
# Contents

## Encoder motor ECM Series



ECM series encoders make an impression with their robust design and high signal quality.
ECM encoder is a 360° angle sensor that provides contactless high-resolution angular position data based on magnetic Circular Vertical Hall techn
The 3-channel encoder with differential signals guarantees interference-free function even under the highest loads.
A variety of smart EC motors and high resolution encoders can be combined to form a high precision control system.
Smart EC motors can be configured and ordered online. Fast , easy and online : **www.dnj.co.kr (dnj@dnj.co.kr)**


No. 2003C V10. 2020 DNJWITH

**Digital Quadrature Encoder integrated in the Smart EC Motor**

ECM series encoders make an impression with their robust design and high signal quality.

ECM encoder is a 360° angle sensor that provides contactless high-resolution angular position data based on magnetic Circular Vertical Hall technology.

Multiple output formats supported for ease of system integration

- ABZ output provides high resolution, low latency, and PWM for initial position
- Output resolution on ABZ are selectable

The 3-channel encoder with differential signals guarantees interference-free function even under the highest loads.

A variety of smart EC motors and high resolution encoders can be combined to form a high precision control system.

Supports harsh operating conditions required for automotive and industrial applications, including direct connection to 12V battery

The resolution can be factory-set.

## Features

**Built in digitial encoder ECM**

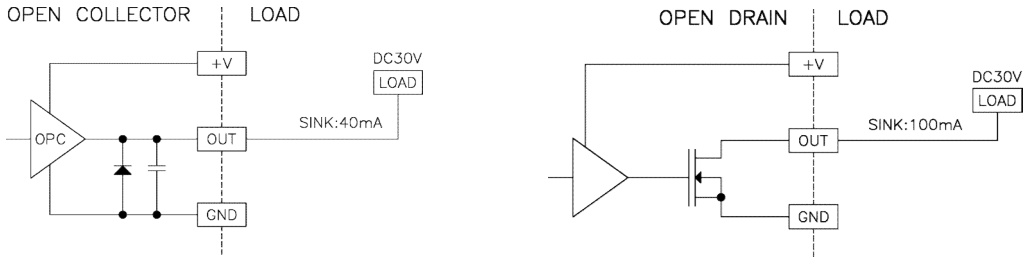
- Relative position signal suitable for positioning tasks
- Rotation direction recognition
- Speed information from number of pulses per time unit
- Incremental ABZ Quadrature Encoder interface with pulse per turn from 128~4096
- PWM Output 12-bit
- Open Collector, Totem Pole, Line Driver, Open Drain
- Wide input range 5~24Vdc
- Standard solution for many applications
- Customizing (absolute type)

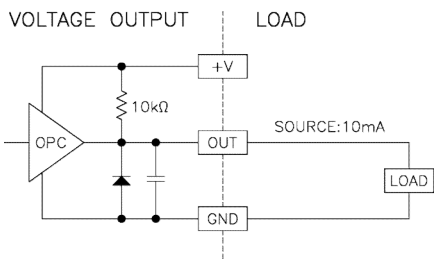
| ECM Type | Resolution | Output Phase | Output Type | Supply Voltage |
|---|---|---|---|---|
| MEI | 07<br>08<br>09<br>10 | 2C<br>4C | OPC<br>VOP<br>TOP | 05 |
| MEI | 07<br>08<br>09<br>10 | 2C<br>4C | OPD | 24 |
| MEI | 07<br>08<br>09<br>10 | 6C | LDP | 05 |
| MEI | 12 | 3C | OPD | 24 |

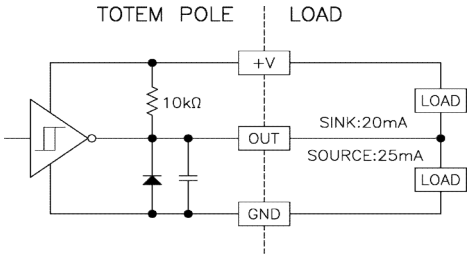
**Model information**

| | | |
|---|---|---|
| **ECM Type** | **MEI** | Incremental type |
| **Resolution** | **07** | Cycles per Shaft Turn, 7 bit (Incremental 128 Steps / 2.81°) |
| | **08** | Cycles per Shaft Turn, 8 bit (Incremental 256 Steps / 1.40°) |
| CPR (Count per Revolution) | **09** | Cycles per Shaft Turn, 9 bit (Incremental 512 Steps / 0.70°) |
| | **10** | Cycles per Shaft Turn, 10 bit (Incremental 1024 Steps / 0.35°) |
| | **12** | Cycles per Shaft Turn, 12 bit (Incremental 4096 Steps / 0.0879°) |
| **Output Phase** | **2C** | 2 channels dual quadrature A, B |
| | **3C** | 3 channels dual quadrature A, B, with index Z |
| No. of channels | **4C** | 4 channels dual quadrature A, B, with index Z and PWM output |
| | **6C** | 3 channels A, B, Z and complementary output A \ , B \ , Z \ |
| **Output type** | **OPC** | NPN Open Collector output (max 30Vdc) |
| | | Sink current per channel (max 30mA) |
| Control interface output | | External pull-up resistor 4.7k~10kΩ |
| | **VOP** | Voltage Output. |
| | | Open collector output of the sensors with integrated pull-up resistor 4.7kΩ |
| | | Supply voltage(Vin) = Ouput voltage(Vout) |
| | | Source current : max 10mA |
| | **TOP** | Totem Pole output (Internally has two values, high or low) |
| | | Schmitt trigger (74HC14) and TTL output (DC 5V) |
| | | High : Source (max 25mA, min 3.5Vdc) |
| | | Low : Sink (max 20mA, max 0.4Vdc) |
| | **OPD** | N channel Open Drain output |
| | | VH : max 30Vdc |
| | | VL : max DC 0.5Vdc |
| | | Sink current : max 100mA |
| | **LDP** | Line Driver output, The 3-channel encoder with differential signals |
| | | High : max -20mA, min 2.5Vdc |
| | | Low : max 20mA, max 0.5Vdc |
| | | Signal rise time : 100ns or less (CL=30pF, RL=1kΩ, 25℃) |
| | | Signal fall time : 100ns or less (CL=30pF, RL=1kΩ, 25℃) |
| | | Line Receiver Recommanded IC : AM26LS32 |
| **Supply Voltage** | **05** | Supply Voltage Vcc +5Vdc ± 10% |
| | **24** | Supply Voltage Vcc +7Vdc ~ +24Vdc |

