NPN Silicon Phototransistor

OP505, OP505W, OP506, OP506W

OP535, OP705

Features:

- T-1 package style
- Variety of sensitivity ranges
- Choice of narrow or wide receiving angle
- Small package size ideal for space-limited applications
- 0.050” [1.27mm] or 0.100” [2.54mm] Lead spacing

Description:

Each OP505 and OP506 devices consist of an NPN silicon phototransistor, the OP535 device consist of an NPN silicon photodarlington transistor and the OP705 device consist of an NPN silicon phototransistor with a large value resistor integrated between the Base and Emitter for low light signal rejection. All of the devices are molded in a blue-tinted T-1 (3mm) epoxy package

The OP505, OP535 and OP70**5** devices have a narrow receiving angle that provides excellent on-axis coupling while the OP506 device has a wider receiving angle for those applications where a narrow receiving angle of the OP505, OP535 and OP705 is not required. The OP505W and OP506W device have the widest receiving angle and provides relatively even reception over a large area.

Devices are 100% production tested, using infrared light for close correlation with Optek’s GaAs and GaAlAs emitters.

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

Please see your OPTEK representative for custom versions of these devices.

Applications:

- Space-limited applications
- Interruptive applications to detect media which is semi-transparent to infrared light

Ordering Information

Part Number	Sensor	Viewing Angle	Lead Spacing	Lead Length
OP505A	Transistor	20°	0.050” [1.27 mm]	0.50" [12.7 mm]
OP505B				
OP505C				
OP505D				
OP505W		90°		
OP506A		20°	0.100” [2.54 mm]	
OP506B				
OP506C				
OP506W		90°		
OP535A	Darlington	20°	0.050” [1.27 mm]	
OP535B				
OP705A	R_{BE} Transistor			

RoHS

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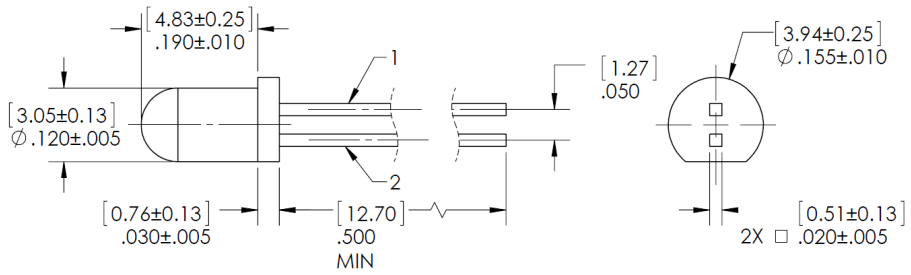
NPN Silicon Phototransistor

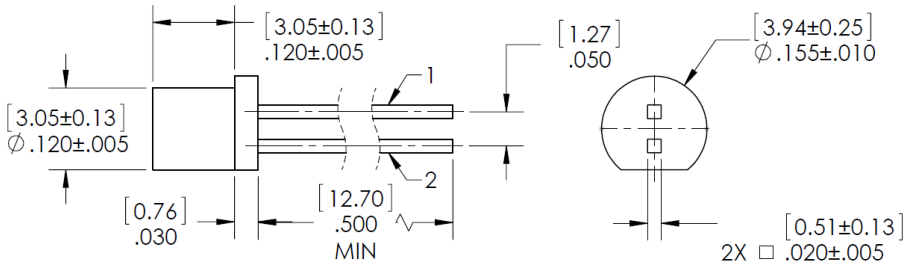
OP505, OP505W, OP506, OP506W
OP535, OP705

