

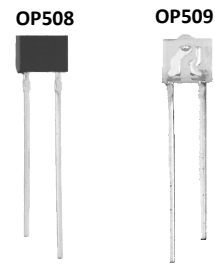
NPN Silicon Phototransistor

OP508F, OP509 Series



Features:

- Flat lensed for wide acceptance angle (OP508F)
- Lensed for high sensitivity (OP509)
- Easily stackable on 0.100" (2.54 mm) hole centers
- Inexpensive plastic package
- Mechanically and spectrally matched to OP168 and OP268 series of infrared emitting diodes



Description:

Each device in the **OP508F** series consists of a NPN silicon phototransistor mounted in a flat, black plastic “end-looking” package. The flat sensing surface allows an acceptance half-angle of 60° when measured from the optical axis to the half power point.

Each device in the **OP509** series consists of a NPN silicon phototransistor mounted in a lensed, clear plastic “end-looking” package. The lensing effect of the package allows an acceptance half-angle of 25° when measured from the optical axis to the half power point.

OP508F and **OP509** series devices can be mounted on 0.100" (2.54 mm) hole centers, which makes them an ideal low-cost alternate to hermetic OP600 sensors. ***OP508F** and **OP509** series devices are mechanically and spectrally matched to the OP168F and OP268F series of infrared emitting diodes.*

Please refer to Application Bulletins 208 and 210 for additional design information and reliability (degradation) data.

For custom versions of the **OP508F**, **OP509** and **OP538F** series devices please contact your OPTEK representative.

Applications:

- Applications requiring a wide acceptance angle
- Applications requiring high sensitivity
- Space-limited applications

Ordering Information			
Part Number	Sensor	Viewing Angle	Lead Length
OP508FA	Phototransistor	120°	0.50"
OP508FC			
OP509A		50°	
OP509B			
OP509C			



General Note
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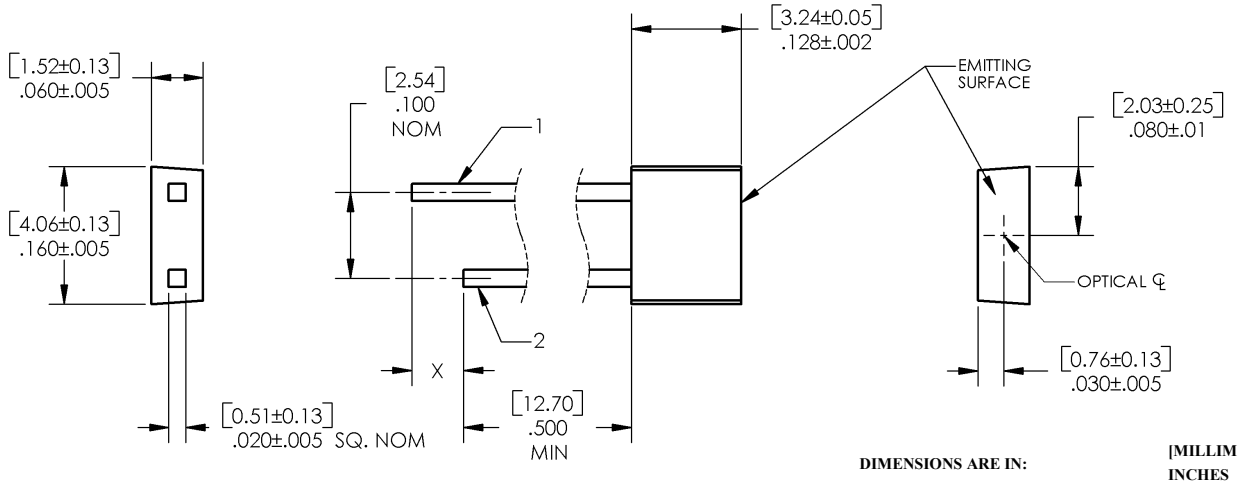
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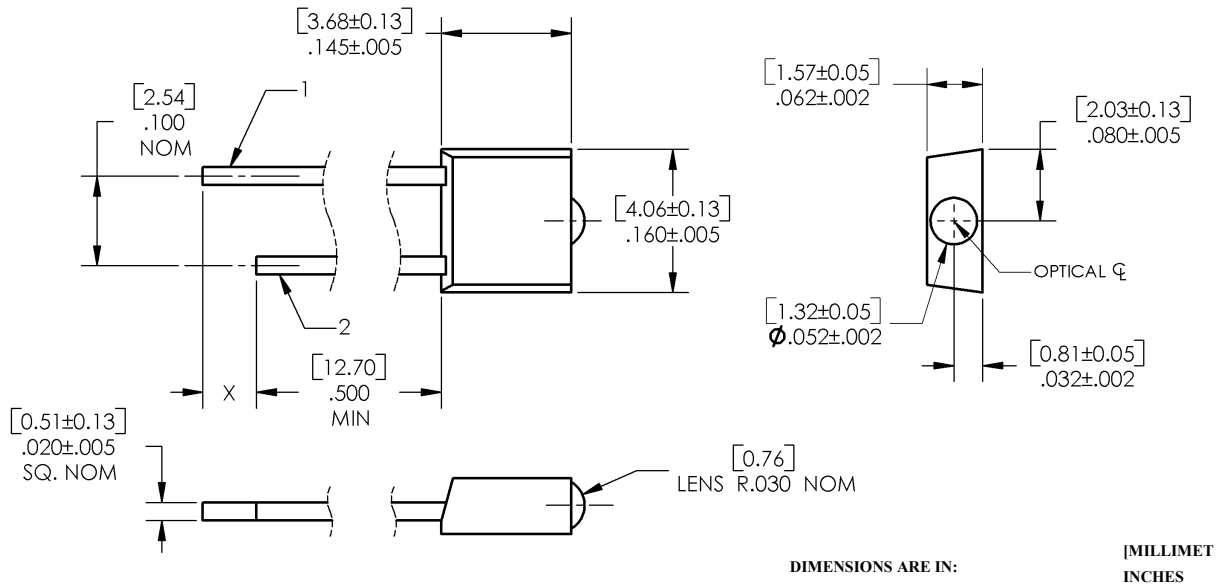
OP508F, OP509 Series



