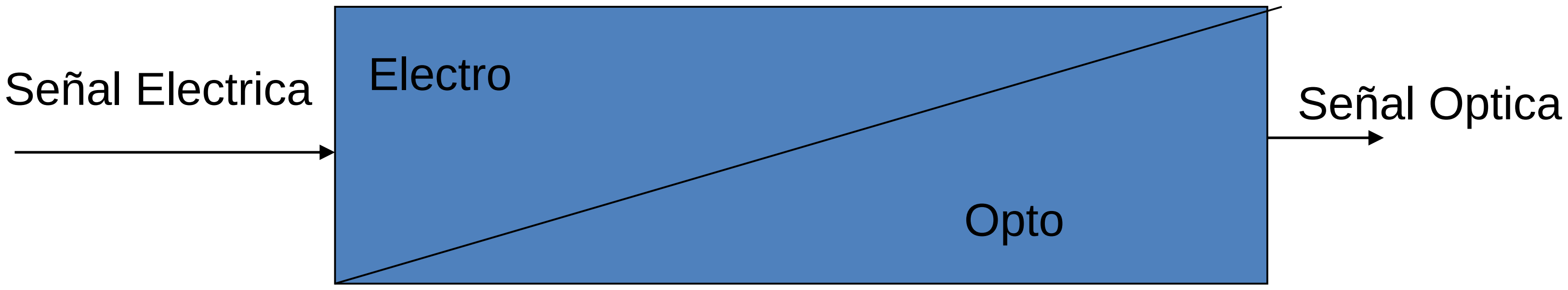
DIODOS EMISORES DE LUZ (LED’S)