OP505, OP535, OP705

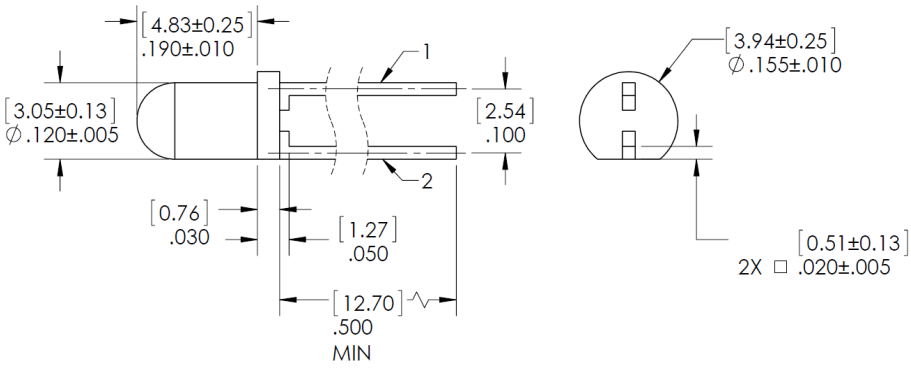


Pin #	Transistor
1	Emitter
2	Collector

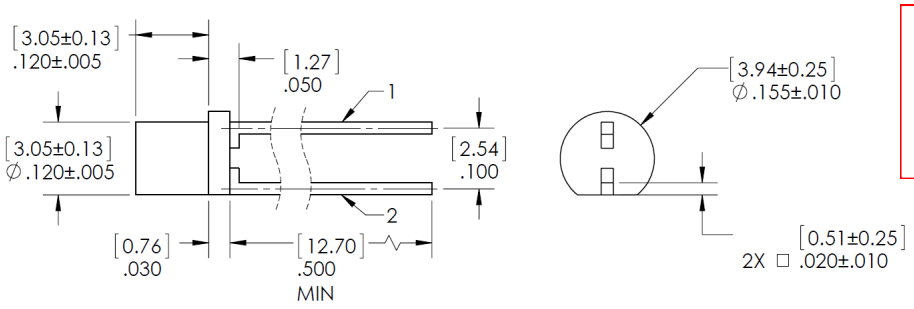
OP505W



OP506

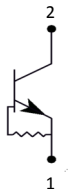


OP506W

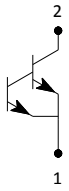


OP505, OP506
OP505W, OP506W

OP705



OP535



CONTAINS POLYSULFONE

Methanol and isopropanol alcohols
are recommended cleaning agents.
Housings are soluble in chlorinated hydrocarbons and keytones.
Highly activated or water soluble fluxes may damage body.
Testing reagents before use is recommended prior to use.

TOLERANCES ARE ± .010" [.25] UNLESS OTHERWISE STATED
DIMENSIONS ARE IN INCHES [MILLIMETERS]

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Electrical Specifications

Absolute Maximum Ratings (T_A = 25° C unless otherwise noted)	
Storage & Operating Temperature Range	-40°C to +100° C
Collector-Emitter Voltage (OP505, OP506, OP505W, OP506W, OP705)	30 V
Collector-Emitter Voltage (OP535)	15 V
Emitter-Collector Voltage (OP505 and OP506 series only)	5.0 V
Lead Soldering Temperature (1/16 inch (1.6 mm) from case for 5 seconds with soldering iron)	260° C
Power Dissipation	100 mW (2)
Emitter Reverse Current (OP705 series only)	10 mA
Collector DC Current (OP705 series only)	30 mA

Electrical Characteristics (T_A = 25° C unless otherwise noted)
OP505, OP506, OP505W, OP506W, OP705

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current					
	OP505A, OP506A	4.30	-	-	mA	V_{CE} = 5 V, E_e = 0.50 mW/cm^2 , Note 3
	OP505B, OP506B	2.15	-	5.95		
	OP505C, OP506C	1.10	-	3.00		
	OP505D	0.55	-	-		
	OP705A	3.95	-	12.00	mA	V_{CE} = 5 V, E_e = 0.50 mW/cm^2, Note 3
	OP505W, OP506W	0.10	-	-	mA	V_{CE} = 5 V, E_e = 0.75 mW/cm^2, Note 3
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage OP505, OP506, OP705	-	-	0.40	V	I_C = 250 µA, E_E = 0.5 mW/cm^2, Note 3
	OP505W, OP506W	-	-	0.40	V	I_C = 50 µA, E_E = 0.75 mW/cm^2, Note 3
I_{CEO}	Collector-Dark Current	-	-	100	nA	V_{CE} = 10 V, E_E = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	30	-	-	V	I_C = 100 µA, E_E = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage OP505, OP506	5	-	-	V	I_E = 100 µA, E_E = 0
	OP705	0.4	-	-	V	I_E = 100 µA, E_E = 0
$\Delta I_C/\Delta T$	Relative I_C Changes with Temperature	-	1.00	-	% / °C	V_{CE} = 5 V, E_E = 1.0 mW/cm^2
E_{KP}	Knee Point Irradiance (OP705)	-	0.02	-	mW/cm^2	V_{CE} = 5 V, Note 4

Notes:

(1) RMA flux is recommended. Duration can be extended to 10 seconds maximum when flow soldering. A maximum of 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 LED with a peak emission wavelength of 935 nm and a radiometric intensity level, which varies less than 10% over the entire lens surface of the phototransistor being tested.
(4) The knee point irradiance is defined as the irradiance required to increase Ic(on) to 50 µA.

