iC-RZ Series EVAL RZ3M

EVALUATION KIT DESCRIPTION

preliminary

ORDERING INFORMATION

iC-RZxxxx EVAL RZ3M is an evaluation kit to test the optical twin-scan encoder IC with safety channel in a test application. It includes the scanner module RZ3M (assembled with iC-RZxxxx oQFN38-7x5 according to the order designation), a suitable LED module, code disc and a BiSS adapter cable.

Type	Description	Options	Order Designation
Evaluation kit	Scanner module RZ3M blue LED module code disc, and BiSS adapter cable	disc ⌀ 26.5 mm, 1024 CPR disc ⌀ 26.5 mm, 2048 CPR disc ⌀ 42.5 mm, 1024 CPR disc ⌀ 42.5 mm, 2048 CPR	iC-RZ2624 EVAL RZ3M[1] iC-RZ2648 EVAL RZ3M[1] iC-RZ4224 EVAL RZ3M[1] iC-RZ4248 EVAL RZ3M[1]

[1] See P. 3 for details.

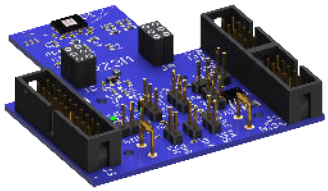


Figure 1: Scanner module RZ3M

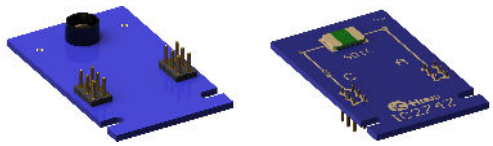


Figure 2: Blue LED module iC-TL46 EVAL IC274-1

Figure 3: BiSS adapter cable

ORDERING INFORMATION: RECOMMENDED TOOLS

Type	Description	Options	Order Designation
PC Adapters	High-Performance isolated PC-USB adapter for BiSS C		iC-MB5 iCSY MB5U

