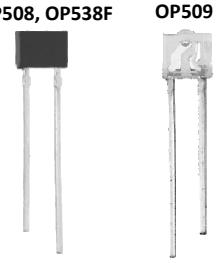
NPN Silicon Phototransistor

OP508F, OP509, OP538F 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.

Each device in the **OP538F** series consists of a NPN silicon photodarlington mounted in a flat, black plastic "end-looking" package. The flat sensing surface allows an acceptance half-angle of 65° when measured from the optical axis to the half power point.

OP508F, OP509 and **OP538F** 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, OP509*** *and* ***OP538F*** *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"
OP508FB			
OP508FC			
OP509A		50°	
OP509B			
OP509C			
OP538FA	Photodarlington	120°	
OP538FB			
OP538FC			

RoHS

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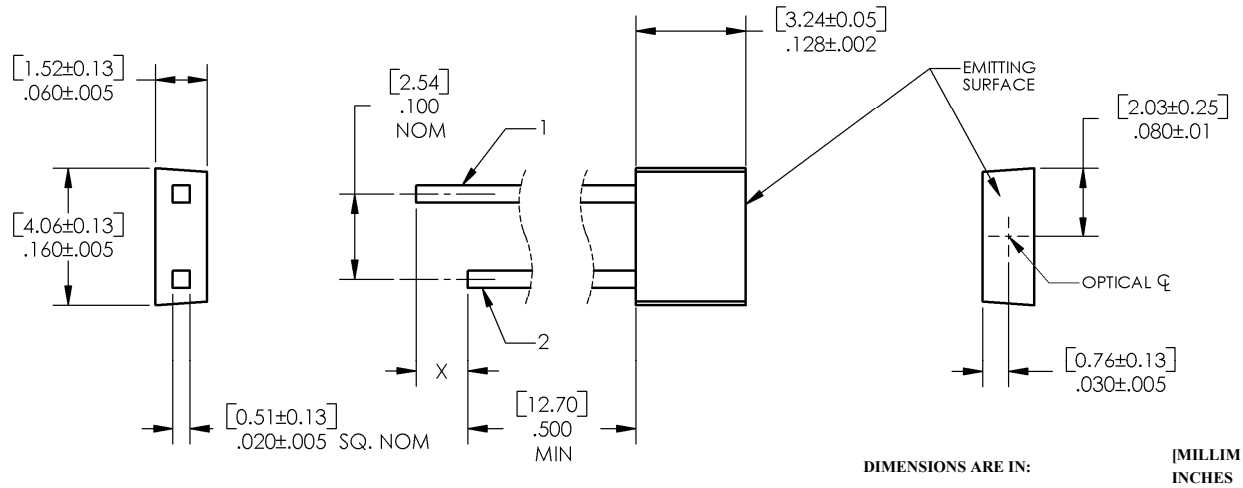
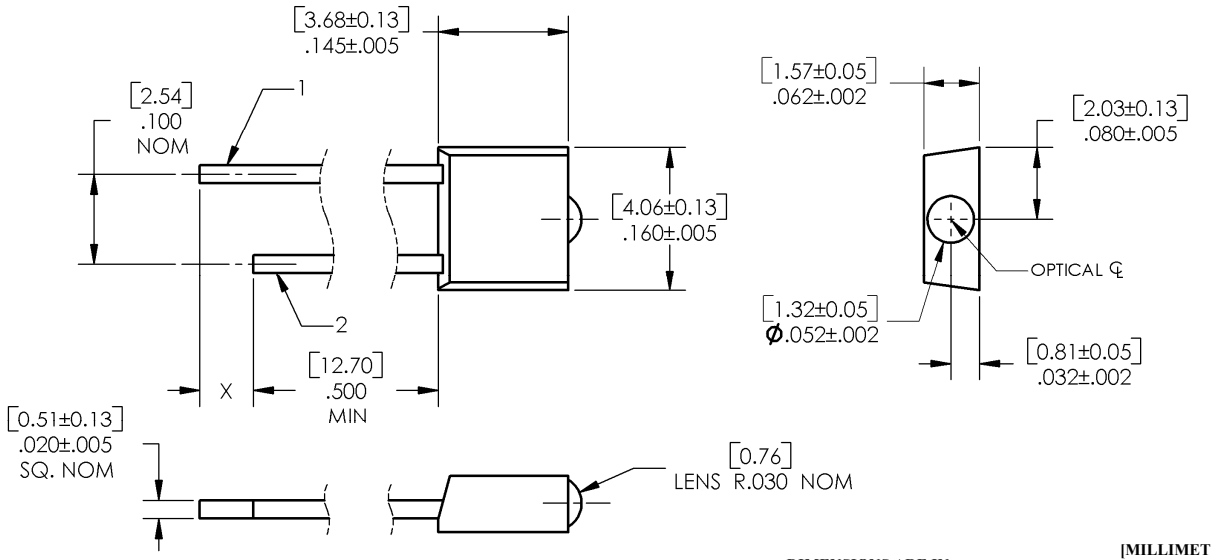
OP508F, OP538F (A, B, C)



