TBM™2G

English **Instruction Manual**

Edition: A, July 2022
Part Number: 908-900000-99
European Version (CE region)

English Deutsch Italiano Español Français 中国人 日本 한국인

Original Language is English. All other content is translated from the original language.

For safe and proper use, follow these instructions.
Keep them for future reference.

Record of Document Revisions

Version	Date	Notes
A	July 2022	Initial release

Table of Contents

Trademarks

- TBM2G is a registered trademark of Kollmorgen Corporation
- CANopen is a registered trademark of CAN in Automation (CiA)
- EtherCAT is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH
- LOCTITE is a registered trademark of Henkel Corporation
- Mylar is a DuPont® Corporation trade name
- Scotch-Weld ™ 2214 is a registered trademark of 3M

1 Table of Contents

--- / ---

2 English

2.1 General

2.1.1 About This Manual

This manual describes the TBM2G frameless motors (standard version). In the case that TBM2G motors are operated in drive systems together with Kollmorgen® servo drives, please observe the entire system documentation, consisting of:

- Installation manual for the servo drives
- Fieldbus communication manual (e.g. CANopen or EtherCAT)

More background information can be found on the Kollmorgen Developer Network, available at kdn.kollmorgen.com.

2.1.2 Abbreviations Used

NOTE

- Abbreviations used for technical data can be found under Definition of Terms.
- In this document, the symbolism (➜ # 25) means: see page 25.

2.1.3 Symbols Used

Symbol	Indication
 **DANGER**	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
 **WARNING**	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
 **CAUTION**	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates situations which, if not avoided, could result in property damage.
NOTE	This symbol indicates important notes.
	Warning of a danger (general). The type of danger is specified by the text next to the symbol.
	Warning of danger from electricity and its effects.
	Warning of danger from hot surface.
	Warning of suspended loads.

2.1.4 Safety

2.1.4.0.1 Safety notes

WARNING Pacemaker!

The strong magnetic fields which are produced as long as the magnetic rotor is not installed, constitute a hazard for persons with implants, such as cardiac pacemakers, that can be influenced by magnetic fields. As a general rule, all persons who may suffer impairment to health through the influence of strong magnetic fields must keep at a safe distance of at least 1 meter from the rotor.

CAUTION Magnetic field!

The strong magnetic fields which are produced constitute a hazard for persons with implants that can be influenced by magnetic fields. As a general rule, all persons who may suffer impairment to health through the influence of strong magnetic fields must keep at a safe distance of at least 1 meter from the motor.

Only properly qualified persons are permitted to perform activities such as transport, installation, commissioning and maintenance. Properly qualified persons are those who are familiar with the transport, assembly, installation, commissioning and operation of motors, and who have the appropriate qualifications for their job. Qualified personnel must know and observe the following standards and directives: IEC 60364, 60662 and national accident prevention regulations.

The recommendations included in this document are intended to serve as general installation guidelines and are for reference purpose.

Kollmorgen assumes no responsibility for incorrect implementation of these techniques, which remain the sole responsibility of the user.

CAUTION Wear gloves!

Always wear gloves when working on the motor.

Read the available documentation before installation and commissioning. Incorrect handling of the motor components can cause injury and damage to persons and equipment. Special care must be taken when installing the rotor inside the stator of the motor. Tooling or fixtures may be required.

CAUTION Magnetic field!

Strong magnetic fields attract metallic objects and create potential safety hazards for hands and fingers. During work on or in the vicinity of TBM2G motors make sure that at least two finely pointed wedges of tough non-magnetic material -e.g. V2A -(with a wedge angle of approx. 10°-15°) and a non-metallic hammer (approx. 3 kg) are at hand. In an emergency you can then use these tools to detach objects that are magnetically bound to the magnetic rotor (for instance, to free trapped parts of the body).

Keep watches and magnetic data media (credit cards, diskettes, etc.) and digital displays (mobile phones, laptops, etc.) out of the immediate vicinity (<500 mm) of the TBM2G motor. Because of the high forces of attraction, special care must be taken within a range of about 50 mm from the magnetic rotor. Inside this area, heavy (>1 kg) or large-area (>1 dm^2) objects of steel or iron must not be held in the hand.

The rotor must never be stored in an unpacked condition. Use non-magnetic packaging material that is at least 20 mm thick. The storage location must be dry and protected from heat. Do not expose the motor rotor to heat in excess of 110°C, unless installed inside the stator. Heat over 110°C can de-magnetize the rotor magnets.

Put up warning signs where the motors are stored: Caution : STRONG MAGNETS

Attach easily visible warning signs (e.g. permanent self-adhesive labels) to the machine. Caution : The drives on this machine are fitted with strong magnets. STRONG MAGNETIC FIELDS + HIGH ATTRACTION FORCES!

DANGER Earthing! High voltages!

It is mandatory to ensure that the metallic parts of the motor stator are properly grounded to the PE (protective earth) busbar in the switchgear cabinet. Safety for personnel cannot be assured without a low-resistance protective earth. See Grounding section of Mounting and Installation Guidelines of this documentation for more detailed information.

Power connections may still be live, even though the motor is not moving. Never undo the electrical connections to the motor while voltage is present. In unfavorable cases this can cause arcing, with injury and damage to people and equipment.

2.1.5 Important Notice

Specialist staff required!

Only properly qualified personnel are permitted to perform such tasks as transport, assembly, setup and maintenance. Qualified specialist staff are persons who are familiar with the transport, installation, assembly, commissioning and operation of motors and who bring their relevant minimum qualifications to bear on their duties:

- **Transport:** only by personnel with knowledge of handling electrostatic sensitive components.
- **Mechanical Installation:** only by mechanically qualified personnel.
- **Electrical Installation:** only by electrically qualified personnel.
- **Setup:** only by qualified personnel with extensive knowledge of electrical engineering and drive technology.

The qualified personnel must know and observe IEC 60364 / IEC 60664 and national accident prevention regulations.

Read the documentation!

Read the available documentation before installation and commissioning. Improper handling of the stator/rotor can cause harm to people or damage to property. The operator must therefore ensure that all persons entrusted to work on the frameless motor have read and understood the manual and that the safety notices in this manual are observed.

Pay attention to the technical data!

Adhere to the technical data and the specifications on connection conditions (electrical ratings in Technical Data). If permissible voltage values or current values are exceeded, the frameless motors can be damaged, for example by overheating .

Perform a risk assessment!

The manufacturer of the machine must generate a risk assessment for the machine and take appropriate measures to ensure that unforeseen movements cannot cause injury or damage to any person or property. Additional requirements on specialist staff may also result from the risk assessment.

CAUTION Hot surface!

The surfaces of the TBM2G motors can be very hot in operation, according to their protection category. Risk of minor burns! The surface temperature can exceed 155°C.

- Measure the temperature and wait until the TBM2G motor has cooled down below 40°C before touching it.

DANGER Earthing! High voltages!

It is vital that you ensure that the TBM2G motor is safely earthed to the PE (protective earth) busbar in the switch cabinet. Risk of electric shock. Without low-resistance earthing, no personal protection can be guaranteed and there is a risk of death from electric shock.

- Not having optical displays does not guarantee an absence of voltage. Power connections may carry voltage even if the rotor is not rotating.
- Do not unplug any connectors during operation. There is a risk of death or severe injury from touching exposed contacts. Power connections may be live even when the rotor is not rotating. This can cause flashovers with resulting injuries to persons and damage to the contacts.
- After disconnecting the servo drive from the supply voltage, wait several minutes before touching any components which are normally live (e.g. contacts, screw connections) or opening any connections.
- The capacitors in the servo drive can still carry a dangerous voltage several minutes after switching off the supply voltages. To ensure safety, measure the DC-link voltage and wait until the voltage has fallen below 60 V.

Use as Directed (“Intended Use”)

- The user is only permitted to operate the motors under the ambient conditions which are defined in this documentation.
- The series of motors is exclusively intended to be driven by servo drives.
- The motors are installed as components in electrical apparatus or machines and can only be commissioned and put into operation as integral components of such apparatus or machines.
- The End User assumes responsibility for machine conformity.

2.1.6 Prohibited Use

The use of the motors in the following environments is prohibited, without consulting Kollmorgen Customer Support:

- potentially explosive areas
- environments with corrosive and/or electrically conductive acids, alkaline solutions, oils, vapors, dusts
- vacuum
- directly on supply networks, mains

Commissioning the motor is prohibited if the machine in which it was installed

- does not meet the requirements of the EC Machinery Directive
- does not comply with the EMC Directive
- does not comply with the Low Voltage Directive

2.1.7 Model Nomenclature

TBM2G - 060 08 A - N N A A - 00

Frame Size

050	50 mm OD
060	60 mm OD
068	68 mm OD
076	76 mm OD
085	85 mm OD
094	94 mm OD
115	115 mm OD

Stack Length

08	8.2 mm Stack
13	12.7 mm Stack
26	26.3 mm Stack

Winding

A to Z

Thermal Device

A	PT1000
B	3x PTC Devices
N	No Device
S	Special

Sensor Options

A	Hall Device Sensor (alt. loc.) Not available on 050 Frame
H	Hall Device Sensor
N	No Halls
S	Special

Connection Options

A	0.5 m Length
N	No Leads
S	Special

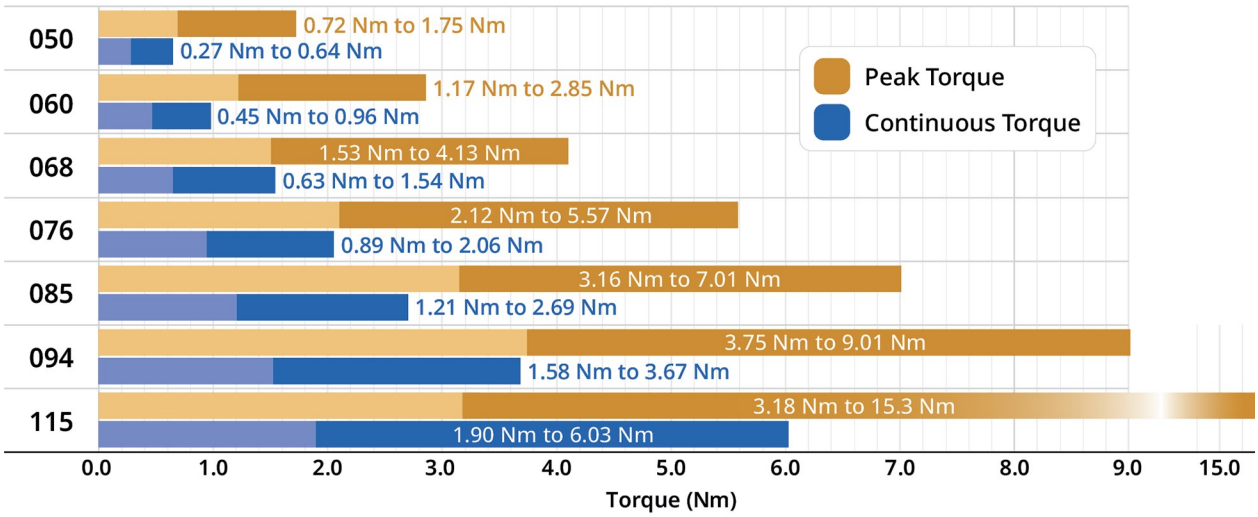
Field Options

A	Standard
S	Special

Custom Options

00	Standard
01, 02, 03...	Special

2.1.8 Torque Overview



2.1.9 Component Material Drawing

1. Yoke
   - Material: 400 Series Stainless Steel
2. Ring Magnet
   - Material: NdFeB (Neodymium)
   - Coating: Epoxy
3. Printed Circuit Board (PCB)
4. Coil
   - Material: Copper
   - Coating: Varnish
5. End Insulators
   Material: Polymer Resin
6. Power Leads
7. Lamination Stack
   Material: Electrical Steel
8. Optional Thermal Devices (mounted underneath PCB)
   - PT1000
   - PTC Avalanche (3 in series)
9. Optional Hall Sensors (mounted underneath PCB)
   - Allegro A1260

2.2 Storage, Operation and Transport Guidelines

2.2.1 Storage

Climate Category	1K4 according to IEC 60721-3-1, EN61800-2.
Storage Temperature	-25 to +55°C, max. variation 20°K per hour
Humidity	relative humidity 5% - 95%, no condensation
Storage Time	unlimited

NOTE

Only store motors in the manufacturer's original packaging.

2.2.2 Operation

Ambient Temperature (at rated values)	-20 to +40°C for site altitude up to 1000 m amsl
Permissible Humidity (at rated values)	95% relative humidity, no condensation
Power Derating (currents and torques)	No derating for site altitudes above 1000 m amsl with temperature reduction of 10°K per 1000 m. It must be ensured, that winding temperature doesn't exceed 155°C.

2.2.3 Transport

Climate Category	2K3 according to IEC 60721-3-2, EN61800-2
Storage Temperature	-25 to +70°C, max. variation 20°K/hour
Humidity	relative humidity 5% - 95%, no condensation

NOTE

Avoid shocks. If the packaging is damaged, check the motor parts for visible damage. Inform the carrier and, if appropriate, the manufacturer.

2.2.4 Unpacking

The Stator and Rotor set is typically shipped together in a single or bulk package. Custom bulk packaging is available as a special option. The Rotor and Stator are separated from each other by packing material so not to impact each other due to the strong magnetic forces. Care in unpacking should be taken to keep the parts separated and to keep the highly magnetized rotor from impacting other objects.

The Stator may contain hall sensor devices if requested. These devices are susceptible to static electricity damage. ESD bags are used in shipping Stators with hall devices. During unpacking, care should be taken to continue ESD protection.

2.3 Mounting and Installation Guidelines

IMPORTANT

The recommendations included in this Kollmorgen manual are intended to serve as general installation guidelines, and are for reference purposes only. Kollmorgen assumes no responsibility for incorrect implementation of these techniques, which remain the sole responsibility of the user.

2.3.1 Armature and Field Assembly Definitions

Armature Assembly (Stator)

The Armature Assembly is the stationary portion of the frameless motor. This assembly is comprised of the magnetic steel laminations, coils, and lead wire assembly. It may also contain additional options such as Hall Devices or Thermal Sensors.

Field Assembly (Rotor)

The Field Assembly is the moving portion of the frameless motor. This assembly is comprised of a rare-earth ring magnet and yoke ring.

Frameless Motor (Set)

A motor manufactured and shipped as separate parts: stator and rotor. The individual parts must be assembled into an end user fabricated housing, shaft, and bearing system.

2.3.2 User Interface Responsibilities

To ensure proper performance and reliability of the motor when installed in the system, the user is responsible for designing the mounting interface using the following information as a guideline. The user is responsible for designing the rotor shaft, stator enclosure, bearing system, housing design details, material selection, fit calculations and tolerance analysis based on the needs of the intended application.

2.3.2.1 Bearings

The user-supplied bearing system in the motor application must exhibit sufficient stiffness to maintain a rigid, uniform clearance gap between the rotor and the stator under all operating conditions. Uniform clearance includes limits for runout and concentricity between the rotor and stator.

2.3.2.2 Stator Mounting Materials

A metallic housing or clamp structure is suggested to rigidly mount the stator to assure the best conductive heatsinking path and proper structural integrity. Aluminum alloys are preferred due to their superior thermal conductivity and strength-to-weight ratio, although stainless steel alloys (300 series or equivalent) are an acceptable alternative for applications that are less thermally critical. Carbon steel, cast iron, 400 series stainless alloys and other magnetic flux conducting ferrous metals are the least desirable choices for stator mounting. Consult a Kollmorgen engineer for assistance if such metals must be used. Plastics or other similar thermally isolating materials are not recommended, since they adversely affect the heatsinking capacity of the system, making it necessary to significantly derate the motor's performance.

2.3.2.3 Rotor Mounting Materials

The magnetized rotor may be mounted to any metallic shaft of the user's choice. Carbon steel and stainless steel are the most commonly used shaft materials, although aluminum alloys are occasionally used when properly designed for the intended torque and thermal operating range. The method used to attach the rotor to the shaft may influence the optimum material and tolerance choices for the shaft. The shaft does not need to carry flux or function as a portion of the magnetic circuit to achieve rated performance when using a Kollmorgen brushless motor.

2.3.2.4 Grounding

When mounted in the application, the laminated stack (or bare metal outer sleeve) of the stator should be at the same electrical ground potential as the system chassis and the servo drive chassis. If this common ground path is not ensured, the application may exhibit electrical noise, and also create an electrical shock hazard. The risk of shock is particularly prevalent when using high pole-count motors with large capacitance characteristics. Typically, if the stator is mounted using electrically conductive metallic components, then a robust ground path between stator lamination stack and machine chassis is inherently achieved. Kollmorgen recommends performing a continuity check to confirm proper ground path before enabling the motor system. In some applications, depending on the mounting configuration and materials chosen, a separate conductive ground strap may be required. In such cases, the user is responsible for installation of the ground path and electrical verification.

2.3.2.5 Basic Assembly Instructions

Kollmorgen's TBM2G series and other frameless brushless motors utilize high-performance rare earth magnets. Use extreme caution when handling or transporting to avoid injury and product damage. The attractive forces between magnetized rotors and nearby metallic objects can be extremely powerful. Improper handling can result in sudden unexpected impacts. The strong magnetic field can also damage nearby computers, display screens and memory storage devices. Keep the rotor in its shipping container or wrapped protectively until ready to install. This practice will help avoid accidents and prevent contamination such as metallic chips or debris that tend to cling to the magnets.

Below is a generic assembly process that can be followed when inserting a Rotor (Field Assembly) into a Stator (Armature Assembly)

1. Securely mount the customer-supplied housing on a stable surface to prevent any sudden movements.
2. Slide the stator into the housing and secure it by either bonding or clamping the stator as shown in Stator Mounting Practices.
3. Slide the rotor onto the customer-supplied shaft and secure it by either bonding or clamping the rotor as shown in Rotor Mounting Practices.
   ⚠CAUTION
   Rare earth magnets are susceptible to cracking and chipping. Take care not to drop the magnets and to avoid impacts with other surfaces when mounting the rotor onto the shaft.
4. Prior to inserting the Rotor/Shaft Assembly into the Stator/Housing Assembly, Kollmorgen recommends first installing a thin layer of shim material, such as Mylar® film, in the stator's inner bore.
   - The Mylar film can be installed as a single piece that is wrapped entirely around the circumference of the stator bore or multiple pieces may be inserted axially at equally spaced points. The optimum film thickness and number of shim layers required is dependent upon the gap clearance between the rotor and stator for the specific motor size the user is attempting to install. See the Radial Running Clearance chart below for guidance.
     ⚠CAUTION
     The outer surface of the rotor may stick to the nearest point on the inner bore of the stator due to magnetic attractive forces as the user attempts to install the rotor. The resulting friction as the Rotor slides along the inside of the Stator can potentially damage the Rotor band, magnets, coatings, or stator bore surfaces.
5. Insert the rotor slowly and smoothly along the central axis line to position the rotor inside the stator. This can be done by hand or by using a custom installation fixture.
6. Install bearings onto rotor assembly as needed to maintain shaft alignment prior to removing shims.
7. Remove the shim material from the airgap between the rotor and stator prior to operation.

Typical Radial Running Clearance

		TBM2G Frame Size						
		050	060	068	076	085	094	115
Nominal Mechanical Gap	**mm**	0.26	0.29	0.26	0.26	0.26	0.26	0.40
	in.	0.010	0.011	0.010	0.010	0.010	0.010	0.016
Concentricity requirements noted on each model-specific Kollmorgen outline drawing must be considered by the user. Bearings with the lowest possible friction and high quality lubricant should be chosen to minimize overall system friction, which allows optimal motor operation.								

2.3.3 Stator Mounting Practices

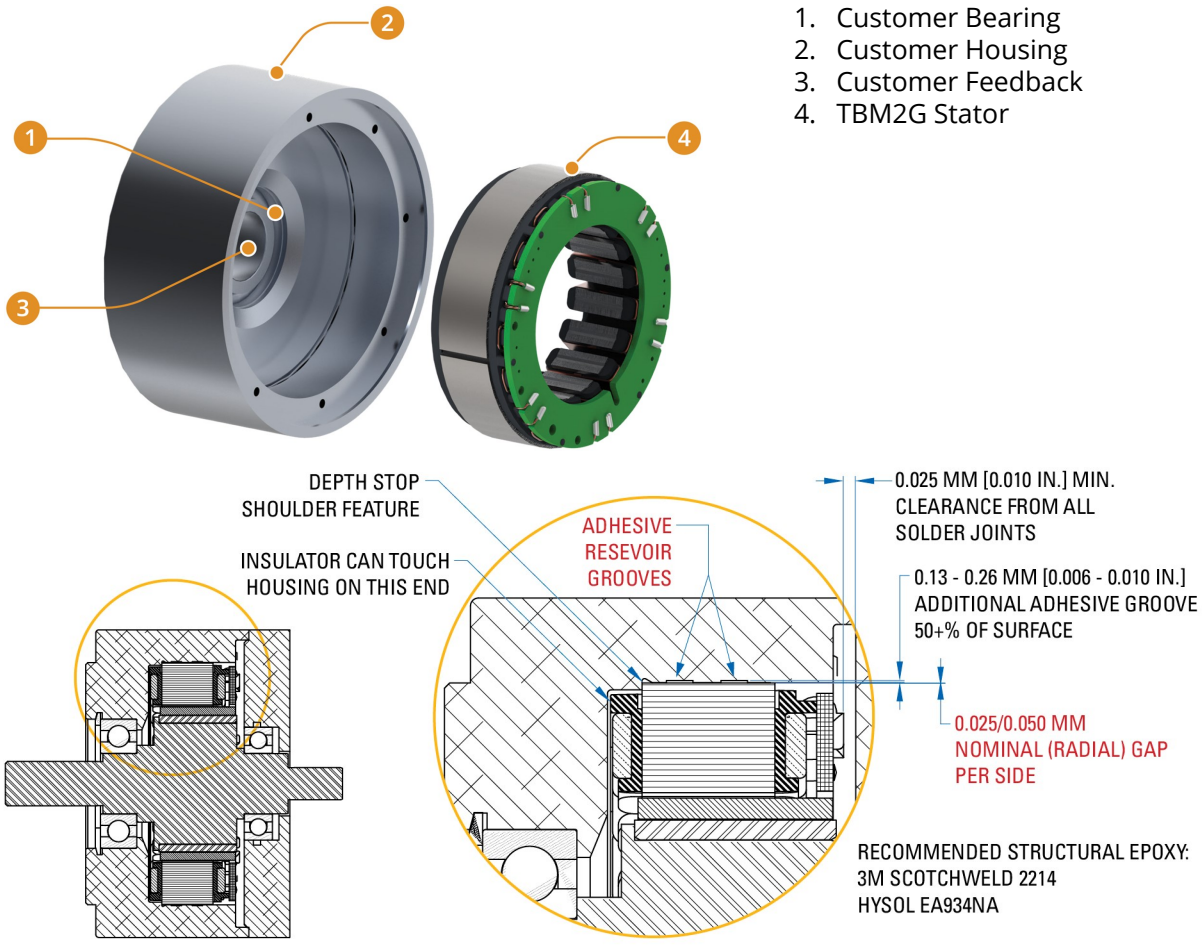
Kollmorgen suggests the following options for installation of the motor stator depending on torque, vibration, and the thermal characteristics of the application, as well as cost, ease of assembly and serviceability desired by the user.

2.3.3.1 Stator Bonding

NOTE

Stator and housing surfaces should be cleaned thoroughly prior to bonding to ensure good adhesion. Reference the data sheet of the adhesive being used for cleaning techniques based on housing material.

In most cases, motors in the general peak torque range up to 2,400 Nm may have the stator bonded in place using a structural epoxy, such as 3M™ Scotch-Weld™ 2214 or other similar adhesives. Bonding is a preferred permanent installation technique for all TBM2G stators. As shown in Illustrations of Stator Bonding below, to successfully utilize adhesive bonding, the stator enclosure should be designed as a cylindrical cup, with a small shoulder for axial positioning at one end and open at the opposite end. The shoulder serves as a stop point for the stator to bank against when inserted from the open end and should generally clear the maximum outer diameter of the winding end-turn as indicated on the outline drawing. Corner reliefs are required to accommodate the sharp corners of the stator laminations. A small internal chamfer at the open end of the housing cup simplifies stator insertion. If the assembly procedure is performed with the stator housing lying flat [rotation axis vertical], the hydrostatic pressure of the structural adhesive will assist the stator in self-centering within the stator housing.



1. Customer Bearing
2. Customer Housing
3. Customer Feedback
4. TBM2G Stator

Figure 2-1 Illustrations of Stator Bonding

Temperature extremes can create a potential issue due to dissimilar expansion coefficients [e.g. steel laminations vs. aluminum housing]. The user should consult the adhesive manufacturer for proper bond line thickness, application process and curing instructions. The grooves shown in the inner diameter of the housing in the Illustrations of Stator Bonding are intended to serve as adhesive reservoirs for the thick structural epoxy helping to provide significant torsional strength across a broad temperature range. If using a thick structural epoxy, the inner diameter of the housing cup should be approximately 0.05 mm - 0.1 mm larger than the maximum outer diameter of the stator. When used in the manufacturer's recommended manner, these bonding agents provide excellent life and strength characteristics over time.

If a retaining compound, such as LOCTITE® 640™ or other similar adhesive, is preferred instead of a structural epoxy, a tighter clearance between housing inner diameter and stator outer diameter must be controlled to maintain appropriate bond line thickness. Refer to the adhesive manufacturer's guidelines for recommendations.

NOTICE

User assumes responsibility for selecting proper adhesive and for designing housing dimensions per expected thermal growth rate at intended temperature extremes of application. Adhesive cure temperatures should not exceed 155°C to avoid damaging the motor stator.

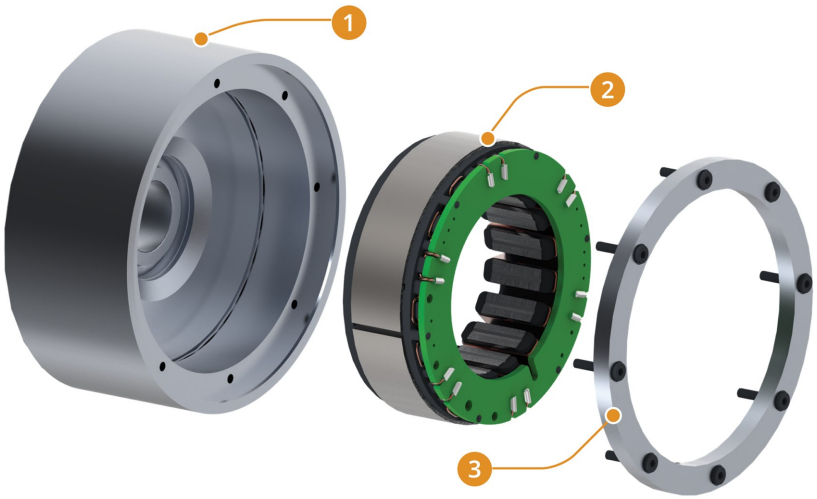
2.3.3.2 Stator Clamping

For applications where the stator may need to be repeatedly installed and removed from the system, axial clamping may be an acceptable option. Kollmorgen does not generally recommend this technique for high shock and vibration applications or extreme temperature applications without special design consideration. The stator enclosure shown in the illustration below is very similar to the epoxy bonding technique. When using the clamping technique for mounting the stator, the inner diameter of the housing cup should be approximately 0.025 mm – 0.050 mm larger than the maximum outer diameter of the stator. If desired, the small radial space between the stator outer diameter and the housing inner diameter may be filled with a thermal compound for more efficient conduction to the heatsink.

