


All dimensions are in mm. Drawing not to scale. Pins facing upward view.

Motor – sensor configurations			
Sensor \ Motor	PMSM	BLDC	DC BRUSH
Incr. Encoder	Ⓢ		Ⓢ
Incr. Encoder + Dig. Hall	Ⓢ	Ⓢ	
Linear Halls	Ⓢ		
Digital Halls control only	Ⓢ		
SSI / BiSS-C/ EnDAT/ TAMAGAWA/ Panasonic/ Nikon/ Sanyo Denki	Ⓢ	Ⓢ	Ⓢ
Tacho			Ⓢ

Mating Connectors			
Producer	Part No.	Connector	Description
Samtec	SQW-117-01-F-D(-VS)	J1	2x17, 2.0mm THT (SMD) socket
	CLT-117-02-F-D		2x17, 2.0mm SMD pass-through socket
	SQW-111-01-F-D(-VS)	J2	2x10, 2.0mm THT (SMD) socket
	CLT-111-02-F-D		2x10, 2.0mm SMD pass-through socket

Features

- Motion controller and drive in a single compact unit based on MotionChip TM technology
- Universal solution for control of rotary and linear brushless and brushed motors
- Advanced motion control capabilities (CSP, PVT, S-curve, electronic gearing and cam)
- Motor supply: 48V nominal
- Motor output current:
 - Nominal:
 - 4A_{RMS} / 5.6A amplitude when soldering pins directly to the motherboard;
 - Limited to 3A_{RMS} / 4.2A amplitude using the recommended mating connectors;
 - Peak: 10A_{RMS} / 14A amplitude peak.
- Logic supply: 24V nominal, 48V max
- Feedback Options (up to 1x Hall sensors + 2x encoders)
 - 1 x Hall sensor interface (digital or linear)
 - Feedback#1 and Feedback#2 can be:
 - Incremental A / B (index Z available only for 1 encoder): differential or single-ended.
 - Absolute: differential or single-ended. Supported protocols: SSI, BiSS, EnDAT, Tamagawa, Panasonic, Nikon, Sanyo Denki;
- 1 x analogue input software selectable: 12-bit 0-5V or ±10V: Reference, Feedback or general purpose
- 3 x digital inputs: 2 for limit switches + one Enable, NPN, pull-to-GND to activate, pull-up on-board to +5V. Pull to GND to activate
- 3 x configurable I/Os, each software selectable as:
 - Digital input, NPN, with pull-up on-board to +5V. Pull to GND to activate;
 - Digital output, NPN (open-collector), with pull-up on-board to +5V. Sink current: 1 x 1.5A to drive inductive loads (such as mechanical brake), 2 x 0.1A.
- Communication interfaces: RS232; USB; TMLCAN and CANopen (CiA 301 v4.2, CiA 305 v.2.2.13 and CiA 402 v3.0) protocols
- 24k x 16 E²ROM to store setup data, TML motion programs, cam tables and other user data
- 16k x 16 SRAM memory for data acquisition
- Operating ambient temperature: 0-40°C (over 40°C with de-rating)
- Programmable protections: any short-circuit between motor phases, GND and/or supply, over/under-voltage, over-current, I²t, control error
- >99% voltage efficiency

