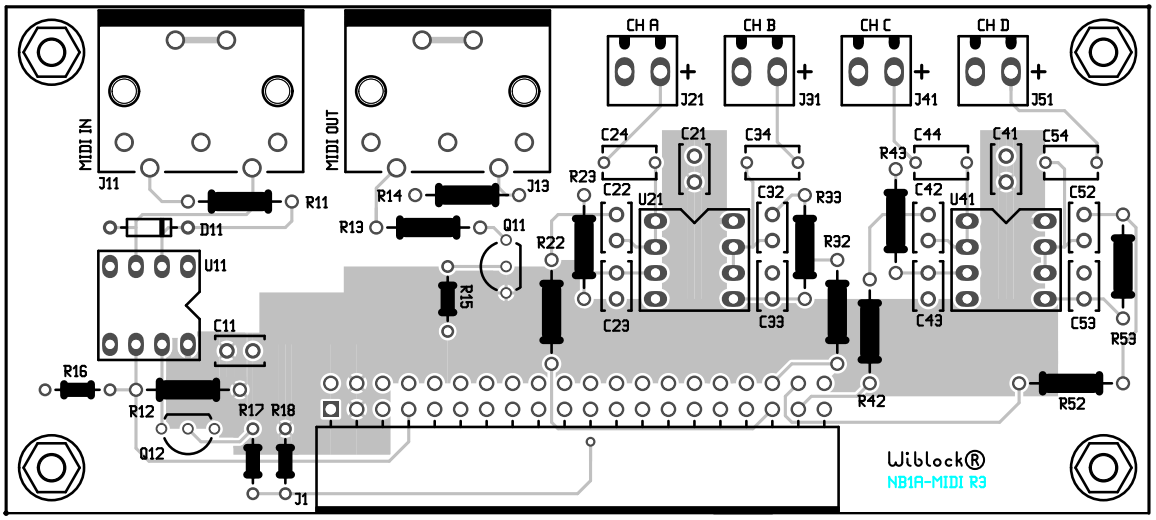

NB1A-MIDI Description

The NB1A-MIDI is a music peripheral card for the NB1A, NB1 and ZB1. The NB1A-MIDI features a MIDI input, MIDI output and four two-pole Sallen-Key filters. The DACs are used to smooth waveforms generated by an NB1A. Since there are no DACs on the NB1 and ZB1 only the MIDI input and output will be functional for these boards.

Features

- MIDI input and output per the MIDI 1.0 spec.
- MIDI input is disabled on boot-up.
- Four two-pole Sallen-Key filters for smoothing waveforms generated using the NB1A DAC.
- Works with MIDI.cpp version 3.

1 Assembling the NB1A-MIDI

Semiconductors are electrostatic-sensitive devices. Proper ESD handling precautions need to be taken to avoid damage.

The Bill of Materials (BOM) and Component List are in section 4. For full page assembly drawings see Figure 1 (top) and **??** (bottom).

1.1 MIDI Components

- R11, R12
  220Ω *red, red, black, black, brown*
- R13, R14
  180Ω *brown, gray, black, black, brown*
- R15, R17, R18
  10KΩ *(brown, black, black, red, brown)*
- R16
  100KΩ *(brown, black, black, orange, brown)*
- D11
  Line the cathode marking on D1 with the cathode marking on the silkscreen
- Q11
- Q12
- U11 (socket)
- J11, J13
- J1

1.2 Filter Components

- R22, R23, R32, R33, R42, R43, R52, R53
  10KΩ *(brown, black, black, red, brown)*
- U21, U41 (sockets)
- J21, J31, J41, J51
- B21 battery holder
- C21, C41
- C22, C23, C32, C33, C42, C43, C53, C54
- C24, C34, C44, C54

1.3 IC Installation and Test

1.3.1 U11 (6N138)

Remove U11 (6N138) from the antistatic foam and insert it into the socket aligning the notch in the IC package with the notch mark indicated on the PCB silkscreen. Be careful to align pins on both sides of the socket prior to pressing the IC into the socket.

1.3.2 U21, U41 (ATmega328P)

Remove U21 and U41 from the antistatic foam and insert each into the appropriate socket aligning the notch in the IC package with the notch mark indicated on the PCB silkscreen. Be careful to align pins on both sides of the socket prior to pressing the IC into the socket.

