

Switching HV for gatingGEM

Requirements



$l = 232.817 \text{ mm}$

$A = 37288.739 \text{ mm}^2$

$l = 208.21 \text{ mm}$

$L = 169 \text{ mm}$

$l = 232.817 \text{ mm}$

$A = 37288.739 \text{ mm}^2$

$l = 208.21 \text{ mm}$

13 mm

$l = 143 \text{ mm}$

13 mm

Border Area

$$\begin{aligned} 232.82 \text{ mm} \times 13 \text{ mm} &= 3026.6 \text{ mm}^2 \\ 208.21 \text{ mm} \times 13 \text{ mm} &= 2706.7 \text{ mm}^2 \\ &= 5733.3 \text{ mm}^2 \end{aligned}$$

Active Area

$$\begin{aligned} 37288.7 \text{ mm}^2 - 5733.3 \text{ mm}^2 &= 31555.4 \text{ mm}^2 \\ 31555.4 \text{ mm}^2 \times 0.174 &= 5490.6 \text{ mm}^2 \end{aligned}$$

$$C = \epsilon_r \epsilon_0 A/d = 3.4 \epsilon_0 11223.9 \text{ mm}^2 / 12.5 \mu\text{m} = 27 \text{ nF}$$

Switching of 10 V $\Rightarrow Q = C \cdot U = 270 \text{ nC}$

With $R = 1 \Omega \rightarrow$ time constant $\tau = R \cdot C = 270 \text{ ns}$

Current $I \sim 1 \text{ A}$

Main issue is, that the switching has to be done at HV: ~ 545-555 V (MM)
~2995-3005 V (tGEM)

Assuming both voltages are supplied externally and are available → pretty easy.
GND is shifted to $GND = 545/2995 \text{ V}$

The trigger signal for switching can be converted by an optocoupler
(z.B. Toshiba TLP2367 → Insulation resistance $V_{\text{rms}} = 3750 \text{ V}$)

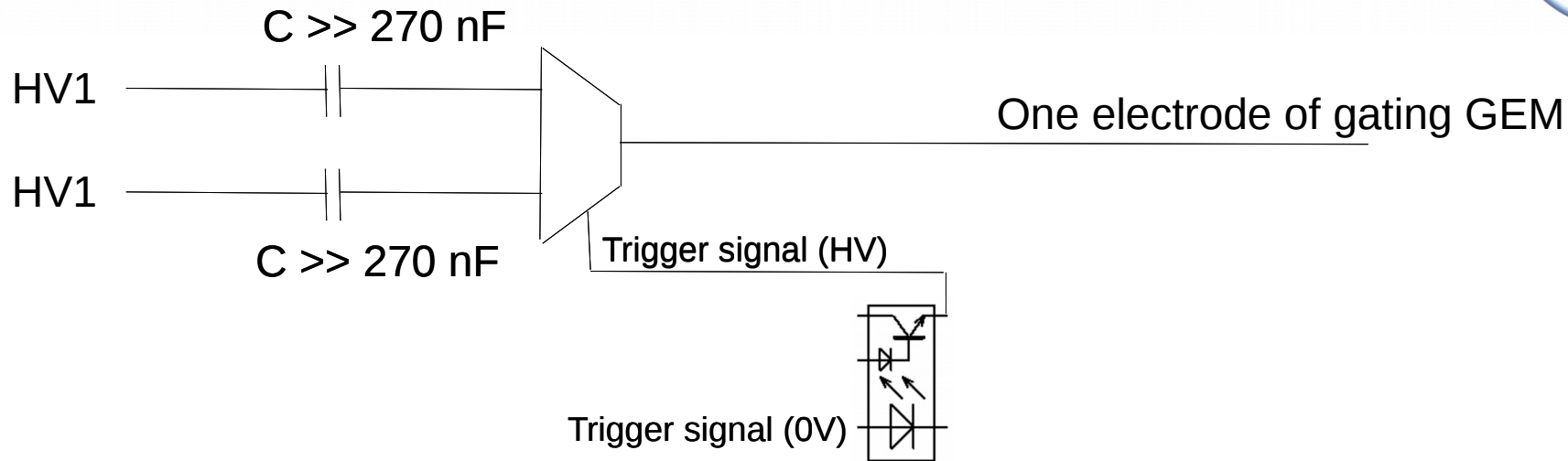


Many optocouplers are laid out for low currents only (5-10 mA).

For switching many device can be used. One with 10 V and low resistance is not too common.

Has to operate in $B = 4 \text{ T}$.

First simple idea



- Questions: 1.) protection resistor for gating GEM? If yes, not after multiplexer/C but then?
2.) power supply for IC on HV ? (multiplexer/optocoupler)
One could use the voltage difference between HV1 and HV2 as supply voltage
– taken from before C to avoid switching noise → low extra current

Case of GEM