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Pin	Name	Type	Description
1	+Vlog	I	Positive terminal of the logic supply input: 6 to 48 VDC
2	A	O	Phase A for 3-ph motors, Motor+ for DC brush motors
3	GND	-	Ground return for logic supply
4	B	O	Phase B for 3-ph motors, Motor- for DC brush motors
5	GND	-	Shield for motor windings cable
6	C	O	Phase C for 3-ph motors
7	+Vmot	I	Positive terminal of the motor supply: 7 to 48 VDC
8	Rsvd.	-	Reserved.
9	BFS	-	Connect to GND to perform a firmware update after a critical firmware failure
10	ID2	I	AxisID ² selection pin. See AxisID register settings table
11	TX1-	I/O	Transmit/Receive negative, OUT port.
12	RX1-	I/O	Receive/Transmit negative, OUT port.
13	TX1+	I/O	Transmit/Receive positive, OUT port.
14	RX1+	I/O	Receive/Transmit positive, OUT port.
15	GND	-	Ground shield for port 1
16	GND	-	Ground shield for port 0
17	TX0-	I/O	Transmit/Receive negative, IN port.
18	RX0-	I/O	Receive/Transmit negative, IN port.
19	TX0+	I/O	Transmit/Receive positive, IN port.
20	RX0+	I/O	Receive/Transmit positive, IN port.
21	ID0	I	AxisID ⁰ selection pin. See AxisID register settings table
22	ID1	I	AxisID ¹ selection pin. See AxisID register settings table
23	232TX	O	RS-232 Data Transmission.
24	232RX	I	RS-232 Data Reception.
25	CAN Hi	-	CAN-Bus positive line (dominant high)
26	CAN Lo	-	CAN-Bus negative line (dominant low)
27	IN2/LSP	I	5-60V digital NPN input. Positive limit switch input
28	IN3/LSN	I	5-60V digital NPN input. Negative limit switch input
29	IN5/Enable	I	5-60V digital NPN input. Drive Enable input
30	I/O0	I/O	5-50V NPN general-purpose digital programmable input IN0 / or NPN 1.5A output OUT0
31	I/O1	I/O	5-50V NPN general-purpose digital programmable input IN1 / or NPN 0.1A output OUT1
32	I/O2	I/O	5-50V NPN general-purpose digital programmable input IN4 / or NPN 0.1A output OUT4
33	GND	-	Ground return and shield
34	AnalogIn	I	Analog input (range software selectable 0-5V or ±10V)

Pin	Name	Type	Description
1	+V USB	I	5V input from USB
2	GND	-	Ground return for USB
3	Hall1	I	Digital Hall, or Linear Hall sensor 1
4	Hall2	I	Digital Hall, or Linear Hall sensor 2
5	Hall3	I	Digital Hall, or Linear Hall sensor 3
6	GND	-	Ground return and shield
7	+5V	O	Supply for all feedback sensors
8	GND	-	Ground return and shield
9	EncA1+/EncA1/ Dt1+/Dt1	I	Encoder 1 A+/Data+ diff. input or single-ended input
10	EncA1-/Dt1-	I	Encoder 1 A-/Data- diff. input. Leave open for single-ended; Add externally 120Ω to pin 9 for differential
11	EncB1+/EncB1/ Clk1+/Clk1	I	Encoder 1 B+/Clock+ diff. input or single-ended input
12	EncB1-/Clk1-	I	Encoder 1 B-/Clock- diff. input. Leave open for single-ended; Add externally 120Ω to pin 11 for differential
13	EncA2+/EncA2/ Dt2+/Dt2	I	Encoder 2 A+/Data+ diff. input or single-ended input
14	EncA2-/Dt2-	I	Encoder 2 A-/Data- diff. input. Leave open for single-ended; Add externally 120Ω to pin 13 for differential
15	EncB2+/EncB2/ Clk2+/Clk2	I/O	Encoder 2 B+/Clock+ diff. input or single-ended input
16	EncB2-/Clk2-	I	Encoder 2 B-/Clock- diff. input. Leave open for single-ended; Add externally 120Ω to pin 15 for differential
17	Z1+	I	Encoder 1 Z+ diff. input or single-ended input
18	Z1-	I	Encoder 1 Z- diff. input. Leave open for single-ended; Add externally 120Ω to pin 17 for differential
19	USB DM	I/O	USB data-
20	USB DP	I/O	USB data+

Electrical characteristics

All parameters measured under the following conditions (unless otherwise specified):

- V_{LOG} = 24 VDC; V_{MOT} = 48VDC; F_{PWM} = 20 kHz
- Supplies start-up / shutdown sequence: -any-
- Load current (sinusoidal amplitude) = 5.6A

