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TT Electronics/Optek Technology
OP506A

For any questions, you can email us directly:
sales@integrated-circuit.com

NPN Silicon Phototransistor

OP505, OP506, OP535 & OP705 Series

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 **OP705** devices have a narrow receiving angle (typically 25°) that provides excellent on-axis coupling while the **OP506** device has a wider receiving angle (typically 60°) 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 (typically 90°) 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	25°	0.050" [1.27 mm]	0.50" [12.7 mm] (all devices in series)
OP505B				
OP505C				
OP505D				
OP505W		90°		
OP506A		60°	0.100" [2.54 mm]	
OP506B				
OP506C				
OP506D				
OP506W		90°		
OP535A	Darlington	25°	0.050" [1.27 mm]	
OP535B				
OP535C				
OP705A	R_{BE} Transistor			
OP705B				
OP705C				
OP705D				

RoHS

General Note
TT Electronics reserves the right to make changes in product specification without notice or liability. All information is subject to TT Electronics' own data and is considered accurate at time of going to print.

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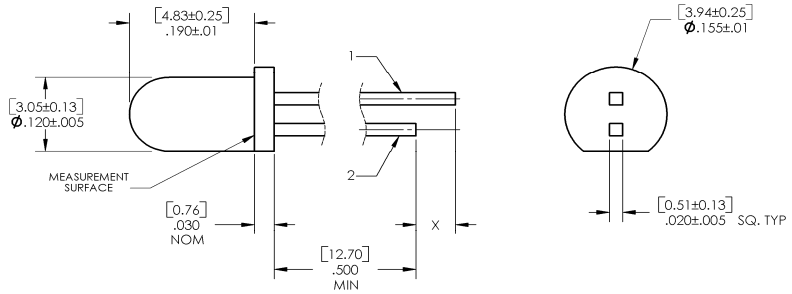
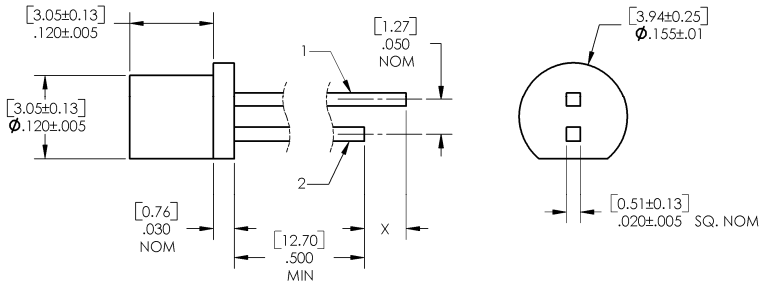
OP505, OP506, OP535 & OP705 Series

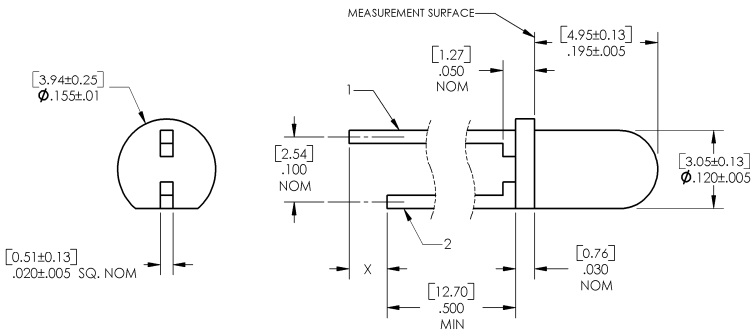
OP505, OP535 & OP705 (A, B, C, D)



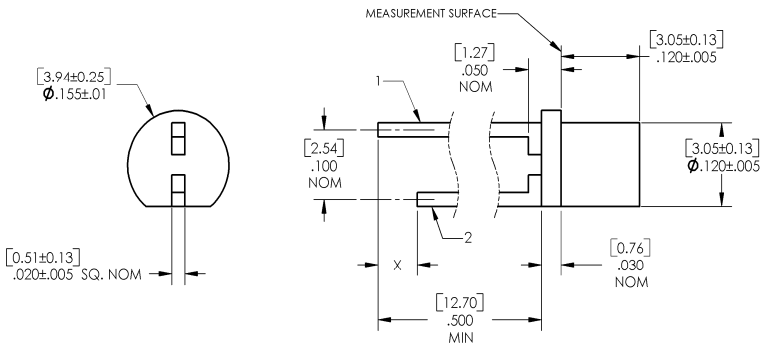
OP505W



OP506 (A, B, C, D)



