**C64 Keyboard Controlled Kernal Switch Rev. 1**

**Functional Description**

This document applies to hardware version v1 with firmware version v0.1 or later.

IC1 is an ATmega328P processor and it provides the functionality of an Arduino Uno. X1 is the 16MHz quartz and forms the quartz oscillator together with C4, C5 and R3. J2 is the connector for in-system programming of IC1. It is required at least once for writing the Arduino bootloader.

A serial interface for debugging is provided on J3. This interface has a TTL-level serial signals. To connect it to a PC, a USB/serial converter board is required. Once the bootloader is programmed to IC1, the serial interface can serve to transfer a compiled Arduino sketch to the Kernal Switch. In case this serial interface is not required and J3, C7, D1and R7 can stay unpopulated.

The Kernal Switch has to distinguish between C64 long boards and C64 short boards; this because with a short board BASIC resides in the lowest 8k of the EPROM.

The address pins A[15..13] (of the EPROM) ranges from 001BIN to111BIN. With a long board all 8k memory slots can serve as a Kernal so A[15..13] range from 000BIN to 111BIN.

* CP1 serves for setting the board type: (i) to configure a long board leave CP1 open; (ii) to configure a short board CP1 must be closed by a simple solder bridge.
* The transistor Q1 serves for resetting the C64 and provides the required open collector output. A HIGH level on C64RES will pull the output LOW, which then resets the C64.
* J4 is the pin header, which provides the signals for selecting the Kernal (KSW\_A13 .. KSW\_A15), for resetting the C64 (), the signal and one GPIO pin (RESIO) which is utilized to drive a power LED (firmware v0.2). The GND pin (in conjunction with the RESIO) might be used for connection an LED.
* R8 will limit the current on , in case a cartridge holds this signals HIGH. It is calculated to provide a stable LOW level voltage together with the 3.9kΩ pull-up resistor (network) on the C64 mainboard. A value of 300Ω might also work, but is not tested.
* R9 can be used as a bias resistor for an LED. 330Ω is a suitable value for a red or green LED.
* J1 is a bottom entry receptacle, the pins of the keyboard connector are inserted through holes in the PCB into this connector from below. All keyboard signals are connected here. J1 provides the supply voltage (+5V) for the circuit on the Kernal switch.
* J5 is the pin header for connecting the keyboard. All (keyboard) signals from J1 are connected to the same pin on J5.
* Only the required scan signals are connected to IC1. That is column 1, 2, 3, 4 and 7, as well as row 0 and 3. The row signals are pulled LOW in case a key in the row is being pressed. These row signals are connected to the two external interrupt pins (INT0 and INT1) of IC1. The key scan signals have to be configured as “input with weak pull-up resistor”, since the TTL logic of the C64 interprets an open input as a HIGH input, while it is an illegal state for the MOS logic of IC1.