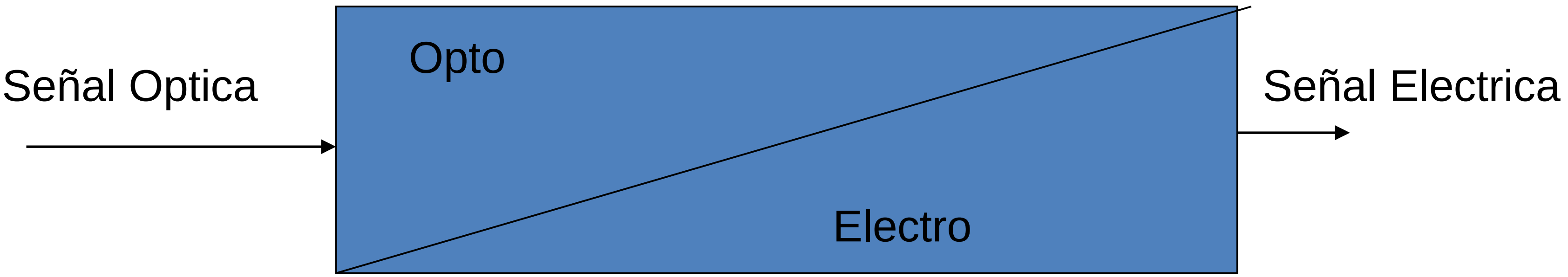
OPTOELECTRONICA

- Conversión electro optica

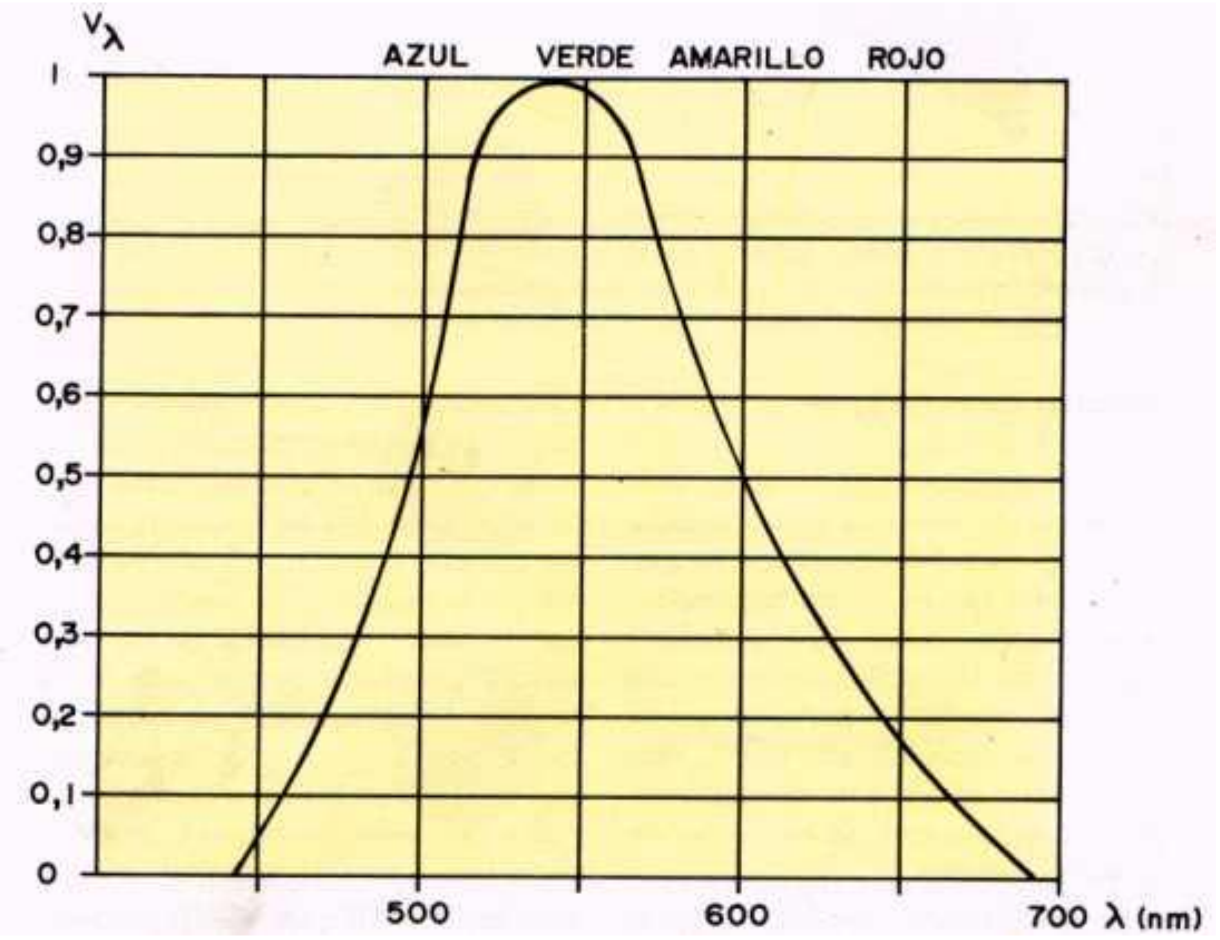


OPTOELECTRONICA

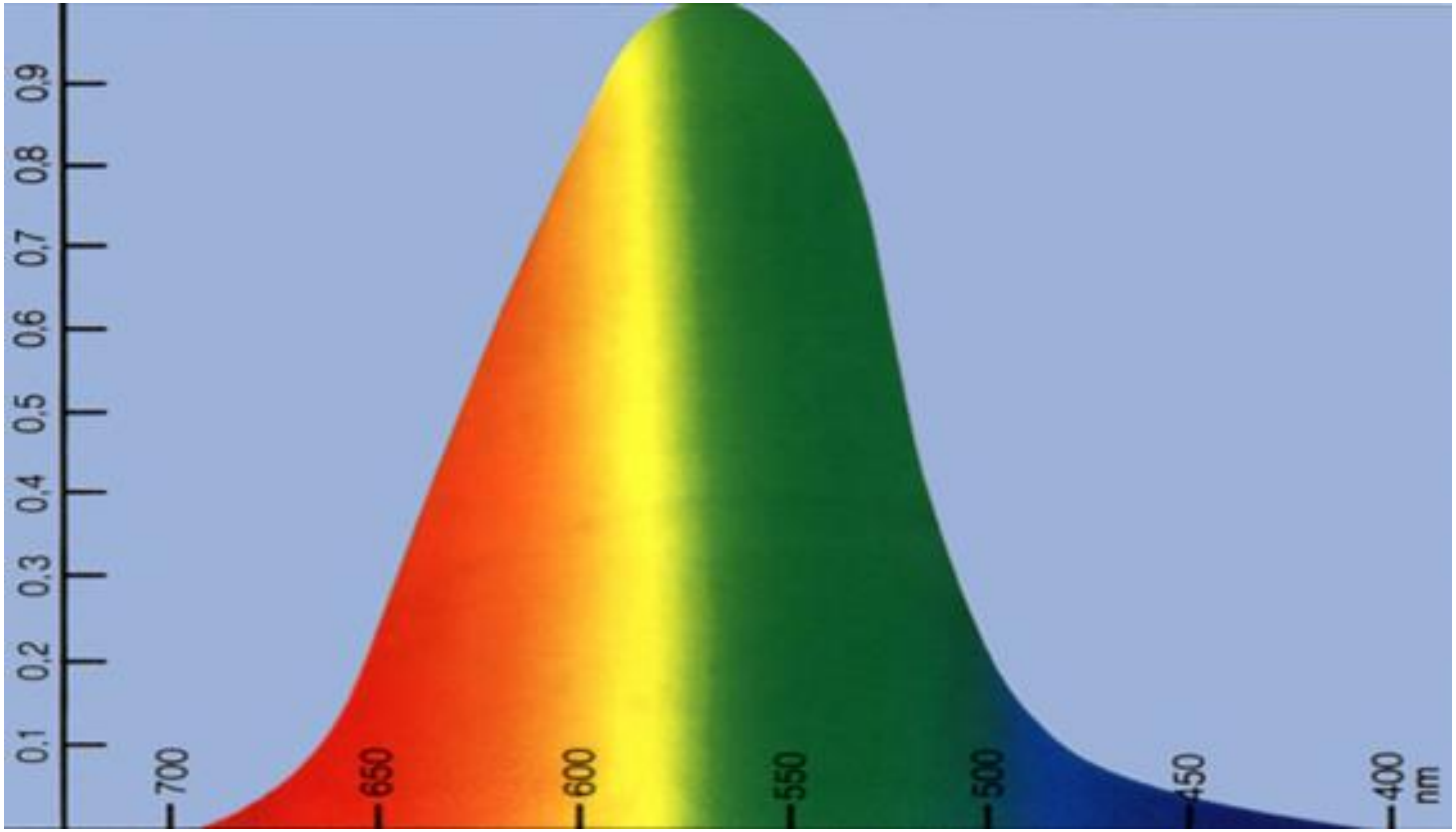
- Conversión optica electrica



Sensibilidad del ojo humano



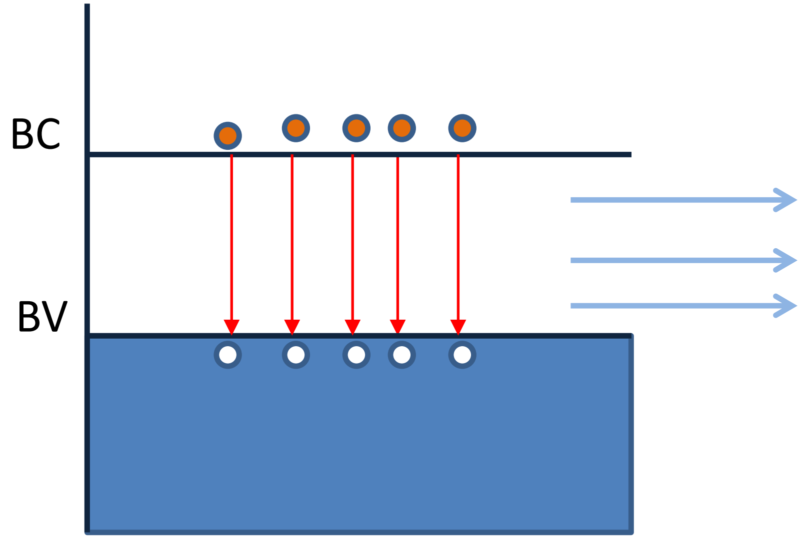
Sensibilidad del ojo humano



GENERACION DE FOTONES

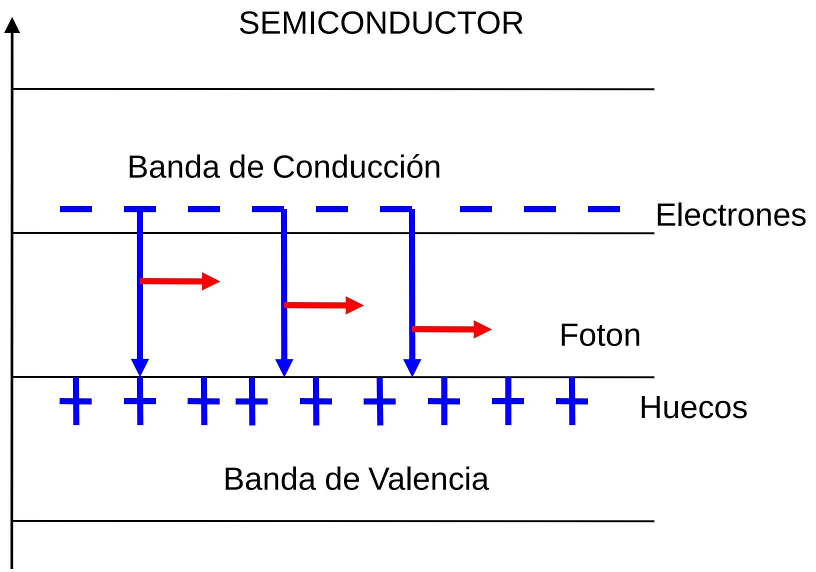
- Cuando un electrón salta de la banda de conducción a la banda de valencia

- Desaparecen dos portadores
  - Un electrón en la banda de conducción
  - Un hueco en la banda de valencia
- Se emite un cuanto de energía E = h f
- Donde E es la energía de la banda prohibida



