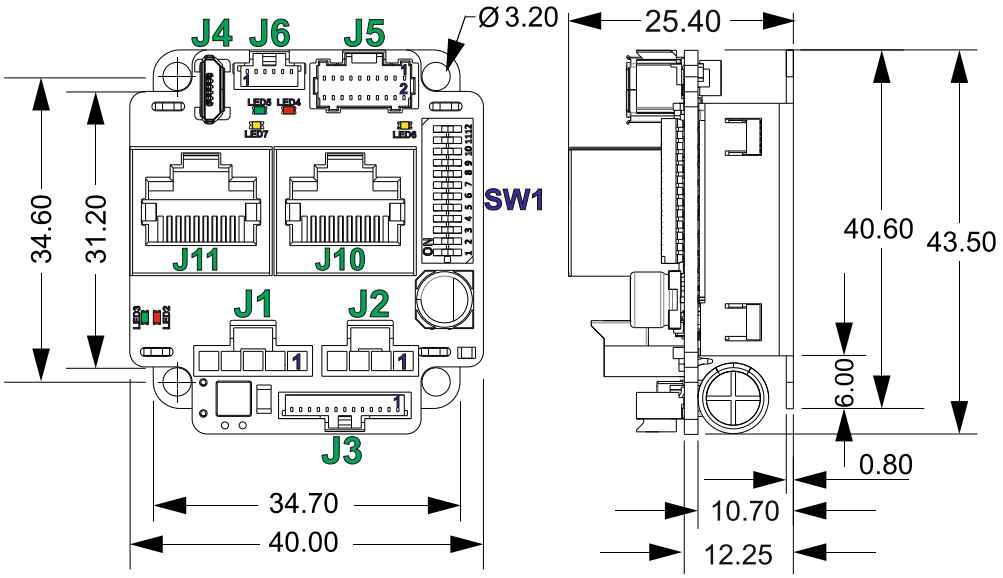
Micro 4804 CZ-CAT
DATASHEET
P/N: P020.802.E222



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	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	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	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	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

- Motion controller and drive in a single compact unit based on MotionChip™ technology
- Universal solution for control of rotary and linear brushless, brushed and 2 or 3-phase step motors
- Advanced motion control features, including CSP, CSV, CST, PVT, S-curve, electronic gearing, camming, and more.
- Motor supply: 48V nominal
- Motor output current:
  - Nominal: 5.7A_{RMS} / 8A amplitude for PMSM motors
    7A for DC / BLDC / Step motors
  - Peak: 11.3A_{RMS} / 16A amplitude
- Logic supply: 24V nominal, 48V max
- Feedback Options:
  - 1 x Hall sensor interface (digital or linear)
  - Feedback#1 and Feedback#2 can be:
    - Incremental encoder A / B (index Z only for Feedback 1): differential or single-ended;
    - Absolute encoder: differential or single-ended. Supported protocols: SSI, BiSS, EnDAT, Tamagawa, Panasonic, Nikon, Sanyo Denki.
- 1 x analogue input, 12-bit, software selectable: 0-5V or ±10V; Reference, Feedback or General purpose
- 3 x digital inputs: 2 for limit switches + one Enable, NPN, 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.
- Commissioning (set-up) possible through RS232, USB, FoE (file-over-EtherCAT) or EoE (Ethernet-over-EtherCAT)
- EtherCAT connection: standard RJ45 ports
- 24Kwords E^2ROM to store setup data, TML motion programs, cam tables and other user data
- 16Kwords 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, I^2t drive & motor, control error
- >98% voltage efficiency, >98% power efficiency

J1

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

J2

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

J3

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_{DC}.
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/Enable	I	5-48V digital NPN input. Drive Enable 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.

J5

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- / Data - 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_{DC}.

J4

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.

J6

Pin	Name	Type	Description
Reserved. Do not connect.			

