-Bridge Motor Driver — Netlist Description & Simulation No

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This document describes the structure and behavior of the provided H-Bridge SPICE net
explains key parameters and summarizes expected waveforms for common operating m
Reverse, Brake, Coast). Illustrative plots are provided for conceptual understanding; the
direct SPICE simulation outputs.

Circuit Overview

Block 1 — Supply & Decoupling: Defines the DC bus (VBUS) feeding the H-Bridge and ar
bulk/decoupling capacitors. The shunt resistor (RSENSE) on the return path enables curr
measurement.

Block 2 — Power MOSFETs: Four MOSFETs form the H-Bridge legs (High/Low on each side
and pull-downs are included to shape edge rates and guarantee default-off behavior.

Block 3 — Gate Drive & PWM: Gate drive sources (or behavioral sources) produce PWM
high/low sides. Parameters control frequency (FSW) and duty cycle (DUTY). Mode logic s
leg is modulated.

Block 4 — Output/Load: The motor or load connects between PH_A and PH_B. Different
combinations set the polarity and magnitude of the applied voltage, enabling forward/re
rotation, dynamic braking, or coasting.

Parameter Values

Key Parameters (from .param lines, where detected):

VCC = 12

VDRV = 12

FSW = 20k

DUTY = 0.5

RSH = 0.1

MODE = 4

T = {1/FSW}

TON = {DUTY*T}

Notes:

• FSW sets the PWM period T = 1/FSW. DUTY sets the high-time as D·T for the modulate

• Typical defaults used for plots in this report: VBUS≈12.0 V, VDRV≈12.0 V, FSW≈20000

Operating Modes & Expectations

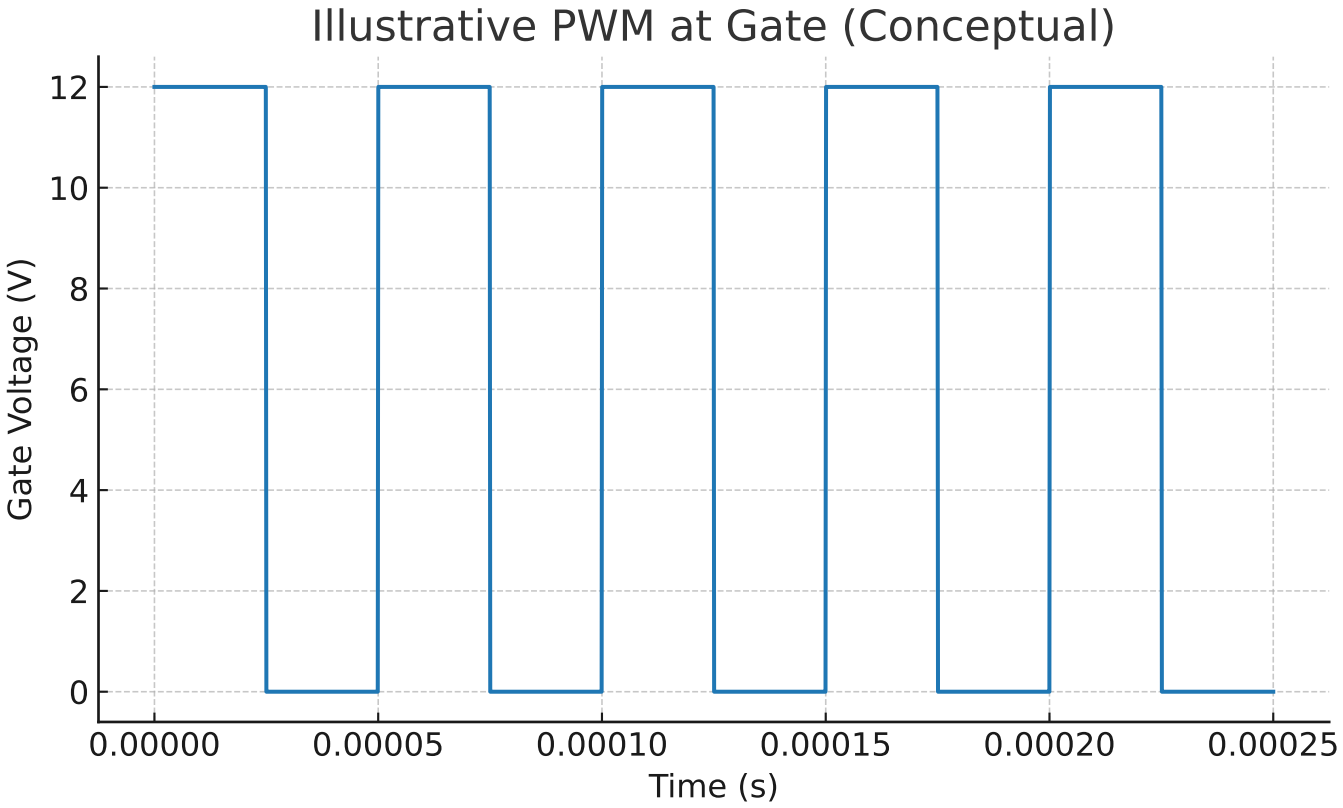
Forward Mode: High-side of Phase A is PWM-driven while the low-side of Phase B is ON. T
positive average voltage across the motor (PH_A > PH_B).