OP506W

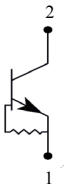


DIMENSIONS ARE IN: [MILLIMETERS] INCHES

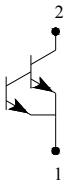
Pin #	Transistor
1	Emitter
2	Collector

OP505, OP506
OP505W, OP506W

OP705



OP535



CONTAINS POLYSULFONE

To avoid stress cracking, we suggest using ND Industries' **Vibra-Tite** for thread-locking. **Vibra-Tite** evaporates fast without causing structural failure in OPTEK'S molded plastics.

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NPN Silicon Phototransistor

OP505, OP506, OP535 & OP705 Series

Electrical Specifications

Absolute Maximum Ratings (T_A = 25° C unless otherwise noted)	
Storage & Operating Temperature Range	-40°C to +100° C
Collector-Emitter Voltage	30 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, OP705 Series

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/cm²(3)
	OP705A	3.95	-	12.00		
	OP705B	2.65	-	7.25		
	OP505B, OP506B	2.15	-	5.95		
	OP705C	1.50	-	4.85		
	OP705D	1.50	-	12.00		
	OP505C, OP506C	1.10	-	3.00		
	OP505D, OP506D	0.55	-	-		
	OP505W, OP506W	0.10	-	-	mA	V_{CE} = 5 V, E_e = 0.13 mW/cm²(3)
I_{CEO}	Collector-Dark Current	-	-	100	nA	V_{CE} = 10 V, E_E = 0(4)
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage					
	OP505, OP505W, OP506, OP506W	30	-	-	V	I_C = 100 µA
	OP705	24	-	-		
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5	-	-	V	I_E = 100 µA
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	-	-	0.40	V	I_C = 250 µA, E_E = 0.5 mW/cm²(2)
$\Delta I_C/\Delta T$	Relative I_C Changes with Temperature	-	1.00	-	%/°C	V_{CE} = 5 V, E_E = 1.0 mW/cm²
E_{KP}	Knee Point Irradiance OP705	-	0.02	-	mW/cm²	V_{CE} = 5 V(5)
I_{CEO}	Collector-Emitter Dark Current	-	-	100	nA	V_{CE} = 10 V, E_E = 0
I_{ECO}	Emitter-Collector Reverse Current	-	-	100	µA	V_{CE} = 5 V, E_E = 0

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) For OP505, OP505W, OP506, OP506W and OP705, to calculate typical collector dark current in nA, use the formula $I_{CED} = 10^{(0.040T_A - 3.4)}$ where T_A is ambient temperature in ° C.

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OP505, OP506, OP535 & OP705 Series

Electrical Specifications

Electrical Characteristics (T_A = 25° C unless otherwise noted)						
SYMBOL	**PARAMETER**	**MIN**	**TYP**	**MAX**	**UNITS**	**TEST CONDITIONS**
Photodarlington (OP535)						
$I_{C(ON)}$	On-State Collector Current OP535C OP535B OP535A	 1.5 3.5 10.5	 - - -	 - 32.0 -	mA	V_{CE} = 5 V, E_E = 0.13 mW/cm^2 (1)
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
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	-	-	1.10	V	I_C = 250 µA, E_E = 5 mW/cm^2 (1)(2)

Notes:
(1) 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.

