DVK90CAN1

Hardware User Guide

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Section 1

Introduction

Congratulations on your purchase of the AVR® DVK90CAN1 - AT90CAN128 Development Kit. This kit is designed to give designers a quick start to develop code on the AT90CAN128 and for prototyping and testing of new designs.

1.1 Overview

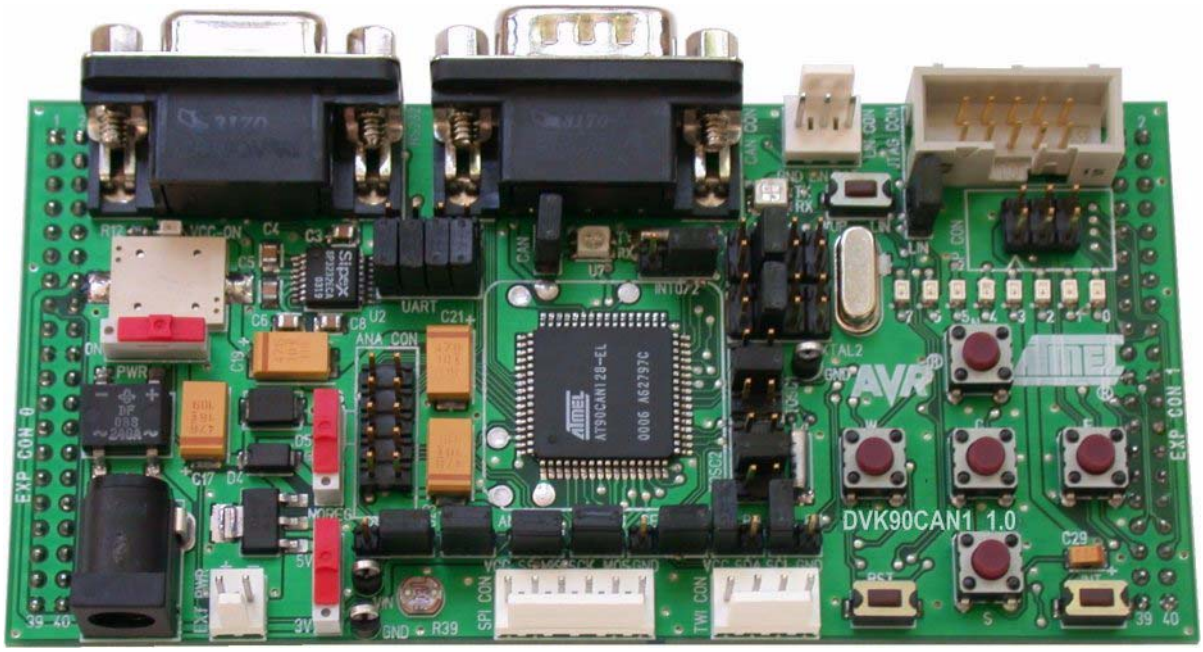
This document describes the DVK90CAN1 dedicated to the AT90CAN128 AVR micro controller. This board is designed to allow an easy evaluation of the product using demonstration software (refer to Software User Guide).

To complement the evaluation and enable additional development capability, the DVK90CAN1 can be plugged into the Atmel STK500 Starter Kit Board in order to use the AT90CAN128 with advanced features as variable VCC, variable VRef, variable XTAL, ..., and supports all AVR development tools.

To increase its demonstrative capabilities, this stand alone board has numerous serial interfaces (dual RS232, CAN, LIN, SPI & TWI) and on-board resources (keyboard, LEDs, voltage reading, light and temperature sensors, & speaker).

This user guide acts as a general getting started guide as well as a complete technical reference for advanced users.

Figure 1-1 . DVK90CAN1



1.2 DVK90CAN1 - AT90CAN128 Development Kit Features

The DVK90CAN1 provides the following features:

- AT90CAN128 TQFP device (3 or 5V),
- AVR Studio® software interface (1),
- STK500 compatible (2),
- Power supply flagged by “VCC-ON” LED:
  - regulated 3 or 5V,
  - from an external power connector,
  - from an external battery,
  - from STK500 (2),
- ISP connector for on-chip ISP,
- JTAG connector:
  - for on-chip ISP,
  - for on-chip debugging using JTAG ICE,
- Serial interfaces:
  - 2 RS-232C ports with available RTS/CTS handshake lines,
  - 1 SPI port,
  - 1 TWI port,
  - 1 CAN port with RxCAN and TxCAN LEDs,
  - 1 LIN port with RxLIN and TxLIN LEDs (2),
- On-board resources:
  - 5-button keyboard,
  - 8 LEDs,
  - voltage reading (0 - 12V)

  - luminosity sensor,
  - temperature sensor,
  - speaker for sound generation,
- On-board RESET button,
- On-board INT0 (or INT2) button.
- System clock:
  - external clock [2],
  - 8 MHz crystal,
  - 32 kHz watch crystal,
- RTC implementations:
  - external clock [2],
  - 32 kHz watch crystal,
- Analog I/O connector [2],
- Numerous access points for test [2].

Notes:
1. The DVK90CAN1 is supported by AVR Studio®, version 3.2 or higher. For up-to-date information on this and other AVR tool products, please read consult our web site. The newest version of AVR Studio®, AVR tools and this User Guide can be found in the AVR section of the Atmel web site, http://www.atmel.com.
2. Optional implementation.

Section 2

Getting Started

2.1 Unpacking the System

Kit contents:

- DVK90CAN1:
  - AT90CAN128 sample micro controller
  - default setting configuration
- Cables for DVK90CAN1:
  - (1 pc) 9V battery power cable
  - (1 pc) male JACK outlet and 2-wire cable for DC power supply
- Atmel CD-ROM with datasheets, manuals and software

2.2 System Requirements

DVK90CAN1 is a stand alone board. For AVR tools, the minimum hardware and software PC requirements are:

- 486 processor (Pentium® is recommended)
- 16 MB RAM
- 15 MB free hard disk space (AVR Studio)
- Windows® 95/98/2000/ME and Windows NT® 4.0 or higher
- 115200 baud RS-232 port (COM port)

2.3 Quick Start

The DVK90CAN1 is shipped with an AT90CAN128 micro controller. The default jumper settings will allow the micro controller to execute a basic test program that toggles the LEDs. The test program in the AT90CAN128 is (similar) to the example application code described in Section “Basic Test Program”.

An external 5 - 15V DC power supply is required. The input circuit is a full bridge rectifier, and the DVK90CAN1 automatically handles both positive or negative center of the male JACK outlet. The **POWER** switch turns the DVK90CAN1 main power on (or off). The green **VCC-ON** LED is lit when power is on. At power up, the DVK90CAN1 runs the test program flashed in the AT90CAN128.

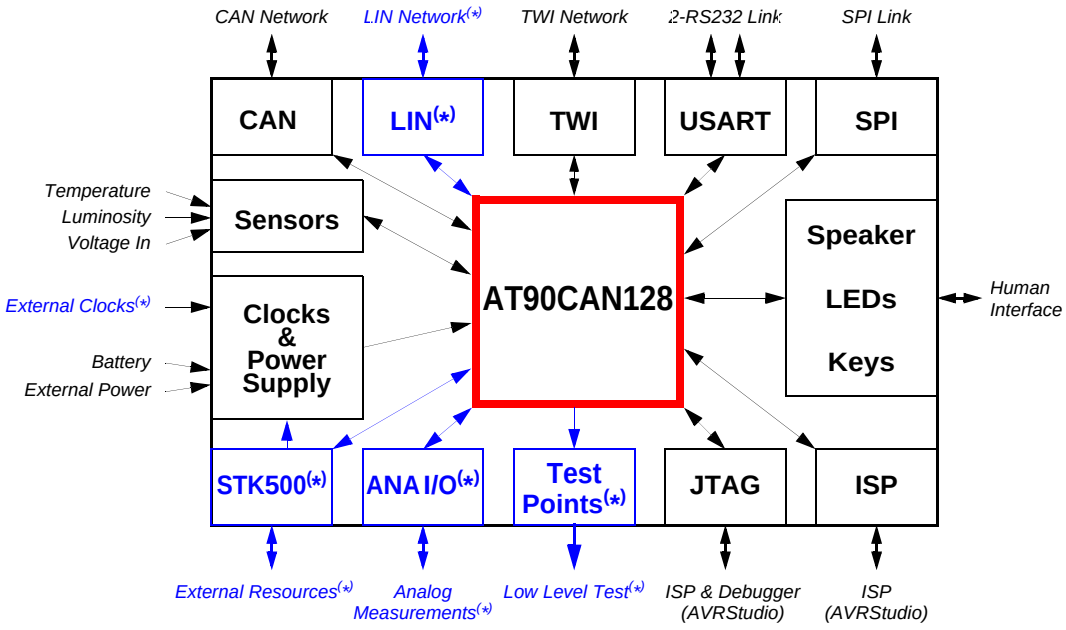
Section 3

Using the DVK90CAN1

This chapter describes the board with all options implemented.

3.1 Block Diagram

Figure 3-1 . DVK90CAN1 Block Diagram



3.2 Power Supply

The on-board power supply circuitry allows various power supply configurations.

3.2.1 Power Supply Sources

The power supply source can come from three different and **exclusive** sources:

- either from JACK PWR connector,
- either from EXT PWR connector,
- either from STK500.

JACK PWR connector:

- Need of a male JACK outlet,
- Input supply from 2.7 up to 15V (1) DC,
- No specific polarization (2) mandatory.

Figure 3-2 . JACK PWR Connector

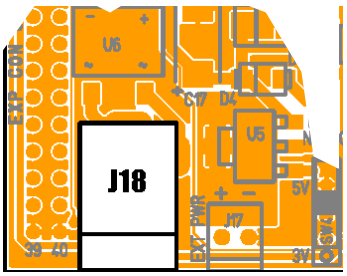
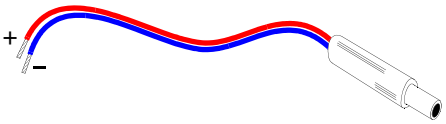


Figure 3-3 . Male JACK Outlet and Wires



Caution: Do not mount more than **one** power supply source on DVK90CAN1.

EXT PWR connector:

- Need of a female 2 points connector,
- Input supply from 2.7 up to 15V (1) DC (example: 9V battery),
- Polarization mandatory,

Figure 3-4 . EXT PWR On-Board Male Connector

Pin	Name
1	Pwr +
2	Pwr -

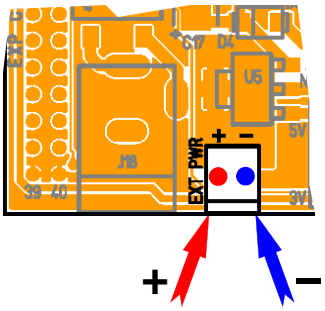


Figure 3-5 . EXT PWR Female Connector / Cable for 9V Battery



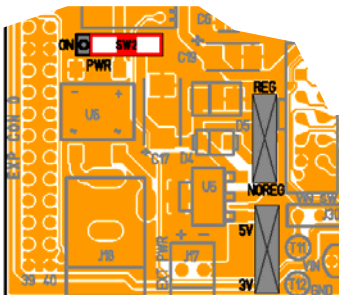
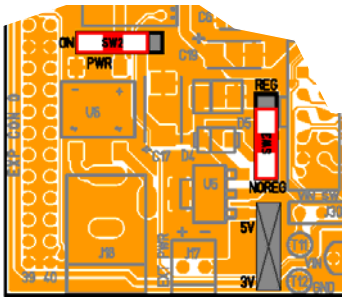
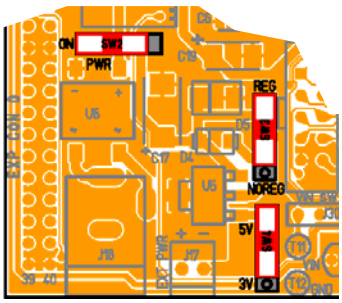
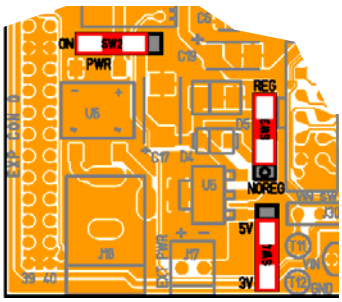
STK500 Powered: (c.f. “STK500 Resources” on page 34).

Notes:
1. 15V is the maximum level limitation of an unidirectional transil diode.
2. There is a diode (bridge) voltage level between the negative output of the power supply and the DVK90CAN1 “GND”. This could introduce some gap of voltage during measurement and instrumentation.
3. **Caution**: Do not mount more than **one** power supply source on DVK90CAN1.

3.2.2 Power Supply Setting

Once the power source chosen and the setting done, the “ON/OFF” switch can be set.

Table 3-1 . Power Supply [1] Setting

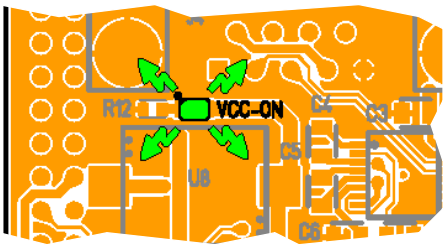
Setting	POWER switch	REGUL switch	5V / 3V switch	View
Power "OFF"	**OFF**	**Don't care**	**Don't care**	
Direct Powered	**ON**	**NO REG**	**Don't care**	
5V Regulated	**ON**	**REG**	**5V**	
3V Regulated	**ON**	**REG**	**3V**	
STK500 [1]	**ON**	**REG** or **NO REG**	If **REG**, **3V** or **5V**	(Depends on STK500 VTG setting)

Notes: 1. The ML317 regulator is capable of supplying in excess of 1.0 A.
2. **Caution:** The STK500 has its own "ON/OFF" switch.

3.2.3 "VCC-ON" LED

The “VCC-ON“ LED is always lit when power is applied to DVK90CAN1 regardless of power supply source and the regulation.

Figure 3-6 . “VCC-ON” LED



3.2.4 VCC Test

(c.f. “Test Points” on page 40)

3.3 RESET

Although the AT90CAN128 has its on-chip RESET circuitry (c.f. AT90CAN128 Datasheet, section “System Control and Reset), the DVK90CAN1 provides to the AT90CAN128 a RESET signal witch can come from 3 different sources:

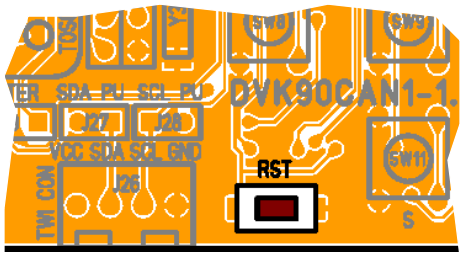
3.3.1 Power-on RESET

The on-board RC network acts as power-on RESET.

3.3.2 RESET Push Button

By pressing the RESET push button on the DVK90CAN1, a warm RESET of the AT90CAN128 is performed.

Figure 3-7 . RESET Push Button (RST) Implementation



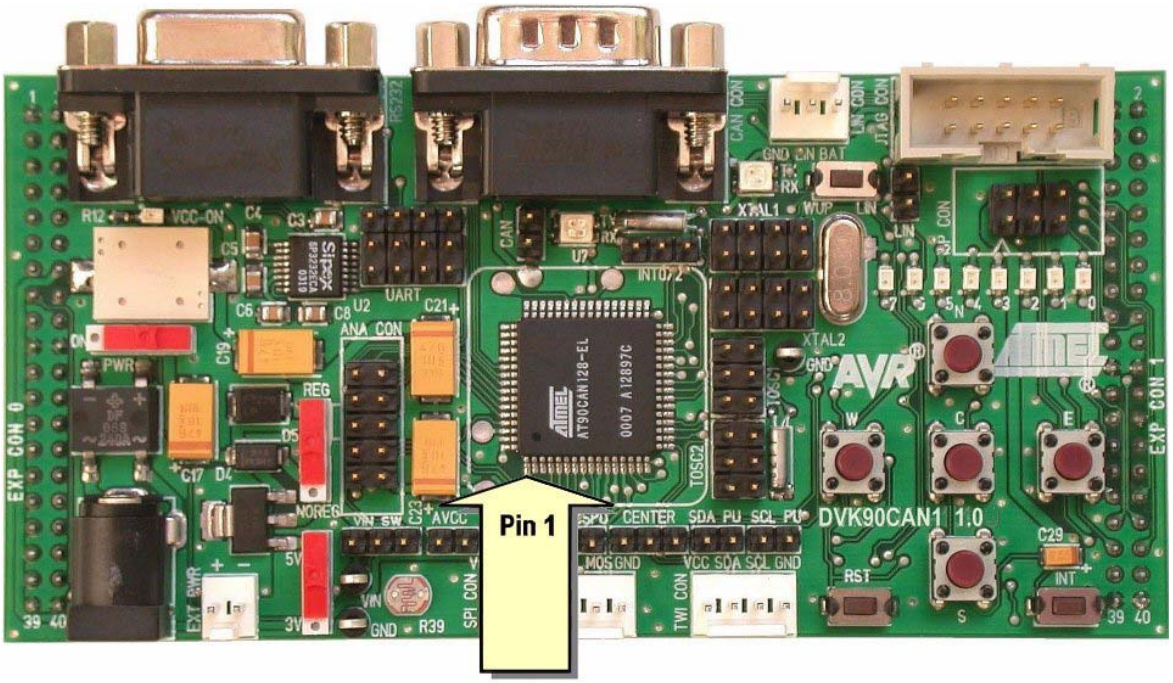
3.3.3 STK500 RESET

(c.f. “RESET from STK500” on page 36)

3.4 AT90CAN128 AVR Micro Controller

When DVK90CAN1 - AT90CAN128 Development Kit is shipped, the AVR micro controller is soldered in the center of the DVK90CAN1.

