Serial Wire Debug Open Library

libswd 0.2-devel

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Contents

Chapter 1

Serial Wire Debug Open Library.

1.1 Introduction

LibSWD is an Open-Source framework to deal with with Serial Wire Debug Port in accordance to ADI (Arm Debug Interface, version 5.0 at the moment) specification. It is released under 3-clause BSD license. For more information please visit project website at http://libswd.sf.net

1.2 What is this about

Serial Wire Debug is an alternative to JTAG (IEEE1149.1) transport layer for accessing the Debug Access Port in ARM-Cortex based devices. LibSWD provides methods for bitstream generation on the wire using simple but flexible API that can reuse capabilities of existing applications for easier integration. Every bus operation such as control, request, turnaround, acknowledge, data and parity packet is named a "command" represented by a swd_cmd_t data type that builds up the queue that later can be flushed into real hardware using standard set of (application-specific) driver functions. This way LibSWD is almost standalone and can be easily integrated into existing utilities for low-level access and only requires in return to define driver bridge that controls the physical interface interconnecting host and target. Drivers and other application-specific functions are "extern" and located in external file crafted for that application and its hardware. LibSWD is therefore best way to make your application SWD aware.

1.3 How it works

1.3.1 SWD Context

The most important data type in LibSWD is swd_ctx_t structure, a context that represents logical entity of the swd bus (transport layer between host and target) with all its parameters, configuration and command queue. Context is being created with swd_init() function that returns pointer to allocated virgin structure, and it can be destroyed with swd_deinit() function taking the pointer as argument. Context can be set only for one interface-target pair, but there might be many different contexts in use if necessary, so amount of devices in use is not limited.

1.3.2 Functions

All functions in general operates on pointer type and returns number of processed elements on success or negative value with swd_error_code_t on failure. Functions are grouped by functionality that is denoted by function name prefix (ie. swd_bin∗ are for binary operations, swd_cmdq∗ deals with command queue, swd_cmd_enqueue∗ deals with creating commands and attaching them to queue, swd_bus∗ performs operation on the swd transport system, swd_drv∗ are the interface drivers, etc).

Standard end-users are encouraged to only use high level functions (swd_bus∗, swd_dap∗, swd_dp∗) to perform operations on the swd transport layer and the target's DAP (Debug Access Port) and its components such as DP (Debug Port) and the AP (Access Port). More advanced users however may use low level functions (swd_cmd∗, swd_cmdq∗) to group them into new high-level functions that automates some tasks (such as high-level functions does). Functions of type "extern" are the ones to implement in external file by developers that want to incorporate LibSWD into their application. Context structure also has void pointer in the swd_driver_t structure that can hold address of the external driver structure to be passed into internal swd drivers (extern swd_drv∗ functions) that wouldn't be accessible otherwise.

1.3.3 Commands

Bus operations are split into "commands" represented by swd_cmd_t data type. They form a bidirectional command queue that is part of swd_ctx_t structure. Command type, and so its payload, can be one of: control (user defined 8-bit payload), request (according to the standard), ack, data, parity (data and parity are separate commands!), trn, bitbang and idle (equals to control with zero data). Command type is defined by swd_cmdtype_t and its code can be negative (for MOSI operations) or positive (for MISO operations) - this way bus direction can be easily calculated by multiplying two operation codes (when the result is negative bus will have to change direction), so the libswd "knows" when to put additional TRN command of proper type between enqueued commands.

Payload is stored within union type and its data can be accessed according to payload name, or simply with data8 (char) and data32 (int) fields. Payload for write (MOSI) operations is stored on command creation, but payload for read (MISO) operations becomes available only after command is executed by the interface driver. There are 3 methods of accessing read data - flushing the queue into driver then reading queue directly, single stepping queue execution (flush one-by-one) then reading context log of last executed command results (there are separate fields of type swd_transaction_t in swd_ctx_t's log structure for read and write operations), or providing a double pointer on command creation to have constant access to its data after execution.

After all commands are enqueued with swd_cmd_enqueue∗ function set, it is time to send them into physical device with swd_cmdq_flush() funtion. According to the swd_operation_t parameter commands can be flushed one-by-one, all of them, only to the selected command or only after selected command. For low level functions all of these options are available, but for high-level functions only two of them can be used - SWD_OPERATION_ENQUEUE (but not send to the driver) and SWD_OPERATION_EXECUTE (all unexecuted commands on the queue are executed by the driver sequentially) - that makes it possible to perform bus operations one after another having their result just at function return, or compose more advanced sequences leading to preferred result at execution time. Because high-level functions provide simple and elegant manner to get the operation result, it is advised to use them instead dealing with low-level functions (implementing memory management, data allocation and queue operation) that exist only to make high-level functions possible.

1.4 Drivers

Calling the swd_cmdq_flush() function leads to execution of not yet executed commands from the queue (in a manner specified by the operation parameter) on the SWD bus (transport layer between interface and

target, not the bus of the target itself) by swd_drv_transmit() function that use application specific "extern" functions defined in external file (ie. libswd_urjtag.c) to operate on a real hardware using drivers from existing application. LibSWD use only swd_drv_{mosi,miso}_{8,32} (separate for 8-bit char and 32-bit int data cast type) and swd_drv_{mosi,miso}_trn functions to interact with drivers, so it is possible to easily reuse low-level and high-level devices for communications, as they have all information necessary to perform exact actions - number of bits, payload, command type, shift direction and bus direction. It is even possible to send raw bytes on the bus (control command) or bitbang the bus (bitbang command) if necessary. MOSI (Master Output Slave Input) and MISO (Master Input Slave Output) was used to clearly distinguish transfer direction (from master-interface to target-slave), as opposed to ambiguous read/write statements, so after swd_drv_mosi_trn() master should have its buffers set to output and target inputs active. Drivers, as most of the LibSWD functions, works on data pointers instead data copy and returns number of elements processed (bits in this case) or negative error code on failure.

1.5 Example

```
#include <libswd.h>
int main(){
 swd_ctx_t *swdctx;
 int res, *idcode;
 swdctx=swd_init();
 if (swdctx==NULL) return -1;
 //we might need to pass external driver structure to swd_drv* functions
 //swdctx->driver->device=...
 res=swd_dap_detect(swdctx, SWD_OPERATION_EXECUTE, &idcode);
 if (res<0){
  printf("ERROR: %s\n", swd_error_string(res));
  return res;
 } else printf("IDCODE: 0x%X (%s)\n", *idcode, swd_bin32_string(*idcode));
 swd_deinit(swdctx);
 return 0;
}
```

Chapter 2

Data Structure Index

2.1 Data Structures

Here are the data structures with brief descriptions:

Chapter 3

File Index

3.1 File List

Here is a list of all documented files with brief descriptions:

Chapter 4

Data Structure Documentation

4.1 swd_ahbap_t Struct Reference

Most actual Advanced High Bandwidth Access Peripherial Bus Reisters.

`#include <libswd.h>`

Data Fields

- char ack

  Last known state of ACK response.

- int controlstatus

  Last known CONTROLSTATUS register value.

- int tar

  Last known TAR register value.

- int drw

  Last known DRW register value.

- int bd0

  Last known BD0 register value.

- int bd1

  Last known BD1 register value.

- int bd2

  Last known BD2 register value.

- int bd3

  Last known BD3 register value.

- int dromt

  Last known DROMT register value.

- int idr

  Last known IDR register value.

4.1.1 Detailed Description

Most actual Advanced High Bandwidth Access Peripherial Bus Reisters.

The documentation for this struct was generated from the following file:

- src/libswd.h

4.2 swd_cmd_t Struct Reference

SWD Command Element Structure.

`#include <libswd.h>`

Data Fields

- union {
  char TRNnMOSI
  Holds/sets bus direction: MOSI when zero, MISO for others.
  char request
  Request header data.
  char ack
  Acknowledge response from target.
  int misodata
  Data read from target (MISO).
  int mosidata
  Data written to target (MOSI).
  int data32
  Holds "int" data type for inspection.
  char misobit
  Single bit read from target (bit-per-char).
  char mosibit
  Single bit written to target (bit-per-char).
  char parity
  Parity bit for data payload.
  char control
  Control transfer data (one byte).
  char data8
  Holds "char" data type for inspection.
  };

- char bits

  Payload bit count == clk pulses on the bus.

- swd_cmdtype_t cmdtype

  Command type as defined by swd_cmdtype_t.

- char done

  Non-zero if operation already executed.

- struct swd_cmd_t * prev

  Pointer to the previous command.

- struct swd_cmd_t * next

  Pointer to the next command.

4.2.1 Detailed Description

SWD Command Element Structure. In libswd each operation is split into separate commands (request, trn, ack, data, parity) that can be appended to the command queue and later executed. This organization allows better granularity for tracing bugs and makes possible to compose complete bus/target operations made of simple commands.

The documentation for this struct was generated from the following file:

- src/libswd.h

4.3 swd_context_config_t Struct Reference

Context configuration structure.

```
#include <libswd.h>
```

Data Fields

- char initialized

  Context must be initialized prior use.

- char trnlen

  How many CLK cycles will TRN use.

- int maxcmdqlen

  How long command queue can be.

- swd_loglevel_t loglevel

  Holds Logging Level setting.

4.3.1 Detailed Description

Context configuration structure.

The documentation for this struct was generated from the following file:

- src/libswd.h

4.4 swd_ctx_t Struct Reference

SWD Context Structure definition.

`#include <libswd.h>`

Data Fields

- swd_cmd_t * cmdq
  Command queue, stores all bus operations.
- swd_context_config_t config
  Target specific configuration.
- swd_driver_t * driver
  Pointer to the interface driver structure.
- struct {
  swd_swdp_t dp
  Last known value of the SW-DP registers.
  swd_ahbap_t ap
  Last known value of the AHB-AP registers.
  swd_transaction_t read
  Last read operation fields.
  swd_transaction_t write
  Last write operation fields.
  } **log**

4.4.1 Detailed Description

SWD Context Structure definition. It stores all the information about the library, drivers and interface configuration, target status along with DAP/AHBAP data/instruction internal registers, and the command queue. Bus operations are stored on the command queue. There may be more than one context in use by a host software, each one for single interface-target pair. Most of the target operations made with libswd are required to pass swd_ctx_t pointer structure that also remembers last known state of the target's internal registers.

The documentation for this struct was generated from the following file:

- src/libswd.h

4.5 swd_driver_t Struct Reference

Interface Driver structure.

`#include <libswd.h>`

Data Fields

- void * **device**

4.5.1 Detailed Description

Interface Driver structure. It holds pointer to the driver structure that keeps driver information necessary to work with the physical interface.

The documentation for this struct was generated from the following file:

- src/libswd.h

4.6 swd_swdp_t Struct Reference

Most actual Serial Wire Debug Port Registers.

`#include <libswd.h>`

Data Fields

- char ack

  Last known state of ACK response.

- char parity

  Parity bit of the data transfer.

- int idcode

  Target's IDCODE register value.

- int abort

  Last known ABORT register value.

- int ctrlstat

  Last known CTRLSTAT register value.

- int wcr

  Last known WCR register value.

- int select

  Last known SELECT register value.

- int rdbuf

  Last known RDBUF register (payload data) value.

4.6.1 Detailed Description

Most actual Serial Wire Debug Port Registers.

The documentation for this struct was generated from the following file:

- src/libswd.h

4.7 swd_transaction_t Struct Reference

Most actual SWD bus transaction/packet data.

`#include <libswd.h>`

Data Fields

- char request

  Last known request on the bus.

- char ack

  Last known ack on the bus.

- char addr

  Last known address operation on the bus.

- int data

  Last known data on the bus.

- int control

  Last known control data on the bus.

- char parity

  Last known parity on the bus.

4.7.1 Detailed Description

Most actual SWD bus transaction/packet data.

The documentation for this struct was generated from the following file:

- src/libswd.h

Chapter 5

File Documentation

5.1 src/libswd.h File Reference

Serial Wire Debug Open Library Header File.

```
#include <stdlib.h>
#include <stdarg.h>
```

Data Structures

- struct swd_cmd_t
  SWD Command Element Structure.
- struct swd_context_config_t
  Context configuration structure.
- struct swd_swdp_t
  Most actual Serial Wire Debug Port Registers.
- struct swd_ahbap_t
  Most actual Advanced High Bandwidth Access Peripherial Bus Reisters.
- struct swd_transaction_t
  Most actual SWD bus transaction/packet data.
- struct swd_driver_t
  Interface Driver structure.
- struct swd_ctx_t
  SWD Context Structure definition.

Defines

- #define SWD_REQUEST_START_BITNUM 7

SWD Packets Bit Fields and Values.