2 IO Connectors

J11 MIDI input

J13 MIDI output

J21 Channel A output

J31 Channel B output

J41 Channel C output

J51 Channel D output

3 MIDI Hints

3.1 MIDI Input

During bootup MIDI input is disabled. This is done so that the bootloader will not try to read serial data coming from MIDI port as input. The MIDI input is disabled by forcing the output of the opto-coupler (U11) high using the BJT Q12. The base of the BJT is connected to digital pin 6 (PD6).

After bootup it is necessary to enable MIDI by pulling the base of Q12 low. The code in Listing 1 enables MIDI input.

Listing 1: Enabling MIDI Input

```
//
// Enable MIDI input
//
pinMode(6, OUTPUT),
digitalWrite(6, LOW);
```

3.2 MIDI Input Example

Listing 2: MIDI Input Example

```
#include <MIDI.h>

//
//  Modified from MIDI_Basic_IO.pde
//  that is in the example directory
//  of the MIDI library
//
//  MIDI_Basic_IO by Franky 28/07/2009
//

//
// Constants for NB1A pins
//
// LED pin on NB1A
// MIDI input enable
//
#define LED        7
#define RX_ENABLE 6

// MIDI note number for middle C

#define MIDDLE_C 60

void play_note(uint8_t note_num) {
   MIDI.sendNoteOn(note_num,127,2);
   MIDI.sendNoteOff(note_num,0,2);
}

void setup() {
  pinMode(RX_ENABLE, OUTPUT),
  pinMode(LED, OUTPUT);
  digitalWrite(LED, LOW);
  digitalWrite(RX_ENABLE, LOW);
  MIDI.begin(2);
  MIDI.setInputChannel(MIDI_CHANNEL_OMNI);
  delay(1000);
  //
  // Play C Arpegio
  //
  play_note(MIDDLE_C);
  play_note(MIDDLE_C + 4);
  play_note(MIDDLE_C + 7);
  play_note(MIDDLE_C + 12);
}

void loop() {
  //
  // Is there a MIDI message?
  //
  if (MIDI.read()) {
    //
    // If the type of message
    // is a NoteOn then play
    // a middle-C
    //
    switch(MIDI.getType()) {
      case NoteOn:
        play_note(MIDDLE_C);
        break;
      default:
        break;
    }
  }
}
```

3.3 MIDI Output Example

Listing 3: MIDI Output Example

```
#include <MIDI.h>

//
//  Modified from MIDI_Basic_IO.pde
//  that is in the example directory
//  of the MIDI library
//
//  MIDI_Basic_IO by Franky 28/07/2009
//


//
// Constants for NB1A pins
//
// LED pin on NB1A
// MIDI input enable
//
#define LED        7
#define RX_ENABLE 6

// MIDI note number for middle C

#define MIDDLE_C 60
#define NOTE_DELAY     50

void setup() {
  pinMode(LED, OUTPUT);
  digitalWrite(LED, LOW);
  MIDI.begin(4); // input channel 4
}

void loop() {
  while(1) {
    //
    // Play a chromatic scale starting at
    // middle C
    //
    for (uint8_t i = 0; i <= 12; i++) {
      // start note
      MIDI.sendNoteOn(MIDDLE_C + i, 127, 2);
      digitalWrite(LED, HIGH);
      delay(NOTE_DELAY);
      // stop note
      MIDI.sendNoteOff(MIDDLE_C + i, 0, 2);
      digitalWrite(LED, LOW);
      delay(NOTE_DELAY);
    }
  }
}
```

References

Atmel. (2009). 8-bit AVR Microcontroller with 4/8/16/32K Bytes In-System Programmable Flash. (Retrieved March 14, 2009, from http://www.atmel.com/dyn/resources/prod_documents/doc8025.pdf)

