

# Photologic Hermetic Sensors

OPL800, OPL800-OC, OPL801, OPL801-OC, OPL810, OPL810-OC, OPL811, OPL811-OC, OPL812-OC, OPL813-OC, OPL820, OPL820-OC, OPL821-OC



## Features:

- Four output options available
- High noise immunity
- Direct TTL/LSTTL interface
- TO-18 hermetically sealed package
- Sensors mechanically and spectrally matched to other Optek devices (see device descriptions detailed below)

## Description:

All **OPL800**, **OPL801**, **OPL820** and **OPL821** sensors consist of a photodiode, a linear amplifier and a Schmitt trigger on a single silicon chip (monolithic chip for **OPL820** and **OPL821**). **OPL810**, **OPL811**, **OPL812** and **OPL813** sensors also have a voltage regulator added to their photologic chips. Each device's photologic chip is mounted onto a standard TO-18 header and hermetically sealed in a lensed metal can.

All devices in the series feature TTL/LSTTL compatible logic level output, which can drive up to 8 TTL loads (**OPL800**, **OPL801**) or up to 10 TTL loads (**OPL810**, **OPL811**, **OPL812**, **OPL813**, **OPL820** and **OPL821**) without additional circuitry. On all these devices, the Schmitt trigger's hysteresis characteristics provide high immunity to noise on input and  $V_{CC}$ .

**OPL800** series devices feature medium-speed data rates to 250 kBaud, with typical rise and fall times of 25 nanoseconds.

*OPL800 and OPL801 devices are mechanically and spectrally matched to OP130 and OP231 series LEDs. OPL810, OPL811, OPL812 and OPL813 devices are mechanically and spectrally matched to OP130 and OP230 series devices. OPL820 and OPL821 devices are mechanically and spectrally matched to OP130 and OP231 series LEDs.*

## Applications:

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

Pin #	OPL80_ or OPL81_	OPL82_	Transistor
1	Ground	Ground	Collector
2	$V_{CC}$	Output	Base
3	Output	$V_{CC}$	Emitter

## Mounted to TO-18 Base



## General Note

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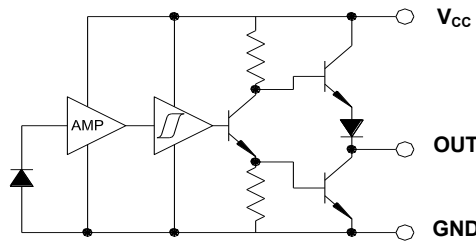
OPL800, OPL800-OC, OPL801, OPL801-OC, OPL810, OPL810-OC, OPL811, OPL811-OC, OPL812-OC, OPL813-OC, OPL820, OPL820-OC, OPL821-OC



Ordering Information							
Part Number	Photologic®	Input Power $E_E$ ( $\mu\text{W}/\text{cm}^2$ ) Min / Max	$V_{CC}$ (V) Min / Max	$I_{OH} / I_{OL}$	Lead Length		
OPL800	Totem-Pole	50 / 600	4.5 / 16.0	0.10 / 12.8	0.50"		
OPL800-OC	Open-Collector						
OPL801	Inv-Totem-Pole						
OPL801-OC	Inv-Open-Collector						
OPL810	Totem-Pole	5 / 100		4.5 / 16.0		0.10 / 16.0	0.50"
OPL810-OC	Open-Collector						
OPL811	Inv-Totem-Pole						
OPL811-OC	Inv-Open-Collector						
OPL812-OC	Open-Collector						
OPL813-OC	Inv-Open-Collector						
OPL820	10K Pull-Up	2 / 35		4.5 / 16.0		0.10 / 16.0	0.50"
OPL820-OC	Open Collector						
OPL821-OC	Inv. Open Collector						