- #define SWD_REQUEST_APnDP_BITNUM 6
  Access Port (high) or Debug Port (low) access.
- #define SWD_REQUEST_RnW_BITNUM 5
  Read (high) or Write (low) access.
- #define SWD_REQUEST_ADDR_BITNUM 4
  LSB of the address field in request header.
- #define SWD_REQUEST_A2_BITNUM 4
  Target Register Address bit 2.
- #define SWD_REQUEST_A3_BITNUM 3
  Target Register Address bit 3.
- #define SWD_REQUEST_PARITY_BITNUM 2
  Odd Parity calculated from APnDP, RnW, A[2:3].
- #define SWD_REQUEST_STOP_BITNUM 1
  Packet Stop bit, always 0.
- #define SWD_REQUEST_PARK_BITNUM 0
  Park wire and switch between receive/transmit.
- #define SWD_REQUEST_START_VAL 1
  Start Bit Value is always 1.
- #define SWD_REQUEST_STOP_VAL 0
  Stop Bit Value is always 0.
- #define SWD_REQUEST_PARK_VAL 1
  Park bus and put outputs into Hi-Z state.
- #define SWD_REQUEST_BITLEN 8
  Number of bits in request packet header.
- #define SWD_ADDR_MINVAL 0
  Address field minimal value.
- #define SWD_ADDR_MAXVAL 3
  Address field maximal value.
- #define SWD_ACK_BITLEN 3
  Number of bits in Acknowledge packet.
- #define SWD_ACK_OK_VAL 4
  OK code value.

- #define SWD_ACK_WAIT_VAL 2

  WAIT code value.

- #define SWD_ACK_FAULT_VAL 1

  FAULT code value.

- #define SWD_DP_IDCODE_ADDR 0

  IDCODE register address (RO).

- #define SWD_DP_ABORT_ADDR 0

  ABORT register address (WO).

- #define SWD_DP_CTRLSTAT_ADDR 1

  CTRLSTAT register address (R/W, CTRLSEL=b0).

- #define SWD_DP_WCR_ADDR 1

  WCR register address (R/W, CTRLSEL=b1).

- #define SWD_DP_RESEND_ADDR 2

  RESEND register address (RO).

- #define SWD_DP_SELECT_ADDR 2

  SELECT register address (WO).

- #define SWD_DP_RDBUF_ADDR 3

  RDBUF register address (RO).

- #define SWD_DP_ABORT_DAPABORT_BITNUM 0

  SW-DP ABORT Register map.

- #define SWD_DP_ABORT_DSTKCMPCLR_BITNUM 1

  DSTKCMPCLR bit number.

- #define SWD_DP_ABORT_DSTKERRCLR_BITNUM 2

  DSTKERRCLR bit number.

- #define SWD_DP_ABORT_DWDERRCLR_BITNUM 3

  DWDERRCLR bit number.

- #define SWD_DP_ABORT_DORUNERRCLR_BITNUM 4

  DORUNERRCLR bit number.

- #define SWD_DP_ABORT_DAPABORT (1 << SWD_DP_ABORT_DAPABORT_BITNUM)

  DAPABORT bitmask.

- #define SWD_DP_ABORT_DSTKCMPCLR (1 << SWD_DP_ABORT_DSTKCMPCLR_BITNUM)

  DSTKCMPCLR bitmask.

- #define SWD_DP_ABORT_DSTKERRCLR (1 << SWD_DP_ABORT_DSTKERRCLR_-BITNUM)

  DSTKERRCLR bitmask.

- #define SWD_DP_ABORT_DWDERRCLR (1 << SWD_DP_ABORT_DWDERRCLR_-BITNUM)

  DWDERRCLR bitmask.

- #define SWD_DP_ABORT_DORUNERRCLR (1 << SWD_DP_ABORT_DORUNERRCLR_-BITNUM)

  DORUNERRCLR bitmask.

- #define SWD_DP_CTRLSTAT_ORUNDETECT_BITNUM 0

  SW-DP CTRL/STAT Register map.

- #define SWD_DP_CTRLSTAT_STICKYORUN_BITNUM 1

  STICKYORUN bit number.

- #define SWD_DP_CTRLSTAT_TRNMODE_BITNUM 2

  TRNMODE bit number.

- #define SWD_DP_CTRLSTAT_STICKYCMP_BITNUM 4

  STICKYCMP bit number.

- #define SWD_DP_CTRLSTAT_STICKYERR_BITNUM 5

  STICKYERR bit number.

- #define SWD_DP_CTRLSTAT_READOK_BITNUM 6

  READOK bit number.

- #define SWD_DP_CTRLSTAT_WDATAERR_BITNUM 7

  WDATAERR bit number.

- #define SWD_DP_CTRLSTAT_MASKLANE_BITNUM 8

  MASKLANE bit number.

- #define SWD_DP_CTRLSTAT_TRNCNT_BITNUM 12

  TRNCNT bit number.

- #define SWD_DP_CTRLSTAT_CDBGRSTREQ_BITNUM 26

  CDBGRSTREQ bit number.

- #define SWD_DP_CTRLSTAT_CDBGRSTACK_BITNUM 27

  CDBGRSTACK bit number.

- #define SWD_DP_CTRLSTAT_CDBGPWRUPREQ_BITNUM 28

  CDBGPWRUPREQ bit number.

- #define SWD_DP_CTRLSTAT_CDBGPWRUPACK_BITNUM 29

  CDBGPWRUPACK bit number.

- #define SWD_DP_CTRLSTAT_CSYSPWRUPREQ_BITNUM 30

  CSYSPWRUPREQ bit number.

- #define SWD_DP_CTRLSTAT_CSYSPWRUPACK_BITNUM 31

  CSYSPWRUPACK bit number.

- #define SWD_DP_CTRLSTAT_ORUNDETECT (1 << SWD_DP_CTRLSTAT_ORUNDETECT_-BITNUM)

  ORUNDETECT bitmask.

- #define SWD_DP_CTRLSTAT_STICKYORUN (1 << SWD_DP_CTRLSTAT_-OSTICKYORUN_BITNUM)

  STICKYORUN bitmask.

- #define SWD_DP_CTRLSTAT_STICKYCMP (1 << SWD_DP_CTRLSTAT_OSTICKYCMP_-BITNUM)

  STICKYCMP bitmask.

- #define SWD_DP_CTRLSTAT_STICKYERR (1 << SWD_DP_CTRLSTAT_OSTICKYERR_-BITNUM)

  STICKYERR bitmask.

- #define SWD_DP_CTRLSTAT_READOK (1 << SWD_DP_CTRLSTAT_OREADOK_BITNUM)

  READOK bitmask.

- #define SWD_DP_CTRLSTAT_WDATAERR (1 << SWD_DP_CTRLSTAT_OWDATAERR_-BITNUM)

  WDATAERR bitmask.

- #define SWD_DP_CTRLSTAT_CDBGRSTREQ (1 << SWD_DP_CTRLSTAT_-OCDBGRSTREQ_BITNUM)

  CDBGRSTREQ bitmask.

- #define SWD_DP_CTRLSTAT_CDBGRSTACK (1 << SWD_DP_CTRLSTAT_-OCDBGRSTACK_BITNUM)

  CDBGRSTACK bitmask.

- #define SWD_DP_CTRLSTAT_CDBGPWRUPREQ (1 << SWD_DP_CTRLSTAT_-OCDBGPWRUPREQ_BITNUM)

  CDBGPWRUPREQ bitmask.

- #define SWD_DP_CTRLSTAT_CDBGPWRUPACK (1 << SWD_DP_CTRLSTAT_-OCDBGPWRUPACK_BITNUM)

  CDBGPWRUPACK bitmask.

- #define SWD_DP_CTRLSTAT_CSYSPWRUPREQ (1 << SWD_DP_CTRLSTAT_-OCSYSPWRUPREQ_BITNUM)

  CSYSPWRUPREQ bitmask.

- #define SWD_DP_CTRLSTAT_CSYSPWRUPACK (1 << SWD_DP_CTRLSTAT_OCSYSPWRUPACK_BITNUM)

  CSYSPWRUPACK bitmask.

- #define SWD_MASKLANE_0 0b0001

  SW-DP CTRLSTAT MASKLANE available values.

- #define SWD_MASKLANE_1 0b0010

  Compare byte lane 1 (0x----FF--).

- #define SWD_MASKLANE_2 0b0100

  Compare byte lane 2 (0x--FF----).

- #define SWD_MASKLANE_3 0b1000

  Compare byte lane 3 (0xFF------).

- #define SWD_DP_SELECT_CTRLSEL_BITNUM 0

  SW-DP SELECT Register map.

- #define SWD_DP_SELECT_APBANKSEL_BITNUM 4

  APBANKSEL bit number.

- #define SWD_DP_SELECT_APSEL_BITNUM 24

  APSEL bit number.

- #define SWD_DP_SELECT_CTRLSEL (1 << SWD_DP_SELECT_CTRLSEL_BITNUM)

  CTRLSEL bitmask.

- #define SWD_DP_SELECT_APBANKSEL (1 << SWD_DP_SELECT_APBANKSEL_BITNUM)

  APBANKSEL bitmask.

- #define SWD_DP_SELECT_APSEL (1 << SWD_DP_SELECT_APSEL_BITNUM)

  APSEL bitmask.

- #define SWD_DP_WCR_PRESCALER_BITNUM 0

  SW-DP WCR Register map.

- #define SWD_DP_WCR_WIREMODE_BITNUM 6
- #define SWD_DP_WCR_TURNROUND_BITNUM 8
- #define SWD_TURNROUND_1_CODE 0

  SW-DP WCR TURNROUND available values.

- #define **SWD_TURNROUND_1_VAL** 1
- #define SWD_TURNROUND_2_CODE 1
- #define **SWD_TURNROUNT_2_VAL** 2
- #define SWD_TURNROUND_3_CODE 2
- #define **SWD_TURNROUND_3_VAL** 3
- #define SWD_TURNROUND_4_CODE 3
- #define **SWD_TURNROUND_4_VAL** 4

- #define SWD_TURNROUND_MIN_VAL SWD_TURNROUND_1_VAL
- #define **SWD_TURNROUND_MIN_CODE** SWD_TURNOUND_1_CODE
- #define SWD_TURNROUND_MAX_VAL SWD_TURNROUND_4_VAL
- #define **SWD_TURNROUND_MAX_CODE** SWD_TURNROUND_4_CODE
- #define SWD_TURNROUND_DEFAULT_VAL SWD_TURNROUND_1_VAL
- #define AHB_AP_CONTROLSTATUS 0x00

  AHB-AP Registers Map.

- #define AHB_AP_TAR 0x04

  R/W, 32bit, reset value: 0x00000000.

- #define AHB_AP_DRW 0x0C

  R/W, 32bit.

- #define AHB_AP_BD0 0x10

  R/W, 32bit.

- #define AHB_AP_BD1 0x14

  R/W, 32bit.

- #define AHB_AP_BD2 0x18

  R/W, 32bit.

- #define AHB_AP_BD3 0x1C

  R/W, 32bit.

- #define AHB_AP_DROMT 0xF8

  RO, 32bit, reset value: 0xE00FF000.

- #define AHB_AP_IDR 0xFC

  RO, 32bit, reset value: 0x24770001.

- #define SWD_DATA_MAXBITCOUNT 32

  SWD queue and payload data definitions.

- #define SWD_DATA_BYTESIZE 8

  How many bits are there in a byte.

- #define SWD_DATA_BITLEN 32

  How many bits are there in data payload.

- #define SWD_CMDQLEN_DEFAULT 1024;

  How long is the command queue by default.

Typedefs

- typedef struct swd_cmd_t swd_cmd_t

  SWD Command Element Structure.

Enumerations

- enum swd_error_code_t {

  SWD_OK = 0, SWD_ERROR_GENERAL = -1, SWD_ERROR_NULLPOINTER = -2, SWD_ERROR_NULLQUEUE = -3,

  SWD_ERROR_NULLTRN = -4, SWD_ERROR_PARAM = -5, SWD_ERROR_OUTOFMEM = -6, SWD_ERROR_RESULT = -7,

  SWD_ERROR_RANGE = -8, SWD_ERROR_DEFINITION = -9, SWD_ERROR_NULLCONTEXT = -10, SWD_ERROR_QUEUE = -11,

  SWD_ERROR_ADDR = -12, SWD_ERROR_APnDP = -13, SWD_ERROR_RnW = -14, SWD_ERROR_PARITY = -15,

  SWD_ERROR_ACK = -16, SWD_ERROR_ACKUNKNOWN = -19, SWD_ERROR_ACKNOTDONE = -20, SWD_ERROR_ACKMISSING = -21,

  SWD_ERROR_ACKMISMATCH = -22, SWD_ERROR_ACKORDER = -23, SWD_ERROR_BADOPCODE = -24, SWD_ERROR_NODATACMD = -25,

  SWD_ERROR_DATAPTR = -26, SWD_ERROR_NOPARITYCMD = -27, SWD_ERROR_PARITYPTR = -28, SWD_ERROR_NOTDONE = -29,

  SWD_ERROR_QUEUEROOT = -30, SWD_ERROR_QUEUETAIL = -31, SWD_ERROR_BADCMDTYPE = -32, SWD_ERROR_BADCMDDATA = -33,

  SWD_ERROR_TURNAROUND = -34, SWD_ERROR_DRIVER = -35, SWD_ERROR_ACK_WAIT = -36, SWD_ERROR_ACK_FAULT = -37,

  SWD_ERROR_QUEUENOTFREE = -38, SWD_ERROR_TRANSPORT = -39, SWD_ERROR_DIRECTION = -40, SWD_ERROR_LOGLEVEL = -41 }

  Status and Error Codes definitions.

