Debugfs

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Contents

1 Introduction

Debugfs is a simple-to-use RAM-based file system, specially designed for debugging purposes.

It is provided as a simple way for kernel developers to make information available to the user space.

It is part of a pseudo filesystem. Unlike procfs, which is only meant for process information, or sysfs, which has strict one-value-per-file rules, debugfs has no rules at all.

Developers are free to put any information into debugfs.

2 Installing debugfs on your target board

Debugfs is enabled and ready to be used in all STM32MPU Embedded Software distributions, via the Linux® kernel configuration **CONFIG_DEBUG_FS**, set to yes by default.

```
Symbol: DEBUG_FS
Location:
  Kernel Hacking --->
    Compile-time checks and compiler options -->
      [*] Debug Filesystem
```

Please refer to the Menuconfig or how to configure kernel article for instructions on modifying the configuration and recompiling the Linux kernel image in the distribution package context.

3 Getting started

3.1 How to mount debugfs

Debugfs is typically mounted at */sys/kernel/debug* with a command such as:

```
Board $> mount -t debugfs none /sys/kernel/debug
```

3.2 How to use debugfs in Linux kernel drivers

Debugfs is a simple way for kernel drivers to make information available to user space.

It can be manipulated using several calls from the C header file *include/linux/debugfs.h* , such as:

```
debugfs_create_file → for creating a file in the debug filesystem.
debugfs_create_dir → for creating a directory in the debug filesystem.
debugfs_create_symlink → for creating a symbolic link in the debug filesystem.
debugfs_create_u32 → for creating a file containing a single 32-bit unsigned integer
value
debugfs_remove → for removing a debugfs entry from the debug filesytem.
...
```

For further details, refer to the Linux kernel documentation for debugfs[1].

For example, you can refer to an OpenSourceForU article: [2].

3.3 How to visualize debugfs information

On the target board, go the debugfs mount directory:

```
Board $> cd /sys/kernel/debug
```

There you will find all the debugfs entries created by Linux kernel frameworks

```
Board $> ls -l
```

```
drwxr-xr-x   2 root root 0 Jan  1  1970 49000000.usb-otg
drwxr-xr-x   4 root root 0 Jan  1  1970 asoc
drwxr-xr-x  40 root root 0 Jan  1  1970 bdi
drwxr-xr-x  10 root root 0 Jan  1  1970 block
drwxr-xr-x   2 root root 0 Jan  1  1970 bluetooth
drwxr-xr-x   3 root root 0 May 28 15:52 cec
```

```
drwxr-xr-x 225 root root 0 Jan  1  1970 clk
drwxr-xr-x   2 root root 0 Jan  1  1970 dma_buf
drwxr-xr-x   3 root root 0 Jan  1  1970 dri
drwxr-xr-x   2 root root 0 Jan  1  1970 dynamic_debug
drwxr-xr-x   2 root root 0 Jan  1  1970 extfrag
-rw-r--r--   1 root root 0 Jan  1  1970 fault_around_bytes
drwxr-xr-x   3 root root 0 May 28 15:52 gc
-r--r--r--   1 root root 0 Jan  1  1970 gpio
drwxr-xr-x   2 root root 0 Jan  1  1970 hid
drwxr-xr-x   2 root root 0 Jan  1  1970 ieee80211
drwxr-xr-x   7 root root 0 Jan  1  1970 iio
-r--r--r--   1 root root 0 Jan  1  1970 irq_domain_mapping
drwxr-xr-x   2 root root 0 Jan  1  1970 memblock
drwxr-xr-x   3 root root 0 Jan  1  1970 mmc0
drwxr-xr-x   3 root root 0 Jan  1  1970 mmc1
drwxr-xr-x  11 root root 0 Jan  1  1970 mtd
drwxr-xr-x   4 root root 0 Jan  1  1970 pinctrl
drwxr-xr-x   4 root root 0 Jan  1  1970 pm_genpd
drwxr-xr-x   2 root root 0 Jan  1  1970 pm_qos
-r--r--r--   1 root root 0 Jan  1  1970 pwm
drwxr-xr-x   2 root root 0 Jan  1  1970 ras
drwxr-xr-x  13 root root 0 Jan  1  1970 regmap
drwxr-xr-x  21 root root 0 Jan  1  1970 regulator
drwxr-xr-x   3 root root 0 Jan  1  1970 remoteproc
-r--r--r--   1 root root 0 Jan  1  1970 sleep_time
drwxr-xr-x   3 root root 0 Jan  1  1970 stmmaceth
-r--r--r--   1 root root 0 Jan  1  1970 suspend_stats
dr-xr-xr-x   3 root root 0 Jan  1  1970 tracing
drwxr-xr-x   2 root root 0 Jan  1  1970 ubi
drwxr-xr-x   2 root root 0 Jan  1  1970 ubifs
drwxr-xr-x   4 root root 0 Jan  1  1970 usb
-r--r--r--   1 root root 0 Jan  1  1970 wakeup_sources
```

You can then browse to find the requested information.