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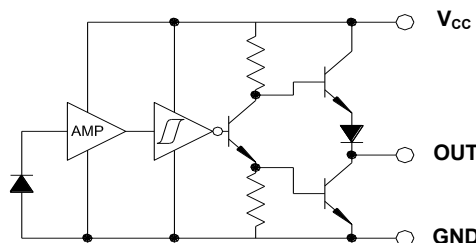
**OPL800/800B/810 Buffered Totem-Pole**



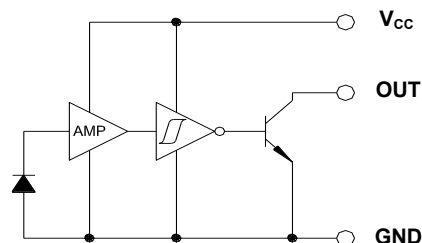
**OPL800-OC/810-OC/812-OC/820/OC Open-Collector**



**OPL801/811 Inverted Totem-Pole**



**OPL801-OC/811-OC/813-OC/821-OC Inverted Open-Collector**



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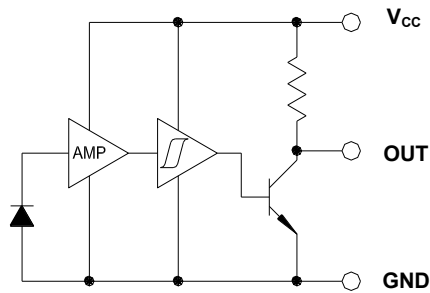
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## OPL820

### OPL820 10K Pull-Up



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 OC, OPL820, OPL820-OC, OPL821-OC



## Electrical Specifications

**Absolute Maximum Ratings** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)  
**OPB800/801/810/811 and OPB800-OC Series**

Input Diode	
Operating Temperature Range OPL800, OPL801 OPL810, OPL811 OPL820	-55° C to +110° C -55° C to +105° C -40° C to +100° C
Storage Temperature Range OPL800, OPL801 OPL810, OPL811 OPL820	-65° C to +150° C -65° C to +125° C -55° C to +125° C
Lead Soldering Temperature [1/16 inch (1.6mm) from the case for 5 sec. with soldering iron]	260°C <sup>(1)</sup>
Input Infrared LED	
Supply Voltage, $V_{CC}$ (not to exceed 3 seconds) OPL800, OPL801 OPL810, OPL811, OPL820	10 V 18 V
Sourcing Current OPL810, OPL811	10 mA
Output Voltage (high state) OPL800, OPL801, OPL810, OPL811 OPL820	35 V 30 V
Output Current Sink (low state) OPL810, OPL811 OPL820	50 mA 16 mA
Irradiance OPL800, OPL801 OPL810, OPL810-OC, OPL811, OPL811-OC OPL812, OPL812-OC, OPL813, OPL813-OC	3 mW/cm <sup>2</sup> 2 mW/cm <sup>2</sup> 1 mW/cm <sup>2</sup>

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OC, OPL820, OPL820-OC, OPL821-OC



## Electrical Specifications

**Absolute Maximum Ratings** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)  
**OPB800/801/810/811/812/813 and OPB800-OC Series**

Output Photologic®	
Voltage at Output Lead OPL800, OPL801, OPL810, OPL811 OPL820	35 V 30 V
Duration of Output Short to $V_{CC}$	1 second
Power Dissipation OPL800, OPL801 OPL810, OPL811 OPL820	120 mW <sup>(2)</sup> 250 mW <sup>(2)</sup> 200 mW <sup>(2)</sup>

**Notes:**

- (1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. For OPB820, a maximum of 20 grams force may be applied to leads while at soldering temperatures.
- (2) Derate linearly 2.5 mW/°C above 25° C for OPL800, OPL801, OPL810, OPL811. Derate linearly 5.7 mW/°C above 90° C for OPL820.
- (3) For OPL800, OPL801, OPL810, OPL811, light measurements are made with  $\lambda_i = 935\text{ nm}$ . For OPB820, light measurements are made with an LED source having a wavelength of 935 nm.

