

General description

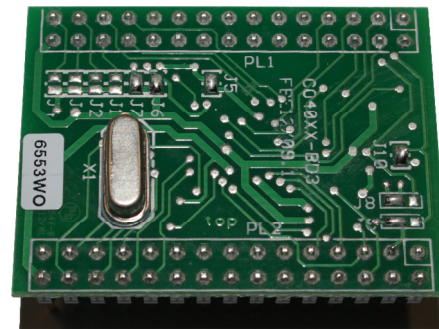
The CO4017A-BD is a CANopen remote I/O module using the single chip controller CO4017A. So this data sheet is an appendix of the CO4017A data sheet.

The CO4017A-BD remote I/O module is especially designed for automotive and industrial applications. The module offers the complex implementation of the CANopen standards DS301 and DS401. They are suitable for simple low cost applications like sensor interfacing as well as for complex I/O systems.

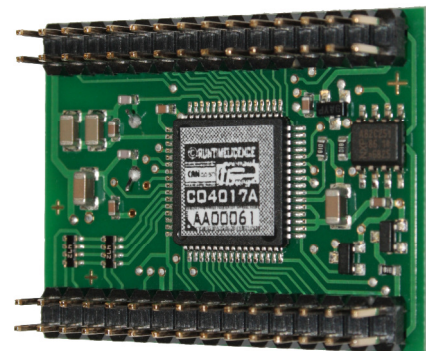
The CO4017A provides up to 32 digital I/O lines, of which 8 channels are able to convert analog input signals at 10 bit resolution. 8 of the output lines support PWM.

To support output overload monitoring, a special error interrupt input is provided.

All usual baud rates up to 1 Mbit are supported. To minimize external interface recommendations all output pins have high current drive capability of 4 mA. For interfacing optoisolators no external drivers are required.



Top view



Bottom view

Features

- According to CiA Draft Standards DS301 Version 4.0 and DS401 Version 2.0
- Baud rate up to 1MBit
- CAN bus ISO11898 transceiver 82C251
- Internal noise filtering for all input lines with individual setting for each channel
- Error interrupt input for output overload monitoring
- Output drivers with 4mA
- Watchdog output
- Temperature ranges up to -40 to 85 °C
- Package 60 pin module
- Dimensions (41mm x 31mm x 18mm)

Applications

The boards are optimized for automotive and industrial applications such as:

- CANopen Remote I/O Modules
- CANopen Interface for keyboards and control panels
- Low-cost CANopen Interface for sensors like photoelectric reflex switches photo interrupters etc.
- Low-cost CANopen Interface for actors like pneumatic valves, warning panels etc.

CANopen features

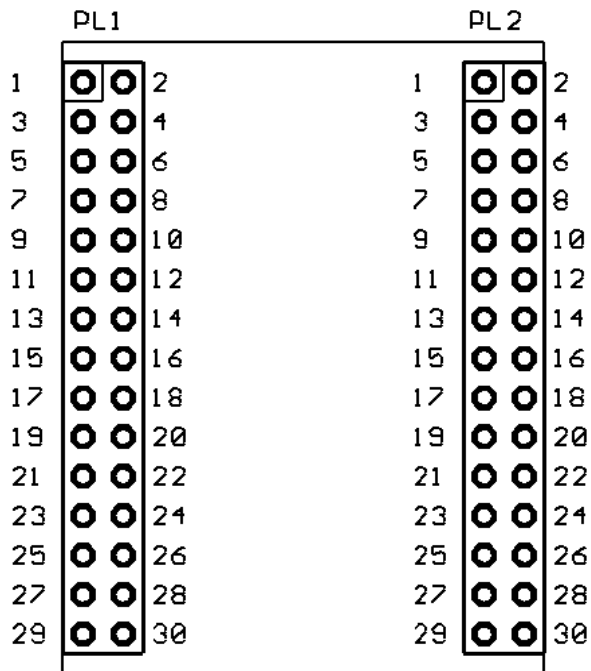
- 4 Transmit- and 4 Receive PDOs
- Dynamic PDO mapping
- Variable PDO identifier
- All CANopen specific PDO transmission types supported: synchronous, asynchronous, event driven, cyclic, acyclic and remote frame dependent.
- Event timer and inhibit timer features for all transmit PDOs.
- Node guarding
- Life guarding
- Heartbeat
- Variable SYNC identifier
- Emergency messages
- Minimum boot up

