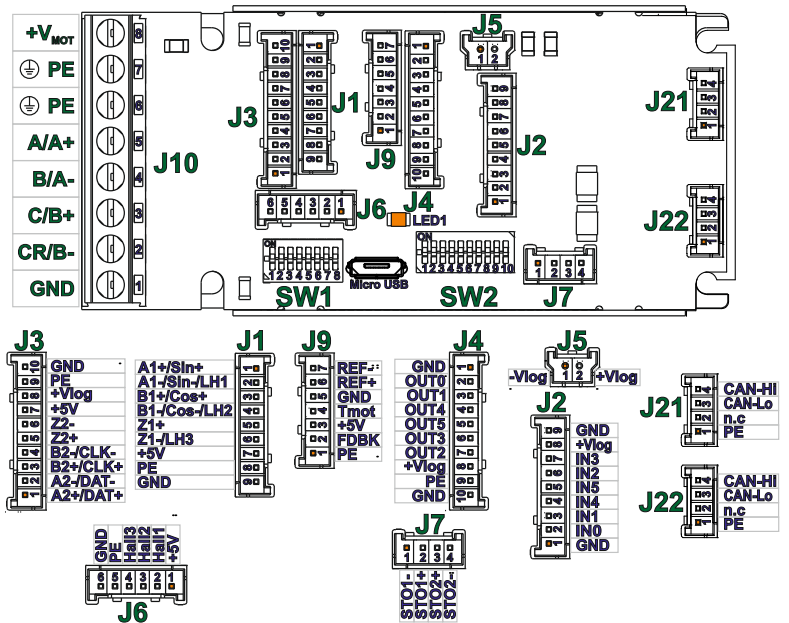


All dimensions are in mm; Drawing not to scale.



### 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	ⓧ				
Analog Sin/Cos encoder	ⓧ	ⓧ	ⓧ	ⓧ	
SSI / BiSS-C/ EnDAT/ TAMAGAWA/ Panasonic / Nikon / Sanyo Denki	ⓧ	ⓧ	ⓧ	ⓧ	
Tacho			ⓧ		
Open-loop (no sensor)				ⓧ	ⓧ

### Mating Connectors

Producer	Part No.	Connector	Description
Molex	355070900	J1, J2	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 9 Circuits
Molex	355071000	J3, J4	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 10 Circuits
Molex	355070200	J5	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 2 Circuits
Molex	355070600	J6	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 6 Circuits
Molex	355070400	J7, J21, J22	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 4 Circuits
Molex	355070700	J9	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 7 Circuits
Molex	797581021	J1, J2, J3, J4, J5, J6, J7, J9, J21, J22	Cable Assembly, PicoBlade Crimp Terminal Socket to PicoBlade Crimp Terminal Socket, 11.8", 300 mm
	638190500		Hand Crimp Tool for 2.00mm Pitch Terminal 24-30 AWG
	502128100		2.00mm Pitch, Micro-Latch Female Crimp Terminal, Tin (Sn) Plating, 24-30 AWG, Bag

### 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 capabilities (PVT, S-curve, electronic cam)
- Motor supply: 11-50V; Logic SELV/ PELV supply: 9-36V; STO SELV/ PELV supply: 18-40V
- Output current: 10A RMS cont. (BLDC mode); 28A RMS peak, up to 100kHz PWM
- Operating ambient temperature: 0-40°C (over 40°C with derating)
- NTC/PTC analogue Motor Temperature sensor input
- Communication interfaces: USB; TMLCAN and CANopen (CiA 301 v4.2, CiA 305 v.2.2.13 and CiA 402 v3.0) protocols
- 128 h/w addresses selectable by h/w sliding switches
- 16k x 16 SRAM memory for data acquisition
- 24k x16 E2ROM to store setup data, TML motion programs, cam tables and other user data
- Feedback Devices (dual-loop support)
  - 1<sup>st</sup> feedback devices supported:
    - Incremental encoder interface (single ended or differential)
    - Analogue sin/cos encoder interface (differential 1V<sub>pp</sub>)
    - Digital Hall sensor interface (single-ended and open collector)
    - Linear Hall sensors interface
  - 2<sup>nd</sup> feedback devices supported:
    - Incremental encoder interface (differential)
    - pulse & direction interface (differential) for external (master) digital reference
  - BISS / SSI / EnDAT / TAMAGAWA / Panasonic/ Nikon / Sanyo Denki encoder interface
- Integrated termination resistors for differential Feedback#1 pairs, selectable through sliding switches.
- 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.
- 6 digital inputs, 12-36V, PNP/NPN programmable: 2 for limit switches, 4 general-purpose
- 6 digital outputs, 5-36V, PNP/NPN programmable: Ready, Error, 4 general-purpose (0.3A sourcing/NPN or 0.2A sinking/PNP)
- 2 analogue inputs: 12-bit: ±10V Reference, 0-5V Feedback or general purpose

