

# NetDCU11

## Hardware

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# 1 Arrangement of Connectors

Figure 1.1: Top View

J10

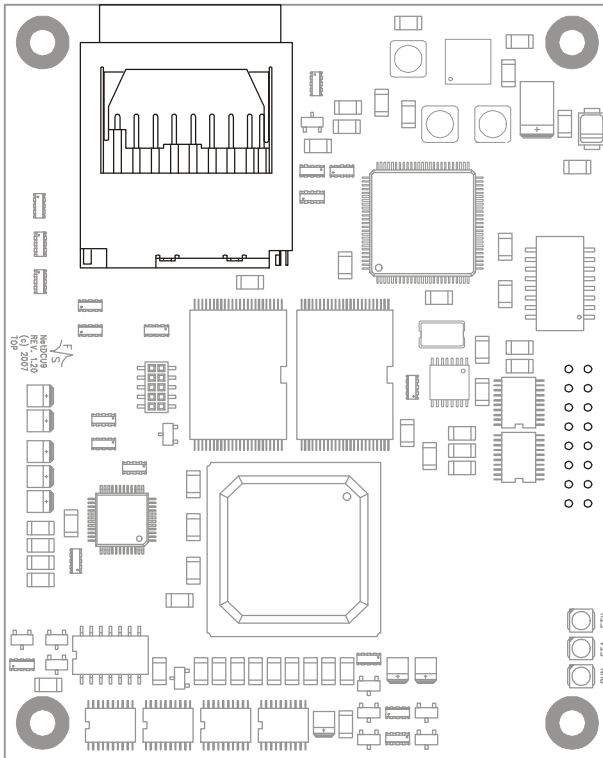
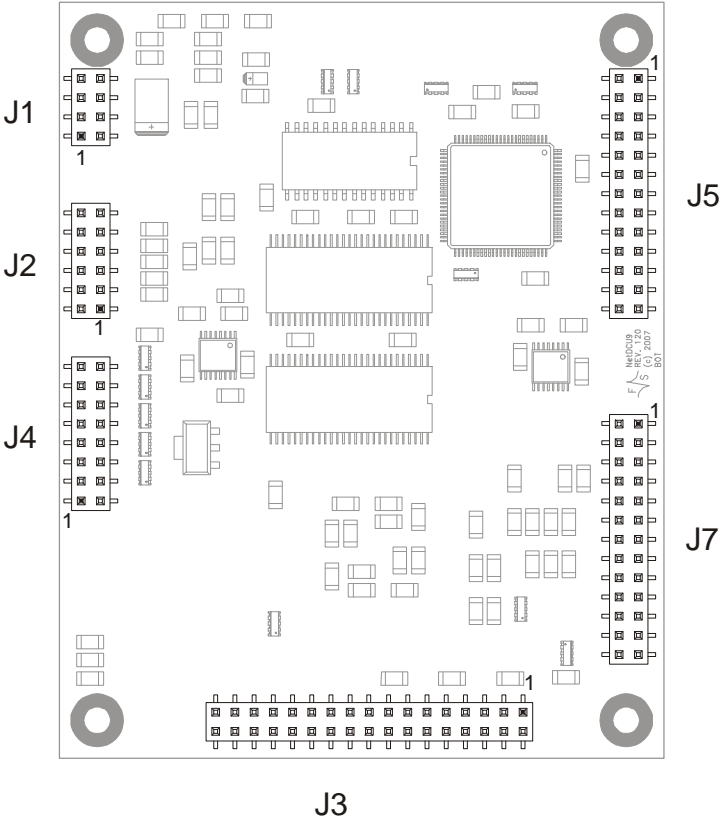


Figure 1.2: Bottom View



## **2 Connectors**

### **2.1 Counting of the connector pins**

All connections prepared for two-row connectors on the NetDCU11 are treated as follow.

The row with pin 1 contains all odd-numbered pins (1, 3, 5, 7, etc.), and, corresponding to this, the row without pin 1 contains all even-numbered pins (2, 4, 6, 8, etc.).

## 2.2 J1 Power Supply

J1 Power Supply	
Pin	Function
1	+3V ... +15V / max. 2A DC (CFL- Converter)
2	-
3	+5V $\pm$ 5% DC at max. 0,6A (*)
4	+5V $\pm$ 5% DC at max. 0,6A (*)
5	+3V...+3,6V DC (Battery buffering RTC) (**)
6	-
7	GND (Ground Power Supply)
8	GND (Ground Power Supply)

(\*)  $\bar{\emptyset}$  No Display connected.

