Pololu 37D Metal Gearmotors are powerful brushed DC motors paired with 37mm-diameter gearboxes. There are nine different gearbox options available, ranging from 6.3:1 to 150:1, and two different motor options: 12 V and 24 V. The 24 V versions offer approximately the same speed and torque at 24 V as their 12 V counterparts do at 12 V, with approximately half the current draw. This datasheet includes two sets of performance graphs for each version, one at its nominal voltage and one at half of its nominal voltage. Each version is available with an integrated 64 CPR quadrature encoder on the motor shaft.

Note: The original versions of these gearmotors had gearboxes with all spur gears. In August 2019, these were replaced by functionally identical “Helical Pinion” versions that feature helical gears for the first stage of the gearbox, which reduces noise and vibration and improves efficiency. The picture on the right shows the helical pinion gear and first mating gear.

Performance summary and table of contents

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Notes:
1. Max efficiency data and performance graphs currently unavailable for the motors without gearboxes (items #4750 and #4690).
2. Listed stall torques and currents are theoretical extrapolations; units will typically stall well before these points as the motors heat up. Stalling or overloading gearmotors can greatly decrease their lifetimes and even result in immediate damage. The recommended upper limit for continuously applied loads is 100 kg-mm, and the recommended upper limit for instantaneous torque is 250 kg-mm. Stalls can also result in rapid (potentially on the order of seconds) thermal damage to the motor windings and brushes; a general recommendation for brushed DC motor operation is 25% or less of the stall current.
3. Output power for these units is constrained by gearbox load limits; spec provided is output power at max recommended load of 100 kg-mm.
Dimensions (units: mm over [inches])

Gearmotor versions without encoders (items #2829, 4681–4689, 4741–4748)  
weight: 175 g to 195 g

<table>
<thead>
<tr>
<th>Gear ratio</th>
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<tr>
<td>6.3:1, 10:1</td>
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<td>100:1, 131:1, 150:1</td>
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Gearmotor versions with encoders (items #2828, 4691–4699, 4751–4758)  
weight: 190 g to 210 g

<table>
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Threaded to a depth of 3.0 mm [0.12 in]; exceeding this depth can damage gears in the gearbox.

 Leads are approximately 200 mm [8 in] long and are terminated by a 1×6 female header with a 2.54 mm [0.1 in] pitch.
Using the encoder

Versions with encoders have additional electronics mounted on the rear of the motor. Two Hall-effect sensors are used to sense the rotation of a magnetic disc on a rear protrusion of the motor shaft. The encoder electronics and magnetic disc are enclosed by a removable plastic end cap. The following pictures show what the encoder portion looks like with the end cap removed:

The quadrature encoder provides a resolution of 64 counts per revolution (CPR) of the motor shaft when counting both edges of both channels. To compute the counts per revolution of the gearbox output, multiply the gear ratio by 64.

The motor/encoder has six color-coded, 20 cm (8") leads terminated by a 1×6 female connector with a 2.54 mm (0.1") pitch. This connector works with standard 0.1" male breakaway headers and Pololu male premium jumper and precrimped wires. If this header is not convenient, the crimped wires can be pulled out of the 1×6 housing and used with different crimp connector housings instead (e.g. 1×2 for the motor power and 1×1 housings for the other four leads), or the connectors can be cut off entirely.
The Hall sensors require an input voltage, Vcc, between 3.5 V and 20 V and draw a maximum of 10 mA. The A and B outputs are square waves from 0 V to Vcc approximately 90° out of phase. The speed of the motor can be determined from the frequency, and the direction of rotation can be determined from the order of the transitions. The following oscilloscope capture shows the A and B (yellow and white) encoder outputs using a 12 V motor at 12 V and a Hall sensor Vcc of 5 V:

Counting both the rising and falling edges of both the A and B outputs results in 64 counts per revolution of the motor shaft. Using just a single edge of one channel results in 16 counts per revolution of the motor shaft, so the frequency of the A output in the above oscilloscope capture is 16 times the motor rotation frequency.
Pololu Items #4747, #4757 (6.3:1 Metal Gearmotor 37D 12V) Performance at 12 V