Figure 3-8 . AT90CAN128 Implementation



The customer can deal with modification of the DVK90CAN1:

- To use AVR ICE 50 (c.f. “Debugging with AVR ICE 50” on page 39),
- To mount a socket in place of the micro controller.

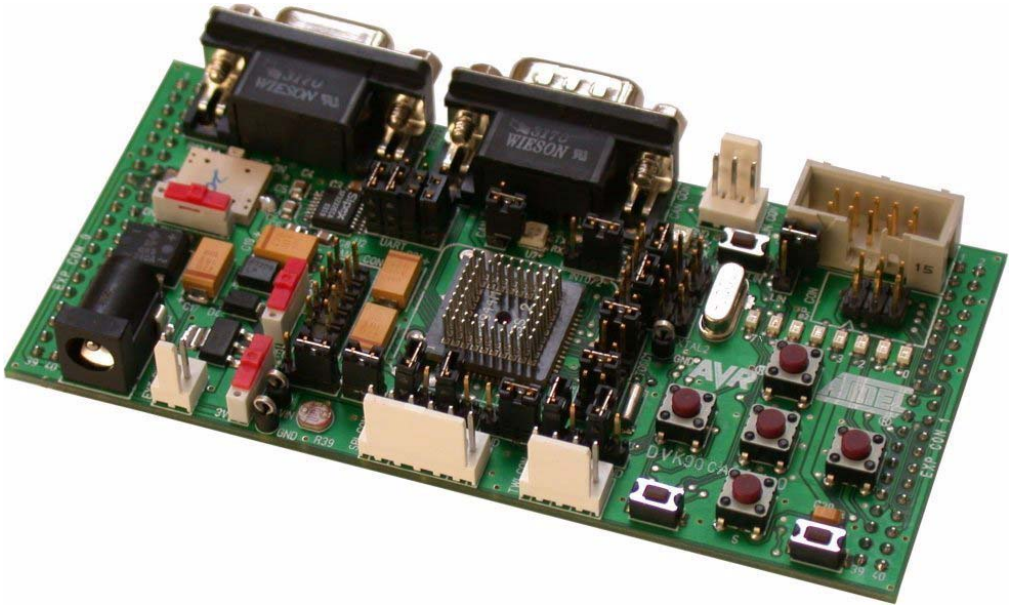
3.4.1 Using AVR ICE50

The TQFP-64 Personality Adapter (provided in AVR ICE50 package - Atmel advanced In-Circuit Emulator) should be soldered in place of the AT90CAN128.

- Provider: WISLOW ADAPTIC. - http://www.winslow.co.uk/uk/Default.asp
  - reference: W9844M

When mounting the TQFP-64 adapter, make sure that the adapter is positioned with the correct orientation and use low temperature solder.

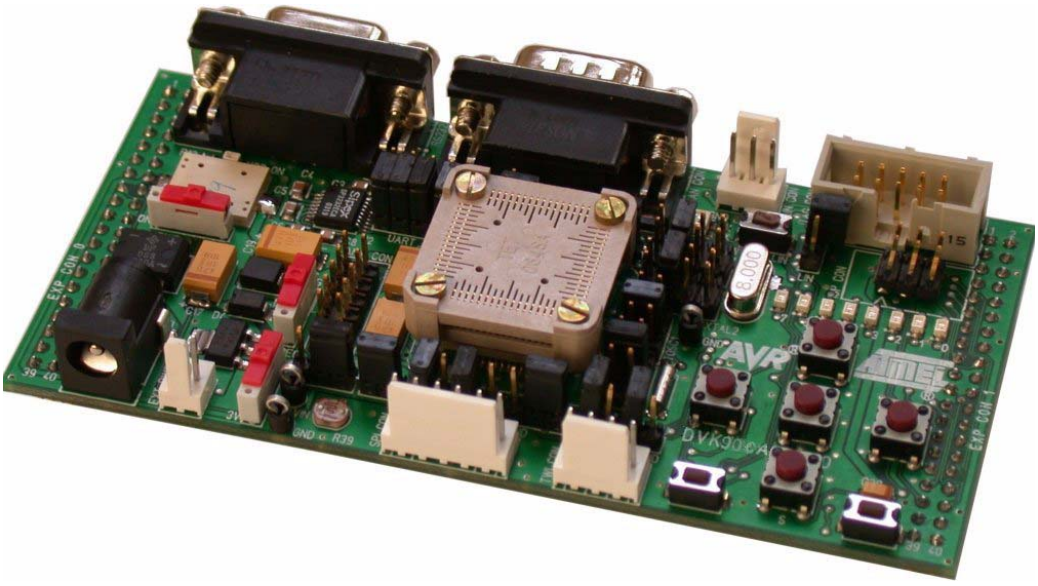
Figure 3-9 . DVK90CAN1 with TQFP-64 Personality Adapter



3.4.2 Using AT90CAN128 on Socket

The socket should have the same footprint as the AT90CAN128.

Figure 3-10 . DVK90CAN1 with Socket for AT90CAN128



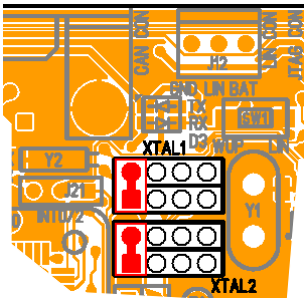
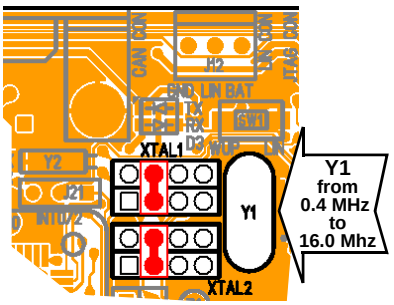
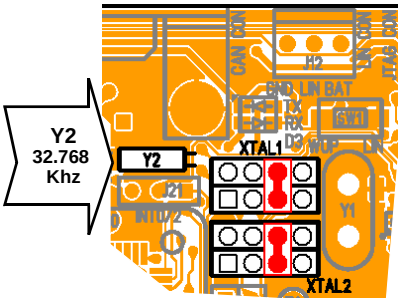
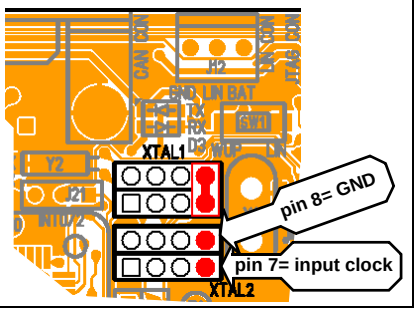
Hereunder is a reference of socket:

- Provider: TET, TOKYO ELETECH CORP. - http://www.tetc.co.jp/e_tet_product.htm
  - Connector (bottom part) reference: NQPACK064SA160
  - Top Cover (upper part) reference: HQPACK064SA160

3.5 AT90CAN128 Configuration

3.5.1 Main Clock XTAL

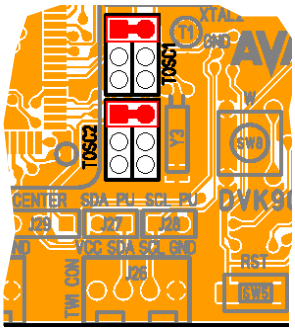
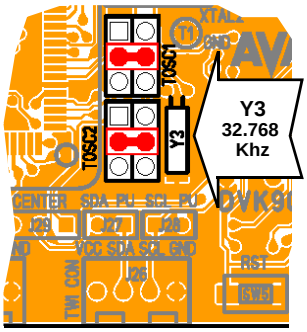
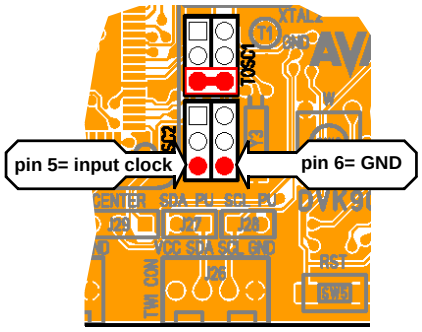
Table 3-2 . Main Clock Setting

Setting / Source		CKSEL [3..0] (1)	XTAL1 switch (2)	XTAL2 switch (2)	View
Setting	Clock from STK500	**1111** to **1000** or **0111** to **0100**	**2**	**2**	
Source	STK500 via EXP.CON.1				
Setting	External Crystal or Ceramic Resonator	**1111** to **1000**	**3-4**	**3-4**	
Source	Y1				
Setting	External Low-frequency Crystal	**0111** to **0100**	**5-6**	**5-6**	
Source	Y2 (3)				
Setting	External Clock	**0000**	**7-8**	**7= input clock** **8 = GND**	
Source	External				

Notes:
1. CKSEL [3..0] is the clock selection field of Fuse Low Byte (c.f. AT90CAN128 Datasheet, section “Memory Programming”).
2. c.f. “Schematics, 1 of 5” on page 51 for connections
3. Y2-to-ground capacitors not required

3.5.2 RTC Clock TOSC

Table 3-3 . RTC Clock Setting

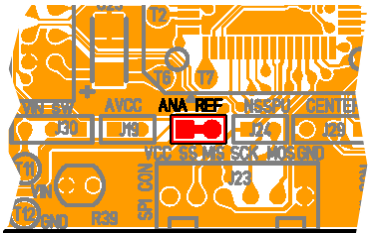
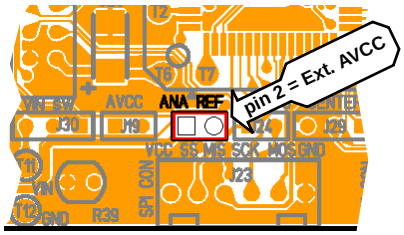
Setting / Source		TOSC1 switch (1)	TOSC2 switch (1)	View
Setting	TOSC1 as PG4 & TOSC2 as PG3	**2**	**2**	
Source	(*Synchronous clock*)			
Setting	External Low-frequency Crystal	**3-4**	**3-4**	
Source	Y3 (2)			
Setting	External Clock	**5-6**	**5 = input clock** **6 = GND**	
Source	External			

Notes: 1. c.f. “Schematics, 1 of 5” on page 51 for connections
2. Y3-to-ground capacitors not required

3.5.3 Analog Power Supply

AVCC By default, AVCC is equivalent to VCC.
An external AVCC source can be chosen.

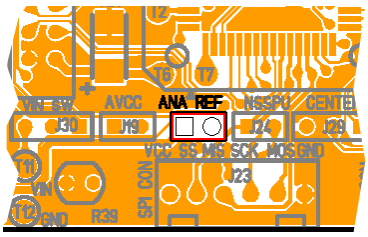
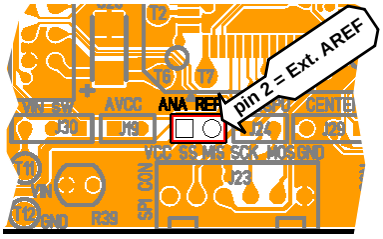
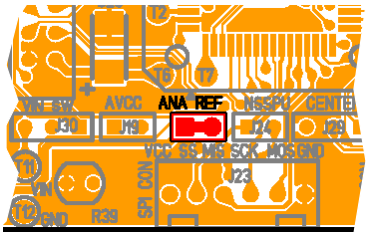
Table 3-4 . AVCC Setting

Setting / Source		AVCC switch (*)	View
Setting	On-board AVCC	2	
Source	VCC+ filter		
Setting	External AVCC	off	
Source	External		

Note: *. c.f. “Schematics, 3 of 5” on page 53 for connections

ANA REF By default, AREF is an output of AT90CAN128.
An external AREF source can be chosen (c.f. “STK500 Resources” on page 34).

Table 3-5 . ANA REF Setting

Setting / Source		ANA REF switch (*)	View
Setting	Output	off	
Source	AT90CAN128		
Setting	External Input	off	
Source	External		
Setting	External AREF	2	
Source	STK500		

Note: *. c.f. “Schematics, 2 of 5” on page 52 for connections

3.6 Serial Links

3.6.1 RS-232C

The AT90CAN128 is a micro-controller with two on-chip USART peripherals, USART0. and USART1. Only the asynchronous mode is supported by the DVK90CAN1.

The DVK90CAN1 is supplied with a RS-232 driver/receiver. Only one female DB9 connector assumes the RS-232 connections. A full range of configuration can be set with two Rx lines and two Tx lines.

Figure 3-11 . RS-232 DB9 Connector

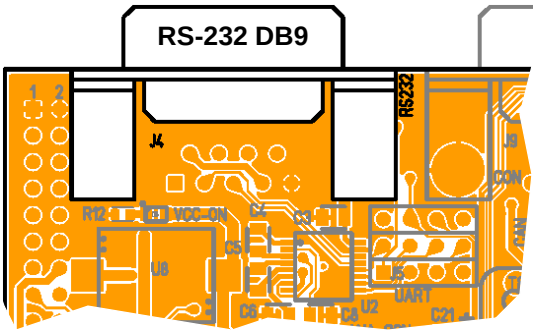


Figure 3-12 . RS-232 DB9 Connections

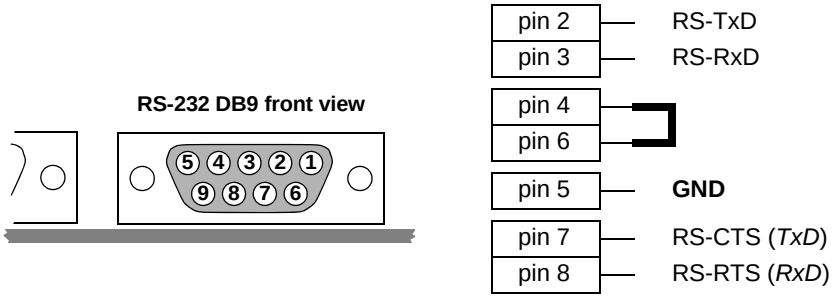


Figure 3-13 . Typical PC Connection Lay-out

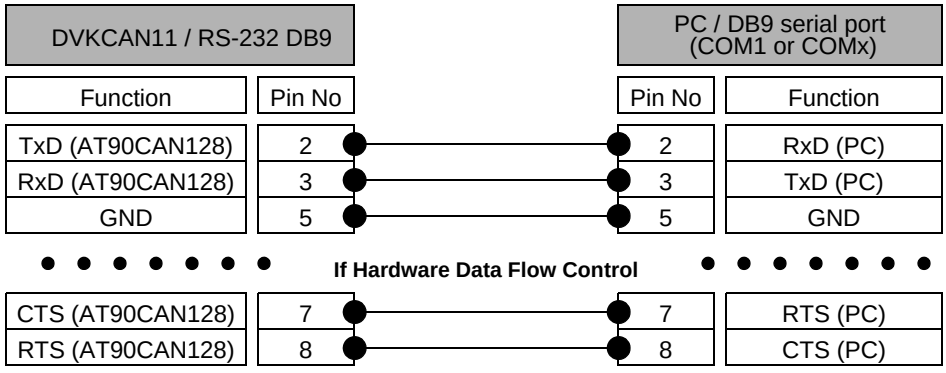
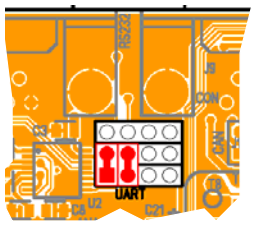
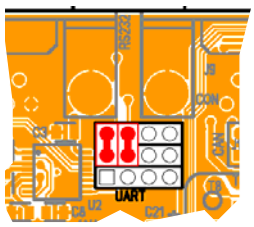
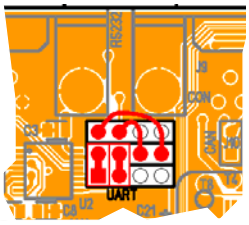
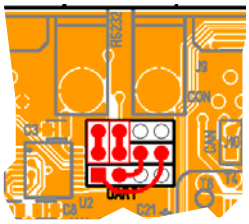
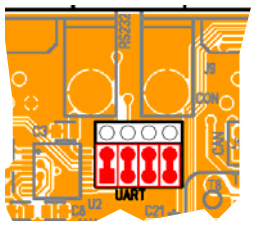
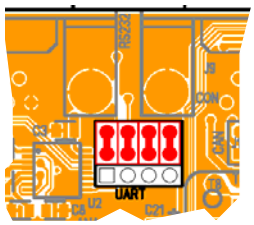


Table 3-6 . UARTs Setting

Mode	UART0	UART1	DB9 Connection (1)		UART Switch (2)	View
1 UART & Software Data Flow Control	**On** (Standard)	**Off**	Tx0 Rx0	Pin 2 Pin 3	2 4 - 5	
	Off	**On** (Standard)	Tx1 Rx1	Pin 2 Pin 3	3 - 2 6 - 5	
2 UARTs & Software Data Flow Control	**On** (Standard)	**On**	Tx0 Rx0 Tx1 Rx1	Pin 2 Pin 3 Pin 7 Pin 8	2 4 - 5 3 - 11 6 - 8	
	On	**On** (Standard)	Tx1 Rx1 Tx0 Rx0	Pin 2 Pin 3 Pin 7 Pin 8	3 - 2 6 - 5 1 -11 4 - 8	
1 UART & Hardware Data Flow Control	**On** (Standard)	**Off**	Tx0 Rx0 CTS0 RTS0	Pin 2 Pin 3 Pin 7 Pin 8	2 4 - 5 7 - 8 10 - 11	
	Off	**On** (Standard)	Tx1 Rx1 CTS1 RTS1	Pin 2 Pin 3 Pin 7 Pin 8	3 - 2 6 - 5 9 - 8 12 -1 1	

Notes: 1. Tx reference: DVK90CAN1 source, Rx reference: DVK90CAN1 destination
2. c.f. “Schematics, 1 of 5” on page 51 for connections

3.6.2 CAN

The AT90CAN128 is a micro-controller with an on-chip full-CAN controller.