(\*\*)  $\bar{\emptyset}$  Can be left out depending on application.

## 2.3 J2 Ethernet Interface

J2 Ethernet Interface		
Pin	Signal	Function
1	RxD	Pin 6 of RJ45 connector
2	RxD	Pin 3 of RJ45 connector
3	---	
4	---	
5	---	
6	---	
7	TxD	Pin 2 of RJ45 connector
8	TxD	Pin 1 of RJ45 connector
9	GND	Signal Ground
10	V <sub>CC</sub>	+5V DC
11	---	
12	---	

(- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!

## 2.4 J2 Serial RS232 Port A

J2 serial RS232 port 1			
Pin	Signal	Function	I/O
1	---		
2	---		
3	RxD1	Received Data	I
4	RTS1	Request To Send	O
5	TxD1	Transmitted Data	O
6	CTS1	Clear To Send	I
7	---		
8	---		
9	GND	Signal Ground	Power
10	V <sub>CC</sub>	+5V DC	Power
11	---		
12	---		

(- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!

## 2.5 J2 CAN Interface

J2 CAN Interface			
Pin	Signal	Function	I/O
1	---		
2	---		
3	---		
4	---		
5	---		
6	---		
7	---		
8	---		
9	GND	Signal Ground	Power
10	V <sub>CC</sub>	+5V DC	Power
11	CAN-RxD	Receive signal	I
12	CAN-TxD	Transmit signal	O

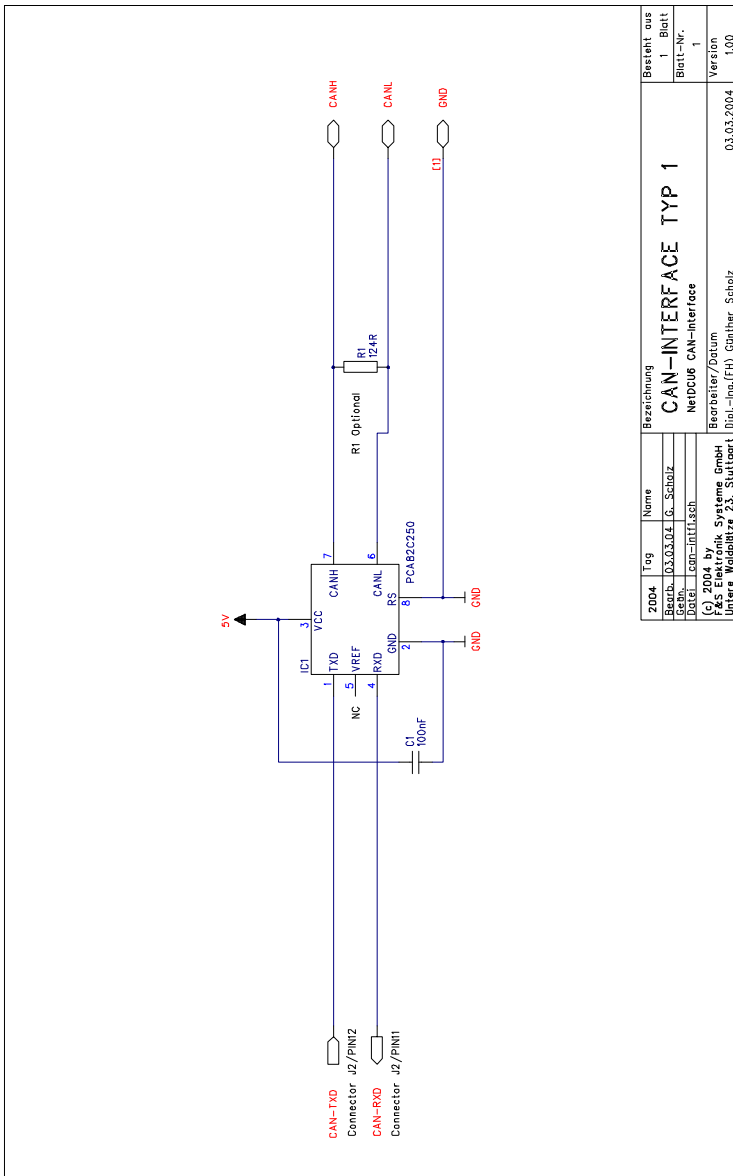
(- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!

### Note:

The two CAN signals can NOT be connected directly to the CAN bus. You need a special interface logic to do this. Take a look at the following to examples to get an idea how to connect the CAN bus.