Operating Conditions	Min.	Typ.	Max.	Units
Ambient temperature	0		40 ¹	°C
Ambient humidity	Non-condensing	0	90	%Rh
Altitude / pressure ²	Altitude (vs. sea level)	-0.1	0 + 2.5	Km
	Ambient Pressure	0 ²	0.75 + 1	10.0 atm
Storage Conditions	Min.	Typ.	Max.	Units
Ambient temperature	-40		100	°C
Ambient humidity	Non-condensing	0	100	%Rh
Ambient Pressure	0		10.0	atm
ESD capability (Human body model)	Not powered; applies to any accessible part		±0.5	kV
	Original packaging		±15	kV
Mechanical Mounting	Min.	Typ.	Max.	Units
Airflow			natural convection ³ , closed box	
Spacing required for horizontal mounting	Between adjacent drives	10		mm
	Between drives and nearby walls	10		mm
	Space needed for drive removal	20		mm
	Between drives and roof-top	30		mm
Insertion force	Using recommended mating connectors	20		N
Extraction force		8		N
Environmental Characteristics	Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Global size	38.3 x 26.8 x 11.3		mm
		~1.51 x 1.05 x 0.44		inch
Weight		8		g
Cleaning agents	Dry cleaning is recommended	Only Water- or Alcohol-		based
Protection degree	According to IEC60529	IP20		-

MSB **AxisID register** **LSB**

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ID2			ID1			ID0		
Nominal[V]	Minimum[V]	Maximum[V]	IDx* Bits	IDx* Value				
0.000	0.00	0.53	000	0				
1.057	0.53	1.41	001	1				
1.756	1.41	2.01	010	2				
2.254	2.01	2.43	011	3				
2.600	2.43	2.75	100	4				
2.894	2.75	3.01	101	5				
3.128	3.01	3.22	110	6				
3.319	3.22	3.35	111	7				


Remarks:

- If Bit 7 (ID2) = 1 -> TMLCAN mode is selected
- If Bit 7 (ID2) = 0 -> CANOpen mode is selected
- Bit 8 (MSB of ID2) is ignored, and always considered as "0"
- The maximum AxisID value is 127 (Bit 0 ... Bit 6)
- TMLCAN mode: AxisID = (64*ID2_Value - 128) + (8*ID1_Value) + ID0_Value
- CANOpen mode: AxisID = (64*ID2_Value) + (8*ID1_Value) + ID0_Value
- If the AxisID pins are not connected, the AxisID value can't be determined.
- If all "IDx" pins are connected to GND the AxisID value is 255
- If the CANOpen mode is selected and the AxisID value is 255, drive will be in "LSS inactive" state and the Green LED will flash at 1 second intervals

where "x" can be 1, 2 or 3

¹ Operating temperature at higher temperatures is possible with reduced current and power ratings
² Micro 4803 can be operated in vacuum (no altitude restriction), but at altitudes over 2,500m, current and power rating are reduced due to thermal dissipation efficiency.

³ In case of forced cooling (conduction or ventilation) the spacing requirements may drop substantially down to zero as long as the ambient temperature is kept below the maximum operating limit

