

Top view; Pins facing upward; All dimensions are in mm; Header pitch of J1 & J2 is 1.27mm and for J3 is 2.54 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 | Ⓢ | Ⓢ | Ⓢ | Ⓢ | |
| Tacho | | | Ⓢ | | |
| Open-loop (no sensor) | | | | Ⓢ | Ⓢ |

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: 15A¹ RMS cont. (BLDC mode); 28 A_{PEAK} RMS, 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
 - RS232
 - TMLCAN and CANopen (CiA 301 v4.2, CiA 305 v2.2.13 and CiA 402 v3.0) protocols

Feedback Devices (dual-loop support)


1st feedback devices supported:

- Incremental encoder interface (single ended or differential)
- Analogue sin/cos encoder interface (differential 1V_{pp})
- Digital Hall sensor interface (single-ended and open collector)
- Linear Hall sensors interface
- pulse & direction interface (single ended or differential) for external (master) digital reference

2nd feedback devices supported:

- Incremental encoder interface (differential)
- pulse & direction interface (differential) for external (master) digital reference
- BiSS / SSI / EnDAT / TAMAGAWA / Panasonic encoder interface
- 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, programmable polarity: 0.3A sourcing/NPN or 0.2 A sinking/PNP: (Ready, Error and 4 general-purpose)
- 2 analogue inputs: 12-bit, 0-5V: Reference, Feedback or general purpose
- Integrated termination resistors for differential Feedback#2 pairs
- 128 h/w addresses selectable by h/w pins configuration
- 16k x 16 SRAM memory for data acquisition
- 24k x 16 E²ROM to store setup data, TML motion programs, cam tables and other user data

¹Nominal current can be increased if external cooling is ensured over cooling area

| | | | | |
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| Mating Connectors | | | |
|--|--|----------------------|--|
| When J3 is plugged into a connector and maximum current should not exceed 18A Sine amplitude | | | |
| Ref | Producer | Part No. | Description |
| J1, J2 | Harwin | M52-5012045 | 1x20 contacts, socket 1.27mm-pitch; 4 pcs needed for one drive |
| | Samtec | SMS-140-01-L-S | 1x40 contacts, socket 1.27mm-pitch; 2 pcs needed for one drive |
| | | SMS-140-01-G-S | |
| J3 | Mill-Max | 801-47-012-10-001000 | 1x12 contacts, High-current socket 2.54mm-pitch accepting 0.635mm square pin; 1 pcs is needed for one drive; the current should not exceed 12.7A |
| When J3 is soldered directly onto a motherboard and the maximum current can exceed 13A Sine amplitude | | | |
| Ref | Producer | Part No. | Description |
| J1, J2 | Harwin | M52-5012045 | 1x20 contacts, socket 1.27mm-pitch; 4 pcs needed for one drive |
| J3 | The pins are directly soldered onto a motherboard for increased current capability | | |

| Pin | Name | Type | Description |
|-------|-------------------|------|--|
| 1,2 | GND | - | Return ground for motor. Internally connected to all GND signals except STO GND. |
| 3,4 | Cr/B- | O | Chopping resistor / Phase B- for 2-ph steppers |
| 5,6 | C/B+ | O | Phase C for 3-ph motors, B+ for 2-ph steppers |
| 7,8 | B/A- | O | Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors |
| 9,10 | A/A+ | O | Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors |
| 11,12 | +V _{MOT} | I | Positive terminal of the motor supply: 11 to 48V _{DC} . |