### 2.5.1 Example CAN-Interface type 1

The following schematic shows the needed interface between NetDCU11 and CAN bus. It has no galvanic isolation.

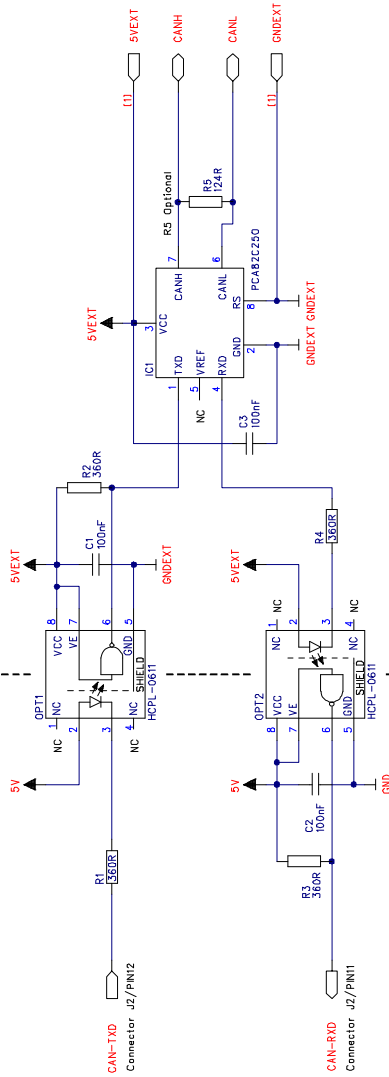


Z004		Name		Bezeichnung		Besteht aus	
Bezirb.	03.03.04	G.	Scholz	<b>CAN-INTERFACE TYP 1</b>		1 Blatt	
Gebüh.	000-INTL133h			NetD006 CAN-Interface		Blatt-Nr.	
Gr.	0004			Bearbeiter/Datum		Version	
FS Elektronik Systeme GmbH				Dipl.-Ing.(FH) Gunther Scholz		1	
Untere Waldplätze 23, Stuttgart						03.03.2004	
						1,00	

## 2.5.2 Example CAN-Interface type 2

The following schematic shows the needed interface between NetDCU8 and CAN bus. It has galvanic isolation.

Galvanic Isolation



Galvanic Isolation

2004	Tag	Name	Bezeichnung	Besteht aus
04.03.04	G. Scholz	CAN-INTERFACE TYP 2	CAN-INTERFACE TYP 2	1 Blatt
04.03.04	G. Scholz	NetDDBE CAN-Interface	NetDDBE CAN-Interface	Blatt-Nr.
04.03.04	G. Scholz	F&S Elektronik Systeme GmbH	Bearbeiter/Datum	1
04.03.04	G. Scholz	Untere Waldpitze 23, Stuttgart	Dipl.-Ing.(FH) Günther Scholz	Version
				04.03.2004
				1,00



## 2.6 J3 Display Interface

J3 Display Interface		
Pin	Signal	Function
1	GND	Signal Ground
2	R1	Red Bit 1
3	R0	Red Bit 0 (LSB)
4	G5	Green Bit 5 (MSB)
5	G4	Green Bit 4
6	G3	Green Bit 3
7	G2	Green Bit 2
8	GND	Signal Ground
9	B3	Blue Bit 3
10	B2	Blue Bit 2
11	B1	Blue Bit 1
12	B0	Blue Bit 0 (LSB)
13	G1	Green Bit 1
14	G0	Green Bit 0 (LSB)
15	B5	Blue Bit 5 (MSB)
16	B4	Blue Bit 4
17	GND	Signal Ground
18	V <sub>E EK</sub>	(*)
19	CLP	Data clock pulse
20	FRP	Frame Impulse
21	M	Display data valid signal

J3 Display Interface		
Pin	Signal	Function
22	LIP	Line Impulse
23	DEN	Display ON
24	GND	Signal Ground
25	V <sub>LCD</sub>	Power supply LCD +5V (+3,3V)
26	--	NC
27	--	NC
28	GND	Signal Ground
29	--	NC
30	V <sub>CFL</sub>	Max. +12V for CFL converter
31	R2	Red Bit 2
32	R3	Red Bit 3
33	R4	Red Bit 4
34	R5	Red Bit 5 (MSB)

(\*)  $\bar{O}$  software adjustable output voltage 0V...+3,3V.

