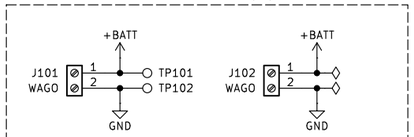
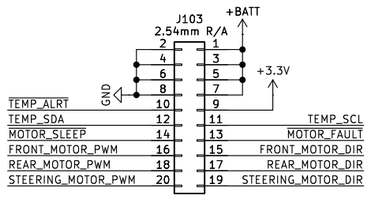
BATTERY CONNECTOR(s)

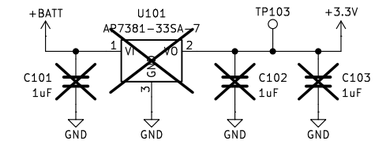


REPLACE WITH HIGH CURRENT RATED PART?

I/O CONNECTOR

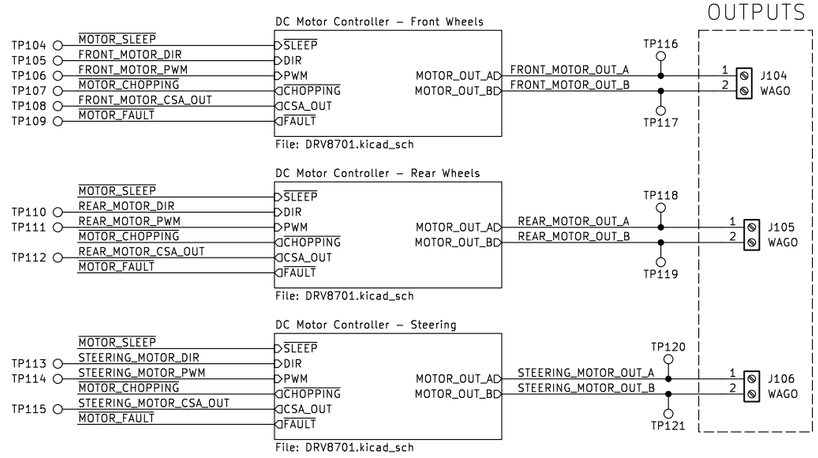


3.3V REGULATOR (OPTIONAL)

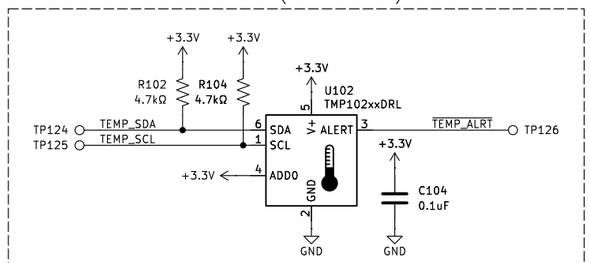


This regulator can be DNP if 3.3V is supplied externally.

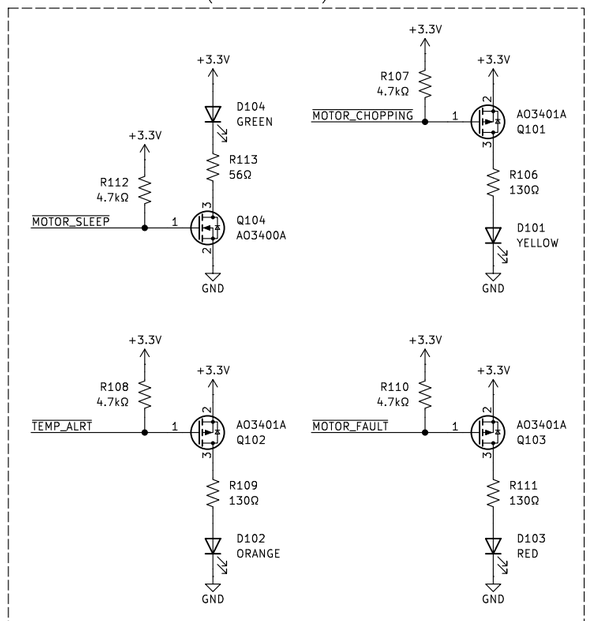
MOTOR OUTPUTS



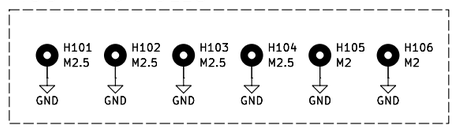
TEMPERATURE SENSOR (OPTIONAL)



