Elektronica tutorial

MOSFET-chopper (ohms belast)

W. Van Wichelen

ELECTRIVIAL TUTORIALS

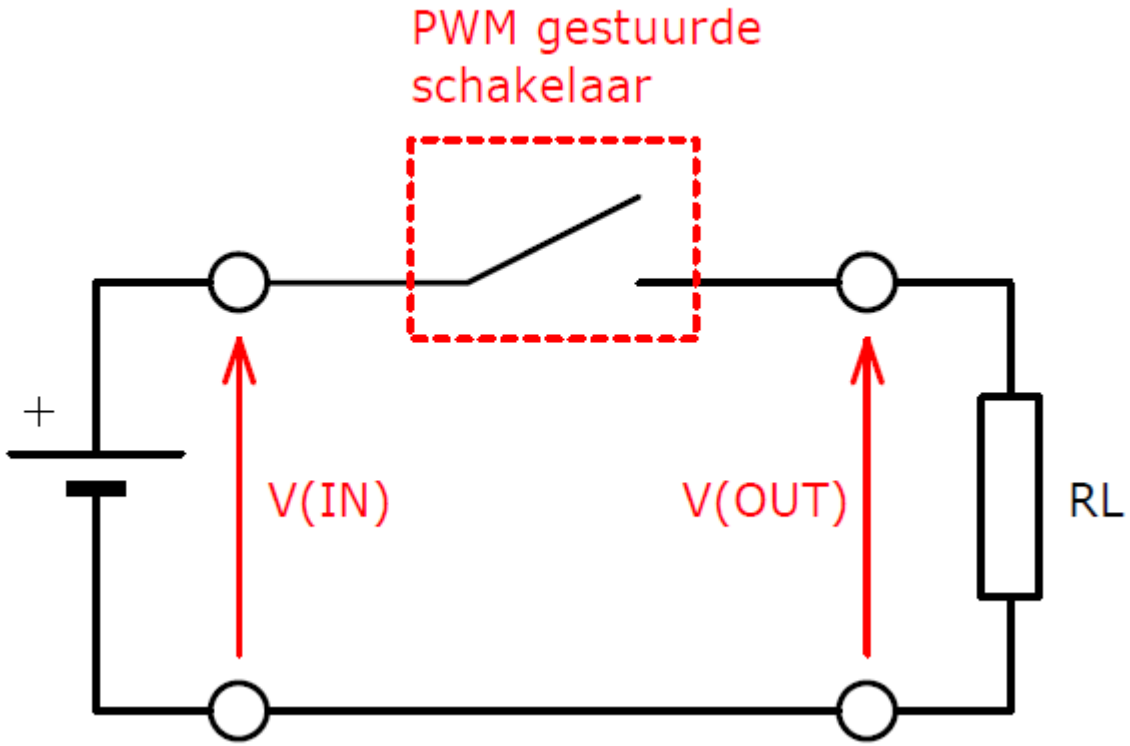
Wat gaan we in deze les leren?

- Principe DC/DC-converter
- Chopper (hakker) met MOSFET's
- Gemiddelde waarden
- R.M.S. waarden
- Vermogencontrole
- Simulatie LTspice