## 2.7 J4 FS-Bus (8 bit Extension interface)

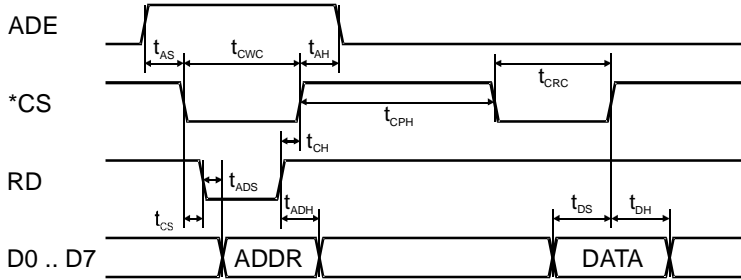
J4 parallel extension interface		
Pin	Signal	Function
1	D0	Data Bit D0, I/O (*)
2	D1	Data Bit D1, I/O (*)
3	D2	Data Bit D2, I/O (*)
4	D3	Data Bit D3, I/O (*)
5	D4	Data Bit D4, I/O (*)
6	D5	Data Bit D5, I/O (*)
7	D6	Data Bit D6, I/O (*)
8	D7	Data Bit D7, I/O (*)
9	V <sub>IO</sub>	IO Voltage, +3,3V or +5V (***)
10	RD	Read, output, active High (*)
11	NCS	Chip Select, output, active Low (*)
12	ADE	Address Enable, output, active High (*)
13	NIRQ	Interrupt, input, active Low (*)
14	NRES	Reset, input, active Low (**)
15	V <sub>EXT</sub>	External +V <sub>EEK</sub> voltage for LCD
16	GND	Signal Ground

(\*)  $\bar{\text{O}}$  Input/output with Pull Up resistor 4,7k $\bullet$  at +3,3V or +5V (-> configuration parallel port).

(\*\*)  $\bar{\text{O}}$  Input with Pull Up resistor 3k $\bullet$  at +3,3V.

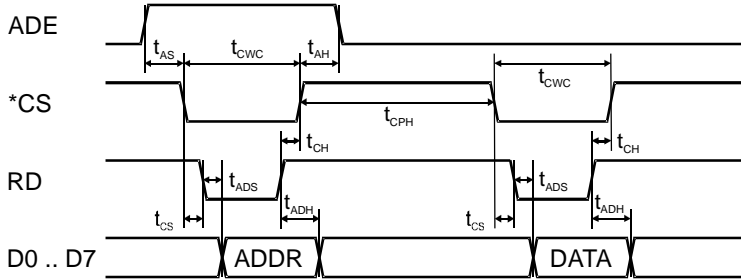
(\*\*\*)  $\bar{\text{O}}$  See also configuration of the parallel port.

## 2.7.1 FS-Bus Timing Read Cycle



Item	Symbol	Min.	Typ.	Max.	Unit
ADE set up time	$t_{AS}$	20	-	-	ns
ADE hold time	$t_{AH}$	20	-	-	ns
CS cycle write time	$t_{CWC}$	180	-	-	ns
CS set up time	$t_{CS}$	0	-	-	ns
CS hold time	$t_{CH}$	0	-	-	ns
ADDR set up time	$t_{ADS}$	2	-	-2	ns
ADDR hold time	$t_{ADH}$	0	-	-	ns
CS pulse high width	$t_{CPH}$	100	-	-	ns
CS cycle read time	$t_{CRC}$	180	-	-	ns
DATA set up time	$t_{DS}$	25	-	-	ns
DATA hold time	$t_{DH}$	0	-	-	ns

## 2.7.2 FS-Bus Timing Write Cycle



Item	Symbol	Min.	Typ.	Max.	Unit
ADE set up time	$t_{AS}$	20	-	-	ns
ADE hold time	$t_{AH}$	20	-	-	ns
CS cycle write time	$t_{CWC}$	180	-	-	ns
CS set up time	$t_{CS}$	0	-	-	ns
CS hold time	$t_{CH}$	0	-	-	ns
ADDR set up time	$t_{ADS}$	2	-	-2	ns
ADDR hold time	$t_{ADH}$	0	-	-	ns
CS pulse high width	$t_{CPH}$	100	-	-	ns