Ordering information

CO4017A-BD or CO4017AE-BD (both include license)

Part	Temp. Range	Package
CO4017A-BD	-40°C to 85°C	60 Pin module

Pin assignment



Top view

Pin listing CO4017A-BD

PL1		
Pin No.	Pin Name	Function
1	GND	Ground
2	LED	4 mA limited output (anode) for a status LED
3	WD	Watch dog out
8 to 19	IN11.. IN0	input pins (IN0...7 suitable for analog input)
4 to 7	IO4 .. IO7	input/output pins
20	AVCC	Supply for A/D-Converter
21	AVREF	Reference Voltage for A/D-Converter
22	AVSS	Ground for A/D-Converter
23 to 25	BD2 .. BD0	Baud rate selection input
26 to 29	CF3 .. CF0	Configuration bits 0 to 3 for I/O setting
30	VCC	Power supply

PL2		
Pin No.	Pin Name	Function
1	VCC	Power supply
2	CANH	CAN high line
3	CANL	CAN low line
4	EMY#	Emergency
5	RES#	Reset
6 to 9	IO3 .. IO0	input/output pins
10 to 21	OUT11 .. OUT0	output pins (OUT0...7 suitable for PWM output)
22 to 28	ID6 .. ID0	Identifier selection input
29	BOOT#	Firmware Update
30	GND	Ground

Handling the device

Preventing latch up

The CO4017A is a CMOS device and may suffer latch up under the following conditions:

- 1) A voltage higher than VCC or lower than VSS is applied to any pin.
- 2) Absolute maximum ratings are exceeded
- 3) AVCC power is provided before VCC supply

Handling unused input Pins

The CO4017A provides internal pull up devices, so unused pins may be left unconnected.

Power Supply Pins

Make sure that all ground and power supply pins are connected to the same potential. Do not leave any ground or power pins open. Connect at least two ceramic capacitors of 100nF and a tantalum capacitor of 1µF between VCC and VSS as close as possible to the device.

Power Supply for A/D converter

The power supply for the A/D converter must not be turned on before the power supply VCC.

If the A/D converter is not used, connect the pins as follows: AVCC = AVREF = VCC, AVSS = VSS.

Pull up/down resistors

The CO4017A provides internal pull up resistors.

Note:

Use a pull-up resistor on EMY# (PL2, pin 4).

Input / output pins

All input and output pins for digital signals are active low, for default configuration. This means for input pins, that inverted pin level is mapped to PDO. For output pins the inverted byte value from received PDO is written to the output pins.

Additional inverting capabilities are supported.

The output pins are not driven after reset until the object 6200.xx is written or the device receives a start node command. This gives the possibility to keep output pins in a defined state using external pull devices until configuration (for example setting of active output polarity) is done.

Pin description

BOOT#: Firmware Update

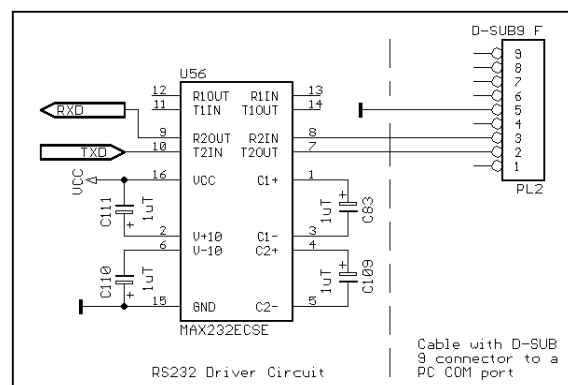
A low level during reset at this pin, and an ID0 and ID1 at low level, activate the firmware update mode. In this case the pins IN9/IN8 or OUT8/OUT9 will be used for an asynchronous communication.