The DVK90CAN1 is supplied with an ATMEL CAN transceiver (ATA6660). A male DB9 connector assumes the CAN bus connections.

Figure 3-14 . CAN DB9 Connector

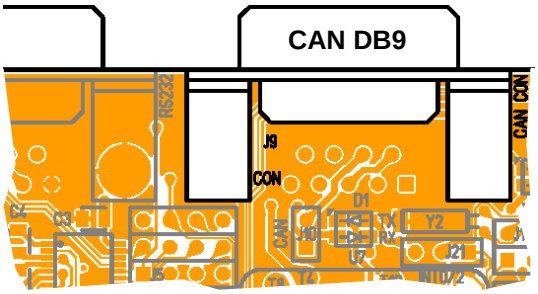
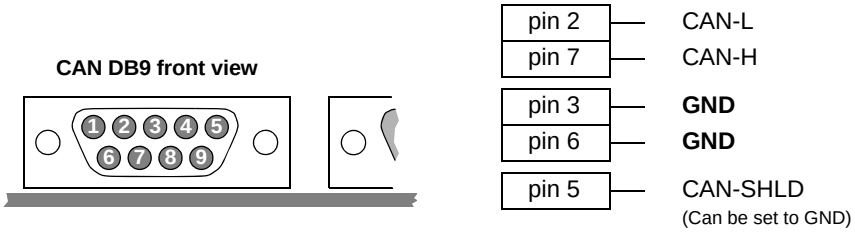
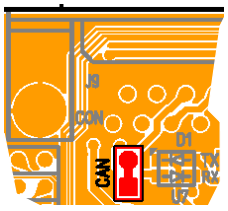
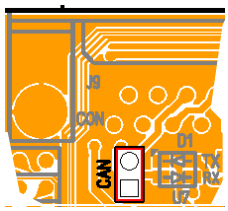


Figure 3-15 . CAN DB9 Connections



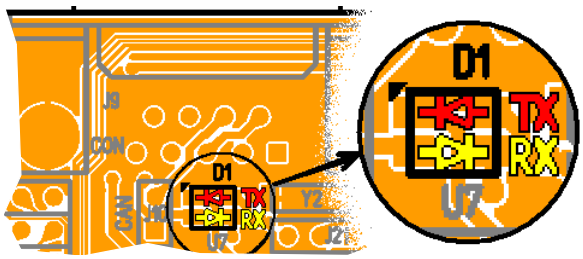
If a network termination is needed (CAN baudrate higher than 100 Kb/s), J10 switch inserts a 120 ohms resistor between CAN-H and CAN-L.

Table 3-7 . CAN Network Termination

Mode	View	Mode	View
120 ohms termination		**No termination**	

A red LED indicates a TxCAN traffic, a yellow one indicates a RxCAN traffic.

Figure 3-16 . CAN LEDs

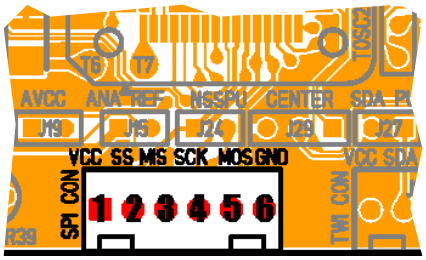


3.6.3 SPI

The AT90CAN128 is a micro-controller with an on-chip full duplex SPI interface, master or slave.

A 6-pin male connector assumes the SPI bus connections.

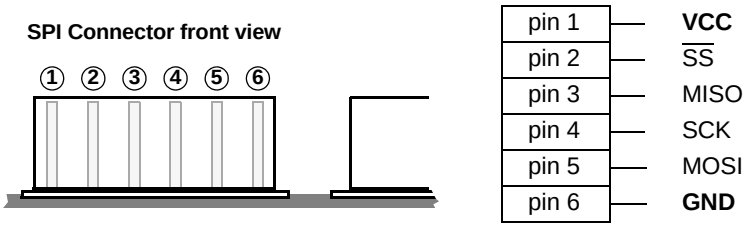
Figure 3-17 . SPI 6-pin Connector



SPI 6-pin

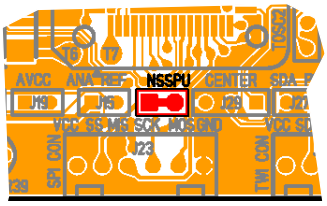
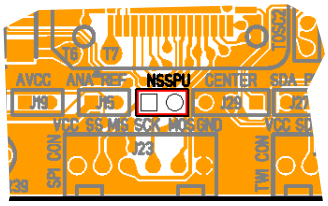
The SPI 6-pin connector also provides to the user VCC and GND.

Figure 3-18 . SPI 6-pin Connections



A 4.7 KΩ pull-up resistor on $\overline{SS}$ signal is available if needed.

Table 3-8 . $\overline{SS}$ Pull-up

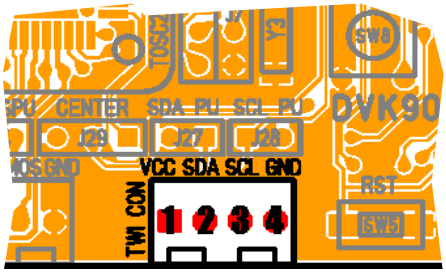
Mode	View	Mode	View
4.7 KΩ pull-up		**No pull-up**	

3.6.4 TWI

The AT90CAN128 is a micro-controller with an on-chip TWI interface, master or slave.

A 4-pin male connector assumes the TWI bus connections.

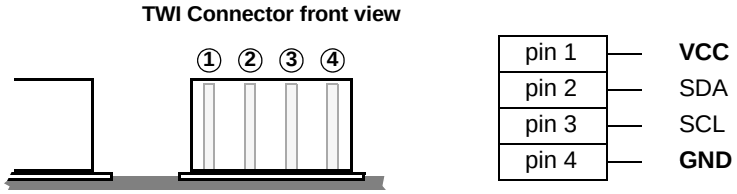
Figure 3-19 . TWI 4-pin Connector



TWI 4-pin

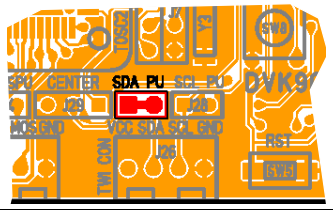
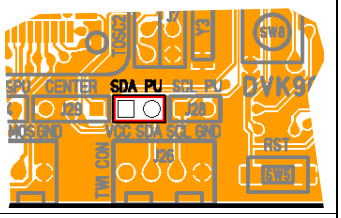
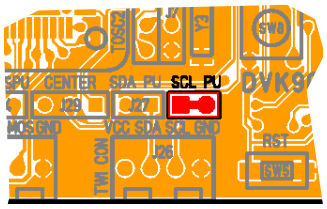
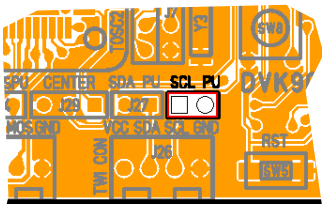
The TWI 4-pin connector also provides to the user VCC and GND.

Figure 3-20 . TWI 4-pin Connections



4.7 KΩ pull-up resistors on SDA or/and SCL signals are available if needed.

Table 3-9 . SDA or/and SCL Pull-up $\overline{SS}$ Pull-up

	Mode	View	Mode	View
SDA	**4.7 KΩ pull-up**		**No pull-up**	
SCL	**4.7 KΩ pull-up**		**No pull-up**	

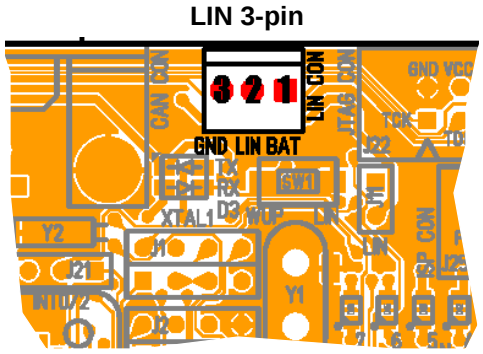
3.6.5 LIN

The AT90CAN128 may support a software LIN implementation. This software LIN implementation uses either the UART1 or a bit manipulation method on PD.2/PD.3 for LIN master or LIN slave.

The DVK90CAN1 is ready to implement (option) an ATMEL LIN transceiver (ATA6661). A 3-pin male connector assumes the LIN bus connections.

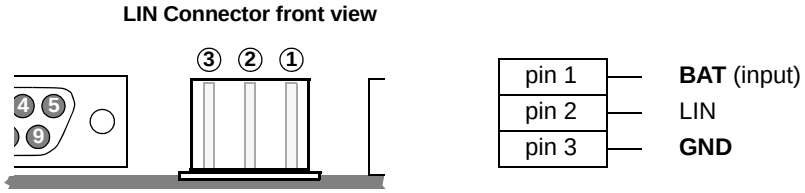
Note: Due to ATA6661 design, it is mandated to enable the internal pull-up on PD.2 (RxLIN) when LIN is used (c.f. AT90CAN128 Datasheet, section “I/O Ports”).

Figure 3-21 . LIN 3-pin Connector



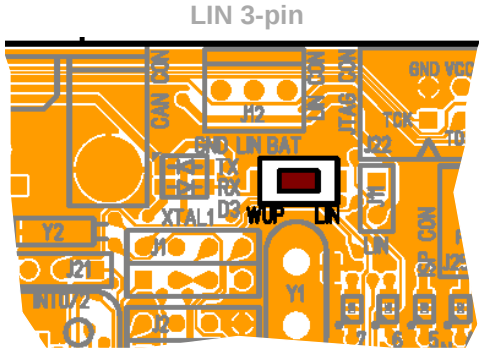
The LIN 3-pin connector must provide the V-Battery (BAT) up to +12 volts and GND.

Figure 3-22 . LIN 3-pin Connections



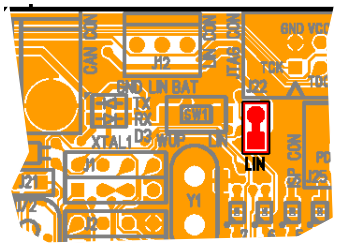
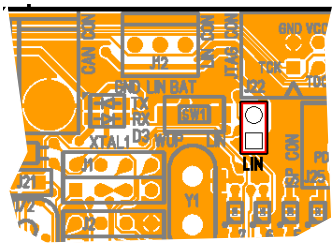
For slave LIN, LIN Wake-up is provided by a switch (active low signal).

Figure 3-23 . LIN Wake-up



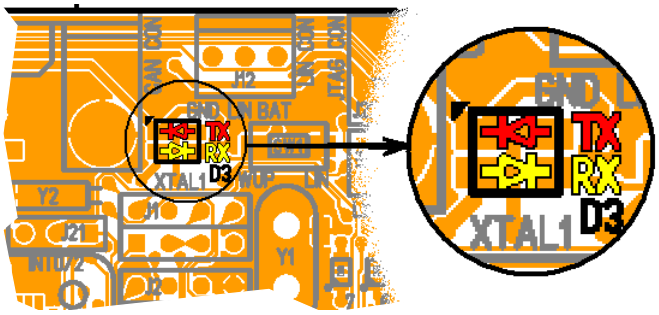
In case of master LIN, a pull-up resistor is needed. J11 switch enables a 1 KΩ pull-up resistor on the LIN bus.

Table 3-10 . LIN Pull-up

Mode	View	Mode	View
1 KΩ pull-up		**No pull-up**	

A red LED indicates a TxLIN traffic, a yellow one indicates a RxLIN traffic.

Figure 3-24 . LIN LEDs



3.7 On-board Resources

3.7.1 Compass Card Keyboard

The 4 de-centered push-buttons of compass card keyboard are connected to the synchronous external interrupts INT [7..4] to filter possible pulses.
Pushing a push-button causes the corresponding signal to be pulled low, while releasing (not pressed) causes an H.Z state on the signal. The user must enable internal pull-ups on the input pins, removing the need for an external pull-up resistor on the push-button. 150Ω resistors limit the current going into the AT90CAN128.

The central push-button receives its own filtering and is connected by default to the asynchronous external interrupt INT [2]. If the “CENTER” switch is set-up in the non-default configuration, the central push-button is connected as “Port E.2” input.
Pushing a push-button causes the corresponding signal to be pulled low, while releasing (not pressed) gives a logical “1” without the need of pull-up resistor.

Figure 3-25 . Compass Card Keyboard Schematic

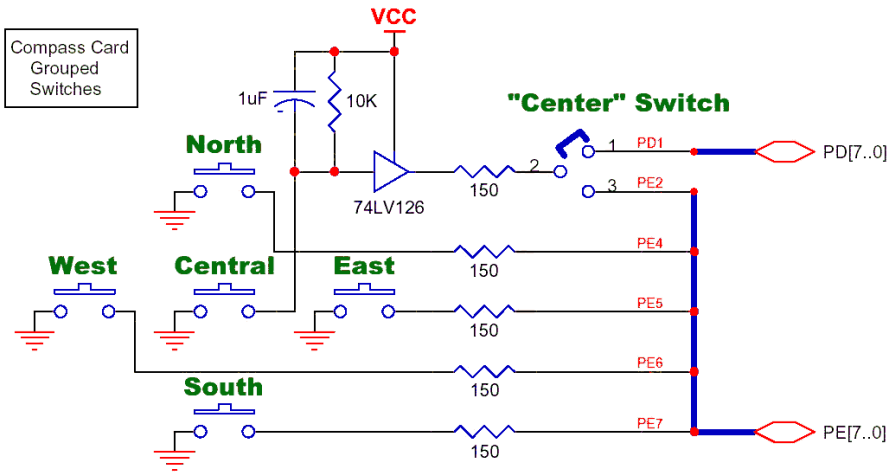


Figure 3-26 . Compass Card Keyboard Implementation

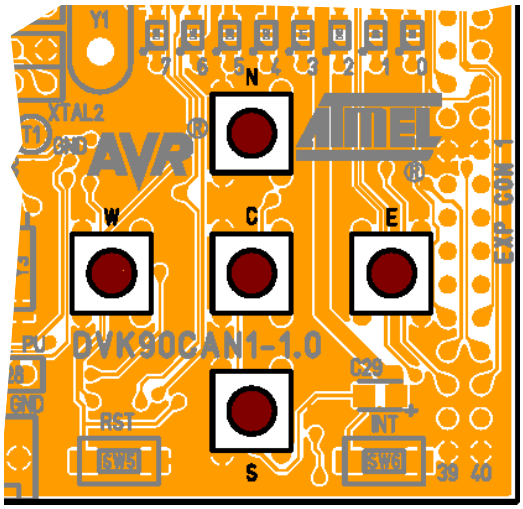
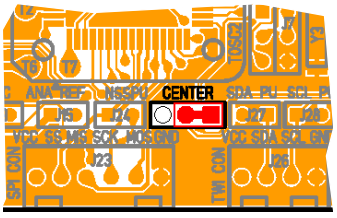
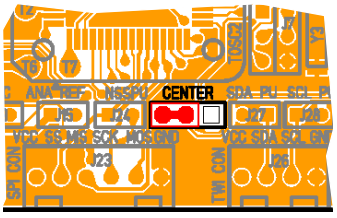


Table 3-11 . Center Switch Configuration

Mode	View	Mode	View
PortD.1		PortE.2	

3.7.2 LEDs

The DVK90CAN1 includes 8 green LEDs implemented on one line. They are connected to the “Port A” of AT90CAN128.
To light on a LED, the corresponding port pin must drive an high level. To light off a LED, the corresponding port pin must drive an low level. It is the opposite method of that

which is used in STK500.
Port A.0 drives the right LED (lsb) - index 0 and Port A.7 drives the left LED (msb) - index 7.

Figure 3-27 . Unit Schematic of LED

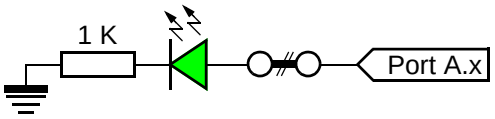
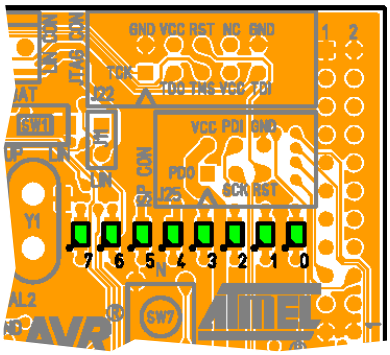


Figure 3-28 . LEDs Implementation



3.7.3 Interrupt 0 / 2

The “INT” push-button receives its own filtering and is connected by default to the asynchronous external interrupt INT [0]. If the “INT 0/2” switch is set-up in the non-default configuration, the “INT” push-button is connected to the asynchronous external interrupt INT [2].

Pushing a push-button causes the corresponding signal to be pulled low, while releasing (not pressed) gives a logical “1” without the need of pull-up resistor.

