# Formulas

## D = Duty Cycle

### Approximate

Approximately D = VOUT / VIN

#### For 1.1V:

* D = 1.1 / 5 = 0,22
* D = 1.1 / 3.3 = 0,33

#### For 1.2 V:

### Accurate

Accurately D = (VOUT + VSW\_BOT) / (VIN + VSW\_BOT - VSW\_TOP)

#### For 1.1V:

* **D** = (1.1 + 0.1) / (5 + 0.1 – 0.15) = 1.2 / 4,95 = **0,243**

## Peak Current Inductor

**The typical current limit is 3.3 A!** (too high)

### Internal voltage-drops (needed for calc.)

VSW\_BOT = Voltage drop across internal NMOS ()

VSW\_TOP = Voltage drop across internal PMOS ()

NMOS Resistance = 50 mOhm (RDSON\_BOT)

PMOS Resistance = 75 mOhm (RDSON\_TOP)

Typically:

IOUT = 2 A

VSW\_BOT = R x I => 0.05 x 2 = 0.1 V

VSW\_TOP = 0.075 x 2 = 0.15 V

### Peak Current

Peak current inside of Inductor = ILPK

ILPK = IOUT + Delta-iL

* **ILPK**= 2 + 0.4 = **2.4 A**

In general:

Delta-iL = 0.1 x IOUT => 0.2 x IOUT

(0.2 = 20% of IOUT)

=> **Delta-iL** = 0.2 x 2 = **0.4 A**

### Inductor value:

VIN – VOUT / L = (2 x Delta-iL) / (D x Ts)

Ts = 1/fs

* 1 / 2.15 Mhz = 4,6511627906976744186046511627907e-7 (4,65 nS??)

L = ( (D x Ts) / (2 x Delta-iL)) x (VIN - VOUT)

#### For 1.1V:

**D** = **0,243**

**ILPK**= **2.4 A** (true IOUT)

**Ts = 4.65e-7**

**Delta-iL** = **0.4 A**

L = ((0.243 x 4.67e-7) / (2 x 0.4)) x (5 – 1.1)

* L = ((1.13e-7) / (0.8)) x (3.9)
* L = (1.41e-7) x 3.9 = 5.51e-7 = 0.55 uH

**L = 0.55 uH**

LT = (L1 x L2) / (L1 + L2)

* 0.55 = (1 x L2) / (1 + L2)
* 0.55 x (1+L2) = (1 x L2)
* 0,55 + 0,55L2 = (1 x L2)
* ((0,55/0,55) + (0,55 x L2 /0,55)) = (1 x L2)/0.55
* 1 + L2 = 1.818
* **L2 = 0,818 uH**

## Programming Output Voltage

R1 = ((VOUT / VREF) - 1) x R2

VREF = 0.8 V (apparently…)

### If VOUT = 2.5V:

Attempt1:

R1 = ((2.5 / VREF) -1) x 10e+3

21.25e+3 = ((2.5 / VREF) – 1) x 10e+3

=> 2125 = ((2.5 / VREF) – 1

=> 2125 + 1 = (2.5 / VREF)

=> 2126 x VREF = 2.5

=> VREF = 2.5 / 2126

=> VREF = 0,001176 V = 1.18 mV

Attempt2:

R1 = ((2.5 / 0.8) – 1) x 10,000

=> R1 = (3.125 – 1) x 10,000

=> R1 = 2.125 x 10,000 **= 21.25 Kohm**

### If VOUT = 1.1V:

R1 = ((1.1 / 0.8) – 1) x 10,000

R1 = (1.375)-1) x 10,000

R1 = 0.375 x 10,000

**R1 = 3.75 Kohm**

### If VOUT = 1.2V:

R1 = ((1.2/0.8)-1 x 10,000

R1 = ((1,5)-1 x 10k

R1 = 0,5 x 10k = 5k