## 2.8 J5 Matrix Keyboard

J5 Matrix Keyboard			
Pin	Signal	Function	I/O
1	---		
2	GPIO7	Row 7 – Matrix key	O
3	GPIO6	Row 6 - Matrix key	O
4	GPIO5	Row 5 - Matrix key	O
5	GPIO4	Row 4 - Matrix key	O
6	GPIO3	Row 3 - Matrix key	O
7	GPIO2	Row 2 - Matrix key	O
8	GPIO1	Row 1 - Matrix key	O
9	GPIO0	Row 0 - Matrix key	O
10	GPIO9	Column 8 - Matrix key	I (*)
11	GPIO10	Column 9 - Matrix key	I (*)
12	---		
13	GPIO11	Column 10 - Matrix key	I (*)
14	---		
15	GPIO12	Column 11 - Matrix key	I (*)
16	GND	Signal Ground	Power
17	KBIN0	Column 0 .- Matrix key	I (*)
18	KBIN1	Column 1 - Matrix key	I (*)
19	KBIN2	Column 2 - Matrix key	I (*)
20	KBIN3	Column 3 - Matrix key	I (*)
21	KBIN4	Column 4 - Matrix key	I (*)

J5 Matrix Keyboard			
Pin	Signal	Function	I/O
22	KBIN5	Column 5 - Matrix key	I (*)
23	KBIN6	Column 6 – Matrix key	I (*)
24	KBIN7	Column 7 – Matrix key	I (*)
25	V <sub>CC</sub>	+5V DC	Power
26	V <sub>DD</sub>	+3,3V (0,1A max.) DC	Power

- (\*) ⚠ Note: I/O pins have pull-up resistor 4,7k• to +3,3V.  
 (- - -) ⚠ Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

All voltage levels of the input and output signals must be compatible to the LVC (3,3V) specification !

## 2.8.1 Matrix Keyboard example connection

The following schematic show the connection of a keyboard with a 8x8 matrix and four static keys.



## 2.9 J5 I/O interface

J5 I/O Interface			
Pin	Signal	Function	I/O
1	GPIO8	Interrupt	I/O (*)
2	GPIO7	IO-Port 7	I/O
3	GPIO6	IO-Port 6	I/O
4	GPIO5	IO-Port 5	I/O
5	GPIO4	IO-Port 4	I/O
6	GPIO3	IO-Port 3	I/O
7	GPIO2	IO-Port 2	I/O
8	GPIO1	IO-Port 1	I/O
9	GPIO0	IO-Port 0	I/O
10	GPIO9	IO-Port 9	I/O (*)
11	GPIO10	IO-Port 10	I/O (*)
12	---		
13	GPIO11	IO-Port 11	I/O (*)
14	---		
15	GPIO12	IO-Port 12	I/O (*)
16	GND	Signal Ground	Power
17	KBIN7	Input-Port 7	I (*)
18	KBIN6	Input-Port 6	I (*)
19	KBIN5	Input-Port 5	I (*)
20	KBIN4	Input-Port 4	I (*)
21	KBIN3	Input-Port 3	I (*)

J5 I/O Interface			
Pin	Signal	Function	I/O
22	KBIN2	Input-Port 2	I (*)
23	KBIN1	Input-Port 1	I (*)
24	KBIN0	Input-Port 0	I (*)
25	V <sub>CC</sub>	+5V DC	Power
26	V <sub>DD</sub>	+3,3V (0,1A max.) DC	Power

- (\*) ⚠ Note: I/O pins have pull-up resistor 4,7k• at +3,3V.  
 (- - -) ⚠ Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

All voltage levels of the input and output signals must be compatible to the LVC (3,3V) specification !

## 2.10 J5 serial RS232 port B

J5 serial RS232 Interface			
Pin	Signal	Function	I/O
1	---		
.	---	.	.
.	.	.	.
.	.	.	.
12	RxD2	Received Data	I
13	---		
14	TxD2	Transmitted Data	O
15	---		
16	GND	Signal Ground	Power
.	---	.	.
.	.	.	.
.	.	.	.
25	V <sub>CC</sub>	+5V DC	Power
26	V <sub>DD</sub>	+3,3V (0,1A max.) DC	Power

(- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!

## 2.11 J7 serial RS232 port C

J7 serial RS232 Interface			
Pin	Signal	Function	I/O
1	---		
.	---	.	.
.	.	.	.
.	.	.	.
9	RxD3	Received Data	I
10	TxD3	Transmitted Data	O
.	---	.	.
.	.	.	.
.	.	.	.
13	V <sub>CC</sub>	+5V DC	Power
14	GND	Signal Ground	Power
.	---	.	.
.	.	.	.
.	.	.	.
19	V <sub>DD</sub>	+3,3V (0,1A max.) DC	Power
.	---	.	.
.	.	.	.
.	.	.	.

(- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!