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Electrical Specifications

Electrical Characteristics (T_A = 25° C unless otherwise noted)
OP535

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$I_{C(ON)}$	On-State Collector Current OP535A OP535B	 10.5 3.5	 - -	 - 32.0	mA	V_{CE} = 5 V, E_E = 0.13 mW/cm^2, Note 3
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	-	-	1.10	V	I_C = 400 µA, E_E = 0.13 mW/cm^2 , Note 3
I_{CEO}	Collector-Dark Current	-	-	100	nA	V_{CE} = 10 V, E_E = 0
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	15.0	-	-	V	I_C = 1.0 mA, E_E = 0
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5.0	-	-	V	I_E = 100 µA, E_E = 0

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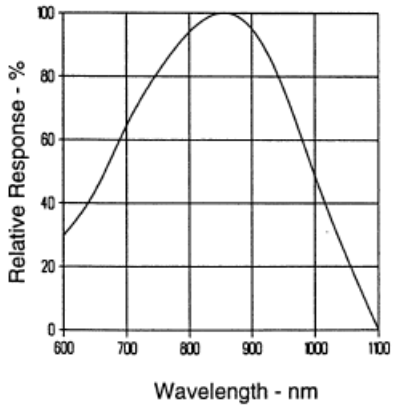
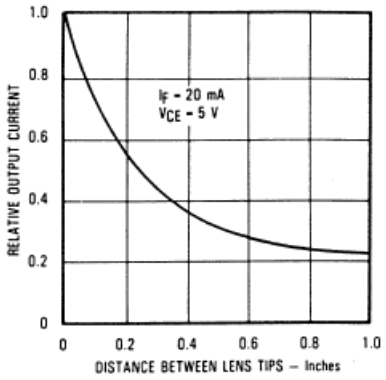
Performance

OP505A, OP505B, OP505C, OP505D

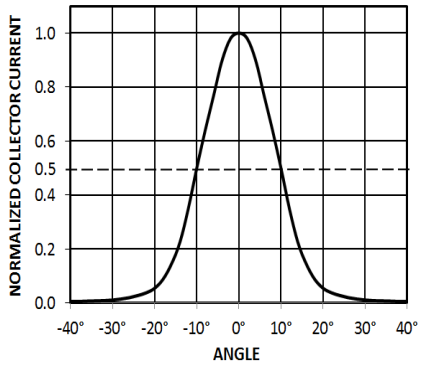
Typical Spectral Response



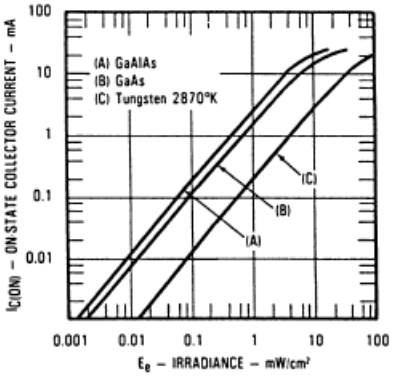
Coupling Characteristics OP165 and OP505



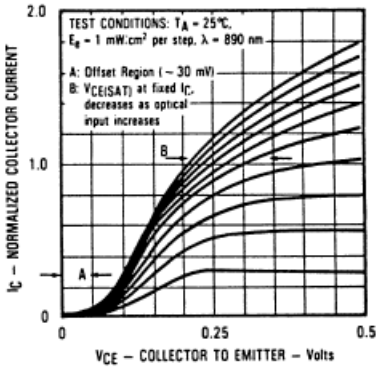
Normalized Collector Current vs. Angular Displacement



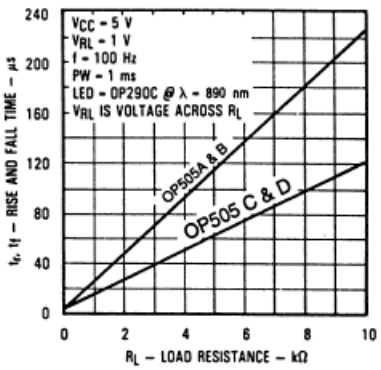
On-State Collector Current vs. Irradiance



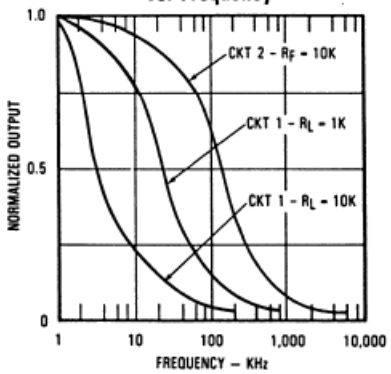
Normalized Collector Current vs. Collector to Emitter Voltage



