IDEC Chip Design Contest

GaN-Based High Frequency Buck Converter Design

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Introduction

- GaN FET has not a body diode, V_sw is dropped to -3V, which may lead to an additional current loss and device destruction.

- The designed high frequency Buck converter with the following control techniques:
  a. The absence of body diode in GaN FET is solved using BST switch block;
  b. Provided Stable transient response at high frequency operation using Constant On Time compensation mode;

- GaN-based high frequency buck converter implemented with a 0.18-µm BCDMOS process and is able to deliver a maximum load current of 1A at VIN = 12 V and VOUT = 5 V.

- The chip fabrication was supported by the IC Design Education Center(IDEC), Korea.

Circuit Design

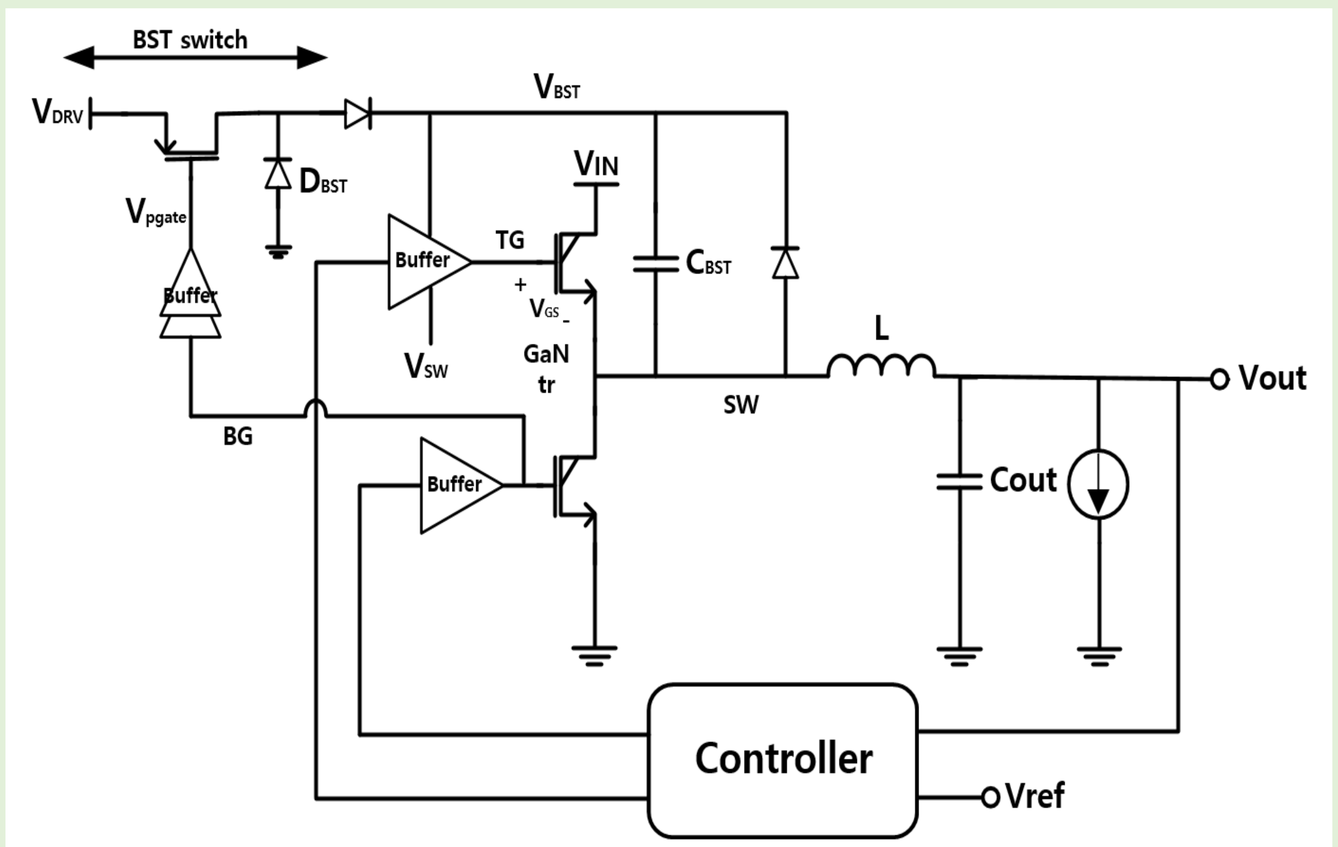

Fig. 1. Schematic of the proposed GaN-based buck converter with BST switch block

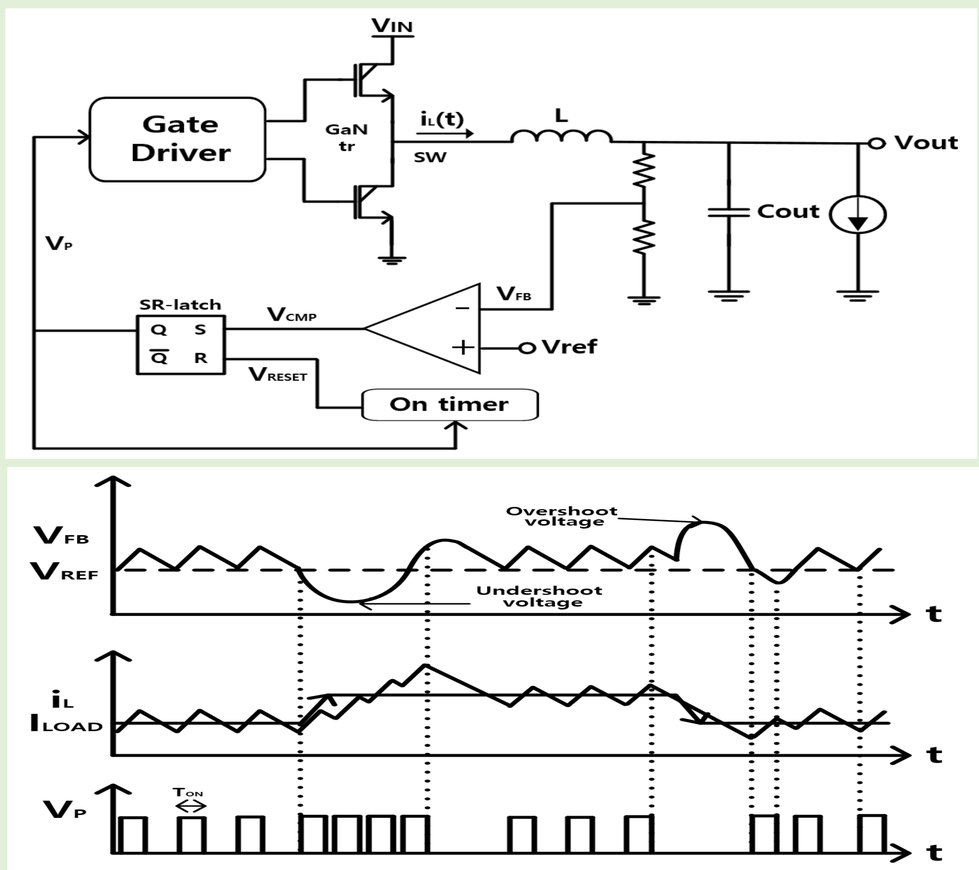

Fig. 2. GaN-based buck converter with Constant On Time controller

Experimental Results

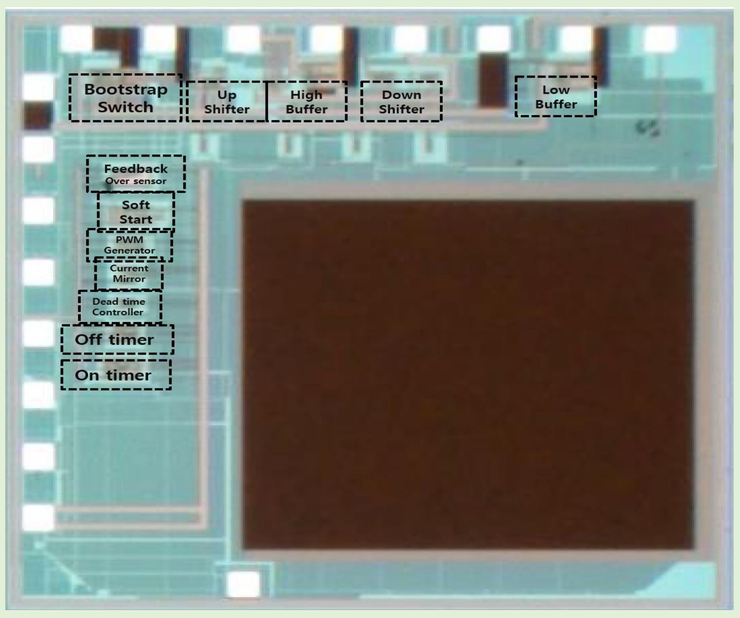

Fig. 3. Chip layout.

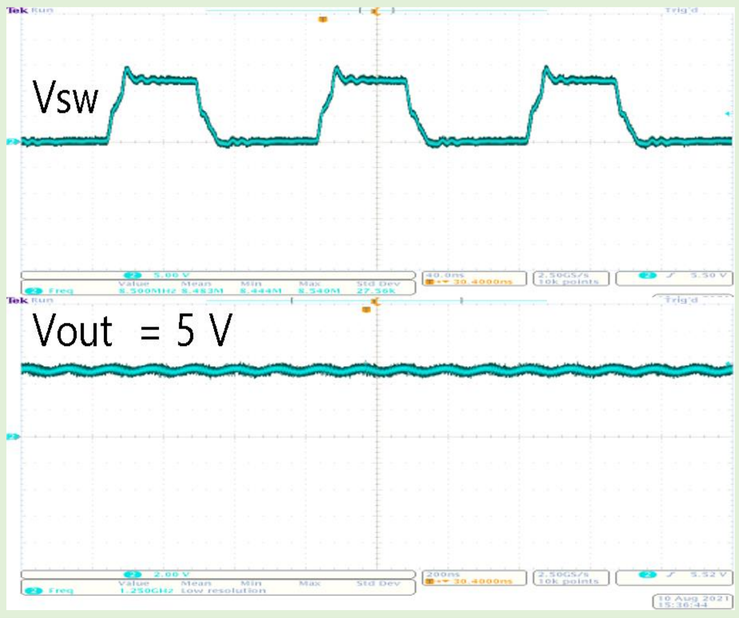

Fig. 4. Measured Vsw & Vout

Specifications	
Technology	TSMC 0.18 um BCDMOS
Chip area	2500 um * 2500um
VIN	12 V
VOUT	5 V
Switching frequuncy	10MHz
Cout	10uF
Inductor	0.47uF
Efficiency	87%