## Block Diagram





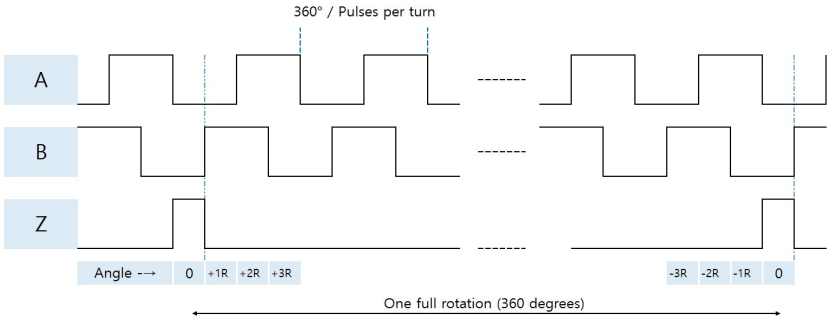




## Output Interface

### Incremental AB

A/B Phase difference : 1/4T±1/8T

ECM Encoder AB output emulates a 10~12bit incremental encoder providing logic pulses in quadrature. Signals A and B are quadrature signals, shifted by 90°, and signal Z is a reference mark. (index)
The A and B signals toggle with a 50% duty cycle(relative to angular distance, not necessarily time) at a frequency of $2^N$ cycles per revolution, giving a cycle resolution of (360 / $2^N$) degrees per cycle.
B is offset from A by 1/4 of the cycle period.

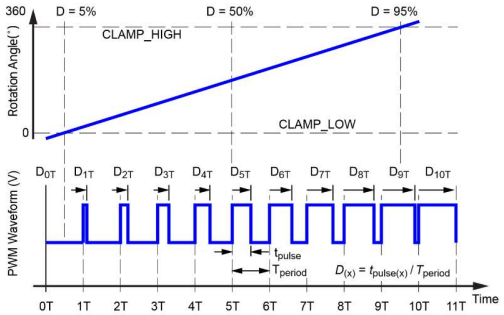



### Index Z

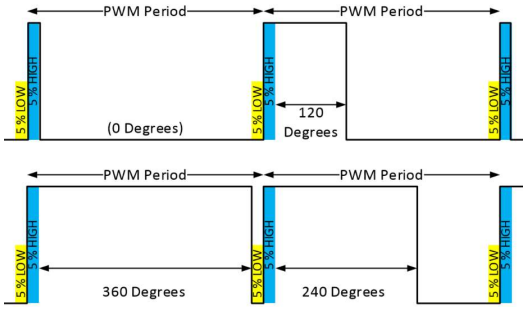
Encoder Z signal is an index pulse that occurs once per revolution to mark the zero (0) angle position.
Under rotation, this allows the receiver to synchronize to a known mechanical/magnetic position, and then se the incremental A/B signals to keep track of the absolute position.
The width of the Z pulse is 1/4 of the quadrature signal period and it is synchronized with the A and B signals.
The index rising edge is aligned with the channel B falling edge.

### PWM

The ECM encoder provides a pulse-width-modulated open-drain output, with the duty cycle(DC) proportional to measured angle. The PWM duty cycle is clamped at 5% and 95% for diagnostics purposes.
A 5% DC corresponds to 0°; a 95% DC corresponds to 360°.
Within each cycle, the output is high for the first 5% and low for the last 5% of the period.
The middle 90% of the period is a linear interpolation of the angle as sampled the start of the PWM period
The angle is represented in 12-bit resolution and can never reach 360°.
The maximum duty cycle high period is : **DutyCycleMax (%) = (4095 / 4096) x 90 + 5**




**PWM Outputs a Duty-Cycle Proportional To Sensed Angle**




**Pulse-Width Modulation (PWM) Examples**

## Pin Allocation

**Connection Encoder Interface**

UL1061 AWG28
( F.G : AWG22 )

| Pin No. | COLOR | MEI | MEI (LDP) | MEC | Comments |
|---|---|---|---|---|---|
| Pin 1 | red | VCC | VCC | VCC | Supply power |
| Pin 2 | black | GND | GND | GND | Ground |
| Pin 3 | brown | ENC A | ENC A | ENC A | |
| Pin 4 | blue | - | ENC nA | - | |
| Pin 5 | gray | ENC B | ENC B | ENC B | |
| Pin 6 | green | - | ENC nB | - | |
| Pin 7 | yellow | ENC Z | ENC Z | ENC Z | |
| Pin 8 | orange | - | ENC nZ | Tx / SSCK | |
| Pin 9 | white | PWM | - | Rx / SSD | |
| Pin 10 | black | F.G | F.G | F.G | Frame Ground |

