


All dimensions are in mm.

Motor – sensor configurations						
Sensor \ Motor	PMSM	BLDC	DC BRUSH	STEP (2-ph)	STEP (3-ph)	
Incr. Encoder						
Incr. Encoder + Hall						
Analog Sin/Cos encoder						
Tacho						
Open-loop (no sensor)						

Mating Connector				
Producer	Part No.	Connector	Description	Wire Gauge
MOLEX	43025-0200	J1	MICROFIT RECEPTACLE HOUSING, 2x1 WAY	AWG 20..24
MOLEX	43025-0400	J5,J6,J7	MICROFIT RECEPTACLE HOUSING, 2x2 WAY	AWG 20..24
MOLEX	43025-1000	J2	MICROFIT RECEPTACLE HOUSING, 2x5 WAY	AWG 20..24
MOLEX	43025-1400	J4	MICROFIT RECEPTACLE HOUSING, 2x7 WAY	AWG 20..24
MOLEX	43030-0007	J1,J2,J4,J5,J6,J7	CRIMP PIN, MICROFIT, 5A	AWG 20..24
MOLEX	51110-1056	J3	MILLIGRID RECEPTACLE HOUSING, 2x5 WAY	AWG 24..30
MOLEX	50394-8400	J3	CRIMP PIN, MILLIGRID	AWG 24..30

Features
▪ Motor supply: 9-36V. Optional logic supply: 9-36V
▪ Output current: 2A cont. (BLDC mode); 3.2A _{PEAK} , up to 100KHz PWM
▪ Digital Hall sensor interface (single-ended and open collector)
▪ Incremental encoder interface (differential)
▪ Analogue sin/cos encoder interface (differential 1V _{pp})
▪ 5 digital inputs, 5-36V, PNP or NPN software selectable: Enable, 2 for limit switches, 2 general-purpose
▪ 4 digital outputs, 5-36V, 0.5A, NPN open-collector: Ready, Error, 2 general-purpose
▪ 1 analogue input: 12-bit, 0-5V: Reference/Feedback or general purpose
▪ RS-232 serial & CAN-bus 2.0B interfaces with H/W selectable addresses
▪ TMLCAN and CANopen (CiA 301 v4.2 and CiA 402 v3.0) protocols selectable by jumper
▪ 2K × 16 SRAM for data acquisition
▪ 4K × 16 E ² ROM to store TML motion programs and data
▪ Operating ambient temperature: 0-40°C (over 40°C with derating)
▪ Hardware Protections: short-circuit between motor phases and from motor phases to GND, over-voltage, under-voltage and I ² t
▪ Firmware: F509M+ or F524E+

Connector Description				
Pin	Name	Type	Description	
J1	1	GND	-	Negative return (ground) of the power supply
	2	+V _{MOT}	I	Positive terminal of the motor supply: 9 to 36V _{DC} / Positive terminal of the logic supply if J4 pin 7 not connected
Pin	Name	Type	Description	
J2	1	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
	2	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
	3	Hall 1	I	Digital input Hall 1 sensor
	4	Hall 2	I	Digital input Hall 2 sensor
	5	Hall 3	I	Digital input Hall 3 sensor
	6	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
	7	CR/B-	O	Chopping resistor / Phase B- for step motors
	8	+5V _{OUT}	O	5V output supply - internally generated
	9	GND	-	Negative return (ground) of the motor supply
	10	GND	-	Negative return (ground) of the motor supply
Pin	Name	Type	Description	
J3	1	GND	-	Return ground for sensors supply
	2	+5V _{OUT}	O	5V output supply for I/O usage
	3	GND	-	Return ground for sensors supply
	4	+5V _{OUT}	O	5V output supply for I/O usage
	5	A- /Sin-	I	Incr. encoder A- diff. input, or analogue encoder Sin-diff. input
	6	A+ /Sin+	I	Incr. encoder A+ diff. input, or analogue encoder Sin+ diff. input
	7	B- /Cos-	I	Incr. encoder B- diff. input, or analogue encoder Cos-diff. input
	8	B+ /Cos+	I	Incr. encoder B+ diff. input, or analogue encoder Cos+ diff. input
	9	Z-	I	Incr. encoder Z- diff. input
	10	Z / Z+	I	Incr. encoder Z+ (index) diff. input