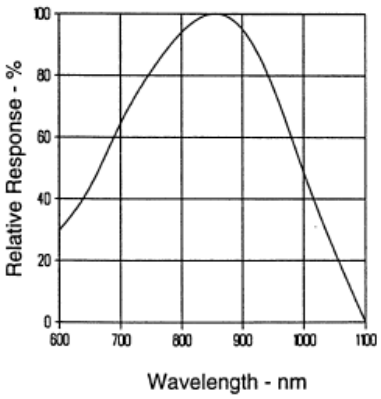
NPN Silicon Phototransistor

OP505, OP506, OP535 & OP705 Series

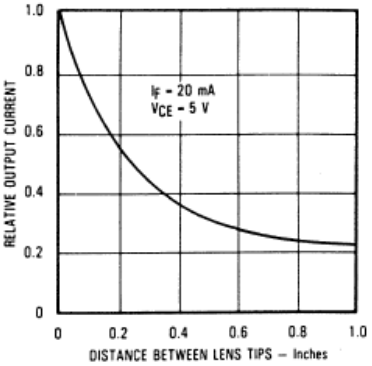
Performance

OP505A, OP505B, OP505C, OP505D

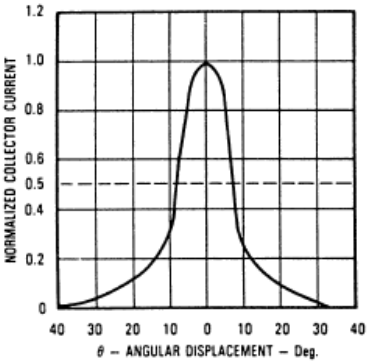
Typical Spectral Response



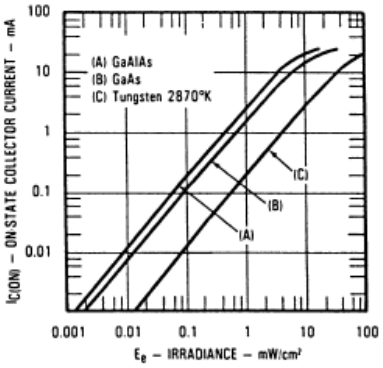
Coupling Characteristics OP165 and OP505



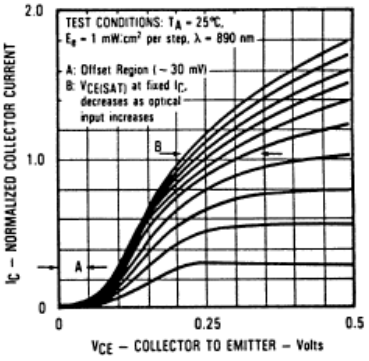
Normalized Collector Current vs. Angular Displacement



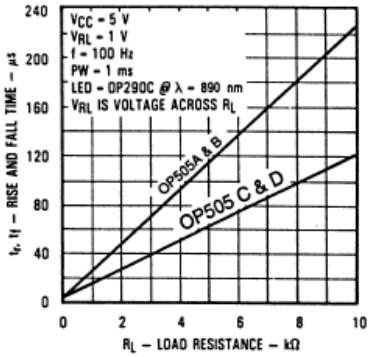
On-State Collector Current vs. Irradiance



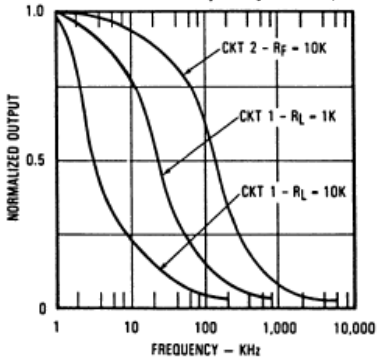
Normalized Collector Current vs. Collector to Emitter Voltage



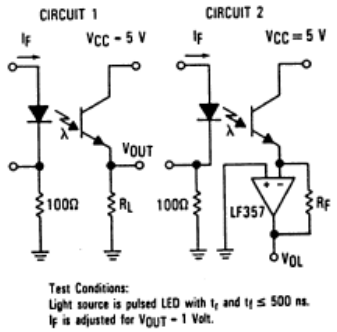
Rise and Fall Time vs. Load Resistance



Normalized Output vs. Frequency



Switching Time Test Circuit



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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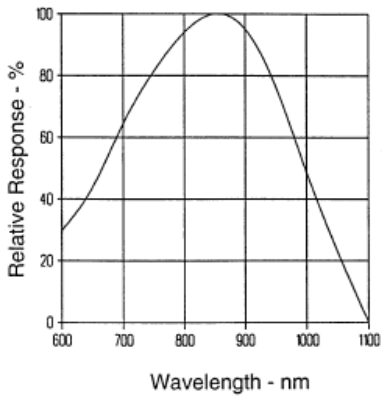
OP505, OP506, OP535 & OP705 Series

