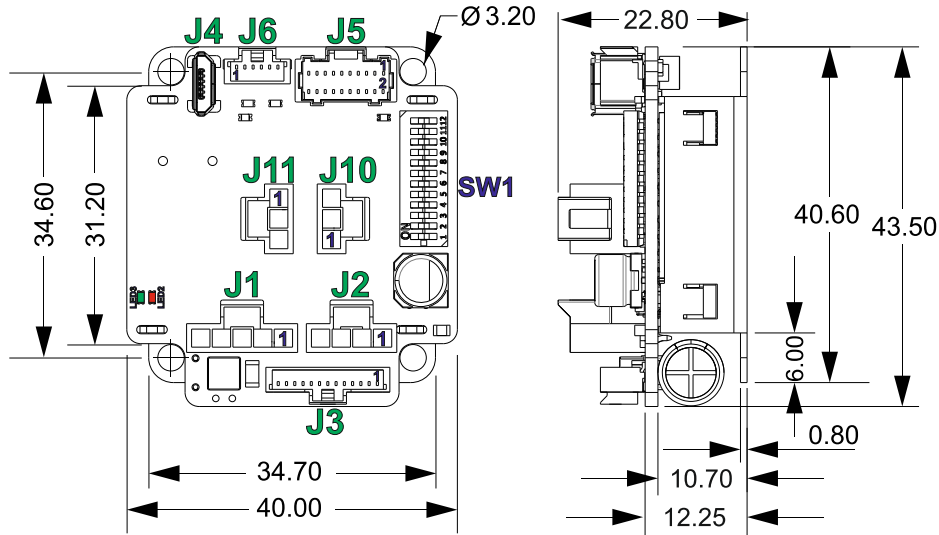




# Micro 4804 CZ-CAN-STO DATASHEET

P/N: P020.803.E202



All dimensions are in mm. Drawing not to scale.

Motor – sensor configurations					
Sensor	Motor				
	PMSM	BLDC	DC BRUSH	STEP (2-ph)	STEP (3-ph)
Incr. Encoder	Ⓢ		Ⓢ	Ⓢ	
Incr. Encoder + Dig. Hall	Ⓢ	Ⓢ			
Linear Halls	Ⓢ				
Digital Hall control only	Ⓢ				
BISS / SSI / EnDAT / TAMAGAWA / Nikon / Sanyo Denki / Panasonic	Ⓢ	Ⓢ	Ⓢ	Ⓢ	
Tacho			Ⓢ		
Open-loop (no sensor)				Ⓢ	Ⓢ

Mating Connectors			
Producer	Part No.	Connector	Description
Molex	1053071205	J1	1x5 Nano-Fit, 2.50mm Pitch Nano-Fit Wire-to-Board Housing, 5 circuits
Molex	1053071203	J10, J11	1x3 Nano-Fit, 2.50mm Pitch Nano-Fit Wire-to-Board Housing, 3 circuits
Molex	1053071204	J2	1x4 Nano-Fit, 2.50mm Pitch Nano-Fit Wire-to-Board Housing, 4 circuits
Molex	5013301300	J3	1x13 Pico-Clasp, 1.00mm Pitch Pico-Clasp Wire-to-Board Housing, 13 Circuits
Molex	5011892010	J5	2x10 Pico-Clasp, 1.00mm Pitch Pico-Clasp Wire-to-Board Housing, 20 Circuits
Molex	5013300600	J6	1x6 Pico-Clasp, 1.00mm Pitch Pico-Clasp Wire-to-Board Housing, 6 Circuits
Tensility International Corp	1002333	J4	USB cable, Cable USB A Male - Micro B Male, 1m, shielded, black, 9.6mm plastic width
Molex	0797582140	J1, J2, J10, J11	Pre-Crimped wires for Nano-Fit   Cable Assembly, Nano-Fit Crimp Terminal Socket to Nano-Fit Crimp Terminal Socket, 300mm
Molex	0797581019	J3, J5, J6	Pre-Crimped wires for Pico-Clasp   Cable Assembly, Pico-Clasp Crimp Terminal Socket to Pico-Clasp Crimp Terminal Socket, 300mm
Molex	1053001400	J1, J2, J10, J11	Pins for Nano-Fit   Nano-Fit Crimp Terminal, Female, 0.76µm Gold (Au) Plating, Lubricated, 24-26 AWG
Molex	5011937000	J3, J5, J6	Pins for Pico-Clasp   1.00mm Pitch, Pico-Clasp Female Crimp Terminal, Gold Plating 0.10µm, 28-32 AWG, Reel
Molex	638276000	J1, J2, J10, J11	Crimp tool Nano Fit   Crimp Tool, Ratchet, Molex Nano-Fit 105300 Series 26-24AWG Socket Contacts, 207129 Series
Molex	638191500	J3, J5, J6	Crimp tool Pico-Clasp   Crimp Tool, Ratchet, Molex Pico-Clasp 501193 & 501334 Series 32-28AWG Contacts

