

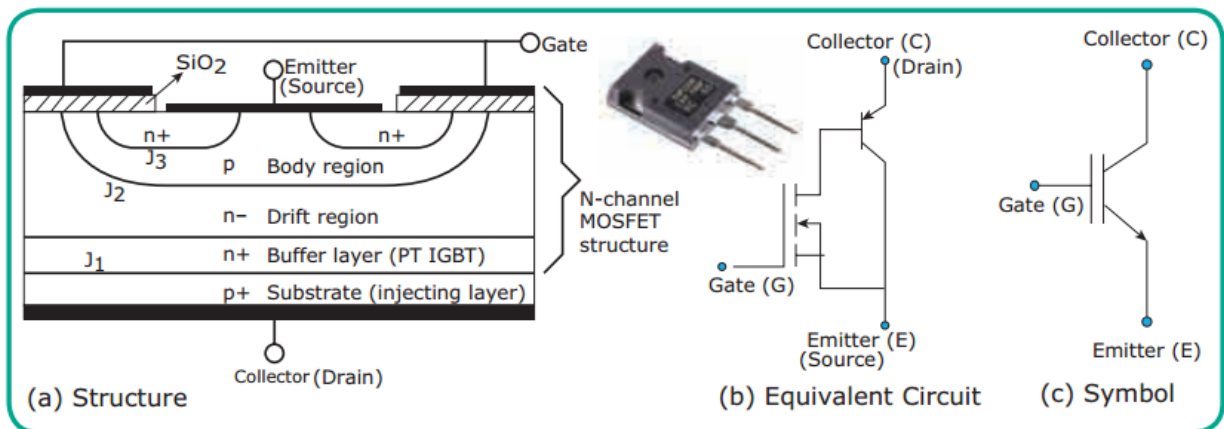
INSULATED GATE BIPOLAR TRANSISTOR (IGBT)

IGBT is a three terminal semiconductor device with huge bipolar current carrying capability. So, this device is designed to make use of the benefits of both BJT and MOSFET devices in the form of monolithic.

IGBT has several applications in power electronics, particularly, PWM, UPS, SMPS and other power circuits. It increases the efficiency, dynamic performance and reduces the level of the audible noise. IGBT are also named as bipolar MOS transistor and conductivity modulated field effect transistor (COMFET).

Construction:

Figure 6.23 shows the structure, equivalent circuit and symbol of an IGBT. It is similar to the structure of MOSFET and the main difference is the presence of p+ layer that is added to the drain side. This p+ layer is also called injecting layer. The next layer is n+ layer also called as buffer layer. There is a p-n junction J_1 between the injecting layer and the buffer layer. There are two more p-n junctions J_2 and J_3 as shown in Figure. The junction J_1 blocks reverse voltage. The junction J_2 blocks forward voltage when IGBT is off.



Insulated Gate Bipolar Transistor

Working Principle:

When a positive voltage is applied between the gate and source, the power MOSFET turns 'ON' and acts as a low resistance between the base and collector of the PNP transistor, thereby the IGBT is turned 'ON'. When there is no gate to source voltage the MOSFET is turned off and hence the PNP transistor is also off because no longer base current is supplied. Thus, the IGBT acts as a switch.

Application of IGBT

1. The IGBT is used in medium to high power application like SMPS, traction motor control etc.
2. Large IGBT modules consist of many devices in parallel have the capability to control current in hundreds of amperes with blocking voltage of 6500 V.