- enum swd_loglevel_t {

  SWD_LOGLEVEL_MIN = 0, SWD_LOGLEVEL_SILENT = 0, SWD_LOGLEVEL_ERROR = 1, SWD_LOGLEVEL_WARNING = 2,

  SWD_LOGLEVEL_NORMAL = 3, SWD_LOGLEVEL_INFO = 4, SWD_LOGLEVEL_DEBUG = 5, **SWD_LOGLEVEL_MAX** = 5 }

  Logging Level Codes definition.

- enum swd_cmdtype_t {

  SWD_CMDTYPE_MOSI_DATA = -7, SWD_CMDTYPE_MOSI_REQUEST = -6, SWD_CMDTYPE_MOSI_TRN = -5, SWD_CMDTYPE_MOSI_PARITY = -4,

  SWD_CMDTYPE_MOSI_BITBANG = -3, SWD_CMDTYPE_MOSI_CONTROL = -2, SWD_CMDTYPE_MOSI = -1, SWD_CMDTYPE_UNDEFINED = 0,

  SWD_CMDTYPE_MISO = 1, SWD_CMDTYPE_MISO_ACK = 2, SWD_CMDTYPE_MISO_BITBANG = 3, SWD_CMDTYPE_MISO_PARITY = 4,

  SWD_CMDTYPE_MISO_TRN = 5, SWD_CMDTYPE_MISO_DATA = 6 }

  SWD Command Codes definitions.

- enum swd_shiftdir_t { SWD_DIR_LSBFIRST = 0, SWD_DIR_MSBFIRST = 1 }

  What is the shift direction LSB-first or MSB-first.

- enum swd_operation_t {

  SWD_OPERATION_FIRST = 1, SWD_OPERATION_ENQUEUE = 1, SWD_OPERATION_EXECUTE = 2, SWD_OPERATION_TRANSMIT_HEAD = 3,

  SWD_OPERATION_TRANSMIT_TAIL = 4, SWD_OPERATION_TRANSMIT_ALL = 5, SWD_OPERATION_TRANSMIT_ONE = 6, SWD_OPERATION_TRANSMIT_LAST = 7,

  SWD_OPERATION_LAST = 7 }

  Command Queue operations codes.

- enum swd_bool_t { SWD_FALSE = 0, SWD_TRUE = 1 }

  Boolean values definition.

Functions

- int swd_bin8_parity_even (char *data, char *parity)

  Some comments on the function behavior.

- int swd_bin32_parity_even (int *data, char *parity)

  Data parity calculator, calculates even parity on integer type.

- int swd_bin8_print (char *data)

  Prints binary data of a char value on the screen.

- int swd_bin32_print (int *data)

  Prints binary data of an integer value on the screen.

- char * swd_bin8_string (char *data)

  Generates string containing binary data of a char value.

- char * swd_bin32_string (int *data)

  Generates string containing binary data of an integer value.

- int swd_bin8_bitswap (unsigned char *buffer, int bitcount)

  *Bit swap helper function that reverse bit order in char *buffer.*

- int swd_bin32_bitswap (unsigned int *buffer, int bitcount)

  *Bit swap helper function that reverse bit order in int *buffer.*

- int swd_cmdq_init (swd_cmd_t *cmdq)

  Initialize new queue element in memory that becomes a queue root.

- swd_cmd_t * swd_cmdq_find_root (swd_cmd_t *cmdq)

  Find queue root (first element).

- swd_cmd_t * swd_cmdq_find_tail (swd_cmd_t *cmdq)

  Find queue tail (last element).

- int swd_cmdq_append (swd_cmd_t *cmdq, swd_cmd_t *cmd)

  *Append element pointed by *cmd at the end of the quque pointed by *cmdq.*

- int swd_cmdq_free (swd_cmd_t *cmdq)
  *Free queue pointed by *cmdq element.*
- int swd_cmdq_free_head (swd_cmd_t *cmdq)
  *Free queue head up to *cmdq element.*
- int swd_cmdq_free_tail (swd_cmd_t *cmdq)
  *Free queue tail starting after *cmdq element.*
- int swd_cmdq_flush (swd_ctx_t *swdctx, swd_operation_t operation)
  Flush command queue contents into interface driver.
- int swd_cmd_enqueue (swd_ctx_t *swdctx, swd_cmd_t *cmd)
  Append selected command to a context's command queue.
- int swd_cmd_enqueue_mosi_request (swd_ctx_t *swdctx, char *request)
  Appends command queue with SWD Request packet header.
- int swd_cmd_enqueue_mosi_trn (swd_ctx_t *swdctx)
  Append command queue with Turnaround activating MOSI mode.
- int swd_cmd_enqueue_miso_trn (swd_ctx_t *swdctx)
  Append command queue with Turnaround activating MISO mode.
- int swd_cmd_enqueue_miso_nbit (swd_ctx_t *swdctx, char **data, int count)
  Append command queue with bus binary read bit-by-bit operation.
- int swd_cmd_enqueue_mosi_nbit (swd_ctx_t *swdctx, char *data, int count)
  Append command queue with bus binary write bit-by-bit operation.
- int swd_cmd_enqueue_mosi_parity (swd_ctx_t *swdctx, char *parity)
  Append command queue with parity bit write.
- int swd_cmd_enqueue_miso_parity (swd_ctx_t *swdctx, char **parity)
  Append command queue with parity bit read.
- int swd_cmd_enqueue_miso_data (swd_ctx_t *swdctx, int **data)
  Append command queue with data read.
- int swd_cmd_enqueue_miso_data_p (swd_ctx_t *swdctx, int **data, char **parity)
  Append command queue with data and parity read.
- int swd_cmd_enqueue_miso_n_data_p (swd_ctx_t *swdctx, int **data, char **parity, int count)
  Append command queue with series of data and parity read.
- int swd_cmd_enqueue_mosi_data (swd_ctx_t *swdctx, int *data)
  Append command queue with data and parity write.
- int swd_cmd_enqueue_mosi_data_ap (swd_ctx_t *swdctx, int *data)

Append command queue with data and automatic parity write.

- int swd_cmd_enqueue_mosi_data_p (swd_ctx_t *swdctx, int *data, char *parity)
  Append command queue with data and provided parity write.
- int swd_cmd_enqueue_mosi_n_data_ap (swd_ctx_t *swdctx, int **data, int count)
  Append command queue with series of data and automatic parity writes.
- int swd_cmd_enqueue_mosi_n_data_p (swd_ctx_t *swdctx, int **data, char **parity, int count)
  Append command queue with series of data and provided parity writes.
- int swd_cmd_enqueue_miso_ack (swd_ctx_t *swdctx, char **ack)
  Append queue with ACK read.
- int swd_cmd_enqueue_mosi_control (swd_ctx_t *swdctx, char *ctlmsg, int len)
  Append command queue with len-octet size control seruence.
- int swd_cmd_enqueue_mosi_dap_reset (swd_ctx_t *swdctx)
  Append command queue with SW-DP-RESET sequence.
- int swd_cmd_enqueue_mosi_idle (swd_ctx_t *swdctx)
  Append command queue with idle sequence.
- int swd_cmd_enqueue_mosi_jtag2swd (swd_ctx_t *swdctx)
  Append command queue with JTAG-TO-SWD DAP-switch sequence.
- int swd_cmd_enqueue_mosi_swd2jtag (swd_ctx_t *swdctx)
  Append command queue with SWD-TO-JTAG DAP-switch sequence.
- char * swd_cmd_string_cmdtype (swd_cmd_t *cmd)
  *Return human readable command type string of *cmd.*
- int swd_bus_setdir_mosi (swd_ctx_t *swdctx)
  Append command queue with TRN WRITE/MOSI, if previous command was READ/MISO.
- int swd_bus_setdir_miso (swd_ctx_t *swdctx)
  Append command queue with TRN READ/MISO, if previous command was WRITE/MOSI.
- int swd_bus_write_request (swd_ctx_t *swdctx, swd_operation_t operation, char *APnDP, char *RnW, char *addr)
  Perform Request.
- int swd_bus_read_ack (swd_ctx_t *swdctx, swd_operation_t operation, char **ack)
  *Perform ACK read into *ack and verify received data.*
- int swd_bus_write_data_p (swd_ctx_t *swdctx, swd_operation_t operation, int *data, char *parity)
  Perform (MOSI) data write with provided parity value.
- int swd_bus_write_data_ap (swd_ctx_t *swdctx, swd_operation_t operation, int *data)
  Perform (MOSI) data write with automatic parity calculation.

- int swd_bus_read_data_p (swd_ctx_t *swdctx, swd_operation_t operation, int **data, char **parity)

  Perform (MISO) data read.

- int swd_bus_write_control (swd_ctx_t *swdctx, swd_operation_t operation, char *ctlmsg, int len)

  Write CONTROL byte to the Target's DAP.

- int swd_bitgen8_request (swd_ctx_t *swdctx, char *APnDP, char *RnW, char *addr, char *request)

  Generate 8-bit SWD-REQUEST packet contents with provided parameters.

- int swd_drv_transmit (swd_ctx_t *swdctx, swd_cmd_t *cmd)

  Transmit selected command from the command queue to the interface driver.

- int **swd_drv_mosi_8** (swd_ctx_t *swdctx, swd_cmd_t *cmd, char *data, int bits, int nLSBfirst)
- int **swd_drv_mosi_32** (swd_ctx_t *swdctx, swd_cmd_t *cmd, int *data, int bits, int nLSBfirst)
- int **swd_drv_miso_8** (swd_ctx_t *swdctx, swd_cmd_t *cmd, char *data, int bits, int nLSBfirst)
- int **swd_drv_miso_32** (swd_ctx_t *swdctx, swd_cmd_t *cmd, int *data, int bits, int nLSBfirst)
- int **swd_drv_mosi_trn** (swd_ctx_t *swdctx, int clks)
- int **swd_drv_miso_trn** (swd_ctx_t *swdctx, int clks)
- int swd_dap_reset (swd_ctx_t *swdctx, swd_operation_t operation)

  Debug Access Port Reset sends 50 CLK with TMS high that brings both SW-DP and JTAG-DP into reset state.

- int swd_dap_select (swd_ctx_t *swdctx, swd_operation_t operation)

  Activate SW-DP by sending out RESET and JTAG-TO-SWD sequence on SWDIOTMS line.

- int swd_dap_detect (swd_ctx_t *swdctx, swd_operation_t operation, int **idcode)

  Macro: Reset target DAP, select SW-DP, read out IDCODE.

- int swd_dp_read_idcode (swd_ctx_t *swdctx, swd_operation_t operation, int **idcode)

  Macro: Read out IDCODE register and return its value on function return.

- int swd_dp_read (swd_ctx_t *swdctx, swd_operation_t operation, char addr, int **data)

  Macro: Generic read of the DP register.

- int swd_dp_write (swd_ctx_t *swdctx, swd_operation_t operation, char addr, int *data)

  Macro function: Generic write of the DP register.

- int swd_ap_read (swd_ctx_t *swdctx, swd_operation_t operation, char addr, int **data)

  Macro function: Generic read of the AP register.

- int swd_ap_write (swd_ctx_t *swdctx, swd_operation_t operation, char addr, int *data)

  Macro function: Generic write of the AP register.

- int swd_log (swd_ctx_t *swdctx, swd_loglevel_t loglevel, char *msg,...)

  Put a message into swd context log at specified verbosity level.

- int swd_log_level_set (swd_ctx_t *swdctx, swd_loglevel_t loglevel)

Change log level to increase or decrease verbosity level.

- int swd_log_level_inherit (swd_ctx_t *swdctx, int loglevel)

  Set debug level according to caller's application settings.

- char * **swd_error_string** (swd_error_code_t error)
- swd_ctx_t * swd_init (void)

  LibSWD initialization routine.

- int swd_deinit_ctx (swd_ctx_t *swdctx)

  De-initialize selected swd context and free its memory.

- int swd_deinit_cmdq (swd_ctx_t *swdctx)

  De-initialize command queue and free its memory on selected swd context.

- int swd_deinit (swd_ctx_t *swdctx)

  De-initialize selected swd context and its command queue.

5.1.1 Detailed Description

Serial Wire Debug Open Library Header File.

5.1.2 Define Documentation

5.1.2.1 #define AHB_AP_BD0 0x10

R/W, 32bit.

R/W, 32bit

5.1.2.2 #define AHB_AP_BD1 0x14

R/W, 32bit.