4 Assembly Documentation and Schematics

Table 1: Bill of Materials

Kit: NB1A-MIDI-KIT

Qty	Reference	Part Number	Description
3	C11, C21, C41	CAPR-0U10-50V-X7R-100M	capacitor, ceramic, 0.1uF, 10%, 50V, X7R
8	C22, C23, C32, C33, C42, C43, C52, C53	Kemet_C320C472K1R5CA	
4	C24, C34, C44, C54	CAPR-10U0-10V-X5R-20T-5MM	capacitor, ceramic, 10uF, 20%, 10V, X5R
1	D11	DIOA-1N4148	diode, 1N4148
1	J1	HDRF_RA-20x2-100M	header, female, RA, 20x2, 100mils
2	J11, J13	CUI_SDS-50J	
4	J21, J31, J41, J51	CON_TB-2x1-3MM5	connector, terminal block, 2x1, 3.5mm centers
1	Q11	BJT-2N3906	BJT, 2N3906
1	Q12	BJT-2N3904	BJT, 2N3904
2	R11, R12	RES-220R-0W25-1T00	resistor, 220 Ohm, 1/4W, 1%
2	R13, R14	RES-180R-0W25-1T00	resistor, 180 Ohm, 1/4W, 1%
3	R15, R17, R18	RES-10K0-0W125-1T00	resistor, 10K, 1/8W, 1%
1	R16	RES-100K-0W125-1T00	resistor, 100K, 1/8W, 1%
8	R22, R23, R32, R33, R42, R43, R52, R53	RES-10K0-0W25-1T00	resistor, 10K, 1/4W, 1%
1	U11	Fairchild_6N138	
2	U21, U41	TI_TLC277CP	
3		DIP-8P-300M	DIP Socket, 8 Pin, 300mil centers
1		wiblock_NB1A-MIDI-PCB	

Table 2: Component List

Kit: NB1A-MIDI-KIT

Reference	Part Number	Description
C11	CAPR-0U10-50V-X7R-100M	capacitor, ceramic, 0.1uF, 10%, 50V, X7R
C21	CAPR-0U10-50V-X7R-100M	capacitor, ceramic, 0.1uF, 10%, 50V, X7R
C41	CAPR-0U10-50V-X7R-100M	capacitor, ceramic, 0.1uF, 10%, 50V, X7R
C22	Kemet_C320C472K1R5CA	
C23	Kemet_C320C472K1R5CA	
C32	Kemet_C320C472K1R5CA	
C33	Kemet_C320C472K1R5CA	
C42	Kemet_C320C472K1R5CA	
C43	Kemet_C320C472K1R5CA	
C52	Kemet_C320C472K1R5CA	
C53	Kemet_C320C472K1R5CA	
C24	CAPR-10U0-10V-X5R-20T-5MM	capacitor, ceramic, 10uF, 20%, 10V, X5R
C34	CAPR-10U0-10V-X5R-20T-5MM	capacitor, ceramic, 10uF, 20%, 10V, X5R
C44	CAPR-10U0-10V-X5R-20T-5MM	capacitor, ceramic, 10uF, 20%, 10V, X5R
C54	CAPR-10U0-10V-X5R-20T-5MM	capacitor, ceramic, 10uF, 20%, 10V, X5R
D11	DIOA-1N4148	diode, 1N4148
J1	HDRF_RA-20x2-100M	header, female, RA, 20x2, 100mils
J11	CUI_SDS-50J	
J13	CUI_SDS-50J	
J21	CON_TB-2x1-3MM5	connector, terminal block, 2x1, 3.5mm centers
J31	CON_TB-2x1-3MM5	connector, terminal block, 2x1, 3.5mm centers
J41	CON_TB-2x1-3MM5	connector, terminal block, 2x1, 3.5mm centers
J51	CON_TB-2x1-3MM5	connector, terminal block, 2x1, 3.5mm centers
Q11	BJT-2N3906	BJT, 2N3906
Q12	BJT-2N3904	BJT, 2N3904
R11	RES-220R-0W25-1T00	resistor, 220 Ohm, 1/4W, 1%
R12	RES-220R-0W25-1T00	resistor, 220 Ohm, 1/4W, 1%
R13	RES-180R-0W25-1T00	resistor, 180 Ohm, 1/4W, 1%
R14	RES-180R-0W25-1T00	resistor, 180 Ohm, 1/4W, 1%
R15	RES-10K0-0W125-1T00	resistor, 10K, 1/8W, 1%
R17	RES-10K0-0W125-1T00	resistor, 10K, 1/8W, 1%
R18	RES-10K0-0W125-1T00	resistor, 10K, 1/8W, 1%
R16	RES-100K-0W125-1T00	resistor, 100K, 1/8W, 1%
R22	RES-10K0-0W25-1T00	resistor, 10K, 1/4W, 1%
R23	RES-10K0-0W25-1T00	resistor, 10K, 1/4W, 1%
R32	RES-10K0-0W25-1T00	resistor, 10K, 1/4W, 1%
R33	RES-10K0-0W25-1T00	resistor, 10K, 1/4W, 1%
R42	RES-10K0-0W25-1T00	resistor, 10K, 1/4W, 1%
R43	RES-10K0-0W25-1T00	resistor, 10K, 1/4W, 1%
R52	RES-10K0-0W25-1T00	resistor, 10K, 1/4W, 1%
R53	RES-10K0-0W25-1T00	resistor, 10K, 1/4W, 1%
U11	Fairchild_6N138	
U21	TI_TLC277CP	
U41	TI_TLC277CP	
	DIP-8P-300M	DIP Socket, 8 Pin, 300mil centers
	wiblock_NB1A-MIDI-PCB	