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OPL810-OC, OPL811, OPL811-OC, OPL812-OC, OPL813-  
OC, OPL820, OPL820-OC, OPL821-OC



## Electrical Specifications

Electrical Characteristics (T <sub>A</sub> = 25° C unless otherwise noted)						
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V <sub>CC</sub>	Operating Supply Voltage					
	OPL800/801	4.5	-	5.5	V	-
	OPL810/811	4.5	-	16	V	-
	OP820	4.5	-	16	V	-
V <sub>CC</sub>	Peak-to-Peak V <sub>CC</sub> Ripple Necessary to Cause False Triggering of Output					
	OPL800/801	-	2	-	V	f = DC to 50 MHz
	OPL810/811	-	-	1	V	f = DC to 50 MHz
I <sub>CC</sub>	Supply Current	-	-	15	mA	E <sub>e</sub> = 0 or 1 mW/cm <sup>2</sup>
E <sub>eT</sub> <sup>(+)</sup>	Positive-Going Threshold Irradiance <sup>(3)</sup>					
	OPL800/801	0.050	0.180	0.600	mW/cm <sup>2</sup>	T <sub>A</sub> = 25°C
	OPL810/811	0.015	0.060	0.200	mW/cm <sup>2</sup>	T <sub>A</sub> = 25°C
	OPL820	0.002	0.015	0.035	mW/cm <sup>2</sup>	See below <sup>(3)</sup>
E <sub>eT</sub> <sup>(+)</sup> /E <sub>eT</sub> <sup>(-)</sup>	Hysteresis Ratio					
	OPL800/801	1.5	2.0	2.5	-	-
	OPL810/811	1.2	1.5	2.0	-	-
E <sub>e</sub> <sup>(+)</sup> /E <sub>e</sub> <sup>(-)</sup>	Hysteresis Ratio					
OPL820	1.05	1.20	1.90	-	See below <sup>(3)</sup>	
I <sub>CCH</sub>	High State Supply Current					
OPL820	-	5	12	mA	See below <sup>(4)</sup>	
I <sub>CCL</sub>	Low State Supply Current					
OPL820	-	4	12	mA	See below <sup>(5)</sup>	

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OPL810-OC, OPL811, OPL811-OC, OPL812-OC, OPL813-  
OC, OPL820, OPL820-OC, OPL821-OC



## Electrical Specifications

Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise noted)						
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$V_{OH}$	High Level Output Voltage					
	OPL800	2.4	-	-	V	$I_{OH} = -800\ \mu\text{A}$ , $E_e = 1\ \text{mW}/\text{cm}^2$
	OPL801	2.4	-	-	V	$I_{OH} = -800\ \mu\text{A}$ , $E_e = 0$
	OPL810	$V_{CC}-2.1$	-	-	V	$I_{OH} = -1\text{mA}$ , $E_e = 0.4\ \text{mW}/\text{cm}^2$
	OPL811	$V_{CC}-2.1$	-	-	V	$I_{OH} = -1\text{mA}$ , $E_e = 0$
OPL820-OC/821-OC	$V_{CC}-1.5$	-	$V_{CC}$	V	$I_{OH} = -100\ \mu\text{A}^{(4)}$	

### Notes:

- (1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. For OPL820, a maximum of 20 grams force may be applied to leads while at soldering temperatures.
- (2) Derate linearly  $2.5\ \text{mW}/^\circ\text{C}$  above  $25^\circ\text{C}$  for OPL800, OPL801, OPL810, OPL811. Derate linearly  $5.7\ \text{mW}/^\circ\text{C}$  above  $90^\circ\text{C}$  for OPL820.
- (3) For OPL800, OPL801, OPL810, OPL811, light measurements are made with  $\lambda_i = 935\ \text{nm}$ . For OPL820, light measurements are made with an LED source having a wavelength of  $935\ \text{nm}$ .
- (4) High output state limits are valid for  $4.5\ \text{V} < V_{CC} < 16\ \text{V}$  and  $E_e > 0.035\ \text{mW}/\text{cm}^2$  (OPL820, OPL820-OC),  $E_e < 0.001\ \text{mW}/\text{cm}^2$  (OPL821-OC).
- (5) Low output state limits are valid for  $4.5\ \text{V} < V_{CC} < 16\ \text{V}$  and  $E_e > 0.035\ \text{mW}/\text{cm}^2$  (OPL821-OC),  $E_e < 0.001\ \text{mW}/\text{cm}^2$  (OPL820, OPL820-OC).