R/W, 32bit

5.1.2.3 #define AHB_AP_BD2 0x18

R/W, 32bit.

R/W, 32bit

5.1.2.4 #define AHB_AP_BD3 0x1C

R/W, 32bit.

R/W, 32bit

5.1.2.5 #define AHB_AP_CONTROLSTATUS 0x00

AHB-AP Registers Map.

TODO!!!! R/W, 32bit, reset value: 0x43800042 R/W, 32bit, reset value: 0x43800042

5.1.2.6 #define AHB_AP_DROMT 0xF8

RO, 32bit, reset value: 0xE00FF000.

RO, 32bit, reset value: 0xE00FF000

5.1.2.7 #define AHB_AP_DRW 0x0C

R/W, 32bit.

R/W, 32bit

5.1.2.8 #define AHB_AP_IDR 0xFC

RO, 32bit, reset value: 0x24770001.

RO, 32bit, reset value: 0x24770001

5.1.2.9 #define AHB_AP_TAR 0x04

R/W, 32bit, reset value: 0x00000000.

R/W, 32bit, reset value: 0x00000000

5.1.2.10 #define SWD_DATA_MAXBITCOUNT 32

SWD queue and payload data definitions.

What is the maximal bit length of the data.

5.1.2.11 #define SWD_DP_ABORT_DAPABORT_BITNUM 0

SW-DP ABORT Register map.

DAPABORT bit number.

5.1.2.12 #define SWD_DP_CTRLSTAT_ORUNDETECT_BITNUM 0

SW-DP CTRL/STAT Register map.

ORUNDETECT bit number.

5.1.2.13 #define SWD_DP_SELECT_CTRLSEL_BITNUM 0

SW-DP SELECT Register map.

CTRLSEL bit number.

5.1.2.14 #define SWD_DP_WCR_PRESCALER_BITNUM 0

SW-DP WCR Register map.

PRESCALER bit number. PRESCALER bit number.

5.1.2.15 #define SWD_DP_WCR_TURNROUND_BITNUM 8

TURNROUND bit number.

5.1.2.16 #define SWD_DP_WCR_WIREMODE_BITNUM 6

WIREMODE bit number.

5.1.2.17 #define SWD_MASKLANE_0 0b0001

SW-DP CTRLSTAT MASKLANE available values.

Compare byte lane 0 (0x------FF)

5.1.2.18 #define SWD_REQUEST_START_BITNUM 7

SWD Packets Bit Fields and Values.

Packet Start bit, always set to 1.

5.1.2.19 #define SWD_TURNROUND_1_CODE 0

SW-DP WCR TURNROUND available values.

TRN takes one CLK cycle. TRN takes one CLK cycle.

5.1.2.20 #define SWD_TURNROUND_2_CODE 1

TRN takes two CLK cycles.

5.1.2.21 #define SWD_TURNROUND_3_CODE 2

TRN takes three CLK cycles.

5.1.2.22 #define SWD_TURNROUND_4_CODE 3

TRN takes four CLK cycles. ????

5.1.2.23 #define SWD_TURNROUND_DEFAULT_VAL SWD_TURNROUND_1_VAL

Default TRN length is one CLK.

5.1.2.24 #define SWD_TURNROUND_MAX_VAL SWD_TURNROUND_4_VAL

longest TRN time.

5.1.2.25 #define SWD_TURNROUND_MIN_VAL SWD_TURNROUND_1_VAL

shortest TRN time.

5.1.3 Typedef Documentation

5.1.3.1 typedef struct swd_cmd_t swd_cmd_t

SWD Command Element Structure.

In libswd each operation is split into separate commands (request, trn, ack, data, parity) that can be appended to the command queue and later executed. This organization allows better granularity for tracing bugs and makes possible to compose complete bus/target operations made of simple commands.

5.1.4 Enumeration Type Documentation

5.1.4.1 enum swd_bool_t

Boolean values definition.

Enumerator:

SWD_FALSE False is 0.

SWD_TRUE True is 1.

5.1.4.2 enum swd_cmdtype_t

SWD Command Codes definitions.

Available values: MISO>0, MOSI<0, undefined=0. To check command direction (read/write) multiply tested value with one of the MOSI or MISO commands

- result is positive for equal direction and negative if direction differs. Command Type codes definition, use this to see names in debugger.

Enumerator:

SWD_CMDTYPE_MOSI_DATA Contains MOSI data (from host).

SWD_CMDTYPE_MOSI_REQUEST Contains MOSI request packet.

SWD_CMDTYPE_MOSI_TRN Bus will switch into MOSI mode.

SWD_CMDTYPE_MOSI_PARITY Contains MOSI data parity.

SWD_CMDTYPE_MOSI_BITBANG Allows MOSI operation bit-by-bit.

SWD_CMDTYPE_MOSI_CONTROL MOSI control sequence (ie. sw-dp reset, idle).

SWD_CMDTYPE_MOSI Master Output Slave Input direction.

SWD_CMDTYPE_UNDEFINED undefined command, not transmitted.

SWD_CMDTYPE_MISO Master Input Slave Output direction.

SWD_CMDTYPE_MISO_ACK Contains ACK data from target.

SWD_CMDTYPE_MISO_BITBANG Allows MISO operation bit-by-bit.

SWD_CMDTYPE_MISO_PARITY Contains MISO data parity.

SWD_CMDTYPE_MISO_TRN Bus will switch into MISO mode.

SWD_CMDTYPE_MISO_DATA Contains MISO data (from target).

5.1.4.3 enum swd_error_code_t

Status and Error Codes definitions.

Error Codes definition, use this to have its name on debugger.

Enumerator:

SWD_OK No error.

SWD_ERROR_GENERAL General error.

SWD_ERROR_NULLPOINTER Null pointer.

SWD_ERROR_NULLQUEUE Null queue pointer.

SWD_ERROR_NULLTRN Null TurnaRouNd pointer.

SWD_ERROR_PARAM Bad parameter.

SWD_ERROR_OUTOFMEM Out of memory.

SWD_ERROR_RESULT Bad result.

SWD_ERROR_RANGE Out of range.

SWD_ERROR_DEFINITION Definition (internal) error.

SWD_ERROR_NULLCONTEXT Null context pointer.

SWD_ERROR_QUEUE Queue error.

SWD_ERROR_ADDR Addressing error.

SWD_ERROR_APnDP Bad APnDP value.

SWD_ERROR_RnW Bad RnW value.

SWD_ERROR_PARITY Parity error.

SWD_ERROR_ACK Acknowledge error.

SWD_ERROR_ACKUNKNOWN Unknown ACK value.

SWD_ERROR_ACKNOTDONE ACK not yet executed on target.

SWD_ERROR_ACKMISSING ACK command not found on the queue.

SWD_ERROR_ACKMISMATCH Bad ACK result address.

SWD_ERROR_ACKORDER ACK not in order REQ->TRN->ACK.

SWD_ERROR_BADOPCODE Unsupported operation requested.

SWD_ERROR_NODATACMD Command not found on the queue.

SWD_ERROR_DATAPTR Bad DATA pointer address.

SWD_ERROR_NOPARITYCMD Parity after Data missing or misplaced.

SWD_ERROR_PARITYPTR Bad PARITY pointer address.

SWD_ERROR_NOTDONE Could not end selected task.

SWD_ERROR_QUEUEROOT Queue root not found or null.

SWD_ERROR_QUEUETAIL Queue tail not found or null.

SWD_ERROR_BADCMDTYPE Unknown command detected.

SWD_ERROR_BADCMDDATA Bad command data.

SWD_ERROR_TURNAROUND Error during turnaround switch.

SWD_ERROR_DRIVER Driver error.

SWD_ERROR_ACK_WAIT Received ACK WAIT.

SWD_ERROR_ACK_FAULT Received ACK FAULT.

SWD_ERROR_QUEUENOTFREE Cannot free resources, queue not empty.

SWD_ERROR_TRANSPORT Transport type unknown or undefined.

SWD_ERROR_DIRECTION Direction error (LSb/MSb first).

SWD_ERROR_LOGLEVEL Invalid loglevel number.

5.1.4.4 enum swd_loglevel_t

Logging Level Codes definition.

Logging Level codes definition, use this to have its name on debugger.

Enumerator:

SWD_LOGLEVEL_SILENT Remain silent.

SWD_LOGLEVEL_ERROR Show errors.

SWD_LOGLEVEL_WARNING Show warnings.

SWD_LOGLEVEL_NORMAL Normal verbosity.

SWD_LOGLEVEL_INFO Show messages.

SWD_LOGLEVEL_DEBUG Show all including debug information.

5.1.4.5 enum swd_operation_t

Command Queue operations codes.

Enumerator:

SWD_OPERATION_FIRST First operation to know its code.

SWD_OPERATION_ENQUEUE Append command(s) to the queue.

SWD_OPERATION_EXECUTE Queue commands then flush the queue.

SWD_OPERATION_TRANSMIT_HEAD Transmit root..current (head).

SWD_OPERATION_TRANSMIT_TAIL Transmit current..last (tail).

SWD_OPERATION_TRANSMIT_ALL Transmit all commands on the queue.

SWD_OPERATION_TRANSMIT_ONE Transmit only current command.

SWD_OPERATION_TRANSMIT_LAST Transmit last command on the queue.

SWD_OPERATION_LAST Last operation to know its code.

5.1.4.6 enum swd_shiftdir_t

What is the shift direction LSB-first or MSB-first.

Enumerator:

SWD_DIR_LSBFIRST Data is shifted in/out right (LSB-first).

SWD_DIR_MSBFIRST Data is shifted in/out left (MSB-first).

5.1.5 Function Documentation

5.1.5.1 int swd_ap_read (swd_ctx_t * *swdctx*, swd_operation_t *operation*, char *addr*, int ** *data*)

Macro function: Generic read of the AP register.

Parameters

swdctx swd context to work on.

operation can be SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE.

addr is the address of the AP register to read.

data is the pointer to data where result will be stored.

Returns

number of elements processed or SWD_ERROR code on failure.

5.1.5.2 int swd_ap_write (swd_ctx_t * *swdctx*, swd_operation_t *operation*, char *addr*, int * *data*)

Macro function: Generic write of the AP register.

Parameters

swdctx swd context to work on.

operation can be SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE.

addr is the address of the AP register to write.

data is the pointer to data to be written.

Returns

number of elements processed or SWD_ERROR code on failure.

5.1.5.3 int swd_bin32_bitswap (unsigned int * *buffer*, int *bitcount*)

Bit swap helper function that reverse bit order in int *buffer.

Most Significant Bit becomes Least Significant Bit. It is possible to swap only n-bits from int (32-bit) *buffer.

Parameters

∗***buffer*** unsigned char (32-bit) data pointer.

bitcount how many bits to swap.

Returns

swapped bit count (positive) or error code (negative).

5.1.5.4 int swd_bin32_parity_even (int ∗ *data*, char ∗ *parity*)

Data parity calculator, calculates even parity on integer type.

Parameters

∗***data*** source data pointer.

∗***parity*** resulting data pointer.

Returns

negative value on error, 0 or 1 as parity result.

5.1.5.5 int swd_bin32_print (int ∗ *data*)

Prints binary data of an integer value on the screen.

Parameters

∗***data*** source data pointer.

Returns

number of characters printed.

5.1.5.6 char∗ swd_bin32_string (int ∗ *data*)

Generates string containing binary data of an integer value.

Parameters

∗***data*** source data pointer.

Returns

pointer to the resulting string.

5.1.5.7 int swd_bin8_bitswap (unsigned char * *buffer,* int *bitcount*)

Bit swap helper function that reverse bit order in char *buffer.

Most Significant Bit becomes Least Significant Bit. It is possible to swap only n-bits from char (8-bit) *buffer.

Parameters

buffer unsigned char (8-bit) data pointer.

bitcount how many bits to swap.

Returns

swapped bit count (positive) or error code (negative).

5.1.5.8 int swd_bin8_parity_even (char * *data,* char * *parity*)

Some comments on the function behavior.

Some comments on the function behavior.

Parameters

data source data pointer.

parity resulting data pointer.

Returns

negative value on error, 0 or 1 as parity result.

5.1.5.9 int swd_bin8_print (char * *data*)

Prints binary data of a char value on the screen.

Parameters

data source data pointer.

Returns

number of characters printed.

5.1.5.10 char* swd_bin8_string (char * *data*)

Generates string containing binary data of a char value.

Parameters

data source data pointer.

Returns

pointer to the resulting string.

5.1.5.11 int swd_bitgen8_request (swd_ctx_t * *swdctx*, char * *APnDP*, char * *RnW*, char * *addr*, char * *request*)

Generate 8-bit SWD-REQUEST packet contents with provided parameters.

Note that parity bit value is calculated automatically.

Parameters

swdctx swd context pointer.

APnDP AccessPort (high) or DebugPort (low) access type pointer.

RnW Read (high) or Write (low) operation type pointer.

addr target register address value pointer.

request pointer where to store resulting packet.

