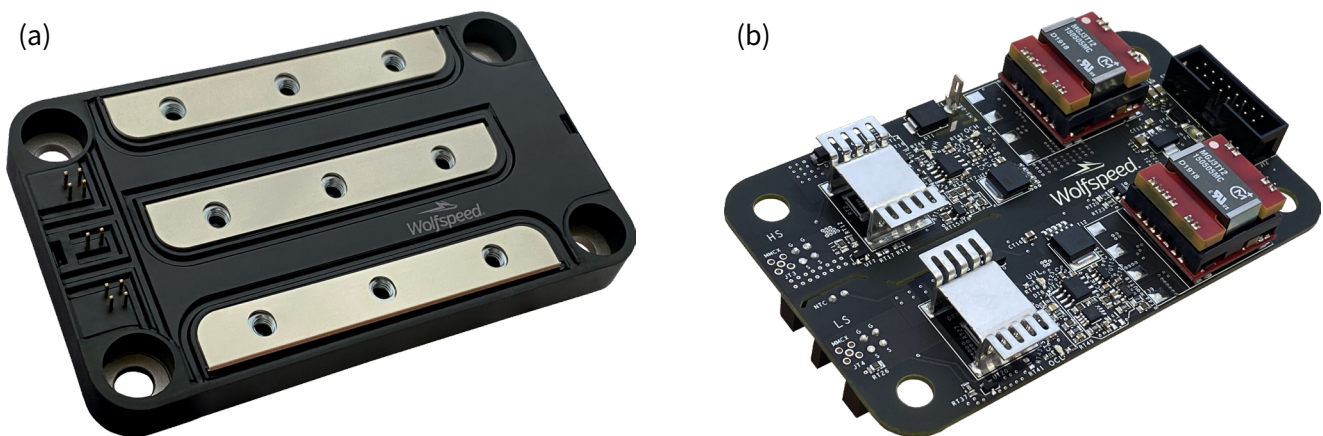


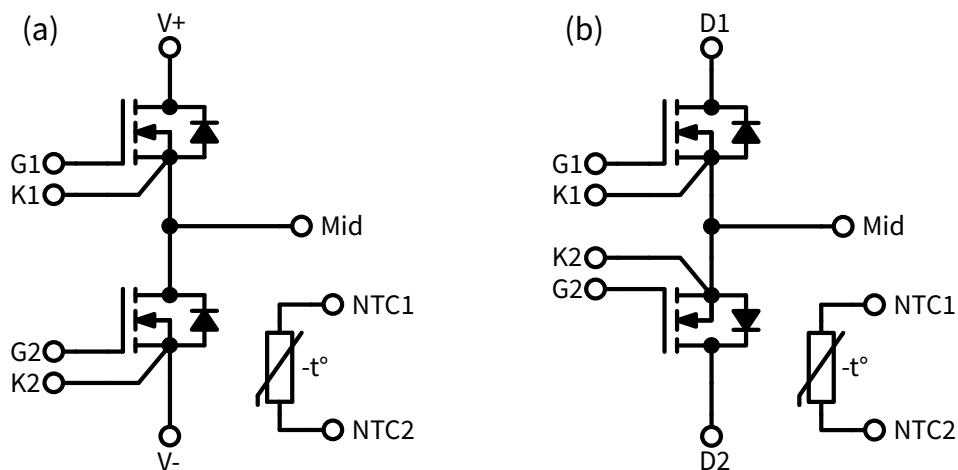
# CGD1700HB3P-HM3 Common-Source Guide

## Gate Driver Modifications to Support Common-Source HM Modules

The Wolfspeed HM power module family is offered in various configurations, including half-bridge (HB) and common-source (CS) modules. The CGD1700HB3P-HM3 gate driver was initially developed by Wolfspeed to support half-bridge modules, though it can be easily adapted to support other module variants. This document outlines the modifications needed for the CGD1700HB3P-HM3 gate driver to support common-source HM modules.