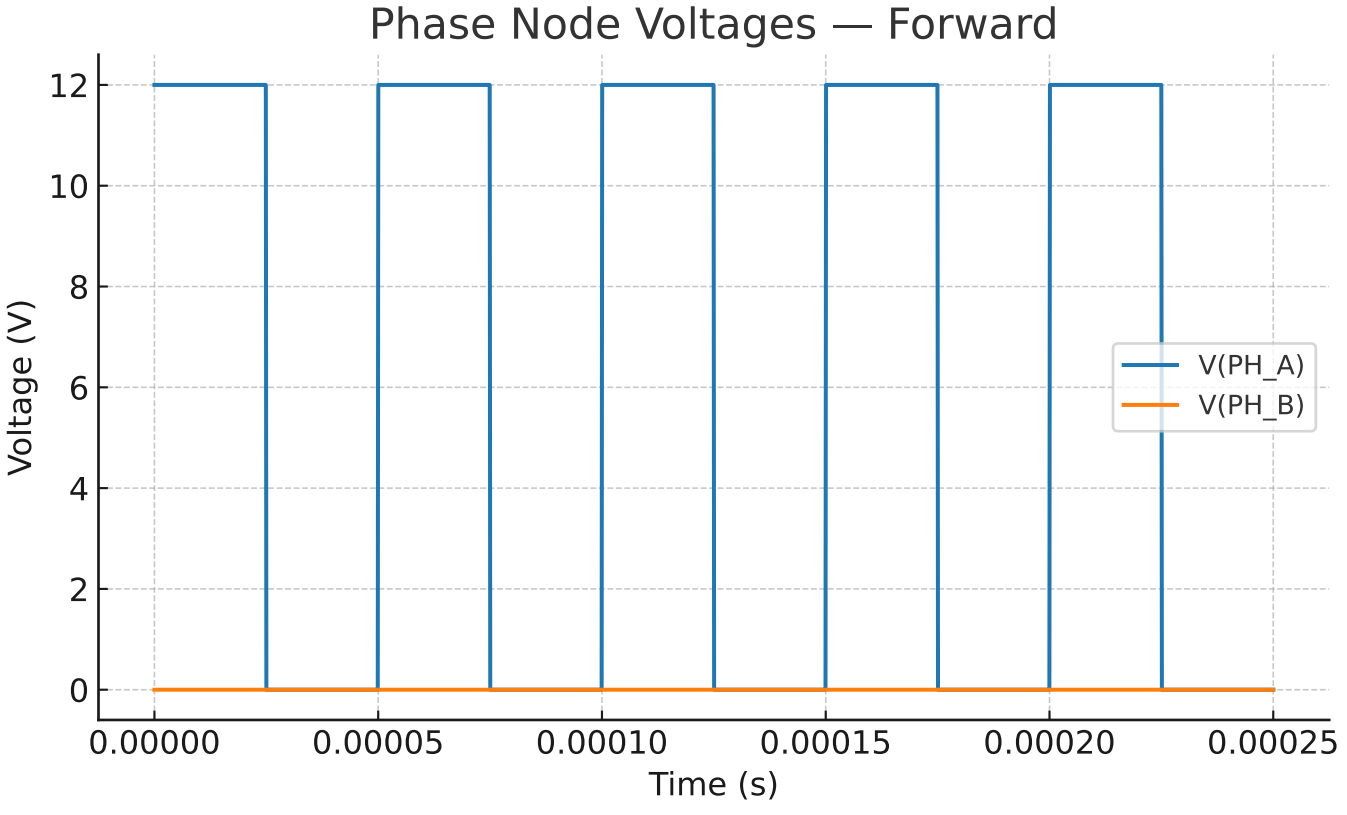
Reverse Mode: High-side of Phase B is PWM-driven while the low-side of Phase A is ON. T
negative average voltage across the motor (PH_B > PH_A).