Returns

number of generated packets (1), or SWD_ERROR_CODE on failure.

5.1.5.12 int swd_bus_read_ack (swd_ctx_t * *swdctx*, swd_operation_t *operation*, char ** *ack*)

Perform ACK read into *ack and verify received data.

Parameters

swdctx swd context pointer.

operation type of action to perform with generated request.

ack pointer to the result location.

Returns

number of commands processed, or SWD_ERROR_CODE on failure.

5.1.5.13 int swd_bus_read_data_p (swd_ctx_t * *swdctx*, swd_operation_t *operation*, int ** *data*, char ** *parity*)

Perform (MISO) data read.

Parameters

swdctx swd context pointer.

operation type of action to perform on generated command.

data payload value pointer.

parity payload parity value pointer.

Returns

number of elements processed, or SWD_ERROR_CODE on failure.

5.1.5.14 int swd_bus_setdir_miso (swd_ctx_t * *swdctx*)

Append command queue with TRN READ/MISO, if previous command was WRITE/MOSI.

Parameters

swdctx swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.1.5.15 int swd_bus_setdir_mosi (swd_ctx_t * *swdctx*)

Append command queue with TRN WRITE/MOSI, if previous command was READ/MISO.

Parameters

swdctx swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.1.5.16 int swd_bus_write_control (swd_ctx_t * *swdctx,* swd_operation_t *operation,* char * *ctlmsg,* int *len*)

Write CONTROL byte to the Target's DAP.

Parameters

swdctx swd context.

operation can be SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE.

ctlmsg byte/char array that contains control payload.

len number of bytes in the *ctlmsg to send.

Returns

number of bytes sent or SWD_ERROR_CODE on failure.

5.1.5.17 int swd_bus_write_data_ap (swd_ctx_t * *swdctx,* swd_operation_t *operation,* int * *data*)

Perform (MOSI) data write with automatic parity calculation.

Parameters

swdctx swd context pointer.

operation type of action to perform on generated command.

data payload value pointer.

Returns

number of elements processed, or SWD_ERROR_CODE on failure.

5.1.5.18 int swd_bus_write_data_p (swd_ctx_t * *swdctx*, swd_operation_t *operation*, int * *data*, char * *parity*)

Perform (MOSI) data write with provided parity value.

Parameters

swdctx swd context pointer.

operation type of action to perform on generated command.

data payload value pointer.

parity payload parity value pointer.

Returns

number of elements processed, or SWD_ERROR_CODE on failure.

5.1.5.19 int swd_bus_write_request (swd_ctx_t * *swdctx*, swd_operation_t *operation*, char * *APnDP*, char * *RnW*, char * *addr*)

Perform Request.

Parameters

swdctx swd context pointer.

operation type of action to perform with generated request.

APnDP AccessPort (high) or DebugPort (low) access value pointer.

RnW Read (high) or Write (low) access value pointer.

addr target register address value pointer.

Returns

number of commands processed, or SWD_ERROR_CODE on failure.

5.1.5.20 int swd_cmd_enqueue (swd_ctx_t * *swdctx*, swd_cmd_t * *cmd*)

Append selected command to a context's command queue.

Parameters

swdctx swd context pointer containing the command queue.

cmd command to be appended to the context's command queue.

Returns

number of elements appended or SWD_ERROR_CODE on failure.

5.1.5.21 int swd_cmd_enqueue_miso_ack (swd_ctx_t * *swdctx*, char ** *ack*)

Append queue with ACK read.

Parameters

swdctx swd context pointer.
ack packet value pointer.

Returns

number of elements appended (1), or SWD_ERROR_CODE on failure.

5.1.5.22 int swd_cmd_enqueue_miso_data (swd_ctx_t * *swdctx*, int ** *data*)

Append command queue with data read.

Parameters

swdctx swd context pointer.
data data pointer.

Returns

of elements appended (1), or SWD_ERROR_CODE on failure.

5.1.5.23 int swd_cmd_enqueue_miso_data_p (swd_ctx_t * *swdctx*, int ** *data*, char ** *parity*)

Append command queue with data and parity read.

Parameters

swdctx swd context pointer.
data data value pointer.
parity parity value pointer.

Returns

number of elements appended (2), or SWD_ERROR_CODE on failure.

5.1.5.24 int swd_cmd_enqueue_miso_n_data_p (swd_ctx_t * *swdctx*, int ** *data*, char ** *parity*, int *count*)

Append command queue with series of data and parity read.

Parameters

swdctx swd context pointer.
data data value array pointer.
parity parity value array pointer.
count number of (data+parity) elements to read.

Returns

number of elements appended (2*count), or SWD_ERROR_CODE on failure.

5.1.5.25 int swd_cmd_enqueue_miso_nbit (swd_ctx_t * *swdctx,* char ** *data,* int *count*)

Append command queue with bus binary read bit-by-bit operation.

This function will append command to the queue for each bit, and store one bit into single char array element, so read is not constrained to 8 bits. On error memory is released and apropriate error code is returned. Important: Memory pointed by *data must be allocated prior call!

Parameters

swdctx swd context pointer.

****data*** allocated data array to write result into.

count number of bits to read (also the **data size).

Returns

number of elements processed, or SWD_ERROR_CODE on failure.

5.1.5.26 int swd_cmd_enqueue_miso_parity (swd_ctx_t * *swdctx,* char ** *parity*)

Append command queue with parity bit read.

Parameters

swdctx swd context pointer.

parity parity value pointer.

Returns

number of elements appended (1), or SWD_ERROR_CODE on failure.

5.1.5.27 int swd_cmd_enqueue_miso_trn (swd_ctx_t * *swdctx*)

Append command queue with Turnaround activating MISO mode.

Parameters

swdctx swd context pointer.

Returns

return number of elements appended (1), or SWD_ERROR_CODE on failure.

5.1.5.28 int swd_cmd_enqueue_mosi_control (swd_ctx_t * *swdctx,* char * *ctlmsg,* int *len*)

Append command queue with len-octet size control seruence.

This control sequence can be used for instance to send payload of packets switching DAP between JTAG and SWD mode.

Parameters

swdctx swd context pointer.

∗***ctlmsg*** control message array pointer.

len number of elements to send from ∗ctlmsg.

Returns

number of elements appended (len), or SWD_ERROR_CODE on failure.

5.1.5.29 int swd_cmd_enqueue_mosi_dap_reset (swd_ctx_t ∗ *swdctx*)

Append command queue with SW-DP-RESET sequence.

Parameters

∗***swdctx*** swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.1.5.30 int swd_cmd_enqueue_mosi_data (swd_ctx_t ∗ *swdctx,* int ∗ *data*)

Append command queue with data and parity write.

Parameters

∗***swdctx*** swd context pointer.

∗***data*** data value pointer.

Returns

number of elements appended (1), or SWD_ERROR_CODE on failure.

5.1.5.31 int swd_cmd_enqueue_mosi_data_ap (swd_ctx_t ∗ *swdctx,* int ∗ *data*)

Append command queue with data and automatic parity write.

Parameters

∗***swdctx*** swd context pointer.

∗***data*** data value pointer.

Returns

number of elements appended (2), or SWD_ERROR_CODE on failure.

5.1.5.32 int swd_cmd_enqueue_mosi_data_p (swd_ctx_t * *swdctx,* int * *data,* char * *parity*)

Append command queue with data and provided parity write.

Parameters

swdctx swd context pointer.

data data value pointer.

parity parity value pointer.

Returns

number of elements appended (2), or SWD_ERROR_CODE on failure.

5.1.5.33 int swd_cmd_enqueue_mosi_idle (swd_ctx_t * *swdctx*)

Append command queue with idle sequence.

Parameters

swdctx swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.1.5.34 int swd_cmd_enqueue_mosi_jtag2swd (swd_ctx_t * *swdctx*)

Append command queue with JTAG-TO-SWD DAP-switch sequence.

Parameters

swdctx swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.1.5.35 int swd_cmd_enqueue_mosi_n_data_ap (swd_ctx_t * *swdctx,* int ** *data,* int *count*)

Append command queue with series of data and automatic parity writes.

Parameters

swdctx swd context pointer.

data data value array pointer.

count number of (data+parity) elements to read.

Returns

number of elements appended (2*count), or SWD_ERROR_CODE on failure.

5.1.5.36 int swd_cmd_enqueue_mosi_n_data_p (swd_ctx_t * *swdctx,* int ** *data,* char ** *parity,* int *count*)

Append command queue with series of data and provided parity writes.

Parameters

swdctx swd context pointer.

****data*** data value array pointer.

****parity*** parity value array pointer.

count number of (data+parity) elements to read.

Returns

number of elements appended (2*count), or SWD_ERROR_CODE on failure.

5.1.5.37 int swd_cmd_enqueue_mosi_nbit (swd_ctx_t * *swdctx,* char * *data,* int *count*)

Append command queue with bus binary write bit-by-bit operation.

This function will append command to the queue for each bit and store one bit into single char array element, so read is not constrained to 8 bits. On error memory is released and apropriate error code is returned. Important: Memory pointed by *data must be allocated prior call!

Parameters

swdctx swd context pointer.

****data*** allocated data array to write result into.

count number of bits to read (also the **data size).

Returns

number of elements processed, or SWD_ERROR_CODE on failure.

5.1.5.38 int swd_cmd_enqueue_mosi_parity (swd_ctx_t * *swdctx,* char * *parity*)

Append command queue with parity bit write.

Parameters

swdctx swd context pointer.

****parity*** parity value pointer.

Returns

number of elements appended (1), or SWD_ERROR_CODE on failure.

5.1.5.39 int swd_cmd_enqueue_mosi_request (swd_ctx_t * *swdctx*, char * *request*)

Appends command queue with SWD Request packet header.

Note that contents is not validated, so bad request can be sent as well.

Parameters

swdctx swd context pointer.

request pointer to the 8-bit request payload.

Returns

return number elements appended (1), or SWD_ERROR_CODE on failure.

5.1.5.40 int swd_cmd_enqueue_mosi_swd2jtag (swd_ctx_t * *swdctx*)

Append command queue with SWD-TO-JTAG DAP-switch sequence.

Parameters

swdctx swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.1.5.41 int swd_cmd_enqueue_mosi_trn (swd_ctx_t * *swdctx*)

Append command queue with Turnaround activating MOSI mode.

Parameters

swdctx swd context pointer.

Returns

return number elements appended (1), or SWD_ERROR_CODE on failure.

5.1.5.42 char* swd_cmd_string_cmdtype (swd_cmd_t * *cmd*)

Return human readable command type string of *cmd.

Parameters

cmd command the name is to be printed.

Returns

string containing human readable command name, or NULL on failure.

5.1.5.43 int swd_cmdq_append (swd_cmd_t * *cmdq,* swd_cmd_t * *cmd*)

Append element pointed by *cmd at the end of the quque pointed by *cmdq.

After this operation queue will be pointed by appended element (ie. last element added becomes actual quque pointer to show what was added recently).

Parameters

***cmdq** pointer to any element on command queue

***cmd** pointer to the command to be appended

Returns

number of appended elements (one), SWD_ERROR_CODE on failure

5.1.5.44 swd_cmd_t* swd_cmdq_find_root (swd_cmd_t * *cmdq*)

Find queue root (first element).

Parameters

***cmdq** pointer to any queue element

Returns

swd_cmd_t* pointer to the first element (root), NULL on failure

5.1.5.45 swd_cmd_t* swd_cmdq_find_tail (swd_cmd_t * *cmdq*)

Find queue tail (last element).

Parameters

***cmdq** pointer to any queue element

Returns

swd_cmd_t* pointer to the last element (tail), NULL on failure

5.1.5.46 int swd_cmdq_flush (swd_ctx_t * *swdctx,* swd_operation_t *operation*)

Flush command queue contents into interface driver.

Operation is specified by SWD_OPERATION and can be used to select how to flush the queue, ie. head-only, tail-only, one, all, etc.

Parameters

***swdctx** swd context pointer.

***operation** tells how to flush the queue.

Returns

number of commands transmitted, or SWD_ERROR_CODE on failure.

5.1.5.47 int swd_cmdq_free (swd_cmd_t * *cmdq*)

Free queue pointed by *cmdq element.

Parameters

cmdq pointer to any element on command queue

Returns

number of elements destroyed, SWD_ERROR_CODE on failure

5.1.5.48 int swd_cmdq_free_head (swd_cmd_t * *cmdq*)

Free queue head up to *cmdq element.

Parameters

cmdq pointer to the element that becomes new queue root.

Returns

number of elements destroyed, or SWD_ERROR_CODE on failure.

5.1.5.49 int swd_cmdq_free_tail (swd_cmd_t * *cmdq*)

Free queue tail starting after *cmdq element.

Parameters

cmdq pointer to the last element on the new queue.

Returns

number of elements destroyed, or SWD_ERROR_CODE on failure.

5.1.5.50 int swd_cmdq_init (swd_cmd_t * *cmdq*)

Initialize new queue element in memory that becomes a queue root.

