TECHNOLOGY OPPORTUNITY BULLETIN

Efficient Power Conversion – The NRGD circuit
Tech ID: 2004-024

Researchers at Queen's University have developed a cost-effective, energy-efficient scheme suitable for use in next-generation switching power supplies – the **N**ovel **R**esonant **G**ate **D**rive (**NRGD**) circuits. Unlike conventional drive circuits and existing resonant gate drive circuits, the **NRGD** circuit not only recovers gate drive energy, but significantly reduces switching loss by providing a constant gate charge/discharge current**.**

NRGD solves the following issues common to existing schemes:
1. High switching losses,
2. Slow turn-on and turn-off transitions, and
3. A lack of Cdv/dt immunity.

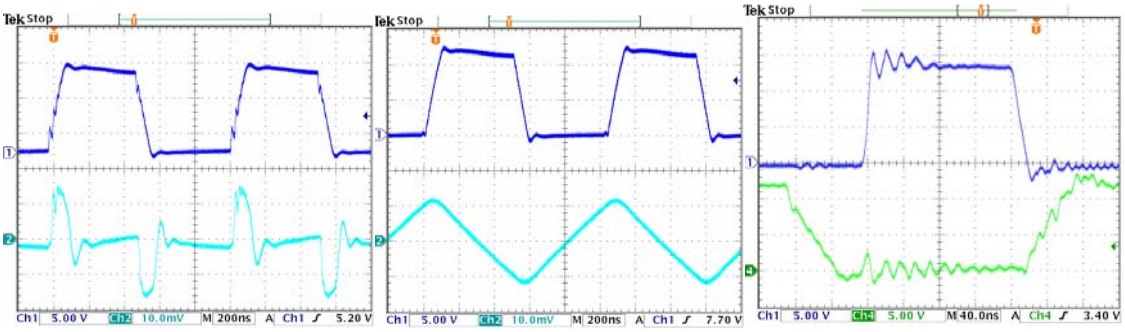
With the use of **NRGD**, the switching frequency and the resulting dynamic performance can be increased by a factor of three, reducing the component size and cost as well as the corresponding board real estate.

Background:
Existing switching power supply designs are not capable of meeting all the requirements of next-generation computing and telecom technologies. To partially address this situation, switching frequencies have increased to the megahertz region. However, conventional gate drive schemes suffer at high frequencies as switching time, and therefore switching loss, remains the same as lower switching frequency designs, and hence efficiency is significantly reduced. It is also noted that the parasitic inductance increases the switching time. At high frequency, the gate drive loss also increases, which makes the driver chip very hot. Fast switching speed is crucial for performance of power converters, and can contribute to reduced switching loss especially for low-voltage, high-current output converters. However, the conventional gate driver operation is based on R-C charge and discharge. Thus the turn-on and turn-off transition time is highly dependant on the value of the gate capacitance. Paralleled gate drivers are employed to help this issue, but of course, this exacerbates the component costs.

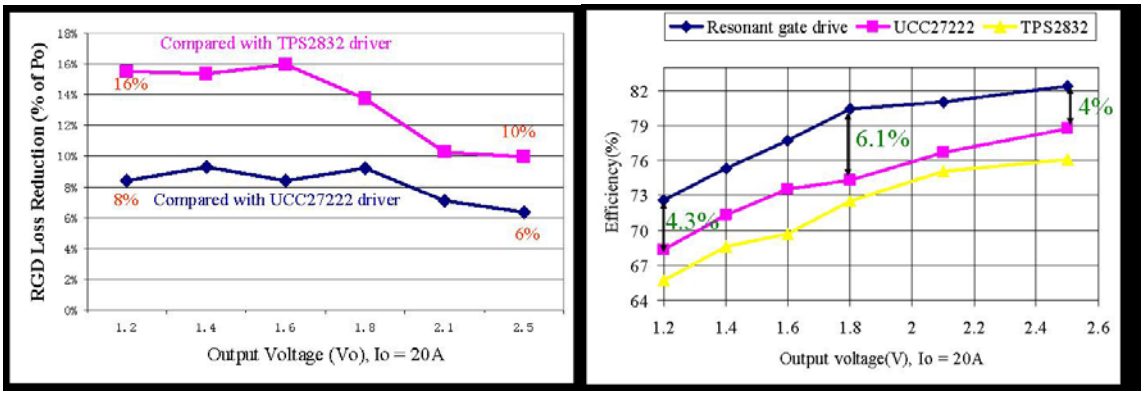
NRGD Advantages:
1. The same efficiency at 1MHz as conventional technology at 300KHz.
2. Very cost effective topology – only one additional inductor
3. Optimized for Buck VRM and Bus converter applications
4. Significantly lower total power loss

5. Excellent High Frequency performance - dv/dt and parasitic inductance immunity
6. Improved dynamic response
7. Lower parts count and cost
8. Reduced board real estate

Experimental Results:
Charge/Discharge times are constant, resulting in improved switching times:



Improved efficiency and power loss:



Status of Commercialization:
PARTEQ Innovations, the technology transfer arm of Queen's University, is seeking industrial partners willing to support on-going development of the technology and/or are interested in licensing the intellectual property

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