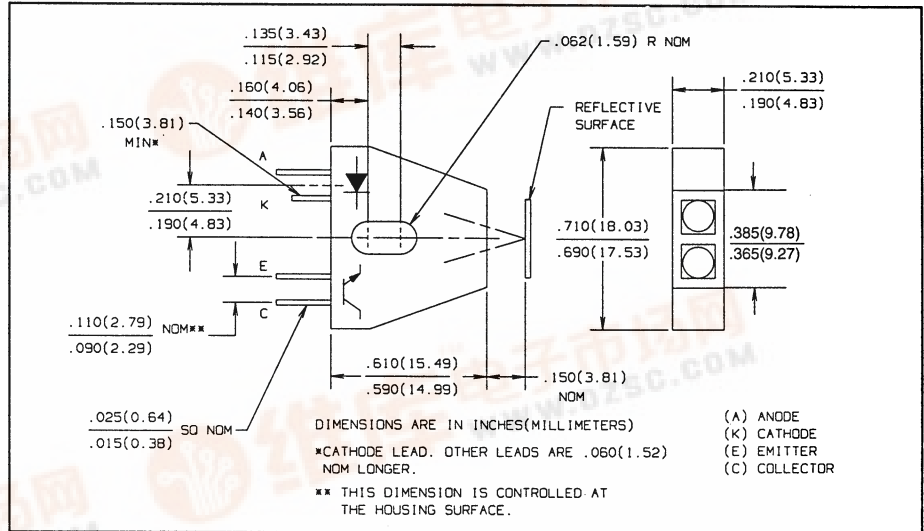
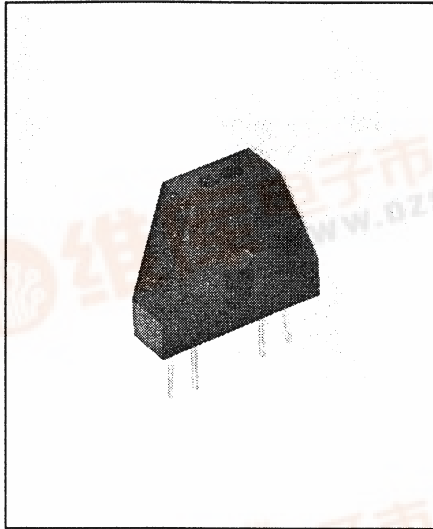


Product Bulletin OPB708, OPB709  
June 1996

# Reflective Object Sensors

## Types OPB708, OPB709



### Features

- Focused for maximum sensitivity
- Phototransistor (OPB708) or photodarlington (OPB709) output
- Crosstalk does not exceed specified  $I_{CEO}$
- Low cost plastic housing

### Description

The OPB708 and OPB709 each consists of an infrared emitting diode and an NPN silicon phototransistor (OPB708) or photodarlington (OPB709), mounted side-by-side on converging optical axes, in a black plastic housing. Maximum sensitivity typically occurs 0.125 inches from the front of the housing.

The photosensor responds to radiation from the LED only when a reflective object passes within its field of view.

Both parts are constructed using either OP165 or OP265 series LEDs. The OPB708 uses an OP505 type phototransistor and the OPB709 uses an OP535 type photodarlington.

### Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

|                                                                                          |                                              |
|------------------------------------------------------------------------------------------|----------------------------------------------|
| Storage Temperature Range                                                                | -40 $^\circ\text{C}$ to +85 $^\circ\text{C}$ |
| Operating Temperature Range                                                              | -40 $^\circ\text{C}$ to +85 $^\circ\text{C}$ |
| Lead soldering temperature (1/6 inch [1.6 mm] from case for 5 sec. with soldering iron). | 240 $^\circ\text{C}$                         |

### Input Diode

|                            |                      |
|----------------------------|----------------------|
| Reverse Voltage            | 2.0 V                |
| Continuous Forward Current | 40 mA                |
| Power Dissipation          | 60 mW <sup>(2)</sup> |

### Output Photosensor

|                                    |                       |
|------------------------------------|-----------------------|
| Collector-Emitter Voltage - OPB708 | 30 V                  |
| OPB709                             | 15 V                  |
| Emitter-Collector Voltage          | 5.0 V                 |
| Power Dissipation - OPB708         | 50 mW <sup>(3)</sup>  |
| OPB709                             | 125 mW <sup>(4)</sup> |

### Notes:

- (1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
- (2) Derate linearly 1.00 mW/ $^\circ\text{C}$  above 25 $^\circ\text{C}$ .
- (3) Derate linearly 0.83 mW/ $^\circ\text{C}$  above 25 $^\circ\text{C}$ .
- (4) Derate linearly 2.08 mW/ $^\circ\text{C}$  above 25 $^\circ\text{C}$ .
- (5) d is the distance from the assembly face to the reflective surface.
- (6) Reflective surface is Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface. Reference: Eastman Kodak, Catalog #1257795.
- (7) Lower curve is based on a calculated worst case condition rather than the conventional -2 $\sigma$  limit.