| Pin | Name | Type | Description |
|-----|--------------|------|--|
| 1 | Temp Mot | I | NTC/PTC 3.3V input. Used to read an analog temperature value |
| 2 | 232TX | O | RS-232 Data Transmission |
| 3 | 232RX | I | RS-232 Data Reception |
| 4 | USB Data- | I/O | USB Data negative |
| 5 | USB Data+ | I/O | USB Data positive |
| 6 | USB V+ | I | USB +5V input |
| 7 | Reserved | O | Reserved. Do not use |
| 8 | Reserved | O | Reserved. Do not use |
| 9 | Axis ID Bit7 | - | 8 bit H/W Axis ID register. |
| 10 | Axis ID Bit6 | I | Connect pin to GND to set bit to 1. |
| 11 | Axis ID Bit5 | I | Pin 16 is Bit 0... Pin 9 is Bit 7 of the Axis value. |
| 12 | Axis ID Bit4 | I | Possible values: from 1 to 128; and 255 when all pins OFF. |
| 13 | Axis ID Bit3 | I | When Axis ID is 255 and in CANOpen, the drive will be in LSS inactive state and the GREEN led will flash at 1s intervals |
| 14 | Axis ID Bit2 | I | BIT 7 OFF = TMLCAN; BIT 7 ON = CANOpen |
| 15 | Axis ID Bit1 | I | |
| 16 | Axis ID Bit0 | I | |
| 17 | Reserved | - | Reserved. Do not use |
| 18 | Reserved | - | Reserved. Do not use |
| 19 | Spi2 Clk | O | Reserved. Do not use |
| 20 | Spi2 Out | O | Reserved. Do not use |
| 21 | Spi2 In | I | Reserved. Do not use |
| 22 | Spi2 CS | O | Reserved. Do not use |
| 23 | Spi2 Irq | I | Reserved. Do not use |
| 24 | Reserved | - | Reserved. Do not use |
| 25 | Reserved | - | Reserved. Do not use |
| 26 | Reserved | - | Reserved. Do not use |
| 27 | Reserved | - | Reserved. Do not use |
| 28 | Reserved | - | Reserved. Do not use |
| 29 | Reserved | - | Reserved. Do not use |
| 30 | Reserved | - | Reserved. Do not use |
| 31 | Reserved | - | Reserved. Do not use |
| 32 | Reserved | - | Reserved. Do not use |
| 33 | Reserved | - | Reserved. Do not use |
| 34 | Reserved | - | Reserved. Do not use |
| 35 | Reserved | - | Reserved. Do not use |
| 36 | GND | - | Return ground. Internally connected to all GND signals except STO GND. |
| 37 | STO2- | I | Safe Torque Off input 2, negative return (opto-isolated, 0V) |
| 38 | STO2+ | I | Safe Torque Off input 2, positive input (opto-isolated, 18÷40V) |
| 39 | STO1- | I | Safe Torque Off input 1, negative return (opto-isolated, 0V) |
| 40 | STO1+ | I | Safe Torque Off input 1, positive input (opto-isolated, 18÷40V) |

Apply between both STO1+, STO2+ and STO1-, STO2- 24V DC from SELV/ PELV power supply for motor PWM output operation

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| Pin | Name | Type | Description |
|-----|------------------------|------|--|
| 1 | LH1 | I | Linear Hall 1 input |
| 2 | LH2 | I | Linear Hall 2 input |
| 3 | LH3 | I | Linear Hall 3 input |
| 4 | FDBK | I | Analogue input, 12-bit, 0-5V. Reads an analogue feedback (tacho), or general purpose |
| 5 | REF | I | Analogue input, 12-bit, 0-5V. Reads analog reference, or general-purpose analogue input |
| 6 | Hall 3 | I | Digital input Hall 3 sensor |
| 7 | Hall 2 | I | Digital input Hall 2 sensor |
| 8 | Hall 1 | I | Digital input Hall 1 sensor |
| 9 | GND | - | Return ground. Internally connected to all GND signals except STO GND. |
| 10 | IN5 | I | 12-36V general-purpose digital PNP/NPN input |
| 11 | IN4 | I | 12-36V general-purpose digital PNP/NPN input |
| 12 | IN1 | I | 12-36V general-purpose digital PNP/NPN input |
| 13 | IN0 | I | 12-36V general-purpose digital PNP/NPN input |
| 14 | IN2/LSP | I | 12-36V digital PNP/NPN input. Positive limit switch input |
| 15 | IN3/LSN | I | 12-36V digital PNP/NPN input. Negative limit switch input |
| 16 | OUT3 | O | 5-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable |
| 17 | OUT2 | O | 5-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable |
| 18 | OUT5 | O | 5-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable |
| 19 | OUT4 | O | 5-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable |
| 20 | OUT1 | O | 5-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable |
| 21 | OUT0 | O | 5-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable |
| 22 | Z1+ | I | Incr. encoder1 Z single-ended, or Z+ diff. input, |
| 23 | Z1- | I | Incr. encoder1 Z- diff. input |
| 24 | B1+/Cos+ | I | Incr. encoder1 B single-ended, or B+ diff. input, or analogue encoder Cos+ diff. input |
| 25 | B1-/Cos- | I | Incr. encoder1 B- diff. input, or analogue encoder Cos- diff. input |
| 26 | A1+/Sin+ | I | Incr. encoder1 A single-ended, or A+ diff. input, or analogue encoder Sin+ diff. input |
| 27 | A1-/Sin- | I | Incr. encoder1 A- diff. input, or analogue encoder Sin- diff. input |
| 28 | Z2+ | I | Incr. encoder2 Z+ diff. input; has 150Ω resistor between pins 28 and 29 |
| 29 | Z2- | I | Incr. encoder2 Z- diff. input; has 150Ω resistor between pins 28 and 29 |
| 30 | B2-/Dir-/CLK-/MA- | I/O | Incr. encoder2 B- diff. input, or Dir-, or Clock- for SSI, or Master- for BiSS; has 150Ω resistor between pins 30 and 31 |
| 31 | B2+/Dir+/CLK+/MA+ | I/O | Incr. encoder2 B+ diff. input, or Dir+, or Clock+ for SSI, or Master+ for BiSS; has 150Ω resistor between pins 30 and 31 |
| 32 | A2+/Pulse+ / Data+/SL+ | I | Incr. encoder2 A+ diff. input, or Pulse+, or Data+ for SSI, or Slave+ for BiSS; has 150Ω resistor between pins 32 and 33 |
| 33 | A2-/Pulse-/ Data-/SL- | I | Incr. encoder2 A- diff. input, or Pulse-, or Data- for SSI, or Slave- for BiSS; has 150Ω resistor between pins 32 and 33 |
| 34 | CAN-Lo | I | CAN negative line |
| 35 | CAN-Hi | I | CAN positive line |
| 36 | Reserved | - | Reserved. Do not use |
| 37 | Reserved | - | Reserved. Do not use |
| 38 | +5V _{OUT} | O | 5V output supply for I/O usage |
| 39 | -V _{LOG} | I | Negative terminal of the logic supply input: 9 to 36V _{DC} from SELV/ PELV type power supply. |
| 40 | +V _{LOG} | I | Positive terminal of the logic supply input: 9 to 36V _{DC} from SELV/ PELV type power supply. |

