BLDC motor driver

LBD-V3, Analog & Digital, 200watt

BLDC DRIVER

- Surface-mount technology
- Small size, low cost, easy
- Hall sensor commutation
- Set value speed : Volume(2.5Vdc), PWM, Analog(5Vdc)
- Slow start, slow stop
- Brake, Direction and Enable input
- RMS Current limit adjustable
- Motor lock detection : Blockage protection
- Alarm output funtion at time of error
- FG out

General Description

The LBD series drivers are designed to drive 3-phase brushless DC motors at a high switching frequency.

Driver has enable, direction, and brake input.

In addition, rotation of the motor can be detected by logic output FG.

All models interface with digital controllers or can be used as stand-alone drives.

Driver require only a single regulated DC power supply and a red/green led indicates operating status.

Electrical Data	LBD-V3
DC supply voltage V_m	12 - 24 Vdc
Absolute minimum supply voltage Vm min	12 Vdc
Absolute maximum supply voltage Vm max	28 Vdc
Max. output voltage	V_m - 0.5
Peak. Current (1 sec. max., internally limited)	30 A
Max. continuous output current	8 A
Switching frequency of power stage	25 kHz
Power dissipation at cont. current	200 W
Input	
Set value speed	PWM : Open collector, TTL(3.3V) Input, 250Hz~1KHz Volume : 0~2.5Vdc analog input.
Enable	Open collector, TTL(3.3V) Input
Brake	Open collector, TTL(3.3V) Input
Direction	Open collector, TTL(3.3V) Input
Output	
FG	Open collector, Vceo : 30Vdc, Ic max : 200mA
ALARM	Open collector, Vceo : 30Vdc, Ic max : 200mA
Hall A	Open collector, Vceo : 50Vdc, Ic max : 200mA
Hall B	Open collector, Vceo : 50Vdc, Ic max : 200mA
Hall C	Open collector, Vceo : 50Vdc, Ic max : 200mA
Voltage outputs	
Hall sensor supply voltage Vcc hall	+5.8Vdc ± 5%, max. output current 20mA
Indicator	RED LED blink (Driver on), RED LED on (Fault)
Trim potentiometers	Set of motor acceleration time (slow start), decelation time (slow stop).
Protective function	
RMS Current limit (OCP)	19A Typ, The set current limit is adjusted at volume.
Blockage protection	Detect a motor lock if motor shaft is blocked for longer than 3 sec. Set in communication mode.(2~5sec)
Ambient temperature and humidity	
Operation condition	Dry bulb temp:-10~+50 [℃], Relative humidity : 0 ~ 90 [%]
Storage condition	Dry bulb temp:-10~+60 [℃], Relative humidity : 10 ~ 90 [%]

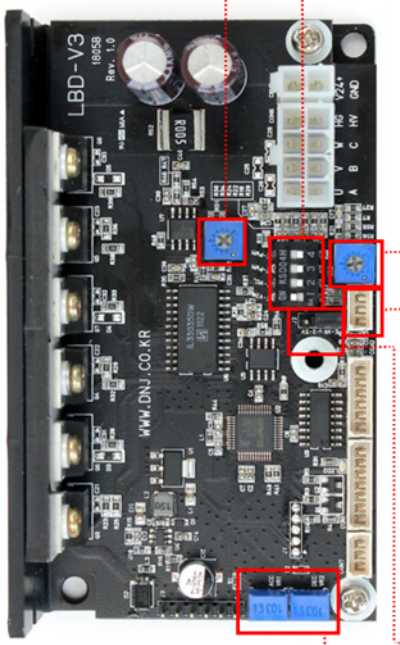
Mechanical data

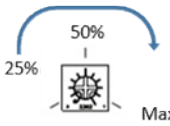
Weight	161g Typ
Dimention (L x W x H)	108 x 62 x 38 mm
Mounting threads	Flange for M3-screws

Terminals

Power, Motor	Male header (PCB) : MOLEX 5566 (4.20mm Pitch Mini-Fit Jr.™ Header, Dual Row)
	Suitable plug : MOLEX 5557
Signal I/O	Male header (PCB) : MOLEX 53014
	Suitable plug : MOLEX 51004