Figure 4: Adapter MB5U

FUNCTIONAL BLOCK DIAGRAM

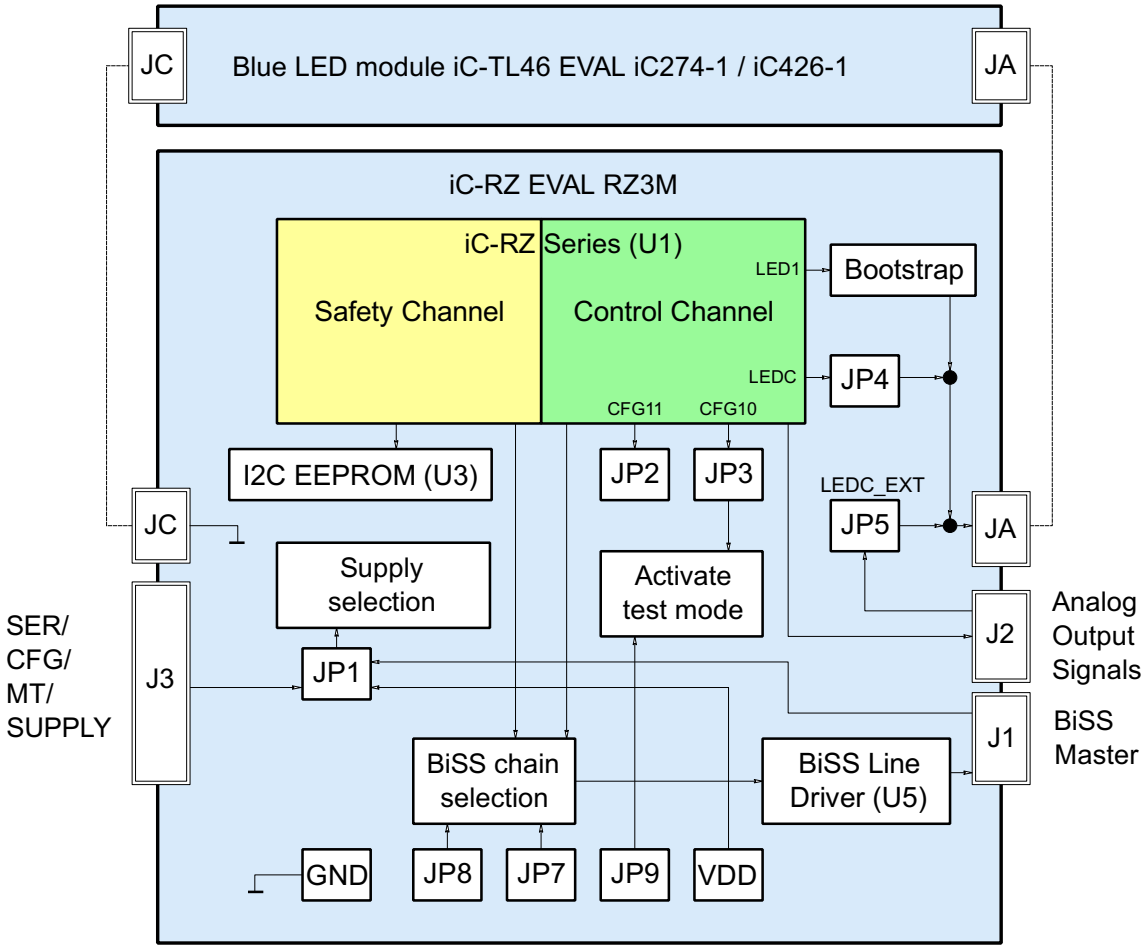


Figure 5: RZ3M Functional Block Diagram

EVALUATION KIT: COMPONENTS

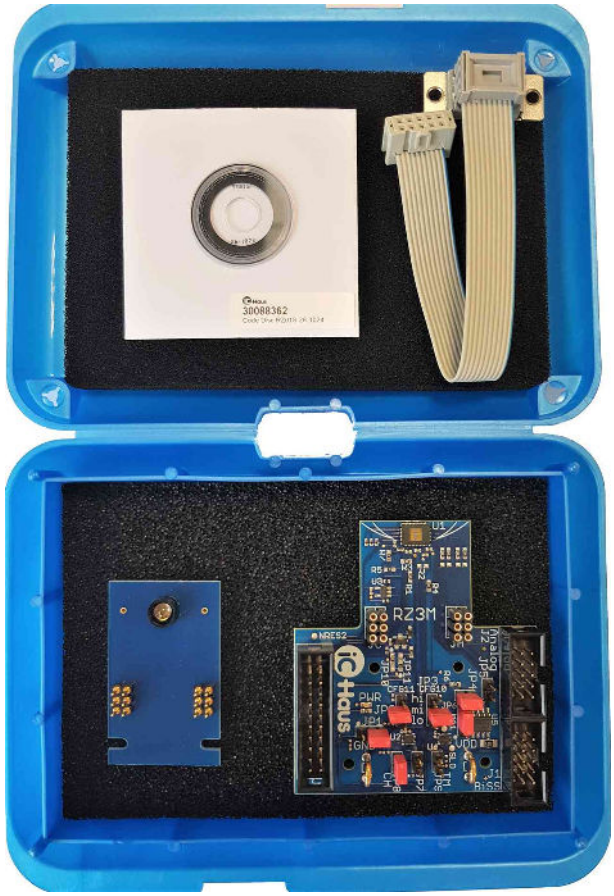


Figure 6: Evaluation kit. Scope of delivery:
Scanner module, LED module,
BiSS adapter cable, and code disc. (hub not included)

The content of the kit depends on the iC-RZxxxx:
iC-RZ2624 EVAL RZ3M with LED Module iC-TL46 EVAL IC274-1 and Code Disc RZ01S 26-1024
iC-RZ2648 EVAL RZ3M with LED Module iC-TL46 EVAL IC274-1 and Code Disc RZ02S 26-2048
iC-RZ4224 EVAL RZ3M with LED Module iC-TL46 EVAL IC426-1 and Code Disc RZ05S 42-1024
iC-RZ4248 EVAL RZ3M with LED Module iC-TL46 EVAL IC426-1 and Code Disc RZ06S 42-2048
All evaluation kits include the BiSS adapter cable (see Figure 9).