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) = 15A RMS

| Operating Conditions | | Min. | Typ. | Max. | Units |
|--|--|--|----------|-----------------|-----------------|
| Ambient temperature | | 0 | | 40 ¹ | °C |
| Ambient humidity | Non-condensing | 0 | | 90 | %Rh |
| Altitude / pressure ² | Altitude (vs. sea level) | -0.1 | 0 ± 2.5 | ² | 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 | 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 ³ , 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 | | TBD | TBD | N |
| Extraction force | | TBD | TBD | | N |
| Environmental Characteristics | | Min. | Typ. | Max. | Units |
| Size (Length x Width x Height) | Global size | 64 x 43.8 x 15.7 | | | mm |
| | | ~2.52 x 1.72 x 0.62 | | | inch |
| Weight | | 36.3 | | | g |
| Cleaning agents | Dry cleaning is recommended | Only Water- or Alcohol- based | | | |
| Protection degree | According to IEC60529, UL508 | IP20 | | | - |
| Logic Supply Input (+V _{Lo}) | | Min. | Typ. | Max. | Units |
| Supply voltage | Nominal values | 9 | | 36 | V _{DC} |
| | Absolute maximum values, drive operating but outside guaranteed parameters | 8 | | 40 | V _{DC} |
| | Absolute maximum values, continuous | -0.6 | | 42 | V _{DC} |
| | Absolute maximum values, surge (duration ≤ 10ms) [†] | -1 | | +45 | V |
| Supply current | +V _{Lo} = 12V | | TBD | | mA |
| | +V _{Lo} = 24V | | TBD | | |
| | +V _{Lo} = 40V | | TBD | | |
| Motor Supply Input (+V _{Mot}) | | Min. | Typ. | Max. | Units |
| Supply voltage | Nominal values | 11 | | 50 | V _{DC} |
| | Absolute maximum values, drive operating but outside guaranteed parameters | 9 | | 52 | V _{DC} |
| | Absolute maximum values, continuous | -0.6 | | 54 | V _{DC} |
| | Absolute maximum values, surge (duration ≤ 10ms) [†] | -1 | | 57 | V |
| Supply current | Idle | | 1 | 5 | mA |
| | Operating | -40 | ±10 | +40 | A |
| | Absolute maximum value, short-circuit condition (duration ≤ 10ms) [†] | | | 43 | A |
| Supply Output (+5V) | | Min. | Typ. | Max. | Units |
| Output voltage | Current sourced = 250mA | 4.8 | 5 | 5.2 | V |
| Output current | | | TBD | | mA |
| Short-circuit | | NOT protected | | | |
| Over-voltage | | NOT protected | | | |
| ESD protection | Human body model | ±1 | | | kV |

