

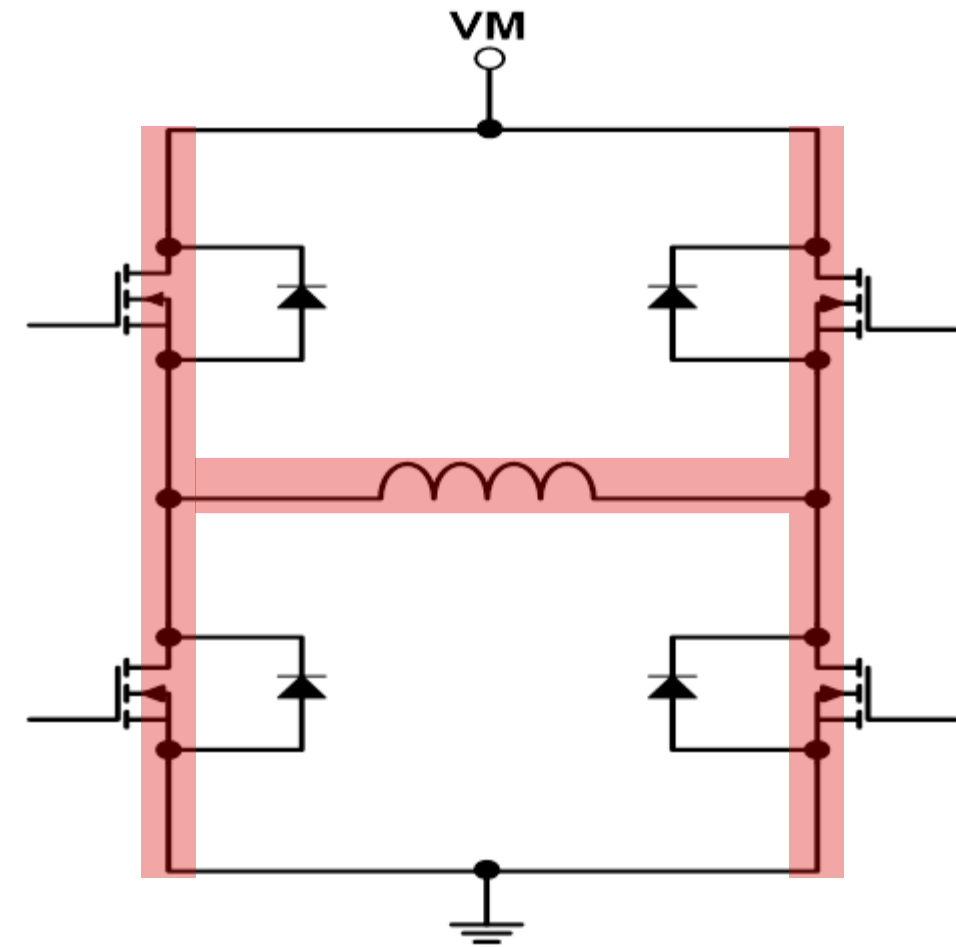
Brushed DC Motor 2: The H-Bridge

TI Precision Labs – Motor Drivers

Presented and prepared by Hector Hernandez

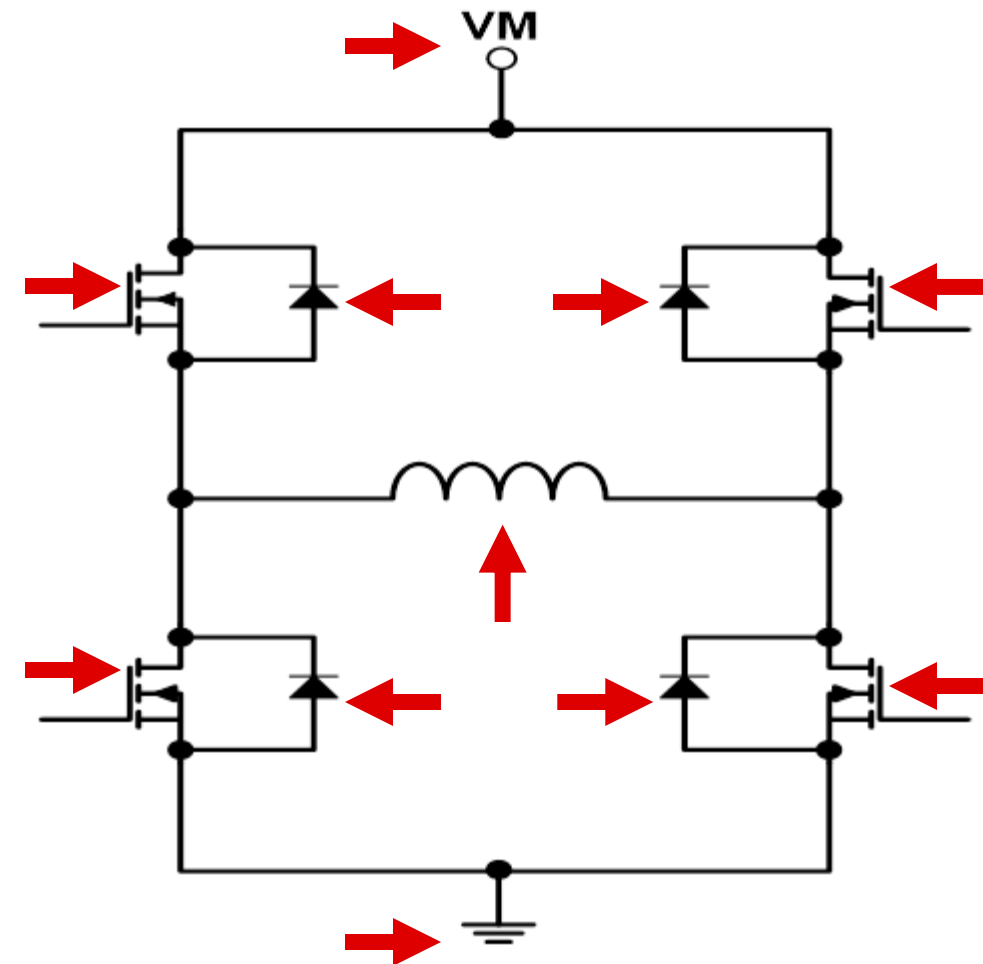
What is an H-bridge?

- Electronic circuit shaped like the letter “H”
- Drives a motor in both directions
- Controls the flow of current to a load