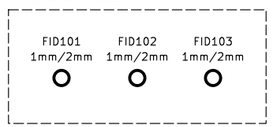
LED INDICATORS (OPTIONAL)



MOUNTING HOLES



FIDUCIALS



Geeks for Kids
Learn Science and Math Club

Sheet: /
File: motor-controller-v3.kicad_sch

Title: Brushed DC Motor Driver

Size: USLedger	Date: 2025-10-21	**Rev: V3**
KiCad E.D.A. 9.0.5		Id: 1/4

DC MOTOR CONTROLLER

IC Notes:

The DRV8701 is a single H-bridge gate driver that uses four external N-channel MOSFETs targeted to drive a 12-V to 24-V bidirectional brushed DC motor.

VBAT Voltage Range: 6V to 45V (abs. max)
Motor Drive Current: up to 35 A continuous
Inputs compatible with 1.8, 3.3, and 5 V logic
PWM operation up to 100 kHz
CSA output prop. to motor current (20 mV/A)
Active current chopping at 50 A
Undervoltage shutdown
Short circuit protection

DRV8701 Datasheet

MOT6142G Datasheet

Bulk Capacitor Sizing for DC Motor Drivers

DESIGN NOTES

FET: MOT6142G (Qgd = 6.8 nC typ.)

FET Gate Rise Time $t_R = Q_{gd}/I_{DRIVE}$

To achieve 100ns < t_R < 300ns,
22.7mA < I_{DRIVE} < 68mA.

Connecting a 200kΩ resistor from IDRIVE pin to GND yields I_{DRIVE} = 25mA.

Choosing R_{SENSE} = 1mOhm

$I_{CHOP} = (V_{REF} - V_{OFFSET})/(Av*R_{SENSE})$

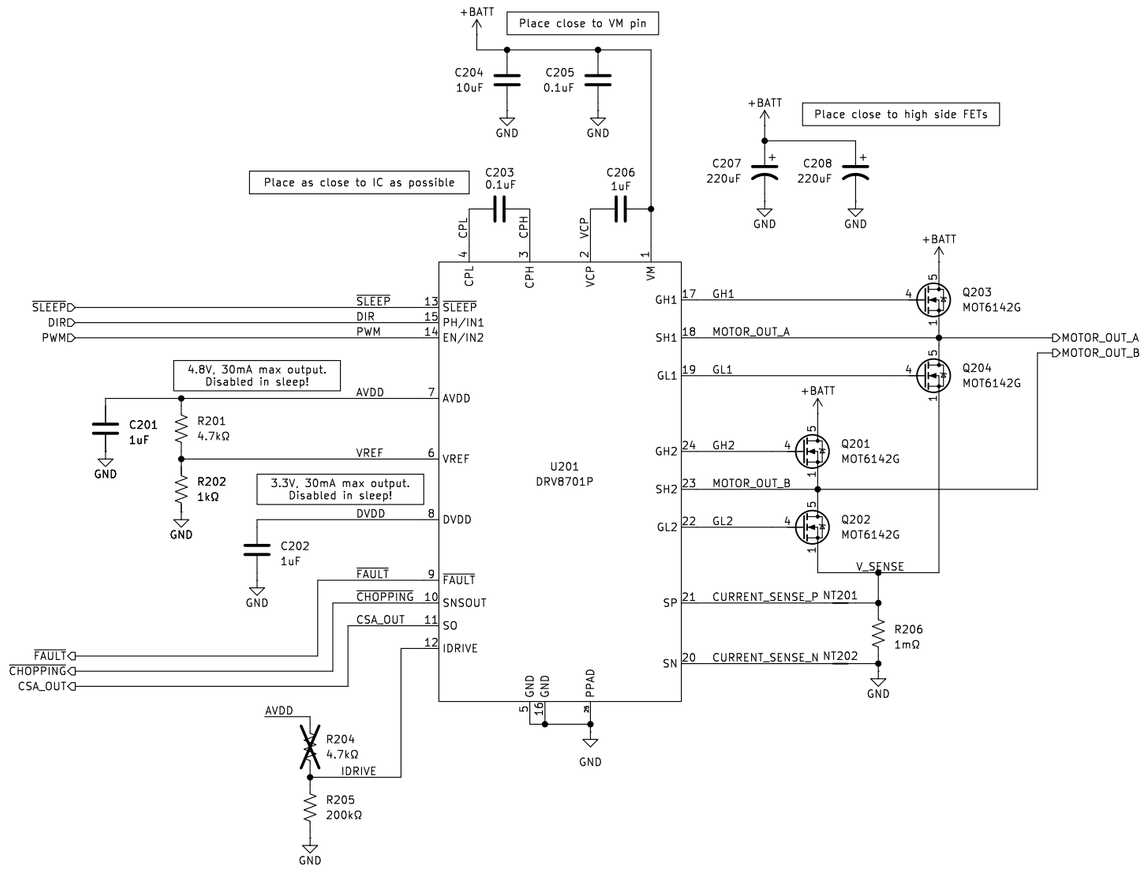
For I_{CHOP} = 40A,
V_{REF} must be set to 0.85V.
Use R_U = 4.7k, R_D = 1.0k (0.842V typ.)

