



Laboratorio di Elettronica

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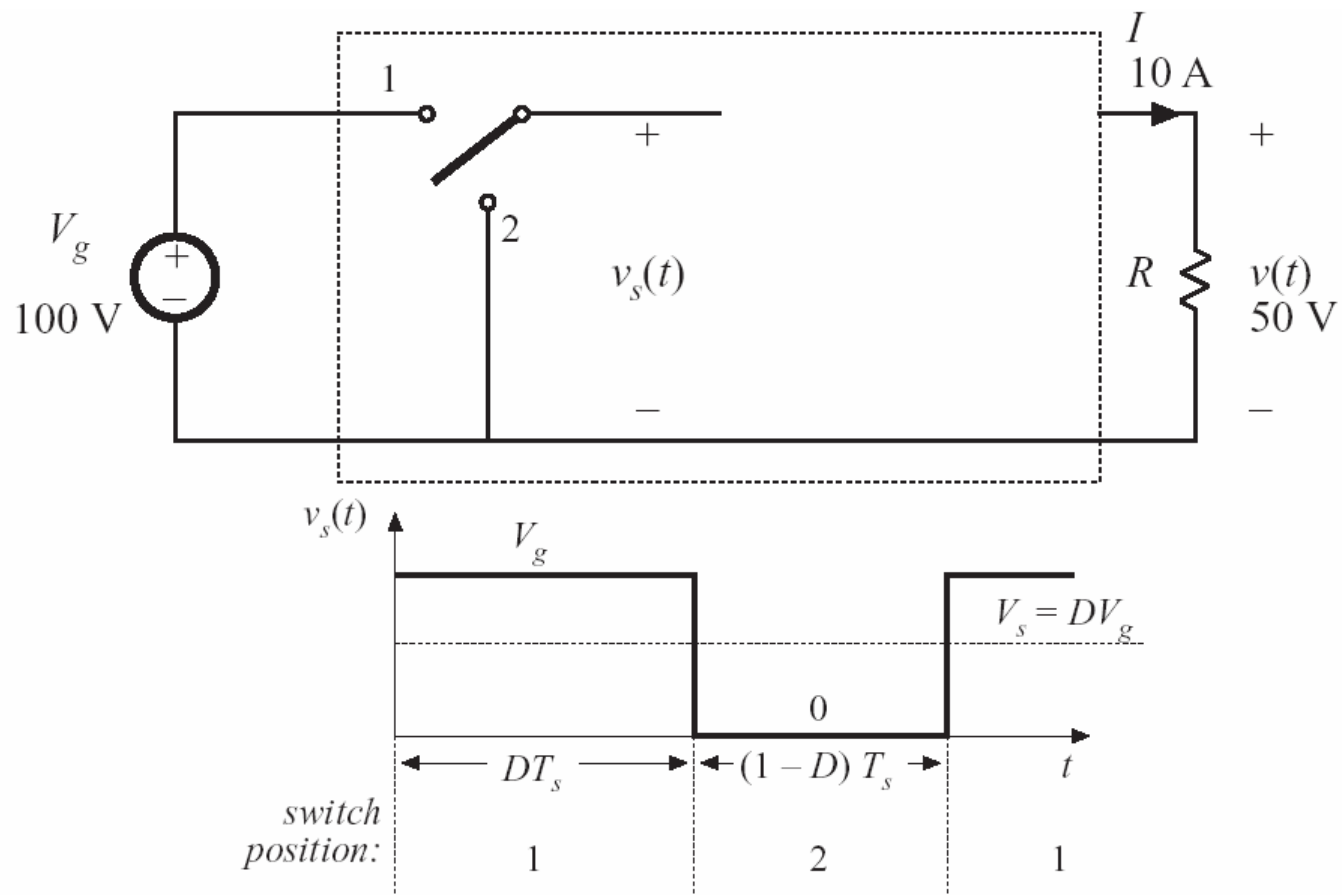
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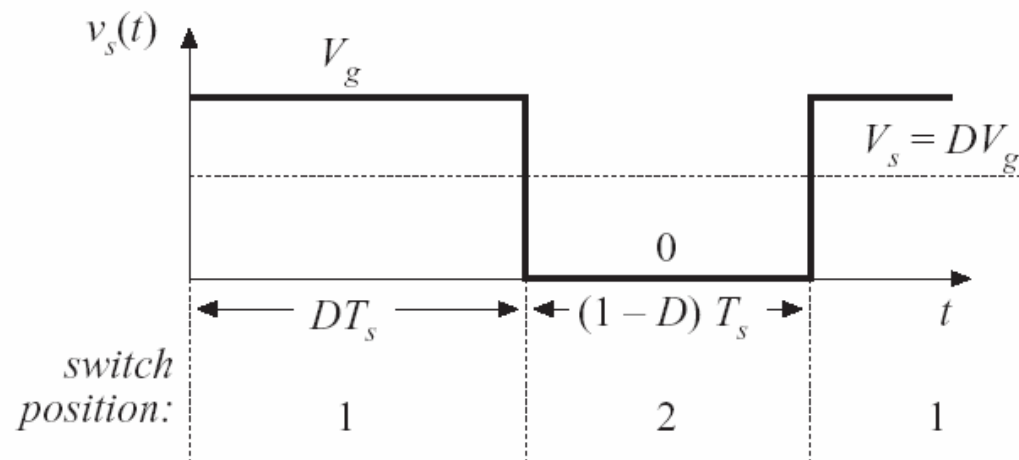
Convertitori DC/DC di tipo Buck