Features
<ul style="list-style-type: none"> <li>Motion controller and drive in a single compact unit based on MotionChip™ technology</li> </ul>
<ul style="list-style-type: none"> <li>Universal solution for control of rotary and linear brushless, brushed and 2 or 3-phase step motors</li> </ul>
<ul style="list-style-type: none"> <li>Advanced motion control features, including CSP, CSV, CST, PVT, S-curve, electronic gearing, camming, and more.</li> </ul>
<ul style="list-style-type: none"> <li>Motor supply: 48V nominal</li> </ul>
<ul style="list-style-type: none"> <li>Motor output current: <ul style="list-style-type: none"> <li>Nominal: 5.7A<sub>RMS</sub> / 8A amplitude for PMSM motors</li> <li>7A for DC / BLDC / Step motors</li> <li>Peak: 11.3A<sub>RMS</sub> / 16A amplitude</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>Logic supply: 24V nominal, 48V max</li> </ul>
<ul style="list-style-type: none"> <li>Feedback#1 and Feedback#2 can be: <ul style="list-style-type: none"> <li>1 x Hall sensor interface (digital or linear)</li> <li>Feedback#1 and Feedback#2 can be: <ul style="list-style-type: none"> <li>Incremental encoder A / B (index Z only for Feedback #1): differential or single-ended;</li> <li>Absolute encoder: differential or single-ended. Supported protocols: SSI, BiSS, EnDAT, Tamagawa, Panasonic, Nikon, Sanyo Denki.</li> </ul> </li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>1 x analogue input, 12-bit, software selectable: 0-5V or ±10V; Reference, Feedback or General purpose</li> </ul>
<ul style="list-style-type: none"> <li>3 x digital inputs: 2 for limit switches + one general-purpose, NPN, pull-up on-board to +5V. Pull to GND to activate.</li> </ul>
<ul style="list-style-type: none"> <li>3 x configurable I/Os, each software selectable as: <ul style="list-style-type: none"> <li>Digital input, NPN, with pull-up on-board to +5V. Pull to GND to activate;</li> <li>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.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>Communication interfaces: RS232; USB; TMLCAN and CANopen (CiA 301 v4.2, CiA 305 v.2.2.13 and CiA 402 v3.0) protocols</li> </ul>
<ul style="list-style-type: none"> <li>STO: 2 safe torque-off inputs, safety integrity level (SIL3/Cat3/PLe) acc. to EN61800-5-1; -2/ EN61508-3; -4/ EN ISO 13849-1.</li> </ul>
<ul style="list-style-type: none"> <li>24Kwords E<sup>2</sup>ROM to store setup data, TML motion programs, cam tables and other user data</li> </ul>
<ul style="list-style-type: none"> <li>16Kwords SRAM memory for data acquisition</li> </ul>
<ul style="list-style-type: none"> <li>Operating ambient temperature: 0-40°C (over 40°C with de-rating)</li> </ul>
<ul style="list-style-type: none"> <li>Programmable protections: any short-circuit between motor phases, GND and/or supply, over/under-voltage, over-current, I<sup>2</sup>t drive &amp; motor, control error</li> </ul>
<ul style="list-style-type: none"> <li>&gt;98% voltage efficiency, &gt;98% power efficiency</li> </ul>

Name ALN	First edition August 30, 2024	Document template: P099.TQT.564.0001	Last edition October 29, 2024	Visa:
		Title of document <b>Micro 4804 CZ-CAN-STO PRODUCT DATA SHEET</b>	N° document <b>P020.803.E202.DSH.10B</b>	
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# Micro 4804 CZ-CAN-STO DATASHEET P/N: P020.803.E202

Pin	Name	Type	Description
1	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
2	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
3	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
4	Cr/B-	O	Chopping resistor / Phase B- for 2-ph steppers
5	PE	-	Earth connection

Pin	Name	Type	Description
1	+Vmot	I	Positive terminal of the motor supply: 7 to 48 V <sub>DC</sub> .
2	GND	-	Ground return.
3	+Vlog	I	Positive terminal of the logic supply input: 6 to 48 V <sub>DC</sub> .
4	PE	-	Earth connection

