

Photologic® Sensor

OPL530, OPL531, OPL535, OPL536, OPL550, OPL551, OPL560, OPL561, OPL562, OPL563



Features:

- Choice of four output options in low-cost side-looking package
- Choice of two sensitivity options (OPL560/561/562/563)
- High noise immunity
- Direct TTL/LSTTL CMOS interface
- Data rates to 250 kBaud for all except OPL560 series (200 kBaud)
- Low power consumption

Description:

All components in this series include a photodiode, amplifier, voltage regulator, Schmitt trigger and NPN output transistor on a single silicon chip. **OPL560** chips also include a voltage regulator on the chip. All devices in the series have a Photologic® chip that is encapsulated in a molded plastic side-looking package with an integral lens (recessed integral lens for OPL535 and OPL536). This packaging provides enhanced optical coupling, combined with mechanical protection. The hysteresis characteristics of the Schmitt trigger on each device offers high immunity to noise on input and V_{CC} .

OPL530, OPL531, OPL535 and **OPL536** include a 10 K Ω pull-up resistor (R_L) from output to V_{CC} . These components exhibit very stable performance over supply voltages ranging from 4.5 V to 16 V and a wide range of irradiance levels. **OPL550** and **OPL551** devices feature TTL/LSTTL compatible logic level output which can drive up to 8 TTL loads without additional circuitry and medium-speed data rates to 250 kBaud, with typical rise and fall times of 25 nanoseconds. **OPL560, OPL561, OPL562** and **OPL563** devices feature TTL/LSTTL compatible logic level output which can drive up to 10 TTL loads over supply voltages ranging from 4.5 V to 16 V.

OPL530, OPL531, OPL550, OPL551, OPL560, OPL561, OPL562 and **OPL563** are mechanically and spectrally matched to OP140 and OP240 LEDs. **OPL535** and **OPL536** are mechanically and spectrally matched to OP145 and OP245 series LEDs.

Applications:

- Non-contact reflective object sensor
- Assembly line automation
- Machine automation
- Machine safety
- End of travel sensor
- Door sensor

| Base Part Number | Package | Output Type - with Light | Input Power Range (mW/cm ²) [Min/Max] | | |
|--|---------------|--------------------------|---|------------|-----------|
| | | | - | A | B |
| OPL530 | External Lens | Internal 10 K - High | 0.12/0.38 | -- | -- |
| OPL530-OC | | Open Collector - High | | | |
| OPL531A | | Internal 10 K - Low | -- | | -- |
| OPL531-OCA | | Open Collector - Low | | 0.12/0.280 | |
| OPL535A, OPL535B | Recessed Lens | Internal 10 K - High | -- | | 0.23/0.38 |
| OPL536A, Obsolete - OPL536-OC, OPL536-OCA | | Internal 10 K - Low | | | |
| OPL550, OPL550A Obsolete - OPL550-OC | External Lens | Totem Pole - High | 0.25/2.4 | 0.25/1.4 | N/A |
| OPL550-OCA | | Open Collector - High | | | |
| OPL551, Obsolete - OPL551A | | Totem Pole - Low | | | |
| OPL551-OC, OPL551-OCA | | Open Collector - Low | | | |
| OPL560, OPL560A | | Totem Pole - High | 0.09/0.55 | 0.09/0.36 | N/A |
| OPL560-OCA | | Open Collector - High | | | |
| OPL561 | | Totem Pole - Low | | | |
| OPL561-OC, OPL561-OCA | | Open Collector - Low | 0.025/0.23 | 0.025/0.14 | N/A |
| OPL562, Obsolete - OPL562A | | Totem Pole - High | | | |
| OPL562-OC, OPL562-OCA | | Open Collector - High | | | |
| OPL563, Obsolete - OPL563-OC, OPL563-OCA | | Totem Pole - Low | | | |
| OC = Open Collector Output | | | | | |
| OCA = Open Collector Output Inverted | | | | | |

