

8.5 Aplicaciones industriales de la Electrónica de Potencia: iluminación

Light-emitting diode

From Wikipedia, the free encyclopedia

"LED" redirects here. For other uses, see [LED \(disambiguation\)](#).

This article is about the basics of light emitting diodes. For application to area lighting, see [LED lamp](#).

Not to be confused with [LCD](#).

A **light-emitting diode** (**LED**) is a [semiconductor light source](#) that emits light when [current](#) flows through it. [Electrons](#) in the semiconductor recombine with [electron holes](#), releasing energy in the form of [photons](#). The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the [band gap](#) of the semiconductor.^[5] White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.^[6]

Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity [infrared](#) (IR) light.^[7] Infrared LEDs are used in [remote-control](#) circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Modern LEDs are available across the [visible](#), [ultraviolet](#) (UV), and infrared wavelengths, with high light output.

Early LEDs were often used as indicator lamps, replacing small incandescent bulbs, and in [seven-segment displays](#). Recent developments have produced high-output white light LEDs suitable for room and outdoor area lighting. LEDs have led to new displays and sensors, while their high switching rates are useful in advanced communications technology.

LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. LEDs are used in applications as diverse as [aviation lighting](#), [automotive headlamps](#), advertising, [general lighting](#), [traffic signals](#), camera flashes, [lighted wallpaper](#), [horticultural grow lights](#), and medical devices.^[8]

Unlike a [laser](#), the light emitted from an LED is neither spectrally [coherent](#) nor even highly [monochromatic](#). However, its [spectrum](#) is sufficiently narrow that it appears to the [human eye](#) as a pure ([saturated](#)) color.^{[9][10]} Also unlike most lasers, its radiation is not [spatially coherent](#), so it cannot approach the very high [brightnesses](#) characteristic of [lasers](#).

Light-emitting diode (LED)



Blue, green, and red LEDs in 5 mm diffused case

Working principle	Electroluminescence
Invented	H. J. Round (1907) ^[1] Oleg Losev (1927) ^[2] James R. Biard (1961) ^[3] Nick Holonyak (1962) ^[4]
First production	October 1962
Pin configuration	Anode and cathode
	Electronic symbol