# Types OPB708

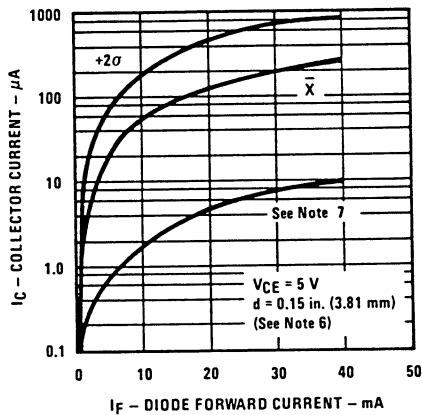
Electrical Characteristics ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

REFLECTIVE OBJECT SENSORS

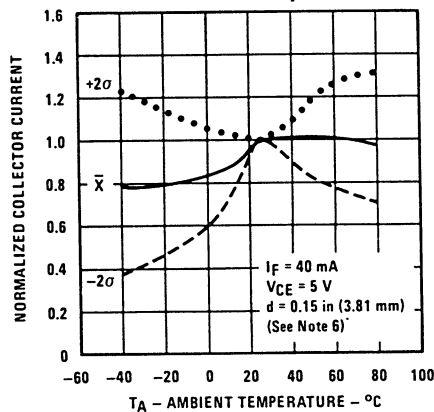
| SYMBOL                        | PARAMETER                            | MIN  | MAX  | UNITS         | TEST CONDITIONS                                                                     |
|-------------------------------|--------------------------------------|------|------|---------------|-------------------------------------------------------------------------------------|
| <b>Input Diode</b>            |                                      |      |      |               |                                                                                     |
| $V_F$                         | Forward Voltage                      |      | 1.70 | V             | $I_F = 40\text{ mA}$                                                                |
| $I_R$                         | Reverse Current                      |      | 100  | $\mu\text{A}$ | $V_R = 2.0\text{ V}$                                                                |
| <b>Output Phototransistor</b> |                                      |      |      |               |                                                                                     |
| $V_{(BR)CEO}$                 | Collector-Emitter Breakdown Voltage  | 30   |      | V             | $I_C = 100\ \mu\text{A}$                                                            |
| $V_{(BR)ECO}$                 | Emitter-Collector Breakdown Voltage  | 5.0  |      | V             | $I_E = 100\ \mu\text{A}$                                                            |
| $I_{CEO}$                     | Collector Dark Current               |      | 100  | nA            | $V_{CE} = 10.0\text{ V}, I_F = 0, E_e = 0$                                          |
| <b>Combined</b>               |                                      |      |      |               |                                                                                     |
| $I_{C(ON)}$                   | On-State Collector Current           | 10.0 |      | $\mu\text{A}$ | $V_{CE} = 5.0\text{ V}, I_F = 40\text{ mA}, d = 0.150\text{'' (3.81 mm)}^{(5)(6)}$  |
| $V_{CE(SAT)}$                 | Collector-Emitter Saturation Voltage |      | 0.40 | V             | $I_F = 40\text{ mA}, I_C = 3.0\ \mu\text{A}, d = 0.150\text{'' (3.81 mm)}^{(5)(6)}$ |

## Typical Performance Curves

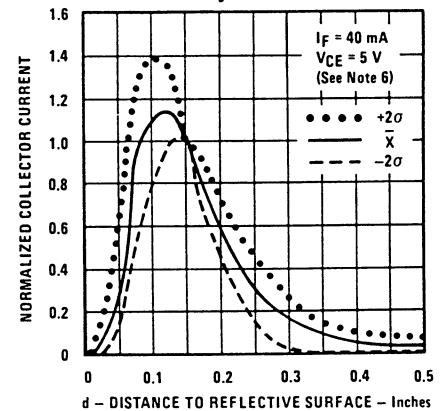
**Collector Current vs. Diode Forward Current**