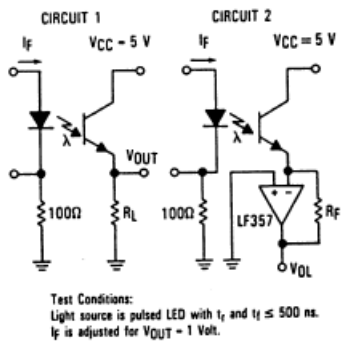
Rise and Fall Time vs. Load Resistance



Normalized Output vs. Frequency



Switching Time Test Circuit



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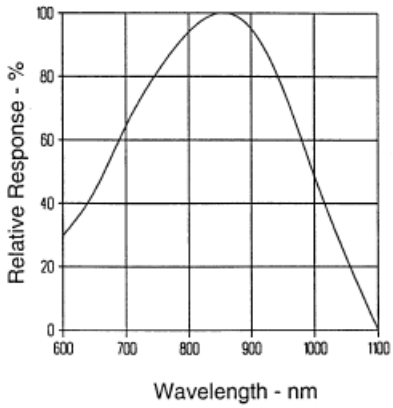
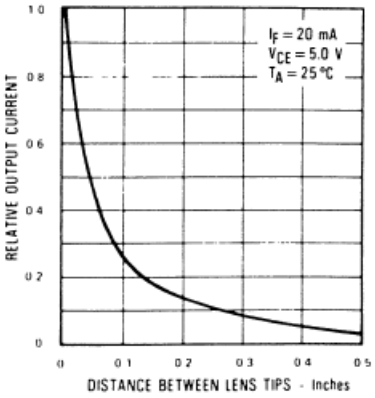
Performance

OP505W

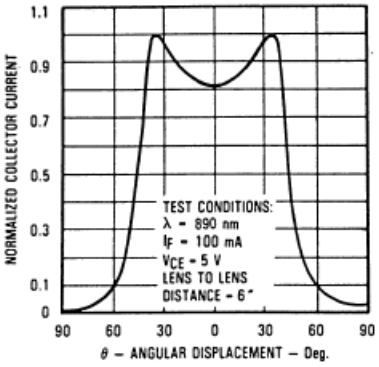
Typical Spectral Response



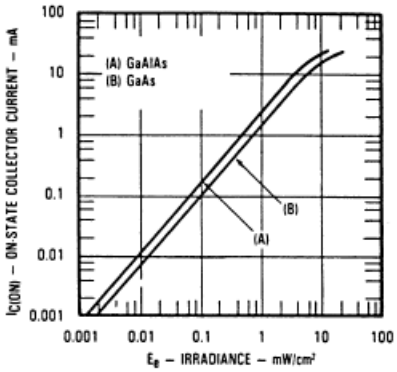
Coupling Characteristics of OP165W and OP505W



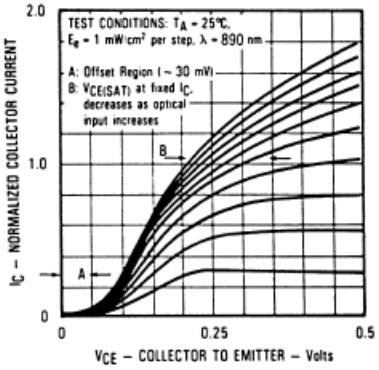
Normalized Collector Current vs. Angular Displacement



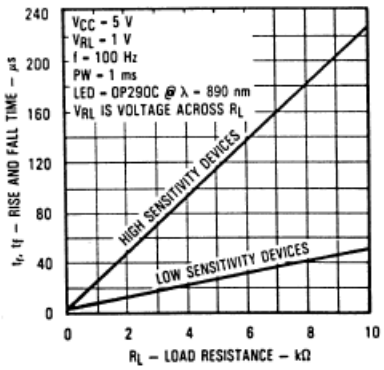
On-State Collector Current vs Irradiance



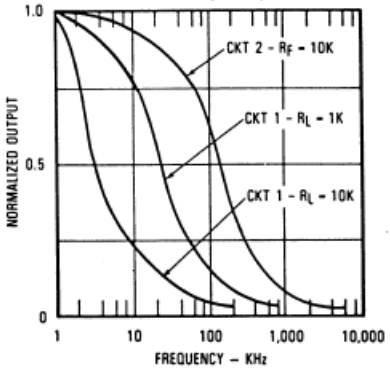
Normalized Collector Current vs. Collector to Emitter Voltage