**[ DSM 701 24V 40P ECM ]** **Smart EC Motor with Encoder**

**Ø70 mm, 24VDC, brushless, 2650rpm, 40 Watt, Standard Hollow Shaft (front only), Encoder**

DSM EC MOTOR

- Brushless DC motor with high resolution encoder
- External diameter Ø70
- Incremental ABZ Quadrature Encoder output
- PWM output 12-bit
- Hall sensor (5~24Vdc, open-collector)
- High torque density
- Insulation class F
- Robust ball bearing system for long service life
- Customizing

| Motor data (with Hall sensors) | | Part numbers 701-24V-40P | 701-24V-60P |
|---|---|---|---|
| **Ratings** | | | |
| 1 Nominal Voltage | V | 24 | 24 |
| 2 Current | A | 2.5 | 3.5 |
| 3 Power | W | 40 | 60 |
| 4 Speed | RPM | 2300 | 3000 |
| 5 Torque | N.m | 0.18 | 0.19 |
| **Electrical characteristics** | | | |
| 1 Maximum Operating Voltage | V | 30 | 30 |
| 2 Maximum Output Power | W | 80 | 110 |
| 3 No Load Speed | RPM | 2650 | 3500 |
| 4 No Load Current | mA | 320 | 450 |
| 5 Stall Torque | N.m | 0.96 | 0.86 |
| 6 Torque Constant | mN.m/A | 81 | 61 |
| 7 Back EMF Constant | mV/RPM | 8.72 | 6.60 |
| 8 Terminal resistance phase to phase | Ω | 1.45 | 0.82 |
| 9 Terminal inductance phase to phase | mH | 2.15 | 1.27 |
| 10 Minimum Insulation resistance (dc 500V) | MΩ | 10 | 10 |
| 11 Noise (Rad.30[cm] DC24V, No load) | dB | 50.0 | 50.4 |

## Specifications

**Mechanical data (preload ball bearing)**

| | | |
|---|---|---|
| 1 Max. axial load (dynamic) | kgf.cm | 455 |
| 2 Max. force for press fits (static) | kgf.cm | 600 |

**Thermal data**

Temperature ratings

| | | |
|---|---|---|
| 1 Max. permissible winding temp. | ℃ | +160 |
| 2 Max. permissible bearing temp. | ℃ | +110 |

Ambient condition

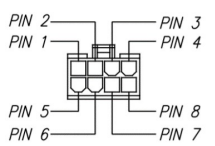
| | | |
|---|---|---|
| 1 Operation condition | ℃ | -10~50 |
| 2 Storage condition | ℃ | -10~60 |

**Other specifications**

| | | |
|---|---|---|
| 1 Number of pole pairs | pole | 8 |
| 2 Number of phases | phase | 3 |
| 3 Weight | gram | 475 |

## Pin Allocation (Molex 5557-08R)

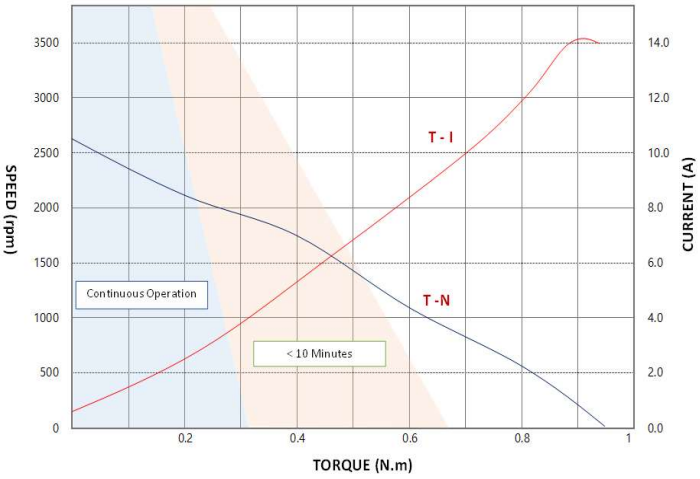
| | | | |
|---|---|---|---|
| 1 | black | GND | Motor UL1061 AWG 22 |
| 2 | blue | Motor winding W | Hall sensor UL1061 AWG 26 |
| 3 | green | Motor winding V | |
| 4 | yellow | Motor winding U | |
| 5 | red | Vhall 5 ... 24Vdc | |
| 6 | brown | Hall sensor C | |
| 7 | gray | Hall sensor B | |
| 8 | white | Hall sensor A | |



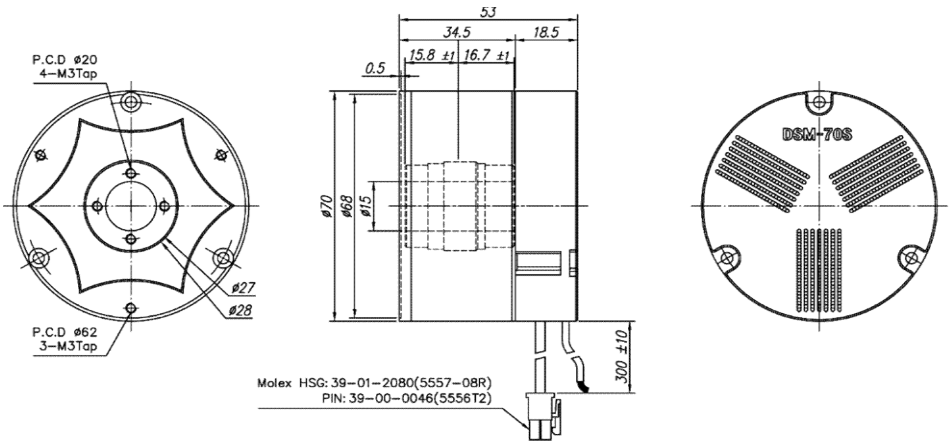

## Characteristic Curves

Refer to bellow T-I, T-N drawing

**701-24V-40P T-N-I curve**




Dimensions in [mm]



