SDC_Zero

- a minimalistic 65C02-based computer by gbm

Features:

- hardware monitor with single-stepping, disassembly, memory editing and drag-and-drop HEX file loading
- 16 KiB RAM, 64 KiB ROM
- terminal (console) interface
- timer and single LED
- Power supply, h/w monitor communication and target computer terminal via USB double VCOM device

Assembly time: 30 min

Components

Total cost: < 8 USD

- „830” type breadboard
- ca. 40 male-male jumper wires
- one female-male jumper wire
- 1..2 pcs 100 nF through-hole ceramic capacitor
- one 10 kOhm through-hole resistor
- 65C02 CPU
- „BluePill” board (STM32F103C8T6 Minimum Development Board)

Software needed on PC side: a terminal emulator program (TeraTerm is recommended).

List of **connections**:

STM32F103R MDB + W65C02S minimal virtual computer

STM32F103R				MDB pin			W65C02S		
		pin	fun	pin	dir	fixed	name	pin	Remarks (rs – series resistor, ds – series diode)
PA	0	10		6	↔		D0	33	
	1	11		7	↔		D1	32	
	2	12		8	↔		D2	31	
	3	13		9	↔		D3	30	
	4	14		10	↔		D4	29	
	5	15		11	↔		D5	28	
	6	16		12	↔		D6	27	
	7	17		13	↔		D7	26	
	8	29		25	←		RWB	34	
	9	30		26	←		SYNC	7	
	10	31		27	→		RESB	40	
	11	32	USBDM	28					
	12	33	USBDP	29					
	13	34	SWDIO						
	14	37	SWCLK						
	15	38		30	→		PHI2	37	clk out via software & DMA
PB	0	18		14	→		A0	9	
	1	19		15	→		A1	10	
	2	20		B2	→		A2	11	replace R4 100k series resistor with 10k!, connect via BOOT1
	3	39		31	→		A3	12	
	4	40		32	→		A4	13	
	5	41		33	→		A5	14	
	6	42		34	→		A6	15	
	7	43		35	→		A7	16	
	8	45		36	→		A8	17	
	9	46		37	→		A9	18	
	10	21		16	→		A10	19	
	11	22		17	→		A11	20	
	12	25		21	→		A12	22	
	13	26		22	→		A13	23	
	14	27		23	→		A14	24	
	15	28		24	→		A15	25	
PC	13	2		3	→				LED (lit when low) control
	14	3		4	→		IRQB	4	
	15	4		5	→		NMIB	6	
							Power		
				38			Vdd	8	Vdd
				19,	20,	39	Vss	21	GND
							Fixed inputs		
							BE	36	Vdd
							SOB	38	Vdd
							RDY	2	Vdd via 10k

Assembly

1. First, a little modification must be applied to the BluePill board: R4 resistor (in series with PB2) should be either replaced with 10 kOhm resistor or shorted with a piece of wire.
   Also, it is useful to replace the LED series resistors (R1, R5 – originally 510 Ohm) with 2..3 kOhm ones to reduce LED brightness.

2. Program the BluePill with the SDC_Zero firmware. (Using ST-Link, this may be done anytime after assembly; if using serial loader, PA9 and PA10 lines must be disconnected from 65C02).
3. Insert the BluePill board into the breadboard with microUSB connector facing towards the edge. Place the 65C02 CPU on the breadboard, pin 1 (cutoff) facing the BluePill debug connector, leaving approx. 10 rows of holes between BluePill and CPU.
4. Using short jumper wires, connect BluePill GND and 3.3V pins to breadboard's power buses.
5. Using short jumper wires, connect the 65C02 pins from the list below to power buses.
6. Put the capacitors on power buses close to 65C02 Vdd and GND connections.
7. Connect the RDY pin to 3.3 V bus using 10 kOhm resistor.
8. Using longer jumper wires, make the connections betweeen the BluePill and 65C02. The recommended order of connections is: D0..D7, A3..A9, IRQ, NMI, A12..15, A0, A1, A10, A11, R/-W, SYNC, -RES, PHI2.
9. Remove the jumper from BOOT1 header. Using a female-to-male jumper wire connect BluePill PB2(BOOT1) pin to A2 pin of 65C02.
10. Connect the BluePill to PC with USB A to micro-B cable. Open two TeraTerm sessions. Configure serial connection with two SDC virtual COM ports using default settings (115200, 8, no parity). SDC monitor displays signon message and prompt after a key is pressed.