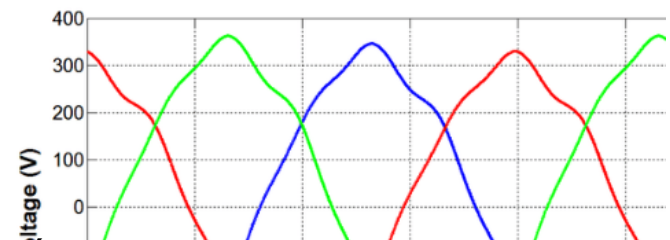
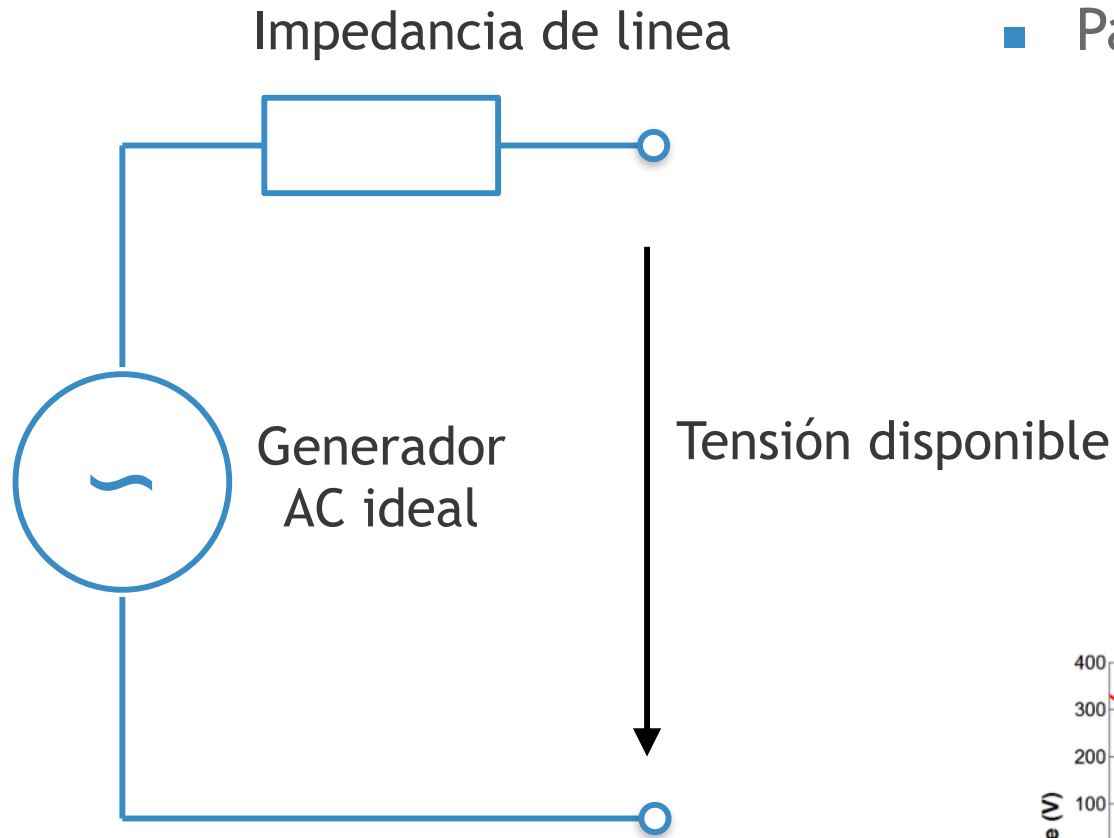
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Circuito equivalente de la red monofásica

- Impedancia normalizada
 - Parte resistiva 0.4Ω
 - Parte inductiva $800\mu\text{H}$

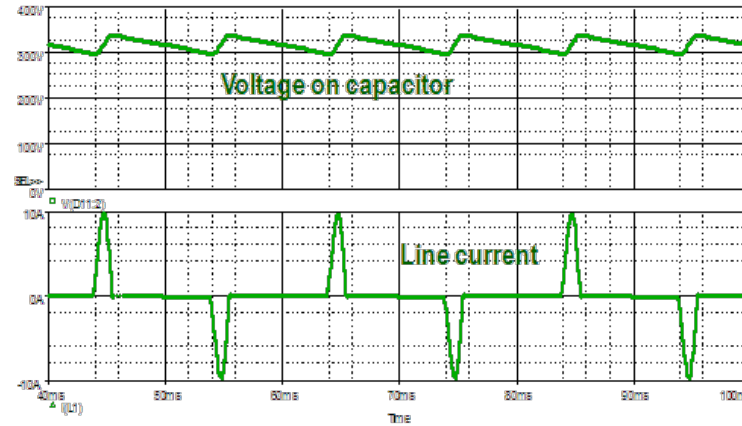
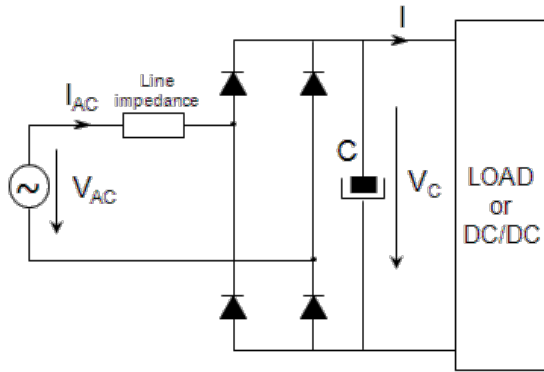