Parameters

cmdq pointer to the command queue element of type swd_cmd_t

Returns

SWD_OK on success, SWD_ERROR_CODE code on failure

5.1.5.51 int swd_dap_detect (swd_ctx_t * *swdctx,* swd_operation_t *operation,* int ** *idcode*)

Macro: Reset target DAP, select SW-DP, read out IDCODE.

This is the proper SW-DP initialization as stated by ARM Information Center.

Parameters

swdctx swd context pointer.

operation type (SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE).

Returns

Target's IDCODE, or SWD_ERROR_CODE on failure.

5.1.5.52 int swd_dap_reset (swd_ctx_t * *swdctx,* swd_operation_t *operation*)

Debug Access Port Reset sends 50 CLK with TMS high that brings both SW-DP and JTAG-DP into reset state.

Parameters

swdctx swd context pointer.

operation type (SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE).

Returns

number of elements processed or SWD_ERROR_CODE code on failure.

5.1.5.53 int swd_dap_select (swd_ctx_t * *swdctx,* swd_operation_t *operation*)

Activate SW-DP by sending out RESET and JTAG-TO-SWD sequence on SWDIOTMS line.

Parameters

swdctx swd context.

Returns

number of control bytes executed, or error code on failre.

5.1.5.54 int swd_deinit (swd_ctx_t * *swdctx*)

De-initialize selected swd context and its command queue.

Parameters

swdctx swd context pointer.

Returns

number of elements freed, or SWD_ERROR_CODE on failure.

5.1.5.55 int swd_deinit_cmdq (swd_ctx_t * *swdctx*)

De-initialize command queue and free its memory on selected swd context.

Parameters

swdctx swd context pointer.

Returns

number of commands freed, or SWD_ERROR_CODE on failure.

5.1.5.56 int swd_deinit_ctx (swd_ctx_t * *swdctx*)

De-initialize selected swd context and free its memory.

Note: This function will not free command queue for selected context!

Parameters

swdctx swd context pointer.

Returns

SWD_OK on success, SWD_ERROR_CODE on failure.

5.1.5.57 int swd_dp_read (swd_ctx_t * *swdctx,* swd_operation_t *operation,* char *addr,* int ** *data*)

Macro: Generic read of the DP register.

Parameters

swdctx swd context to work on.

operation can be SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE.

addr is the address of the DP register to read.

****data*** is the pointer to data where result will be stored.

Returns

number of elements processed or SWD_ERROR_CODE on failure.

5.1.5.58 int swd_dp_read_idcode (swd_ctx_t * *swdctx,* swd_operation_t *operation,* int ** *idcode*)

Macro: Read out IDCODE register and return its value on function return.

Parameters

swdctx swd context pointer.

operation operation type.

Returns

Number of elements processed or SWD_ERROR code error on failure.

5.1.5.59 int swd_dp_write (swd_ctx_t * *swdctx,* swd_operation_t *operation,* char *addr,* int * *data*)

Macro function: Generic write of the DP register.

Parameters

swdctx swd context to work on.

operation can be SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE.

addr is the address of the DP register to write.

data is the pointer to data to be written.

Returns

number of elements processed or SWD_ERROR code on failure.

5.1.5.60 int swd_drv_transmit (swd_ctx_t * *swdctx,* swd_cmd_t * *cmd*)

Transmit selected command from the command queue to the interface driver.

Parameters

swdctx swd context pointer.

cmd pointer to the command to be sent.

Returns

number of commands transmitted (1), or SWD_ERROR_CODE on failure.

5.1.5.61 swd_ctx_t* swd_init (void)

LibSWD initialization routine.

It should be called prior any operation made with libswd. It initializes command queue and basic parameters for context that is returned as pointer.

Returns

pointer to the initialized swd context.

5.1.5.62 int swd_log (swd_ctx_t * *swdctx,* swd_loglevel_t *loglevel,* char * *msg,* ...)

Put a message into swd context log at specified verbosity level.

If specified message's log level is lower than actual context configuration, message will be omitted. Verbosity level increases from 0 (silent) to 4 (debug).

Parameters

swdctx swd context.

loglevel at which to put selected message.

∗***msg*** message body with variable arguments as in "printf".

Returns

number of characters written or error code on failure.

5.1.5.63 int swd_log_level_inherit (swd_ctx_t ∗ *swdctx,* int *loglevel*)

Set debug level according to caller's application settings.

∗swdctx swd context to work on. loglevel caller's application log level to be converted.

Returns

SWD_OK on success, of error code on failure.

5.1.5.64 int swd_log_level_set (swd_ctx_t ∗ *swdctx,* swd_loglevel_t *loglevel*)

Change log level to increase or decrease verbosity level.

Parameters

∗***swdctx*** swd context.

loglevel is the target verbosity level to be set.

Returns

SWD_OK on success or error code.

5.2 src/libswd_bin.c File Reference

```
#include <libswd.h>
```

Functions

- int swd_bin8_parity_even (char ∗data, char ∗parity)
  Data parity calculator, calculates even parity on char type.
- int swd_bin32_parity_even (int ∗data, char ∗parity)
  Data parity calculator, calculates even parity on integer type.
- int swd_bin8_print (char ∗data)
  Prints binary data of a char value on the screen.
- int swd_bin32_print (int ∗data)
  Prints binary data of an integer value on the screen.
- char ∗ swd_bin8_string (char ∗data)
  Generates string containing binary data of a char value.

- char * swd_bin32_string (int *data)
  Generates string containing binary data of an integer value.
- int swd_bin8_bitswap (unsigned char *buffer, int bitcount)
  *Bit swap helper function that reverse bit order in char *buffer.*
- int swd_bin32_bitswap (unsigned int *buffer, int bitcount)
  *Bit swap helper function that reverse bit order in int *buffer.*

5.2.1 Detailed Description

5.2.2 Function Documentation

5.2.2.1 int swd_bin32_bitswap (unsigned int * *buffer*, int *bitcount*)

Bit swap helper function that reverse bit order in int *buffer.

Most Significant Bit becomes Least Significant Bit. It is possible to swap only n-bits from int (32-bit) *buffer.

Parameters

buffer unsigned char (32-bit) data pointer.

bitcount how many bits to swap.

Returns

swapped bit count (positive) or error code (negative).

5.2.2.2 int swd_bin32_parity_even (int * *data*, char * *parity*)

Data parity calculator, calculates even parity on integer type.

Parameters

data source data pointer.

parity resulting data pointer.

Returns

negative value on error, 0 or 1 as parity result.

5.2.2.3 int swd_bin32_print (int * *data*)

Prints binary data of an integer value on the screen.

Parameters

data source data pointer.

Returns

number of characters printed.

5.2.2.4 char* swd_bin32_string (int * *data*)

Generates string containing binary data of an integer value.

Parameters

data source data pointer.

Returns

pointer to the resulting string.

5.2.2.5 int swd_bin8_bitswap (unsigned char * *buffer,* int *bitcount*)

Bit swap helper function that reverse bit order in char *buffer.

Most Significant Bit becomes Least Significant Bit. It is possible to swap only n-bits from char (8-bit) *buffer.

Parameters

buffer unsigned char (8-bit) data pointer.

bitcount how many bits to swap.

Returns

swapped bit count (positive) or error code (negative).

5.2.2.6 int swd_bin8_parity_even (char * *data,* char * *parity*)

Data parity calculator, calculates even parity on char type.

Some comments on the function behavior.

Parameters

data source data pointer.

parity resulting data pointer.

Returns

negative value on error, 0 or 1 as parity result.

5.2.2.7 int swd_bin8_print (char * *data*)

Prints binary data of a char value on the screen.

Parameters

∗***data*** source data pointer.

Returns

number of characters printed.

5.2.2.8 char∗ swd_bin8_string (char ∗ *data*)

Generates string containing binary data of a char value.

Parameters

∗***data*** source data pointer.

Returns

pointer to the resulting string.

5.3 src/libswd_bitgen.c File Reference

```
#include <libswd.h>
```

Functions

- int swd_bitgen8_request (swd_ctx_t ∗swdctx, char ∗APnDP, char ∗RnW, char ∗addr, char ∗request)
  Generate 8-bit SWD-REQUEST packet contents with provided parameters.

5.3.1 Detailed Description

5.3.2 Function Documentation

5.3.2.1 int swd_bitgen8_request (swd_ctx_t ∗ *swdctx,* char ∗ *APnDP,* char ∗ *RnW,* char ∗ *addr,* char ∗ *request*)

Generate 8-bit SWD-REQUEST packet contents with provided parameters.

Note that parity bit value is calculated automatically.

Parameters

∗***swdctx*** swd context pointer.
∗***APnDP*** AccessPort (high) or DebugPort (low) access type pointer.
∗***RnW*** Read (high) or Write (low) operation type pointer.
∗***addr*** target register address value pointer.
∗***request*** pointer where to store resulting packet.

Returns

number of generated packets (1), or SWD_ERROR_CODE on failure.

5.4 src/libswd_bus.c File Reference

```
#include <libswd.h>
```

Functions

- int swd_bus_setdir_mosi (swd_ctx_t *swdctx)
  Append command queue with TRN WRITE/MOSI, if previous command was READ/MISO.
- int swd_bus_setdir_miso (swd_ctx_t *swdctx)
  Append command queue with TRN READ/MISO, if previous command was WRITE/MOSI.
- int swd_bus_write_request (swd_ctx_t *swdctx, swd_operation_t operation, char *APnDP, char *RnW, char *addr)
  Perform Request.
- int swd_bus_read_ack (swd_ctx_t *swdctx, swd_operation_t operation, char **ack)
  *Perform ACK read into *ack and verify received data.*
- int swd_bus_write_data_p (swd_ctx_t *swdctx, swd_operation_t operation, int *data, char *parity)
  Perform (MOSI) data write with provided parity value.
- int swd_bus_write_data_ap (swd_ctx_t *swdctx, swd_operation_t operation, int *data)
  Perform (MOSI) data write with automatic parity calculation.
- int swd_bus_read_data_p (swd_ctx_t *swdctx, swd_operation_t operation, int **data, char **parity)
  Perform (MISO) data read.
- int swd_bus_write_control (swd_ctx_t *swdctx, swd_operation_t operation, char *ctlmsg, int len)
  Write CONTROL byte to the Target's DAP.

5.4.1 Detailed Description

5.4.2 Function Documentation

5.4.2.1 int swd_bus_read_ack (swd_ctx_t * *swdctx*, swd_operation_t *operation*, char ** *ack*)

Perform ACK read into *ack and verify received data.

Parameters

swdctx swd context pointer.

operation type of action to perform with generated request.

ack pointer to the result location.

Returns

number of commands processed, or SWD_ERROR_CODE on failure.

5.4.2.2 int swd_bus_read_data_p (swd_ctx_t * *swdctx,* swd_operation_t *operation,* int ** *data,* char ** *parity*)

Perform (MISO) data read.

Parameters

swdctx swd context pointer.

operation type of action to perform on generated command.

data payload value pointer.

parity payload parity value pointer.

Returns

number of elements processed, or SWD_ERROR_CODE on failure.

5.4.2.3 int swd_bus_setdir_miso (swd_ctx_t * *swdctx*)

Append command queue with TRN READ/MISO, if previous command was WRITE/MOSI.

Parameters

swdctx swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.4.2.4 int swd_bus_setdir_mosi (swd_ctx_t * *swdctx*)

Append command queue with TRN WRITE/MOSI, if previous command was READ/MISO.

Parameters

swdctx swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.4.2.5 int swd_bus_write_control (swd_ctx_t * *swdctx,* swd_operation_t *operation,* char * *ctlmsg,* int *len*)

Write CONTROL byte to the Target's DAP.

Parameters

swdctx swd context.

operation can be SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE.

ctlmsg byte/char array that contains control payload.

len number of bytes in the *ctlmsg to send.

Returns

number of bytes sent or SWD_ERROR_CODE on failure.

5.4.2.6 int swd_bus_write_data_ap (swd_ctx_t * *swdctx*, swd_operation_t *operation*, int * *data*)

Perform (MOSI) data write with automatic parity calculation.

Parameters

swdctx swd context pointer.

operation type of action to perform on generated command.

data payload value pointer.

Returns

number of elements processed, or SWD_ERROR_CODE on failure.

5.4.2.7 int swd_bus_write_data_p (swd_ctx_t * *swdctx*, swd_operation_t *operation*, int * *data*, char * *parity*)

Perform (MOSI) data write with provided parity value.

Parameters

swdctx swd context pointer.

operation type of action to perform on generated command.

data payload value pointer.

parity payload parity value pointer.

Returns

number of elements processed, or SWD_ERROR_CODE on failure.

5.4.2.8 int swd_bus_write_request (swd_ctx_t * *swdctx*, swd_operation_t *operation*, char * *APnDP*, char * *RnW*, char * *addr*)

Perform Request.

