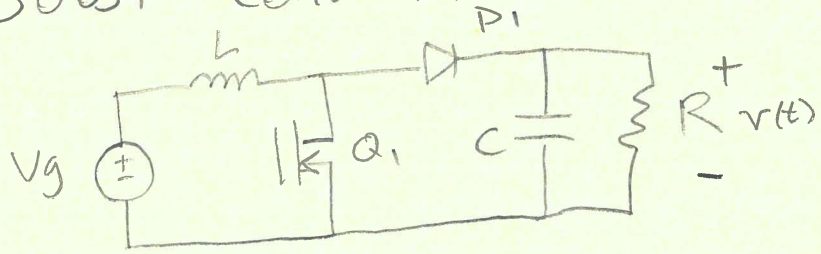
Boost Converter



$V_g = 48V$

$v(t) \approx V = 120V$

$P_{out} = 150W$

$f_{sw} = 100kHz$

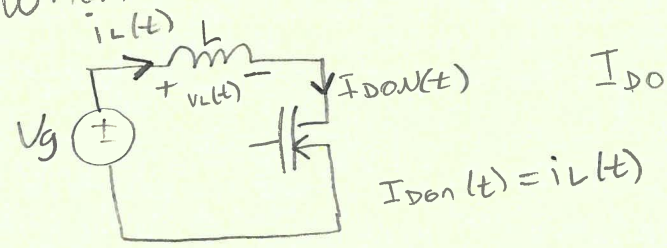
$\Delta i_L = 20\% I_L$

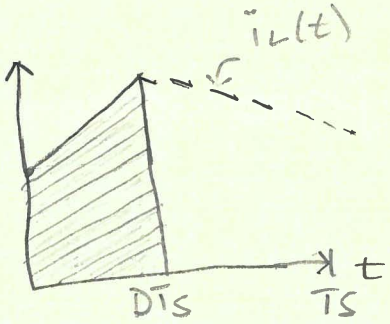
$\Delta V = 100mV$

Q_1 - IRFR18N15D

D_1 - BYW29-D

To find I_{DON}, consider current through Q_1 when Q_1 is on





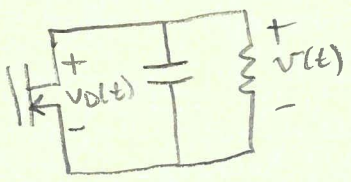
When Q_1 is on, switch current, $I_{Don}(t)$ is equal to inductor current. If we apply SRA: $I_{Don}(t) \approx I_L$

for a Boost $\quad \langle i_L(t) \rangle_{Ts} = \dfrac{V}{D'R} = I_L$

$$I_{Don}(t) \approx \frac{V}{D'R} \approx \underline{10.4167A} \text{ @ } 500W$$

per mfile variable "IDONmax"