GENERACION DE FOTONES

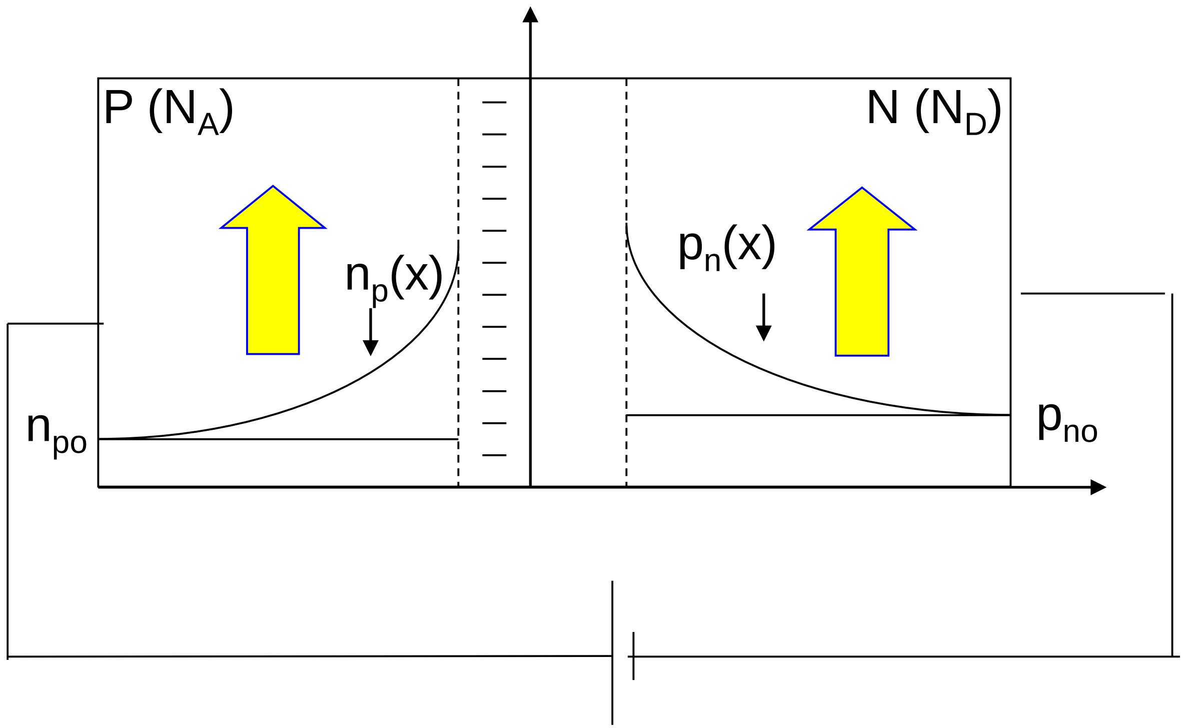
- **Fenómeno de recombinación de electrones de la banda de Conducción con huecos de la banda de Valencia**
- **Si el semiconductor es del tipo Directo se genera un Fotón desapareciendo el electrón y el hueco**
    - **El ARSENIURO DE GALIO GaAs es del tipo Directo**
    - **El Silicio Si es del tipo Indirecto, la recombinación de electrones de la banda de conducción con huecos de la banda de Valencia genera Fonones (Calor)**



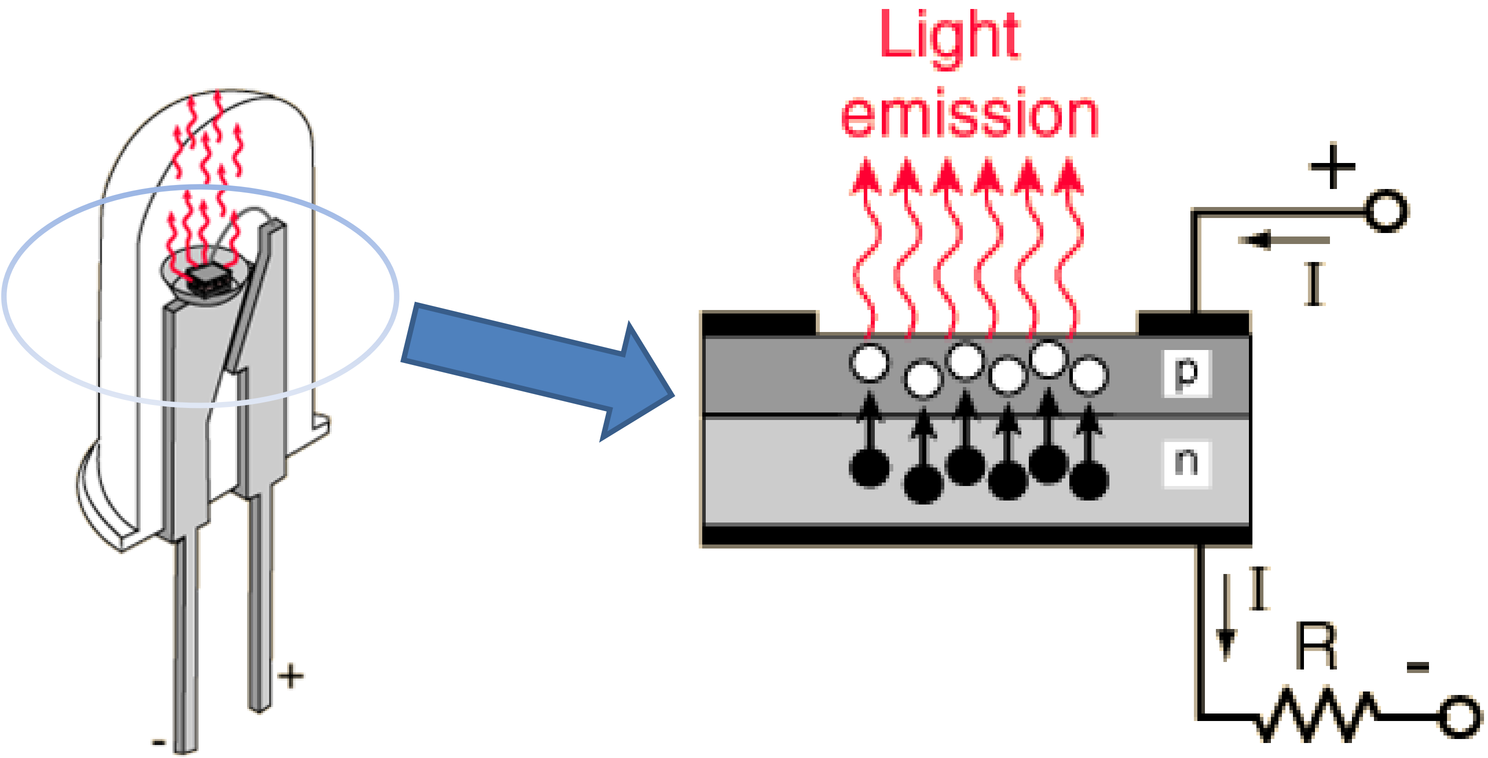
LED Light Emiting Diode

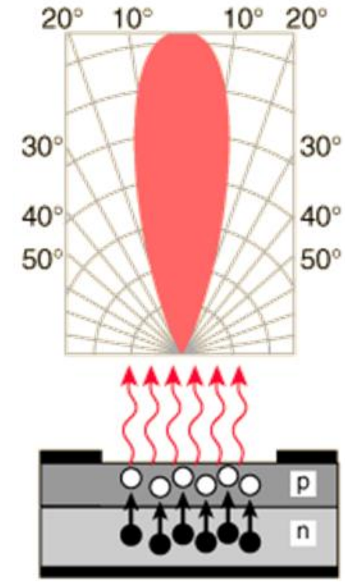
Conversión
Electro - Optica

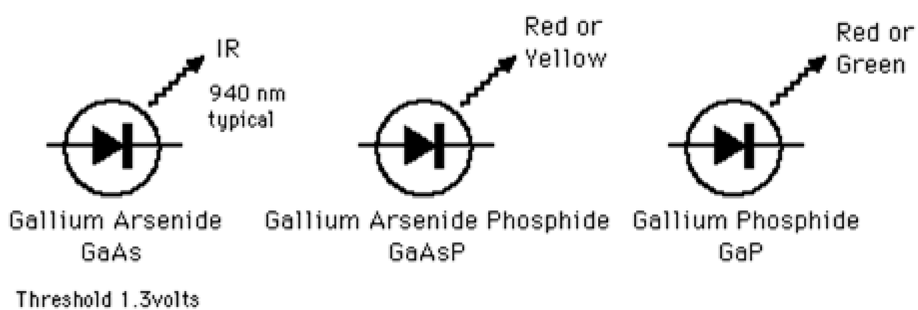
- **Juntura PN polarizada directa para favorecer el fenómeno de recombinación en zonas neutras**



