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noForth website

Seeed Studio GD32VF dev board with noForth r(cv)

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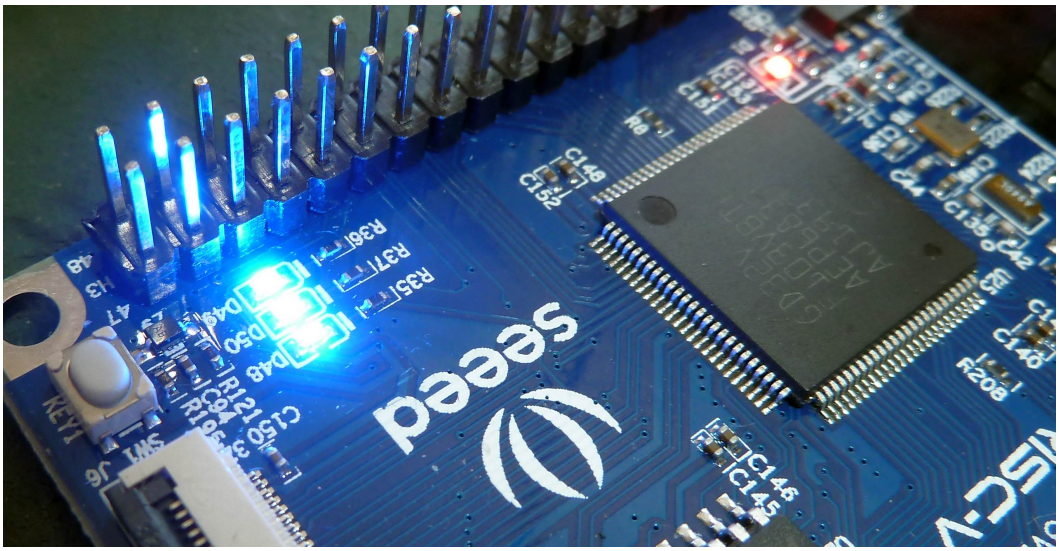
In this text we refer to these two documents:
- GD32VF103_Datasheet_Rev1.0.pdf
- GD32VF103_User_Manual_EN_V1.2.pdf

1. Seeed Studio GD32VF dev board



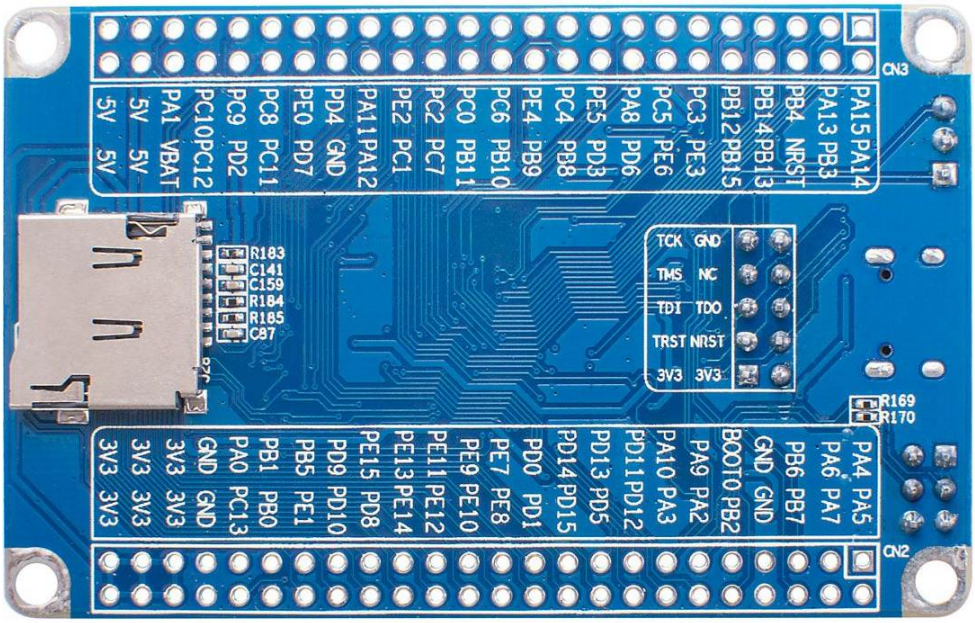
Core Sub-Architecture: RISC-V IMAC
Kit Contents: Seeed Studio GD32 RISC-V Dev Board