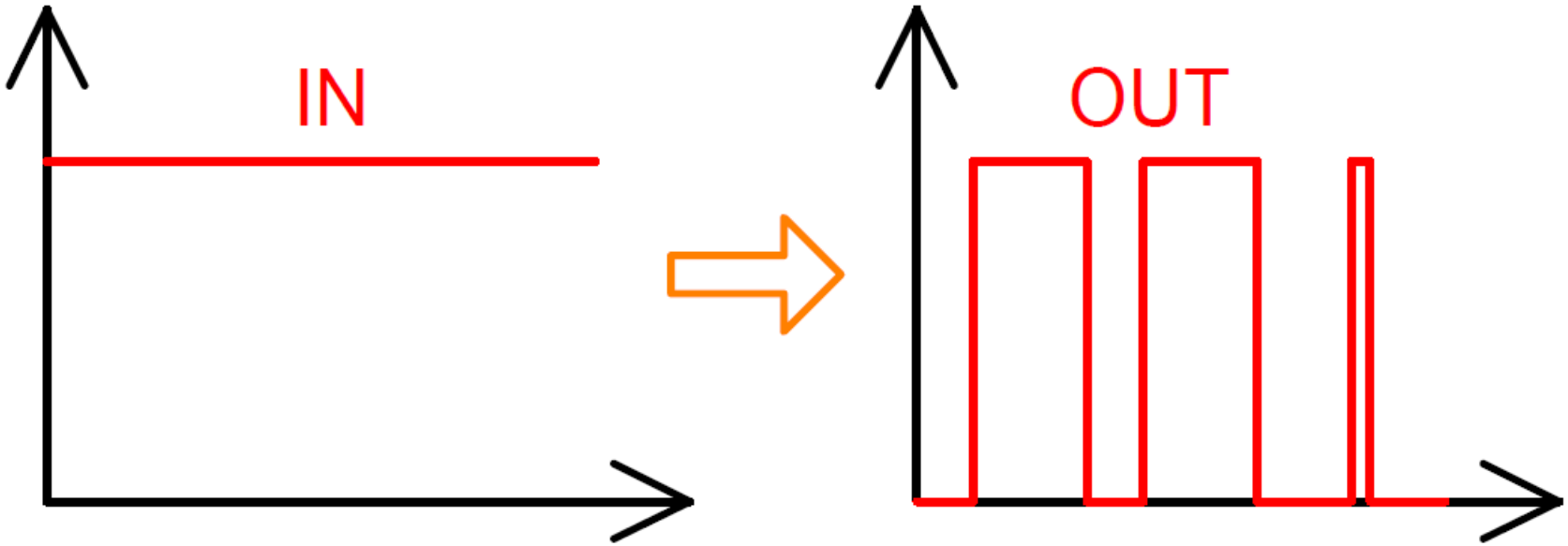
ELECTRIVIAL TUTORIALS

DC/DC-converter

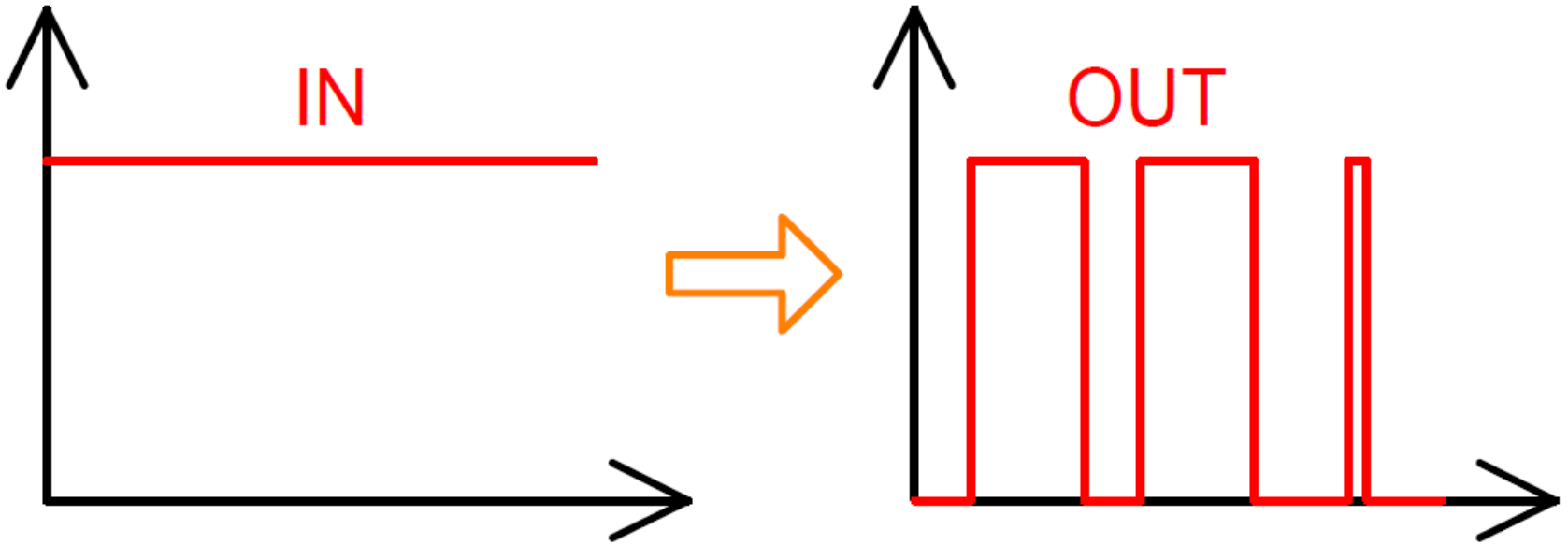
PRINCIPE



DC/DC-converter



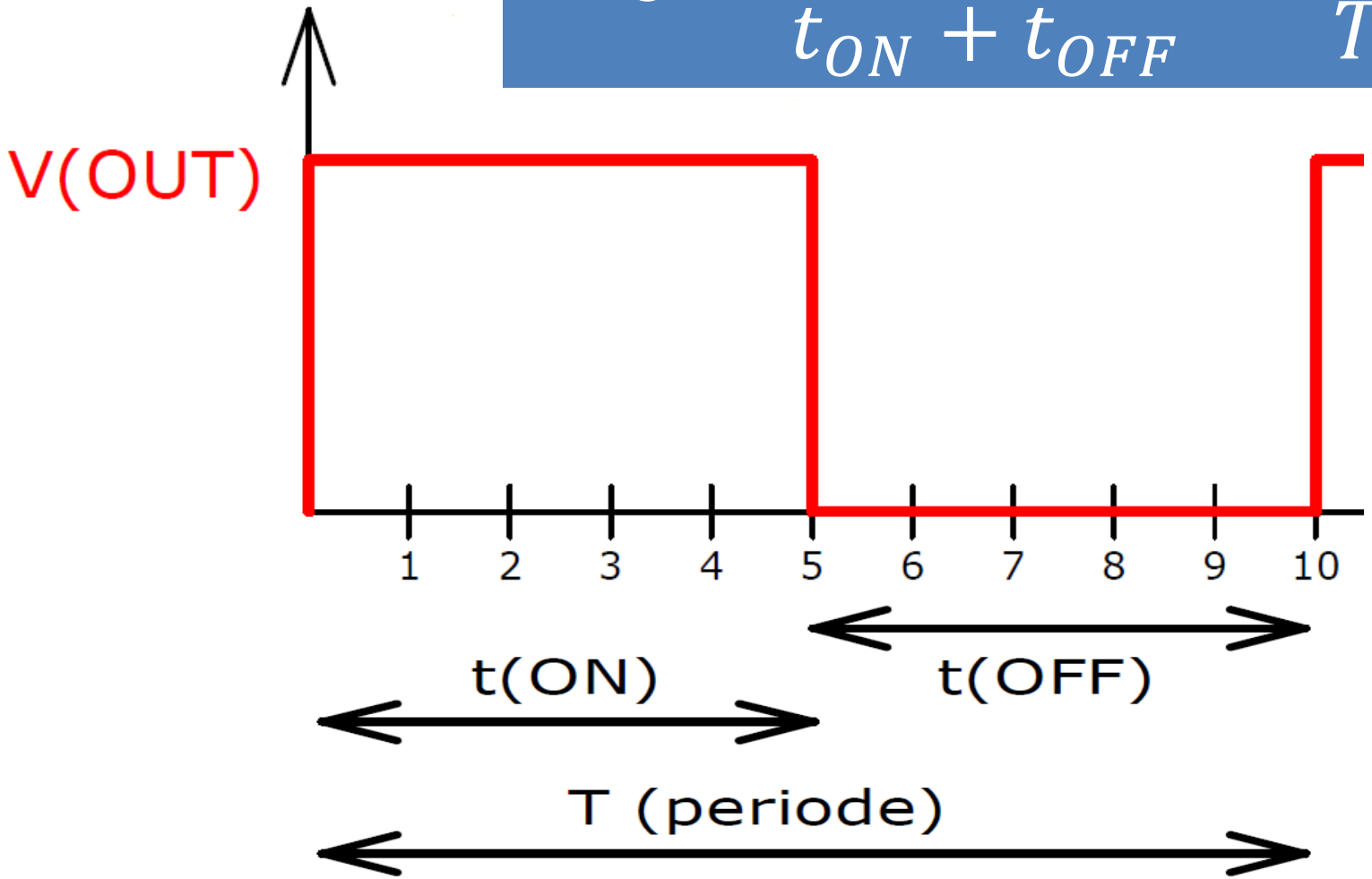
DC/DC-converter



CHOPPER (HAKKER)

Duty Cycle

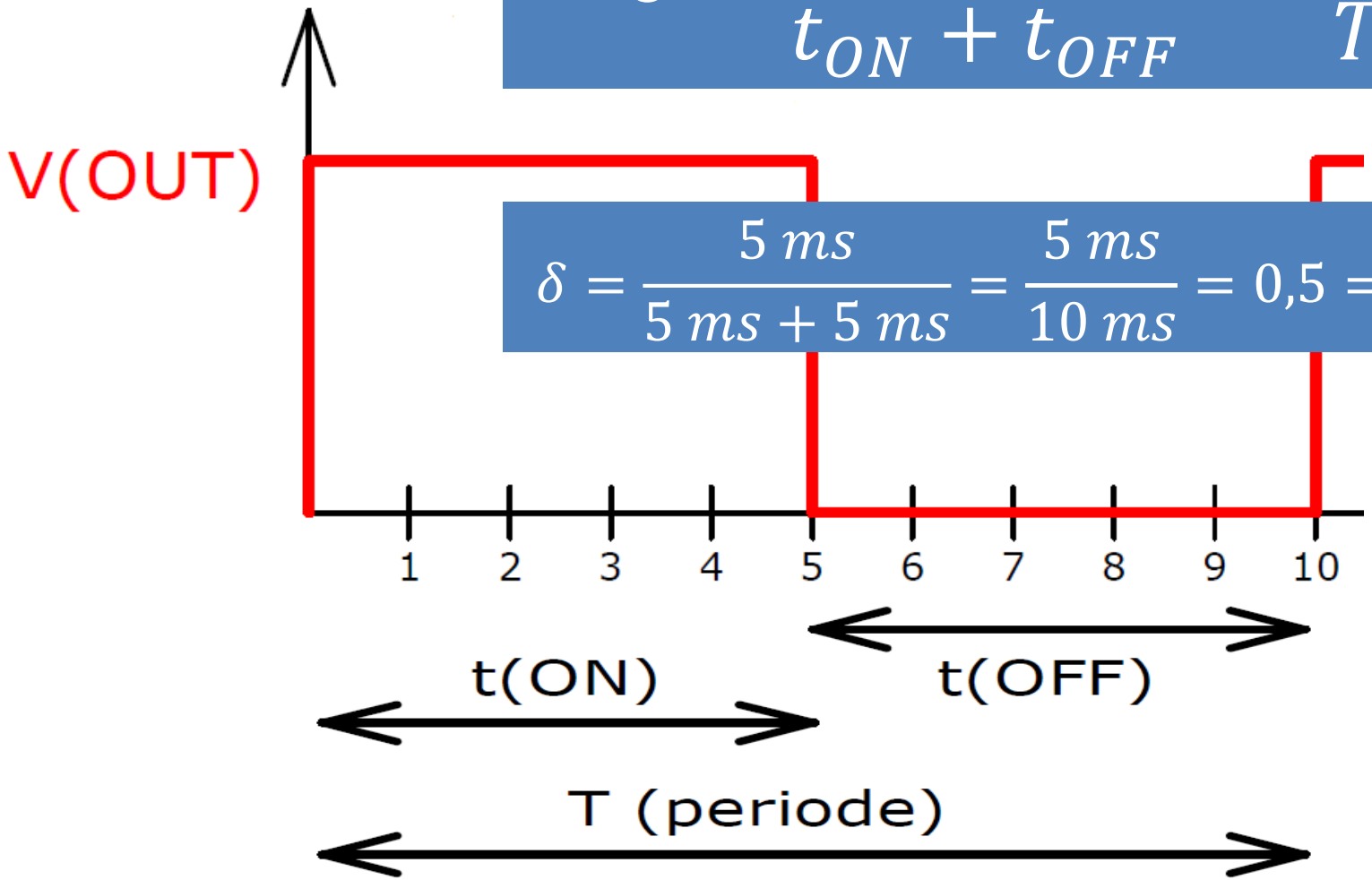
$$\delta = \frac{t_{ON}}{t_{ON} + t_{OFF}} = \frac{t_{ON}}{T}$$



ELECTRIVIAL TUTORIALS

Duty Cycle

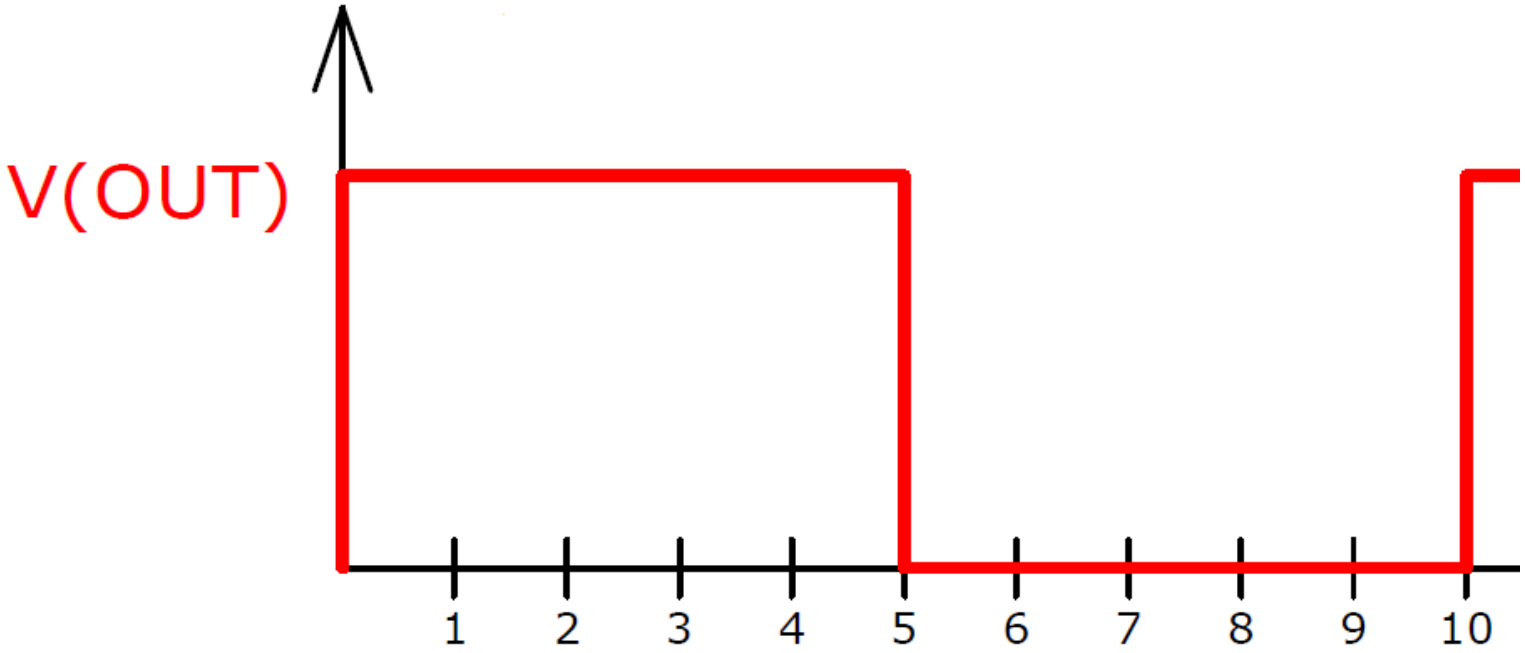
$$\delta = \frac{t_{ON}}{t_{ON} + t_{OFF}} = \frac{t_{ON}}{T}$$