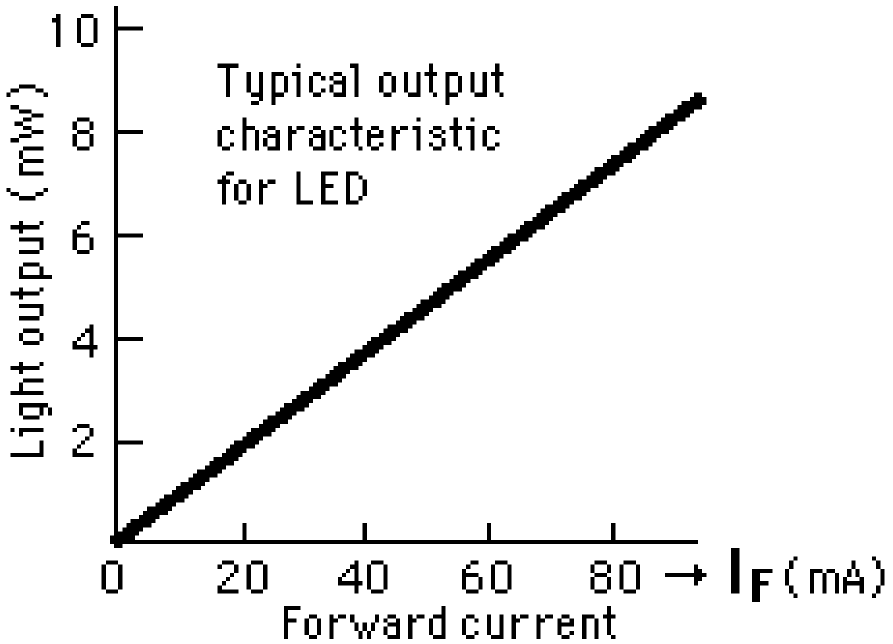
ESTRUCTURA DEL DIODO LED

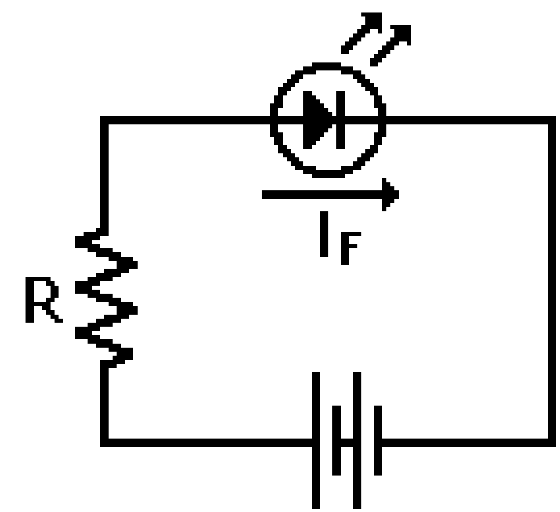






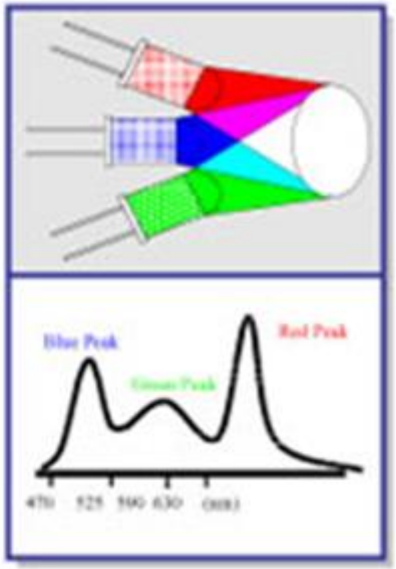
EMISION DE LUZ vs IF





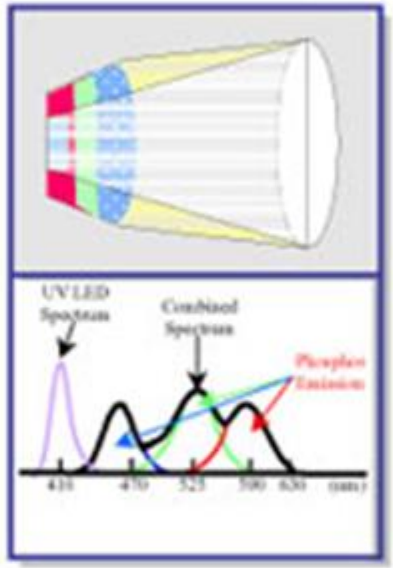
Generating White Light with LEDs

Red + Green + Blue LEDs



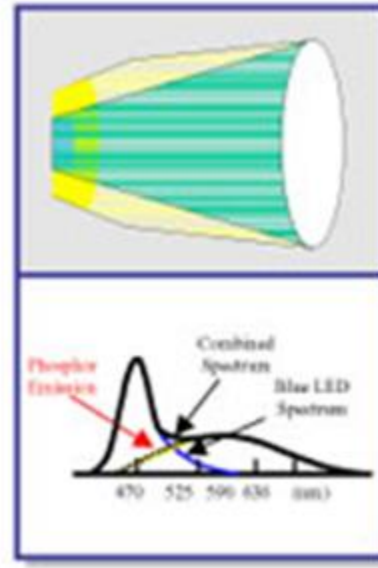
- Dynamic color tuning
- Excellent color rendering
- Large color gamut

UV LED + RGB Phosphor



- White point tunable by phosphors
- Excellent color rendering
- Simple to create white

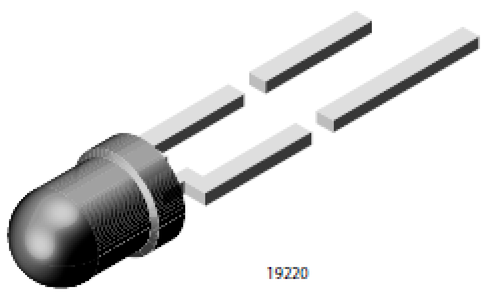
Blue LED + Yellow Phosphor



- Simple to create white
- Good color rendering

There are various ways to create white light from LEDs, each with specific advantages.

High Efficiency LED, Ø 3 mm Tinted Undiffused Package



FEATURES

- Choice of five bright colors
- Standard T-1 package
- Small mechanical tolerances
- Suitable for DC and high peak current
- Wide viewing angle
- Luminous intensity categorized
- Yellow and green color categorized
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/E

Pb Pb-free

e8

RoHS COMPLIANT

GREEN (5-2008)**

DESCRIPTION

The TLH.42.. series was developed for standard applications like general indicating and lighting purposes.

It is housed in a 3 mm tinted clear plastic package. The wide viewing angle of these devices provides a high on-off contrast.