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OPL810-OC, OPL811, OPL811-OC, OPL812-OC, OPL813-  
OC, OPL820, OPL820-OC, OPL821-OC



## Electrical Specifications

Electrical Characteristics (T <sub>A</sub> = 25° C unless otherwise noted)						
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V <sub>OH</sub>	High Level Output Voltage					
	OPL800	2.4	-	-	V	I <sub>OH</sub> = -800 μA, E <sub>e</sub> = 1 mW/cm <sup>2</sup>
	OPL801	2.4	-	-	V	I <sub>OH</sub> = -800 μA, E <sub>e</sub> = 0
	OPL810	V <sub>CC</sub> -2.1	-	-	V	I <sub>OH</sub> = -1mA, E <sub>e</sub> = 0.4 mW/cm <sup>2</sup>
	OPL811	V <sub>CC</sub> -2.1	-	-	V	I <sub>OH</sub> = -1mA, E <sub>e</sub> = 0
OPL820-OC/821-OC	V <sub>CC</sub> -1.5	-	V <sub>CC</sub>	V	I <sub>OH</sub> = -100 μA <sup>(4)</sup>	
V <sub>OL</sub>	Low Level Output Voltage					
	OPL800/800-OC	-	-	0.4	V	I <sub>OL</sub> = 12.8 mA, E <sub>e</sub> = 0
	OPL801/801-OC	-	-	0.4	V	I <sub>OL</sub> = 12.8 mA, E <sub>e</sub> = 1 mW/cm <sup>2</sup>
	OPL810/810-OC	-	-	0.4	V	I <sub>OL</sub> = 16 mA, E <sub>e</sub> = 0
	OPL811/811-OC	-	-	0.4	V	I <sub>OL</sub> = 16 mA, E <sub>e</sub> = 0.4 mW/cm <sup>2</sup>
	OPL812-OC	-	-	0.4	V	I <sub>OL</sub> = 16 mA, E <sub>e</sub> = 0
	OPL813-OC	-	-	0.4	V	I <sub>OL</sub> = 16 mA, E <sub>e</sub> = 0.2 mW/cm <sup>2</sup>
OPL820	-	-	0.4	V	I <sub>OL</sub> = 16 mA <sup>(5)</sup>	
I <sub>OH</sub>	High Level Output Current					
	OPL800-OC	-	-	100	μA	V <sub>OH</sub> = 30 V, E <sub>e</sub> = 2 mW/cm <sup>2</sup>
	OPL801-OC	-	-	100	μA	V <sub>OH</sub> = 30 V, E <sub>e</sub> = 0
	OPL810-OC	-	-	100	μA	V <sub>OH</sub> = 30 V, E <sub>e</sub> = 0.4 mW/cm <sup>2</sup>
	OPL811-OC	-	-	100	μA	V <sub>OH</sub> = 30 V, E <sub>e</sub> = 0
	OPL812-OC	-	-	100	μA	V <sub>OH</sub> = 30 V, E <sub>e</sub> = 0.2 mW/cm <sup>2</sup>
OPL813-OC	-	-	100	μA	V <sub>OH</sub> = 30 V, E <sub>e</sub> = 0	
I <sub>OS</sub>	Short Circuit Output Current					
	OPL800	-20			mA	E <sub>e</sub> = 1 mW/cm <sup>2</sup> , Output = GND
	OPL801	-		-100	mA	E <sub>e</sub> = 0, Output = GND