Please note that the different Linux software frameworks available in STM32MP15 Linux kernel overview provide specific trace and debug information in a "*How to trace and debug the framework*" dedicated chapter, incuding debugfs.

Some examples:

- To list the wakeup sources:

```
Board $> cat /sys/kernel/debug/wakeup_sources
name            active_count    event_count     wakeup_count    expire_count
active_since    total_time      max_time        last_change     prevent_suspend_time
5c002000.i2c:stpmu1@33:onkey    0               0               0
0               0               0               0               4075            0
0-0033          0               0               0               0
0               0               0               3949            0
alarmtimer      0               0               0               0
0               0               0               3901            0
5c004000.rtc    1               1               0               0
0               0               0               5246            0
deleted         0               0               0               0
0               0               0               0               0
```

- To obtain a summary of the clock settings:

```
Board $> cat /sys/kernel/debug/clk/clk_summary
  clock                         enable_cnt  prepare_cnt        rate   accuracy   phase
----------------------------------------------------------------------------------------
-
```

```
ck_usbo_48m                       1        1    48000000          0 0
   usbo_k                         1        1    48000000          0 0
ck_dsi_phy                        1        1           0          0 0
   dsi_k                          1        1           0          0 0
i2s_ckin                          0        0           0          0 0
clk-csi                           1        1     4000000          0 0
   ck_csi                         1        1     4000000          0 0
      rng2_k                      0        0     4000000          0 0
      rng1_k                      0        0     4000000          0 0
clk-lsi                           1        1       32000          0 0
   ck_lsi                         1        1       32000          0 0
      dac12_k                     0        0       32000          0 0
clk-lse                           1        1       32768          0 0
   ck_lse                         1        1       32768          0 0
      ck_rtc                      2        2       32768          0 0
         rtc_lsco                 1        1       32768          0 0
      lptim5_k                    0        0       32768          0 0
      lptim4_k                    0        0       32768          0 0
      cec_k                       0        0       32768          0 0
clk-hsi                           1        1    64000000          0 0
   clk-hsi-div                    1        1    64000000          0 0
      ck_hsi                      2        2    64000000          0 0
         ck_mco1                  0        0    64000000          0 0
         uart8_k                  0        0    64000000          0 0
         uart7_k                  0        0    64000000          0 0
         uart6_k                  0        0    64000000          0 0
         uart5_k                  0        0    64000000          0 0
         uart4_k                  1        1    64000000          0 0
         usart3_k                 0        0    64000000          0 0
         usart2_k                 1        1    64000000          0 0
         usart1_k                 0        0    64000000          0 0
         i2c6_k                   0        0    64000000          0 0
         i2c4_k                   0        0    64000000          0 0
         i2c5_k                   0        0    64000000          0 0
         i2c3_k                   0        0    64000000          0 0
         i2c2_k                   0        0    64000000          0 0
         i2c1_k                   0        0    64000000          0 0
         spi6_k                   0        0    64000000          0 0
         spi5_k                   0        0    64000000          0 0
         spi4_k                   0        0    64000000          0 0
clk-hse                           1        1    24000000          0 0
   ck_hse                         7        7    24000000          0 0
      ck_hse_rtc                  0        0     1000000          0 0
      stgen_k                     1        1    24000000          0 0
      usbphy_k                    1        1    24000000          0 0
      ck_per                      1        1    24000000          0 0
         adc12_k                  1        1    24000000          0 0
      ref4                        1        1    24000000          0 0
         pll4                     1        1   594000000          0 0
            pll4_r                0        0    74250000          0 0
            pll4_q                1        1    31263158          0 0
               ltdc_px            1        1    31263158          0 0
               dsi_px             0        0    31263158          0 0
               fdcan_k            0        0    31263158          0 0
            pll4_p                0        0    74250000          0 0
      ref3                        1        1    24000000          0 0
         pll3                     2        3   786431640          0 0
            pll3_r                1        1    98303955          0 0
               sdmmc3_k           0        0    98303955          0 0
               sdmmc2_k           1        1    98303955          0 0
               sdmmc1_k           0        0    98303955          0 0
            pll3_q                0        1    49151978          0 0
               adfsdm_k           0        0    49151978          0 0
               sai4_k             0        0    49151978          0 0
               sai3_k             0        0    49151978          0 0
               sai2_k             0        2    49151978          0 0
               sai1_k             0        0    49151978          0 0
```

```
      spi3_k                0            0    49151978          0 0
      spi2_k                0            0    49151978          0 0
      spi1_k                0            0    49151978          0 0
      spdif_k               0            0    49151978          0 0
   pll3_p                   1            1   196607910          0 0
      ck_mcu                6           16   196607910          0 0
         dfsdm_k            0            0   196607910          0 0
         gpiok              0            0   196607910          0 0
         gpioj              0            0   196607910          0 0
         gpioi              0            1   196607910          0 0
         gpioh              0            1   196607910          0 0
         gpiog              0            1   196607910          0 0
         gpiof              0            1   196607910          0 0
         gpioe              0            1   196607910          0 0
         gpiod              0            1   196607910          0 0
         gpioc              0            1   196607910          0 0
         gpiob              0            1   196607910          0 0
         gpioa              0            1   196607910          0 0
         ipcc               2            2   196607910          0 0
         hsem               0            0   196607910          0 0
         crc2               0            0   196607910          0 0
         rng2               0            0   196607910          0 0
         hash2              0            0   196607910          0 0
         cryp2              0            0   196607910          0 0
         dcmi               0            0   196607910          0 0
         sdmmc3             0            0   196607910          0 0
         usbo               0            0   196607910          0 0
         adc12              1            1   196607910          0 0
         dmamux             1            1   196607910          0 0
         dma2               0            0   196607910          0 0
         dma1               1            1   196607910          0 0
         pclk3              1            1    98303955          0 0
            lptim3_k        0            0    98303955          0 0
            lptim2_k        0            0    98303955          0 0
            hdp             0            0    98303955          0 0
            pmbctrl         0            0    98303955          0 0
            tmpsens         0            0    98303955          0 0
            vref            0            0    98303955          0 0
            syscfg          1            1    98303955          0 0
            sai4            0            0    98303955          0 0