Several selection types with different luminous intensities are offered. All LEDs are categorized in luminous intensity groups. The green and yellow LEDs are categorized additionally in wavelength groups.

That allows users to assemble LEDs with uniform appearance.

APPLICATIONS

- Status lights
- Off/On indicator
- Background illumination
- Readout lights
- Maintenance lights
- Legend light

PRODUCT GROUP AND PACKAGE DATA

- Product group: LED
- Package: 3 mm
- Product series: standard
- Angle of half intensity: ± 22°

PARTS TABLE		
PART	COLOR, LUMINOUS INTENSITY	TECHNOLOGY
TLHR4200	Red, $I_V > 4$ mcd	GaAsP on GaP
TLHR4201	Red, $I_V > 6.3$ mcd	GaAsP on GaP
TLHR4201-AS12Z	Red, $I_V > 6.3$ mcd	GaAsP on GaP
TLHR4205	Red, $I_V > 10$ mcd	GaAsP on GaP
TLHR4205-AS12	Red, $I_V > 10$ mcd	GaAsP on GaP
TLHR4205-AS12Z	Red, $I_V > 10$ mcd	GaAsP on GaP
TLHO4200	Soft orange, $I_V > 4$ mcd	GaAsP on GaP
TLHO4200-AS12Z	Soft orange, $I_V > 4$ mcd	GaAsP on GaP
TLHO4201	Soft orange, $I_V > 10$ mcd	GaAsP on GaP
TLHY4200	Yellow, $I_V > 4$ mcd	GaAsP on GaP
TLHY4200-AS12Z	Yellow, $I_V > 4$ mcd	GaAsP on GaP
TLHY4201	Yellow, $I_V > 6.3$ mcd	GaAsP on GaP
TLHY4201-AS21	Yellow, $I_V > 6.3$ mcd	GaAsP on GaP
TLHY4201-MS12Z	Yellow, $I_V > 6.3$ mcd	GaAsP on GaP
TLHY4205	Yellow, $I_V > 10$ mcd	GaAsP on GaP
TLHY4205-BT12Z	Yellow, $I_V > 10$ mcd	GaAsP on GaP
TLHY4205-LS21	Yellow, $I_V > 10$ mcd	GaAsP on GaP
TLHY4205-LS21Z	Yellow, $I_V > 10$ mcd	GaAsP on GaP
TLHY4205-MS12	Yellow, $I_V > 10$ mcd	GaAsP on GaP
TLHG4200	Green, $I_V > 6.3$ mcd	GaP on GaP
TLHG4200-AS12	Green, $I_V > 6.3$ mcd	GaP on GaP
TLHG4200-AS12Z	Green, $I_V > 6.3$ mcd	GaP on GaP
TLHG4200-AS21	Green, $I_V > 6.3$ mcd	GaP on GaP
TLHG4200-BT12Z	Green, $I_V > 6.3$ mcd	GaP on GaP
TLHG4201	Green, $I_V > 10$ mcd	GaP on GaP
TLHG4201-BT12Z	Green, $I_V > 10$ mcd	GaP on GaP
TLHG4205	Green, $I_V > 16$ mcd	GaP on GaP
TLHG4205-AS12Z	Green, $I_V > 16$ mcd	GaP on GaP
TLHG4205-AS21	Green, $I_V > 16$ mcd	GaP on GaP
TLHG4205-BT12Z	Green, $I_V > 16$ mcd	GaP on GaP
TLHG4205-LS21	Green, $I_V > 16$ mcd	GaP on GaP
TLHG4205-LS21Z	Green, $I_V > 16$ mcd	GaP on GaP
TLHG4205-MS21Z	Green, $I_V > 16$ mcd	GaP on GaP

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C unless otherwise specified) **TLHG420., TLHO420., TLHR420., TLHY420.**				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Reverse voltage [1)]		V_R	6	V
DC forward current		I_F	30	mA
Surge forward current	$t_p \leq 10$ µs	I_{FSM}	1	A
Power dissipation		P_V	100	mW
Junction temperature		T_j	100	°C
Operating temperature range		T_{amb}	- 40 to + 100	°C
Storage temperature range		T_{stg}	- 55 to + 100	°C
Soldering temperature	t ≤ 5 s, 2 mm from body	T_{sd}	260	°C
Thermal resistance junction/ ambient		R_{thJA}	400	K/W

OPTICAL AND ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified) **TLHR420., RED**							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Luminous intensity	I_F = 10 mA	TLHR4200	I_V	4	8		mcd
		TLHR4201	I_V	6.3	10		mcd
		TLHR4205	I_V	10	15		mcd
Dominant wavelength	I_F = 10 mA		λ_d	612		625	nm
Peak wavelength	I_F = 10 mA		λ_p		635		nm
Angle of half intensity	I_F = 10 mA		φ		± 22		deg
Forward voltage	I_F = 20 mA		V_F		2	3	V
Reverse current	V_R = 6 V		I_R			10	µA
Junction capacitance	V_R = 0, f = 1 MHz		C_j		50		pF

