

Homework2

Page 42, Chinese textbook

Question 1.7

Comparing with the mosfet working on the analog electronic circuits, what are the structural characteristics of a power mosfet to make it endure high voltage and large current?

Question 1.8

Try to analyze the similarities and differences between IGBT and power mosfet in internal structure and switching characteristics.

Answer 1.7

1. The majority of the MOSFET uses vertical conducting structure, increasing effective area of current flowing, which makes MOSFET withstand more current.
2. There is a region called the low doped region in the power MOSFET. This region's characteristic is close to the intrinsic semiconductor. Due to the low doping concentration, this region can withstand higher voltage than the MOSFET working on the analog electronic circuits without the low doped region.

Answer 1.7**Similarities:**

The driving principle is very close to the MOSFET, both of which are a kind of field controller, meaning that users only need to control the N channel of input stage of MOSFET.

When the channel of MOSFET formed, the hole injected from P+ basic electrode to the N-layer, implements the conductivity modulation to the N- layer, reducing the resistance of N-layer, which enables the IGBT to get low On-state voltage when high voltage is applied.

Difference:

IGBT has got a region called P+ inject region in the back, which MOSFET doesn't have. The switching rate and the switching loss of IGBT is pretty low. Thus the IGBT has the capacity of impulse resistance as well as the decreasing on state pressure drop. However, the switching rate of IGBT is lower than the power MOSFET. Besides, the power MOSFET has the higher input impedance and the better thermal stability.