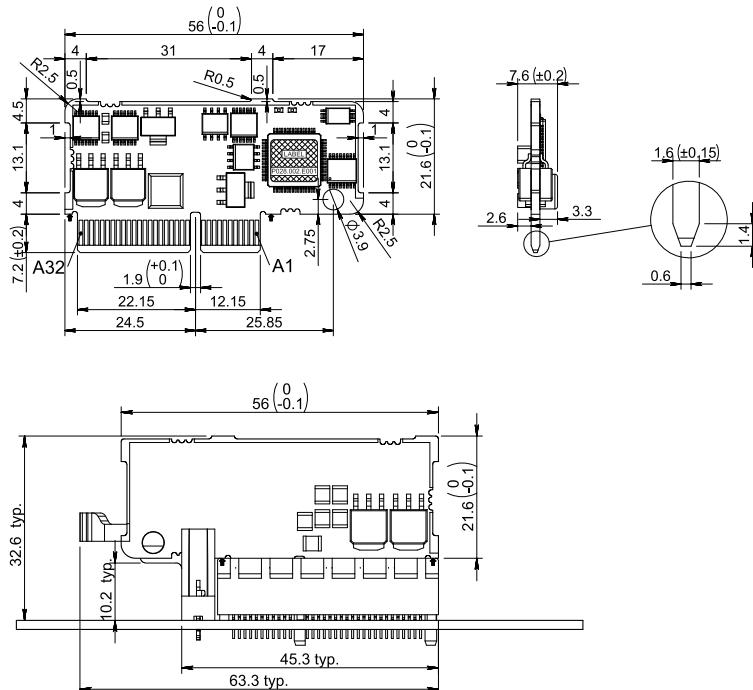


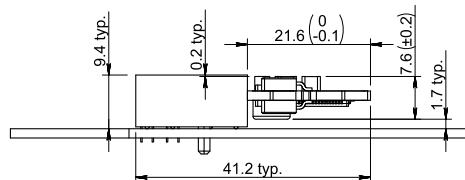


# iPOS3604 VX-CAT DATASHEET

P/N: P028.002.E021



**Overall dimensions for vertical mounting using recommended mating connector and retainer**



**Overall dimensions for horizontal mounting**

## Features

- Motor supply: 9-36V. Optional logic supply: 7-36V
- Output current: 4A cont. (BLDC mode); 10 A<sub>PEAK</sub>, up to 100KHz PWM
- Digital Hall sensor interface (single-ended and open collector)
- Incremental encoder interface (single-ended, open collector and differential)
- Linear Hall sensors interface
- Analogue sin/cos encoder interface (differential 1V<sub>pp</sub>)
- 5 digital inputs, 5-36V, NPN: Enable, 2 for limit switches, 2 general-purpose
- 4 digital outputs, 5-36V, 0.5A, NPN O.C.: Ready, Error, 2 general-purpose
- 2 analogue inputs: 12-bit, 0-5V: Reference, Feedback or general-purpose
- RS-232 serial & EtherCAT compatible with h/w selectable addresses
- TMLCAN and EtherCAT (through the E-CAT VX interface board) protocols
- 2K × 16 SRAM for data acquisition
- 4K × 16 E<sup>2</sup>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<sup>2</sup>t
- Firmware: F511J+

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

Mating Connectors		
Producer	Part No.	Description
Tyco	2-1775801-4	PCIe 4x vertical card edge connector, 1.0mm pitch, 2x32 contacts
FCI	10018784-11101TLF	
Tyco	1761465-2	PCIe 4x horizontal card edge connector, 1.0mm pitch, 2x32 contacts
Samtec	PCIE-064-02-F-D-RA	
FCI	10035591-001LF	
FCI	10042618-002LF	Retainer for vertical PCIe card