Parameters

swdctx swd context pointer.

operation type of action to perform with generated request.

APnDP AccessPort (high) or DebugPort (low) access value pointer.

RnW Read (high) or Write (low) access value pointer.

addr target register address value pointer.

Returns

number of commands processed, or SWD_ERROR_CODE on failure.

5.5 src/libswd_cmd.c File Reference

```
#include <libswd.h>
```

Functions

- int swd_cmd_enqueue (swd_ctx_t *swdctx, swd_cmd_t *cmd)
  Append selected command to a context's command queue.
- int swd_cmd_enqueue_mosi_request (swd_ctx_t *swdctx, char *request)
  Appends command queue with SWD Request packet header.
- int swd_cmd_enqueue_mosi_trn (swd_ctx_t *swdctx)
  Append command queue with Turnaround activating MOSI mode.
- int swd_cmd_enqueue_miso_trn (swd_ctx_t *swdctx)
  Append command queue with Turnaround activating MISO mode.
- int swd_cmd_enqueue_miso_nbit (swd_ctx_t *swdctx, char **data, int count)
  Append command queue with bus binary read bit-by-bit operation.
- int swd_cmd_enqueue_mosi_nbit (swd_ctx_t *swdctx, char *data, int count)
  Append command queue with bus binary write bit-by-bit operation.
- int swd_cmd_enqueue_mosi_parity (swd_ctx_t *swdctx, char *parity)
  Append command queue with parity bit write.
- int swd_cmd_enqueue_miso_parity (swd_ctx_t *swdctx, char **parity)
  Append command queue with parity bit read.
- int swd_cmd_enqueue_miso_data (swd_ctx_t *swdctx, int **data)
  Append command queue with data read.
- int swd_cmd_enqueue_miso_data_p (swd_ctx_t *swdctx, int **data, char **parity)
  Append command queue with data and parity read.
- int swd_cmd_enqueue_miso_n_data_p (swd_ctx_t *swdctx, int **data, char **parity, int count)
  Append command queue with series of data and parity read.
- int swd_cmd_enqueue_mosi_data (swd_ctx_t *swdctx, int *data)
  Append command queue with data and parity write.
- int swd_cmd_enqueue_mosi_data_ap (swd_ctx_t *swdctx, int *data)
  Append command queue with data and automatic parity write.
- int swd_cmd_enqueue_mosi_data_p (swd_ctx_t *swdctx, int *data, char *parity)
  Append command queue with data and provided parity write.
- int swd_cmd_enqueue_mosi_n_data_ap (swd_ctx_t *swdctx, int **data, int count)
  Append command queue with series of data and automatic parity writes.
- int swd_cmd_enqueue_mosi_n_data_p (swd_ctx_t *swdctx, int **data, char **parity, int count)
  Append command queue with series of data and provided parity writes.

- int swd_cmd_enqueue_miso_ack (swd_ctx_t *swdctx, char **ack)
  Append queue with ACK read.
- int swd_cmd_enqueue_mosi_control (swd_ctx_t *swdctx, char *ctlmsg, int len)
  Append command queue with len-octet size control seruence.
- int swd_cmd_enqueue_mosi_dap_reset (swd_ctx_t *swdctx)
  Append command queue with SW-DP-RESET sequence.
- int swd_cmd_enqueue_mosi_idle (swd_ctx_t *swdctx)
  Append command queue with idle sequence.
- int swd_cmd_enqueue_mosi_jtag2swd (swd_ctx_t *swdctx)
  Append command queue with JTAG-TO-SWD DAP-switch sequence.
- int swd_cmd_enqueue_mosi_swd2jtag (swd_ctx_t *swdctx)
  Append command queue with SWD-TO-JTAG DAP-switch sequence.
- char * swd_cmd_string_cmdtype (swd_cmd_t *cmd)
  *Return human readable command type string of *cmd.*

5.5.1 Detailed Description

5.5.2 Function Documentation

5.5.2.1 int swd_cmd_enqueue (swd_ctx_t * *swdctx*, swd_cmd_t * *cmd*)

Append selected command to a context's command queue.

Parameters

***swdctx** swd context pointer containing the command queue.
***cmd** command to be appended to the context's command queue.

Returns

number of elements appended or SWD_ERROR_CODE on failure.

5.5.2.2 int swd_cmd_enqueue_miso_ack (swd_ctx_t * *swdctx*, char ** *ack*)

Append queue with ACK read.

Parameters

***swdctx** swd context pointer.
***ack** packet value pointer.

Returns

number of elements appended (1), or SWD_ERROR_CODE on failure.

5.5.2.3 int swd_cmd_enqueue_miso_data (swd_ctx_t * *swdctx*, int ** *data*)

Append command queue with data read.

Parameters

swdctx swd context pointer.

data data pointer.

Returns

of elements appended (1), or SWD_ERROR_CODE on failure.

5.5.2.4 int swd_cmd_enqueue_miso_data_p (swd_ctx_t * *swdctx*, int ** *data*, char ** *parity*)

Append command queue with data and parity read.

Parameters

swdctx swd context pointer.

data data value pointer.

parity parity value pointer.

Returns

number of elements appended (2), or SWD_ERROR_CODE on failure.

5.5.2.5 int swd_cmd_enqueue_miso_n_data_p (swd_ctx_t * *swdctx*, int ** *data*, char ** *parity*, int *count*)

Append command queue with series of data and parity read.

Parameters

swdctx swd context pointer.

data data value array pointer.

parity parity value array pointer.

count number of (data+parity) elements to read.

Returns

number of elements appended (2*count), or SWD_ERROR_CODE on failure.

5.5.2.6 int swd_cmd_enqueue_miso_nbit (swd_ctx_t * *swdctx*, char ** *data*, int *count*)

Append command queue with bus binary read bit-by-bit operation.

This function will append command to the queue for each bit, and store one bit into single char array element, so read is not constrained to 8 bits. On error memory is released and apropriate error code is returned. Important: Memory pointed by *data must be allocated prior call!

Parameters

∗***swdctx*** swd context pointer.

∗∗***data*** allocated data array to write result into.

count number of bits to read (also the ∗∗data size).

Returns

number of elements processed, or SWD_ERROR_CODE on failure.

5.5.2.7 int swd_cmd_enqueue_miso_parity (swd_ctx_t ∗ *swdctx,* char ∗∗ *parity*)

Append command queue with parity bit read.

Parameters

∗***swdctx*** swd context pointer.

∗***parity*** parity value pointer.

Returns

number of elements appended (1), or SWD_ERROR_CODE on failure.

5.5.2.8 int swd_cmd_enqueue_miso_trn (swd_ctx_t ∗ *swdctx*)

Append command queue with Turnaround activating MISO mode.

Parameters

∗***swdctx*** swd context pointer.

Returns

return number of elements appended (1), or SWD_ERROR_CODE on failure.

5.5.2.9 int swd_cmd_enqueue_mosi_control (swd_ctx_t ∗ *swdctx,* char ∗ *ctlmsg,* int *len*)

Append command queue with len-octet size control seruence.

This control sequence can be used for instance to send payload of packets switching DAP between JTAG and SWD mode.

Parameters

∗***swdctx*** swd context pointer.

∗***ctlmsg*** control message array pointer.

len number of elements to send from ∗ctlmsg.

Returns

number of elements appended (len), or SWD_ERROR_CODE on failure.

5.5.2.10 int swd_cmd_enqueue_mosi_dap_reset (swd_ctx_t * *swdctx*)

Append command queue with SW-DP-RESET sequence.

Parameters

**swdctx* swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.5.2.11 int swd_cmd_enqueue_mosi_data (swd_ctx_t * *swdctx,* int * *data*)

Append command queue with data and parity write.

Parameters

**swdctx* swd context pointer.

**data* data value pointer.

Returns

number of elements appended (1), or SWD_ERROR_CODE on failure.

5.5.2.12 int swd_cmd_enqueue_mosi_data_ap (swd_ctx_t * *swdctx,* int * *data*)

Append command queue with data and automatic parity write.

Parameters

**swdctx* swd context pointer.

**data* data value pointer.

Returns

number of elements appended (2), or SWD_ERROR_CODE on failure.

5.5.2.13 int swd_cmd_enqueue_mosi_data_p (swd_ctx_t * *swdctx,* int * *data,* char * *parity*)

Append command queue with data and provided parity write.

Parameters

**swdctx* swd context pointer.

**data* data value pointer.

**parity* parity value pointer.

Returns

number of elements appended (2), or SWD_ERROR_CODE on failure.

5.5.2.14 int swd_cmd_enqueue_mosi_idle (swd_ctx_t * *swdctx*)

Append command queue with idle sequence.

Parameters

swdctx swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.5.2.15 int swd_cmd_enqueue_mosi_jtag2swd (swd_ctx_t * *swdctx*)

Append command queue with JTAG-TO-SWD DAP-switch sequence.

Parameters

swdctx swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.5.2.16 int swd_cmd_enqueue_mosi_n_data_ap (swd_ctx_t * *swdctx,* int ** *data,* int *count*)

Append command queue with series of data and automatic parity writes.

Parameters

swdctx swd context pointer.

data data value array pointer.

count number of (data+parity) elements to read.

Returns

number of elements appended (2*count), or SWD_ERROR_CODE on failure.

5.5.2.17 int swd_cmd_enqueue_mosi_n_data_p (swd_ctx_t * *swdctx,* int ** *data,* char ** *parity,* int *count*)

Append command queue with series of data and provided parity writes.

Parameters

swdctx swd context pointer.

data data value array pointer.

parity parity value array pointer.

count number of (data+parity) elements to read.

Returns

number of elements appended (2*count), or SWD_ERROR_CODE on failure.

5.5.2.18 int swd_cmd_enqueue_mosi_nbit (swd_ctx_t * *swdctx*, char * *data*, int *count*)

Append command queue with bus binary write bit-by-bit operation.

This function will append command to the queue for each bit and store one bit into single char array element, so read is not constrained to 8 bits. On error memory is released and apropriate error code is returned. Important: Memory pointed by *data must be allocated prior call!

Parameters

swdctx swd context pointer.

****data*** allocated data array to write result into.

count number of bits to read (also the **data size).

Returns

number of elements processed, or SWD_ERROR_CODE on failure.

5.5.2.19 int swd_cmd_enqueue_mosi_parity (swd_ctx_t * *swdctx*, char * *parity*)

Append command queue with parity bit write.

Parameters

swdctx swd context pointer.

parity parity value pointer.

Returns

number of elements appended (1), or SWD_ERROR_CODE on failure.

5.5.2.20 int swd_cmd_enqueue_mosi_request (swd_ctx_t * *swdctx*, char * *request*)

Appends command queue with SWD Request packet header.

Note that contents is not validated, so bad request can be sent as well.

Parameters

swdctx swd context pointer.

request pointer to the 8-bit request payload.

Returns

return number elements appended (1), or SWD_ERROR_CODE on failure.

5.5.2.21 int swd_cmd_enqueue_mosi_swd2jtag (swd_ctx_t * *swdctx*)

Append command queue with SWD-TO-JTAG DAP-switch sequence.

Parameters

swdctx swd context pointer.

Returns

number of elements appended, or SWD_ERROR_CODE on failure.

5.5.2.22 int swd_cmd_enqueue_mosi_trn (swd_ctx_t * *swdctx*)

Append command queue with Turnaround activating MOSI mode.

Parameters

swdctx swd context pointer.

Returns

return number elements appended (1), or SWD_ERROR_CODE on failure.

5.5.2.23 char* swd_cmd_string_cmdtype (swd_cmd_t * *cmd*)

Return human readable command type string of *cmd.

Parameters

cmd command the name is to be printed.

Returns

string containing human readable command name, or NULL on failure.

5.6 src/libswd_cmdq.c File Reference

```
#include <libswd.h>
```

Functions

- int swd_cmdq_init (swd_cmd_t *cmdq)
  Initialize new queue element in memory that becomes a queue root.
- swd_cmd_t * swd_cmdq_find_root (swd_cmd_t *cmdq)
  Find queue root (first element).
- swd_cmd_t * swd_cmdq_find_tail (swd_cmd_t *cmdq)
  Find queue tail (last element).
- int swd_cmdq_append (swd_cmd_t *cmdq, swd_cmd_t *cmd)
  *Append element pointed by *cmd at the end of the quque pointed by *cmdq.*
- int swd_cmdq_free (swd_cmd_t *cmdq)
  *Free queue pointed by *cmdq element.*
- int swd_cmdq_free_head (swd_cmd_t *cmdq)

Free queue head up to ∗cmdq element.

- int swd_cmdq_free_tail (swd_cmd_t ∗cmdq)
  Free queue tail starting after ∗cmdq element.
- int swd_cmdq_flush (swd_ctx_t ∗swdctx, swd_operation_t operation)
  Flush command queue contents into interface driver.

