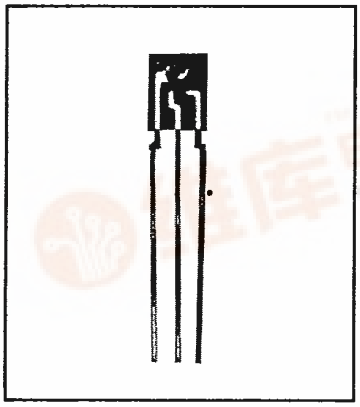
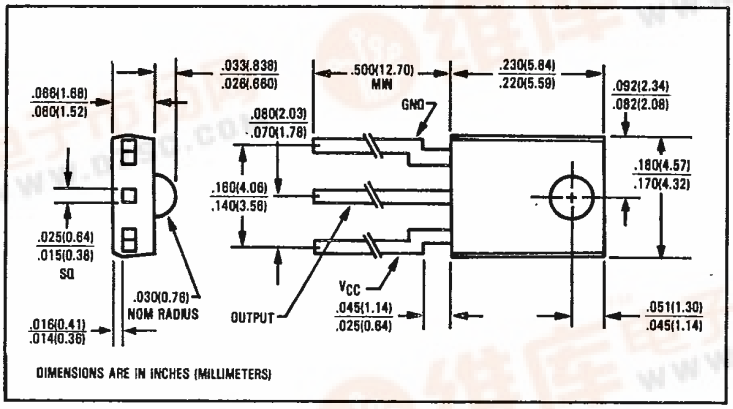
**Optoelectronics Division**
TRW Electronic Components Group

Product Bulletin 5154
January 1985

# Photologic™ Plastic Sensors
## Types OPL550, OPL550-OC, OPL551, OPL551-OC, SLB, SLA






### Features
- Four output options
- High noise immunity
- Direct TTL/LSTTL interface
- Low cost plastic side looking package
- Mechanically and spectrally matched to OP140SL and OP240SL series LEDs
- Data rates to 250 K-baud

### Description
The OPL550, OPL550-OC, OPL551, and OPL551-OC contain a monolithic integrated circuit which incorporates a photodiode, a linear amplifier and a Schmitt trigger on a single silicon chip. The devices feature TTL/LSTTL compatible logic level output which can drive up to 8 TTL loads without additional circuitry. Also featured are medium speed data rates to 250 K-baud with typical rise and fall times of 25 nsec. The Schmitt trigger's hysteresis characteristics provide high immunity to noise on input and $V_{CC}$. The Photologic™ chip is encapsulated in a molded plastic package which has an integral lens for enhanced optical coupling. These devices are mechanically and spectrally matched to the OP140SL and OP240SL infrared emitting diodes.

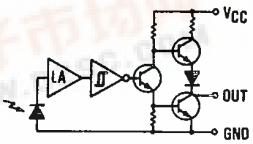
### Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| | |
|---|---|
| Supply Voltage, $V_{CC}$ (not to exceed 3 seconds) | +10.0 V |
| Storage Temperature Range | −40°C to +100°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) |
| Power Dissipation | 85 mW(2) |
| Duration of Output Short to $V_{CC}$ or Ground (OPL550, OPL551) | 1.00 sec. |
| Duration of Output Short to $V_{CC}$ (OPL550-OC, OPL551-OC) | 1.00 sec. |
| Voltage at Output Lead (OPL550-OC, OPL551-OC) | 35 V |
| Low Level Output Current | 16.0 mA |
| High Level Output Current (OPL550, OPL551) | 1.00 mA |
| Irradiance | 25 mW/cm² |

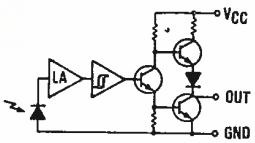
**Notes:**
(1) RMA flux is recommended. Duration can be extended to 10 seconds max. when flow soldering.
(2) Derate linearly 4.25 mW/°C above 80°C.

### Schematics

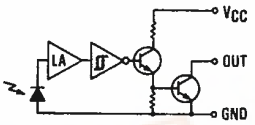
**OPL550** (Totem-Pole Output) Buffer




**OPL551** (Totem-Pole Output) Inverter




**OPL550-OC** (Open-Collector Output) Buffer

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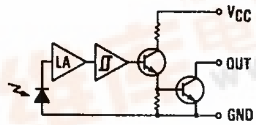