$V_{CSA\_OUT} = R_{SENSE}*Av*I + V_{OFFSET}$
$V_{CSA\_OUT} = 0.020*I + 0.05$

Note: $f_{PWM} < I_{VCP} / 2*Q_{GD}$.
Do not allow f_{PWM} to exceed 400kHz!

DRV8701P (PWM) CONTROL INTERFACE

SLEEP	IN1	IN2	Description
0	X	X	Sleep; H-Bridge Disabled, High-Z
1	0	0	Coast; H-Bridge Disabled, High-Z
1	0	1	Reverse; Current SH2 -> SH1
1	1	0	Forward; Current SH1 -> SH2
1	1	1	Brake; Low-Side Slow Decay



Geeks for Kids
Learn Science and Math Club
Sheet: /DC Motor Controller – Front Wheels/
File: DRV8701.kicad_sch

Title: Brushed DC Motor Driver

Size: USLedger	Date: 2025-10-21	**Rev: V3**
KiCad E.D.A. 9.0.5		Id: 2/4

DC MOTOR CONTROLLER

IC Notes:

The DRV8701 is a single H-bridge gate driver that uses four external N-channel MOSFETs targeted to drive a 12-V to 24-V bidirectional brushed DC motor.

VBAT Voltage Range: 6V to 45V (abs. max)
Motor Drive Current: up to 35 A continuous
Inputs compatible with 1.8, 3.3, and 5 V logic
PWM operation up to 100 kHz
CSA output prop. to motor current (20 mV/A)
Active current chopping at 50 A
Undervoltage shutdown
Short circuit protection

DRV8701 Datasheet

MOT6142G Datasheet

Bulk Capacitor Sizing for DC Motor Drivers

DESIGN NOTES

FET: MOT6142G (Qgd = 6.8 nC typ.)

FET Gate Rise Time $t_R = Q_{gd}/I_{DRIVE}$

To achieve 100ns < t_R < 300ns,
22.7mA < I_{DRIVE} < 68mA.

Connecting a 200kΩ resistor from IDRIVE pin to GND yields I_{DRIVE} = 25mA.

