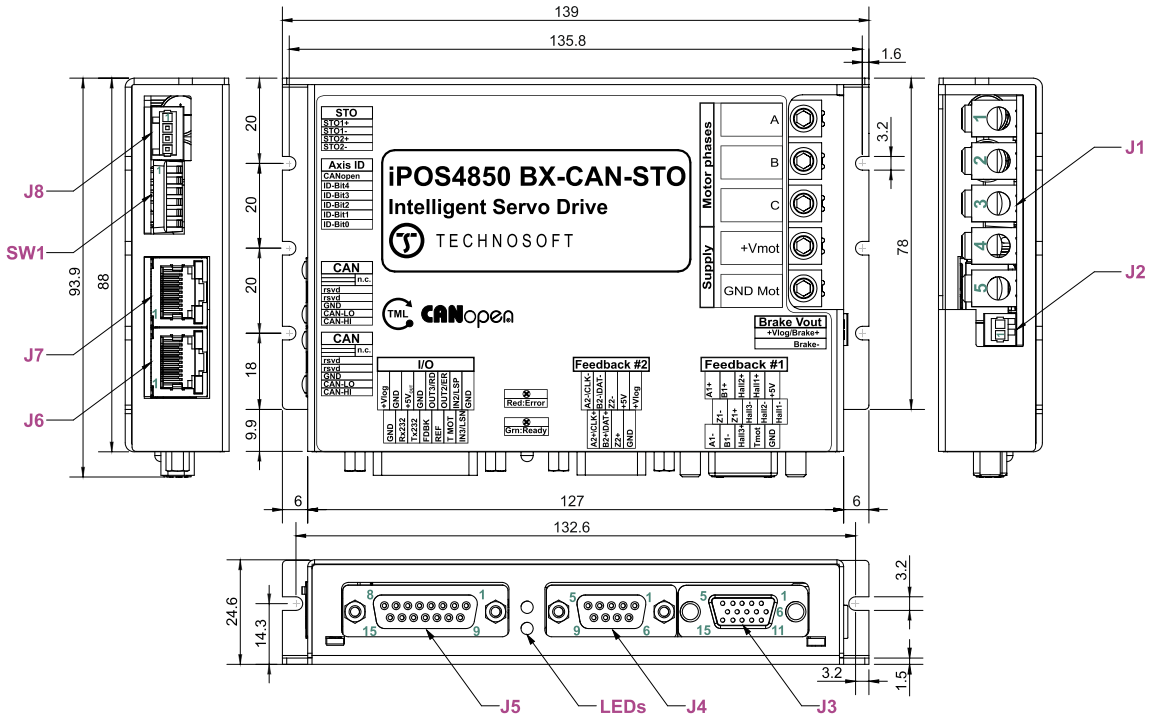
iPOS4850 BX-CAN-STO DATASHEET
P/N: P029.300.E201



Global tolerance [mm]	0.1

All dimensions are in mm. Drawings not to scale.

Features
▪ Motion controller and drive in a single compact unit based on MotionChip™ technology
▪ Universal solution for control of rotary and linear brushless and brushed motors
▪ PMSM and BLDC motion control capability
▪ Motor supply: 11-60V; Logic supply: 9-36V
▪ Output current with / without external heat sink: ▪ Nominal: 45 / 35.4A_{RMS} (64 / 50A sinusoidal amplitude) ▪ Peak: 64A_{RMS} (90A sinusoidal amplitude)
▪ Thermal Protection: The internal temperature sensor disables the PWM outputs if the measured temperature exceeds 95ºC
▪ Feedback Devices (dual-loop support)
1st feedback devices supported:
▪ Incremental encoder interface (differential)
2nd feedback devices supported:
▪ Incremental encoder interface (differential)
▪ pulse & direction interface (differential) for external (master) digital reference
▪ BiSS / SSI / EnDAT[1] encoder interface
▪ *STO: 2 safe torque-off inputs, 18-36V, safety integrity level (SIL3/Cat3/PLe) acc. to EN61800-5-1;-2/ EN61508-3;-4/ EN ISO 13849-1.
▪ Digital Hall sensor interface (differential)
▪ 2 digital PNP inputs, 7-36V: 2 limit switches
▪ 2 digital outputs, 5-36V, NPN open-collector: Ready, Error 0.5A
▪ Solenoid driver for motor brake, 2A, commanded by OUT0
▪ 2 analogue inputs, 12-bit, 0-5V: Reference and Feedback (for Tacho), or general purpose
▪ CAN-bus 2.0B interface (±58V max voltage)
▪ 32 h/w addresses selectable by DIN switch
▪ TMLCAN and CANopen (CiA 301 v4.2, CiA 305 v.2.2.13 and CiA 402 v3.0) protocols selectable by DIN switch
▪ 16k x 16 SRAM memory for data acquisition
▪ 16k x 16 E^2ROM to store setup data, TML motion programs, cam tables and other user data