## 2.12 J7 Touchpanel Interface

J7 Touchpanel Interface		
Pin	Signal	Function
1	- - -	
.	- - -	.
.	.	.
.	.	.
13	V <sub>CC</sub>	+5V DC
14	GND	Signal Ground
15	TOUCH X+	X- Voltage Measurement
16	TOUCH Y+	Y- Voltage Measurement
17	TOUCH X-	X- Set Active Measurement
18	TOUCH Y-	Y- Set Active Measurement
19	V <sub>DD</sub>	+3,3V DC
20	GND	Signal Ground
.	- - -	.
.	.	.
.	.	.
26	- - -	

(- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!

### 2.13 J7 USB Interface 1

J7 USB Interface 1		
Pin	Signal	Function
1	---	
.	---	.
.	.	.
13	V <sub>CC</sub>	+5V DC
14	GND	Signal Ground
.	---	.
.	.	.
19	V <sub>DD</sub>	+3,3V DC
20	GND	Signal Ground
21	---	
22	---	
23	M2	USB negative (Host)
24	P2	USB positive (Host)
25	---	
26	W2	USB power supply

- (- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!

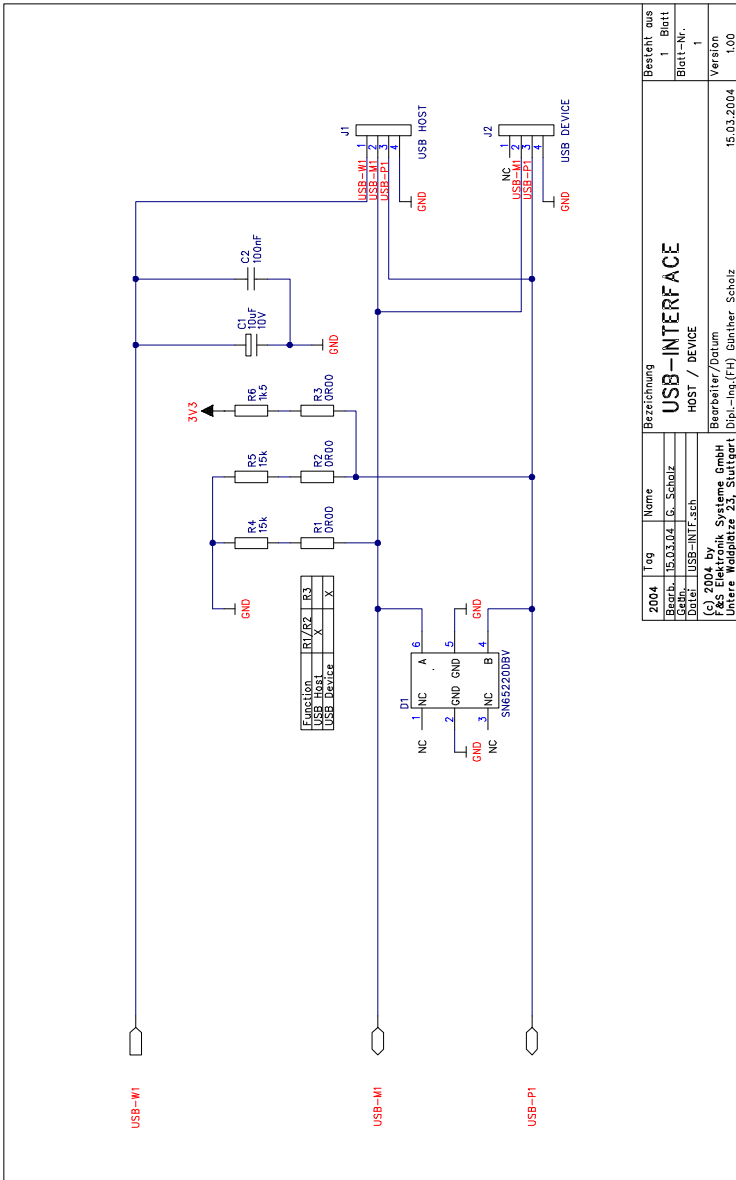
## 2.14 J7 USB Interface 2

J7 USB Interface 2		
Pin	Signal	Function
1	---	
.	---	
.	.	
13	V <sub>CC</sub>	+5V DC
14	GND	Signal Ground
.	---	.
.	.	.
19	V <sub>DD</sub>	+3,3V DC
20	GND	Signal Ground
21	M1	USB negative (Device)
22	P1	USB positive (Device)
23	---	
24	---	
25	W1	USB power in (Device)
26	---	

(- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!

## 2.15 Example USB Interface (Host/Device)

The following schematic shows the usage of the USB host or device interface (next page).