RELATED PRODUCTS AND DOCUMENTATION

- IC Documentation,
  GUI Software (Windows),
  Code Disc Datasheets:

  check for download links at
  → http://www.ichaus.de/RZ

- LED Datasheets
  → http://www.ichaus.de/TL46
- BiSS-to-PC Adapter Descriptions
  → http://www.ichaus.de/MB3U_datasheet_en
  → http://www.ichaus.de/MB4U_datasheet_en
  → http://www.ichaus.de/MB5U_datasheet_en

BLUE LED MODULE iC-TL46 EVAL IC274-1

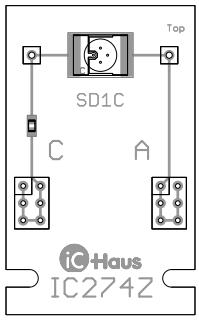


Figure 7: Blue LED module (top view); size approx. 28 mm x 46 mm

ASSEMBLED COMPONENTS

D1	iC-TL46 BLCC SD1C
R1	Series resistor 0 Ω, for order designation iC-TL46 EVAL IC274-**1**
J1, J2	LED Connector, 2x3-pin male

BLUE LED MODULE iC-TL46 EVAL IC426-1

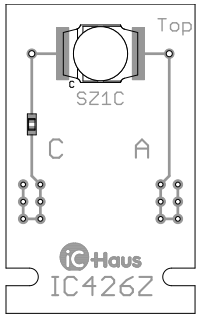


Figure 8: Blue LED module (top view); size approx. 28 mm x 46 mm

ASSEMBLED COMPONENTS

D1	iC-TL46 BLCC SZ1C
R1	Series resistor 0 Ω, , for order designation iC-TL46 EVAL IC426-**1**
J1, J2	LED Connector, 2x3-pin male

BiSS ADAPTER CABLE

Figure 9: BiSS adapter cable

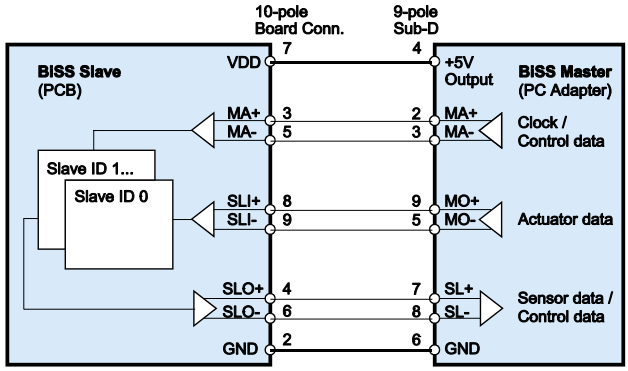


Figure 10: Typical BiSS slave to master connection

Board Connector

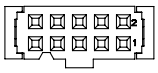


Figure 11: 10-pole connector (to board)

Pin	Slave	Function
1	n.c.	(not connected)
2	GND	Ground
3	MA +	Clock Input
4	SLO +	Slave Data Output
5	MA -	Clock Input, inverted
6	SLO -	Slave Data Output, inverted
7	VDD	+5 V Sensor Supply
8	SLI +	(not connected)
9	SLI -	(not connected)
10	n.c.	(not connected)

BiSS Slave Connector to PC Adapter

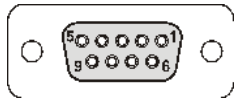


Figure 12: D-sub 9-pole connector (to PC adapter)

Pin	Slave	Master	Function
1	n.c.	(VB)	(12 V Sensor Supply Output)
2	MA +	MA +	Clock Line
3	MA -	MA -	Clock Line, inverted
4	VDD	VDD	+5 V Sensor Supply Output
5	SLI -	MO -	Master Data Output, inverted to Slave Data Input, inverted
6	GND	GND	Ground
7	SLO +	SL +	Data Line
8	SLO -	SL -	Data Line, inverted
9	SLI +	MO +	Master Data Output to Slave Data Input

