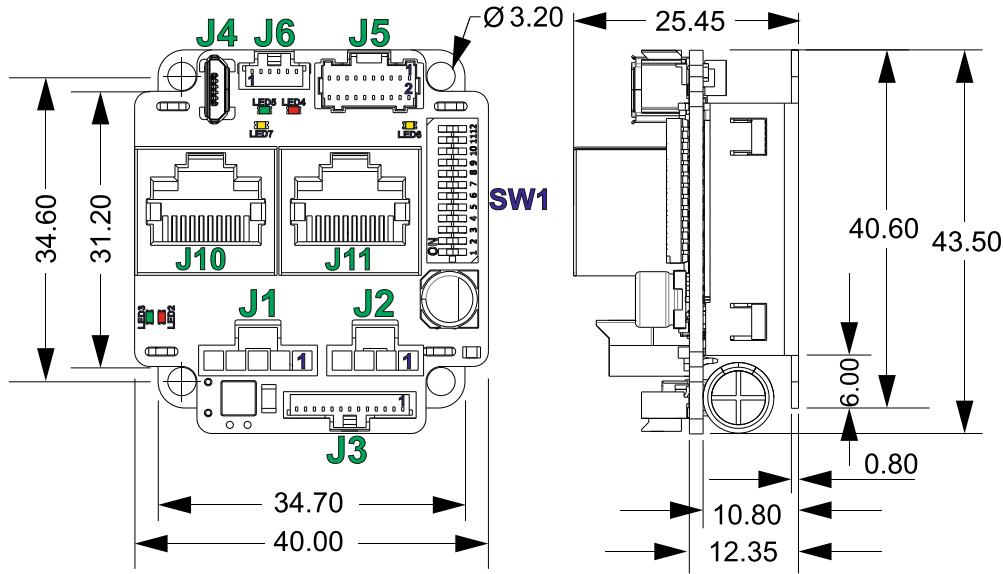




Micro 4804 CZ-CAT-STO DATASHEET

P/N: P020.803.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
<ul style="list-style-type: none"> Motion controller and drive in a single compact unit based on MotionChip™ technology
<ul style="list-style-type: none"> Universal solution for control of rotary and linear brushless, brushed and 2 or 3-phase step motors
<ul style="list-style-type: none"> Advanced motion control features, including CSP, CSV, CST, PVT, S-curve, electronic gearing, camming, and more.
<ul style="list-style-type: none"> Motor supply: 48V nominal
<ul style="list-style-type: none"> Motor output current: <ul style="list-style-type: none"> Nominal: 5.7A_{RMS} / 8A amplitude for PMSM motors 7A for DC / BLDC / Step motors Peak: 11.3A_{RMS} / 16A amplitude
<ul style="list-style-type: none"> Logic supply: 24V nominal, 48V max
<ul style="list-style-type: none"> Feedback Options: <ul style="list-style-type: none"> 1 x Hall sensor interface (digital or linear) Feedback#1 and Feedback#2 can be: <ul style="list-style-type: none"> 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 general-purpose, NPN, pull-up on-board to +5V. Pull to GND to activate. 3 x configurable I/Os, each software selectable as: <ul style="list-style-type: none"> 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.
<ul style="list-style-type: none"> Commissioning (set-up) possible through RS232, USB, FoE (file-over-EtherCAT) or EoE (Ethernet-over-EtherCAT)
<ul style="list-style-type: none"> EtherCAT connection: standard RJ45 ports
<ul style="list-style-type: none"> 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.
<ul style="list-style-type: none"> 24Kwords E²ROM to store setup data, TML motion programs, cam tables and other user data
<ul style="list-style-type: none"> 16Kwords SRAM memory for data acquisition
<ul style="list-style-type: none"> Operating ambient temperature: 0-40°C (over 40°C with de-rating)
<ul style="list-style-type: none"> Programmable protections: any short-circuit between motor phases, GND and/or supply, over/under-voltage, over-current, I² drive & motor, control error
<ul style="list-style-type: none"> >98% voltage efficiency, >98% power efficiency