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Pin	Name	Type	Description
1	+5V_{OUT}	O	5V output supply for I/O usage
2	Reserved	-	Reserved. Do not connect.
3	IN0	I	5-36V general-purpose digital PNP/NPN input
4	IN4/Enable	I	5-36V digital PNP input. Drive enable input
5	IN3/LSN	I	5-36V digital PNP input. Negative limit switch input
6	OUT2/Error	O	5-36V 0.5A, drive Error output, active low, NPN open-collector/TTL pull-up. Also drives the red LED
7	+V_{LOG}	I	Positive terminal of the logic supply: 9 to 36V _{DC} / If not connected, the logic supply is automatically routed from J1 pin 2 ¹
8	GND	-	Return ground for I/O pins
9	REF/FDBK	I	Analogue input, 12-bit, 0-5V. Used to read an analogue position/speed reference or feedback, or used as general purpose analogue input
10	IN1	I	5-36V general-purpose digital PNP/NPN input
11	IN2/LSP	I	5-36V digital PNP/NPN input. Positive limit switch input
12	OUT0	O	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
13	OUT3/Ready	O	5-36V 0.5A, drive Ready output, active low, NPN open-collector/TTL pull-up. Also drives the green LED.
14	OUT1	O	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up

Pin	Name	Type	Description
1	+V_{LOG}	O	Positive terminal of the logic supply: 9 to 36V _{DC}
2	GND	-	Return ground for CAN-Bus
3	Can-Hi	I/O	CAN-Bus positive line (dominant high)
4	Can-Lo	I/O	CAN-Bus negative line (dominant low)

Pin	Name	Type	Description
1	232TX	O	RS-232 Data Transmission
2	GND	-	Return ground for RS-232 pins
3	232RX	I	RS-232 Data Reception
4	GND	-	Return ground for RS-232 pins

Electrical characteristics

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

- Tamb = 0...40°C, VLOG = 24 VDC; VMOT = 36VDC
- Supplies start-up / shutdown sequence: -any-
- Load current (sinusoidal amplitude / continuous BLDC, DC, stepper) = 4A

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature ²		0		+40	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure ³	Altitude (vs. sea level)	-0.1	0 ÷ 2.5		Km
	Ambient Pressure	0 ²	0.75 ÷ 1	10.0	atm
Storage Conditions		Min.	Typ.	Max.	Units
Ambient temperature		-40		+85	°C
Ambient humidity	Non-condensing	0		100	%Rh
Ambient Pressure		0		10.0	atm
Mechanical Mounting		Min.	Typ.	Max.	Units
Airflow		natural convection ⁴ , closed box			
Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Without mating connectors	80 x 55 x 16.3			mm
		~3.15 x 2.17 x 0.64			inch
	With recommended mating connectors.	84 x 63 x 16.3			mm
		~3.3 x 2.5 x 0.64			inch


Weight	Without mating connectors		70			g
Power dissipation	Idle (no load)			1		W
	Operating			3	5	
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		36	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters		5.9		39	V _{DC}
	Absolute maximum values, continuous		0		39	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) [†]		0		+45	V
Supply current	No Load on Digital Outputs	+V _{LOG} = 9V		125	300	mA
		+V _{LOG} = 12V		80	200	
		+V _{LOG} = 24V		50	125	
		+V _{LOG} = 39V		40	100	
Motor Supply Input (+V _{MOT})			Min.	Typ.	Max.	Units
Supply voltage	Nominal values		9		36	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters		8.5		40	V _{DC}
	Absolute maximum values, continuous		-0.7		42	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) [†]		-1		+45	V
Supply current	Idle			1	5	mA
	Operating		-3.2	±2	+3.2	A
	Absolute maximum value, short-circuit condition (duration ≤ 10ms) [†]				5	A
Motor Outputs (A/A+, B/A-, C/B+, BR/B-)			Min.	Typ.	Max.	Units
Nominal output current, continuous	for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control				2	A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)				2	
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)				1.41	
Motor output current, peak	maximum 24s		-3.2		+3.2	A
Short-circuit protection threshold	measurement range			±4.3	±5	A
Short-circuit protection delay			5	10		µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance			±0.3	±0.5	V
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} = 36 V	F _{PWM}				µH
		20 kHz	250			
		40 kHz	120			
		60 kHz	100			
		80 kHz	60			
	Minimum value, limited by short-circuit protection; +V _{MOT} = 36 V	100 kHz	45			µH
		20 kHz	75			
		40 kHz	25			
60 kHz		20				
80 kHz		10				
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	100 kHz	5			µs
		20 kHz	250			
		40 kHz	125			
		60 kHz	100			
		80 kHz	63			