**[ DSM 701H 24V 40P ECM ]** | **Smart EC Motor with Encoder**

**Ø70 mm, 24VDC, brushless, 2650rpm, 40 Watt, Hollow disc flange option (front only), Encoder**

DSM EC MOTOR

- Brushless DC motor with high resolution encoder
- External diameter Ø70
- Incremental ABZ Quadrature Encoder output
- PWM output 12-bit
- Hall sensor (5~24Vdc, open-collector)
- High torque density
- Insulation class F
- Robust ball bearing system for long service life
- Customizing

| Motor data (with Hall sensors) | | Part numbers 701-24V-40P | 701-24V-60P |
|---|---|---|---|
| **Ratings** | | | |
| 1 Nominal Voltage | V | 24 | 24 |
| 2 Current | A | 2.5 | 3.5 |
| 3 Power | W | 40 | 60 |
| 4 Speed | RPM | 2300 | 3000 |
| 5 Torque | N.m | 0.18 | 0.19 |
| **Electrical characteristics** | | | |
| 1 Maximum Operating Voltage | V | 30 | 30 |
| 2 Maximum Output Power | W | 80 | 110 |
| 3 No Load Speed | RPM | 2650 | 3500 |
| 4 No Load Current | mA | 320 | 450 |
| 5 Stall Torque | N.m | 0.96 | 0.86 |
| 6 Torque Constant | mN.m/A | 81 | 61 |
| 7 Back EMF Constant | mV/RPM | 8.72 | 6.60 |
| 8 Terminal resistance phase to phase | Ω | 1.45 | 0.82 |
| 9 Terminal inductance phase to phase | mH | 2.15 | 1.27 |
| 10 Minimum Insulation resistance (dc 500V) | MΩ | 10 | 10 |
| 11 Noise (Rad.30[cm] DC24V, No load) | dB | 50.0 | 50.4 |

## Specifications

**Mechanical data (preload ball bearing)**

| | | |
|---|---|---|
| 1 Max. axial load (dynamic) | kgf.cm | 455 |
| 2 Max. force for press fits (static) | kgf.cm | 600 |

**Thermal data**

Temperature ratings

| | | |
|---|---|---|
| 1 Max. permissible winding temp. | ℃ | +160 |
| 2 Max. permissible bearing temp. | ℃ | +110 |

Ambient condition

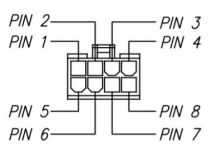
| | | |
|---|---|---|
| 1 Operation condition | ℃ | -10~50 |
| 2 Storage condition | ℃ | -10~60 |

**Other specifications**

| | | |
|---|---|---|
| 1 Number of pole pairs | pole | 8 |
| 2 Number of phases | phase | 3 |
| 3 Weight | gram | 515 |

## Pin Allocation (Molex 5557-08R)

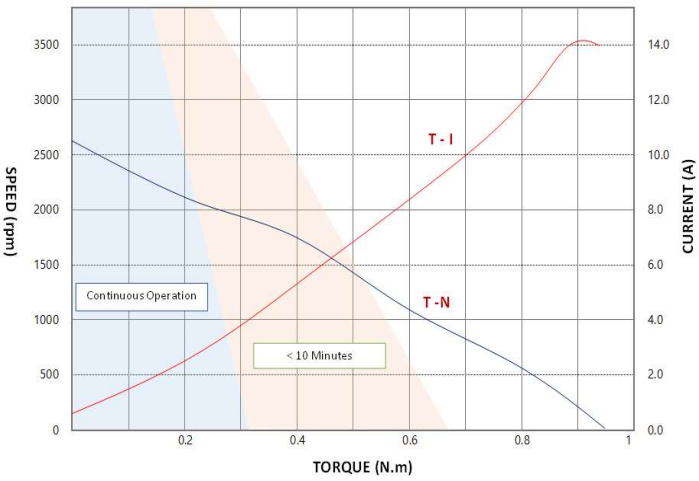
| | | | |
|---|---|---|---|
| 1 | black | GND | Motor UL1061 AWG 22 |
| 2 | blue | Motor winding W | Hall sensor UL1061 AWG 26 |
| 3 | green | Motor winding V | |
| 4 | yellow | Motor winding U | |
| 5 | red | Vhall 5 ... 24Vdc | |
| 6 | brown | Hall sensor C | |
| 7 | gray | Hall sensor B | |
| 8 | white | Hall sensor A | |



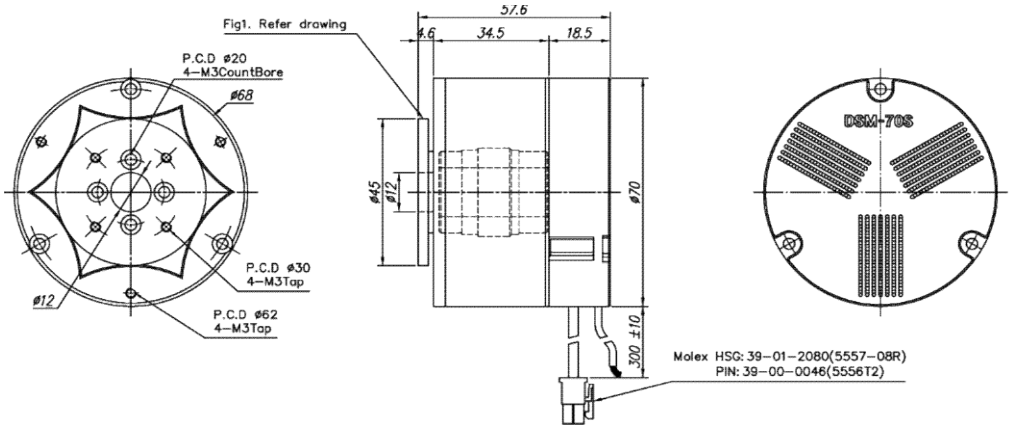

## Characteristic Curves

Refer to bellow T-I, T-N drawing

**701-24V-40P T-N-I curve**




Dimensions in [mm]



