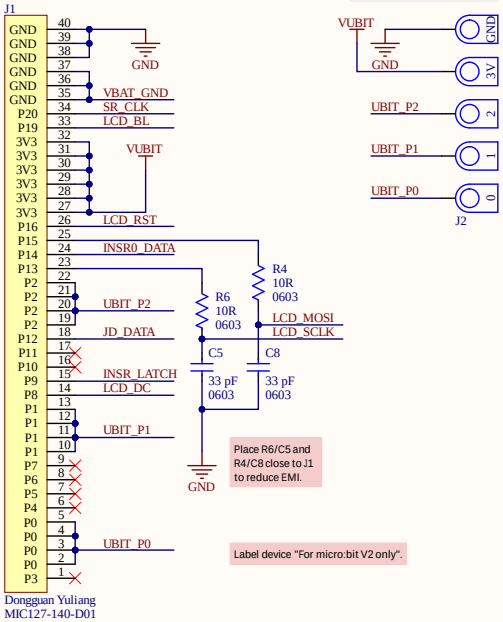
micro:bit connections

190 mA max current draw from micro:bit V2.

Exposing the 5 micro:bit edge connector 'rings' means users can use them to extend the functionality of their games.

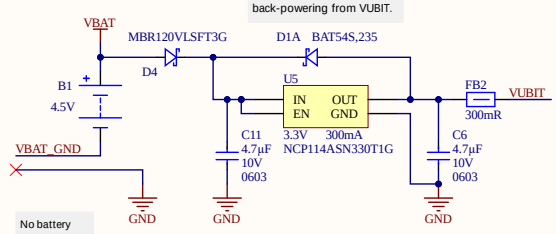


Place R6/C5 and R4/C8 close to J1 to reduce EMI.

Label device "For micro:bit V2 only".

On-shield battery supply

D1A protects U5 in case of back-powering from VUBIT.



No battery drain unless micro:bit is plugged in, which shorts GND and VBAT_GND.

D4 protects battery against reverse current. Over-current protection also necessary if rechargeable battery used.

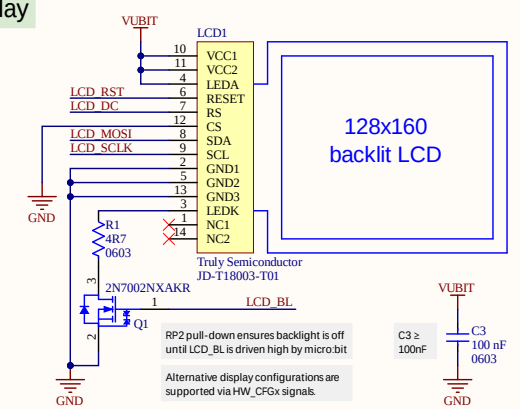
FB2 inserts a ≥30mV drop (@100mA) from the shield-regulated supply. This means USB power from the micro:bit will be at a higher voltageif present, thereby preserving shield batteries.

Shield display needs 3.3V to operate reliably.

If the micro:bit is USB-powered, 3.3V from the edge connector is used. Otherwise, 3x on-board AA cells provide 3.3V for the shield via U5.

If the micro:bit is battery powered and the 3x on-shield AA cells provide less than ~3.0V, shield operation is unreliable.

Display



RP2 pull-down ensures backlight is off until LCD_BL is driven high by micro:bit

C3 ≥ 100nF

Alternative display configurations are supported via HW_CFGx signals.

Hardware configuration

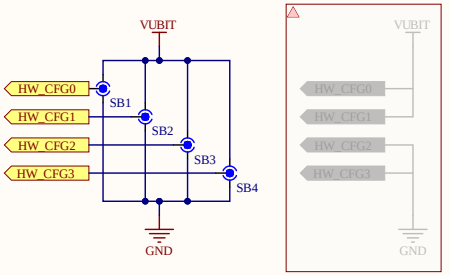
HW_CFG0	Display rotation
0	Rotated 180 degrees.
1	Not rotated.

HW_CFG3	HW_CFG2	HW_CFG1	Hardware configuration
0	0	0	Reserved, do not use.
0	0	1	ST7735 (CFG1=0x603 or =0x12c2d).
0	1	0	ILI9163C with BGR color order (CFG1=0xe14ff).
0	1	1	ST7735 inverted color palette (CFG1 as above, CFG0 = 0x1??????).
1	0	0	Future configuration.
1	0	1	Future configuration.
1	1	0	Future configuration.
1	1	1	Reserved, do not use.

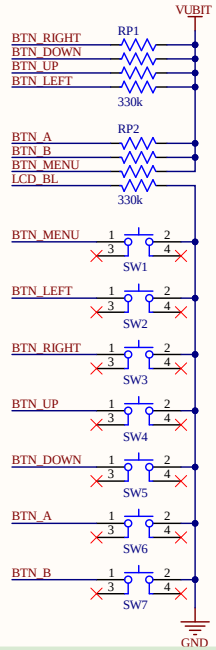
Inputs E-H of U2 (HW_CFG0 - HW_CFG3) are read at power-on to specify Arcade shield hardware configuration. Connect according to these tables.