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Valor medio della tensione v_s



D = switch duty cycle

$$0 \leq D \leq 1$$

T_s = switching period

f_s = switching frequency
 $= 1 / T_s$

DC component of $v_s(t)$ = average value:

$$V_s = \frac{1}{T_s} \int_0^{T_s} v_s(t) dt = DV_g$$

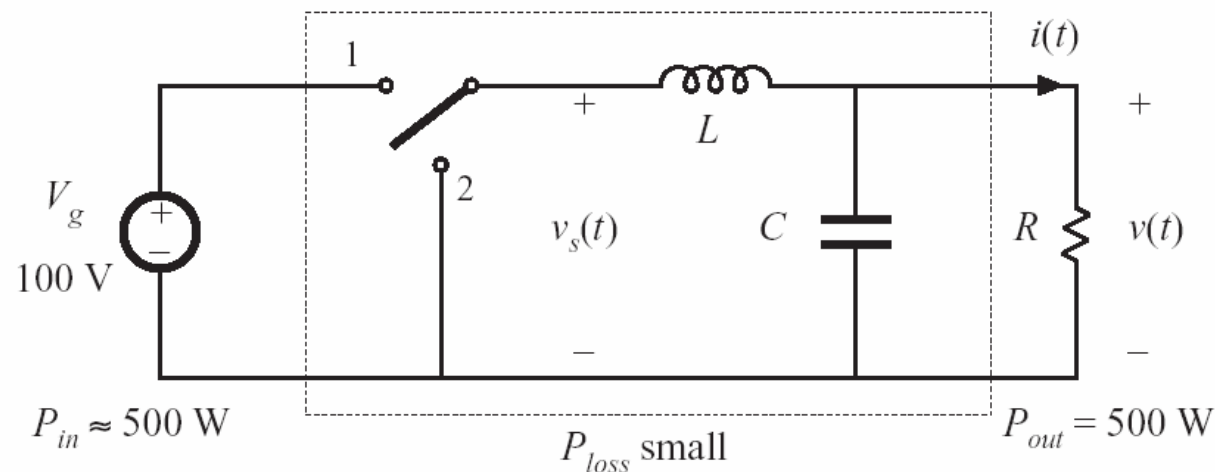
Il valor medio V_s della tensione $v_s(t)$ è dato da $D \cdot V_g$



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Convertitore Buck

Addition of (ideally lossless) L - C low-pass filter, for removal of switching harmonics:

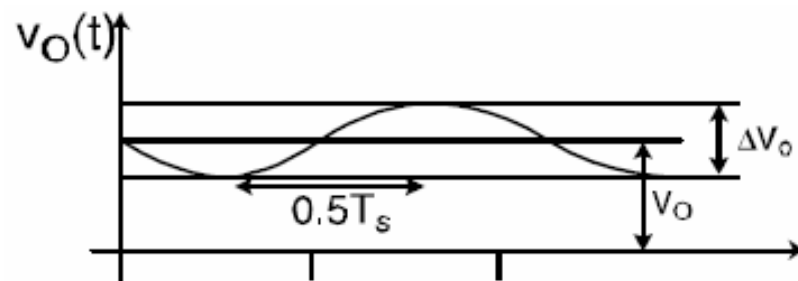
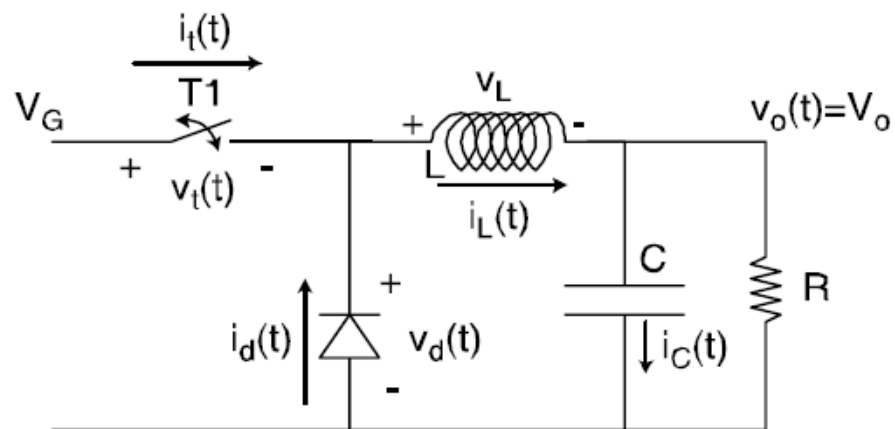


- Choose filter cutoff frequency f_0 much smaller than switching frequency f_s
- This circuit is known as the “buck converter”



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Equazioni Convertitore Buck



Valor medio della tensione di uscita

$$V_O = V_G * \frac{t_{on}}{T_s} = V_G * D$$

ripple

$$\frac{\Delta V_O}{V_O} = \frac{1}{8} \frac{T_s^2 (1-D)}{LC}$$



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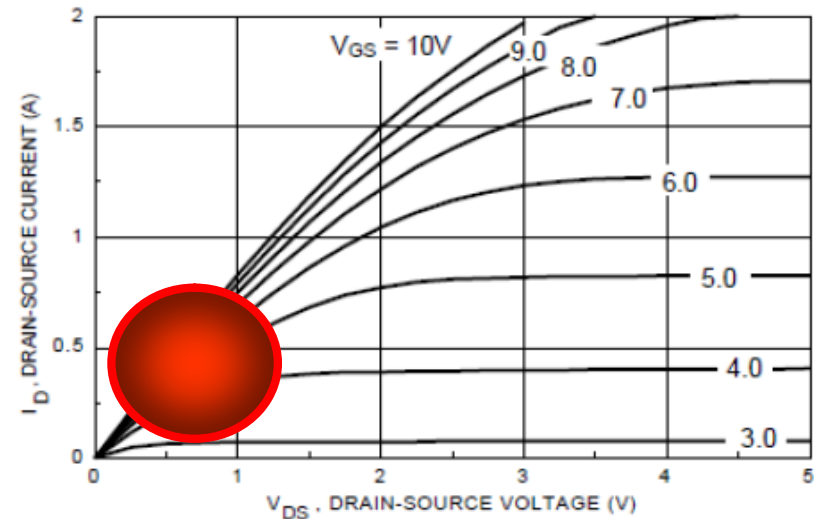
Interruttore (nMOS-BS170)