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OC, OPL820, OPL820-OC, OPL821-OC



## Electrical Specifications

Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise noted)						
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$t_r, t_f$	Output Rise Time, Fall Time OPL800/801	-	70	-	ns	$T_A = 25^\circ\text{C}$ , $E_e = 0$ or $1\text{ mW/cm}^2$ , $R_L = 8$ TTL loads, $f = 10\text{ kHz}$ , D.C. = 50%
	OPL800-OC/801-OC	-	70	-	ns	$T_A = 25^\circ\text{C}$ , $E_e = 0$ or $1\text{ mW/cm}^2$ , $R_L = 360\ \Omega$ , $f = 10\text{ kHz}$ , D.C. = 50%
	OPL810/811	-	70	-	ns	$T_A = 25^\circ\text{C}$ , $E_e = 0$ or $0.4\text{ mW/cm}^2$ , $R_L = 10$ TTL loads, $f = 10\text{ kHz}$ , D.C. = 50%
	OPL810-OC/811-OC/812-OC/ 813-OC	-	100	-	ns	$T_A = 25^\circ\text{C}$ , $E_e = 0$ or $1\text{ mW/cm}^2$ , $R_L = 300\ \Omega$ , $f = 10\text{ kHz}$ , D.C. = 50%
	OPL820	-	60	-	ns	$R_L = 390\ \Omega$
$t_{PLH}, t_{PHL}$	Propagation Delay Low/High - High/Low OPL800/801	-	5	-	$\mu\text{s}$	$T_A = 25^\circ\text{C}$ , $E_e = 0$ or $1\text{ mW/cm}^2$ , $R_L = 8$ TTL loads, $f = 10\text{ kHz}$ , D.C. = 50%
	OPL800-OC/801-OC	-	5	-	$\mu\text{s}$	$T_A = 25^\circ\text{C}$ , $E_e = 0$ or $1\text{ mW/cm}^2$ , $R_L = 8$ TTL loads, $f = 10\text{ kHz}$ , D.C. = 50%
	OPL810/811	-	5	-	$\mu\text{s}$	$T_A = 25^\circ\text{C}$ , $E_e = 0$ or $0.4\text{ mW/cm}^2$ , $R_L = 10$ TTL loads, $f = 10\text{ kHz}$ , D.C. = 50%
	OPL810-OC/811-OC/812-OC/ 813-OC	-	5	-	$\mu\text{s}$	$T_A = 25^\circ\text{C}$ , $E_e = 0$ or $1\text{ mW/cm}^2$ , $R_L = 300\ \Omega$ , $f = 10\text{ kHz}$ , D.C. = 50%
	OPL820 (to high state) OPL820 (to low state)	- -	1 2.1	- -	$\mu\text{s}$ $\mu\text{s}$	$E_e = 0.1\text{ mW/cm}^2$ , $R_L = 390\ \Omega$ $E_e = 0.1\text{ mW/cm}^2$ , $R_L = 390\ \Omega$
Data Rate	Data Rate Using NRZ Format	-	100	-	kHz	$E_e = 0.1\text{ mW/cm}^2$ , $R_L = 390\ \Omega$

### Notes:

- (1) RMA flux is recommended. Duration can be extended to 10 sec. max. when flow soldering. For OPB820, a maximum of 20 grams force may be applied to leads while at soldering temperatures.
- (2) Derate linearly  $2.5\text{ mW/}^\circ\text{C}$  above  $25^\circ\text{C}$  for OPL800, OPL801, OPL810, OPL811. Derate linearly  $5.7\text{ mW/}^\circ\text{C}$  above  $90^\circ\text{C}$  for OPL820.
- (3) For OPL800, OPL801, OPL810, OPL811, light measurements are made with  $\lambda_i = 935\text{ nm}$ . For OPB820, light measurements are made with an LED source having a wavelength of  $935\text{ nm}$ .
- (4) High output state limits are valid for  $4.5\text{ V} < V_{CC} < 16\text{ V}$  and  $E_e > 0.035\text{ mW/cm}^2$  (OPL820, OPL820-OC),  $E_e < 0.001\text{ mW/cm}^2$  (OPL821-OC).
- (5) Low output state limits are valid for  $4.5\text{ V} < V_{CC} < 16\text{ V}$  and  $E_e > 0.035\text{ mW/cm}^2$  (OPL821-OC),  $E_e < 0.001\text{ mW/cm}^2$  (OPL820, OPL820-OC).

