

Figure 1: DynAMx Development Kit

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1.0 Overview

The DynAMx Development Kit is an easy-to-use platform designed to help you get started with implementing and testing your analog designs on the Okika Technologies DynAMx silicon devices.

This manual provides an overview on how to effectively use this board to implement your analog design. But first, here are some salient features of the DynAMx Development Kit:

DynAMx Development Kit Features

- Board footprint – 4.8 x 3.8 inches.
- Standard USB serial interface and PC serial interface for downloading Okika Technologies DynAMx Design Lab circuit configuration files.
- Ability to store configurations into onboard non-volatile memory.
- Ability to store configurations in the onboard Microcontroller. Utilizes Microchip PIC FLASH, once stored this configuration can be used as the Boot circuit.
- Ability to write to and then boot from EEPROM, (external EEPROM is not supplied, empty socket is onboard).
- Small footprint.
- Large breadboard area around the OTC24000 device.
- Header pins for all the OTC24000 device analog I/Os.
- Ability to separate, electrically and physically, the digital section.
- Two circuit footprints for configuration as Rauch filters, single to diff converters, level shifters etc.
- Daisy chain capability – that allows multiple boards to be connected to evaluate multi-chip systems.
- On-board 16-MHz oscillator module.

2.0 Layout

Figure 2 shows the layout of the board allowing easy location of all the components, power connections and jumpers.

