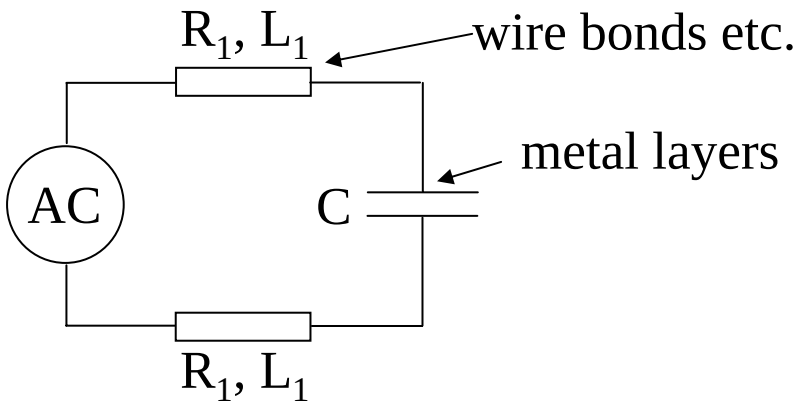
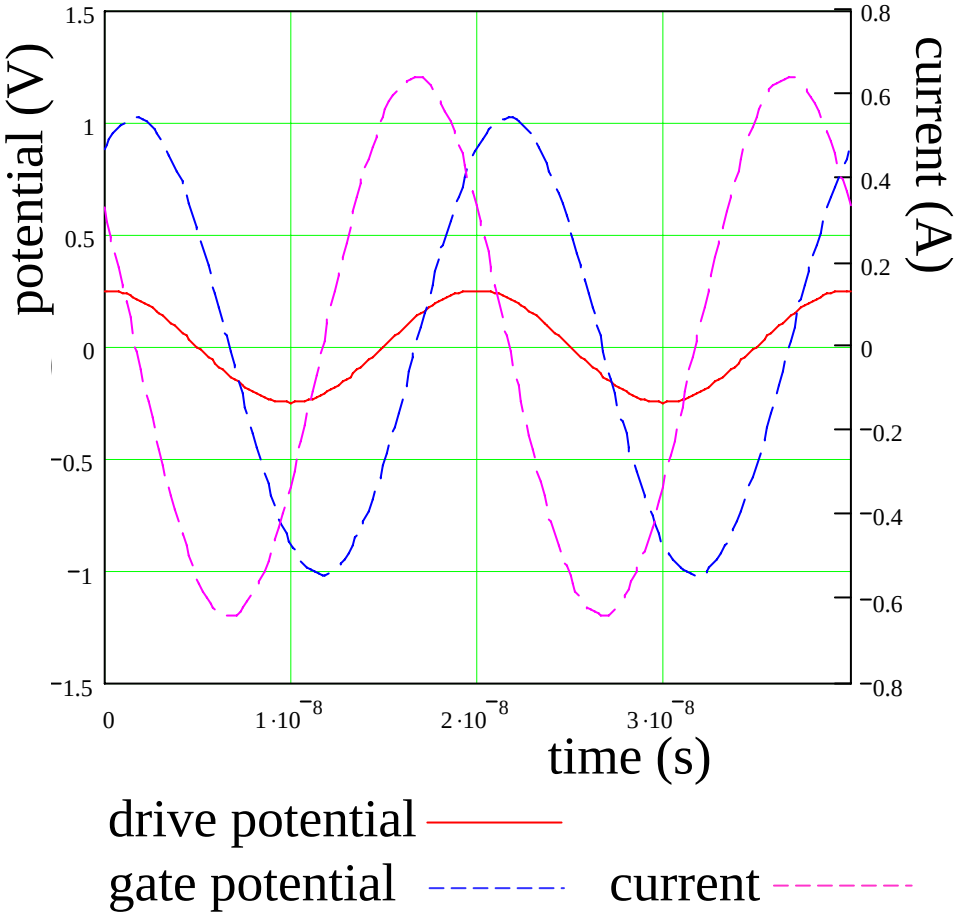
Thoughts on drive circuit for CPCCD

- Current drive circuit, showing only dominant(?) capacitances etc.