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Logic Supply Input (+V _{LOG})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	6	24	48	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	4.9		60	V _{DC}
	Absolute maximum values, continuous	-0.5		63	V _{DC}
Supply current	+V _{LOG} = 12V		90	150	mA
	+V _{LOG} = 24V		60	90	
	+V _{LOG} = 48V		45	60	
Voltage Measurement	Total error			1.5	%
Utilization category	Acc. to 60947-4-1 (I _{PEAK} ≤ 1.05 * I _{NOM})	DC-1			
Motor Supply Input (+V _{MOT})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	7		48	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	6		60	V _{DC}
	Absolute maximum values, continuous	-0.5		63	V _{DC}
Supply current	Idle		25		mA
	Operating	-15	±3	+15	
	Absolute maximum value, short-circuit condition (Duration ≤ 10ms) †			16.5	
Voltage Measurement	Total error			1.5	%
Utilization category	Acc. to 60947-4-1 (I _{PEAK} ≤ 4.0 * I _{NOM})	DC-3			
Motor Outputs (A/A+, B/A-, C)		Min.	Typ.	Max.	Units
Nominal current	PMSM motors sinusoidal amplitude			5.6	A
	PMSM motors sinusoidal RMS			4	A _{RMS}
	DC/BLDC motors continuous ¹			4.85	A
Peak current	maximum 2.5s			+14	A
Short-circuit protection threshold		±16.5		±18	A
Short-circuit protection delay		2		4	µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance		0.1		V
Off-state leakage current			0.3	1	mA
Voltage Efficiency			92		%
Motor inductance (phase-to-phase)	Recommended value, for current ripple max. ±5% of full range; +V _{MOT} = 48 V	F _{PWM}			µH
		20 kHz		900	
		40 kHz		480	
		60 kHz		320	
		80 kHz		240	
	Minimum value, limited by short-circuit protection; +V _{MOT} = 48 V	20 kHz		270	µH
		60 kHz		150	
		40 kHz		100	
		80 kHz		80	
		100 kHz		60	
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz		330	µs
		40 kHz		170	
		60 kHz		140	
		80 kHz		80	
		100 kHz		66	
Current measurement	FS = Full Scale accuracy		±2	±3	%FS
Encoder Inputs (A+, A-, B+, B-, Z+, Z-, A2+, A2-, B2+, B2-) ²		Min.	Typ.	Max.	Units
Single-ended mode compliance	Leave A1-, B1-, Z1-, A2-, B2- floating	TTL/CMOS/Open-collector (NPN)			
Single-ended threshold	A1+, B1+, Z1+, A2+, B2+	1.2	1.3	1.5	V
Single-ended input current	Input pulled to GND against on-board 2.2 kΩ pull-up to 5V		2.2	2.5	mA
Differential mode compliance	For full RS422 compliance, see ²	TIA/EIA-422-A			
Input voltage	Hysteresis	±0.03	±0.05	±0.2	V
	Differential mode	-15		+15	
	Common-mode range (A+ to GND, etc.)	-7		+12	
Input impedance, differential	A+, A2+, B+, B2+, Z+, Z2+		2.2		kΩ
	A-, A2-, B-, B2-, Z-, Z2-		4.4		
Input frequency	Differential mode	0		15	MHz
Minimum pulse width	Differential mode		33		ns
ESD protection	Human body model	±30			kV

Digital Outputs (OUT0, OUT1, OUT4)		Min.	Typ.	Max.	Units	
Mode compliance	All outputs (OUT0, OUT1, OUT4)	NPN 24V				
Default state	Not supplied (+V _{LOG} floating)	High-Z (floating)				
	Immediately after power-up	Logic "HIGH"				
Output voltage	Logic "LOW"; output current = 1.5A for OUT0/ 0.05A for the other digital outputs			0.4	V	
	Logic "HIGH"; output current = 0, no load	4	4.5	5		
	Logic "HIGH", external load to +V _{LOG}		V _{LOG}			
	Absolute maximum, continuous (free-wheeling diodes to +V _{LOG} to GND)	-0.5		V _{LOG} +0.5		
	Absolute maximum, surge (duration ≤ 1s) †	-1		V _{LOG} +1		
Output current	Logic "LOW", sink current, short duration, duty cycle ≤ 1%	5s max		0.1	A	
				2		
	5.5s max	OUT1, OUT4		0.15	A	
		OUT0		2.5		
	Logic "HIGH", source current; external load to GND; V _{OUT} ≥ 2.0V			5	mA	
Logic "HIGH", leakage current; external load to +V _{LOG} ; V _{OUT} = V _{LOG} max = 40V		0.05	0.1	mA		
Minimum pulse width		0.5			µs	
ESD protection	Human body model	±15			kV	
Hall Inputs (Hall1, Hall2, Hall3)		Min.	Typ.	Max.	Units	
Mode compliance	TTL / CMOS / Open-collector (NPN sink), or analog (linear) 0...5V					
Default state	Input floating (Wiring disconnected)	4.5	4.7	5	V	
Input voltage	Digital	Logic "LOW"	1.5	1.7		
		Logic "HIGH"	3	2.5		
	Hysteresis		0.5			
Analog		0	0.5...4.5	4.95		
Input current	Logic "LOW"; Pull to GND		2.3		mA	
	Logic "HIGH"; Internal 2.2kΩ pull-up to 5V		0			
Minimum pulse width			70		µs	
ESD protection	Human body model	±15			kV	
Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN4, IN5/ENA)		Min.	Typ.	Max.	Units	
Mode compliance		NPN				
Default state	Input floating (wiring disconnected)	Logic HIGH				
Input voltage	Logic "LOW"	IN0, IN1, IN4, IN5/ENA		1.4	1.8	V
			Logic "HIGH"	3.1	2.5	
			Hysteresis	0.9	1.1	
	Logic "LOW"	IN2/LSP, IN3/LSN		1.4	1.6	
			Logic "HIGH"	4	3.5	
	Hysteresis		0.6			
	Floating voltage (not connected)		4.5			
Input current	Absolute maximum, continuous	-5		+55	mA	
	Logic "LOW"; Pulled to GND		9	10		
	Logic "HIGH"; Pulled to +24V			0.4		
Input frequency		0		500	kHz	
Minimum pulse		1			µs	
ESD protection	Human body model	±2			kV	
RS-232		Min.	Typ.	Max.	Units	
Compliance		TIA/EIA-232-C				
Bit rate	Software selectable	9600		115200	Baud	
Short-circuit	232TX short to GND	Guaranteed				
ESD protection	Human body model	±2			kV	
Supply Output (+5V)		Min.	Typ.	Max.	Units	
Output voltage	Current sourced = 400mA	5.05	5.2	5.25	V	
Output current ³		650			mA	
	24V motor		800			
Short-circuit to GND protection		Yes / Drive resets at event				
Over-voltage protection		NOT protected				
ESD protection	Human body model	±1			kV	