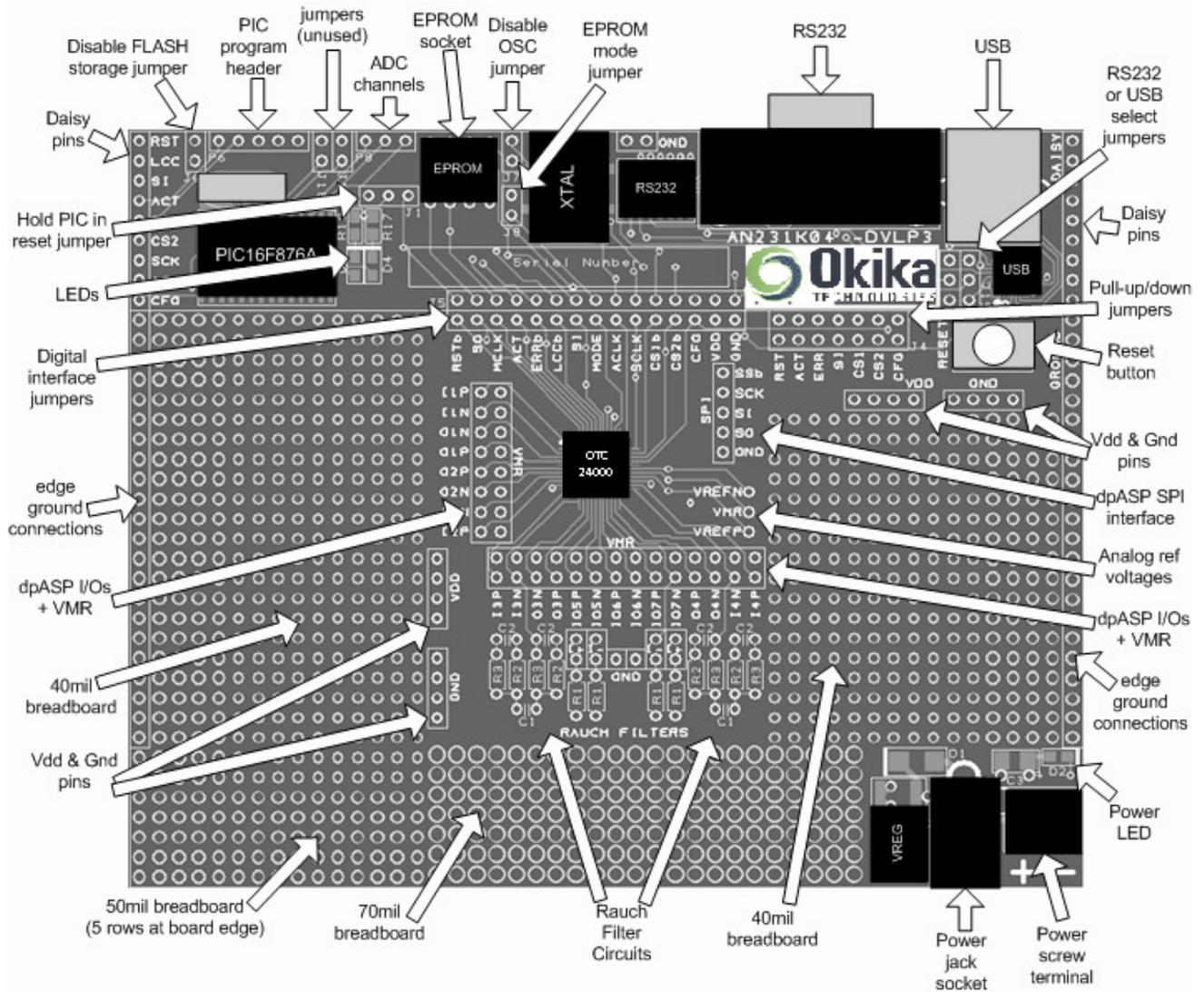


Figure 2: Top-level layout of the DynAMx Development Kit

3.0 Powering up the DynAMx Development Kit

The options for powering up the board are as follows:

- Connect a transformer with center voltage between +4V and +12V to the jack socket input, OR
- Connect wires from a single precision, regulated supply to the on-board 2-way terminal with the voltage set to between 4V and 12V.
- Okika Technologies recommends the use of a standard supply regulator or d.c. power supply with a regulated output of either 6 or 9 volt d.c.

Note: the board is protected against connection to a supply with the wrong polarity

Note: The power supply "jack socket" specification is 5.5mm outer conductor, 2.1mm inner connector, and inner (or center) connector is positive.

WARNING: the board should not be powered with more than 12.5V

There is a green LED to indicate that the board is successfully powered up. The board should take approximately 25mA when first powered up and before the OTC24000 is configured. The current after the OTC24000 is configured depends very much on the circuit programmed into it.

4.0 Programming the board

It is possible to physically connect both the RS232 and USB cables at the same time, however only one or the other is needed; please choose one and set the shorting link on the Development board appropriately to enable either USB or RS232.

4.1 Programming the Board (serial Interface – RS232)

Once the board has been powered up, simply connect the board to the serial port of a PC using a standard RS232 cable. Check the position of Jumper pair J15, both jumpers should be in the upper position.

Open Okika DynAMx Design Lab software on the PC, create a circuit and click on Configure. If configuration is successful, the green LED next to the PIC in the digital section will illuminate.

If the red LED illuminates then the configuration failed. If this happens then check the supply to the board and check that the pins marked VDD have +3.3V on them. Also check that the jumpers are in their default state (see figure 3 in section 7). Press the reset button and try again.

If configuration was successful then the circuit created in Okika DynAMx Design Lab software will be programmed into the OTC24000. The analog inputs and outputs can be accessed via the header pins that surround the OTC24000. Note that the outer rings of pins are connected to the OTC24000 analog I/Os, the inner ring of pins are all connected to VMR which is at analog signal ground (+1.5V).

4.2 Programming the Board (USB serial Interface)

Introduction

The DynAMx Development Kit's board uses a Silicon Labs **USB to UART Bridge**, this device uses a standard USB cable, installs like a USB port but internally to the PC and software it appears as a Serial port.

Check the position of Jumper pair J15, both jumpers should be in the upper position.

Driver Installation

Do not connect the board to your PC via the USB cable nor start the board GUI at this time - the driver must be installed first.

It is assumed that Okika DynAMx Design Lab software is already installed and registered on your PC. The following steps can be used to install the drivers:

- 1) Download the drivers from <https://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>
- 2) Remove old drivers that have previously been installed. For Windows systems, open the Add or Remove Programs window from the Control Panel. Next, select each CP210x entry and click on Remove.
- 3) Run the driver executable that was downloaded in step 1, CP210x_Drivers.exe, to extract the device drivers included with this release (this application is tested with Windows Only). The default installation directory for these extracted files is "C:\Silabs\Mcu\CP210x". To complete the driver installation.....
- 4) Connect the DynAMx Development Kit board and power it up.
- 5) Install the new drivers. For Windows systems, the Add New Hardware Wizard should open when this new device is detected. Use the wizard to install the drivers by directing it to the "C:\SiLabs\MCU\CP210x\WIN" directory created in step 4.
- 6) The hardware wizard will install CP210x Composite device, then the CP2102 USB to UART Bridge Controller Drivers.