BS170 / MMBF170

N-Channel Enhancement Mode Field Effect Transistor

Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	BS170	MMBF170	Units
V_{DSS}	Drain-Source Voltage	60		V
V_{DGR}	Drain-Gate Voltage ($R_{GS} \leq 1M\Omega$)	60		V
V_{GSS}	Gate-Source Voltage	± 20		V
I_D	Drain Current - Continuous	500	500	mA
	- Pulsed	1200	800	
T_J, T_{STG}	Operating and Storage Temperature Range	- 55 to 150		$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering Purposes, 1/16" from Case for 10 Seconds	300		$^\circ\text{C}$





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Diodo (BYV27-100)

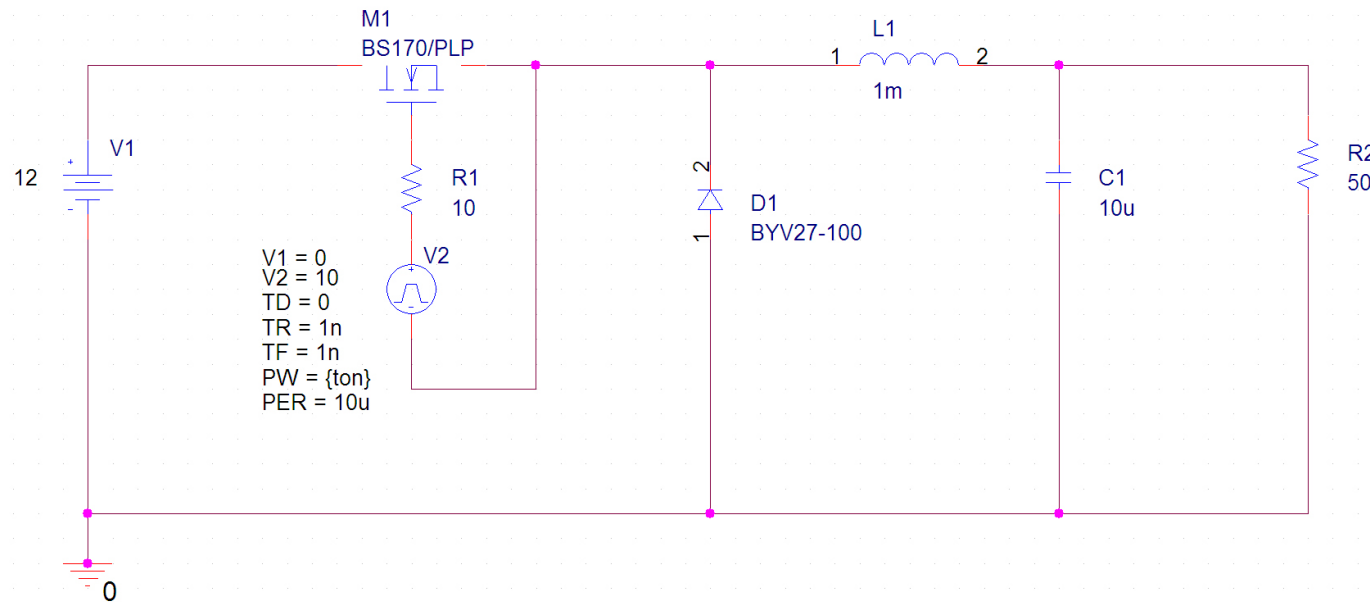
Parameter	Test condition	Part	Symbol	Value	Unit
Peak reverse voltage, non repetitive	see electrical characteristics	BYV27-50	V_{RSM}	55	V
		BYV27-100	V_{RSM}	110	V
		BYV27-150	V_{RSM}	165	V
		BYV27-200	V_{RSM}	220	V
Reverse voltage = Repetitive peak reverse voltage	see electrical characteristics	BYV27-50	$V_R = V_{RRM}$	50	V
		BYV27-100	$V_R = V_{RRM}$	100	V
		BYV27-150	$V_R = V_{RRM}$	150	V
		BYV27-200	$V_R = V_{RRM}$	200	V
Peak forward surge current	$t_p = 10$ ms, half sinewave		I_{FSM}	50	A
Repetitive peak forward current			I_{FRM}	15	A

