**Ultra-Efficiency DC-DC Converter using GaN Devices**

High conversion efficiency is invariably desirable in all power converters. The main objective of this PhD project is to achieve the highest possible conversion efficiency in an isolated dc-dc converter.

Silicon has been used as a major semiconductor material in power devices for many decades. The material properties of Silicon as power device has almost reached its maximum theoretical limit. Wide band-gap materials such as Silicon carbide (SiC) and Gallium Nitride (GaN) are promising semiconductors for power devices due to their superior material properties, such as high switching speed, low on-resistance and low switching losses. The lower device loss in GaN devices reduces the heat sink requirement, thus makes the converters more compact in size.

The project covers the optimal utilization of GaN devices in an isolated dc-dc converter to achieve ultra-high efficiency. Design considerations in extensive paralleling of GaN FETs are also included in this project.

Some of the other objectives of this research project include:

* the implementation of high efficiency magnetics,
* the power loss modelling of an isolated dc-dc converter,
* the development of a compact bidirectional isolated dc-dc converter.

Design and analysis of various isolated dc-dc converter utilizing GaN devices in the power range of 1 to 2.5 kW has been implemented during this PhD work. An ultra-high conversion efficiency of 98.8% in an isolated dc-dc converter has been experimentally demonstrated and analytically verified in this research work. Finally an optimized bidirectional isolated dc-dc converter having an extremely high efficiency of above 98.5% in both directions of power flow over a wide range of operating load conditions is also presented in this project.