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Pin	Name	Type	Description
J1 1	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
J1 2	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
J1 3	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
J1 4	Cr/B-	O	Chopping resistor / Phase B- for 2-ph steppers
J1 5	PE	-	Earth connection

Pin	Name	Type	Description
J2 1	+Vmot	I	Positive terminal of the motor supply: 7 to 48 V _{DC} .
J2 2	GND	-	Ground return.
J2 3	+Vlog	I	Positive terminal of the logic supply input: 6 to 48 V _{DC} .
J2 4	PE	-	Earth connection

Pin	Name	Type	Description
J3 1	232TX	O	RS-232 Data Transmission.
J3 2	232RX	I	RS-232 Data Reception.
J3 3	GND	-	Ground return.
J3 4	+Vlog	I	Positive terminal of the logic supply input: 6 to 48 V _{DC} .
J3 5	IN2/LSP	I	5-48V digital NPN input. Positive limit switch input.
J3 6	IN3/LSN	I	5-48V digital NPN input. Negative limit switch input.
J3 7	I/O0	I/O	5-48V 1.5A NPN (sink) general-purpose digital programmable input IN0 or output OUT0
J3 8	I/O1	I/O	5-48V 0.1A NPN (sink) general-purpose digital programmable input IN1 or output OUT1
J3 9	I/O4	I/O	5-48V 0.1A NPN (sink) general-purpose digital programmable input IN4 or output OUT4
J3 10	IN5	I	5-48V digital general-purpose NPN input
J3 11	GND	-	Ground return.
J3 12	AnalogIn	I	Analog input (range software selectable 0-5V or ±10V)
J3 13	+5V	O	Supply for all feedback sensors.

Pin	Name	Type	Description
J5 1	GND	-	Ground return.
J5 2	Hall1 / LH1	I	Digital Hall, or Linear Hall sensor 1.
J5 3	+5V	O	5V supply for all feedback sensors.
J5 4	Hall2 / LH2	I	Digital Hall, or Linear Hall sensor 2.
J5 5	+5V	O	5V supply for all feedback sensors.
J5 6	Hall3 / LH3	I	Digital Hall, or Linear Hall sensor 3.
J5 7	EncA1+/EncA1 Dt1+/Dt1	I	Encoder 1 A / Data+ diff. input or single-ended input; set SW1 position 7 for differential.
J5 8	GND	-	Ground return.
J5 9	EncA1-/Dt1-	I	Encoder 1 A-/Data- diff. input.; set SW1 position 7 for differential.
J5 10	+5V	O	5V supply for all feedback sensors.
J5 11	EncB1+/EncB1 Clk1+/Clk1	I	Encoder 1 B+ / Clock+ diff. input or single-ended input; set SW1 position 8 for differential.
J5 12	EncA2+/EncA2 Dt2+/Dt2	I	Incr. encoder 2 A / Data+ diff. input or single-ended input; set SW1 position 9 for differential.
J5 13	EncB1/ Clk1-	I	Encoder 1 B- / Clock- diff. input.; set SW1 position 8 for differential.
J5 14	EncA2-/Dt2-	I	Incr. encoder 2 A- diff. input; set SW1 position 9 for differential.
J5 15	Z1+	I	Incr. encoder 1 Z / Z+ diff. input or single-ended input; set SW1 position 11 for differential.
J5 16	EncB2+/EncB2 Clk2+/Clk2	I/O	Incr. encoder 2 B+ / Clock+ diff. input or single-ended input; set SW1 position 10 for differential.
J5 17	Z1-	I	Incr. encoder 1 Z- diff. input; set SW1 position 11 for differential.
J5 18	EncB2-/ Clk2-	I	Encoder 2 B- / Clock- diff. input; set SW1 position 10 for differential.
J5 19	GND	-	Ground return.
J5 20	+Vlog	I	Positive terminal of the logic supply: 6 to 48 V _{DC} .