The drivers are now installed.

NOTE: Driver installation and Port selection is only needed ONCE.
If you subsequently plug into a different USB controller on your PC you may need to repeat step 6.

Board use – following driver installation is same as with the RS232 port.

Open Okika DynAMx Design Lab software on the PC, create a circuit and click on Configure. If configuration is successful, the green LED next to the PIC in the digital section will illuminate.

If the red LED illuminates then the configuration failed. If this happens then check the supply to the board and check that the pins marked VDD have +3.3V on them. Also check that the jumpers are in their default state (see figure 3 in section 7). Press the reset button and try again.

If configuration was successful then the circuit created in Okika DynAMx Design Lab software will be programmed into the OTC24000. The analog inputs and outputs can be accessed via the header pins that surround the OTC24000.

Note that the outer ring of pins are connected to the analog I/Os, the inner ring of pins are all connected to VMR which is at analog signal ground (+1.5V).

5.0 Evaluating Multi-chip Designs – Daisy Chaining

The DynAMx Development board supports daisy chaining multiple boards together to simplify programming when multiple OTC24000 chips are needed. Daisy chaining boards is out of scope for this document. Contact Okika Technologies for more information.

6.0 Other Features

6.1 V_{REF} Pins

The 3 reference pins on the OTC24000 device – VMR (+1.5V), VREFP (+2.5V) and VREFN (+0.5V) – have been connected via the p.c.b. tracks to the 3 holes to the right of the OTC24000 (see figure 2). In addition, VMR is available on the inner ring or inner two rows of pins that are adjacent to the analog I/Os.

NOTE: These reference voltages are not designed to provide current.

6.2 Header Pins

All of the analog I/Os of the OTC24000 are brought out to header pins for easy connection. Next to these header pins is a second row of header pins connected to VMR (+1.5V). This allows the user to connect any OTC24000 analog I/O to VMR using shorting jumpers, resistor jumpers or capacitor jumpers. A shorting link (jumper) should only be used when the I/O cell is configured as an input. Damage may occur to the device if an output is shorted to VMR.

6.3 EEPROM

There is an SPI EEPROM socket in the digital section of the board. To put the board into EEPROM mode, starting from the default jumper position (detailed below, section 7):

1. Put a jumper onto J8 which sits right next to the EPROM socket, and
2. Put a jumper on J4 in the position marked SI so that this pin is connected to a pull-down.
3. Make sure that there are jumpers on J5 in the positions marked GND, VDD, CFG, ACLK, SI, MCLK and SO (it is OK to put jumpers in all positions of J5).
4. Move the jumper on J1 to the left to disable the PIC.

Press the “reset” button to download the circuit from the EPROM into the OTC24000.

Note that an EEPROM integrated circuit is not supplied with this Development Kit. If you wish to use an SPI EEPROM, source one and place it in to the socket on the board. An example of a compatible SPI EPROM is the Atmel AT25080.

To write the EPROM follow this procedure:

1. With the board powered down, place a jumper on J8 to put the board in EEPROM mode.
2. Make sure that the jumper J1 is placed to the right to enable the PIC.
3. Make sure that there is no jumper on J6 (FLASH storage must be enabled to write the EEPROM).
4. Remove the jumpers marked MCLK and SO from the digital interface J5.
5. Power up the board and configure it in the usual way with the circuit that is required to be stored in EEPROM.
6. Power down the board and replace the jumpers marked MCLK and SO on the digital interface J5.
7. Move the jumper J1 to the left to disable the PIC.
8. Keep the jumper on J8. Also make sure that there is a jumper on J4 in the SI position.
9. Power up the board and it will configure from the EPROM. Resetting the board will also cause it to be configured from the EEPROM. Note that there will be no LEDs lit to show that the configuration was successful. This is because the LEDs are driven by the PIC and this is disabled when booting from EEPROM.