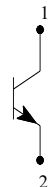
OP508F (A, C)



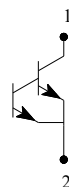
OP509 (A, B)



OP508F & OP509



OP538



Pin #	Transistor
1	Collector
2	Emitter

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OP508F, OP509 Series



Electrical Specifications

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ unless otherwise noted)	
Storage and Operating Temperature Range	-40°C to $+100^\circ\text{C}$
Collector-Emitter Voltage	30 V
Emitter-Collector Voltage	5 V
Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 seconds with soldering iron]	$260^\circ\text{C}^{(1)}$
Power Dissipation	$100\text{ mW}^{(2)}$

Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)						
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current			20.00		$V_{CE} = 5.0\text{ V}, E_E = 5\text{ mW/cm}^2^{(3)}$
	OP509A (Dome Lens)	5.70	-	-		
	OP508FA (Flat Lens)	2.70	-	10.60	mA	
	OP509B (Dome Lens)	1.40	-	-		
	OP508FC (Flat Lens)	0.34	-	-		
$I_C/\Delta T$	Relative I_C Change with Temperature	-	1.00	-	%/ $^\circ\text{C}$	$V_{CE} = 5\text{ V}, E_E = 1.0\text{ mW/cm}^2^{(3)}, \lambda = 890\text{ nm}$
I_{CEO}	Collector-Dark Current			100		$V_{CE} = 10.0\text{ V}, E_E = 0^{(4)}$
	OP508F & OP509	-	-	225	nA	
	OP538F	-	-	-		
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage					$I_C = 1.00\text{ mA}, E_E = 0$
	OP508F & OP509	30	-	-	V	
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5	-	-	V	$I_E = 100\text{ }\mu\text{A}$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage					$I_C = 300\text{ }\mu\text{A}, E_E = 5\text{ mW/cm}^2^{(3)}$
	OP508F	-	-	0.4	V	
	OP509	-	-	0.4	V	

Notes:

1. RMA flux is recommended. Duration can be extended to 10 seconds maximum when flow soldering. A maximum 20 grams force may be applied to the leads when soldering.
2. Derate linearly $1.33\text{ mW}/^\circ\text{C}$ above 25°C .
3. Light source is an unfiltered GaAs or GaAlAs LED with a peak emission wavelength of 935 or 890 nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
4. To calculate typical collector dark current in μA , use the formula $I_{CEO} = 10^{(0.040 T_A - 3.4)}$, where T_A is ambient temperature in $^\circ\text{C}$.