Pin Name	Pin No.	Normal operation	Firmware update
BOOT#		high	low
ID0	PL2 / 28	x	low
ID1	PL2 / 27	x	low
IN9 / OUT8	PL1/10 or PL2/13	IN9 or OUT8	TXD1 (TTL) TXD2 (TTL)
IN8 / OUT9	PL1/11 or PL2/12	IN8 or OUT9	RXD1 (TTL) RXD2 (TTL)

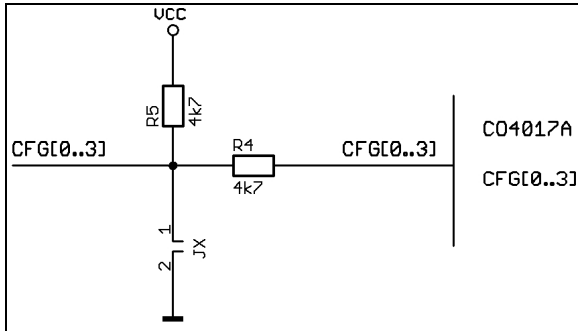
The update may be done with a COM-Port from a PC/Notebook and an in circuit update tool for the Fujitsu MB96F356 microcontroller.

TXD and RXD are the transmitter and receiver pins of the asynchronous serial interface that is only used for the firmware update.

The pins TXD and RXD work with 5V TTL-level. So if you need a connection to a PC COM-Port, you have to add a RS232 driver circuit like it is shown by the followed figure.



CF0 .. CF3: Configuration input pins

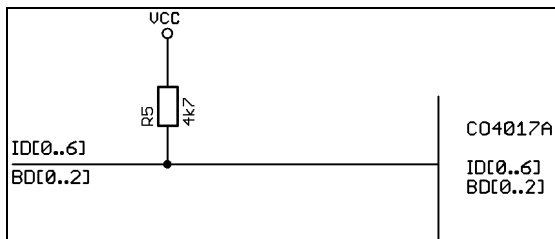


Note: These pins have also jumper onboard. To preventing malfunctions and short circuits check the jumper settings before using this pins.

Set device configuration to preferred operation mode using CF0 to CF3. If you leave any configuration input unconnected make sure, that the correct configuration is set via the onboard jumpers.

Refer to chapter 'Device Configuration' for details and functionality.

ID0 .. ID6, BD0 .. BD2: Identifier and baud rate input pins



Refer to chapter 'Device Configuration' for details and functionality.

CANH, CANL (CANTX, CANRX) CAN Interface

The CAN Bus with its associated protocol allows communication between a number of stations which are connected to this bus with high efficiency (transfer speed's up to 1 Mbit).

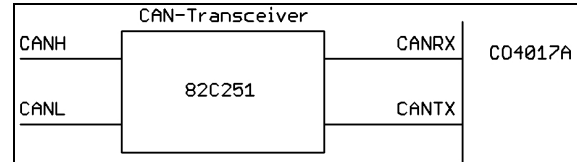
The on board CAN transceiver (82C251) can be used or not, depending on the setting of Jumper J8, J9.

Without using the CAN transceiver:

In case without using the on board CAN transceiver, a user specific (optoisolated) CAN driver circuit may be realized on the application board. Therefore the Jumpers J8 and J9 have to be set to position 1-2.

In this condition the CANH pin is connected to signal RX and CANL to TX (TTL level).

With using the CAN transceiver:



By using the on board CAN transceiver it is possible to connect the board directly to a two wire CAN bus associated to ISO11898. Therefore the Jumpers J8 and J9 have to be set to position 2-3. Jumper J10 has to be closed, too.

Note: It is not allowed to set the Jumper J8 or J9 in position 1-2-3 same times. This might cause permanent damage to the device.

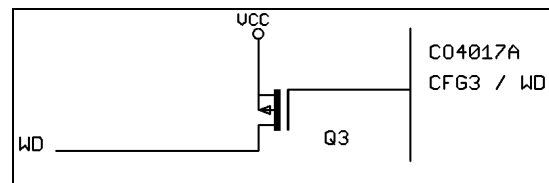
RES#: Reset input pin

The on board reset chip does the power up reset. It pulls the RES# line low. So it is possible to reset external components during power up using this signal.

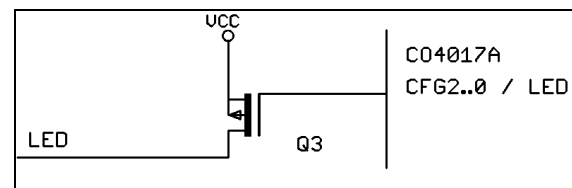
The reset pin may also be used as reset input. For a correct device reset by external components, provide a low level longer than 50ms to the input RES#.