¹ For current values >3A_{RMS} pins needs to be soldered instead of socketed

² Full RS-422 compatibility, as well as noise rejection improvement requires an external 120Ω resistor connected across each signal pair (A1+/A1-, B1+/B1-, Z1+/Z1-, A2+/A2-, B2+/B2-)

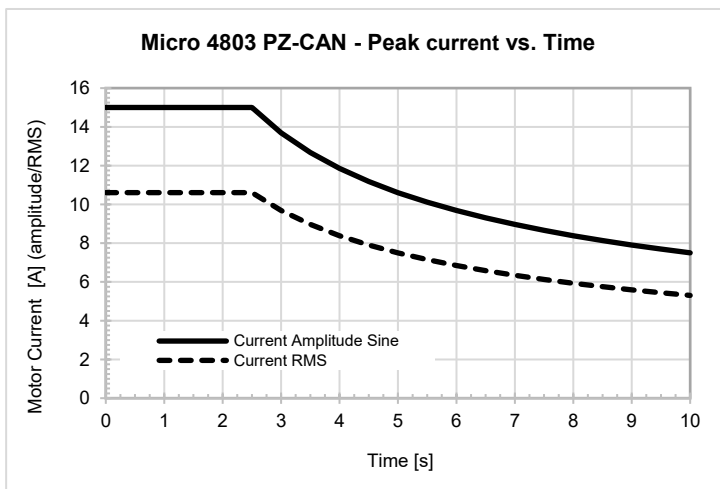
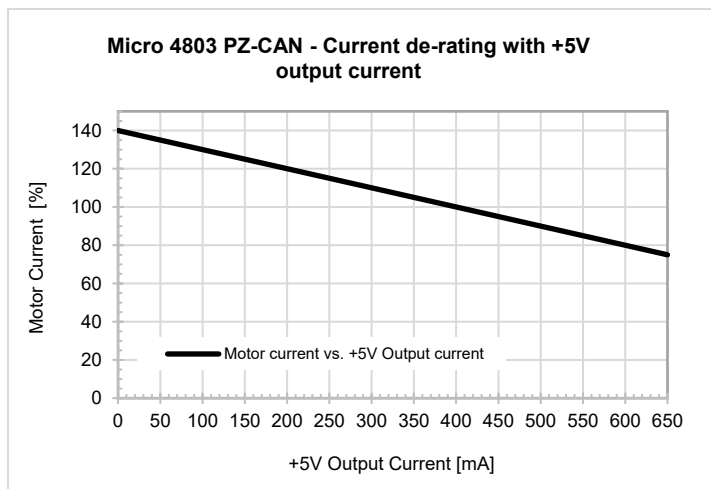
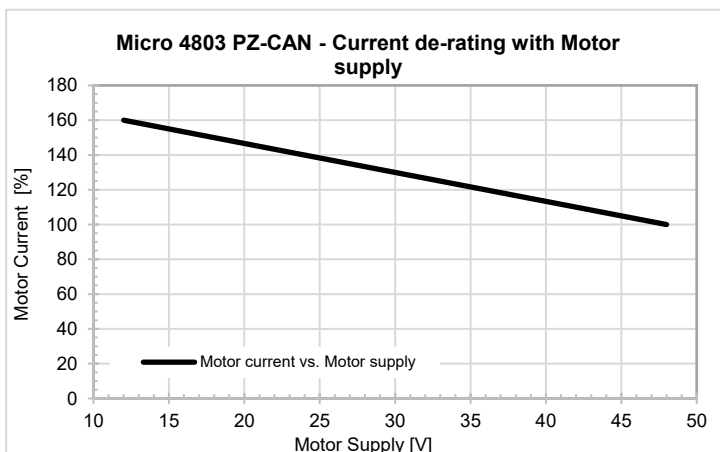
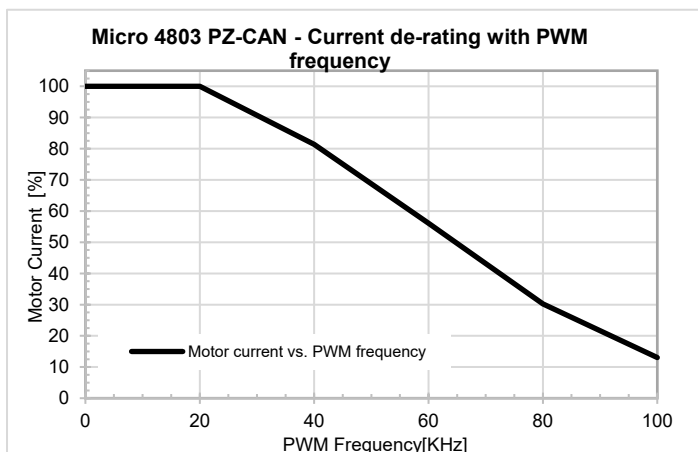
³ For more details see the "Current de-rating with +5V output current" graph