## [ DSM 701S 24V 40P ECM ]

## Smart EC Motor with Encoder

**Ø70 mm, 24VDC, brushless, 2650rpm, 40 Watt, Solid shaft option, Encoder**

DSM EC MOTOR

- Brushless DC motor with high resolution encoder
- External diameter Ø70
- Incremental ABZ Quadrature Encoder output
- PWM output 12-bit
- Hall sensor (5~24Vdc, open-collector)
- High torque density
- Insulation class F
- Robust ball bearing system for long service life
- Customizing

| Motor data (with Hall sensors) | | Part numbers 701-24V-40P | 701-24V-60P |
|---|---|---|---|
| **Ratings** | | | |
| 1 Nominal Voltage | V | 24 | 24 |
| 2 Current | A | 2.5 | 3.5 |
| 3 Power | W | 40 | 60 |
| 4 Speed | RPM | 2300 | 3000 |
| 5 Torque | N.m | 0.18 | 0.19 |
| **Electrical characteristics** | | | |
| 1 Maximum Operating Voltage | V | 30 | 30 |
| 2 Maximum Output Power | W | 80 | 110 |
| 3 No Load Speed | RPM | 2650 | 3500 |
| 4 No Load Current | mA | 320 | 450 |
| 5 Stall Torque | N.m | 0.96 | 0.86 |
| 6 Torque Constant | mN.m/A | 81 | 61 |
| 7 Back EMF Constant | mV/RPM | 8.72 | 6.60 |
| 8 Terminal resistance phase to phase | Ω | 1.45 | 0.82 |
| 9 Terminal inductance phase to phase | mH | 2.15 | 1.27 |
| 10 Minimum Insulation resistance (dc 500V) | MΩ | 10 | 10 |
| 11 Noise (Rad.30[cm] DC24V, No load) | dB | 50.0 | 50.4 |

## Specifications

**Mechanical data (preload ball bearing)**

| | | |
|---|---|---|
| 1 Max. axial load (dynamic) | kgf.cm | 455 |
| 2 Max. force for press fits (static) | kgf.cm | 600 |

**Thermal data**

Temperature ratings

| | | |
|---|---|---|
| 1 Max. permissible winding temp. | ℃ | +160 |
| 2 Max. permissible bearing temp. | ℃ | +110 |

Ambient condition

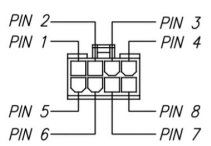
| | | |
|---|---|---|
| 1 Operation condition | ℃ | -10~50 |
| 2 Storage condition | ℃ | -10~60 |

**Other specifications**

| | | |
|---|---|---|
| 1 Number of pole pairs | pole | 8 |
| 2 Number of phases | phase | 3 |
| 3 Weight | gram | 530 |

## Pin Allocation (Molex 5557-08R)

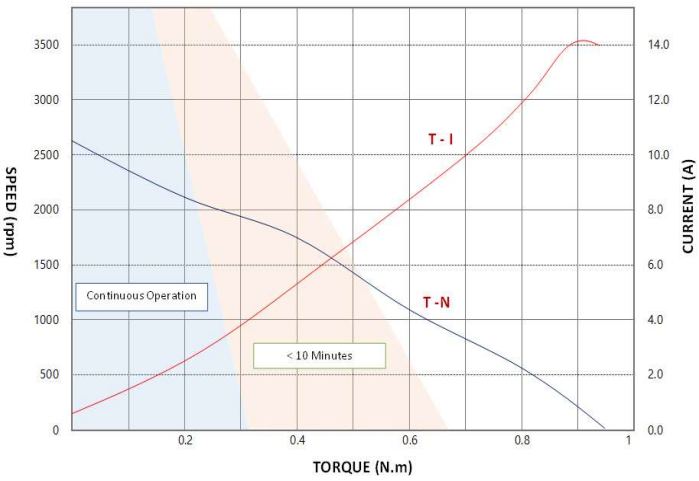
| | | | |
|---|---|---|---|
| 1 | black | GND | Motor UL1061 AWG 22 |
| 2 | blue | Motor winding W | Hall sensor UL1061 AWG 26 |
| 3 | green | Motor winding V | |
| 4 | yellow | Motor winding U | |
| 5 | red | Vhall 5 ... 24Vdc | |
| 6 | brown | Hall sensor C | |
| 7 | gray | Hall sensor B | |
| 8 | white | Hall sensor A | |



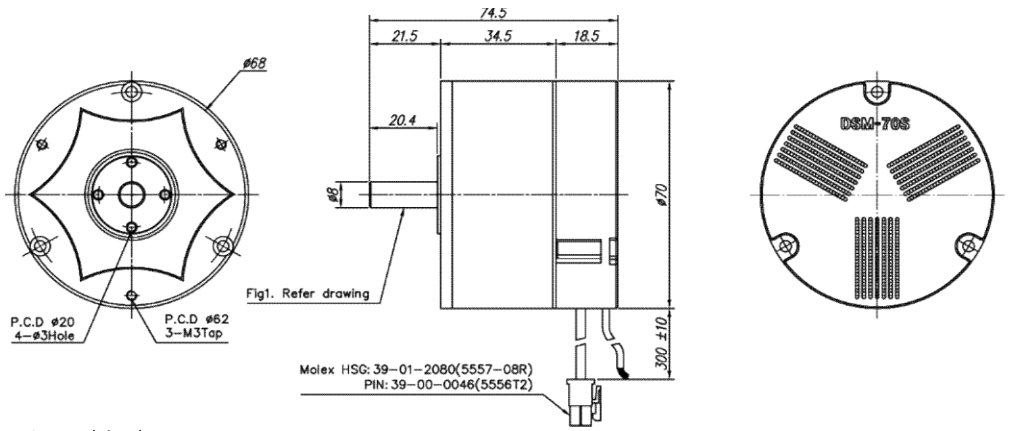

## Characteristic Curves

Refer to bellow T-I, T-N drawing

**701-24V-40P T-N-I curve**




Dimensions in [mm]