Port	Name	Type	Description
J10	ECAT IN	I	EtherCAT standard RJ45 Ethernet IN port.
J11	ECAT OUT	O	EtherCAT standard RJ45 Ethernet OUT port.

SW1

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	AxisID register Bit 7.
7	ON = Connect an 120Ω resistor between EncA1-/Dt1- and EncA1+/EncA1/Dt1+/Dt1 feedback pins.
8	ON = Connect an 120Ω resistor between EncB1/Clk1- and EncB1+/EncB1/Clk1+/Clk1 feedback pins.
9	ON = Connect an 120Ω resistor between EncA2-/Dt2- and EncA2+/EncA2/Dt2+/Dt2 feedback pins.
10	ON = Connect an 120Ω resistor between EncB2/Clk2- and EncB2+/EncB2/Clk2+/Clk2 feedback pins.
11	ON = Connect an 120Ω resistor between Z1- and Z1+ feedback pins.
12	ON = Connect an 120Ω resistor between CAN Hi and CAN Lo signals.

ON: Bit x = 1.
OFF: Bit x = 0.
Possible AxisID values: 1÷31 and 128÷159.
When all Bits are set to 0, AxisID value is 255.
When the AxisID value is 255, the EtherCAT register called "configured station alias" will be 0

LEDs

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.
LED4	ECAT ERR	RED	EtherCAT® ERROR indicator.
LED5	ECAT RUN	GREEN	EtherCAT® RUN indicator.
LED6	ECAT ACT0	YELLOW	Shows the state of the physical link and activity for ECAT IN and OUT ports.
LED7	ECAT ACT1	YELLOW	

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[1]	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure[2]	Altitude (vs. sea level)	-0.1	0 ÷ 2.5	[3]	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			±5	kV
	Original packaging			±15	kV

[1] Operating temperature at higher temperatures is possible with reduced current and power ratings

[2] 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.

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Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Global size		43.5 x 40 x 25.4		mm
			~ 1.7 x 1.6 x 1		inch
Weight			38.3		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	W
	Full power (I_{MOT} = nominal)		2.0	2.4	
Power efficiency	Full power (I_{MOT} = nominal)		98.7		%
Voltage efficiency	f_{PWM} = 20KHz		98.3		
	f_{PWM} = 100KHz		91.4		
Surface temperature of metallic baseplate				40	ºC

Mechanical Mounting		Min	Typ	Max	Units
Airflow	natural convection, closed box				
Spacing required between adjacent drives		10			mm
Spacing required above drive	For counter-connectors & cable bending	30	80		

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		50	V_{DC}
	Absolute maximum values, continuous	-0.5		53	V_{DC}
Supply current	+V_{LOG} = 12V		90	150	mA
	+V_{LOG} = 24V		60	90	
	+V_{LOG} = 48V		45	60	
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		50	V_{DC}
	Absolute maximum values, continuous	-0.5		53	V_{DC}
Supply current	Idle		0.3		mA
	Operating	-16	±7	+16	A
Voltage measurement error			±0.15	±0.25	V
Utilization category	Acc. to 60947-4-1 (I_{PEAK}<=4.0*I_{NOM})	DC-3			

Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 400mA	5.05	5.2	5.25	V
Output current	Output voltage ≥ 4.85V			1,200	mA
Short-circuit to GND protection		Yes / Drive resets at event			
Over-voltage protection		NOT protected			
ESD protection	Human body model	±1			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_{RMS}
	DC/BLDC/STEP motors continuous					7	A
Peak current	maximum 4 seconds			-16		+16	A
Short-circuit protection threshold					±25	±28	A
Short-circuit protection delay				2.6		3.5	µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance				50	70	mV
Off-state leakage current					0.3	1	mA
Current measurement	Accuracy (FS = Full Scale)				±1	±1.5	%FS
	Noise (current ≤ 2A)				±4	±6	mA
	Noise (current ≥ 2A)				±30	±50	
	Offset drift (compensated @ AxisOn)					±0.16	mA/ºC
Motor inductance (phase-to-phase)	Recommended value to avoid spurious short-circuit protection, triggered by ripple	Fast loop[1]	V_{MOT}				µH
		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_{PWM} = 20 kHz			330		µs
		F_{PWM} = 40 kHz			170		
		F_{PWM} = 60 kHz			140		
		F_{PWM} = 80 kHz			80		
		F_{PWM} = 100 kHz			66		