Figure 3-29 . Interrupt 0 / 2 Schematic

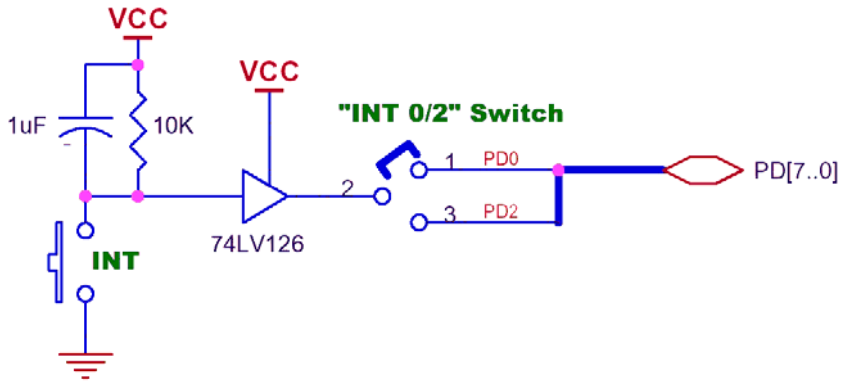


Figure 3-30 . Interrupt Push-button (INT) Implementation

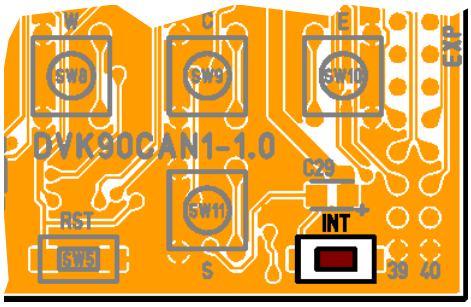
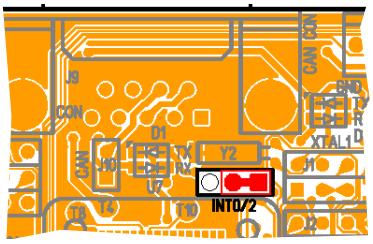
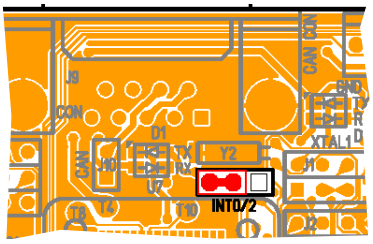


Table 3-12 . Interrupt 0 / 2 Switch Configuration

Mode	View	Mode	View
INT0		**INT2**	

3.7.4 Piezo Audio Transducer

The piezo audio transducer is connected to the PortB.7 of the AT90CAN128. This means that each synchronous Timer 0 or Timer 1 (OC0A and OC1C) can drive the transducer or the together using the Output Compare Modulator (OCM). The type of modulation (logical OR or AND) can be selected by PortB.7 bit-register. See the AT90CAN128 Datasheet for how to use Timers.

Figure 3-31 . Frequency Response of the Transducer

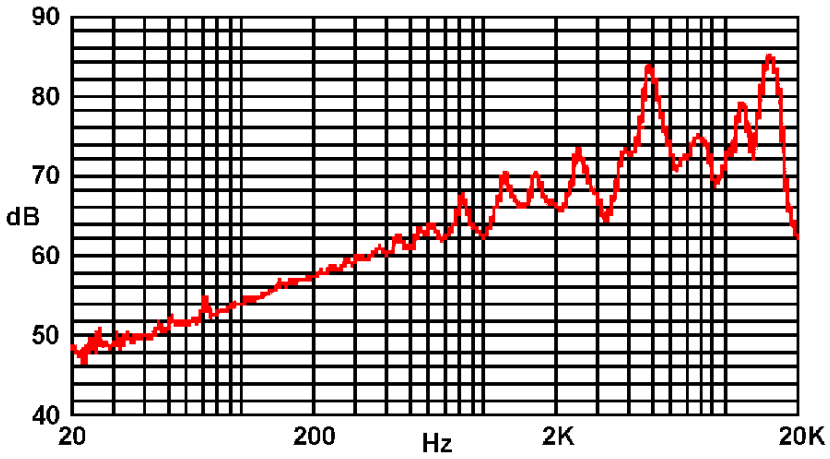


Table 3-13 . Tone Table Proposal

Tone N[b]	Name	Freq.[1] (Hz)	ICR1 (@ 1 MHz)	Tone N[b]	Name	Freq.[1] (Hz)	ICR1 (@ 1 MHz)	Tone N[b]	Name	Freq.[1] (Hz)	ICR1 (@ 1 MHz)	Tone N[b]	Name	Freq.[1] (Hz)	ICR1 (@ 1 MHz)
0	No Tone			**32**	G	98.0	0x13EE	**64**	D#	622.3	0x0323	**96**	B	3951.1	0x007E
1	C	16.4	0x7717	**33**	G#	103.8	0x12D0	**65**	E	659.3	0x02F6	**97**	C	4186.0	0x0077
2	C#	17.3	0x70E5	**34**	A	110.0	0x11C1	**66**	F	698.5	0x02CB	**98**	C#	4434.9	0x0070
3	D	18.4	0x6A25	**35**	A#	116.5	0x10C3	**67**	F#	740.0	0x02A3	**99**	D	4698.6	0x006A
4	D#	19.4	0x64AD	**36**	B	123.5	0x0FD0	**68**	G	784.0	0x027D	**100**	D#	4978.0	0x0064
5	E	20.6	0x5ECF	**37**	C	130.8	0x0EEE	**69**	G#	830.6	0x0259	**101**	E	5274.0	0x005E
6	F	21.8	0x5997	**38**	C#	138.6	0x0E17	**70**	A	880.0	0x0238	**102**	F	5587.7	0x0059
7	F#	23.1	0x548D	**39**	D	146.8	0x0D4D	**71**	A#	932.3	0x0218	**103**	F#	5919.9	0x0054
8	G	24.5	0x4FB8	**40**	D#	155.6	0x0C8D	**72**	B	987.8	0x01FA	**104**	G	6271.9	0x004F
9	G#	26.0	0x4B1E	**41**	E	164.8	0x0BD9	**73**	C	1046.5	0x01DD	**105**	G#	6644.9	0x004B
10	A	27.5	0x4705	**42**	F	174.6	0x0B2F	**74**	C#	1108.7	0x01C2	**106**	A	7040.0	0x0047
11	A#	29.1	0x431E	**43**	F#	185.0	0x0A8E	**75**	D	1174.7	0x01A9	**107**	A#	7458.6	0x0043
12	B	30.9	0x3F35	**44**	G	196.0	0x09F7	**76**	D#	1244.5	0x0191	**108**	B	7902.1	0x003F
13	C	32.7	0x3BBA	**45**	G#	207.7	0x0967	**77**	E	1318.5	0x017B	**109**	C	8372.0	0x003B
14	C#	34.6	0x3872	**46**	A	220.0	0x08E0	**78**	F	1396.9	0x0165	**110**	C#	8869.8	0x0038
15	D	36.7	0x3537	**47**	A#	233.1	0x0861	**79**	F#	1480.0	0x0151	**111**	D	9397.3	0x0035
16	D#	38.9	0x3235	**48**	B	246.9	0x07E9	**80**	G	1568.0	0x013E	**112**	D#	9956.1	0x0032
17	E	41.2	0x2F67	**49**	C	261.6	0x0777	**81**	G#	1661.2	0x012C	**113**	E	10548.1	0x002F
18	F	43.7	0x2CB1	**50**	C#	277.2	0x070B	**82**	A	1760.0	0x011C	**114**	F	11175.3	0x002C
19	F#	46.2	0x2A46	**51**	D	293.7	0x06A6	**83**	A#	1864.7	0x010C	**115**	F#	11839.8	0x002A
20	G	49.0	0x27DC	**52**	D#	311.1	0x0647	**84**	B	1975.5	0x00FD	**116**	G	12543.9	0x0027
21	G#	51.9	0x25A1	**53**	E	329.6	0x05EC	**85**	C	2093.0	0x00EE	**117**	G#	13289.8	0x0025
22	A	55.0	0x2382	**54**	F	349.2	0x0597	**86**	C#	2217.5	0x00E1	**118**	A	14080.0	0x0023
23	A#	58.3	0x2180	**55**	F#	370.0	0x0547	**87**	D	2349.3	0x00D4	**119**	A#	14917.2	0x0021
24	B	61.7	0x1FA7	**56**	G	392.0	0x04FB	**88**	D#	2489.0	0x00C8	**120**	B	15804.3	0x001F
25	C	65.4	0x1DDD	**57**	G#	415.3	0x04B3	**89**	E	2637.0	0x00BD	**121**	C	16744.0	0x001D
26	C#	69.3	0x1C2F	**58**[2]	A	440.0	0x0470	**90**	F	2793.8	0x00B2	**122**	C#	17739.7	0x001C
27	D	73.4	0x1A9B	**59**	A#	466.2	0x0430	**91**	F#	2960.0	0x00A8	**123**	D	18794.5	0x001A
28	D#	77.8	0x191A	**60**	B	493.9	0x03F4	**92**	G	3136.0	0x009F	**124**	D#	19912.1	0x0019
29	E	82.4	0x17B3	**61**	C	523.3	0x03BB	**93**	G#	3322.4	0x0096	**125**	E	21096.2	0x0017
30	F	87.3	0x165F	**62**	C#	554.4	0x0385	**94**	A	3520.0	0x008E	**126**	F	22350.6	0x0016
31	F#	92.5	0x151D	**63**	D	587.3	0x0353	**95**	A#	3729.3	0x0086	**127**	F#	23679.6	0x0015

Notes: 1. Approximate ideal human hearing range: 20-20,000 Hz
2. Reference A tone = tone Nb 58 = 440 Hz

The 16-bit Timer1 offers a large range of features. See the AT90CAN128 Datasheet for how to use the 16-bit Timers. It is easy to set up the Timer1 to output one of the hereinabove frequencies:

- Timer1 clock at 1 MHz
- Phase/Freq-correct PWM mode
- Top value = ICR1 (Input Capture Register Timer 1)
- Set OC1C (Output Compare “C” of Timer 1) when upcounting & clear when downcounting mode

And use the following expression:

$$ICR1Value = 1,000,000 / ToneFrequency / 2$$

ICR1 (in hexadecimal) is given in Table 3-13 . Tone Table Proposal.

Figure 3-32 . Transducer Schematic

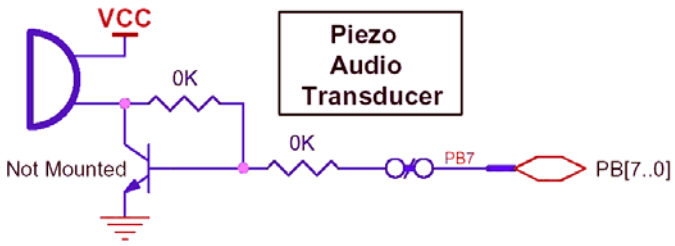
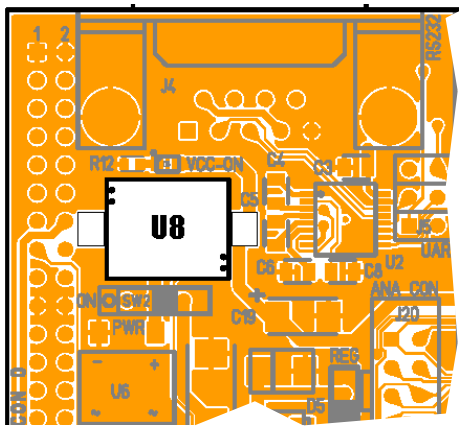


Figure 3-33 . Transducer Implementation



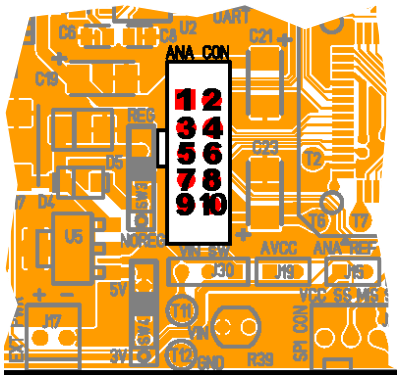
3.7.5 Analog I/O Connector

6 ADC inputs and the 2 inputs of the analog comparator are available on this connector. The connector is shaped as STK500 10-pin connector with GND & VCC (pin 9 & 10).

ADC-0, ADC-1 & ADC-2 are already used on board respectively by the temperature sensor, the luminosity sensor and the voltage reading. If another use is required through the Analog I/O Connector, refer to the configuration pads features (c.f. Section "Configuration Pads", page 40) to customize these analog inputs.

AIN-0, or PortE.2, can be already used as logic input if “CENTER” switch is not in its default configuration (c.f. Section "Interrupt 0 / 2", page 25).

Figure 3-34 . Analog I/O Connector Implementation



ADC-4	1	2	ADC-5
ADC-2	3	4	ADC-3
ADC-0	5	6	ADC-1
AIN-0	7	8	AIN-1
GND	9	10	VCC

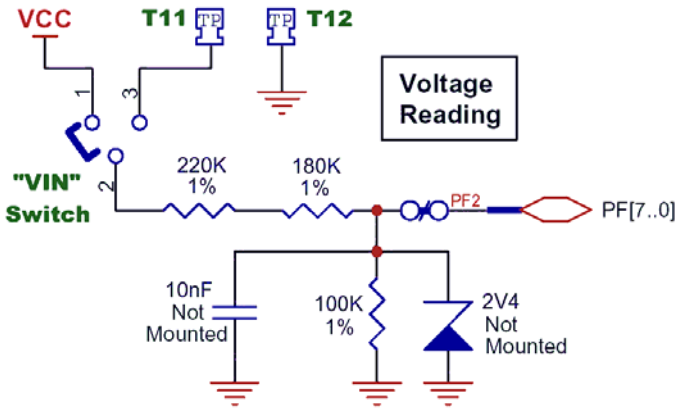
ANA CON
(top view)

Note: ADC-4 & ADC-5 take share with the JTAG connections. If these analog inputs are used through the Analog I/O Connector, be sure that the JTAGEN fuse is unprogrammed.

3.7.6 Voltage Reading

The voltage reading is made with a bridge of ±1% resistors. The read value is 1/5 of the voltage witch is to measure (100 KΩ / (220+180) KΩ + 100 KΩ). The high values of resistors protect the micro controller input. If necessary, the read value can be limited to 2.4V by a zener diode. This will give a voltage reading range from 0 to 12.0V with internal VRef (the zener diode can have a impedance close to 80 KΩ).

Figure 3-35 . Voltage Reading Schematic



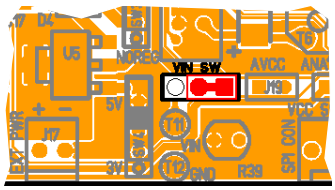
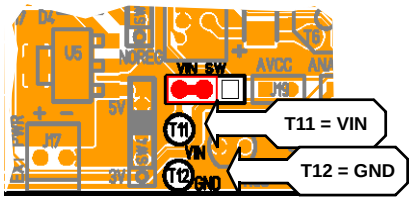
The voltage over this resistor (100 KΩ) can be found using the A/D converter. See the AT90CAN128 Datasheet for how to use the ADC. The input voltage value (V_{IN}) is calculate with the following expression:

$$V_{IN} = 5 \cdot V_{ADC2}$$

Where: V_{IN} = Input voltage value (V)
V_{ADC2} = Voltage value on ADC-2 input (V)

The voltage input can be configured. It can be either the board supply voltage (VCC) or an external input on T11 test pin. To improve the connection, close to T11, there is the test pin T12 wrapped to GND.

Table 3-14 . Voltage Input Switch Configuration

Mode	View	Mode	View
VCC		**External Input (T11)**	

3.7.7 Temperature Sensor

The temperature sensor uses a thermistor, or temperature-sensitive resistor. This thermistor have a negative temperature coefficient (NTC), meaning the resistance goes up as temperature goes down. Of all passive temperature measurement sensors, thermistors have the highest sensitivity (resistance change per degree of temperature change). Thermistors do not have a linear temperature/resistance curve.

The voltage over the NTC can be found using the A/D converter. See the AT90CAN128 Datasheet for how to use the ADC. The thermistor value (R_T) is calculate with the following expression:

$$R_T = (R_H \cdot V_{ADC0}) / (VCC - V_{ADC0})$$

Where:
- R_T = Thermistor value (Ω) at **T** temperature (°Kelvin)
- R_H = Second resistor of the bridge -100 KΩ ±10% at 25°C
- V_{ADC0} = Voltage value on ADC-0 input (V)
- **V**CC = Board power supply

The NTC thermistor used in DVK90CAN1 has a resistance of 100 KΩ ±5% at 25°C (T_0) and a beta-value of 4250 ±3%. By the use of the following equation, the temperature (T) can be calculated:

$$T = \frac{\beta}{\left(\ln\frac{R_T}{R_0}\right) + \frac{\beta}{T_0}}$$

Where:
- R_T = Thermistor value (Ω) at **T** temperature (°Kelvin)
- ß = 4250 ±3%
- R_0 = 100 KΩ ±5% at 25°C
- T_0 = 298 °K (273 °K + 25°K)

The following cross table also can be used. It is based on the above equation.

