

# Three Ways to Use High Side Switch Driver Using LM74502



## Introduction

High side switch using P-Channel Metal Oxide Field Effect Transistor (MOSFET) is easy to use topology to realize load connect and disconnect functionality. N-channel MOSFET based high side switch is preferred over P-channel MOSFET due to better thermal efficiency and smaller solution size. Discrete charge pump based N-channel MOSFET gate driver is a traditional way to drive N-channel MOSFET. To implement feature such as overvoltage protection, additional discrete components are often used to sense the supply voltage and turn off the MOSFET in case of overvoltage event. Though discrete component based circuits are popular to realize high side switch using N-channel MOSFET, it comes at an expense of increased component count, poorer accuracy and higher rate of failure, especially critical for safety applications.

LM74502 is an integrated high side switch controller with reverse polarity and overvoltage protection that offers size and performance benefits against discrete gate driver circuit as shown in Figure 1.

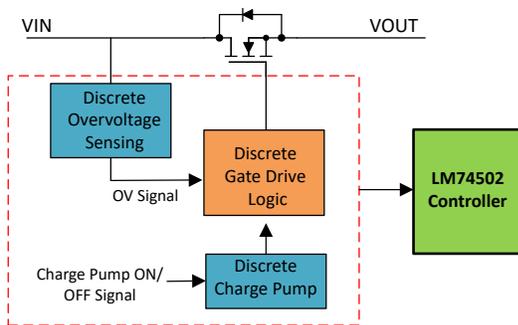


Figure 1. Discrete High Side Switch Driver vs LM74502

In this application brief we discuss three easy to use high-side switch applications using LM74502.

## Back-to-Back MOSFET Driver Using LM74502

The LM74502 controller has all the features necessary to implement a reverse polarity protection circuit with load disconnect feature as shown in Figure 2. LM74502 is paired with an external back-to-back connected N-channel MOSFETs to

replace traditional back-to-back connected P-channel MOSFETs. LM74502 has internal charge pump which generates gate drive voltage 12-V higher than input supply  $V_S$ , typically. When device is enabled, gate voltage is applied between GATE and SRC pin to drive external MOSFET. MOSFET Q1 acts as load disconnect switch while MOSFET Q2 provides protection against input reverse polarity events.

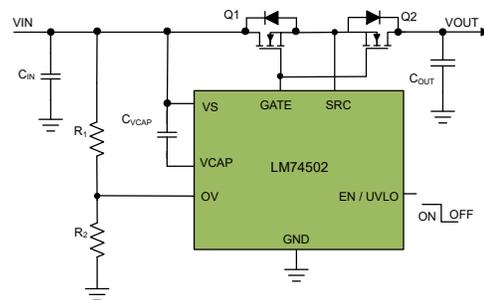


Figure 2. LM74502 as Back-to-Back MOSFET Driver

Figure 3 shows LM74502 typical response to input reverse polarity and overvoltage event.

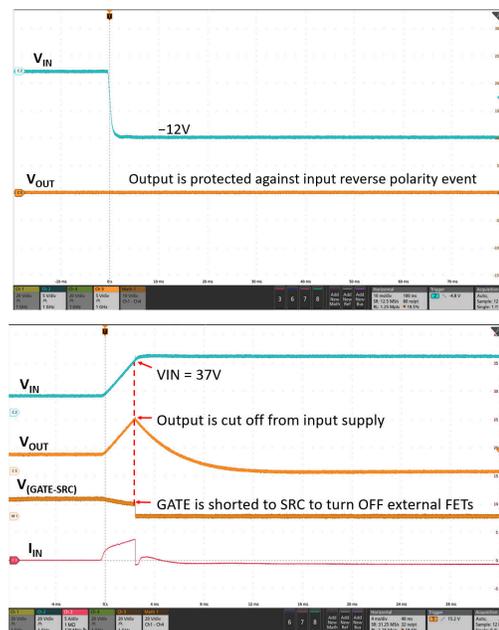


Figure 3. Input Reverse Polarity and Overvoltage Response of LM74502

## Input Surge Stopper Using LM74502

Many industrial applications are required to comply with input overvoltage transient events described by standards such as IEC61000-4-x. LM74502 can be configured as input surge stopper to provide overvoltage protection against input transients as shown in Figure 4. MOSFET Q1 is used to turn off or clamp output voltage to safe level and protect the downstream loads from input transient event. Note that only the VS pin is exposed to input transient through a resistor R1. A zener diode  $D_Z$  is used to clamp and protect the VS pin within recommended operating condition. Rest of the circuit is not exposed to higher voltage as the MOSFET Q1 can either be turned off completely or output voltage is clamped to safe level. For additional information on surge stopper configuration, refer to [LM74502 data sheet applications section](#).