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### Connector's description

J1 Feedback #1		
Pin	Name	Description
1	A1+/Sin+	Incr. encoder1 A single-ended, or A+ diff. input, or analogue encoder Sin+ diff. input
2	A1-/Sin-/LH1	Incr. encoder1 A- diff. input, or analogue encoder Sin- diff. input if SW2 pin2= ON and pin3=OFF Linear Hall 1 input if SW2 pin2= OFF and pin3=ON
3	B1+/Cos+	Incr. encoder1 B single-ended, or B+ diff. input, or analogue encoder Cos+ diff. input
4	B1-/Cos-/LH2	Incr. encoder1 B- diff. input, or analogue encoder Cos- diff. input if SW2 pin5= ON and pin6=OFF Linear Hall 2 input if SW2 pin5= OFF and pin6=ON
5	Z1+	Incr. encoder1 Z single-ended, or Z+ diff. input
6	Z1-/LH3	Incr. encoder1 Z- diff. input if SW2 pin8= ON and pin9=OFF Linear Hall 3 input if SW2 pin8= OFF and pin9=ON
7	+5V <sub>OUT</sub>	5V output supply
8	PE	Protection Earth
9	GND	Return ground. Internally connected to all GND signals except STO GND.

J2 Digital Inputs		
Pin	Name	Description
1	GND	Return ground. Internally connected to all GND signals except STO GND.
2	IN0	12-36V general-purpose digital PNP/NPN input
3	IN1	12-36V general-purpose digital PNP/NPN input
4	IN4	12-36V general-purpose digital PNP/NPN input
5	IN5	12-36V general-purpose digital PNP/NPN input
6	IN2/LSP	12-36V digital PNP/NPN input. Positive limit switch input
7	IN3/LSN	12-36V digital PNP/NPN input. Negative limit switch input
8	+V <sub>LOG</sub>	Positive terminal of the logic supply input: 9 to 36V <sub>DC</sub> . Internally connected to other +V <sub>LOG</sub> pins
9	GND	Return ground. Internally connected to all GND signals except STO GND.

J3 Feedback #2		
Pin	Name	Description
1	A2+/Pulse+/Data+/SL+	Incr. encoder2 A+ diff. input, or Pulse+, or Data+ for SSI, or Slave+ for BiSS; has internal 120Ω resistor between pins 11 and 12
2	A2-/Pulse-/Data-/SL-	Incr. encoder2 A- diff. input, or Pulse-, or Data- for SSI, or Slave- for BiSS; has internal 120Ω resistor between pins 11 and 12
3	B2+/Dir+/CLK+/MA+	Incr. encoder2 B+ diff. input, or Dir+, or Clock+ for SSI, or Master+ for BiSS; has internal 120Ω resistor between pins 9 and 10
4	B2-/Dir-/CLK-/MA-	Incr. encoder2 B- diff. input, or Dir-, or Clock- for SSI, or Master- for BiSS; has internal 120Ω resistor between pins 9 and 10
5	Z2+	Incr. encoder2 Z+ diff. input; has internal 120Ω resistor between pins 7 and 8
6	Z2-	Incr. encoder2 Z- diff. input; has internal 120Ω resistor between pins 7 and 8
7	+5V <sub>OUT</sub>	5V output supply
8	+V <sub>LOG</sub>	Positive terminal of the logic supply input: 9 to 36V <sub>DC</sub> . Internally connected to other +V <sub>LOG</sub> pins
9	PE	Protection Earth
10	GND	Return ground. Internally connected to all GND signals except STO GND.