2004		Tag		Name		Bezeichnung		Besteht aus	
Baub.		15.03.04		G. Scholz		<b>USB-INTERFACE</b>		1 Blatt	
Datum		15.03.04		G. Scholz		HOST / DEVICE		Blatt-Nr.	
Firma		ES		Elektronik Systeme GmbH		Bearbeiter/Datum		1	
Untere Waldplätze 23		Stuttgart		Dipl.-Ing.(FH) Günther Scholz		Version		1.00	
								15.03.2004	

## 2.16 J7 Audio Interface

J7 Audio Interface		
Pin	Signal	Function
1	LINEOUT-L	Line out left channel
2	LINEOUT-R	Line out right channel
3	GND	Signal Ground
4	LINEIN-L	Line in left channel
5	LINEIN-R	Line in right channel
6	GND	Signal Ground
7	MIC	Microphone input
8	MICGND	Signal Ground (Microphone)
.	---	.
.	.	.
13	V <sub>CC</sub>	+5V DC
14	GND	Signal Ground
.	---	.
.	.	.
19	V <sub>DD</sub>	+3.3V DC
20	GND	Signal Ground
.	---	.
.	.	.
26	---	

(- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in

*unexpected behavior or even destruction of the component!*

## 2.17 J7 Analog Input

J7 analog Input		
Pin	Signal	Function
1	---	
.	---	.
.	.	.
9	AD2	Analog Input 2 (*) / altern. RxD3
10	AD3	Analog Input 3 (*) / altern. TxD3
11	AD0	Analog Input 0 (*)
12	AD1	Analog Input 1 (*)
13	V <sub>CC</sub>	+5V DC
14	GND	Signal Ground
.	---	.
.	.	.
19	V <sub>DD</sub>	+3,3V DC
20	GND	Signal Ground
.	---	.
.	.	.
26	---	

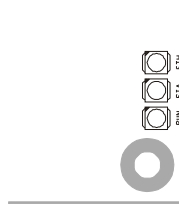
- (\*)    ⚠ Input Voltage: 0V to 3,3V  
 AD-Converter Resolution: 10 Bit, Error ±1 LSB  
 47k• Pull Down resistor to GND.
- (- - -)    ⚠ Please note: These pins carry active signals. *Any invalid connection of these signals may result in*

*unexpected behavior or even destruction of the component!*

### 3 Status Indicators

The NetDCU11 comprises three LED status indicators. They are located on the top side of the board in the bottom right corner

Figure 3.1: Status LED



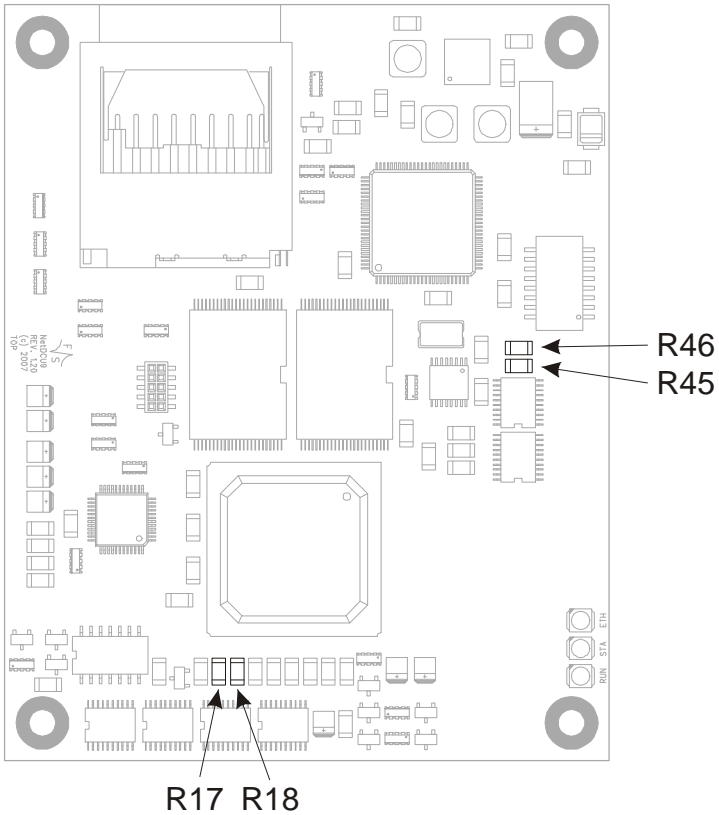
The following status information is displayed:

Status LED		
LED	Signal	Description
1	RUN	CPU in Run-Mode
2	STA	Status indicator(see SW documentation)
3	ETH	Ethernet: connection online

## 4 Configuration NetDCU11

By hardware-configuration of NetDCU11 some settings for peripheral devices can be done.