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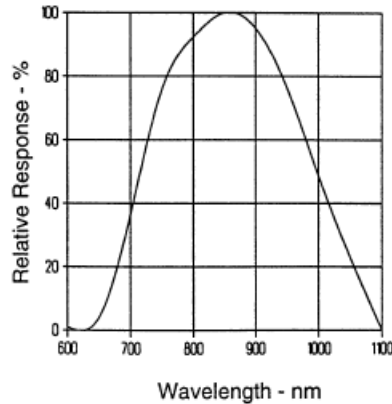
OP508F, OP509 Series



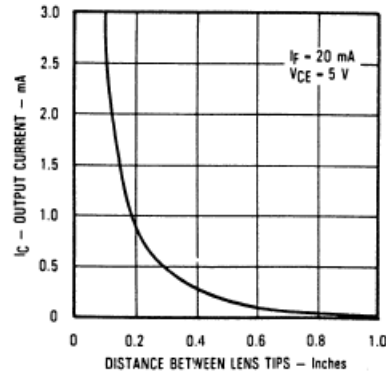
Performance

OP508FA, OP508FC, OP508FD

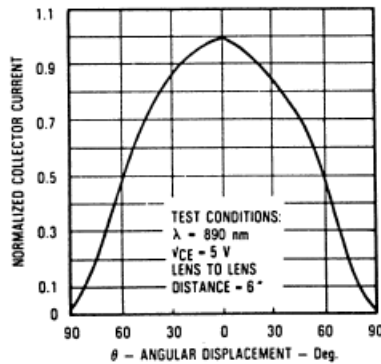
Typical Spectral Response



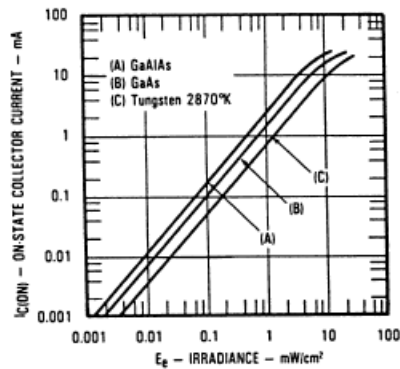
Coupling Characteristics of OP168F and OP508F



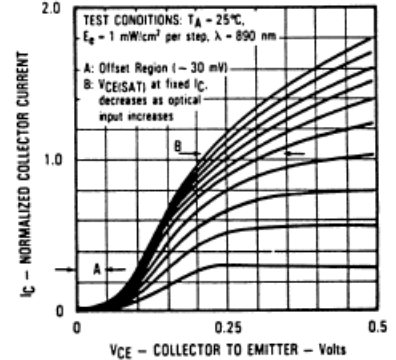
Normalized Collector Current vs. Angular Displacement



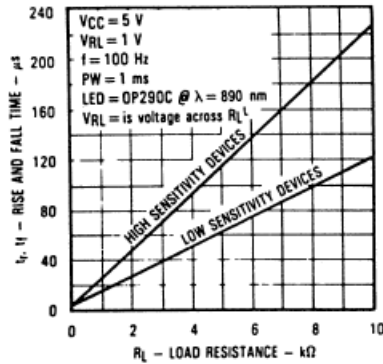
On-State Collector Current vs. Irradiance



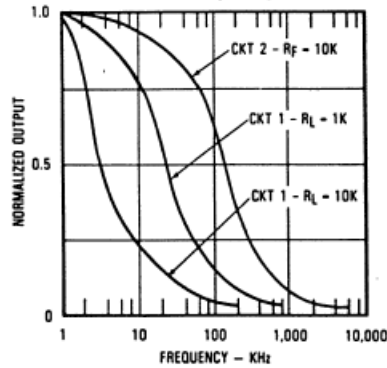
Normalized Collector Current vs. Collector to Emitter Voltage