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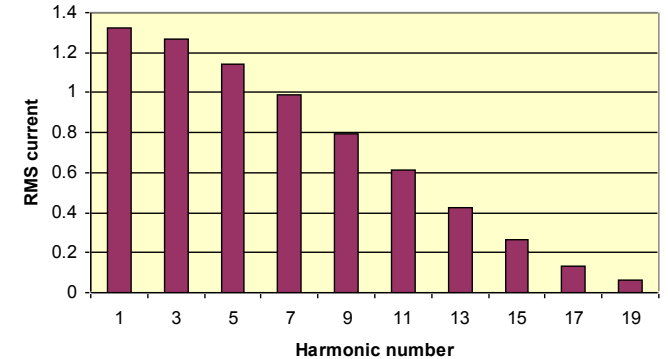
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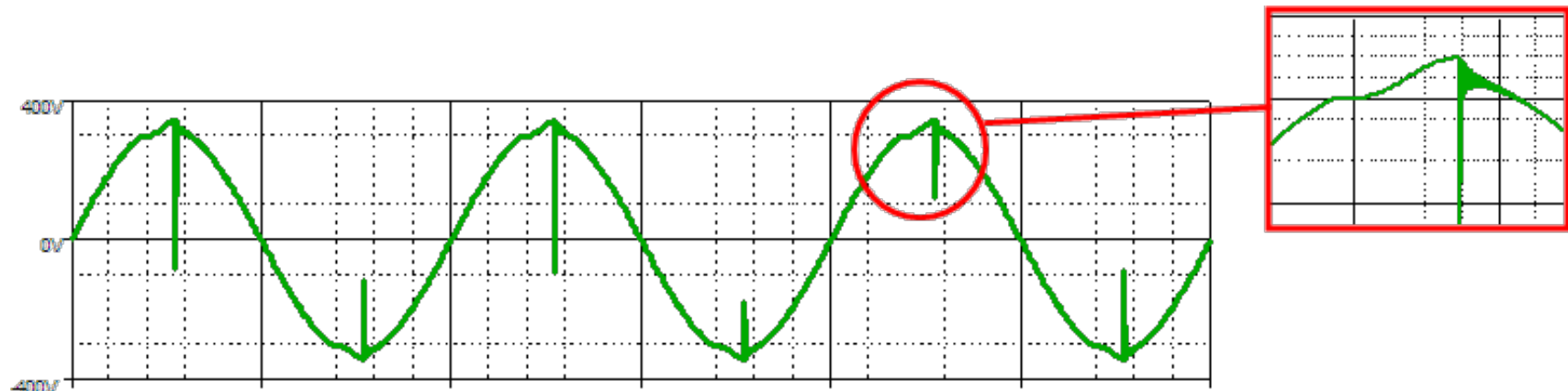
Rectificador de 300W y filtro por condensador



- Muy alta corriente eficaz (2.63A en lugar de 1.30A)



- Distorsión de tensión



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Definición de factor de potencia

$$P.F. = \frac{\text{Active power}}{\text{Aparent power}} = \frac{\frac{1}{T} \int_0^T u(t) \cdot i(t) dt}{\sqrt{\frac{1}{T} \int_0^T u^2(t) dt} \cdot \sqrt{\frac{1}{T} \int_0^T i^2(t) dt}}$$

- Si la tensión es sinusoidal:

$$P.F. = \frac{I_{1,RMS}}{I_{RMS}} \cdot \cos \phi = k_d \cdot k_\phi$$

- El factor de potencia depende de:

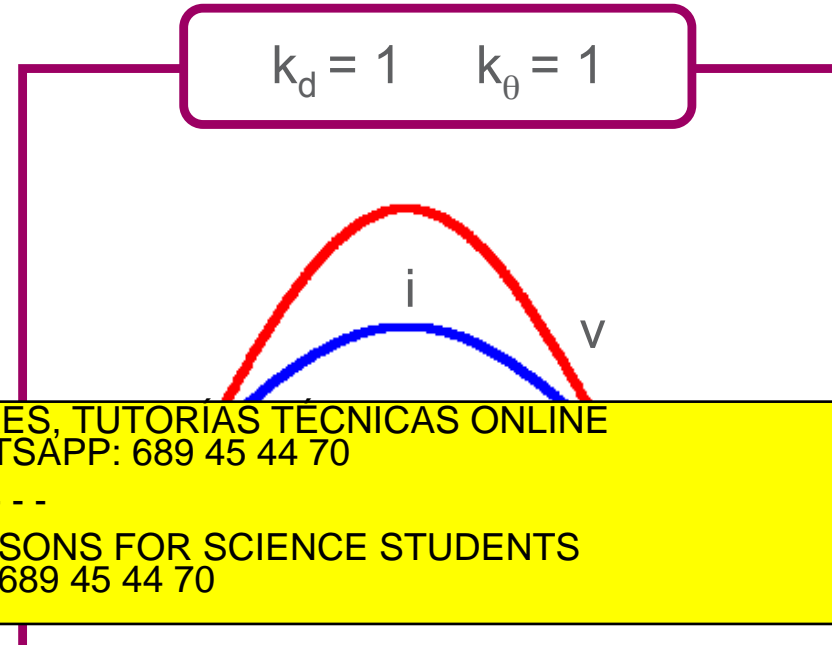
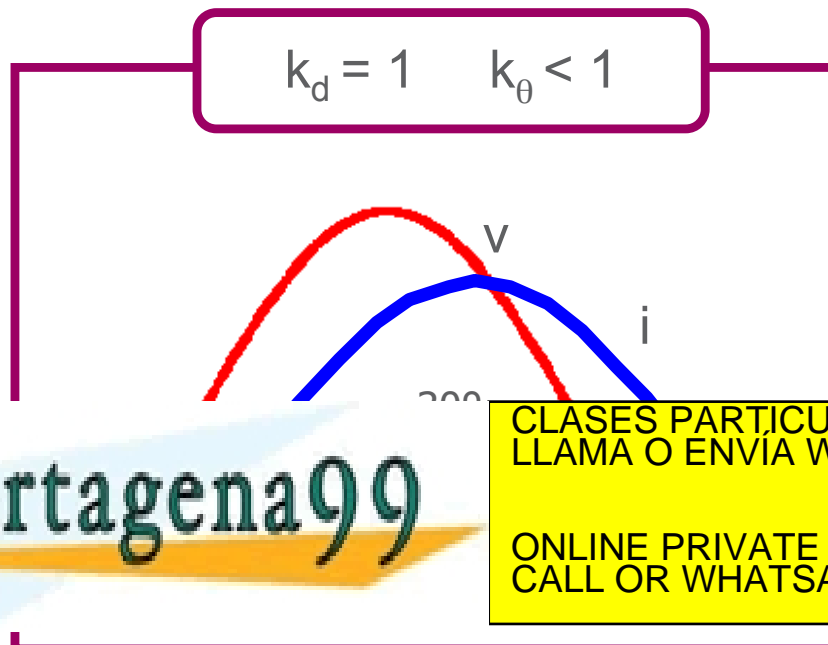