DIMENSIONS ARE IN: [MILLIM
INCHES

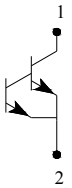
OP509 (A, B, C)



DIMENSIONS ARE IN: [MILLIMET
INCHES

OP508F & OP509

OP538



Pin #	Transistor
1	Collector
2	Emitter

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NPN Silicon Phototransistor

OP508F, OP509, OP538F Series

Electrical Specifications

Absolute Maximum Ratings (T_A = 25° C unless otherwise noted)	
Storage and Operating Temperature Range	-40° C to +100° 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° C(1)
Power Dissipation	100 mW(2)

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

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current OP509A (Dome Lens) OP508FA (Flat Lens) OP509B (Dome Lens) OP509C (Dome Lens) OP508FB (Flat Lens) OP508FC (Flat Lens)	 5.70 2.70 1.40 0.70 0.65 0.34	 - - - - - -	 20.00 - 10.60 - 5.10 -	mA	V_{CE} = 5.0 V, E_E = 5 mW/cm^2 (3)
	OP538A (Flat Lens) OP538B (Flat Lens) OP538C (Flat Lens)	6.80 2.30 1.10	- - -	- 20.50 -	mA	V_{CE} = 5.0 V, E_E = 0.5 mW/cm^2 (3)
$I_C/\Delta T$	Relative I_C Charge with Temperature	-	1.00	-	%/°C	V_{CE} = 5 V.0, E_E = 1.0 mW/cm$^{2(3)}$, λ = 890 nm
I_{CEO}	Collector-Dark Current OP508F & OP509 OP538F	 - -	 - -	 100 225	nA	V_{CE} = 10.0 V, E_E = 0(4)
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage OP508F & OP509 OP538F	 30 15	 - -	 - -	V	I_C = 1.00 mA, E_E = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5	-	-	V	I_E = 100 µA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage OP508F	-	-	0.4	V	I_C = 300 µA, E_E = 5 mW/cm^2 (3)
	OP509	-	-	0.4	V	I_C = 250 µA, E_E = 5 mW/cm^2 (3)
	OP538F	-	-	1.0		I_C = 100 µA, E_E = 5 mW/cm^2 (3)

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 mW/° 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 °C.

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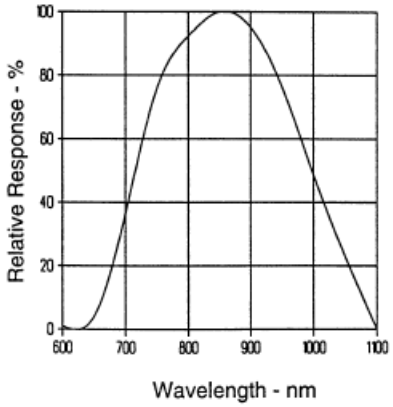
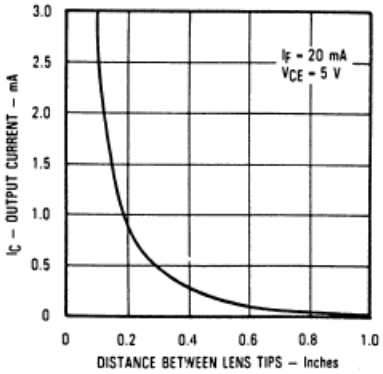
Performance