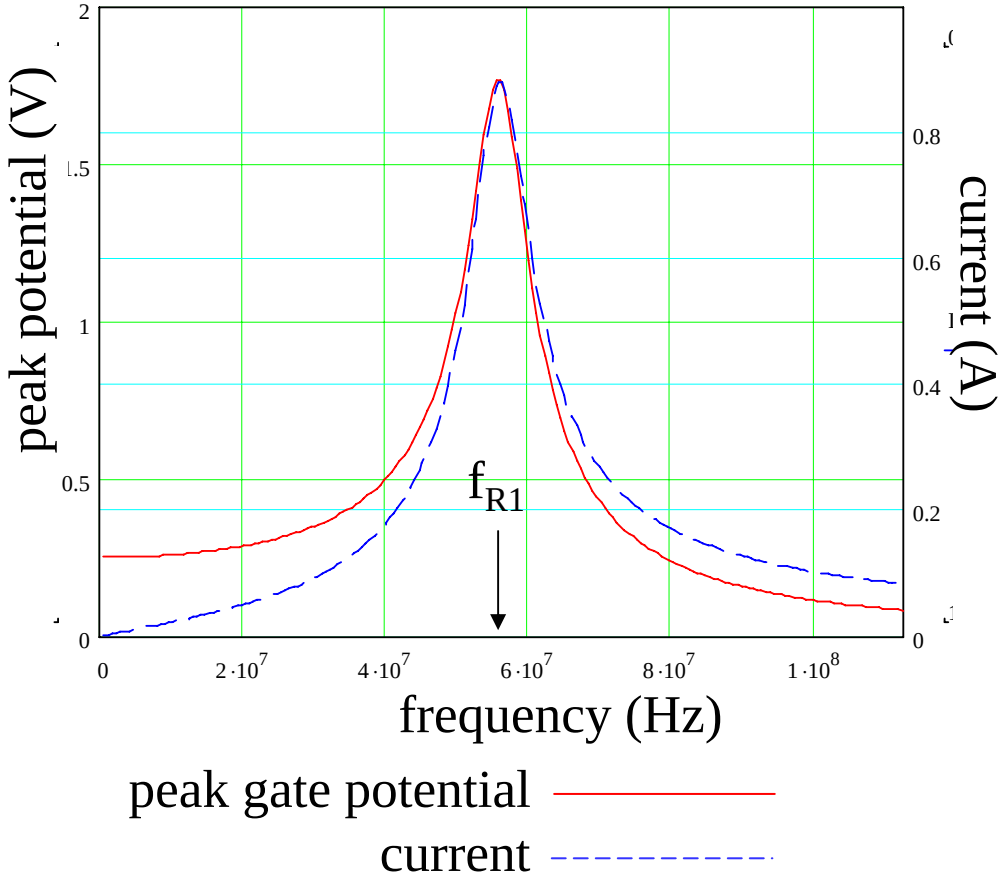
- Resonates at frequency $f_{R1} = \frac{1}{2\pi\sqrt{2L_1C}}$
- Set L_1 = 2 nH, C = 2 nF and R_1 = 0.1 Ω, $\Rightarrow f_R$ = 56 MHz.
- Assume sinusoidal drive with amplitude 0.25V at f = 50 MHz.