# Smart EC Motor with Encoder

**Ø70 mm, 24VDC, Brushless, 3500rpm, 60 Watt, Standard Hollow Shaft (front only), Encoder**

DSM EC MOTOR

- Brushless DC motor with high resolution encoder
- External diameter Ø70
- Incremental ABZ Quadrature Encoder output
- PWM output 12-bit
- Hall sensor (5~24Vdc, open-collector)
- High torque density
- Insulation class F
- Robust ball bearing system for long service life
- Customizing

| Motor data (with Hall sensors) | | Part numbers 701-24V-40P | 701-24V-60P |
|---|---|---|---|
| **Ratings** | | | |
| 1 Nominal Voltage | V | 24 | 24 |
| 2 Current | A | 2.5 | 3.5 |
| 3 Power | W | 40 | 60 |
| 4 Speed | RPM | 2300 | 3000 |
| 5 Torque | N.m | 0.18 | 0.19 |
| **Electrical characteristics** | | | |
| 1 Maximum Operating Voltage | V | 30 | 30 |
| 2 Maximum Output Power | W | 80 | 110 |
| 3 No Load Speed | RPM | 2650 | 3500 |
| 4 No Load Current | mA | 320 | 450 |
| 5 Stall Torque | N.m | 0.96 | 0.86 |
| 6 Torque Constant | mN.m/A | 81 | 61 |
| 7 Back EMF Constant | mV/RPM | 8.72 | 6.60 |
| 8 Terminal resistance phase to phase | Ω | 1.45 | 0.82 |
| 9 Terminal inductance phase to phase | mH | 2.15 | 1.27 |
| 10 Minimum Insulation resistance (dc 500V) | MΩ | 10 | 10 |
| 11 Noise (Rad.30[cm] DC24V, No load) | dB | 50.0 | 50.4 |

## Specifications

**Mechanical data (preload ball bearing)**

| | | |
|---|---|---|
| 1 Max. axial load (dynamic) | kgf.cm | 455 |
| 2 Max. force for press fits (static) | kgf.cm | 600 |

**Thermal data**

Temperature ratings

| | | |
|---|---|---|
| 1 Max. permissible winding temp. | ℃ | +160 |
| 2 Max. permissible bearing temp. | ℃ | +110 |

Ambient condition

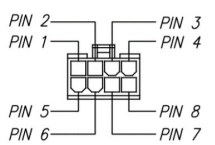
| | | |
|---|---|---|
| 1 Operation condition | ℃ | -10~50 |
| 2 Storage condition | ℃ | -10~60 |

**Other specifications**

| | | |
|---|---|---|
| 1 Number of pole pairs | pole | 8 |
| 2 Number of phases | phase | 3 |
| 3 Weight | gram | 470 |

## Pin Allocation (Molex 5557-08R)

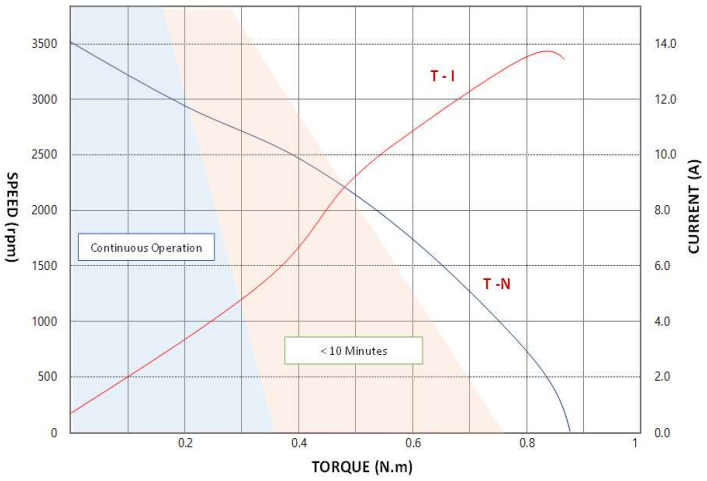
| | | | |
|---|---|---|---|
| 1 | black | GND | Motor UL1061 AWG 22 |
| 2 | blue | Motor winding W | Hall sensor UL1061 AWG 26 |
| 3 | green | Motor winding V | |
| 4 | yellow | Motor winding U | |
| 5 | red | Vhall 5 ... 24Vdc | |
| 6 | brown | Hall sensor C | |
| 7 | gray | Hall sensor B | |
| 8 | white | Hall sensor A | |



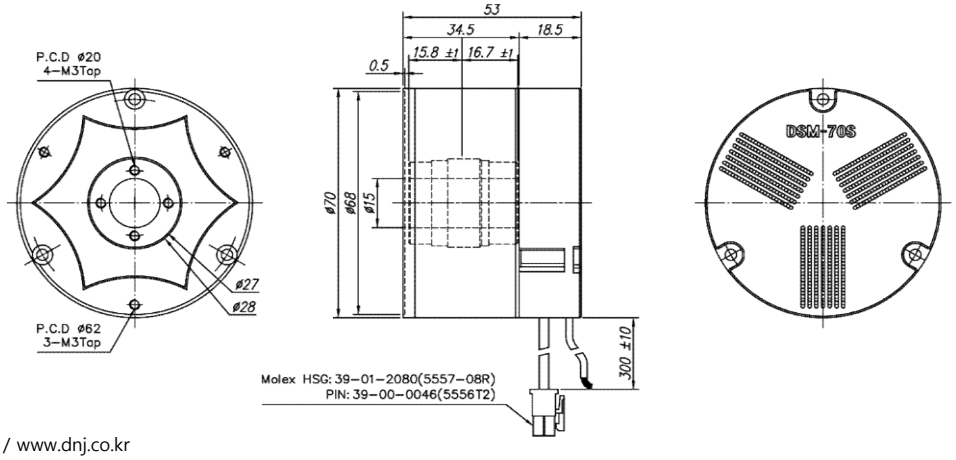

## Characteristic Curves

Refer to bellow T-I, T-N drawing

**701-24V-60P T-N-I curve**




Dimensions in [mm]



