Pololu Micro Metal Gearmotors are available in a variety of different gear ratios, from 5:1 up to 1000:1, and with five different motor options:

- **LP 6V**: Low-power 6 V with precious metal brushes
- **MP 6V**: Medium-power 6 V with precious metal brushes
- **HP 6V**: High-power 6 V with precious metal brushes
- **HPCB 6V**: High-power 6 V with long-life carbon brushes
- **HPCB 12V**: High-power 12 V with long-life carbon brushes

Each motor is available with an optional extended rear motor shaft to allow for the addition of an encoder such as Pololu item #3081 Magnetic Encoder Pair Kit.

### Dimensions of versions with carbon brushes (HPCB)

![Dimensions Diagram with Carbon Brushes]

### Dimensions of versions with precious metal brushes (HP, MP, LP)

![Dimensions Diagram with Precious Metal Brushes]

*L = 9 mm [0.35 in] for all gear ratios except 1000:1. L = 12.5 mm [0.49 in] for the 1000:1 gear ratio. Max length for M1.6 mounting screws is 1.3 mm (from gearbox mounting surface). Approximate weight is 10 g.*
## Performance summary and table of contents

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### Notes:
1. Extrapolated data and performance graphs currently unavailable for all 5:1 gear ratios and LP 10:1 gear ratios.
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 instantaneous torque is 25 kg mm for the 380:1 and 10:1 gearboxes, and 20 kg mm for all other gear ratios; we strongly advise keeping applied loads well under these limits. Stalls can also result in rapid (potentially on the order of seconds) thermal damage to the motor windings and brushes, especially for the versions that use high-power (HP and HPBCB) motors; a general recommendation for brushed DC motor operation is 25% or less of the stall current.

* Operating the 1000:1 gear ratios at maximum power is likely to damage the gearboxes.


2
Pololu Items #4780, #4781 (15:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

- **Max power:** 0.37 W at 0.85 kg⋅mm, 31% efficiency, 420 rpm, 0.20 A
- **Max efficiency:** 40% at 0.40 kg⋅mm, 0.27 W, 640 rpm, 0.11 A
- **No-load speed:** 860 rpm, no-load current: 0.028 A

Equations:
- \( f(\tau) = 850 - 500\tau \)
- \( f(\tau) = 0.035 + 0.19\tau \)

Torque: \( \approx 1.7 \text{ kg} \cdot \text{mm} \)
Current: \( \approx 0.36 \text{ A} \)
Pololu Items #993, #2202 (30:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

Max power: 0.31 W at 1.4 kg⋅mm, 26% efficiency, 210 rpm, 0.20 A torque (kg⋅mm)

No-load speed: 450 rpm

Max efficiency: 34% at 0.66 kg⋅mm, 0.22 W, 320 rpm, 0.11 A

Stall torque: ≈ 2.9 kg⋅mm

Stall current: ≈ 0.36 A

No-load current: 0.019 A

No-load speed: 450 rpm

Power (W) vs. Efficiency (%)

Current (A) vs. Torque (kg⋅mm)

Current (A) vs. Speed (rpm)

f(τ) = 420 – 150τ
f(τ) = 0.032 + 0.11τ
Pololu Items #1098, #2203 (50:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

- **Max power**: 0.29 W at 2.2 kg⋅mm, 25% efficiency, 130 rpm, 0.19 A
- **Max efficiency**: 34% at 0.95 kg⋅mm, 0.20 W, 200 rpm, 0.10 A

**No-load current**: 0.019 A

**No-load speed**: 270 rpm

**Stall current**: 0.36 A

**Stall torque**: 4.4 kg⋅mm

**Torque equation**: $f(\tau) = 260 - 59\tau$

**Efficiency equation**: $f(\tau) = 0.027 + 0.075\tau$
Pololu Items #2360, #2209 (75:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

- **Max Power**: 0.29 W at 3.2 kg⋅mm, 24% efficiency, 88 rpm, 0.20 A
- **Torque**: (kg⋅mm)

Pololu Items #2360, #2209 (75:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

- **Max Efficiency**: 33% at 1.3 kg⋅mm, 0.19 W, 140 rpm, 0.10 A
- **Stall Torque**: ≈ 6.4 kg⋅mm
- **Stall Current**: ≈ 0.37 A
- **No-Load Speed**: 180 rpm
- **No-Load Current**: 0.017 A