- Max power: 12 W at 15 kg⋅mm
- 32% efficiency
- 760 rpm, 3.1 A
- Max efficiency: 47%
- at 4.9 kg⋅mm, 6.4 W, 1300 rpm, 1.2 A
- No-load speed: 1600 rpm
- No-load current: 0.18 A
- Stall torque: 30 kg⋅mm
- Stall current: 5.9 A

\[ f(\tau) = 1500 - 51\tau \]
\[ f(\tau) = 0.22 + 0.19\tau \]
Pololu Items #4747, #4757 (6.3:1 Metal Gearmotor 37D 12V) Performance at 6 V

- **Max power:** 3.2 W at 8.4 kg⋅mm, 32% efficiency, 380 rpm, 1.7 A
- **Torque (kg⋅mm):**
  - Stall: \( \tau_{\text{stall}} \approx 17 \text{ kg⋅mm} \)
  - No-load: \( \tau_{\text{no-load}} \approx 0.13 \text{ A} \)

Graph:
- **Efficiency (%):**
- **Power (W):**
- **Speed (rpm):**
- **Current (A):**

Pololu 37D Motor Performance Chart

- **Max efficiency:** 43% at 3.4 kg⋅mm, 2.1 W, 600 rpm, 0.82 A
- **F(\tau) = 750 - 45\tau**
- **F(\tau) = 0.21 + 0.18\tau**

Pololu Items #4748, #4758 (10:1 Metal Gearmotor 37D 12V) Performance at 12 V

- **max power**: 12 W at 24 kg\cdot mm, 34% efficiency, 490 rpm, 3.0 A
- **max efficiency**: 52% at 6.6 kg\cdot mm, 5.7 W, 850 rpm, 0.91 A

\[ f(\tau) = 980 - 20\tau \]
\[ f(\tau) = 0.14 + 0.12\tau \]

- **no-load speed**: 1000 rpm
- **no-load current**: 0.15 A
- **\( \tau_{\text{stall}} \approx 49 \text{ kg}\cdot\text{mm} \)
- **\( I_{\text{stall}} \approx 5.8 \text{ A} \)
max power: 3.3 W at 13 kg⋅mm, 34% efficiency, 240 rpm, 1.6 A

Pololu Items #4748, #4758 (10:1 Metal Gearmotor 37D 12V) Performance at 6 V

max efficiency: 49% at 4.6 kg⋅mm, 1.9 W, 400 rpm, 0.65 A

\[ f(\tau) = 480 - 18\tau \]
\[ f(\tau) = 0.14 + 0.11\tau \]

\[ \tau_{\text{stall}} \approx 27 \text{ kg}\cdot\text{mm} \]
\[ I_{\text{stall}} \approx 3.1 \text{ A} \]

no-load speed: 490 rpm
no-load current: 0.11 A
Pololu Items #4741, #4751 (19:1 Metal Gearmotor 37D 12V) Performance at 12 V

- Max power: 12 W, at 42 kg⋅mm, 35% efficiency, 270 rpm, 2.8 A
- Max efficiency: 55% at 10 kg⋅mm, 5.0 W, 470 rpm, 0.76 A

f(τ) = 530 − 6.3τ
f(τ) = 0.11 + 0.062τ

τ_{stall} ≈ 85 kg⋅mm
I_{stall} ≈ 5.4 A

No-load speed: 540 rpm
No-load current: 0.12 A
Pololu Items #4741, #4751 (19:1 Metal Gearmotor 37D 12V) Performance at 6 V

- Max power: 3.5 W at 25 kg⋅mm, 35% efficiency, 130 rpm, 1.6 A
- Max efficiency: 53% at 7.2 kg⋅mm, 1.7 W, 230 rpm, 0.53 A
- No-load speed: 270 rpm
- No-load current: 0.091 A
- Stall, τstall ≈ 50 kg⋅mm
- Stall current, Istall ≈ 3.2 A

Torque (kg⋅mm) vs. Speed (rpm) graph

- Blue line: f(τ) = 270 - 5.4τ
- Orange line: f(τ) = 0.089 + 0.062τ

Efficiency (%) vs. Power (W) graph

- Dotted line: Max efficiency: 53% at 7.2 kg⋅mm, 1.7 W, 230 rpm, 0.53 A
- Solid line: Max power: 3.5 W at 25 kg⋅mm, 35% efficiency, 130 rpm, 1.6 A