Note: Do never drive a high level to the RES# pin. This may cause permanent damage to the device. Use a push button or an open drain driver for this condition.

WD: Watch dog output pin



LED: Status LED output pin



Device configuration

The following sections describe the device configuration with meaning:

- 1: ViH logic high level
0: ViL logic low level

CAN Identifier

The CAN Identifier will be set with Pins ID0 to ID6. This configuration pins use internal inverter. The ID is set as follows:

ID6	ID5	ID4	ID3	ID2	ID1	ID0	CAN-Identifier
1	1	1	1	1	1	1	Programmable ID
1	1	1	1	1	1	0	1 = 0x01
1	1	1	1	1	0	1	2 = 0x02
1	1	1	1	1	0	0	3 = 0x03
1	1	1	1	0	1	1	4 = 0x04
		
1	0	0	0	0	0	0	63 = 0x3F
0	1	1	1	1	1	1	64 = 0x40
0	1	1	1	1	1	0	65 = 0x41
		
0	0	0	0	0	1	0	125 = 0x7C
0	0	0	0	0	0	1	126 = 0x7E
0	0	0	0	0	0	0	127 = 0x7F

All Identifiers from 1 to 127 are valid settings. Identifier 0 is used to load the ID from object 2100.

Baud rate

The baud rate configuration will be done with configuration inputs BD0 to BD2

BD2	BD1	BD0	CAN-Baud Rate / Bus length
1	1	1	1 Mbit/sec 25 m *1)
1	1	0	800 kbit/sec 50 m *1)
1	0	1	500 kbit/sec 100 m *2)
1	0	0	250 kbit/sec 250 m *2)
0	1	1	125 kbit/sec 500 m *3)
0	1	0	50 kbit/sec 1000 m *3)
0	0	1	20 kbit/sec 2500 m *3)
0	0	0	10 kbit/sec 5000 m *3)

- *1) Calculation without optoisolators.
For optoisolators bus length is reduced for about 4m per 10ns propagation delay of employed optoisolator type
- *2) Calculation with 40ns optoisolator propagation delay
- *3) Calculation with 100ns optoisolator propagation delay
- The calculation of the bus length is based on a line propagation delay of 5ns/m.

I/O Configuration

Configuration bits CFG0 to CFG3 select the I/O configuration of the CO4017A chip.

CFG Pins	I/O Configuration	
	Mode	Description
3 2 1 0		
1 1 1 1	0	16 input lines 16 output lines IO7..IO4 work as IN12..IN15 IO0..IO3 work as OUT12..OUT15 Output drivers are: active LOW
0 1 1 1	8	16 input lines 16 output lines IO7..IO4 work as IN12..IN15 IO0..IO3 work as OUT12..OUT15 Output drivers are: active HIGH

CFG0 to CFG2: Configuration input pins / LED output pins

Set device configuration to preferred operation mode using CFG0 to CFG3. The CO4017A provides internal pull up devices, so it is recommended to leave unused configuration inputs unconnected. Do not use direct connection to VCC or VSS.

LED functions (active low):

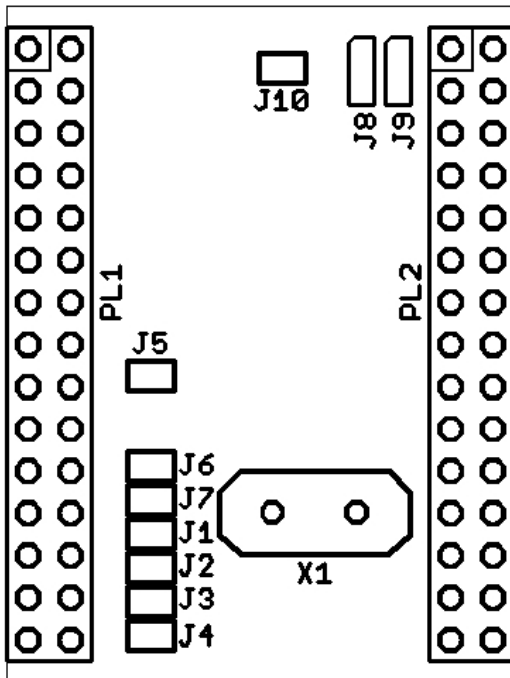
CFG0	Chip-Status LED shows the Chip status always blinking:
10%	Duty cycle indicates no error
50%	Duty cycle indicates uncritical error or warning (no NMT state change outputs not in error condition)
90%	Duty cycle indicates critical error (NMT state change or outputs in error condition)
CFG1	CANopen RUN LED shows NMT state according to DRP303-3
CFG2	CANopen Error LED shows Error state according to DRP303-3

CFG3/WD: Configuration input / watchdog output

CFG3/WD is scanned during reset to switch the CO4017A to enable additional CAN features. Then CFG3/WD is switched to output and drives the watchdog trigger. To monitor correct device operation, this feature may be used in combination with an external watchdog timer.

