General Description

Tiles:

* up to 96 tiles 8x8;
* up to 16 tiles 8x16;
* up to 8 tiles 16x16;
* tiles group (metatile) up to 8 tiles;
* any colors per sprite from palette of 80 colors;
* add tiles;
* delete tiles;
* draw tiles;

Draw functions:

* almost all from GFX lib;
* GUI;

Interface:

* USART to interface GPU (1200, 2400, 9600, 57600, 115200, 1M) ;
* SPI2 to interface SD;
* Paralel (8080) to interface LCD (STM32F103VET6);
* SPI1 to interface LCD (STM32F103C8T6);

Input GPU buffer:

* at least 200 commands (depend on size of commands and type of MCU RAM);

Data packet size:

* CMD consume 1 byte;
* DATA consume max 6\*uint16\_t bytes;

MCU:

* STM32F103C8T6 64 Flash, 20 RAM;
* STM32F103VET6 512 Flash, 64 RAM;

DMA supported by:

* STM32F103C8T6 64 Flash, 20 RAM;
* STM32F103VET6 512 Flash, 64 RAM;

FSMC:

* only by STM32F103VET6 512 Flash, 64 RAM;

GPIO Pinout

CPU\_GPU interface:

|  |  |  |  |
| --- | --- | --- | --- |
| Name In Code | MCU periph name | GPIO port | GPIO number |
| - | USART1\_RX | GPIOA | GPIO\_Pin\_10 |
| - | USART1\_TX | GPIOA | GPIO\_Pin\_9 |
| GPU\_BSY\_PIN | - | GPIOA | GPIO\_Pin\_11 |
| BAUD\_9600\_PIN | -not yet ready- |  |  |
| BAUD\_57600\_PIN | -not yet ready- |  |  |
| BAUD\_115200\_PIN | -not yet ready- |  |  |
| BAUD\_1M\_PIN | -not yet ready- |  |  |

SD Card (SPI2):

|  |  |  |  |
| --- | --- | --- | --- |
| Name In Code | MCU periph name | GPIO port | GPIO number |
| GPIO\_Pin\_SPI\_SD\_MISO | SPI2\_MISO | GPIOB | GPIO\_Pin\_14 |
| GPIO\_Pin\_SPI\_SD\_MOSI | SPI2\_MOSI | GPIOB | GPIO\_Pin\_15 |
| GPIO\_Pin\_SPI\_SD\_SCK | SPI2\_SCK | GPIOB | GPIO\_Pin\_13 |
| GPIO\_Pin\_SPI\_SD\_CS | SPI2\_CS | GPIOB | GPIO\_Pin\_12 |

LCD (SPI1):

|  |  |  |  |
| --- | --- | --- | --- |
| Name In Code | MCU periph name | GPIO port | GPIO number |
| GPIO\_Pin\_SPI\_LCD\_MOSI | SPI1\_MOSI | GPIOA | GPIO\_Pin\_7 |
| GPIO\_Pin\_SPI\_LCD\_SCK | SPI1\_SCK | GPIOA | GPIO\_Pin\_5 |
| TFT\_SS\_PIN | SPI1\_CS | GPIOB | GPIO\_Pin\_10 |
| TFT\_DC\_PIN | - | GPIOB | GPIO\_Pin\_11 |
| TFT\_RES\_PIN | - | GPIOB | GPIO\_Pin\_1 |

LCD (8080):

|  |  |  |  |
| --- | --- | --- | --- |
| Name In Code | MCU periph name | GPIO port | GPIO number |
| FSMC\_PIN\_D0 | D0 | GPIOD | GPIO\_Pin\_14 |
| FSMC\_PIN\_D1 | D1 | GPIOD | GPIO\_Pin\_15 |
| FSMC\_PIN\_D2 | D2 | GPIOD | GPIO\_Pin\_0 |
| FSMC\_PIN\_D3 | D3 | GPIOD | GPIO\_Pin\_1 |
| FSMC\_PIN\_D4 | D4 | GPIOE | GPIO\_Pin\_7 |
| FSMC\_PIN\_D5 | D5 | GPIOE | GPIO\_Pin\_8 |
| FSMC\_PIN\_D6 | D6 | GPIOE | GPIO\_Pin\_9 |
| FSMC\_PIN\_D7 | D7 | GPIOE | GPIO\_Pin\_10 |
| FSMC\_PIN\_D8 | D8 | GPIOE | GPIO\_Pin\_11 |
| FSMC\_PIN\_D9 | D9 | GPIOE | GPIO\_Pin\_12 |
| FSMC\_PIN\_D10 | D10 | GPIOE | GPIO\_Pin\_13 |
| FSMC\_PIN\_D11 | D11 | GPIOE | GPIO\_Pin\_14 |
| FSMC\_PIN\_D12 | D12 | GPIOE | GPIO\_Pin\_15 |
| FSMC\_PIN\_D13 | D13 | GPIOD | GPIO\_Pin\_8 |
| FSMC\_PIN\_D14 | D14 | GPIOD | GPIO\_Pin\_9 |
| FSMC\_PIN\_D15 | D15 | GPIOD | GPIO\_Pin\_10 |
| FSMC\_PIN\_WR | NWE | GPIOD | GPIO\_Pin\_5 |
| FSMC\_PIN\_RD | NOE | GPIOD | GPIO\_Pin\_4 |
| FSMC\_PIN\_CS | NE1 | GPIOD | GPIO\_Pin\_7 |
| FSMC\_PIN\_RS | A16 | GPIOD | GPIO\_Pin\_11 |
| TFT\_RES\_PIN |  |  |  |

Some Math

HEAP size is limited and share to all type of tiles!

uint16\_t lastTile16x16[256]; // 512

uint16\_t lastTile8x16[128]; // 256

uint16\_t lastTile8x8[64]; // 128

// total: 896

// If RAM is 10240 then:

8 tiles if 16x16;

16 tiles if 8x16;

96 tiles if 8x8;

each 16x16 consume as 4 8x8

each 8x16 consume as 2 8x8

160x128 px

20x16 | 8x8

10x8 | 16x16

20x16 = 320 bytes for one screen

320x240 px

40x30 | 8x8

20x15 | 16x16

40x30 = 1200 bytes for one screen

Memory map:

10240 bytes for tiles;

3072 bytes for USART command buffer;

1024 bytes for stack;

363 bytes WTF;

Free RAM:

5781 bytes

// if tiles 2 bytes

4 x (16x16) = 2048

8 x (8x16) = 2048

48x (8x8) = 6144

// if tiles 1 bytes

8 x (16x16) = 2048

16 x (8x16) = 2048

96 x (8x8) = 6144