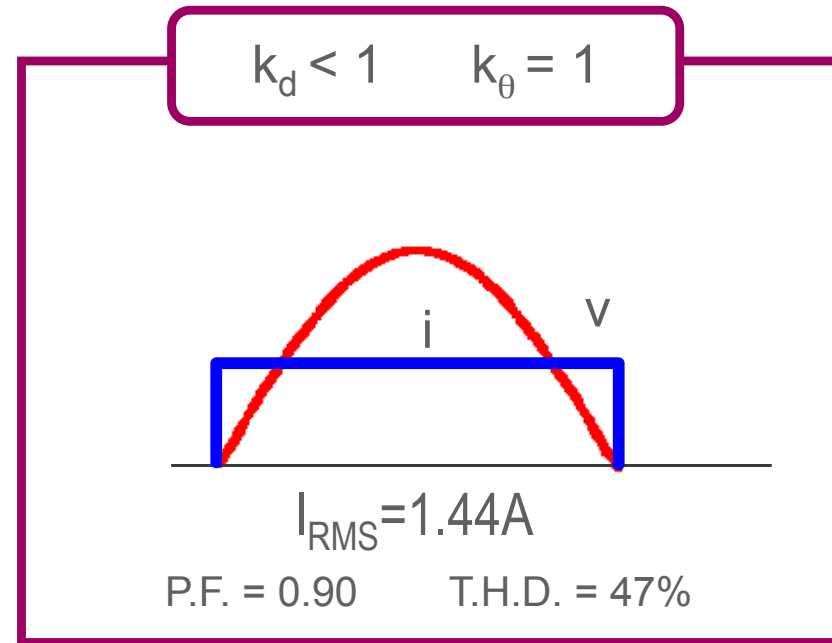
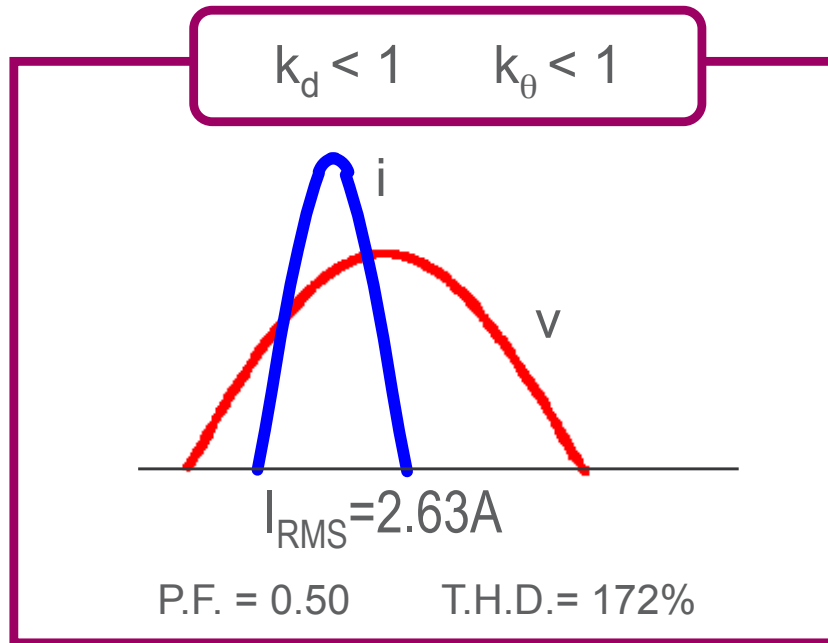
➤ El contenido armónico de la corriente