Parameter	Test condition	Part	Symbol	Value	Unit
Average forward current			I_{FAV}	2	A
Pulse energy in avalanche mode, non repetitive (inductive load switch off)	$I_{(BR)R} = 1$ A, $T_j = 175$ °C		E_R	20	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C



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BUCK - Schematico

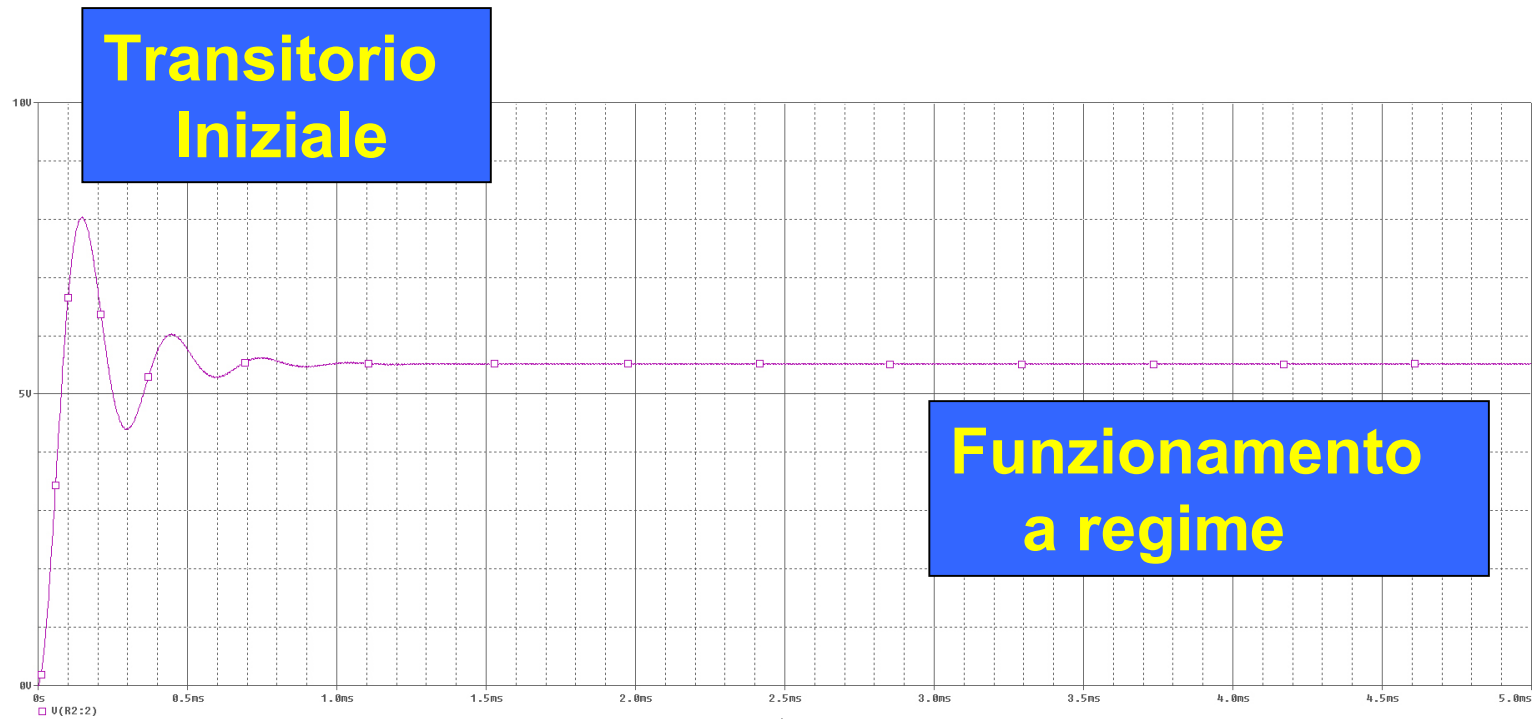


Per il BS170 la libreria da utilizzare è la PHIL_FET
Per il BYV-27-100 la libreria da utilizzare è la DIODE