Pin	Name	Type	Description
A1	GND	-	Return ground for extension bus
A2	Clock	O	3.3V digital output; for ECAT interface board
A3	reserved	I/O	Reserved, do not connect
A4	Data In	O	3.3V digital output; for ECAT interface board
A5	Chip Select	O	3.3V digital output; for ECAT interface board
A6	OUT1†	O	5-36V 0.5A digital output, NPN O.C. / TTL pull-up
A7	Data Out	I	3.3V digital input; for ECAT interface board
A8	Hall 1	I	Digital input Hall 1 sensor
A9	Hall 2	I	Digital input Hall 2 sensor
A10	Hall 3	I	Digital input Hall 3 sensor
A11	+5VOUT	O	5V supply for sensors - internally generated
A12	GND	-	Return ground for sensors supply
A13	A-Sin-/LH1	I	Incr. encoder A- diff. input, or analogue encoder Sin- diff. input, or linear Hall 1 input
A14	A/A+/Sin+	I	Incr. encoder A single-ended, or A+ diff. input, or analogue encoder Sin+ diff. input
A15	B-/Cos-/LH2	I	Incr. encoder B- diff. input, or analogue encoder Cos- diff. input, or linear Hall 2 input
A16	B/B+/Cos+	I	Incr. encoder B single-ended, or B+ diff. input, or analogue encoder Cos+ diff. input
A17	Z-/LH3	I	Incr. encoder Z- diff. input, or linear Hall 3 input
A18	Z/Z+	I	Incr. encoder Z (index) single-ended, or Z+ diff. input
A19	reserved	I/O	Reserved, do not connect
A20	GND	-	Negative return (ground) of the logic supply
A21-A22	+V <sub>MOT</sub>	I	Positive terminal of the motor supply: 9 to 36V <sub>DC</sub>
A23-A24	GND	-	Negative return (ground) of the motor supply
A25-A28	CR/B-	O	Chopping resistor / Phase B- for step motors
A29-A32	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors

Name ALN	First edition June 23, 2021	Document template: P099.TQT.564.0001	Last edition June 23, 2023	Visa:
TECHNOSOFT	Title of document	iPOS3604 VX-CAT PRODUCT DATA SHEET	N° document <b>P028.002.E021.DSH.10B</b>	Page: 1 of 5



# iPOS3604 VX-CAT DATASHEET

P/N: P028.002.E021



Pin	Name	Type	Description
B1	GND	-	Return ground for CAN-Bus and RS-232 pins
B2	232TX	O	RS-232 Data Transmission
B3	232RX	I	RS-232 Data Reception
B4	OUT0	O	5-36V 0.5A general-purpose digital output, NPN open-collector / TTL pull-up
B5	GND	-	Return ground for I/O pins
B6	Interrupt	I	3.3V digital input; for ECAT interface board
B7	ECAT Ready	I	3.3V digital input; for ECAT interface board
B8	Sync	I	3.3V digital input; for ECAT interface board
B9	REF	I	Analogue input, 12-bit, 0-5V. Used to read an analog position, speed or torque reference, or used as general-purpose analogue input
B10	FDBK	I	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tacho), or used as general-purpose analogue input
B11	+5VOUT	O	5V output supply for I/O usage
B12	OUT2/Error	O	5-36V 0.5A drive error output, active low, NPN open-collector/TTL pull-up. Also drives the red LED
B13	OUT3/Ready	O	5-36V 0.5A drive ready output, active low, NPN open-collector/TTL pull-up. Also drives the green LED.
B14	IN0	I	5-36V digital input, General-purpose
B15	IN1	I	5-36V digital input
B16	IN2/LSP	I	5-36V digital input Positive limit switch input
B17	IN3/LSN	I	5-36V digital input. Negative limit switch input
B18	IN4/Enable	I	5-36V digital input. Drive enable input
B19	Rsvd.	I/O	Reserved, do not connect
B20	+VLOG	I	Positive terminal of the logic supply: 7 to 36VDC
B21-B22	+VMOT	I	Positive terminal of the motor supply: 9 to 36VDC
B23-B24	GND	-	Negative return (ground) of the motor supply
B25-B28	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
B29-B32	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors

† not available when additional feedback extension module is used

## 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 <sup>1</sup>		0		+40	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure <sup>2</sup>	Altitude (vs. sea level)	-0.1	0 ÷ 2.5	2	Km
Ambient Pressure		0 <sup>2</sup>	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
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
Insertion force	Using recommended mating connectors	20	36	N	
Extraction force	Without retainer	5	10	N	
Environmental Characteristics		Min.	Typ.	Max.	Units
Size ( Length x Width x Height )	Without mating connector / retainer	56 x 28.8 x 7.6			
		~2.2 x 1.1 x 0.3			
	With recommended mating vertical connector and retainer. Height above PCB surface.	63.3 x 32.6 x 16.3			
		~2.5 x 1.3 x 0.64			
	With recommended mating horizontal connector. Height above PCB surface.	56 x 41.2 x 7.6			
Weight		~2.2 x 1.6 x 0.3			
Power dissipation	Idle (no load)	1			W
	Operating	3			
Efficiency		98			%
Cleaning agents	Dry cleaning is recommended	Only Water- or Alcohol-based			
Protection degree	According to IEC60529, UL508	IP00			
Logic Supply Input (+V <sub>LOG</sub> )		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	7		36	V <sub>DC</sub>
	Absolute maximum values, drive operating but outside guaranteed parameters	4.9		40	V <sub>DC</sub>
	Absolute maximum values, continuous	-0.7		42	V <sub>DC</sub>
	Absolute maximum values, surge (duration ≤ 10ms) <sup>†</sup>	-1		+45	V
	+V <sub>LOG</sub> = 7V		125	300	mA
Supply current	+V <sub>LOG</sub> = 12V		80	200	
	+V <sub>LOG</sub> = 24V		50	125	
	+V <sub>LOG</sub> = 40V		40	100	

<sup>1</sup> Operating temperature can be extended up to +65°C with reduced current and power ratings.

<sup>2</sup> 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.

<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

Name ALN	First edition June 23, 2021	Document template: P099.TQT.564.0001	Last edition June 23, 2023	Visa:
 TECHNOSOFT	Title of document <b>iPOS3604 VX-CAT</b> <b>PRODUCT DATA SHEET</b>	N° document <b>P028.002.E021.DSH.10B</b>		Page: 2 of 5