Pin	Name	Type	Description
1	232TX	O	RS-232 Data Transmission.
2	232RX	I	RS-232 Data Reception.
3	GND	-	Ground return.
4	+Vlog	I	Positive terminal of the logic supply input: 6 to 48 V <sub>DC</sub> .
5	IN2/LSP	I	5-48V digital NPN input. Positive limit switch input.
6	IN3/LSN	I	5-48V digital NPN input. Negative limit switch input.
7	I/O0	I/O	5-48V 1.5A NPN (sink) general-purpose digital programmable input IN0 or output OUT0
8	I/O1	I/O	5-48V 0.1A NPN (sink) general-purpose digital programmable input IN1 or output OUT1
9	I/O4	I/O	5-48V 0.1A NPN (sink) general-purpose digital programmable input IN4 or output OUT4
10	IN5	I	5-48V digital general-purpose NPN input
11	GND	-	Ground return.
12	AnalogIn	I	Analog input (range software selectable 0-5V or ±10V)
13	+5V	O	Supply for all feedback sensors.

Pin	Name	Type	Description
1	GND	-	Ground return.
2	Hall1 / LH1	I	Digital Hall, or Linear Hall sensor 1.
3	+5V	O	5V supply for all feedback sensors.
4	Hall2 / LH2	I	Digital Hall, or Linear Hall sensor 2.
5	+5V	O	5V supply for all feedback sensors.
6	Hall3 / LH3	I	Digital Hall, or Linear Hall sensor 3.
7	EncA1+/EncA1 Dt1+/Dt1	I	Encoder 1 A / Data+ diff. input or single-ended input; set SW1 position 7 for differential.
8	GND	-	Ground return.
9	EncA1-/Dt1-	I	Encoder 1 A-/Data- diff. input.; set SW1 position 7 for differential.
10	+5V	O	5V supply for all feedback sensors.
11	EncB1+/EncB1 Clk1+/Clk1	I	Encoder 1 B+ / Clock+ diff. input or single-ended input; set SW1 position 8 for differential.
12	EncA2+/EncA2 Dt2+/Dt2	I	Incr. encoder 2 A / Data+ diff. input or single-ended input; set SW1 position 9 for differential.
13	EncB1/ Clk1-	I	Encoder 1 B- / Clock- diff. input.; set SW1 position 8 for differential.
14	EncA2-/Dt2-	I	Incr. encoder 2 A- diff. input; set SW1 position 9 for differential.
15	Z1+	I	Incr. encoder 1 Z / Z+ diff. input or single-ended input; set SW1 position 11 for differential.
16	EncB2+/EncB2 Clk2+/Clk2	I/O	Incr. encoder 2 B+ / Clock+ diff. input or single-ended input; set SW1 position 10 for differential.
17	Z1-	I	Incr. encoder 1 Z- diff. input; set SW1 position 11 for differential.
18	EncB2- Clk2-	I	Encoder 2 B- / Clock- diff. input; set SW1 position 10 for differential.
19	GND	-	Ground return.
20	+Vlog	I	Positive terminal of the logic supply: 6 to 48 V <sub>DC</sub> .

Pin	Name	Type	Description
1	+V USB	I	USB supply.
2	USB DM	I/O	USB data-.
3	USB DP	I/O	USB data+.
4	Rsvd	-	Reserved. Do not connect.
5	GND	-	Ground return.

Pin	Name	Type	Description
1	STO2-	I	Safe Torque Off input 2, negative return (opto-isolated, 0V)
2	STO2+	I	Safe Torque Off input 2, positive input (opto-isolated, 18+40V)
3	PE	-	Earth connection
4			
5	STO1+	I	Safe Torque Off input 1, positive input (opto-isolated, 18+40V)
6	STO1-	I	Safe Torque Off input 1, negative return (opto-isolated, 0V)

Pin	Name	Type	Description
1	GND	-	Ground return.
2	CAN Lo	-	CAN-Bus negative line (dominant low)
3	CAN Hi	-	CAN-Bus positive line (dominant high)

