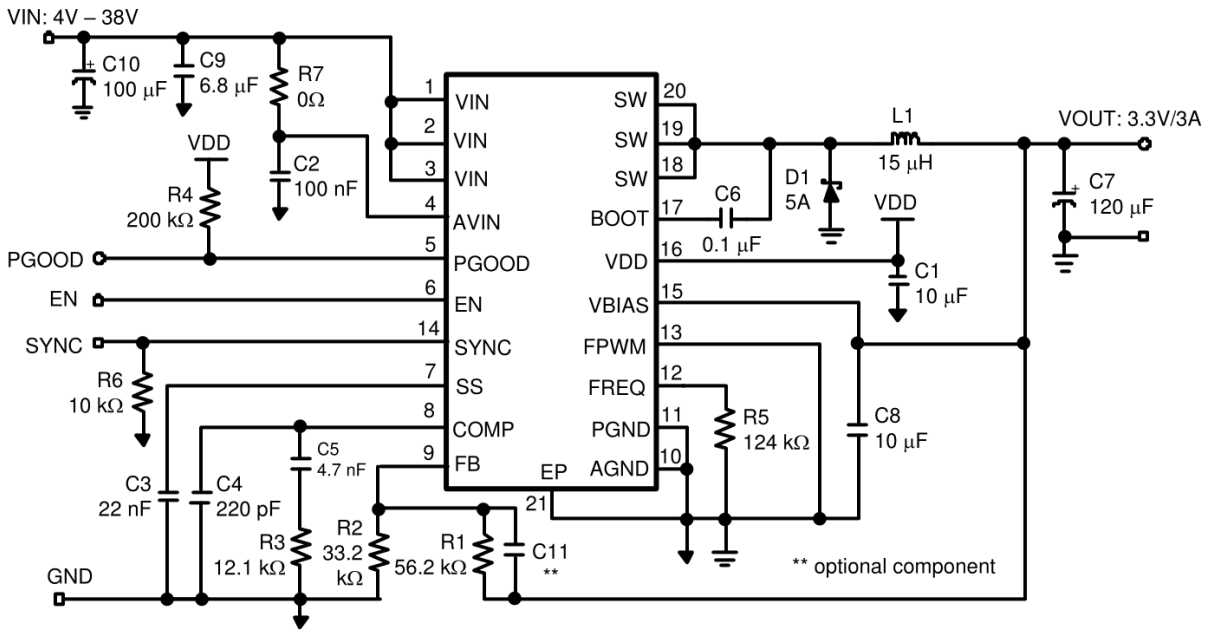

Figure 16. Example Circuit 3A, 300 kHz

Det anbefales at læse databladet for LM26003 s. 18 og frem sammen med disse udregninger. (../Datablade/lm26003.pdf)
Til dette design skal følgende parametre bestemmes: VOUT, VIN min, VIN max, Iout max, fsw, fbw

Output voltage:

$$Vfb := 1.235\ V \qquad VOUT := 5\ V$$

$$R2 = \frac{R1}{\left(\frac{Vout}{Vfb} - 1\right)} \xrightarrow{solve, Vout} 1.235 \cdot V \cdot \left(\frac{R1}{R2} + 1.0\right)$$

$$R2 + R1 \leq 150\ k\Omega$$

$$R1 := 82\ k\Omega \qquad R2 := 27\ k\Omega$$

$$VOUT := 1.235 \cdot V \cdot \left(\frac{R1}{R2} + 1.0\right) = 4.986\ V$$

Inductor:

$$VIN := 7.2\ V \qquad fsw := 100\ kHz \qquad Iripple := 5\% \cdot 2\ A = 100\ mA$$

$$L_{min} := \frac{(VIN - VOUT) \cdot VOUT}{fsw \cdot Iripple \cdot VIN} = 153.329\ \mu H$$

Output capacitor C7:

$\Delta Vt := 0.3\ V$ $\Delta It := 1\ A$ Skud fra hoften

$Re_{max} := \frac{\Delta Vt}{\Delta It} = (300 \cdot 10^{-3})\ \Omega$ $Re := 0.063\ \Omega$ ESR

$$C_{min} := L \cdot \frac{\left(\Delta Vt - \sqrt{\Delta Vt^2 - (\Delta It \cdot Re)^2}\right)}{VOUT \cdot Re^2} = 338.056\ \frac{m \cdot s^2 \cdot A^2}{kg} \cdot \mu F$$

$C_{out} := 100\ \mu F$

Input capacitor:

$I_{load} := 2\ A$

$$I_{rms} := \frac{I_{load} \cdot \sqrt{VOUT \cdot (VIN - VOUT)}}{VIN} = 922.947\ mA$$

$C_{10} := 100\ \mu F$

$C_9 := 10\ \mu F$

Bootstrap:

$Cboot := 50\ nF$

Catch diode:

$Iload := 2\ A$

$$I_{D.avg} := Iload \cdot \left(1 - \frac{VOUT}{8.2\ V}\right) = 783.966\ mA$$

Feedback transfer function / compensation:

$$fz := \frac{1}{2\ \pi \cdot Re \cdot C_{10}} = 25.263\ \textbf{kHz}$$

$$fp := \frac{1}{20\ \pi \cdot \frac{VOUT}{2\ \textbf{A}} \cdot C_{10}} + \frac{0.5}{2 \cdot \pi \cdot L_{min} \cdot fsw \cdot C_{10}} = 115.744\ \textbf{Hz}$$

$$fn := \frac{fsw}{2} = 50\ \textbf{kHz}$$

$$B := 3.3\ \frac{\textbf{V}}{\textbf{V}}$$

$gm := 675 \cdot 10^{-6} \cdot \textbf{S}$ fra databladet, typical. 400-1000 ellers

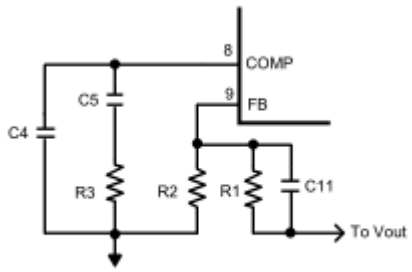

Figure 19. Compensation Network

$$R3 := \frac{B}{gm} \cdot \left(\frac{R1 + R2}{R2}\right) = 19.737\ \textbf{k}\Omega$$

$$R1 = \left(82 \cdot 10^{3}\right)\ \Omega$$

$fp_{MAX} := 1000\ \textbf{Hz}$ $fp_{MIN} := 100\ \textbf{Hz}$

$$C5 := \frac{1}{2 \cdot \pi \cdot fp_{MAX} \cdot R3} = 8.064\ \textbf{nF}$$

$$C4 := \frac{1}{2 \cdot \pi \cdot fz \cdot R3} = 319.204\ \textbf{pF}$$ Behøves måske ikke, mindsker støj

Kerne data fundet i Epcos_ETD29_16_10.pdf:

$gap := 0.5\ \textbf{mm}$

$$L_{min} = \left(153.329 \cdot 10^{-6}\right)\ \textbf{H}$$

$A_L := 200 \cdot 10^{-9} \cdot \textbf{H} \cdot 95\%$ per vinding

$$\sqrt{\frac{0.7\ \textbf{mm}^2}{\pi}} = 472.035\ \boldsymbol{\mu}\textbf{m}$$

$N_{primær} := 29$

$$N_{sekundær} := \text{round}\left(N_{primær} \cdot \frac{3.4\ \textbf{V}}{VOUT + 0.4\ \textbf{V}}\right) = 18$$

$viklebredde := 28\ \textbf{mm}$

$$L_{primær} := N_{primær}^{\ 2} \cdot A_L = \left(159.79 \cdot 10^{-6}\right)\ \textbf{H}$$

$$VOUT_{3V} := (VOUT + 0.4\ \textbf{V}) \cdot \frac{N_{sekundær}}{N_{primær}} = 3.343\ \textbf{V}$$

$A_e := 234$ $[m^2]$

$L_e := 97$ $[m]$ $\mu_i := 2200$ $A_L := 1439$

$L_g := \left(\frac{4\ \pi \cdot A_e}{A_L}\right) - \left(\frac{L_e}{\mu_i}\right) = 1.999$ $[mm]$ total spalte

Genberegninger af udgangsskondensator og diode for 3V udgangen:

Catch diode:

$Iload := 2\ A$

$I_{D.avg} := Iload \cdot \left(1 - \frac{VOUT}{8.2\ V}\right) = 783.966\ mA$

Output capacitor C12:

$\Delta Vt := 0.2\ V$ $\Delta It := 20\ mA$ Skud fra hoften

$Re_{max} := \frac{\Delta Vt}{\Delta It} = 10\ \Omega$ $Re := 0.063\ \Omega$ ESR

$L := N_{sekundær}^{\ 2} \cdot 1439 \cdot 10^{-9} \cdot H \cdot 75\% = \left(349.677 \cdot 10^{-6}\right)\ H$

$C_{min3V} := L \cdot \frac{\left(\Delta Vt - \sqrt{\Delta Vt^2 - (\Delta It \cdot Re)^2}\right)}{VOUT_{3V} \cdot Re^2} = \left(104.605 \cdot 10^{-3}\right)\ \mu F$

$C_{out3V} := 100\ \mu F$

Vikling af spole/transformer

$N_{primær} = 29$

$N_{sekundær} = 18$

$20\ mm \cdot \pi \cdot 29 = 1.822\ m$

$$\frac{20\ mA}{\left(\frac{0.4\ mm}{2}\right)^2 \cdot \pi} = \left(159.155 \cdot 10^{-3}\right) \frac{A}{mm^2}$$

$$\frac{20\ mA}{0.4\ mm^2} = \left(50 \cdot 10^{-3}\right) \frac{A}{mm^2}$$

$$\frac{0.183\ \Omega}{15} = \left(12.2 \cdot 10^{-3}\right)\ \Omega$$

$$\frac{0.151\ \Omega}{18} = \left(8.389 \cdot 10^{-3}\right)\ \Omega$$