            lptim5          0            0    98303955          0 0
            lptim4          0            0    98303955          0 0
            lptim3          0            0    98303955          0 0
            lptim2          0            0    98303955          0 0
         pclk2              0            0    98303955          0 0
            fdcan           0            0    98303955          0 0
            dfsdm           0            0    98303955          0 0
            sai3            0            0    98303955          0 0
            sai2            0            0    98303955          0 0
            sai1            0            0    98303955          0 0
            usart6          0            0    98303955          0 0
            spi5            0            0    98303955          0 0
            spi4            0            0    98303955          0 0
            spi1            0            0    98303955          0 0
            tim17           0            0    98303955          0 0
            tim16           0            0    98303955          0 0
            tim15           0            0    98303955          0 0
            tim8            0            0    98303955          0 0
            tim1            0            0    98303955          0 0
            ck2_tim         0            0   196607910          0 0
               tim17_k       0            0   196607910          0 0
               tim16_k       0            0   196607910          0 0
               tim15_k       0            0   196607910          0 0
               tim8_k        0            0   196607910          0 0
               tim1_k        0            0   196607910          0 0
         pclk1              0            2    98303955          0 0
            lptim1_k        0            0    98303955          0 0
```

```
                  mdio                0            0    98303955          0 0
                  dac12               0            0    98303955          0 0
                  cec                 0            0    98303955          0 0
                  spdif               0            0    98303955          0 0
                  i2c5                0            0    98303955          0 0
                  i2c3                0            0    98303955          0 0
                  i2c2                0            0    98303955          0 0
                  i2c1                0            0    98303955          0 0
                  uart8               0            0    98303955          0 0
                  uart7               0            0    98303955          0 0
                  uart5               0            0    98303955          0 0
                  uart4               0            0    98303955          0 0
                  usart3              0            0    98303955          0 0
                  usart2              0            0    98303955          0 0
                  spi3                0            0    98303955          0 0
                  spi2                0            1    98303955          0 0
                  lptim1              0            0    98303955          0 0
                  tim14               0            0    98303955          0 0
                  tim13               0            0    98303955          0 0
                  tim12               0            0    98303955          0 0
                  tim7                0            0    98303955          0 0
                  tim6                0            0    98303955          0 0
                  tim5                0            0    98303955          0 0
                  tim4                0            0    98303955          0 0
                  tim3                0            0    98303955          0 0
                  tim2                0            0    98303955          0 0
                  ck1_tim             0            1   196607910          0 0
                     tim14_k           0            0   196607910           0 0
                     tim13_k           0            0   196607910           0 0
                     tim12_k           0            0   196607910           0 0
                     tim7_k            0            0   196607910          0 0
                     tim6_k            0            1   196607910          0 0
                     tim5_k            0            0   196607910          0 0
                     tim4_k            0            0   196607910          0 0
                     tim3_k            0            0   196607910          0 0
                     tim2_k            0            0   196607910          0 0
      ref1                             2            2    24000000          0 0
         pll2                          2            2   533000000          0 0
            pll2_r                     1            1   533000000          0 0
            pll2_q                     0            0   533000000          0 0
               gpu_k                   0            0   533000000          0 0
            pll2_p                     1            1   266500000          0 0
               ck_axi                  8            9   266500000          0 0
                  ck_trace             0            0   133250000          0 0
                  ck_sys_dbg           0            0   266500000          0 0
                  qspi_k               0            0   266500000          0 0
                  fmc_k                0            0   266500000          0 0
                  ethstp               0            0   266500000          0 0
                  usbh                 1            1   266500000          0 0
                  crc1                 0            0   266500000          0 0
                  sdmmc2               0            0   266500000          0 0
                  sdmmc1               0            0   266500000          0 0
                  qspi                 0            0   266500000          0 0
                  fmc                  0            0   266500000          0 0
                  ethmac               1            1   266500000          0 0
                  ethrx                1            1   266500000          0 0
                  ethtx                1            1   266500000          0 0
                  gpu                  0            0   266500000          0 0
                  mdma                 1            1   266500000          0 0
                  bkpsram              0            0   266500000          0 0
                  rng1                 0            0   266500000          0 0
                  hash1                0            0   266500000          0 0
                  cryp1                0            0   266500000          0 0
                  gpioz                0            1   266500000          0 0
                  tzc2                 0            0   266500000          0 0
                  tzc1                 0            0   266500000          0 0
                  pclk5                1            1    66625000          0 0
```

```
                    stgen                0            0    66625000          0 0
                    bsec                 0            0    66625000          0 0
                    iwdg1                0            0    66625000          0 0
                    tzpc                 0            0    66625000          0 0
                    rtcapb               2            2    66625000          0 0
                    usart1               0            0    66625000          0 0
                    i2c6                 0            0    66625000          0 0
                    i2c4                 0            0    66625000          0 0
                    spi6                 0            0    66625000          0 0
                pclk4                    1            1   133250000          0 0
                    stgenro              0            0   133250000          0 0
                    usbphy               0            0   133250000          0 0
                    iwdg2                1            1   133250000          0 0
                    dsi                  0            0   133250000          0 0
                    ltdc                 0            0   133250000          0 0
         pll1                            1            1   650000000          0 0
            pll1_p                       1            1   650000000          0 0
               ck_mpu                    1            1   650000000          0 0
                  ck_mco2                0            0   650000000          0 0
      clk-hse-div2                       0            0    12000000          0 0
ethptp_k                                 0            0           0          0 0
ethck_k                                  0            0           0          0 0
```