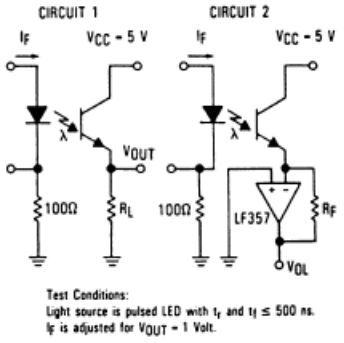
Rise and Fall Time vs. Load Resistance



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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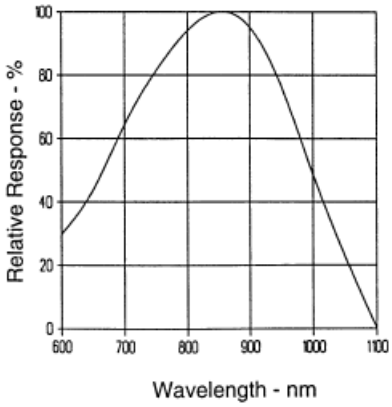
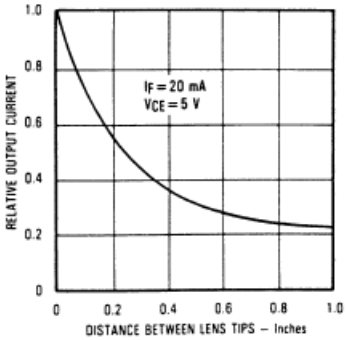
Performance

OP506A, OP506B, OP506C

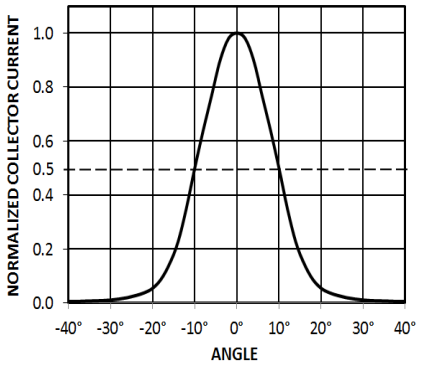
Typical Spectral Response



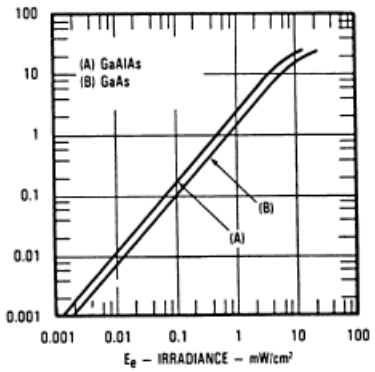
Coupling Characteristics of OP166 and OP506



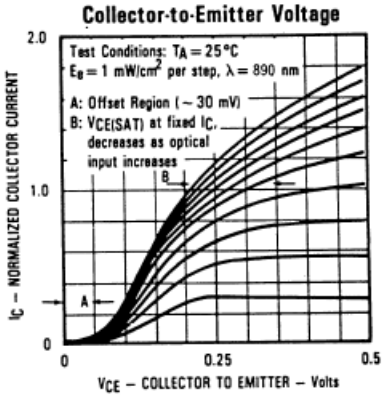
Normalized Collector Current vs. Angular Displacement



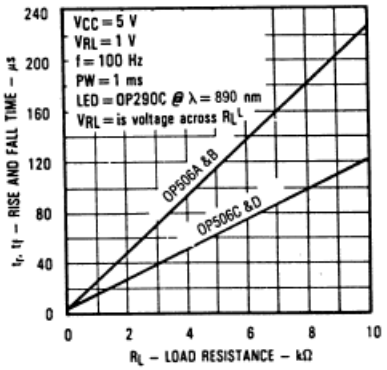
On-State Collector Current vs Irradiance



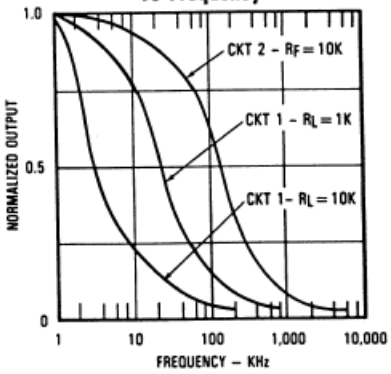
Normalized Collector Current vs Collector-to-Emitter Voltage