The graph shows the relationship between torque and speed, with equations for the curves:

\[ f(\tau) = 180 - 27\tau \]

\[ f(\tau) = 0.025 + 0.054\tau \]
Pololu Items #992, #2204 (100:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

max power: 0.25 W at 3.7 kg⋅mm, 21% efficiency, 65 rpm, 0.19 A

max efficiency: 28% at 1.7 kg⋅mm, 0.17 W, 100 rpm, 0.10 A

no-load speed: 130 rpm

no-load current: 0.020 A

f(τ) = 130 - 17τ
f(τ) = 0.031 + 0.044τ

τ_{stall} ≈ 7.4 kg⋅mm
I_{stall} ≈ 0.36 A
Pololu Items #1097, #2205 (150:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

- **Maximum efficiency:** 28% at 2.6 kg\(\cdot\)mm, 0.18 W, 67 rpm, 0.11 A
- **No-load current:** 0.018 A
- **Max power:** 0.25 W at 5.7 kg\(\cdot\)mm, 21% efficiency, 43 rpm, 0.20 A
- **No-load speed:** 90 rpm
- **Stall torque:** \(\tau_{\text{stall}} \approx 11\) kg\(\cdot\)mm
- **Stall current:** \(I_{\text{stall}} \approx 0.37\) A

Mathematical formulas:
- \(f(\tau) = 87 - 7.6\tau\)
- \(f(\tau) = 0.032 + 0.029\tau\)
Pololu Items #1096, #2206 (210:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

- Max power: 0.25 W at 8.1 kg mm, 21% efficiency, 30 rpm, 0.20 A
- Max efficiency: 27% at 4.1 kg mm, 0.19 W, 46 rpm, 0.12 A
- No-load speed: 65 rpm
- No-load current: 0.018 A
- \( f(\tau) = 61 - 3.7\tau \)
- \( f(\tau) = 0.040 + 0.019\tau \)
- \( \tau_{\text{stall}} \approx 16 \text{ kg mm} \)
- \( I_{\text{stall}} \approx 0.35 \text{ A} \)
Pololu Items #1095, #2207 (250:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

- Max power: 0.23 W at 8.6 kg⋅mm, 21% efficiency, 26 rpm, 0.19 A
- Max efficiency: 26% at 4.2 kg⋅mm, 0.17 W, 39 rpm, 0.11 A

No-load speed: 54 rpm
No-load current: 0.018 A

\[ f(\tau) = 51 - 3.0\tau \]
\[ f(\tau) = 0.035 + 0.017\tau \]

\[ \tau_{\text{stall}} \approx 17 \text{ kg}\cdot\text{mm} \]
\[ I_{\text{stall}} \approx 0.34 \text{ A} \]
Pololu Items #1094, #2208 (298:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

- Max power: 0.22 W at 10 kg⋅mm, 21% efficiency, 22 rpm, 0.18 A
- Torque (kg⋅mm)
- Max efficiency: 27% at 4.4 kg⋅mm, 0.15 W, 34 rpm, 0.094 A
- No-load speed: 45 rpm
- No-load current: 0.018 A
- $f(\tau) = 44 - 2.2\tau$
- $f(\tau) = 0.027 + 0.015\tau$
- $\tau_{\text{stall}} \approx 20$ kg⋅mm
- $I_{\text{stall}} \approx 0.33$ A
Pololu Items #4790, #4791 (380:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

- Max power: 0.27 W at 15 kg⋅mm, 24% efficiency, 18 rpm, 0.18 A
- Max efficiency: 34% at 5.4 kg⋅mm, 0.16 W, 29 rpm, 0.080 A

\[ f(\tau) = 36 - 1.2\tau \]
\[ f(\tau) = 0.018 + 0.011\tau \]

\[ \tau_{\text{stall}} \approx 29 \text{ kg}\cdot\text{mm} \]
\[ I_{\text{stall}} \approx 0.35 \text{ A} \]

No-load speed: 36 rpm
No-load current: 0.021 A
Pololu Items #1596, #3058 (1000:1 Micro Metal Gearmotor LP 6V) Performance at 6 V

- Max efficiency: 24%
- Slope: $f(\tau) = 13 - 0.24\tau$
- Stall current: $I_{\text{stall}} = 0.33$ A
- Stall torque: $\tau_{\text{stall}} \approx 55$ kg-mm
- No-load speed: 13 rpm
- No-load current: 0.018 A

At 12 kg-mm, 0.12 W, 10 rpm, 0.088 A
Pololu Items #4782, #4783 (15:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

- Max power: 0.70 W at 1.0 kg⋅mm, 31% efficiency, 680 rpm, 0.38 A
- Max efficiency: 39% at 0.47 kg⋅mm, 0.50 W, 1000 rpm, 0.21 A