¹ If +V_{LOG} (J4 pin7) is not connected, the digital outputs and inputs will not be operational.

² Operating temperature can be extended up to **+65°C** with reduced current and power ratings.

³ iPOS360x 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.

⁴ It is recommended to mount the iPOS3604 BX-CAN on a metallic support using the provided mounting holes, for better reliability and reduced de-rating due to heat dissipation

and power rating are reduced due to thermal dissipation efficiency.					
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Current measurement	FS = Full Scale accuracy		±4	±8	%FS
Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN4/Enable)		Min.	Typ.	Max.	Units
Mode compliance		PNP			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic "LOW"		0	1.6	V
	Logic "HIGH"	1.8	24	39	
	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	0	mA
	Logic "HIGH"		2.9	3.4	

Mode compliance		NPN/ TTL / CMOS / LVTTTL (3.3V) / Open-collector			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"	2	5÷24		V
	Logic "HIGH"		3		
	Floating voltage (not connected)	-10		+30	
	Absolute maximum, continuous	-20		+40	
	Absolute maximum, surge (duration ≤ 1s) [†]	2	5÷24		
Input current	Logic "LOW"; Pulled to GND		0.6	1	mA
	Logic "HIGH"; Internal 4.7KΩ pull-up to +3.3	0	0	0	
	Logic "HIGH"; Pulled to +5V		0.15	0.2	
	Logic "HIGH"; Pulled to +24V		2	2.5	


Input frequency		0		150	kHz
Minimum pulse		3.3			μs
ESD protection	Human body model	±5			kV
Digital Outputs (OUT0, OUT1, OUT2/Error, OUT3/ Ready)		Min.	Typ.	Max.	Units
Mode compliance	All outputs (OUT0, OUT1, OUT2/Error, OUT3/Ready)	TTL / CMOS / Open-collector / NPN 24V			
Default state	Not supplied (+V _{LOG} floating or to GND)	High-Z (floating)			
	Immediately after power-up	OUT0, OUT1	Logic "HIGH"		
		OUT2/Error, OUT3/ Ready	Logic "LOW"		
	Normal operation	OUT0, OUT1, OUT2/Error	Logic "HIGH"		
Output voltage	Logic "LOW"; output current = 0.5A		0.2	0.8	V
	Logic "HIGH"; output current = 0, no load	OUT2/Error, OUT3/ Ready	2.9	3	
		OUT0, OUT1	4	4.5	
	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			0.5	A
	Logic "LOW", sink current, pulse ≤ 5 sec.			1	A
	Logic "HIGH", source current; external load to	OUT2/Error, OUT3/ Ready		2	mA

	GND; V _{OUT} ≥ 2.0V	OUT0, OUT1			4	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, 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
Encoder Inputs (A+, A-, B+, B-, Z+, Z-)		Min.	Typ.	Max.	Units	
Differential mode compliance	For full RS422 compliance, see ¹	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	A+ to A-, B+ to B-, Z+ to Z-	4.2	4.7		kΩ	
		6.1	7.2			
Input frequency	Single-ended mode, Open-collector / NPN	0		500	kHz	
	Differential mode, or Single-ended driven by push-pull (TTL / CMOS)	0		10		
Minimum pulse width	Single-ended mode, Open-collector / NPN	1			μs	
	Differential mode, or Single-ended driven by push-pull (TTL / CMOS)	50				
Input voltage, any pin to GND	Absolute maximum values, continuous	-7		+7	V	
	Absolute maximum, surge (duration ≤ 1s) [†]	-11		+14		
ESD protection	Human body model		±1			kV
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 _{PP}	
Input voltage, any pin to GND	Operational range	-1	2.5	4	V	
	Absolute maximum values, continuous	-7		+7		
	Absolute maximum, surge (duration ≤ 1s) [†]	-11		+14		
Input impedance	Differential, Sin+ to Sin-, Cos+ to Cos- ²	4.2	4.7		kΩ	
	Common-mode, to GND		2.2			
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

¹ For full RS-422 compliance, 120Ω termination resistors must be connected across the differential pairs, as close as possible to the drive input pins.