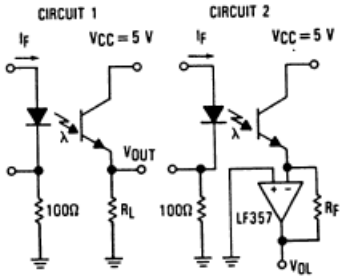
Rise and Fall Time vs Load Resistance



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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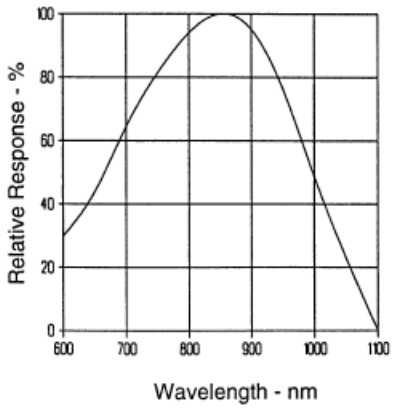
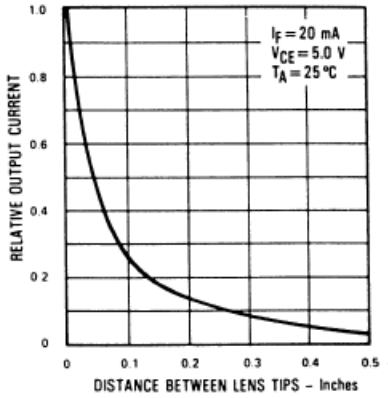
Performance

OP506W

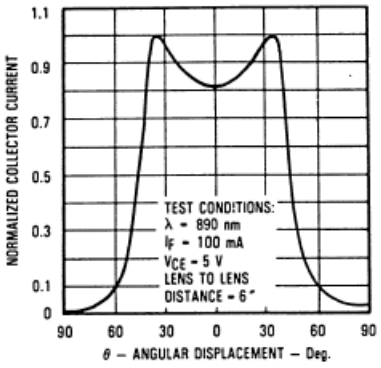
Typical Spectral Response



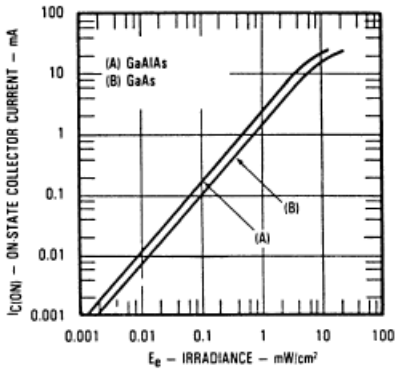
Coupling Characteristics



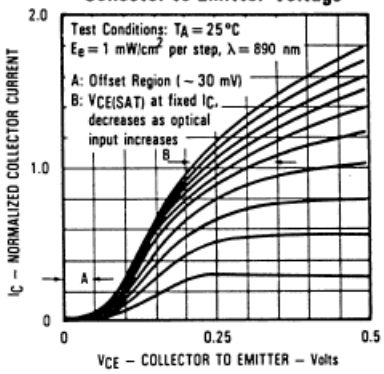
Normalized Collector Current vs. Angular Displacement



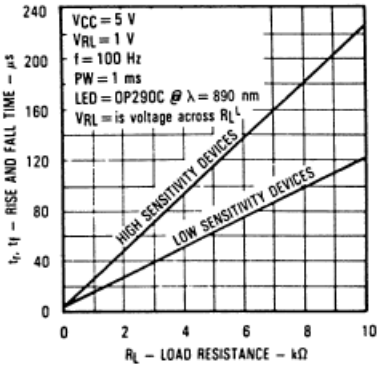
On-State Collector Current vs Irradiance



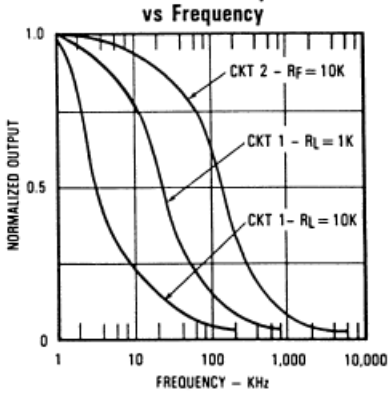
Normalized Collector Current vs Collector-to-Emitter Voltage