This reference design uses un-rotated JD-T18003 display with ST7735 controller so HW_CFG0/1 = 1 and HW_CFG2/3 = 0.

If you would like to propose a new configuration please email: arcadehdw@microsoft.com.



Buttons

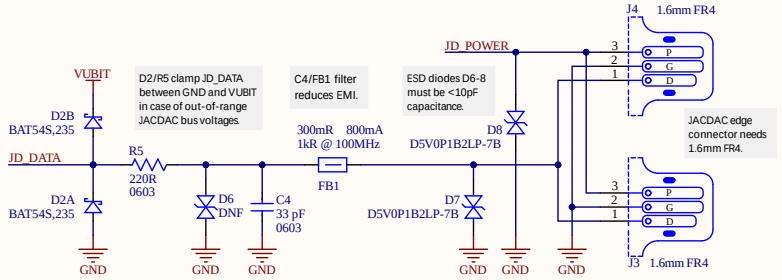


JACDAC interface

Optionally include 1 or more JACDAC connectors. Power delivery optional.

JACDAC (https://aka.ms/jacdac) is a new "plug and play" protocol for connecting microcontrollers and peripherals. Its flexible topology, dynamic discovery and power delivery provide a great user experience for makers and students.

JACDAC provides 1Mbps communications and power delivery. JD_DATA uses 3.3V logic, JD_POWER is nominally 5V.



D2/R5 clamp JD_DATA between GND and VUBIT in case of out-of-range JACDAC bus voltages.

C4/FB1 filter reduces EMI.

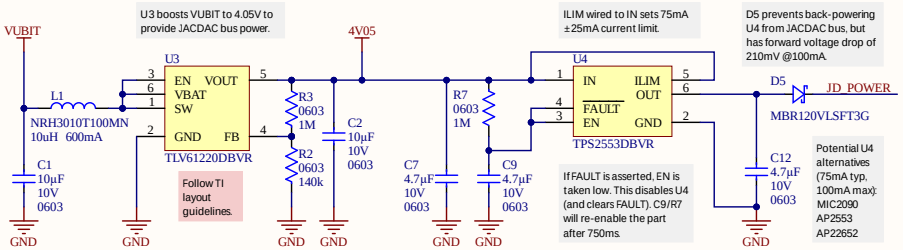
ESD diodes D6-8 must be <10pF capacitance.

JACDAC edge connector needs 1.6mm FR4.

JACDAC power delivery is optional. Spec requires current limiting with auto retry, and that nothing gets hot! This shield delivers 75mA typical, 100mA max.

A JACDAC supply of up to 100mA must be ≥3.84V at the connector, i.e. U3 output ≥4.05V. This draws ~145mA from 3.3V VUBIT supply. LCD1 takes ~45mA to give 190mA total.

Check JACDAC spec for voltages required at higher currents and MCU-based 'smart power providers'.



U3 boosts VUBIT to 4.05V to provide JACDAC bus power.

Follow TI layout guidelines.

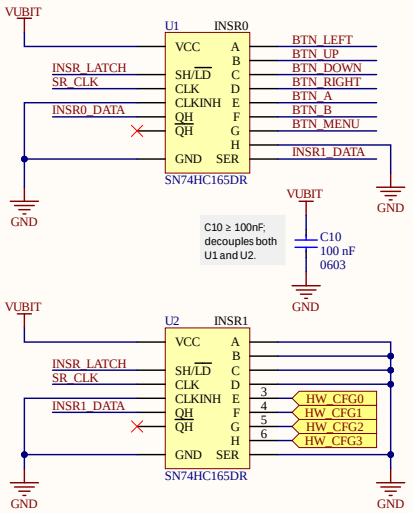
ILIM wired to IN sets 75mA ±25mA current limit.

If FAULT is asserted, EN is taken low. This disables U4 (and clears FAULT). C9/R7 will re-enable the part after 750ms.

D5 prevents back-powering U4 from JACDAC bus, but has forward voltage drop of 210mV @100mA.

Potential U4 alternatives (75mA typ, 100mA max): MIC2090 AP2553 AP22652

Input shift registers



C10 ≥ 100nF; decouples both U1 and U2.

Key:

- Silkscreen & layout notes
- Block name
- Design notes

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When this PDF is viewed with Adobe Reader, clicking on components shows part numbers and other details.

Microsoft	PROJECT DESCRIPTION: Arcade shield reference design for the BBC micro:bit V2		SHEET DESCRIPTION: complete design
SHEET FILENAME: MicroBitArcadeShieldMVD 08.SchDoc	PROJECT FILENAME: MicroBitArcadeShieldMVD 08.PrjPCB	PROJECT CODENAME: MicroBitArcadeShieldMVD	LICENCE: Attribution 4.0 International (CC BY 4.0)
LAST MODIFIED: 24/12/2020	PAGE: 1 OF 2	DRAWN BY: JD, SH & MM	REVISION: 1.1 PCB ID: 08-1.1