Smart EC motor

DSEM-7024-D, 24V brushless, built in digital DRV, 40watt

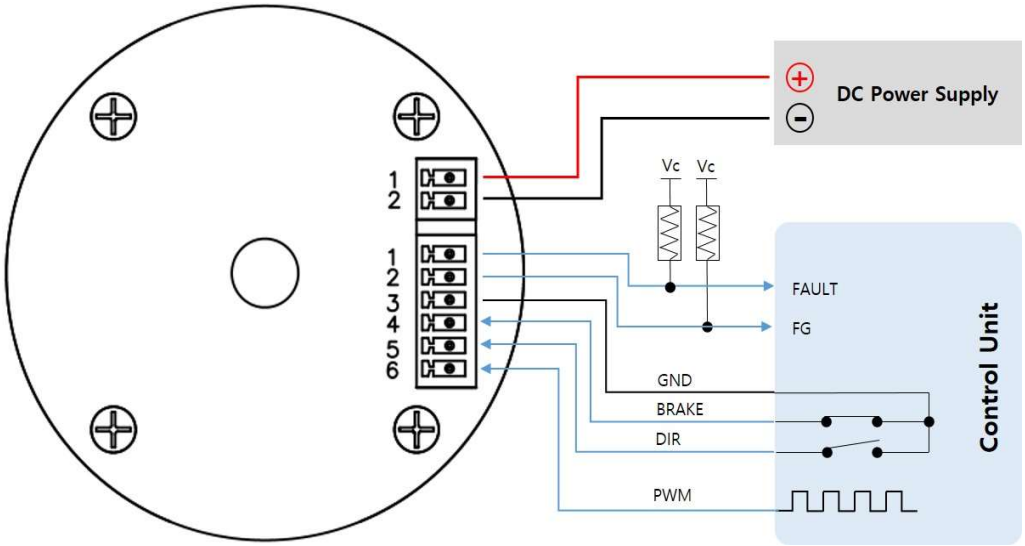
SMART EC MOTOR

- Hollow shaft
- Disk shape of compact structure
- Hall sensor commutation
- Digital(PWM) speed control
- Brake, Direction input
- Current limit
- Blockage protection : Detect a motor lock if motor shaft is blocked for longer than 3 sec.
- Alarm output funtion at time of error
- FG out

3 Phase 14 poles sensor motor

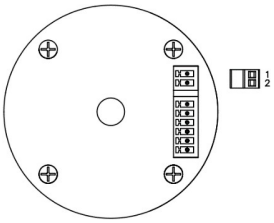
Motor data		Part numbers			
		DSEM-7012-D	**DSEM-7024-D**		
Rated Specifications					
1 Nominal Voltage	V	12	24		
2 Current	A	2.1	2.2		
3 Power	W	20	40		
4 Speed	RPM	1300	1730		
5 Torque	Nm	0.15	0.22		
Electrical Specifications					
1 Operating Voltage	V	12	24		
2 Maximum output Power	W	48	96		
3 Maximum Efficiency	%	80	76		
4 No Load Speed	RPM	1490	2070		
5 No Load Current	A	0.45	0.25		
6 Torque Constant	mN.m/A	168	110		
7 Back EMF Constant	mV/RPM	7.67	11.5		
8 Coil Resistance	Ω	0.62	1.2		
Interface					
1 Input		BRAKE, DIRECTION, PWM(5V), GND			
2 Output		ALARM, 1FG			
Characteristics					
Ambient condition					
1 Operation condition - Dry bulb temp	℃	-10~50	-10~50		
2 Operation condition - Relative humidity	%	0~85	0~85		
3 Storage condition - Dry bulb temp	℃	-10~60	-10~60		
4 Storage condition - Relative humidity	%	10~90	10~90		
Mechanical characteristics					
1 Stator Length	mm	10	10		
2 Stator Diameter	Ø	68	68		
3 Shaft Diameter	Ø	43	43		
4 Weight	Kg				
5 Rotor Inertia	g•cm^2	356	356		
6 Mechanical Time Constant	m.s	0.78	3.3		
7 Rotational Direction		CW/CCW	CW/CCW		
Other Specifications					
1 Number of pole pairs		14	14		
2 Number of phases		3	3		
3 Weight of motor	g	381	381		
4. Protection class		IP40	IP40		
5. Insulation class		F	F		
6. Noise (Rad.30[cm] DC24V, No load)	dB(A) Max.	40	45		
Maximum permissive Temperature					
1 Coil	℃	120	120		
2 Main IC	℃	100	100		
3 MOSFET	℃	110	110		
4 Bearing	℃	90	90		
Protective function					
1 Current limit	A	3	3.5		
2 Thermal shutdown (IC temperature/design specification.)	℃	160±10	160±10		
3 Motor lock protection	sec	3	3		