No-load speed: 1400 rpm
No-load current: 0.048 A
Pololu Items #2364, #2378 (30:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

- **Max Power**: 0.57 W at 1.7 kg⋅mm
- **Max Efficiency**: 33% at 0.80 kg⋅mm, 0.41 W, 510 rpm, 0.21 A

**No-Load Speed**: 720 rpm

**No-Load Current**: 0.033 A

**Torque Stall**: 3.3 kg⋅mm

**Stall Current**: \( I_{stall} \approx 0.67 \text{ A} \)

**Performance Graph**:
- Efficiency (%)
- Current (A)
- Speed (rpm)
- Torque (kg⋅mm)

**Equations**:
- \( f(\tau) = 660 - 200\tau \)
- \( f(\tau) = 0.066 + 0.18\tau \)

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Pololu Items #2365, #2379 (50:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

max power: 0.55 W at 2.7 kg⋅mm, 25% efficiency, 200 rpm, 0.36 A

torque (kg⋅mm)

max efficiency: 33% at 1.2 kg⋅mm, 0.38 W, 310 rpm, 0.19 A

f(τ) = 390 − 72τ

f(τ) = 0.053 + 0.11τ

τ_{stall} ≈ 5.4 kg⋅mm

I_{stall} ≈ 0.67 A

no-load speed: 420 rpm

no-load current: 0.033 A

Pololu Items #2366, #2380 (75:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

- Max power: 0.54 W at 3.9 kg⋅mm, 25% efficiency, 140 rpm, 0.36 A
- Max efficiency: 34% at 1.6 kg⋅mm, 0.35 W, 220 rpm, 0.17 A

Mathematical equations:

\[ f(\tau) = 270 - 35\tau \]

\[ f(\tau) = 0.044 + 0.080\tau \]

- No-load speed: 290 rpm
- No-load current: 0.032 A
- Stall current: ≈ 0.67 A
- Stall torque: ≈ 7.8 kg⋅mm
- Torque (kg⋅mm): no-load: 0, stall: 7.8

Graphs showing efficiency, power, speed, current, and torque relationships.
Pololu Items #2367, #2381 (100:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

- Max power: 0.50 W at 4.7 kg⋅mm, 24% efficiency, 100 rpm, 0.35 A
- Max efficiency: 33% at 1.9 kg⋅mm, 0.32 W, 170 rpm, 0.17 A

- No-load speed: 220 rpm
- No-load current: 0.033 A

- $f(\tau) = 210 - 22\tau$
- $f(\tau) = 0.042 + 0.065\tau$

- $\tau_{\text{stall}} \approx 9.4 \text{ kg}\cdot\text{mm}$
- $I_{\text{stall}} \approx 0.66 \text{ A}$
Pololu Items #2368, #2382 (150:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

- **Max Power**: 0.48 W at 6.5 kg mm, 24% efficiency, 71 rpm, 0.33 A

- **Max Efficiency**: 33% at 2.6 kg mm, 0.30 W, 110 rpm, 0.15 A

- **No-Load Speed**: 150 rpm

- **No-Load Current**: 0.037 A

- **Stall Torque**: Approximately 13 kg mm

- **Stall Current**: Approximately 0.63 A

- **Mathematical Formulas**:
  - \( f(\tau) = 140 - 11\tau \)
  - \( f(\tau) = 0.038 + 0.045\tau \)
Pololu Items #2369, #2383 (210:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

- **Max Power:** 0.46 W at 8.7 kg⋅mm, 23% efficiency, 52 rpm, 0.34 A
- **Torque (kg⋅mm)**
- **Max Efficiency:** 31% at 3.4 kg⋅mm, 0.29 W, 83 rpm, 0.16 A

**No-load Current:** 0.040 A

**No-load Speed:** 100 rpm

**Stall Torque:** Approximately 17 kg⋅mm

**Stall Current:** Approximately 0.64 A

**F(τ) = 100 - 6.0τ**

**F(τ) = 0.039 + 0.035τ**
Pololu Items #2370, #2384 (250:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

- **Max power**: 0.48 W at 11 kg⋅mm, 23% efficiency, 43 rpm, 0.35 A
- **Max efficiency**: 31% at 4.5 kg⋅mm, 0.31 W, 69 rpm, 0.17 A

**Torque (kg⋅mm)**:
- **Stall**: ≈ 22 kg⋅mm
- **No-load current**: 0.041 A
- **No-load speed**: 88 rpm

**Power (W)**: $f(\tau) = 87 - 4.0\tau$

**Current (A)**: $f(\tau) = 0.043 + 0.028\tau$

Pololu Items #2371, #2385 (298:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