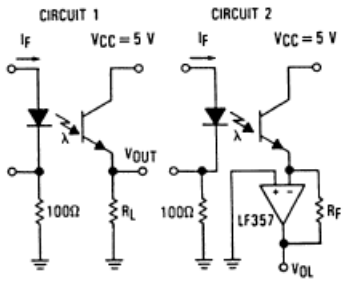
Rise and Fall Time vs Load Resistance



Normalized Output vs Frequency



Switching Time Test Circuit



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

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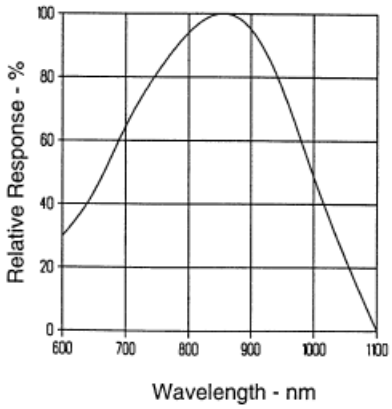
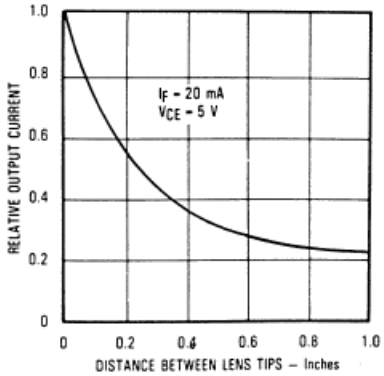
Performance

OP535A, OP535B, OP535D

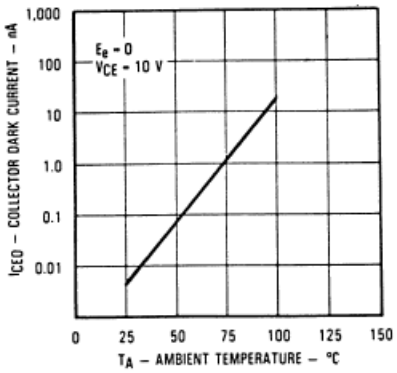
Typical Spectral Response



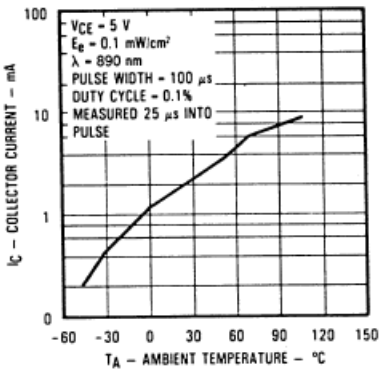
Coupling Characteristics of OP165 and OP535



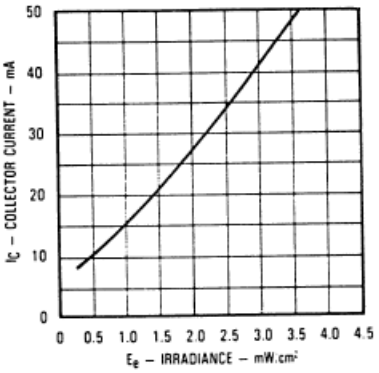
Collector Dark Current vs. Ambient Temperature



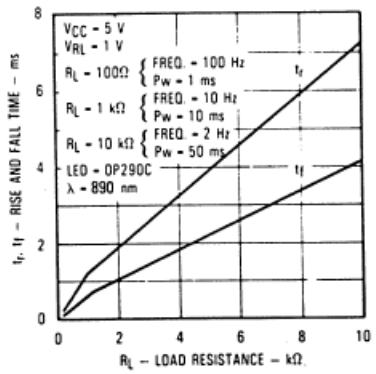
Collector Current vs. Ambient Temperature



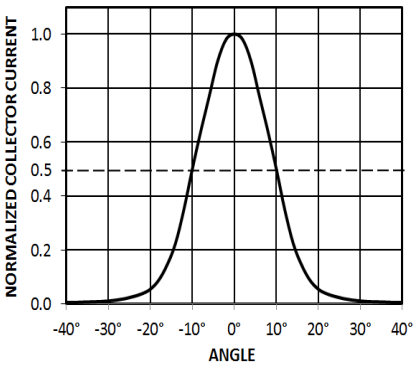
Collector Current vs. Irradiance



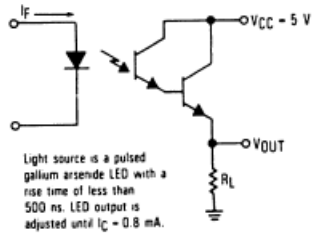
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



Switching Time Test Circuit



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1645 Wallace Drive, Carrollton, TX 75006|Ph: +1 972 323 2200
www.optekinc.com | www.ttelectronics.com