Table 3-15 . Thermistor Values versus Temperature

Temp. (°C)	RT (KΩ)	Temp. (°C)	RT (KΩ)	Temp. (°C)	RT (KΩ)	Temp. (°C)	RT (KΩ)
-20	1263,757	10	212,958	40	50,486	70	15,396
-19	1182,881	11	201,989	41	48,350	71	14,851
-18	1107,756	12	191,657	42	46,316	72	14,329
-17	1037,934	13	181,920	43	44,380	73	13,828
-16	973,006	14	172,740	44	42,537	74	13,347
-15	912,596	15	164,083	45	40,781	75	12,885
-14	856,361	16	155,914	46	39,107	76	12,442
-13	803,984	17	148,205	47	37,513	77	12,017
-12	755,175	18	140,926	48	35,992	78	11,608
-11	709,669	19	134,051	49	34,542	79	11,215
-10	667,221	20	127,555	50	33,159	80	10,838
-9	627,604	21	121,414	51	31,840	81	10,476
-8	590,613	22	115,608	52	30,580	82	10,128
-7	556,056	23	110,116	53	29,378	83	9,793
-6	523,757	24	104,919	54	28,229	84	9,471
-5	493,555	25	100,000	55	27,133	85	9,161
-4	465,300	26	95,342	56	26,085	86	8,863
-3	438,854	27	90,930	57	25,084	87	8,576
-2	414,089	28	86,750	58	24,126	88	8,300
-1	390,890	29	82,787	59	23,211	89	8,035
0	369,145	30	79,030	60	22,336	90	7,779
1	348,757	31	75,466	61	21,498	91	7,533
2	329,630	32	72,085	62	20,697	92	7,296
3	311,680	33	68,876	63	19,930	93	7,067
4	294,826	34	65,830	64	19,196	94	6,847
5	278,995	35	62,937	65	18,493	95	6,635
6	264,119	36	60,188	66	17,820	96	6,430
7	250,134	37	57,576	67	17,174	97	6,233
8	236,981	38	55,093	68	16,556	98	6,043
9	224,606	39	52,732	69	15,964	99	5,860

Figure 3-36 . Thermistor Schematic

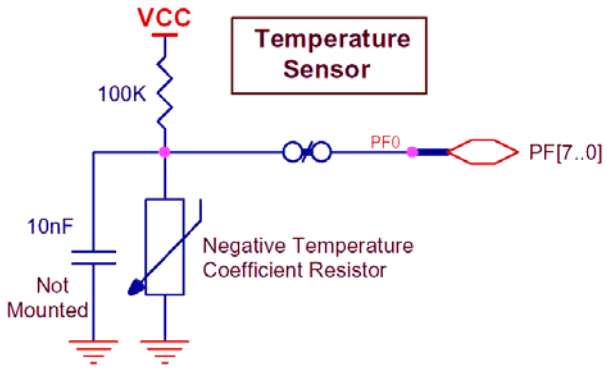
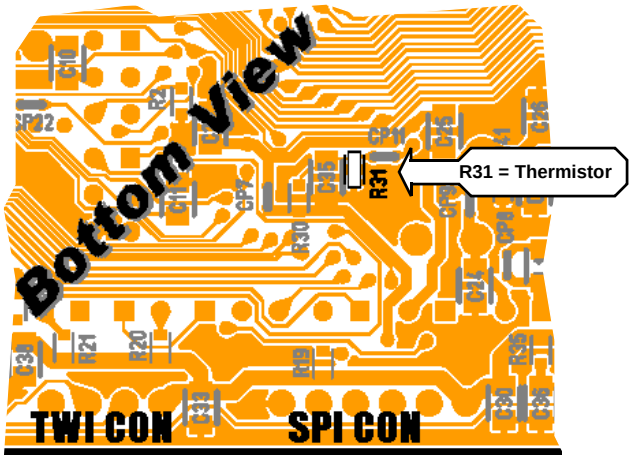


Figure 3-37 . Thermistor Implementation



3.7.8 Luminosity Sensor

The luminosity sensor uses a CdS photoconductive cell, or luminosity-sensitive resistor. The luminosity-sensitive resistor have a negative coefficient, meaning the resistance goes up as luminosity goes down. This luminosity sensor have a linear resistance/temperature curve from 0 up to 75°C.
The luminosity sensor used in DVK90CAN1 has a resistance close to 60 KΩ at 10 lux and 5 KΩ at 100 lux for a wavelength of 550 nm.

Table 3-16 . CdS Photoconductive Cell Electrical characteristics at temp=25°C

Parameter (temp=25°C)	**Min**	**Typ**	**Max**	**Units**	**Test Conditions**
Light Resistance	20		100	KΩ	10 lux
		5		KΩ	100 lux
Peak Spectral Wavelength		550		nm	10 s after removal of light
Dark Resistance	20			KΩ	10 s after removal of light

The voltage over the luminosity sensor can be found using the A/D converter. See the AT90CAN128 Datasheet for how to use the ADC. The resistor value (R_L) is calculate

with the following expression:

$$R_L = (R_H \cdot V_{ADC1}) / (VCC - V_{ADC1})$$

Where:
- R_T = Luminosity-sensitive resistor value (Ω)
- R_H = Second resistor of the bridge -3.3 KΩ ±10% at 25°C
- V_{ADC1} = Voltage value on ADC-1 input (V)
- VCC = Board power supply

The following cross table also can be used. It is based on the above table.

Table 3-17 . Resistor Values versus Luminosity

Luminosity (lux)	R_L (KΩ)	Luminosity (lux)	R_L (KΩ)	Luminosity (lux)	R_L (KΩ)	Luminosity (lux)	R_L (KΩ)
8	61	32	47	56	32	80	17
10	60	34	45	58	31	82	16
12	59	36	44	60	29	84	15
14	58	38	43	62	28	86	14
16	56	40	42	64	27	88	12
18	55	42	40	66	26	90	11
20	54	44	39	68	25	92	10
22	53	46	38	70	23	94	9
24	51	48	37	72	22	96	7
26	50	50	36	74	21	98	6
28	49	52	34	76	20	100	5
30	48	54	33	78	18	102	4

Figure 3-38 . Luminosity Sensor Schematic

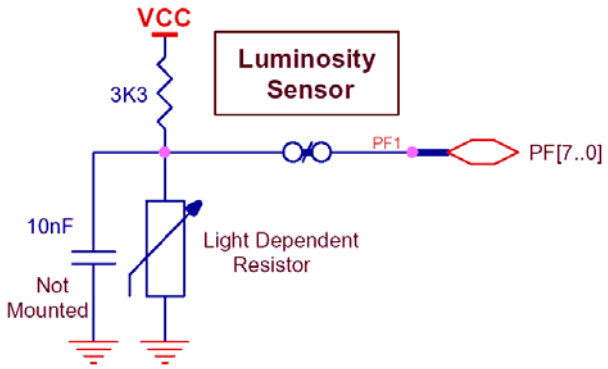
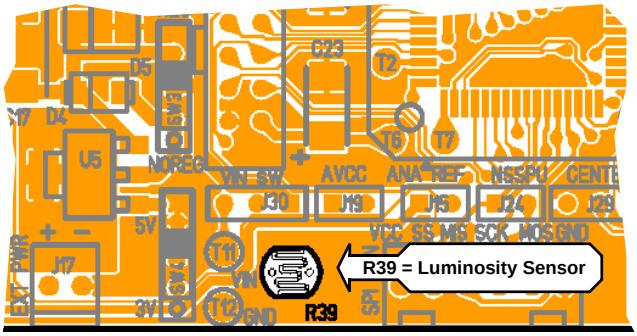
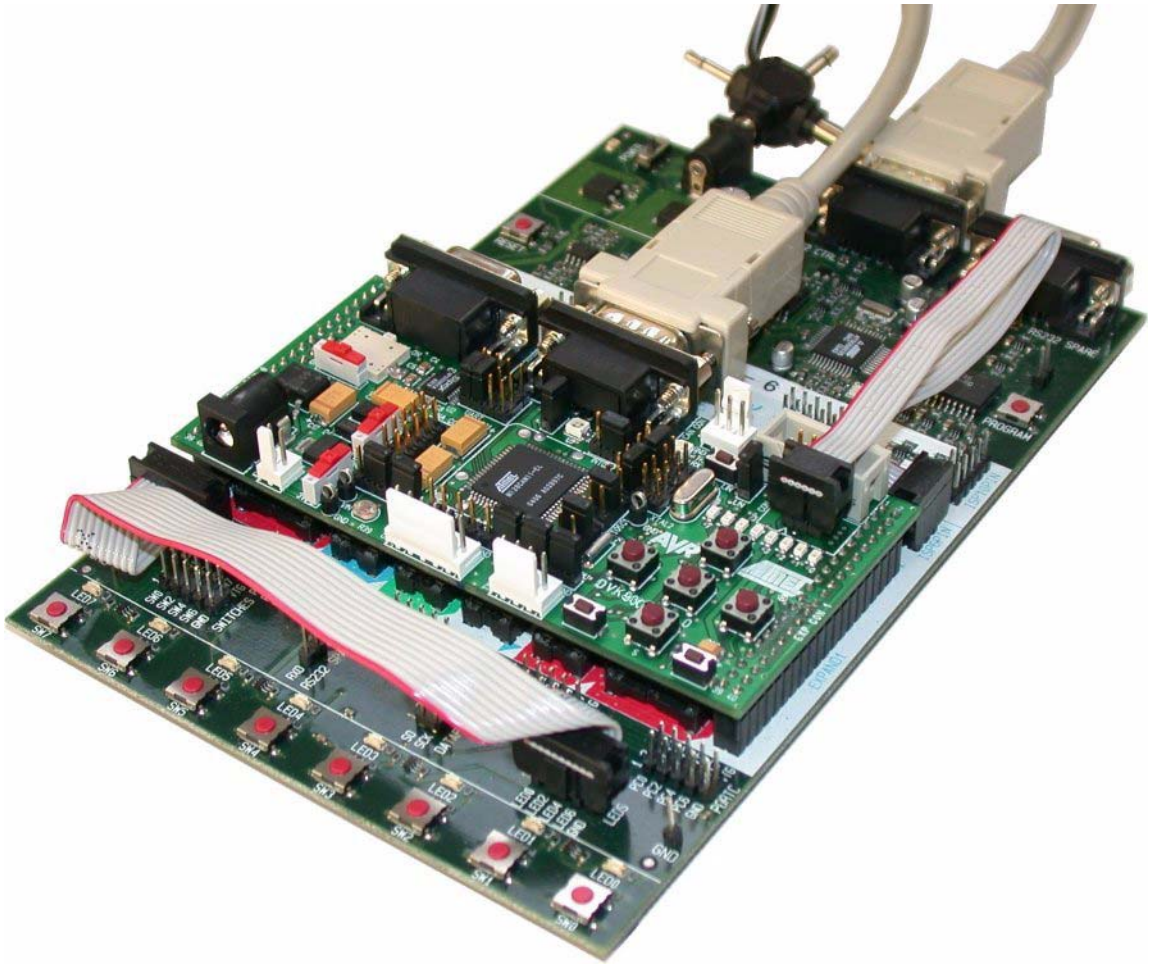


Figure 3-39 . Luminosity Sensor Implementation



3.8 STK500 Resources

Figure 3-40 . Connecting DVK90CAN1 to the STK500 Board



Note: **Caution:** Do not mount an AVR micro controller on the STK500 board when DVK90CAN1 is plugged on STK500.

3.8.1 Supply Voltage from STK500

The AVR supply voltage coming from STK500 (VTG) can also be controlled from AVR Studio®.

- Need of the optional expended connectors EXP.CON 0 & EXP.CON 1 (J13 & J14),
- Need of the optional specific decoupling capacitors (C14 & C15 = 100 nF),
- The supply voltage coming from STK500 is controlled by power supply circuitry of the DVK90CAN1. Refer to Table 3-1 . Power Supply (1) Setting to configure.

3.8.2 Analog Reference Voltage from STK500

The AVR Analog Reference Voltage coming from STK500 (REF) can also be controlled from AVR Studio®.

- Need of the optional expended connectors EXP.CON 0 & EXP.CON 1 (J13 & J14),
- Need of the optional specific decoupling capacitor (C16 = 100 nF),
- Refer to Table 3-5 . ANA REF Setting to configure.

3.8.3 EXP.CON 0 & EXP.CON 1 Connectors

Figure 3-41 . EXP.CON 0 and EXP.CON 1 Connectors

GND	1	2	GND
n.c. (*AUXI0*)	3	4	n.c. (*AUXO0*)
n.c. (*CT7*)	5	6	n.c. (*CT6*)
n.c. (*CT5*)	7	8	n.c. (*CT4*)
n.c. (*CT3*)	9	10	n.c. (*CT2*)
n.c. (*CT1*)	11	12	n.c. (*BSEL2*)
n.c.	13	14	REF
NRST	15	16	PG2
PG1	17	18	PG0
GND	19	20	GND
VTG	21	22	VTG
PC7	23	24	PC6
PC5	25	26	PC4
PC3	27	28	PC2
PC1	29	30	PC0
PA7	31	32	PA6
PA5	33	34	PA4
PA3	35	36	PA2
PA1	37	38	PA0
GND	39	40	GND

EXP. CON 0

GND	1	2	GND
n.c. (*AUXI1*)	3	4	n.c. (*AUXO1*)
n.c. (*DATA7*)	5	6	n.c. (*DATA6*)
n.c. (*DATA5*)	7	8	n.c. (*DATA4*)
n.c. (*DATA3*)	9	10	n.c. (*DATA2*)
n.c. (*DATA1*)	11	12	n.c. (*DATA0*)
n.c. (*SI*)	13	14	n.c. (*SO*)
n.c. (*SCK*)	15	16	n.c. (*CS*)
XT1	17	18	XT2
VTG	19	20	VTG
GND	21	22	GND
PB7	23	24	PB6
PB5	25	26	PB4
PB3	27	28	PB2
PB1	29	30	PB0
PD7	31	32	PD6
PD5	33	34	PD4
PD3	35	36	PD2
PD1	37	38	PD0
GND	39	40	GND

EXP. CON 1

Top View

3.8.4 Main Clock from STK500

The AVR clock frequency (external) coming from STK500 (XT1/XT2) can also be controlled from AVR Studio®.

- Need of the optional expended connectors EXP.CON 0 & EXP.CON 1 (J13 & J14),
- Refer to Table 3-2 . Main Clock Setting to configure XTAL1 & XTAL2.

3.8.5 RESET from STK500

The AVR RESET coming from STK500 (NRST - EXP.CON 0) can also control the DVK90CAN1. DVK90CAN1 is protected against +12V RESET pulse (parallel programing not allowed for AT90CAN128 on DVK90CAN1) coming from STK500.

3.9 In-System Programming

The AT90CAN128 can be programmed using specific SPI serial links. This sub section will explain how to connect the programming.

The Flash, EEPROM and all Fuse and Lock Bit options ISP-programmable can be programmed individually or with the sequential automatic programming option.

3.9.1 Programming with AVR ISP Programmer

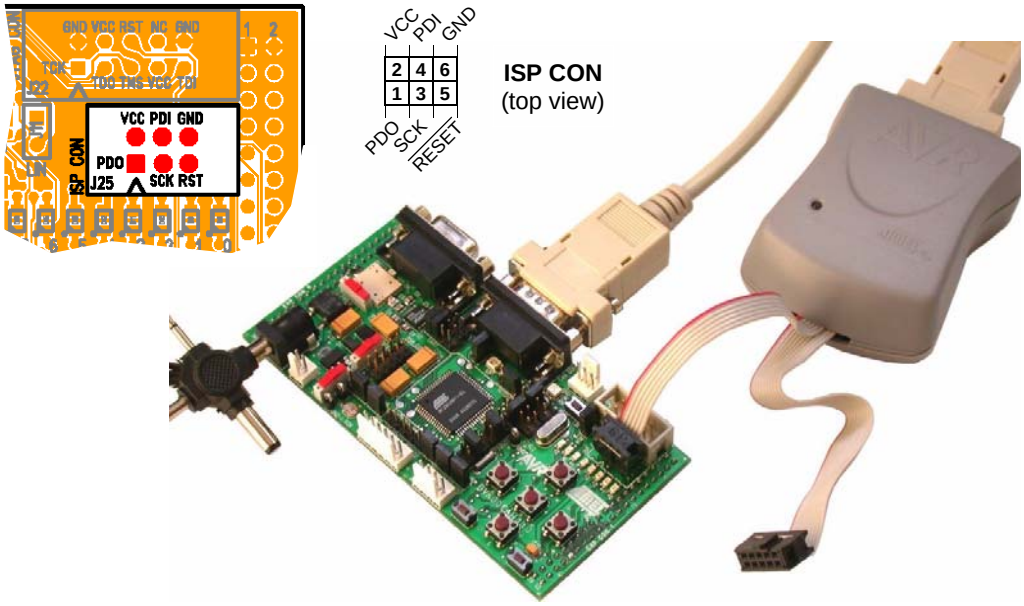
The AVR ISP programmer is a compact and easy-to-use In-System Programming tool for developing applications with AT90CAN128. Due to the small size, it is also an excellent tool for field upgrades of existing applications. It is powered by the DVK90CAN1 and an additional power supply is thus not required.

The AVR ISP programming interface is integrated in AVR Studio®.

To program the device using AVR ISP programmer, connect the 6-wire cable on the ISP connector of the DVK90CAN1 as shown in Figure 3-42.

Note: See AVR Studio® on-line Help for information.

Figure 3-42 . Programming from AVR ISP programmer



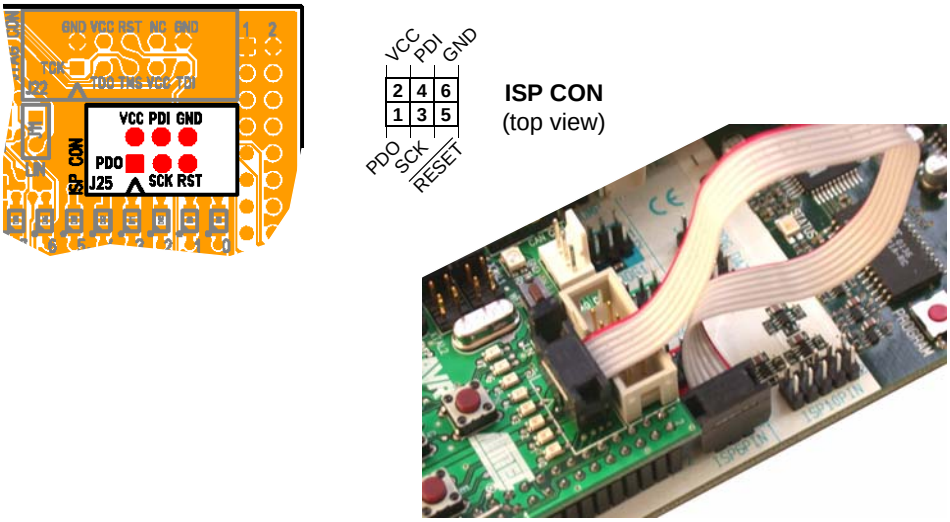
3.9.2 Programming with STK500

The AT90CAN128 can be programmed using the serial programming mode in the AVR Studio STK500 software. The software interface (In-System Programming of an external target system) is integrated in AVR Studio®.