- **max power:** 0.44 W at 12 kg⋅mm, 21% efficiency, 35 rpm, 0.34 A torque (kg⋅mm)

- **no-load speed:** 73 rpm

- **max efficiency:** 29% at 5.0 kg⋅mm, 0.29 W, 56 rpm, 0.17 A

- **no-load current:** 0.034 A

- **f(τ) = 70 – 2.9τ**

- **f(τ) = 0.043 + 0.025τ**

- **τ_{stall} ≈ 24 kg⋅mm**

- **I_{stall} ≈ 0.64 A**

Pololu Items #4792, #4793 (380:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

- **Max Power**: 0.53 W
- **Efficiency**: 24%
- **Torque**: 28 rpm, 0.36 A

- **Max Efficiency**: 34%
- **Torque**: 6.9 kg⋅mm, 0.33 W, 46 rpm, 0.16 A

- **No-load Speed**: 57 rpm
- **No-load Current**: 0.043 A

- **Stall Torque**: ≈ 36 kg⋅mm
- **Stall Current**: ≈ 0.68 A
Pololu Items #2372, #3059 (1000:1 Micro Metal Gearmotor MP 6V) Performance at 6 V

max efficiency: 24%
at 13 kg⋅mm, 0.23 W, 17 rpm, 0.16 A

f(τ) = 21 − 0.32τ
f(τ) = 0.037 + 0.0093τ

no-load speed: 22 rpm
no-load current: 0.032 A

τ_{stall} ≈ 67 kg⋅mm
I_{stall} ≈ 0.66 A
Pololu Items #4784, #4785 (15:1 Micro Metal Gearmotor HP 6V) Performance at 6 V

max power: 1.5 W at 1.5 kg⋅mm, 31% efficiency, 990 rpm, 0.83 A

max efficiency: 42% at 0.58 kg⋅mm, 0.95 W, 1600 rpm, 0.37 A
Pololu Items #1093, #2212 (30:1 Micro Metal Gearmotor HP 6V) Performance at 6 V

- **Max power:** 1.5 W at 2.8 kg⋅mm, 29% efficiency, 510 rpm, 0.86 A
- **Max efficiency:** 41% at 1.0 kg⋅mm, 0.89 W, 830 rpm, 0.36 A

**Torque (kg⋅mm)**
- Stall torque: ≈ 5.7 kg⋅mm
- Max current: ≈ 1.6 A

**Graphs and Equations**
- No-load speed: 1000 rpm
- No-load current: 0.068 A
- Efficiency equation: \[ f(\tau) = 1000 - 180\tau \]
- Torque equation: \[ f(\tau) = 0.081 + 0.27\tau \]
Pololu Items #998, #2213 (50:1 Micro Metal Gearmotor HP 6V) Performance at 6 V

- **Max Power**: 1.3 W at 4.3 kg mm, 27% efficiency, 300 rpm, 0.81 A
- **Max Efficiency**: 38% at 1.5 kg mm, 0.75 W, 490 rpm, 0.32 A

**Speed vs. Torque and Current**

- **No-load Speed**: 590 rpm
- **No-load Current**: 0.067 A
- **Stall Torque**: ≈ 8.6 kg mm
- **Stall Current**: ≈ 1.6 A

**Graph Equations**

- $f(\tau) = 590 - 68\tau$
- $f(\tau) = 0.067 + 0.17\tau$

**Graph Notes**

- Maximum power at 4.3 kg mm, 27% efficiency, 300 rpm, 0.81 A
- Maximum efficiency at 1.5 kg mm, 0.75 W, 490 rpm, 0.32 A
- No-load speed: 590 rpm
- No-load current: 0.067 A
- Stall torque: ≈ 8.6 kg mm
- Stall current: ≈ 1.6 A
Pololu Items #2361, #2215 (75:1 Micro Metal Gearmotor HP 6V) Performance at 6 V

- Max power: 1.4 W at 6.5 kg⋅mm, 28% efficiency, 210 rpm, 0.82 A

- Max efficiency: 40% at 2.3 kg⋅mm, 0.80 W, 340 rpm, 0.34 A

- Torque (kg⋅mm): 
  - Stall: ~13 kg⋅mm
  - No-load: ~0.066 A

- Speed (rpm):
  - No-load speed: 410 rpm

- Current (A):
  - Stall: ~1.6 A

- Efficiency (%):
  - Max: 40% at 2.3 kg⋅mm, 0.80 W, 340 rpm, 0.34 A

- No-load current: 0.066 A

- Torque (kg⋅mm):
  - Stall: ~13 kg⋅mm

- Math functions:
  - \( f(\tau) = 410 - 32\tau \) for speeds
  - \( f(\tau) = 0.073 + 0.11\tau \) for efficiency
Pololu Items #997, #2386 (150:1 Micro Metal Gearmotor HP 6V) Performance at 6 V

