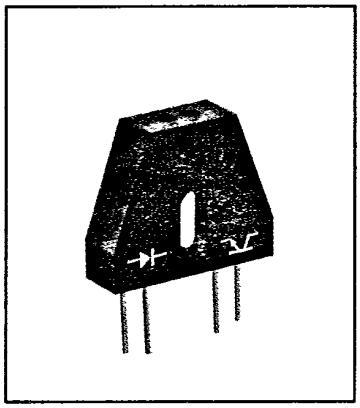
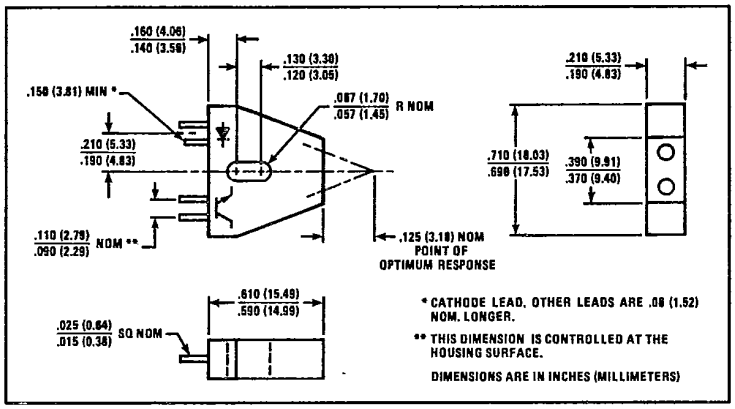
**Optoelectronics Division**
TRW Electronic Components Group

T-41-73

Product Bulletin 5288
January 1985

# 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) mounded side-by-side on converging optical axes, in a black plastic housing. Maximum sensitivity typically occurs .125 in. from the front of the housing. Housing material is flame retardant ABS which meets UL 94V-0 standards.

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 OP160 or OP260 series LEDs. The OPB708 utilizes an OP500 type phototransistor and the OPB709 uses an OP530 type photodarlington.

### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Storage Temperature Range | -40°C to +85°C |
| Operating Temperature Range | -40°C to +85°C |
| Lead Soldering Temperature (1/16 inch (1.6 mm) from case for 5 sec. with soldering iron) | 240°C[1] |
| **Input Diode** | |
| Reverse Voltage | 2.0 V |
| Continuous Forward Current | 40 mA |
| Power Dissipation | 60 mW[2] |
| **Output Photosensor** | |
| Collector-Emitter Voltage – OPB708 | 30 V |
| OPB709 | 15.0 V |
| Emitter-Collector Voltage | 5.0 V |
| Power Dissipation – OPB708 | 50 mW[3] |
| OPB709 | 125 mW[4] |

**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering.
(2) Derate linearly 1.09 mW/°C above 25°C.
(3) Derate linearly 0.91 mW/°C above 25°C.
(4) Derate linearly 2.27 mW/°C above 25°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.
(7) Lower curve is based on a calculated worst case condition rather than the conventional $-2\sigma$ limit.

# Type OPB708

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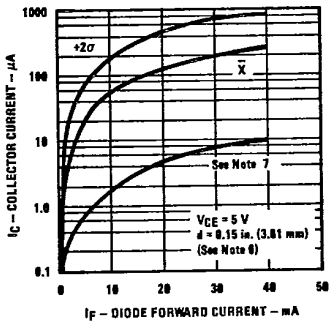
**Electrical Characteristics** ($T_A$=25°C unless otherwise noted)

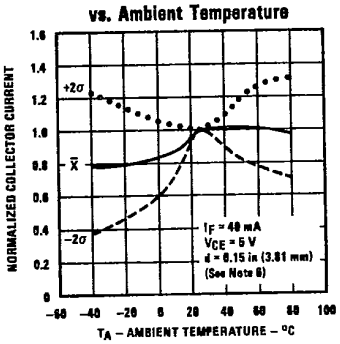
| Symbol | Parameter | Min. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$=40 mA |
| $I_R$ | Reverse Current | | 100 | μA | $V_R$=2.0 V |
| **Output Phototransistor** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 30 | | V | $I_C$=100 μA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$=100 μA |
| $I_{CEO}$ | Collector Dark Current | | 100 | nA | $V_{CE}$=10.0 V, $I_F$=0, $E_e$=0 |
| **Combined** | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 10.0 | | μA | $V_{CE}$ = 5.0 V, $I_F$ = 40 mA, d = 0.150" (3.81 mm)[5][6] |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 0.40 | V | $I_F$ = 40 mA, $I_C$ = 3.0 μA, d = 0.150" (3.81 mm)[5][6] |

## Typical Performance Curves

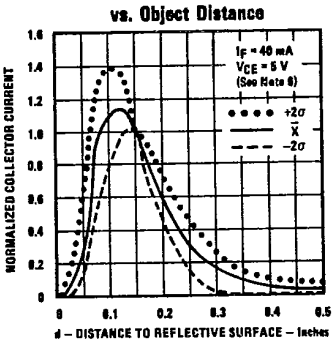
**Collector Current vs. Diode Forward Current**