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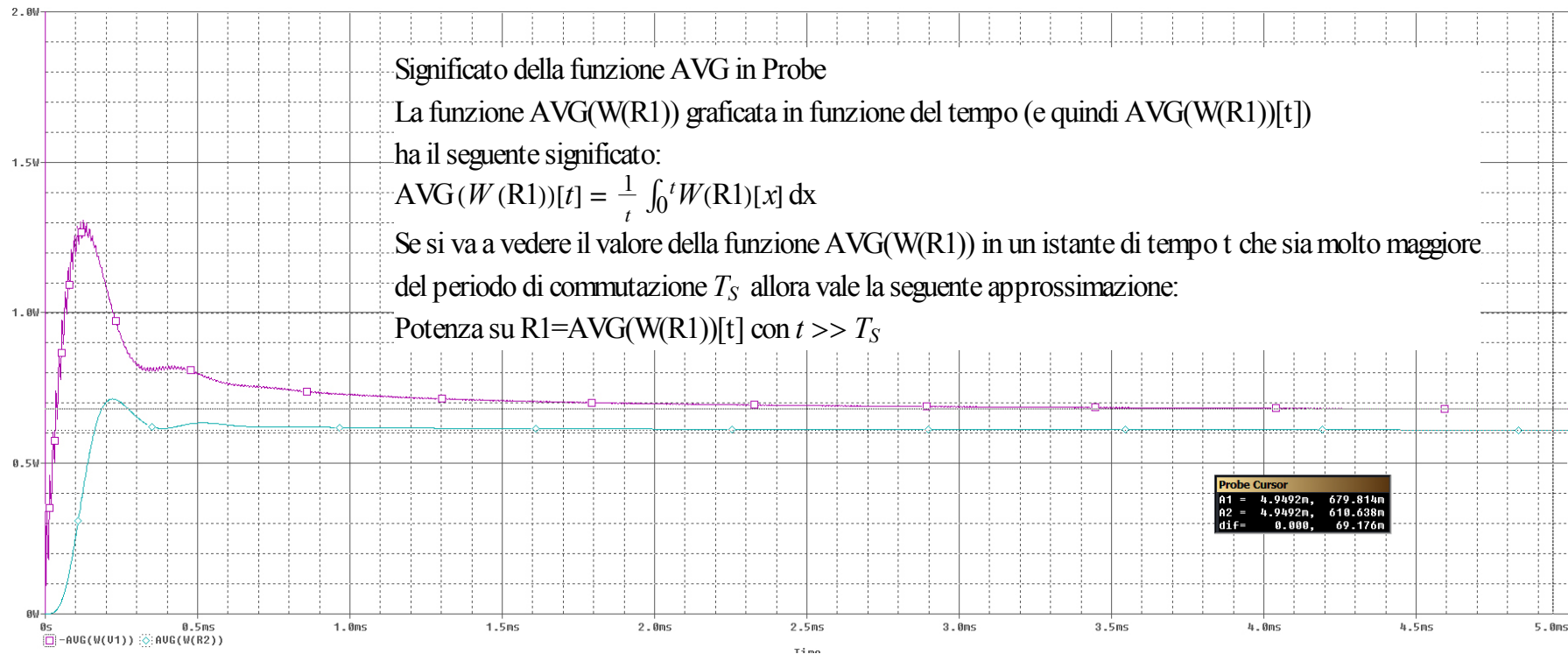
Forma d'onda in uscita





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Potenza in uscita e in ingresso



Efficienza = $P_{out}/P_{in} = 89.7\%$