NOTE

Use caution to avoid contaminating the axial clamping surfaces with greases that may lead to reduced clamping friction.

A machined shoulder feature serving as a stop and location point for the stator to bank against when inserted is required. A separate clamp ring is needed at the opposite end of the stator and bolted to the housing with 4 to 12 equally spaced fasteners. Using the dimensions provided on the Outline drawing, maximize the surface area for clamping. This minimizes the clamping stress on the stator. Design the housing bore depth to ensure that the clamping ring contacts the stator core before contacting the housing at all tolerance and temperature conditions. Clamping on housing surface before the stator will result in insufficient clamping forces. See the Outline drawing for stator tolerances. Clamping pressures are dependent upon the surface area and clamping force. The clamping pressure should be in the range of 5 to 20 Mpa (725 psi to 2900 psi). Care should be taken to avoid excessive clamping pressures. Extreme pressures will result in increased core losses when operating at high rotational speeds. Care should also be taken to ensure sufficient preload on clamping bolts. This along with a removable thread locker will help keep clamping bolts from loosening after extended operation.



1. Customer Housing
2. TBM2G Stator
3. Stator Clamp Ring

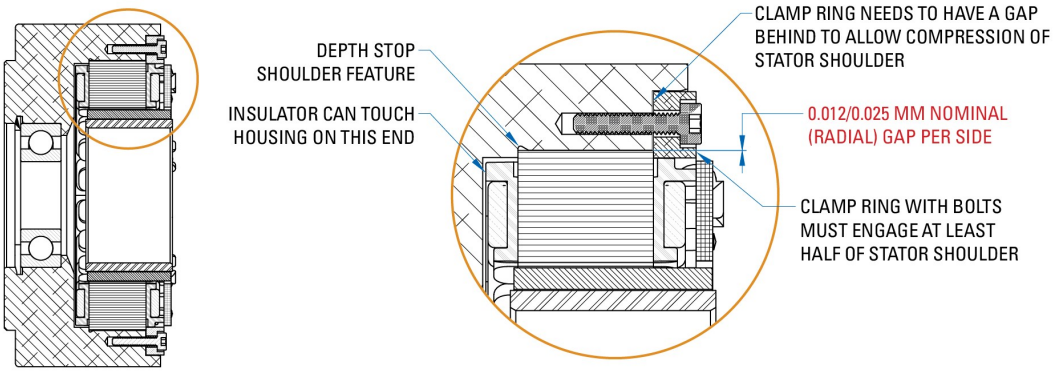


Figure 2-2 Illustrations of Stator Clamping

2.3.4 Rotor Mounting Practices

Kollmorgen's TBM2G series and other frameless brushless motors utilize high-performance rare earth magnets. Use extreme caution when handling or transporting to avoid injury and product damage. The attractive forces between magnetized rotors and nearby metallic objects can be extremely powerful. Improper handling can result in sudden unexpected impacts. The strong magnetic field can also damage nearby computers, display screens and memory storage devices. Keep the rotor in its shipping container or wrapped protectively until ready to install. This practice will help avoid accidents and prevent contamination such as metallic chips or debris that tend to cling to the magnets.

2.3.4.1 Control of Radial Runout

Kollmorgen's model-specific outline drawings note a mounting requirement for runout of the rotor ID to the stator OD. This callout is intended to represent the users shaft OD to housing ID runout requirements. The user is responsible for designing the shaft, housing, and bearing system to meet the specified runout limit between the shaft's bonding surface OD and the housing's bonding surface ID. If this is followed the overall concentricity of the rotor OD to stator ID should be acceptable.

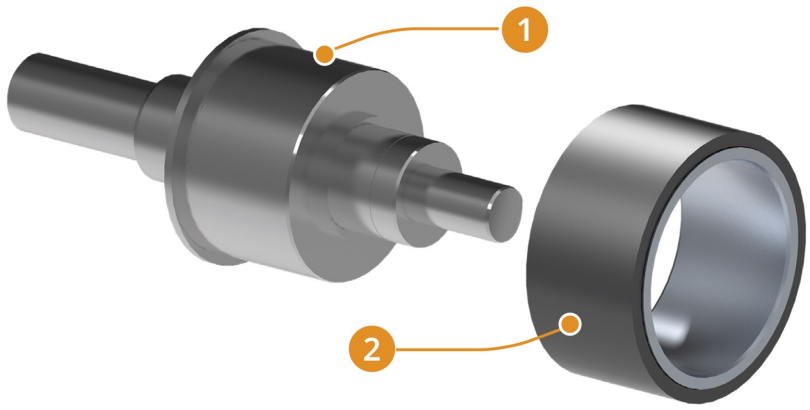
2.3.4.2 Rotor Bonding

NOTE

Stator and housing surfaces should be cleaned thoroughly prior to bonding to ensure good adhesion. Reference the data sheet of the adhesive being used for cleaning techniques based on the housing material.

Generally, for applications where peak torque does not exceed 750 Nm, rotors can be bonded to carbon steel or stainless-steel shafts. Retaining compounds, such as LOCTITE® 640™ or other similar adhesives, usually require smooth continuous interface diameters and tight fit tolerances, such as nominal gaps of 0.012 mm - 0.025 mm. Structural epoxies generally require slightly larger fit clearance to allow a thicker bond line. Epoxies often benefit from grooves in the shaft/rotor interface that function as adhesive reservoirs and may be enhanced by textured machined surfaces via knurling or grit blasting. Consult the adhesive manufacturer for proper bond line thickness, fit tolerances, process details and curing guidelines.

To avoid partial demagnetization of the rotor, do not cure rotor/shaft bond joints at temperatures above 110°C unless the rotor is nested inside the matching stator or the rotor is completely surrounded by a ferrous metal "keeper" fixture. Contact a Kollmorgen engineer if more information is required on this topic. Before bonding rotors to aluminum shafts, consult with the adhesive manufacturer for assistance. A highly flexible adhesive with broad thermal properties may be required.



1. Customer Shaft
2. TBM2G Field Assembly Rotor

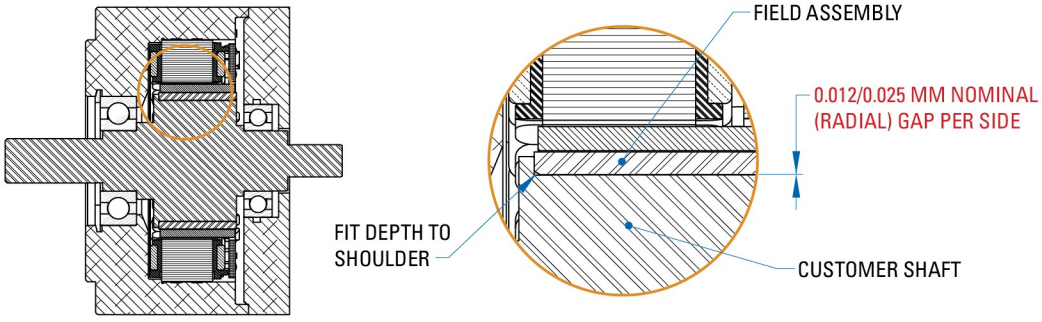


Figure 2-3 Illustrations of Rotor Bonding

2.3.5 Axial Mounting Practices

2.3.5.1 Axial Alignment Control

Kollmorgen's model-specific outline drawings note axial alignment that must be maintained between rotor and stator when mounted to ensure proper motor performance. The user is responsible for designing the rotor shaft, stator enclosure and bearing system to achieve the specified mounting alignment. Machined shoulders on the shaft or grooves for removable retaining rings are common ways of controlling rotor installation position. Maximum diameter of retaining rings or shaft shoulders should be kept below the rotor diameter where magnets are bonded to the steel hub.

2.3.6 Axial Mounting

To assure full performance and proper triggering of the Hall devices, Kollmorgen specifies a mounting dimension between the edge of the lamination stack and the edge of the yoke ring [Figure 2-4].

This mounting dimension ensures magnet material will be fully covering the lamination stack and extends axially to trigger the Hall devices, if applicable.

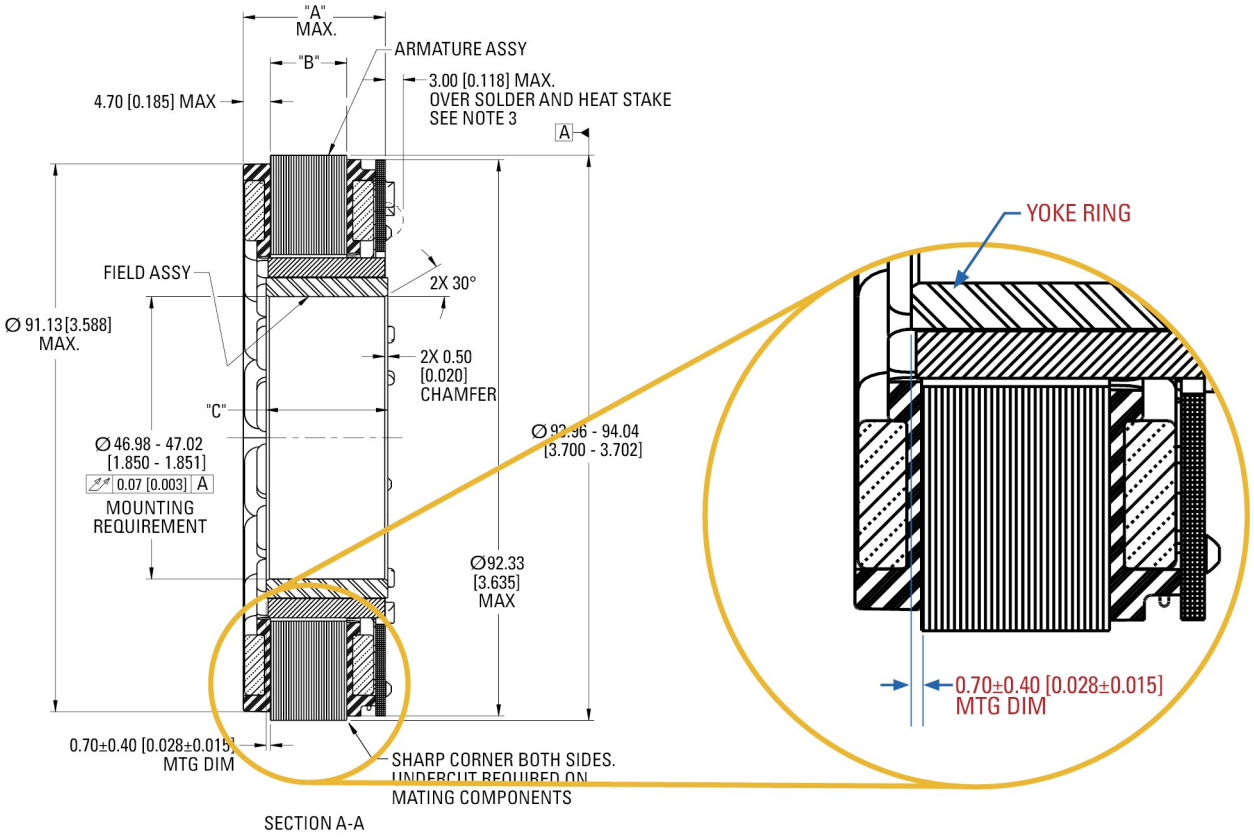


Figure 2-4 Illustration of mounting dimension displayed on a TBM2G-068XXX-XXXX-00 Outline. This dimension is measured from the left edge of the lamination stack to the left edge of the yoke material (not magnet).

If you wish to establish the Alternate Mounting Dimension from the other side of the lamination stack, then the nominal value can be calculated using a few parameters from the drawing. In order to calculate the nominal value from the right edge of the lamination stack to the right edge of the yoke material, use the equation below:

```
Alternate Mounting Dimension (mm, nominal) = "C" – "B" – 0.70 mm
```

To provide an example of calculating the Alternate Mounting Dimension we will use:

- The dimensions for TBM2G-06813-00 from the TBM2G-068XXX-XXXX-00 Outline in Figure 2-4 .
- The equation for Alternate Mounting Dimension.
- A table from the TBM2G-068 Outline that gives the values for “B” and “C”, shown in Figure 2-5 .

Stack Specific Dimensional Data

Part Number	"A" Max	"B" REF ±0.35 [0.014]	“C” ±0.08 [0.004]
TBM2G-06808-00	18.34 [0.722]	8.2 [0.323]	14.76 [0.581]
TBM2G-06813-00	22.84 [0.899]	12.70 [0.500]	19.26 [0.758]
TBM2G-06826-00	36.44 [1.435]	26.30 [1.035]	32.86 [1.294]

Figure 2-5 Table for values “A” MAX, “B” and “C” taken from the TBM2G-068XXX-XXXX-00 Outline.

Example:

For TBM2G-06813-00, “B” = 12.7 mm nominal and “C” = 19.26 mm nominal. The original mounting dimension, 0.70 mm nominal, is already given in the Outline. Using our equation, we now calculate the following:

```
Alternate Mounting Dimension (mm) = 19.26 mm – 12.7 mm – 0.70 mm
= 5.86 mm nominal
```

2.3.7 Electrical Wiring Interface

2.3.7.1 Wiring

TBM2G series motors can be supplied with UL-compliant un-terminated flying lead wires. The user is responsible for proper lead wire routing and connection per the diagrams shown on Kollmorgen drawings. Avoid routing wires across sharp corners, pinch points or edges that may pierce the insulation. Clamp or otherwise secure wire bundles in high vibration applications and avoid wire contact with moving or vibrating surfaces that may abrade the insulation. Provide strain relief for all wire bundles and allow room for a generous bend radius. User assumes responsibility for connector installation, crimping, soldering, shielding, sleeving or any other wire bundling or electrical interface enhancement beyond the configuration shown on the TBM2G outline drawing.

2.3.7.2 Lead Wire Requirements (no lead option)

Recommendations/Guidelines to soldering lead wire onto pad.

2.3.7.3 Power Leads General Specifications and Wiring

POWER LEAD GENERAL SPECIFICATIONS

Motor	TBM2G-050	TBM2G-060	TBMG-068	TBM2G-076	TBM2G-085	TBM2G-094	TBM2G-115
Type	3 flying leads						
Length, mm*	500						
Wire Gauge, AWG	20	20	20	18	16	14	14
Nominal Insulation Diameter, mm	1.47	1.47	1.47	1.70	1.98	2.26	2.26
Min. Static Bend Radius, mm	7.37	7.37	7.37	8.51	9.91	11.3	11.3

*Optional No Lead Version (solder pad only)

POWER LEAD ELECTRICAL INTERFACE

Color	Function (alt)
Red	Phase U (A)
White	Phase V (B)
Black	Phase W (C)

POWER LEADS EXCITATION CHART			
STEP	Phase "U" Red	Phase "V" White	Phase "W" Black
1	⊕	⊖	
2	⊕		⊖
3		⊕	⊖
4	⊖	⊕	
5	⊖		⊕
6		⊖	⊕

CW rotation viewed from PCB/Lead Exit End

2.3.7.4 Thermal Device General Specifications and Wiring

To provide for continuous safe operation of TBM2G series motors in demanding applications, integral thermistors may be attached to the PCBA. The typical option for TBM2G is a PT1000 RTD. As an alternative, three PTC devices wired in series with one placed in each phase winding provides protection of each phase.

THERMAL LEAD GENERAL SPECIFICATIONS

Motor	TBM2G-050	TBM2G-060	TBM2G-068	TBM2G-076	TBM2G-085	TBM2G-094	TBM2G-115
Type	2 flying leads						
Length, mm*	500						
Wire Gauge, AWG	26	26	26	26	26	26	26
Nominal Insulation Diameter, mm	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Min. Static Bend Radius, mm	4.95	4.95	4.95	4.95	4.95	4.95	4.95

*Optional No Lead Version (solder pad only)

THERMAL LEAD ELECTRICAL INTERFACE

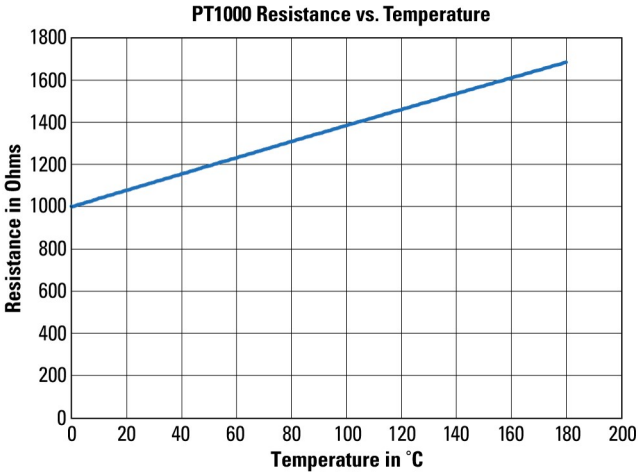
Color	Function (alt.)
White	Thermal Sensor +
White	Thermal Sensor -

2.3.7.4.1 Thermal Protection

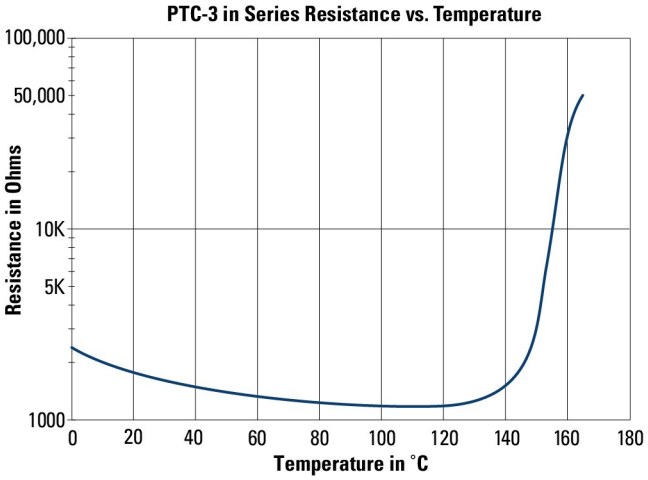
There are two methods for thermal protection for continuous operation. The first method allows for continuous measurement of the motor's temperature by using a PT1000. The motor's temperature is determined by measuring the resistance of the of the PT1000 per IEC-60751 (see chart below). Since only one device can be used, this method can only monitor one of the motor phases. Therefore, it is not recommended for applications where the motor will be in a stall condition for an extended period.

The second method uses three avalanche PTC in series. There is one PTC to monitor each of the three phases to make sure none of the phases exceeds the rated temperature of the motor. This option should be chosen if the motor is in a stall condition for an extended period of time. During normal operation the resistance of the devices will be under 1,500 ohms. When one phase reaches the 155°C the resistance increases rapidly and will exceed > 7,000 ohms.

Neither of these methods protect the motor from overheating when current above the continuous rating is applied. The thermal devices cannot react fast enough to account for the rate of change in temperature that happens when applying peak current. The drive needs to limit the time the peak current in applied to the motor to prevent it from overheating.



This option only has the PT1000 in series and will give the same output as shown on the graph above.



This option has three PTC in series in three different phases. If one of the phases approaches the temperature rating of the motor, the resistance will greatly increase.

2.3.7.5 Hall Sensor Device General Specifications and Wiring

HALL SENSOR GENERAL SPECIFICATIONS

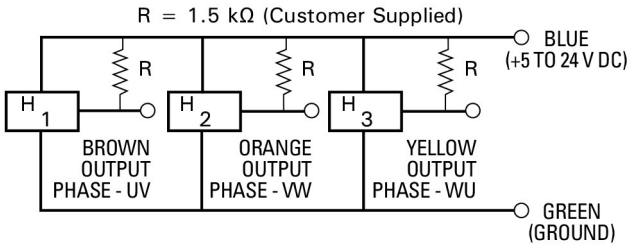
Motor	TBM2G-050	TBM2G-060	TBMG-068	TBM2G-076	TBM2G-085	TBM2G-094	TBM2G-115
Type	5 flying leads, Allegro A1260						
Input Voltage, VDC	+5 to 24						
Output Signal	Sinking Type						
Length, mm*	500						
Wire Gauge, AWG	26	26	26	26	26	26	26
Nominal Insulation Diameter, mm	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Min. Static Bend Radius, mm	4.95	4.95	4.95	4.95	4.95	4.95	4.95

*Optional No Lead Version (solder pad only)

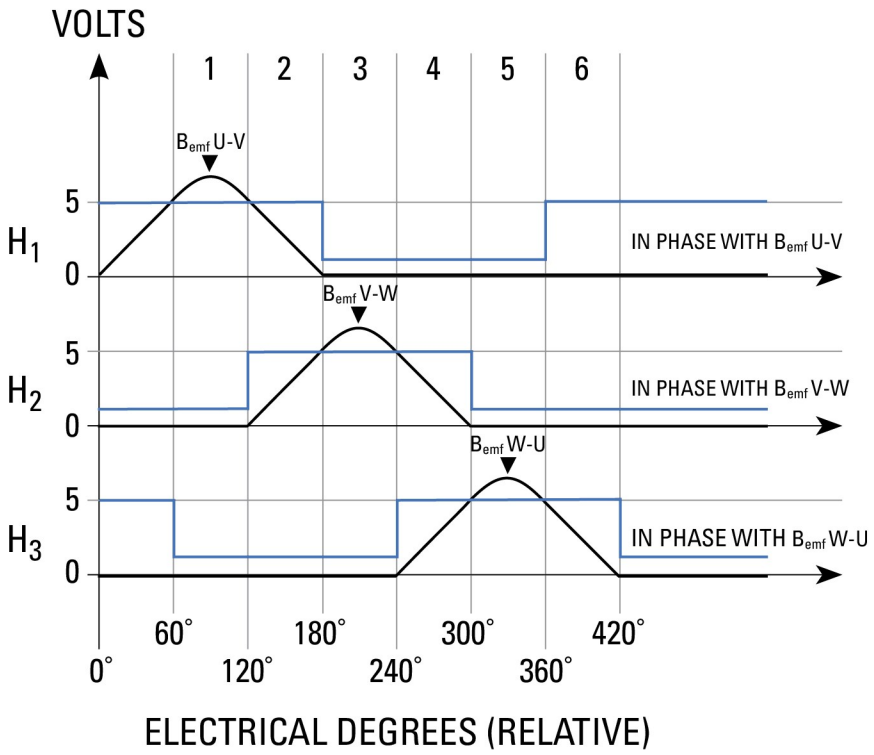
HALL SENSOR LEAD ELECTRICAL INTERFACE

Color	Function (alt)
Brown	Hall 1 (U-V)
Orange	Hall 2 (V-W)
Yellow	Hall 3 (W-U)
Blue	+5 to 24 VDC
Green	Ground

Sensor Wiring Diagram



Sensor Output Diagram



2.4 Definition of Terms for Technical Data

Maximum Continuous Stall Torque, Tmc [Nm]:	The Maximum Continuous Stall Torque can be maintained indefinitely at low speed and rated ambient conditions. There may be additional derating if speed is not high enough to produce even heat distribution across phases. This value assumes an ambient temperature of 25°C.
Maximum Continuous Current, Imc [Arms]:	The Maximum Continuous Current is the effective sinusoidal current which the motor draws at low speed to produce the Maximum Continuous Stall Torque.
Maximum Mechanical Speed, Nmax [rpm]:	The Maximum Mechanical Speed is the highest speed achievable by the motor. Limited by mechanical factors such as adhesion strength of magnet bond.
Peak Torque, Tp [Nm]:	The Peak Torque can be maintained for brief durations of time, dependent on ambient conditions and overall duty cycle. This value may also be limited based on drive specifications and supply voltage.
Peak Current, Ip [Arms]:	The Peak Current of the motor (effective sinusoidal value) is three times the Continuous Current. The actual value is the lessor of the peak current of the motor or the peak current of the drive used.
Rated torque, Trtd [Nm]:	The rated torque is produced when the motor is drawing the rated current at the rated speed. The rated torque can be produced indefinitely at the rated speed in continuous operation (Nrtd). This value assumes an ambient temperature of 25°C.
Torque Constant, Kt [Nm/Arms]:	The Torque Constant defines how much torque is produced by the motor per unit of Current. Measured at both 25°C ambient and 155°C winding temperature.
Back EMF Constant, Ke [Vrms/krpm]:	The BEMF Constant defines the induced motor back EMF, as an effective sinusoidal value between two terminals, per 1000 rpm. Measured at both 25°C ambient and 155°C winding temperature.
Motor Constant, Km [Nm/√W]:	This constant is typically used to compare motors power density at or near stall. It defines the amount torque the motor can produce with a given amount of power. This value is given with the Kt and resistance at 25°C winding temperature.
Resistance, Rm [Ω]:	The Resistance is measured line-to-line and at the PC board. The value does not include the resistance of the motor leads. The resistance value is at 25°C and will increase with winding temperature.
Inductance, L [mH]:	The Inductance is measured line-to-line and at the PC board. This is the average inductance for the motor with respect to the rotor position. The value is measured at 25°C winding temperature.
Rotor Moment of Inertia, Jm [kg-cm²]:	The Rotor Moment of Inertia factors into angular acceleration capability of your motor. This value pertains only to the standard Field Assembly components (Yoke Ring and Ring Magnet). Customer supplied components will alter the total Inertia.

Static Friction, Tf [Nm]:	Static Friction is the torque that must be overcome to get the motor rotating. It is the combination of the low speed hysteresis losses and the peak of the cogging torque. It does not include any bearing losses in the system. This friction should not be included when calculating the rotational losses of the motor at speed.
Thermal Resistance, Rthw-a [deg. C/watt]:	The Thermal Resistance is a measurement of steady state temperature rise per unit of energy dissipated from losses. This value assumes the TBM2G motor is housed and mounted to an Aluminum heat sink as defined on corresponding CD sheet or its equivalent.