**Figure 1.** (a) HM power module and (b) CGD1700HB3P-HM3 gate driver



**Figure 2.** HM power module pinouts: (a) half-bridge and (b) common-source

## 1. Disable Overlap Protection

Remove the XOR gate *UB13* and use a 0  $\Omega$ , 0603 resistor to short pins 4 and 5 of the removed *UB13*. This disables overlap/interlock protection and enables both switch positions to be commanded simultaneously, which is typically required for common-source module applications.

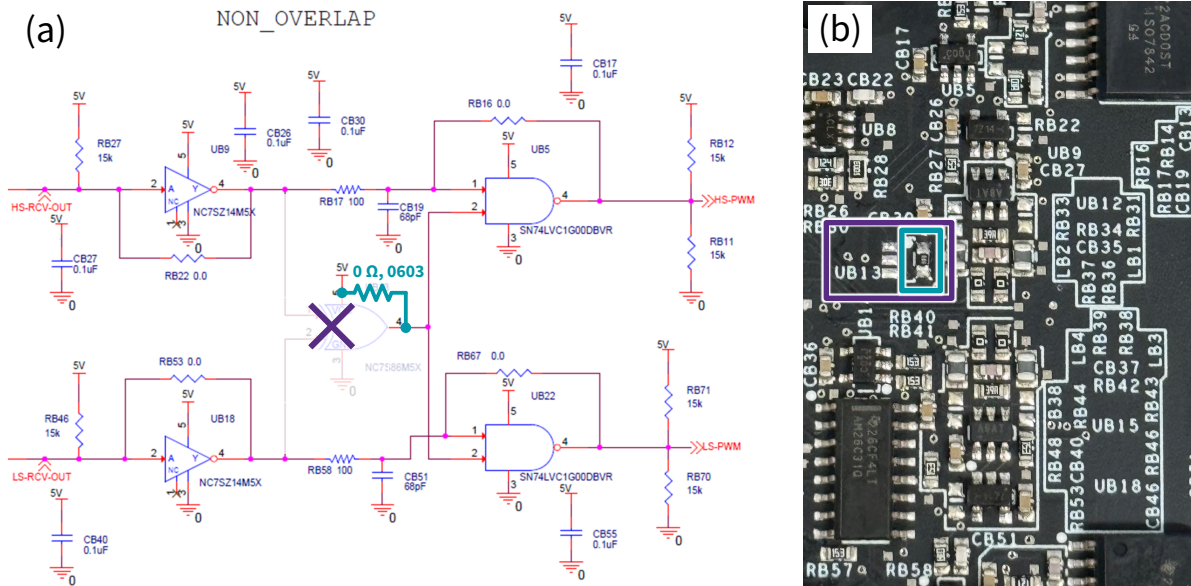


Figure 3. Disable overlap protection: (a) schematic and (b) hardware

## 2. Modify Low-Side DESAT (Two Options)

The low-side (LS) DESAT circuit on the CGD1700HB3P-HM3 is connected directly to the high-side (HS) Kelvin-source on the circuit board by default. This direct connection is advantageous in half-bridge applications since it provides a Kelvin measurement to the LS drain terminal and reduces the number of external connections to the gate driver; however, when driving common-source modules, this connection can lead to the low-side DESAT circuit erroneously indicating short-circuit events or damage to the gate driver. To operate this gate driver with common-source modules, the LS DESAT circuit needs to be either disabled (**Option 2A**) or modified (**Option 2B**). Both options require that the overcurrent protection is activated on the CGD1700HB3P-HM3 by configuring the  $\overline{\text{RESET}}$  signal (pin 15 on the input connector) to be left floating or held high at +5 V. If an overcurrent fault event occurs, the fault condition must be acknowledged with a  $\overline{\text{RESET}}$  signal to return to normal operation. **Option 2A** only protects the HS switch position from overcurrent events. It is simpler to implement but is not recommended for systems requiring bidirectional operation. **Option 2B** protects both switch positions and is the recommended implementation for bidirectional systems, but it requires additional modifications.