- Antratek: Seeed Studio GD32VF dev board
- Seeed: Seeed Studio GD32VF dev board

i/o port connections

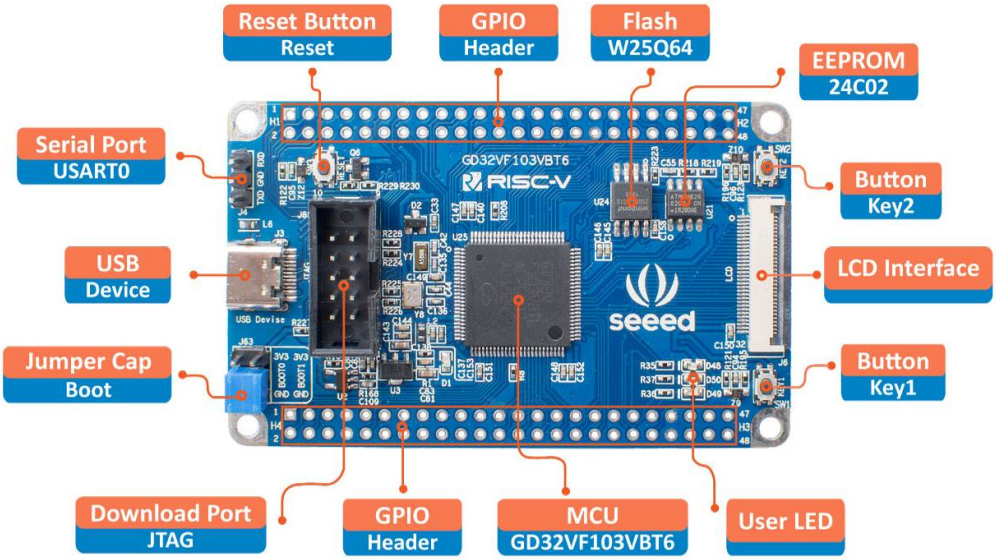
Port A	Port B	Port C
PA.0 - WKUP/KEY1	PB.0 - LED	PC.0 - FLASH_CS Flash
PA.1 - ...	PB.1 - LED	PC.1 - ...
PA.2 - ...	PB.2 - BOOT1	PC.2 - ...
PA.3 - ...	PB.3 - JTDO	PC.3 - ...
PA.4 - ...	PB.4 - nTRST	PC.4 - ...
PA.5 - SPI0_SCK Flash	PB.5 - LED	PC.5 - ...
PA.6 - SPI0_MISO Flash	PB.6 - I2C0_SCL EEPROM	PC.6 - ...
PA.7 - SPI0_MOSI Flash	PB.7 - I2C0_SDA EEPROM	PC.7 - ...
PA.8 - TXD	PB.8 - ...	PC.8 - ...
PA.9 - RXD	PB.9 - ...	PC.9 - ...
PA.10 - ...	PB.10 - ...	PC.10 - ...
PA.11 - ...	PB.11 - ...	PC.11 - USB
PA.12 - ...	PB.12 - TF_CS SD	PC.12 - USB
PA.13 - JTMS	PB.13 - SPI1_SCK SD	PC.13 - KEY2
PA.14 - JTCK	PB.14 - SPI1_MISO SD	PC.14 - OSC32_IN
PA.15 - JTDI	PB.15 - SPI1_MOSI SD	PC.15 - OSC32_OUT

Port D	Port E
PD.0 - ...	PE.0 - ...
PD.1 - ...	PE.1 - ...
PD.2 - ...	PE.2 - ...
PD.3 - ...	PE.3 - ...
PD.4 - ...	PE.4 - ...
PD.5 - ...	PE.5 - ...
PD.6 - ...	PE.6 - ...
PD.7 - ...	PE.7 - ...
PD.8 - ...	PE.8 - ...
PD.9 - ...	PE.9 - ...
PD.10 - ...	PE.10 - ...
PD.11 - ...	PE.11 - ...
PD.12 - ...	PE.12 - ...
PD.13 - ...	PE.13 - ...
PD.14 - ...	PE.14 - ...
PD.15 - ...	PE.15 - ...



Connectors

```
H1      = i/o PA, PB, PC, PD, 5V and GND
H4      = i/o PA, PB, PC, PD, PE, GND and 3V3
J4      = RS232 & GND
J89     = JTAG connector
J63     = BOOT0 & BOOT1
J3      = USB-C Programming connector
J6      = LCD connector
J28     = Micro SD connector
```



Hardware

- Three leds on PB.0, PB1 and PB.5
- Switch SW1 on PA.0
- Switch SW2 on PC.13
- Jumpers for boot mode setting
- Reset switch RST
- JTAG 14-pin connector
- LCD connector
- Micro SD connector
- SPI Flash
- I2C EEPROM
- 32.768 crystal

2. i/o ports

Port addresses

The port registers are memory mapped.
First the base addresses for the I/O-ports:

```
Port-A = 40010800
Port-B = 40010C00
Port-C = 40011000
Port-D = 40011400
Port-E = 40011800
```

Port register offsets

Label	PA/PB/PC/PD/PE	Function
x_CRL	00	Control reg. P0 to P7
x_CRH	04	Control reg. P8 to P15
x_IDR	08	Input data reg.
x_ODR	0C	Output data reg.
x_BSRR	10	Set/Reset reg. P0 to P15
x_BRR	14	Reset reg. P0 to P15
x_LCKR	18	Lock register

Values for port control (CRL/CRH)-Registers

```
 0:  Analog Input
 1:  Output Push/Pull, 10 MHz
 2:  Output Push/Pull,  2 MHz
 3:  Output Push/Pull, 50 MHz
 4:  Floating Input (Reset state)
 5:  Open-Drain Output, 10 MHz
 6:  Open-Drain Output,  2 MHz
 7:  Open-Drain Output, 50 MHz
 8:  Input with pull-up / pull-down
 9:  Alternate Function, Push/Pull, 10 MHz
 A:  Alternate Function, Push/Pull,  2 MHz
 B:  Alternate Function, Push/Pull, 50 MHz
 C:  Reserved
 D:  Alternate Function, Open-Drain, 10 MHz
 E:  Alternate Function, Open-Drain,  2 MHz
 F:  Alternate Function, Open-Drain, 50 MHz
```

The reset value for all port control registers is 44444444. More info in the GD32VF103_User_Manual_EN_V1.2.PDF from page 101.