- To obtain a summary of the regulator settings:

```
Board $> cat /sys/kernel/debug/regulator/regulator_summary
regulator                      use open bypass voltage current     min     max
---------------------------------------------------------------------------------
regulator-dummy                  0   11      0     0mV     0mA     0mV     0mV
   49000000.usb-otg                                                 0mV     0mV
   49000000.usb-otg                                                 0mV     0mV
   5a000000.dsi.0                                                   0mV     0mV
   vddcore                       0    0      0  1200mV     0mA   800mV  1350mV
   vdd_ddr                       0    1      0  1350mV     0mA  1350mV  1350mV
      vtt_ddr                    0    0      0   675mV     0mA   675mV   675mV
   vdd                           0    1      0  3300mV     0mA  3300mV  3300mV
      vref                       1    1      0  2500mV     0mA  2500mV  2500mV
         48003000.adc                                               0mV     0mV
   v3v3                          0    5      0  3300mV     0mA  3300mV  3300mV
      0-004a                                                        0mV     0mV
      58007000.sdmmc                                             3300mV  3300mV
      58005000.sdmmc                                             3300mV  3300mV
      v1v8_audio                 0    3      0  1800mV     0mA  1800mV  1800mV
         0-004a                                                     0mV     0mV
         0-004a                                                     0mV     0mV
         0-004a                                                     0mV     0mV
      v1v2_hdmi                  0    1      0  1200mV     0mA  1200mV  1200mV
         0-0039                                                     0mV     0mV
   v3v3_hdmi                     0    1      0  3300mV     0mA  3300mV  3300mV
      0-0039                                                        0mV     0mV
   vdd_usb                       2    2      0  3300mV     0mA  3300mV  3300mV
      phy-5a006000.usbphyc.1                                        0mV     0mV
      phy-5a006000.usbphyc.0                                        0mV     0mV
   vdda                          0    0      0  2900mV     0mA  2900mV  2900mV
   bst_out                       0    2      0  5000mV     0mA     0mV     0mV
      vbus_otg                   0    0      0  5000mV     0mA     0mV     0mV
      vbus_sw                    0    0      0  5000mV     0mA     0mV     0mV
reg11                            1    1      0  1100mV     0mA  1100mV  1100mV
   5a006000.usbphyc                                             0mV     0mV
reg18                            2    2      0  1800mV     0mA  1800mV  1800mV
   5a006000.usbphyc                                             0mV     0mV
   5a000000.dsi                                                 0mV     0mV
usb33                            1    1      0  3300mV     0mA  3300mV  3300mV
   49000000.usb-otg                                             0mV     0mV
vref_ddr                         0    0      0   675mV     0mA     0mV     0mV
```