*The STO circuit must be supplied with minimum 18V to enable PWM output

Mating Connectors			
Ref	**Producer**	**Part No.**	**Description**
J2**	Wago	733-102	Pluggable terminal block 2-pole Pin spacing 2.5 mm
J3	generic 15-pin High Density D-Sub male		Feedback #1 + Digital Hall input
J4	9-pin Sub-D male		Feedback #2
J5	generic 15-pin D-Sub male, DB15		I/O; Analog; RS232
J6&J7	-	-	Standard 8P8C modular jack (RJ-45) male
J8**	Wago	733-104	Pluggable terminal block 4-pole Pin spacing 2.5 mm
J1*	High AMP wire. 4mm HEX socket. AWG 6-16 wire gauge. Strip: - min 8 mm for cables with isolation diameter less than 6.5 mm; - min 12 mm/ max 15 mm for cables with isolation diameter bigger than 6.5 mm.		
	Avoid generating metal debris/filings into drive from the wire leads! In case of multi-stranded wires, a proper ferrule must be used as wire terminal.		

* For more recommendations about wires and ferrules, check the User Manual of the drive.

** Connector delivered with the drive

Sensor \ Motor	PMSM	BLDC	DC BRUSH
Incr. Encoder	✓		✓
Incr. Encoder + Dig. Hall	✓	✓	
Digital Hall Only	✓		
SSI / BiSS-C	✓	✓	✓
Tacho			✓

[1] *Available starting with F514K firmware version*

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	Pin	Name	Type	Description
J1	1	A/A+	O	Phase A for 3-ph motors, Motor+ for DC brush motors
	2	B/A-	O	Phase B for 3-ph motors, Motor- for DC brush motors
	3	C	O	Phase C for 3-ph motors
	4	+V_{MOT}	I	Positive terminal of the motor supply input: 11 to 60V_{DC}
	5	GND	-	Ground for motor supply

	Pin	Name	Type	Description
J2	1	BRAKE-	O	Negative terminal for the motor brake input; commanded as OUT0
	2	BRAKE+	O	Positive terminal for the motor brake input; connected internally to +Vlog to pin

	Pin	Name	Type	Description
J3	1	+5V_{OUT}	O	5V output supply for I/O usage
	2	Hall 1+	I	Digital input Hall 1+ diff. sensor input; has 120Ω resistor between pins 2 and 6
	3	Hall 2+	I	Digital input Hall 2+ diff. sensor input; has 120Ω resistor between pins 3 and 7
	4	B1+	I	Incr. encoder 1 B+ diff. input; has 120Ω resistor between pins 4 and 14
	5	A1+	I	Incr. encoder 1 A+ diff. input; has 120Ω resistor between pins 5 and 15
	6	Hall 1-	I	Digital input Hall 1- diff. sensor input; has 120Ω resistor between pins 2 and 6
	7	Hall 2-	I	Digital input Hall 2- diff. sensor input; has 120Ω resistor between pins 3 and 7
	8	Hall 3-	I	Digital input Hall 3- diff. sensor input; has 120Ω resistor between pins 13 and 8
	9	Z1+	I	Incr. encoder 1 Z+ diff. input; has 120Ω resistor between pins 9 and 10
	10	Z1-	I	Incr. encoder 1 Z- diff. input; has 120Ω resistor between pins 9 and 10
	11	GND	-	Return ground for sensors supply
	12	Temp Mot	I	Analogue input, 12-bit, 0-3.3V. Used to read an analog temperature value
	13	Hall 3+	I	Digital input Hall 3+ diff. sensor input; has 120Ω resistor between pins 13 and 8
	14	B1-	I	Incr. encoder 1 B- diff. input; has 120Ω resistor between pins 4 and 14
	15	A1-	I	Incr. encoder 1 A- diff. input; has 120Ω resistor between pins 5 and 15