Wiring diagram



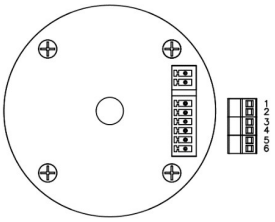
Pin configuration

Power



PIN	DESCRIPTION / NOTES	I/O
1 +Vm	DC power input	I
2 GND	Power ground	Power GND

Signal



PIN	DESCRIPTION / NOTES	I/O
1 ALARM	Fault out (LED red)	O
2 FG	1FG signal out	O
3 GND	Reference ground	Signal GND
4 BRAKE	Brake active/not active	I
5 DIRECTION	Direction of rotation	I
6 PWM	Set value speed reference : PWM input	I

Terminals

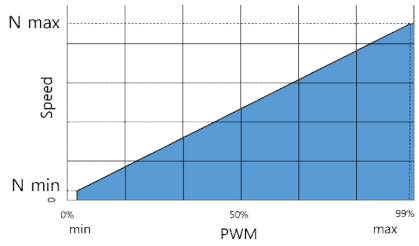
Power	Male header PCB : ECH350R-2P, 1 row, Pitch : 3.5 mm Suitable plug : EC350V-2P Suitable for wire cross section : AWG#22 UL1007
Signal I/O	Male header (PCB) : ECH350R-6P, 1 row, Pitch : 3.5 mm Suitable plug : EC350V-6P Suitable for wire cross section : AWG#26 UL1007

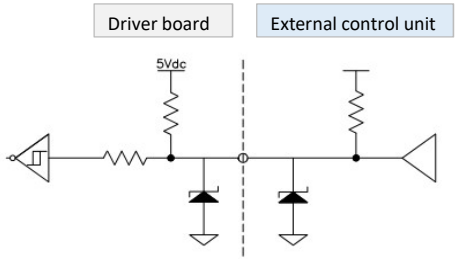
Inputs and outputs

PWM

Set value speed

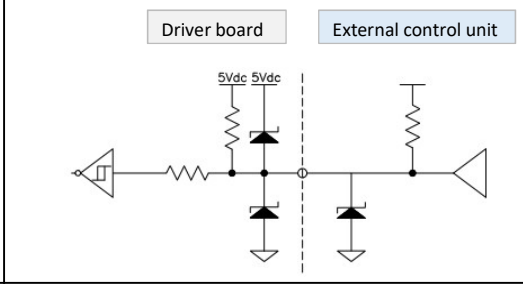
You should connect a Schottky Barrier Diode between each signal line to ground to prevent IC from damage.



Input voltage range	High(1) : 3.3 to 5 V or Input OPEN	Motor OFF
	Low(0) : 0 to 0.8 V or Input to GND	Motor ON
Frequency	PWM frequency range is 25kHz (between 20 ~ 30 [kHz])	
Set value input	Speed setting for speed control via PWM duty 0~99%	
Interface		

Control input brake <BLK>

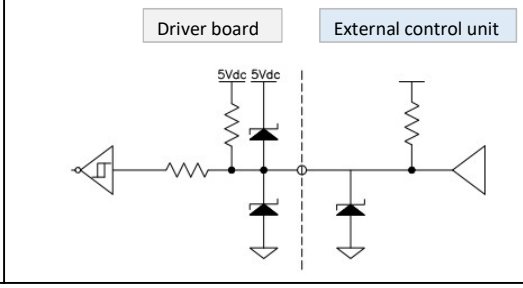
The motor shaft slows down in an uncontrolled fashion to a standstill by short-circuiting the motor windings.

Input voltage range	High(1) : 3.3 to 5 V or Input OPEN	Brake function active
	Low(0) : 0 to 0.8 V or Input to GND	Brake function not active
Interface		

Control input rotation <Direction>

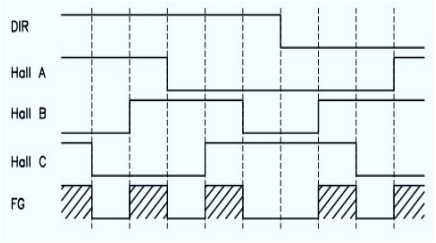
When the level changes, motors shaft slows down in an uncontrolled fashion to a standstill by short-circuiting the motor windings, and accelerates in the opposite direction, until the nominal speed reaches again.

Change CW/CCW input signal after motor had stopped completely.
If you change the CW/CCW signal during motor running, there is a danger of the damage of electronic parts inside motor.