To program the device using ISP from STK500, connect the 6-wire cable between the ISP6PIN connector of the STK500 board and the ISP connector of the DVK90CAN1 as shown in Figure 3-43.

Note: See AVR Studio® on-line Help for information.

Figure 3-43 . Programming from STK500

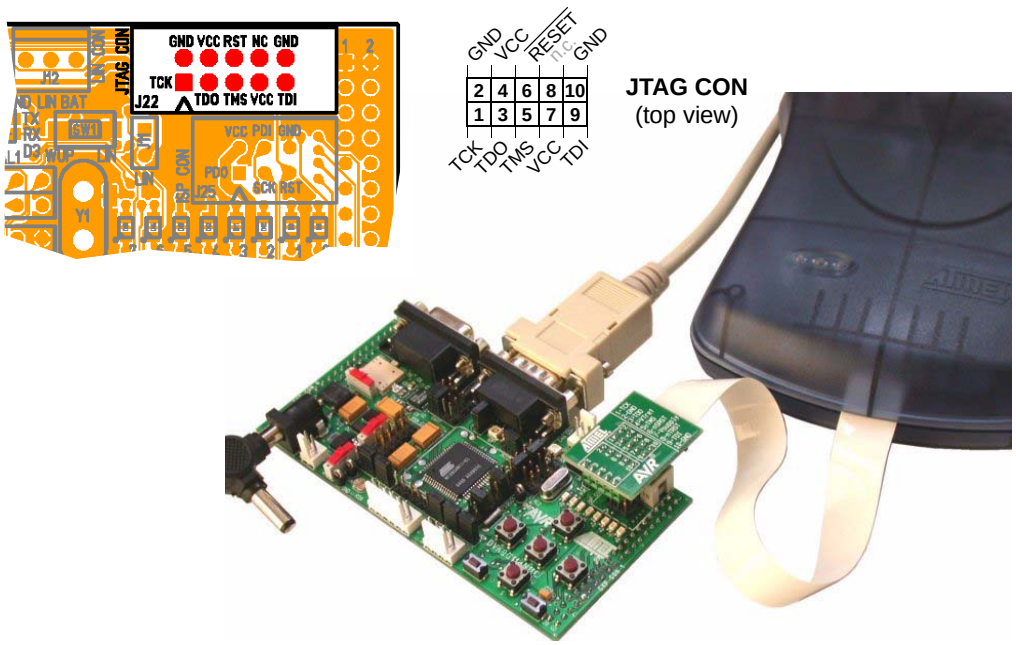


3.9.3 Programming with AVR JTAG ICE

The AT90CAN128 can be programmed using specific JTAG link. This sub section will explain how to connect and use the AVR JTAG ICE.

Note: When the JTAGEN Fuse is unprogrammed, the four TAP pins are normal port pins, and the TAP controller is in reset. When programmed, the input TAP signals are internally pulled high and the JTAG is enabled for Boundary-scan and programming. The AT90CAN128 device is shipped with this fuse programmed.

Figure 3-44 . Connecting AVR JTAG ICE to DVK90CAN1



The Flash, EEPROM and all Fuse and Lock Bit options ISP-programmable can be programmed individually or with the sequential automatic programming option.

Note: See AVR Studio® on-line Help for information.

3.10 Debugging

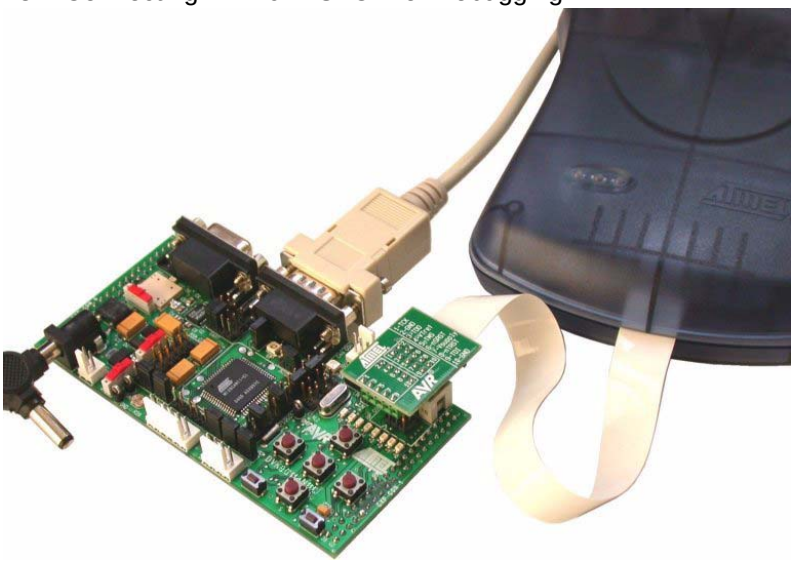
3.10.1 Debugging with AVR JTAG ICE

Every DVK90CAN1 can be used for debugging with JTAG ICE / JTAG ICE MK II.

For debugging, please refer to AVR Studio® Help information.

Note: “AT90CAN128 Plug-in” for AVR Studio®, available on our Web site, offers a dockable window displaying a full view (non-paginated) of the CAN mailbox providing an efficient debugging (JTAG ICE MK II only).

Figure 3-45 . Connecting AVR JTAG ICE for Debugging



3.10.2 Debugging with AVR ICE 50

Only a DVK90CAN1 provided with the TQFP-64 Personality Adapter can be used (c.f.Section "Using AVR ICE50", page 12).

For debugging, please refer to AVR Studio® Help information.

Note: "AT90CAN128 Plug-in" for AVR Studio®, available on our Web site, offers a "stop mode" and a dockable window displaying a full view (non-paginated) of the CAN mailbox providing an efficient debugging (JTAG ICE MK II only).

Figure 3-46 . Connecting AVR ICE 50 for Debugging



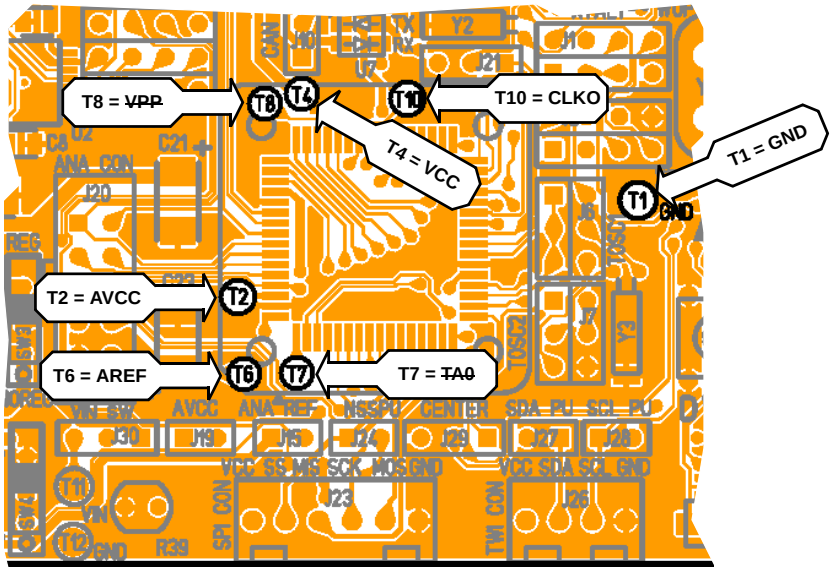
3.11 Test Points

Excepted for T1, all the test points are free of connection. These tests points are referred in the micro controller sheet of schematics.

There are 7 test points implemented close to AT90CAN128 micro-controller:

1. (T1) **GND** - Board reference voltage
2. (T6) **AREF** - Pin Analog Reference of AT90CAN128
3. (T4) **VCC** - Board and AT90CAN128 Power Supply
4. (T2) **AVCC** - Pin Analog Power Supply of AT90CAN128
5. (T7) **~~TA0~~** (no signal)
6. (T8) **~~VPP~~** (no signal, PG.2 signal only)
7. (T10) **CLKO** - Pin PortC.7/Clock Output of AT90CAN128 (c.f. AT90CAN128 Datasheet, sections “I/O Ports” and “Memory Programming”)

Figure 3-47 . AT90CAN128 Test Points



3.12 Configuration Pads

All configuration pads are located on the bottom side of the board. They are used to disconnect/connect on-board peripherals or elements.

The default configuration is: ***connect***.

3.12.1 Configuration Pads Listing

Table 3-18 . Configuration Pads

Config. Pads Reference	Related Signals	Function
CP1	RxCAN (PD6)	These configuration pads are used to disconnect/connect the CAN transceiver from AT90CAN128.
CP2	TxCAN (PD5)	
CP3	C-GND (GND)	This configuration pad is used to disconnect/connect the CAN Ground (C-GND) from DVK90CAN1 Ground (GND).
CP4	RxLIN (PD2)	These configuration pads are used to disconnect/connect the LIN transceiver from AT90CAN128.
CP5	$\overline{\text{SleepLIN}}$ (PD7)	
CP6	TxLIN (PD3)	
CP7	VCCµC (VCC)	This configuration pad is used to disconnect/connect the AT90CAN128 VCC (VCCµC) from DVK90CAN1 power supply (VCC). It is useful to measure the AT90CAN128 consumption.
CP8	AVCC (VCC)	This configuration pad is used to disconnect/connect the ferrite bar when AVCC is supplied to AT90CAN128 by VCC.
CP9	AVCC	This configuration pad is used to disconnect/connect the AT90CAN128 AVCC from DVK90CAN1 AVCC. It is useful to measure the analog AT90CAN128 consumption.
CP10	AUDIO-T (PB7)	This configuration pad is used to disconnect/connect the piezo audio transducer from AT90CAN128.
CP11	TEMP-S (PF0)	This configuration pad is used to disconnect/connect the temperature sensor from AT90CAN128, analog connector.
CP15	LIGHT-S (PF1)	This configuration pad is used to disconnect/connect the luminosity sensor from AT90CAN128.
CP17	VOLT-S (PF2)	This configuration pad is used to disconnect/connect the voltage reading from AT90CAN128.
CP12	LED-0 (PA0)	These configuration pads are used to disconnect/connect the 8-LED group from AT90CAN128.
CP13	LED-1 (PA1)	
CP14	LED-2 (PA2)	
CP16	LED-3 (PA3)	
CP18	LED-4 (PA4)	
CP19	LED-5 (PA5)	
CP20	LED-6 (PA6)	
CP21	LED-7 (PA7)	
CP22	$\overline{\text{NRESET}}$ ($\overline{\text{RESET}}$)	This configuration pad is used to disconnect the NRESET from application and re-connect the RESET pin of AT90CAN128 to +12Volts in case of parallel programming (EXP. CON 0 pin15 if STK500 used).

3.12.2 Configuration Pads - Disconnection

Figure 1. Configuration Pad - Disconnection



Cut Connection

3.12.3 Configuration Pads - Connection

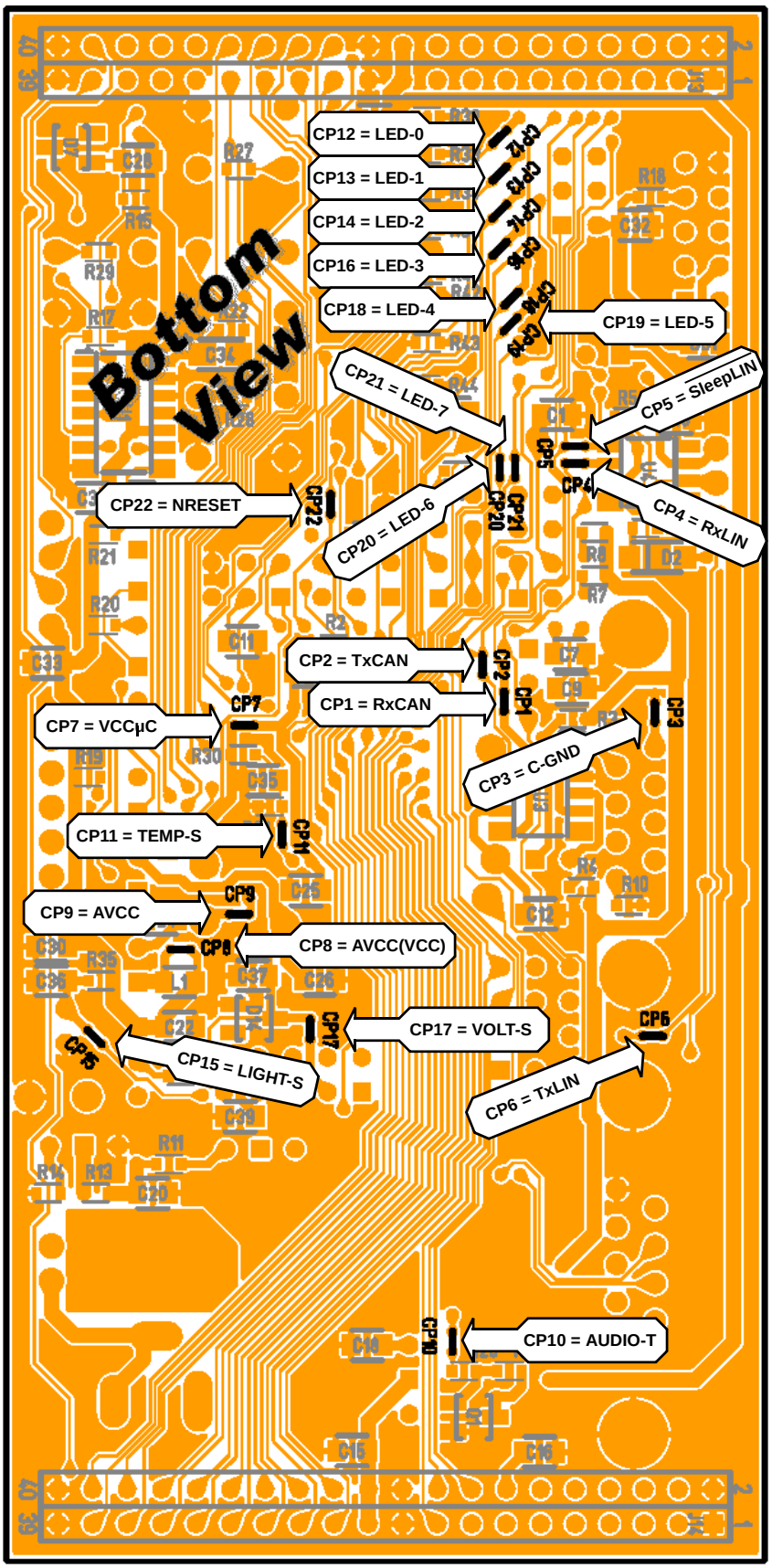
Figure 2. Configuration Pad - Re-connection



Droplet of Solder **Wire**

3.12.4 Configuration Pads - Location

Figure 3-48 . Configuration Pads Location (Board Bottom View)



Section 4

Basic Test Program

```
;**** S T K A N 1 1 - B A S I C  T E S T  P R O G R A M ***************
;*
;* Title  : Basic Test Program
;* Version: 1.0
;* Last updated: 14 May 2004
;* Target : AT90CAN128
;* Platform: AVRStudio Assembler
;*
;* DESCRIPTION:
;* This test program is a basic test for DVK90CAN1.
;* This program is a led chaser.
;* The led chaser is stopped in case of keyboard hit.
;*
;*********************************************************************

.include "can128def.inc"

;***** Global register variables

.def temp1=R16           ; first working register
.def temp2=R17           ; second working register

.cseg
.org 0

;***** Program Execution Starts Here

.equ MAX  =0xFF          ; Max value for 8-bit data
.equ ONE  =0x01          ; value=1 for 8-bit data

.equ DEL_H_VAL=0xFF      ; MSB of delay value
.equ DEL_L_VAL=0xFF      ; LSB of delay value

.equ MSK_E=0xF4          ; mask port E (keyboard)
.equ MSK_D=0x02          ; mask port D (keyboard)

;***** Test program

Reset:
          ldi  temp1, MAX
          out  DDRA, temp1         ; Init PortA direction

Loop_0:
          ldi  temp1, ONE
Loop_1:
          in   temp2, PINE         ; Wait if keyboard hit
```

```
            andi temp2, MSK_E
            brne Loop_1

            in   temp2, PIND
            andi temp2, MSK_D
            brne Loop_1

            out  PORTA, temp1        ; Output PortA value

Delay:
            ldi  R30, DEL_L_VAL      ; Init delay
            ldi  R31, DEL_H_VAL
            rjmp Delay_0
Delay_1:
            sbiw R31:R30, ONE
Delay_0:
            mov  temp1, R30
            or   temp1, R31
            brne Delay_1

Shift:
            in   temp1, PINA         ; Read PORTA
            lsl  temp1               ; Shift left
            brne Loop_1
            rjmp Loop_0
```

Section 5

Troubleshooting Guide

Figure 5-1 . Troubleshooting Guide

Problem	Reason	Solution
The Green “VCC-ON” LED is not on	No power supply	Switch-on the “POWER” switch
		Verify the power supply source
DVK90CAN1 does not work		Connect the DC power supply source
The AT90CAN128 cannot be prgrammed	The STK500 ISP header is not connected.	Connect a 6-pin flexible cable from STK500 ISP 6-PIN header to the correct DVK90CAN1 ISP header (page 37)
	The AVR ISP probe is not connected	Connect the AVR ISP 6-PIN header to the correct DVK90CAN1 ISP header (page 36)
	The AVR JTAG ICE probe is not connected	Connect the JTAG ICE 10-PIN header to the correct DVK90CAN1 JTAG header (page 37)
	The memory lock bits are programmed	Erase the memory before programming
	The fuse bits are wrong programmed	Check the fuse bits
	Programming too fast with ISP SPI	Check oscillator settings and make sure it is not set higher than SPI clock
AVR Studio does not detect the AVR tool used	Serial cable is not connected, or power is off	Connect serial cable to RS232 (STK500 - AVR ISP - JATG ICE) and check power connections
		Connect serial cable to USB (JATG ICE MKII) and check power connections
	PC COM port is in use	Disable other programs that are using PC COM port.
		Change PC COM port
	AVR Studio does not detect COM port.	Disable COM port auto-detection in AVR Studio file menu. Force COM port to correct COM port

Section 6

Technical Specifications

- **System Unit**
  - Physical Dimensions ..... L=119 x W=56 x H=27 mm
  - Weight ..... 60 g

- **Operating Conditions**
  - Voltage Supply ..... 2.7V - 5.5V

- **Connections**
  - RS 232C Connector ..... 9-pin D-SUB female
  - RS 232C Communications Maximum Speed ..... 250 kbps
  - CAN Connector ..... 9-pin D-SUB male
  - CAN Communications Maximum Speed ..... 1 Mbps
  - LIN Connector ..... 3-pin SIL male
  - LIN Communications Maximum Speed ..... 9600 bps
  - SPI Connector ..... 6-pin SIL male
  - SPI Communications Maximum Speed ..... 4 Mbps
  - TWI Connector ..... 64-pin SIL male
  - TWI Communications Maximum Speed ..... 400 kbps

Section 7

Technical Support

For Technical support, please contact avr@atmel.com. When requesting technical support, please include the following information:

- Which target AVR device is used (complete part number)
- Target voltage and speed
- Clock source and fuse setting of the AVR
- Programming method (ISP, JTAG or specific Boot-Loader)
- Hardware revisions of the AVR tools, found on the PCB
- Version number of AVR Studio. This can be found in the AVR Studio help menu.
- PC operating system and version/build
- PC processor type and speed
- A detailed description of the problem

Section 8

Complete Schematics

On the next pages, the following documents of DVK90CAN1 revision 4381A are shown:

- Complete schematics,
- Assembly drawing,
- Bill of materials.