SW1	Description
1	ON = Bit x = 1.
2	OFF = Bit x = 0.
3	The maximum AxisID value is 31.
4	When all Bits are set to 0, AxisID value is 255.
5	In CANOpen mode, if the AxisID is set to 255, the drive enters the "LSS inactive" state. In this state, the Green LED will flash at 1-second intervals.
6	ON = TMLCAN mode is selected
7	OFF = CANOpen mode is selected
8	ON = Connect an 120Ω resistor between EncA1-/Dt1- and EncA1+/EncA1/Dt1+/Dt1 feedback pins.
9	ON = Connect an 120Ω resistor between EncB1-/Clk1- and EncB1+/EncB1/Clk1+/Clk1 feedback pins.
10	ON = Connect an 120Ω resistor between EncA2-/Dt2- and EncA2+/EncA2/Dt2+/Dt2 feedback pins.
11	ON = Connect an 120Ω resistor between EncB2-/Clk2- and EncB2+/EncB2/Clk2+/Clk2 feedback pins.
12	ON = Connect an 120Ω resistor between Z1- and Z1+ feedback pins.
13	ON = Connect an 120Ω resistor between CAN Hi and CAN Lo signals.



Position	Description
1	AxisID register Bit 0.
2	AxisID register Bit 1.
3	AxisID register Bit 2.
4	AxisID register Bit 3.
5	AxisID register Bit 4.
6	ON = TMLCAN mode is selected
7	OFF = CANOpen mode is selected
8	ON = Connect an 120Ω resistor between EncA1-/Dt1- and EncA1+/EncA1/Dt1+/Dt1 feedback pins.
9	ON = Connect an 120Ω resistor between EncB1-/Clk1- and EncB1+/EncB1/Clk1+/Clk1 feedback pins.
10	ON = Connect an 120Ω resistor between EncA2-/Dt2- and EncA2+/EncA2/Dt2+/Dt2 feedback pins.
11	ON = Connect an 120Ω resistor between EncB2-/Clk2- and EncB2+/EncB2/Clk2+/Clk2 feedback pins.
12	ON = Connect an 120Ω resistor between Z1- and Z1+ feedback pins.
13	ON = Connect an 120Ω resistor between CAN Hi and CAN Lo signals.

No.	Name	Color	Description
LED2	TML ERR	RED	Turned on when the drive detects an error condition.
LED3	TML RDY	GREEN	Lit after power-on when the drive initialization ends. Turned off when an error occurs.



# Micro 4804 CZ-CAN-STO DATASHEET

P/N: P020.803.E202

## Electrical characteristics

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

- $V_{LOG} = 24$  VDC;  $V_{MOT} = 48$  VDC;  $F_{PWM} = 20$  kHz
- Ambient temperature = 25°C (typical values) / 0°C...40°C (min/max values)
- Supplies start-up / shutdown sequence: -any-
- Load current = nominal

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature		0		40 <sup>1</sup>	°C
Ambient humidity		Non-condensing		90	%Rh
Altitude / pressure <sup>2</sup>		-0.1	0 ± 2.5	2	Km
		0	0.75 ± 1	10.0	atm
Storage Conditions		Min	Typ	Max	Units
Ambient temperature		-40		100	°C
Ambient humidity		Non-condensing		100	%Rh
Ambient Pressure		0		10.0	atm
ESD capability (Human body model)		Not powered; applies to any accessible part		±5	kV
		Original packaging		±15	kV
Mechanical Mounting		Min	Typ	Max	Units
Airflow		natural convection, closed box			
Spacing required between adjacent drives		10			mm
Spacing required above drive		30	80		
Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)		43.5 x 40 x 22.8			mm
Global size		~ 1.7 x 1.6 x 0.9			inch
Weight		34.3			g
Cleaning agents		Dry cleaning is recommended Only Water- or Alcohol-based			
Protection degree		According to IEC60529 IP20			-
Power dissipation		Idle ( $I_{MOT} = 0A$ )		1	1.2
		Full power ( $I_{MOT} = \text{nominal}$ )		2.0	2.4
Power efficiency		Full power ( $I_{MOT} = \text{nominal}$ )		98.7	
Voltage efficiency		$f_{PWM} = 20KHz$		98.3	
		$f_{PWM} = 100KHz$		91.4	
Surface temperature of metallic baseplate		40			°C
Logic Supply Input (+V <sub>LOG</sub> )		Min	Typ.	Max.	Units
Nominal values		6	24	48	V <sub>DC</sub>
Supply voltage		Absolute maximum values, drive operating but outside guaranteed parameters		4.9	50
		Absolute maximum values, continuous		-0.5	53
Supply current		+V <sub>LOG</sub> = 12V		90	150
		+V <sub>LOG</sub> = 24V		60	90
		+V <sub>LOG</sub> = 48V		45	60
Utilization category		Acc. to 60947-4-1 ( $I_{PEAK} \leq 1.05 \cdot I_{NOM}$ )			DC-1
Motor Supply Input (+V <sub>MOT</sub> )		Min	Typ.	Max.	Units
Nominal values		7		48	V <sub>DC</sub>
Supply voltage		Absolute maximum values, drive operating but outside guaranteed parameters		6	50
		Absolute maximum values, continuous		-0.5	53
Supply current		Idle		0.3	mA
		Operating		-16	±7
Voltage measurement error		±0.15			±0.25
Utilization category		Acc. to 60947-4-1 ( $I_{PEAK} \leq 4.0 \cdot I_{NOM}$ )			DC-3
Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage		Current sourced = 400mA		5.05	5.2
Output current		Output voltage ≥ 4.85V			5.25
					1,200
Short-circuit to GND protection		Yes / Drive resets at event			
Over-voltage protection		NOT protected			
ESD protection - Human body model		±1			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)			
Input voltage		4.5	4.8	5.2	V
		Logic "LOW"		1.5	1.7
		Logic "HIGH"		3	2.5
		Hysteresis		0.5	
		Analog		0	0.5...4.5
Input current		Logic "LOW"; Pull to GND		2.4	
		Logic "HIGH"; Internal 2.2KΩ pull-up to +5		0	
Minimum pulse width		66			µs
ESD protection - Human body model		±15			kV