3 Technical Data

3.1 Dictionary for technical data tables

3.1.1 Motor Terminology

English	Deutsch	Italiano	Español	Français
Back EMF Constant				
Data	Daten	Dati	Datos	Caractéristiques
Symbol [Unit]	Symbol [Einheit]	Simbolo [unità]	Símbolo [unidad]	Symbole [unité]
Electrical data	Elektrische Daten	Dati elettrici	Datos eléctricos	Caractéristiques électriques
Inductance				
Standstill torque	Stillstandsdrehmoment	Coppia cont. allo stallo	Par motor de parada	Couple d'arrêt
Standstill current	Stillstandsstrom	Corrente cont. allo stallo	Corriente de parada	Courant d'arrêt
Maximum Continuous Current				
Maximum Continuous Stall Torque				
Motor Constant				
max. Mains voltage	max. Netz-Nennspannung	Tensione di rete nom. max.	Tensión max del red	Tension secteur max.
Rated speed	Nenndrehzahl	Velocità nominale	Velocidad nominal	Vitesse nominale
Rated torque	Nenndrehmoment	Coppia nominale	Par motor nominal	Couple nominal
Rated power	Nennleistung	Potenza nominale	Potencia nominal	Puissance nominale
Resistance				
Rotor Moment of Inertia				
Peak current	Spitzenstrom	Corrente di picco	Corriente máxima	Courant de crête
Peak torque	Spitzendrehmoment	Coppia di picco	Par motor motor máximo	Couple de crête
Static Friction				
Thermal Resistance				
Torque constant	Drehmomentkonstante	Costante di coppia	Constante de par motor	Constante de couple
Voltage constant	Spannungskonstante	Costante di tensione	Constante de tensión	Constante de tension
Winding resistance	Wicklungswiderstand	Resistenza avvolgimento	Resistencia de la bobina	Résistance de l'enroulement
Winding inductance	Wicklungsinduktivität	Induttivà avvolgimento	Inductividad de la bobina	Inductance de l'enroulement
Mechanical data	Mechanische Daten	Dati meccanici	Datos mecánicos	Caractéristiques mécaniques

English	Deutsch	Italiano	Español	Français
Rotor moment of inertia	Rotorträgheitsmoment	Momento di inerzia del rotore	Momento de inercia del rotor	Moment d'inertie du rotor
Number of Poles	Polzahl	Numero di poli	N° de polos	Nombre de pôles
Static friction torque	Statisches Reibmoment	Momento di aderenza statica	Par estático de fricción	Couple de friction statique
Thermal time constant	Thermische Zeitkonstante	Costante di tempo termica	Constante térmica de tiempo	Constante de temps thermique
Weight standard	Gewicht standard	Peso standard	Peso de estándar	Poids standard
Radial load permitted at shaft end	Zulässige Radialkraft am Wellenende	Soll. radiale ammessa sull estr. dell'albero	Fuerza radiale admitido en el extremo del eje	Charge radiale admissible en bout d'arbre
Axial load permitted	Zulässige Axialkraft	Soll. assiale ammessa	Fuerza axial admitido	Charge axiale admissible
Minimum cross section	Minimaler Querschnitt	Sezione max.	Sección máx.	Section minimale
Reference flange	Bemessungsflansch	Flangia di calcolo	Brida de la referencia	Bride de référence
Derating for feedback, brake, shaft seal	Begrenzung der Nennwerte bei eingebautem Encoder (und Bremse)	Riducendo le imposte nel caso del codificatore (e del freno) incorporati	El reducir la capacidad normal en caso de codificador (y de freno) incorporados	Réduction de puissance pour la rétroaction, le frein, le joint d'arbre

3.1.2 Brake Terminology

English	Deutsch	Italiano	Español	Français	Русский
Brake data	Bremsendaten	Dati freno	Datos de frenos	Caractéristiques du frein	Характеристики тормозной системы
Holding torque	Haltemoment	Coppia di arresto	Momento de parada	Couple de maintien	Удерживающий момент
Operating voltage	Anschlussspannung	Tensione di allaciamento	Tensión de conexión	Tension de service	Рабочее напряжение
Electrical power	Elektrische Leistung	Potenza elettrica	Potencia eléctrica	Puissance électrique	Электрическая мощность
Moment of inertia	Trägheitsmoment	Momento d'inerzia	Momento de inerciame	Moment d'inertie	Момент инерции
Release delay time	Lüftverzögerungszeit	Ritardo al rilascio	Tiempo de respuesta	Délai d'attente de desserrage	Задержка отпускания
Engage delay time	Einfallverzögerungszeit	Ritardo all'incidenza	Tiempo de reacción	Délai d'attente de serrage	Задержка включения
Weight of the brake	Gewicht der Bremse	Peso del freno	Peso de freno	Poids du frein	Вес тормоза
Typical backlash	typisches Spiel	Gioco tipico	Contragolpe típico	Jeu typique	Стандартный люфт

3.2 TBM2G-050 Data & Drawings

3.2.1 TBM2G-05008 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	0.27	0.27	0.27
			lb-in	2.39	2.39	2.39
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	3.31	6.61	11.5
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	0.20	0.20	0.20
			lb-in	1.76	1.76	1.76
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	2.30	4.59	7.95
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	0.72	0.72	0.72
			lb-in	6.4	6.4	6.4
Peak Current (6)(8)		Ip	Arms	9.9	19.8	34.2
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.19	0.17	0.16
			lb-in	1.67	1.55	1.43
Rated Speed		Nrtd	rpm	2300	5200	8000
Rated Power (speed) (2)(3)		Prtd	kW	0.45	0.095	0.135
			Hp	0.061	0.128	0.181
24 V DC @ 155°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.27	0.26	0.24
			lb-in	2.35	2.26	2.17
Rated Speed		Nrtd	rpm	1800	4900	8000
Rated Power (speed) (2)(3)		Prtd	kW	0.050	0.131	0.205
			Hp	0.067	0.176	0.275
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.17	0.16	0.16
			lb-in	1.55	1.43	1.42
Rated Speed		Nrtd	rpm	5200	8000	8000
Rated Power (speed) (2)(3)		Prtd	kW	0.095	0.135	0.135
			Hp	0.128	0.181	0.181

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.26	0.24	0.24
			lb-in	2.26	2.17	2.16
Rated Speed		Nrtd	rpm	4900	8000	8000
Rated Power (speed) (1)(3)		Prtd	kW	0.131	0.205	0.205
			Hp	0.176	0.275	0.274
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.081	0.040	0.023
			lb-in/Arms	0.72	0.36	0.21
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.090	0.045	0.026
			lb-in/Arms	0.80	0.40	0.23
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	4.89	2.45	1.41
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	5.44	2.72	1.57
Motor Constant (5)	Nom	Km	Nm/√W	0.061	0.061	0.061
			lb-in/√W	0.54	0.54	0.54
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	1.47	0.37	0.12
Inductance Q-Axis (line-line)(6)(8)	+/- 20%	Lqll	mH	0.86	0.22	0.07

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.079
		lb-in-s2	6.99E-05
Weight (7)	W	kg	0.111
		lb	0.245
Thermal resistance	Rthw-a	°C/W	3.60
Pole Pairs	PP		7
Heatsink Size	4" x 3.75" x 0.25" Aluminum Plate		
Housing Geometry [L x T]	1.26" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.2.2 TBM2G-05013 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	0.38	0.38	0.38
			lb-in	3.39	3.33	3.33
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	3.09	6.08	10.5
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	0.30	0.29	0.29
			lb-in	2.61	2.57	2.57
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	2.25	4.43	7.67
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	1.03	1.01	1.01
			lb-in	9.1	9.0	9.0
Peak Current (6)(8)		Ip	Arms	9.2	18.2	31.5
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.28	0.26	0.23
			lb-in	2.51	2.30	2.05
Rated Speed		Nrtd	rpm	1400	3400	6300
Rated Power (speed) (2)(3)		Prtd	kW	0.042	0.092	0.153
			Hp	0.056	0.124	0.205
24 V DC @ 155°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.38	0.36	0.34
			lb-in	3.34	3.17	2.99
Rated Speed		Nrtd	rpm	1100	3100	6100
Rated Power (speed) (2)(3)		Prtd	kW	0.043	0.116	0.216
			Hp	0.058	0.156	0.290
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.26	0.22	0.21
			lb-in	2.34	1.97	1.90
Rated Speed		Nrtd	rpm	3400	7300	8000
Rated Power (speed) (2)(3)		Prtd	kW	0.094	0.170	0.180
			Hp	0.126	0.228	0.241

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.36	0.33	0.32
			lb-in	3.22	2.93	2.87
Rated Speed		Nrtd	rpm	3100	7200	8000
Rated Power (speed) (1)(3)		Prtd	kW	0.118	0.249	0.271
			Hp	0.159	0.334	0.364
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.122	0.061	0.035
			lb-in/Arms	1.08	0.54	0.31
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.136	0.068	0.039
			lb-in/Arms	1.21	0.60	0.35
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	7.36	3.68	2.12
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	8.24	4.12	2.38
Motor Constant (5)	Nom	Km	Nm/√W	0.083	0.082	0.082
			lb-in/√W	0.74	0.73	0.73
Resistance (line-line) (5)(6)(8)	+/- 10%	Rm	Ω	1.78	0.46	0.15
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	1.24	0.31	0.10

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.104
		lb-in-s2	9.20E-05
Weight (7)	W	kg	0.149
		lb	0.328
Thermal resistance	Rthw-a	°C/W	3.40
Pole Pairs	PP		7
Heatsink Size	4" x 3.75" x 0.25" Aluminum Plate		
Housing Geometry [L x T]	1.44" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.2.3 TBM2G-05026 Frameless Motor Specifications

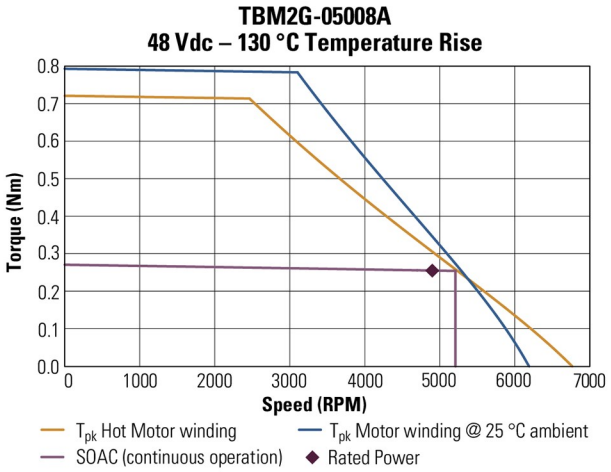
Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	0.64	0.64	0.64
			lb-in	5.66	5.62	5.62
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	2.59	5.18	8.96
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	0.48	0.48	0.48
			lb-in	4.28	4.28	4.28
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	1.86	3.73	6.45
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	1.74	1.75	1.75
			lb-in	15.4	15.5	15.5
Peak Current (6)(8)		Ip	Arms	7.7	15.5	26.8
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.47	0.45	0.41
			lb-in	4.18	3.96	3.64
Rated Speed		Nrtd	rpm	600	1600	3100
Rated Power (speed) (2)(3)		Prtd	kW	0.030	0.075	0.134
			Hp	0.040	0.101	0.179
24 V DC @ 155°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.63	0.62	0.59
			lb-in	5.59	5.45	5.21
Rated Speed		Nrtd	rpm	300	1400	2900
Rated Power (speed) (2)(3)		Prtd	kW	0.020	0.090	0.179
			Hp	0.027	0.121	0.240
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.45	0.40	0.33
			lb-in	3.96	3.54	2.89
Rated Speed		Nrtd	rpm	1600	3600	6600
Rated Power (speed) (2)(3)		Prtd	kW	0.075	0.151	0.225
			Hp	0.100	0.202	0.302

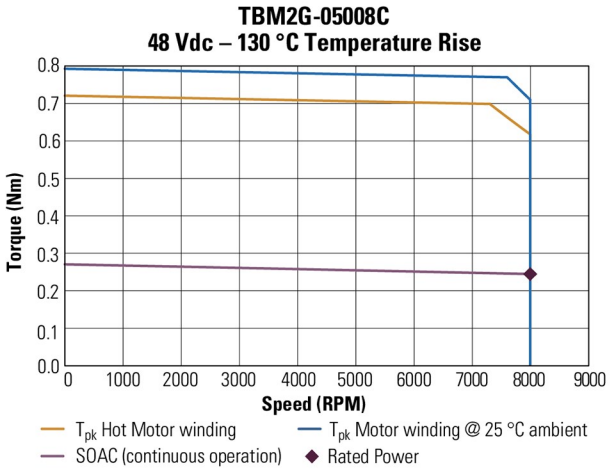
Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.62	0.58	0.53
			lb-in	5.44	5.14	4.65
Rated Speed		Nrtd	rpm	1400	3500	6600
Rated Power (speed) (1)(3)		Prtd	kW	0.090	0.213	0.363
			Hp	0.121	0.286	0.487
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.241	0.121	0.070
			lb-in/Arms	2.13	1.07	0.62
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.270	0.135	0.078
			lb-in/Arms	2.39	1.19	0.69
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	14.6	7.29	4.21
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	16.3	8.16	4.71
Motor Constant (5)	Nom	Km	Nm/√W	0.128	0.128	0.128
			lb-in/√W	1.13	1.13	1.13
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	2.97	0.74	0.25
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	2.38	0.59	0.20

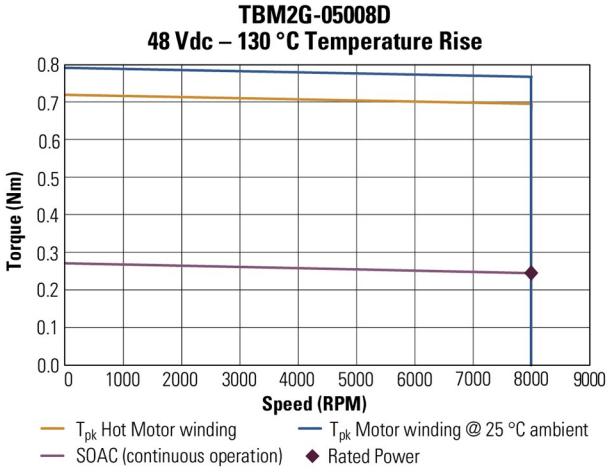
Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.176
		lb-in-s2	1.56E-04
Weight (7)	W	kg	0.260
		lb	0.573
Thermal resistance	Rthw-a	°C/W	2.90
Pole Pairs	PP		7
Heatsink Size	4" x 3.75" x 0.25" Aluminum Plate		
Housing Geometry [L x T]	1.97" x 0.25" Aluminum Housing		

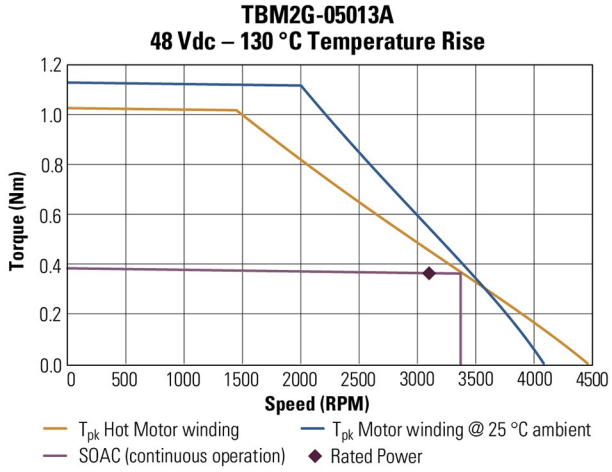
1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

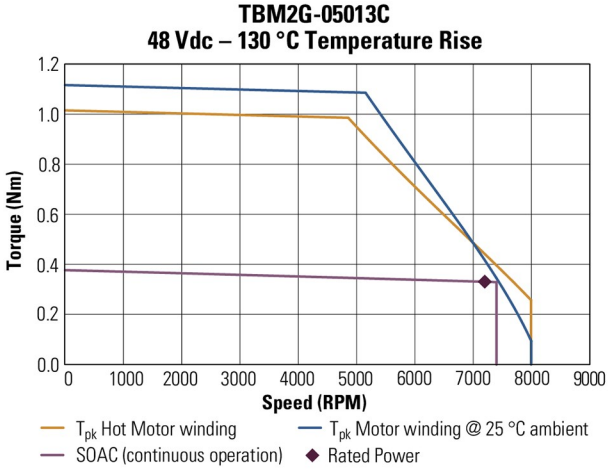
3.2.4 TBM2G-050 Frameless Motor Performance Curves

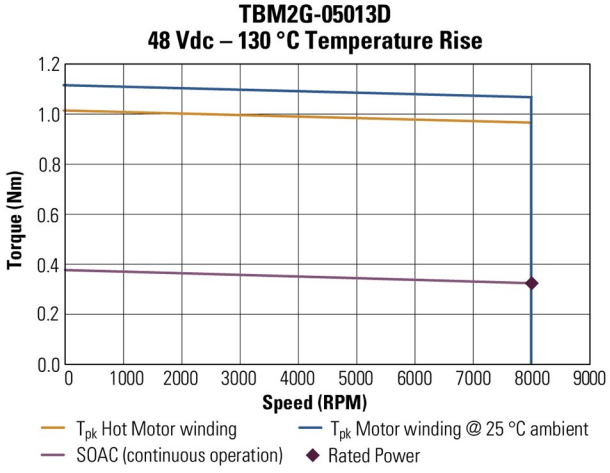


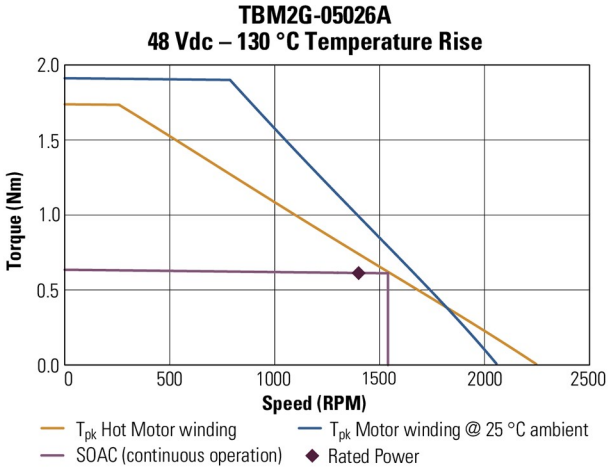


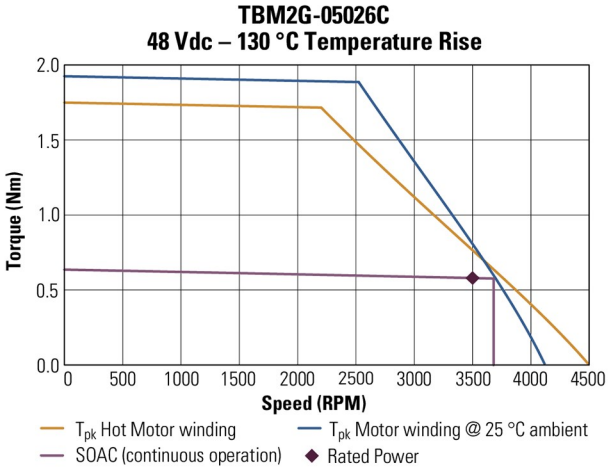


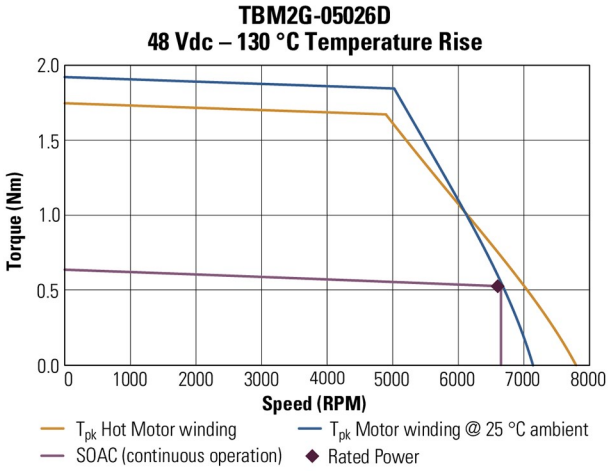




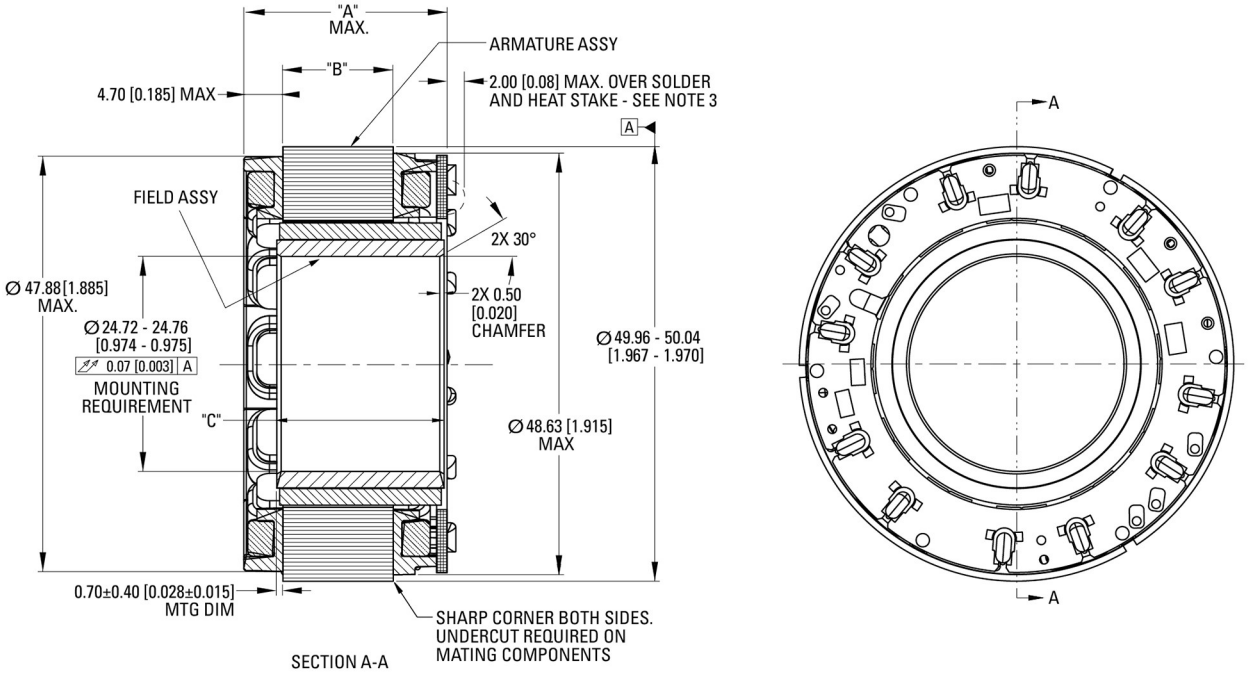



TBM2G-05026A
48 Vdc – 130 °C Temperature Rise
Torque (Nm)
2.0
1.5
1.0
0.5
0.0
0
500
1000
1500
2000
2500
Speed (RPM)
Tpk Hot Motor winding
Tpk Motor winding @ 25 °C ambient
SOAC (continuous operation)
Rated Power


TBM2G-05026C
48 Vdc – 130 °C Temperature Rise
Torque (Nm)
2.0
1.5
1.0
0.5
0.0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Speed (RPM)
Tpk Hot Motor winding
Tpk Motor winding @ 25 °C ambient
SOAC (continuous operation)
Rated Power


TBM2G-05026D
48 Vdc – 130 °C Temperature Rise
Torque (Nm)
2.0
1.5
1.0
0.5
0.0
0
1000
2000
3000
4000
5000
6000
7000
8000
Speed (RPM)
Tpk Hot Motor winding
Tpk Motor winding @ 25 °C ambient
SOAC (continuous operation)
Rated Power

3.2.5 TBM2G-050 Frameless Motor Outline Drawing



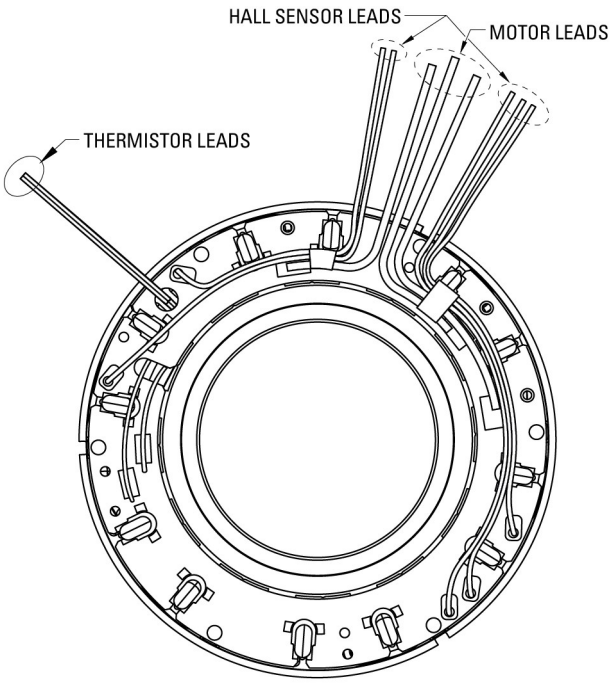
Stack Specific Dimensional Data

MODEL	"A" MAX.	"B" REF ±0.35 [0.014]	"C" ±0.08 [0.004]
TBM2G-05008	19.84 [0.781]	8.2 [0.323]	14.76 [0.581]
TBM2G-05013	24.34 [0.958]	12.70 [0.500]	19.26 [0.758]
TBM2G-05026	37.94 [1.494]	26.30 [1.035]	32.86 [1.294]

Notes:

1. All dimensions are in mm [inches] and are for reference only.
2. Motor supplied as two separate components: armature and sensor assembly and field assembly.
3. Customer must provide 0.25 [0.010] min. clearance from all solder and heat stakes.