SCANNER MODULE RZ3M

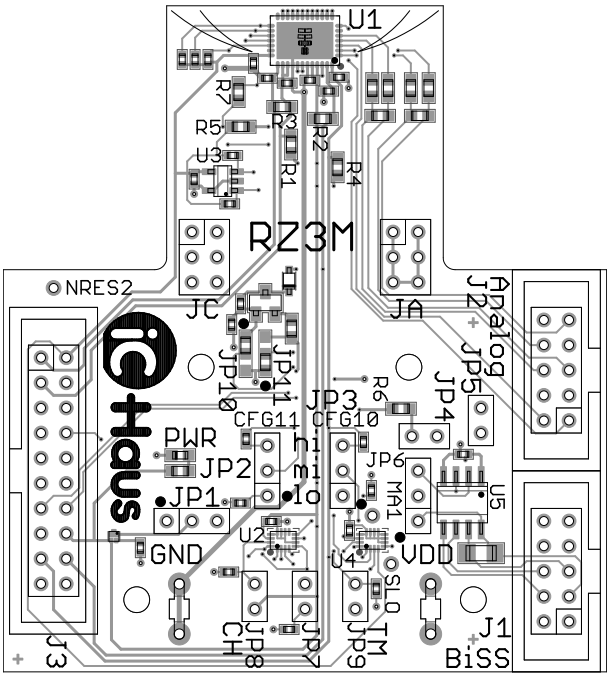


Figure 13: Scanner module (top view);
size approx. 61 mm x 67mm

PLUG	CONFIGURATION
J1	BiSS interface (to master)
J2	Analog output signals
J3	SER/CFG/MT/supply interfaces
JA	LED connector (anode)
JC	LED connector (cathode)
TML	**SIGNAL**
VDD	+5 V supply input. ≈ 44 mA (no adapter connected); set JP1=1-2 if in use.
GND	Ground (0 V)

DESCRIPTION OF JUMPERS

OVERVIEW

JP1 Supply selection (BiSS/VDD clamp/J3)
JP2 CFG11 selection (lo/hi/open)
JP3 CFG10 selection (lo/hi/open)
JP4 LEDC (iC-RZ) link to LED_A
JP5 LEDC_EXT (J2) link to LED_A
JP6 MA1 selection (single-ended/differential)
JP7 SDI2 selection (pull-down/open)
JP8 BiSS chain selection (CC only/SC-CC chained)
JP9 Activate test mode (for mech. sensor alignment)

Default	**Default settings are highlighted.**

Jumper JP1	**Function**
1-2 Closed	VDD1 is supplied by VDD clamp
2-3 Closed	VDD1 is supplied by VDD_MASTER (BiSS connector J1)
Open	Individual supply of VDD1/2, VDDM1/2, VDDIO1/2 using J3. Customize R1...5 if necessary. See P. 10.

Jumper JP2	**Function**
1-2 Closed	10kΩ Pull-Down at pin CFG11 (lo)
Open	Pin CFG11 open (mi)
2-3 Closed	10kΩ Pull-Up at pin CFG11 (hi)

Jumper JP3	**Function**
1-2 Closed	10kΩ Pull-Down at pin CFG10 (lo)
Open	pin CFG10 open (if JP9 open) (mi)
2-3 Closed	10kΩ Pull-Up at pin CFG10 (hi)

Jumper JP4	**Function**
Closed	LED_A connected to pin LEDC
Open	Pin LEDC open (no connection to LED_A)

Jumper JP5	**Function**
Closed	LED_A connected to terminal LEDC_EXT
Open	Terminal LEDC_EXT open (no connection to LED_A)

Jumper JP6	**Function**
1-2 Closed	BiSS single-ended mode(PMA connection to MA1)
2-3 Closed	BiSS differential mode (Output Line-Driver connected to MA1)
Open	MA1 open

Jumper JP7	**Function***
Closed	10kΩ Pull-Down at pin SDI2
Open	SDI2 open
	*effect only if JP8 is open

Jumper JP8	**Function**
Closed	BiSS chain SC-CC active (SLO1 → SDI2)
Open	BiSS CC only

Jumper JP9	**Function**
Closed	Test mode active for adjustment by electrical signals. See P. 9.
Open	Normal operation, test mode inactive

PINOUT OF CONNECTORS

J1: BiSS Interface (to PC adapter)
10-pin connector - male

Pin	Name	Function
1	n.c.	
2	GND	Ground
3	MA +	Clock input
4	SLO +	Slave data output
5	MA -	Clock input, inverted
6	SLO -	Slave data output, inverted
7	VDD_ BiSS	+ 5 V sensor supply voltage
8	n.c.	
9	n.c.	
10	n.c.	