Choosing R_{SENSE} = 1mOhm

$I_{CHOP} = (V_{REF} - V_{OFFSET})/(Av*R_{SENSE})$

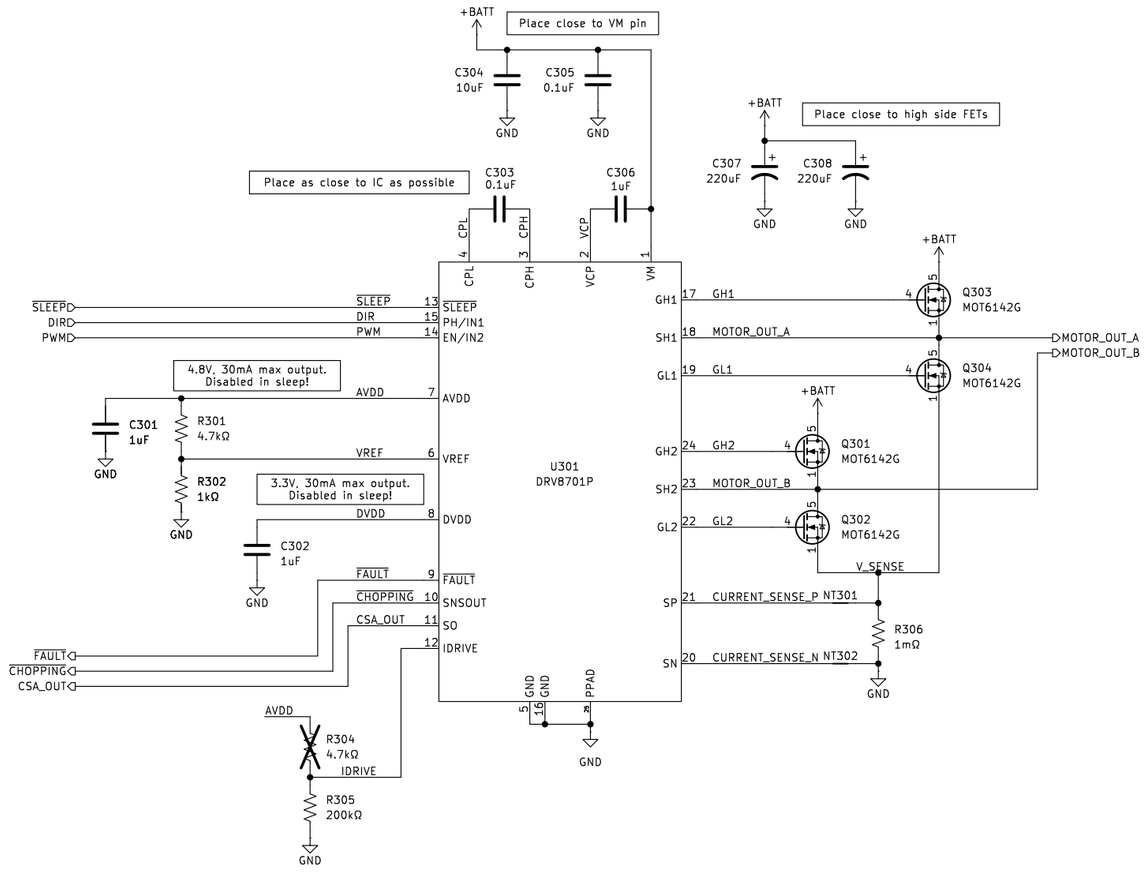
For I_{CHOP} = 40A,
V_{REF} must be set to 0.85V.
Use R_U = 4.7k, R_D = 1.0k (0.842V typ.)

$V_{CSA\_OUT} = R_{SENSE}*Av*I + V_{OFFSET}$
$V_{CSA\_OUT} = 0.020*I + 0.05$

Note: $f_{PWM} < I_{VCP} / 2*Q_{GD}$.
Do not allow f_{PWM} to exceed 400kHz!

DRV8701P (PWM) CONTROL INTERFACE

SLEEP	IN1	IN2	Description
0	X	X	Sleep; H-Bridge Disabled, High-Z
1	0	0	Coast; H-Bridge Disabled, High-Z
1	0	1	Reverse; Current SH2 -> SH1
1	1	0	Forward; Current SH1 -> SH2
1	1	1	Brake; Low-Side Slow Decay



Geeks for Kids
Learn Science and Math Club

Sheet: /DC Motor Controller – Rear Wheels/
File: DRV8701.kicad_sch

Title: Brushed DC Motor Driver

Size: USLedger	Date: 2025-10-21	**Rev: V3**
KiCad E.D.A. 9.0.5		Id: 3/4

DC MOTOR CONTROLLER

IC Notes:

The DRV8701 is a single H-bridge gate driver that uses four external N-channel MOSFETs targeted to drive a 12-V to 24-V bidirectional brushed DC motor.

VBAT Voltage Range: 6V to 45V (abs. max)
Motor Drive Current: up to 35 A continuous
Inputs compatible with 1.8, 3.3, and 5 V logic
PWM operation up to 100 kHz
CSA output prop. to motor current (20 mV/A)
Active current chopping at 50 A
Undervoltage shutdown
Short circuit protection

DRV8701 Datasheet

MOT6142G Datasheet

Bulk Capacitor Sizing for DC Motor Drivers

DESIGN NOTES

FET: MOT6142G (Qgd = 6.8 nC typ.)

FET Gate Rise Time $t_R = Q_{gd}/I_{DRIVE}$

To achieve 100ns < t_R < 300ns,
22.7mA < I_{DRIVE} < 68mA.

Connecting a 200kΩ resistor from IDRIVE pin to GND yields I_{DRIVE} = 25mA.

