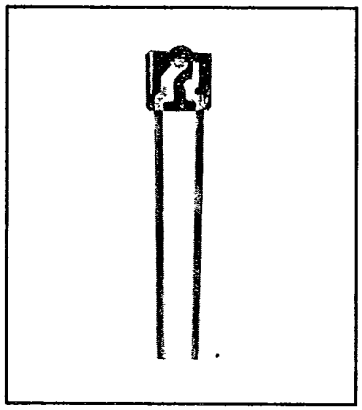
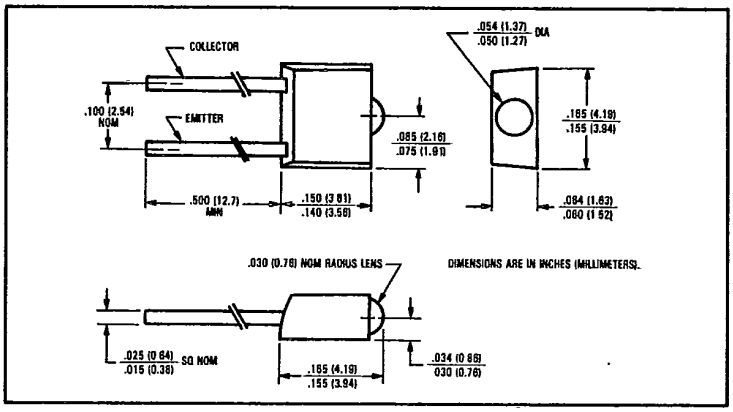
Optoelectronics Division
TRW Electronic Components Group

Product Bulletin 5114
January 1985

T-41-61

NPN Silicon Phototransistors
Types OP509, OP509SLD, OP509SLC





Features
- Lensed for high sensitivity
- Can be mounted on 0.100" (2.54 mm) hole centers
- Low cost plastic package
- Mechanically and spectrally matched to the OP169SL and OP269SL series of infrared emitting diodes

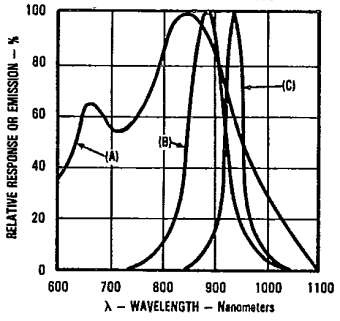
Description
The OP509, OP509SLD, and OP509SLC each consist of an NPN silicon phototransistor mounted in a lensed, clear plastic, end looking package. The lensing effect of the package allows an acceptance half angle of 25° measured from the optical axis to the half power point.

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)
Collector-Emitter Voltage ..... 30 V
Emitter-Collector Voltage ..... 5.0 V
Storage and Operating Temperature Range ..... −40°C to +100°C
Lead Soldering Temperature (1/16 inch [1.6 mm] from case for 5 sec. with soldering iron)[1] ..... 240°C
Power Dissipation ..... 100 mW[2]

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 sec. max. when wave soldering.
(2) Derate linearly 1.33 mW/°C above 25°C.
(3) Junction temperature maintained at 25°C.
(4) Light source is an unfiltered tungsten bulb operating at CT = 2870°K or equivalent infrared source.
(5) 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.

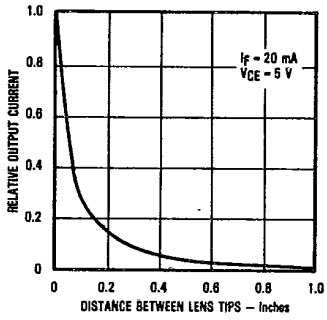
Typical Performance Curves

Photosensor Spectral Response vs. GaAlAs and GaAs



Test Conditions (LED): $T_A = T_J = 25°C$, I_F = 100 mA, DC = 0.1%, PW = 100 μs
Peak Wavelength – λp: (A) XSTR – 850 ± 30 nm, (B) LED GaAlAs – 875 ± 20 nm, (C) LED GaAs – 930 ± 15 nm