J4 Digital Outputs		
Pin	Name	Description
1	GND	Return ground. Internally connected to all GND signals except STO GND.
2	OUT0	12-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable
3	OUT1	12-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable
4	OUT4	12-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable
5	OUT5	12-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable
6	OUT3/Ready	12-36V Ready signal digital output, 0.2A PNP/ 0.3A NPN, software selectable
7	OUT2/Error	12-36V Error signal digital output, 0.2A PNP/ 0.3A NPN, software selectable
8	+V <sub>LOG</sub>	Positive terminal of the logic supply input: 9 to 36V <sub>DC</sub> . Internally connected to other +V <sub>LOG</sub> pins
9	PE	Protection Earth
10	GND	Return ground. Internally connected to all GND signals except STO GND.

J5 Logic supply input		
Pin	Name	Description
1	-V <sub>LOG</sub>	Negative terminal of the logic supply input: 9 to 36V <sub>DC</sub> from SELV/ PELV type power supply.
2	+V <sub>LOG</sub>	Positive terminal of the logic supply input: 9 to 36V <sub>DC</sub> from SELV/ PELV type power supply.

J6 Digital Hall		
Pin	Name	Description
1	+5V <sub>OUT</sub>	5V output supply
2	Hall 1	Digital input Hall 1 sensor
3	Hall 2	Digital input Hall 2 sensor
4	Hall 3	Digital input Hall 3 sensor
5	PE	Protection Earth
6	GND	Return ground. Internally connected to all GND signals except STO GND.

J7 STO (Safe Torque Off)		
Pin	Name	Description
1	STO1-	Safe Torque Off input 1, negative return (opto-isolated, 0V)
2	STO1+	Safe Torque Off input 1, positive input (opto-isolated, 18+40V)
3	STO2+	Safe Torque Off input 2, positive input (opto-isolated, 18+40V)
4	STO2-	Safe Torque Off input 2, negative return (opto-isolated, 0V)

J9 Analogue inputs		
Pin	Name	Description
1	PE	Protection Earth
2	FDBK	Analogue input, 12-bit, 0-5V. Reads an analogue feedback (tacho), or general purpose
3	+5V <sub>OUT</sub>	5V output supply
4	Temp Mot	NTC/PTC 3.3V input. Used to read an analog temperature value
5	GND	Return ground. Internally connected to all GND signals except STO GND.
6	REF+	Analogue Input+, 11-bit for 0...10V
7	REF-	Analogue Input+, 11-bit for -10...0V

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J10 Power input and Motor outputs		
Pin	Name	Description
1	GND	Negative return (ground) of the power supply
2	CR/B-	Chopping Resistor output/ Phase B- for step motors
3	C/B+	Phase C for 3-ph motors, B+ for 2-ph steppers
4	B/A-	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
5	A/A+	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
6	PE	Earth connection
7	PE	Earth connection
8	+Vmot	Positive terminal of the motor supply: 12 to 48V <sub>DC</sub> .

J11 & J12 CAN		
Pin	Name	Description
1	PE	Earth connection
2	GND	Return ground. Internally connected to all GND signals except STO GND.
3	Can Lo	CAN-Bus negative line (dominant low)
4	Can Hi	CAN-Bus positive line (dominant high)

SW1 – Axis ID settings	
Position	Description
1..7	Sets hardware Axis; Possible values: from 1 to 127; and 255 when all pins OFF.
8	ON = CANOpen mode; OFF = TMLCAN mode.

