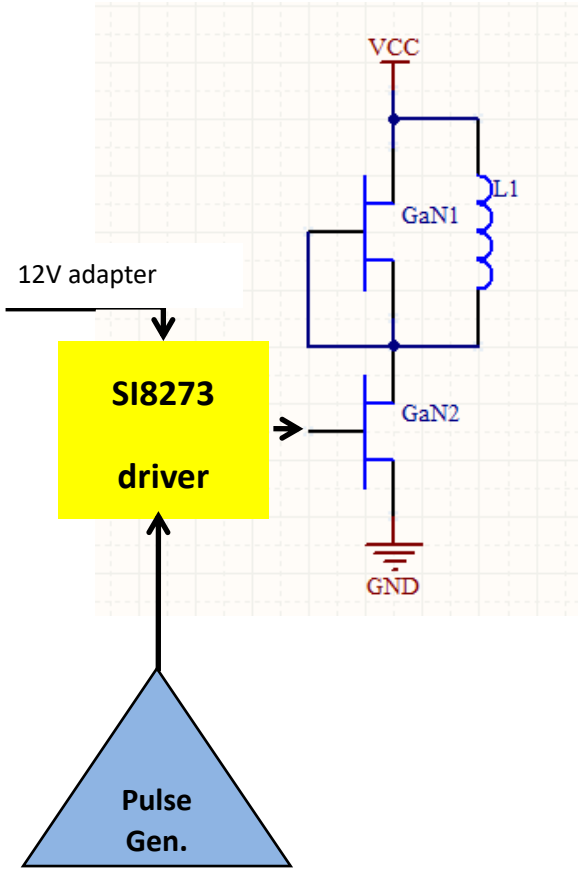
Double-Pulse Testing Board For GaN Devices

Abstract

GaN power devices have gained popularity while conventional testing platform for MOSFET or IGBT are unable to directly measure the switching characteristics of GaN. A special double-pulse testing system for GaN is described here using a driving circuitry optimized for GaN.

Feature

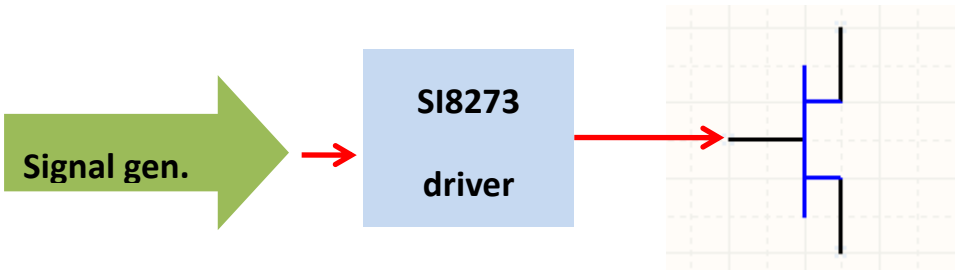
- Volume LxWxH 45x80x40mm
- Driving circuit optimized for GaN
- Low-side driving with SI8273 for flexibility in driving voltages
- -5V driving of high-side for reverse conduction testing
- 12V DC supply for ease of use



1、System Description

The testing system uses two sets of power supplies. One set is 12VDC powering the double-pulse control circuitry. It is further converted to 5V and -5V. -5V can be used for the high-side when testing reverse conduction. The other set of power supply is used on the load inductor and can be adjusted according to measurement needs.

A SI8273 isolated driver converts the double-pulse into 2/4A driving capability for the GaN. Figure 1 is the block diagram of the system.



Double-pulse testing has become a popular method for investigating dynamic property of GaN power devices in both forward and reverse directions. Our reference valuation PCB design provides an effective testing platform for GaN devices for extraction of dynamic parameters as well as evaluation of GaN prior to application in realistic switching mode power systems.

2、Basic Principle

2.1 Gate Driver

GaNPower's GPI65015 is E-mode device rate 650V/15A with gate driving voltage less than 7V. GPI65015 has low switch loss and nearly zero reverse recovery charg. It is especially suitable for hard switching.

SI8273 is an isolated driver with independent pull-up ad pull-down outputs and this makes it especially easy to use and simple to layout on PCB. The following Figure 1 indicates two independent driver paths.

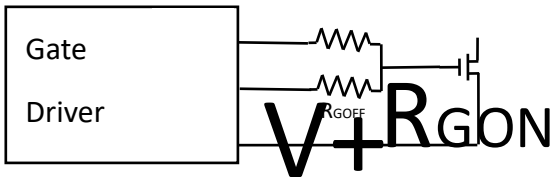


Figure 1 Independent on/off driver circuit connections

2.2 Auxiliary Power Supply Design

V-

5V Auxialiary power supply is converted from the 12V adapter. Since GaN operates at a different voltage than MOSFET, DC to DC isolated conversion is used for 5V DC supply for the gate driver.