- To list the pin control settings:

```
Board $> cat /sys/kernel/debug/pinctrl/soc\:pin-controller@50002000/pinconf-pins
Pin config settings per pin
Format: pin (name): configs
pin 0 (PA0): analog
pin 1 (PA1): alternate 11 (ETH1_GMII_RX_CLK ETH1_MII_RX_CLK ETH1_RGMII_RX_CLK
ETH1_RMII_REF_CLK) - push pull - floating - low speed
pin 2 (PA2): alternate 11 (ETH1_MDIO) - push pull - floating - very high speed
pin 3 (PA3): alternate 14 (LCD_B5) - push pull - floating - high speed
pin 4 (PA4): analog
pin 5 (PA5): analog
pin 6 (PA6): analog
pin 7 (PA7): alternate 11 (ETH1_GMII_RX_DV ETH1_MII_RX_DV ETH1_RGMII_RX_CTL
ETH1_RMII_CRS_DV) - push pull - floating - low speed
pin 8 (PA8): analog
pin 9 (PA9): analog
pin 10 (PA10): output - high - push pull - floating - low speed
pin 11 (PA11): analog
pin 12 (PA12): analog
pin 13 (PA13): output - low - open drain - floating - very high speed
pin 14 (PA14): input - high - floating
pin 15 (PA15): analog
pin 16 (PB0): alternate 11 (ETH1_GMII_RXD2 ETH1_MII_RXD2 ETH1_RGMII_RXD2) - push pull
- floating - low speed
pin 17 (PB1): alternate 11 (ETH1_GMII_RXD3 ETH1_MII_RXD3 ETH1_RGMII_RXD3) - push pull
- floating - low speed
pin 18 (PB2): alternate 8 (UART4_RX) - push pull - floating - low speed
pin 19 (PB3): alternate 9 (SDMMC2_D2) - push pull - pull up - very high speed
pin 20 (PB4): alternate 9 (SDMMC2_D3) - push pull - pull up - very high speed
pin 21 (PB5): analog
pin 22 (PB6): alternate 5 (CEC) - open drain - floating - low speed
pin 23 (PB7): analog
pin 24 (PB8): alternate 14 (LCD_B6) - push pull - floating - high speed
pin 25 (PB9): analog
pin 26 (PB10): analog
pin 27 (PB11): alternate 11 (ETH1_GMII_TX_EN ETH1_MII_TX_EN ETH1_RGMII_TX_CTL
ETH1_RMII_TX_EN) - push pull - floating - very high speed
pin 28 (PB12): analog
pin 29 (PB13): analog
pin 30 (PB14): alternate 9 (SDMMC2_D0) - push pull - pull up - very high speed
pin 31 (PB15): alternate 9 (SDMMC2_D1) - push pull - pull up - very high speed
pin 32 (PC0): alternate 14 (LCD_R5) - push pull - floating - high speed
pin 33 (PC1): alternate 11 (ETH1_MDC) - push pull - floating - very high speed
pin 34 (PC2): alternate 11 (ETH1_GMII_TXD2 ETH1_MII_TXD2 ETH1_RGMII_TXD2) - push pull
- floating - very high speed
pin 35 (PC3): analog
pin 36 (PC4): alternate 11 (ETH1_GMII_RXD0 ETH1_MII_RXD0 ETH1_RGMII_RXD0
ETH1_RMII_RXD0) - push pull - floating - low speed
pin 37 (PC5): alternate 11 (ETH1_GMII_RXD1 ETH1_MII_RXD1 ETH1_RGMII_RXD1
ETH1_RMII_RXD1) - push pull - floating - low speed
pin 38 (PC6): analog
pin 39 (PC7): analog
pin 40 (PC8): analog
pin 41 (PC9): analog
pin 42 (PC10): analog
pin 43 (PC11): analog
pin 44 (PC12): analog
pin 45 (PC13): analog
pin 46 (PC14): analog
pin 47 (PC15): analog
pin 48 (PD0): analog
pin 49 (PD1): analog
pin 50 (PD2): analog
```

```
pin 51 (PD3): alternate 7 (USART2_CTS USART2_NSS) - push pull - floating - low speed
pin 52 (PD4): alternate 7 (USART2_RTS USART2_DE) - push pull - floating - very high
speed
pin 53 (PD5): alternate 7 (USART2_TX) - push pull - floating - very high speed
pin 54 (PD6): alternate 7 (USART2_RX) - push pull - floating - low speed
pin 55 (PD7): analog
pin 56 (PD8): alternate 14 (LCD_B7) - push pull - floating - high speed
pin 57 (PD9): alternate 14 (LCD_B0) - push pull - floating - high speed
pin 58 (PD10): alternate 14 (LCD_B3) - push pull - floating - high speed
pin 59 (PD11): output - low - push pull - floating - low speed
pin 60 (PD12): alternate 5 (I2C1_SCL) - open drain - floating - low speed
pin 61 (PD13): analog
pin 62 (PD14): analog
pin 63 (PD15): analog
pin 64 (PE0): alternate 10 (SAI2_MCLK_A) - push pull - floating - high speed
pin 65 (PE1): analog
pin 66 (PE2): alternate 11 (ETH1_GMII_TXD3 ETH1_MII_TXD3 ETH1_RGMII_TXD3) - push pull