SW2 – Feedback #1 Signal routing and termination resistors	
Position	Description
1	Internally connect 150Ω termination resistor between J1 pin 1 and 2.
2	Internally connect A1-/Sin- signal to J1 pin2; <b>Remark:</b> If this pin is ON, SW2 pin 3 must be OFF.
3	Internally connect Linear Hall 1 (LH1) signal to J1 pin2; <b>Remark:</b> If this pin is ON, SW2 pin 2 must be OFF.
4	Internally connect 150Ω termination resistor between J1 pin 3 and 4.
5	Internally connect B1-/Cos- signal to J1 pin4; <b>Remark:</b> If this pin is ON, SW2 pin 6 must be OFF.
6	Internally connect Linear Hall 2 (LH2) signal to J1 pin4; <b>Remark:</b> If this pin is ON, SW2 pin 5 must be OFF.
7	Internally connect 150Ω termination resistor between J1 pin 5 and 6.
8	Internally connect Z1- signal to J1 pin6; <b>Remark:</b> If this pin is ON, SW2 pin 9 must be OFF.
9	Internally connect Linear Hall 3 (LH3) signal to J1 pin6; <b>Remark:</b> If this pin is ON, SW2 pin 8 must be OFF.
10	Internally connect 120Ω termination resistor between CAN-Hi and CAN-Lo signals (pins 3 and 4 of J11 & J12 connectors are internally connected)

LEDs	
LED1 - yellow	Indicates that logic supply is present.

## Electrical characteristics

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

- VLOG = 24 VDC; VMOT = 48VDC
- Supplies start-up / shutdown sequence: -any-
- Load current (sinusoidal amplitude / cont. BLDC, DC, stepper) = 10A RMS

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature		0		40 <sup>1</sup>	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure <sup>2</sup>	Altitude (vs. sea level)	-0.1	0 ÷ 2.5 <sup>2</sup>		Km
	Ambient Pressure	0 <sup>2</sup>	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 <sup>3</sup> , closed box			
Spacing required for vertical mounting	Between adjacent drives	30			mm
	Between drives and nearby walls	30			mm
	Between drives and roof-top	20			mm
Spacing required for horizontal mounting	Between adjacent drives	4			mm
	Between drives and nearby walls	5			mm
	Space needed for drive removal	10			mm
	Between drives and roof-top	15			mm
Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Global size	93 x 43.8 x 32			mm
		~3.66 x 1.72 x 1.26			inch
Weight		83			g
Cleaning agents	Dry cleaning is recommended	Only Water- or Alcohol- based			
Protection degree	According to IEC60529, UL508	IP20			-
Logic Supply Input (+V <sub>LOG</sub> )		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	9		36	V <sub>DC</sub>
	Absolute maximum values, drive operating but outside guaranteed parameters	8		40	V <sub>DC</sub>
	Absolute maximum values, continuous	-0.6		42	V <sub>DC</sub>
	Absolute maximum values, surge (duration ≤ 10ms) <sup>†</sup>	-1		+45	V
Supply current	+V <sub>LOG</sub> = 12V		70		mA
	+V <sub>LOG</sub> = 24V		40		
	+V <sub>LOG</sub> = 40V		20		
Motor Supply Input (+V <sub>MOT</sub> )		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	11		50	V <sub>DC</sub>
	Absolute maximum values, drive operating but outside guaranteed parameters	9		52	V <sub>DC</sub>
	Absolute maximum values, continuous	-0.6		54	V <sub>DC</sub>
	Absolute maximum values, surge (duration ≤ 10ms) <sup>†</sup>	-1		57	V
Supply current	Idle		1	5	mA
	Operating	-40	±15	+40	
	Absolute maximum value, short-circuit condition (Duration ≤ 10ms) <sup>†</sup>			43	