Choosing R_{SENSE} = 1mOhm

$I_{CHOP} = (V_{REF} - V_{OFFSET})/(Av*R_{SENSE})$

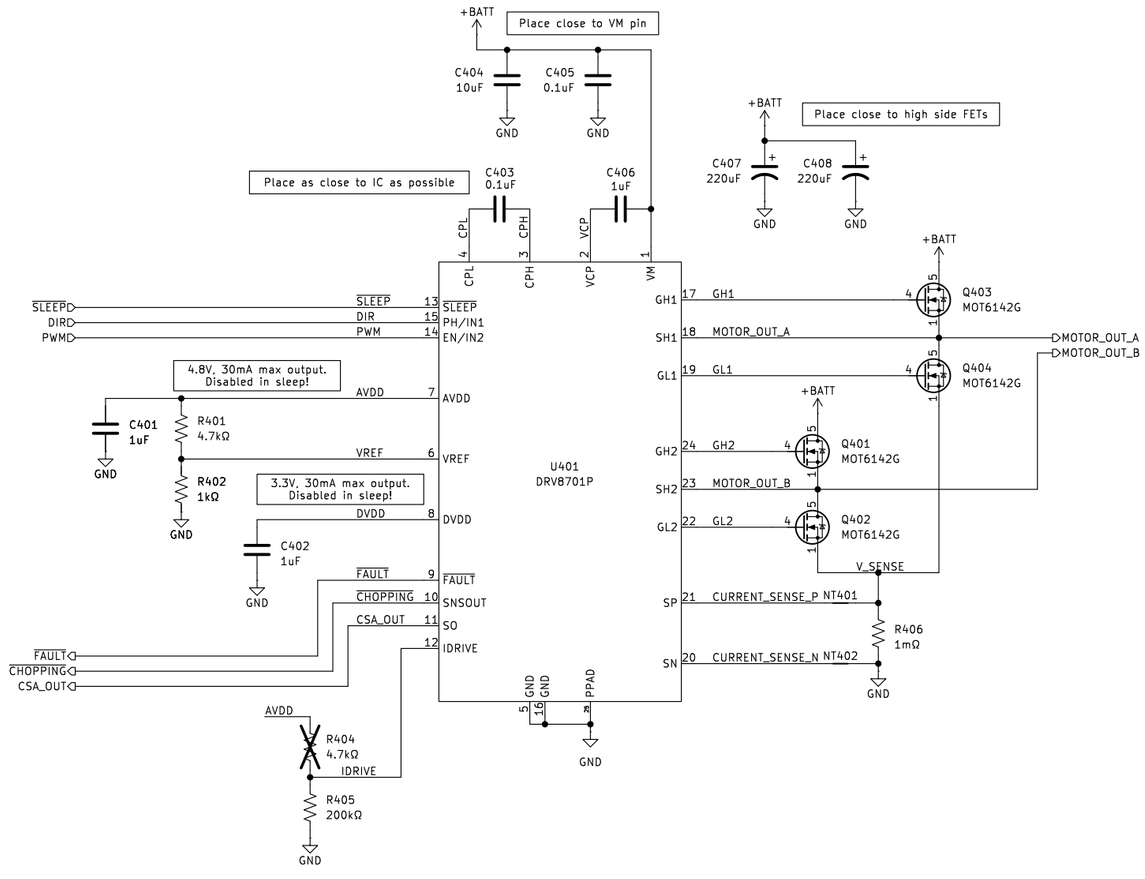
For I_{CHOP} = 40A,
V_{REF} must be set to 0.85V.
Use R_U = 4.7k, R_D = 1.0k (0.842V typ.)

$V_{CSA\_OUT} = R_{SENSE}*Av*I + V_{OFFSET}$
$V_{CSA\_OUT} = 0.020*I + 0.05$

Note: $f_{PWM} < I_{VCP} / 2*Q_{GD}$.
Do not allow f_{PWM} to exceed 400kHz!

DRV8701P (PWM) CONTROL INTERFACE

SLEEP	IN1	IN2	Description
0	X	X	Sleep; H-Bridge Disabled, High-Z
1	0	0	Coast; H-Bridge Disabled, High-Z
1	0	1	Reverse; Current SH2 -> SH1
1	1	0	Forward; Current SH1 -> SH2
1	1	1	Brake; Low-Side Slow Decay



Geeks for Kids
Learn Science and Math Club
Sheet: /DC Motor Controller – Steering/
File: DRV8701.kicad_sch

Title: Brushed DC Motor Driver

Size: USLedger	Date: 2025-10-21	**Rev: V3**
KiCad E.D.A. 9.0.5		Id: 4/4