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Absolute encoder interface: SSI, BiSS-C, EnDAT, Tamagawa, Nikon, Sanyo Denki		Min.	Typ.	Max.	Units
Differential mode (CLOCK, DATA)	For full RS422 compliance, see ¹	TIA/EIA-422-A			
CLOCK (DATA) Output voltage	Differential; 50Ω differential load	1.5	3.3		V
	Common-mode, referenced to GND	1	1.7	3	
CLOCK frequency	Software selectable	1000, 2000, 3000, 4000			kHz
CLOCK (DATA) Short-circuit protection	Common-mode voltage ±15V	Yes, protected			
DATA format	Software selectable	Binary / Gray			
		Single-turn / Multi-turn			
		Counting direction			
		CRC type			
DATA resolution	Single-turn			56	Bits
	Multi-turn and single-turn			56	
	If total resolution >31 bits, some bits must be ignored by software setting to achieve a max 31 bits resolution				
Analog Inputs (REF, FDBK)					
0...5V Mode		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		4.95	V
	Absolute maximum values, continuous	-12		+18	
	Absolute maximum, surge (duration ≤ 1s)			±36	
Input impedance	To 1.447V		20		kΩ
Resolution			12		bits
Integral linearity				±2	bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS ²
Bandwidth (-3dB)	Software selectable	0		1.5	kHz
ESD protection	Human body model	±2			kV

±10V Mode		Min.	Typ.	Max.	Units
Differential voltage range			±10		V
Common-mode voltage range	Referenced to GND	-12	0...10	+50	V
Input impedance	To 1.447V		20		kΩ
Resolution			12		bits
Integral linearity				0.036	%FS ²
Offset error	Common-mode voltage = 0...10 V		±0.2	±0.5	%FS ²
Gain error			±0.5	±3	%FS ²
Bandwidth (-3dB)	Software selectable	0		5.5	kHz
CAN-Bus		Min.	Typ.	Max.	Units
Compliance	ISO11898, CiA-301v4.2, CiA 305 v2.2.13, 402v3.0				
Bit rate	Software selectable	125		1000	Kbps
Bus length	1Mbps			25	m
	500Kbps			100	
	≤ 250Kbps			250	
Resistor	Between CAN-Hi, CAN-Lo	none on-board			
Node addressing	Hardware: by "IDx" pins	1-127 & 255			TMLCAN
		1-127 & 255(LSS inactive)			CANopen
	Software	1 + 127 (CANopen); 1- 255 (TMLCAN)			
Voltage, CAN-Hi or CAN-Lo to GND		-58		+58	V
Voltage, CAN-Hi to CAN-Lo		-45		+45	
ESD protection	Human body model	±15			kV