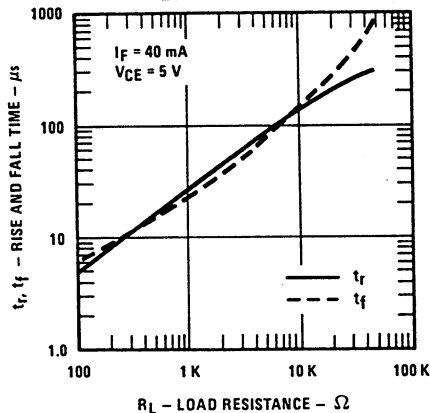
**Normalized Collector Current vs. Ambient Temperature**



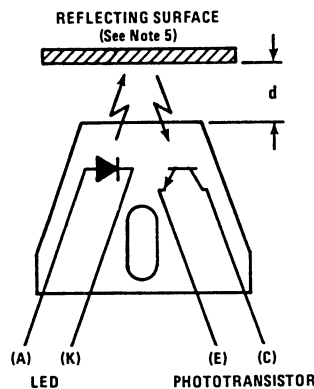
**Normalized Collector Current vs. Object Distance**



**Rise and Fall Time vs. Load Resistance**



**Test Condition**



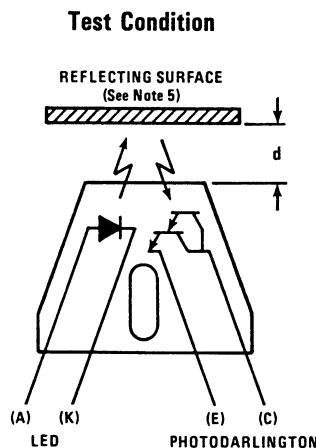
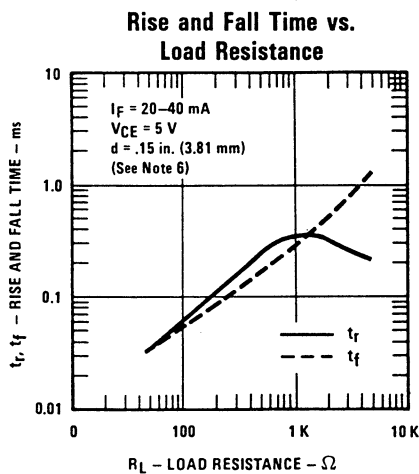
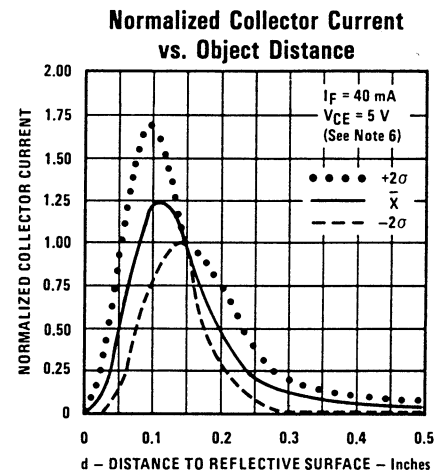
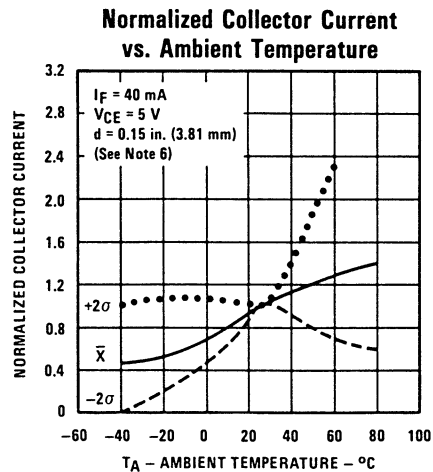
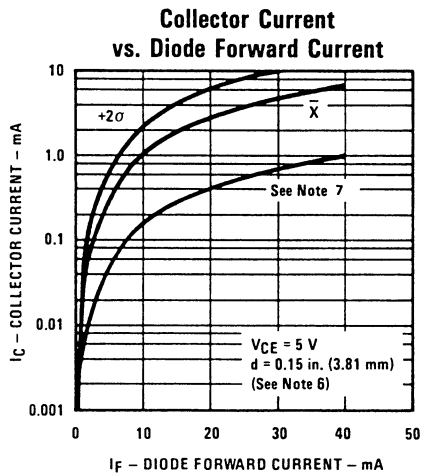
# Types OPB709



