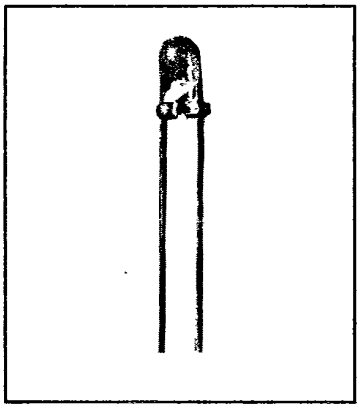
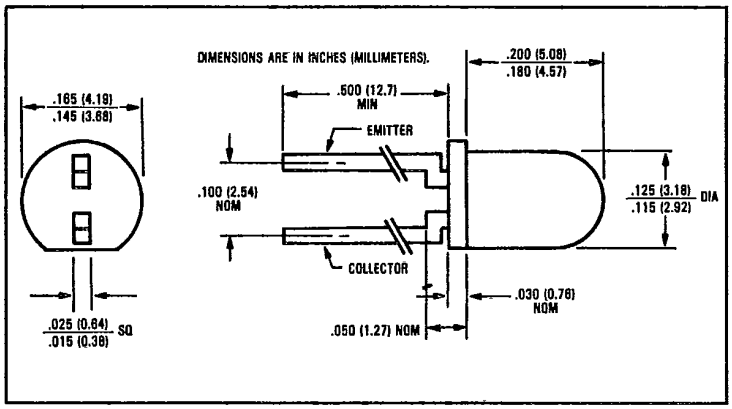
Optoelectronics Division
TRW Electronic Components Group

Product Bulletin 5098
January 1985

Infrared Selected NPN Silicon Phototransistors
Types OP501SR, OP501SRD, OP501SRC, OP501SRB, OP501SRA





Features
- Tested using infrared for close correlation to TRW infrared emitters
- 0.100" (2.54 mm) lead spacing
- Wide range of collector currents
- Lensed for high sensitivity

Description
The OP501SR and OP501SRD through SRA 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 8° measured from the optical axis to the half power point. This series is identical to the OP500 except for lead spacing. The series is 100% factory tested using infrared for close correlation to TRW GaAs or GaAlAs emitters and the most accurate design-in possible. This series is mechanically and spectrally matched to the OP160SL and OP260SL series of infrared emitting diodes.

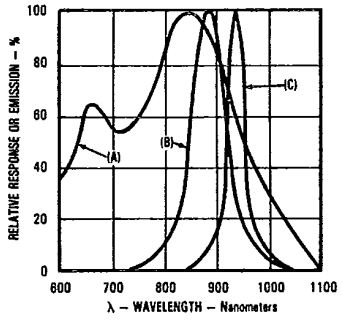
Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

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 GaAs LED with a peak emission wavelength of 930 nm and a radiometric intensity level which varies less than 10% over the entire lens surface of the phototransistor being tested.
(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.

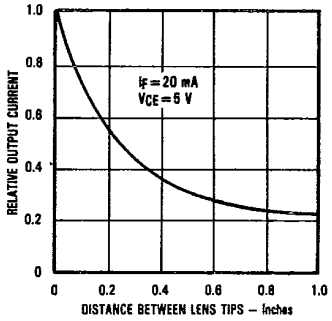
Typical Performance Curves

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 – λ_P: (A) XSTR – 850 ±30 nm,
(B) LED GaAlAs – 875 ±20 nm,
(C) LED GaAs – 930 ±15 nm

Coupling Characteristics of OP161SL and OP501



Types OP501SR, OP501SRD, OP501SRC, OP501SRB, OP501SRA

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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	OP501SR	0.080			mA	V_{CE} = 5.0 V, E_e = 0.130 mW/cm² [4]
		OP501SRD	0.080		0.24	mA	V_{CE} = 5.0 V, E_e = 0.130 mW/cm² [4]
		OP501SRC	0.160		0.48	mA	V_{CE} = 5.0 V, E_e = 0.130 mW/cm² [4]
		OP501SRB	0.32		0.96	mA	V_{CE} = 5.0 V, E_e = 0.130 mW/cm² [4]
		OP501SRA	0.64			mA	V_{CE} = 5.0 V, E_e = 0.130 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 = 930 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				0.50	V	I_C = 50 μA, E_e = 0.130 mW/cm² [4], λ = 930 nm

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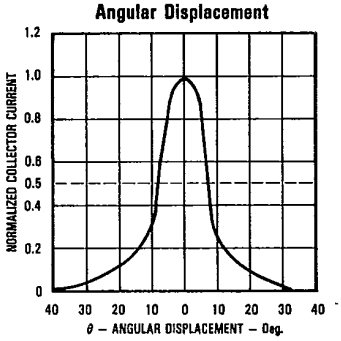
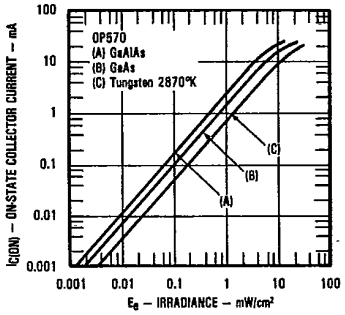
Typical Performance Curves

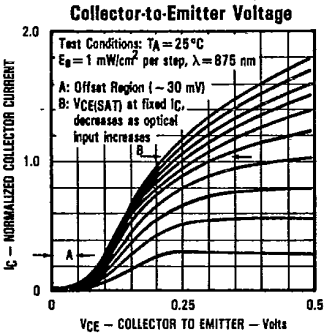
Normalized Collector Current vs Angular Displacement



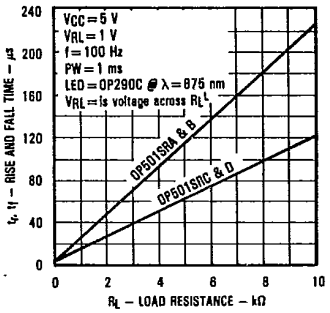
On-State Collector Current vs Irradiance



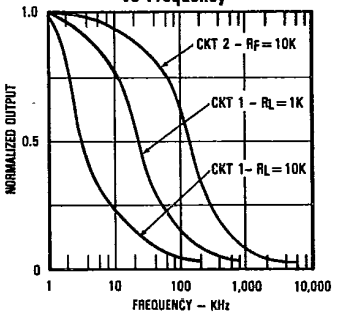
Normalized Collector Current vs Collector-to-Emitter Voltage



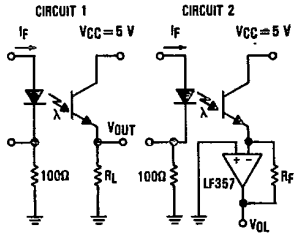
Rise and Fall Time vs Load Resistance



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.

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