Note: CFGx are input pins during start up and output pins in normal operation mode. In order to prevent short circuit overload a series resistor between CFGx and configuration device (e.g. DIP-switch) should be used.

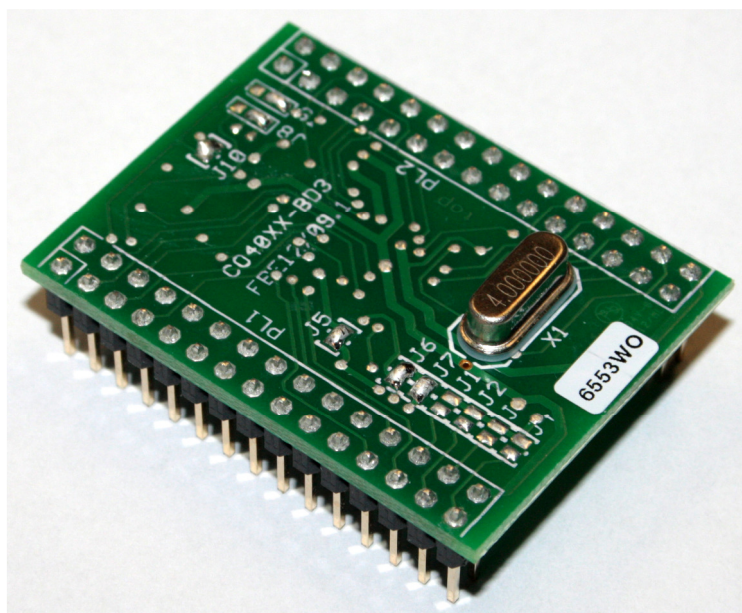
Jumper settings



Jumper's positions (scheme)

Jumper	Setting	Prescription
J1	open	CFG0 = 1 (or configured by the CF0 pin)
	closed	CFG0 = 0
J2	open	CFG1 = 1 (or configured by the CF1 pin)
	closed	CFG1 = 0
J3	open	CFG2 = 1 (or configured by the CF2 pin)
	closed	CFG2 = 0
J4	open	CFG3 = 1 (or configured by the CF3 pin)
	closed	CFG3 = 0
J5	open	AVSS set by pin
	closed	AVSS connected to Ground
J6	open	AVREF set by pin
	closed	AVREF connected to VCC
J7	open	AVCC set by pin
	closed	AVCC connected to VCC
J8	1-2	Signal CANTX on PL2 Pin 2
	3-2	Signal CANH on PL2 Pin 2
J9	1-2	Signal CANRX on PL2 Pin 3
	3-2	Signal CANL on PL2 Pin 3
J10	open	Disable CAN-Transceiver
	closed	Enable CAN-Transceiver

Note: Most jumpers are alternative to module pins with the same functionality. To prevent malfunctions and short circuits leave the corresponding pin open if the jumper is used.



Jumper's positions (real)

Absolute maximum ratings

Stresses greater than those parameters listed may cause permanent damage to the device. Functional operation should be restricted to recommended operation conditions. Exposure to absolute maximum rating conditions for extended times may affect reliability.