Pin	Name	Type	Description
J4 1	+V USB	I	USB supply.
J4 2	USB DM	I/O	USB data-.
J4 3	USB DP	I/O	USB data+.
J4 4	Rsvd	-	Reserved. Do not connect.
J4 5	GND	-	Ground return.

Pin	Name	Type	Description
J6 1	STO2-	I	Safe Torque Off input 2, negative return (opto-isolated, 0V)
J6 2	STO2+	I	Safe Torque Off input 2, positive input (opto-isolated, 18÷40V)
J6 3	PE	-	Earth connection
J6 4	PE	-	Earth connection
J6 5	STO1+	I	Safe Torque Off input 1, positive input (opto-isolated, 18÷40V)
J6 6	STO1-	I	Safe Torque Off input 1, negative return (opto-isolated, 0V)

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. ON: Bit x = 1.
3	AxisID register Bit 2. OFF: Bit x = 0.
4	AxisID register Bit 3. <i>Possible AxisID values: 1+31 and 128+159. When all Bits are set to 0, AxisID value is 255.</i>
5	AxisID register Bit 4. <i>When the AxisID value is 255, the EtherCAT register called "configured station alias" will be 0</i>
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	Reserved.

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	



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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		90	%Rh	
Altitude / pressure ²		-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		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	
Environmental Characteristics		Min.	Typ.	Max.	Units	
Size (Length x Width x Height)		Global size		43.5 x 40 x 25.4	mm	
Weight				~ 1.7 x 1.6 x 1	inch	
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	
Power efficiency		Full power ($I_{MOT} = \text{nominal}$)		2.0	2.4	
Voltage efficiency		$f_{PWM} = 20KHz$		98.7		
		$f_{PWM} = 100KHz$		98.3		
Surface temperature of metallic baseplate				40	°C	
Mechanical Mounting		Min	Typ	Max	Units	
Airflow		natural convection, closed box				
Spacing required between adjacent drives		10			mm	
Spacing required above drive		30		80		
For counter-connectors & cable bending						
Logic Supply Input (+V _{LOG})		Min	Typ.	Max.	Units	
Supply voltage		Nominal values		6	24	48
		Absolute maximum values, drive operating but outside guaranteed parameters		4.9		50
		Absolute maximum values, continuous		-0.5		53
Supply current		+V _{LOG} = 12V		90	150	
		+V _{LOG} = 24V		60	90	mA
		+V _{LOG} = 48V		45	60	
Utilization category		Acc. to 60947-4-1 ($I_{PEAK} \leq 1.05 \cdot I_{NOM}$)		DC-1		
Motor Supply Input (+V _{MOT})		Min	Typ.	Max.	Units	
Supply voltage		Nominal values		7		48
		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	+16
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		5.25
Output current		Output voltage ≥ 4.85V				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		Digital		4.5	4.8	5.2
		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	
		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 _{RMS}
		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
On-state voltage drop		Nominal output current; including typical mating connector contact resistance		50	70
Off-state leakage current				0.3	1
Current measurement		Accuracy (FS = Full Scale)		±1	±1.5
		Noise (current ≤ 2A)		±4	±6
		Noise (current ≥ 2A)		±30	±50
		Offset drift (compensated @ AxisOn)		±0.16	
Motor inductance (phase-to-phase)		Recommended value to avoid spurious short-circuit protection, triggered by ripple		Fast loop ³ V_{MOT}	
		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	
				$F_{PWM} = 40$ kHz	
				170	
				$F_{PWM} = 60$ kHz	
				140	
				$F_{PWM} = 80$ kHz	
				80	
				$F_{PWM} = 100$ kHz	
				66	
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"		3.1	1.4
		Logic "HIGH"		0.9	2.5
		Hysteresis		1.1	1.4
		Logic "LOW"		1.4	1.6
		Logic "HIGH"		4	3.5
		Hysteresis		0.6	
		Floating voltage (not connected)		4.7	
		Absolute maximum, continuous		-2	+80
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	
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	
		Logic "HIGH"; output current = 0, no load		4	4.7
		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	
		OUT0		2	
		0.5s max		OUT1, OUT4	
				0.15	
		OUT0		2.5	
		Logic "LOW", sink current, continuous; $V_{OUT} \leq 0.4V$		OUT1, OUT4	
				0.05	
		OUT0		1.5	
		Logic "HIGH", source current; external load to GND; $V_{OUT} \geq 2.0V$		5	
		Logic "HIGH", leakage current; external load to +V _{LOG} ; $V_{OUT} = V_{LOG} \text{ max} = 40V$		$V_{LOG} = 24V$	
				0.18	
				$V_{LOG} = 48V$	
				0.42	
				0.45	
Minimum pulse width				0.5	
ESD protection - Human body model				±25	