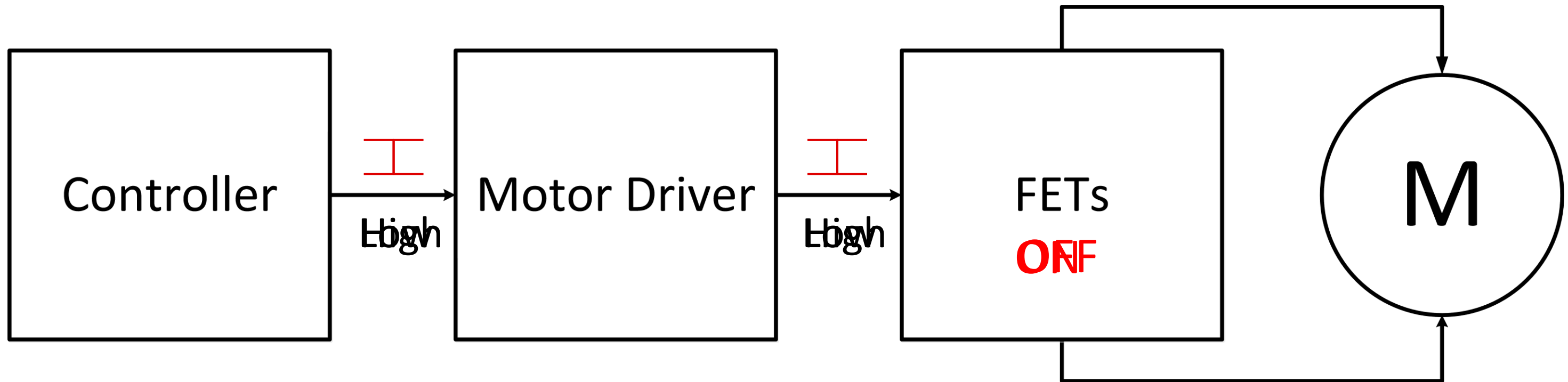
Components

- Voltage supply with ground
- Diodes
- Load, such as a motor
- Switches
 - Most common transistor utilized is the MOSFET
 - NMOS FETs are used more than PMOS FETs due to having a lower R_{dson} due to their size
 - Drawback is that the gate is driven 5-10 V higher than the source.