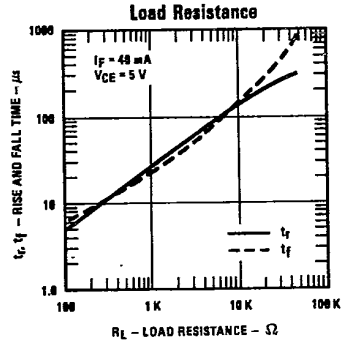

**Normalized Collector Current vs. Ambient Temperature**



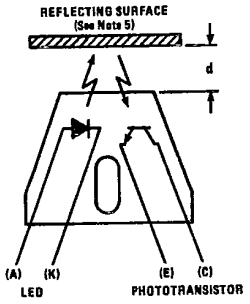

**Normalized Collector Current vs. Object Distance**




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




**Test Condition**

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# Type OPB709

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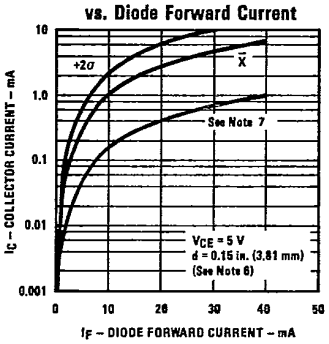
**Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted)

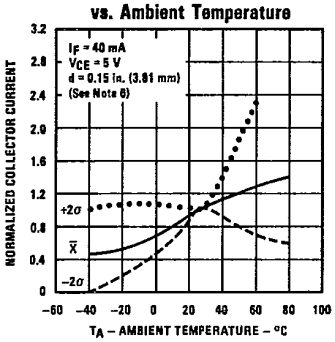
| Symbol | Parameter | Min. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|
| **Input Diode** | | | | | |
| $V_F$ | Forward Voltage | | 1.70 | V | $I_F$ = 40 mA |
| $I_R$ | Reverse Current | | 100 | μA | $V_R$ = 2.0 V |
| **Output Photodarlington** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | 15.0 | | V | $I_C$ = 100 μA |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage | 5.0 | | V | $I_E$ = 100 μA |
| $I_{CEO}$ | Collector Dark Current | | 250 | nA | $V_{CE}$ = 10.0 V, $I_F$ = 0, $E_B$ = 0 |
| **Combined** | | | | | |
| $I_{C(ON)}$ | On-State Collector Current | 1.00 | | mA | $V_{CE}$ = 5.0 V, $I_F$ = 40 mA, d = 0.150" (3.81 mm)[5][6] |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | | 1.10 | V | $I_F$ = 40 mA, $I_C$ = 3.0 μA, d = 0.150" (3.81 mm)[5][6] |

## Typical Performance Curves

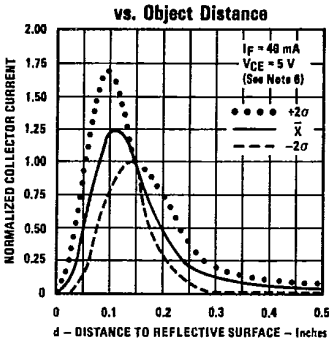
**Collector Current vs. Diode Forward Current**



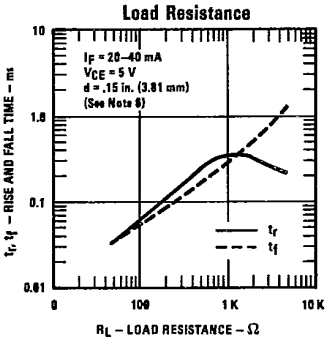

**Normalized Collector Current vs. Ambient Temperature**



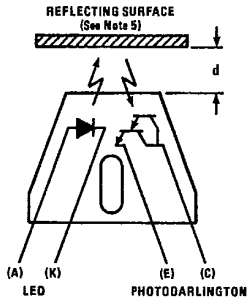

**Normalized Collector Current vs. Object Distance**




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

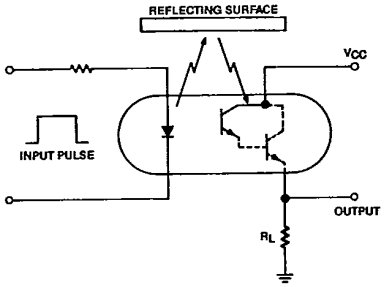



**Test Condition**

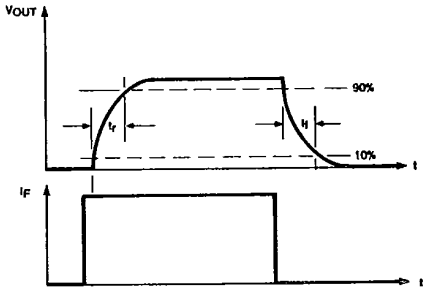


# Types OPB708, OPB709

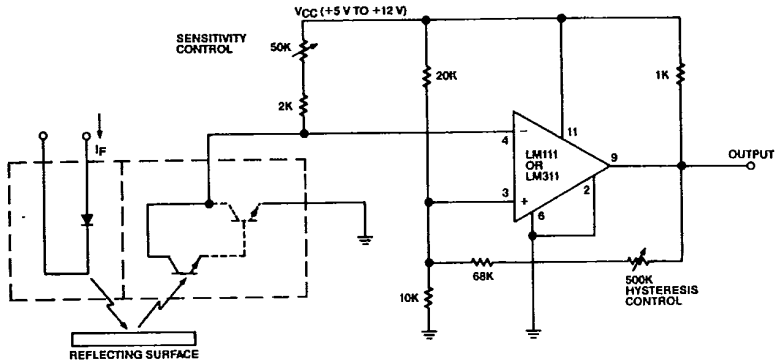
**Response Time Test Circuit**




**Switching Time Waveforms**




**Typical Interfacing Circuit**
**Recommended for applications requiring adjustments on both sensitivity and hysteresis.**

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TRW reserves the right to make changes at any time in order to improve design and to supply the best product possible.