**Thermal Analysis**

In analysis part, there are 5 components that should be considered in thermal view. These are three-phase rectifier unit, the timer unit, gate driver unit, IGBT which is aimed to be used as the switch, and buck converter diode. At our on-going stage for the project, the losses for timer and gate driver unit were hold since the prototype and more experimental measurements are presumably needed.

Over IGBT, there are 2 types of losses: switching losses and conduction losses. Switching losses are calculated by given section of the datasheet while taking into maximum frequency account:

Text

Description automatically generated

Text

Description automatically generated with medium confidence

For ON mode :

For OFF mode :

As maximum frequency was limited at 5 kHz,

Conduction losses can be calculated for IGBT by given section of the datasheet:

Graphical user interface, table

Description automatically generated

Overall, for our IGBT

*Thermal circuit for IGBT:*

Diagram, schematic

Description automatically generated

*Typical thermal model in power electronics*

Ignoring the capacitances for steady state,



And

Overall,

Considering the changes in the parameters after 125 ,