Setting



Vol 1	Function
RMS Current limit	 25% : 8.5 A 50% : 12 A 75% : 16,5 A 100% : 19 A

DIP S/W	Function (Control mode)			
External Volume	ON	OFF	OFF	OFF
Internal Volume	OFF	ON	OFF	OFF
External PWM	OFF	OFF	ON	ON

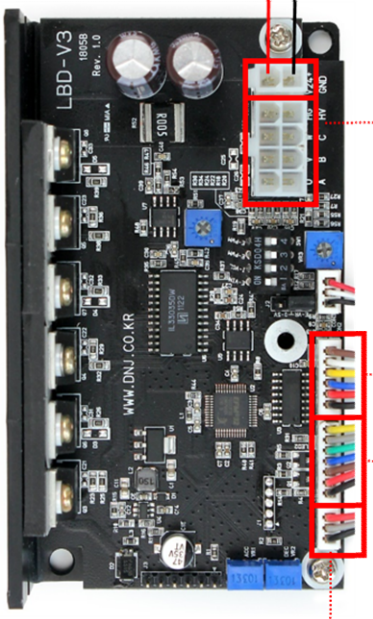
Vol 2	Function
Internal Volume	Controls motor speed with internal volume trimmer(10kΩ)

Vol 3	External speed
External Volume	+3.3 Vdc out
	0~2.5Vdc input Input speed control with external volume (10kΩ)
	GND

Jumper	Motor speed Control mode
E-VR 	External volume input mode
0-5V 	External 0 ~ 5V input mode

Vol 4	Function
ACC	Acceleration time adjustment
DEC	Deceleration time adjustment

Pin configuration



CON 1	Power
+PWR	+12 ~ 24 Vdc supply voltage input
PGND	Power grounded

CON 2	Motor
Motor connection	Motor U / Motor V / Motor W / Hall GND Hall A / Hall B / Hall C / Hall Vcc

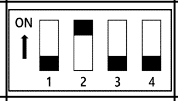
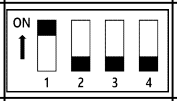
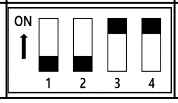
CON 3	Control Input
Speed in <5V>	Motor speed control input (0 ~ 5V)
Speed in <PWM>	Motor speed control input (PWM)
Enable	Motor ON/OFF control input
Direction	Motor rotation direction control input
Brake	Motor brake control input
GND	Signal grounded

CON 4	Control Output
Hall A out	Hall sensor U signal out
Hall B out	Hall sensor V signal out
Hall C out	Hall sensor W signal out
Alarm out	Fault out
FG out	1FG signal out
3.3V out	For customer use. Auxiliary voltage out +3.3Vdc
GND	Signal grounded

CON 5	RS485
NC	NC

Speed control mode <Dip switch>

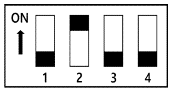
Setting of motor speed control mode

No	DIP switch	Function	Discription
1		I-VOL	Internal volume control mode - Controlled by internal volume control
2		E-VIN	External volume control mode - Controlled by external volume input - Controlled by external 5V input
3		E-PWM	External pwm control mode - Controlled by external pwm input

Internal Volume input <I-VOL>

Motor speed control input

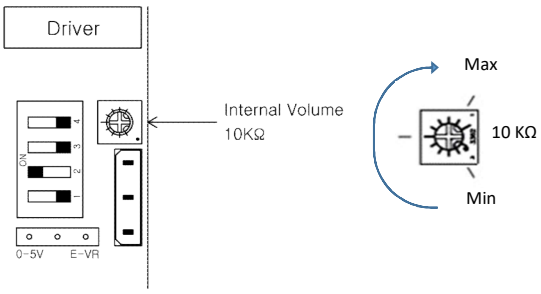
Dip-switch no. 2 is turned on.