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	4.8	5.2	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			2.4		mA
	Logic "HIGH"; Internal 2.2KΩ pull-up to +5			0		
Minimum pulse width				66		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 (sink)			
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	1.4	
	Logic "LOW"	IN2/LSP, IN3/LSN		1.4	1.6	
	Logic "HIGH"		4	3.5		
	Hysteresis			0.6		
	Floating voltage (not connected)			4.7		
	Absolute maximum, continuous	IN2/LSP, IN3/LSN, IN5/ENA	-2		+80	
		IN0, IN1, IN4	-0.5		V_{LOG}+0.5	
Input current	Logic "LOW"; Pulled to GND			6.5	8	mA
	Logic "HIGH"; Pulled to +24V			0.2	0.4	
Input frequency			0		500	kHz
Minimum pulse			1			µs
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_{LOG} 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	V
	Logic "HIGH"; output current = 0, no load			4	4.7	5.2	
	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	OUT1, OUT4			0.1	A
			OUT0			2	
		0.5s max	OUT1, OUT4			0.15	
			OUT0			2.5	
	Logic "LOW", sink current, continuous; V_{OUT} ≤ 0.4V		OUT1, OUT4			0.05	
			OUT0			1.5	
	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		V_{LOG}=24V		0.18	0.2	mA
			V_{LOG}=48V		0.42	0.45	
Minimum pulse width				0.5			µs
ESD protection - Human body model				±25			kV

Encoder Inputs (A1+, A1-, B1+, B1-, Z1+, Z1-, 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 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[1]		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

[1] Fast loop period of 50µs is not possible with all feedback device types.

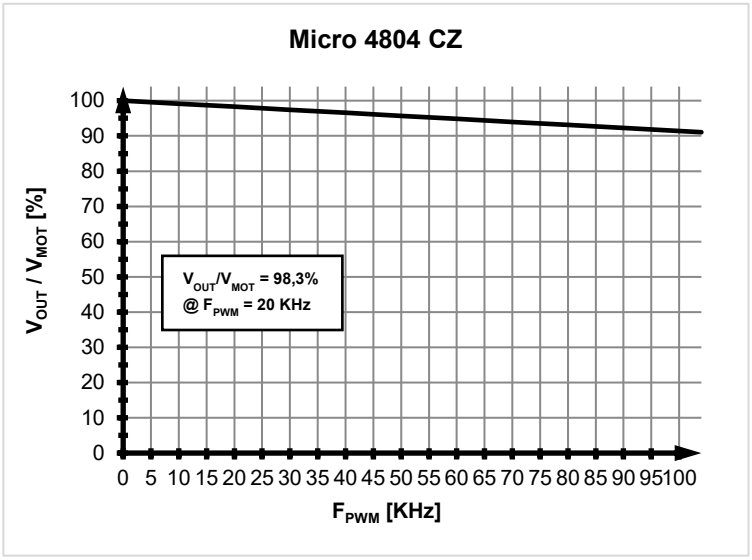
[2] Full RS-422 compatibility, as well as noise rejection improvement requires an external 120Ω resistor connected across each signal pair (A1+/A1-, B1+/ B1-, Z1+/Z1-, A2+/A2-, B2+/B2-)