# Types OPL550, OPL550-OC, OPL551, OPL551-OC, SLB, SLA

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**Electrical Characteristics** (−40°C to +85°C unless otherwise noted)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Operating Supply Voltage | 4.5 | | 5.5 | V | |
| | Peak-to-Peak $V_{CC}$ Ripple Necessary to Cause False Triggering of Output | | 2.0 | | V | $V_{CC}$ = 5.0 VDC<br>f = DC to 50 MHz |
| $E_{eT(+)}$ | Positive-Going Threshold Irradiance | | | | | |
| | OPL550, OPL550-OC, OPL551, OPL551-OC | .25 | | 2.4 | mW/cm² | $V_{CC}$ = 5.0 V |
| | OPL550SLA, OPL550-OCSLA, OPL551SLA, OPL551-OCSLA | .25 | | 1.40 | mW/cm² | $V_{CC}$ = 5.0 V |
| | OPL550SLB, OPL550-OCSLB, OPL551SLB, OPL551-OCSLB | .65 | | 1.90 | mW/cm² | $V_{CC}$ = 5.0 V |
| $E_{eT(+)}/E_{eT(-)}$ | Hysteresis Ratio | 1.50 | 2.0 | 3.0 | | |
| $I_{CC}$ | Supply Current | | 8.0 | 15.0 | mA | $V_{CC}$ = 5.5 V, $E_e$ = 0 or 3.0 mW/cm² |

**OPL550** (Buffer, Totem-Pole)

| | | | | | | |
|---|---|---|---|---|---|---|
| $V_{OH}$ | High Level Output Voltage | 2.4 | 3.3 | | V | $V_{CC}$ = 4.5 V, $I_{OH}$ = −800 μA, $E_e$ = 3.0 mW/cm² |
| $V_{OL}$ | Low Level Output Voltage | | .25 | 0.40 | V | $V_{CC}$ = 4.5 V, $I_{OL}$ = 12.8 mA, $E_e$ = 0 |
| $I_{OS}$ | Short Circuit Output Current | −20 | −55 | −100 | mA | $V_{CC}$ = 5.5 V, $E_e$ = 3.0 mW/cm², Output = GND |

**OPL550-OC** (Buffer, Open-Collector)

| | | | | | | |
|---|---|---|---|---|---|---|
| $I_{OH}$ | High Level Output Current | | 1.00 | 100 | μA | $V_{CC}$ = 4.5 V, $V_{OH}$ = 30 V, $E_e$ = 3.0 mW/cm² |
| $V_{OL}$ | Low Level Output Voltage | | .25 | 0.40 | V | $V_{CC}$ = 4.5 V, $I_{OL}$ = 12.8 mA, $E_e$ = 0 |

**OPL551** (Inverter, Totem-Pole)

| | | | | | | |
|---|---|---|---|---|---|---|
| $V_{OH}$ | High Level Output Voltage | 2.4 | 3.3 | | V | $V_{CC}$ = 4.5 V, $I_{OH}$ = −800 μA, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | .25 | 0.40 | V | $V_{CC}$ = 4.5 V, $I_{OL}$ = 12.8 mA, $E_e$ = 3.0 mW/cm² |
| $I_{OS}$ | Short Circuit Output Current | −20 | −55 | −100 | mA | $V_{CC}$ = 5.5 V, $E_e$ = 0, Output = GND |

**OPL551-OC** (Inverter, Open-Collector)

| | | | | | | |
|---|---|---|---|---|---|---|
| $I_{OH}$ | High Level Output Current | | 1.00 | 100 | μA | $V_{CC}$ = 4.5 V, $V_{OH}$ = 30 V, $E_e$ = 0 |
| $V_{OL}$ | Low Level Output Voltage | | .25 | 0.40 | V | $V_{CC}$ = 4.5 V, $I_{OL}$ = 12.8 mA, $E_e$ = 3.0 mW/cm² |

**OPL550, OPL551**

| | | | | | | |
|---|---|---|---|---|---|---|
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | 25 | 70 | ns | $V_{CC}$ = 5.0 V, $T_A$ = 25°C, $E_e$ = 0 or 3.0 mW/cm²<br>f = 10.0 kHz, D.C. = 50%, $R_L$ = 8 TTL Loads |
| $t_{PLH}$,$t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 2.5 | 5.0 | μs | |

**OPL550-OC, OPL551-OC**

| | | | | | | |
|---|---|---|---|---|---|---|
| $t_r$, $t_f$ | Output Rise Time, Output Fall Time | | 25 | 70 | ns | $V_{CC}$ = 5.0 V, $T_A$ = 25°C, $E_e$ = 0 or 3.0 mW/cm²<br>f = 10.0 kHz, D.C. = 50%, $R_L$ = 360Ω |
| $t_{PLH}$,$t_{PHL}$ | Propagation Delay, Low-High, High-Low | | 2.5 | 5.0 | μs | |

Note: (1) Irradiance measurements are made with $\lambda_i$ = 935 nm, through an aperture .020×.060, centered on the lens, parallel to the leads, and flush +.005 to the lens surface.