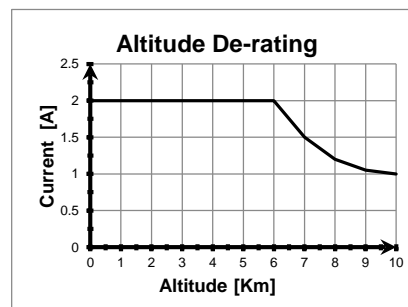
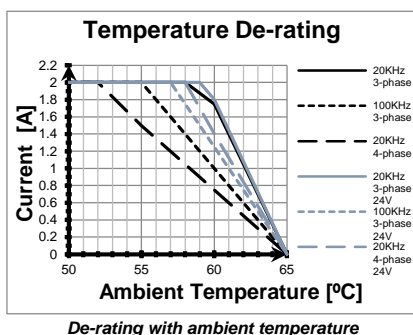
² For many applications, a 120Ω termination resistor should be connected across SIN+ to SIN-, and across COS+ to COS-. Please consult the feedback device datasheet for confirmation.

differential pairs, as close as possible to the drive input pins.
 across 500V to 600V. Please consult the feedback device datasheet for confirmation.

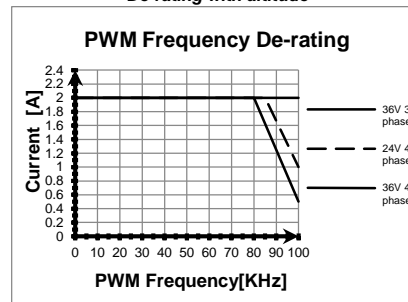
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Analog Input (REF/FDBK)		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		4.95	V
	Absolute maximum values, continuous	-12		+18	
	Absolute maximum, surge (duration ≤ 1s) [†]			±36	
Input impedance	To GND		30		kΩ
Resolution			12		bits
Integral linearity				±2	bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS ¹
Bandwidth (-3dB)	Software selectable	0		1	kHz
ESD protection	Human body model	±5			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
CAN-Bus		Min.	Typ.	Max.	Units
Compliance				ISO11898, CiA-301v4.2, 402v3.0	
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 Hex switch			1 ÷ 15 & 255	
	Software			1 ÷ 127; 255 (CANopen); 1- 255 (TLMCAN)	
ESD protection	Human body model	±15			kV
Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 250mA	4.8	5	5.2	V
Output current		250	350		mA
Short-circuit				NOT protected	
Over-voltage				NOT protected	
ESD protection	Human body model	±1			kV
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)				

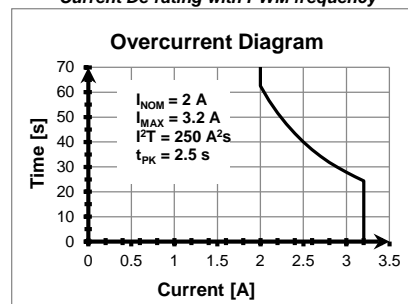
[†] Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.



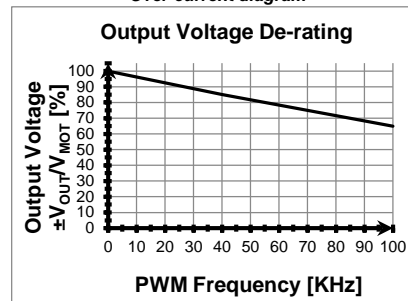
De-rating with altitude



Current De-rating with PWM frequency




Over-current diagram



Output Voltage De-rating with PWM frequency²

¹ "FS" stands for "Full Scale"

² V_{OUT} – the output voltage, V_{MOT} – the motor supply voltage

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