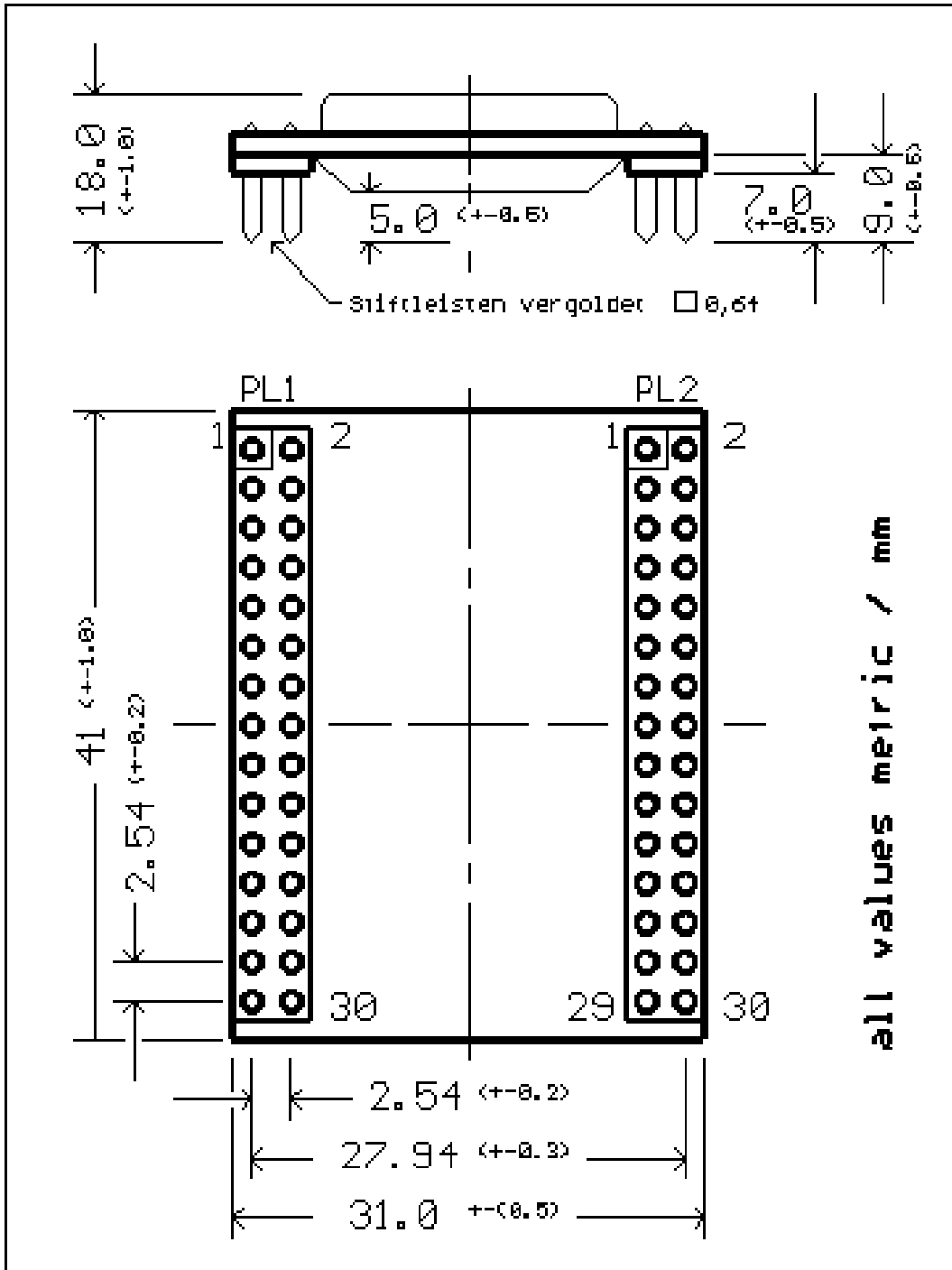
Parameter	Symbol	Rated Value		Units	Remarks
		Min.	Max.		
Power supply voltage	VCC	VSS – 0.3	VSS + 6.0	V	
Analog power supply voltage	AVCC	VSS – 0.3	VCC	V	
Analog reference voltage	AVREF	VSS – 0.3	VCC	V	
Input voltage	Vi	VSS – 0.3	VSS + 6.0	V	Vi < VCC + 0.3V
Output voltage	Vo	VSS – 0.3	VSS + 6.0	V	Vo < VCC + 0.3V
L level maximum output current	IOLMAX		15	mA	Time < 20 msec
L level maximum output current	IOL		4	mA	
H level maximum output current	IOHMAX		15	mA	Time < 20 msec
H level maximum output current	IOH		4	mA	
Maximum Power dissipation	P _{MAX}		800	mW	
Operating temperature	T _A	0	+70	°C	CO401xA-BD
	T _A	-40	+85	°C	CO401xAE-BD
Storing temperature	T _A	-55	+150	°C	