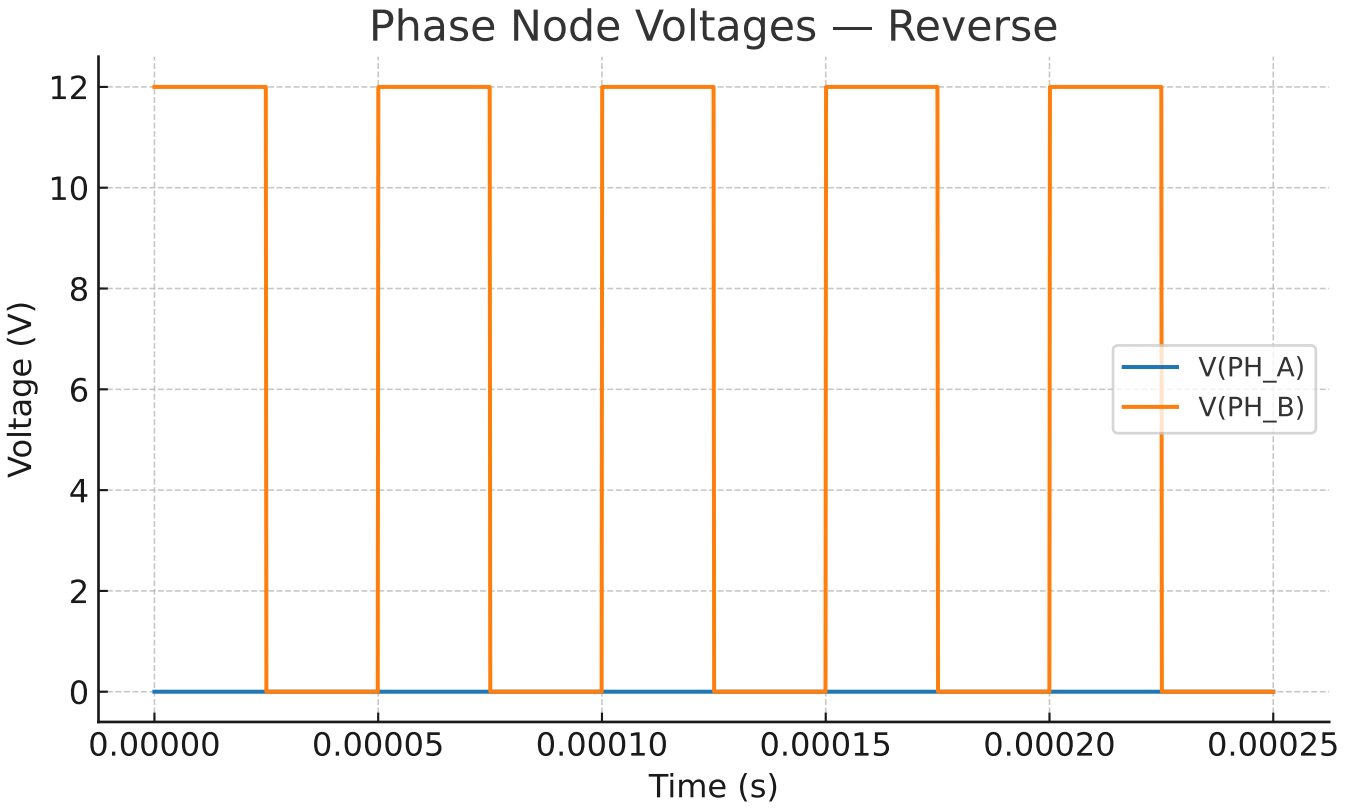
Brake Mode (Dynamic Braking): Both low-side MOSFETs turn ON, shorting the motor term
Back-EMF energy dissipates in the winding and MOSFET Rds(on), quickly reducing speed