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Ejemplos de factor de potencia



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EN 61000-3-2 Europea (enero 2001). Límites para la corrientes armónicas para equipos de menos de 16A por fase

IEEE 519 IEEE Recommended practices and requirements for harmonic control in electrical power systems

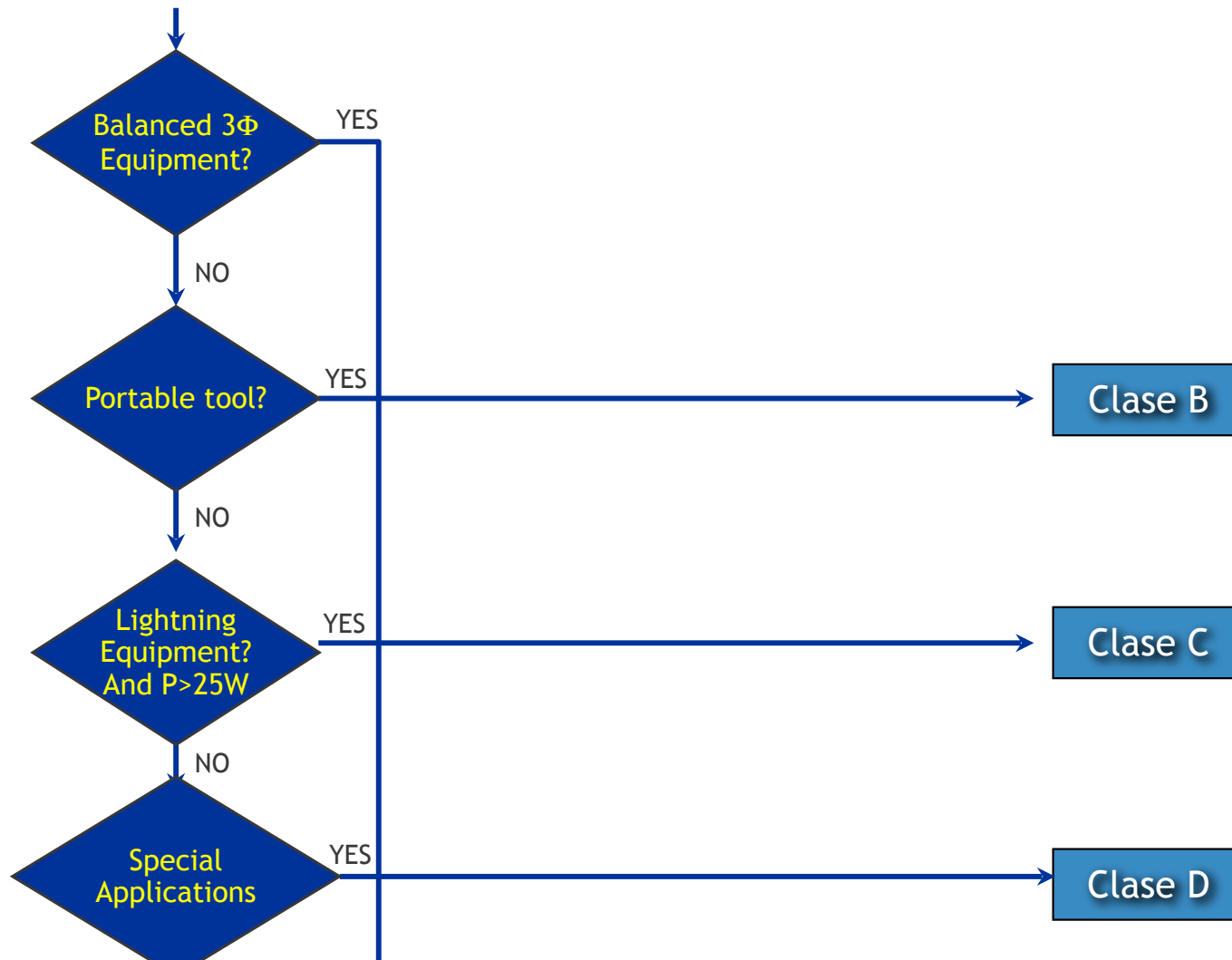
Ninguna requiere un factor de potencia unidad

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Flujograma de la Regulación EN61000-3-2



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Límites impuestos por la regulación EN61000-3-2

	Clase A		Clase B		Clase C		Clase D	
		A_{RMS}	A_{RMS}	%	A_{RMS}	mA/W		
Armónicos impares	3	2.30	3.45	30*PF.	2.30	3.40		
	5	1.14	1.71	10	1.14	1.90		
	7	0.77	1.15	7	0.77	1.00		
	9	0.40	0.60	5	0.40	0.50		
	11	0.33	0.49	3	0.33	0.35		
	13	0.21	0.31	3	0.21	0.29		
	15 a 39	2.25/n	3.375/n	3	2.25/n	3.85/n		
Armónicos pares	2	1.08	1.62	2				
	4	0.43	0.64					
	6	0.30	0.45					
	8 a 40	1.84/n	2.76/n					