Current (A) vs. Speed (rpm) graph

- Green line: No-load current: 0.091 A
- Red line: Power vs. Speed with efficiency curve
- Blue line: Efficiency vs. Power with speed curve

Pololu Items #4742, #4752 (30:1 Metal Gearmotor 37D 12V) Performance at 12 V

- Max power: 12 W at 72 kg⋅mm, 35% efficiency, 160 rpm, 2.8 A
- Max efficiency: 54% at 18 kg⋅mm, 5.1 W, 280 rpm, 0.78 A

Torque (kg⋅mm) vs. Efficiency (%) for Pololu Items #4742, #4752 (30:1 Metal Gearmotor 37D 12V)

- No-load speed: 330 rpm
- No-load current: 0.15 A

Equations:

\[ f(\tau) = 320 - 2.2\tau \]

\[ f(\tau) = 0.11 + 0.038\tau \]

Stall torque: \( \approx 140 \) kg⋅mm
Stall current: \( \approx 5.6 \) A

No-load speed: 330 rpm
No-load current: 0.15 A
Pololu Items #4742, #4752 (30:1 Metal Gearmotor 37D 12V) Performance at 6 V

- **Max power:** 3.4 W at 39 kg⋅mm, 36% efficiency, 83 rpm, 1.5 A
- **Max efficiency:** 54% at 12 kg⋅mm, 1.7 W, 140 rpm, 0.53 A

**Torque (kg⋅mm)**

- No-load speed: 170 rpm
- No-load current: 0.091 A

**f(τ) = 170 − 2.1τ**

**f(τ) = 0.093 + 0.037τ**

**τ_{stall} ≈ 79 kg⋅mm**

**I_{stall} ≈ 3.0 A**
Pololu Items #4743, #4753 (50:1 Metal Gearmotor 37D 12V) Performance at 12 V

- **theoretical max power:** 10 W at 22 kg-mm, 4.0 W, 180 rpm, 0.66 A
- **max efficiency:** 51% at 22 kg-mm, 4.0 W, 180 rpm, 0.66 A
- **no-load speed:** 200 rpm
- **no-load current:** 0.12 A
- **stall torque:** $\tau_{\text{stall}} \approx 210$ kg-mm
- **stall current:** $I_{\text{stall}} \approx 5.4$ A

$f(\tau) = 200 - 1.0\tau$

$f(\tau) = 0.080 + 0.026\tau$
Pololu Items #4743, #4753 (50:1 Metal Gearmotor 37D 12V) Performance at 6 V

- Max power: 3.2 W at 63 kg⋅mm, 33% efficiency, 50 rpm, 1.6 A
d- Max efficiency: 52% at 15 kg⋅mm, 1.4 W, 88 rpm, 0.44 A

- Torque (kg⋅mm)
  - Stall: \( f(\tau) = 100 - 0.79\tau \)
  - No-load: \( f(\tau) = 0.059 + 0.025\tau \)

- Current (A)

- Speed (rpm)
  - No-load: 100 rpm
  - Stall: \( \tau_{\text{stall}} \approx 130 \text{ kg}\cdot\text{mm} \)
  - Stall current: \( I_{\text{stall}} \approx 3.2 \text{ A} \)
Pololu Items #4744, #4754 (70:1 Metal Gearmotor 37D 12V) Performance at 12 V

- **Theoretical max power:** 10 W at 140 kg mm, 33% efficiency, 73 rpm, 2.6 A

- **Max efficiency:** 52% at 32 kg mm, 4.2 W, 130 rpm, 0.68 A

- **No-load speed:** 150 rpm
- **No-load current:** 0.11 A

- **Stall torque:** \(\tau_{\text{stall}} \approx 270 \text{ kg mm}\)
- **Stall current:** \(I_{\text{stall}} \approx 5.2 \text{ A}\)

\[f(\tau) = 150 - 0.53\tau\]
\[f(\tau) = 0.088 + 0.018\tau\]
Pololu Items #4744, #4754 (70:1 Metal Gearmotor 37D 12V) Performance at 6 V