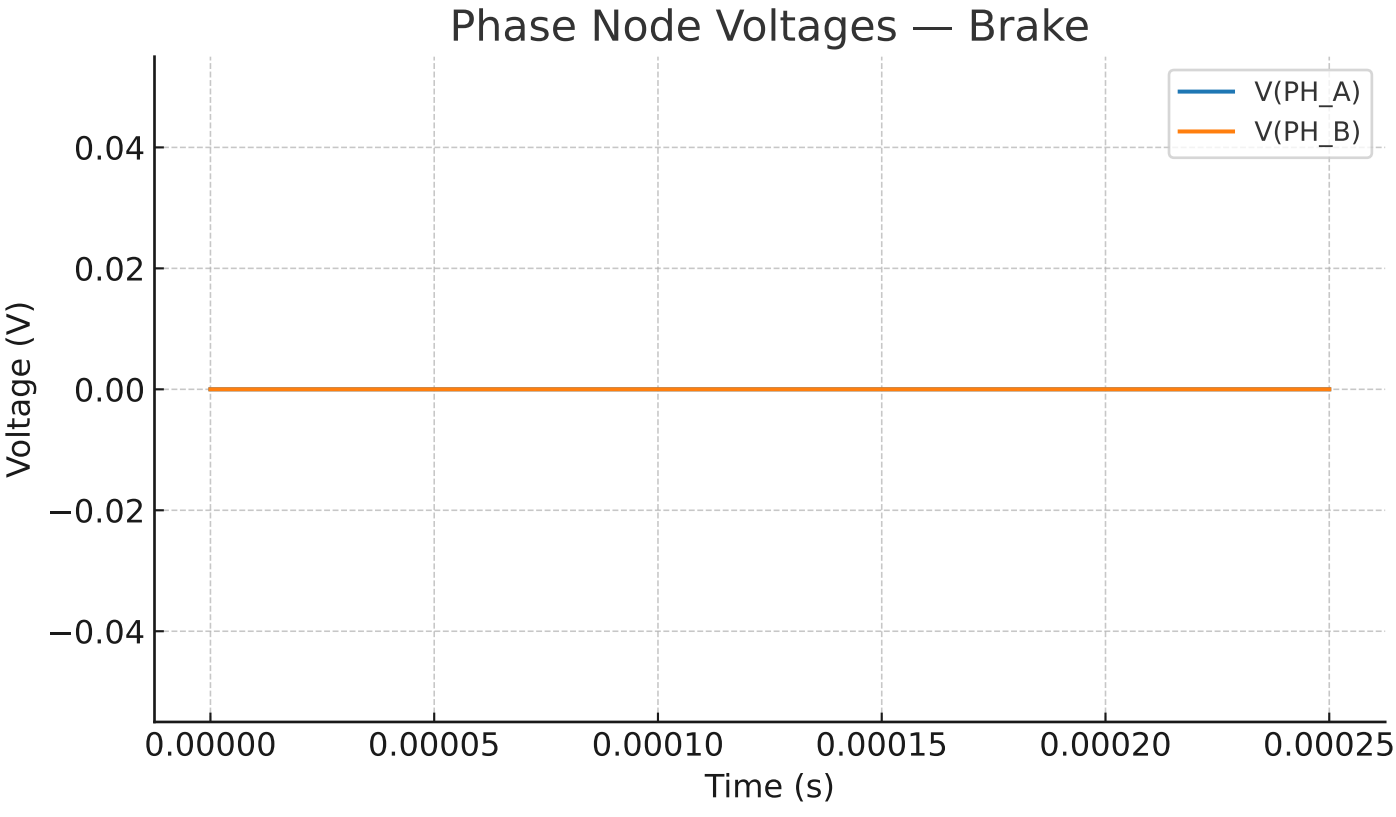
Coast Mode: All MOSFETs are OFF (or both high-sides OFF). The motor is left floating and
due to friction; minimal electrical damping occurs.