Motor Outputs (A/A+, B/A-, C/B+, CR/B-)		Min.	Typ.	Max.	Units
Nominal current		PMSM motors sinusoidal amplitude		±8	A
		PMSM motors sinusoidal RMS		5.7	A <sub>RMS</sub>
		DC/BLDC/STEP motors continuous		7	A
Peak current		maximum 4 seconds		-16	+16
Short-circuit protection threshold		±25			±28
Short-circuit protection delay		2.6			3.5
					µs
On-state voltage drop		Nominal output current; including typical mating connector contact resistance		50	70
Off-state leakage current		0.3			1
		±1			±1.5
					%FS
Current measurement		Accuracy (FS = Full Scale)		±4	±6
		Noise (current ≤ 2A)		±30	±50
		Noise (current ≥ 2A)			±0.16
		Offset drift (compensated @ AxisOn)			±0.16
					mA/°C
Motor inductance (phase-to-phase)		Recommended value to avoid spurious short-circuit protection, triggered by ripple		Fast loop <sup>3</sup> V <sub>MOT</sub>	
		50µs		48V	133
		100µs		48V	266
		50µs		24V	66
		100µs		24V	133
Motor electrical time-constant (L/R)		Recommended value for ±5% current measurement error		F <sub>PWM</sub> = 20 kHz	330
				F <sub>PWM</sub> = 40 kHz	170
				F <sub>PWM</sub> = 60 kHz	140
				F <sub>PWM</sub> = 80 kHz	80
				F <sub>PWM</sub> = 100 kHz	66
					µs
Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN4, IN5)		Min.	Typ.	Max.	Units
Mode compliance		NPN (sink)			
Default state		Input floating (wiring disconnected) Logic HIGH			
Input voltage		Logic "LOW"		1.4	1.8
		Logic "HIGH"		3.1	2.5
		Hysteresis		0.9	1.1
		Logic "LOW"			1.4
		Logic "HIGH"		4	3.5
		Hysteresis			0.6
		Floating voltage (not connected)			4.7
		Absolute maximum, continuous		IN2/LSP, IN3/LSN, IN5	-2
				IN0, IN1, IN4	-0.5
					V <sub>LOG</sub> +0.5
Input current		Logic "LOW"; Pulled to GND		6.5	8
		Logic "HIGH"; Pulled to +24V		0.2	0.4
Input frequency		0			500
Minimum pulse		1			
ESD protection - Human body model		±2			
					kV
Digital Outputs (OUT0, OUT1, OUT4)		Min.	Typ.	Max.	Units
Mode compliance		NPN (sink) 24V			
Load type		Resistive, Inductive			
Default state		Not supplied (+V <sub>LOG</sub> floating) High-Z (floating)			
		Immediately after power-up Logic "HIGH"			
Output voltage		Logic "LOW"; output current = 1.5A for OUT0/ 0.05A for OUT1, OUT4			0.4
		Logic "HIGH"; output current = 0, no load		4	4.7
		Logic "HIGH", external load to +V <sub>LOG</sub>			V <sub>LOG</sub>
		Absolute maximum, continuous (free-wheeling diodes to +V <sub>LOG</sub> to GND)		-0.5	V <sub>LOG</sub> +0.5
		Absolute maximum, surge (duration ≤ 1s) †		-1	V <sub>LOG</sub> +1
Output current		Logic "LOW", sink current, short duration, duty cycle <=1%		5s max	OUT1, OUT4
				0.5s max	OUT1, OUT4
					OUT0
					0.15
					2.5
					0.05
		Logic "LOW", sink current, continuous; V <sub>OUT</sub> ≤ 0.4V			1.5
		Logic "HIGH", source current; external load to GND; V <sub>OUT</sub> ≥ 2.0V			5
				V <sub>LOG</sub> =24V	0.18
				V <sub>LOG</sub> =48V	0.2
					0.42
					0.45
Minimum pulse width		0.5			
ESD protection - Human body model		±25			
					µs
					kV