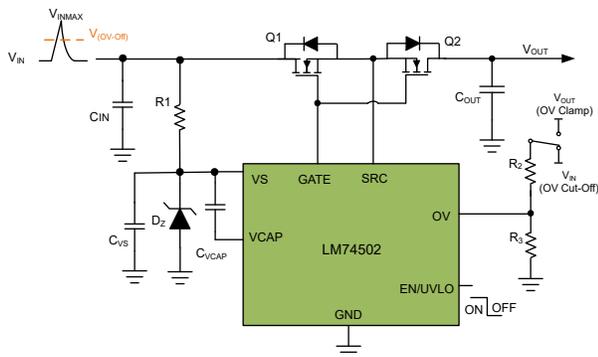


Figure 4. Surge Stopper Using LM74502

## Fast Turn ON and OFF High Side Switch Driver Using LM74502H

Many industrial applications such as industrial motor drives and industrial PLC digital output modules require fast turn on and off high side switch to disconnect downstream loads in case of input supply overvoltage and undervoltage event. Some of the safety applications also require this supply line disconnect switch to be turned on and off quickly (withing few  $\mu$ s) for system level diagnostic to verify the proper functioning of the load disconnect switch. LM74502H can be used to realize fast switching high side switch driver as shown in Figure 4.

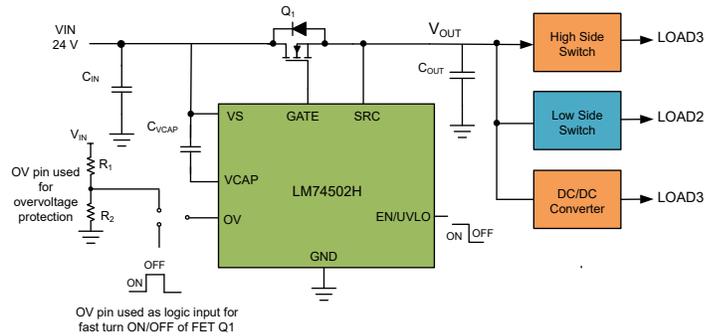


Figure 5. Fast Turn ON and OFF High Side Switch Driver Using LM74502H

LM74502H OV pin can be used in traditional way to set overvoltage protection. However OV pin can also be used as logic input to turn on and off external MOSFET within few  $\mu$ s. When OV pin pulled above device's  $V_{OVR}$  threshold (1.25-V typical), LM74502H with its peak gate sink current of 2 A turns off external MOSFET within 1- $\mu$ s typically. When OV pin is pulled low below  $V_{OVF}$  threshold (1.14-V typical), device turns on external MOSFET with turn on speed of 7- $\mu$ s typical. Figure 6 shows typical response of LM74502H GATE pin to 300- $\mu$ s logic input applied to OV pin.

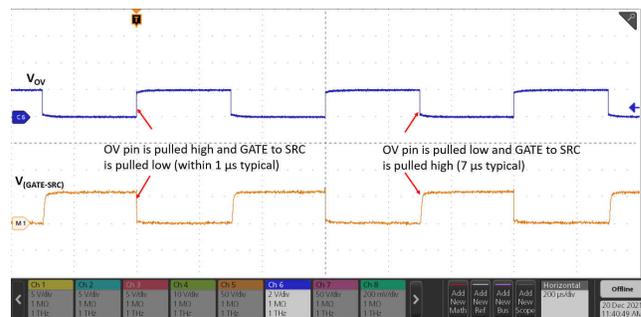


Figure 6. LM74502H Gate Response to OV Logic Input Pulse

## Conclusion

LM74502 controllers has all the features required to implement high side switch driver topologies supporting reverse polarity and overvoltage protection. Compared to discrete charge pump based gate driver and protection circuits, LM74502 based solution offers solution size, performance and cost benefit. The device also offers higher gate drive variant LM74502H optimized for fast switching high side switch applications.

## References

Texas Instruments, [Low IQ High Side Switch Controller with Reverse Polarity and Overvoltage Protection](#) data sheet.

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