	Pin	Name	Type	Description
J4	1	+V_{LOG}	I	Positive terminal of the logic supply input: 12 to 36V_{DC}
	2	+5V_{OUT}	O	5V output supply
	3	Z2-	I	Incr. encoder 2 Z- diff. input; has 120Ω resistor between pins 3 and 7
	4	B2-/ Dir-/ Data-/SL-	I	Incr. encoder 2 B- diff. input, or Dir-, or Data- for SSI & EnDAT, or Slave- for BiSS; has 120Ω resistor between pins 4 and 8
	5	A2-/ Pulse-/CLK-/MA-	I	Incr. encoder 2 A- diff. input, or Pulse-, or Clock- for SSI & EnDAT, or Master- for BiSS; has 120Ω resistor between pins 5 and 9
	6	GND	-	Ground
	7	Z2+	I	Incr. encoder 2 Z+ diff. input; has 120Ω resistor between pins 3 and 7
	8	B2+/ Pulse+/ Data+/ SL+	I	Incr. encoder 2 B+ diff. input, or Dir+, or Data+ for SSI & EnDAT, or Slave+ for BiSS; has 120Ω resistor between pins 4 and 8
	9	A2+/ Pulse+/ CLK+/ MA+	I	Incr. encoder 2 A+ diff. input, or Pulse+, or Clock+ for SSI & EnDAT, or Master+ for BiSS; has 120Ω resistor between pins 5 and 9

	Pin	Name	Type	Description
J6, J7	1	Can-Hi	I/O	CAN-Bus positive line (dominant high)
	2	Can-Lo	I/O	CAN-Bus negative line (dominant low)
	3	GND	-	Return ground for CAN-Bus
	4, 5	-	-	Reserved. Do not use.
	6..8	n.c.	-	Not connected

	Pin	Name	Type	Description	
J8	1	STO1+	I	Safe Torque Off input 1, positive input (opto-isolated, 18÷36V)	Apply between both STO1+, STO2+ and STO1-, STO2- 24V DC from SELV/ PELV power supply for motor PWM output operation
	2	STO1-	I	Safe Torque Off input 1, negative return (opto-isolated, 0V)	
	3	STO2+	I	Safe Torque Off input 2, positive input (opto-isolated, 18÷36V)	
	4	STO2-	I	Safe Torque Off input 2, negative return (opto-isolated, 0V)	

	Pin	Name	Type	Description
J5	1	GND	-	Ground
	2	IN2/LSP	I	5-36V digital PNP input. Positive limit switch input
	3	OUT2/ Error	O	5-36V 0.5A, drive Error output, active low, NPN open-collector/TTL pull-up. Also drives the red LED
	4	OUT3/ Ready	O	5-36V 0.5A, drive Ready output, active low, NPN open-collector/TTL pull-up. Also drives the green LED.
	5	GND	-	Ground
	6	+5V_{OUT}	O	5V output supply
	7	GND	-	Ground
	8	+V_{LOG}	I	Positive terminal of the logic supply input: 9 to 36V_{DC} from SELV/ PELV type power supply
	9	IN3/LSN	I	5-36V digital PNP input. Negative limit switch input
	10	Temp Mot	I	Analogue input, 12-bit, 0-3.3V. Used to read an analog temperature value
	11	REF	I	Analogue input, 12-bit, 0-5V
	12	FDBK	I	Analogue input, 12-bit, 0-5V
	13	232TX	O	RS-232 Data Transmission
	14	232RX	I	RS-232 Data Reception
	15	GND	-	Ground

	Pin	Name	Type	Description
SW1	1	CANopen	-	ON (down): CANopen communication protocol OFF (up): TMLCAN communication protocol
	2	ID-Bit4	-	Hardware AxisID selection switches All ON – AxisID= 31 All OFF – AxisID = 255 in TMLCAN or 127 in CANopen
	3	ID-Bit3	-	
	4	ID-Bit2	-	
	5	ID-Bit1	-	
	6	ID-Bit0	-	