5.6.1 Detailed Description

5.6.2 Function Documentation

5.6.2.1 int swd_cmdq_append (swd_cmd_t ∗ *cmdq*, swd_cmd_t ∗ *cmd*)

Append element pointed by ∗cmd at the end of the quque pointed by ∗cmdq.

After this operation queue will be pointed by appended element (ie. last element added becomes actual quque pointer to show what was added recently).

Parameters

∗cmdq pointer to any element on command queue

∗cmd pointer to the command to be appended

Returns

number of appended elements (one), SWD_ERROR_CODE on failure

5.6.2.2 swd_cmd_t∗ swd_cmdq_find_root (swd_cmd_t ∗ *cmdq*)

Find queue root (first element).

Parameters

∗cmdq pointer to any queue element

Returns

swd_cmd_t∗ pointer to the first element (root), NULL on failure

5.6.2.3 swd_cmd_t∗ swd_cmdq_find_tail (swd_cmd_t ∗ *cmdq*)

Find queue tail (last element).

Parameters

∗cmdq pointer to any queue element

Returns

swd_cmd_t∗ pointer to the last element (tail), NULL on failure

5.6.2.4 int swd_cmdq_flush (swd_ctx_t * *swdctx,* swd_operation_t *operation*)

Flush command queue contents into interface driver.

Operation is specified by SWD_OPERATION and can be used to select how to flush the queue, ie. head-only, tail-only, one, all, etc.

Parameters

swdctx swd context pointer.

operation tells how to flush the queue.

Returns

number of commands transmitted, or SWD_ERROR_CODE on failure.

5.6.2.5 int swd_cmdq_free (swd_cmd_t * *cmdq*)

Free queue pointed by *cmdq element.

Parameters

***cmdq** pointer to any element on command queue

Returns

number of elements destroyed, SWD_ERROR_CODE on failure

5.6.2.6 int swd_cmdq_free_head (swd_cmd_t * *cmdq*)

Free queue head up to *cmdq element.

Parameters

***cmdq** pointer to the element that becomes new queue root.

Returns

number of elements destroyed, or SWD_ERROR_CODE on failure.

5.6.2.7 int swd_cmdq_free_tail (swd_cmd_t * *cmdq*)

Free queue tail starting after *cmdq element.

Parameters

***cmdq** pointer to the last element on the new queue.

Returns

number of elements destroyed, or SWD_ERROR_CODE on failure.

5.6.2.8 int swd_cmdq_init (swd_cmd_t * *cmdq*)

Initialize new queue element in memory that becomes a queue root.

Parameters

cmdq pointer to the command queue element of type swd_cmd_t

Returns

SWD_OK on success, SWD_ERROR_CODE code on failure

5.7 src/libswd_core.c File Reference

```
#include <libswd.h>
```

Functions

- swd_ctx_t * swd_init (void)

  LibSWD initialization routine.

- int swd_deinit_ctx (swd_ctx_t *swdctx)

  De-initialize selected swd context and free its memory.

- int swd_deinit_cmdq (swd_ctx_t *swdctx)

  De-initialize command queue and free its memory on selected swd context.

- int swd_deinit (swd_ctx_t *swdctx)

  De-initialize selected swd context and its command queue.

5.7.1 Detailed Description

5.7.2 Function Documentation

5.7.2.1 int swd_deinit (swd_ctx_t * *swdctx*)

De-initialize selected swd context and its command queue.

Parameters

swdctx swd context pointer.

Returns

number of elements freed, or SWD_ERROR_CODE on failure.

5.7.2.2 int swd_deinit_cmdq (swd_ctx_t * *swdctx*)

De-initialize command queue and free its memory on selected swd context.

Parameters

swdctx swd context pointer.

Returns

number of commands freed, or SWD_ERROR_CODE on failure.

5.7.2.3 int swd_deinit_ctx (swd_ctx_t * *swdctx*)

De-initialize selected swd context and free its memory.

Note: This function will not free command queue for selected context!

Parameters

swdctx swd context pointer.

Returns

SWD_OK on success, SWD_ERROR_CODE on failure.

5.7.2.4 swd_ctx_t* swd_init (void)

LibSWD initialization routine.

It should be called prior any operation made with libswd. It initializes command queue and basic parameters for context that is returned as pointer.

Returns

pointer to the initialized swd context.

5.8 src/libswd_dap.c File Reference

```
#include <libswd.h>
```

Functions

- int swd_dap_reset (swd_ctx_t *swdctx, swd_operation_t operation)

  Debug Access Port Reset sends 50 CLK with TMS high that brings both SW-DP and JTAG-DP into reset state.

- int swd_dap_select (swd_ctx_t *swdctx, swd_operation_t operation)

  Activate SW-DP by sending out RESET and JTAG-TO-SWD sequence on SWDIOTMS line.

- int swd_dp_read_idcode (swd_ctx_t *swdctx, swd_operation_t operation, int **idcode)

Macro: Read out IDCODE register and return its value on function return.

- int swd_dap_detect (swd_ctx_t *swdctx, swd_operation_t operation, int **idcode)
  Macro: Reset target DAP, select SW-DP, read out IDCODE.
- int swd_dp_read (swd_ctx_t *swdctx, swd_operation_t operation, char addr, int **data)
  Macro: Generic read of the DP register.
- int swd_dp_write (swd_ctx_t *swdctx, swd_operation_t operation, char addr, int *data)
  Macro function: Generic write of the DP register.
- int swd_ap_read (swd_ctx_t *swdctx, swd_operation_t operation, char addr, int **data)
  Macro function: Generic read of the AP register.
- int swd_ap_write (swd_ctx_t *swdctx, swd_operation_t operation, char addr, int *data)
  Macro function: Generic write of the AP register.

5.8.1 Detailed Description

5.8.2 Function Documentation

5.8.2.1 int swd_ap_read (swd_ctx_t * *swdctx*, swd_operation_t *operation*, char *addr*, int ** *data*)

Macro function: Generic read of the AP register.

Parameters

swdctx swd context to work on.

operation can be SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE.

addr is the address of the AP register to read.

data is the pointer to data where result will be stored.

Returns

number of elements processed or SWD_ERROR code on failure.

5.8.2.2 int swd_ap_write (swd_ctx_t * *swdctx*, swd_operation_t *operation*, char *addr*, int * *data*)

Macro function: Generic write of the AP register.

Parameters

swdctx swd context to work on.

operation can be SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE.

addr is the address of the AP register to write.

data is the pointer to data to be written.

Returns

number of elements processed or SWD_ERROR code on failure.

5.8.2.3 int swd_dap_detect (swd_ctx_t * *swdctx,* swd_operation_t *operation,* int ** *idcode*)

Macro: Reset target DAP, select SW-DP, read out IDCODE.

This is the proper SW-DP initialization as stated by ARM Information Center.

Parameters

swdctx swd context pointer.

operation type (SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE).

Returns

Target's IDCODE, or SWD_ERROR_CODE on failure.

5.8.2.4 int swd_dap_reset (swd_ctx_t * *swdctx,* swd_operation_t *operation*)

Debug Access Port Reset sends 50 CLK with TMS high that brings both SW-DP and JTAG-DP into reset state.

Parameters

swdctx swd context pointer.

operation type (SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE).

Returns

number of elements processed or SWD_ERROR_CODE code on failure.

5.8.2.5 int swd_dap_select (swd_ctx_t * *swdctx,* swd_operation_t *operation*)

Activate SW-DP by sending out RESET and JTAG-TO-SWD sequence on SWDIOTMS line.

Parameters

swdctx swd context.

Returns

number of control bytes executed, or error code on failre.

5.8.2.6 int swd_dp_read (swd_ctx_t * *swdctx,* swd_operation_t *operation,* char *addr,* int ** *data*)

Macro: Generic read of the DP register.

Parameters

swdctx swd context to work on.

operation can be SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE.

addr is the address of the DP register to read.

∗∗***data*** is the pointer to data where result will be stored.

Returns

number of elements processed or SWD_ERROR_CODE on failure.

5.8.2.7 int swd_dp_read_idcode (swd_ctx_t ∗ *swdctx*, swd_operation_t *operation*, int ∗∗ *idcode*)

Macro: Read out IDCODE register and return its value on function return.

Parameters

∗***swdctx*** swd context pointer.

operation operation type.

Returns

Number of elements processed or SWD_ERROR code error on failure.

5.8.2.8 int swd_dp_write (swd_ctx_t ∗ *swdctx*, swd_operation_t *operation*, char *addr*, int ∗ *data*)

Macro function: Generic write of the DP register.

Parameters

∗***swdctx*** swd context to work on.

operation can be SWD_OPERATION_ENQUEUE or SWD_OPERATION_EXECUTE.

addr is the address of the DP register to write.

∗***data*** is the pointer to data to be written.

Returns

number of elements processed or SWD_ERROR code on failure.

5.9 src/libswd_drv.c File Reference

```
#include <libswd.h>
```

Functions

- int **swd_drv_mosi_8** (swd_ctx_t ∗swdctx, swd_cmd_t ∗cmd, char ∗data, int bits, int nLSBfirst)
- int **swd_drv_mosi_32** (swd_ctx_t ∗swdctx, swd_cmd_t ∗cmd, int ∗data, int bits, int nLSBfirst)
- int **swd_drv_miso_8** (swd_ctx_t ∗swdctx, swd_cmd_t ∗cmd, char ∗data, int bits, int nLSBfirst)
- int **swd_drv_miso_32** (swd_ctx_t ∗swdctx, swd_cmd_t ∗cmd, int ∗data, int bits, int nLSBfirst)

- int **swd_drv_mosi_trn** (swd_ctx_t *swdctx, int bits)
- int **swd_drv_miso_trn** (swd_ctx_t *swdctx, int bits)
- int swd_drv_transmit (swd_ctx_t *swdctx, swd_cmd_t *cmd)

  Transmit selected command from the command queue to the interface driver.

5.9.1 Detailed Description

5.9.2 Function Documentation

5.9.2.1 int swd_drv_transmit (swd_ctx_t * *swdctx*, swd_cmd_t * *cmd*)

Transmit selected command from the command queue to the interface driver.

Parameters

swdctx swd context pointer.

cmd pointer to the command to be sent.

Returns

number of commands transmitted (1), or SWD_ERROR_CODE on failure.

5.10 src/libswd_error.c File Reference

```
#include <libswd.h>
```

Functions

- char * **swd_error_string** (swd_error_code_t error)

5.10.1 Detailed Description

5.11 src/libswd_externs.c File Reference

Template for driver bridge between libswd and your application.

```
#include <libswd.h>
#include <stdlib.h>
```

Functions

- int **swd_drv_mosi_8** (swd_ctx_t *swdctx, swd_cmd_t *cmd, char *data, int bits, int nLSBfirst)
- int **swd_drv_mosi_32** (swd_ctx_t *swdctx, swd_cmd_t *cmd, int *data, int bits, int nLSBfirst)
- int **swd_drv_miso_8** (swd_ctx_t *swdctx, swd_cmd_t *cmd, char *data, int bits, int nLSBfirst)
- int **swd_drv_miso_32** (swd_ctx_t *swdctx, swd_cmd_t *cmd, int *data, int bits, int nLSBfirst)
- int **swd_drv_mosi_trn** (swd_ctx_t *swdctx, int bits)
- int **swd_drv_miso_trn** (swd_ctx_t *swdctx, int bits)

- int swd_log_level_inherit (swd_ctx_t *swdctx, int loglevel)
  Set debug level according to caller's application settings.

5.11.1 Detailed Description

Template for driver bridge between libswd and your application.

5.11.2 Function Documentation

5.11.2.1 int swd_log_level_inherit (swd_ctx_t * *swdctx,* int *loglevel*)

Set debug level according to caller's application settings.

*swdctx swd context to work on. loglevel caller's application log level to be converted.

Returns

SWD_OK on success, of error code on failure.

5.12 src/libswd_log.c File Reference

```
#include <libswd.h>
```

Functions

- int swd_log (swd_ctx_t *swdctx, swd_loglevel_t loglevel, char *msg,...)
  Put a message into swd context log at specified verbosity level.
- int swd_log_level_set (swd_ctx_t *swdctx, swd_loglevel_t loglevel)
  Change log level to increase or decrease verbosity level.

5.12.1 Detailed Description

5.12.2 Function Documentation

5.12.2.1 int swd_log (swd_ctx_t * *swdctx,* swd_loglevel_t *loglevel,* char * *msg,* ...)

Put a message into swd context log at specified verbosity level.

If specified message's log level is lower than actual context configuration, message will be omitted. Verbosity level increases from 0 (silent) to 4 (debug).

Parameters

***swdctx** swd context.

***loglevel** at which to put selected message.

***msg** message body with variable arguments as in "printf".

Returns

number of characters written or error code on failure.

5.12.2.2 int swd_log_level_set (swd_ctx_t * *swdctx*, swd_loglevel_t *loglevel*)

Change log level to increase or decrease verbosity level.

Parameters

swdctx swd context.

loglevel is the target verbosity level to be set.

Returns

SWD_OK on success or error code.

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