- Max power: 1.2 W at 12 kg⋅mm, 26% efficiency, 100 rpm, 0.81 A
- Max efficiency: 37% at 3.9 kg⋅mm, 0.68 W, 170 rpm, 0.31 A

No-load speed: 210 rpm
No-load current: 0.055 A

\[ f(\tau) = 200 - 8.5\tau \]
\[ f(\tau) = 0.060 + 0.063\tau \]

\[ \tau_{\text{stall}} \approx 24 \text{ kg} \cdot \text{mm} \]
\[ I_{\text{stall}} \approx 1.6 \text{ A} \]

\[ \text{Torque} (\text{kg} \cdot \text{mm}) \]
\[ \text{Power} (\text{W}) \]
\[ \text{Efficiency} (\%) \]
\[ \text{Speed} (\text{rpm}) \]
\[ \text{Current} (\text{A}) \]
Pololu Items #996, #2216 (210:1 Micro Metal Gearmotor HP 6V) Performance at 6 V

max power: 1.1 W at 15 kg⋅mm, 22% efficiency, 72 rpm, 0.82 A

max efficiency: 32% at 5.0 kg⋅mm, 0.62 W, 120 rpm, 0.32 A

no-load speed: 150 rpm

no-load current: 0.062 A

τ_{stall} ≈ 30 kg⋅mm

I_{stall} ≈ 1.6 A

f(τ) = 140 − 4.9τ

f(τ) = 0.066 + 0.051τ
Pololu Items #995, #2217 (250:1 Micro Metal Gearmotor HP 6V) Performance at 6 V

max power: 1.1 W
at 17 kg⋅mm,
22% efficiency,
62 rpm, 0.81 A

max efficiency: 32%
at 5.5 kg⋅mm, 0.59 W,
100 rpm, 0.30 A

no-load speed: 120 rpm
no-load current: 0.071 A

f(τ) = 120 − 3.7τ
f(τ) = 0.059 + 0.044τ

τ_{stall} ≈ 34 kg⋅mm
I_{stall} ≈ 1.6 A
Pololu Items #994, #2218 (298:1 Micro Metal Gearmotor HP 6V) Performance at 6 V

max power: 1.1 W at 20 kg⋅mm, 21% efficiency, 52 rpm, 0.83 A

max efficiency: 31% at 6.5 kg⋅mm, 0.58 W, 87 rpm, 0.31 A

no-load speed: 100 rpm

f(τ) = 100 − 2.8τ

I_{stall} ≈ 1.6 A

τ_{stall} ≈ 40 kg⋅mm

no-load current: 0.073 A
Pololu Items #4794, #4795 (380:1 Micro Metal Gearmotor HP 6V) Performance at 6 V

- max efficiency: 36%
  - at 8.4 kg mm, 0.61 W, 70 rpm, 0.28 A

- no-load speed: 84 rpm
- no-load current: 0.058 A
- \( f(\tau) = 0.052 + 0.028 \tau \)
- \( f(\tau) = 83 - 1.5 \tau \)
- \( \tau_{\text{stall}} = 55 \text{ kg mm} \)
- \( I_{\text{stall}} = 1.6 \text{ A} \)
Pololu Items #1595, #2373 (1000:1 Micro Metal Gearmotor HP 6V) Performance at 6 V

- Max efficiency: 28%
- At 20 kg\(\cdot\)mm, 0.53 W, 26 rpm, 0.32 A
- No-load speed: 31 rpm
- No-load current: 0.072 A
- Stall torque: \(\tau_{\text{stall}} \approx 120\) kg\(\cdot\)mm
- Stall current: \(I_{\text{stall}} \approx 1.6\) A

\[
f(\tau) = 31 - 0.26\tau \\
f(\tau) = 0.063 + 0.013\tau
\]
Pololu Items #3061, #3071 (10:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

- **max power**: 1.3 W at 0.84 kg⋅mm, 26% efficiency, 1500 rpm, 0.85 A
- **max efficiency**: 33% at 0.42 kg⋅mm, 1.0 W, 2300 rpm, 0.51 A

- **no-load current**: 0.11 A
- **no-load speed**: 3300 rpm

- **\( f(\tau) = 3100 - 1800\tau \)**
- **\( f(\tau) = 0.17 + 0.82\tau \)**

- **\( \tau_{\text{stall}} \approx 1.7 \text{ kg mm} \)**
- **\( I_{\text{stall}} \approx 1.5 \text{ A} \)**
Pololu Items #4786, #4787 (15:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