3.2.6 TBM2G-050 Series Optional Lead Specifications



Motor Leads

#20 AWG, ETFE Coated, Per UL Style 10086
3 Leads, 0.5 m Length
1 - Red, 1 - White, 1 - Black
Minimum Motor Lead Bend Radius 7.37 [0.290]

Hall Sensor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
5 Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Thermistor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
2 White Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Connection Options

PN Lead Designation	Lead Length (Min)
A	0.5 m
N	No leads

Sensor Options

PN Lead Designation	Lead Length (Min)
H	Hall Sensor
N	No Device

Thermal Device Options

PN Lead Designation	Lead Length (Min)
A	PT1000
B	3x PTC Devices
N	No Device

3.3 TBM2G-060 Data & Drawings

3.3.1 TBM2G-06008 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	0.45	0.45	0.45
			lb-in	3.97	3.97	3.97
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	3.73	7.46	12.9
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	0.35	0.35	0.35
			lb-in	3.06	3.06	3.06
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	2.67	5.34	9.25
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	1.22	1.22	1.22
			lb-in	10.8	10.8	10.8
Peak Current (6)(8)		Ip	Arms	11.1	22.3	38.6
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.33	0.31	0.28
			lb-in	2.91	2.71	2.49
Rated Speed		Nrtd	rpm	1400	3400	6300
Rated Power (speed) (2)(3)		Prtd	kW	0.048	0.109	0.185
			Hp	0.065	0.146	0.249
24 V DC @ 155°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.44	0.43	0.41
			lb-in	3.92	3.79	3.64
Rated Speed		Nrtd	rpm	1000	3100	6000
Rated Power (speed) (2)(3)		Prtd	kW	0.046	0.139	0.258
			Hp	0.062	0.187	0.347
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.28	0.22	0.25
			lb-in	2.51	1.92	2.23
Rated Speed		Nrtd	rpm	3400	7500	8000
Rated Power (speed) (2)(3)		Prtd	kW	0.101	0.171	0.211
			Hp	0.135	0.229	0283

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.42	0.39	0.39
			lb-in	3.73	3.41	3.48
Rated Speed		Nrtd	rpm	3100	7200	8000
Rated Power (speed) (1)(3)		Prtd	kW	0.137	0.291	0.329
			Hp	0.183	0.390	0.442
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.121	0.061	0.035
			lb-in/Arms	1.07	0.54	0.31
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.135	0.067	0.039
			lb-in/Arms	1.19	0.60	0.34
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	7.33	3.66	2.11
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	8.15	4.07	2.35
Motor Constant (5)	Nom	Km	Nm/√W	0.087	0.087	0.087
			lb-in/√W	0.77	0.77	0.077
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	1.60	0.400	0.133
Inductance Q-Axis (line-line)	+/- 20%	Lqll	mH	1.06	0.27	0.09

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.137
		lb-in-s2	1.21E-04
Weight (7)	W	kg	0.139
		lb	0.306
Thermal resistance	Rthw-a	°C/W	2.60
Pole Pairs	PP		10
Heatsink Size	5" x 5" x 0.25" Aluminum Plate		
Housing Geometry [L x T]	1.15" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.3.2 TBM2G-06013 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	0.60	0.60	0.60
			lb-in	5.30	5.30	5.30
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	3.38	6.75	11.7
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	0.46	0.46	0.46
			lb-in	4.10	4.10	4.10
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	2.42	4.85	8.39
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	1.67	1.67	1.67
			lb-in	14.8	14.8	14.8
Peak Current (6)(8)		Ip	Arms	10.1	20.2	35.0
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.44	0.42	0.39
			lb-in	3.94	3.71	3.43
Rated Speed		Nrtd	rpm	900	2200	4200
Rated Power (speed) (2)(3)		Prtd	kW	0.042	0.097	0.171
			Hp	0.056	0.130	0.229
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.59	0.58	0.56
			lb-in	5.25	5.11	4.92
Rated Speed		Nrtd	rpm	600	2000	4000
Rated Power (speed) (1)(3)		Prtd	kW	0.037	0.121	0.223
			Hp	0.050	0.162	0.312
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.39	0.31	0.27
			lb-in	3.47	2.74	2.43
Rated Speed		Nrtd	rpm	2300	5100	8000
Rated Power (speed) (2)(3)		Prtd	kW	0.094	0.165	0.230
			Hp	0.126	0.221	0.309

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.57	0.53	0.50
			lb-in	5.03	4.65	4.38
Rated Speed		Nrtd	rpm	2000	4800	8000
Rated Power (speed) (1)(3)		Prtd	kW	0.119	0.264	0.415
			Hp	0.160	0.355	0.556
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.177	0.089	0.051
			lb-in/Arms	1.57	0.78	0.45
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.199	0.099	0.057
			lb-in/Arms	1.76	0.88	0.51
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	10.72	5.36	3.09
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	12.0	6.00	3.47
Motor Constant (5)	Nom	Km	Nm/√W	0.114	0.114	0.114
			lb-in/√W	1.01	1.01	1.01
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	2.01	0.503	0.168
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	1.55	0.39	0.13

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.147
		lb-in-s2	1.30E-04
Weight (7)	W	kg	0.195
		lb	0.430
Thermal resistance	Rthw-a	°C/W	2.52
Pole Pairs	PP		10
Heatsink Size	5" x 5" x 0.25" Aluminum Plate		
Housing Geometry [L x T]	1.33" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.3.3 TBM2G-06026 Frameless Motor Specifications

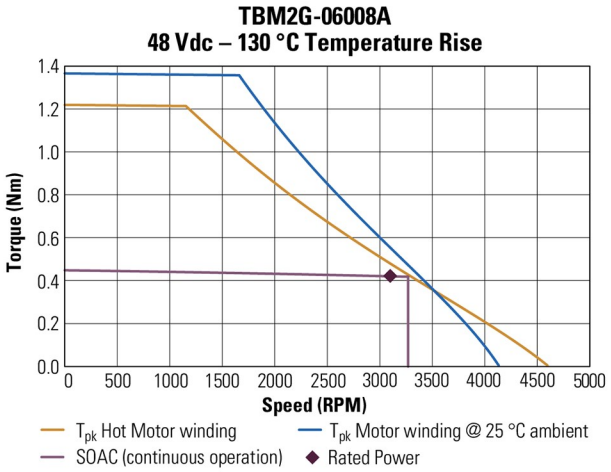
Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	0.96	0.96	0.96
			lb-in	8.54	8.54	8.54
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	2.72	5.45	9.43
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	0.75	0.75	0.75
			lb-in	6.64	6.64	6.64
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	1.97	3.93	6.81
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	2.60	2.76	2.76
			lb-in	23.0	24.4	24.4
Peak Current (6)(8)		Ip	Arms	7.7	16.3	28.2
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.74	0.71	0.67
			lb-in	6.53	6.24	5.90
Rated Speed		Nrtd	rpm	300	1000	2000
Rated Power (speed) (2)(3)		Prtd	kW	0.023	0.074	0.140
			Hp	0.031	0.099	0.187
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.96	0.94	0.92
			lb-in	8.52	8.36	8.12
Rated Speed		Nrtd	rpm	100	900	1900
Rated Power (speed) (1)(3)		Prtd	kW	0.010	0.089	0.183
			Hp	0.014	0.119	0.245
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.69	0.59	0.48
			lb-in	6.09	5.19	4.21
Rated Speed		Nrtd	rpm	1000	2400	4500
Rated Power (speed) (2)(3)		Prtd	kW	0.072	0.147	0.224
			Hp	0.097	0.198	0.301

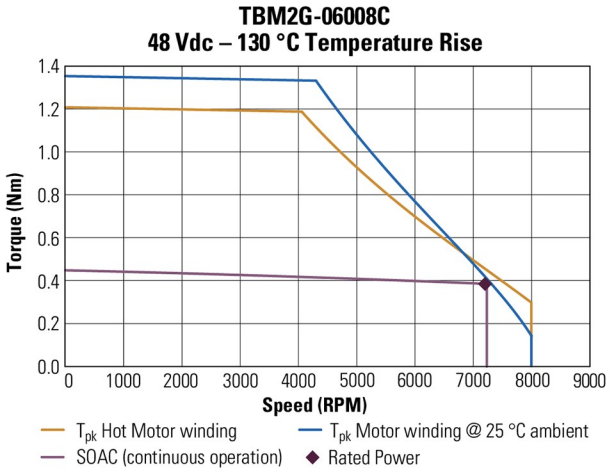
Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.94	0.89	0.82
			lb-in	8.32	7.84	7.30
Rated Speed		Nrtd	rpm	900	2300	4400
Rated Power (speed) (1)(3)		Prtd	kW	0.089	0.213	0.380
			Hp	0.119	0.286	0.510
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.354	0.177	0.102
			lb-in/Arms	3.13	1.57	0.90
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.397	0.198	0.114
			lb-in/Arms	3.51	1.75	1.01
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	21.4	10.7	6.18
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	24.0	12.0	6.9
Motor Constant (5)	Nom	Km	Nm/√W	0.176	0.176	0.176
			lb-in/√W	1.56	1.56	1.56
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	3.39	0.847	0.282
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	3.03	0.76	0.25

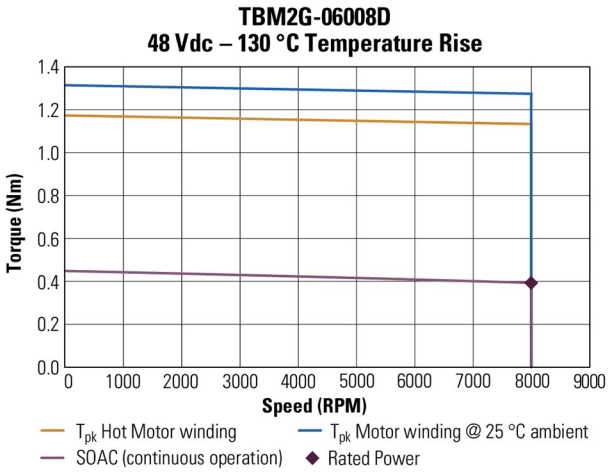
Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.308
		lb-in-s2	2.73E-04
Weight (7)	W	kg	0.351
		lb	0.774
Thermal resistance	Rthw-a	°C/W	2.30
Pole Pairs	PP		10
Heatsink Size	5" x 5" x 0.25" Aluminum Plate		
Housing Geometry [L x T]	1.86" x 0.25" Aluminum Housing		

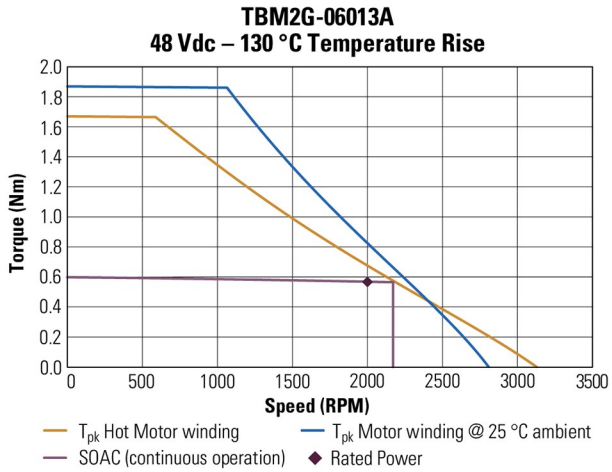
1. Motor winding at temp. rise, δT = 130°C , at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C , at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

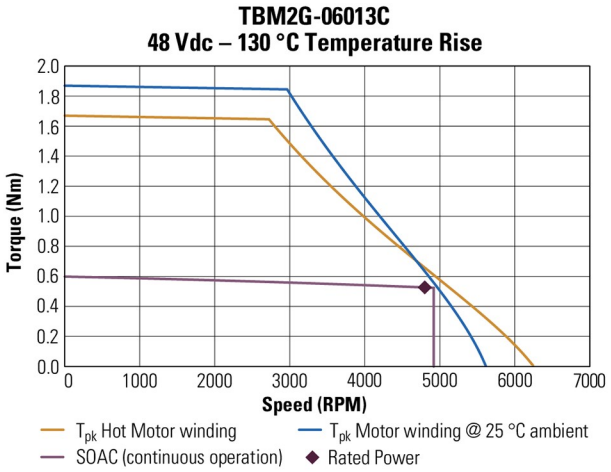
3.3.4 TBM2G-060 Frameless Motor Performance Curves

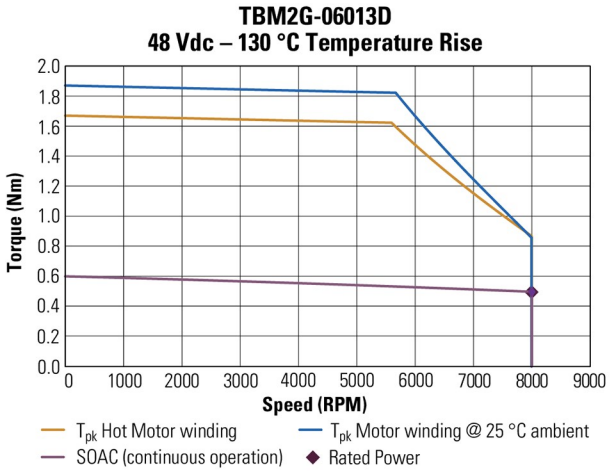




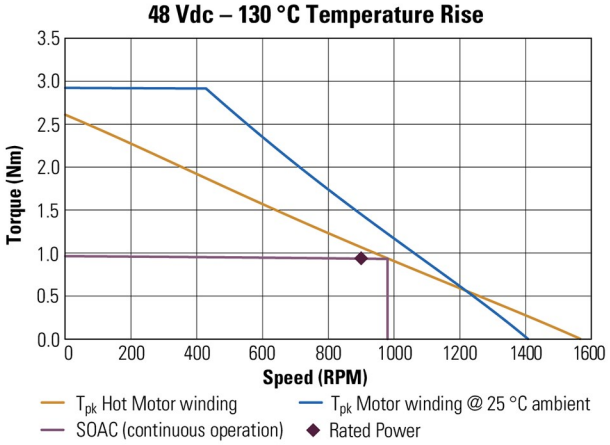




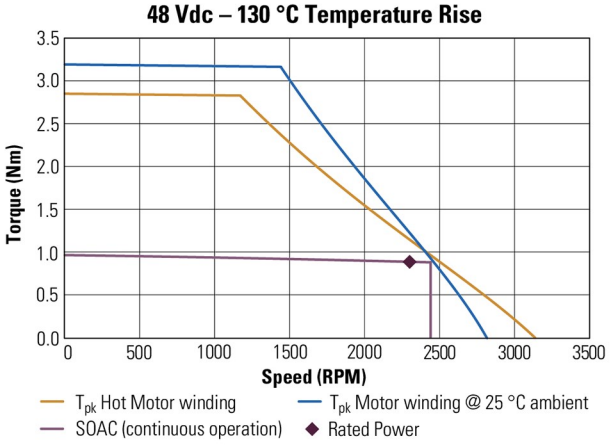




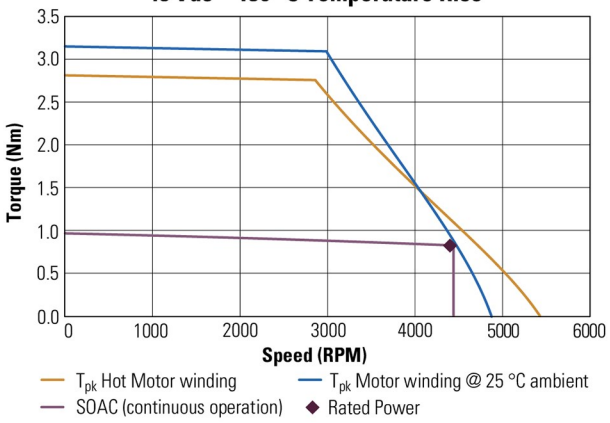
TBM2G-06026A
48 Vdc – 130 °C Temperature Rise



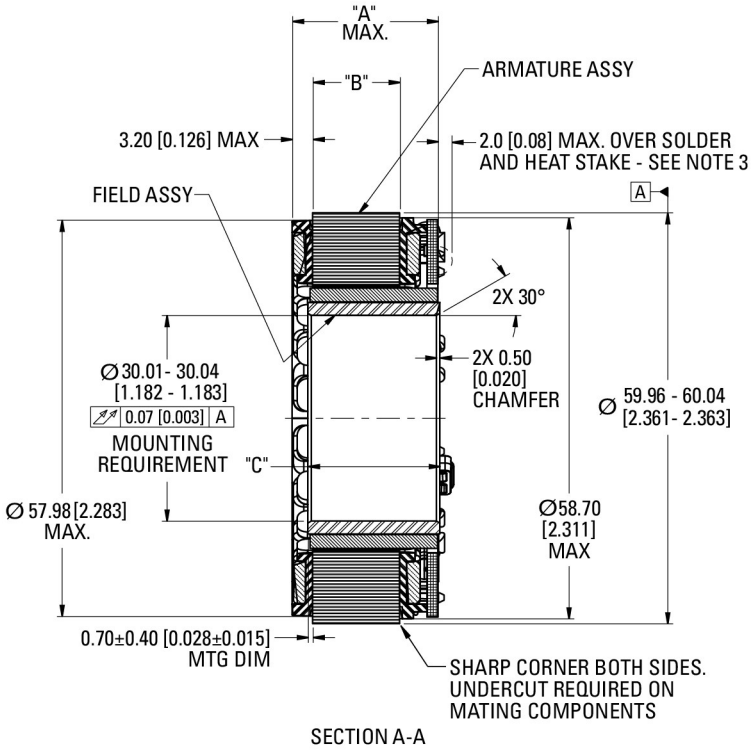
TBM2G-06026C
48 Vdc – 130 °C Temperature Rise

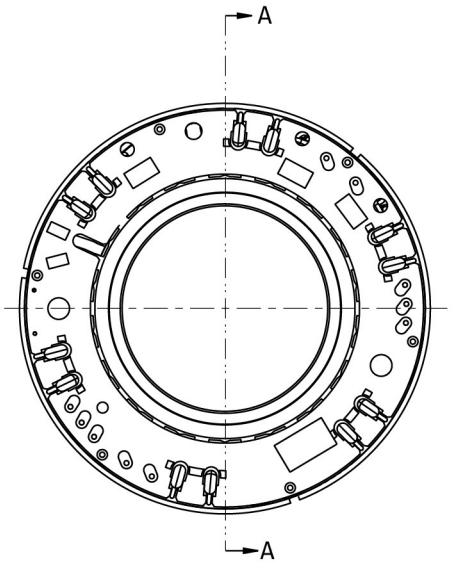


TBM2G-06026D
48 Vdc – 130 °C Temperature Rise



3.3.5 TBM2G-060 Frameless Motor Outline Drawing





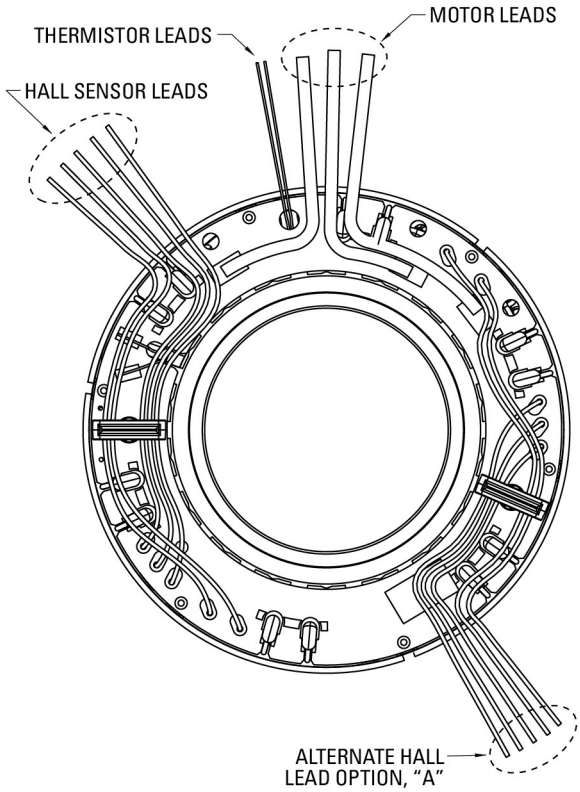
Stack Specific Dimensional Data

MODEL	"A" MAX.	"B" REF ±0.35 [0.014]	"C" ±0.08 [0.004]
TBM2G-06008	17.71 [0.697]	8.2 [0.323]	14.76 [0.581]
TBM2G-06013	22.21 [0.874]	12.70 [0.500]	19.26 [0.758]
TBM2G-06026	35.81 [1.410]	26.30 [1.035]	32.86 [1.294]

Notes:

1. All dimensions are in mm [inches] and are for reference only.
2. Motor supplied as two separate components: armature and sensor assembly and field assembly.
3. Customer must provide 0.25 [0.010] min. clearance from all solder and heat stakes.

3.3.6 TBM2G-060 Series Optional Lead Specifications



Motor Leads

#20 AWG, ETFE Coated, Per UL Style 10086
3 Leads, 0.5 m Length
1 - Red, 1 - White, 1 - Black
Minimum Motor Lead Bend Radius 7.37 [0.290]

Hall Sensor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
5 Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Thermistor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
2 White Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Connection Options

PN Lead Designation	Lead Length (Min)
A	0.5 m
N	No leads

Sensor Options

PN Lead Designation	Lead Length (Min)
A	Hall Sensor Alternate Location
H	Hall Sensor
N	No Device

Thermal Device Options

PN Lead Designation	Lead Length (Min)
A	PT1000
B	3x PTC Devices
N	No Device

3.4 TBM2G-068 Data & Drawings

3.4.1 TBM2G-06808 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	0.63	0.63	0.63
			lb-in	5.58	5.60	5.60
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	4.14	8.27	14.3
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	0.50	0.50	0.50
			lb-in	4.39	4.39	4.39
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	3.01	6.02	10.4
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	1.54	1.53	1.53
			lb-in	13.6	13.5	13.5
Peak Current (6)(8)		Ip	Arms	12.4	24.7	42.8
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.48	0.46	0.43
			lb-in	4.27	4.09	3.83
Rated Speed		Nrtd	rpm	1100	2600	4900
Rated Power (speed) (2)(3)		Prtd	kW	0.056	0.126	0.222
			Hp	0.074	0.169	0.298
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.63	0.61	0.59
			lb-in	5.55	5.42	5.26
Rated Speed		Nrtd	rpm	800	2400	4700
Rated Power (speed) (1)(3)		Prtd	kW	0.053	0.154	0.292
			Hp	0.070	0.207	0.392
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.46	0.41	0.39
			lb-in	4.02	3.62	3.41
Rated Speed		Nrtd	rpm	2600	5700	8000
Rated Power (speed) (2)(3)		Prtd	kW	0.124	0.244	0.323
			Hp	0.166	0.327	0.433

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.61	0.58	0.56
			lb-in	5.41	5.13	4.94
Rated Speed		Nrtd	rpm	2400	5500	8000
Rated Power (speed) (1)(3)		Prtd	kW	0.154	0.334	0.468
			Hp	0.206	0.448	0.627
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.153	0.076	0.044
			lb-in/Arms	1.35	0.68	0.39
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.171	0.086	0.049
			lb-in/Arms	1.52	0.76	0.44
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	9.24	4.62	2.67
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	10.4	5.18	2.99
Motor Constant (5)	Nom	Km	Nm/√W	0.119	0.119	0.119
			lb-in/√W	1.05	1.05	1.05
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	1.38	0.345	0.115
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	1.26	0.32	0.11

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.239
		lb-in-s2	2.12E-04
Weight (7)	W	kg	0.188
		lb	0.414
Thermal resistance	Rthw-a	°C/W	2.45
Pole Pairs	PP		10
Heatsink Size	7.5" x 7" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	1.36" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.4.2 TBM2G-06813 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)		Tmc1	Nm	0.85	0.86	0.86
			lb-in	7.48	7.64	7.64
Max Cont. Current for ΔT wdg. = 130°C (1)(4)		Imc1	Arms	3.76	7.67	13.3
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)		Tmc2	Nm	0.66	0.67	0.67
			lb-in	5.82	5.94	5.93
Max Cont. Current for ΔT wdg. = 60°C (2)(4)		Imc2	Arms	2.71	5.54	9.60
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	2.14	2.19	2.19
			lb-in	19.0	19.4	19.4
Peak Current		Ip	Arms	11.2	22.9	39.7
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.66	0.64	0.61
			lb-in	5.84	5.68	5.42
Rated Speed		Nrtd	rpm	700	1700	3300
Rated Power (speed) (2)(3)		Prtd	kW	0.147	0.114	0.212
			Hp	0.064	0.153	0.284
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.84	0.85	0.83
			lb-in	7.45	7.49	7.32
Rated Speed		Nrtd	rpm	500	1600	3200
Rated Power (speed) (1)(3)		Prtd	kW	0.044	0.142	0.277
			Hp	0.059	0.190	0.372
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.62	0.59	0.53
			lb-in	5.48	5.22	4.73
Rated Speed		Nrtd	rpm	1700	3900	7000
Rated Power (speed) (2)(3)		Prtd	kW	0.110	0.241	0.392
			Hp	0.148	0.323	0.526

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.83	0.81	0.78
			lb-in	7.32	7.20	6.87
Rated Speed		Nrtd	rpm	1600	3700	6900
Rated Power (speed) (1)(3)		Prtd	kW	0.139	0.315	0.561
			Hp	0.186	0.422	0.753
Hot Torque Constant (1)	+/- 10%	Kt	Nm/Arms	0.225	0.113	0.065
			lb-in/Arms	1.99	1.00	0.57
Cold Torque Constant (5)	+/- 10%	Kt	Nm/Arms	0.252	0.126	0.073
			lb-in/Arms	2.23	1.12	0.64
Hot Back EMF Constant (1)	+/- 10%	Ke	Vrms/krpm	13.6	6.80	3.93
Cold Back EMF Constant (5)	+/- 10%	Ke	Vrms/krpm	15.2	7.62	4.40
Motor Constant (5)	Nom	Km	Nm/√W	0.154	0.157	0.157
			lb-in/√W	1.37	1.39	1.39
Resistance (line-line) (5)	+/- 10%	Rm	Ω	1.78	0.427	0.142
Inductance Q-Axis (line-line)	+/- 20%	Lqll	mH	1.82	0.46	0.15

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.309
		lb-in-s2	2.73E-04
Weight (7)	W	kg	0.254
		lb	0.560
Thermal resistance	Rthw-a	°C/W	2.30
Pole Pairs	PP		10
Heatsink Size	7.5" x 7" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	1.53" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.4.3 TBM2G-06826 Frameless Motor Specifications

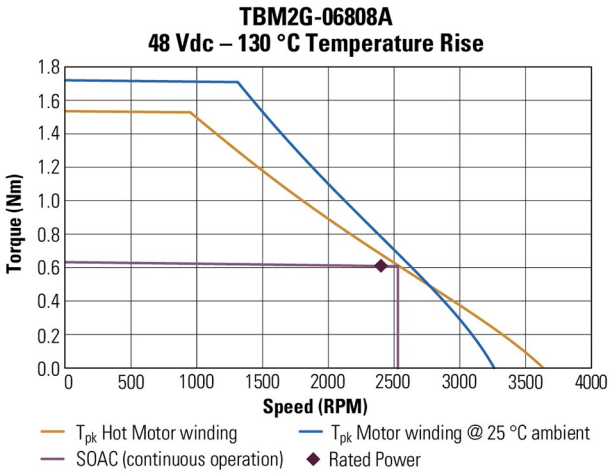
Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	1.54	1.54	1.54
			lb-in	13.6	13.6	13.6
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	3.48	6.96	12.1
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	1.19	1.19	1.19
			lb-in	10.6	10.6	10.6
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	2.50	5.01	8.68
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	3.96	4.12	4.13
			lb-in	35.1	36.4	36.5
Peak Current (6)(8)		Ip	Arms	10.0	20.8	36.1
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.19	1.17	1.14
			lb-in	10.5	10.3	10.1
Rated Speed		Nrtd	rpm	300	800	1600
Rated Power (speed) (2)(3)		Prtd	kW	0.037	0.098	0.191
			Hp	0.050	0.131	0.256
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.54	1.53	1.51
			lb-in	13.6	13.5	13.4
Rated Speed		Nrtd	rpm	100	700	1500
Rated Power (speed) (1)(3)		Prtd	kW	0.016	0.112	0.237
			Hp	0.022	0.150	0.318
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.16	1.12	1.07
			lb-in	10.3	9.9	9.4
Rated Speed		Nrtd	rpm	800	1900	3500
Rated Power (speed) (2)(3)		Prtd	kW	0.097	0.223	0.391
			Hp	0.130	0.300	0.524