<sup>1</sup> Operating temperature at higher temperatures is possible with reduced current and power ratings  
<sup>2</sup> Micro 4804 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.

<sup>3</sup> Fast loop period of 50µs is not possible with all feedback device types.

Name	First edition	Document template: P099.TQT.564.0001	Last edition	Visa:
ALN	August 30, 2024		October 29, 2024	
		Title of document	N° document	
		Micro 4804 CZ-CAN-STO PRODUCT DATA SHEET	P020.803.E202.DSH.10B	
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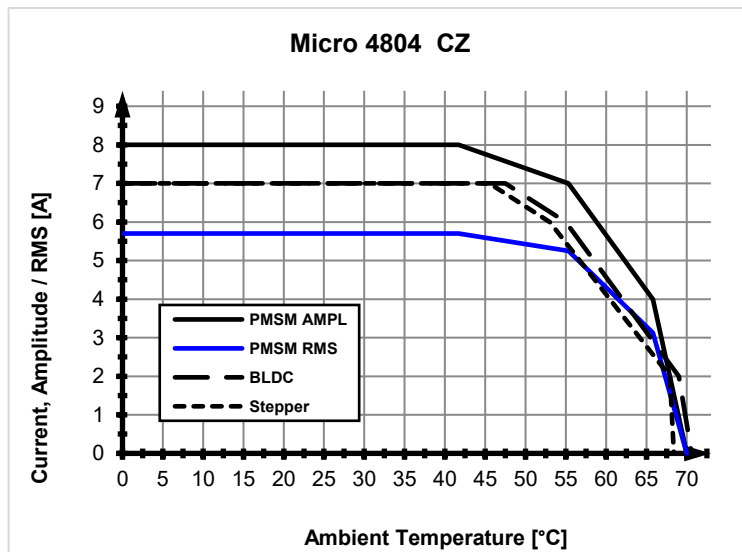
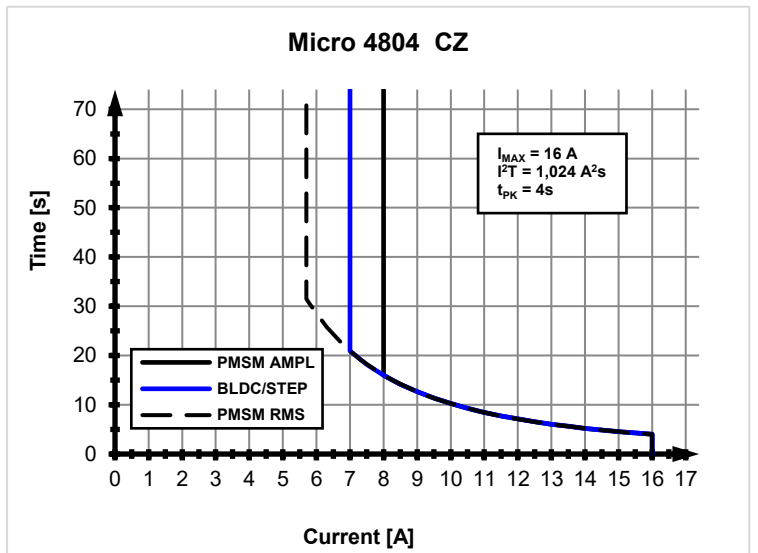
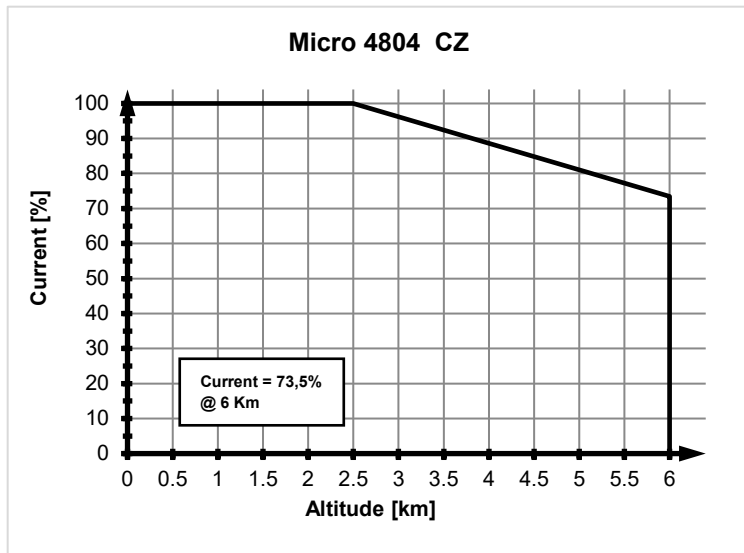
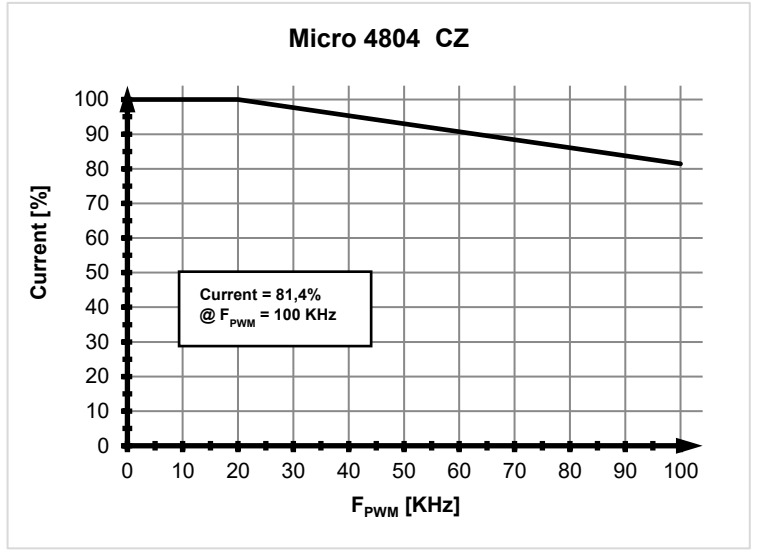
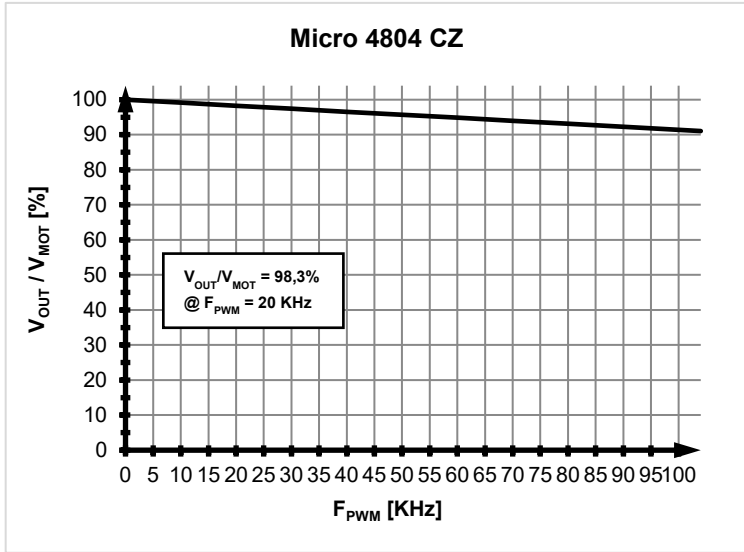
Encoder Inputs (A1+, A1-, B1+, B1-, Z1+, Z1-, A2+, A2-, B2+, B2-) <sup>1</sup>		Min.	Typ.	Max	Units
Single-ended mode compliance	Leave A1-, B1-, Z1-, A2-, B2- floating	TTL / CMOS / Open-collector (NPN sink)			
Single-ended threshold	A1+, B1+, Z1+, A2+, B2+	1.3	1.4	1.5	V
Single-ended input current	Input pulled to GND against on-board 2.2 KΩ pull-up to +5V		2.4	2.7	mA
Differential mode compliance	For full RS422 compliance, see <sup>1</sup>	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	Common-mode (A1+ to GND, etc.)		2.2		kΩ
	Differential (A1+ to A1-, etc.)		4.4		
Input frequency	Differential mode	0		15	MHz
Minimum pulse width	Differential mode	33			ns
ESD protection	Human body model	±30			kV