The motor speed is controlled by a 1-turn potentiometers.(10kΩ)

Left end stop of potentiometers : Motor speed is minimum

Right end stop of potentiometers : Motor speed is maximum

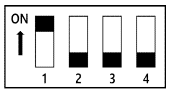


External Volume input <E-VIN>

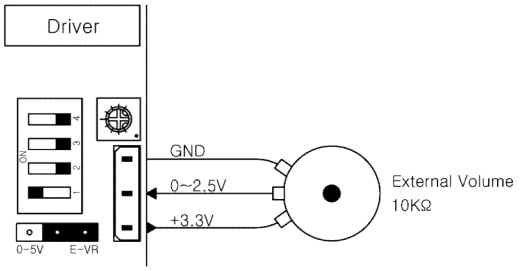
Motor speed control input

Dip-switch no. 1 is turned on.

Jumper pin header <E-VR>



E-VR

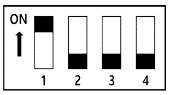


External Ref 5V input <E-VIN>

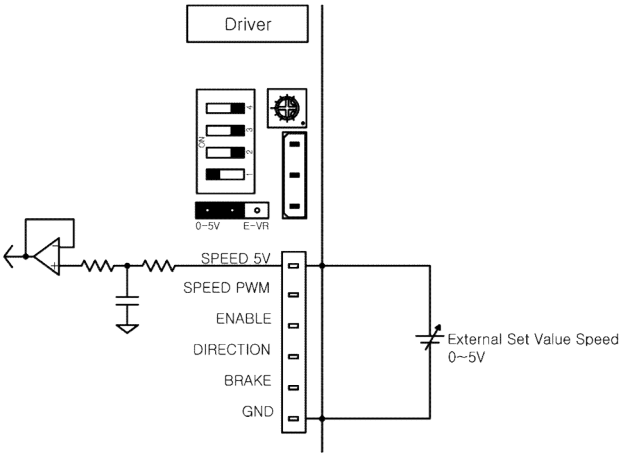
Motor speed control input

Dip-switch no. 1 is turned on.

Jumper pin header <0-5V>



0-5V

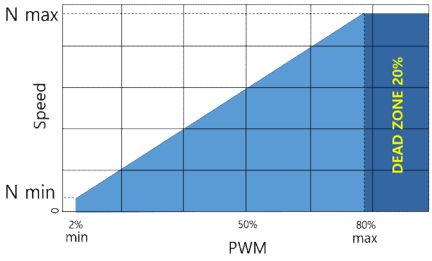


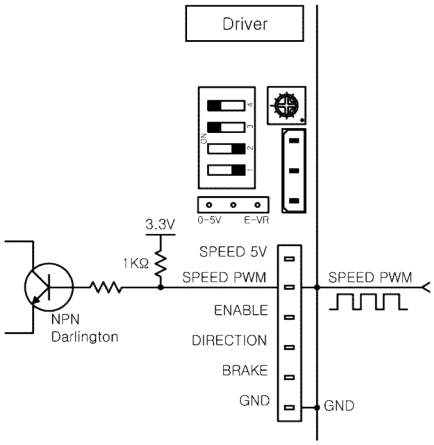
External PWM input <E-PWM>

Motor speed control input

Pulse Width Modulated input

Dip-switch no. 3 and 4 is turned on.



Input	Open-collector, TTL(3.3V) Input
Frequency	PWM frequency range is 250Hz (between 0.2 ~ 1 [kHz])
Set value input	Speed setting for speed control via PWM duty 0~80%
Interface	

Inputs and outputs

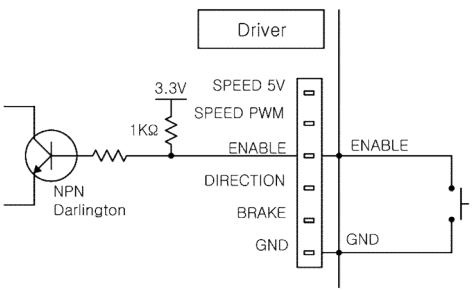
Control input ON/OFF <ENABLE>

Enables or disables the power stage.

If the <ENABLE> input contacts ground potentia, the driver is activated.