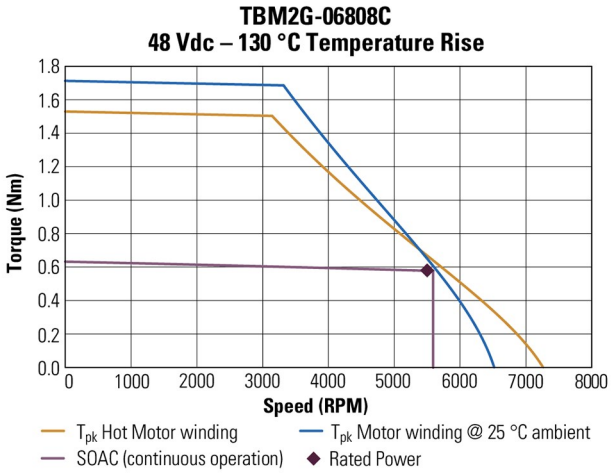
Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.53	1.50	1.46
			lb-in	13.5	13.3	12.9
Rated Speed		Nrtd	rpm	700	1800	3400
Rated Power (speed) (1)(3)		Prtd	kW	0.112	0.283	0.521
			Hp	0.150	0.380	0.699
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.442	0.221	0.128
			lb-in/Arms	3.92	1.96	1.13
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.496	0.248	0.143
			lb-in/Arms	4.39	2.19	1.27
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	26.7	13.4	7.72
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	30.0	15.0	8.65
Motor Constant (5)	Nom	Km	Nm/√W	0.251	0.251	0.251
			lb-in/√W	2.22	2.22	2.22
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	2.60	0.651	0.217
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	3.51	0.88	0.29

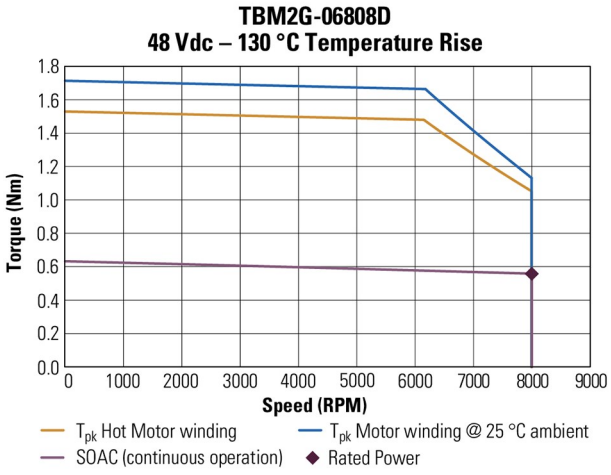
Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.518
		lb-in-s2	4.58E-04
Weight (7)	W	kg	0.462
		lb	1.019
Thermal resistance	Rthw-a	°C/W	1.83
Pole Pairs	PP		10
Heatsink Size	7.5" x 7" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	2.06" x 0.25" Aluminum Housing		

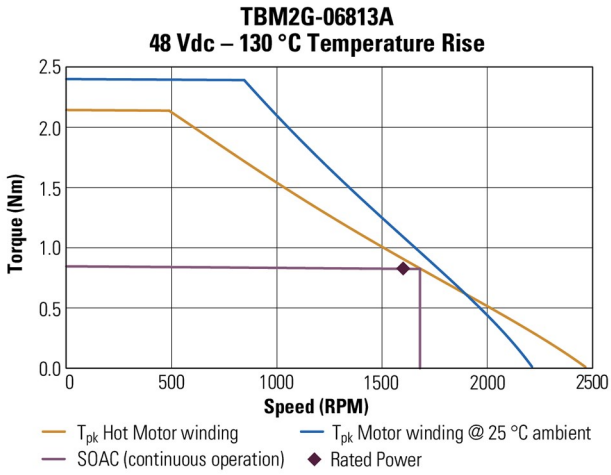
1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

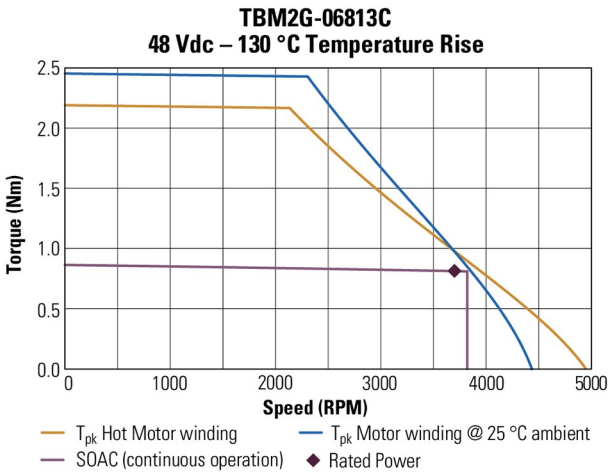
3.4.4 TBM2G-068 Frameless Motor Performance Curves

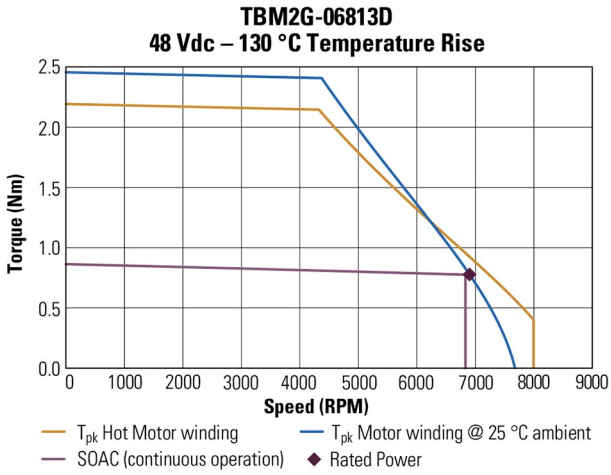




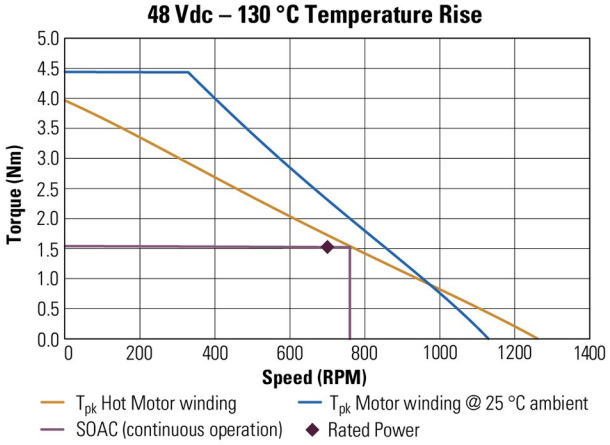




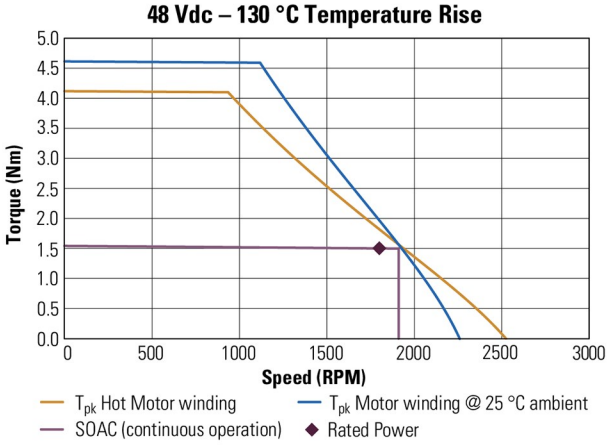




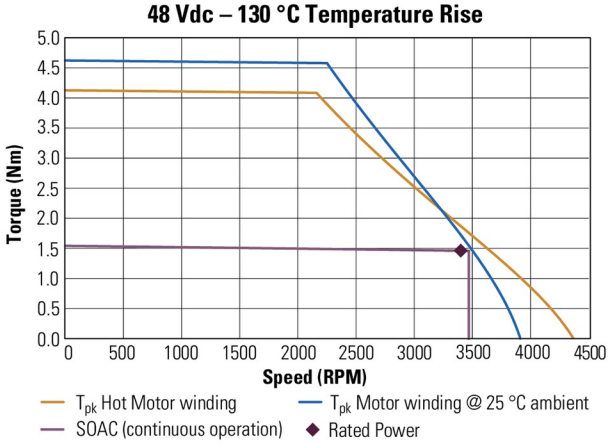
TBM2G-06826A
48 Vdc – 130 °C Temperature Rise



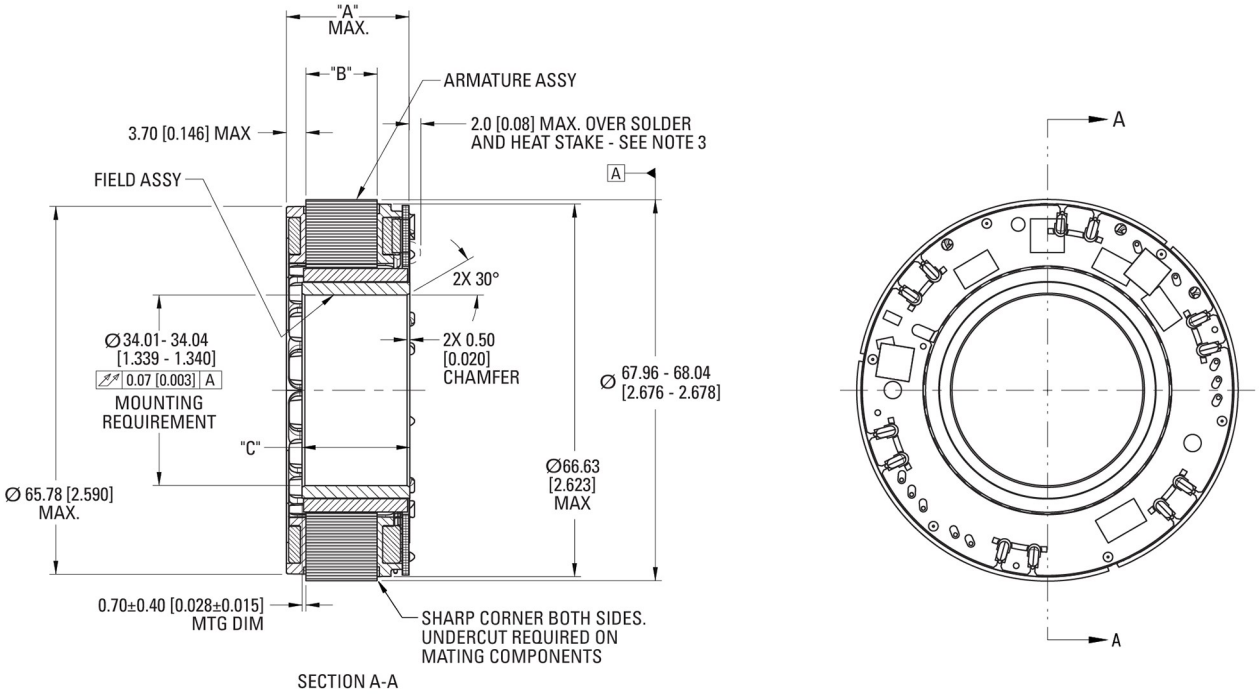
TBM2G-06826C
48 Vdc – 130 °C Temperature Rise



TBM2G-06826D
48 Vdc – 130 °C Temperature Rise



3.4.5 TBM2G-068 Frameless Motor Outline Drawing



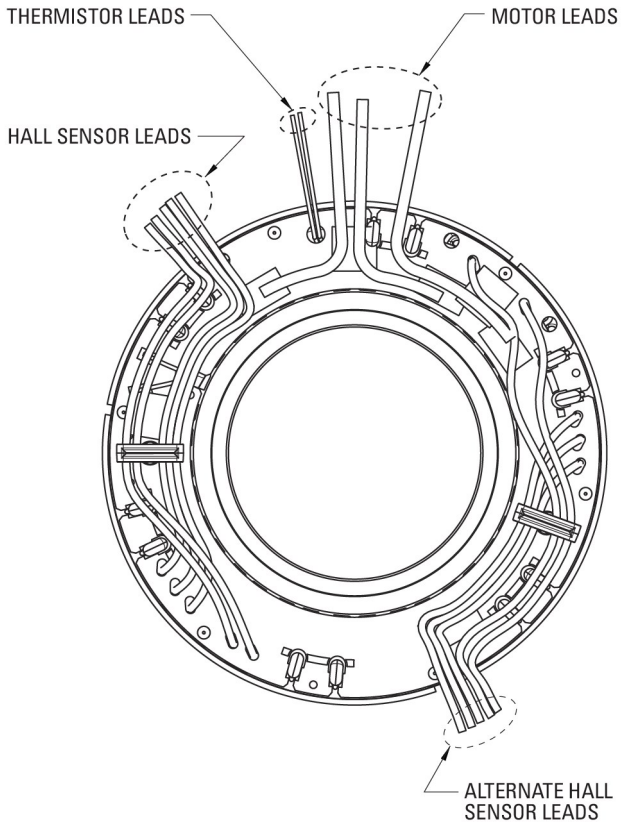
Stack Specific Dimensional Data

Part Number	"A" Max	"B" REF ±0.35 [0.014]	"C" ±0.08 [0.004]
TBM2G-06808-00	18.34 [0.722]	8.2 [0.323]	14.76 [0.581]
TBM2G-06813-00	22.84 [0.899]	12.70 [0.500]	19.26 [0.758]
TBM2G-06826-00	36.44 [1.435]	26.30 [1.035]	32.86 [1.294]

Notes:

1. All dimensions are in mm [inches] and are for reference only.
2. Motor supplied as two separate components: armature and sensor assembly and field assembly.
3. Customer must provide 0.25 [0.010] min. clearance from all solder and heat stakes.

3.4.6 TBM2G-068 Series Optional Lead Specifications



Motor Leads

#20 AWG, ETFE Coated, Per UL Style 10086
3 Leads, 0.5 m Length
1 - Red, 1 - White, 1 - Black
Minimum Motor Lead Bend Radius 7.37 [0.290]

Hall Sensor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
5 Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Thermistor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
2 White Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Connection Options

PN Lead Designation	Lead Length (Min)
A	0.5 m
N	No leads

Sensor Options

PN Lead Designation	Lead Length (Min)
H	Hall Sensor
N	No Device

Thermal Device Options

PN Lead Designation	Lead Length (Min)
A	PT1000
B	3x PTC Devices
N	No Device

3.5 TBM2G-076 Data & Drawings

3.5.1 TBM2G-07608 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	0.89	0.89	0.89
			lb-in	7.85	7.85	7.88
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	4.60	9.19	15.9
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	0.70	0.70	0.70
			lb-in	6.20	6.20	6.20
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	3.37	6.74	11.7
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	2.23	2.23	2.23
			lb-in	19.7	19.7	19.7
Peak Current (6)(8)		Ip	Arms	13.7	27.5	47.6
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.68	0.65	0.59
			lb-in	6.06	5.78	5.21
Rated Speed		Nrtd	rpm	800	2000	3900
Rated Power (speed) (2)(3)		Prtd	kW	0.057	0.137	0.240
			Hp	0.077	0.183	0.322
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	0.88	0.86	0.82
			lb-in	7.79	7.60	7.25
Rated Speed		Nrtd	rpm	600	1900	3800
Rated Power (speed) (1)(3)		Prtd	kW	0.055	0.171	0.326
			Hp	0.074	0.229	0.437
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.65	0.56	0.41
			lb-in	5.78	4.99	3.60
Rated Speed		Nrtd	rpm	2000	4500	7500
Rated Power (speed) (2)(3)		Prtd	kW	0.137	0.266	0.319
			Hp	0.183	0.358	0.428
48 V DC @ 155°C						

Parameters	Tol	Symbol	Units	A	C	D
Rated Torque (speed) (1)(3)		Trtd	Nm	0.86	0.80	0.70
			lb-in	7.60	7.11	6.19
Rated Speed		Nrtd	rpm	1900	4500	8000
Rated Power (speed) (1)(3)		Prtd	kW	0.171	0.378	0.586
			Hp	0.229	0.507	0.786
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.193	0.096	0.056
			lb-in/Arms	1.71	0.85	0.49
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.216	0.108	0.062
			lb-in/Arms	1.91	0.96	0.55
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	11.7	5.83	3.37
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	13.1	6.53	3.77
Motor Constant (5)	Nom	Km	Nm/√W	0.156	0.156	0.156
			lb-in/√W	1.38	1.38	1.38
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	1.27	0.318	0.106
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	0.90	0.22	0.07

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.441
		lb-in-s2	3.90E-04
Weight (7)	W	kg	0.236
		lb	0.520
Thermal resistance	Rthw-a	°C/W	2.15
Pole Pairs	PP		10
Heatsink Size	7.5" x 7" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	1.35" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.5.2 TBM2G-07613 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	1.23	1.23	1.23
			lb-in	10.9	10.9	10.9
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	4.37	8.74	15.1
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	0.93	0.93	0.93
			lb-in	8.25	8.25	8.25
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	3.08	6.15	10.7
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	3.43	3.42	3.42
			lb-in	30.3	30.3	30.3
Peak Current (6)(8)		Ip	Arms	13.1	26.1	45.2
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.92	0.88	0.82
			lb-in	8.11	7.82	7.22
Rated Speed		Nrtd	rpm	500	1300	2600
Rated Power (speed) (2)(3)		Prtd	kW	0.048	0.120	0.222
			Hp	0.064	0.161	0.298
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.23	1.20	1.16
			lb-in	10.85	10.65	10.27
Rated Speed		Nrtd	rpm	300	1200	2500
Rated Power (speed) (1)(3)		Prtd	kW	0.039	0.151	0.304
			Hp	0.052	0.203	0.407
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.88	0.79	0.58
			lb-in	7.82	7.00	5.10
Rated Speed		Nrtd	rpm	1300	3000	5700
Rated Power (speed) (2)(3)		Prtd	kW	0.120	0.248	0.344
			Hp	0.161	0.333	0.461

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.20	1.15	1.02
			lb-in	10.65	10.14	9.07
Rated Speed		Nrtd	rpm	1200	2900	5600
Rated Power (speed) (1)(3)		Prtd	kW	0.151	0.348	0.601
			Hp	0.203	0.466	0.806
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.281	0.141	0.081
			lb-in/Arms	2.49	1.25	0.72
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.315	0.158	0.091
			lb-in/Arms	2.79	1.39	0.81
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	17.0	8.51	4.91
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	19.1	9.53	5.50
Motor Constant (5)	Nom	Km	Nm/√W	0.201	2.01	0.201
			lb-in/√W	1.78	1.78	1.78
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	1.64	0.409	0.136
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	1.49	0.37	0.12

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.576
		lb-in-s2	5.10E-04
Weight (7)	W	kg	0.321
		lb	0.708
Thermal resistance	Rthw-a	°C/W	1.85
Pole Pairs	PP		10
Heatsink Size	7.5" x 7" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	1.52" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.5.3 TBM2G-07626 Frameless Motor Specifications

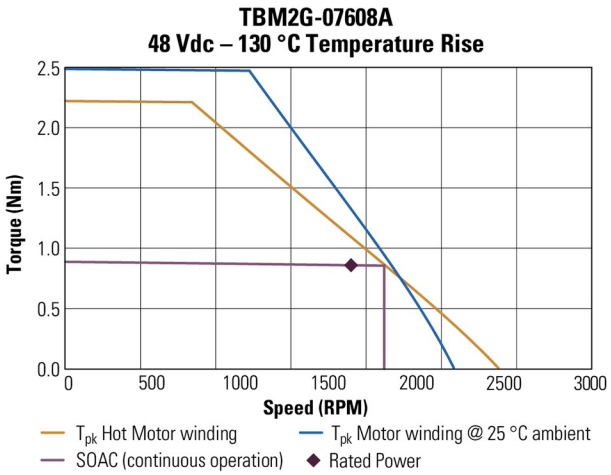
Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	2.06	2.06	2.06
			lb-in	18.2	18.2	18.2
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	3.82	7.64	13.2
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	1.60	1.60	1.60
			lb-in	14.2	14.2	14.2
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	2.75	5.51	9.54
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	5.56	5.66	5.67
			lb-in	49.2	50.1	50.2
Peak Current (6)(8)		Ip	Arms	11.2	22.8	39.6
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.59	1.55	1.48
			lb-in	14.0	13.7	13.1
Rated Speed		Nrtd	rpm	200	600	1300
Rated Power (speed) (2)(3)		Prtd	kW	0.033	0.098	0.202
			Hp	0.045	0.131	0.270
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	2.06	2.04	1.99
			lb-in	18.2	18.0	17.6
Rated Speed		Nrtd	rpm	100	500	1200
Rated Power (speed) (1)(3)		Prtd	kW	0.022	0.107	0.250
			Hp	0.029	0.143	0.336
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.55	1.46	1.24
			lb-in	13.7	12.9	11.1
Rated Speed		Nrtd	rpm	600	1500	2800
Rated Power (speed) (2)(3)		Prtd	kW	0.098	0.229	0.369
			Hp	0.131	0.324	0.494

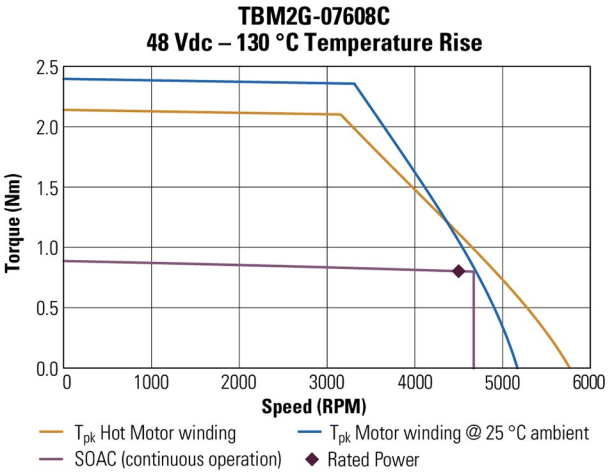
Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	2.04	1.98	1.85
			lb-in	18.0	17.5	16.4
Rated Speed		Nrtd	rpm	500	1400	2800
Rated Power (speed) (1)(3)		Prtd	kW	0.107	0.290	0.544
			Hp	0.143	0.389	0.729
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.539	0.270	0.156
			lb-in/Arms	4.77	2.39	1.38
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.604	0.302	0.174
			lb-in/Arms	5.35	2.67	1.54
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	32.6	16.3	9.41
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	36.5	18.3	10.5
Motor Constant (5)	Nom	Km	Nm/√W	0.324	0.324	0.324
			lb-in/√W	2.87	2.87	2.87
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	2.32	0.579	0.193
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	3.25	0.82	0.27

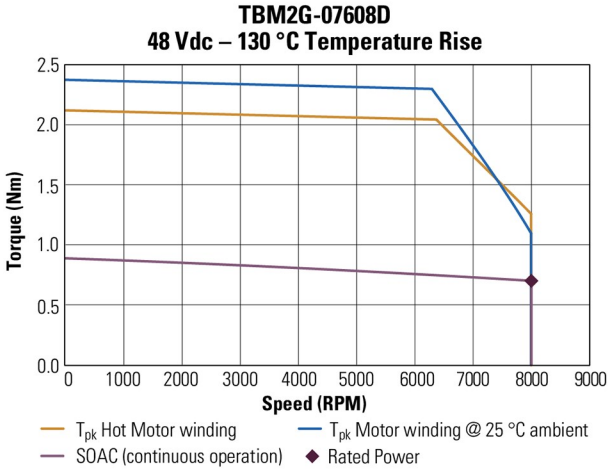
Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.972
		lb-in-s2	8.60E-04
Weight (7)	W	kg	0.596
		lb	1.314
Thermal resistance	Rthw-a	°C/W	1.71
Pole Pairs	PP		10
Heatsink Size	7.5" x 7" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	2.05" x 0.25" Aluminum Housing		

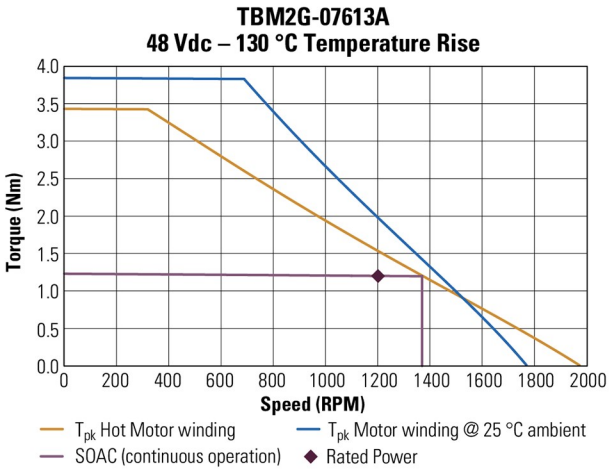
1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C , at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

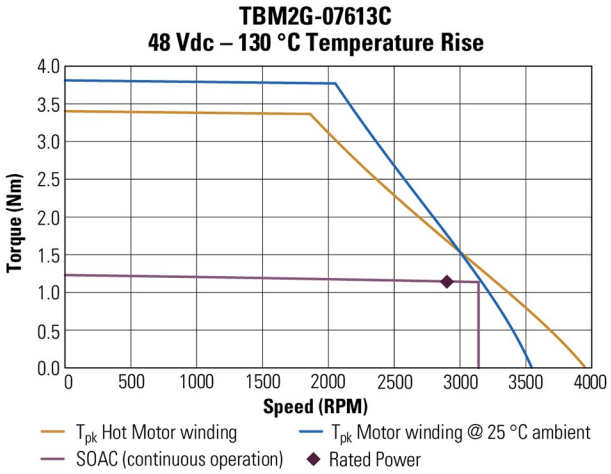
3.5.4 TBM2G-076 Frameless Motor Performance Curves