OP508FA, OP508FB, OP508FC, OP508FD

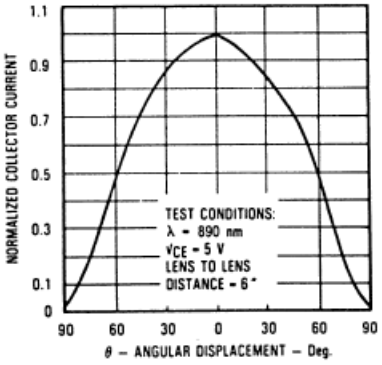
Typical Spectral Response



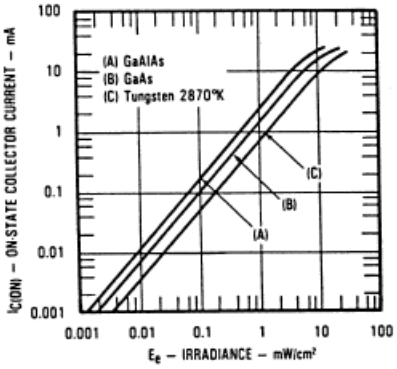
Coupling Characteristics of OP168F and OP508F



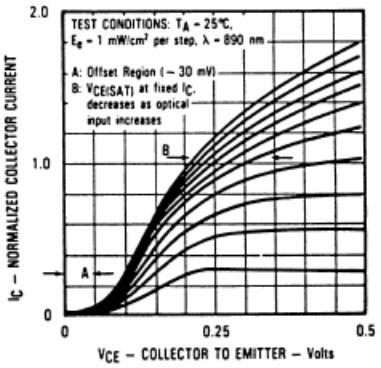
Normalized Collector Current vs. Angular Displacement



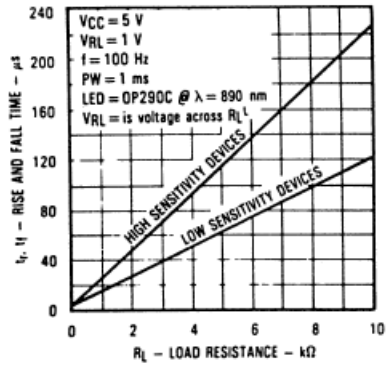
On-State Collector Current vs. Irradiance



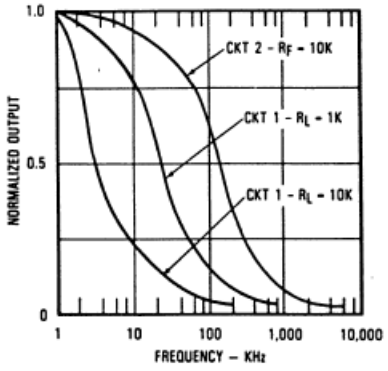
Normalized Collector Current vs. Collector to Emitter Voltage



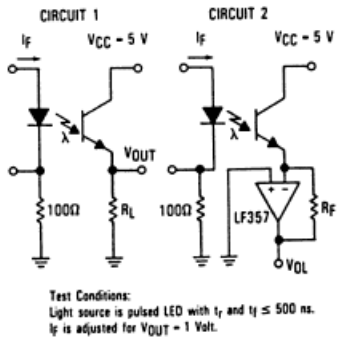
Rise and Fall Time vs Load Resistance



Normalized Output vs. Frequency



Switching Time Test Circuit



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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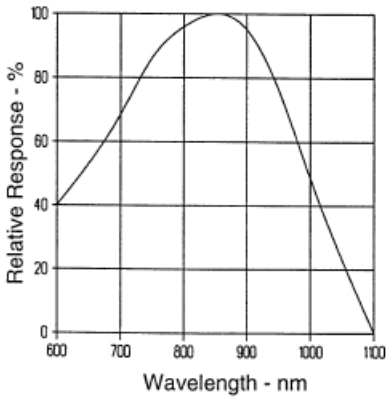
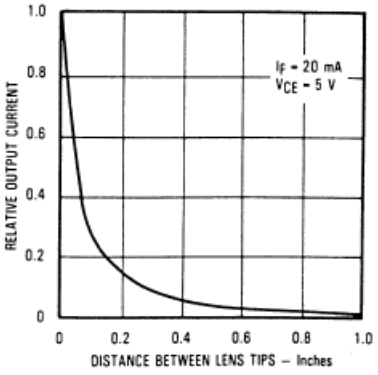
Performance