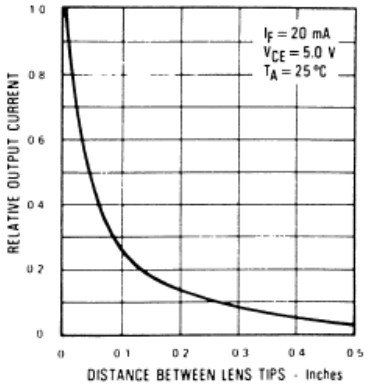
Performance

OP505W

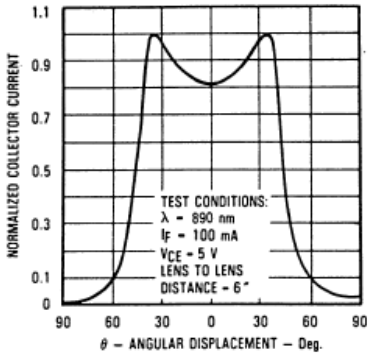
Typical Spectral Response



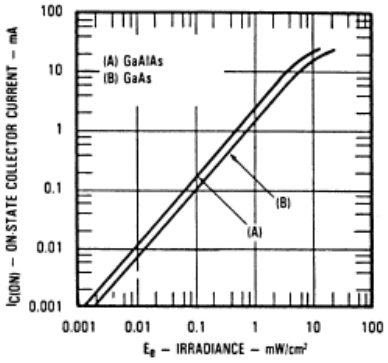
Coupling Characteristics of OP165W and OP505W



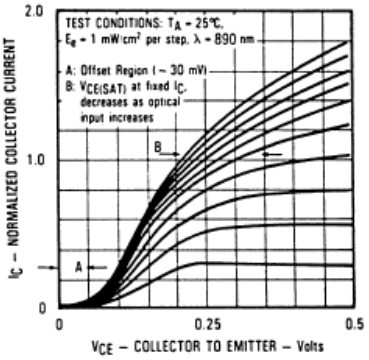
Normalized Collector Current vs. Angular Displacement



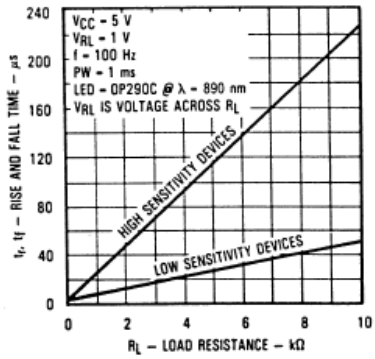
On-State Collector Current vs Irradiance



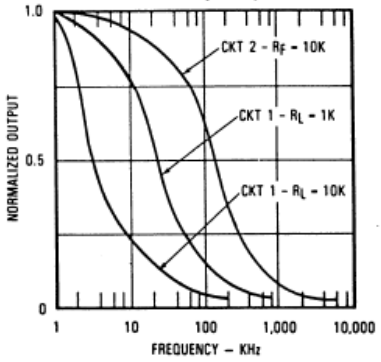
Normalized Collector Current vs. Collector to Emitter Voltage