<sup>1</sup>Operating temperature at higher temperatures is possible with reduced current and power ratings  
<sup>2</sup>iPOS4810 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>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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Motor Outputs (A/A+, B/A-, C/B+, CR/B-)			Min.	Typ.	Max.	Units
Nominal output current, continuous <sup>1</sup>	for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control			14.1		A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)			14.1		
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)			10		
Motor output current, peak	maximum TBD s		-40		+40	A
Short-circuit protection threshold			±43		±43	A
Short-circuit protection delay				TBD		µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance			TBD		V
Voltage efficiency				100		%
Off-state leakage current				±0.5	±1	mA
Motor inductance (phase-to-phase)	Recommended value, for current ripple max. ±5% of full range; +V <sub>MOT</sub> = 36 V	F <sub>PWM</sub>				µH
		20 kHz				
		40 kHz				
		60 kHz				
		80 kHz				
		100 kHz				
	Minimum value, limited by short-circuit protection; +V <sub>MOT</sub> = 36 V	20 kHz				µH
		60 kHz				
		40 kHz				
		80 kHz				
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz				µs
		40 kHz				
		60 kHz				
		80 kHz				
		100 kHz				
Current measurement	FS = Full Scale accuracy			TBD		%FS
Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN4, IN5) <sup>2</sup>			Min.	Typ.	Max.	Units
Mode compliance			PNP			
Default state	Input floating (wiring disconnected)		Logic LOW			
Input voltage	Logic "LOW"		-10	0	2.2	V
	Logic "HIGH"		6.3	24	36	
	Hysteresis		1.2	2.4	2.8	
	Floating voltage (not connected)			0		
	Absolute maximum, continuous		-10		+39	
	Absolute maximum, surge (duration ≤ 1s) <sup>†</sup>		-20		+40	
Input current	Logic "LOW"; pulled to GND			0		mA
	Logic "HIGH"			8	10	
Mode compliance			NPN			
Default state	Input floating (wiring disconnected)		Logic HIGH			
Input voltage	Logic "LOW"			0	2.2	V
	Logic "HIGH"		6.3	24	36	
	Hysteresis		1.2	2.4	2.8	
	Floating voltage (not connected)			15		
	Absolute maximum, continuous		-10		+39	
	Absolute maximum, surge (duration ≤ 1s) <sup>†</sup>		-20		+40	
Input current	Logic "LOW"; Pulled to GND			8	10	mA
	Logic "HIGH"; Pulled to +24V		0	0	0	
Input frequency			0		10	kHz
Minimum pulse			6			µs
ESD protection	Human body model		±5			kV

Encoder1 Inputs (A1/A1+, A1-, B1/B1+, B1-, Z1/Z1+, Z1-)		Min.	Typ.	Max.	Units
Single-ended mode compliance	Leave negative inputs disconnected	TTL / CMOS / Open-collector			
Input voltage, single-ended mode A/A+, B/B+	Logic "LOW"	1.8		1.6	V
	Logic "HIGH"				
	Floating voltage (not connected)		3.3		
Input voltage, single-ended mode Z/Z+	Logic "LOW"	1.4		1.2	V
	Logic "HIGH"				
	Floating voltage (not connected)		4.7		
Input current, single-ended mode A/A+, B/B+, Z/Z+	Logic "LOW"; Pull to GND	0	5.5	6	mA
	Logic "HIGH"; Internal 2.2KΩ pull-up to +5		0	0	
Differential mode compliance	For full RS422 compliance, see <sup>3</sup>	TIA/EIA-422-A			
Input voltage, differential mode	Hysteresis	±0.06	±0.1	±0.2	V
	Common-mode range (A+ to GND, etc.)	-7		+7	
Input impedance, differential	A1+ to A1-, B1+ to B1-		1		kΩ
	Z1+ to Z1-		1		
Input frequency	Single-ended mode, Open-collector / NPN	0		5	MHz
	Differential mode, or Single-ended driven by push-pull (TTL / CMOS)	0		10	MHz
Minimum pulse width	Single-ended mode, Open-collector / NPN	1			μs
	Differential mode, or Single-ended driven by push-pull (TTL / CMOS)	50			ns
Input voltage, any pin to GND	Absolute maximum values, continuous	-7		+7	V
	Absolute maximum, surge (duration ≤ 1s) <sup>†</sup>	-11		+14	
ESD protection	Human body model	±1			kV
Digital Outputs (OUT0, OUT1, OUT2/Error, OUT3/Ready, OUT4, OUT5) <sup>1</sup>		Min.	Typ.	Max.	Units
Mode compliance		PNP 24V			
Default state	Not supplied (+VLOG floating or to GND)	High-Z (floating)			
	Normal operation	Logic "High"			
Output voltage	Logic "HIGH"; output current = 0.2A		V <sub>LOG</sub> -0.2	V <sub>LOG</sub> -0.8	V
	Logic "LOW"; output current = 0, no load	open-collector			
	Logic "HIGH", external load to GND		0		
	Absolute maximum, continuous	-0.3		V <sub>LOG</sub> +0.3	
	Absolute maximum, surge (duration ≤ 1s) <sup>†</sup>	-0.5		V <sub>LOG</sub> +0.5	
Output current	Logic "HIGH", source current, continuous	0.2			A
	Logic "HIGH", source current, pulse ≤ 5 s	0.4			A
	Logic "LOW", means High-Z				mA
Minimum pulse width		2			μs
ESD protection	Human body model	±15			kV