## iPOS3604 VX-CAT DATASHEET

P/N: P028.002.E021



Motor Supply Input (+V <sub>MOT</sub> )		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	9		36	V <sub>DC</sub>
	Absolute maximum values, drive operating but outside guaranteed parameters	8.5		40	V <sub>DC</sub>
	Absolute maximum values, continuous	-0.7		42	V <sub>DC</sub>
	Absolute maximum values, surge (duration $\leq$ 10ms) <sup>†</sup>	-1		+45	V
Supply current	Idle		1	5	mA
	Operating	-10	$\pm 4$	+10	A
	Absolute maximum value, short-circuit condition (Duration $\leq$ 10ms) <sup>†</sup>			15	A
Motor Outputs (A/A+, B/A-, C/B+, CR/B-)		Min.	Typ.	Max.	Units
Nominal output current, continuous	for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control			4	A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)			4	
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)			2.82	
Motor output current, peak	maximum 2.5s	-10		+10	A
Short-circuit protection threshold	measurement range		$\pm 13$	$\pm 15$	A
Short-circuit protection delay		5	10		$\mu$ s
On-state voltage drop	Nominal output current; including typical mating connector contact resistance		$\pm 0.3$	$\pm 0.5$	V
Off-state leakage current			$\pm 0.5$	$\pm 1$	mA
Motor inductance (phase-to-phase)	Recommended value, for current ripple max. $\pm 5\%$ of full range; +V <sub>MOT</sub> = 36 V	F <sub>PWM</sub>			$\mu$ H
		20 kHz	250		
		40 kHz	120		
		60 kHz	100		
		80 kHz	60		
	100 kHz	45			
Motor electrical time-constant (L/R)	Recommended value for $\pm 5\%$ current measurement error	20 kHz	75		$\mu$ H
		40 kHz	25		
		60 kHz	20		
		80 kHz	10		
		100 kHz	5		
	20 kHz	250			
Current measurement	FS = Full Scale accuracy	40 kHz	125		$\mu$ s
		60 kHz	100		
		80 kHz	63		
		100 kHz	50		
		20 kHz	250		
	40 kHz	125			
Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN4/Enable)	Min.	Typ.	Max.	Units	
Mode compliance				TTL / CMOS / LVTTL (3.3V) / Open-collector / NPN / 24V outputs	
Default state	Input floating (wiring disconnected)			Logic HIGH	
Input voltage	Logic "LOW"		0	0.8	V
	Logic "HIGH"	2	5+24		
	Floating voltage (not connected)		3		
	Absolute maximum, continuous	-10		+30	
	Absolute maximum, surge <sup>†</sup> (duration $\leq$ 1s)	-20		+40	
Input current	Logic "LOW"; pulled to GND		0.6	1	mA
	Logic "HIGH"; Internal 4.7K $\Omega$ 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			$\mu$ s
ESD protection	Human body model	$\pm 5$			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			
Ready, Error		Same as above + LVTTL (3.3V)			
Default state	Not supplied (+V <sub>LOG</sub> floating or to GND)	High-Z (floating)			
	Immediately after power-up	OUT0, OUT1 OUT2/Error, OUT3/ Ready	Logic "HIGH"		
	Normal operation	OUT0, OUT1, OUT2/Error OUT3/Ready	Logic "LOW"		
		Logic "LOW"; output current = 0.5A	0.2	0.8	V
Output voltage	Logic "HIGH"; output current = 0, no load	OUT2/Error, OUT3/ Ready	2.9	3	
	Logic "HIGH", external load to +V <sub>LOG</sub>	OUT0, OUT1	4	4.5	
	Absolute maximum, continuous		V <sub>LOG</sub>		
	Absolute maximum, surge <sup>†</sup> (duration $\leq$ 1s)		-0.5		
			-1		
Output current	Logic "LOW", sink current, continuous			0.5	A
	Logic "LOW", sink current, pulse $\leq$ 5 sec.			1	A
	Logic "HIGH", source current; external load to GND; V <sub>OUT</sub> >= 2.0V	OUT2/Error, OUT3/ Ready			mA
	Logic "HIGH", leakage current; external load to +V <sub>LOG</sub> ; V <sub>OUT</sub> = V <sub>LOG</sub> max = 40V	OUT0, OUT1		4	mA
	Minimum pulse width		0.1	0.2	mA
	ESD protection	Human body model	2		$\mu$ s
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 <sup>†</sup> (duration $\leq$ 1s)	-10		+15	
Input current	Logic "LOW"; Pull to GND			1.2	mA
	Logic "HIGH"; Internal 4.7K $\Omega$ pull-up to +5	0	0	0	
Minimum pulse width		2			$\mu$ s
ESD protection	Human body model	$\pm 5$			kV
Encoder Inputs (A/A+, A-, B/B+, B-, Z/Z+, Z)		Min.	Typ.	Max.	Units
Single-ended mode compliance	Leave negative inputs disconnected			TTL / CMOS / Open-collector	
Input voltage	Logic "LOW"			1.6	V
	Logic "HIGH"	1.8			
Input voltage, single-ended mode A/A+, B/B+	Floating voltage (not connected)		4.5		V
	Logic "LOW"			1.2	
	Logic "HIGH"	1.4			
	Floating voltage (not connected)		4.7		
Input current, single-ended mode A/A+, B/B+, Z/Z+	Logic "LOW"; Pull to GND		2.5	3	mA
	Logic "HIGH"; Internal 2.2K $\Omega$ pull-up to +5	0	0	0	
Differential mode compliance	For full RS422 compliance, see			TIA/EIA-422-A	
Input voltage, differential mode	Hysteresis	$\pm 0.06$	$\pm 0.1$	$\pm 0.2$	V
	Common-mode range (A+ to GND, etc.)	-7		+7	
Input impedance, differential	A+ to A-, B+ to B-	4.2	4.7		k $\Omega$
	Z+ to Z-	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	MHz

