**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.

**IGBT Losses:**

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:

*Table. A section of the parameters of IGBT at different temperatures*

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:

*Table. A section of the parameters of IGBT at different temperatures*

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 ,

**Rectifier Three-Phase Diode Losses:**

Conduction losses,

@25°C

Due to lack of data on datasheet, we could not calculate switching losses. (trr is not given). Also, we could not calculate the temperature increase of diode since there is only value on datasheet.

**Buck Converter Diode Losses:**

Conduction losses,

@25°C

Switching loss,

@25°C

@125°C

For temperature increase of diode,