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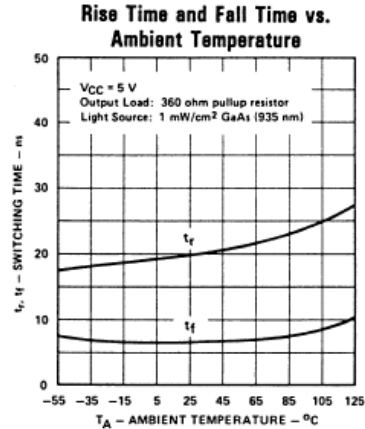
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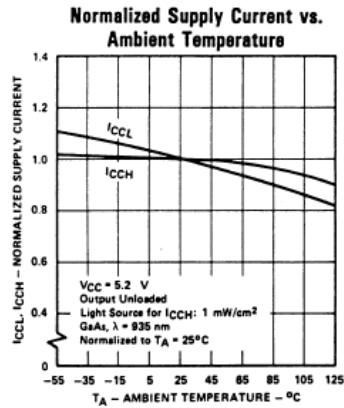
## Performance OPL800, OPL801



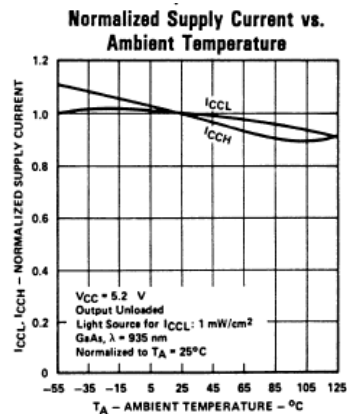
## OPL800-OC, OPL801-OC



## OPL800, OPL800-OC



## OPL801, OPL801-OC



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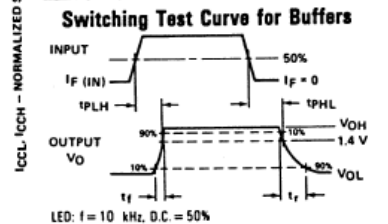
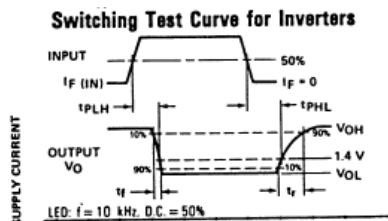
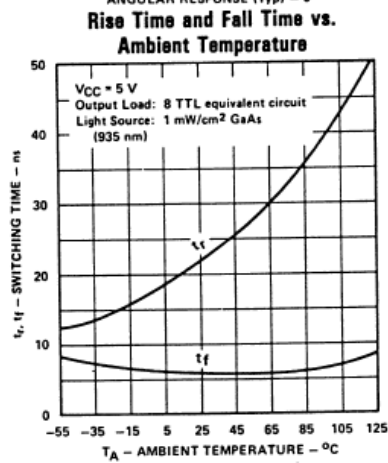
# Photologic Hermetic Sensors

OPL800, OPL800-OC, OPL801, OPL801-OC, OPL810, OPL810-OC, OPL811, OPL811-OC, OPL812-OC, OPL813-OC, OPL820, OPL820-OC, OPL821-OC



## Performance

OPL800, OPL801 Series



**General Note**

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# Photologic Hermetic Sensors

OPL800, OPL800-OC, OPL801, OPL801-OC, OPL810, OPL810-OC, OPL811, OPL811-OC, OPL812-OC, OPL813-OC, OPL820, OPL820-OC, OPL821-OC



## Performance

### OPL810, OPL811 Series

Output Voltage vs. Ambient Temp.