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

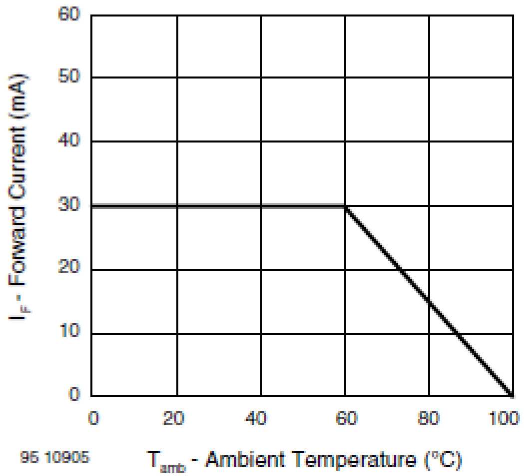


Figure 1. Forward Current vs. Ambient Temperature

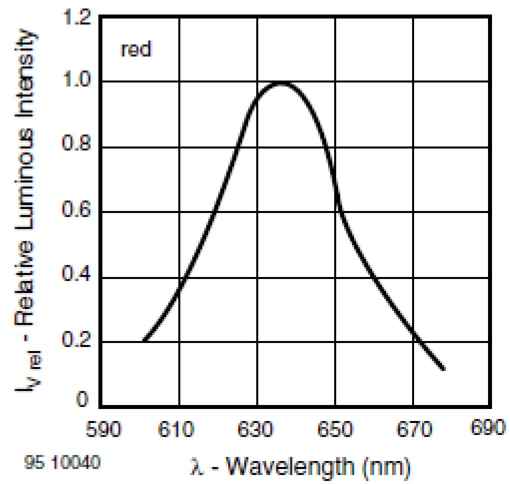


Figure 4. Relative Intensity vs. Wavelength

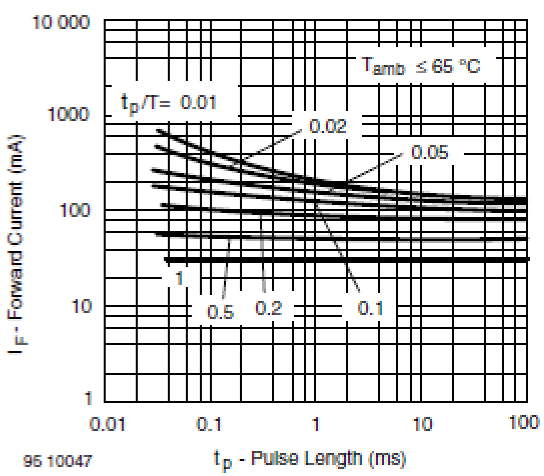


Figure 2. Forward Current vs. Pulse Length

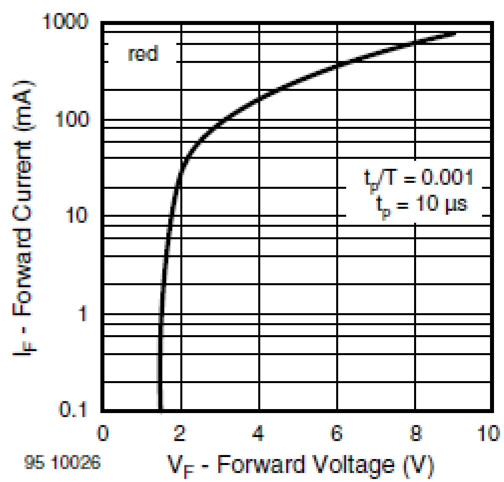


Figure 5. Forward Current vs. Forward Voltage

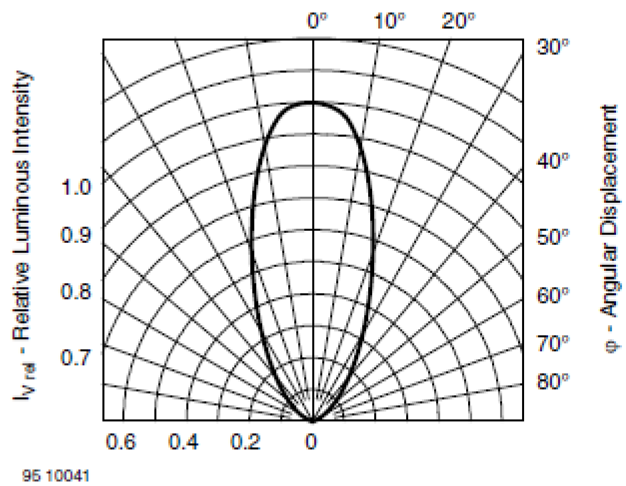


Figure 3. Rel. Luminous Intensity vs. Angular Displacement

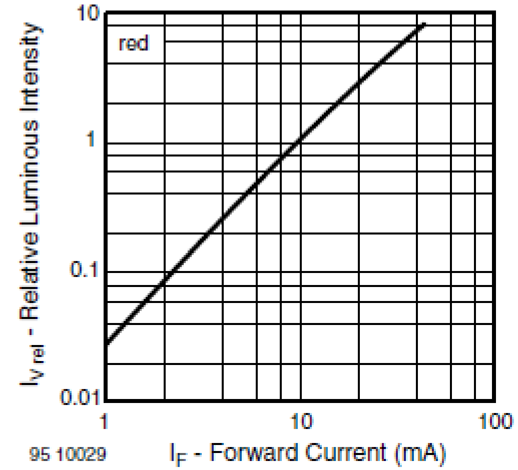
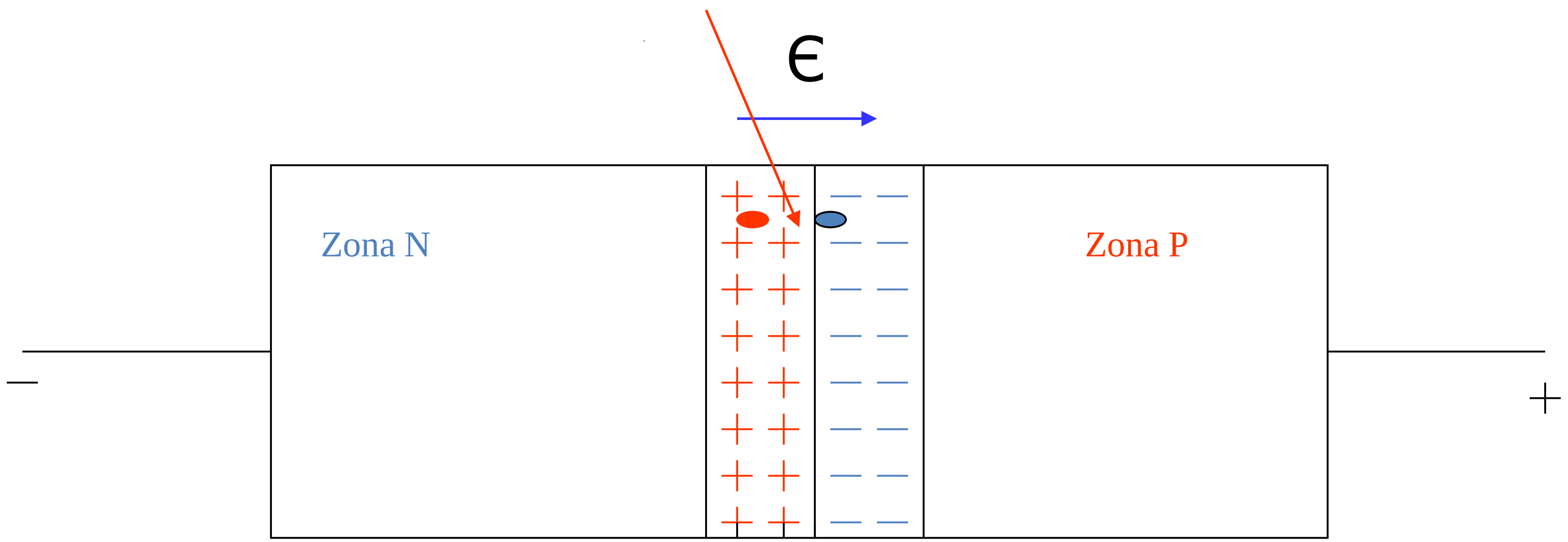