$$\delta = \frac{5\ ms}{5\ ms + 5\ ms} = \frac{5\ ms}{10\ ms} = 0{,}5 = 50\%$$

ELECTRIVIAL TUTORIALS

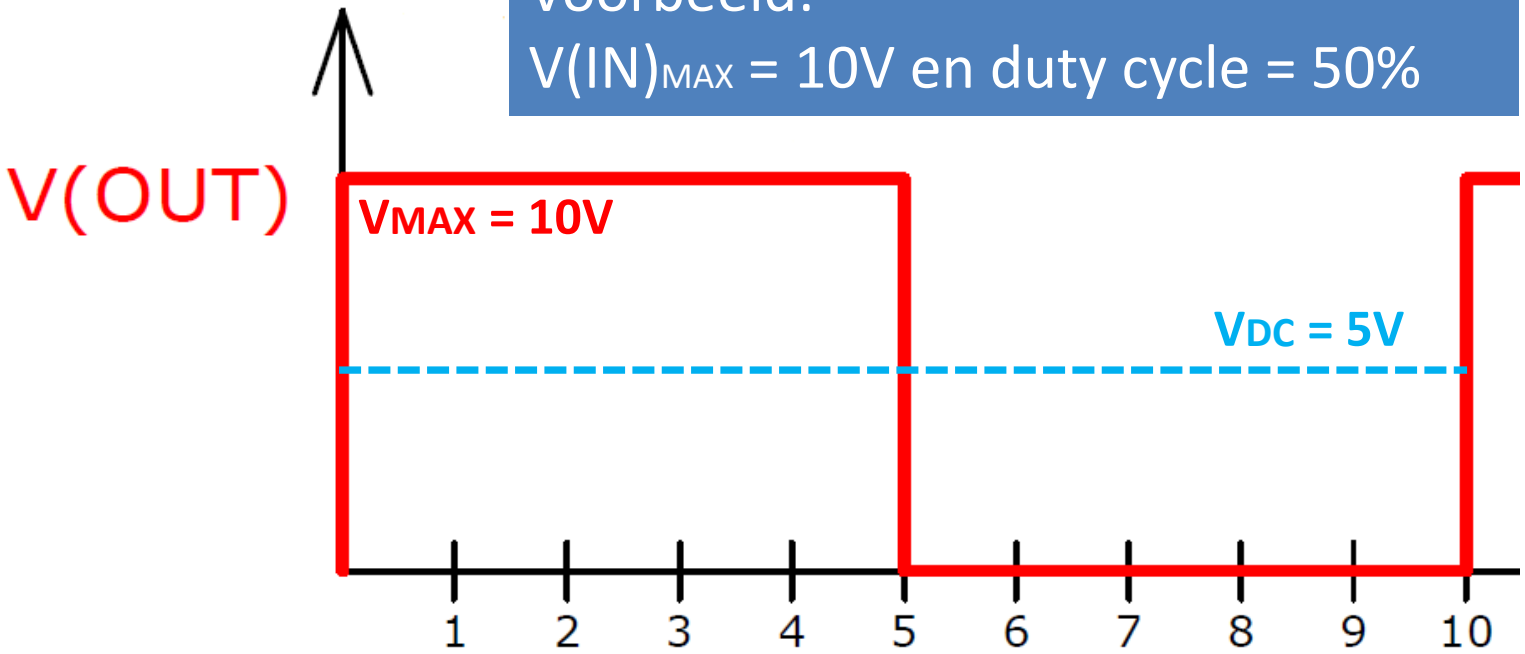
Gemiddelde waarde



$$V(OUT)_{DC} = \delta * V(IN)_{MAX}$$

Gemiddelde waarde

Voorbeeld:
$V(IN)_{MAX}$ = 10V en duty cycle = 50%



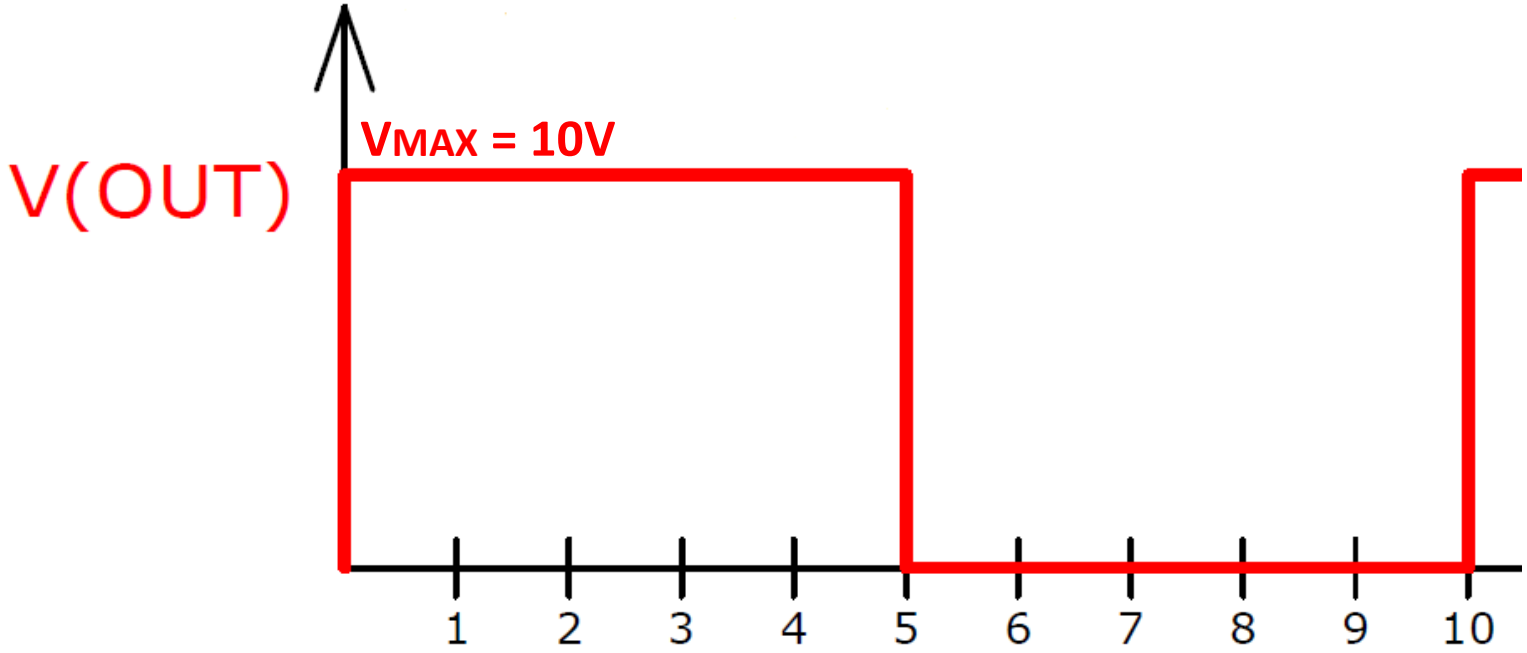
$$V(OUT)_{DC} = \delta * V(IN)_{MAX}$$

$$V(OUT)_{DC} = 0{,}5 * 10\,V = 5\,V$$

ELECTRIVIAL TUTORIALS

Effectieve waarde (R.M.S.)

