**HIP4080 and HIP4081 High Frequency H-Bridge Drivers**

**HIP4080 and HIP4081 Power-up Application**

The HIP4080 and HIP4081 H-Bridge Driver ICs require external circuitry to assure reliable start-up conditions of the upper drivers. If not addressed in the application, the H-bridge power MOSFETs may be exposed to shoot-through current, possibly leading to MOSFET failure. Following the instructions below will result in reliable start-up.

**HIP4081**

The HIP4081 has four inputs, one for each output. Outputs ALO and BLO are directly controlled by input ALI and BLI. By holding ALI and BLI low during start-up no shoot-through conditions can occur. To set the latches to the upper drivers such that the driver outputs, AHO and BHO, are off, the DIS pin must be toggled from low to high after power is applied. This is accomplished with a simple resistor divider, as shown below in Figure 1. As the VDD/VCC supply ramps from zero up, the DIS voltage is below its input threshold of 1.7V due to the R1/R2 resistor divider. When VDD/VCC exceeds approximately 9V to 10V, DIS becomes greater than the input threshold and the chip disables all outputs. It is critical that ALI and BLI be held low prior to DIS reaching its threshold level of 1.7V while VDD/VCC is ramping up, so that shoot-through is avoided. After power is up the chip can be enabled by the ENABLE signal which pulls the DIS pin low.

**HIP4080**

The HIP4080 does not have an input protocol like the HIP4081 that keeps both lower power MOSFETs off other than through the DIS pin. IN+ and IN- are inputs to a comparator that control the bridge in such a way that only one of the lower power devices is on at a time, assuming DIS is low. However, keeping both lower MOSFETs off can be accomplished by controlling the lower turn-on delay pin, LDEL, while the chip is enabled, as shown in Figure 2. Pulling LDEL to VDD will indefinitely delay the lower turn-on delays through the input comparator and will keep the lower MOSFETs off. With the lower MOSFETs off and the chip enabled, i.e. DIS = low, IN+ or IN- can be switched through a full cycle, properly setting the upper driver outputs. Once this is accomplished, LDEL is released to its normal operating point. It is critical that IN+/IN- switch a full cycle while LDEL is held high, to avoid shoot-through. This start-up procedure can be initiated by the supply voltage and/or the chip enable command by the circuit in Figure 2.

![Figure 1](image1.png)

![Figure 2](image2.png)
Timing Diagrams

TIMING DIAGRAM FOR FIGURE 1.

NOTE:
1. ALI and/or BLI may be high after t1, whereupon the ENABLE pin may also be brought high.

NOTE:
1. Between t1 and t2 the IN+ and IN- inputs must cause the OUT pin to go through one complete cycle (transition order is not important). If the ENABLE pin is low after the undervoltage circuit is satisfied, the ENABLE pin will initiate the 10ms time delay during which the IN+ and IN- pins must cycle at least once.

TIMING DIAGRAM FOR FIGURE 2.
Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.

2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.

3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.

4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.

5. Renesas Electronics products are classified according to the following two quality grades: “Standard” and “High Quality.” The intended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below.

   - “Standard”: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment, industrial robots, etc.
   - “High Quality”: Transportation equipment (automobiles, trains, ships, etc.), traffic control (traffic lights), large-scale communication equipment, key financial terminal systems, safety control equipment, etc.

   Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations, etc.), or may cause serious property damage (space systems; underwater repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user’s manual or other Renesas Electronics document.

6. When using Renesas Electronics products, refer to the latest product information (data sheets, user’s manuals, application notes, “General Notes for Handling and Using Semiconductor Devices” in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.

7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain usage conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to, redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.

8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.

9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.

10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.

11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.

12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.