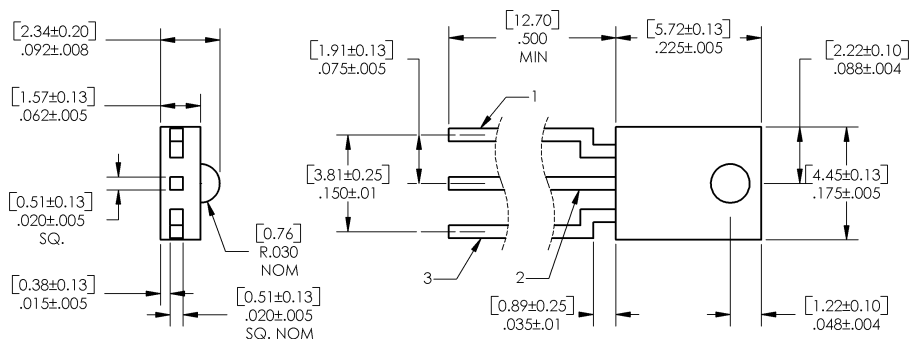


General Note

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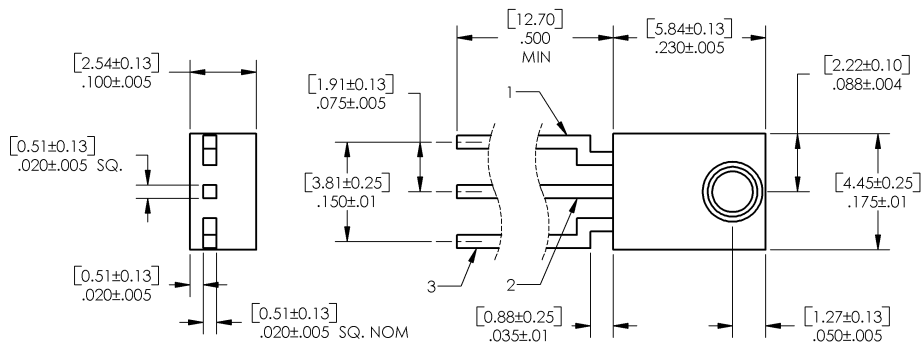
OPL530, OPL550, OPL560 Series



DIMENSIONS ARE IN: [MILLIMETERS]
INCHES

| Pin # | Sensor |
|-------|-----------------|
| 1 | Ground |
| 2 | Output |
| 3 | V _{CC} |

OPL535, OPL536 Series



DIMENSIONS ARE IN: [MILLIMETERS]
INCHES

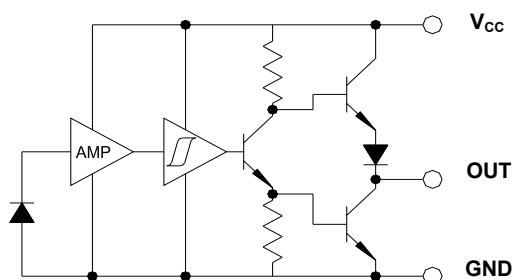
| Pin # | Sensor |
|-------|-----------------|
| 1 | Ground |
| 2 | Output |
| 3 | V _{CC} |

General Note

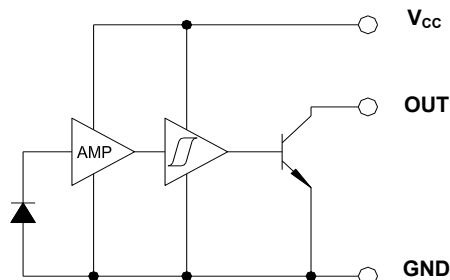
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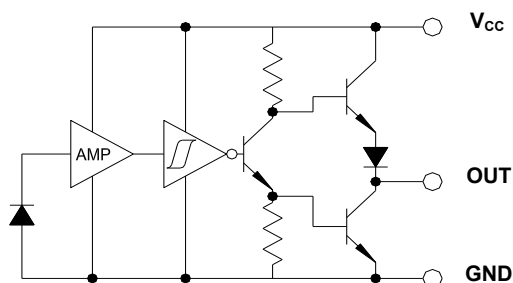
OPL550/550A/560/560A/562 Totem-Pole



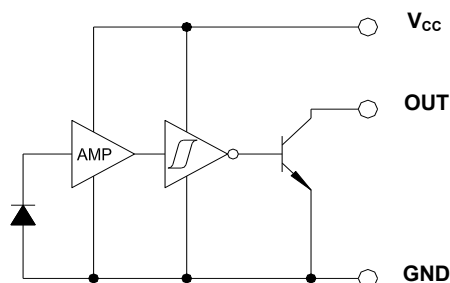
OPL530-OC/550-OCA/560-OCA/562-OC/562-OCA Open-Collector