If the <ENABLE> input is open, mosfets on the bridge drive turns off and the motor shaft freewheels slows down

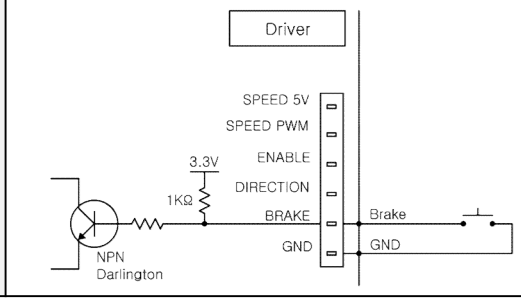
Open-collector, TTL(3.3V) Input

Input	High(1) : Input OPEN	Power stage switched off
	Low(0) : Input to GND	Motor power on
Interface		

Control input brake <BRAKE>

The motor shaft slows down in an uncontrolled fashion to a standstill by short-circuiting the motor windings.

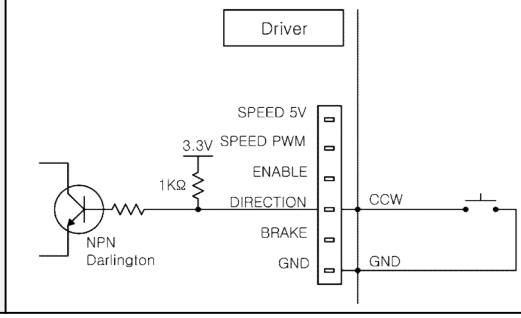
Open-collector, TTL(3.3V) Input

Input	High(1) : Input OPEN	Brake active
	Low(0) : Input to GND	Brake release
Interface		

Control input direction <CCW>

When the level changes, the motor shaft slows down in an uncontrolled fashion to a standstill by short-circuiting the motor windings, and accelerates in the opposite direction, until the nominal speed reaches again.

Open-collector, TTL(3.3V) Input

Input	High(1) : Input OPEN	Clockwise rotation
	Low(0) : Input to GND	Counter-clockwise rotation
Interface		

<Hall sensor signal> out

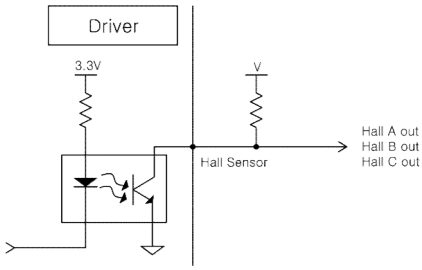
Open collector

Hall A, Hall B, Hall C

Open collector output

U_{CEO} = 50 Vdc

I_{cmax} = 200 mA



<ALARM> out

Driver fault output.

This open collector output is active low during one or more of the following conditions :

Invalid Sensor input code, Enable input at logic 0, over current, motor rock detection, and Thermal shutdown.

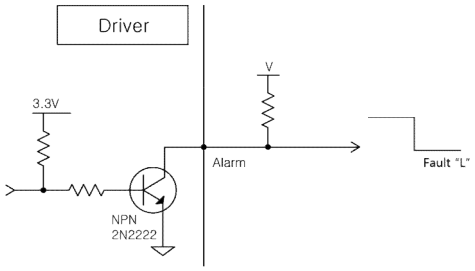
* Reset : Speed in 0, Enable, Power off

Open collector output

U_{CEO} = 30 Vdc

U_{ECO} = 7 Vdc

I_{cmax} = 200 mA

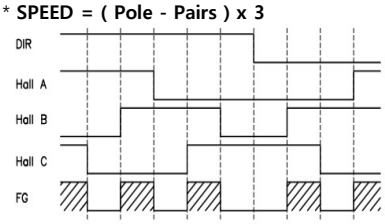


You need to pull up for alarm terminal, so that the terminal is NPN open-collector output.

<FG> out

1FG is put into toggle-operation in which the logic reverses every time when excitation phase is switched by hall input.

* **SPEED = (Pole - Pairs) x 3**

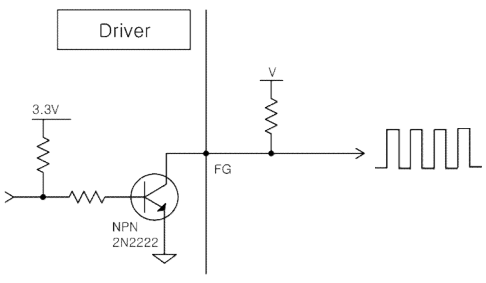


Open collector output

U_{CEO} = 30 Vdc

U_{ECO} = 7 Vdc

I_{cmax} = 200 mA



You need to pull up for 1FG terminal, so that the terminal is NPN open-collector output.