Name ALN	First edition June 23, 2021	Document template: P099.TQT.564.0001	Last edition June 23, 2023	Visa:
 TECHNOSOFT	Title of document <b>iPOS3604 VX-CAT</b> <b>PRODUCT DATA SHEET</b>	N° document <b>P028.002.E021.DSH.10B</b>		Page: 3 of 5



# iPOS3604 VX-CAT DATASHEET

P/N: P028.002.E021



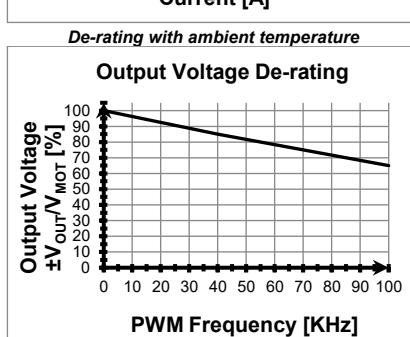
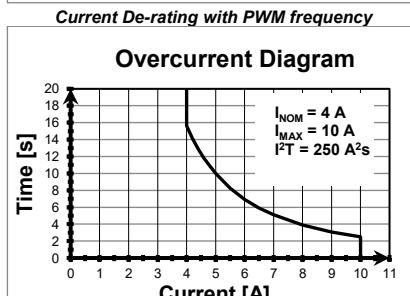
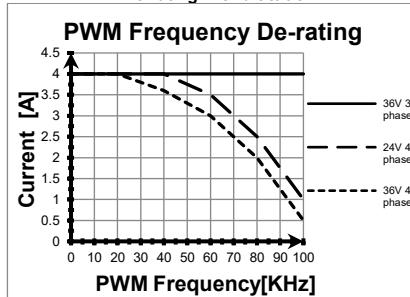
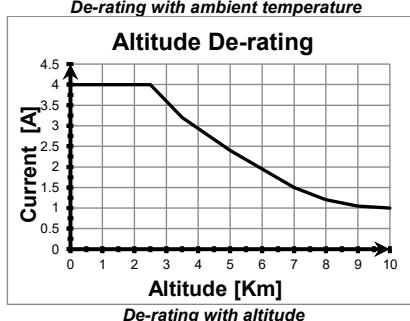
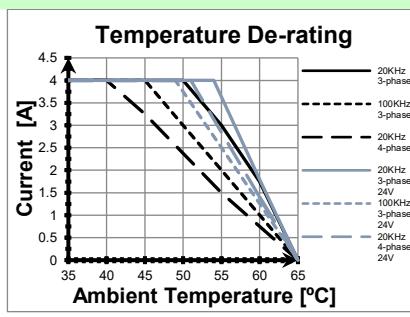
Minimum pulse width	Single-ended mode, Open-collector / NPN	1		$\mu\text{s}$
	Differential mode, or Single-ended driven by push-pull (TTL / CMOS)	50		ns
Input voltage, any pin to GND	Absolute maximum values, continuous	-7	+7	V
	Absolute maximum, surge (duration $\leq 1\text{s}$ ) <sup>†</sup>	-11	+14	V
ESD protection	Human body model	$\pm 1$		kV
<b>Linear Hall Inputs (LH1, LH2, LH3)</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Units</b>
Input voltage	Operational range	0	0.5±4.5	4.9
Input voltage	Absolute maximum values, continuous	-7	+7	V
	Absolute maximum, surge (duration $\leq 1\text{s}$ ) <sup>†</sup>	-11	+14	V
Input current	Input voltage 0...+5V	-1	±0.9	+1
Interpolation Resolution	Depending on software settings		11	bits
Frequency	0		1	kHz
ESD protection	Human body model	$\pm 1$		kV
<b>Sin-Cos Encoder Inputs (Sin+, Sin-, Cos+, Cos-)</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Units</b>
Input voltage, differential	Sin+ to Sin-, Cos+ to Cos-		1	1.25
Input voltage, any pin to GND	Operational range	-1	2.5	4
	Absolute maximum values, continuous	-7	+7	V
Input impedance	Absolute maximum, surge (duration $\leq 1\text{s}$ ) <sup>†</sup>	-11	+14	V
	Differential, Sin+ to Sin-, Cos+ to Cos- <sup>4</sup>	4.2	4.7	$\text{k}\Omega$
Resolution with interpolation	Software selectable, for one sine/cosine period	2		10 bits
Sin-Cos interpolation	0		450	kHz
Frequency	Quadrature, no interpolation	0		10 MHz
ESD protection	Human body model	$\pm 1$		kV
<b>Analog 0...5V Inputs (REF, FDBK)</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Units</b>