* NOTE: before configuring the board, a setting needs to be changed in Okika DynAMx Design Lab software if the circuit is to be stored in EEPROM. To change this setting, go to the Settings menu in DynAMx Design Lab, select Active Chip Settings, then select the Chip tab. In the pull-down menu labelled “How is this mode pin connected on the target board?” select “Mode pin has been tied high (VDD)”. Click on OK. Then configure the board. If an EEPROM programmer is used to program the EPROM, this setting still needs to be changed in Okika DynAMx Design Lab software before generating the data for programming into the EEPROM.

6.4 Reset Button

There is a reset button near the upper right corner of the board. This resets both the OTC24000 and the PIC (unless the PORb jumper is removed from J5 or the J1 jumper is in the left position).

In EEPROM mode, press the reset button to load the circuit from the EEPROM into the OTC24000.

6.5 SPI Port

There is an SPI port for direct control of the OTC24000 by an external SPI controller. Note that all the jumpers should be removed from J5 when the SPI port is used. (see the OTC24000-EVK OTC24000 specification and use guide for details of this SPI connection)

6.6 Digital Section

The digital section of the Development board is provided only so that there is a convenient (serial) interface from the board to a PC to enable direct configuration (instant prototyping) of the OTC24000 from Okika DynAMx Design Lab software. Normal use of the OTC24000 does not require this digital interface; the OTC24000 can be programmed directly from an SPI interface. It is convenient when first developing an analog circuit within the OTC24000 to have the direct interface to Okika Technologies DynAMx Design Lab. When the circuit(s) are implemented into a final design either a host uP (or DSP) or an EEPROM is normally used to store and configure the OTC24000.

The digital section of the board includes an RS-232 transceiver, a USB transceiver and a PIC microcontroller (to perform serial ASCII to bit conversion). It also includes a green LED (to indicate successful configuration), and a red LED (to indicate failed configuration).

The digital section sits along the top side of the board and is connected to the rest of the board by a set of jumpers J5. It is possible to cut away the digital section to leave a purely analog board with header pins on the edge to provide an external digital interface.

If the digital section of the development board is removed or ignored (by pulling jumpers J5), the OTC24000 can be configured directly using any processor with an SPI interface (or port configured with appropriate signals) by connecting signals directly to the OTC24000 side of J5 or by connecting to the set of pins marked "SPI". Full dynamic control of the OTC24000's analog circuitry can be realized under software control via this connection.

Note

Okika Technologies does not recommend any specific processor/controllers – our products work with most processors.

Okika Technologies recommends that our customers use their own processor development boards and connect via jumper J5 to Okika Technologies' OTC24000 for full dynamic control of the OTC24000, in preference to re-engineering the digital section of this development board.

6.7 FLASH Storage

In FLASH storage mode, all primary configurations sent to the development board are stored in the FLASH of the PIC. The last configuration sent will be stored. This means that after the board has been configured, it will remember the last configuration it was sent after being reset or board power being cycling off and on. Note that when chaining boards, the primary configurations for all devices in the chain will be stored. Reconfigurations are not stored.

The FLASH memory can be cleared by briefly shorting the jumper J6.

If FLASH storage of primary configurations is not wanted then a jumper should be placed permanently on J6 to disable this feature.

7.0 Jumpers

Table 1 shows a complete list of the jumpers on the board and figure 3 shows their positions.