Electrical characteristics

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

- T_{amb} = 24ºC, V_{LOG} = 24 VDC; V_{MOT} = 48VDC
- Supplies start-up / shutdown sequence: any
- Load current (sinusoidal amplitude) = 64A

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature		0		+40	ºC
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure[1]	Altitude (vs. sea level)	-0.1	0 ÷ 2	2	km
	Ambient Pressure	0 [2]	0.75 ÷ 1	10.0	atm
Storage Conditions		**Min.**	**Typ.**	**Max.**	**Units**
Ambient temperature		-40		+85	ºC
Ambient humidity	Non-condensing	0		100	%Rh
Ambient Pressure		0		10.0	atm

[1] iPOS4850 BX-CAN 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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Mechanical Mounting		Min.	Typ.	Max.	Units
Mounted on heatsink	It is necessary to mount the iPOS4850 BX-CAN on a metallic heatsink using the provided mounting holes. If the integrated internal thermal sensor exceeds 95ºC, the drive outputs turn off.				

Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Without mating connectors		139 x 93.9 x 24.6		mm
			~5.47 x 3.7 x 0.97		inch
Weight	Without mating connectors		240		g
Power dissipation	Idle (no load)		3.6		W
	Operating		see theoretical chart		
Efficiency			98		%
Cleaning agents	Dry cleaning is recommended		Only Water- or Alcohol- based		
Protection degree	According to IEC60529, UL508		IP20		-

Logic Supply Input (+V_{LOG})			Min.	Typ.	Max.	Units
Supply voltage	Nominal values		9	24	36	V_{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters		8	24	40	V_{DC}
	Absolute maximum values, surge (duration ≤ 10ms) †		-1		+45	V
Supply current	No enc. No Load on Digital Outputs	+V_{LOG} = 9V		280		mA
		+V_{LOG} = 12V		200		
		+V_{LOG} = 24V		130		
		+V_{LOG} = 36V		90		

Motor Supply Input (+V_{MOT})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	12	48	60	V_{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	11		70	V_{DC}
	Absolute maximum values, surge (duration ≤ 10ms) †	-1		75	V
Supply current	Idle		1	5	mA
	Operating	-50	±10	+50	A
	Absolute maximum value, short-circuit condition (duration ≤ 10ms) †			100	A

Motor Outputs (A/A+, B/A-, C)			Min.	Typ.	Max.	Units
Nominal current	Sinusoidal RMS [1]				45	A_{RMS}
	Sinusoidal RMS [2]				35.4	
	Sinusoidal amplitude [1]				64	A
	Sinusoidal amplitude [2]				50	
Peak current	maximum 13s with 6 AWG wires, external heatsink		-90		+90	A
Short-circuit protection threshold					±100	A
Short-circuit protection delay			5	10		µs
Off-state leakage current				±0.5	±1	mA
Motor inductance (phase-to-phase)	Recommended value, for current ripple max. ±5% of full range; +V_{MOT} = 48V	F_{PWM}				µH
		20 kHz	330			
		40 kHz	150			
		60 kHz	120			
	Minimum value, limited by short-circuit protection; +V_{MOT} = 48V	20 kHz	120			µH
		40 kHz	40			
		60 kHz	30			
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz	250			µs
		40 kHz	125			
		60 kHz	100			
Current measurement	FS = Full Scale accuracy			±5	±8	%FS

Digital Inputs (IN2/LSP, IN3/LSN)			Min.	Typ.	Max.	Units
Mode compliance			PNP			
Default state	Input floating (wiring disconnected)		Logic LOW			
Input voltage	Logic “LOW”		-10	0	3.3	V
	Logic “HIGH”		6.7		36	
	Floating voltage (not connected)			0		
	Absolute maximum, continuous		-10		+39	
	Absolute maximum, surge (duration ≤ 1s) †		-20		+40	
Input current	Logic “LOW”; pulled to GND			0		mA
	Logic “HIGH”	Vlog=24V		9.15		
		Vlog=36V		13.7		
Input frequency			0		150	kHz
Minimum pulse			3.3			µs
ESD protection	Human body model 0.1nF 1.5 kΩ		±1			kV