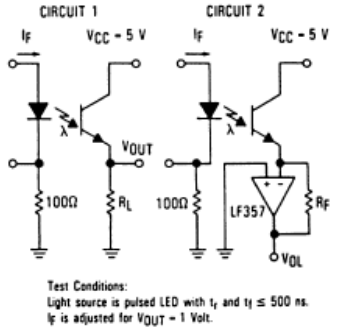
Rise and Fall Time vs. Load Resistance



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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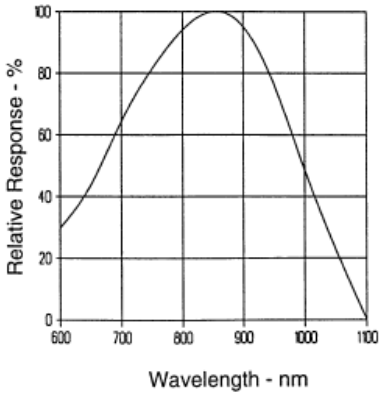
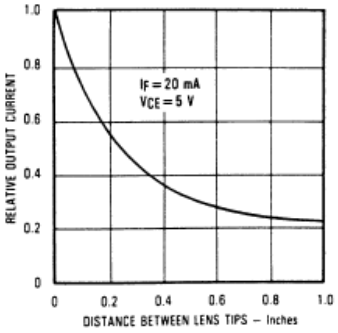
Performance

OP506A, OP506B, OP506C, OP506D

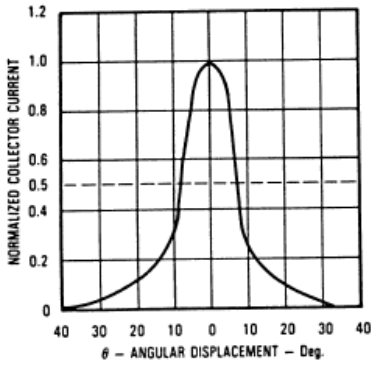
Typical Spectral Response



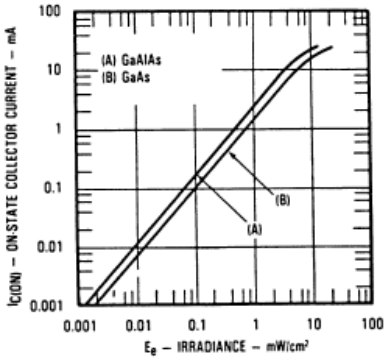
Coupling Characteristics of OP166 and OP506



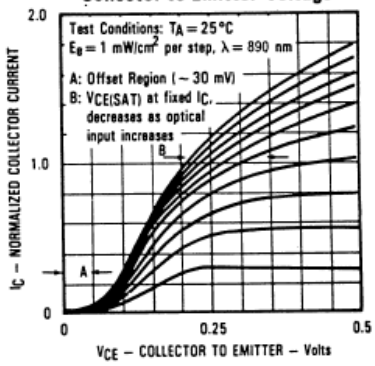
Normalized Collector Current vs Angular Displacement



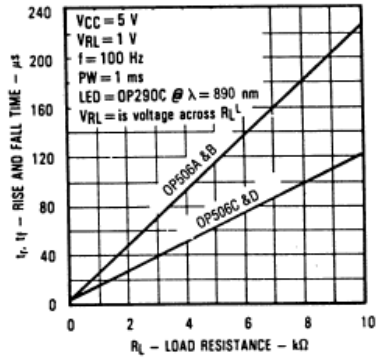
On-State Collector Current vs Irradiance



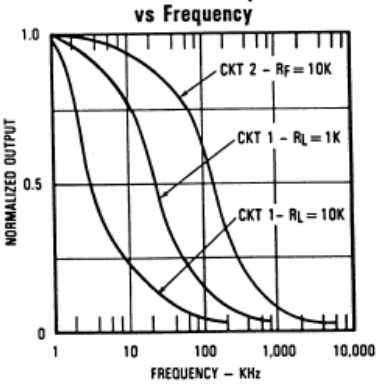
Normalized Collector Current vs Collector-to-Emitter Voltage



