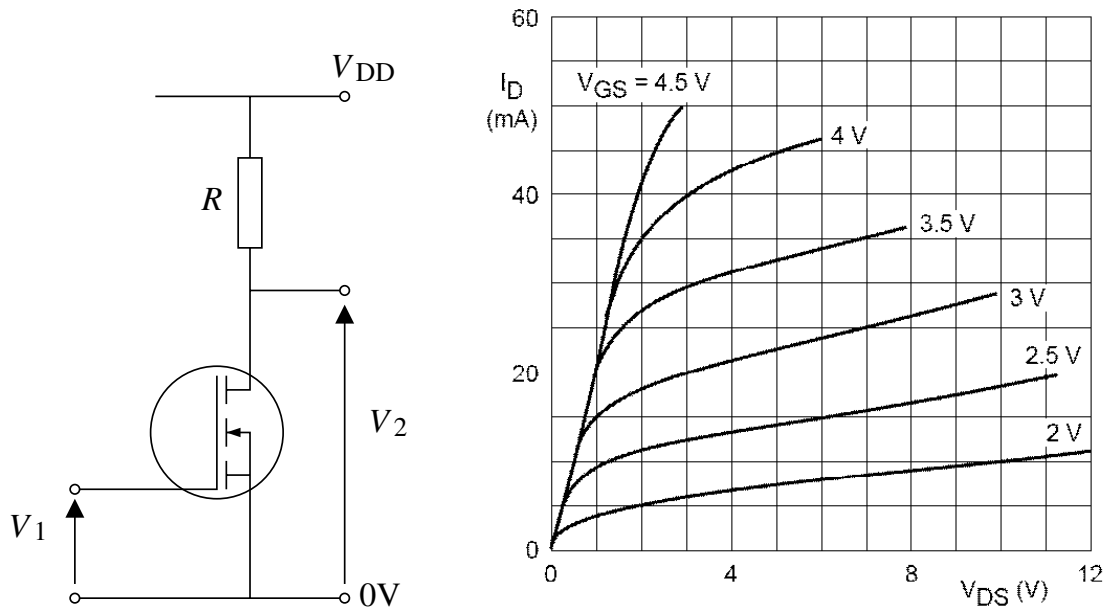


# 2009 Paper 2 Question 1

## Digital Electronics

- (a) With the aid of appropriate sketches, describe how an n-channel MOSFET operates as a switch. [6 marks]
- (b) The left-hand figure below shows a circuit that uses an n-channel MOSFET having the properties given in the right-hand figure. The supply voltage  $V_{DD} = 10V$  and the resistor  $R = 200\Omega$ . The circuit input and output voltages are  $V_1$  and  $V_2$  respectively.



- (i) Find the corresponding values of  $V_2$  when  $V_1 = 0V, 2V, 2.5V, 3V, 3.5V, 4V, 4.5V$ , and sketch  $V_2$  as a function of  $V_1$ . What logical function does this circuit implement? [8 marks]
- (ii) When  $V_1 = 4.5V$ , calculate the power dissipated by the entire circuit and by resistor  $R$ . [2 marks]
- (c) With the aid of a circuit diagram, describe how a p-channel MOSFET can be used in a modified version of the left-hand figure above to significantly reduce total power dissipation. [4 marks]