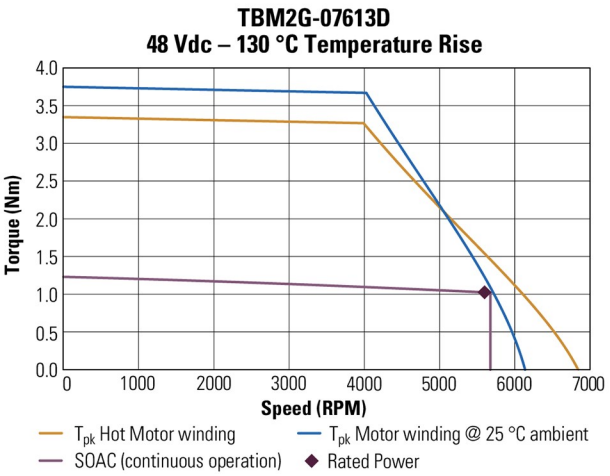


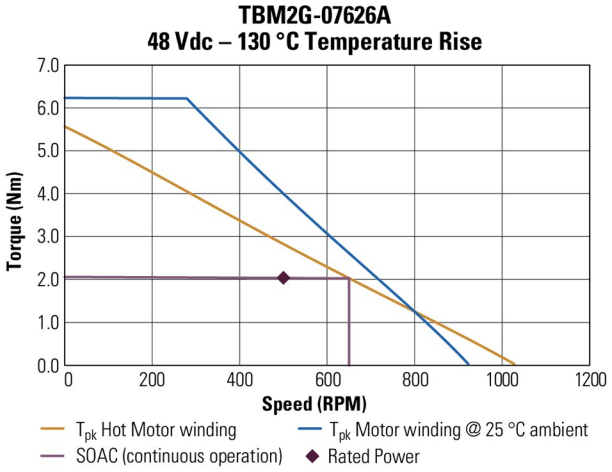


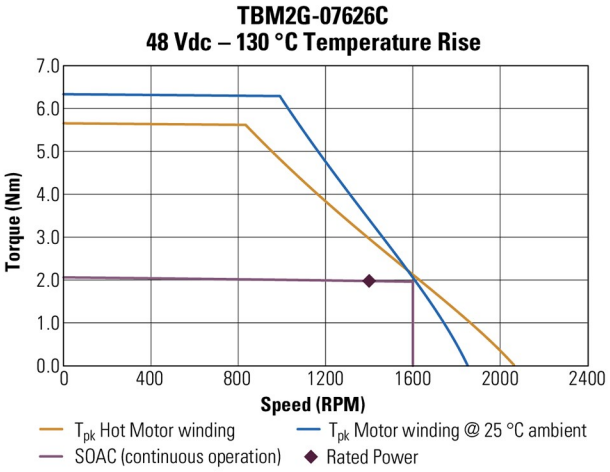


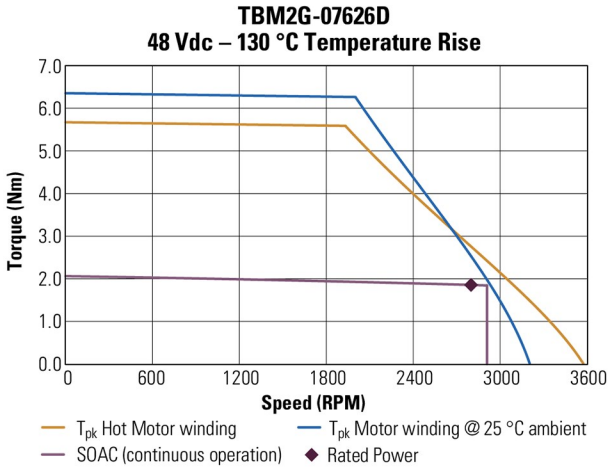




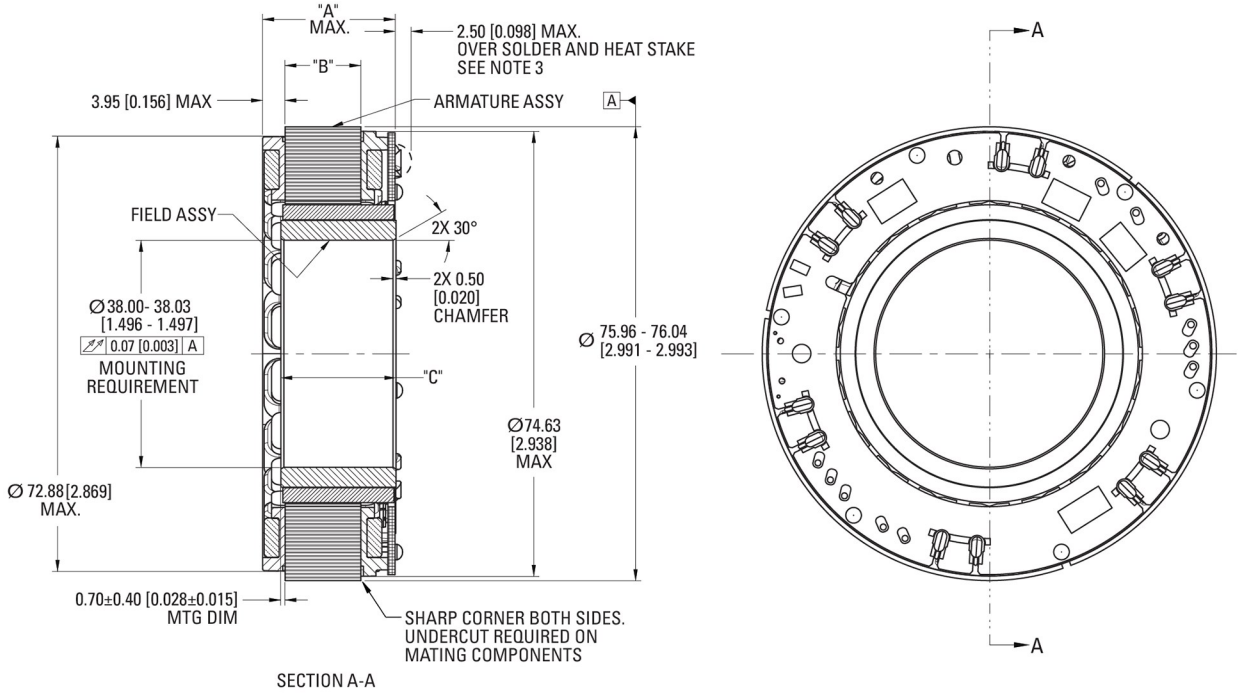



TBM2G-07626A
48 Vdc – 130 °C Temperature Rise
Torque (Nm)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
200
400
600
800
1000
1200
Speed (RPM)
Tpk Hot Motor winding
Tpk Motor winding @ 25 °C ambient
SOAC (continuous operation)
Rated Power


TBM2G-07626C
48 Vdc – 130 °C Temperature Rise
Torque (Nm)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
400
800
1200
1600
2000
2400
Speed (RPM)
Tpk Hot Motor winding
Tpk Motor winding @ 25 °C ambient
SOAC (continuous operation)
Rated Power


TBM2G-07626D
48 Vdc – 130 °C Temperature Rise
Torque (Nm)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
600
1200
1800
2400
3000
3600
Speed (RPM)
Tpk Hot Motor winding
Tpk Motor winding @ 25 °C ambient
SOAC (continuous operation)
Rated Power

3.5.5 TBM2G-076 Frameless Motor Outline Drawing



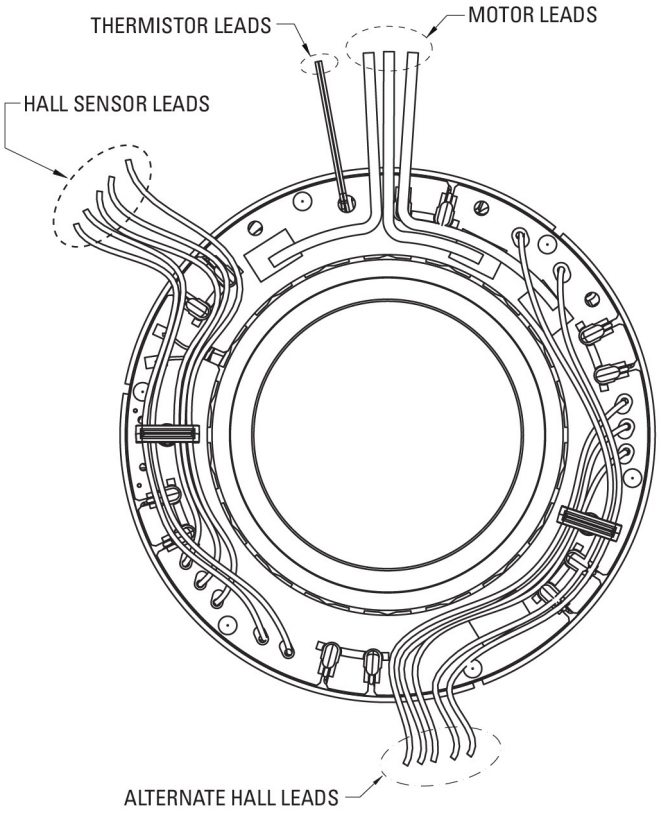
Stack Specific Dimensional Data

Part Number	"A" Max	"B" REF ±0.35 [0.014]	"C" ±0.08 [0.004]
TBM2G-07608-00	18.59 [0.732]	8.2 [0.323]	14.76 [0.581]
TBM2G-07613-00	23.09 [0.909]	12.70 [0.500]	19.26 [0.758]
TBM2G-07626-00	36.69 [1.444]	26.30 [1.035]	32.86 [1.294]

Notes:

1. All dimensions are in mm [inches] and are for reference only.
2. Motor supplied as two separate components: armature and sensor assembly and field assembly.
3. Customer must provide 0.25 [0.010] min. clearance from all solder and heat stakes.

3.5.6 TBM2G-076 Series Optional Lead Specifications



Motor Leads

#18 AWG, ETFE Coated, Per UL Style 10086
3 Leads, 0.5 m Length
1 - Red, 1 - White, 1 - Black
Minimum Motor Lead Bend Radius 8.51 [0.335]

Hall Sensor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
5 Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Thermistor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
2 White Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Connection Options

PN Lead Designation	Lead Length (Min)
A	0.5 m
N	No leads

Sensor Options

PN Lead Designation	Lead Length (Min)
H	Hall Sensor
N	No Device

Thermal Device Options

PN Lead Designation	Lead Length (Min)
A	PT1000
B	3x PTC Devices
N	No Device

3.6 TBM2G-085 Data & Drawings

3.6.1 TBM2G-08508 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	1.21	1.21	1.21
			lb-in	10.7	10.7	10.7
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	5.90	11.8	20.4
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	0.96	0.96	0.96
			lb-in	8.50	8.50	8.50
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	4.37	8.74	15.1
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	3.17	3.17	3.17
			lb-in	28.0	28.1	28.1
Peak Current (6)(8)		Ip	Arms	17.6	35.3	61.1
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.93	0.89	0.79
			lb-in	8.25	7.83	7.00
Rated Speed		Nrtd	rpm	800	1900	3500
Rated Power (speed) (2)(3)		Prtd	kW	0.078	0.176	0.290
			Hp	0.105	0.236	0.388
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.20	1.17	1.12
			lb-in	10.6	10.4	9.88
Rated Speed		Nrtd	rpm	600	1700	3400
Rated Power (speed) (1)(3)		Prtd	kW	0.076	0.209	0.397
			Hp	0.101	0.280	0.533
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	0.89	0.74	0.58
			lb-in	7.83	6.55	5.09
Rated Speed		Nrtd	rpm	1900	4200	5900
Rated Power (speed) (2)(3)		Prtd	kW	0.176	0.325	0.355
			Hp	0.236	0.436	0.477

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.17	1.09	0.91
			lb-in	10.4	9.66	808
Rated Speed		Nrtd	rpm	1700	4000	7500
Rated Power (speed) (1)(3)		Prtd	kW	0.209	0.457	0.717
			Hp	0.280	0.613	0.962
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.206	0.103	0.059
			lb-in/Arms	1.82	0.91	0.53
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.230	0.115	0.066
			lb-in/Arms	2.04	1.02	0.59
Hot Back EMF Constant (1)	+/- 10%	Ke	Vrms/krpm	12.4	6.21	3.59
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	13.9	6.96	4.02
Motor Constant (5)	Nom	Km	Nm/√W	0.203	0.203	0.203
			lb-in/√W	1.79	1.79	1.79
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	0.860	0.215	0.072
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	1.13	0.28	0.09

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.593
		lb-in-s2	5.25E-04
Weight (7)	W	kg	0.295
		lb	0.650
Thermal resistance	Rthw-a	°C/W	1.93
Pole Pairs	PP		10
Heatsink Size	7.5" x 7" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	1.36" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.6.2 TBM2G-08513 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	1.65	1.65	1.65
			lb-in	14.6	14.6	14.6
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	5.71	11.4	19.8
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	1.33	1.33	1.33
			lb-in	11.7	11.7	11.7
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	4.23	8.45	14.6
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	4.45	4.44	4.44
			lb-in	39.4	39.3	39.3
Peak Current (6)(8)		Ip	Arms	17.1	34.1	59.1
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.30	1.25	1.15
			lb-in	11.5	11.0	10.16
Rated Speed		Nrtd	rpm	500	1300	2400
Rated Power (speed) (2)(3)		Prtd	kW	0.068	0.170	0.208
			Hp	0.091	0.228	0.387
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.64	1.61	1.54
			lb-in	14.5	14.2	13.7
Rated Speed		Nrtd	rpm	400	1200	2400
Rated Power (speed) (1)(3)		Prtd	kW	0.069	0.202	0.388
			Hp	0.092	0.271	0.520
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.25	1.09	0.79
			lb-in	11.0	9.67	7.03
Rated Speed		Nrtd	rpm	1300	2900	4900
Rated Power (speed) (2)(3)		Prtd	kW	0.170	0.332	0.408
			Hp	0.228	0.455	0.547

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.61	1.52	1.32
			lb-in	14.2	13.4	11.7
Rated Speed		Nrtd	rpm	1200	2800	5300
Rated Power (speed) (1)(3)		Prtd	kW	0.202	0.445	0.734
			Hp	0.271	0.597	0.985
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.294	0.147	0.085
			lb-in/Arms	2.60	1.30	0.75
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.330	0.165	0.095
			lb-in/Arms	2.92	1.46	0.84
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	17.8	8.89	5.13
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	19.9	9.96	5.75
Motor Constant (5)	Nom	Km	Nm/√W	0.271	0.271	0.271
			lb-in/√W	2.40	2.40	2.40
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	0.984	0.246	0.082
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	1.52	0.38	0.13

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.763
		lb-in-s2	6.75E-04
Weight (7)	W	kg	0.403
		lb	0.888
Thermal resistance	Rthw-a	°C/W	1.80
Pole Pairs	PP		10
Heatsink Size	7.5" x 7" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	1.54" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.6.3 TBM2G-08526 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	2.69	2.69	2.69
			lb-in	23.8	23.8	23.8
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	4.68	9.36	16.2
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	2.14	2.14	2.14
			lb-in	19.0	19.0	19.0
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	3.49	6.98	12.1
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	7.01	6.01	6.01
			lb-in	62.0	62.0	62.0
Peak Current (6)(8)		Ip	Arms	14.0	28.0	48.5
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	2.12	2.07	1.97
			lb-in	18.8	18.3	17.4
Rated Speed		Nrtd	rpm	200	600	1200
Rated Power (speed) (2)(3)		Prtd	kW	0.044	0.130	0.247
			Hp	0.060	0.174	0.332
24 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	2.69	2.65	2.60
			lb-in	23.8	23.5	23.0
Rated Speed		Nrtd	rpm	100	500	1100
Rated Power (speed) (1)(3)		Prtd	kW	0.028	0.139	0.299
			Hp	0.038	0.186	0.401
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	2.07	1.93	1.58
			lb-in	18.3	17.1	14.0
Rated Speed		Nrtd	rpm	600	1400	2700
Rated Power (speed) (2)(3)		Prtd	kW	0.130	0.283	0.446
			Hp	0.174	0.379	0.599

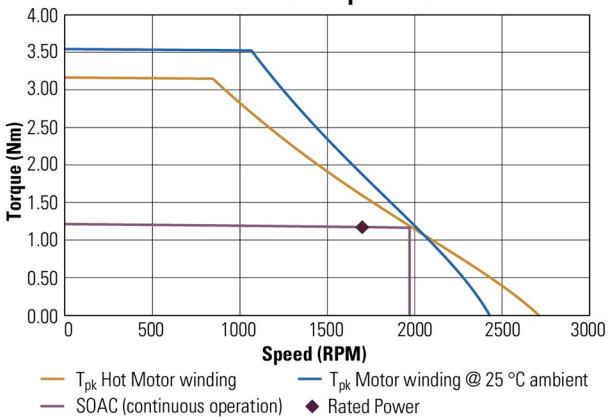
Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	2.65	2.56	2.39
			lb-in	23.5	22.7	21.1
Rated Speed		Nrtd	rpm	500	1400	2600
Rated Power (speed) (1)(3)		Prtd	kW	0.139	0.376	0.650
			Hp	0.186	0.504	0.871
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.575	0.288	0.166
			lb-in/Arms	5.09	2.55	1.47
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.644	0.322	0.186
			lb-in/Arms	5.70	2.85	1.65
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	34.8	17.4	10.0
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	39.0	19.5	11.2
Motor Constant (5)	Nom	Km	Nm/√W	0.419	0.419	0.419
			lb-in/√W	3.70	3.70	3.70
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	1.58	0.395	0.132
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	2.68	0.67	0.22

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	1.27
		lb-in-s2	1.12E-03
Weight (7)	W	kg	0.723
		lb	1.594
Thermal resistance	Rthw-a	°C/W	1.67
Pole Pairs	PP		10
Heatsink Size	7.5" x 7" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	2.06" x 0.25" Aluminum Housing		

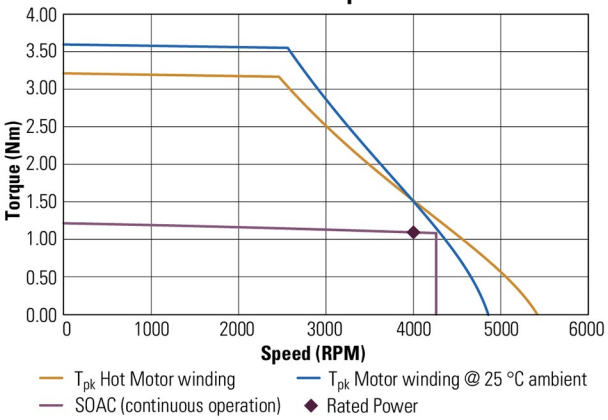
1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.6.4 TBM2G-085 Frameless Motor Performance Curves

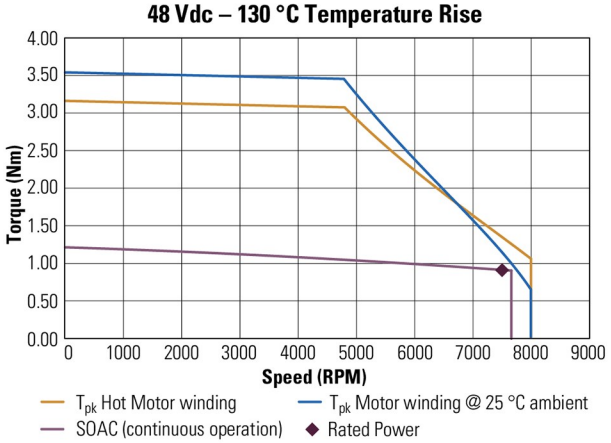
TBM2G-08508A
48 Vdc – 130 °C Temperature Rise



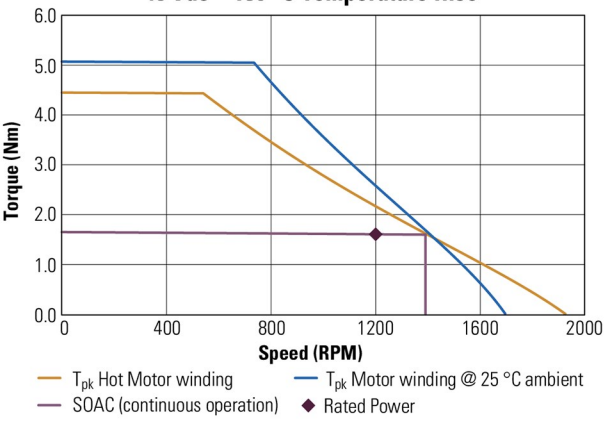
TBM2G-08508C
48 Vdc – 130 °C Temperature Rise



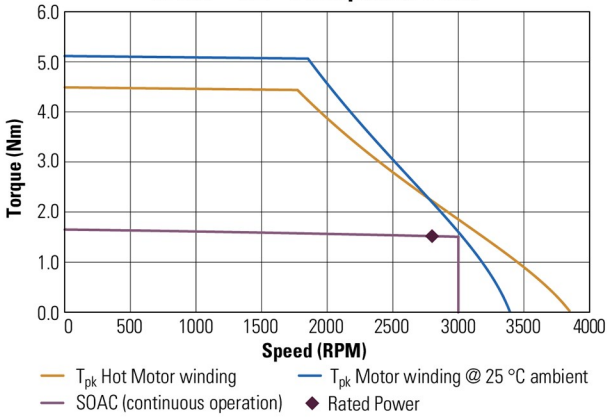
TBM2G-08508D
48 Vdc – 130 °C Temperature Rise



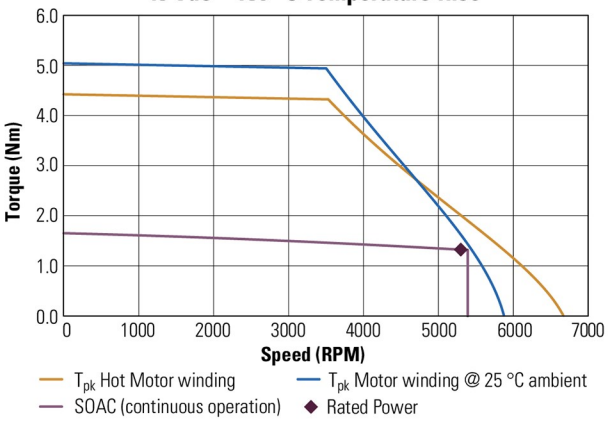
TBM2G-08513A
48 Vdc – 130 °C Temperature Rise



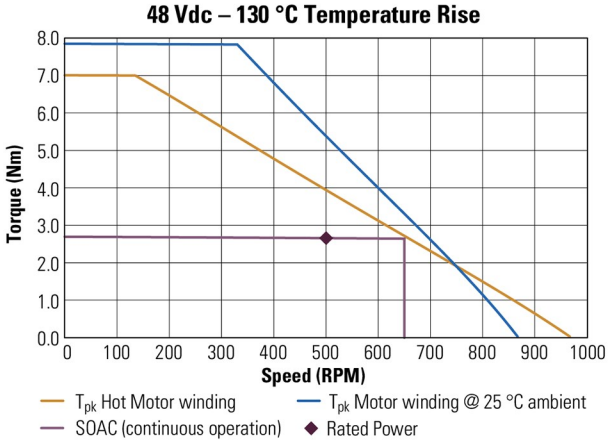
TBM2G-08513C
48 Vdc – 130 °C Temperature Rise



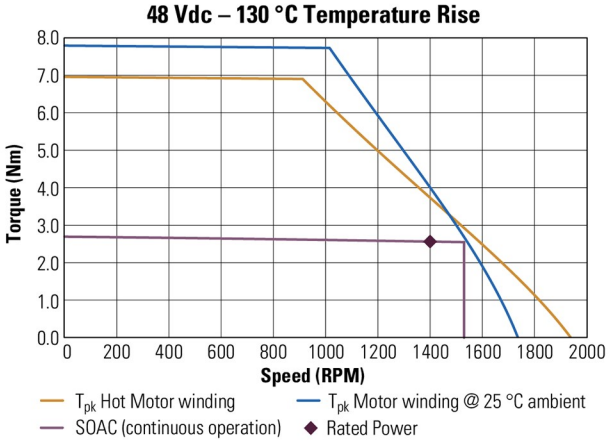
TBM2G-08513D
48 Vdc – 130 °C Temperature Rise



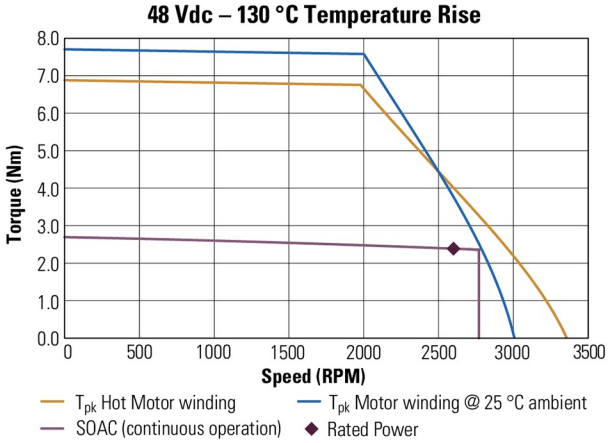
TBM2G-08526A
48 Vdc – 130 °C Temperature Rise



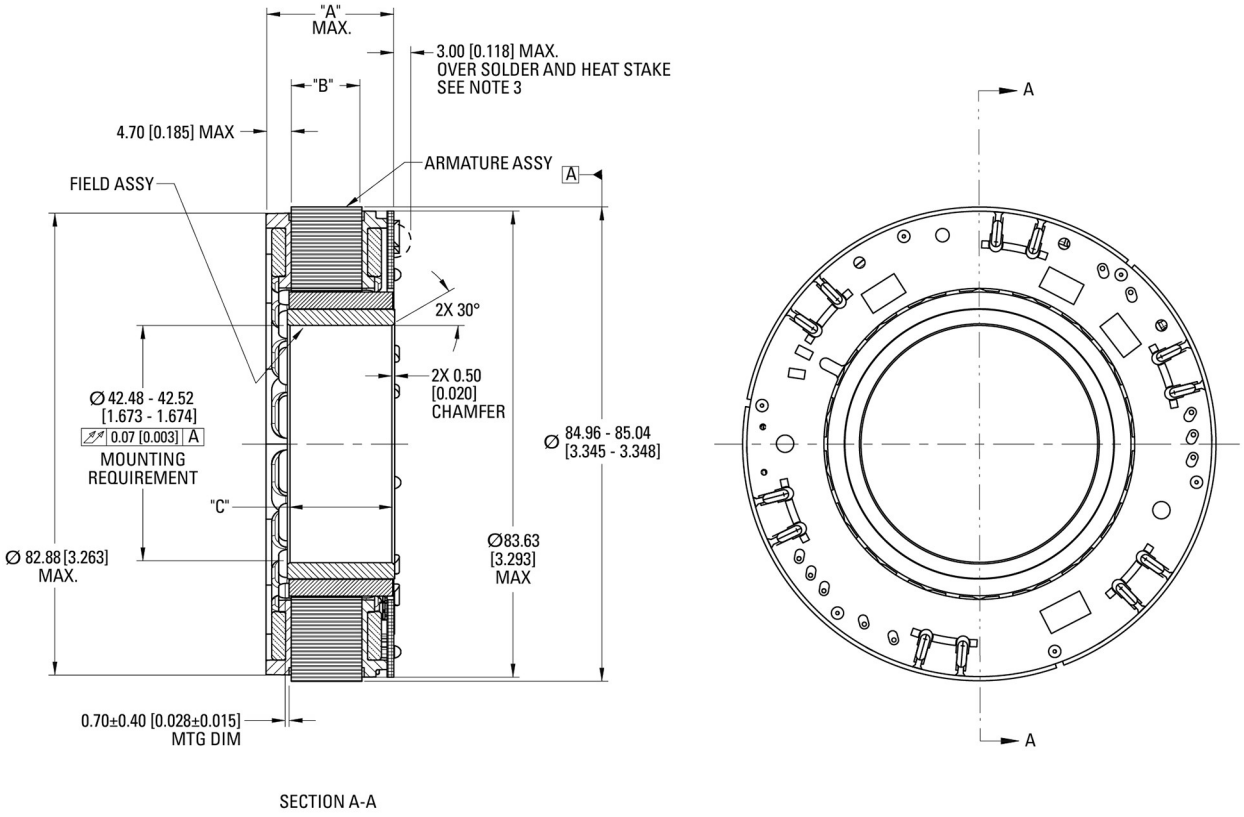
TBM2G-08526C
48 Vdc – 130 °C Temperature Rise



TBM2G-08526D
48 Vdc – 130 °C Temperature Rise



3.6.5 TBM2G-085 Frameless Motor Outline Drawing



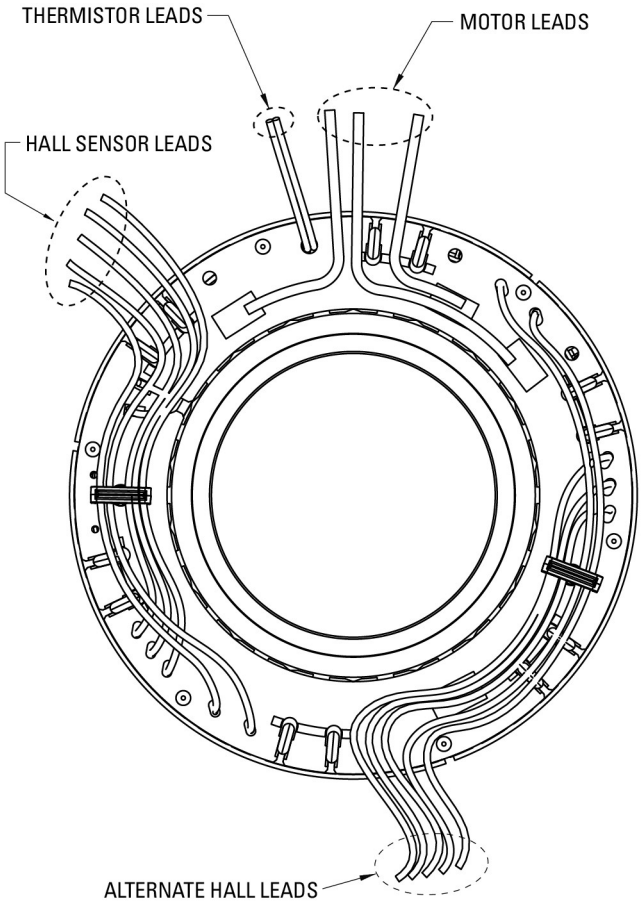
Stack Specific Dimensional Data

Part Number	"A" Max	"B" REF ±0.35 [0.014]	"C" ±0.08 [0.004]
TBM2G-08508-00	19.34 [0.761]	8.2 [0.323]	14.76 [0.581]
TBM2G-08513-00	23.84 [0.939]	12.70 [0.500]	19.26 [0.758]
TBM2G-08526-00	37.44 [1.474]	26.30 [1.035]	32.86 [1.294]

Notes:

1. All dimensions are in mm [inches] and are for reference only.
2. Motor supplied as two separate components: armature and sensor assembly and field assembly.
3. Customer must provide 0.25 [0.010] min. clearance from all solder and heat stakes.