- **Max Power:** 3.0 W at 81 kg⋅mm, 31% efficiency, 36 rpm, 1.6 A

- **Max Efficiency:** 49% at 20 kg⋅mm, 1.3 W, 63 rpm, 0.45 A

- **No-Load Speed:** 73 rpm

- **No-Load Current:** 0.082 A

- **Stall Torque:** \( \tau_{\text{stall}} \approx 160 \text{ kg}\cdot\text{mm} \)

- **Stall Current:** \( I_{\text{stall}} \approx 3.1 \text{ A} \)

- **f(\tau) = 73 - 0.45\tau**

- **f(\tau) = 0.066 + 0.019\tau**
Pololu Items #4745, #4755 (100:1 Metal Gearmotor 37D 12V) Performance at 12 V

Theoretical max power: 8.7 W at 170 kg⋅mm, 28% efficiency, 50 rpm, 2.6 A.

Max efficiency: 44% at 42 kg⋅mm, 3.8 W, 87 rpm, 0.72 A.

Torque stall: \( \tau_{\text{stall}} \approx 340 \text{ kg} \cdot \text{mm} \)

No-load speed: 100 rpm

No-load current: 0.12 A
Pololu Items #4745, #4755 (100:1 Metal Gearmotor 37D 12V) Performance at 6 V

- Theoretical max power: 2.6 W at 100 kg⋅mm, 27% efficiency, 25 rpm, 1.6 A torque (kg⋅mm)

- Max efficiency: 41% at 29 kg⋅mm, 1.3 W, 43 rpm, 0.51 A

- Torque (τ) vs. efficiency (η) curve
  - f(τ) = 0.082 + 0.015τ
  - τ_{stall} ≈ 210 kg⋅mm
  - I_{stall} ≈ 3.2 A

- Speed (rpm) vs. current (A) curve
  - No-load speed: 49 rpm
  - No-load current: 0.087 A

- Efficiency (%), power (W), and speed (rpm) graph

- Pololu Items #4745, #4755 (100:1 Metal Gearmotor 37D 12V) Performance at 6 V

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Pololu Items #4746, #4756 (131:1 Metal Gearmotor 37D 12V) Performance at 12 V

- Theoretical max power: 8.7 W at 220 kg⋅mm, 30% efficiency, 38 rpm, 2.5 A

- Max efficiency: 45% at 60 kg⋅mm, 4.1 W, 66 rpm, 0.74 A

- No-load speed: 76 rpm

- No-load current: 0.13 A

- Stall torque: \( \tau_{\text{stall}} \approx 450 \text{ kg} \cdot \text{mm} \)

- Stall current: \( I_{\text{stall}} \approx 4.8 \text{ A} \)

The graph shows the relationship between torque, speed, and efficiency at various current levels.
Pololu Items #4746, #4756 (131:1 Metal Gearmotor 37D 12V) Performance at 6 V

- **Theoretical max power**: 2.7 W at 140 kg⋅mm, 29% efficiency, 19 rpm, 1.6 A

- **Max efficiency**: 43% at 40 kg⋅mm, 1.3 W, 33 rpm, 0.51 A

- **Torque**:
  - **Stall**: \( \tau_{\text{stall}} \approx 280 \text{ kg}\cdot\text{mm} \)
  - **No-load**: \( \tau_{\text{no-load}} \approx 3.1 \text{ A} \)

- **Power**: \( P = (38 - 0.14\tau) \) for \( \tau \geq 0 \)

- **Efficiency**: \( \eta = 0.085 + 0.011\tau \) for \( \tau \geq 0 \)

- **No-load speed**: 38 rpm

- **No-load current**: 0.095 A

**Pololu Items #2828, #2829 (150:1 Metal Gearmotor 37D 12V) Performance at 12 V**

- **Theoretical max power:** 8.4 W at 250 kg⋅mm, 29% efficiency, 33 rpm, 2.4 A
- **Max efficiency:** 44% at 65 kg⋅mm, 3.8 W, 58 rpm, 0.72 A

