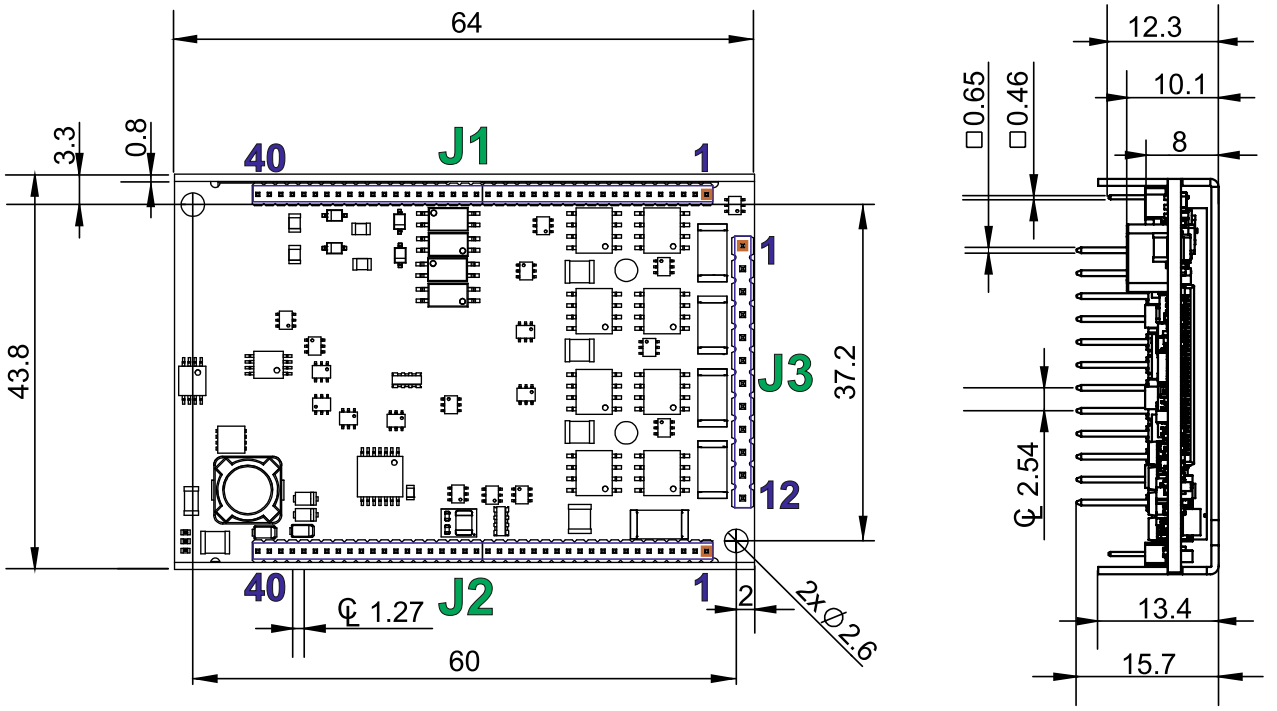
iPOS4815 MZ-CAN DATASHEET

P/N: P022.016.E102

-preliminary-



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/ Nikon / Sanyo Denki	✓	✓	✓	✓	
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: 15A[1] 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 v.2.2.13 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/ Nikon / Sanyo Denki 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 x16 E^2ROM to store setup data, TML motion programs, cam tables and other user data

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

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
J3	**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
J1	**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. Connect pin to GND to set bit to 1. Pin 16 is Bit 0... Pin 9 is Bit 7 of the Axis value. Possible values: from 1 to 128; and 255 when all pins OFF. 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 BIT 7 OFF = TMLCAN; BIT 7 ON = CANOpen*
	10	**Axis ID Bit6**	**I**	
	11	**Axis ID Bit5**	**I**	
	12	**Axis ID Bit4**	**I**	
	13	**Axis ID Bit3**	**I**	
	14	**Axis ID Bit2**	**I**	
	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

	Pin	Name	Type	Description
J2	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]	ºC
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	ºC
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
Power dissipation	Nominal current, 20KHz		TBD		Watt
Global efficiency	Nominal current, 20KHz, CANbus		TBD		%

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$_{LOG}$)		**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$_{LOG}$ = 12V		150		mA
	+V$_{LOG}$ = 24V		100		
	+V$_{LOG}$ = 40V		80		

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, 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

Isolation PE (earth) – GND					±250	V
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	400			
		40 kHz	200			
		60 kHz	150			
		80 kHz	100			
		100 kHz	80			
	Minimum value, limited by short-circuit protection; $+V_{MOT}$ = 36 V	20 kHz	150			µH
		60 kHz	50			
		40 kHz	40			
		80 kHz	20			
		100 kHz	10			
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz	330			µs
		40 kHz	170			
		60 kHz	140			
		80 kHz	80			
		100 kHz	66			
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-		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) †	-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.