J2: Analog Output Signals
10-pin connector - male

Pin	Name	Function
1	ADIOK	ADI status output*
2	VREF	Reference volt. output (≈ 0.9 Vdc)
3	LEDC_ EXT	LED current input from external LED control
4	GND	Ground
5	NSIN	Sine output, neg. (≈ 250 mVpk)
6	PSIN	Sine output, pos. (≈ 250 mVpk)
7	GND	Ground
8	NCOS	Cosine output, pos. (≈ 250 mVpk)
9	PCOS	Cosine output, neg. (≈ 250 mVpk)
10	GND	Ground

J3: SER/CFG/MT/supply Interface
20-pin connector - male

Pin	Name	Function
1	VDDM2 1)	+ 3 V ... + 5 V MT supply voltage (SC)
2	VIO2 1)	+ 2.5 V ... + 5 V IO supply voltage (SC)
3	VDD2 1)	+ 5 V supply voltage (SC)
4	SCL2	I²C clock line (SC)
5	SDA2	I²C data line (SC)
6	SDI2	BiSS/SPI, data input (SC)
7	NCS2	SPI, chip select input (SC)
8	SCI2	BiSS/SPI, clock input (SC)
9	NL2	SPI, latch input (SC)
10	MI2	MT interface, data input (SC)
11	MO2 3)	MT interface, clock input (SC)
12	SDO2 3)	BiSS/SPI, data output (SC)
13	MI1	MT interface, data input (CC)
14	MO1 3)	MT interface, clock output (CC)
15	SLO1 3)	BiSS, data output (CC)
16	VDD1 1)	+ 5 V supply voltage (CC)
17	VIO1 1)	+ 2.5 V ... + 5 V IO supply voltage (CC)
18	VDDM1 2)	+ 3.6 V battery supply voltage for MT (CC), connected to the bootstrap circuit.
19	VDD 1)	+ 5 V supply voltage. Reverse-polarity protected link to VDD1.
20	GND	Ground

Notes:
n.c. = not connected
1) Use VDD = + 5 V supply voltage. VDD1/2, VIO1/2, and VDDM2 are connected to VDD (= + 5 V) by 0 Ω resistors by default. See POWER SUPPLY and LED BOOTSTRAP CIRCUIT on P. 10 for details and exceptions.
2) VDDM1 is connected to a LED flashing bootstrap circuit to enable the internal battery-buffered multiturn counter mode in connection with a 3.6 V battery and the iC-TL46 blue LED. See POWER SUPPLY and LED BOOTSTRAP CIRCUIT on P. 10 for details.
3) These pins are used for mechanical adjustment. See GETTING STARTED on P. 9 for details.

GETTING STARTED

Mechanical Assembly

1. Check jumper configuration
2. Mounting of the code disc with a distance of approx. 100µm to the sensor iC-RZ (air gap, chrome side to sensor)
3. Check sensor position to code disc. The exact alignment can be done at a later time with electrical signals.
4. Clip on the LED module (iC274 or iC426)

Electrical Assembly

1. Connect the supply voltage to the board (5V, min. 50mA, see POWER SUPPLY and LED BOOTSTRAP CIRCUIT)
2. Connect USB BiSS adapter with adapter cable

Initiate BiSS communication

1. Install and start RZ GUI
2. Connect GUI
3. Read Position

Alignment

1. Close JP8 (BiSS-Chain SC/CC)
2. Close JP3=lo (1-2) => CFG10=lo
   (Deactivate test signals CC)
3. CMD_CC = RPL_RESET 0xA3
   (Reset register protect level)
4. TEST_CC = Comparator Random 0x07
   (Activate test mode CC)
5. TEST_SC = Adjustment Mode Radial 0x19
   (Activate test mode SC)
6. Close JP9 (Activate output test signals)
7. Measurement of the test signals with oscilloscope
   MO1=RANVx
   SLO1=RSYNCV
   MO2=DJL
   SDO2=DJH
8. Implementation of radial and tangential alignment
9. Open JP9 (Deactivate test signals)
10. Reset JP3 to default => CFG10=hi/mi/lo
11. Switch to normal mode by power-cycle
    (On-Off-On)

POWER SUPPLY and LED BOOTSTRAP CIRCUIT

Power Supply

This chapter is valid for the as-delivered state of the RZ3M PCB assembly. See ASSEMBLY PARTS LIST on P. 13.