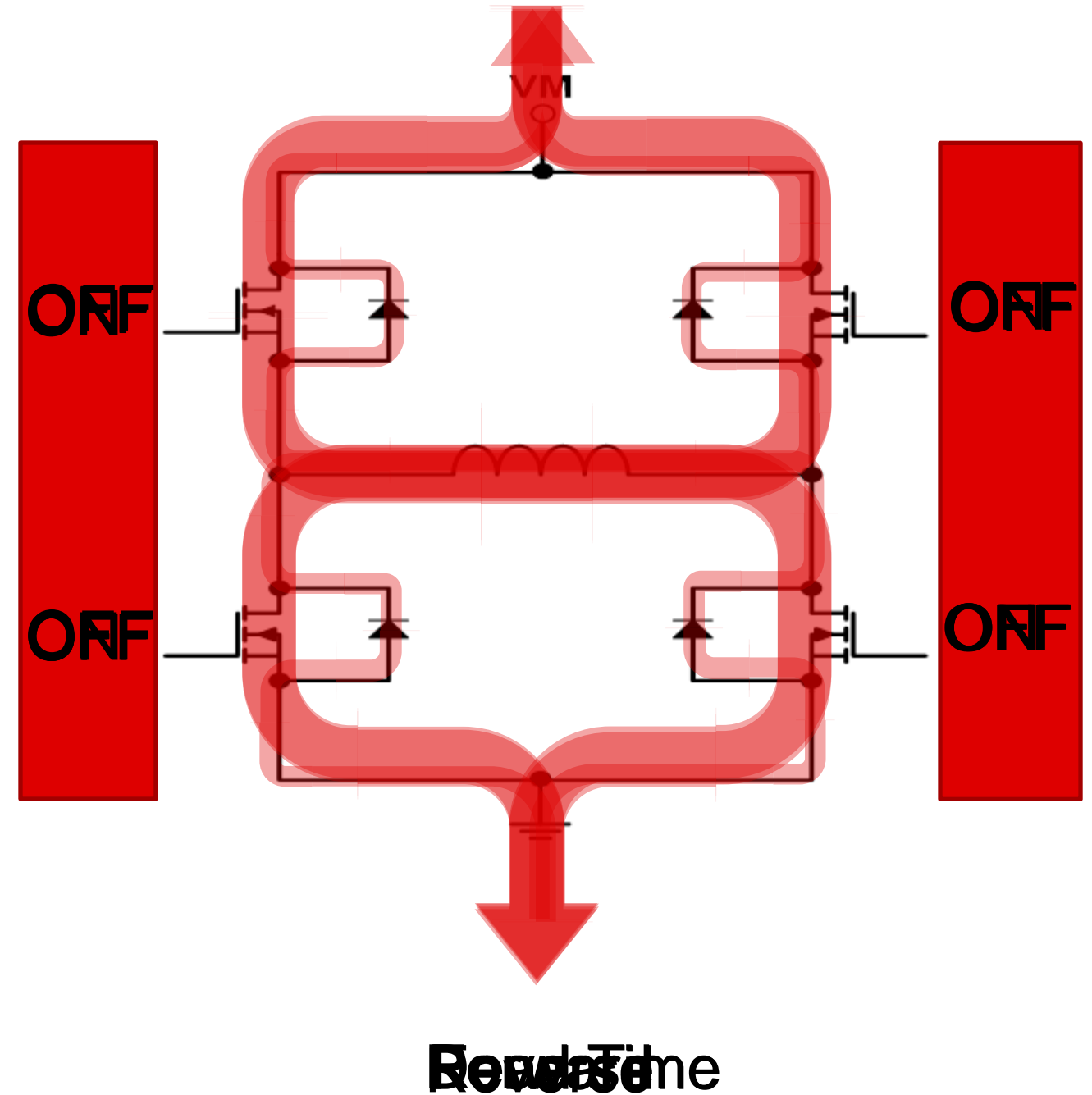
Controlling an H-Bridge

- Controller
 - Generates control signals for the H-bridge
 - Signals can be pulse width modulated (PWM) or DC
- Motor driver
 - Interprets the control signals
 - Amplifies and outputs those signals to the MOSFETs' gates