High Output Current vs. Ambient Temp.



Normalized Threshold Irradiance vs. T<sub>A</sub>



### OPL812, OPL813 Series

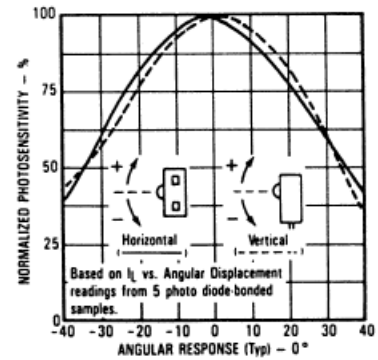
Normalized Threshold Irradiance vs. Amb. Temp.



Normalized Spectral Response



Angular Displacement from Package Mechanical Axis



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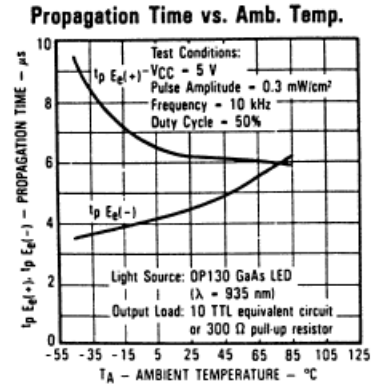
# Photologic Hermetic Sensors

OPL800, OPL800-OC, OPL801, OPL801-OC, OPL810, OPL810-OC, OPL811, OPL811-OC, OPL812-OC, OPL813-OC, OPL820, OPL820-OC, OPL821-OC



## Performance

OPL812, OPL813 Series

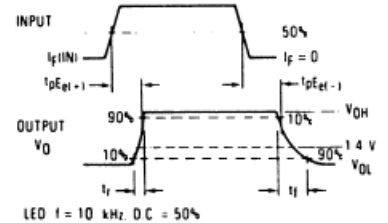


## Switching Test Curves

### Switching Test Curve for Inverters



### Switching Test Curve for Buffers



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# Photologic Hermetic Sensors

OPL800, OPL800-OC, OPL801, OPL801-OC, OPL810, OPL810-OC, OPL811, OPL811-OC, OPL812-OC, OPL813-OC, OPL820, OPL820-OC, OPL821-OC



## Performance

### OPL820, OPL821 Series



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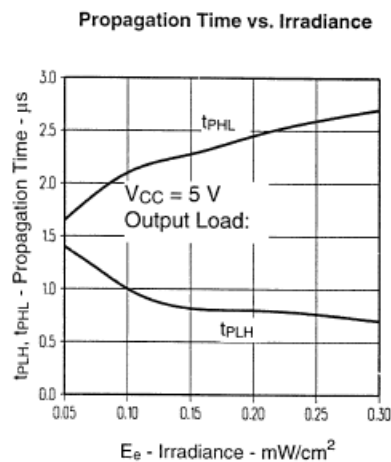
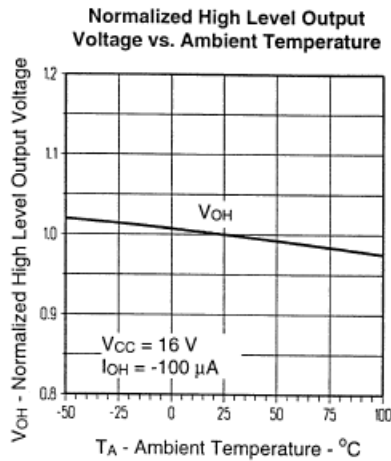
# Photologic Hermetic Sensors

OPL800, OPL800-OC, OPL801, OPL801-OC, OPL810, OPL810-OC, OPL811, OPL811-OC, OPL812-OC, OPL813-OC, OPL820, OPL820-OC, OPL821-OC



## Performance

### OPL820, OPL821 Series



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