The supply voltages on RZ3M are distributed in the following way:

- VDD is linked to VDD1 by a reverse polarity protection PMOS (M1) circuit for convenience. Additional ICs (U2, U4, U5) are also supplied by VDD1.
- R1 links VDD1 to VDD2 (assembled).
- R2 links VDD1 to VDDM1 (R2 is not assembled. Connect a VDDM1 = 3.6 V battery supply for the internal battery-buffered multiturn counter mode, otherwise leave pin open.)
- R3 links VDD2 to VDDM2 (assembled).
- R4 links VDD1 to VIO1 (assembled).
- R5 links VDD2 to VIO2 (assembled). The EEPROM (U3) is also supplied by VIO2.

After initial evaluation, the links between the voltage supply nets can be customized to enable advanced evaluation and interfacing of iC-RZxxxx. The supply nets are connected to connector J3.

LED Bootstrap Circuit

On RZ3M, the iC-RZ Control Channel (CC) is extended by a LED flashing bootstrap circuit to enable the internal battery-buffered multiturn counter mode in connection with a 3.6 V battery and the iC-TL46 blue LED. The LED flashing bootstrap circuit function is based on a depletion-mode NMOS (M2), see P. 12.

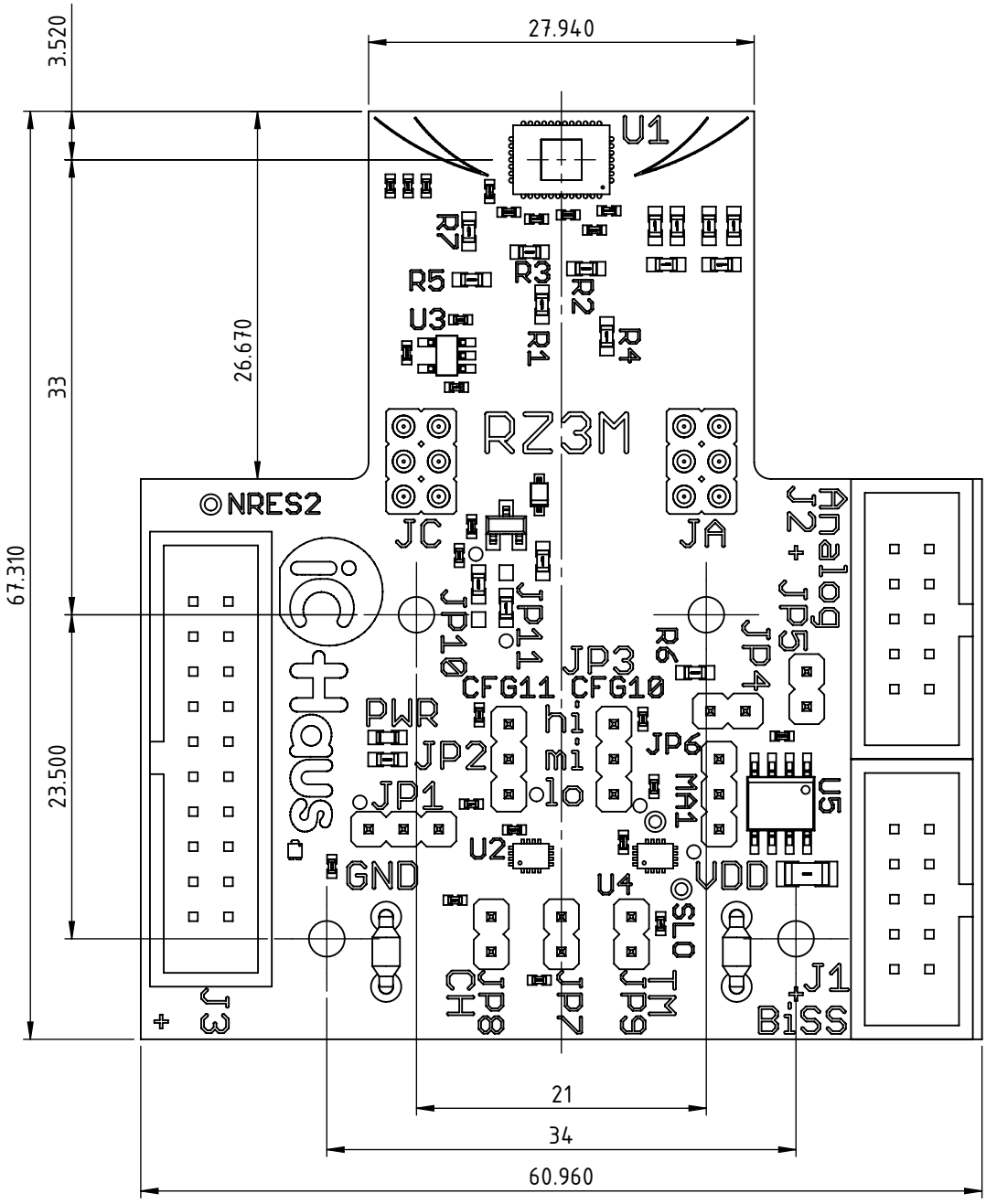
The battery is connected to VDDM1 and the bootstrap circuit supply. The bootstrap circuit is triggered by the LED Flashing Output LED1. The output of the circuit is connected to the LED anode without a series resistor. As a result, the LED forward voltage is reached and the battery-buffered multiturn counter mode is functional.