Performance

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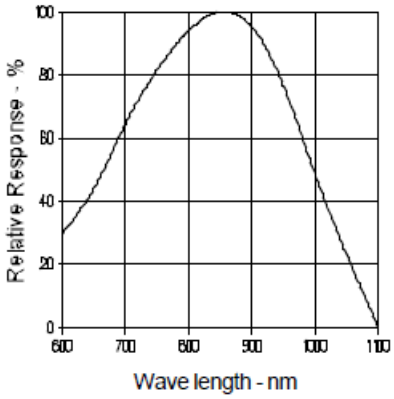
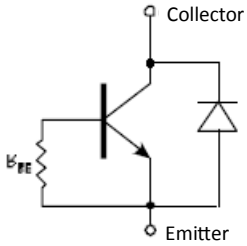
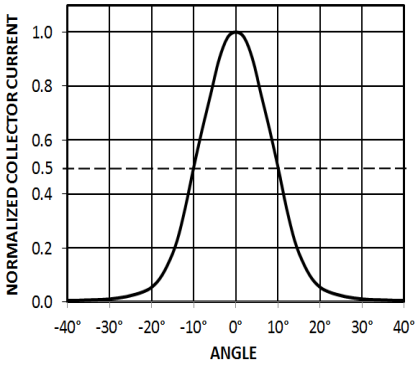
Typical Spectral Response



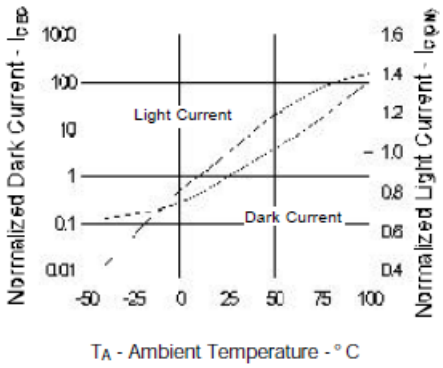
Schematic



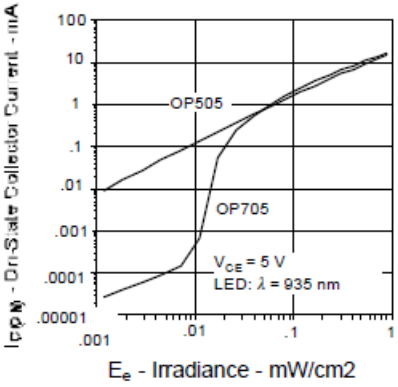
Normalized Collector Current vs. Angular Displacement



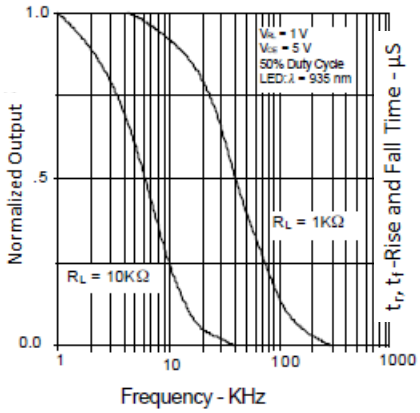
Normalized Light and Dark Current vs. Ambient Temperature



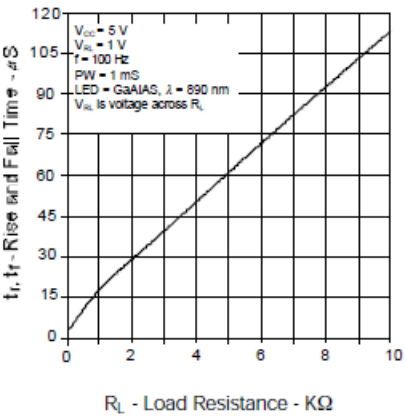
On-State Collector Current vs. Irradiance



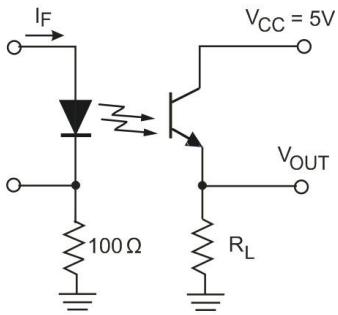
Normalized Output vs. Frequency



Typical Rise and Fall Time vs. Load Resistance



Switching Time Test Circuit



Test Conditions:
Light Source is pulsed LED with tr and tf ≤ 500nS.
I_F is adjusted for V_{OUT} = 1Volt.

OPTEK Technology, Inc.
1645 Wallace Drive, Carrollton, TX 75006 | Ph: +1 972 323 2200
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