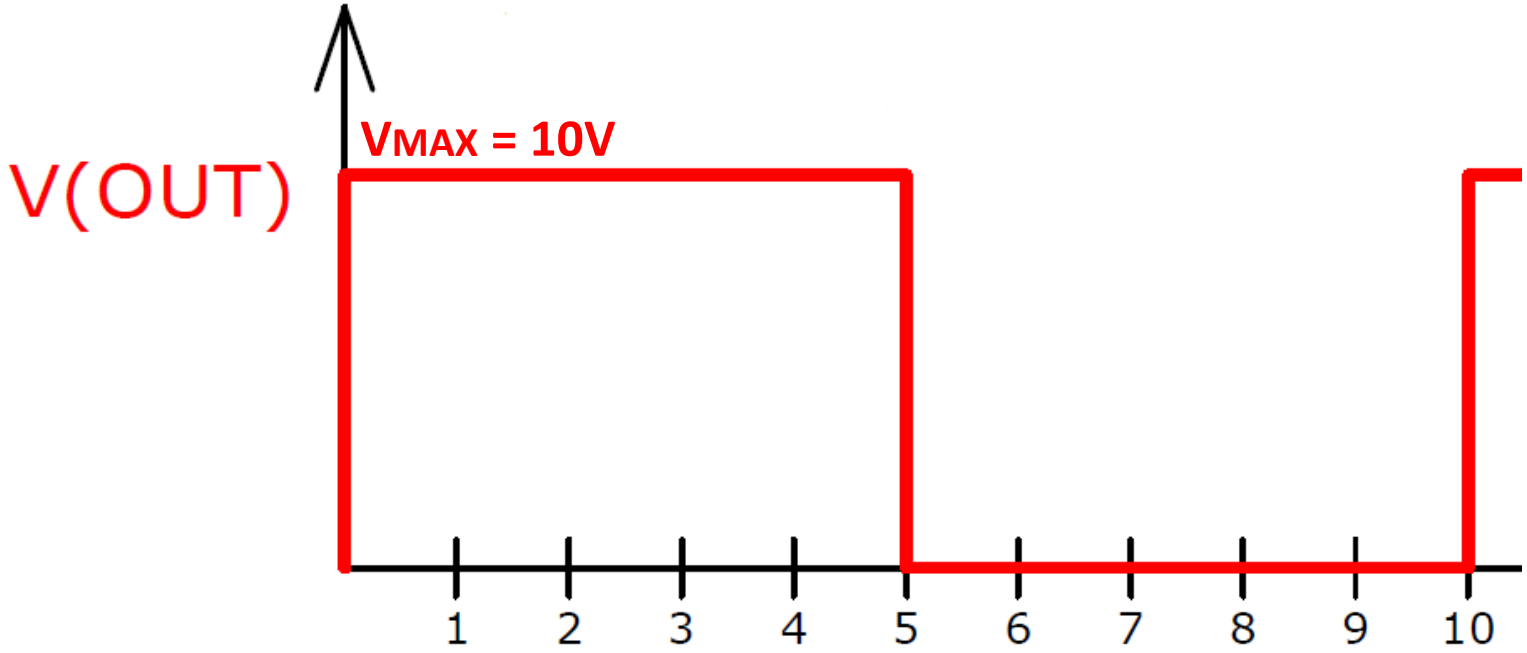
"Vierkantswortel van het gemiddelde van het kwadraat"



ELECTRIVIAL TUTORIALS

Effectieve waarde (R.M.S.)

"Vierkantswortel van het gemiddelde van het kwadraat"

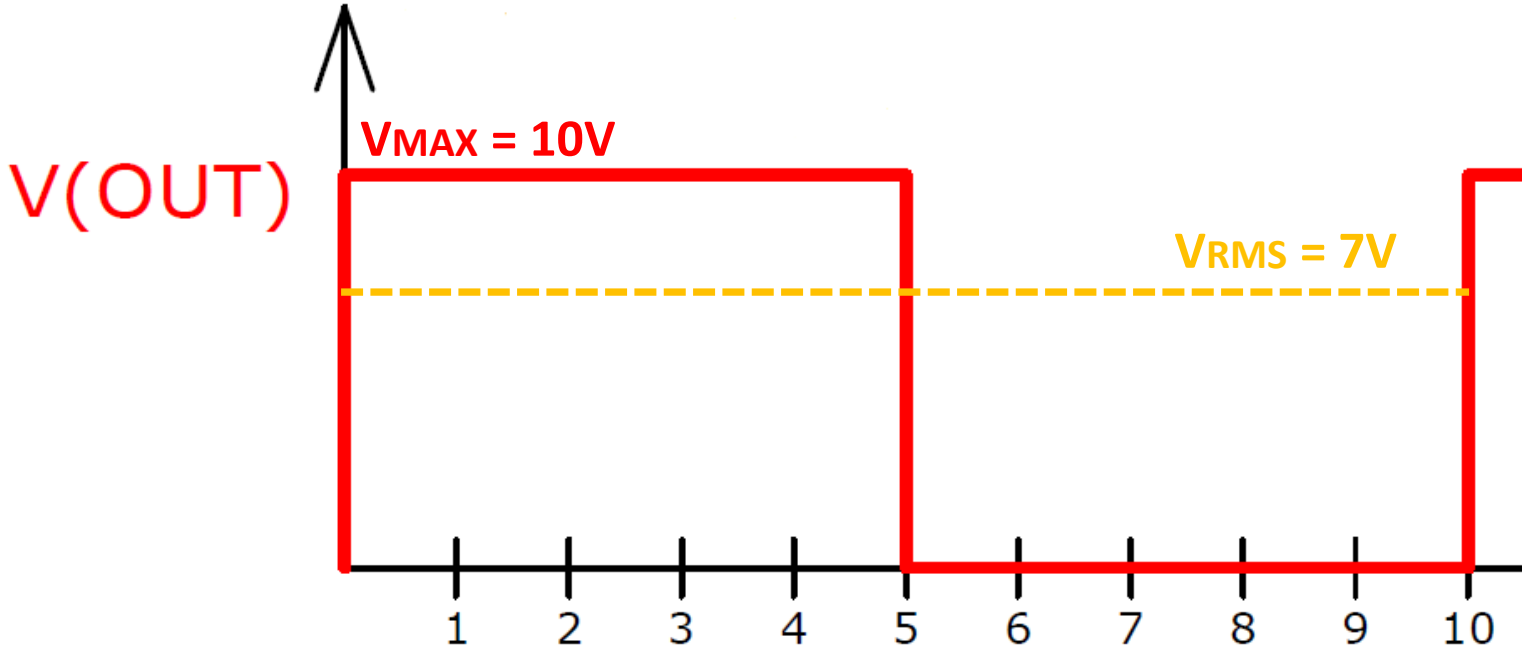


$$V(OUT)_{RMS} = \sqrt{\delta * V(IN)_{MAX}{}^{2}}$$

ELECTRIVIAL TUTORIALS

Effectieve waarde (R.M.S.)

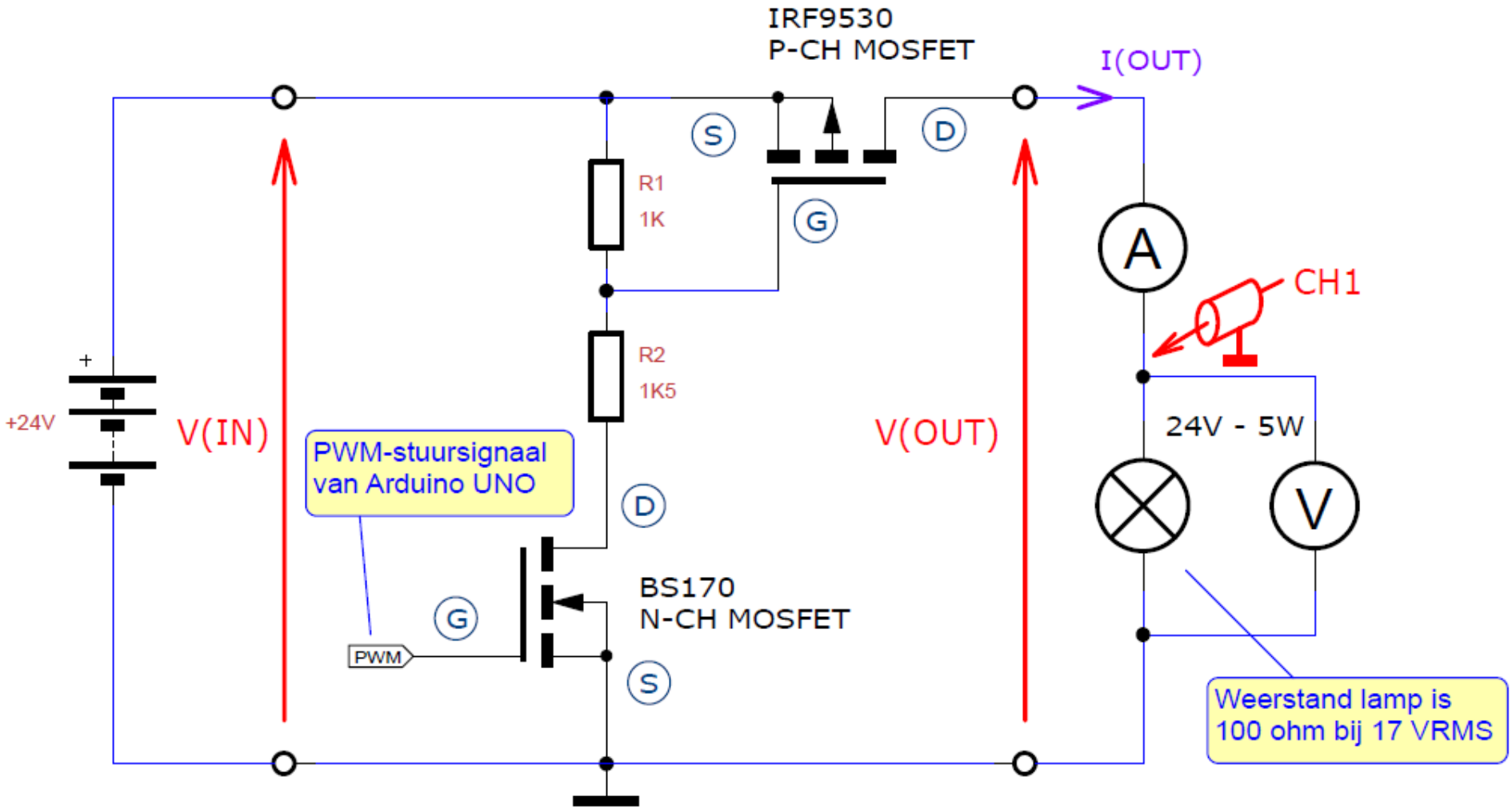
"Vierkantswortel van het gemiddelde van het kwadraat"