- Voltage at driver, current through circuit, voltage across C (CCD gates):



Thoughts on drive circuit for CPCCD

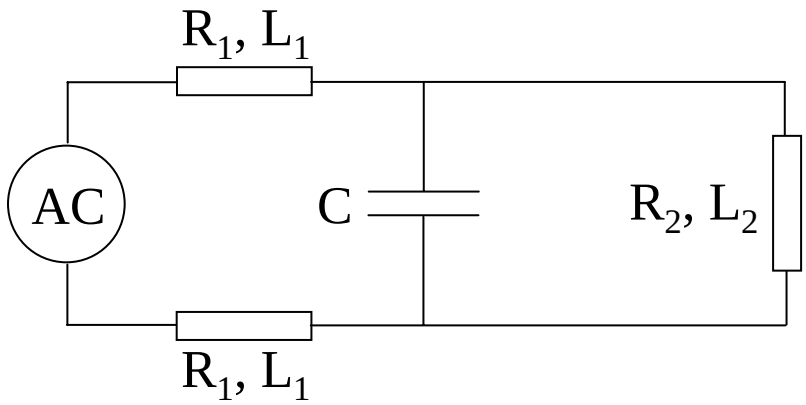
- Look at (peak) voltage across gates and RMS current as function of frequency:



- Capacitance and inductance in current circuit seem to imply operation just below resonant frequency f_R.
- This ensures sufficient voltage across gates to drive charge through CCD.
- Also unfortunately implies current and power consumption are large.
- Note, operation above f_R difficult!
- Can additional inductance be added to overcome problem of large current and reduce power consumption?

Thoughts on drive circuit for CPCCD

- Modified circuit with additional inductance between metal layers:

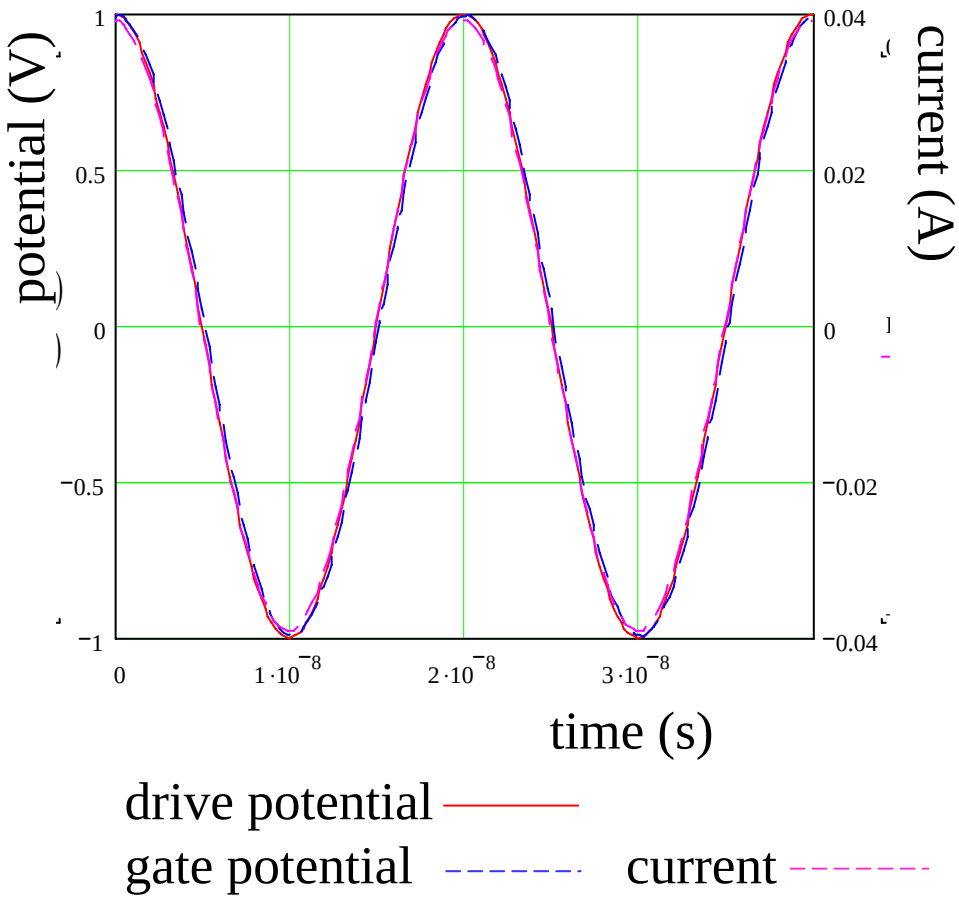


- Second section of circuit resonates at:

$$f_{R2} = \frac{1}{2\pi\sqrt{L_2 C}}$$

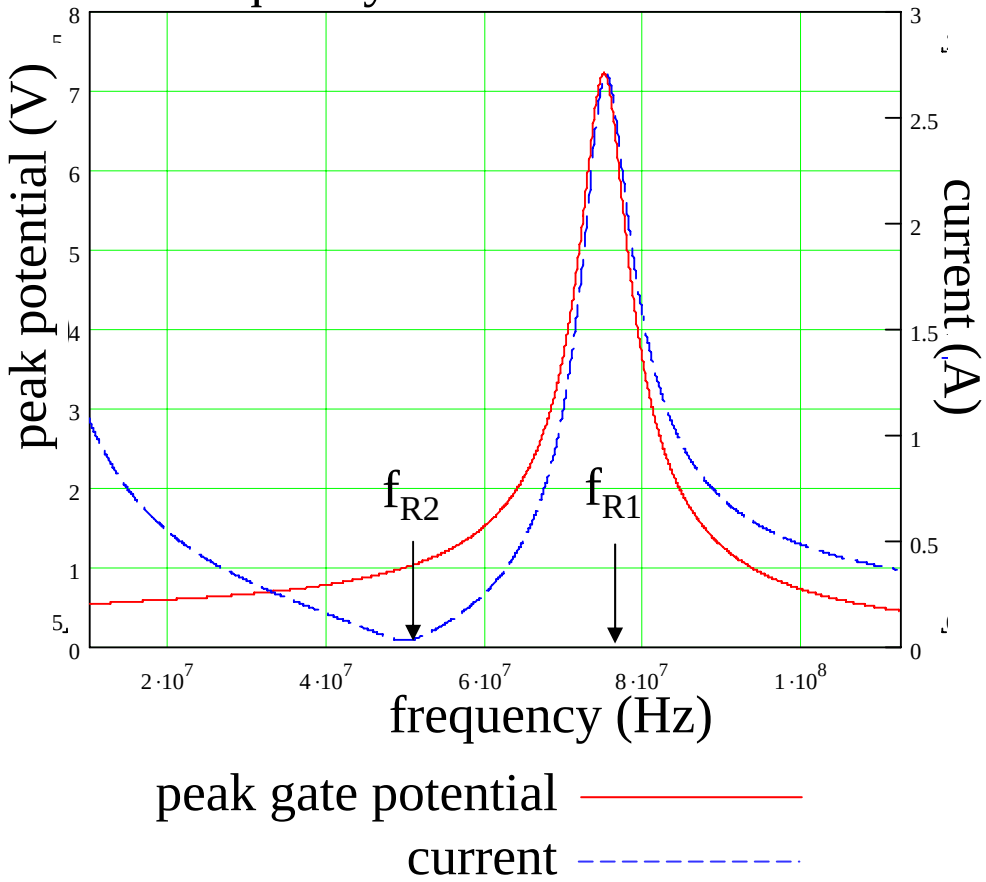
- Choose L_2 so that f_{R2} = 50 MHz.
- Assume R_2 = 0.1 Ω.

- Assume sinusoidal drive with amplitude 1V at f = 50 MHz.



Thoughts on drive circuit for CPCCD

- Look at (peak) voltage across gates and RMS current as function of frequency:



- Current minimised at f_{R2}.
- Comparing two situations at 50 MHz:

	No L_2	With L_2
Drive (V_{PP})	0.25	1.0
Gates (V_{PP})	1.0	1.0
Current (A)	0.46	0.028
Power (W)	0.041	0.020

- Caveat – model unrealistic!
- Study tuning possibilities with better model before pursuing detailed design of driver?