**[ DSM 701H 24V 60P ECM ]** | **Smart EC Motor with Encoder**

**Ø70 mm, 24VDC, Brushless, 3500rpm, 60 Watt, Hollow disc flange option (front only), Encoder**

DSM EC MOTOR

- Brushless DC motor with high resolution encoder
- External diameter Ø70
- Incremental ABZ Quadrature Encoder output
- PWM output 12-bit
- Hall sensor (5~24Vdc, open-collector)
- High torque density
- Insulation class F
- Robust ball bearing system for long service life
- Customizing

| Motor data | | with Hall sensors | Part numbers | |
|---|---|---|---|---|
| | | | 701-24V-40P | 701-24V-60P |
| **Ratings** | | | | |
| 1 Nominal Voltage | V | | 24 | 24 |
| 2 Current | A | | 2.5 | 3.5 |
| 3 Power | W | | 40 | 60 |
| 4 Speed | RPM | | 2300 | 3000 |
| 5 Torque | N.m | | 0.18 | 0.19 |
| **Electrical characteristics** | | | | |
| 1 Maximum Operating Voltage | V | | 30 | 30 |
| 2 Maximum Output Power | W | | 80 | 110 |
| 3 No Load Speed | RPM | | 2650 | 3500 |
| 4 No Load Current | mA | | 320 | 450 |
| 5 Stall Torque | N.m | | 0.96 | 0.86 |
| 6 Torque Constant | mN.m/A | | 81 | 61 |
| 7 Back EMF Constant | mV/RPM | | 8.72 | 6.60 |
| 8 Terminal resistance phase to phase | Ω | | 1.45 | 0.82 |
| 9 Terminal inductance phase to phase | mH | | 2.15 | 1.27 |
| 10 Minimum Insulation resistance (dc 500V) | MΩ | | 10 | 10 |
| 11 Noise (Rad.30[cm] DC24V, No load) | dB | | 50.0 | 50.4 |

## Specifications

**Mechanical data (preload ball bearing)**

| | | |
|---|---|---|
| 1 Max. axial load (dynamic) | kgf.cm | 455 |
| 2 Max. force for press fits (static) | kgf.cm | 600 |

**Thermal data**

Temperature ratings

| | | |
|---|---|---|
| 1 Max. permissible winding temp. | ℃ | +160 |
| 2 Max. permissible bearing temp. | ℃ | +110 |

Ambient condition

| | | |
|---|---|---|
| 1 Operation condition | ℃ | -10~50 |
| 2 Storage condition | ℃ | -10~60 |

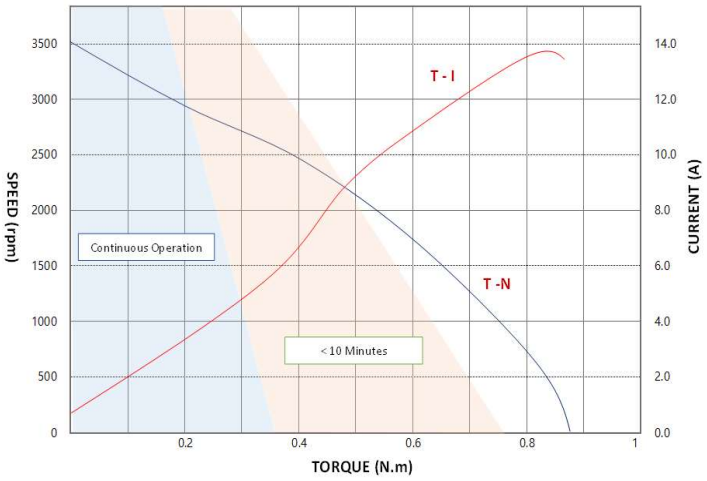
**Other specifications**

| | | |
|---|---|---|
| 1 Number of pole pairs | pole | 8 |
| 2 Number of phases | phase | 3 |
| 3 Weight | gram | 510 |

## Characteristic Curves

Refer to bellow T-I, T-N drawing

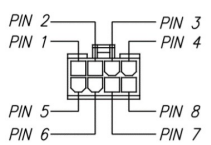
**701-24V-60P T-N-I curve**



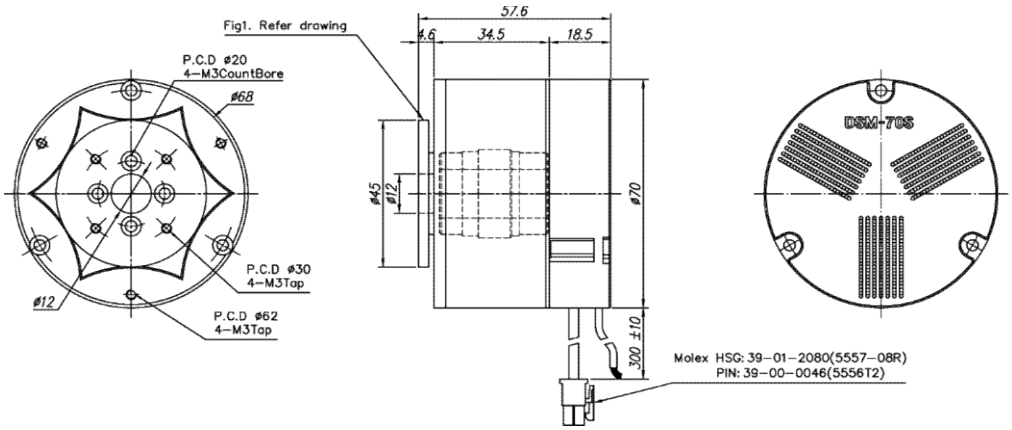

## Pin Allocation

(Molex 5557-08R)