**Performance Characteristics:**
- **No-load speed:** 67 rpm
- **No-load current:** 0.12 A
- **Stall torque:** \( \tau_{\text{stall}} \approx 490 \text{ kg⋅mm} \)
- **Stall current:** \( I_{\text{stall}} \approx 4.8 \text{ A} \)

**Mathematical Relationships:**
- \( f(\tau) = 67 - 0.13\tau \)
- \( f(\tau) = 0.11 + 0.0095\tau \)
theoretical max power: 2.5 W at 150 kg⋅mm, 27% efficiency, 17 rpm, 1.5 A

Pololu Items #2828, #2829 (150:1 Metal Gearmotor 37D 12V) Performance at 6 V

max efficiency: 41% at 43 kg⋅mm, 1.3 W, 28 rpm, 0.51 A

f(τ) = 33 – 0.11τ

f(τ) = 0.086 + 0.010τ

no-load speed: 33 rpm

no-load current: 0.10 A

τ_{stall} ≈ 300 kg⋅mm

I_{stall} ≈ 3.0 A
Pololu Items #4688, #4698 (6.3:1 Metal Gearmotor 37D 24V) Performance at 24 V

- **max power**: 14 W at 17 kg⋅mm
- **efficiency**: 36%
- **speed**: 770 rpm, 1.6 A

- **max efficiency**: 53%
- **at 5.5 kg⋅mm**: 7.4 W, 1300 rpm, 0.58 A

- **Torque (kg⋅mm)**:
  - **Stall**: ≈ 35 kg⋅mm
  - **Stall current**: ≈ 3.1 A

- **No-load speed**: 1600 rpm
- **No-load current**: 0.075 A

- **Speed (rpm)** vs. **Current (A)**:
  - Line equations:
    - $f(\tau) = 1500 - 44\tau$
    - $f(\tau) = 0.11 + 0.086\tau$

- **Graph notes**:
  - Efficiency at 24 V
  - Torque and power values
  - Operating conditions

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Pololu Items #4688, #4698 (6.3:1 Metal Gearmotor 37D 24V) Performance at 12 V

max power: 3.8 W
at 10 kg⋅mm, 35% efficiency, 390 rpm, 0.91 A

max efficiency: 48%
at 3.7 kg⋅mm, 2.4 W, 620 rpm, 0.41 A

no-load speed: 820 rpm
no-load current: 0.064 A

\[ \tau = 770 - 40\tau \]
\[ f(\tau) = 0.10 + 0.084\tau \]
\[ I_{\text{stall}} \approx 1.7 \text{ A} \]
\[ \tau_{\text{stall}} \approx 19 \text{ kg} \cdot \text{mm} \]

\( \tau \) = torque (kg⋅mm)
Pololu Items #4689, #4699 (10:1 Metal Gearmotor 37D 24V) Performance at 24 V

max power: 14 W
at 28 kg mm,
36% efficiency,
490 rpm, 1.6 A

max efficiency: 56%
at 7.5 kg mm, 6.6 W,
850 rpm, 0.49 A

no-load speed: 1000 rpm
no-load current: 0.070 A

\[ f(\tau) = 990 - 18\tau \]
\[ f(\tau) = 0.077 + 0.055\tau \]

\( \tau_{\text{stall}} \approx 55 \text{ kg mm} \)
\( I_{\text{stall}} \approx 3.1 \text{ A} \)
Pololu Items #4689, #4699 (10:1 Metal Gearmotor 37D 24V) Performance at 12 V

- **Max Power**: 3.9 W at 15 kg⋅mm, 36% efficiency, 250 rpm, 0.89 A
- **Max Efficiency**: 51% at 5.6 kg⋅mm, 2.3 W, 400 rpm, 0.38 A
- **No-load Speed**: 520 rpm
- **No-load Current**: 0.058 A
- **Stall Torque**: ≈ 31 kg⋅mm
- **Stall Current**: ≈ 1.7 A

The graph shows the relationship between power, efficiency, speed, current, and torque for the gearmotor. The equations for efficiency and current as functions of torque are also provided.
Pololu Items #4681, #4691 (19:1 Metal Gearmotor 37D 24V) Performance at 24 V

- **Max power:** 13 W at 48 kg mm, 34% efficiency, 260 rpm, 1.6 A
- **Max efficiency:** 52% at 13 kg mm, 6.1 W, 450 rpm, 0.49 A

The graph shows the relationship between torque (kg mm), speed (rpm), current (A), and efficiency (%) for the gearmotor. The equations for the graph are:

\[ f(\tau) = 530 - 5.5\tau \]
\[ f(\tau) = 0.077 + 0.031\tau \]

The stall torque is approximately 95 kg mm, and the stall current is approximately 3.1 A.