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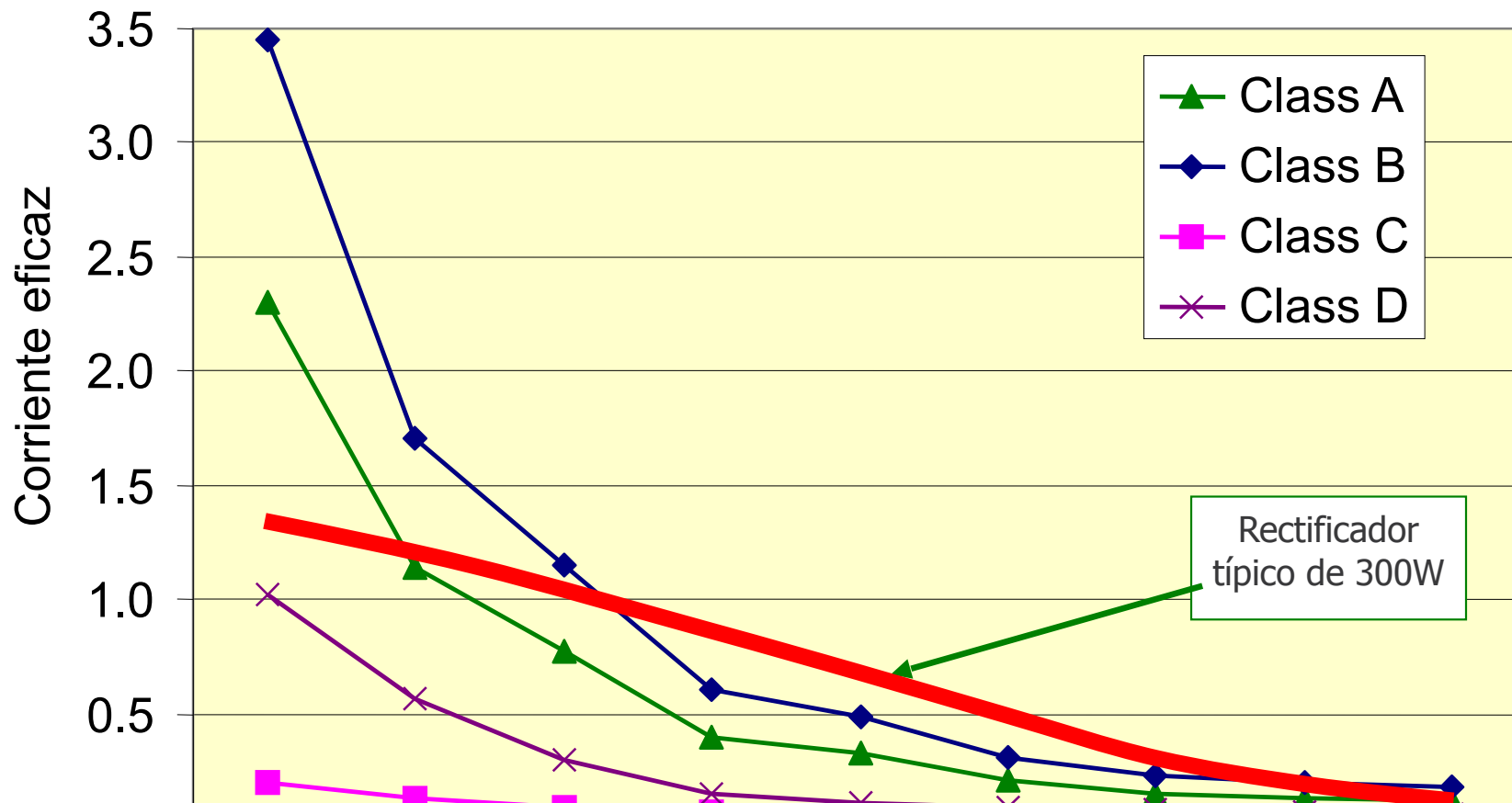
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Límites