3. RS232/USB driver

The USB chip on the SEED board is a dongle with the PL2303TA Prolific USB-chip. This chip needs a specific driver under Windows XP/7/8/10. Unzip this file and execute PL2303-Prolific_DriverInstaller_v1200.exe. The default baudrate for the GD32VF controller is 115200 baud.

4. noForth memory map

RAM 20000000 - 20007FFF

```
20000000 HOT         \ warm Udata (max 200 bytes)
     ... UHERE       \ start of free Uspace
20000200 FLYBUF      \ FLYER buffer (400 bytes)
20000600 FLYBUF/
20000680 S0          \ data stack (80 bytes down)
20000880 R0          \ return stack (200 bytes down)
20000880 TIB         \ input buffer (80 bytes)
20000900 TIB/
20000900 SYSBUF      \ TIDY buffer (400 bytes)
20000D00 SYSBUF/     \ start of alloted RAM
     ... HERE        \ start of free RAM space
20008000 RAMBORDER
```

FLASH ROM 00000000 - 0001FFFF

```
 0000    interrupt vectors
 0200    FROZEN       \ cold Udata (max 200 bytes)
 0400    ORIGIN       \ start of dicionary
  ...    CHERE        \ start of free dictionary space
1F000    BORDER
```

- BORDER and RAMBORDER are changeable uvalues (Udata).
- Udata is saved to FROZEN by FREEZE .
- At start-up (and reset or COLD) noForth moves the Udata at FROZEN to HOT .

5. interrupt vector table

See GD32VF103_User_Manual_EN_V1.2.PDF for more details (page 93-100).

```
0000  - Reset ( Jump opcode )
000C  - CLIC INT SFT
001C  - CLIC INT TMR
0044  - CLIC INT BWEI
0048  - CLIC INT PMOVI
004C  - WWDGT interrupt
0050  - LVD from EXTI interrupt
0054  - Tamper interrupt
0058  - RTC global interrupt
005C  - FMC global interrupt
0060  - RCU global interrupt
0064  - EXTI Line0 interrupt
0068  - EXTI Line1 interrupt
006C  - EXTI Line2 interrupt
0070  - EXTI Line3 interrupt
0074  - EXTI Line4 interrupt
0078  - DMA0 channel0 global interrupt
007C  - DMA0 channel1 global interrupt
0080  - DMA0 channel2 global interrupt
0084  - DMA0 channel3 global interrupt
0088  - DMA0 channel4 global interrupt
008C  - DMA0 channel5 global interrupt
0090  - DMA0 channel6 global interrupt
0094  - ADC0 and ADC1 global interrupt
0098  - CAN0 TX interrupts
009C  - CAN0 RX0 interrupts
00A0  - CAN0 RX1 interrupts
00A4  - CAN0 EWMC interrupts
00A8  - EXTI line[9:5] interrupts
00AC  - TIMER0 break interrupt
00B0  - TIMER0 update interrupt
00B4  - TIMER0 trigger and channel commutation interrupts
00B8  - TIMER0 channel capture compare interrupt
00BC  - TIMER1 global interrupt
00C0  - TIMER2 global interrupt
00C4  - TIMER3 global interrupt
00C8  - I2C0 event interrupt
00CC  - I2C0 event interrupt
00D0  - I2C1 event interrupt
00D4  - I2C1 event interrupt
00D8  - SPI0 global interrupt
00DC  - SPI1 global interrupt
00E0  - USART0 global interrupt
00E4  - USART1 global interrupt
00E8  - USART2 global interrupt
00EC  - EXTI line[15:10] interrupts
00F0  - RTC alarm from EXTI interrupt
00F4  - USBFS wakeup from EXTI interrupt
0114  - TIMER4 global interrupt
0118  - SPI2 global interrupt
011C  - UART3 global interrupt
0120  - UART4 global interrupt
0124  - TIMER5 global interrupt
0128  - TIMER6 global interrupt
012C  - DMA1 channel0 global interrupt
0130  - DMA1 channel1 global interrupt
0134  - DMA1 channel2 global interrupt
0138  - DMA1 channel3 global interrupt
013C  - DMA1 channel4 global interrupt
0148  - CAN1 TX interrupt
014C  - CAN1 RX0 interrupt
0150  - CAN1 RX1 interrupt
0154  - CAN1 EWMC interrupt
0158  - USBFS global interrupt
```