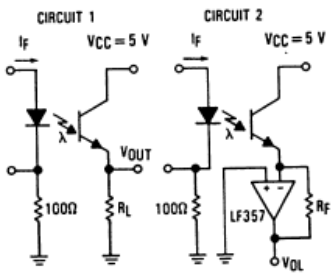
Rise and Fall Time vs Load Resistance



Normalized Output vs Frequency



Switching Time Test Circuit



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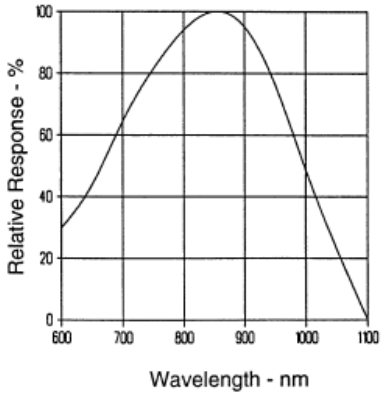
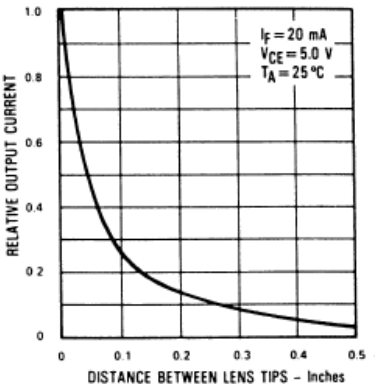
Performance

OP506W

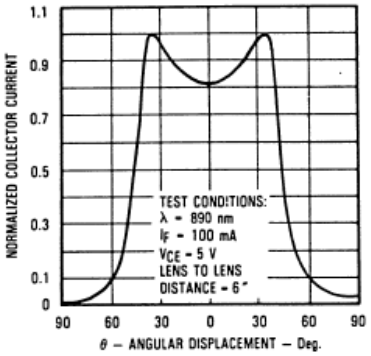
Typical Spectral Response



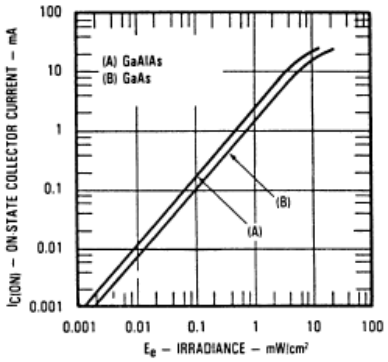
Coupling Characteristics



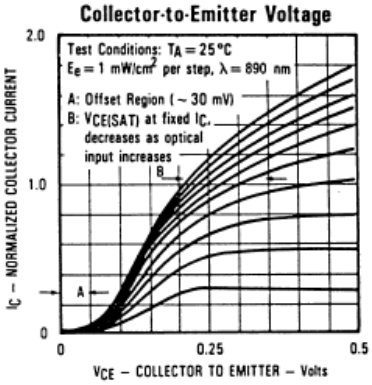
Normalized Collector Current vs. Angular Displacement



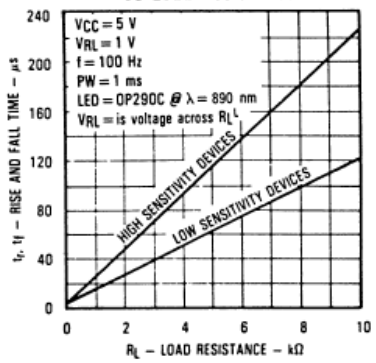
On-State Collector Current vs Irradiance



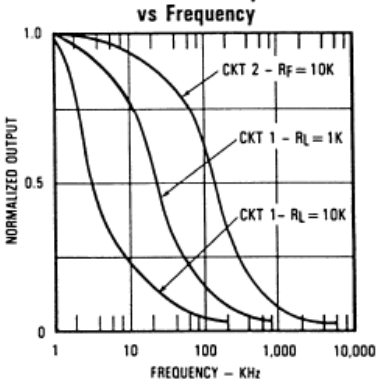
Normalized Collector Current vs Collector-to-Emitter Voltage