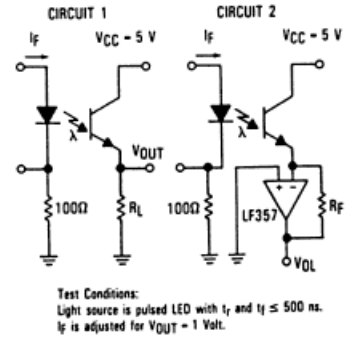
Rise and Fall Time vs Load Resistance



Normalized Output vs. Frequency



Switching Time Test Circuit



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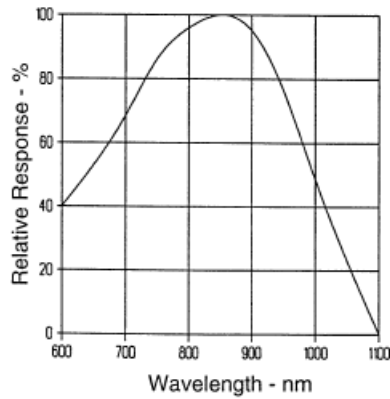
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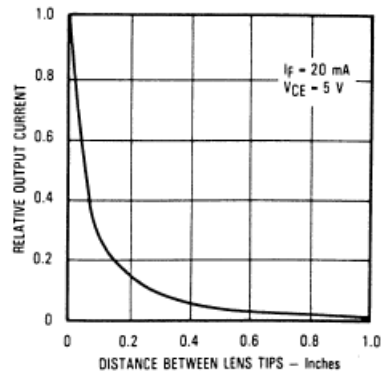
Performance

OP509A, OP509B, OP509D

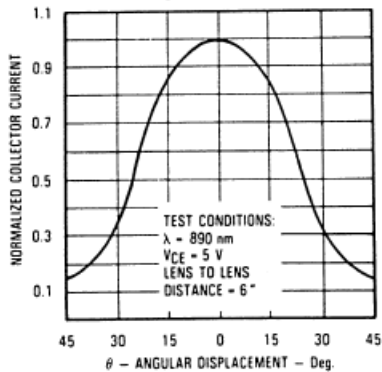
Typical Spectral Response



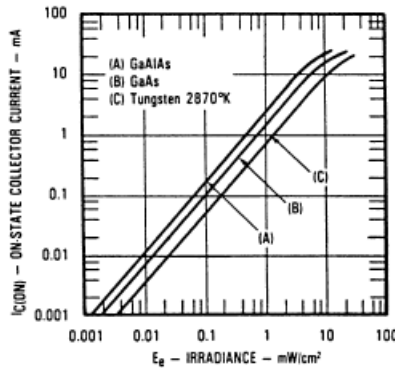
Coupling Characteristics of OP169 and OP509



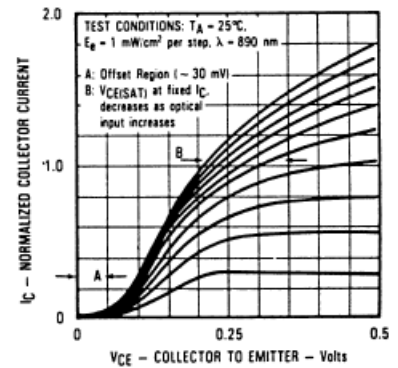
Normalized Collector Current vs. Angular Displacement



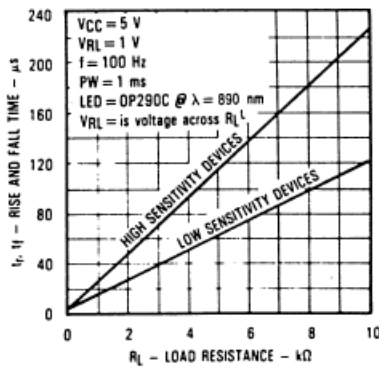
On-State Collector Current vs. Irradiance



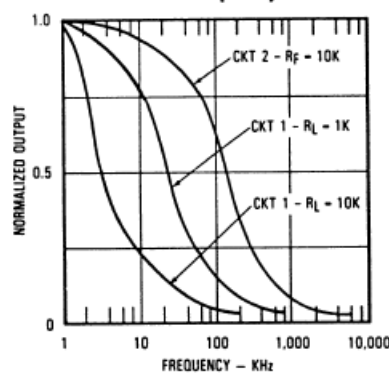
Normalized Collector Current vs. Collector to Emitter Voltage



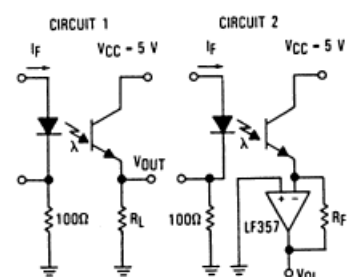
Rise and Fall Time vs Load Resistance



Normalized Output vs. Frequency



Switching Time Test Circuit



Test Conditions:
Light source is pulsed LED with t_r and $t_f \leq 500$ ns.
 I_f is adjusted for $V_{OUT} = 1$ Volt.

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