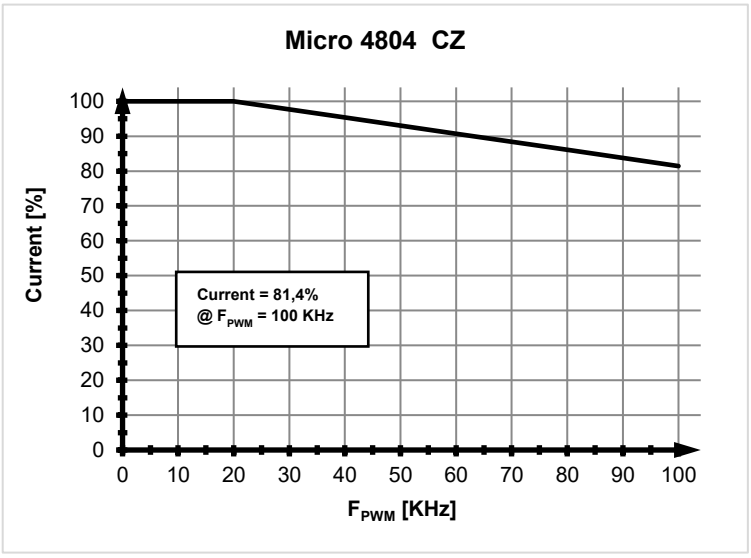
EtherCAT®		Min.	Typ.	Max.	Units
Compliance			IEEE802.3, IEC61158		
Software protocols compatibility			CoE, FoE, EoE, IEC61800-7-301		
Transmission line	According to TIA/EIA-568-5-A	5	5e	6	Category
		UTP	FTP	STP	Shield
Auto	swap + / - inside a pair		Yes (MLT3 encoding)		
	swap Rx / Tx pairs		Yes (auto-MDI/MDIX)		
	Swap port0(IN) / port1(OUT)		NO (EtherCAT requirement)		
Configured Station Alias (using AxisID)			0÷31 and 128÷159		-
ESD protection	Human body model	±5			kV

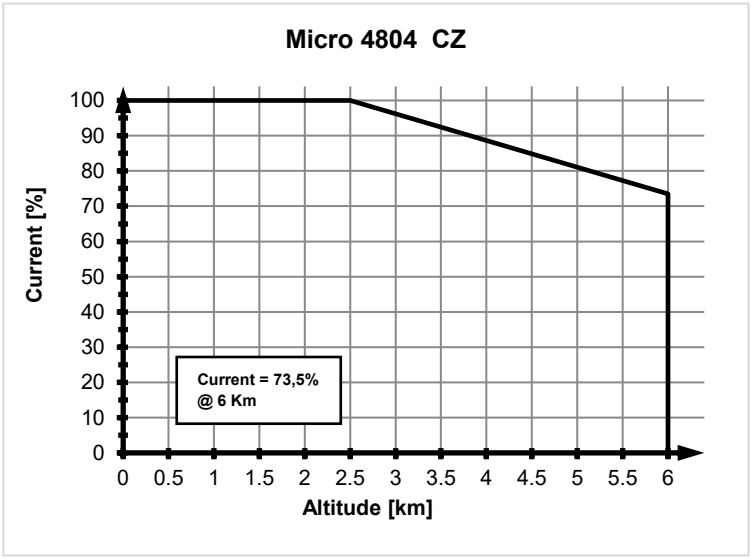
Absolute encoder interface: SSI, BISS-C, EnDAT, Tamagawa, Nikon, Sanyo Denki		Min	Typ.	Max	Units
Single-ended mode	Not recommended, reduced robustness & speed				
Differential mode compliance	For full RS422 compliance, see[1]		TIA/EIA-422-A		
Output voltage	Differential; 50Ω differential load	1.5	3.3		V
	Common-mode, referenced to GND	1	1.7	3	
CLOCK frequency	Nikon, Sanyo Denki		2.5, 4		MHz
	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				