- **max power:** 1.3 W at 1.2 kg\(\cdot\)mm, 25% efficiency, 1000 rpm, 0.85 A
- **max efficiency:** 32% at 0.60 kg\(\cdot\)mm, 0.94 W, 1500 rpm, 0.49 A
- **no-load speed:** 2100 rpm
- **no-load current:** 0.13 A

\[
f(\tau) = 2000 - 820\tau \\
f(\tau) = 0.16 + 0.56\tau
\]

\(\tau_{\text{stall}} \approx 2.5\ \text{kg}\cdot\text{mm}\)

\(I_{\text{stall}} \approx 1.5\ \text{A}\)
Pololu Items #3062, #3072 (30:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

- **Max power**: 1.2 W at 2.2 kg⋅mm, 25% efficiency, 540 rpm, 0.82 A
- **Max efficiency**: 33% at 1.0 kg⋅mm, 0.85 W, 840 rpm, 0.43 A

No-load speed: 1100 rpm
No-load current: 0.10 A

Mathematical models:

\[ f(\tau) = 1100 - 240\tau \]
\[ f(\tau) = 0.12 + 0.31\tau \]

Stall torque: \( \tau_{\text{stall}} \approx 4.5 \text{ kg}\cdot\text{mm} \)
Stall current: \( I_{\text{stall}} \approx 1.5 \text{ A} \)
Pololu Items #3063, #3073 (50:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

- **max power**: 1.2 W at 3.7 kg⋅mm, 24% efficiency, 310 rpm, 0.81 A

- Pololu Items #3063, #3073 (50:1 Micro Metal Gearmotor HPCB 6V)

- **max efficiency**: 32% at 1.6 kg⋅mm, 0.80 W, 490 rpm, 0.42 A

- **no-load speed**: 650 rpm

- **no-load current**: 0.10 A

- **τ_{stall} ≈ 7.4 kg mm**

- **I_{stall} ≈ 1.5 A**

- **f(τ) = 620 − 85τ**

- **f(τ) = 0.11 + 0.19τ**
Pololu Items #3064, #3074 (75:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

- Max power: 1.3 W at 5.7 kg mm, 26% efficiency, 220 rpm, 0.81 A
- Max efficiency: 34% at 2.5 kg mm, 0.87 W, 330 rpm, 0.43 A

f(τ) = 430 − 38τ
f(τ) = 0.12 + 0.12τ

τ_{stall} ≈ 11 kg mm
I_{stall} ≈ 1.5 A

No-load speed: 430 rpm
No-load current: 0.11 A

Pololu Items #3065, #3075 (100:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

- Max power: 1.3 W at 7.9 kg·mm, 25% efficiency, 160 rpm, 0.89 A
- Max efficiency: 33% at 3.3 kg·mm, 0.86 W, 260 rpm, 0.44 A

No-load speed: 330 rpm
No-load current: 0.10 A

\[ f(\tau) = 320 - 21\tau \]
\[ f(\tau) = 0.11 + 0.10\tau \]

\[ \tau_{\text{stall}} \approx 16 \text{ kg·mm} \]
\[ I_{\text{stall}} \approx 1.7 \text{ A} \]
Pololu Items #3066, #3076 (150:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

- **max power:** 1.1 W at 10 kg⋅mm, 23% efficiency, 110 rpm, 0.82 A
- **max efficiency:** 31% at 4.1 kg⋅mm, 0.73 W, 170 rpm, 0.39 A

- Torque (kg⋅mm) 
  - $f(\tau) = 220 - 11\tau$
  - $f(\tau) = 0.10 + 0.071\tau$

- 
  - No-load current: 0.10 A
  - No-load speed: 220 rpm

- Stall torque: $\tau_{\text{stall}} \approx 20$ kg⋅mm
- Stall current: $I_{\text{stall}} \approx 1.5$ A

- Diagram shows performance curves with speed (rpm) and current (A) on the y-axis and torque (kg⋅mm) on the x-axis.
Pololu Items #3067, #3077 (210:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

- Max power: 1.1 W at 14 kg⋅mm, 23% efficiency, 78 rpm, 0.80 A
- Max efficiency: 31% at 5.9 kg⋅mm, 0.74 W, 120 rpm, 0.40 A

f(τ) = 160 − 5.5τ
f(τ) = 0.10 + 0.050τ

τ_{stall} ≈ 28 kg⋅mm
I_{stall} ≈ 1.5 A

No-load speed: 160 rpm
No-load current: 0.095 A
Pololu Items #3068, #3078 (250:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