Figure 4.1: Top View



#### 4.1 Configuration Display Interface

Power supply for the display and display type are configured with jumpers

Configuration	Rxx
LCD Power Supply +5V	R17
LCD Power Supply +3,3V (*)	R18

(\*) Default Setting

Rxx Jumper, 0Ω Resistor Type 1206

#### 4.2 Configuration parallel System Interface

The voltage level of the parallel port (J4) can set by jumpers.

Configuration	Rxx
5V I/O Parallel Interface (*)	R45
3.3V I/O Parallel Interface	R46

(\*) Default Setting

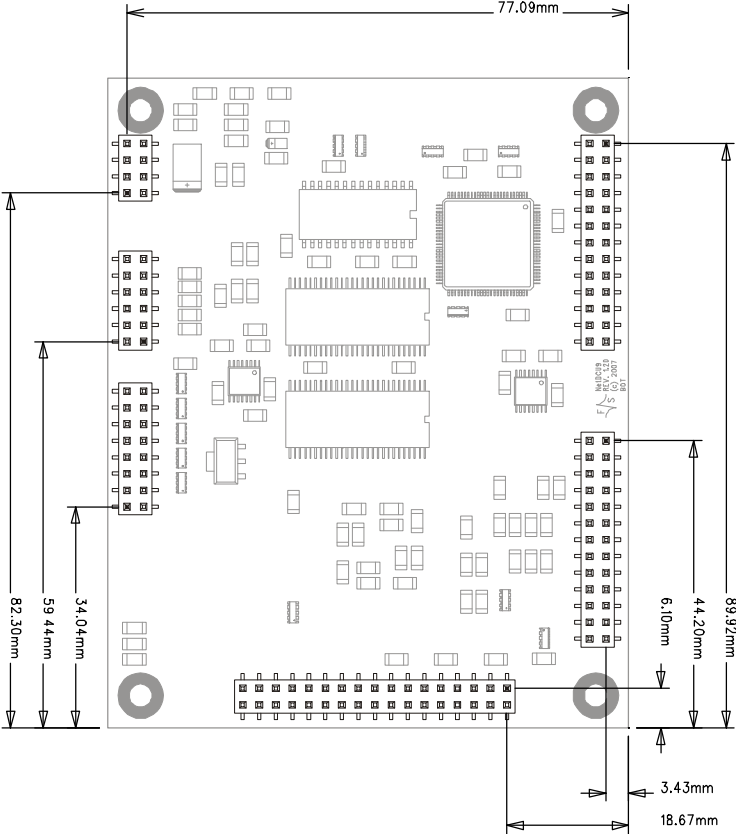
Rxx Jumper, 0Ω Resistor, Type 1206

## 5 Dimensions NetDCU11

Board thickness:	1.6 mm
Height of parts on top side:	5.0 mm
Height on parts on bottom side:	2.5 mm
Pin grid of connectors	2.54 mm
Mounting hole diameter	3.4 mm



Figure 5.2 Bottom View



All values can have tolerances of  $\pm 0.5\text{mm}$ .

## 6 Technical Data NetDCU11

Power Supply:	+5V <sub>DC</sub> / ±5%
Current Consumption:	<800mA (excluding Display)
Touch-Screen:	4 wire, analog resistive
Keyboard:	8 x 12 matrix keyboard alternative Digital-I/O
Inputs/Outputs:	max. 21 I/O ports alternative matrix keyboard 8 bit FS-Bus (hw extension bus) 1x SD-Card-Slot 2x (4x)(*) analog input, 10 bit
Interfaces:	3x RS232 (1x with RTS/CTS) 2x USB1.1 (1x Host, 1x Device) 1x Ethernet 10/100 Mbit 1x CAN2.0
LCD Interface:	TFT: up to 800x600 Pixel 256 / 65536 colors
RAM:	64 MByte SDRAM Optional: 128 MByte
Flash:	64 MByte Flash Optional: 128 MByte
CPU:	PXA270 520Mhz
Temperature:	0°C . . . +70°C
Dimensions:	100 x 80 x 11 mm (l x w x d)
Weight:	60 gr.

(\*) ⌀ Note: If you want to use 4 analog inputs then serial line 3 can not be used.

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