This circuit is a functional evaluation example. For production designs, an extensive evaluation of the battery-buffered multiturn counter mode is mandatory.

In case the bootstrap circuit should be disabled, R2, JP10, R30 can be customized. To use the LED flashing function of the iC-RZ Safety Channel (SC), JP11 can be customized.

The flashing function of CC and SC cannot be used simultaneously. For more details please consult the iC-RZ Series specification.

PHYSICAL DIMENSIONS



All dimensions given im mm

dra_rz3m_dim, 2:1

CIRCUIT SCHEMATIC

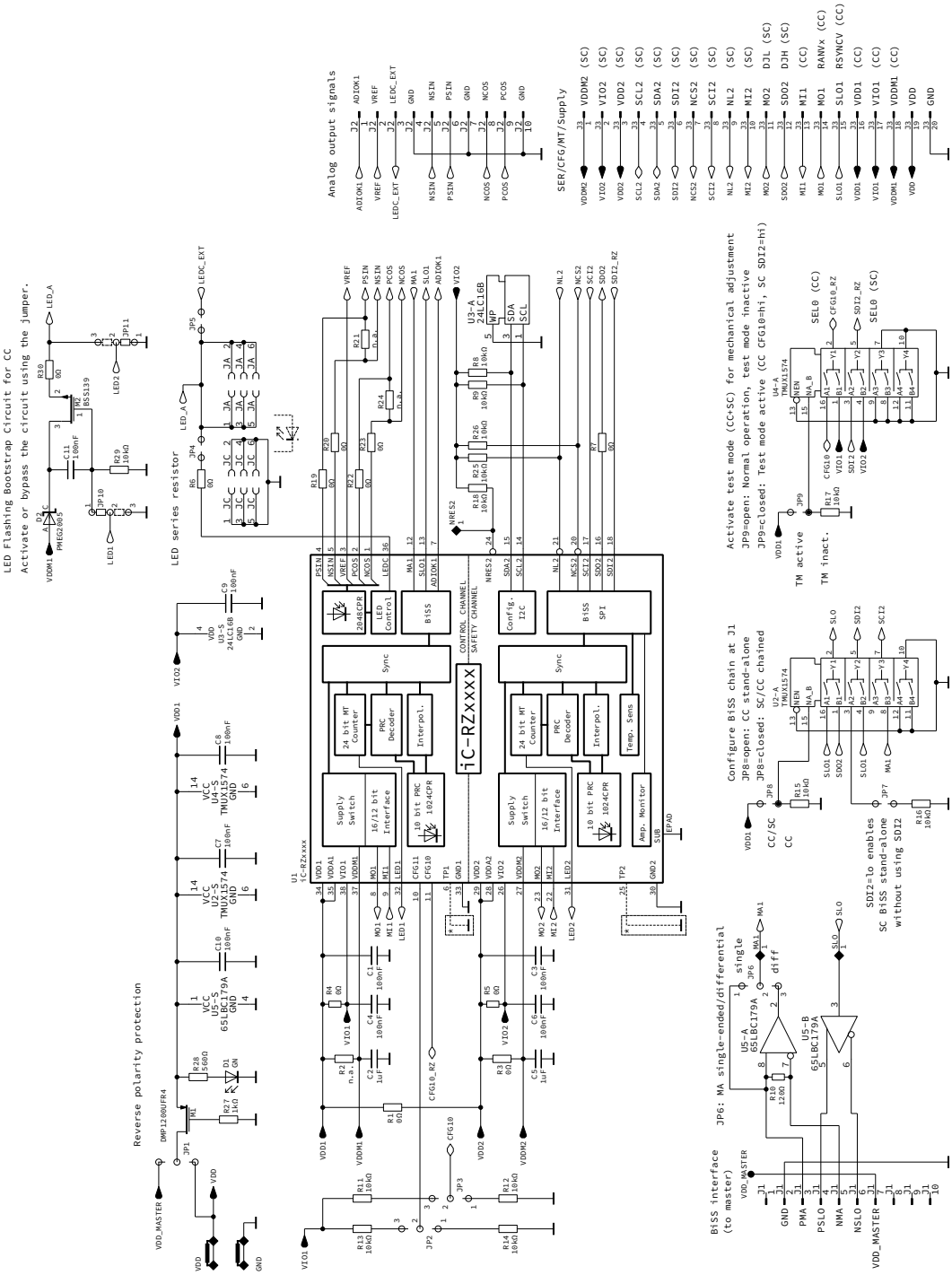


Figure 14: Circuit diagram

Notes:

***)** TP1/2 are open on RZ3M. TP1/2 need to be connected to GND1/2 in a production circuit. See iC-RZ Series specification (PIN FUNCTIONS).

ASSEMBLY PARTS LIST

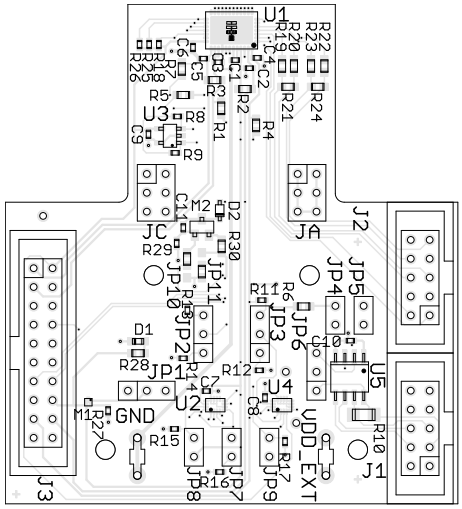


Figure 15: Module RZ3M (top side)

Components (top)	Typical Value	Comment
C1, C3, C4, C6, C7, C8, C9, C10, C11	100nF	SMD-C 100nF 10% X7R 16V Size 0402 h<0,6 mm
C2, C5	1uF	SMD-C 1uF 10% X7R 16V Size 0402
D1	Green	SMD-LED GREEN KPT-1608SGC 0603
