2022/06/11

LTSpice ~~plotted~~ plot. stepped. meas data from Spice error log.

data vs step
↓
selected ~~trace~~ trace → x-axis ↓

can be ~~set~~ changed to other data

For example: Eff vs Iout

How to vary the output current when Vin=10 Vout = 3.3V.

$R_L = 10\Omega$?

Iout = mean value of I_L →

$$G_p(s) = \frac{V_o}{I_L} = \frac{R(1+sr_{esr}C)}{(1+sRC)} \Rightarrow \text{plant}$$

↙ Transfer function ☆ (need to learn) R Cout Freq

pole location

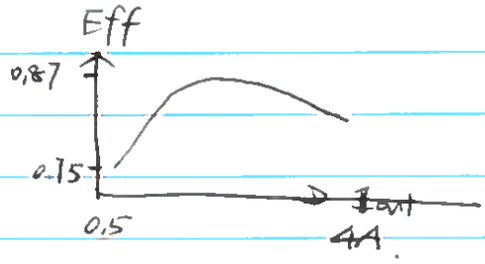
single pole

→ explore later

Q1 ⇒ ① Input V = 10V Vout = 3.3V.

R_L → 0 ~ 33Ω Iout = 0.5 ~ 4A

~~Vout~~ Pout or $\frac{P_{out}}{P_{in}}$ = Eff vs Iout.



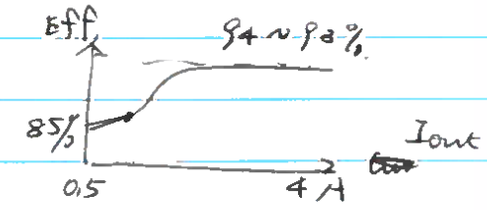
~~②~~ $Eff = 1 - \frac{P_{loss}}{P_{in}}$

$P_{loss} = I^2 \cdot R_{ds}$ conduction.

$P_{loss} = P_{conduction\ loss} + P_{switch\_loss}$

Q2 ⇒ Almost the same: Eff: ~~0.87~~ ~~0.15~~ 56.5% ~ 84%

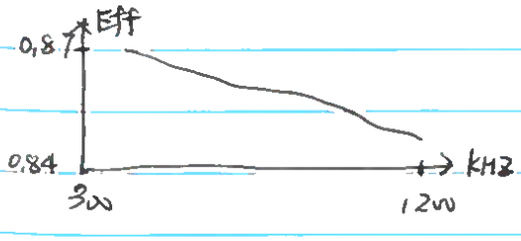
0.5 ~ 3.66A



Q3 Fswitching impacts converter efficiency.

F: 311.1kHz ~ 1198 kHz

Eff: 0.868 ~ 0.842



Switching Losses = $(E_{on} + E_{off})\, f_s$

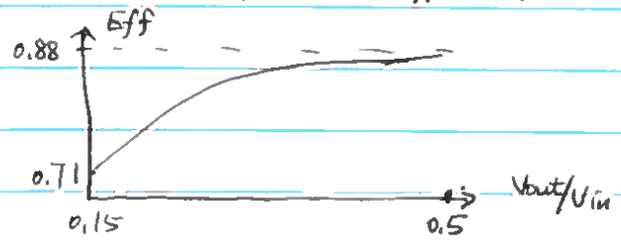
freq↑ Switching losses↑

$P_{switchloss} \propto f_s$

Q4. $\frac{V_{in}}{V_{out}}$ ratio impact Efficiency

$\frac{V_{out}}{V_{in}} = \frac{3.3}{10} = 0.33$ → duty cycle → higher ratio — higher efficiency

0.15 ~ 0.46Ω ⇒ Eff = 71% ~ 88%



during Toff. Inductor convert Energy to electrical energy (output)
This process is lossless
less Toff better efficiency
high D better eff.

Q5: LTSpice Gate resistor impacts converter's Efficiency

Rg. 0.1 1.6 3.5 1 → 37.07%

Pout/Pin 87.28% 80.60% 62.07%

As gate resistance increase, the switching process slow down. Yielding increasing switching loss. At same time. drive loss increase.

Q6: Rg↑ Voltage & Current overshoot of Mosfet ↓

the conduction time longer.

Gat resistor impact on Switching performance of MOSFET

Overshoot ↓ smaller Oscillation ↓ decrease

Transition time longer ↑ ~~efficiency ↓~~ ~~(switch losses)~~ ~~(resistance loss)~~

Q7: SyncBuck from "ON" to "OFF"

Botton MOSFET → Diode

Synchronous Non-Synchronous

Efficiency decrease since. Pswitchloss higher in Diode

$\frac{14.338}{17.22} = 83.26\%$ ↑ $\frac{14.28}{18.42} = 77.52\%$ ↓

2022/06/20

Arduinino Nano 33 IOT

→ 3.3 V device — Jumper - USB — VUSB — sending 3.3 V.

(SAMD21G 32-bit microcontroller) 48MHz. Internal Real-time Clock

(Wifi & Bluetooth using ublox NINA-W102 module) 2.4 GHz Antenna.

(LSM6DS3 IMU Intertial measurement unit)

{ A DC5 - SCL internal pull-up
{ ADC4 - SDA internal pullup

Modulation capable pin : PWM : D2 D3 D5 D6 D9 D10 D11 D12

Library : WiFiNINA - Wifi

Arduino LSM6DS3 - Intertial measurement

Arduino RTCZero - Real time Clock

Arduino BLE - Bluetooth

Download Arduino IDE

Jason Format → Example code

Arduino code → Example

pin configuration.

Arduino Nano 33 IOT

☆ → deserialization message (Jason Format)

→ set pin output (High / Low)

☆ Read Practable/penduino/ Example code.