Figure 8-1 . Schematics, 1 of 5

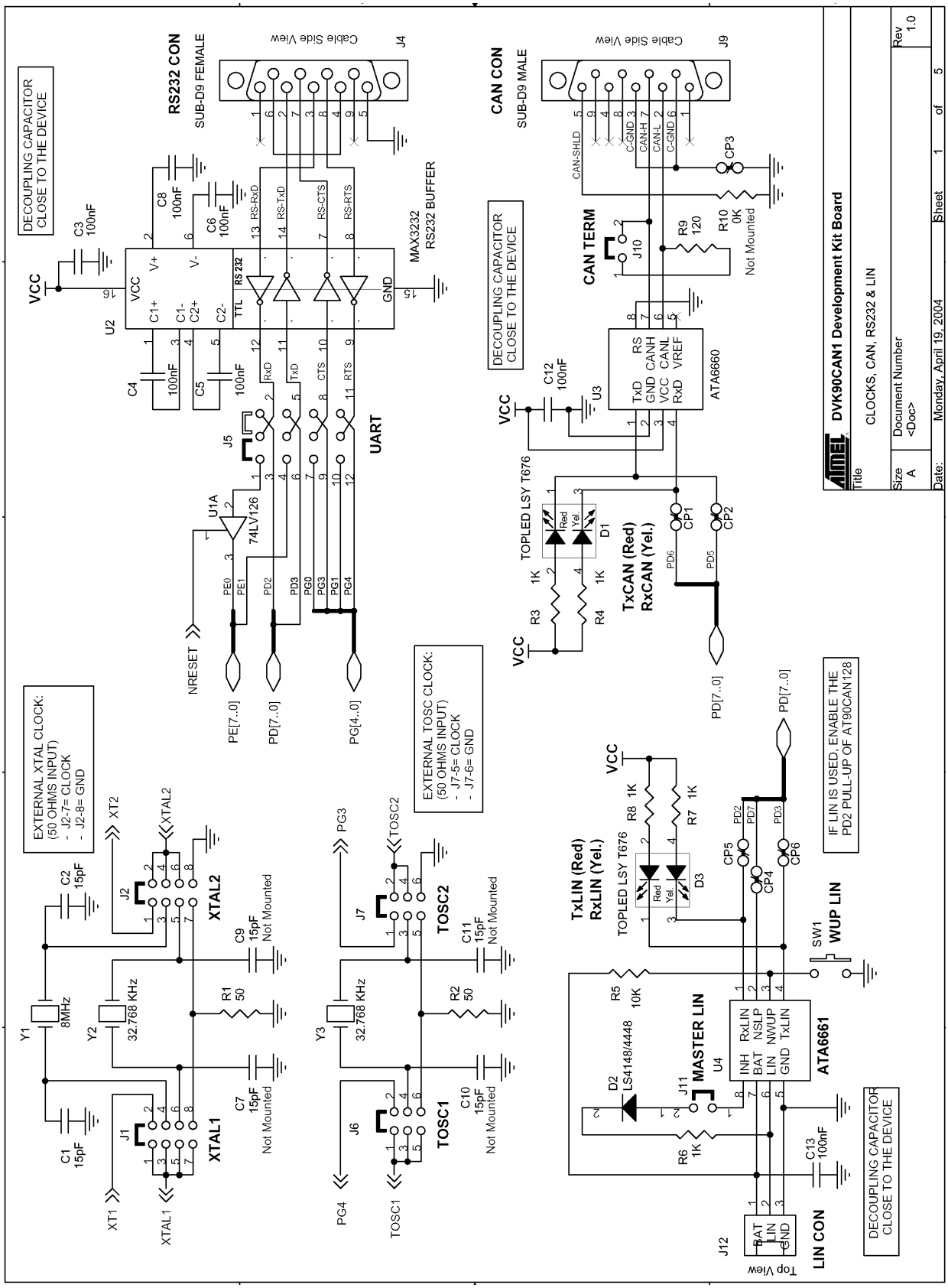


Figure 8-2 . Schematics, 2 of 5

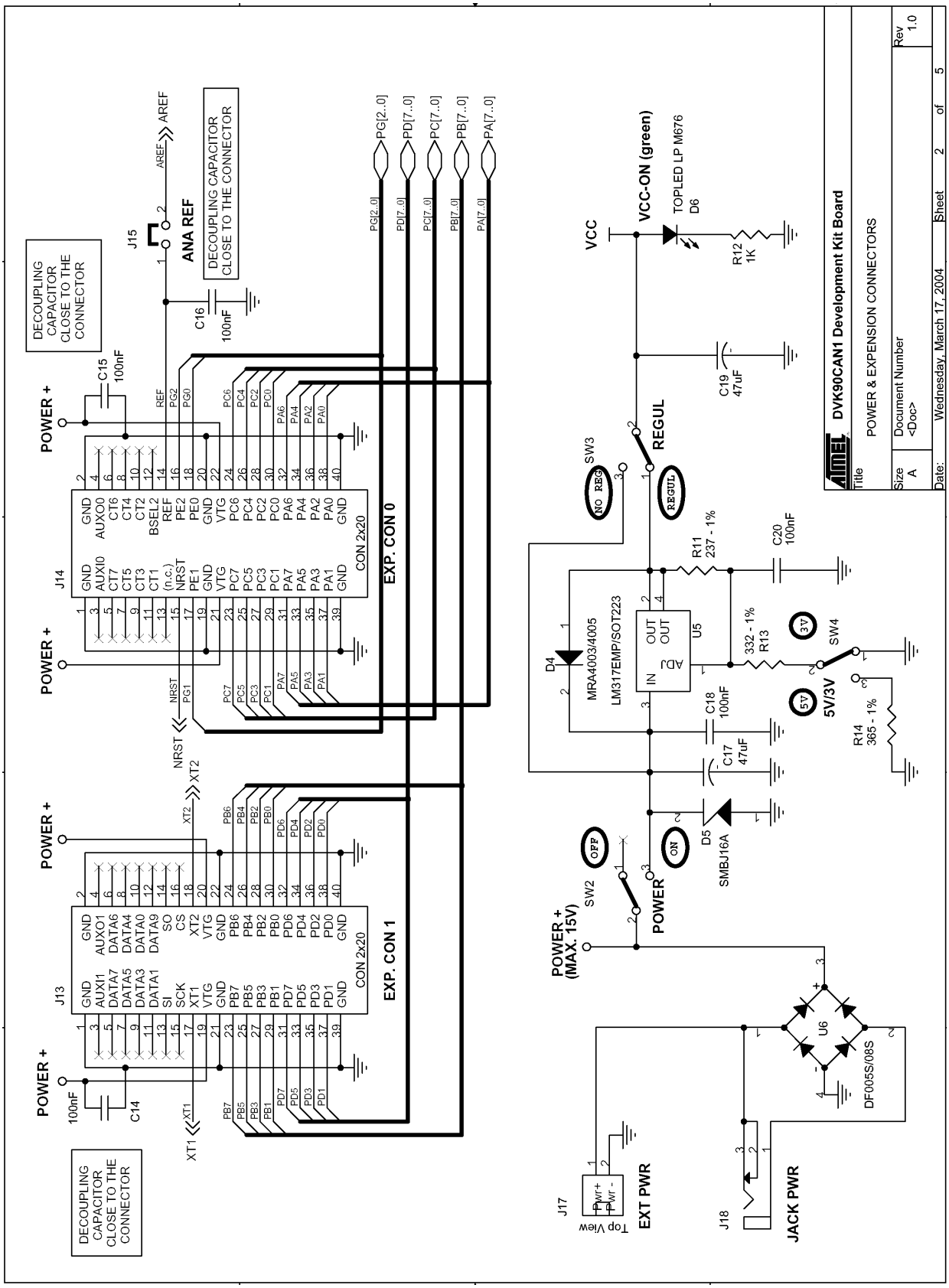


Figure 8-3 . Schematics, 3 of 5

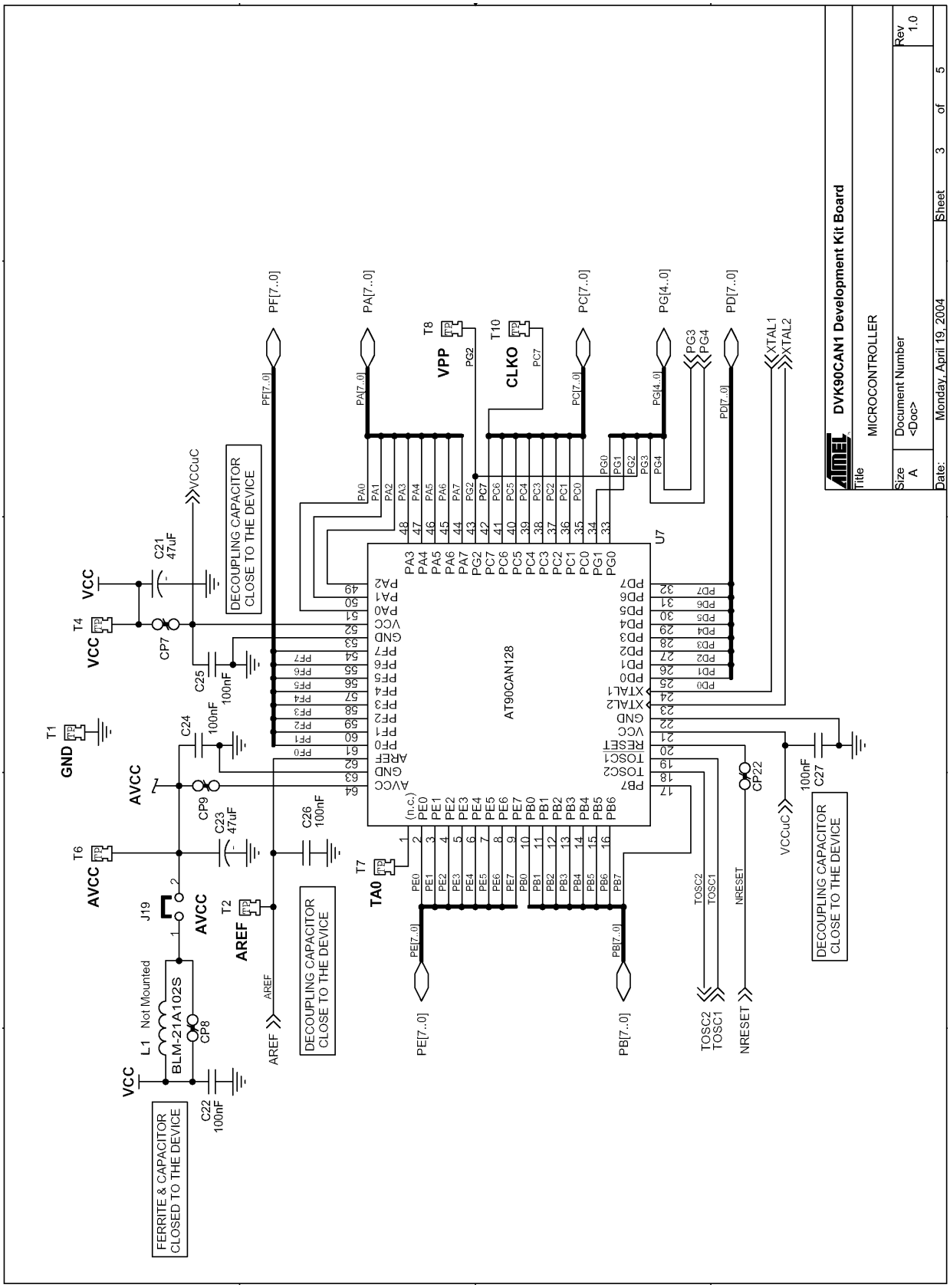


Figure 8-4 . Schematics, 4 of 5

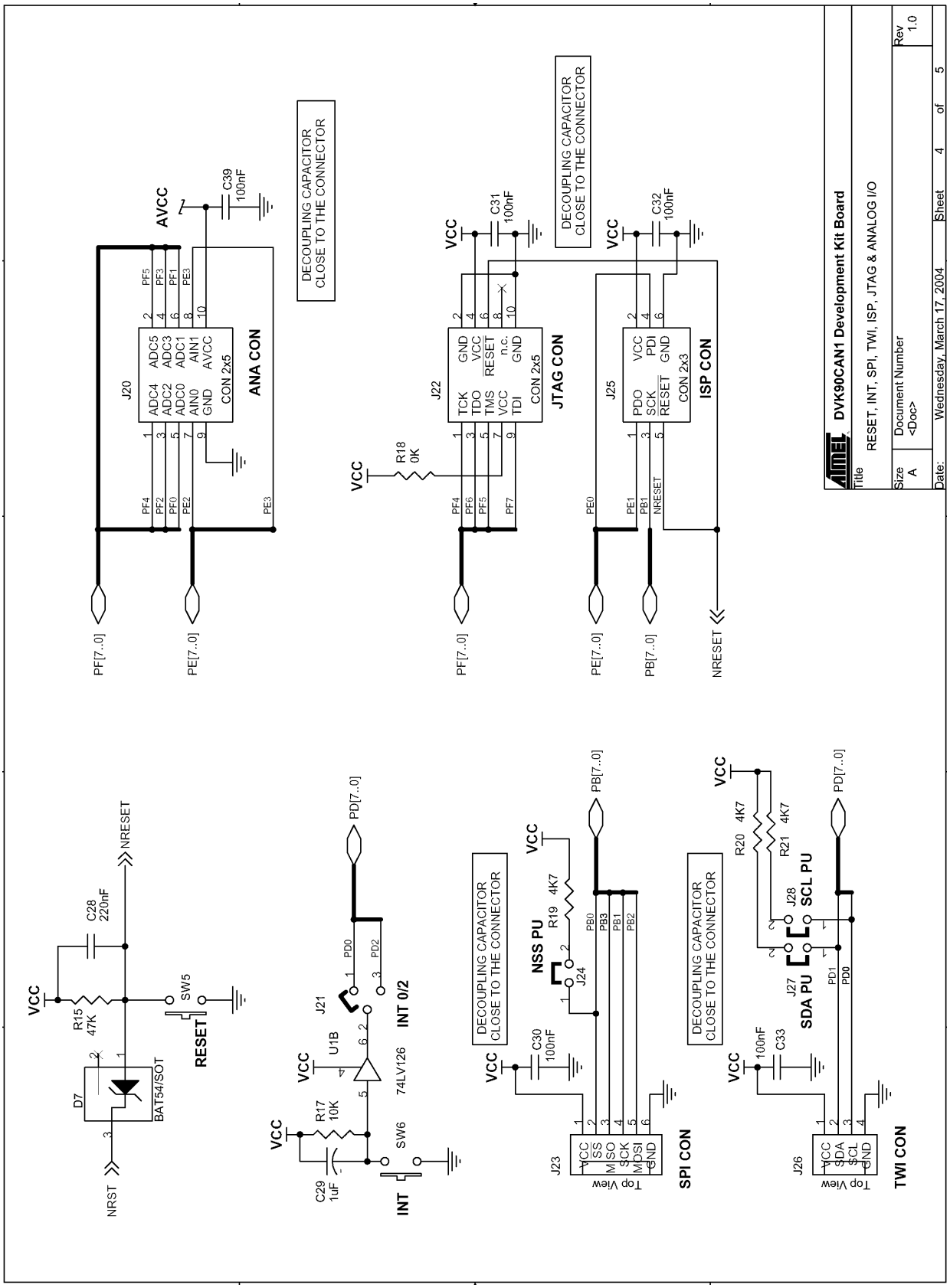


Figure 8-5 . Schematics, 5 of 5

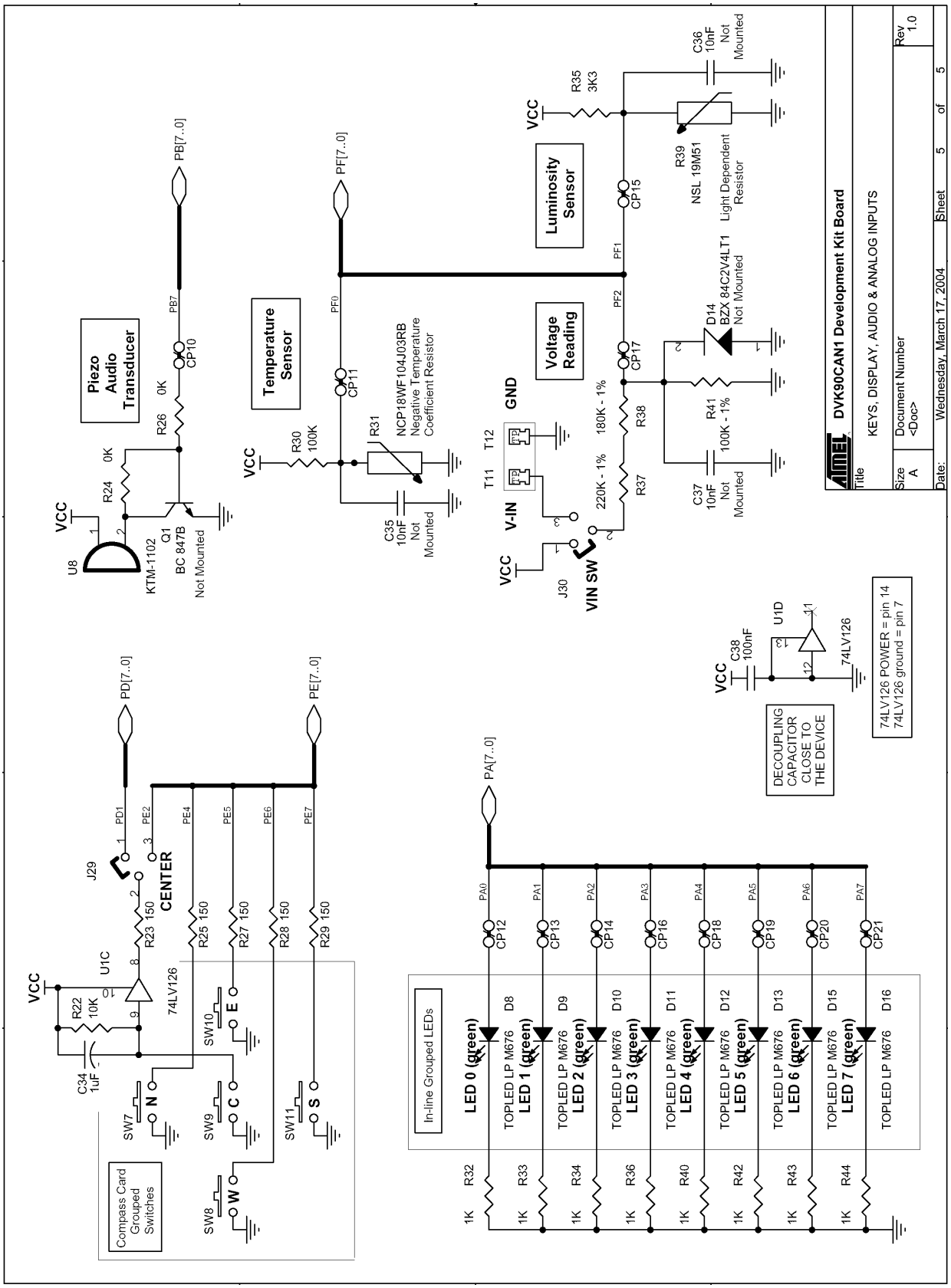


Figure 8-6 . Assembly Drawing, 1 of 2 (component side)

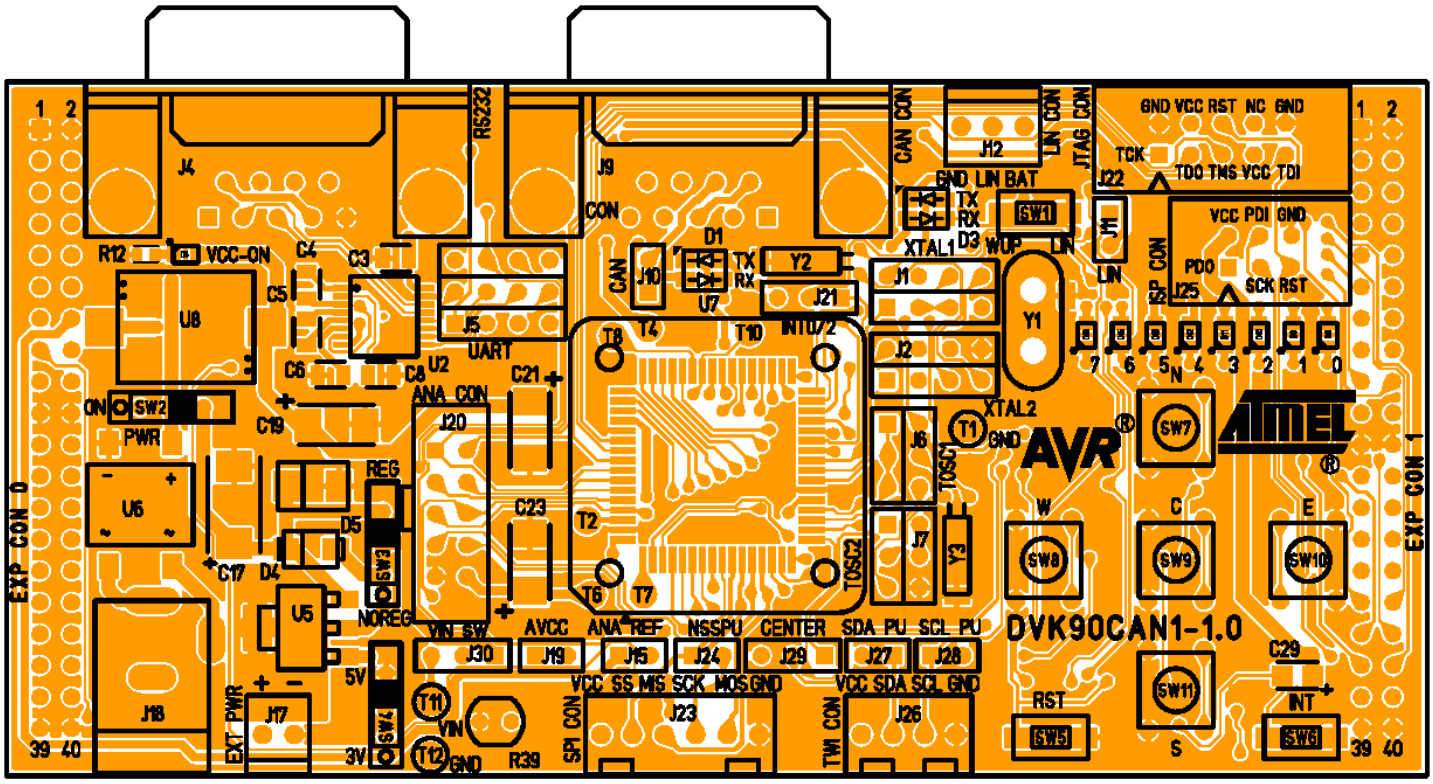


Figure 8-7 . Assembly Drawing, 2 of 2 (solder side)

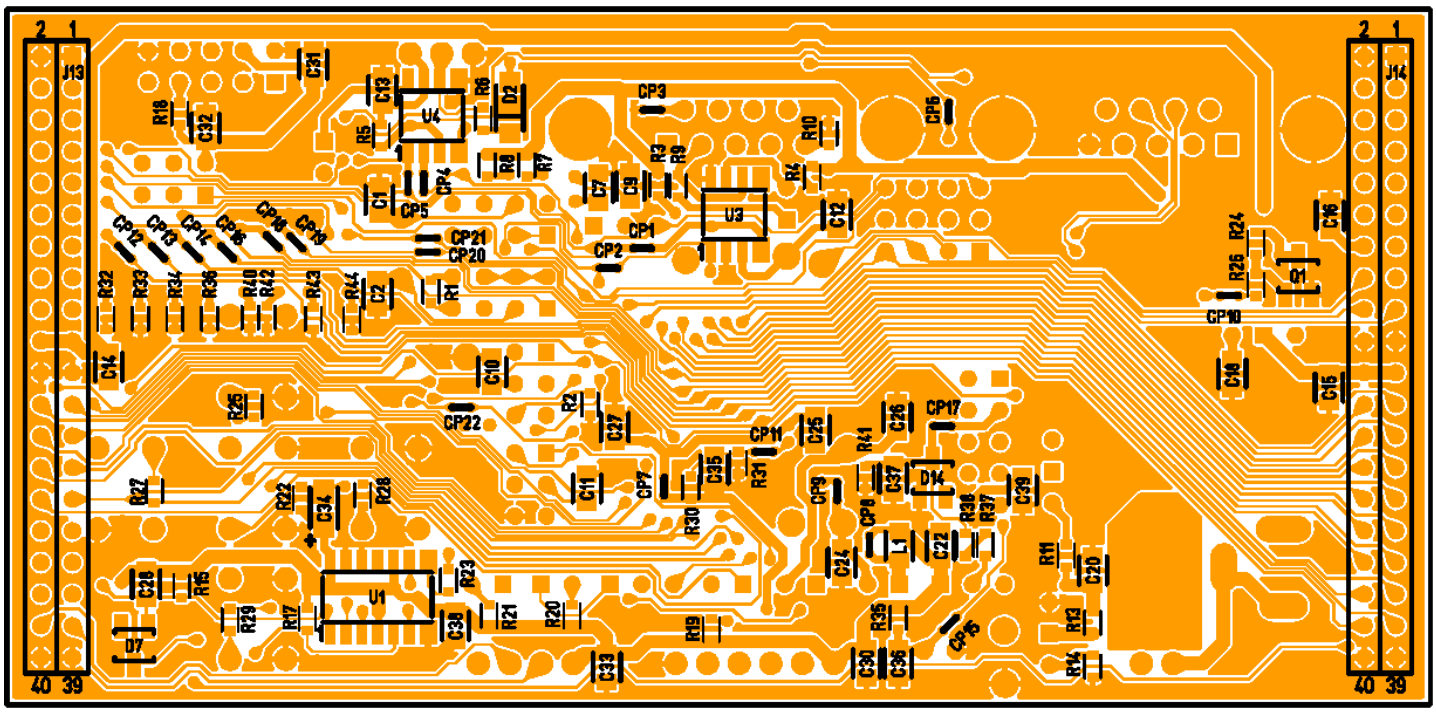


Table 8-1 . Bill of Materials

Item	Quantity	Reference	Part	Description	Package
1	6	C1, C2, C7, C9, C10, C11	15pF	50V-10% SMD Ceramic Capacitor	CASE 0805
2	3	C35, C36, C37	10nF	50V-10% SMD Ceramic Capacitor	CASE 0805
3	23	C3, C4, C5, C6, C8, C12, C13, C14, C15, C16, C18, C20, C22, C24, C25, C26, C27, C30, C31, C32, C33, C38, C39	100nF	50V-10% SMD Ceramic Capacitor	CASE 0805
4	1	C28	220nF	50V-10% SMD Ceramic Capacitor	CASE 0805
5	2	C29,C34	1uF	10V-10%SMD Polarized Capacitor	EIA/IECQ 3216
6	3	C19, C21, C23	47uF	10V-10%SMD Polarized Capacitor	EIA/IECQ 6032
7	1	C17	47uF	16V-10%SMD Polarized Capacitor	EIA/IECQ 7343
8	1	D2	LS4148/4448	Diode 0.30A	SOD80
9	1	D4	MRA4003/4005	Diode 1,0A	SMA
10	1	D5	SMBJ16A	Transil Diode 16V	DO214
11	1	D14	SOT23	Zener 2.4V	SOT23
12	1	D7	BAT54	Schottky Diode	SOT23
13	2	D1, D3	TOPLED LSY T676	Red & Yellow Double LED	PLCC-4
14	9	D6, D8, D9, D10, D11, D12, D13, D15, D16	TOPLED LP M670	Green LED	PLCC-2
15	7	J10, J11, J27, J24, J15, J19, J28	Jumper 1x2	Need 1 shunt	0,1" pitch
16	2	J6, J7	Jumper 2x3	Need 1 shunt	0,1" pitch
17	1	J25	Connector 2x3		0,1" pitch
18	2	J1, J2	Jumper 2x4	Need 1 shunt	0,1" pitch
19	1	J22	Connector HE10 male 10 pts		0,1" pitch
20	1	J20	Connector 2x5		0,1" pitch
21	2	J13, J14	Connector 2x20		0,1" pitch
22	3	J21, J29, J30	Jumper 1x3	1 shunt	0,1" pitch
23	1	J5	Jumper 3x4	4 shunts	0,1" pitch
24	1	J4	SUB-D9 Female	90° with harpoons	
25	1	J9	SUB-D9 Male	90° with harpoons	

Table 8-1 . Bill of Materials

Item	Quantity	Reference	Part	Description	Package
26	1	J17	MTA Connector 1x2	Vertical Connector	0,1" pitch
27	1	J12	MTA Connector 1x3	Vertical Connector	0,1" pitch