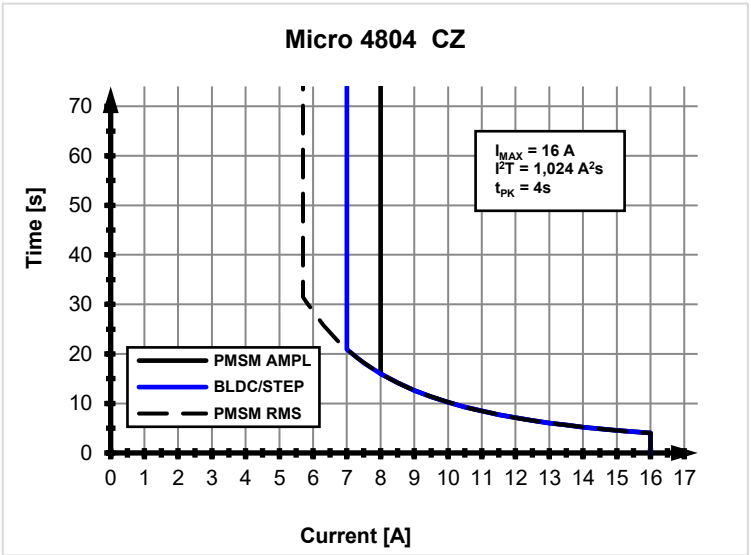
Analog Input (REF/ FDBK)		Min	Typ.	Max	Units
Input voltage	Operational range		0…5, -10…+10		V
	Absolute maximum values, continuous	-22		+26	
	Absolute maximum, surge (duration ≤ 1s)			±38	
Input impedance	To 1.44V		20		kΩ
Bandwidth (-3dB)	Software selectable	0		5.3	kHz
Resolution			12		bits
Integral 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

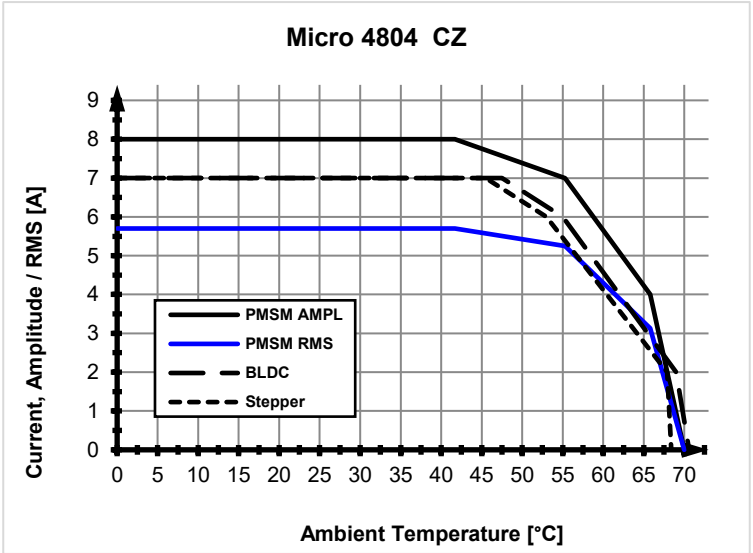
† Stresses beyond values listed under “absolute maximum ratings” may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.


Micro 4804 CZ
V_{OUT} / V_{MOT} [%]
V_{OUT}/V_{MOT} = 98,3%
@ F_{PWM} = 20 KHz
F_{PWM} [KHz]


Micro 4804 CZ
Current [%]
Current = 81,4%
@ F_{PWM} = 100 KHz
F_{PWM} [KHz]


Micro 4804 CZ
Current [%]
Current = 73,5%
@ 6 Km
Altitude [km]


Micro 4804 CZ
Time [s]
I_{MAX} = 16 A
I^2T = 1,024 A^2s
t_{PK} = 4s
PMSM AMPL
BLDC/STEP
PMSM RMS
Current [A]


Micro 4804 CZ
Current, Amplitude / RMS [A]
PMSM AMPL
PMSM RMS
BLDC
Stepper
Ambient Temperature [°C]