Recommended operation conditions and characteristics

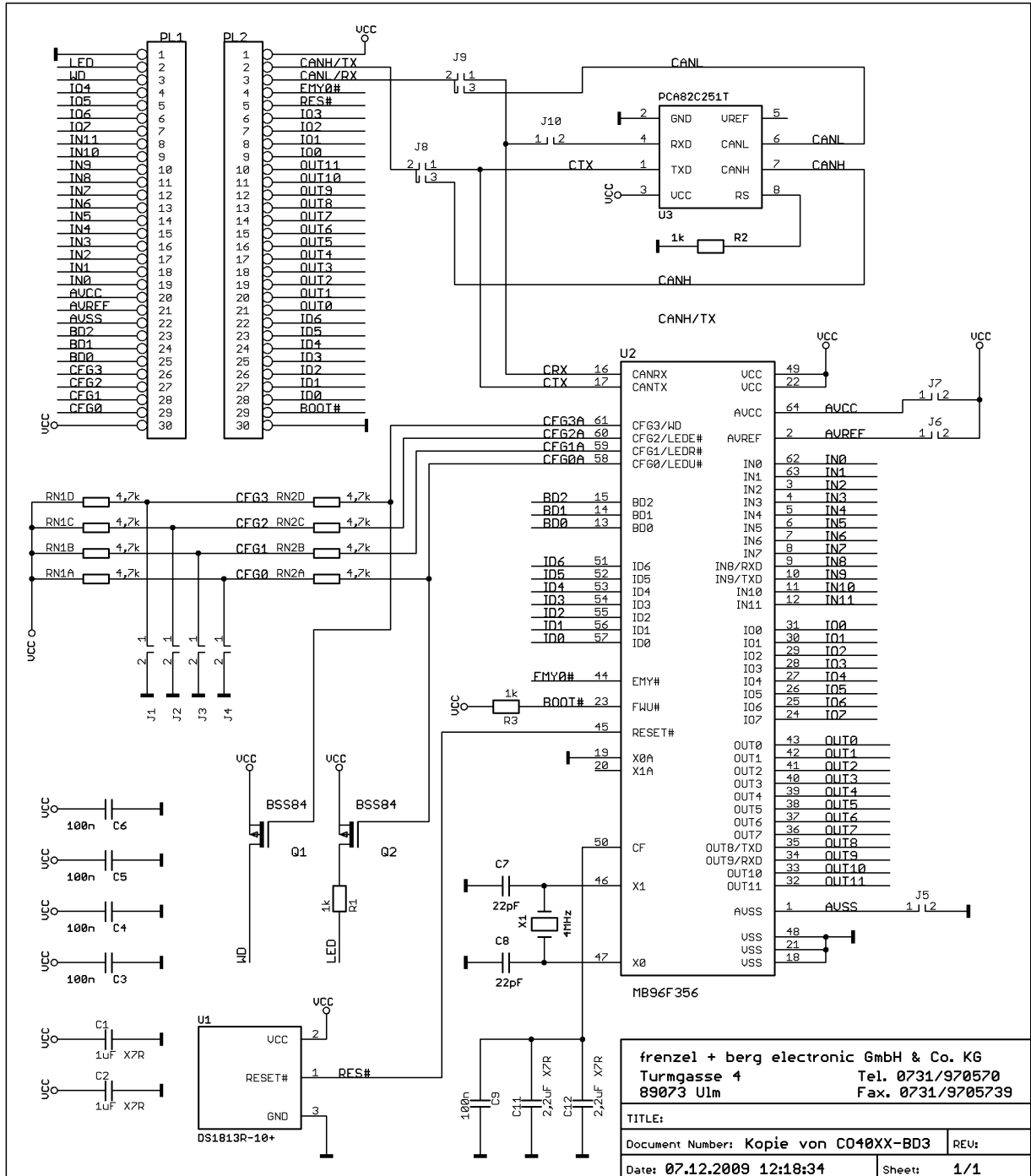
Functional operation should be restricted to recommended operation conditions.

