

This application note provides a description of the functionality of VisIC’s V80N65B ALL-Switch Power GaN switch’s enabling circuitry and it’s operation in conjunction with a typical external MOSFET driver device.

Description of Operation

General

The V80N65B is a normally off GaN power switch with integrated logic and a power enabling circuit. The enabling circuit is based on a VDD voltage monitor to ensure the GaN transistor in the power switch will be enabled in concert with the external driver device’s VDD Under Voltage (UV) detection function. A single 12V VDD voltage operates the V80N65B and its driver. (Fig. 1)

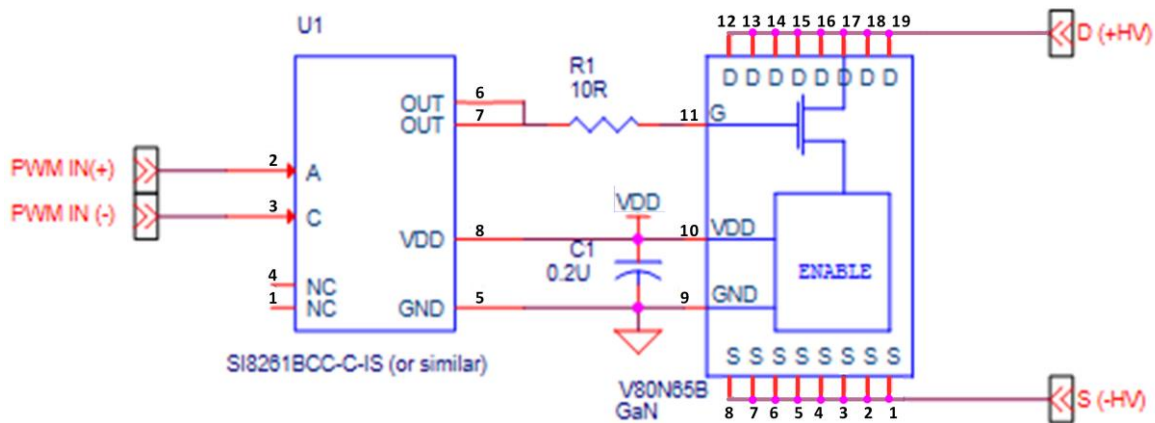


Fig. 1 A typical schematic application for operating the V80N65B

1. Driver Requirements for V80N65B ALL-Switch Power GaN

- 1.1 **VDD supply:** 12V-12.5V operating voltage floating relative to the high voltage BUS.
- 1.2 **Driver type:** a standard MOSFET driver with rise/fall times around 10nsec.
- 1.3 **Under voltage function:** Driver should include UV shutdown function at around 11V trip voltage.
- 1.4 **Driving current:** Since the V80N65B GaN transistor’s Gate Charge and Gate Capacitance, are very low in comparison to Silicon MOSFETs, only a 2A peak Gate drive current capability is necessary to achieve maximum effective switching speeds. The V80N65B’s enabling circuitry needs less than 5mA in addition to the the Gate drive current.

2. Operation of Enabling Functions

2.1 Turn ON/OFF

During *turn on* as shown in Figure 2, as the auxiliary VDD supply voltage rises from 0 to 12V:

- A. At 9-9.5V the internal voltage monitor enables the GaN power transistor,
- B. At 11.4V the UV function inside the external driver puts the driver into operation mode.

During *turn off* as shown in Figure 3, as the auxiliary VDD supply voltage starts to decrease:

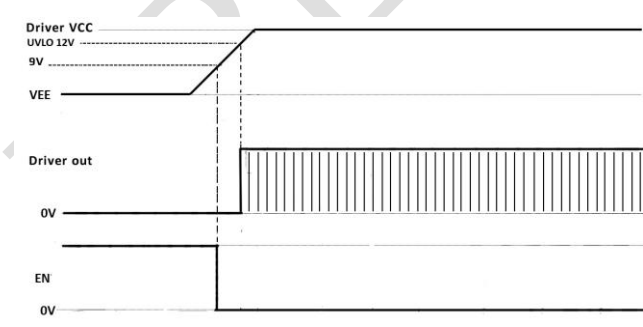
- A. At 10-11V, the external driver’s UV function puts the driver into *off* mode,
- B. At 9-9.5V the V80N65B’s VDD voltage monitor disable the GaN transistor.

For reference, the threshold voltage of the GaN transistor is at 7.5V.

The circuitry as shown thus meets the auxiliary voltage monitor’s requirements for safe operation of the V80N65B’s GaN Power Switch: GaN threshold voltage < **Enable voltage** < internal UV of driver

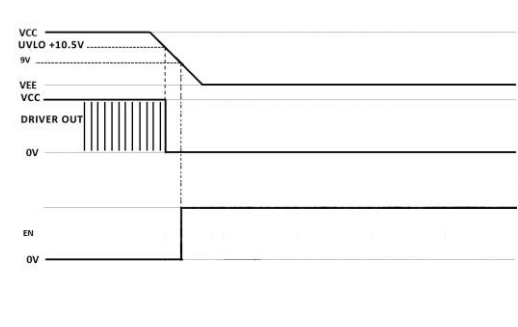
3. BOM for a typical operation of the V80N65B as shown in Fig. 1

| | | |
|----|-----------------------|---------------------------|
| U1 | ISO-Driver | SI8261BCC-C-IS or similar |
| Q1 | GaN Power transistor | VN80N65B |
| C1 | Ceramic capacitor X7R | 0.2uf 25V |
| R1 | resistor | 10 ohm 0.2w 5% |



NOTE: All output signals referenced to VEE

Fig. 2 Turn On



NOTE: All output signals referenced to VEE

Fig. 1 Turn Off