SATURATED PULSE TRANSFORMER BASED POWER MOSFET GATE DRIVE

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ABSTRACT

This thesis described on investigates a circuit proposed by International Rectifier. The proposed circuit depends on the saturated operation of pulse transformer. It is well known that pulse-transformer base-drive offers excellent isolation. However, pulse transformer also needs bipolar primary drive voltage and a DC source at its secondary. This makes pulse-transformer base drive circuit expensive to realized. A RC pulse shaping circuit in series with the saturable transformer will transform a uni-polar rectangular input pulse into two narrow pulses. The pulse energy is transferred to the secondary, i.e., to the base capacitance of the transistor via the source-drain diode of a charge-controlled MOSFET. The voltage of the base capacitance is maintained until the arrival of the negative going pulse. The negative going pulse effectively turns on the charge-controlled FET and drains the base capacitance rapidly.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Pulse transformers are practically utilized in various kinds of electronic circuits and systems. A pulse transformer is, in principle, a simple, reliable and highly noise immune method of providing isolated gate drive. It has many limitations that must be overcome with additional components.

Transformer coupling of low level signals to power switches offers several advantages such as impedance matching. DC isolation and either step up or step down capability. They also provide negative gate bias to reduce the risk of "dv/dt induced turn-on". Unfortunately, transformers can deliver only AC signals since the core flux must be reset each half cycle. This "constant volt seconds" property of transformers results in large voltage swings if a narrow reset pulse, i.e., a large duty cycle is required.

For this reason transformers in semiconductor drive circuits are limited to 50%, duty cycle or roughly equal pulse widths positive and negative because of drive voltage limitations of the semiconductors themselves. For large duty cycle ratios designers must choose an alternative to the transformer, such as an optical coupler to provide the necessary drive isolation.

Optoisolators for power electronics require high dv/dt capability and are expensive. They also require additional floating power sources, which add complexity and cost. Most of them require a buffer stage to handle the large gate capacitances, typical of power devices. If duty cycles are such that optoisolators are the only alternative, they can be used in a more cost-effective way as drivers for a MOS-gate driver[1].