OPL551/561/563 Inverted Totem-Pole

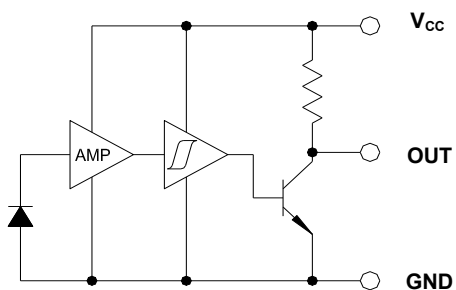


OPL531-OCA/551-OC/551-OCA/561-OC/561-OCA Inverted Open-Collector

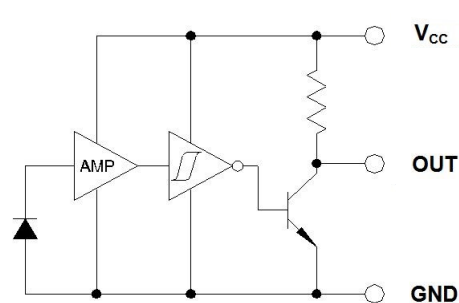


OPL530, OPL531A, OPL535A, OPL535B, OPL536A

OPL530/535A/535B 10 K Pull-Up



OPL531A/536A Inverted 10 K Pull-Up



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Electrical Specifications

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

| Input Diode | |
|---|---|
| Supply Voltage (V_{CC}) OPL530, OPL530-OC OPL550 OPL560, OPL561, OPL562, OPL563 | 18 V 10 V 18 V |
| Operating Temperature Range | -40° C to + 85° C |
| Storage Temperature Range | -40° C to + 100° C |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from the case for 5 sec. with soldering iron] | 260°C |
| Sourcing Current OPL560, OPL561, OPL562, OPL563 | 10 mA |
| Power Dissipation OPL530, OPL530-OC OPL550, OPL560, OPL561, OPL562, OPL563 | 90 mW 200 mW ⁽²⁾ |
| Sinking Current OPL530, OPL530-OC OPL550 OPL560, OPL561, OPL562, OPL563 | 50 mA - 50 mA |
| Voltage at Output Lead ⁽⁴⁾ OPL530, OPL530-OC OPL550-OCA, OPL551-OC, OPL551-OCA OPL561-OC, OPL562-OC | 35 V 35 V 35 V |
| Duration of Output Short to V_{CC} or Ground OPL550 | 1 second |
| Duration of Output Short to V_{CC} OPL550-OCA, OPL551-OC, OPL551-OCA OPL560, OPL561, OPL562, OPL563, OPL561-OC, OPL562-OC | 1 second 1 second |
| Low Level Output Current OPL550, OPL551 Series | 16 mA |
| High Level Output Current OPL550, OPL551 Series | 1 mA |
| Irradiance OPL550, OPL551 Series OPL560, OPL561, OPL561-OC OPL562, OPL562-OC, OPL563 | 10 mW/cm ² 9 mW/cm ² 3 mW/cm ² |

Notes:

- (1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. For OPL530, OPL530-OC, OPL531A, OPL531-OCA, OPL535A, OPL535B, and OPL536A a maximum of 20 grams force may be applied to leads while at soldering temperatures.
- (2) Derate linearly 2.67 mW/° C above 70° C for OPL530, OPL530-OC, OPL531A, OPL531-OC, OPL535A/B, and OPL536A. Derate linearly 2.5 mW/° C above 25° C for all devices in the OPL550, OPL551, OPL560, OPL561, OPL562 and OPL563 series.
- (3) Irradiance measurements are made with $\lambda_i = 935\text{ nm}$.
- (4) This applies to OC versions only. For I_{CC} on pull-up versions, add $V_{CC}/10\text{ K}\Omega$.