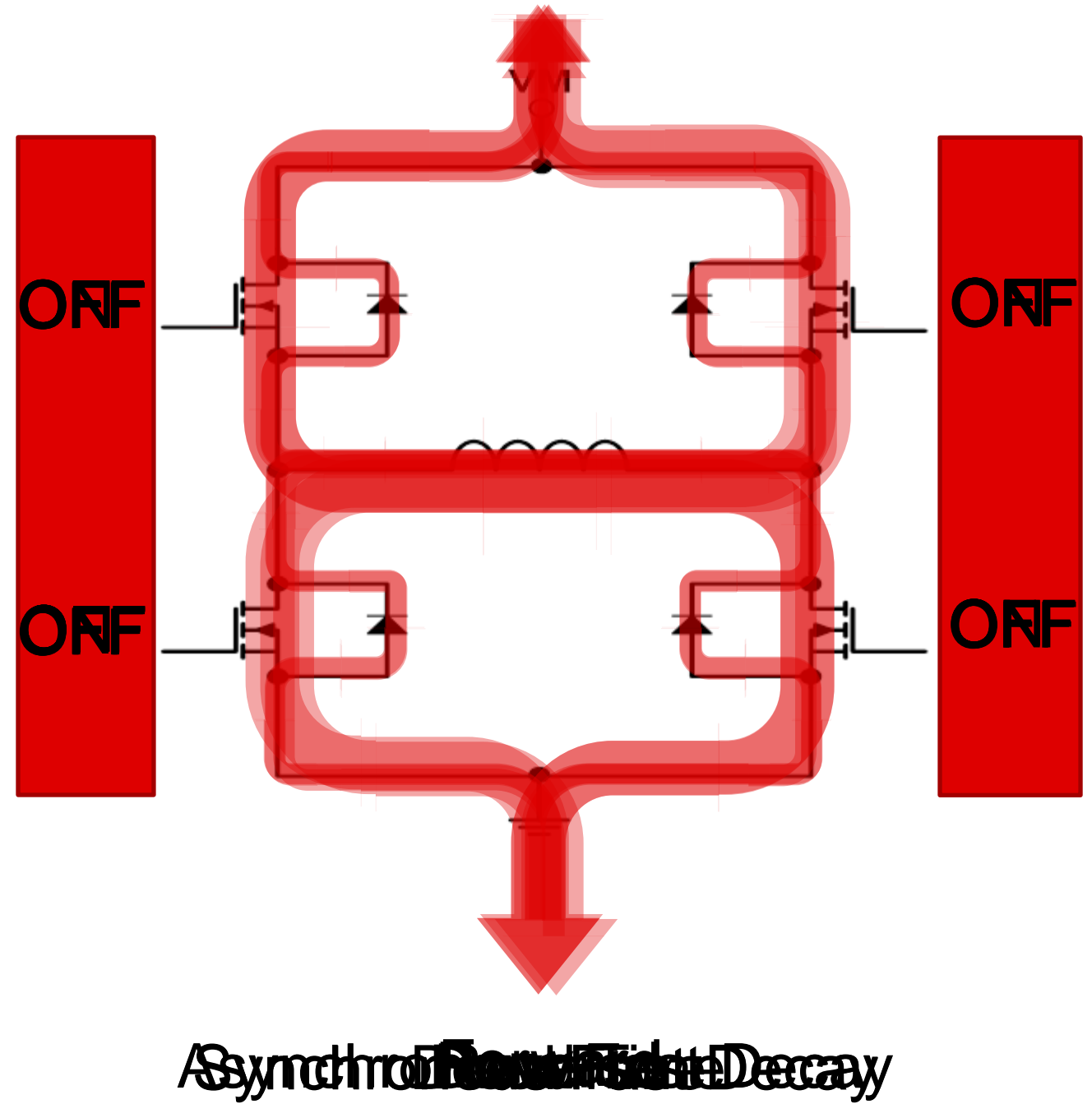
Current Flow

- OUT2 to OUT1 drive (Reverse)
- OUT1 to OUT2 drive (Forward)
- Current recirculation
 - Once the current is flowing in Forward direction, the direction of the current is maintained by the inductance of a Brushed DC motor.
 - Not giving a safe path for this current to flow, while it decays down to zero or switches to the new direction of the current, can result in a shoot through.
 - Dead time is when all FETs are off.
 - Dead time introduces a decay in the current flowing through the motor.