| Jumper | Function | Default State | Default Condition |
|--------|--|----------------------------------|---|
| J1 | This jumper allows the MCLRb pin of the PIC to either be connected to the PORb pin of the OTC24000 or to be grounded. Grounding the MCLRb pin tristates all of the PIC I/Os and thus allows connection of another controller or EPROM to the digital pins of the OTC24000. Useful for daisy chaining boards where one PIC controls 2 or more OTC24000s, and also for using an EPROM. | Jumper to right | MCLRb pin of PIC is connected to PORb pin of OTC24000. |
| J4 | Connects pull-ups and downs to some of the OTC24000 digital pins, or ties CS1b low. A jumper in place connects the pull-up/down in the following way: POR – 10k pull-up on PORb ACT – 10k pull-up on ACTIVATE ERR – 10k pull-up on ERRb SI – 10k pull-down on SI CS1 – ties CS1b low CS2 – 10k pull-down on CS2b CFG – 10k pull-up on CFGFLG | Jumpers on POR, ERR, CS1 and CS2 | PORb is pulled high, ERRb is pulled high, CS1b is tied low and CS2b is pulled low. |
| J5 | Connects the digital section to the analog section | All 15 jumpers should be on. | Fully connects power, ground and all OTC24000 digital signals to the digital section. |
| J6 | Disables the storage of primary configurations in the PIC's FLASH. If the jumper is left off, the board will remember the last primary configuration after reset or power cycling. Briefly shorting this jumper will cause the configuration memory to be cleared. | Jumper on | Not in primary configuration storage mode. |
| J7 | A jumper on J7 will disable the 16MHz oscillator module and tristate its output. This means that the ACLK pin of the OTC24000 will not be clocked. Useful in daisy chaining boards where the ACLK pin of 2 or more OTC24000s should be driven by one source. | Jumper off | 16MHz oscillator enabled. |
| J8 | A jumper on J8 enables EPROM mode. Boot from EPROM, SPI master mode. Also allows writing of configurations to the EPROM. | Jumper off | Board in micro mode (SPI is a slave). |
| J15 | 2 jumpers select if the board is in RS232 mode or USB mode. Place both jumpers in the upper position for RS232, in the lower position for USB. | Both jumpers in upper position | Board in RS232 mode. |

Table 1: Summary of Development Board Jumpers

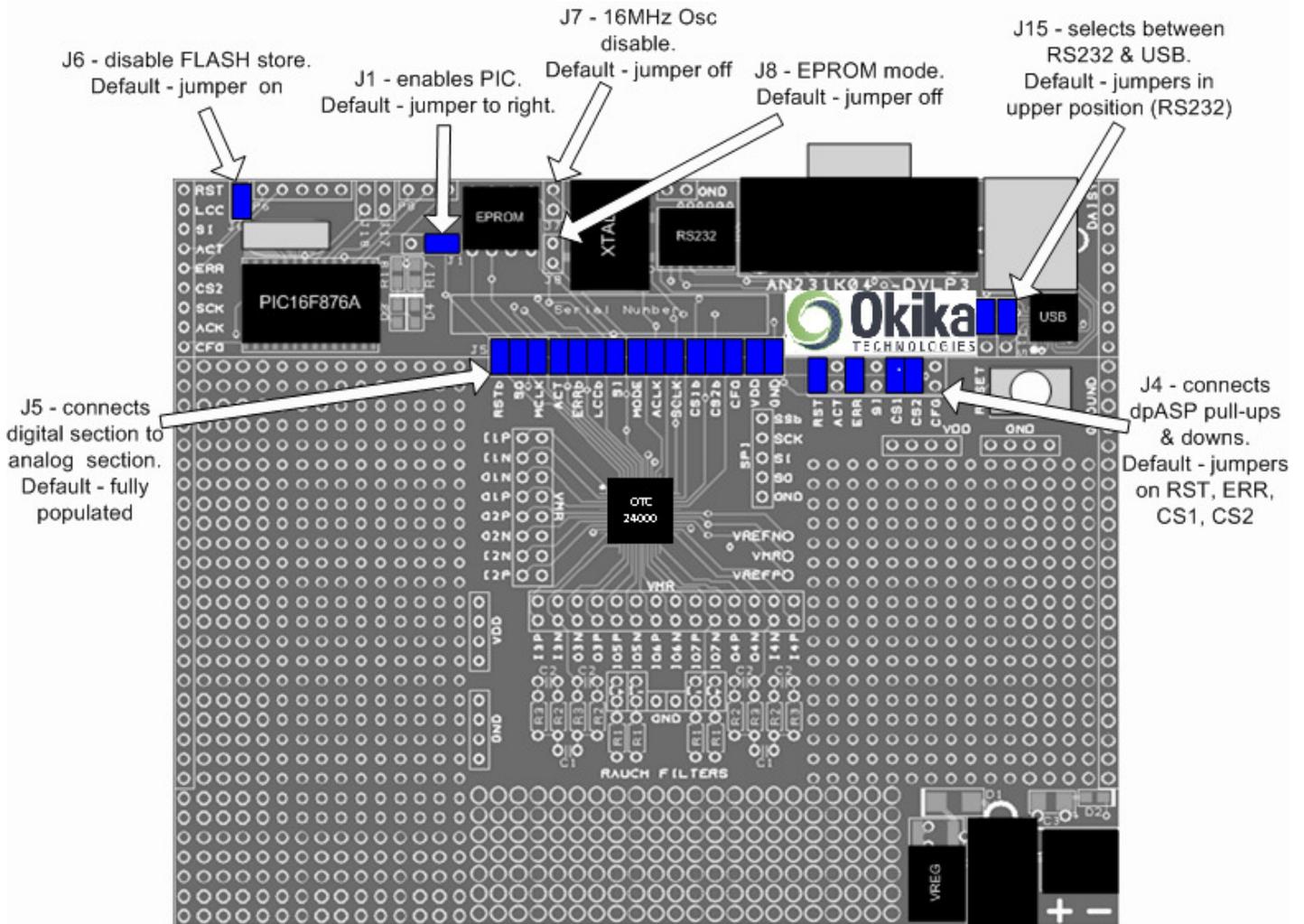
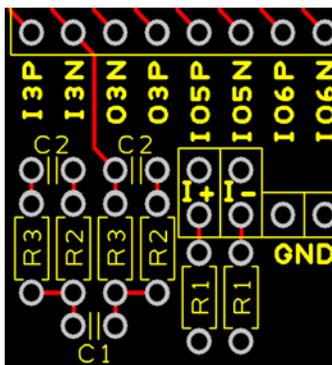


