

# Brushless Flat DC-Micromotors

## 4 Pole Technology

0,5 mNm  
1,5 W

### Series 1509 ... B

Values at 22°C and nominal voltage		1509 T	006 B	012 B	
1	Nominal voltage	$U_N$	6	12	V
2	Terminal resistance, phase-phase	$R$	22	92,7	$\Omega$
3	Efficiency, max.	$\eta_{max}$	54	53	%
4	No-load speed	$n_0$	15 000	14 900	$\text{min}^{-1}$
5	No-load current, typ. (with shaft $\varnothing$ 1,5 mm)	$I_0$	0,019	0,009	A
6	Stall torque	$M_H$	0,953	0,904	mNm
7	Friction torque, static	$C_0$	0,019	0,019	mNm
8	Friction torque, dynamic	$C_V$	$3,42 \cdot 10^{-6}$	$3,42 \cdot 10^{-6}$	$\text{mNm}/\text{min}^{-1}$
9	Speed constant	$k_n$	2 682	1 339	$\text{min}^{-1}/\text{V}$
10	Back-EMF constant	$k_E$	0,373	0,747	$\text{mV}/\text{min}^{-1}$
11	Torque constant	$k_M$	3,56	7,13	$\text{mNm}/\text{A}$
12	Current constant	$k_I$	0,281	0,14	$\text{A}/\text{mNm}$
13	Slope of n-M curve	$\Delta n/\Delta M$	16 577	17 423	$\text{min}^{-1}/\text{mNm}$
14	Terminal inductance, phase-phase	$L$	570	2 282	$\mu\text{H}$
15	Mechanical time constant	$\tau_m$	120	126	ms
16	Rotor inertia	$J$	0,69	0,69	$\text{gcm}^2$
17	Angular acceleration	$\alpha_{max}$	14	13	$\cdot 10^3 \text{rad}/\text{s}^2$
18	Thermal resistance	$R_{th1} / R_{th2}$	65 / 45		K/W
19	Thermal time constant	$\tau_{w1} / \tau_{w2}$	12 / 133		s
20	Operating temperature range:				
	– motor		-25 ... +80		$^{\circ}\text{C}$
	– winding, max. permissible		+80		$^{\circ}\text{C}$
21	Shaft bearings		ball bearings, preloaded		
22	Shaft load max.:				
	– with shaft diameter		1,5		mm
	– radial at 3 000 $\text{min}^{-1}$ (3 mm from mounting flange)		2		N
	– axial at 3 000 $\text{min}^{-1}$ (push only)		2		N
	– axial at standstill (push only)		15		N
23	Shaft play:				
	– radial	$\leq$	0,015		mm
	– axial	$=$	0		mm
24	Housing material		plastic		
25	Mass		6,9		g
26	Direction of rotation		electronically reversible		
27	Speed up to	$n_{max}$	40 000		$\text{min}^{-1}$
28	Number of pole pairs		2		
29	Hall sensors		digital		
30	Magnet material		NdFeB		
<b>Rated values for continuous operation</b>					
31	Rated torque	$M_N$	0,45	0,44	mNm
32	Rated current (thermal limit)	$I_N$	0,147	0,071	A
33	Rated speed	$n_N$	5 860	5 550	$\text{min}^{-1}$

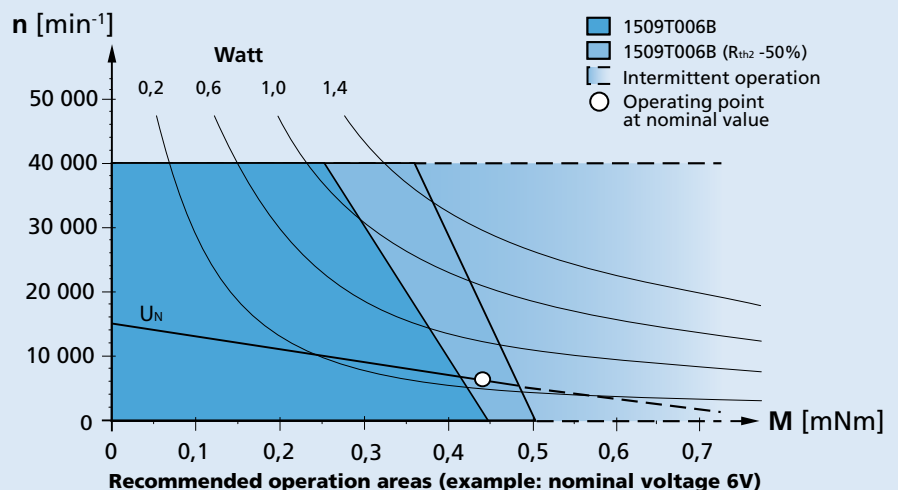
**Note:** Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The  $R_{th2}$  value has been reduced by 25%.

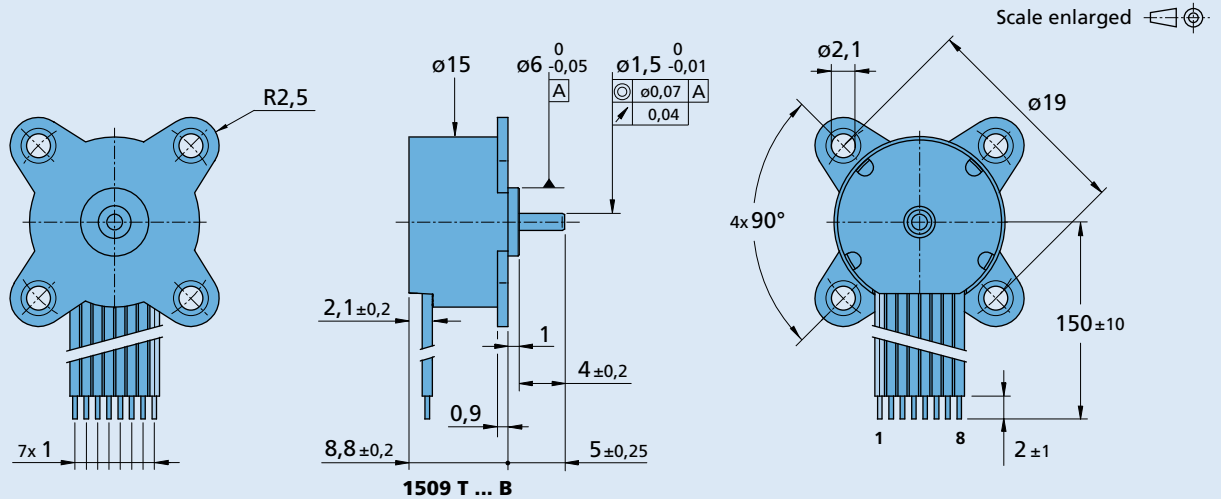
**Note:**

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition ( $R_{th2}$  50% reduced).

The nominal voltage ( $U_N$ ) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



**Dimensional drawing**

**Option, cable and connection information**

 Example product designation: **1509T006B-X4192**

Option	Type	Description	Connection	
			No.	Function
X4192	Bearing lubrication	For vacuum of $10^{-5}$ Pa @ 22°C	1	Phase C
4082	Temperature range	Extended temperature range (-40...+85°C)	2	Phase B
			3	Phase A
			4	GND
			5	U <sub>DD</sub> (+5V)
			6	Hall sensor C
			7	Hall sensor B
			8	Hall sensor A
			<b>Standard cable</b>	
			Insulation: PVC	
			8 conductors, AWG 28	
			pitch 1 mm, wires tinned	

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
		SC 1801 P SC 1801 S	