No-load speed is 550 rpm, and no-load current is 0.068 A.

The graph includes a line indicating no-load speed at 550 rpm and another line indicating stall torque at 95 kg mm.
Pololu Items #4681, #4691 (19:1 Metal Gearmotor 37D 24V) Performance at 12 V

max power: 3.6 W at 26 kg⋅mm, 34% efficiency, 130 rpm, 0.88 A

max efficiency: 49% at 8.2 kg⋅mm, 1.9 W, 220 rpm, 0.32 A

no-load speed: 270 rpm

f(τ) = 270 − 5.1τ

f(τ) = 0.080 + 0.032τ

τ_{stall} ≈ 52 kg⋅mm

I_{stall} ≈ 1.7 A

no-load current: 0.054 A

Pololu Items #4682, #4692 (30:1 Metal Gearmotor 37D 24V) Performance at 24 V

- Max power: 13 W at 76 kg⋅mm, 32% efficiency, 160 rpm, 1.6 A
- Max efficiency: 50% at 19 kg⋅mm, 5.5 W, 280 rpm, 0.46 A

Torque (kg⋅mm) vs. Effeciency (%)
- Torque stall ≈ 150 kg⋅mm
- I_{stall} ≈ 3.2 A

Speed (rpm) vs. Current (A)
- No-load speed: 330 rpm
- No-load current: 0.070 A

Equations:
- \( f(\tau) = 320 - 2.1\tau \)
- \( f(\tau) = 0.086 + 0.021\tau \)
Pololu Items #4682, #4692 (30:1 Metal Gearmotor 37D 24V) Performance at 12 V

- **max power**: 3.5 W at 41 kg⋅mm
- **efficiency**: 34%
- **speed**: 83 rpm
- **current**: 0.86 A

- **max efficiency**: 49% at 14 kg⋅mm, 1.9 W, 140 rpm, 0.33 A
- **no-load speed**: 170 rpm
- **no-load current**: 0.053 A
- **τ_{stall}**: ≈ 81 kg⋅mm
- **I_{stall}**: ≈ 1.6 A

\[ f(τ) = 0.067 + 0.019τ \]
\[ f(τ) = 170 - 2.0τ \]
Pololu Items #4683, #4693 (50:1 Metal Gearmotor 37D 24V) Performance at 24 V

- **Max Efficiency:** 50%
  - at 27 kg⋅mm, 4.9 W, 170 rpm, 0.41 A
- **No-Load Speed:** 200 rpm
- **Stall Torque:** 230 kg⋅mm
- **Max Efficiency** (at 27 kg⋅mm, 4.9 W):
  - 31% efficiency
  - 99 rpm, 1.6 A
- **Theoretical Max Power:** 12 W
  - at 120 kg⋅mm,
  - 31% efficiency
  - 99 rpm, 1.6 A
- **No-Load Current:** 0.069 A
- **Stall Current:** 3.1 A

### Equations

- \( \tau = 200 - 0.85 \tau \) (blue)
- \( f(\tau) = 0.055 + 0.013 \tau \) (orange)
- \( \tau_{\text{stall}} \approx 230 \text{ kg} \cdot \text{mm} \)
- \( I_{\text{stall}} \approx 3.1 \text{ A} \)

### Notes

- No-load speed: 200 rpm
- No-load current: 0.069 A
Pololu Items #4683, #4693 (50:1 Metal Gearmotor 37D 24V) Performance at 12 V

- **Max power:** 3.4 W at 65 kg⋅mm, 33% efficiency, 50 rpm, 0.86 A

- **Max efficiency:** 49% at 20 kg⋅mm, 1.7 W, 86 rpm, 0.29 A

- **Torque (kg⋅mm):**
  - **No-load torque:** 0.056 A
  - **Stall torque:** ≈ 130 kg⋅mm