In either case, the HS-overcurrent (HS-OC) connector, *JT1*, cannot be left floating as the HS-OC fault will trip immediately when the HS gate is actuated. In normal operation, the HS-OC connector should be connected to the HS drain terminal (*D1*) using a flying wire. If bench-top testing of the gate driver is required, it is acceptable to short the HS-OC connection to the HS source to prevent the overcurrent fault from tripping. **This modification will disable the HS-OC protection.**

### Option 2A. Disable Low-Side DESAT

Remove *DB10* and *DB11* (**Figure 4**). Remove *CB54* and move *RB59* to the location of the removed *CB54* (**Figure 5**). After performing this modification, the high-side DESAT circuit will continue to operate normally, protecting the high-side switch from first-quadrant short circuit events. In common-source applications where the HS and LS switches operate unidirectionally in series, the HS DESAT circuit will also protect the LS switch from short circuit events. Note that common-source modules do not have a defined HS and LS switch position, since both switch positions are oriented the same with respect to the midpoint. This document defines *Q1* as the HS device and *Q2* as the LS device, though this orientation is not strictly necessary in an end application. If this DESAT modification option (**Option 2A**) is adopted and HS DESAT functionality is still required in the application, ensure that the circuit is configured such that current flows from the terminal *D1* to *Mid* for the DESAT circuit to function as intended (**Figure 6**).

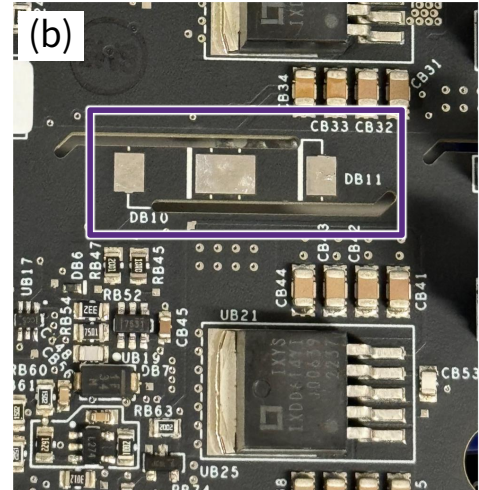
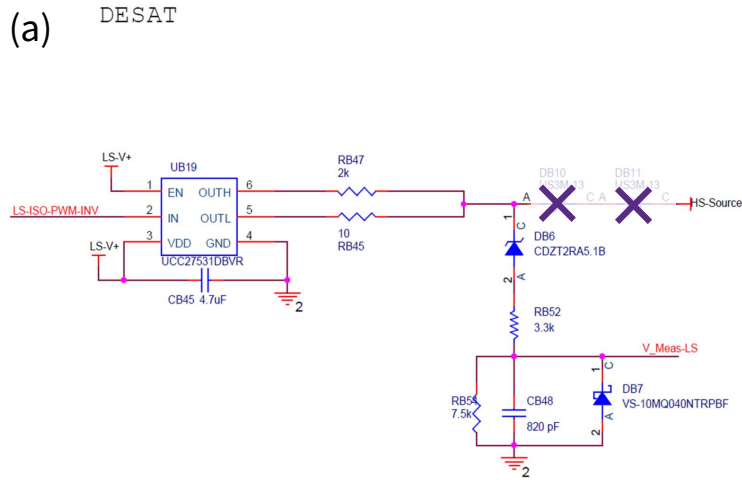