Input voltage range	High(1) : 3.3 to 5 V or Input OPEN	Counter-clockwise rotation
	Low(0) : 0 to 0.8 V or Input to GND	Clockwise rotation
Interface		

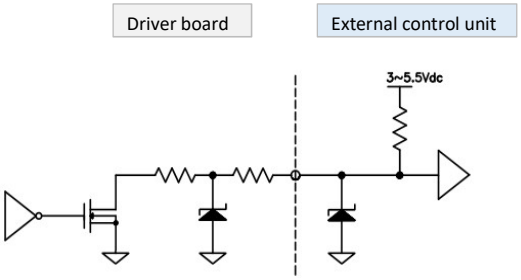
FG out

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



Open Drain

VFG(SAT) = 0.45 VDC
IFG = 2mA
IFG(leak) = 50 μA
VFG = 5.5 VDC



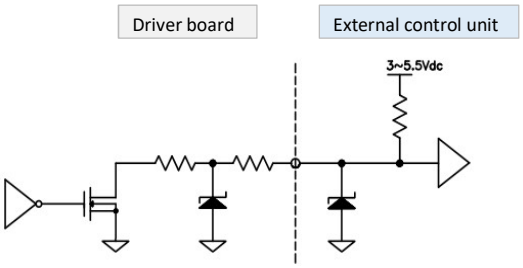
You need to pull up for 1FG terminal, so that the terminal is open-drain output.

Alarm out

Driver fault output.
Output N-ch FET turns on and becomes high during low-voltage, over-current,
motor lock detection, thermal shutdown, and during power-up reset.

Open Drain

$V_{FG(SAT)}$ = 0.45 VDC
I_{FG} = 2mA
$I_{FG(leak)}$ = 50 μA
V_{FG} = 5.5 VDC

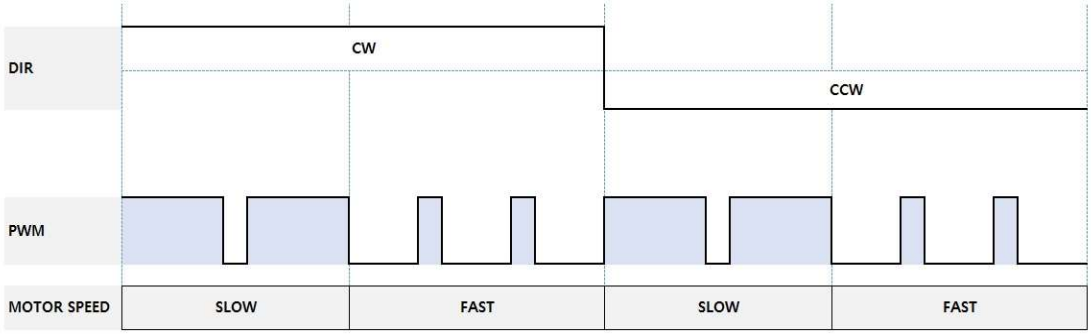


You need to pull up for 1FG terminal, so that the terminal is open-drain output.

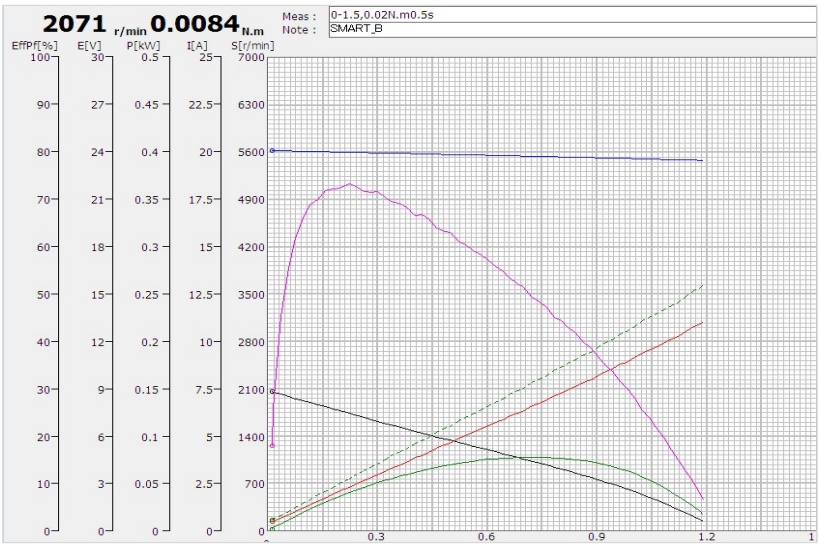
Driver protection

No	Specification	Note
1 Current limit	3.5 [A] Typ	
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. The motor restarts by power supply reset.

Control sequence timing chart



T-I, T-N curve



DSEM-7024-D

X : T (Torque)
Y1 : S (Speed)
Y2 : I (Current)
Y3 : Pi Po (Power)
Y4 : E (Voltage)
Y5 : Ef (Efficiency)

KETI Korea Electronics Technology Institute

This performance is the actual load test data measured by Korea Electronics Technology Institute in July, 2017.

Product safety

1. Locked motor

No burning after locked rotor condition at rated voltage by using a specified drive circuit.

2. Circuit Protect

This motor does not have the protect circuit for over voltage and wrong connection.
So, don't apply to surge voltage such as over rated voltage and wrong connection.

Dimension Drawing

Dimensions in [mm]