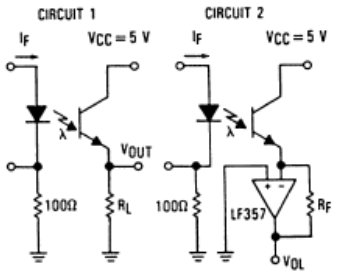
Rise and Fall Time vs Load Resistance



Normalized Output vs Frequency



Switching Time Test Circuit



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

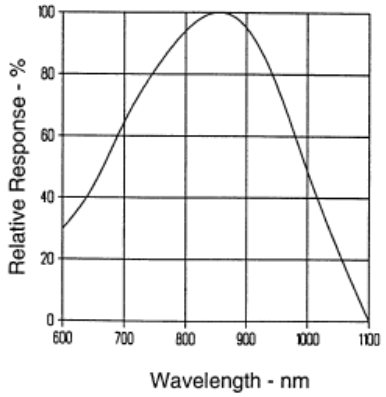
NPN Silicon Phototransistor

OP505, OP506, OP535 & OP705 Series

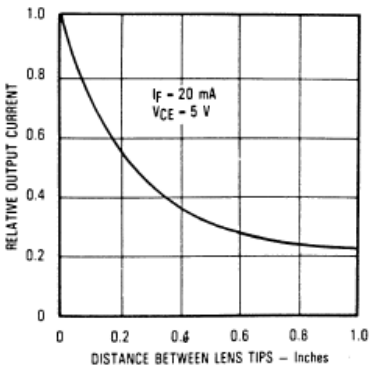
Performance

OP535A, OP535B, OP535C, OP535D

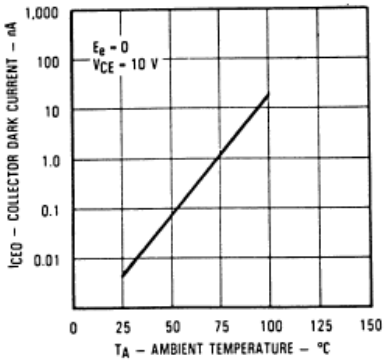
Typical Spectral Response



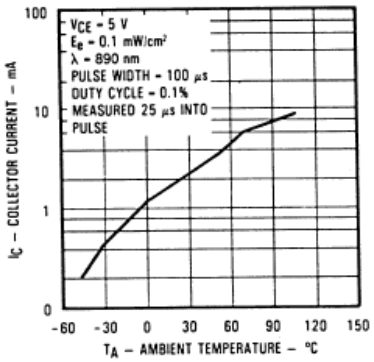
Coupling Characteristics of OP165 and OP535



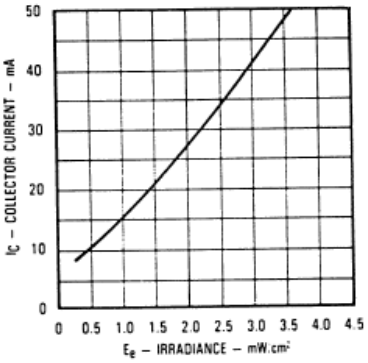
Collector Dark Current vs. Ambient Temperature



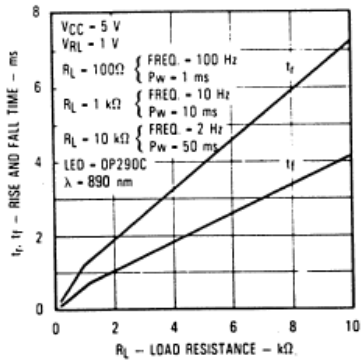
Collector Current vs. Ambient Temperature