Figure 6. Relative Luminous Intensity vs. Forward Current

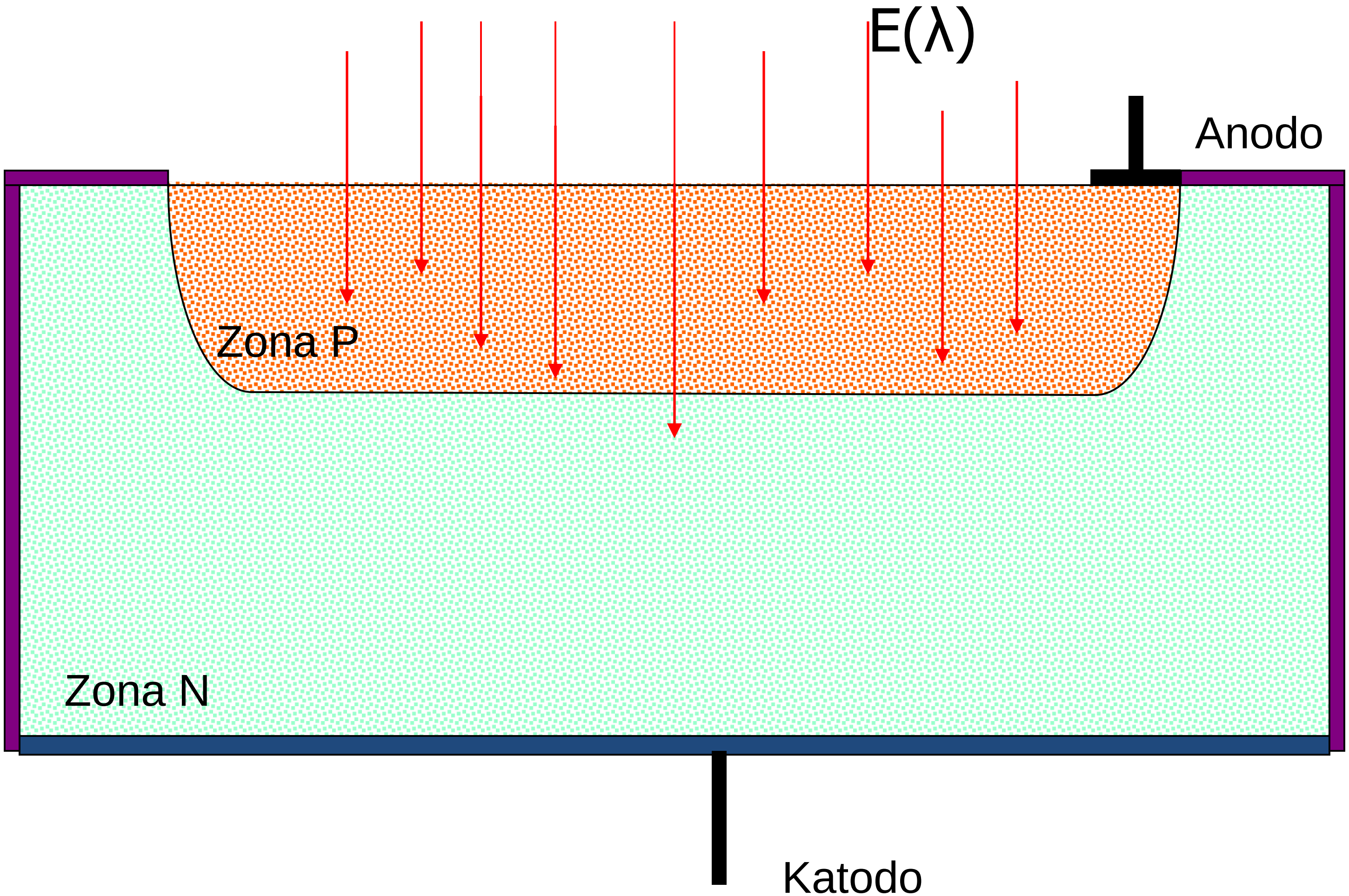
EFECTO FOTOELECTRICO DE JUNTURA

Conversión
Óptica -Electro

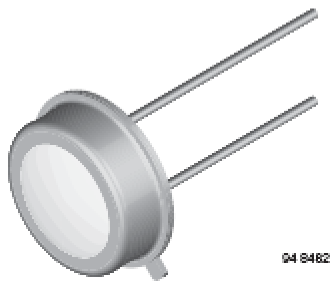
- **Juntura PN polarizada inversa para favorecer el fenómeno de generación en zonas neutras**



FOTODIODO



Silicon Photodiode, RoHS Compliant



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DESCRIPTION

BPW20RF is a planar Silicon PN photodiode in a hermetically sealed short TO-5 case, especially designed for high precision linear applications.

Due to its extremely high dark resistance, the short circuit photocurrent is linear over seven decades of illumination level.

On the other hand, there is a strictly logarithmic correlation between open circuit voltage and illumination over the same range.

Equipped with a clear, flat glass window, the spectral responsitivity reaches from blue to near infrared.

FEATURES

- Package type: leaded
- Package form: TO-5
- Dimensions (in mm): Ø 8.13
- Radiant sensitive area (in mm^2): 7.5
- High photo sensitivity
- High radiant sensitivity
- Suitable for visible and near infrared radiation
- Angle of half sensitivity: $\varphi = \pm 50°$
- Hermetically sealed package
- Cathode connected to package
- Flat glass window
- UV enhanced
- Low dark current
- High shunt resistance
- High linearity
- Compliant to RoHS Directive 2002/95/EC and in accordance with WEEE 2002/96/EC

APPLICATIONS

- Sensor for light measuring techniques in cameras, photometers, color analyzers, exposure meters (e.g. solariums) and other medical and industrial measuring and control applications.

PRODUCT SUMMARY			
COMPONENT	**I_{ra} (µA)**	**φ (deg)**	**$\lambda_{0.1}$ (nm)**
BPW20RF	60	± 50	400 to 1100

Note

- Test condition see table "Basic Characteristics"

ORDERING INFORMATION			
ORDERING CODE	**PACKAGING**	**REMARKS**	**PACKAGE FORM**
BPW20RF	Bulk	MOQ: 500 pcs, 500 pcs/bulk	TO-5

Note

- MOQ: minimum order quantity

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Reverse voltage		V_R	10	V
Power dissipation	$T_{amb} \leq 50$ °C	P_V	300	mW
Junction temperature		T_j	125	°C
Operating temperature range		T_{amb}	- 40 to + 125	°C
Storage temperature range		T_{stg}	- 40 to + 125	°C
Soldering temperature	$t \leq 5$ s	T_{sd}	260	°C
Thermal resistance junction/ambient	Connected with Cu wire, 0.14 mm^2	R_{thJA}	250	K/W

BASIC CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 50 mA	V_F		1.0	1.3	V
Breakdown voltage	I_R = 20 µA, E = 0	$V_{(BR)}$	10			V
Reverse dark current	V_R = 5 V, E = 0	I_{ro}		2	30	nA
Diode capacitance	V_R = 0 V, f = 1 MHz, E = 0	C_D		1.2		nF
	V_R = 5 V, f = 1 MHz, E = 0	C_D		400		pF
Dark resistance	V_R = 10 mV	R_D		38		GΩ
Open circuit voltage	E_A = 1 klx	V_o	330	500		mV
Temperature coefficient of V_o	E_A = 1 klx	TK_{Vo}		- 2		mV/K
Short circuit current	E_A = 1 klx	I_k	20	60		µA
Temperature coefficient of I_k	E_A = 1 klx	TK_{Ik}		0.1		%/K
Reverse light current	E_A = 1 klx, V_R = 5 V	I_{ra}	20	60		µA
	E_e = 1 mW/cm^2, λ = 950 nm, V_R = 5 V	I_{ra}		42		µA
Angle of half sensitivity		φ		± 50		deg
Wavelength of peak sensitivity		λ_p		920		nm
Range of spectral bandwidth		$\lambda_{0.1}$	400		1100	nm
Rise time	V_R = 0 V, R_L = 1 kΩ, λ = 820 nm	t_r		3.4		µs
Fall time	V_R = 0 V, R_L = 1 kΩ, λ = 820 nm	t_f		3.7		µs

