Application Brief

Using the DRV1 Pin on LM51772 and LM251772

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Some applications require a disconnect switch on the input or output side of the switch mode power supply. This can be required for a system specification, like USB, which only allows a max of 10uF on the VBUS until the negotiation has finished and the power supply is enable or a reverse battery protection. The LM51772, LM251772, and the corresponding automotive (-Q1) devices features a high voltage drive pin (DRV1) to support an input or output disconnect FET (see Figure 2). This pin can be also used as a driver for a charge pump output to do a reverse polarity protection using an external n-channel FET. The supply for this pin can be selected by R2D and I2C configurations. In this application brief, various scenarios are shown how this can be used in an applications.

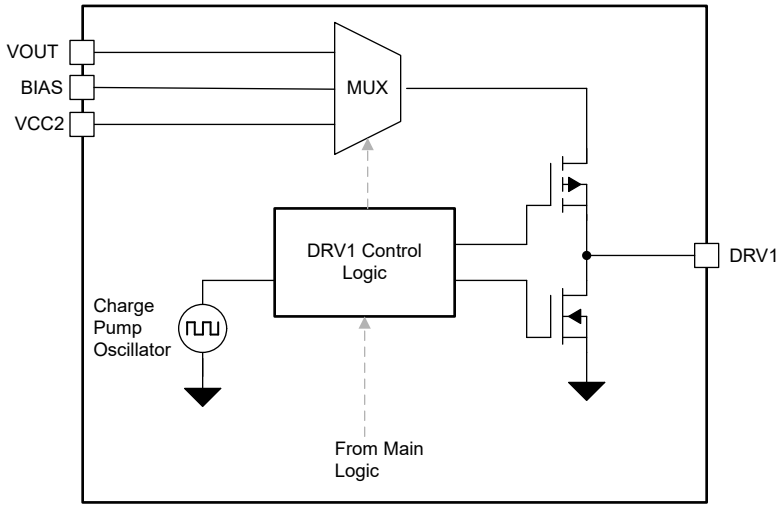

Figure 1. Functional Block Diagram - DRV Pin

The following configurations are possible with to support with the DRV1 pin:

- Open drain output.
- High voltage push-pull supplied by VOUT
- High voltage push-pull supplied by VBIAS
- CP drive pin supplied by the VCC2

The disconnect switch can be place on the input or output side of the power stage, see Figure 2.

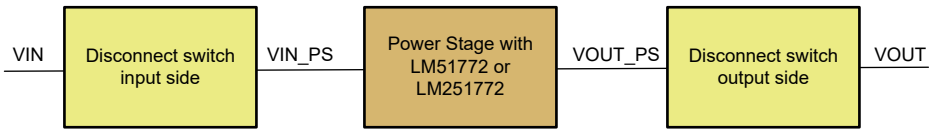

Figure 2. Disconnect Switch On Input or Output Side of the Power Stage

Forward or Reverse Direction: Charge Pump with N-MOSFET

Forward: polarity protection on input side

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Use case: provides a reverse polarity protection, often required for battery power systems. For example, automotive. When powering up with the correct polarity, the initial current flows through the body diode.

Reverse: output disconnect – reverse direction on output side.

Use case: This is required. For example, for USB-PD to disconnected the large output capacitors from the power stage from the VBUS of the USB port.

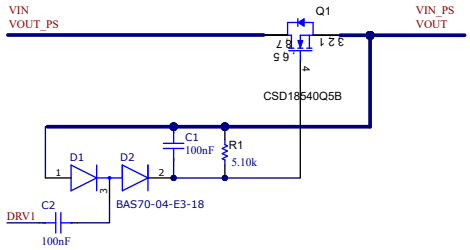

Figure 3. Disconnect in Forward or Reverse Direction with Charge Pump

DRV1 Configuration	
DRV1 Sequence	Pull-low or CP running if converter operation is on
DRV1 Config	VCC2 (charge pump driver)

The charge pump used to provide the gate signal for the n-channel MSOFET need some time to ramp up. There is a slight delay after enabling the charge pump till the MOSFETs starts conducting (typically 2-3 charge pump switching cycles).