To find blocking voltage, VD, consider voltage across Q_1 when off



$v_D(t) = v(t)$

By SRA

$v_D(t) \approx \underline{V = 120V}$

To find k and V_{Th} pick two points from I_D vs V_{GS} curve of IRFR18N15D 25°C

$I_{D1} = 1A \quad I_{D2} = 20A$

$V_{GS1} = 6V \quad V_{GS2} = 8V$

$$I_{D1} = k(V_{GS1} - V_{Th})^2$$
$$I_{D2} = k(V_{GS2} - V_{Th})^2$$

$$1 = k(6 - V_{Th})^2$$
$$20 = k(8 - V_{Th})^2$$

$$1 = k(6 - V_{Th})(6 - V_{Th})$$
$$20 = k(8 - V_{Th})(8 - V_{Th})$$

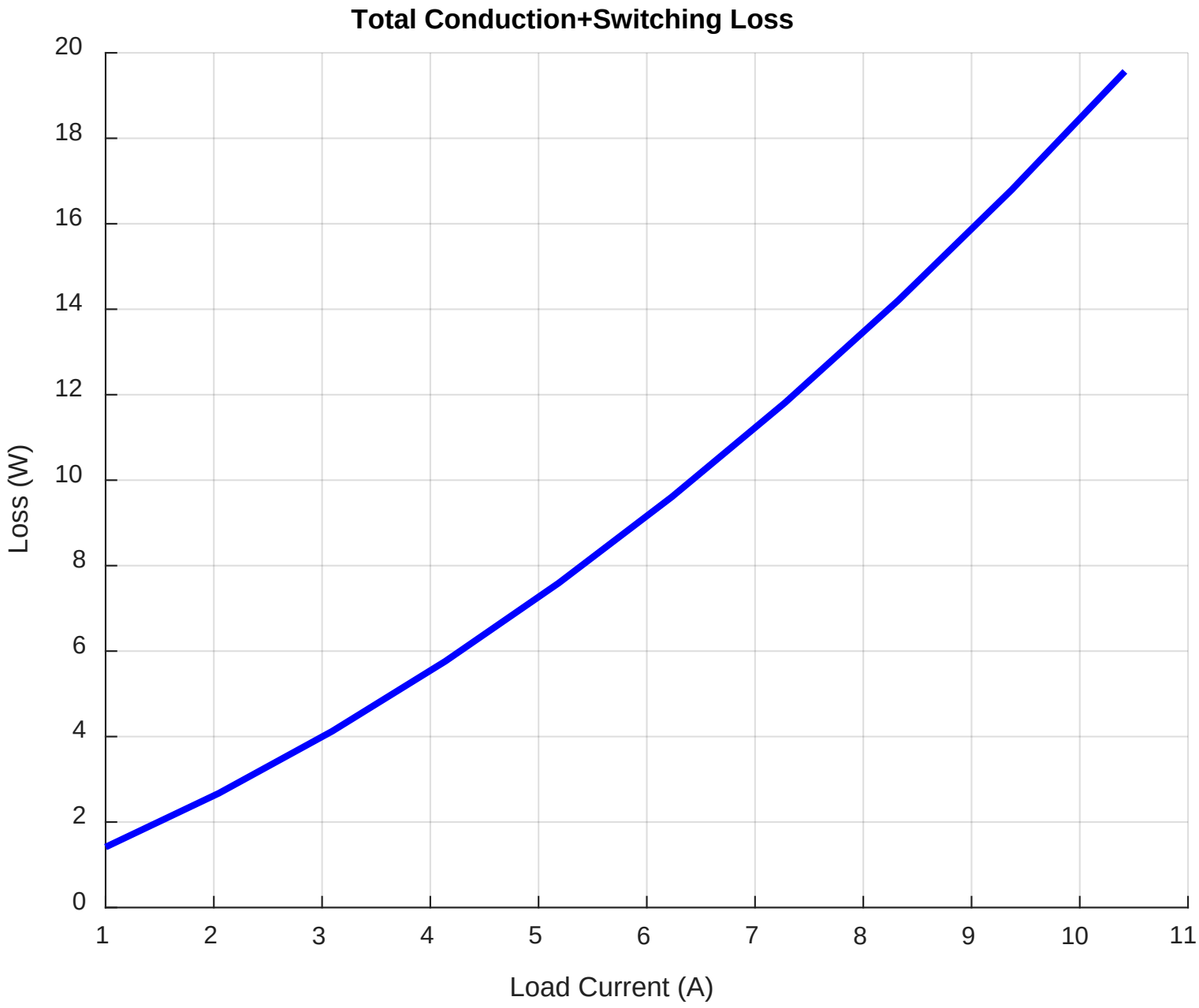
$$1 = k[36 - 6V_{Th} - 6V_{Th} + V_{Th}^2] \quad (1)$$
$$20 = k[64 - 8V_{Th} - 8V_{Th} + V_{Th}^2] \quad (2)$$