BASIC CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

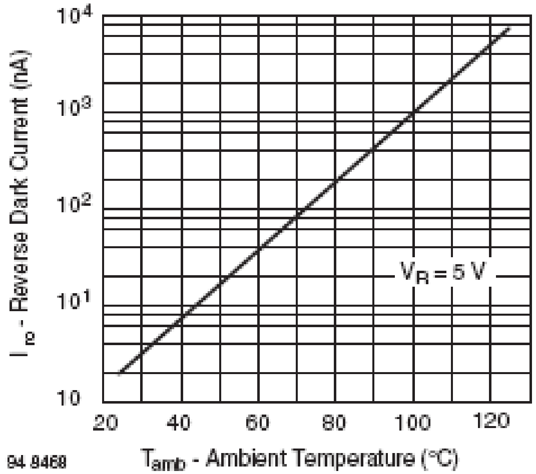

Fig. 1 - Reverse Dark Current vs. Ambient Temperature

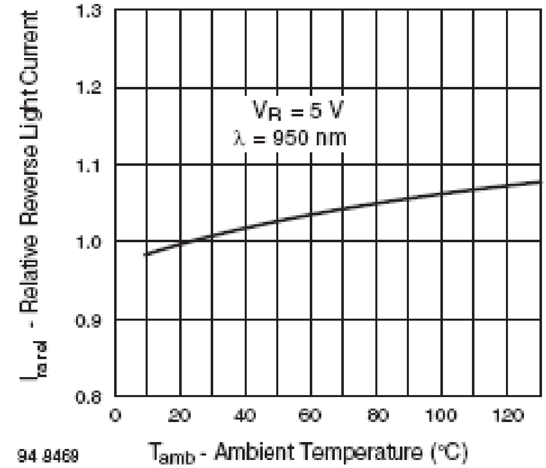

Fig. 2 - Relative Reverse Light Current vs. Ambient Temperature

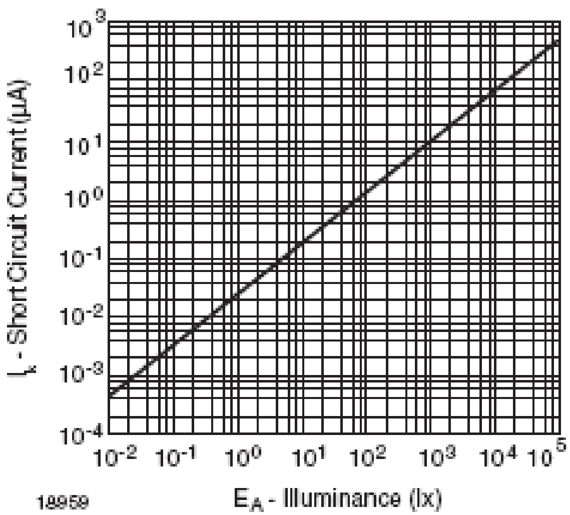

Fig. 3 - Short Circuit Current vs. Illuminance

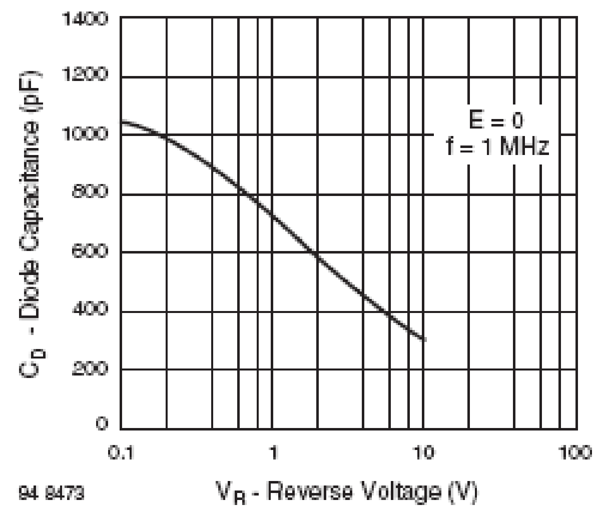

Fig. 6 - Diode Capacitance vs. Reverse Voltage

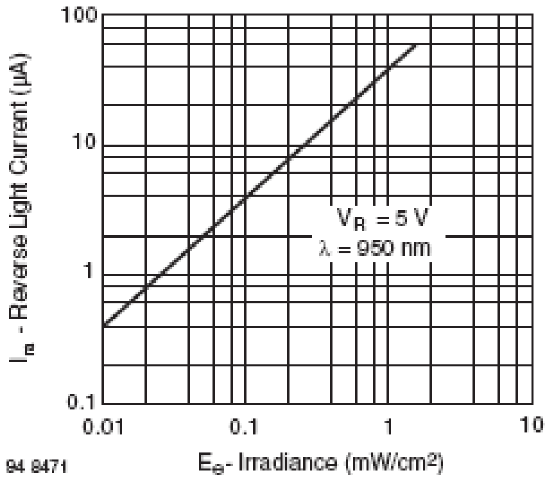

Fig. 4 - Reverse Light Current vs. Irradiance

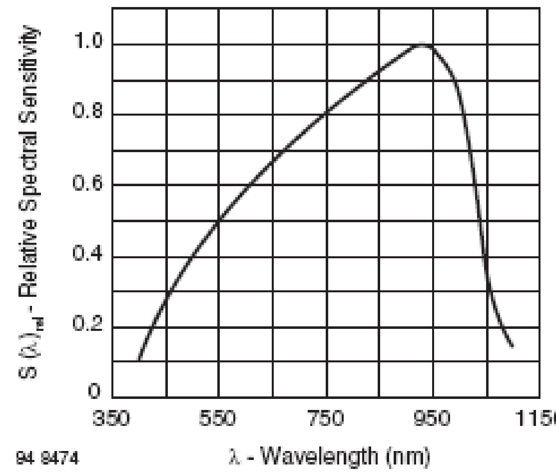

Fig. 7 - Relative Spectral Sensitivity vs. Wavelength

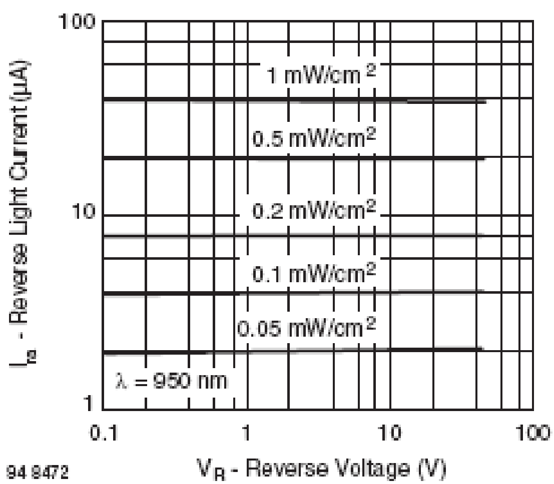

Fig. 5 - Reverse Light Current vs. Reverse Voltage

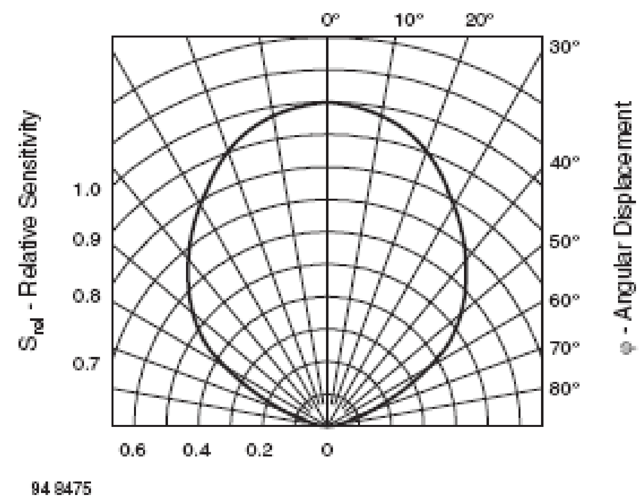

Fig. 8 - Relative Radiant Sensitivity vs. Angular Displacement

PACKAGE DIMENSIONS in millimeters