28	1	J26	MTA Connector 1x4	Vertical Connector	0,1" pitch
29	1	J23	MTA Connector 1x6	Vertical Connector	0,1" pitch
30	1	J18	JACK Female Connector	Int.Diam=2.5mm	PCB Embase
31	1	L1	BLM-21A102S	Ferrite Bead 1 KΩ @ 100 MHz	CASE 0805
32	1	Q1	BC 847B	NPN Ipeak=200mA	SOT23
33	4	R10, R18, R24, R26	0 Ω	SMD Resistor	CASE 0603
34	2	R1, R2	50 Ω (47 Ω)	1/16W-5% SMD Resistor	CASE 0603
35	1	R9	120 Ω	1/16W-5% SMD Resistor	CASE 0603
36	5	R23, R25, R27, R28, R29	150 Ω	1/16W-5% SMD Resistor	CASE 0603
37	14	R3, R4, R6, R7, R8, R12, R32, R33, R34, R36, R40, R42, R43, R44	1 KΩ	1/16W-5% SMD Resistor	CASE 0603
38	1	R35	3.3 KΩ	1/16W-5% SMD Resistor	CASE 0603
39	3	R19, R20, R21	4.7 KΩ	1/16W-5% SMD Resistor	CASE 0603
40	3	R5, R17, R22	10 KΩ	1/16W-5% SMD Resistor	CASE 0603
41	1	R15	47 KΩ	1/16W-5% SMD Resistor	CASE 0603
42	1	R30	100 KΩ	1/16W-5% SMD Resistor	CASE 0603
43	1	R11	237 Ω - 1%	0.1W-1% SMD Resistor	CASE 0603
44	1	R13	332 Ω - 1%	0.1W-1% SMD Resistor	CASE 0603
45	1	R14	365 Ω - 1%	0.1W-1% SMD Resistor	CASE 0603
46	1	R41	100 KΩ - 1%	1/16W-1% SMD Resistor	CASE 0603
47	1	R38	180 KΩ - 1%	1/16W-1% SMD Resistor	CASE 0603
48	1	R37	220 KΩ - 1%	1/16W-1% SMD Resistor	CASE 0603
49	1	R31	NCP18WF104J03	100 KΩ - ß=4250 SMD NTCR	CASE 0603
50	1	R39	NSL 19M51	20 MΩ Max. LDR	Entraxe=2.5mm
51	3	SW2, SW2, SW3	ON/OFF Switch	Std Cursor - Vertical	0,1" pitch
52	3	SW1, SW5, SW6	Smd Push Button	6x3.5 mm - 1.6N	
53	5	SW7, SW8, SW9, SW10, SW11	Push Button	6x6 mm - 1.2N	
54	9	T1, T2, T4, T6, T7, T8, T10, T11, T12	Test Pin		Diam.=1.32mm

Table 8-1 . Bill of Materials

Item	Quantity	Reference	Part	Description	Package
55	1	U1	74HC126	Tri-state Buffer	SOIC14
56	1	U2	MAX3232	RS232-C Buffer	SSOP16_
57	1	U3	ATA6660	ATMEL CAN Transceiver	SO8
58	1	U4	ATA6661	ATMEL LIN Transceiver	SO8
59	1	U5	LM317EMP	Regulator 1A	SOT223
60	1	U6	DF005S/08S	Bridge Rectifier	SMD specific
61	1	U7	AT90CAN128	ATMEL AVR μController	TQFP64
62	1	U8	KTM-1102	Piezo Audio Transducer	10x10mm
63	1	Y1	8MHz Crystal	H=4mm	HC49/4H
64	2	Y2, Y3	32.768 KHz Watch Crystal	Cylinder 2x6mm	Watch B

8.1 Document Revision History

8.1.1 4381B

1. RS-232 Setup modification. See, Table 3-6 on page 18.

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