Figure 4. Remove low-side DESAT diodes: (a) schematic and (b) hardware

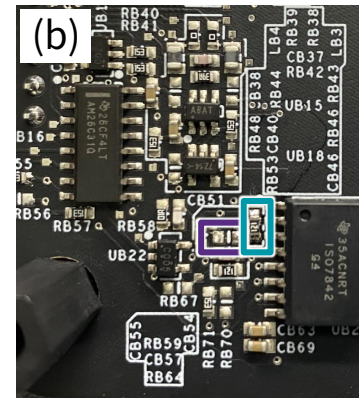
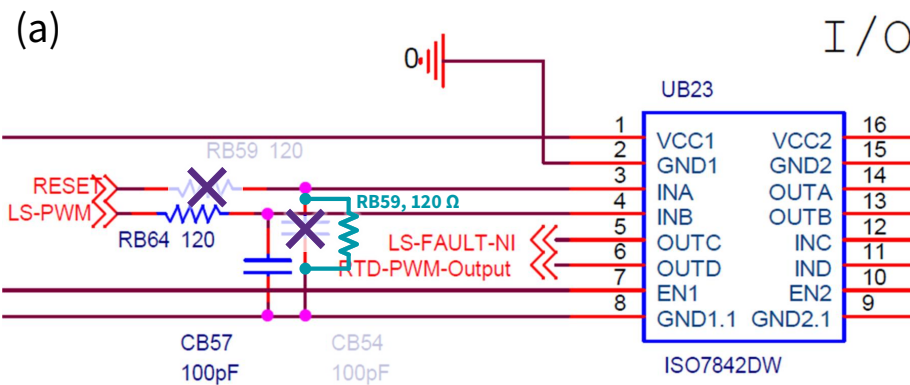


Figure 5. Disable low-side DESAT for Option 2A: (a) schematic and (b) hardware

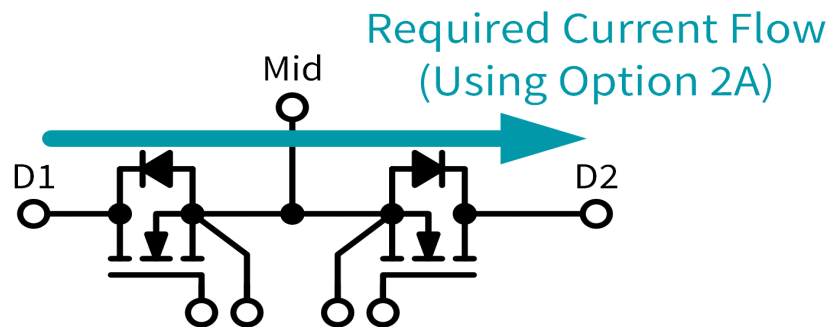
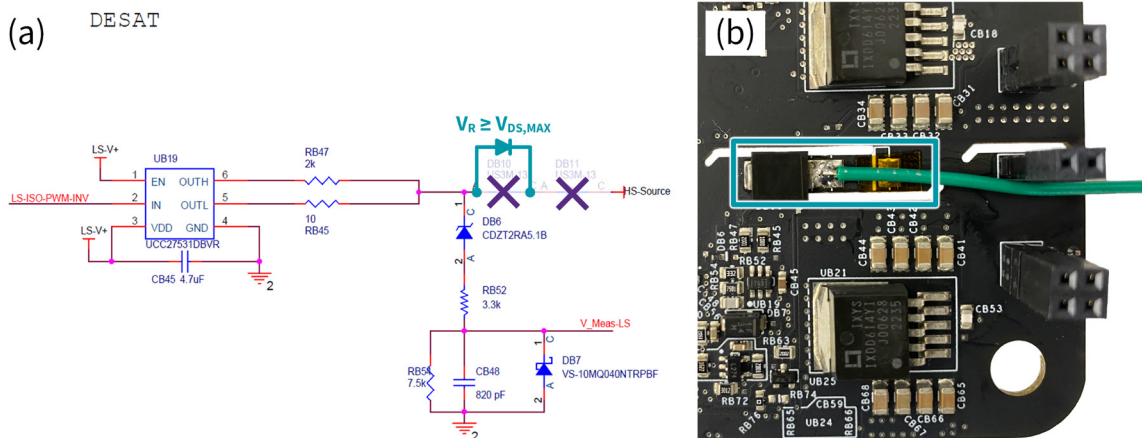