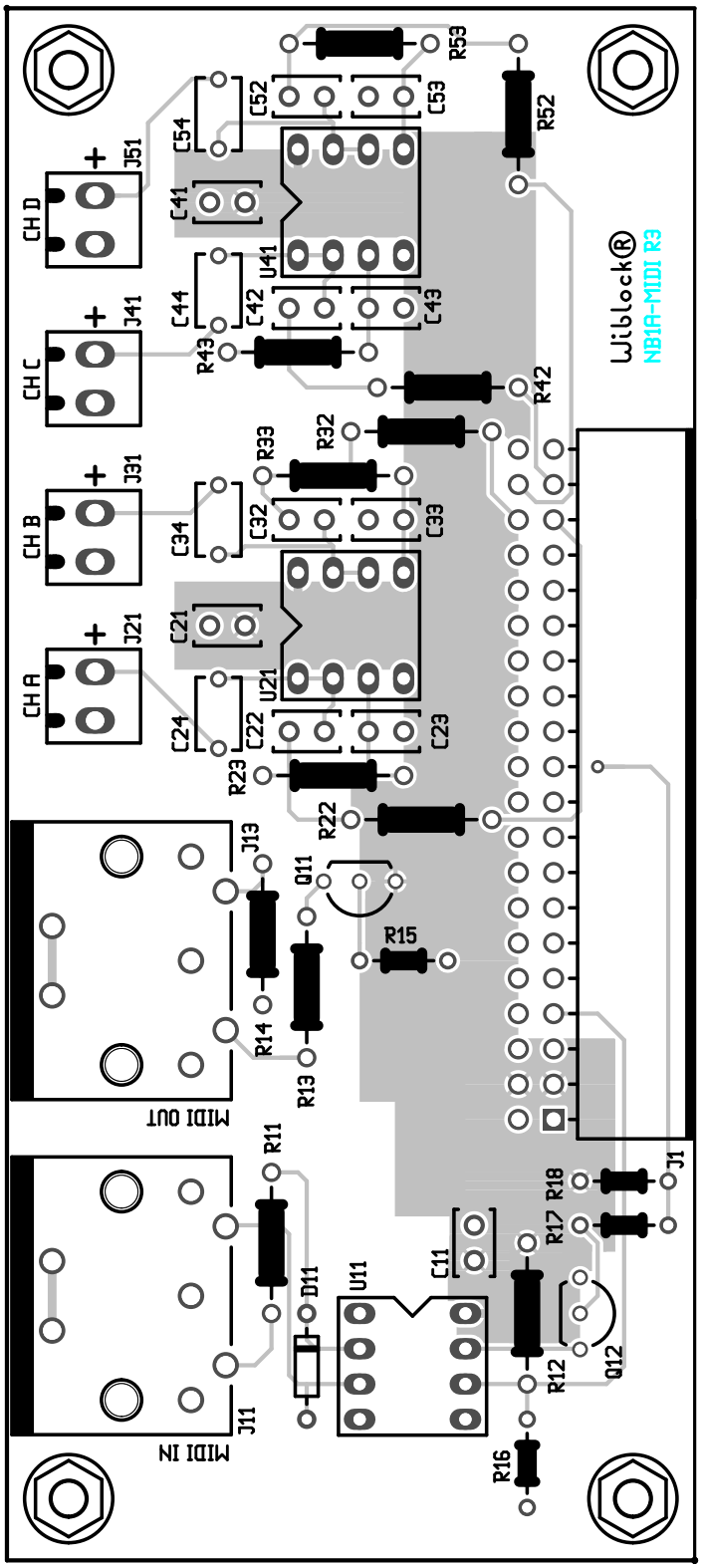

Figure 1: NB1A-MIDI Top Side Assembly Drawing (Rev 3)