Hall Sensor

Hall sensor voltage out

+5.8Vdc @ 20mA

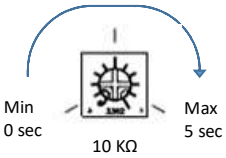
An internal voltage of +5.8 Vdc is provided for powering the hall sensors.
Output voltage 5.8 Vdc ± 5%
Max. output current 20mA (short-circuit protection)

Hall A, Hall B, Hall C

Hall sensor inputs, logic levels, internal 1KΩ pull-up.
Maximum low level input is 1V, Minimum high level input is 3.5V.

Adjusting the potentiometers

Motor accelation time, decelation time
can be adjusted using 1-turn potentiometers.



Pre-adjustment
With pre-adjustment, the potentiometers are set in a preferred position.

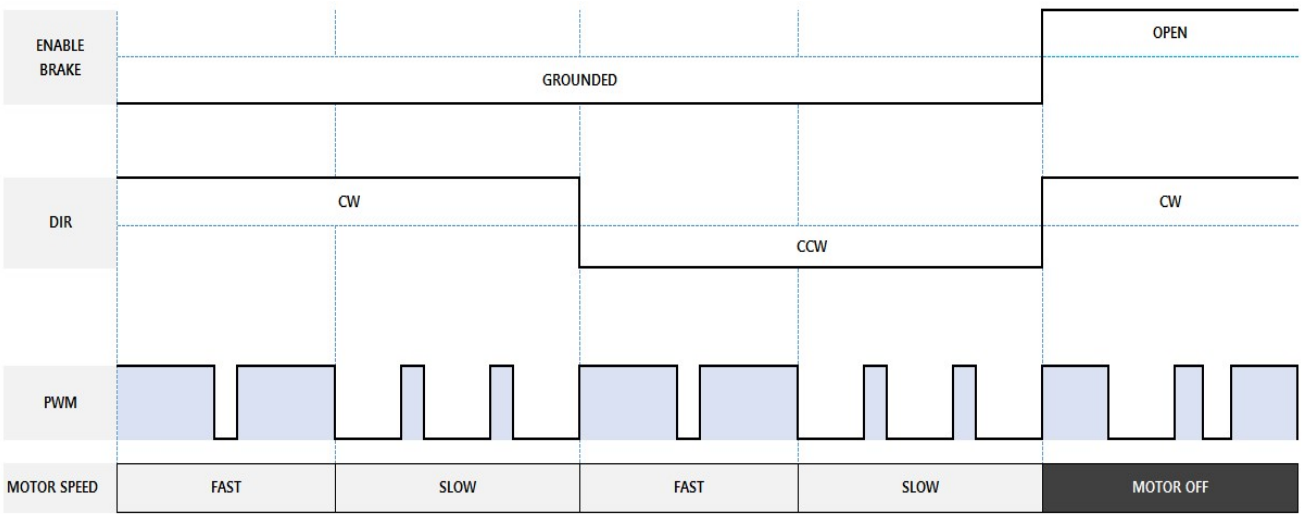
Pre-adjustment of potentiometers

ACC	Set the acceleration time of the motor. (0 or 1~5 sec)
DEC	Set the deceleration time of the motor. (0 or 1~5 sec)

Driver protection

No	Item	Specification	Note
1	RMS Current limit	19 [A] Typ	The RMS continuous current limit level can be set using internal volume (Vol 1). Vol 25% : 8.5A Vol 50% : 12A Vol 75% : 16.5A Vol 100% : 19A 50% 0% 100%
2	Thermal shutdown	160±10 [℃]	When the driver IC reaches the defined temperature, the motor current automatically cuts off. The highest rating temperature of IC is 160 [℃] Component reliability can't be ensured when motor is used in exceeded 160 [℃]. There is no guarantee of proper operation when thermal shutdown motor is reused.
3	Motor lock detection	3 sec	When the motor locks, the motor current automatically cuts off within the defined time. You can set the lock detection time using RS485 communication (2 ~ 60 seconds).

Control sequence timing chart



Dimension Drawing

[mm]