Electrical Characteristics ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| SYMBOL                 | PARAMETER                            | MIN  | MAX  | UNITS         | TEST CONDITIONS                                                                                       |
|------------------------|--------------------------------------|------|------|---------------|-------------------------------------------------------------------------------------------------------|
| Input Diode            |                                      |      |      |               |                                                                                                       |
| $V_F$                  | Forward Voltage                      |      | 1.70 | V             | $I_F = 40\text{ mA}$                                                                                  |
| $I_R$                  | Reverse Current                      |      | 100  | $\mu\text{A}$ | $V_R = 2.0\text{ V}$                                                                                  |
| Output Photodarlington |                                      |      |      |               |                                                                                                       |
| $V_{(BR)CEO}$          | Collector-Emitter Breakdown Voltage  | 15.0 |      | V             | $I_C = 100\ \mu\text{A}$                                                                              |
| $V_{(BR)ECO}$          | Emitter-Collector Breakdown Voltage  | 5.0  |      | V             | $I_E = 100\ \mu\text{A}$                                                                              |
| $I_{CEO}$              | Collector Dark Current               |      | 250  | nA            | $V_{CE} = 10.0\text{ V}$ , $I_F = 0$ , $E_e = 0$                                                      |
| Combined               |                                      |      |      |               |                                                                                                       |
| $I_{C(ON)}$            | On-State Collector Current           | 1.00 |      | mA            | $V_{CE} = 5.0\text{ V}$ , $I_F = 40\text{ mA}$ ,<br>$d = 0.150\text{''}$ (3.81 mm) <sup>(5)(6)</sup>  |
| $V_{CE(SAT)}$          | Collector-Emitter Saturation Voltage |      | 1.10 | V             | $I_F = 40\text{ mA}$ , $I_C = 300\ \mu\text{A}$ ,<br>$d = 0.150\text{''}$ (3.81 mm) <sup>(5)(6)</sup> |

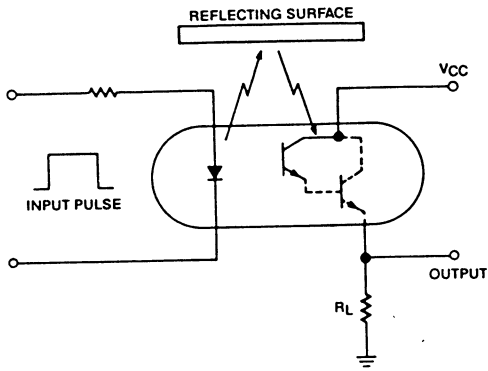
## Typical Performance Curves



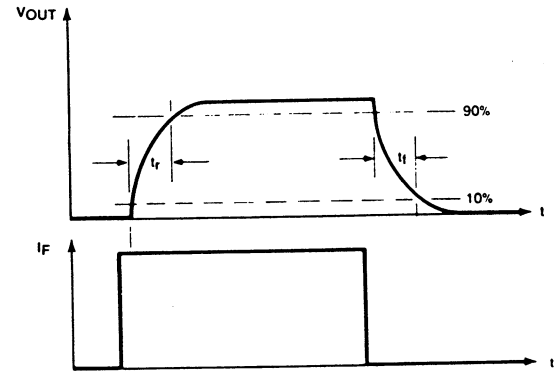
# Types OPB708, OPB709

REFLECTIVE OBJECT SENSORS

## Response Time Test Circuit

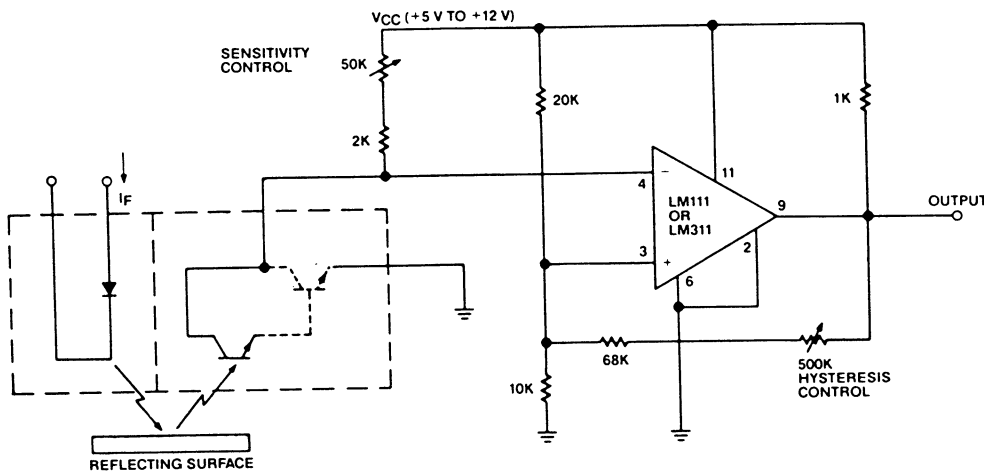


## Switching Time Waveforms



## Typical Interfacing Circuit

Recommended for applications requiring adjustments on both sensitivity and hysteresis.



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