- floating - very high speed
pin 67 (PE3): alternate 9 (SDMMC2_CK) - push pull - pull up - very high speed
pin 68 (PE4): output - high - push pull - floating - low speed
pin 69 (PE5): alternate 14 (LCD_G0) - push pull - floating - high speed
pin 70 (PE6): alternate 14 (LCD_G1) - push pull - floating - high speed
pin 71 (PE7): analog
pin 72 (PE8): analog
pin 73 (PE9): analog
pin 74 (PE10): analog
pin 75 (PE11): analog
pin 76 (PE12): analog
pin 77 (PE13): analog
pin 78 (PE14): analog
pin 79 (PE15): alternate 14 (LCD_R7) - push pull - floating - high speed
pin 80 (PF0): analog
pin 81 (PF1): analog
pin 82 (PF2): input - high - floating
pin 83 (PF3): analog
pin 84 (PF4): analog
pin 85 (PF5): analog
pin 86 (PF6): analog
pin 87 (PF7): analog
pin 88 (PF8): analog
pin 89 (PF9): analog
pin 90 (PF10): alternate 14 (LCD_DE) - push pull - floating - high speed
pin 91 (PF11): alternate 10 (SAI2_SD_B) - push pull - floating - low speed
pin 92 (PF12): analog
pin 93 (PF13): analog
pin 94 (PF14): analog
pin 95 (PF15): alternate 5 (I2C1_SDA) - open drain - floating - low speed
pin 96 (PG0): analog
pin 97 (PG1): input - high - floating
pin 98 (PG2): analog
pin 99 (PG3): analog
pin 100 (PG4): alternate 11 (ETH1_GMII_GTX_CLK ETH1_RGMII_GTX_CLK) - push pull -
floating - very high speed
pin 101 (PG5): alternate 11 (ETH1_GMII_CLK125 ETH1_RGMII_CLK125) - push pull -
floating - very high speed
pin 102 (PG6): alternate 10 (SDMMC2_CMD) - push pull - pull up - very high speed
pin 103 (PG7): alternate 14 (LCD_CLK) - push pull - floating - high speed
pin 104 (PG8): analog
pin 105 (PG9): output - high - push pull - floating - low speed
pin 106 (PG10): alternate 14 (LCD_B2) - push pull - floating - high speed
pin 107 (PG11): alternate 6 (UART4_TX) - push pull - floating - low speed
pin 108 (PG12): alternate 14 (LCD_B1) - push pull - floating - high speed
pin 109 (PG13): alternate 11 (ETH1_GMII_TXD0 ETH1_MII_TXD0 ETH1_RGMII_TXD0
ETH1_RMII_TXD0) - push pull - floating - very high speed
pin 110 (PG14): alternate 11 (ETH1_GMII_TXD1 ETH1_MII_TXD1 ETH1_RGMII_TXD1
ETH1_RMII_TXD1) - push pull - floating - very high speed
pin 111 (PG15): analog
```

```
pin 112 (PH0): analog
pin 113 (PH1): analog
pin 114 (PH2): alternate 14 (LCD_R0) - push pull - floating - high speed
pin 115 (PH3): alternate 14 (LCD_R1) - push pull - floating - high speed
pin 116 (PH4): output - high - push pull - floating - low speed
pin 117 (PH5): analog
pin 118 (PH6): analog
pin 119 (PH7): analog
pin 120 (PH8): alternate 14 (LCD_R2) - push pull - floating - high speed
pin 121 (PH9): alternate 14 (LCD_R3) - push pull - floating - high speed
pin 122 (PH10): alternate 14 (LCD_R4) - push pull - floating - high speed
pin 123 (PH11): analog
pin 124 (PH12): alternate 14 (LCD_R6) - push pull - floating - high speed
pin 125 (PH13): alternate 14 (LCD_G2) - push pull - floating - high speed
pin 126 (PH14): alternate 14 (LCD_G3) - push pull - floating - high speed
pin 127 (PH15): alternate 14 (LCD_G4) - push pull - floating - high speed
pin 128 (PI0): alternate 14 (LCD_G5) - push pull - floating - high speed
pin 129 (PI1): alternate 14 (LCD_G6) - push pull - floating - high speed
pin 130 (PI2): alternate 14 (LCD_G7) - push pull - floating - high speed
pin 131 (PI3): analog
pin 132 (PI4): alternate 14 (LCD_B4) - push pull - floating - high speed
pin 133 (PI5): alternate 10 (SAI2_SCK_A) - push pull - floating - medium speed
pin 134 (PI6): alternate 10 (SAI2_SD_A) - push pull - floating - medium speed
pin 135 (PI7): alternate 10 (SAI2_FS_A) - push pull - floating - medium speed
pin 136 (PI8): analog
pin 137 (PI9): alternate 14 (LCD_VSYNC) - push pull - floating - high speed
pin 138 (PI10): alternate 14 (LCD_HSYNC) - push pull - floating - high speed
pin 139 (PI11): analog
```