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	V
	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	V
	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]		**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_{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 Hz
				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

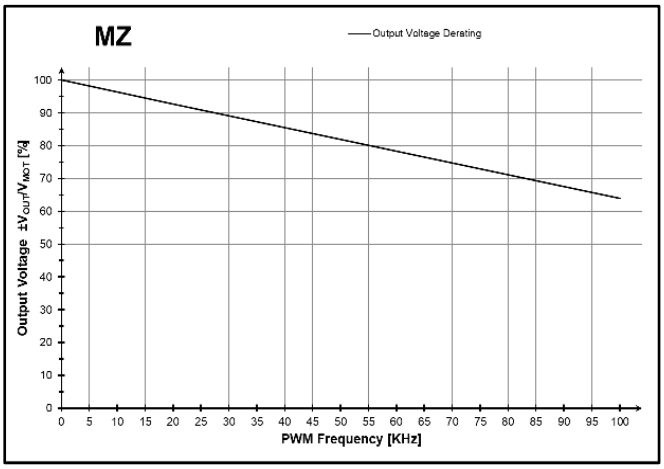
[1] Encoder2 differential input pins have internal 120Ω termination resistors connected across

[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.

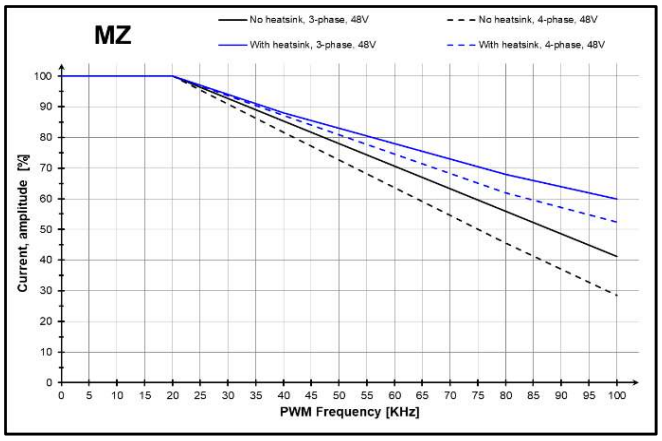
[3] "FS" stands for "Full Scale"

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)				

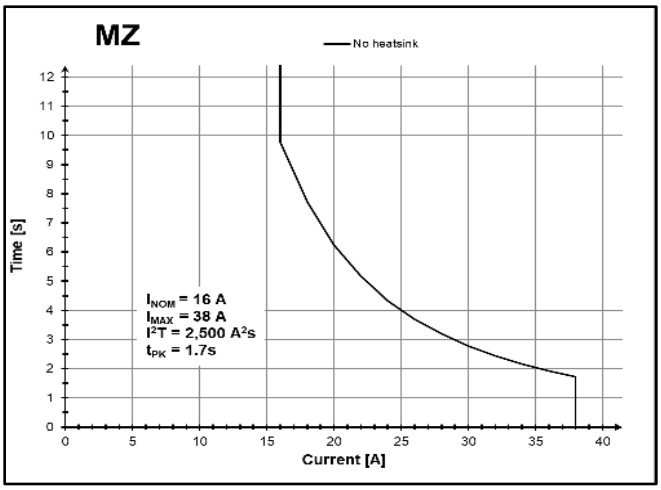
† Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.



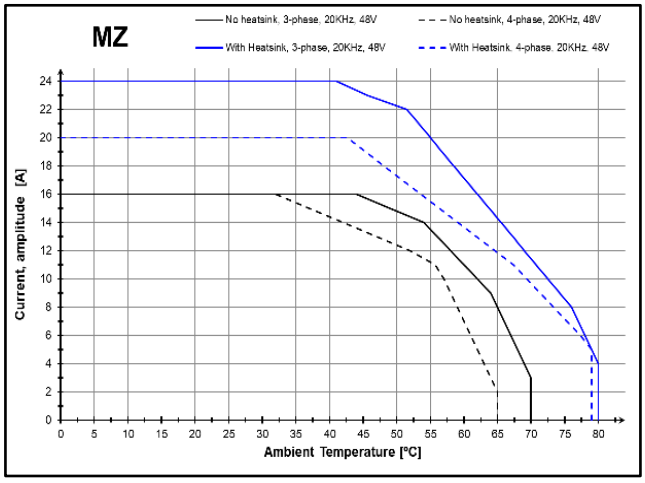
iPOS481x MZ – Output Voltage de-rating with PWM frequency



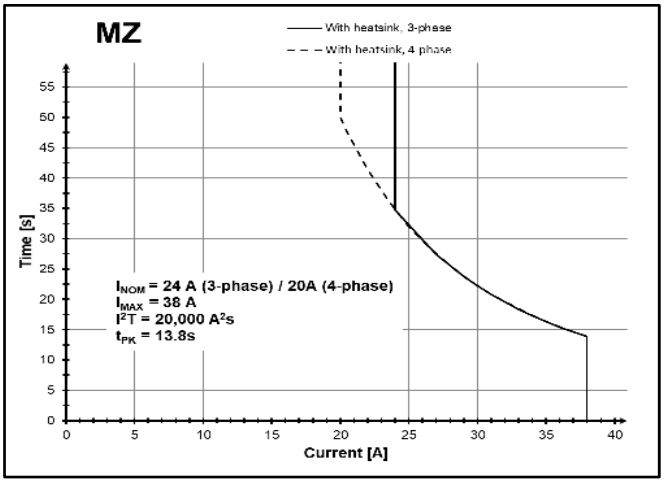
iPOS481x MZ – Current de-rating with PWM frequency, @48V



iPOS481x MZ – Over-current diagram (No heatsink)



iPOS481x MZ – Current de-rating with ambient temperature



iPOS481x MZ – Over-current diagram (With heatsink)