Figure 3: Positions of Jumpers and Default Settings

8.0 Rauch Filters

The DynAMx Development Kit's printed circuit board has an available option for you to use to add Rauch filters, at either the analog input signal path, output signal path or neither. Figure 5 details two suggested Rauch filter circuits.

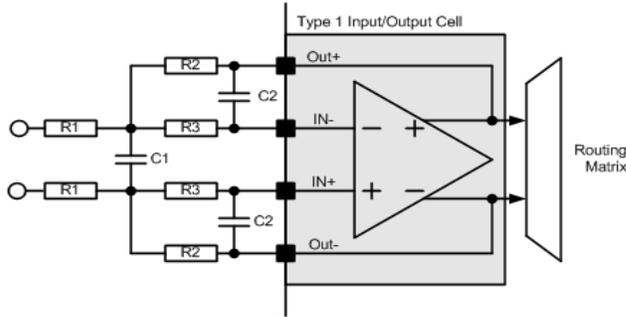


These can be easily implemented by adding appropriate components to the p.c.b.. This picture of the p.c.b show's an example of one of two p.c.b. layouts, for resistor and capacitor placement.

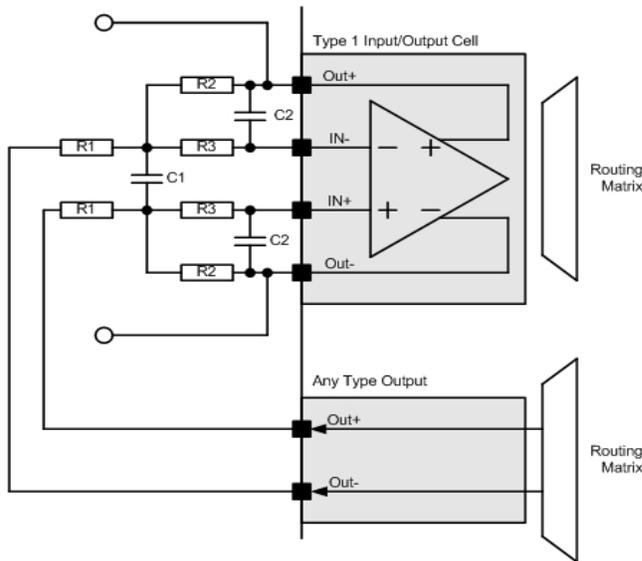
The default signal connection is directly to the header pin connected to the OTC24000-EVK. To use these filters add the correct components and connect the signal input or output appropriately.

The math associated with a typical low pass input filter is also provided here.