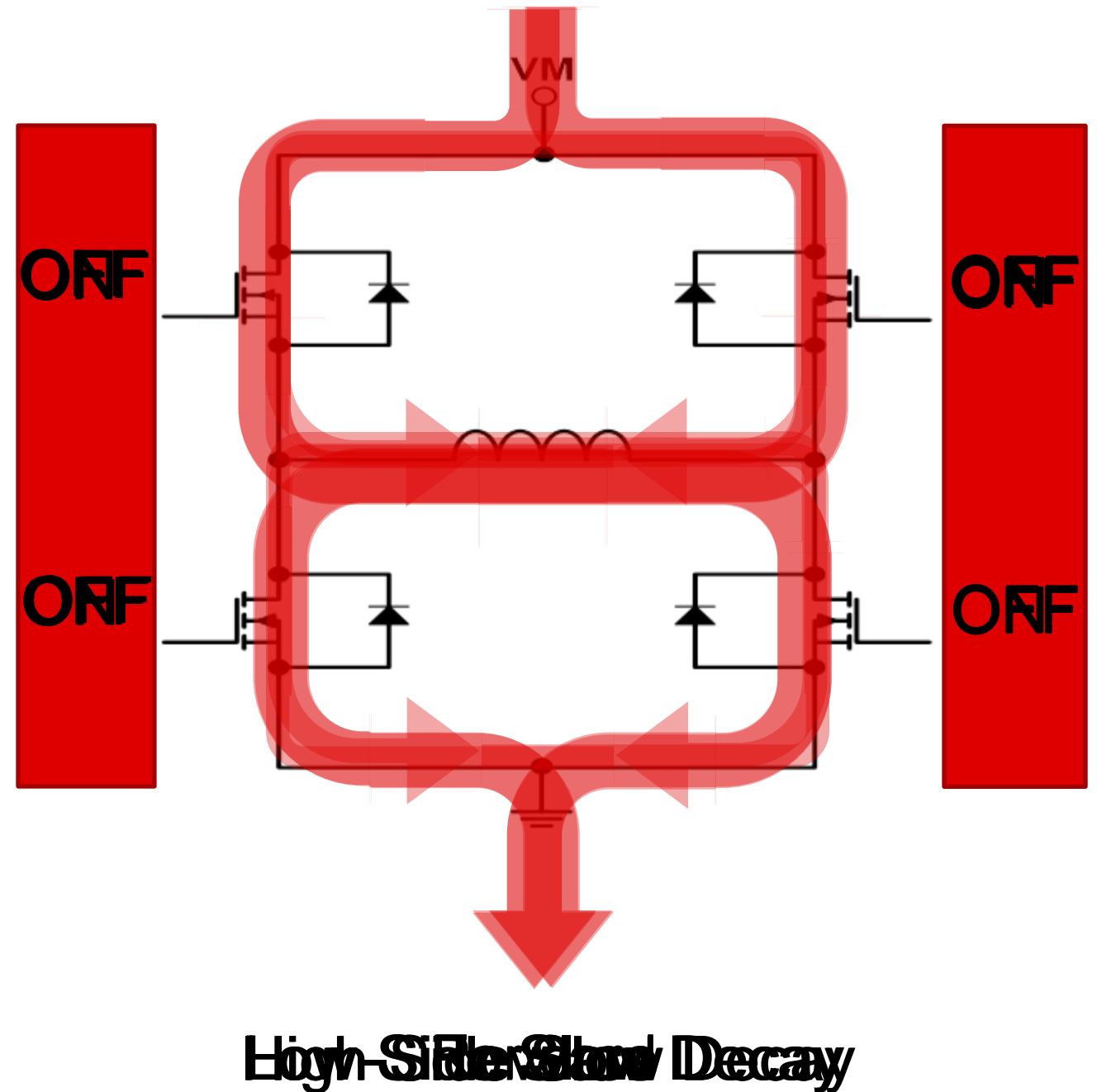
Current Flow

- Fast decay (Coast)
 - Asynchronous fast decay – FETs' body diodes are used to decay the current
 - Synchronous fast decay - when FET on resistance is used to decay the current
 - All FETs must be OFF before current reaches zero otherwise current will begin to flow in the reverse direction



Current Flow

- Slow decay (Brake)
 - Low-Side active freewheeling - disabling the current direction's high side FET and enabling the opposite direction's low side FET
 - High-Side active freewheeling - enabling the opposite direction's high side FET and disabling the current direction's low side FET



To find more brushed motor driver technical resources and search products, visit <http://www.ti.com/motor-drivers/brushed-dc-bdc-drivers/overview.html>