<sup>1</sup> @20kHz F<sub>PWM</sub><sup>2</sup> The digital inputs and outputs are software selectable as PNP or NPN<sup>3</sup> For full RS-422 compliance, termination resistors must be connected across the differential pairs; See SW2 settings.

The digital inputs and outputs are software selectable as I/Nr. or N/I/Nr.					Identification pairs, see EVI2 settings.					
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Mode compliance		NPN 24V			
Default state	Not supplied (+VLOG floating or to GND)	High-Z (floating)			
	Normal operation	High-Z			
Output voltage	Logic "LOW"; output current = 0.3A		0.2	0.8	V
	Logic "HIGH"; output current = 0, no load	open-collector			
	Logic "HIGH", external load to +VLOG		VLOG		
	Absolute maximum, continuous	-0.3		VLOG+0.3	
	Absolute maximum, surge (duration ≤ 1s)†	-0.5		VLOG+0.5	
Output current	Logic "LOW", sink current, continuous			0.3	A
	Logic "LOW", sink current, pulse ≤ 5 s			0.5	A
	Logic "HIGH", means High-Z				mA
Minimum pulse width		2			µs
ESD protection	Human body model	±15			kV
Digital Hall Inputs (Hall1, Hall2, Hall3)		Min.	Typ.	Max.	Units
Mode compliance		TTL / CMOS / Open-collector			
Default state	Input floating (Wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"		0	0.8	V
	Logic "HIGH"	2	5		
	Floating voltage (Not connected)		4.4		
	Absolute maximum, surge (duration ≤ 1s)†	-10		+15	
Input current	Logic "LOW"; Pull to GND			1.2	mA
	Logic "HIGH"; Internal 4.7KΩ pull-up to +5	0	0	0	
Minimum pulse width		2			µs
ESD protection	Human body model	±5			kV
Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 250mA	4.8	5	5.2	V
Output current			TBD		mA
Short-circuit		Yes			
Over-voltage		NOT protected			
ESD protection	Human body model	±1			kV
Linear Hall Inputs (LH1, LH2, LH3)		Min.	Typ.	Max.	Units
Input voltage	Operational range	0	0.5+4.5	4.9	V
Input voltage	Absolute maximum values, continuous	-7		+7	V
	Absolute maximum, surge (duration ≤ 1s)†	-11		+14	
Input current	Input voltage 0...+5V	0		0.2	mA
Interpolation Resolution	Depending on software settings			11	bits
Frequency		0		1	kHz
ESD protection	Human body model	±1			kV
Encoder2 Inputs (A2+, A2-, B2+, B2-, Z2+, Z2-)¹		Min.	Typ.	Max.	Units
Differential mode compliance		TIA/EIA-422-A			
Input voltage	Hysteresis	±0.06	±0.1	±0.2	V
	Differential mode	-14		+14	
	Common-mode range (A+ to GND, etc.)	-11		+14	
Input impedance, differential	A2+, B2+, Z2+ A2-, B2-, Z2-		150		Ω
Input frequency	Differential mode	0		10	MHz
Minimum pulse width	Differential mode	50			ns