Figure 5: Suggested Rauch filter circuits



Type 1 I/O Configured as an Input with Anti-aliasing Filter



Type 1 I/O Configured as a Smoothing Filter for an Output Cell

For low pass response:

$$H(s) = 1 / ((R1/R2) + (sC2(R1+R3+(R1*R3/R2))) + (s^2 R1 R3 (2.C1)C2))$$

$$R1 = R2 = 2R3 = 2R$$

And

$$C1 = 2C2 = 2C$$

$$F_c = 1 / (4\pi RC(\text{SQRT } 2))$$

Re-arranging these equations for low pass filter

$$R1 = R_{in};$$

$$R2 = G * R_{in};$$

$$R3 = G * R_{in};$$

$$C1 = Q.(G+1)/(G.4.\pi.Fo.R_{in});$$

$$C2 = 1/(G.4.\pi.Fo.Q.R1)$$

Examples

Rauch filter settings:

For $F_c = 30\text{kHz}$:

$$R1=R2=10k, R3=5k, C1=0.75nF, C2=0.375nF$$

For $F_c = 40\text{kHz}$:

$$R1=R2=10k, R3=5k, C1=0.56nF, C2=0.28nF$$

For $F_c = 10\text{kHz}$

$$R1=R2=10k, R3=5k, C1=2.2nF, C2=1.1nF$$

Alternative math.

$$C1=2.C2.(G+1).Q^2 \quad R1=1/(Q.4.G.\pi.F.C2) \quad R2=G*R1 \quad R3=1/(Q.4.(G+1).\pi.F.C2)$$

$$\text{from these :} \quad C1=Q.(G+1)/(2.G.\pi.F.R1) \quad \text{and} \quad C2 = 1/(G.\pi.F.R1.4.Q)$$

Example,

Starting from a requirement for a corner frequency of 10kHz and we want a gain of 1

Choose to use 10kohm resistors

so that $R1=R2=10k$,

also if we choose a $Q=0.707$ for flat response then:

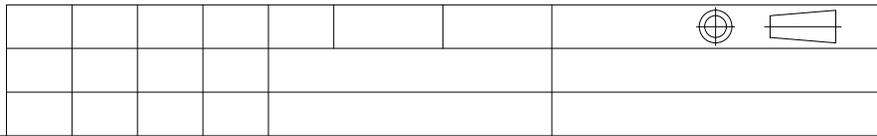
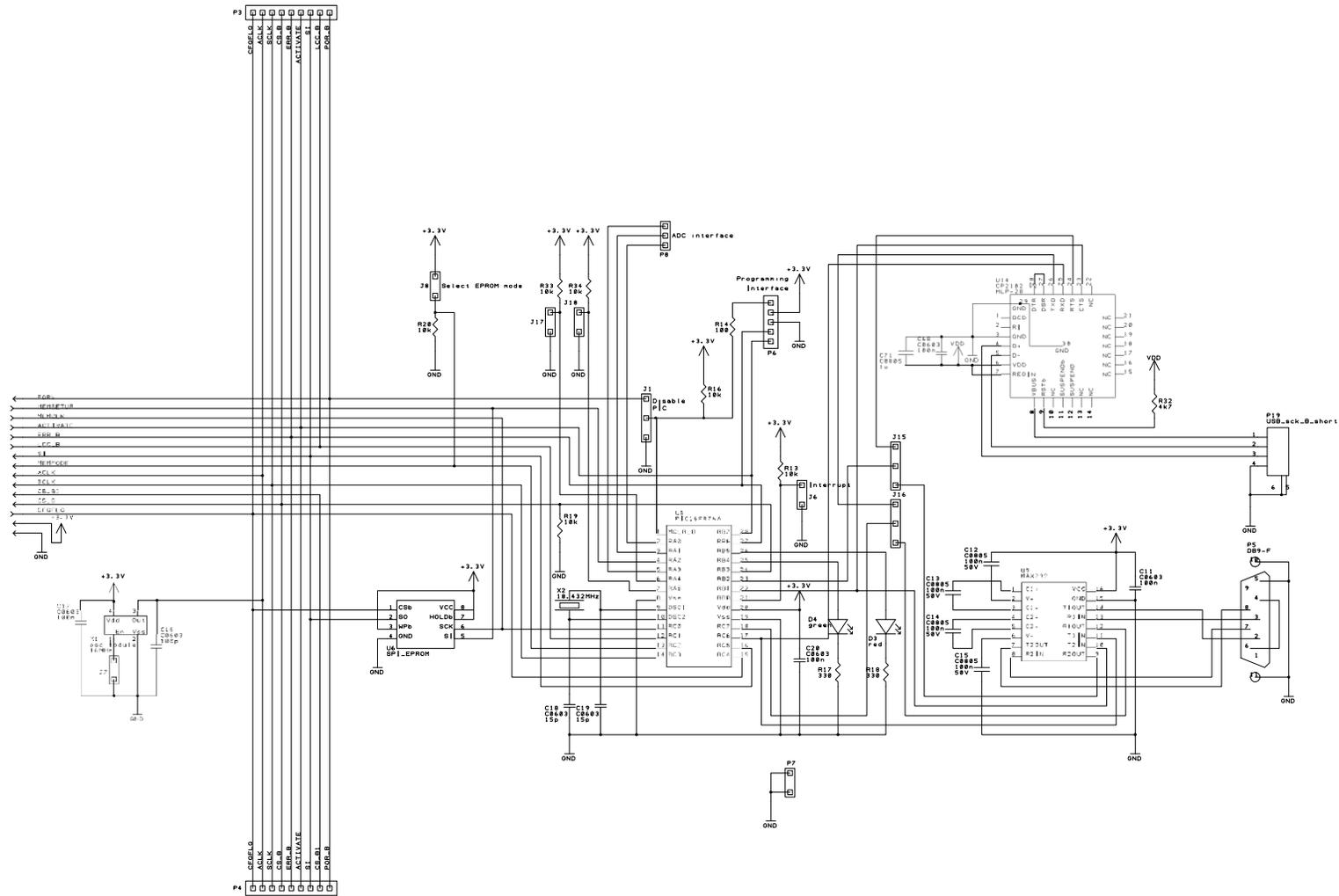
$$C1=1.414/(2 \times \pi \times 10k \times 10k) = 2.25nF$$

