DIFFUSION CAPACITANCE

During forward biased condition, an another capacitance comes into existence called **diffusion capacitance** or **storage capacitance**, denoted as C_D.

In forward biased condition, the width of the depletion region decreases and holes from p side get diffused in n side while electrons from n side move into the p-side. As the applied voltage increases, concentration of injected charged particles increases. This rate of change of the injected charge with applied voltage is defined as a capacitance called **diffusion capacitance.**

$$\therefore \quad \boxed{C_D = \frac{dQ}{dV}} \qquad \ldots (1)$$

The diffusion capacitance can be determined by the expression

$$\boxed{C_D = \frac{\tau I}{\eta V_T}} \qquad \ldots (2)$$

where τ = mean life time for holes.

So diffusion capacitance is proportional to the current. For forward biased condition, the value of diffusion capacitance is of the order of nano farads to micro farads while transition capacitance is of the order of pico farads. So C_D is much larger than C_T.

However in forward biased condition, C_D appears in parallel with the forward resistance which is very very small. Hence the time constant which is function of product of the forward resistance and C_D is also very small for ordinary signals.

transition capacitance

Consider a reverse biased p-n junction diode as shown in the Fig. 2.26.

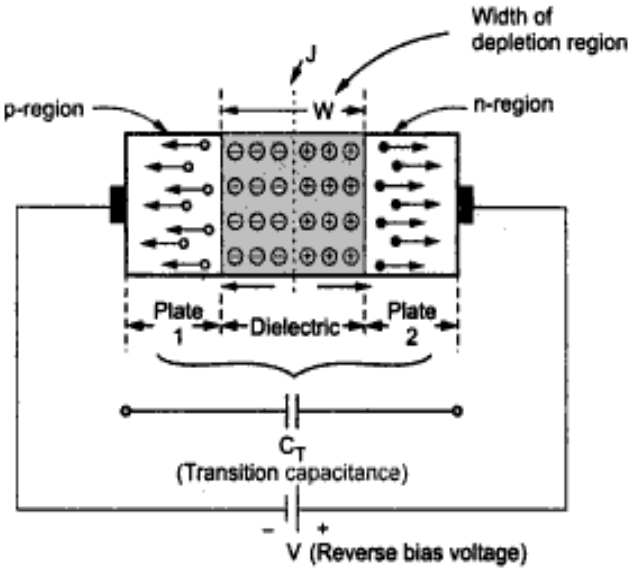

Fig. 2.26 Transition capacitance in reverse biased condition

As seen earlier, when a diode is reverse biased, reverse current flows due to minority carriers. Majority charged particles i.e. electrons in n-region and holes in p-region move away from the junction. This increases the width of the depletion region. The width of the depletion region increases as reverse bias voltage increases. As the charged particles move away from the junction there exists a change in charge with respect to the applied reverse voltage. So change in charge dQ with respect to the change in voltage dV is nothing but a capacitive effect. Such a capacitance which comes into the picture under reverse biased condition is called **transition capacitance,**