3.6.6 TBM2G-085 Series Optional Lead Specifications



Motor Leads

#16 AWG, ETFE Coated, Per UL Style 10086
3 Leads, 0.5 m Length
1 - Red, 1 - White, 1 - Black
Minimum Motor Lead Bend Radius 9.91 [0.390]

Hall Sensor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
5 Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Thermistor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
2 White Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Connection Options

PN Lead Designation	Lead Length (Min)
A	0.5 m
N	No leads

Sensor Options

PN Lead Designation	Lead Length (Min)
H	Hall Sensor
N	No Device

Thermal Device Options

PN Lead Designation	Lead Length (Min)
A	PT1000
B	3x PTC Devices
N	No Device

3.7 TBM2G-094 Data & Drawings

3.7.1 TBM2G-09408 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	1.58	1.58	1.58
			lb-in	14.0	14.0	14.0
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	8.10	16.2	28.0
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	1.20	1.20	1.20
			lb-in	10.6	10.6	10.6
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	5.76	11.5	19.9
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	3.92	3.92	3.92
			lb-in	34.7	34.7	34.7
Peak Current (6)(8)		Ip	Arms	24.2	48.4	83.8
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.17	1.09	0.88
			lb-in	10.3	9.64	7.75
Rated Speed		Nrtd	rpm	900	2100	3900
Rated Power (speed) (2)(3)		Prtd	kW	0.110	0.240	0.357
			Hp	0.148	0.321	0.479
24 V DC @ 155°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.57	1.53	1.44
			lb-in	13.9	13.5	12.7
Rated Speed		Nrtd	rpm	800	2000	3800
Rated Power (speed) (2)(3)		Prtd	kW	0.131	0.320	0.571
			Hp	0.176	0.429	0.766
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.09	0.77	0.77
			lb-in	9.64	6.80	6.79
Rated Speed		Nrtd	rpm	2100	4500	4100
Rated Power (speed) (2)(3)		Prtd	kW	0.240	0.362	0.329
			Hp	0.321	0.485	0.442

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.53	1.39	1.03
			lb-in	13.5	12.3	9.08
Rated Speed		Nrtd	rpm	2000	4400	8000
Rated Power (speed) (1)(3)		Prtd	kW	0.320	0.643	0.860
			Hp	0.429	0.862	1.153
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.193	0.097	0.056
			lb-in/Arms	1.71	0.86	0.49
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.217	0.108	0.063
			lb-in/Arms	1.92	0.96	0.55
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	11.7	5.85	3.38
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	13.1	6.55	3.78
Motor Constant (5)	Nom	Km	Nm/√W	0.263	0.263	0.263
			lb-in/√W	2.33	2.33	2.33
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	0.452	0.113	0.038
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	0.70	0.18	0.06

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	0.861
		lb-in-s2	7.62E-04
Weight (7)	W	kg	0.374
		lb	0.825
Thermal resistance	Rthw-a	°C/W	1.95
Pole Pairs	PP		10
Heatsink Size	10" x 10" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	1.34" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.7.2 TBM2G-09413 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	2.05	2.01	2.05
			lb-in	18.1	17.8	18.1
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	7.56	14.8	26.1
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	1.56	1.53	1.56
			lb-in	13.8	13.6	13.8
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	5.40	10.6	18.7
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	5.06	4.96	5.04
			lb-in	44.7	43.9	44.6
Peak Current (6)(8)		Ip	Arms	22.6	44.3	78.1
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.53	1.41	1.22
			lb-in	13.5	12.5	10.8
Rated Speed		Nrtd	rpm	600	1500	2700
Rated Power (speed) (2)(3)		Prtd	kW	0.096	0.221	0.345
			Hp	0.129	0.297	0.463
24 V DC @ 155°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	2.03	1.95	1.88
			lb-in	18.0	17.3	16.6
Rated Speed		Nrtd	rpm	500	1400	2700
Rated Power (speed) (2)(3)		Prtd	kW	0.106	0.286	0.533
			Hp	0.143	0.383	0.714
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.44	1.07	1.01
			lb-in	12.7	9.51	8.92
Rated Speed		Nrtd	rpm	1500	3200	3300
Rated Power (speed) (2)(3)		Prtd	kW	0.226	0.360	0.348
			Hp	0.303	0.483	0.467

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.99	1.81	1.41
			lb-in	17.6	16.0	12.5
Rated Speed		Nrtd	rpm	1400	3100	5900
Rated Power (speed) (1)(3)		Prtd	kW	0.292	0.587	0.874
			Hp	0.391	0.788	1.172
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.269	0.134	0.078
			lb-in/Arms	2.38	1.19	0.69
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.301	0.151	0.087
			lb-in/Arms	2.66	1.33	0.77
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	16.3	8.13	4.69
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	18.2	9.10	5.25
Motor Constant (5)	Nom	Km	Nm/√W	0.331	0.325	0.331
			lb-in/√W	2.93	2.88	2.93
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	0.550	0.143	0.046
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	1.07	0.27	0.09

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	1.120
		lb-in-s2	9.91E-04
Weight (7)	W	kg	0.510
		lb	1.124
Thermal resistance	Rthw-a	°C/W	1.84
Pole Pairs	PP		10
Heatsink Size	10" x 10" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	1.52" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.7.3 TBM2G-09426 Frameless Motor Specifications

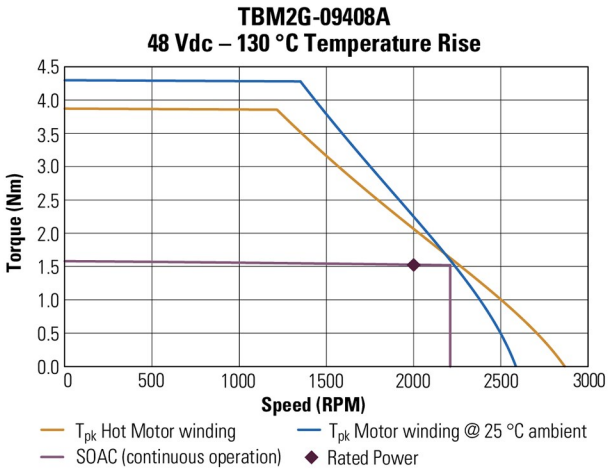
Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	3.67	3.67	3.67
			lb-in	32.5	32.5	32.5
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	6.60	13.2	22.9
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	2.75	2.75	2.75
			lb-in	24.4	24.4	24.4
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	4.72	9.43	16.3
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	8.98	9.01	8.99
			lb-in	79.5	79.7	79.6
Peak Current (6)(8)		Ip	Arms	19.7	39.5	68.3
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	2.73	2.64	2.46
			lb-in	24.2	23.4	21.8
Rated Speed		Nrtd	rpm	200	700	1300
Rated Power (speed) (2)(3)		Prtd	kW	0.057	0.194	0.355
			Hp	0.077	0.260	0.449
24 V DC @ 155°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	3.66	3.62	3.54
			lb-in	32.4	32.0	31.3
Rated Speed		Nrtd	rpm	200	600	1200
Rated Power (speed) (2)(3)		Prtd	kW	0.077	0.227	0.444
			Hp	0.103	0.305	0.596
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	2.64	2.38	1.83
			lb-in	23.4	21.0	16.2
Rated Speed		Nrtd	rpm	700	1500	2400
Rated Power (speed) (2)(3)		Prtd	kW	0.194	0.373	0.460
			Hp	0.260	0.500	0.617

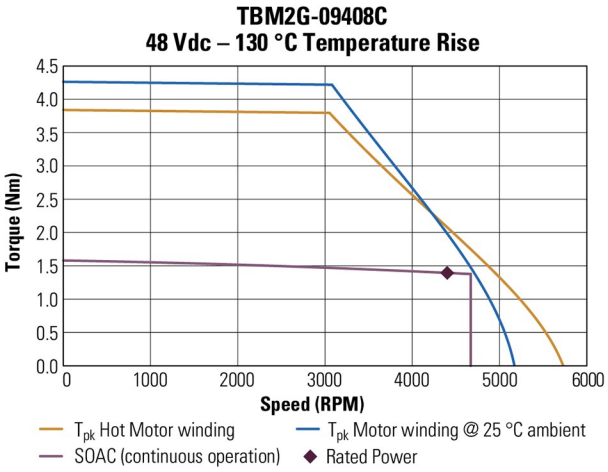
Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	3.62	3.48	3.17
			lb-in	32.0	30.8	28.1
Rated Speed		Nrtd	rpm	600	1500	2700
Rated Power (speed) (1)(3)		Prtd	kW	0.227	0.547	0.897
			Hp	0.305	0.734	1.203
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.546	0.273	0.158
			lb-in/Arms	4.83	2.42	1.40
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.612	0.306	0.177
			lb-in/Arms	5.41	2.71	1.56
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	33.0	16.5	9.53
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	37.0	18.5	10.7
Motor Constant (5)	Nom	Km	Nm/√W	0.528	0.528	0.528
			lb-in/√W	4.67	4.67	4.67
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	0.896	0.224	0.075
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	2.17	0.54	0.18

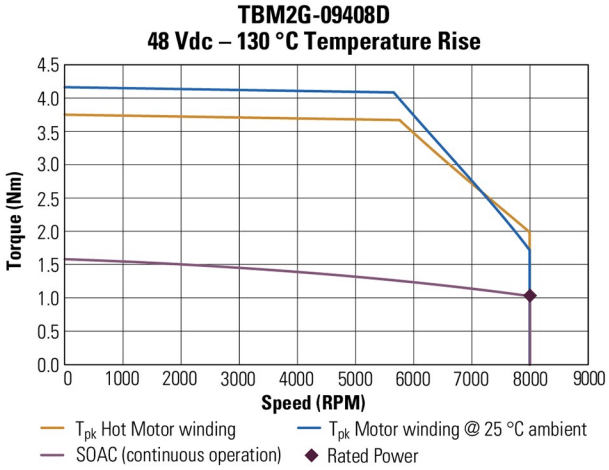
Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	1.900
		lb-in-s2	1.68E-03
Weight (7)	W	kg	0.915
		lb	2.017
Thermal resistance	Rthw-a	°C/W	1.48
Pole Pairs	PP		10
Heatsink Size	10" x 10" x 0.375" Aluminum Plate		
Housing Geometry [L x T]	2.05" x 0.25" Aluminum Housing		

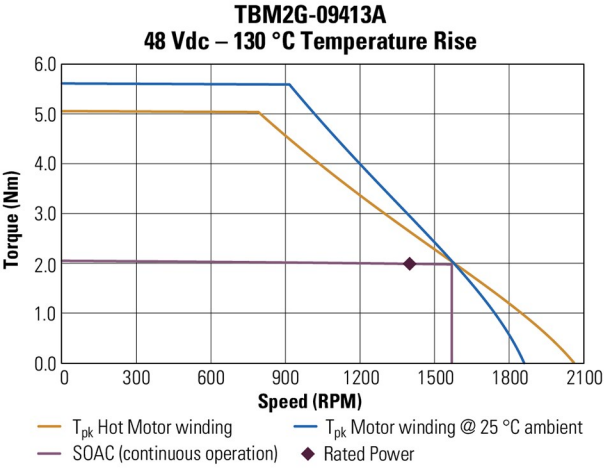
1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

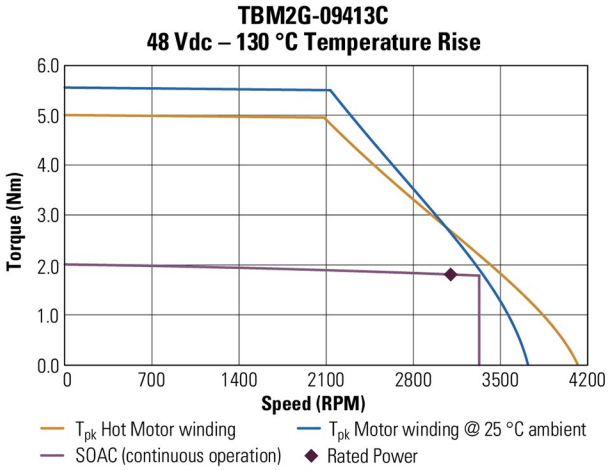
3.7.4 TBM2G-094 Frameless Motor Performance Curves

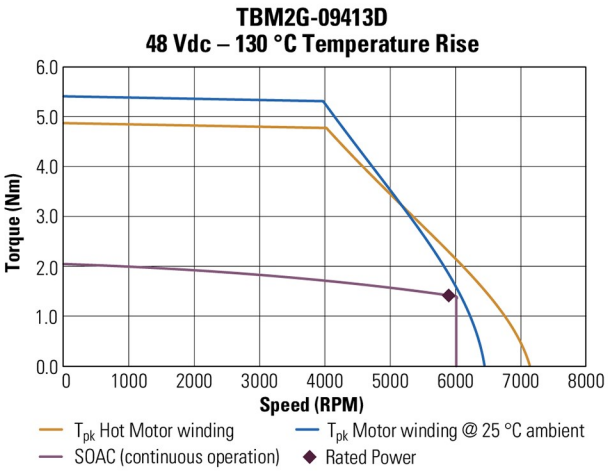




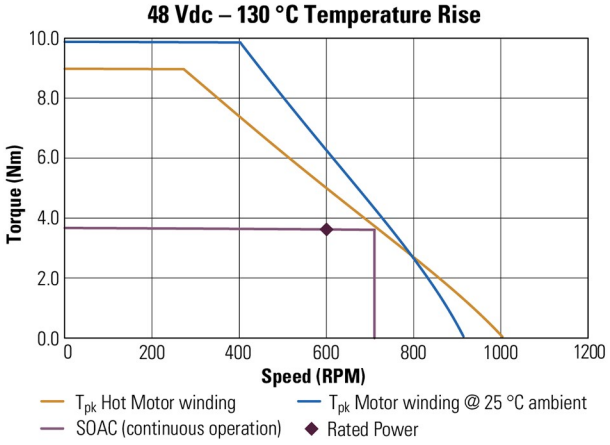




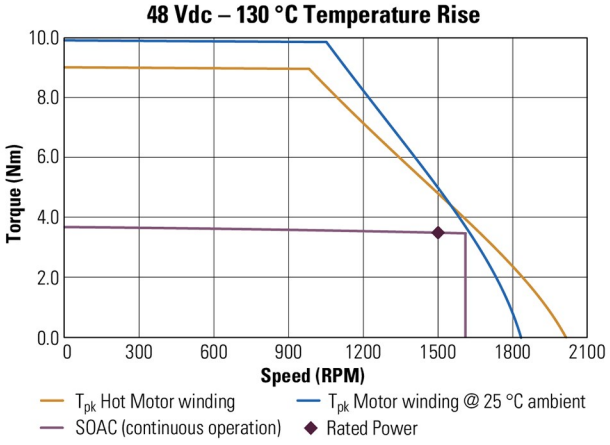




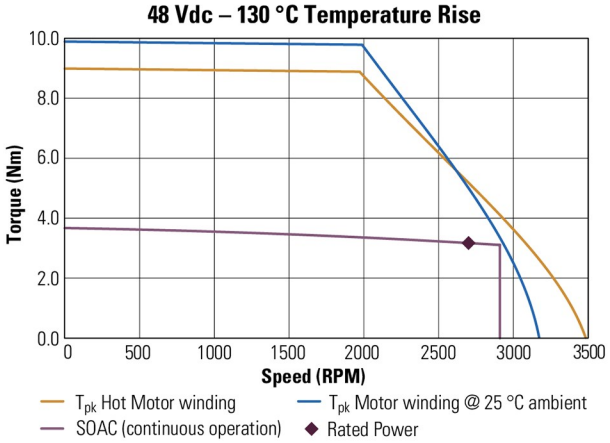
TBM2G-09426A
48 Vdc – 130 °C Temperature Rise



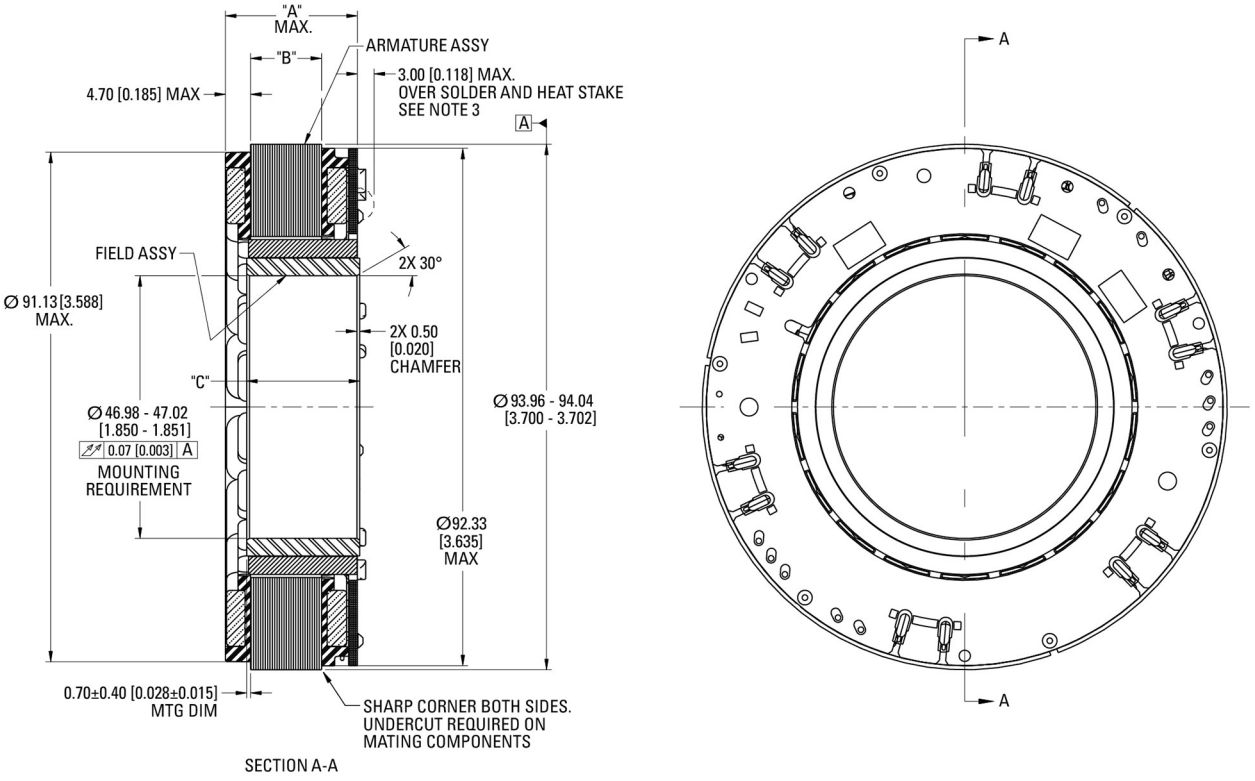
TBM2G-09426C
48 Vdc – 130 °C Temperature Rise



TBM2G-09426D
48 Vdc – 130 °C Temperature Rise



3.7.5 TBM2G-094 Frameless Motor Outline Drawing



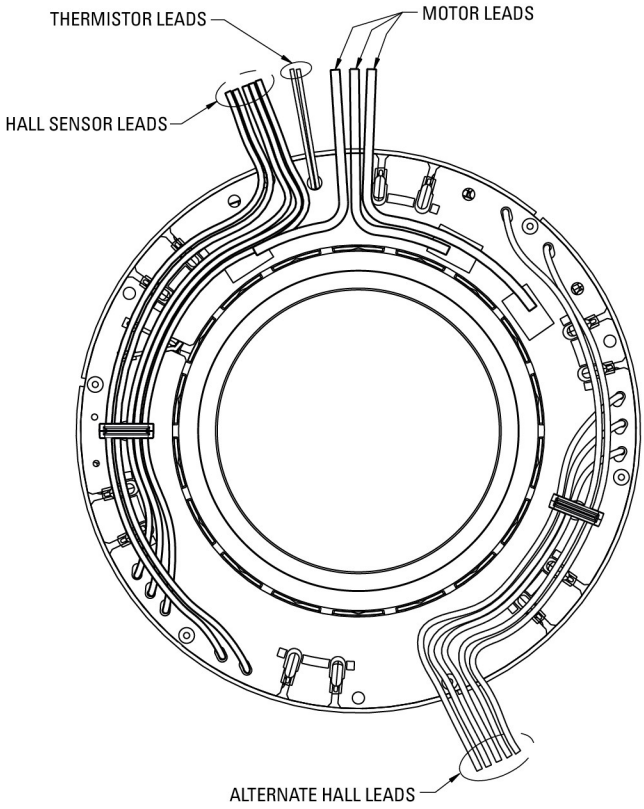
Stack Specific Dimensional Data

MODEL	"A" MAX.	"B" REF ±0.35 [0.014]	"C" ±0.08 [0.004]
TBM2G-09408	19.69 [0.775]	8.2 [0.323]	15.73 [0.619]
TBM2G-09413	24.19 [0.952]	12.70 [0.500]	20.23 [0.797]
TBM2G-09426	37.79 [1.488]	26.30 [1.035]	33.33 [1.312]

Notes:

1. All dimensions are in mm [inches] and are for reference only.
2. Motor supplied as two separate components: armature and sensor assembly and field assembly.
3. Customer must provide 0.25 [0.010] min. clearance from all solder and heat stakes.

3.7.6 TBM2G-094 Series Optional Lead Specifications



Motor Leads

#14 AWG, ETFE Coated, Per UL Style 10086
3 Leads, 0.5 m Length
1 - Red, 1 - White, 1 - Black
Minimum Motor Lead Bend Radius 11.3 [0.445]

Hall Sensor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
5 Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Thermistor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
2 White Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Connection Options

PN Lead Designation	Lead Length (Min)
A	0.5 m
N	No leads

Sensor Options

PN Lead Designation	Lead Length (Min)
H	Hall Sensor
N	No Device

Thermal Device Options

PN Lead Designation	Lead Length (Min)
A	PT1000
B	3x PTC Devices
N	No Device

3.8 TBM2G-115 Data & Drawings

3.8.1 TBM2G-11508 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	1.90	1.90	1.90
			lb-in	16.8	16.8	16.8
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	4.57	22.8	39.6
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	1.51	1.51	1.51
			lb-in	13.4	13.4	13.4
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	3.40	17.0	29.4
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	4.70	4.69	4.68
			lb-in	41.6	41.5	41.4
Peak Current (6)(8)		Ip	Arms	13.7	68.3	118.2
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.50	1.22	0.97
			lb-in	13.3	10.8	8.58
Rated Speed		Nrtd	rpm	300	2500	3400
Rated Power (speed) (2)(3)		Prtd	kW	0.047	0.319	0.345
			Hp	0.063	0.428	0.463
24 V DC @ 155°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.90	1.75	1.49
			lb-in	16.8	15.5	13.2
Rated Speed		Nrtd	rpm	200	2400	4500
Rated Power (speed) (2)(3)		Prtd	kW	0.040	0.441	0.704
			Hp	0.053	0.591	0.944
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	1.46	0.95	0.93
			lb-in	12.9	8.40	8.23
Rated Speed		Nrtd	rpm	800	3400	3100
Rated Power (speed) (2)(3)		Prtd	kW	0.123	0.338	0.302
			Hp	0.164	0.453	0.405

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	1.87	1.34	1.17
			lb-in	16.6	11.9	10.4
Rated Speed		Nrtd	rpm	700	5400	5800
Rated Power (speed) (1)(3)		Prtd	kW	0.137	0.759	0.711
			Hp	0.184	1.02	0.954
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.417	0.083	0.048
			lb-in/Arms	3.69	0.74	0.43
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.467	0.093	0.054
			lb-in/Arms	4.13	0.83	0.48
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	25.2	5.04	2.91
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	28.2	5.64	3.26
Motor Constant (5)	Nom	Km	Nm/√W	0.310	0.310	0.310
			lb-in/√W	2.74	2.74	2.74
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	1.51	0.061	0.020
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	3.29	0.13	0.04

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	1.600
		lb-in-s2	1.42E-03
Weight (7)	W	kg	0.644
		lb	1.420
Thermal resistance	Rthw-a	°C/W	1.83
Pole Pairs	PP		10
Heatsink Size	12" x 12" x 0.5" Aluminum Plate		
Housing Geometry [L x T]	1.69" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.8.2 TBM2G-11513 Frameless Motor Specifications

Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	3.04	3.04	3.04
			lb-in	26.9	26.9	26.9
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	4.75	23.8	41.2
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	2.40	2.40	2.40
			lb-in	21.2	21.2	21.2
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	3.51	17.6	30.4
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	7.41	7.41	7.41
			lb-in	65.6	65.6	65.6
Peak Current (6)(8)		Ip	Arms	14.2	71.0	123
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	2.38	2.09	1.55
			lb-in	21.1	18.5	13.8
Rated Speed		Nrtd	rpm	200	1600	2800
Rated Power (speed) (2)(3)		Prtd	kW	0.050	0.351	0.456
			Hp	0.3067	0.470	0.611
24 V DC @ 155°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	3.04	2.90	2.64
			lb-in	26.9	25.5	23.4
Rated Speed		Nrtd	rpm	100	1500	2800
Rated Power (speed) (2)(3)		Prtd	kW	0.032	0.455	0.774
			Hp	0.043	0.610	1.04
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	2.35	1.53	1.51
			lb-in	20.8	13.5	13.3
Rated Speed		Nrtd	rpm	500	2800	2600
Rated Power (speed) (2)(3)		Prtd	kW	0.123	0.448	0.410
			Hp	0.165	0.601	0.550

Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	3.02	2.48	1.89
			lb-in	26.7	22.0	16.7
Rated Speed		Nrtd	rpm	400	3400	4900
Rated Power (speed) (1)(3)		Prtd	kW	0.126	0.884	0.969
			Hp	0.17	1.19	1.30
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	0.641	0.128	0.074
			lb-in/Arms	5.67	1.13	0.66
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	0.718	0.144	0.083
			lb-in/Arms	6.36	1.27	0.73
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	38.8	7.75	4.48
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	43.4	8.68	5.01
Motor Constant (5)	Nom	Km	Nm/√W	0.464	0.464	0.464
			lb-in/√W	4.10	4.10	4.10
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	1.60	0.064	0.021
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	4.88	0.20	0.07

Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	2.080
		lb-in-s2	1.84E-03
Weight (7)	W	kg	0.838
		lb	1.847
Thermal resistance	Rthw-a	°C/W	1.60
Pole Pairs	PP		10
Heatsink Size	12" x 12" x 0.5" Aluminum Plate		
Housing Geometry [L x T]	1.86" x 0.25" Aluminum Housing		

1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

3.8.3 TBM2G-11526 Frameless Motor Specifications

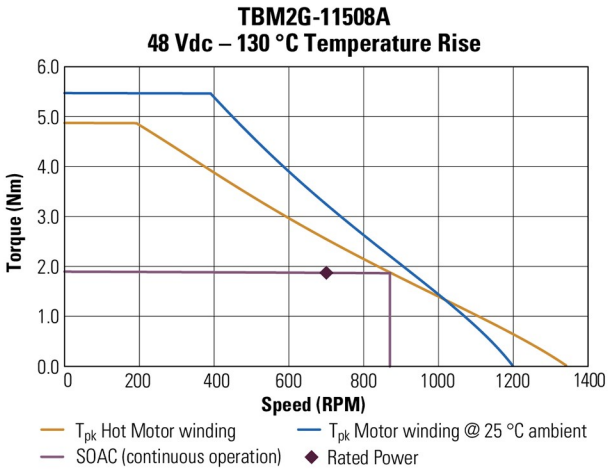
Parameters	Tol	Symbol	Units	A	C	D
Rated Equivalent Line Voltage (6)(8)		V bus	V dc	48	48	48
Max Cont. Torque for ΔT wdg. = 130°C (1)(4)(6)(8)		Tmc1	Nm	6.03	6.03	6.03
			lb-in	53.3	53.3	53.3
Max Cont. Current for ΔT wdg. = 130°C (1)(4)(6)(8)		Imc1	Arms	4.81	24.0	41.6
Max Cont. Torque for ΔT wdg. = 60°C (2)(4)(6)(8)		Tmc2	Nm	4.71	4.71	4.71
			lb-in	41.7	41.7	41.7
Max Cont. Current for ΔT wdg. = 60°C (2)(4)(6)(8)		Imc2	Arms	3.51	17.5	30.4
Max mechanical speed		Nmax	rpm	8000	8000	8000
Peak Torque (1)(4)		Tp	Nm	12.7	14.5	14.5
			lb-in	112	128	128
Peak Current (6)(8)		Ip	Arms	12.6	71.9	125
24 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	-	4.41	3.81
			lb-in	-	39.0	33.8
Rated Speed		Nrtd	rpm	-	800	1500
Rated Power (speed) (2)(3)		Prtd	kW	-	0.369	0.599
			Hp	-	0.495	0.803
24 V DC @ 155°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	-	5.89	5.63
			lb-in	-	52.1	49.8
Rated Speed		Nrtd	rpm	-	700	1400
Rated Power (speed) (2)(3)		Prtd	kW	-	0.432	0.825
			Hp	-	0.579	1.106
48 V DC @ 85°C						
Rated Torque (speed) (2)(3)		Trtd	Nm	4.67	3.45	3.01
			lb-in	41.3	30.6	26.7
Rated Speed		Nrtd	rpm	200	1800	2000
Rated Power (speed) (2)(3)		Prtd	kW	0.098	0.651	0.631
			Hp	0.131	0.873	0.846

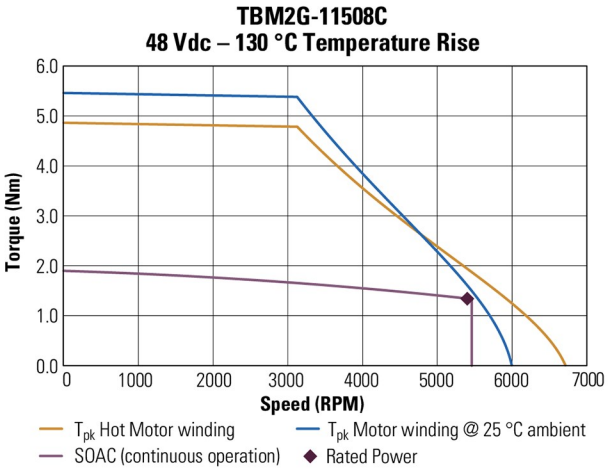
Parameters	Tol	Symbol	Units	A	C	D
48 V DC @ 155°C						
Rated Torque (speed) (1)(3)		Trtd	Nm	6.01	5.52	4.41
			lb-in	53.2	48.9	39.1
Rated Speed		Nrtd	rpm	200	1600	3100
Rated Power (speed) (1)(3)		Prtd	kW	0.126	0.925	1.43
			Hp	0.169	1.241	1.922
Hot Torque Constant (1)(6)(8)	+/- 10%	Kt	Nm/Arms	1.26	0.252	0.145
			lb-in/Arms	11.1	2.23	1.29
Cold Torque Constant (5)(8)	+/- 10%	Kt	Nm/Arms	1.41	0.282	0.163
			lb-in/Arms	12.5	2.50	1.44
Hot Back EMF Constant (1)(6)(8)	+/- 10%	Ke	Vrms/krpm	76.2	15.2	8.79
Cold Back EMF Constant (5)(8)	+/- 10%	Ke	Vrms/krpm	85.3	17.1	9.8
Motor Constant (5)	Nom	Km	Nm/√W	0.802	0.802	0.802
			lb-in/√W	7.09	7.09	7.09
Resistance (line-line) (5)(8)	+/- 10%	Rm	Ω	2.06	0.083	0.028
Inductance Q-Axis (line-line) (6)(8)	+/- 20%	Lqll	mH	9.68	0.39	0.13

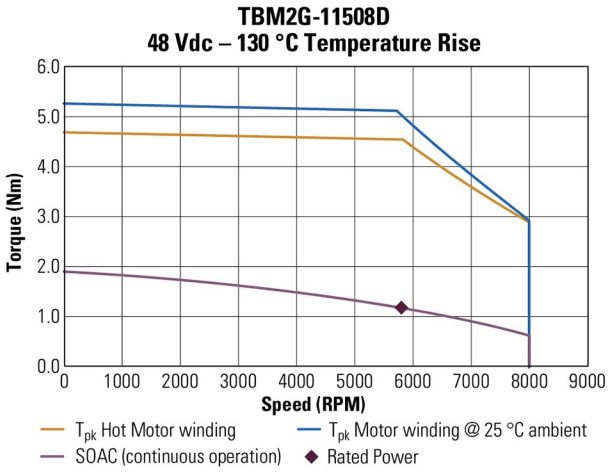
Parameters	Symbol	Unit	Value
Inertia (7)	Jm	kgcm2	3.550
		lb-in-s2	3.14E-03
Weight (7)	W	kg	1.43
		lb	3.15
Thermal resistance	Rthw-a	°C/W	1.21
Pole Pairs	PP		10
Heatsink Size	12" x 12" x 0.5" Aluminum Plate		
Housing Geometry [L x T]	2.40" x 0.25" Aluminum Housing		

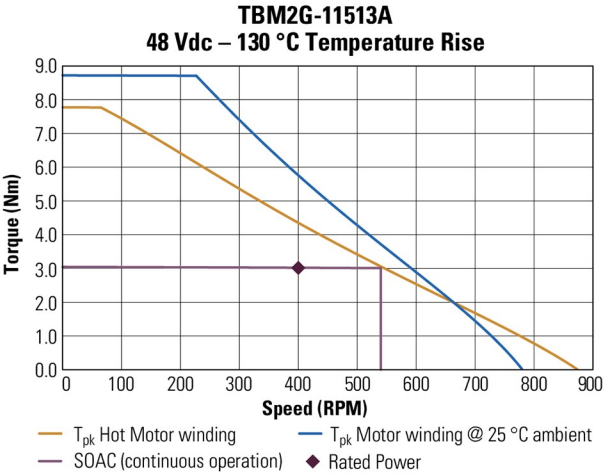
1. Motor winding at temp. rise, δT = 130°C, at 25°C ambient
2. Motor winding at temp. rise, δT = 60°C, at 25°C ambient
3. All data referenced to sinusoidal commutation
4. May be limited at some values of Vbus
5. Measured at 25°C (without leads)
6. All values measured without leads
7. Estimated value
8. With housing and heat sink

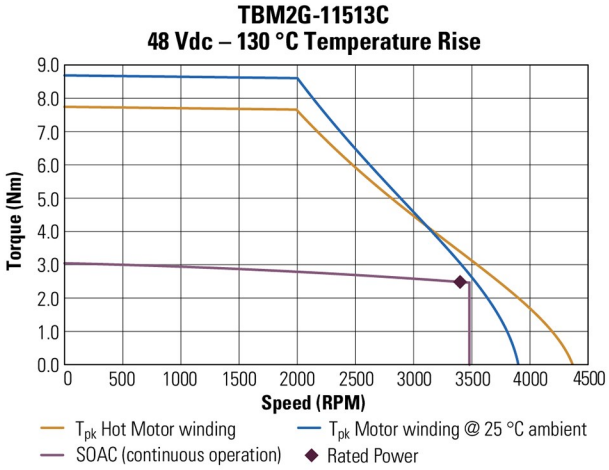
3.8.4 TBM2G-115 Frameless Motor Performance Curves

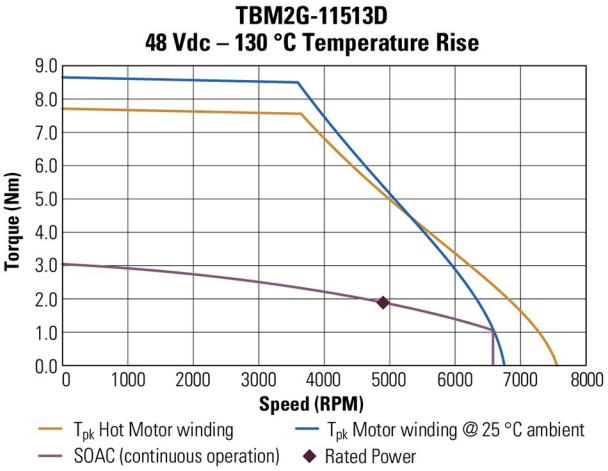




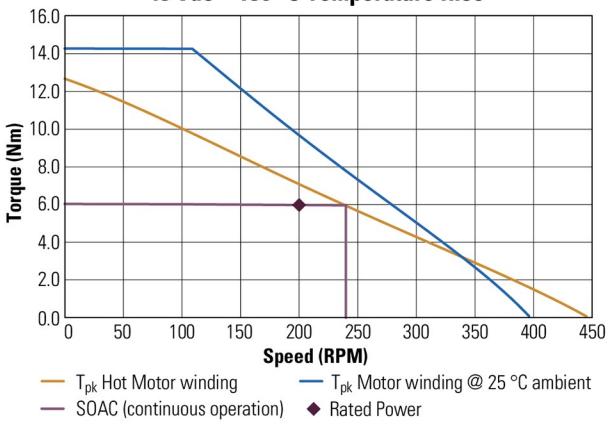




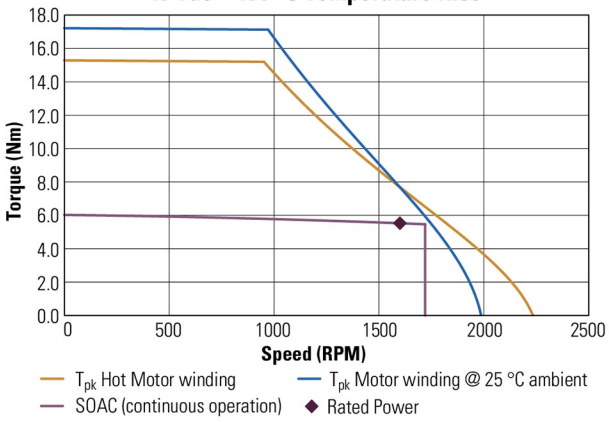




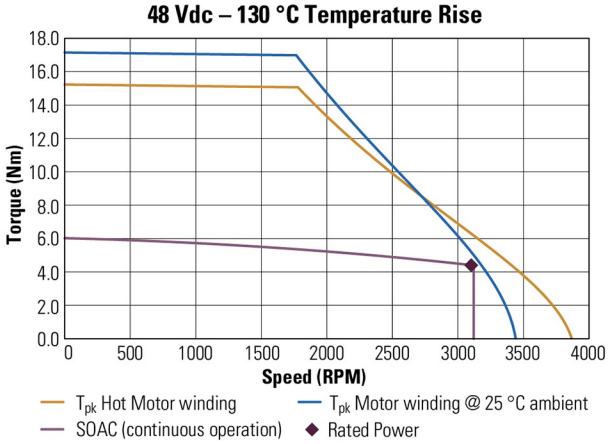
TBM2G-11526A
48 Vdc – 130 °C Temperature Rise



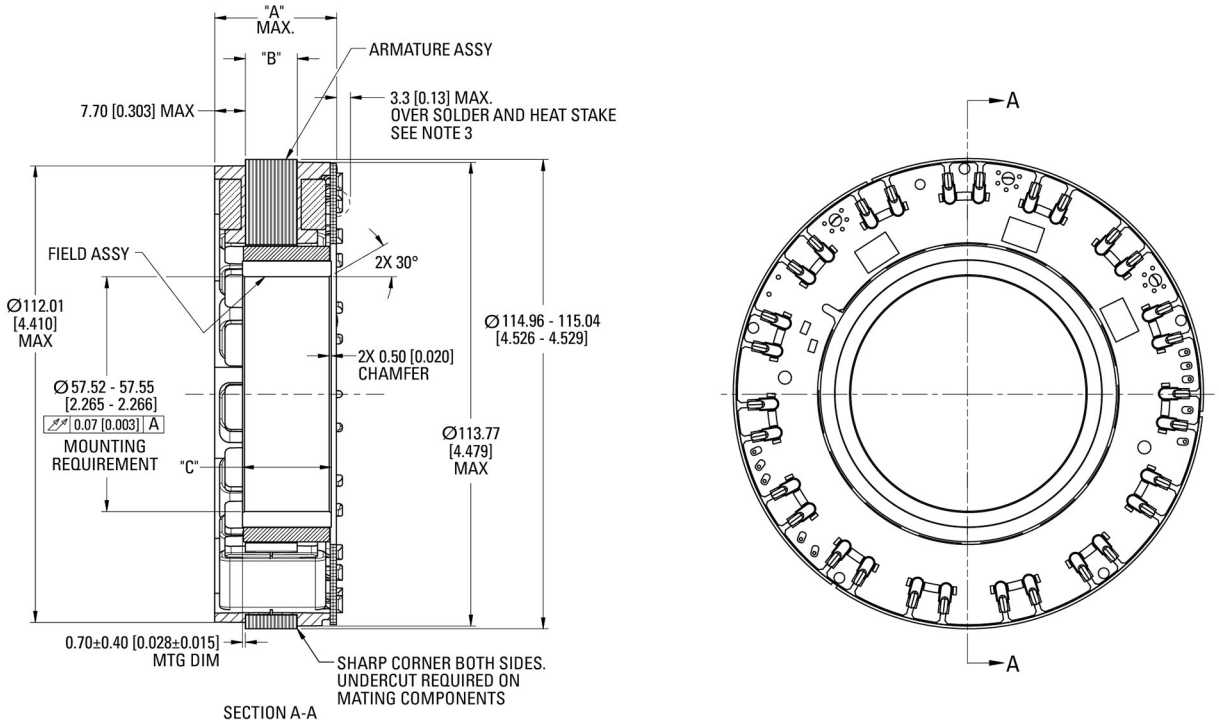
TBM2G-11526C
48 Vdc – 130 °C Temperature Rise



TBM2G-11526D
48 Vdc – 130 °C Temperature Rise



3.8.5 TBM2G-115 Frameless Motor Outline Drawing



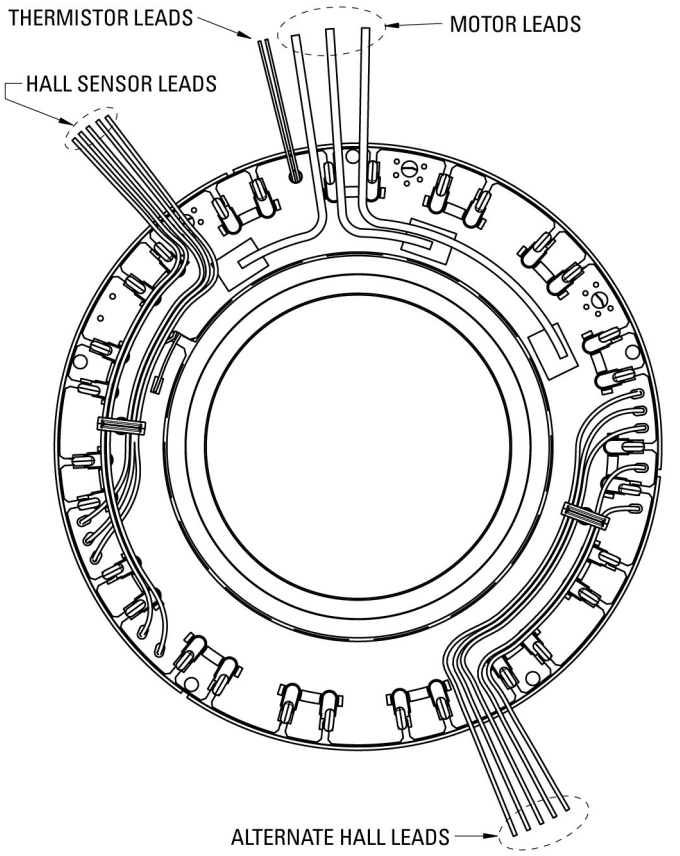
Stack Specific Dimensional Data

MODEL	"A" MAX.	"B" REF ±0.35 [0.014]	"C" ±0.08 [0.004]
TBM2G-11508	26.29 [1.035]	8.2 [0.323]	17.26 [0.679]
TBM2G-11513	30.79 [1.212]	12.70 [0.500]	21.76 [0.856]
TBM2G-11526	44.39 [1.747]	26.30 [1.035]	35.36 [1.392]

Notes:

1. All dimensions are in mm [inches] and are for reference only.
2. Motor supplied as two separate components: armature and sensor assembly and field assembly.
3. Customer must provide 0.25 [0.010] min. clearance from all solder and heat stakes.

3.8.6 TBM2G-115 Series Optional Lead Specifications



Motor Leads

#20 AWG, ETFE Coated, Per UL Style 10086
3 Leads, 0.5 m Length
1 - Red, 1 - White, 1 - Black
Minimum Motor Lead Bend Radius 7.37 [0.290]

Hall Sensor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
5 Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Thermistor Leads

#26 AWG, ETFE Coated, Per UL Style 10086
2 White Leads, 0.5 m Length
Minimum Lead Bend Radius 4.95 [0.195]

Connection Options

PN Lead Designation	Lead Length (Min)
A	0.5 m
N	No leads

Sensor Options

PN Lead Designation	Lead Length (Min)
H	Hall Sensor
N	No Device

Thermal Device Options

PN Lead Designation	Lead Length (Min)
A	PT1000
B	3x PTC Devices
N	No Device

4 Approvals

Certificates can be found on KDN (the Kollmorgen Developer Network) on the Approvals page.

4.1 EC Declaration of Conformity

KOLLMORGEN

Technical Notice

TBM2G CE Certification

Kollmorgen has reviewed the CE requirements for marking the **TBM2G** Frameless Motor product line. After review and consultation, it is determined that the TBM2G is a parts set, and does not constitute a full motor until it is in the customer's final assembly. Since the relevant standards only apply to complete motors, Kollmorgen cannot apply the CE mark to the product.

Product Identification

Product:	TBM2G– Stator and rotor assemblies
Series:	Kollmorgen TBM2G-NNNxx followed by numbers and letters.
Models covered:	TBM2G-050xx, TBM2G-060xx, TBM2G-068xx, TBM2G-076xx, TBM2G-085xx, TBM2G-094xx, and TBM2G-115xx

Manufacturer	**Kollmorgen Corporation**
Address:	501 Main Street Radford, VA 24141- 4099
Country:	USA

European Harmonized Standards

This product is designed to meet the following safety standards when properly installed in a final assembly.

EN 60034-1:2010	Rotating Electrical Machines - Part 1: Rating and performance *This includes Safety and EMC requirements*
EN 60034-18-1:2010	Rotating electrical machines - Part 18-1: Functional evaluation of insulation systems - General guidelines *This includes use of a class F UL rated insulation system KM-155-T2G, UL File number E301483*

CE mark is not applicable to the TBM2G part set.

These products comply with the Low Voltage Directive 2014/35/EU for installation in a machine. Safety depends upon installing and configuring the parts set into a motor per the manufacturer's recommendations. The machine in which this product is to be installed must conform to the provisions of the EMC Directive 2014/30/EU. The installer is responsible for ensuring that the end product complies with the EMI requirements and all the relevant laws in the country where the equipment is installed

Each part set has been designed, built, and tested to meet the requirements of EN 60034-1 as the most appropriate standard.

Signed:
Name: David Digby Empson 21 June, 2022
Title: Compliance Engineer

201 W. Rock Road
Radford, VA 24141
USA

201 West Rock Road • Radford, VA 24141 • Tel: 540.639.2495 • www.kollmorgen.com

KOLLMORGEN

TBM2G Nomenclature TBM2G – 060 13 A – A N A A – 00
1 2 3 4 5 6 7 8 9

	Available Motor						
1 Motor Series	TBM2G						
2 Frame	050	060	068	076	085	094	115
Size in mm	50	60	68	76	85	94	115
3 Lamination Stack Length							
08 = 8.2 mm stack	•	•	•	•	•	•	•
13 = 12.7 mm stack	•	•	•	•	•	•	•
26 = 26.3 mm stack	•	•	•	•	•	•	•
4 Motor Winding							
A = Wye Connected	•	•	•	•	•	•	•
C = Parallel Wye Connected	•	•	•	•	•	•	•
D = Parallel Delta Connected	•	•	•	•	•	•	•

	Available Options						
Motor Series	TBM2G						
Frame	050	060	068	076	085	094	115
5 Thermal Device							
N = None	•	•	•	•	•	•	•
A = PT1000	•	•	•	•	•	•	•
B = 3 PTC's	•	•	•	•	•	•	•
6 Sensor Option							
N = None	•	•	•	•	•	•	•
H = Hall Sensors	•	•	•	•	•	•	•
A = Hall Sensors (Alternate Location)		•	•	•	•	•	•
7 Lead Options							
N = None	•	•	•	•	•	•	•
A = 0.5 m Flying Leads	•	•	•	•	•	•	•
8 Field Options							
A = Standard	•	•	•	•	•	•	•
9 Custom Options							
00 = Standard	•	•	•	•	•	•	•

Kollmorgen will add additional windings and lead options not necessarily included in this table but still covered by this Technical Notice.

201 West Rock Road • Radford, VA 24141 • Tel: 540.639.2495 • www.kollmorgen.com

4.2 Conformance with uL

Recognized for USA and Canada in **File E61960**.

4.3 Conformance with CE

The motors have been tested by an authorized testing laboratory in a defined configuration. Any divergence from the configuration and installation described in this documentation means that the user will be responsible for carrying out new measurements to ensure conformance with regulatory requirements.

NOTICE Feedback systems and contacts must not be tested with high voltage. Feedback systems are not suitable for high voltage testing, it is allowed to exclude sensitive electronic components from these tests. Feedback systems might be destroyed during a high voltage test.

NOTE CE Declaration of Conformity can be found on the Kollmorgen website.

Kollmorgen declares the conformity of the product series TBM2G with the following directives:

- **EC Directive 2014/35/EU, Low voltage**
- **EC Directive 2014/30/EU, Electromagnetic compatibility**

4.4 Conformance with EAC

EAC is the abbreviation for EurAsian Conformity. The mark is used in the states of the Eurasian Customs Union (Russia, Belarus, Kazakhstan) similar to the European CE mark.

Kollmorgen declares, that the TBM2G has passed all required conformity procedures in a member state of the Eurasian Customs Union, and that the TBM2G meets all technical requirements requested in the member states of the Eurasian Customs Union :

- Low voltage (TP TC 020/2011)
- Electromagnetic Compatibility (TP TC 004/2011)

Contact in Russia:
Intelligence Automatics LLC. , Bakuninskaya Str. d 14, Building 1, RU-105005 Moskau

4.5 Conformance with RoHS

Directive 2011/65/EC of the European Union on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) became operative as from the 3rd of January, 2013. Following substances namely are involved

Lead (Pb), Cadmium (Cd), Hexavalent chromium (CrVI), Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE), Mercury (Hg)

The TBM2G motor series is manufactured RoHS conformal.

4.6 Conformance with REACH

EU Regulation no. 1907/2006 deals with the registration, evaluation, authorisation and restriction of chemical substances 1 (abbreviated to "REACH").

TBM2G motors do not contain any substances (CMR substances, PBTsubstances, vPvB substances and similar hazardous substances stipulated in individual cases based on scientific criteria) above 0.1 mass percent per product that are included on the candidate list.

About KOLLMORGEN

Kollmorgen is a leading provider of motion systems and components for machine builders. Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions that are unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

Join the Kollmorgen Developer Network for product support. Ask the community questions, search the knowledge base for answers, get downloads, and suggest improvements.

North America
KOLLMORGEN
201 West Rock Road
Radford, VA 24141, USA

Web: www.kollmorgen.com
Mail: support@kollmorgen.com
Tel.: +1 - 540 - 633 - 3545
Fax: +1 - 540 - 639 - 4162

Europa
KOLLMORGEN Europe GmbH
Pempelfurtstr. 1
40880 Ratingen, Germany

Web: www.kollmorgen.com
Mail: technik@kollmorgen.com
Tel.: +49 - 2102 - 9394 - 0
Fax: +49 - 2102 - 9394 - 3155

South America
KOLLMORGEN
Avenida João Paulo Ablas, 2970
Jardim da Glória, Cotia – SP
CEP 06711-250, Brazil

Web: www.kollmorgen.com
Mail: contato@kollmorgen.com
Tel.: +55 11 4615-6300

China and SEA
KOLLMORGEN Asia
Room 302, Building 5, Lihpao Plaza,
88 Shenbin Road, Minhang District,
Shanghai, China

Web: www.kollmorgen.cn
Mail: sales.china@kollmorgen.com
Tel.: +86 - 400 668 2802