Technical Article
Power Tips: a Simple Circuit for Driving Gate-drive Transformers

TEXAS INSTRUMENTS

Brian King

In my latest Power Tips post on EE Times, I discussed how to use a two-switch flyback to improve efficiency in low-power isolated converters. A major trade-off vs. a single-switch flyback is that the two-switch flyback requires a floating high-side drive. A gate-drive transformer is commonly used for the high-side FET of a two-switch flyback, and a gate-drive transformer can be tricky. If the core does not properly reset every cycle, it may saturate.

One of the most common drive techniques is to use an AC-coupling capacitor in series with the drive winding. The capacitor forces the average current to 0A, which ensures that the transformer does not saturate. However, it may still saturate during transients, and the DC information of the drive signal will be lost on the secondary side of the drive transformer.

Figure 1 shows an easy way to drive a transformer without having to use a coupling capacitor. When the drive signal goes high, the small-signal FET, Q2, turns on, and the drive voltage is applied across the winding of the transformer. When the drive signal goes low, it pulls the dot end of the winding to ground and turns off Q2. When Q2 turns off, the magnetizing current in the transformer forward-biases D1, which applies VDD across the transformer winding in the reverse direction. For duty cycles less than 50%, the transformer is guaranteed to completely reset. By adding a Zener diode in series with D1, you can extend the duty cycle beyond 50%.

This drive circuit provides a couple of other benefits. First, all of the magnetizing energy is recycled back to VDD, improving efficiency. Second, the FET is driven with a negative drive during the magnetizing reset time. This negative drive can reduce switching losses by speeding up the turn-off time.
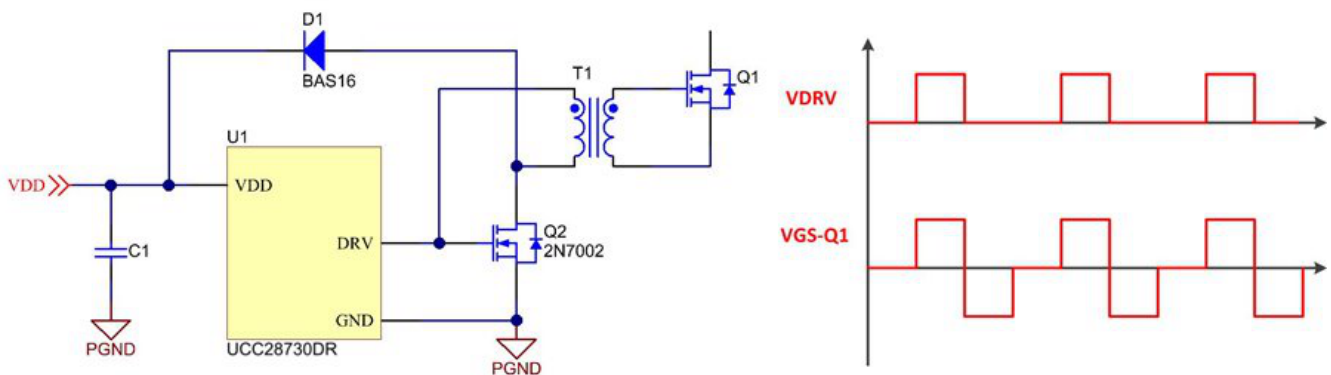

Figure 1. Easily Drive a Transformer Using a Simple Circuit Such as This One

This simple drive circuit ensures proper reset of the drive transformer and can improve efficiency.

Additional Resources
- This TI Designs Universal AC Input 5V/10A/50W PSR Flyback Power Supply With Over 89% Avg Efficiency Reference Design uses the drive technique described in this post.
- Explore more power supply topics
- Watch Power Tips videos to help with your design challenge

IMPORTANT NOTICE AND DISCLAIMER