D2	PMEG2005	SMD-SD PMEG2005AEA SOD323
GND, VDD_EXT	LBA02G	Jumperlink 5,08 mm d<>=1 mm (LBA02G)
J1, J2		Connector 2x5-pole male (WSL10G)
J3		Connector 2x10-pole male (WSL20G)
JA, JC		Connector 2x3-pole 2,54 mm (BL66)
JP1, JP2, JP3, JP6	SLLP10973G	Connector 3x1-pole 2,54 mm (SLLP10973G)
JP4, JP5, JP7, JP8, JP9	SLLP10972G	Connector 2x1-pole 2,54 mm (SLLP10972G)
JP10, JP11		0Ω
M1	DMP1200UFR4	SMD-IC PMOS DMP1200UFR4 1010
M2	BSS139	SMD-IC NMOS BSS139 SOT23
R1, R3, R4, R5, R6, R7, R19, R20, R22, R23, R30	0Ω	SMD-R 0R 5% 1A Size 0603
R2, R21, R24		not assembled
R8, R9, R11, R12, R13, R14, R15, R16, R17, R18, R25, R26, R29	10kΩ	SMD-R 10k 1% Size 0402
R10	120Ω	SMD-R 120R 1% Size 1206
R27	1kΩ	SMD-R 1k 1% Size 0402
R28	560Ω	SMD-R 560R 1% Size 0603
U1	iC-RZxxxx	iC-RZ2648 [see Order] oQFN38-7x5
U2, U4	TMUX1574	SMD-IC MUX 2/1 TMUX1574 UQFN16
U3	24LC16B	SMD-IC EEPROM 16k 24LC16B SOT23-5
U5	65LBC179A	SMD-IC Driver (2x) SN65LBC179A SO8

REVISION HISTORY

Rel.	Rel. Date*	Chapter	Modification	Page
A1	2020-05-12	All	First release	all

* Release Date format: *YYYY-MM-DD*