RS-232		Min.	Typ.	Max.	Units
Compliance		TIA/EIA-232-C			
Bit rate	Software selectable	9600		115200	Baud
Output voltage		±5	±5.7		V
Short-circuit	232TX to GND	Guaranteed			
Input voltage	Absolute maximum, continuous	-30		+30	V
ESD protection	Human body model	±15			kV
Absolute encoder interface:					
SSI, BISS-C, EnDAT, Tamagawa, Nikon, Sanyo Denki		Min	Typ.	Max	Units
Single-ended mode	Not recommended, reduced robustness & speed				
Differential mode compliance	For full RS422 compliance, see <sup>1</sup>	TIA/EIA-422-A			
Output voltage	Differential; 50Ω differential load	1.5	3.3		V
	Common-mode, referenced to GND	1	1.7	3	
CLOCK frequency	Nikon, Sanyo Denki	2.5, 4			kHz
	Panasonic, Tamagawa	2.5			
	All others	1, 2, 3, 4			
Output 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	Including CRC, flags, ...			64	Bits
	If total resolution >31 bits, some bits must be ignored by software setting to achieve a max. 31 bits resolution				
Analog Input (REF/ FDBK)		Min	Typ.	Max	Units
Input voltage	Operational range	0...5, -10...+10			
	Absolute maximum values, continuous	-22		+26	V
	Absolute maximum, surge (duration ≤ 1s)			±38	
Input impedance	To 1.44V		20	kΩ	
Bandwidth (-3dB)	Software selectable	0		5.3	kHz
Resolution			12		bits
Integral linearity				±1	bits
Offset error	Range -10V ... +10V		±3	±10	bits
	Range 0 ... +5V		±10	±30	
Gain error	Range -10V ... +10V		±0.3	±0.5	%
	Range 0 ... +5V		±0.5	±0.8	
ESD protection	Human body model	±1.5			kV