- **Current (A):**
  - **No-load current:** 0.056 A
  - **Stall current:** ≈ 1.7 A

- **Speed (rpm):**
  - **No-load speed:** 100 rpm

- **Power (W):**
  - **Function:** \( f(\tau) = 100 - 0.77\tau \)
  - **Function:** \( f(\tau) = 0.052 + 0.012\tau \)
Pololu Items #4684, #4694 (70:1 Metal Gearmotor 37D 24V) Performance at 24 V

Max efficiency: 50%
- at 39 kg-mm, 5.0 W, 120 rpm, 0.42 A

No-load speed: 140 rpm
- No-load current: 0.071 A

Theoretical max power: 11 W
- at 160 kg-mm, 32% efficiency, 71 rpm, 1.5 A

Torque (kg-mm)

Efficiency (%)

Power (W)

Speed (rpm)

Current (A)
max power: 3.4 W at 92 kg⋅mm, 32% efficiency, 36 rpm, 0.87 A

Pololu Items #4684, #4694 (70:1 Metal Gearmotor 37D 24V) Performance at 12 V

max efficiency: 49% at 27 kg⋅mm, 1.7 W, 61 rpm, 0.29 A

f(τ) = 71 − 0.39τ

no-load current: 0.055 A

no-load speed: 72 rpm

f(τ) = 0.049 + 0.0089τ

τ_{stall} ≈ 180 kg⋅mm

I_{stall} ≈ 1.7 A

no-load speed: 72 rpm

no-load current: 0.055 A
Pololu Items #4685, #4695 (100:1 Metal Gearmotor 37D 24V) Performance at 12 V

theoretical max power: 3.1 W
at 120 kg⋅mm, 29% efficiency, 25 rpm, 0.89 A
torque (kg⋅mm)

max efficiency: 44%
at 35 kg⋅mm, 1.5 W, 42 rpm, 0.29 A

no-load speed: 49 rpm

f(τ) = 49 − 0.20τ
f(τ) = 0.048 + 0.0068τ

τ_{stall} ≈ 240 kg⋅mm
I_{stall} ≈ 1.7 A

no-load current: 0.058 A

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Pololu Items #4686, #4696 (131:1 Metal Gearmotor 37D 24V) Performance at 24 V

- **Theoretical max power**: 9.5 W at 240 kg⋅mm, 30% efficiency, 39 rpm, 1.3 A torque (kg⋅mm)
- **Max efficiency**: 46% at 63 kg⋅mm, 4.4 W, 68 rpm, 0.40 A

**Equations**:
- $f(\tau) = 79 - 0.17\tau$
- $f(\tau) = 0.062 + 0.0054\tau$

**Stall**:
- $\tau_{\text{stall}} \approx 470$ kg⋅mm
- $I_{\text{stall}} \approx 2.6$ A

**No-load**:
- Speed: 79 rpm
- Current: 0.071 A
Pololu Items #4686, #4696 (131:1 Metal Gearmotor 37D 24V) Performance at 12 V

theoretical max power: 3.0 W at 150 kg⋅mm, 29% efficiency, 20 rpm, 0.87 A

max efficiency: 43% at 44 kg⋅mm, 1.5 W, 34 rpm, 0.29 A

no-load speed: 39 rpm

f(τ) = 0.050 + 0.0055τ

τstall ≈ 300 kg⋅mm

Istall ≈ 1.7 A

no-load current: 0.054 A

f(τ) = 40 − 0.13τ

theoretical max power: 3.1 W
at 180 kg mm, 29% efficiency, 17 rpm, 0.88 A

Pololu Items #4687, #4697 (150:1 Metal Gearmotor 37D 24V) Performance at 12 V

max efficiency: 43%
at 53 kg mm, 1.5 W, 29 rpm, 0.30 A

no-load speed: 33 rpm

no-load current: 0.054 A

f(τ) = 34 − 0.094τ

f(τ) = 0.051 + 0.0047τ

τ\text{stall} ≈ 360 kg mm

I\text{stall} ≈ 1.7 A