$$V(OUT)_{RMS} = \sqrt{0{,}5 * 10^2} = 7{,}07\ V$$

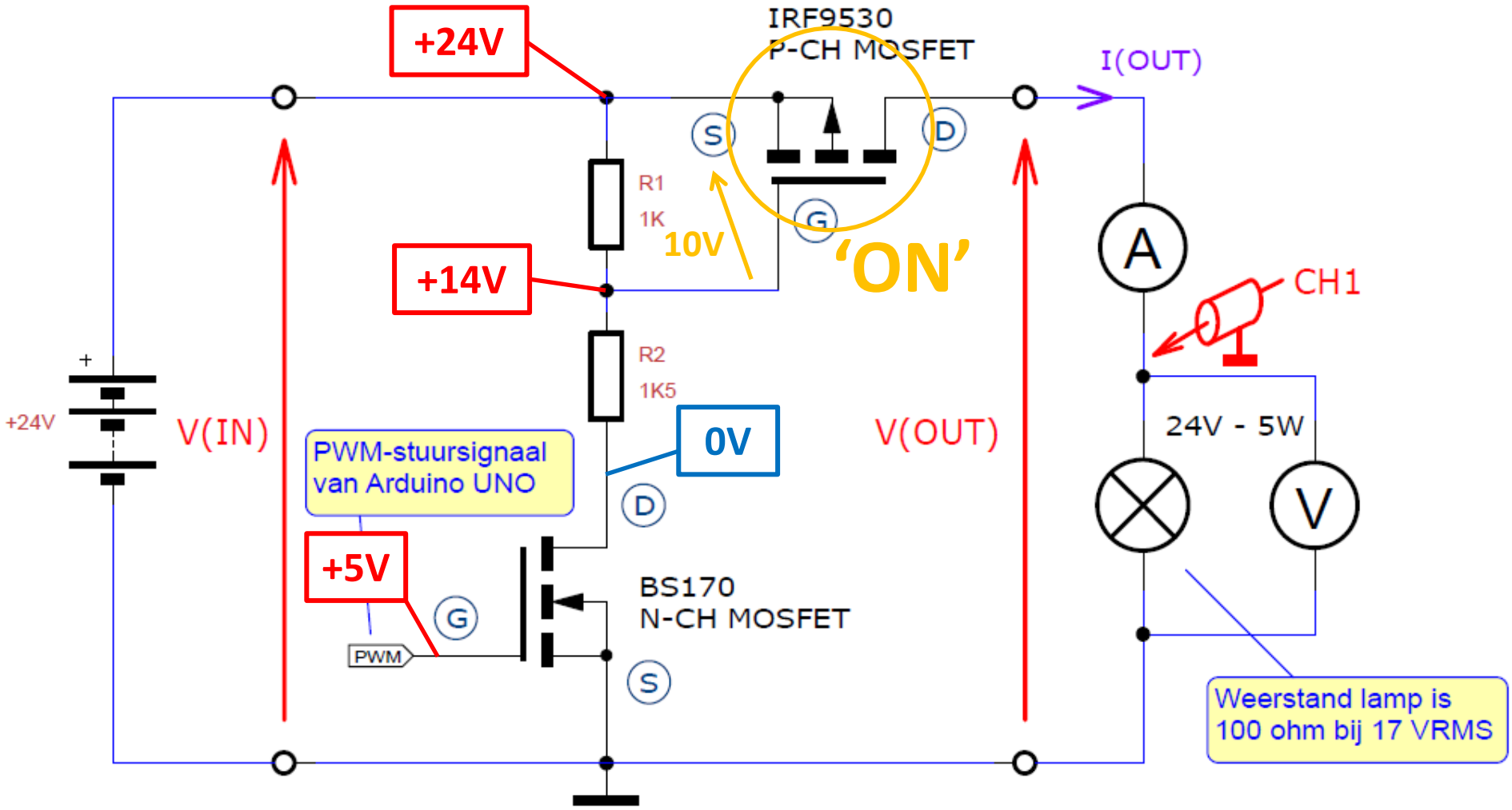
ELECTRIVIAL TUTORIALS

Praktische chopper



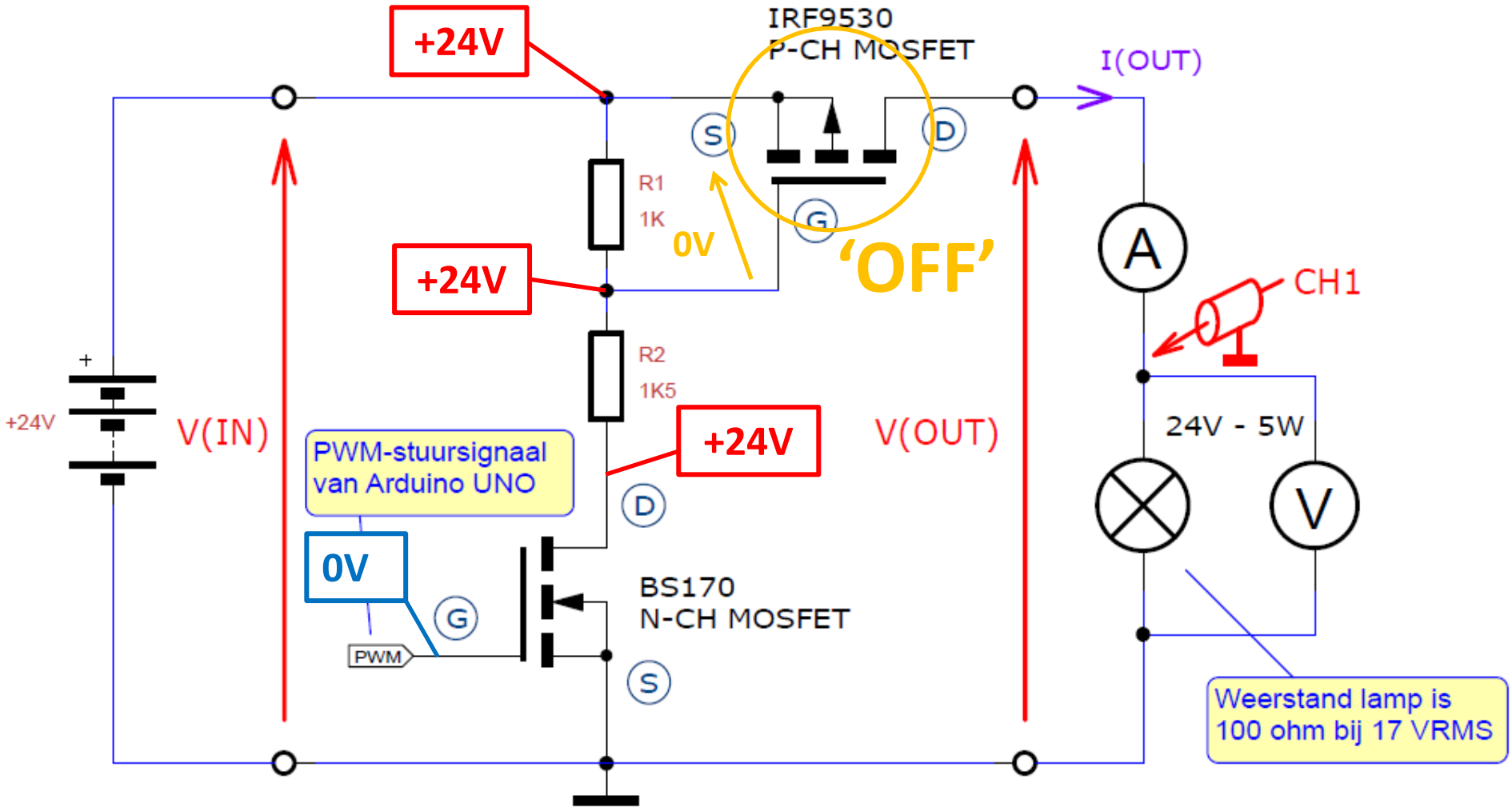
ELECTRIVIAL TUTORIALS

Praktische chopper



ELECTRIVIAL TUTORIALS

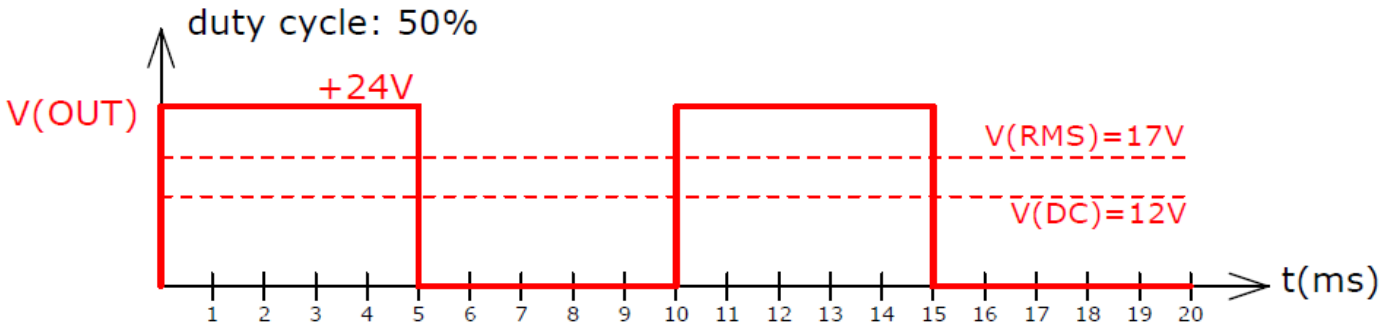
Praktische chopper



ELECTRIVIAL TUTORIALS

Voorbeeld

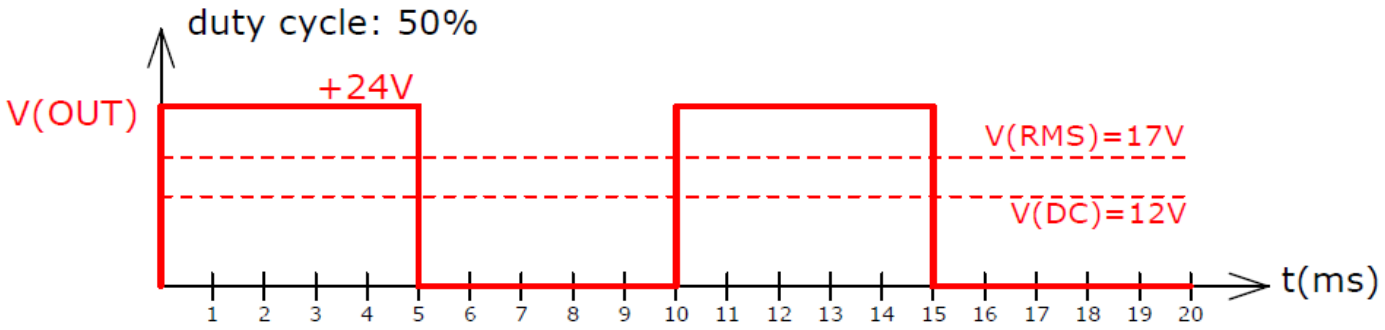
V(IN) = 24 V duty cycle = 50% RL = 100 Ω



ELECTRIVIAL TUTORIALS

Voorbeeld

V(IN) = 24 V duty cycle = 50% RL = 100 Ω



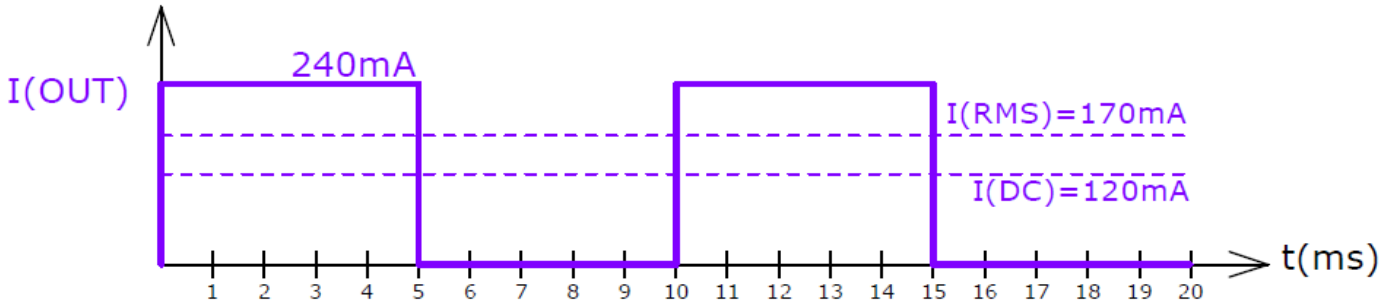