| | | | | |
|---|---|---|---|---|
| 1 | black | GND | Motor | UL1061 AWG 22 |
| 2 | blue | Motor winding W | Hall sensor | UL1061 AWG 26 |
| 3 | green | Motor winding V | | |
| 4 | yellow | Motor winding U | | |
| 5 | red | Vhall 5 ... 24Vdc | | |
| 6 | brown | Hall sensor C | | |
| 7 | gray | Hall sensor B | | |
| 8 | white | Hall sensor A | | |




Dimensions in [mm]



**[ DSM 701S 24V 60P ECM ]** **Smart EC Motor with Encoder**

**Ø70 mm, 24VDC, Brushless, 3500rpm, 60 Watt, Solid shaft option (front only), Encoder**

DSM EC MOTOR

- Brushless DC motor with high resolution encoder
- External diameter Ø70
- Incremental ABZ Quadrature Encoder output
- PWM output 12-bit
- Hall sensor (5~24Vdc, open-collector)
- High torque density
- Insulation class F
- Robust ball bearing system for long service life
- Customizing

| Motor data (with Hall sensors) | | Part numbers 701-24V-40P | 701-24V-60P |
|---|---|---|---|
| **Ratings** | | | |
| 1 Nominal Voltage | V | 24 | 24 |
| 2 Current | A | 2.5 | 3.5 |
| 3 Power | W | 40 | 60 |
| 4 Speed | RPM | 2300 | 3000 |
| 5 Torque | N.m | 0.18 | 0.19 |
| **Electrical characteristics** | | | |
| 1 Maximum Operating Voltage | V | 30 | 30 |
| 2 Maximum Output Power | W | 80 | 110 |
| 3 No Load Speed | RPM | 2650 | 3500 |
| 4 No Load Current | mA | 320 | 450 |
| 5 Stall Torque | N.m | 0.96 | 0.86 |
| 6 Torque Constant | mN.m/A | 81 | 61 |
| 7 Back EMF Constant | mV/RPM | 8.72 | 6.60 |
| 8 Terminal resistance phase to phase | Ω | 1.45 | 0.82 |
| 9 Terminal inductance phase to phase | mH | 2.15 | 1.27 |
| 10 Minimum Insulation resistance (dc 500V) | MΩ | 10 | 10 |
| 11 Noise (Rad.30[cm] DC24V, No load) | dB | 50.0 | 50.4 |

## Specifications

**Mechanical data (preload ball bearing)**

| | | |
|---|---|---|
| 1 Max. axial load (dynamic) | kgf.cm | 455 |
| 2 Max. force for press fits (static) | kgf.cm | 600 |

**Thermal data**

Temperature ratings

| | | |
|---|---|---|
| 1 Max. permissible winding temp. | ℃ | +160 |
| 2 Max. permissible bearing temp. | ℃ | +110 |

Ambient condition

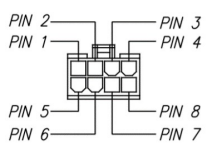
| | | |
|---|---|---|
| 1 Operation condition | ℃ | -10~50 |
| 2 Storage condition | ℃ | -10~60 |

**Other specifications**

| | | |
|---|---|---|
| 1 Number of pole pairs | pole | 8 |
| 2 Number of phases | phase | 3 |
| 3 Weight | gram | 525 |

## Pin Allocation (Molex 5557-08R)

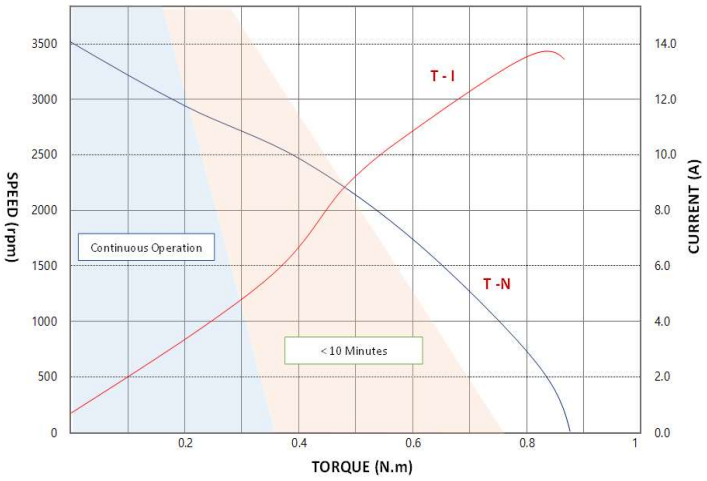
| | | | |
|---|---|---|---|
| 1 | black | GND | Motor UL1061 AWG 22 |
| 2 | blue | Motor winding W | Hall sensor UL1061 AWG 26 |
| 3 | green | Motor winding V | |
| 4 | yellow | Motor winding U | |
| 5 | red | Vhall 5 ... 24Vdc | |
| 6 | brown | Hall sensor C | |
| 7 | gray | Hall sensor B | |
| 8 | white | Hall sensor A | |




## Characteristic Curves

Refer to bellow T-I, T-N drawing

**701-24V-60P T-N-I curve**




Dimensions in [mm]