Límites impuestos por EN61000-3-2

Ejemplo para 300W con $V_{AC}=230V$

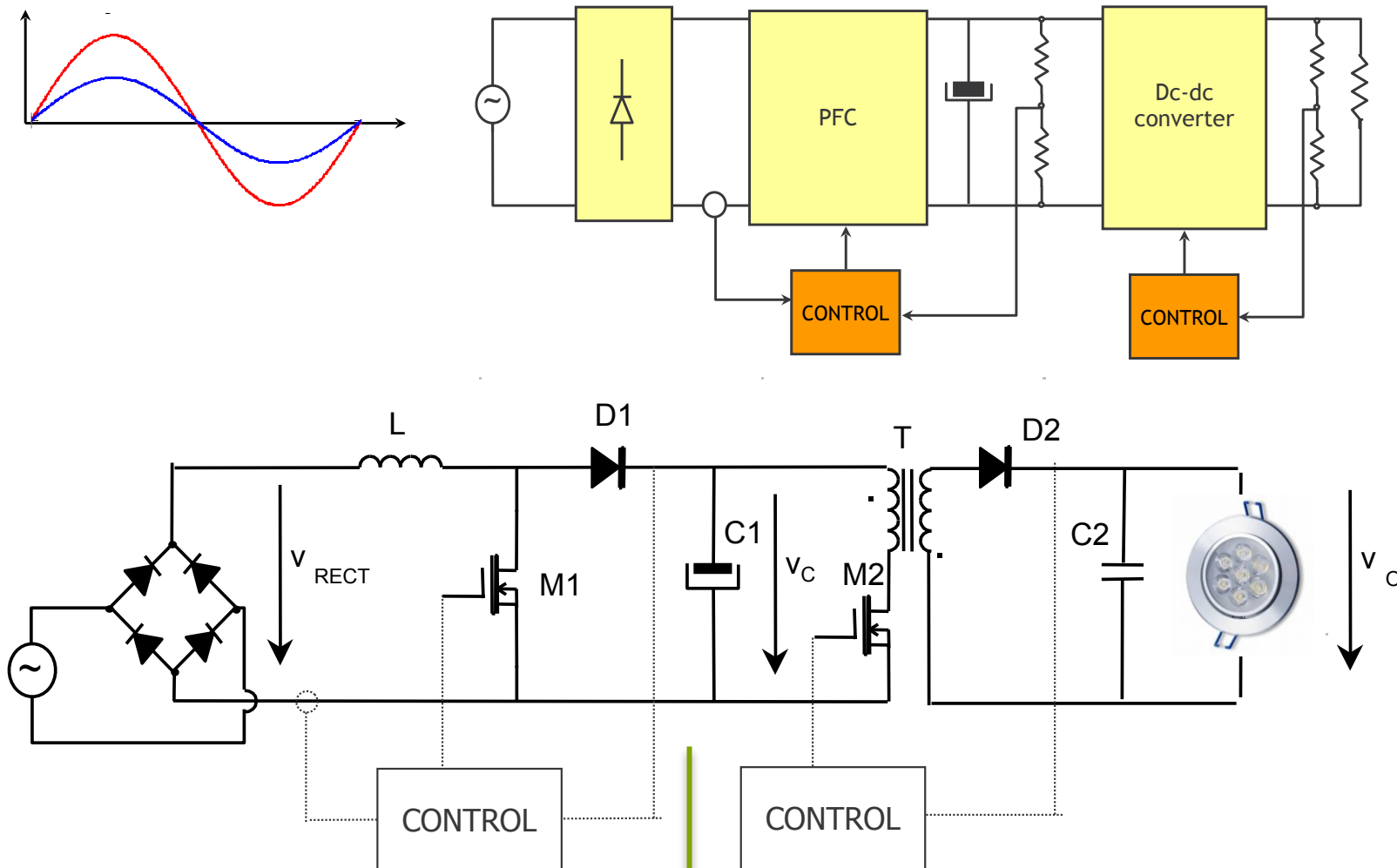


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Circuito para alimentar LEDs



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