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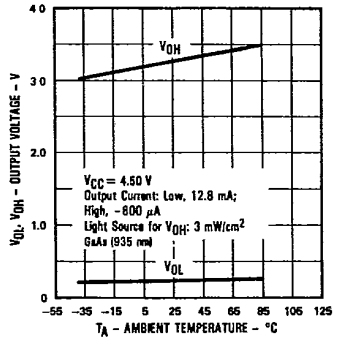
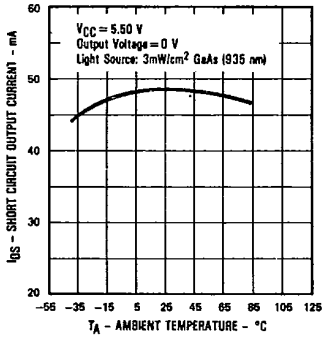
## Typical Performance Curves

### OPL550, OPL551

**Output Voltage vs. Ambient Temperature**

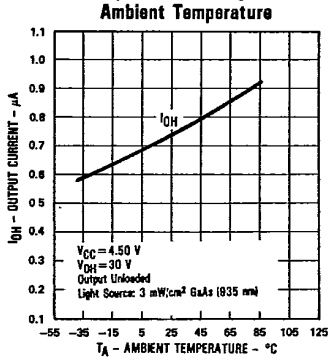



**Short Circuit Output Current vs. Ambient Temperature**

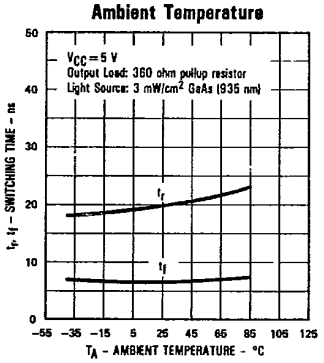



### OPL550-OC, OPL551-OC

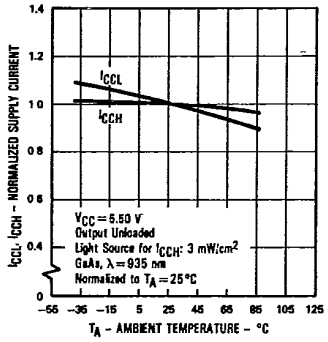
**Output Current (High) vs Ambient Temperature**



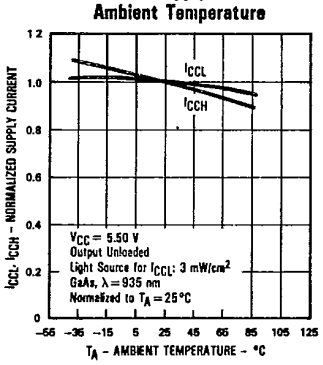

**Rise Time and Fall time vs Ambient Temperature**



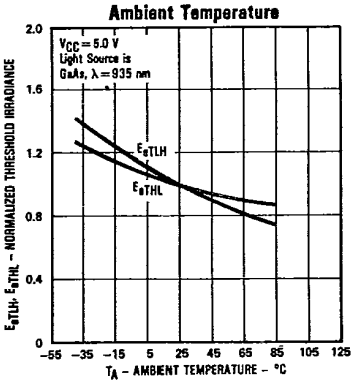

**OPL550, OPL550-OC Normalized Supply Current vs Ambient Temperature**



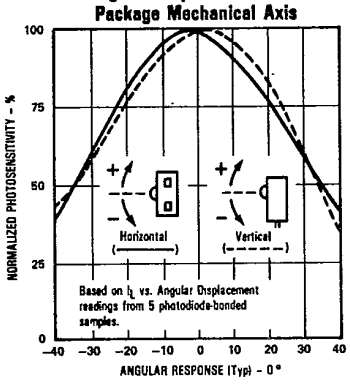

**OPL551, OPL551-OC Normalized Supply Current vs Ambient Temperature**



### Normalized Threshold Irradiance vs Ambient Temperature




### Angular Displacement from Package Mechanical Axis

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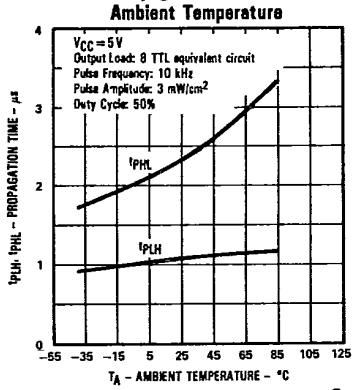
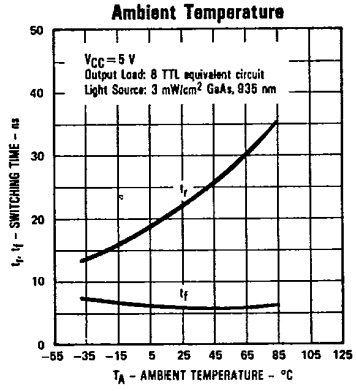
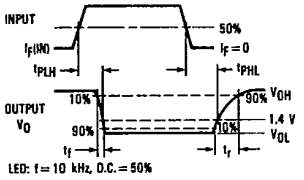
### Propagation Time vs Ambient Temperature




### Rise Time and Fall time vs Ambient Temperature




### Switching Test Curve for Inverters




### Switching Test Curve for Buffers