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Electrical Specifications

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

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|-------------|---|------------|--------|------------|--------------------------------------|--|
| V_{CC} | Operating Supply Voltage OPL530, OPL530-OC, OPL531, OPL531-OC OPL535, OPL536 OPL560, OPL561 Series | 4.5 | - | 16 | V | - |
| | OPL550, OPL551 Series | 4.5 | - | 5.5 | V | - |
| | Peak-to-Peak V_{CC} Ripple Necessary to Cause False Triggering of Output OPL530, OPL530-OC, OPL531, OPL531-OC OPL535, OPL536 OPL560, OPL561 Series | - | - | 2 | V | $f = \text{DC to } 50\text{ MHz}$ |
| | OPL550, OPL551 Series | - | 2 | - | V | $V_{CC} = 5\text{ V DC}, f = \text{DC to } 50\text{ MHz}$ |
| I_{CC} | Supply Current ⁽⁴⁾ OPL530, OPL530-OC | - | 5 | 8 | mA | $E_E = 0$ or 1 mW/cm^2 |
| | OPL550, OPL551 Series | - | 8 | 15 | mA | $E_E = 0$ or $3\text{ mW/cm}^2, V_{CC} = 5.5\text{ V}$ |
| | OPL560, OPL561 Series | - | 8 | 12 | mA | $E_E = 0$ or 1 mW/cm^2 |
| $E_{eT(+)}$ | Positive-Going Threshold Irradiance ⁽³⁾ OPL530, OPL530-OC | 0.08 | - | 0.40 | mW/cm^2 | $T_A = 25^\circ\text{C}$ |
| | OPL531A, OPL531-OCA OPL535A, OPL536A | 0.08 | - | 0.25 | mW/cm^2 | $T_A = 25^\circ\text{C}$ |
| | OPL535B | 0.12 | - | 0.40 | mW/cm^2 | $T_A = 25^\circ\text{C}$ |
| | OPL550, OPL551-OC OPL550A, OPL550-OCA, OPL551-OCA | .25 .25 | - - | 2.4 1.4 | mW/cm^2 mW/cm^2 | $V_{CC} = 5\text{ V}, T_A = 25^\circ\text{C}$ $V_{CC} = 5\text{ V}, T_A = 25^\circ\text{C}$ |

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

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|------------------------------|---|------|------|-----|---------------------|--------------------|
| $E_{eT(+)} / E_{eT(-)}$ | Hysteresis Ratio OPL530, OPL531 Series | 1.05 | 1.3 | 1.6 | - | - |
| | OPL535, OPL536 Series | 1.05 | 1.2 | 1.5 | - | - |
| | OPL550, OPL551 Series | 1.05 | 2 | 2.5 | - | - |
| | OPL560, OPL561 Series | 1.20 | 1.55 | 2 | - | - |
| $\Delta E_{eT(+)}(\Delta T)$ | Temperature Co-efficient OPL530, OPL530-OC | - | -0.6 | - | $\%/^\circ\text{C}$ | $>0^\circ\text{C}$ |

Notes:

- (1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. For OPL530 and OPL530-OC a maximum of 20 grams force may be applied to leads while at soldering temperatures.
- (2) Derate linearly $2.67\text{ mW}/^\circ\text{C}$ above 70°C for OPL530 and OPL530-OC. Derate linearly $2.5\text{ mW}/^\circ\text{C}$ above 25°C for all devices in the OPL550, OPL560, OPL561, OPL562 and OPL563 series.
- (3) Irradiance measurements are made with $\lambda_i = 935\text{ nm}$.
- (4) This applies to OC versions only. For I_{CC} on pull-up versions, add $V_{CC}/10\text{ K}\Omega$.

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

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|-----------------|---|----------------------|------|------|-------|--|
| V _{OH} | Operating Supply Voltage OPL550 | 2.4 | 3.3 | - | V | V _{CC} = 4.5 V, I _{OH} = -800 μA, E _E = 3 mW/cm ² |
| | OPL560 | V _{CC} -2.1 | - | - | V | I _{OH} = -1 μA, E _E = 1 mW/cm ² |
| | OPL561 | V _{CC} -2.1 | - | - | V | I _{OH} = -1 μA, E _E = 0 |
| V _{OL} | Low Level Output Voltage OPL530, OPL530-OC | - | 0.2 | 0.4 | V | I _{OL} = 16 mA, E _E = 0 |
| | OPL550 | - | 0.25 | 0.4 | V | V _{CC} = 4.5 V, I _{OL} = 12.8 mA, E _E = 0 |
| | OPL560 | - | - | 0.4 | V | I _{OL} = 16 mA, E _E = 0 |
| | OPL561, OPL561-OC | - | - | 0.4 | V | I _{OL} = 16 mA, E _E = 1 mW/cm ² |
| I _{OS} | Short Circuit Output Current OPL550 | -20 | -55 | -100 | mA | V _{CC} = 5.5 V, Output = GND, E _E = 3 mW/cm ² |
| I _{OH} | High Level Output Current ⁽⁴⁾ OPL530, OPL530-OC | - | 0.1 | 10 | μA | V _{OH} = 30 V, E _E = 1 mW/cm ² |
| | OPL550-OCA | - | 1 | 100 | μA | V _{CC} = 4.5 V, V _{OH} = 30 V, E _E = 3 mW/cm ² |
| | OPL551-OC, OPL551-OCA | - | 1 | 100 | μA | V _{CC} = 4.5 V, V _{OH} = 30 V, E _E = 0 |
| | OPL561-OC | - | - | 100 | μA | V _{OH} = 30 V, E _E = 0 |