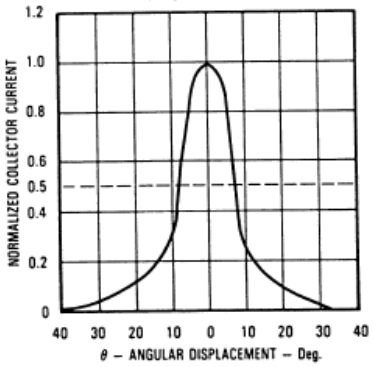
Collector Current vs. Irradiance



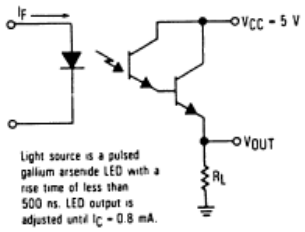
Rise and Fall Time vs. Load Resistance



Normalized Collector Current vs. Angular Displacement



Switching Time Test Circuit



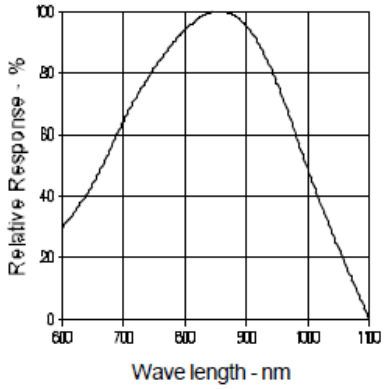
NPN Silicon Phototransistor

OP505, OP506, OP535 & OP705 Series

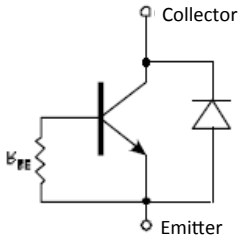
Performance

OP705A, OP705B, OP705C, OP705D

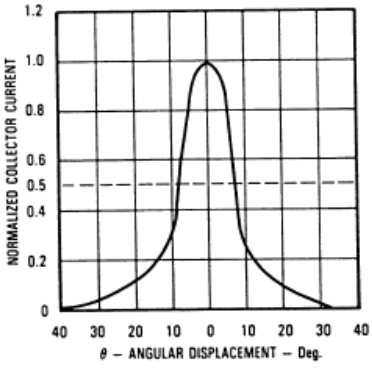
Typical Spectral Response



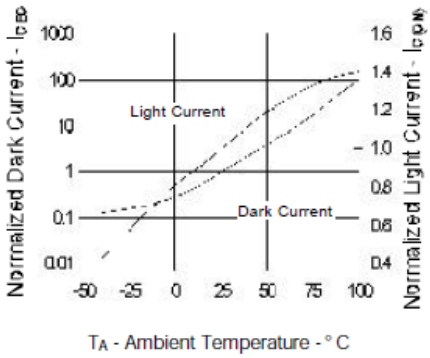
Schematic



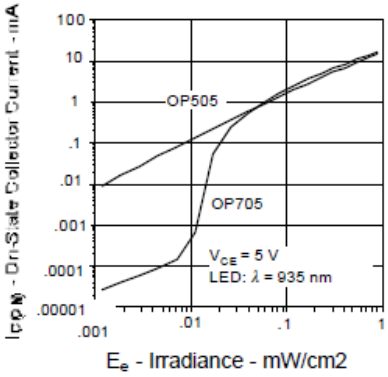
Normalized Collector Current vs. Angular Displacement



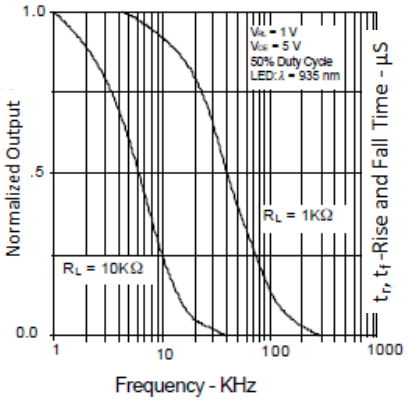
Normalized Light and Dark Current vs. Ambient Temperature



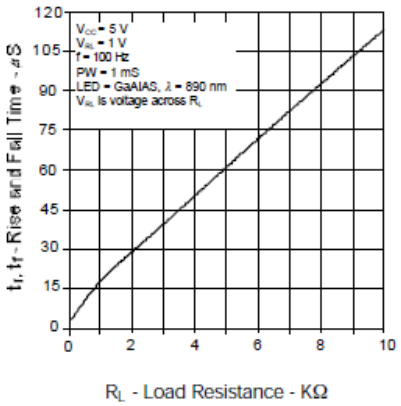
On-State Collector Current vs. Irradiance



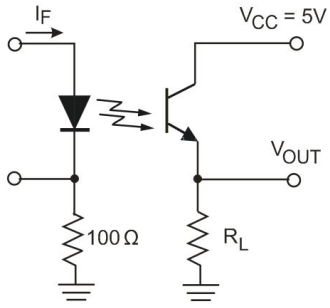
Normalized Output vs. Frequency



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
www.optekinc.com | www.ttelectronics.com