Digital Outputs (OUT2/Error, OUT3/Ready)			Min.	Typ.	Max.	Units
Mode compliance	All outputs (OUT2/Error, OUT3/Ready)		NPN 24V			
Default state	Not supplied (+V_{LOG} floating or to GND)		High-Z (floating)			
	Immediately after power-up	OUT2/Error, OUT3/Ready	Logic “LOW”			
	Normal operation	OUT2/Error	Logic “HIGH”			
		OUT3/Ready	Logic “LOW”			
Output voltage	Logic “LOW”; output current = 0.5A				0.8	V
	Logic “HIGH”; output current = 0, no load	OUT2/Error, OUT3/ Ready	2.9	3	3.3	
	Logic “HIGH”, external load to +V_{LOG}			V_{LOG}		
	Absolute maximum, continuous		-0.5		V_{LOG}+0.5	
	Absolute maximum, surge (duration ≤ 1s) †		-1		V_{LOG}+1	
Output current	Logic “LOW”, sink current, continuous, OUT2/Error, OUT3/Ready				0.5	A
	Logic “HIGH”, source current; external load to GND; V_{OUT} >= 2.0V	OUT2/Error, OUT3/ Ready			2	mA
	Logic “HIGH”, leakage current; external load to +V_{LOG}; V_{OUT} = V_{LOG} max = 40V			0.1	0.2	mA
Minimum pulse width			2			µs
ESD protection	Human body model		±15			kV

Digital Hall Inputs (Hall1+, Hall1-, Hall2+, Hall2, Hall3+, Hall3-)[3]		Min.	Typ.	Max.	Units
Differential mode compliance	For full RS422 compliance, see [3]	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	A1+/A1-, B1+/B1-, Z1+/Z1-, A2+/A2-, B2+/B2-, Z2+/Z2-		120		Ω
Input frequency	Differential mode	0		10	MHz
Minimum pulse width	Differential mode	50			ns

Encoder Inputs (A1+, A1-, B1+, B1-, Z1+, Z1-, A2+, A2-, B2+, B2-, Z2+, Z2-)[3]		Min.	Typ.	Max.	Units
Differential mode compliance	For full RS422 compliance, see [3]	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	A1+/A1-, B1+/B1-, Z1+/Z1-, A2+/A2-, B2+/B2-, Z2+/Z2-		120		Ω
Input frequency	Differential mode	0		10	MHz
Minimum pulse width	Differential mode	50			ns

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) †			±36	
Input impedance	To GND		14.7		kΩ
Resolution			12		bits
Integral linearity				±2	bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS[4]
Bandwidth (-3dB)	Software selectable	0		1	kHz
ESD protection	Human body model	±2			kV

[1] With adequate thermal heat sink
[2] No thermal heat sink (worst case scenario)
[3] All differential input pins have internal 120Ω termination resistors connected across
[4] “FS” stands for “Full Scale”

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BiSS/SSI Encoder Interface		Min.	Typ.	Max.	Units
Differential mode (CLOCK, DATA)	For full RS422 compliance, see[1]	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) †	-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				

CAN-Bus		Min.	Typ.	Max	Units
Compliance		ISO11898			
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 DIN switches	1-31 & 255			TMLCAN
		1-31 & 255(LSS inactive)			CANopen
	Software	1- 255 (TMLCAN); 1-127 (CANopen)			
Voltage, CAN-Hi or CAN-Lo to GND		-58		58	V
ESD protection	Human body model	±8			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

Solenoid Driver (OUT0/Brake)			Min.	Typ.	Max.	Units
Brake+/Brake-: solenoid driver, 2A, overcurrent protected (Brake+ connected internally to +Vlog). Current flows into solenoid from Brake+ to Brake-; commanded by OUT0 digital output						
Default state	Not supplied (+V_{LOG} floating or to GND)		High-Z (floating)			
	Immediately after power-up	Brake-	High-Z (floating)			
	Normal operation	Brake-	High-Z (floating)			
Output voltage	Logic "LOW" (Brake-)				0.2	V
	Logic "HIGH"; load present			+Vlog		
	Logic "HIGH", no load present			+5V		
	Absolute maximum, continuous		-0.5		55	
Output current	Logic "LOW", sink current, continuous, Brake-				2	A
	Logic "HIGH", leakage current; external load to +V_{LOG}; V_{OUT} = V_{LOG} max = 55V				0.2	mA