Notes:

- (1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. For OPL530 and OPL530-OC a maximum of 20 grams force may be applied to leads while at soldering temperatures.
- (2) Derate linearly 2.67 mW/° C above 70° C for OPL530 and OPL530-OC. Derate linearly 2.5 mW/° C above 25° C for all devices in the OPL550, OPL560, OPL561, OPL562 and OPL563 series.
- (3) Irradiance measurements are made with λ_i = 935 nm.
- (4) This applies to OC versions only. For I_{CC} on pull-up versions, add V_{CC}/10 KΩ.

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

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|--------|-----------------------------------|--------|--------|-----------|-------|---|
| t_r | Output Rise Time OPL530 | - | 1500 | - | ns | $E_E = 0$ or 1 mW/cm^2 , $C_L = 50\text{ pF}$, 10K P.U. |
| | OPL530-OC | - | 50 | - | ns | $E_E = 0$ or 1 mW/cm^2 , $R_L = 300\ \Omega$ to 5 V , $C_L = 50\text{ pF}$ |
| | OPL550 | - | 25 | 70 | ns | $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $E_E = 0$ or 3 mW/cm^2 , $f = 10\text{ kHz}$, $\text{DC} = 50\%$ $R_L = 8\text{ TTL loads}$ |
| | OPL550-OCA, OPL551-OC, OPL551-OCA | - | 25 | 70 | ns | $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $E_E = 0$ or 3 mW/cm^2 , $f = 10\text{ kHz}$, $\text{DC} = 50\%$, $R_L = 360\ \Omega$ |
| | OPL560, OPL561 OPL561-OC | - - | - - | 70 100 | ns | $T_A = 25^\circ\text{C}$, $E_E = 0$ or 1 mW/cm^2 , $f = 10\text{ kHz}$, $\text{DC} = 50\%$, $R_L = 360\ \Omega$ |
| t_r | Output Rise Time OPL530 | - | - | - | ns | $E_E = 0$ or 1 mW/cm^2 , $C_L = 50\text{ pF}$ |
| | OPL530-OC | - | - | - | ns | $E_E = 0$ or 1 mW/cm^2 , $R_L = 300\ \Omega$ to 5 V , $C_L = 50\text{ pF}$ |
| | OPL550-OCA, OPL551-OC, OPL551-OCA | - | 25 | 70 | ns | $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $E_E = 0$ or 3 mW/cm^2 , $R_L = 8\text{ TTL loads}$, $f = 10\text{ kHz}$, $\text{DC} = 50\%$ |
| | OPL561-OC | - | - | 70 | ns | $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $E_E = 0$ or 3 mW/cm^2 , $R_L = 8\text{ TTL loads}$, $f = 10\text{ kHz}$, $\text{DC} = 50\%$ |
| | OPL560, OPL561 | - | - | 70 | ns | $T_A = 25^\circ\text{C}$, $E_E = 0$ or 1 mW/cm^2 , $f = 10\text{ kHz}$ |
| | OPL561-OC | - | - | 100 | ns | $T_A = 25^\circ\text{C}$, $E_E = 0$ or 1 mW/cm^2 , $f = 10\text{ kHz}$ |
| t_f | Output Fall Time OPL530 | - | 20 | - | ns | $E_E = 0$ or 1 mW/cm^2 , $C_L = 50\text{ pF}$ |
| | OPL530-OC | - | 20 | - | ns | $E_E = 0$ or 1 mW/cm^2 , $R_L = 300\ \Omega$ to 5 V , $C_L = 50\text{ pF}$ |
| | OPL550-OCA, OPL551-OC, OPL551-OCA | - | 25 | 70 | ns | $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $E_E = 0$ or 3 mW/cm^2 , $R_L = 360\ \Omega$, $f = 10\text{ kHz}$, $\text{DC} = 50\%$ |
| | OPL560, OPL561 OPL561-OC | - - | - - | 70 100 | ns | $T_A = 25^\circ\text{C}$, $E_E = 0$ or 1 mW/cm^2 , $f = 10\text{ kHz}$ |

Notes:

- (1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. For OPL530 and OPL530-OC a maximum of 20 grams force may be applied to leads while at soldering temperatures.
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