- To obtain the GPIO settings:

```
Board $> cat /sys/kernel/debug/gpio
gpiochip0: GPIOs 0-15, parent: platform/soc:pin-controller@50002000, GPIOA:
 gpio-10  (                    |reset               ) out lo

gpiochip1: GPIOs 16-31, parent: platform/soc:pin-controller@50002000, GPIOB:

gpiochip2: GPIOs 32-47, parent: platform/soc:pin-controller@50002000, GPIOC:

gpiochip3: GPIOs 48-63, parent: platform/soc:pin-controller@50002000, GPIOD:
 gpio-59  (                    |heartbeat           ) out lo

gpiochip4: GPIOs 64-79, parent: platform/soc:pin-controller@50002000, GPIOE:
 gpio-68  (                    |reset               ) out hi

gpiochip5: GPIOs 80-95, parent: platform/soc:pin-controller@50002000, GPIOF:

gpiochip6: GPIOs 96-111, parent: platform/soc:pin-controller@50002000, GPIOG:
 gpio-105 (                    |reset               ) out hi

gpiochip7: GPIOs 112-127, parent: platform/soc:pin-controller@50002000, GPIOH:
 gpio-116 (                    |reset               ) out hi

gpiochip8: GPIOs 128-143, parent: platform/soc:pin-controller@50002000, GPIOI:

gpiochip9: GPIOs 400-415, parent: platform/soc:pin-controller-z@54004000, GPIOZ:
```