Figure 6. Current flow direction to ensure DESAT protection using Option 2A

**Option 2B. Flying Wire Low-Side DESAT**

Remove *DB10* and *DB11* (**Figure 4**). Replace *DB10* with a higher voltage rated diode, cover the exposed *DB11* cathode pad with insulating tape, and add an insulated flying wire to the cathode pad of *DB10* (**Figure 7**). The higher voltage diode is necessary because the default DESAT circuit utilizes two 1.0 kV diodes in series for greater voltage blocking capability, but one diode must be removed to break the connection to the HS Kelvin-source. To ensure that the DESAT circuit can protect over the full voltage of the power module, the single diode needs a reverse voltage rating,  $V_R$ , greater than or equal to the maximum power module voltage,  $V_{DS,MAX}$ . Note that changing the blocking diode configuration will influence the calculated overcurrent trip value due to changes in the diode forward voltage. A recommended 1.2 kV diode in the correct footprint is the STMicroelectronics® STTH212S. The exposed side of the flying wire should be terminated with a ring terminal and attached directly to the drain terminal (*D2*) of the low-side device (*Q2*). If this DESAT modification option (**Option 2B**) is adopted, both channels of the gate driver (HS and LS) will be able to detect an overcurrent event. The module orientation will not be critical to overcurrent protection and the gate driver will support bidirectional functionality.

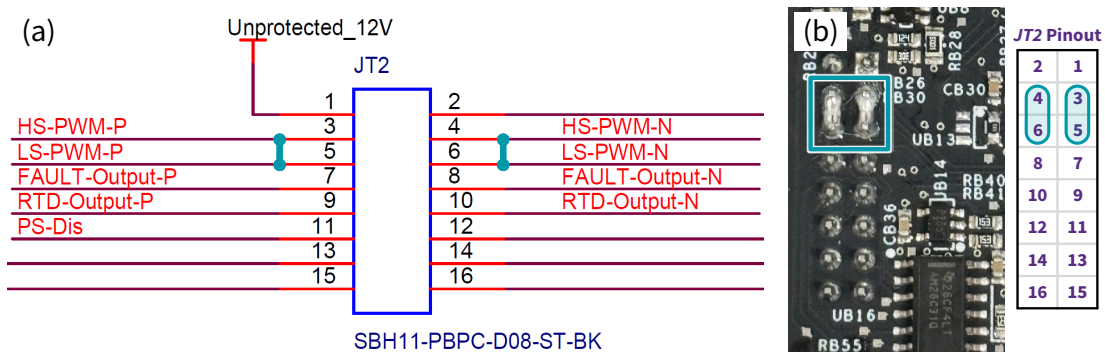
If **Option 2B** is executed, the added flying wire — the LS-overcurrent (LS-OC) connection — cannot be left floating as the LS-OC fault will trip immediately when the LS gate is actuated. If bench-top testing of the gate driver is required, it is acceptable to short the LS-OC connection to the LS source to prevent the overcurrent fault from tripping. **This modification will disable the LS-OC protection.**



**Figure 7.** Replace *DB10* with higher-voltage diode and add flying wire for **Option 2B**: (a) schematic and (b) hardware

**3. (Optional) Combine High-Side and Low-Side Input Signals**

On the connector *JT2*, short pins 3 and 5 together and short pins 4 and 6 together (**Figure 8**). This modification enables the high-side and low-side gate drivers to be driven with only one input signal, which is advantageous in many common-source applications. Either the HS or LS input signal can be used to modulate both gate drivers simultaneously. **Do not attempt to drive the HS and LS gate drivers independently after completing this modification.** Attempting to drive the HS and LS separately will result in a short circuit at the input of the gate driver, potentially damaging the gate driver and the controller used to modulate it.



**Figure 8.** (Optional) Combine high-side and low-side input signals: (a) schematic and (b) hardware



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