100 | kHz | $C_L = 50\text{pF}$, $R_L = 390\text{R}$ $V_{CC} = 5\text{V}$ |

Note 1: Required LED current is the minimum forward LED current required to trigger the detector output from LOW to HIGH. Higher LED current may be required for application where optical transmission is reduced.

Note 2: Hysteresis is defined in terms of irradiance (mW/cm^2) transmitted to the detector and is equal to the difference in the threshold point (min. irradiance to switch the output high) to the release point (reduced amount of irradiance to switch the output back low) divided by the threshold point.

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