R1 in Figure 3 is to discharge the storage cap once charge pump stops. This discharge time depends on R1 and C1 but also on the ramp down of the MOSFET see simulation below.

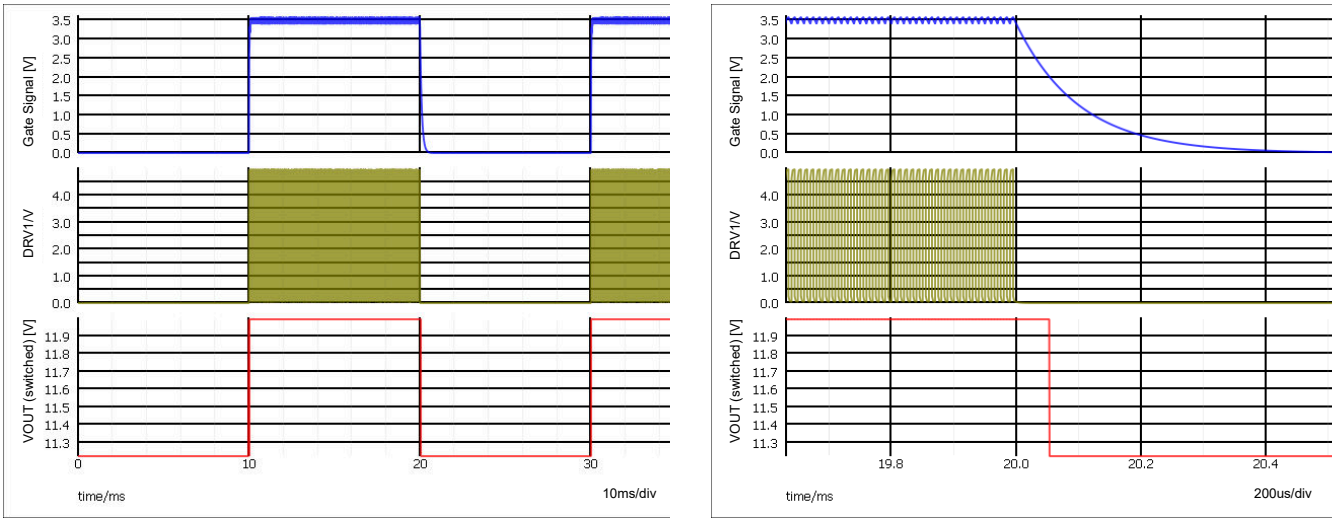

Figure 4. Simulation of DRV1 Enable and Disable with Charge Pump

Forward or Reverse Direction: P-MOSFET

Forward: used as reverse polarity protection on input side

Use case: input disconnect – reverse polarity protection provides a reverse polarity protection, often required for battery power systems. For example, automotive. When powering up with right polarity, the initial current flows through the body diode.

Reverse: used as an additional disconnect switch

Use case: output disconnect – avoid current from the output is driven into the power stage.

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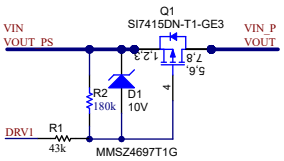

Figure 5. Disconnect in Forward or Reverse Direction with P-MOSFET

DRV1 Configuration	
DRV1 Sequence	Pull-low or CP running if converter operation is on
DRV1 Config	Open drain (active = pull low)

The PMOS when operated in short circuit condition transitions from the conduction mode to the linear mode and work a current limiting resistor. This can cause very high losses. Consider this for the MOSFET selection. This even appears with the average current limit enabled as the current is also limited by this MOSFET as soon as the output voltage drops down so that the gate signal is below the Miller plateau.

Other

Additional options for using the DRV1 pin:

- Use as I2C controlled IO
- Control other circuit parts based on operation status of the LM51772 controller
- Clock signal with 100kHz

DRV1 Configuration	
DRV1 Sequence	Depends on application requirements
DRV1 Config	Depends on application requirements

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