Input voltage	Operational range	0	4.95	V
	Absolute maximum values, continuous	-12	+18	V
	Absolute maximum, surge (duration $\leq 1\text{s}$ ) <sup>†</sup>		±36	V
Input impedance	To GND		30	$\text{k}\Omega$
Resolution			12	bits
Integral linearity			±2	bits
Offset error		±2	±10	bits
Gain error		±1%	±3%	% FS <sup>5</sup>
Bandwidth (-3dB)	Software selectable	0	1	kHz
ESD protection	Human body model	$\pm 5$		kV
<b>Axis ID Inputs (AxisID 0, AxisID 1, AxisID 2)</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Units</b>
External connections	7 levels	Not connected; Strap to GND; Strap to +5V; 4.7 $\text{k}\Omega$ to GND; 4.7 $\text{k}\Omega$ to +5V; 22 $\text{k}\Omega$ to GND; 22 $\text{k}\Omega$ to +5V;		
Pin current	Use to size PCB tracks		±0.5	mA
4.7 $\text{k}\Omega$ /22 $\text{k}\Omega$ resistor	Power rating	3		mW
	Tolerance		±5	%
ESD protection	Human body model	$\pm 5$		kV
<b>RS-232</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Units</b>
Compliance		TIA/EIA-232-C		
Bit rate	Software selectable	9600	115200	Baud
Short-circuit	232TX short to GND		Guaranteed	
ESD protection	Human body model	$\pm 2$		kV
<b>Supply Output (+5V)</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Units</b>
Output voltage	Current sourced = 250mA	4.8	5	5.2
Output current		250	350	mA
Short-circuit		NOT protected		
Over-voltage		NOT protected		
ESD protection	Human body model	$\pm 1$		kV
<b>Conformity</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Units</b>
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>4</sup> For many applications, an 120 $\Omega$  termination resistor should be connected across SIN+ to SIN-, and across COS+ to COS-. Please consult the feedback device datasheet for confirmation.

<sup>5</sup> "FS" stands for "Full Scale"

# iPOS3604 VX-CAT DATASHEET

P/N: P028.002.E021



<sup>6</sup>  $V_{\text{OUT}}$  – the output voltage,  $V_{\text{MOT}}$  – the motor supply voltage

Name ALN	First edition June 23, 2021	Document template: P099.TQT.564.0001	Last edition June 23, 2023	Visa:
<b>TECHNOSOFT</b>	<b>iPOS3604 VX-CAT</b> <b>PRODUCT DATA SHEET</b>			Page: 4 of 5