OP509A, OP509B, OP509C, OP509D

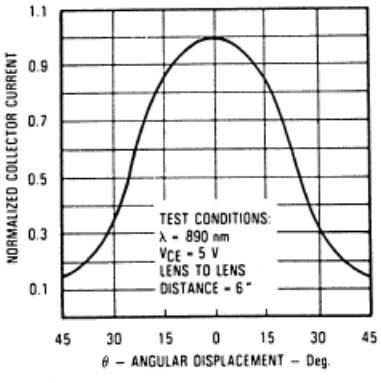
Typical Spectral Response



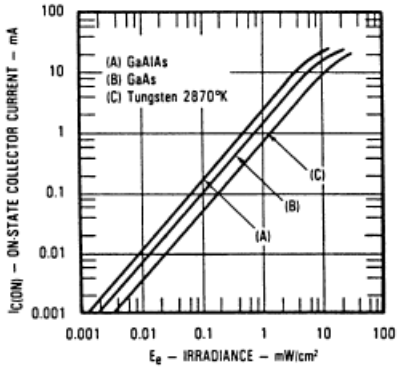
Coupling Characteristics of OP169 and OP509



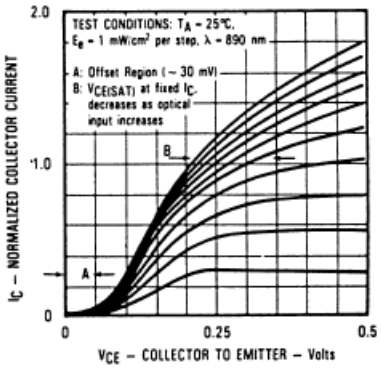
Normalized Collector Current vs. Angular Displacement



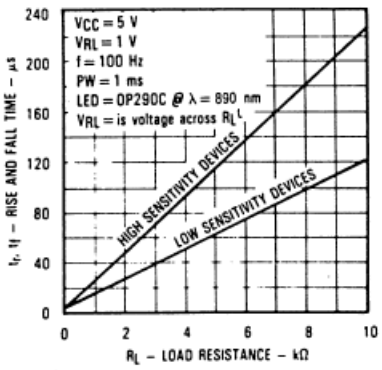
On-State Collector Current vs. Irradiance



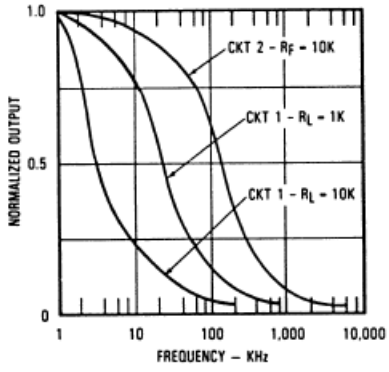
Normalized Collector Current vs. Collector to Emitter Voltage