$$V(OUT)_{DC} = 0{,}5 * 24\,V = 12\,V$$

$$V(OUT)_{RMS} = \sqrt{0{,}5 * 24^2} = 17\,V$$

ELECTRIVIAL TUTORIALS

Voorbeeld

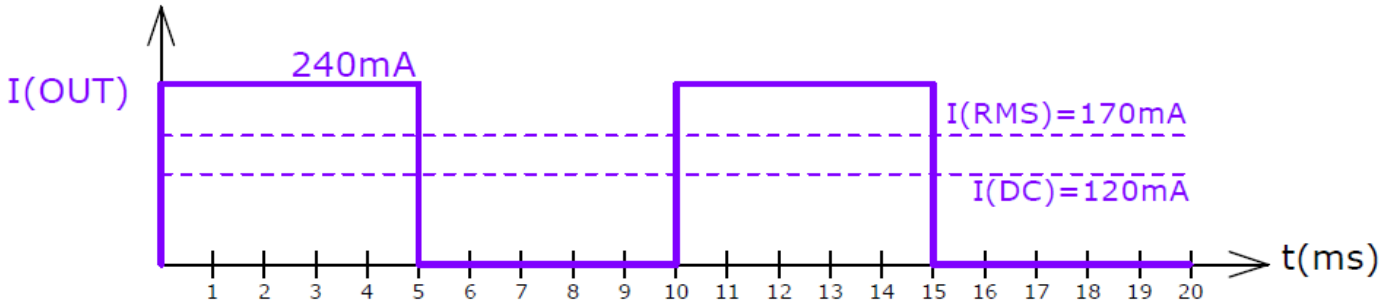
V(IN) = 24 V duty cycle = 50% RL = 100 Ω



ELECTRIVIAL TUTORIALS

Voorbeeld

V(IN) = 24 V duty cycle = 50% RL = 100 Ω

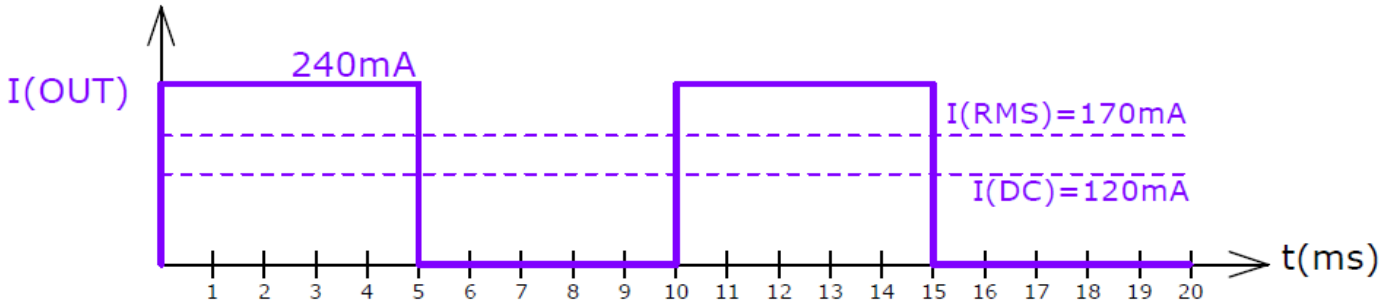


$$I_{MAX} = \frac{V_{MAX}}{R_L} = \frac{24\ V}{100\ \Omega} = 240\ mA$$

ELECTRIVIAL TUTORIALS

Voorbeeld

V(IN) = 24 V duty cycle = 50% RL = 100 Ω



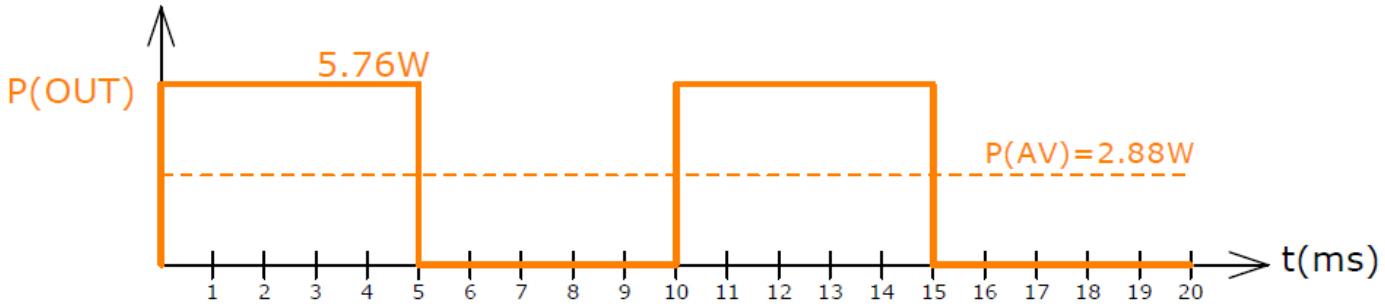
$$I_{DC} = \delta * I_{MAX} = 0{,}5 * 240\,mA = 120\,mA$$