- **Max power:** 1.1 W at 16 kg⋅mm, 22% efficiency, 66 rpm, 0.82 A
- **Max efficiency:** 29% at 6.6 kg⋅mm, 0.71 W, 100 rpm, 0.40 A
- **Stall torque:** \( \tau_{\text{stall}} \approx 32 \text{ kg}\cdot\text{mm} \)
- **Stall current:** \( I_{\text{stall}} \approx 1.5 \text{ A} \)

**No-load speed:** 130 rpm

**No-load current:** 0.11 A

\[ f(\tau) = 130 - 4.1\tau \]

\[ f(\tau) = 0.11 + 0.045\tau \]
max power: 1.0 W
at 17 kg⋅mm,
20% efficiency,
54 rpm, 0.81 A

max efficiency: 26%
at 7.4 kg-mm, 0.65 W,
85 rpm, 0.42 A

f(\tau) = 110 - 3.2\tau

f(\tau) = 0.11 + 0.041\tau

\tau_{\text{stall}} \approx 34 \text{ kg-mm}

I_{\text{stall}} \approx 1.5 \text{ A}

no-load speed: 110 rpm

no-load current: 0.10 A
Pololu Items #4796, #4797 (380:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

- Max efficiency: 30%
- At 10 kg⋅mm, 0.71 W, 68 rpm, 0.40 A

- No-load speed: 85 rpm
- No-load current: 0.11 A

- Theoretical max power

- $f(\tau) = 85 - 1.7\tau$
- $f(\tau) = 0.10 + 0.029\tau$

- Stall torque: $\tau_{\text{stall}} \approx 50 \text{ kg mm}$
- Stall current: $I_{\text{stall}} \approx 1.5 \text{ A}$

- Fitted polynomials to data points.
Pololu Items #3070, #3080 (1000:1 Micro Metal Gearmotor HPCB 6V) Performance at 6 V

max efficiency: 25% at 22 kg\(\cdot\)mm, 0.59 W, 26 rpm, 0.39 A

\[ f(\tau) = 33 - 0.30\tau \quad f(\tau) = 0.10 + 0.013\tau \]

\(\tau_{\text{stall}} \approx 110 \text{ kg}\cdot\text{mm} \quad I_{\text{stall}} \approx 1.6 \text{ A} \]

no-load speed: 33 rpm

no-load current: 0.10 A
Pololu Items #3037, #3048 (10:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

- **Max power:** 1.5 W at 0.86 kg⋅mm, 29% efficiency, 1700 rpm, 0.42 A
- **Max efficiency:** 37% at 0.43 kg⋅mm, 1.1 W, 2500 rpm, 0.25 A

No-load speed: 3400 rpm

No-load current: 0.063 A

Stall torque: \( \approx 1.7 \text{ kg}\cdot\text{mm} \)

Stall current: \( \approx 0.75 \text{ A} \)

\[ f(\tau) = 3300 - 1900\tau \]

\[ f(\tau) = 0.084 + 0.38\tau \]
Pololu Items #4788, #4789 (15:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

- Max power: 1.4 W at 1.2 kg mm, 29% efficiency, 1100 rpm, 0.40 A
d- Torque (kg mm)
- Max efficiency: 37% at 0.59 kg mm, 1.0 W, 1700 rpm, 0.23 A

- No-load speed: 2200 rpm
- No-load current: 0.053 A
- $f(\tau) = 2200 - 880\tau$
- $f(\tau) = 0.070 + 0.27\tau$

- $\tau_{\text{stall}} \approx 2.5 \text{ kg mm}$
- $I_{\text{stall}} \approx 0.73 \text{ A}$
Pololu Items #3038, #3049 (30:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

- **max power**: 1.1 W at 2.0 kg⋅mm, 24% efficiency, 560 rpm, 0.39 A
- **max efficiency**: 30% at 0.95 kg⋅mm, 0.82 W, 840 rpm, 0.23 A

- **no-load speed**: 1100 rpm
- **no-load current**: 0.055 A

- **τ_{stall} ≈ 3.9 kg⋅mm
- **I_{stall} ≈ 0.71 A

\[ f(τ) = 1100 - 280τ \]
\[ f(τ) = 0.073 + 0.16τ \]
Pololu Items #3039, #3050 (50:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

- Max power: 1.1 W at 3.4 kg⋅mm, 24% efficiency, 320 rpm, 0.39 A
- Torque (kg⋅mm)