$$\text{and } C2=1/(1 \times \pi \times 10k \times 10k \times 4 \times 0.707) = 1.1nF$$

$$\text{and } R3=1/(0.707 \times 4 \times 2 \times \pi \times 10k \times 1.1n) = 5.1kohm$$

9.0 Absolute Maximum Ratings

| Parameter | Symbol | Min | Typ | Max | Unit | Comment |
|---|---------------------|------|-------|------------|----------|--|
| DC Power Supply 3.5mm jack socket | V_{jack} | 4 | 9 | 12.5 | V | DC voltage only Centre pole is positive, outer sleeve is ground |
| DC Power Supply Screw terminal "+" post | V_{+} | 4 | 9 | 12.5 | V | DC voltage only Voltage is relative to "Gnd" post |
| DC power Supply regulator, max current, 12volts input | I_{supply} | - | | 150 100 | mA mA | At room temperature At 50 °C The OTC24000 require typically 40mA (max 70mA) The additional available additional power may be used for components you may add to the breadboard area. The current is limit by the regulator power dissipation. |
| OTC24000 Input Voltage | F_{in} | -0.5 | +3.6 | | V | Direct input to OTC24000 on analog IO header pins or digital pins (J5) |
| OTC24000 Output Voltage | F_{out} | -0.5 | +3.6 | | V | Direct output from OTC24000 on analog IO header pins or digital pins (J5) |
| RS-232 Input Voltage | R_{in} | -30 | +/-10 | +30 | V | Standard RS-232 signal levels |
| RS-232 Output Voltage | T_{out} | -15 | +/-10 | +15 | V | Standard RS-232 signal levels |
| Operating Temperature | T_{op} | 10 | | 50 | °C | Ambient Operating Temperature, At 50 °C the power regulator is only capable of supplying 100mA, this is sufficient for the OTC24000 device but will not support a lot of external components on the breadboard area. |
| Storage Temperature | T_{stg} | -20 | | 70 | °C | Ambient Storage Temperature |



Notes:

For More information Contact

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