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.

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

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Encoder Inputs (A1+, A1-, B1+, B1-, Z1+, Z1-, A2+, A2-, B2+, B2-) ¹		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 K Ω 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		k Ω
	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
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					
Single-ended mode		Not recommended, reduced robustness & speed			
Differential mode compliance	For full RS422 compliance, see ¹	TIA/EIA-422-A			
Output voltage	Differential; 50 Ω 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 $\pm 15V$	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 $\leq 1s$)			± 38	
Input impedance	To 1.44V		20	k Ω	
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
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 _{LOG}	External power supply	SELV or PELV			
Pollution Degree	Cabinet / Housing	IP54		2	-
	Bundling / Grouping	Separate wiring for STO1, STO2			
STO wiring	Shielding	Separate shield for STO1, STO2			
	Compatibility	Each STO channels has separate + and - terminals			
Isolation	Each STO channels has separate + and - terminals	PNP (source) or NPN (sink), depending on user connection			
	Isolation	Each STO channel is opto-isolated			
Voltage, STO+ to STO-	Inactive (torque off)		0	5.6	V
	Active (motor driven)	18	24		V
	Abs. maximum, continuous	-70		+70	V
Voltage	Isolation, STO1 to STO2	± 2			KV
	Isolation, STOx to GND	± 2			KV
Current	STOx+ - STOx- = 24V		3	5	mA
ESD protection	Human body model	± 30			kV

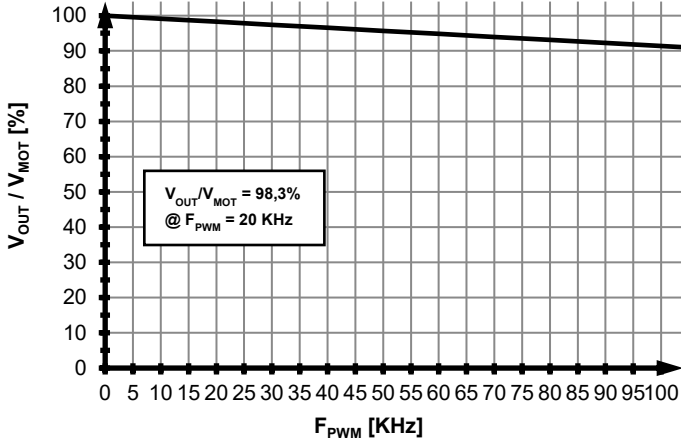
[†] Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