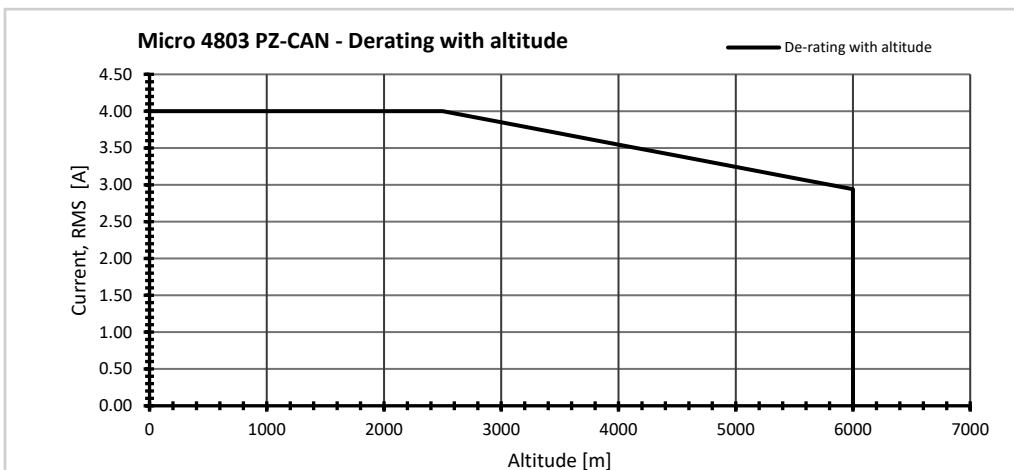
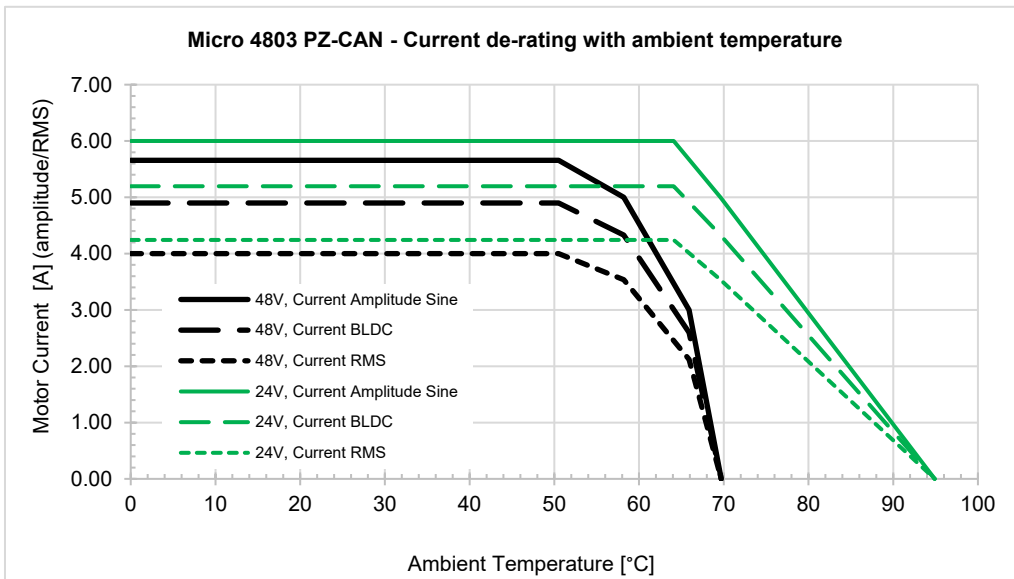
† Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.




¹ Full RS-422 compatibility, as well as noise rejection improvement requires an external 120Ω resistor connected across each signal pair (A1+/A1-, B1+/B1-, Z1+/Z1-, A2+/A2-, B2+/B2-)

² "FS" stands for "Full Scale"

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