4 To go further

4.1 Regmap (register map) cache

Debugfs contains a register cache (mirror) for drivers/peripherals based on regmap API[3].

Regmap is a register map abstraction API of the Linux kernel. It is mainly used for serial bus device drivers (I2C and SPI), but can also be used for internal peripheral drivers.

Many of these drivers contain some very similar code for accessing connected-hardware device registers.
The regmap kernel API proposes a solution which factors out this code from the drivers, saving code and making it much easier to share infrastructure.

- Path of the regmap register cache in debugfs

```
Board $> cd /sys/kernel/debug/regmap
```

- List of devices for which drivers are based on regmap API:

```
Board $> ls -la .
total 0
drwxr-xr-x 18 root root 0 Jan  1  1970 .
drwx------ 32 root root 0 Jan  1  1970 ..
drwxr-xr-x  2 root root 0 Jan  1  1970 0-001b
drwxr-xr-x  2 root root 0 Jan  1  1970 0-0042
drwxr-xr-x  2 root root 0 Jan  1  1970 2-0033
drwxr-xr-x  2 root root 0 Jan  1  1970 40004000.timer
drwxr-xr-x  2 root root 0 Jan  1  1970 4000d000.audio-controller
drwxr-xr-x  2 root root 0 Nov 30 12:19 40016000.cec
drwxr-xr-x  2 root root 0 Jan  1  1970 40017000.dac
drwxr-xr-x  2 root root 0 Jan  1  1970 4400b004.audio-controller
drwxr-xr-x  2 root root 0 Jan  1  1970 4400b024.audio-controller
drwxr-xr-x  2 root root 0 Jan  1  1970 4400d000.dfsdm
drwxr-xr-x  2 root root 0 Jan  1  1970 50027004.audio-controller
drwxr-xr-x  2 root root 0 Jan  1  1970 dummy-interrupt-controller@5000d000
drwxr-xr-x  2 root root 0 Jan  1  1970 dummy-pwr@50001000
drwxr-xr-x  2 root root 0 Jan  1  1970 dummy-rcc@50000000
drwxr-xr-x  2 root root 0 Jan  1  1970 dummy-syscon@50020000
drwxr-xr-x  2 root root 0 Jan  1  1970 dummy-tamp@5c00a000
```

- Check for the corresponding driver: example for **2-0033** regmap entry

```
Board $> cat 2-0033/name
stpmic1
```

Then, on the STM32MPU device tree files, you can check for the device, and the corresponding driver

```
pmic: stpmic@33 {
        compatible = "st,stpmic1";
        reg = <0x33>;
        interrupts-extended = <&exti_pwr 55 IRQ_TYPE_EDGE_FALLING>;
        interrupt-controller;
        #interrupt-cells = <2>;
        status = "okay";
```

- Regmap entries stating by ***dummy-***

This kind of entry is set when there are no associated /dev entries (devtmpfs).

To find the corresponding node in the device tree, you can look for the suffix name after ***dummy-***:

Example for dummy-**interrupt-controller@5000d000**

```
exti: interrupt-controller@5000d000 {
        compatible = "st,stm32mp1-exti", "syscon";
        interrupt-controller;
        #interrupt-cells = <2>;
        reg = <0x5000d000 0x400>;
};
```

- List of registers: example for **2-0033** regmap entry

```
Board $> cat 2-0033/registers
01: 10
02: 00
03: 00
04: 00
05: 60
06: 10
10: 04
11: 00
12: 00
13: 00
14: 00
15: c0
16: 00
17: 00
18: 04
19: 00
1a: 00
1b: 00
1c: 00
1d: 0f
1e: 04
20: 61
21: 79
22: d9
23: d9
24: 01
25: 51
26: 4c
27: 7d
28: 01
29: 51
2a: 25
30: 61
31: 50
32: d9
```

```
33: d9
34: 00
35: 24
36: 24
37: 24
38: 01
39: 51
3a: 04
40: 35
50: 00
51: 00
52: 00
53: 80
60: 00
61: 00
62: 00
63: 00
70: 00
71: 00
72: 00
73: 00
80: fc
81: 8f
82: c4
83: cf
90: fc
91: 8f
92: c4
93: cf
a0: 03
a1: 70
a2: 3b
a3: 00
b0: 00
b1: 00
b2: 00
b3: 80
```

The first column representes the register address, and the second column the register value.

For register definitions, please refer to the device specification.

5 References

- Documentation/filesystems/debugfs.txt
- https://opensourceforu.com/2010/10/debugging-linux-kernel-with-debugfs
- https://elinux.org/images/a/a3/Regmap-_The_Power_of_Subsystems_and_Abstractions.pdf

- Useful external links

Document link	Document Type	Description
Wikipedia debugfs	Standard	Wikipedia
Guide to debugfs	Standard	Guide

Document link	Document Type	Description
regmap: Reducing the Redundancy in Linux Code	Article	Guide

Random Access Memory (Early computer memories generally hadserial access. Memories where any given address can be accessed when desired were then called "random access" to distinguish them from the memories where contents can only be accessed in a fixed order. The term is used today forvolatile random-accesssemiconductor memories.)

Process File System (See https://en.wikipedia.org/wiki/Procfs for more details)

System File System (See https://en.wikipedia.org/wiki/Sysfs for more details)

Debug File System (See https://en.wikipedia.org/wiki/Debugfs for more details)

Receive

Consumer Electronics Control (HDMI standard)

Transmit

Compatibility Test Suite (Android specific) or Clear to send (in UART context)

Serial clock line

Secure digital

Serial DAta line

General-Purpose Input/Output (A realization of open ended transmission between devices on an embedded level. These pins available on a processor can be programmed to be used to either accept input or provide output to external devices depending on user desires and applications requirements.)

Application programming interface

Inter-Integrated Circuit (Bi-directional 2-wire bus standard for efficient inter-IC control.)

Serial Peripheral Interface