Supply Output (+5V)		Min.	Typ.	Max	Units
Output voltage	Current sourced = 500mA	4.8	5	5.2	V
Output current				450	mA
Short-circuit		protected			
Over-voltage		NOT protected			
ESD protection	Human body model 0.1nF 1.5 kΩ	±2			kV

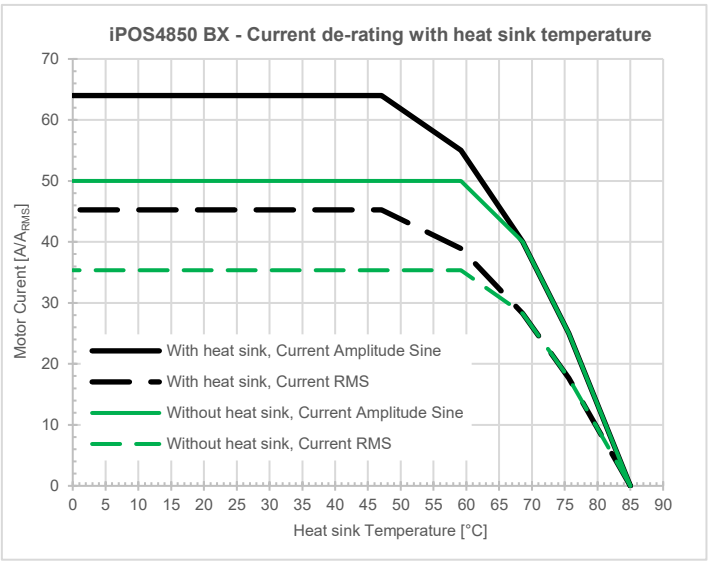
Operating temperature		Min	Typ	Max	Units
Ambient Temperature	Non condensing	0		40	°C
		Ambient temperature can exceed 40ºC if the internal temperature sensor measures less than 95ºC			

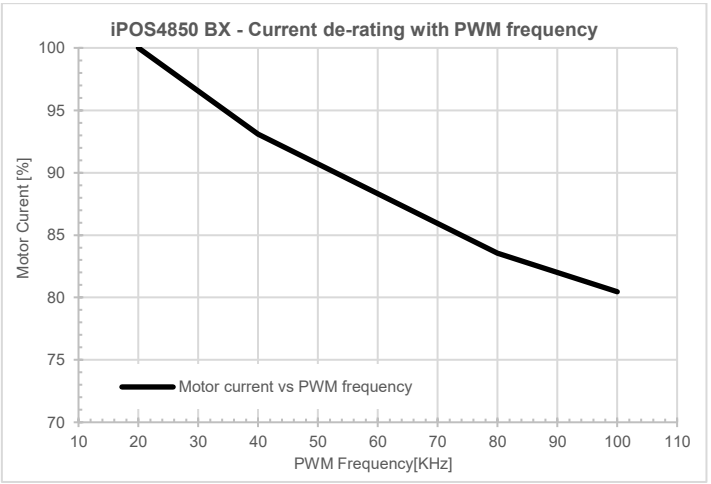
Conformity		Min.	Typ.	Max.	Units
EU Declaration	2014/30/EU (EMC), 2014/35/EU (LVD), 2011/65/EU (RoHS), 1907/2006/EC (REACH), 93/68/EEC (CE Marking Directive), EC 428/2009 (non-dual-use item, output frequency limited to 590Hz)				

Reliability data		Min.	Typ.	Max.	Units
MTBF	MIL-HDBK-217F, Notice 2, TEMP = 25ºC, ENV: GB		37.11		years

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 Classification	Safety Integrity Level	safety integrity level 3 (SIL3)			
	PFHd (Probability of Failures per Hour - dangerous)	$8*10^{-10}$	$hour^{-1}$ (0.8 FIT)		
EN13849-1 Classification	Performance Level	Cat3/PLe			
	MTTFd (meantime to dangerous failure)	377			years
Mode compliance		PNP			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic "LOW" (PWM operation disabled)	-20		5.6	V
	Logic "HIGH" (PWM operation enabled)	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	Hz
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

† 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] All differential input pins have internal 120Ω termination resistors connected across