GND

3、Dynamic Characteristic Measurement

3.1 Principle of Double-Pulse

The basic principle is to apply a double-pulse to an inductor loaded GaN transistor (DUT, GaN2 in Figure 1) and turns it on and off two times. Let t1/t2 label the on/off of the first pulse while t3/t4 for those of the second pulse. At t1，DUT is on and all the voltage applies to the load inductor. The current at the inductor increase linearly to $I_D=I_L$。At t2，the GaN is off and the energy stored energy in the inductor is released through the diode (that is, GaN1 in Figure 1) in a controlled manner. At t3，the 2nd pulse arrives and the DUT is on again. The inductor current flows from the diode to the DUT at a value that the DUT can use to test its dynamic switching characteristic under such a current loading. From t3 to t4，current in DUT $I_D=I_L$ continue to increase linearly，until after t4 when all the energy in the load is released.

3.2 Reference Design for Double-Pulse Testing

Input 30V，Inductor 120uH，Pulse with 10us, as well as other details as defined by user of the reference demo PCB.

4、Demo Testing

Inductor 201uH，input voltage 50V，pulse frequency 30KHz。 Experimental waveform is as shown in Figure 2 where CH1 is driving signal and CH2 is the DUT DS waveform.

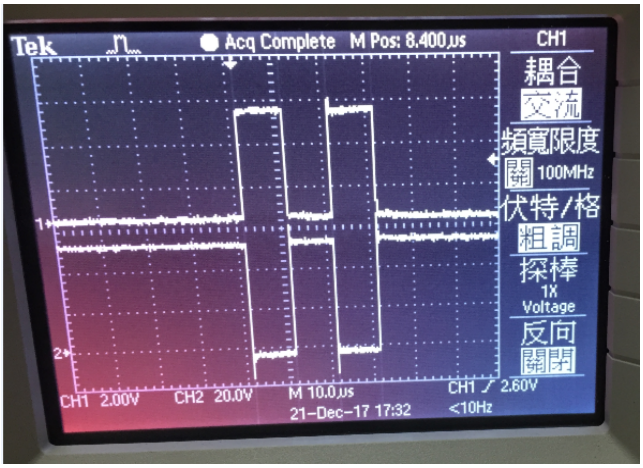


Figure 2 Waveform at 50V input

Results indicates fast switching for the GaN power device. The reverse turn-on voltage depends on the gate voltage and is approximately VG+1.2V.

5、Reference Design

5.1 PCB layout

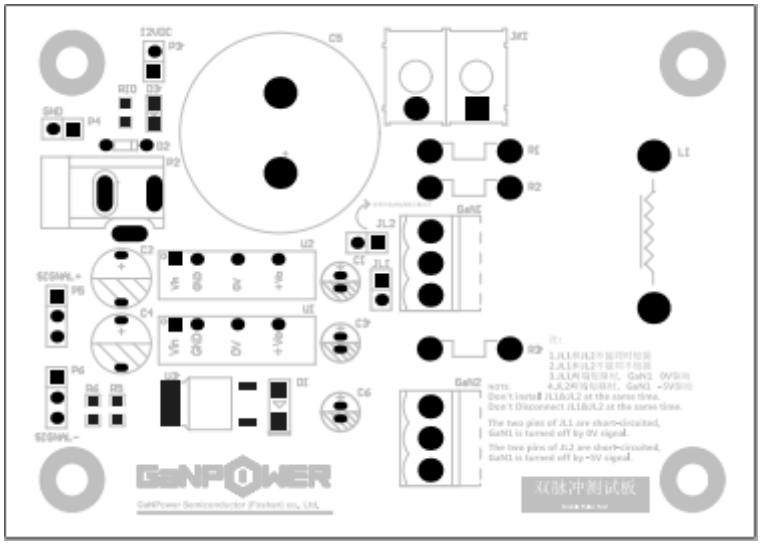


Figure 3 Top view

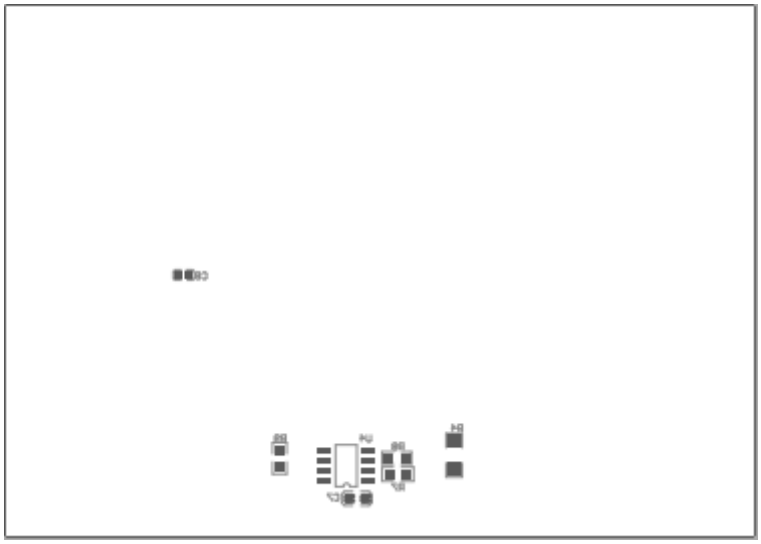


Figure 4 Bottom view

About

GaNPower Semiconductor (Foshan) Co. Ltd is a joint venture of GaNPower Int'l Inc. (www.iganpower.com Vancouver, Canada based) and two other companies.