Sin-Cos Encoder Inputs (Sin+, Sin-, Cos+, Cos-)		Min.	Typ.	Max.	Units
Input voltage, differential	Sin+ to Sin-, Cos+ to Cos-		1	1.25	V <sub>PP</sub>
Input voltage, any pin to GND	Operational range	-1	2.5	4	V
	Absolute maximum values, continuous	-7		+7	
	Absolute maximum, surge (duration ≤ 1s) <sup>†</sup>	-11		+14	
Input impedance	Differential, Sin+ to Sin-, Cos+ to Cos- <sup>2</sup>	4.2	4.7		kΩ
	Common-mode, to GND		2.2		kΩ
Resolution with interpolation	Software selectable, for one sine/cosine period	2		10	bits
Frequency	Sin-Cos interpolation	0		450	kHz
	Quadrature, no interpolation	0		10	MHz
ESD protection	Human body model	±1			kV
Analog 0...5V Inputs (REF, FDBK)		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		5	V
	Absolute maximum values, continuous	-12		+18	
	Absolute maximum, surge (duration ≤ 1s) <sup>†</sup>			±36	
Input impedance	To GND		28		kΩ
Resolution			12		bits
Integral linearity				±2	bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS <sup>3</sup>
Bandwidth (-3Db)	Software selectable	0		1	kHz
ESD protection	Human body model	±5			kV
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	SW2 pin 10			
Node addressing	Hardware: by SW1	1 + 127 & 255 LSS non-configured (CANopen); 1 + 127 & 255 (TLMCAN)			
	Software	1 + 127 (CANopen); 1- 255 (TLMCAN)			
Voltage, CAN-Hi or CAN-Lo to GND	Absolute maximum, continuous	-36		36	V
ESD protection	Human body model	±15			kV
Safe torque OFF (STO1+, STO1-, STO2+, STO2+)		Min.	Typ.	Max.	Units
Safety function	According to EN61800-5-2	STO (Safe Torque OFF)			
EN 61800-5-1/-2 and EN 61508-5-3/-4	Safety Integrity Level	safety integrity level 3 (SIL3)			
Classification	PFHD (probability of dangerous failures per hour)	8*10 <sup>-10</sup>	hour <sup>-1</sup> (0.8 FIT)		
EN13849-1 Classification	Performance Level	Cat3/PLe			
	MTTFM (meantime to dangerous failure)	377			years
Mode compliance		PNP			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic "LOW"	-20		5.6	V
	Logic "HIGH"	18		36	
	Absolute maximum, continuous	-20		+40	
Input current	Logic "LOW"; pulled to GND		0		mA
	Logic "HIGH", pulled to +Vlog		5	13	
Repetitive test pulses (high-low-high)	Ignored high-low-high			5	ms
				20	
Fault reaction time	From internal fault detection to register DER bit 14 = 1 and OUT2/Error high-to-low			30	ms
PWM operation delay	From external STO low-high transition to PWM operation enabled			30	ms
ESD protection	Human body model	±2			kV

<sup>1</sup> Encoder2 differential input pins have internal 120Ω termination resistors connected across<sup>2</sup> For many applications, a termination resistor should be connected across SIN+ to SIN-, and across COS+ to COS-. See SW2 settings.<sup>3</sup> "FS" stands for "Full Scale"


across COS+ to COS-. See SWZ settings.				
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Absolute Encoder Interface		Min.	Typ.	Max.	Units
Differential mode (CLOCK, DATA) <sup>1</sup>	For full RS422 compliance, see <sup>1</sup>	TIA/EIA-422			
CLOCK Output voltage	Differential; 50Ω differential load	2.0	2.5	5.0	V
	Common-mode, referenced to GND	2.3	2.5	2.7	
CLOCK frequency	Software selectable	1000, 2000, 3000			kHz
DATA Input hysteresis	Differential mode	±0.1	±0.2	±0.5	V
Data input impedance	Termination resistor on-board		120		Ω
DATA Input common mode range	Referenced to GND	-7		+12	
	Absolute maximum, surge (duration≤1s) <sup>†</sup>	-25		+25	
DATA format	Software selectable	Binary / Gray			
		Single-turn / Multi-turn			
		Counting direction			
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				

Conformity	
EU Declaration	2014/30/EU (EMC), 2014/35/EU (LVD), 2011/65/EU (RoHS), 1907/2006/EC (REACH), 93/68/EEC (CE Marking Directive), EC 428/2009 (non dual-use item, output frequency limited to 590Hz)

<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.

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