$$I_{RMS} = \sqrt{\delta * I_{MAX}^2} = \sqrt{0{,}5 * 240^2} = 170\,mA$$

ELECTRIVIAL TUTORIALS

Vermogencontrole

V(IN) = 24 V duty cycle = 50% RL = 100 Ω



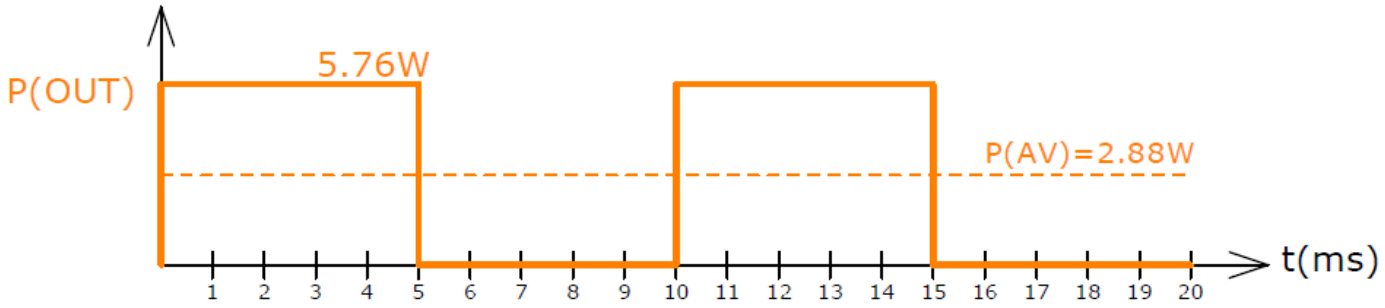
$$P_{MAX} = V_{MAX} * I_{MAX}$$

$$P_{MAX} = 24\,V * 240\,mA = 5{,}76\,W$$

ELECTRIVIAL TUTORIALS

Vermogendissipatie in de belasting

V(IN) = 24 V duty cycle = 50% RL = 100 Ω



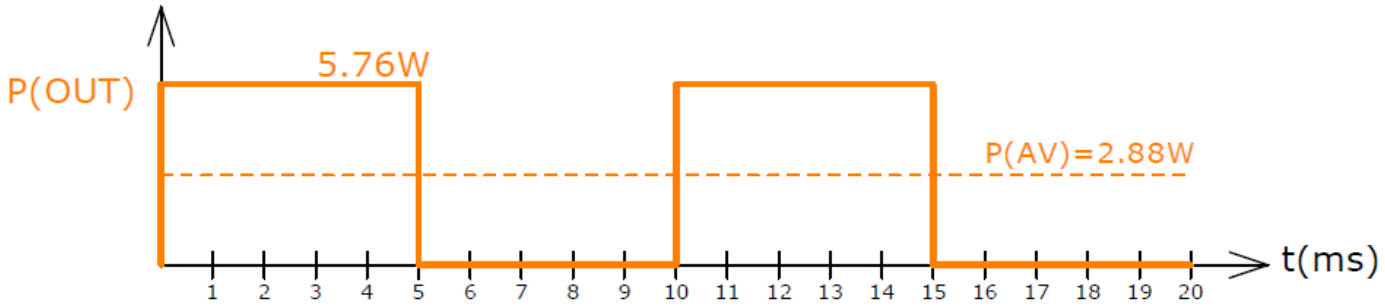
$$P_{RL} = \delta * V_{MAX} * I_{MAX}$$

$$P_{RL} = 0{,}5 * 5{,}76\,W = 2{,}88\,W$$

ELECTRIVIAL TUTORIALS

Vermogendissipatie in de belasting

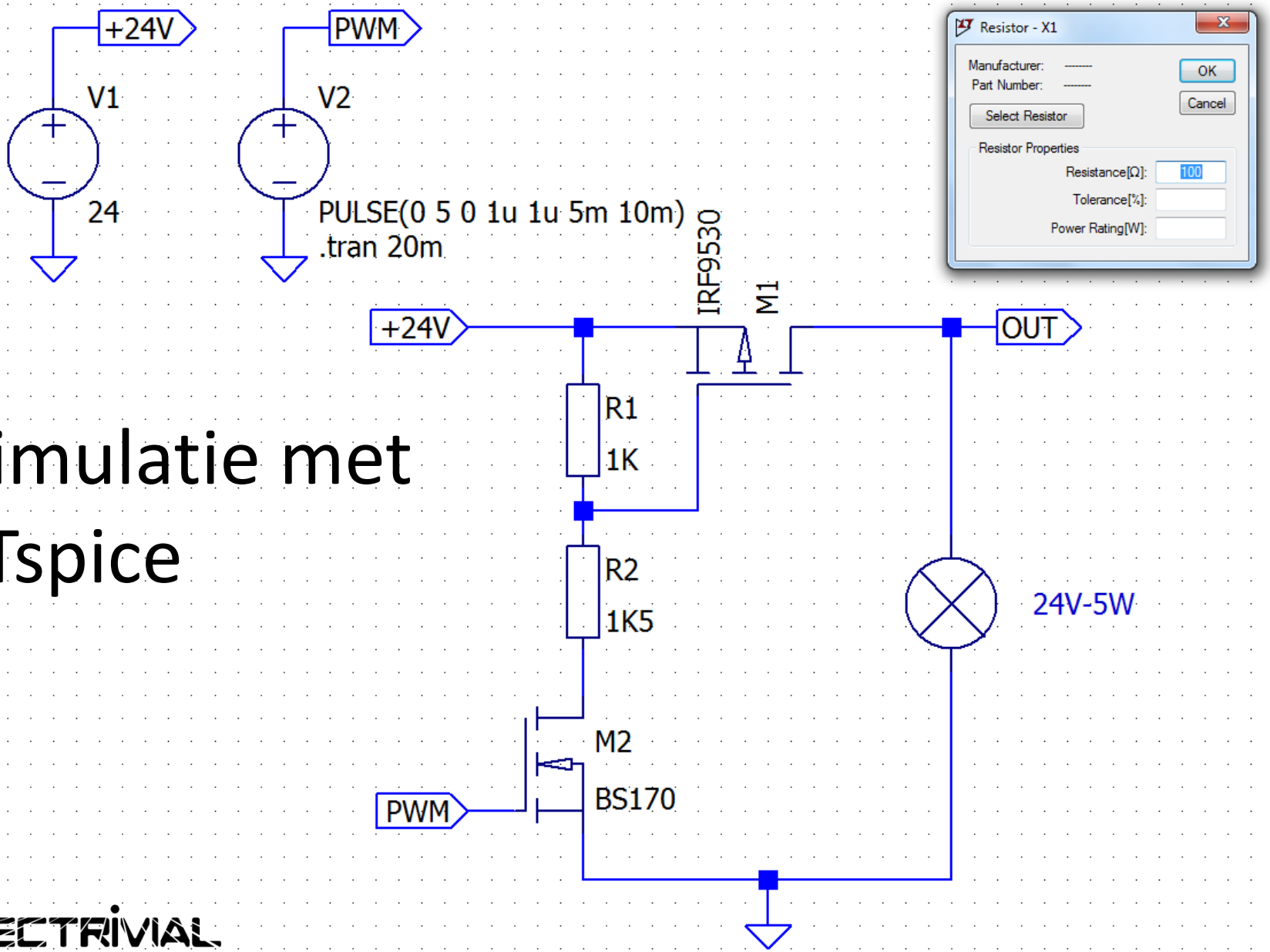
V(IN) = 24 V duty cycle = 50% RL = 100 Ω



$$P_{RL} = V_{RMS} * I_{RMS}$$

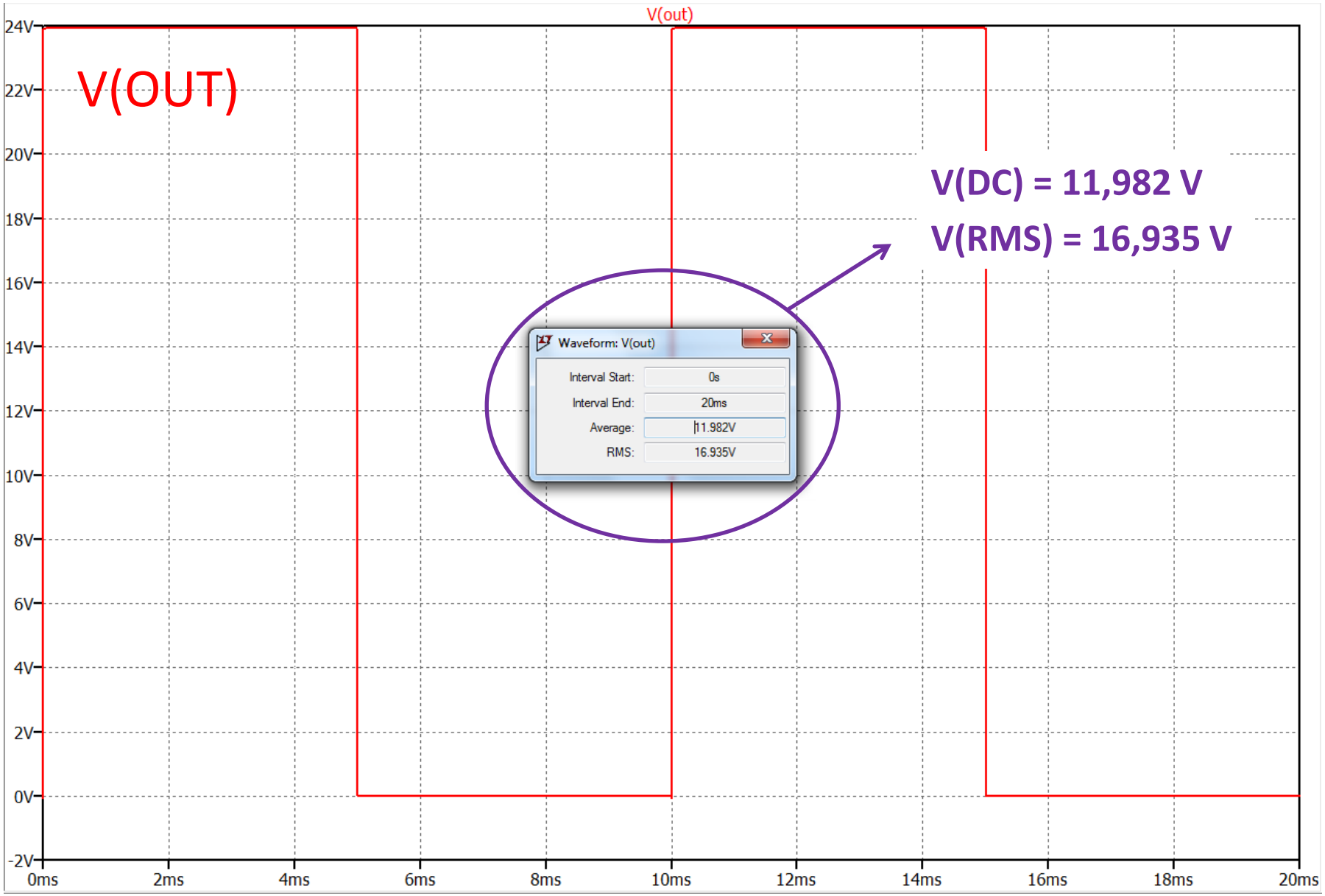
$$P_{RL} = 17\,V * 0{,}17\,A = 2{,}88\,W$$