Parameter	Symbol	Rated Value			Units	Remarks
		Min.	Typ.	Max.		
Power supply voltage	VCC	4.5	5.0	5.5	V	
Analog power supply voltage	AVCC			VCC	V	
Analog reference voltage	AVREF			VCC	V	
Power supply current	I _{CC}		65	110	mA	All inputs V _{IL} or V _{IH} All outputs open CAN bus open
Input H voltage	V _{IH}	0.8 * VCC		VCC + 0.3	V	
Input L voltage	V _{IL}	VSS – 0.3		0.2 * VCC	V	
Output H voltage	V _{OH}	VCC – 0.5			V	I _{OH} = -4.0mA
Output L voltage	V _{OL}			0.4	V	I _{OL} = 4.0mA
Input leakage current	I _{LKC}	-5		5	µA	
Crystal frequency	f _{osc}		4		MHz	
Reset pulse width	t _{res}	10			µs	
Power on rise time	t _{RESLH}	0.05		30	ms	
Maximum CANopen Delay input pin to bus telegram	t _{DITB}	0.05	1	2	ms	No additional bus distribution delay
Maximum CANopen Delay bus telegram to output pin	t _{DBTO}	0.05	1	2	ms	
Watchdog trigger frequency	f _{WDT}	0.5	1	2	kHz	Delayed max. 500 ms after reset
Maximum Power dissipation	P _{MAX}			300	mW	
Operating temperature	T _A	0		+70	°C	CO4017A-BD
	T _A	-40		+85	°C	CO4017AE-BD

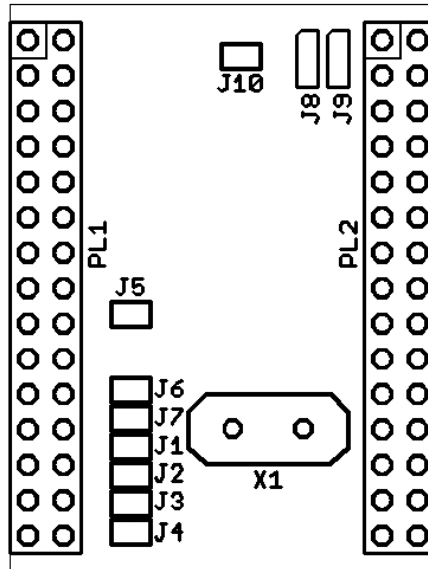
Package dimensions CO4017A



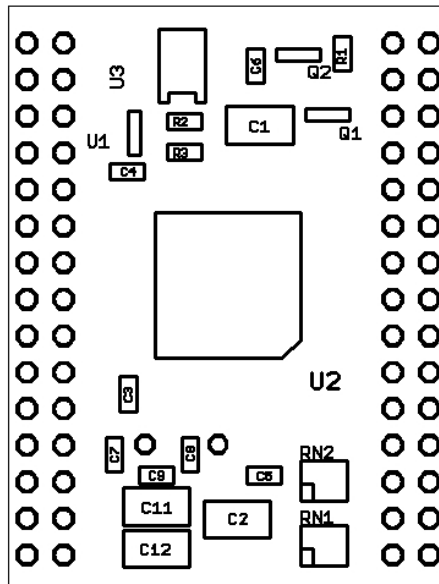
Schematics CO4017A



Position of components CO4017A



Top view



Bottom view

Table of Contents

General description	1
Features	1
Applications	1
CANopen features	1
Ordering information	1
Pin assignment	2
Pin listing CO4017A-BD	2
Handling the device	3
Preventing latch up.....	3
Handling unused input Pins	3
Power Supply Pins	3
Power Supply for A/D converter	3
Pull up/down resistors	3
Input / output pins.....	3
Pin description	3
BOOT#: Firmware Update	3
CF0 .. CF3: Configuration input pins	4
ID0 .. ID6, BD0 .. BD2: Identifier and baud rate input pins	4
CANH, CANL (CANTX, CANRX) CAN Interface	4
RES#: Reset input pin	4
WD: Watch dog output pin.....	4
LED: Status LED output pin	4
Device configuration	5
CAN Identifier.....	5
Baud rate.....	5
I/O Configuration	5
CFG0 to CFG2: Configuration input pins / LED output pins	5
CFG3/WD: Configuration input / watchdog output.....	5
Jumper settings	6
Absolute maximum ratings	7
Recommended operation conditions and characteristics	7
Package dimensions CO4017A	8
Schematics CO4017A	9
Position of components CO4017A	10
Table of Contents	11