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

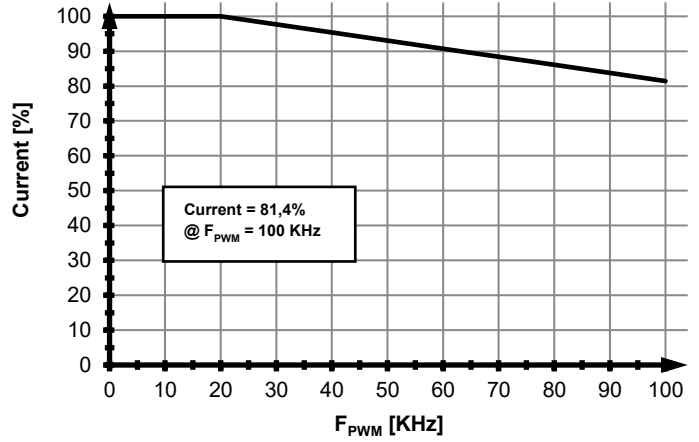
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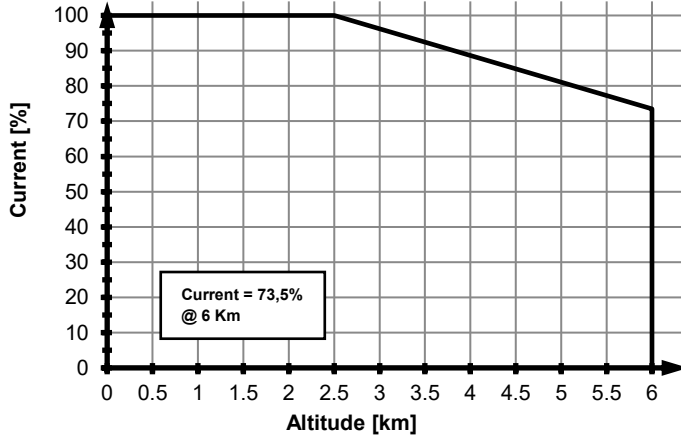
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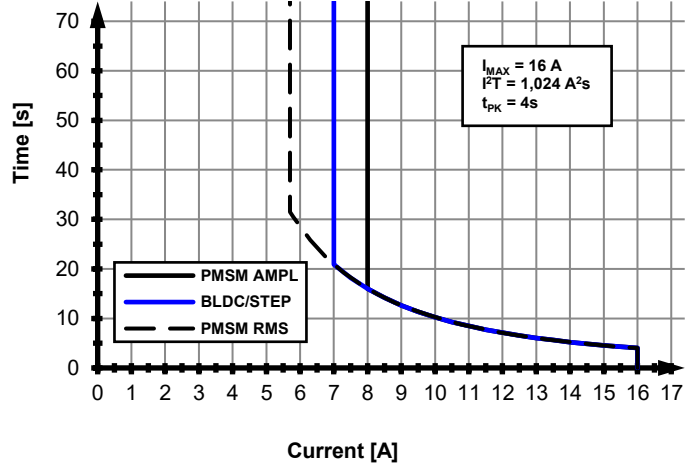
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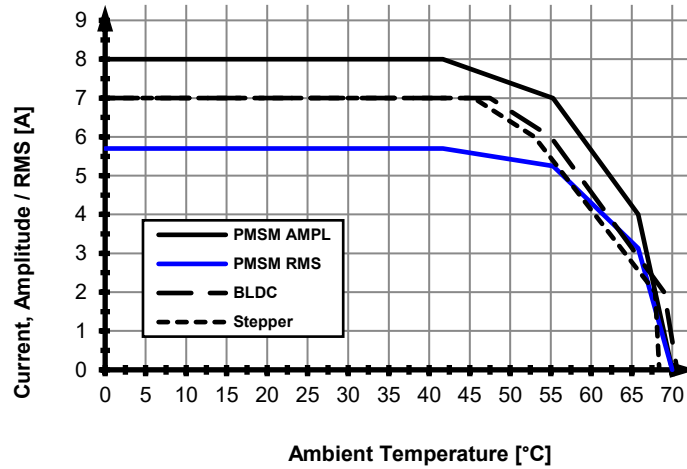
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