# **THERMAL CALCULATIONS**

It is known that thermal calculation is necessary for providing suitable conditions for the temperature vulnerable circuit components. Otherwise, generally, because of the overheating components can be defected or can be harmed. The main reason of the heat increase in a circuit is power losses. These power losses occur as heat in the components so, doing power loss calculations before the thermal calculations is necessary.

## **Power Losses:**

Semiconductors can be heated to the high temperatures due to the losses inside of them. If the temperature exceeds the limit, semiconductor device can be broken. Hence, it must be considered the losses in the semiconductor devices:

* Switching losses
* Conduction losses

**-Switching Loss formula (Reverse Recovery Loss):**

**-Conduction Loss Formula**

### **Three-phase rectifier module VUO36-16NO8:**

From the simulation report, it was indicated that switching loss for this component was unsignificant. So, let’s check for the conduction loss:

(Maximum average current that passes through a diode in our design)



Figure :Thermal resistance of the three-phase rectifier module

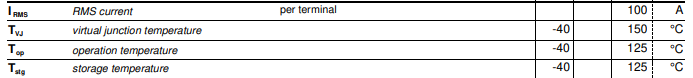


Figure :Temperature specifications of the three-phase rectifier module

Let’s assume Tambient = 40˚C.

Actually, this temperature is in the range of the device’s operation temperature. However, we are also decided to implement a heatsink to this device too.

### **Freewheeling Diode DSEP30-06B:**

Beside of the three-phase rectifier module, for the freewheeling diode, it was indicated that switching loss for this component was unsignificant in the simulation report. So, let’s check for the conduction loss:

(Maximum average current that passes through this diode in our design)