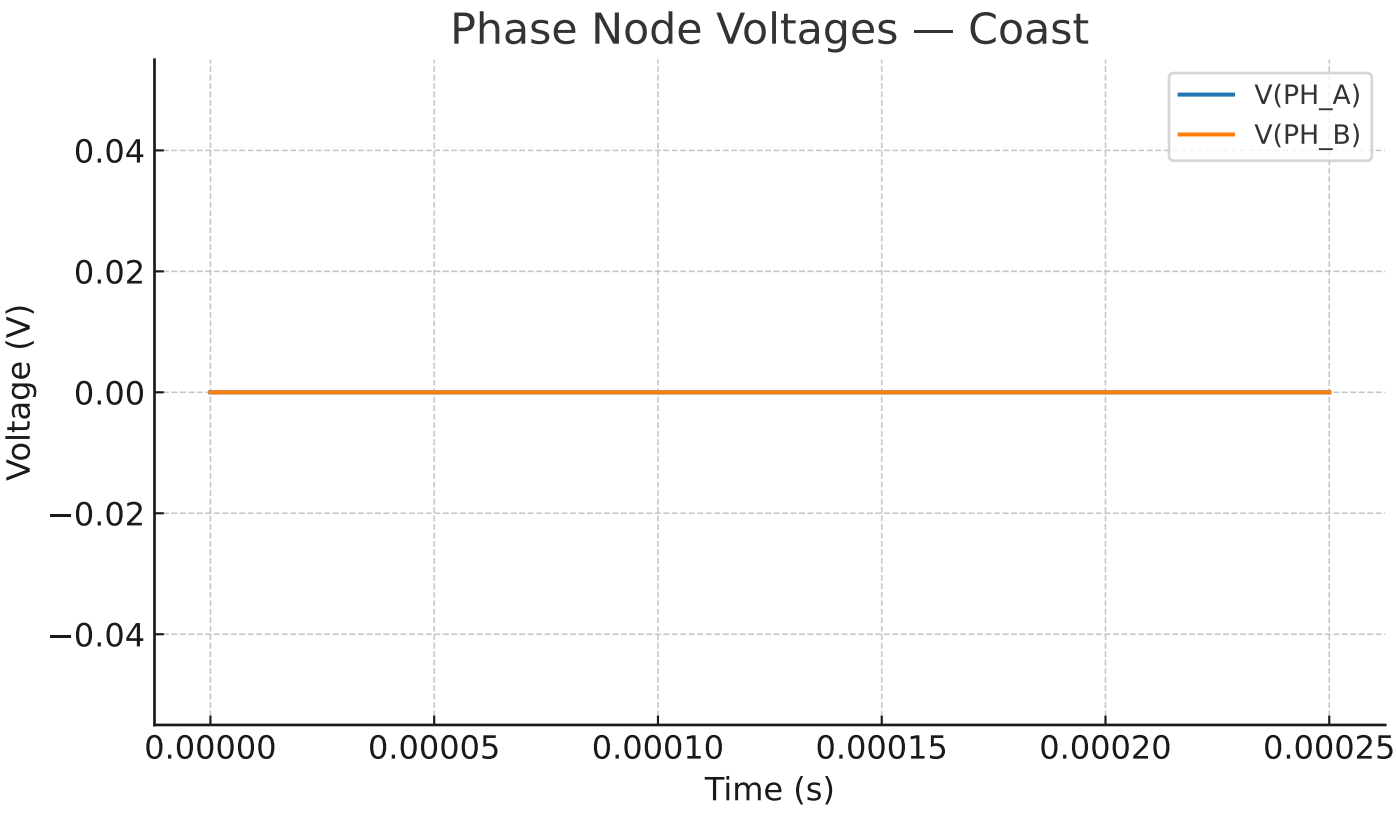
Current Sensing: The shunt resistor (RSENSE) in series with ground produces a voltage p
to phase current. This can be measured to implement current limit or vector control loop


Illustrative PWM at Gate (Conceptual)
Gate Voltage (V)
12
10
8
6
4
2
0
0.00000
0.00005
0.00010
0.00015
0.00020
0.00025
Time (s)


Phase Node Voltages — Forward
Voltage (V)
12
10
8
6
4
2
0
0.00000
0.00005
0.00010
0.00015
0.00020
0.00025
Time (s)
V(PH_A)
V(PH_B)


Phase Node Voltages — Reverse
Voltage (V)
12
10
8
6
4
2
0
0.00000
0.00005
0.00010
0.00015
0.00020
0.00025
Time (s)
V(PH_A)
V(PH_B)


Phase Node Voltages — Brake
V(PH_A)
V(PH_B)
0.04
0.02
0.00
−0.02
−0.04
Voltage (V)
0.00000
0.00005
0.00010
0.00015
0.00020
0.00025
Time (s)


Phase Node Voltages — Coast
V(PH_A)
V(PH_B)
0.04
0.02
0.00
−0.02
−0.04
Voltage (V)
0.00000
0.00005
0.00010
0.00015
0.00020
0.00025
Time (s)