¹ Operating temperature at higher temperatures is possible with reduced current and power ratings
² iPOS4815 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 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 ¹ | for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control | | | | 14.3 | A |
| | for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value) | | | | 14.3 | |
| | 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 _{MOT} = 36 V | F _{PWM} | | | | µH |
| | | 20 kHz | | | | |
| | | 40 kHz | | | | |
| | | 60 kHz | | | | |
| | | 80 kHz | | | | |
| | Minimum value, limited by short-circuit protection; +V _{MOT} = 36 V | 20 kHz | | | | µH |
| | | 40 kHz | | | | |
| | | 60 kHz | | | | |
| | | 80 kHz | | | | |
| | | 100 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 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 |
| 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 |

| Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN4, IN5, IN6) ² | | 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) [†] | -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) [†] | -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" | | | 1.6 | V |
| | Logic "HIGH" | 1.8 | | | |
| | Floating voltage (not connected) | | 3.3 | | |
| Input voltage, single-ended mode Z/Z+ | Logic "LOW" | | | 1.2 | V |
| | 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 | | 5.5 | 6 | mA |
| | Logic "HIGH"; Internal 2.2KΩ pull-up to +5 | 0 | 0 | 0 | |
| Differential mode compliance | For full RS422 compliance, see ³ | 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- Z1+ to Z1- | | 1 | | kΩ |
| | | | 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) [†] | -11 | | +14 | |
| ESD protection | Human body model | ±1 | | | kV |

¹ @20kHz F_{PWM}

² The digital inputs and outputs are software selectable as PNP or NPN

³ For full RS-422 compliance, 120Ω termination resistors must be connected across the differential pairs, as close as possible to the drive input pins.

| | | | | | | |
|--|---------------|---|--|--|------------------------------|--------|
| The digital inputs and outputs are software selectable as T/Nr. or N/Nr. differential pairs, as close as possible to the drive input pins. | | | | | | |
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| Digital Outputs (OUT0, OUT1, OUT2/Error, OUT3/Ready, OUT4, OUT5) ¹ | 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 _{LOG} -0.2 | V _{LOG} -0.8 |
| | Logic "LOW"; output current = 0, no load | open-collector | | |
| | Logic "HIGH", external load to GND | | 0 | |
| | Absolute maximum, continuous | -0.3 | | V _{LOG} +0.3 |
| | Absolute maximum, surge (duration ≤ 1s) [†] | -0.5 | | V _{LOG} +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 |

| | | | | |
|---|--|-------------------|------------------|-----------------------|
| 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 |
| | Logic "HIGH"; output current = 0, no load | open-collector | | |
| | Logic "HIGH", external load to +V _{LOG} | | V _{LOG} | |
| | Absolute maximum, continuous | -0.3 | | V _{LOG} +0.3 |
| | Absolute maximum, surge (duration ≤ 1s) [†] | -0.5 | | V _{LOG} +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 |
| Encoder2 Inputs (A2+/Data+, A2-/Data-, B2+/Clk+, B2-/Clk-, Z2+, Z2-)¹ | | | | |
| Differential mode compliance | | TIA/EIA-422-A | | |
| Input voltage | Hysteresis | ±0.06 | ±0.1 | ±0.2 |
| | 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 _{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 | | 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) [†] | | | ±36 | |
| Input impedance | To GND | | 28 | | kΩ |
| Resolution | | 12 | | | bits |
| Integral linearity | | | | ±2 | bits |
| Offset error | | | ±2 | ±10 | bits |
| Gain error | | | ±1% | ±3% | % FS ³ |
| 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 |
| 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 dangerous failures per hour) | 8*10 ⁻¹⁰ | hour ⁻¹ (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 |

¹ Encoder2 differential input pins have internal 120Ω termination resistors connected across² 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.³ "FS" stands for "Full Scale"

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| 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 | none on-board | | | |
| Node addressing | Hardware: by Hex switch | 1 ÷ 127 & LSS non-configured (CANopen); 1-127 & 255 (TMLCAN) | | | |
| | Software | 1 ÷ 127 (CANopen); 1 ÷ 127 & 255 (TMLCAN) | | | |
| Voltage, CAN-Hi or CAN-Lo to GND | Absolute maximum, continuous | -36 | | 36 | V |
| ESD protection | Human body model | ±15 | | | 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.

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