Coupling Characteristics of OP169SL and OP509



Types OP509, OP509SLD, OP509SLC

T-41-61

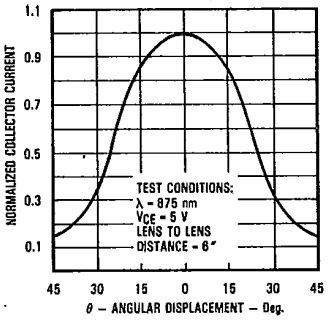
Electrical Characteristics (T_A = 25°C unless otherwise noted)

Symbol	Parameter		Min.	Typ.	Max.	Units	Test Conditions
$I_{C(ON)}$[3]	On-State Collector Current	OP509	0.050			mA	V_{CE} = 5.0 V, E_e = 1.00 mW/cm²[4]
		OP509SLD	0.170		0.50	mA	V_{CE} = 5.0 V, E_e = 1.00 mW/cm²[4]
		OP509SLC	0.30			mA	V_{CE} = 5.0 V, E_e = 1.00 mW/cm²[4]
$\Delta I_C/\Delta T$	Relative I_C Changes with Temperature			1.00		%/°C	V_{CE} = 5.0 V, E_e = 1.00 mW/cm², λ = 875 nm
I_{CEO}[5]	Collector Dark Current				100	nA	V_{CE} = 10.0 V, E_e = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage		30			V	I_C = 100 μA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage		5.0			V	I_E = 100 μA
$V_{CE(SAT)}$[3]	Collector-Emitter Saturation Voltage				0.40	V	I_C = 250 μA, E_e = 5.0 mW/cm²[4]

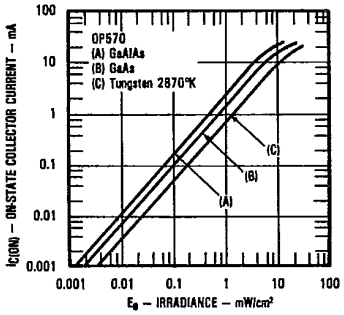
D

Typical Performance Curves

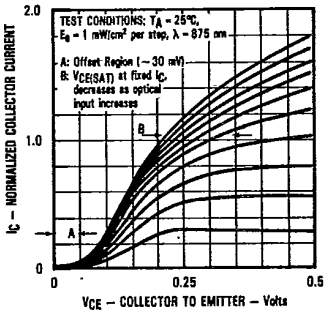
Normalized Collector Current vs. Angular Displacement



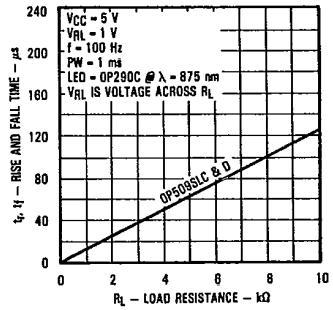
On-State Collector Current vs. Irradiance



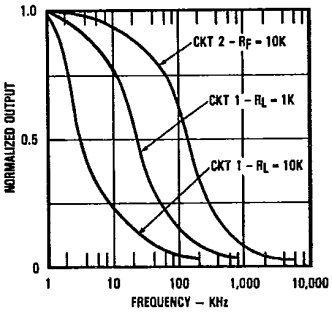
Normalized Collector Current vs. Collector to Emitter Voltage



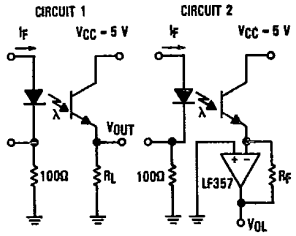
Rise and Fall Time vs. Load Resistance



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.

Optoelectronics Division, TRW Electronic Components Group, 1215 W. Crosby Rd., Carrollton, TX 75006 (214) 323-2200, TLX 6716032 or 215849