- Max efficiency: 31% at 1.5 kg⋅mm, 0.79 W, 500 rpm, 0.22 A

- No-load speed: 650 rpm
- No-load current: 0.053 A
- Stall current: 0.72 A
- Stall torque: 6.7 kg⋅mm

\[
f(\tau) = 650 - 97\tau \\
f(\tau) = 0.085 + 0.10\tau
\]
Pololu Items #3040, #3051 (75:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

- Max power: 1.1 W at 4.9 kg⋅mm, 24% efficiency, 220 rpm, 0.39 A
- Max efficiency: 31% at 2.1 kg⋅mm, 0.76 W, 350 rpm, 0.20 A
- Torque (kg⋅mm) formula: \( f(\tau) = 440 - 46\tau \)
- Current (A) formula: \( f(\tau) = 0.056 + 0.069\tau \)
- No-load speed: 450 rpm
- No-load current: 0.053 A
- Stall torque: \( \tau_{\text{stall}} \approx 10 \text{ kg⋅mm} \)
- Stall current: \( I_{\text{stall}} \approx 0.72 \text{ A} \)
Pololu Items #3041, #3052 (100:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

- Max power: 1.1 W at 6.4 kg⋅mm, 24% efficiency, 170 rpm, 0.39 A
- Max efficiency: 31% at 2.9 kg⋅mm, 0.78 W, 260 rpm, 0.21 A
- No-load speed: 330 rpm
- No-load current: 0.054 A
- Torque (stall): ≈ 13 kg⋅mm
- Current (stall): ≈ 0.72 A
Pololu Items #3042, #3053 (150:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

- **Max power:** 1.0 W at 9.0 kg⋅mm, 22% efficiency, 110 rpm, 0.39 A
- **Max efficiency:** 28% at 4.2 kg⋅mm, 0.73 W, 170 rpm, 0.22 A

**Torque (kg⋅mm) vs. Efficiency (%)**
- Torque stall: ≈ 18 kg⋅mm
- No-load current: 0.060 A
- No-load speed: 220 rpm
- Power formula: $f(\tau) = 220 - 12\tau$
- Efficiency formula: $f(\tau) = 0.066 + 0.036\tau$

**Power (W) vs. Current (A)**
- Current stall: ≈ 0.72 A

Graphs showing performance metrics for the gearmotor under various conditions.
Pololu Items #3043, #3054 (210:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

max power: 1.0 W
at 13 kg⋅mm,
22% efficiency,
80 rpm, 0.39 A

no-load speed: 160 rpm
f(τ) = 160 - 6.3τ
f(τ) = 0.060 + 0.026τ

max efficiency: 28%
at 5.6 kg⋅mm, 0.71 W,
120 rpm, 0.21 A

no-load current: 0.057 A

τ_{stall} ≈ 25 kg⋅mm

I_{stall} ≈ 0.72 A
Pololu Items #3044, #3055 (250:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

- **Max power:** 1.1 W at 15 kg⋅mm, 22% efficiency, 67 rpm, 0.40 A
- **Torque (kg⋅mm):**
  - Stall: ≈ 30 kg⋅mm
  - No-load: ≈ 0.75 A
- **No-load speed:** 130 rpm
- **No-load current:** 0.059 A
- **Max efficiency:** 29% at 6.6 kg⋅mm, 0.72 W, 110 rpm, 0.21 A

\[
f(\tau) = 130 - 4.4 \tau
\]

\[
f(\tau) = 0.058 + 0.023 \tau
\]
Pololu Items #3045, #3056 (298:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

max power: 0.95 W at 17 kg mm, 20% efficiency, 56 rpm, 0.40 A

torque (kg mm)

no-load speed: 110 rpm

f(τ) = 110 − 3.4τ

max efficiency: 26%
at 7.3 kg mm, 0.65 W, 87 rpm, 0.21 A

f(τ) = 0.060 + 0.021τ

I_{stall} ≈ 0.74 A

τ_{stall} ≈ 33 kg mm

no-load current: 0.059 A

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Pololu Items #4798, #4799 (380:1 Micro Metal Gearmotor HPCB 12V) Performance at 12 V

- Theoretical max power
- Torque (kg⋅mm)

- Max efficiency: 31%
- At 11 kg⋅mm, 0.75 W, 67 rpm, 0.20 A

- No-load speed: 85 rpm
- No-load current: 0.057 A

- Stall:
  - $f(\tau) = 86 - 1.7\tau$
  - $f(\tau) = 0.056 + 0.013\tau$
  - $\tau_{\text{stall}} \approx 50 \text{ kg⋅mm}$
  - $I_{\text{stall}} \approx 0.72 \text{ A}$