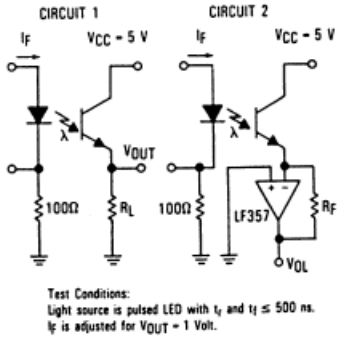
Rise and Fall Time vs Load Resistance



Normalized Output vs. Frequency



Switching Time Test Circuit



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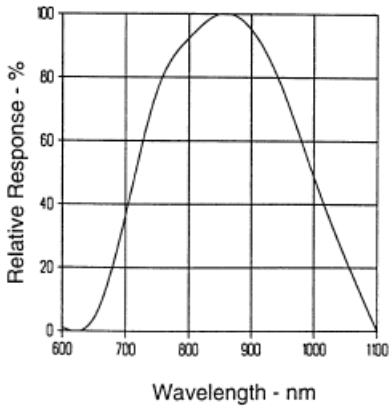
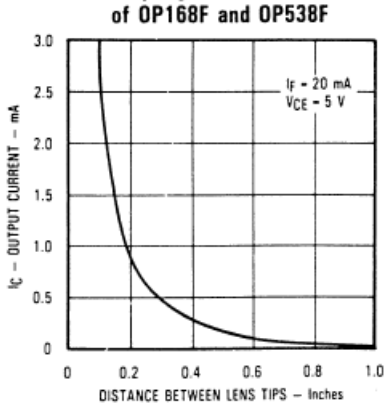
OP538FA, OP538FB, OP538FC,

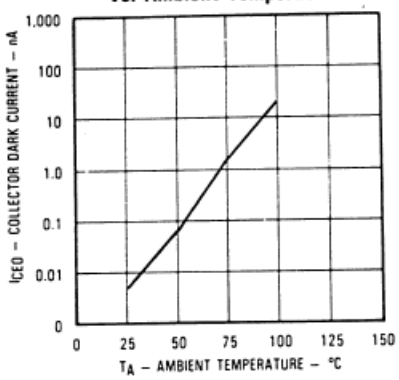
Typical Spectral Response



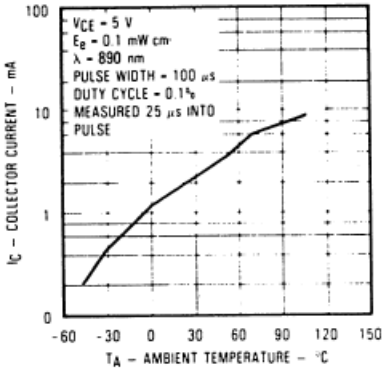
Coupling Characteristics of OP168F and OP538F



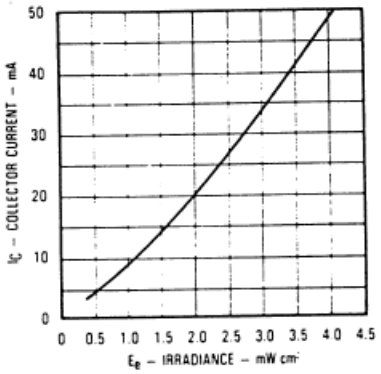
Collector Dark Current vs. Ambient Temperature



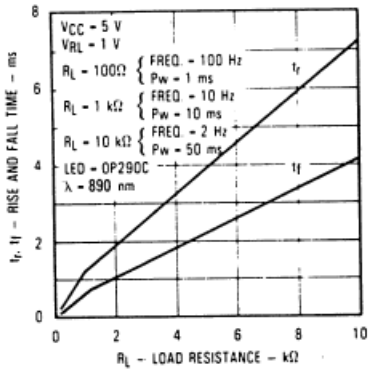
Collector Current vs. Ambient Temperature



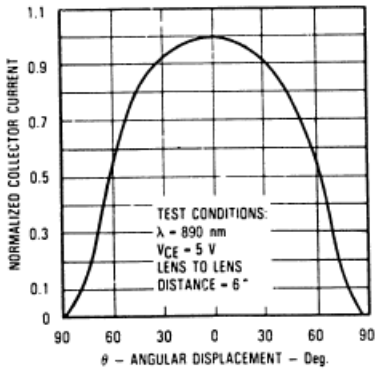
Collector Current vs. Irradiance



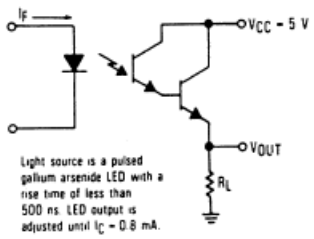
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



Switching Time Test Circuit



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