CAN-Bus		Min.	Typ.	Max.	Units
Compliance		CAN 2.0B, ISO 11898-2			
Software protocols compatibility		CiA301, CiA305, CiA402, TechnoCAN, TMLcan			
Bit rate	Software selectable	125, 250, 500, 1000			KBaud
Node addressing	TMLcan	1 + 255			-
	CANopen	not configured, 1 + 127			-
Voltage	Common-mode, operating	-12		+12	V
	Common-mode, max. continuous	-58		+58	V
	Differential, max. continuous	-45		+45	V
Input impedance	Differential	40		90	kΩ
	Common-mode	20		45	kΩ
Termination resistor (120Ω)		Included – SW1 Position 12			
ESD protection	Human body model	±10			kV
Safe Torque Off (STO) Inputs		Min.	Typ.	Max.	Units
Safety Integrity Level		SIL 3			
Performance Level		PL e			
Safety Category		Cat 3			
Reaction time				30	ms
Ignored diagnostic pulses	Duration			5	ms
	Repetition rate			20	Hz
MTTFd			377		years
DC			90		%
PFH			8E-10		hours
Lifetime			20		years
V <sub>Log</sub>	External power supply	SELV or PELV			
Pollution Degree				2	-
	Cabinet / Housing	IP54			-
STO wiring	Bundling / Grouping	Separate wiring for STO1, STO2			
	Shielding	Separate shield for STO1, STO2			
Compatibility	Each STO channels has separate + and - terminals	PNP (source) or NPN (sink), depending on user connection			
Isolation		Each STO channel is opto-isolated			
Voltage, STOx+ to STOx-	Inactive (torque off)		0	5.6	V
	Active (motor driven)	18	24		V
Voltage	Abs. maximum, continuous	-70		+70	V
	Isolation, STO1 to STO2	±2			KV
Current	Isolation, STOx to GND	±2			KV
	STOx+ - STOx- = 24V		3	5	mA
ESD protection	Human body model	±30			kV

<sup>†</sup> 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.

<sup>1</sup> To achieve full RS-422 compatibility and enhance noise rejection, it is necessary to connect an external 120Ω resistor across each signal pair (A1+/A1-, B1+/B1-, Z1+/Z1-, A2+/A2-, B2+/B2-). This can be done through SW1 positions 7 to 11.

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