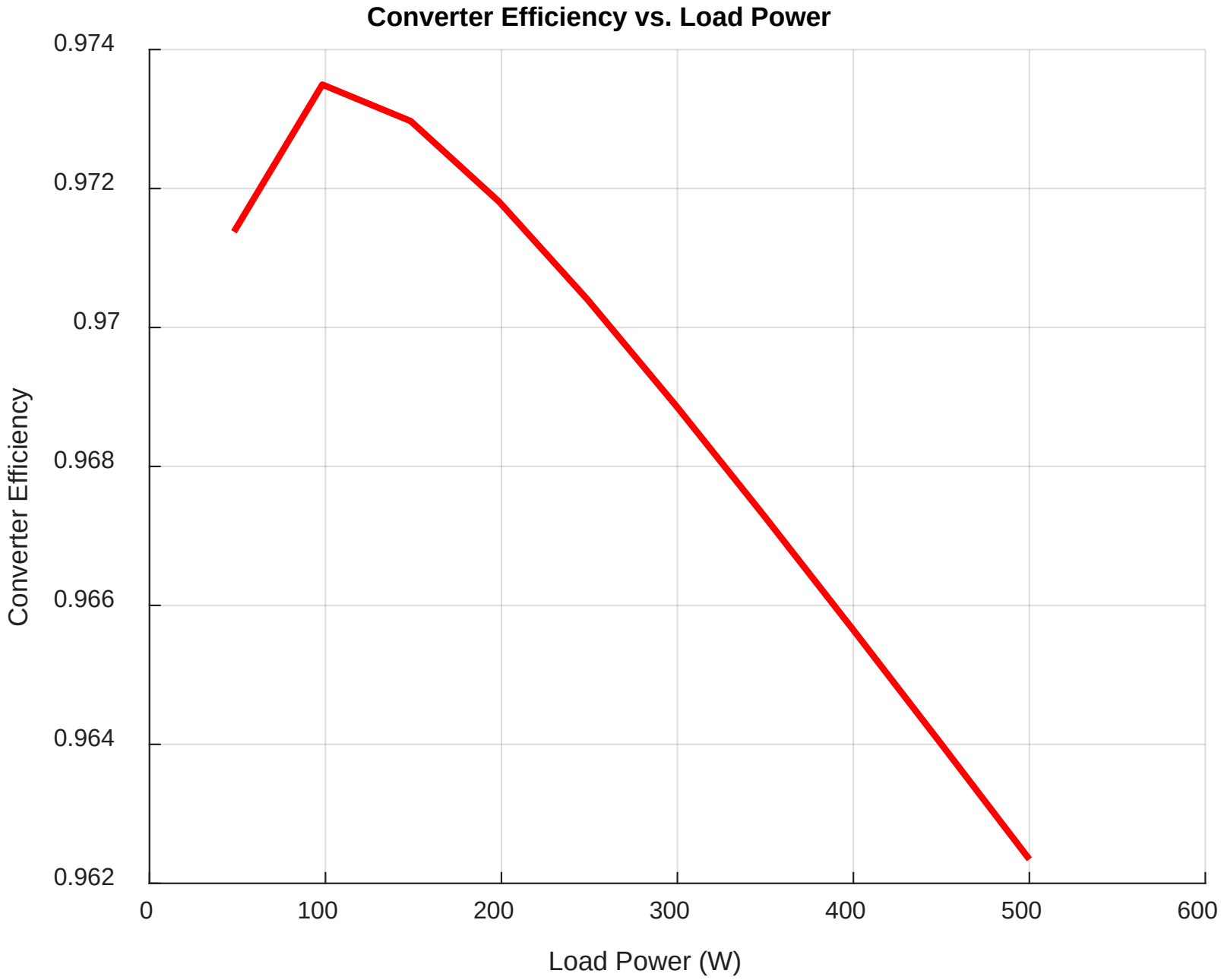
Solve (1) + (2) for k and V_{Th}

$$k = 3.0139$$

$$V_{Th} = 5.4239$$

When multiple solns exist, pick soln corresponding closest to $V_{GS(Th)}$ parameter in datasheet


Total Conduction+Switching Loss
Loss (W)
0
2
4
6
8
10
12
14
16
18
20
1
2
3
4
5
6
7
8
9
10
11
Load Current (A)


Converter Efficiency vs. Load Power
0.974
0.972
0.97
0.968
0.966
0.964
0.962
Converter Efficiency
0
100
200
300
400
500
600
Load Power (W)