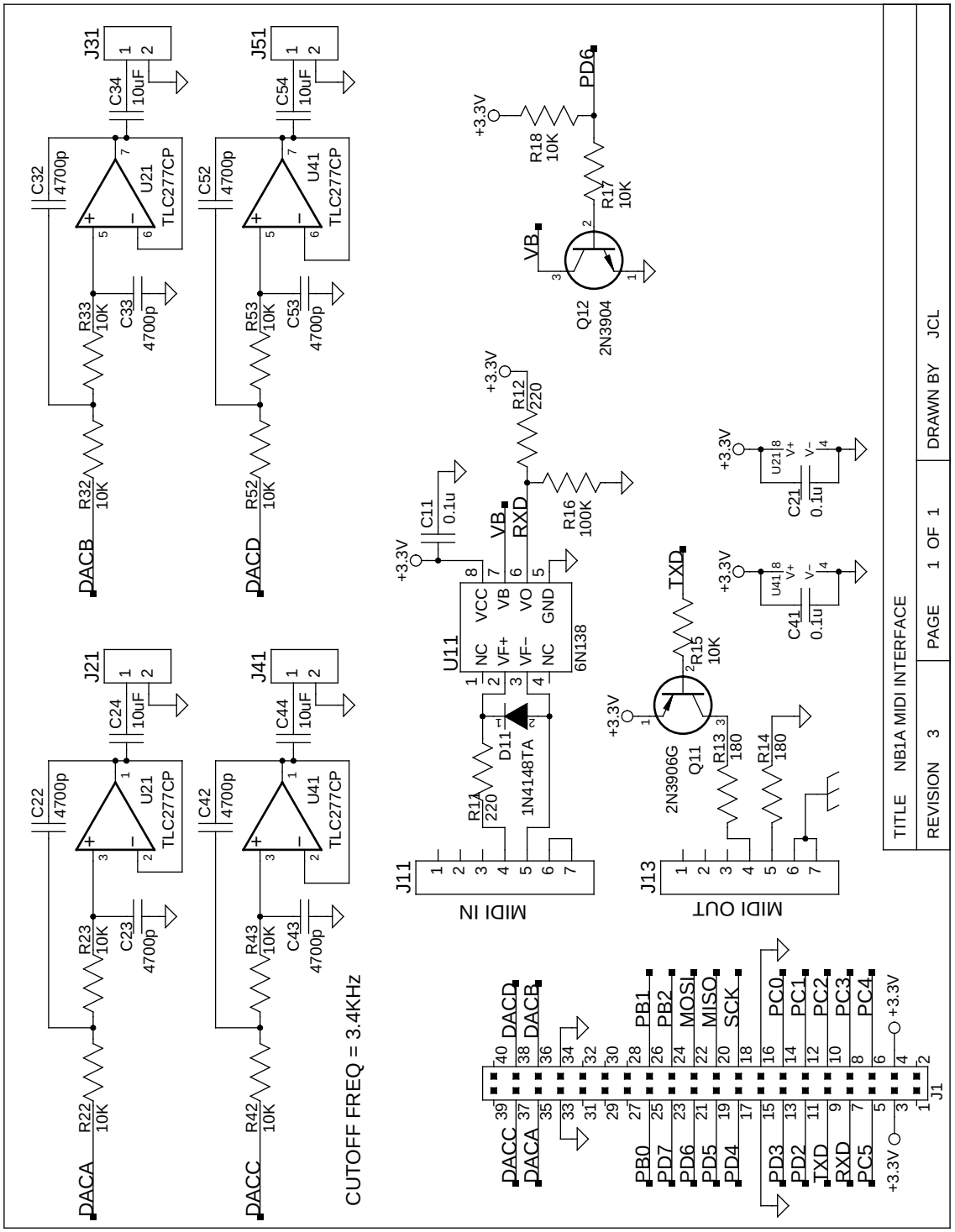

Figure 2: NB1A-MIDI (Rev 3)