ELECTRIVIAL TUTORIALS

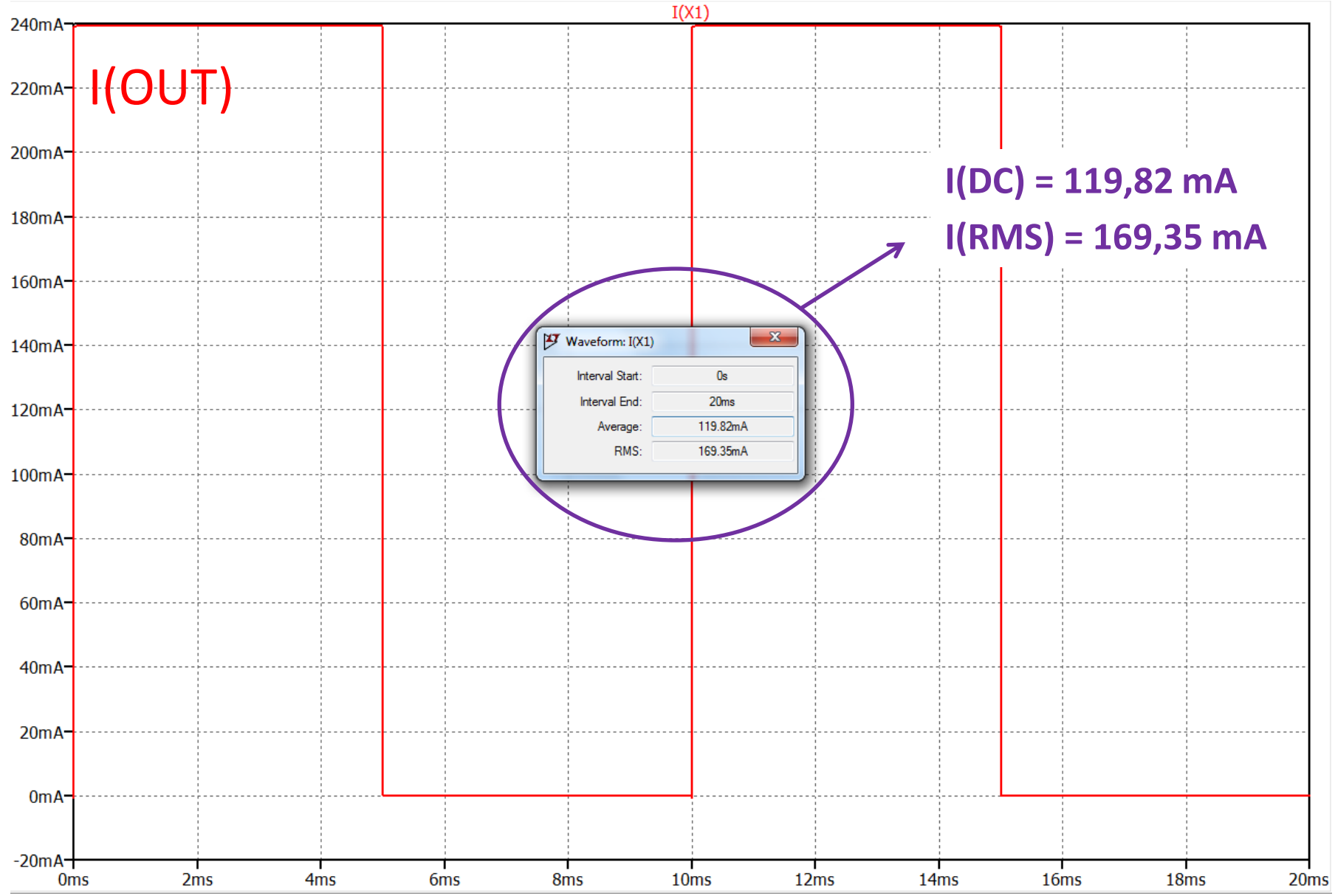


Simulatie met LTspice

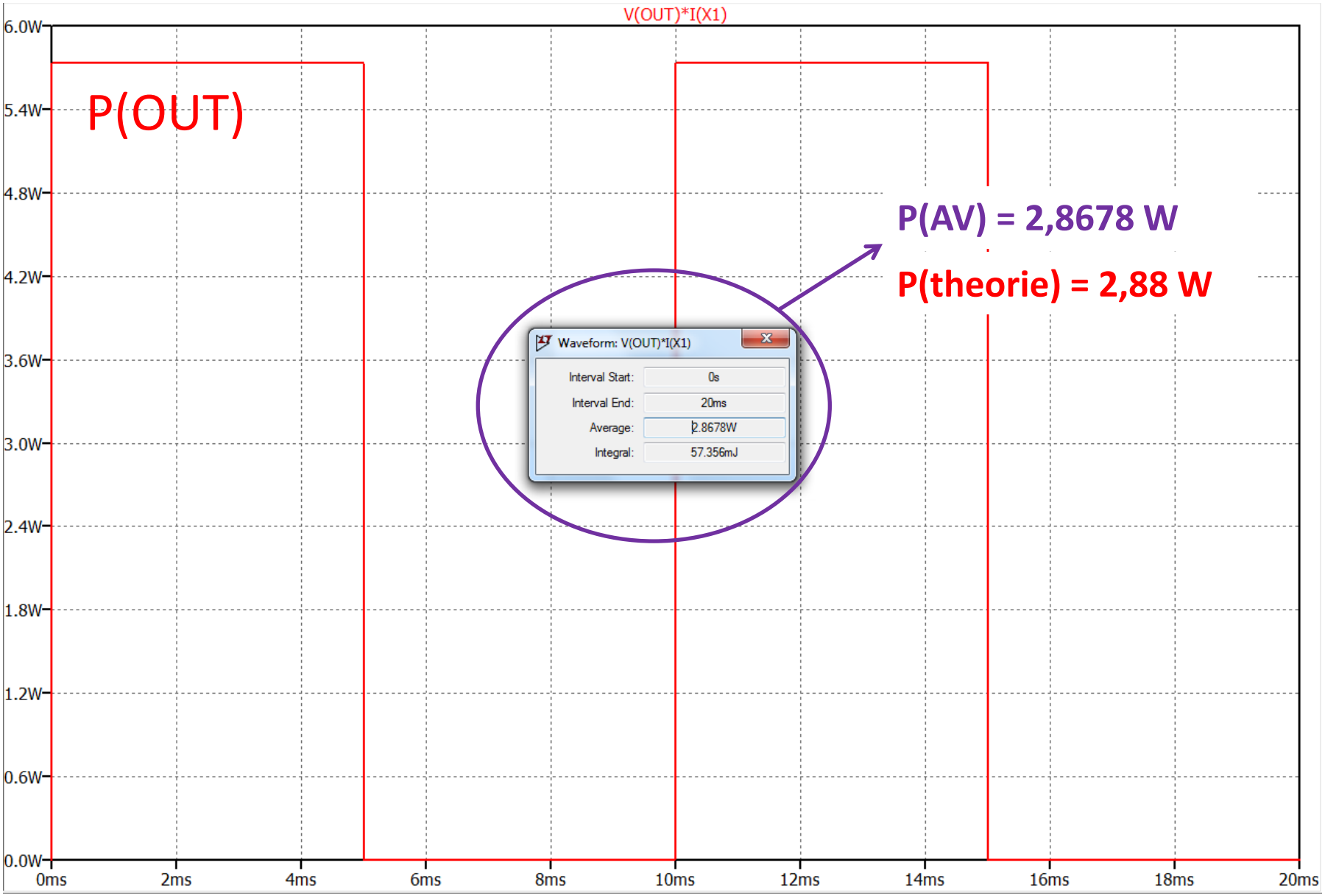
ELECTRIVIAL TUTORIALS



ELECTRIVIAL TUTORIALS



ELECTRIVIAL TUTORIALS



ELECTRIVIAL TUTORIALS

EINDE

CREATIE & VOICE-OVER

W. Van Wichelen

DATUM SCREENCAST

2021.02.09

DOELPUBLIEK

Industriële ICT

Elektromechanica

GEBRUIKTE SOFTWARE

iSpring Free Cam

DATUM PUBLICATIE

2021.02.09

LEERPLANDOELEN

OO-2017-005/26-29

2016-024/110/111/112

183/184

ELECTRIVIAL TUTORIALS