MTD NAND Driver Programming Interface

Thomas Gleixner

<tglx@linutronix.de>

Table of Contents

Chapter 1. Introduction

The generic NAND driver supports almost all NAND and AG-AND based chips and connects them to the Memory Technology Devices (MTD) subsystem of the Linux Kernel.

This documentation is provided for developers who want to implement board drivers or filesystem drivers suitable for NAND devices.

Chapter 2. Known Bugs And Assumptions

None.

Chapter 3. Documentation hints

Table of Contents

The function and structure docs are autogenerated. Each function and struct member has a short description which is marked with an [XXX] identifier. The following chapters explain the meaning of those identifiers.

Function identifiers [XXX]

The functions are marked with [XXX] identifiers in the short comment. The identifiers explain the usage and scope of the functions. Following identifiers are used:

- [MTD Interface]

  These functions provide the interface to the MTD kernel API. They are not replacable and provide functionality which is complete hardware independent.

- [NAND Interface]

  These functions are exported and provide the interface to the NAND kernel API.

- [GENERIC]

  Generic functions are not replacable and provide functionality which is complete hardware independent.

- [DEFAULT]

  Default functions provide hardware related functionality which is suitable for most of the implementations. These functions can be replaced by the board driver if neccecary. Those functions are called via pointers in the NAND chip description structure. The board driver can set the functions which should be replaced by board dependent functions before calling nand_scan(). If the function pointer is NULL on entry to nand_scan() then the pointer is set to the default function which is suitable for the detected chip type.

Struct member identifiers [XXX]

The struct members are marked with [XXX] identifiers in the comment. The identifiers explain the usage and scope of the members. Following identifiers are used:

- [INTERN]

  These members are for NAND driver internal use only and must not be modified. Most of these values are calculated from the chip geometry information which is evaluated during nand_scan().

- [REPLACEABLE]

  Replaceable members hold hardware related functions which can be provided by the board driver. The board driver can set the functions which should be replaced by board dependent functions before calling nand_scan(). If the function pointer is NULL on entry to nand_scan() then the pointer is set to the default function which is suitable for the detected chip type.

- [BOARDSPECIFIC]

  Board specific members hold hardware related information which must be provided by the board driver. The board driver must set the function pointers and datafields before calling nand_scan().

- [OPTIONAL]

  Optional members can hold information relevant for the board driver. The generic NAND driver code does not use this information.

Chapter 4. Basic board driver

Table of Contents

For most boards it will be sufficient to provide just the basic functions and fill out some really board dependent members in the nand chip description structure.

Basic defines

At least you have to provide a mtd structure and a storage for the ioremap'ed chip address. You can allocate the mtd structure using kmalloc or you can allocate it statically. In case of static allocation you have to allocate a nand_chip structure too.

Kmalloc based example

```
static struct mtd_info *board_mtd;
static unsigned long baseaddr;
```

Static example

```
static struct mtd_info board_mtd;
static struct nand_chip board_chip;
static unsigned long baseaddr;
```

Partition defines

If you want to divide your device into partitions, then enable the configuration switch CONFIG_MTD_PARTITIONS and define a partitioning scheme suitable to your board.

```
#define NUM_PARTITIONS 2
static struct mtd_partition partition_info[] = {
        { .name = "Flash partition 1",
          .offset =  0,
          .size =    8 * 1024 * 1024 },
        { .name = "Flash partition 2",
          .offset =  MTDPART_OFS_NEXT,
          .size =    MTDPART_SIZ_FULL },
};
```

Hardware control function

The hardware control function provides access to the control pins of the NAND chip(s). The access can be done by GPIO pins or by address lines. If you use address lines, make sure that the timing requirements are met.

GPIO based example

```
static void board_hwcontrol(struct mtd_info *mtd, int cmd)
{
        switch(cmd){
                case NAND_CTL_SETCLE: /* Set CLE pin high */ break;
                case NAND_CTL_CLRCLE: /* Set CLE pin low */ break;
                case NAND_CTL_SETALE: /* Set ALE pin high */ break;
                case NAND_CTL_CLRALE: /* Set ALE pin low */ break;
                case NAND_CTL_SETNCE: /* Set nCE pin low */ break;
                case NAND_CTL_CLRNCE: /* Set nCE pin high */ break;
        }
}
```

Address lines based example. It's assumed that the nCE pin is driven by a chip select decoder.

```
static void board_hwcontrol(struct mtd_info *mtd, int cmd)
{
        struct nand_chip *this = (struct nand_chip *) mtd->priv;
        switch(cmd){
                case NAND_CTL_SETCLE: this->IO_ADDR_W |= CLE_ADRR_BIT;  break;
                case NAND_CTL_CLRCLE: this->IO_ADDR_W &= ~CLE_ADRR_BIT; break;
                case NAND_CTL_SETALE: this->IO_ADDR_W |= ALE_ADRR_BIT;  break;
                case NAND_CTL_CLRALE: this->IO_ADDR_W &= ~ALE_ADRR_BIT; break;
        }
}
```

Device ready function

If the hardware interface has the ready busy pin of the NAND chip connected to a GPIO or other accesible I/O pin, this function is used to read back the state of the pin. The function has no arguments and should return 0, if the device is busy (R/B pin is low) and 1, if the device is ready (R/B pin is high). If the hardware interface does not give access to the ready busy pin, then the function must not be defined and the function pointer this->dev_ready is set to NULL.

Init function

The init function allocates memory and sets up all the board specific parameters and function pointers. When everything is set up nand_scan() is called. This function tries to detect and identify then chip. If a chip is found all the internal data fields are initialized accordingly. The structure(s) have to be zeroed out first and then filled with the neccecary information about the device.

```
int __init board_init (void)
{
        struct nand_chip *this;
        int err = 0;

        /* Allocate memory for MTD device structure and private data */
        board_mtd = kzalloc(sizeof(struct mtd_info) + sizeof(struct nand_chip), GFP_KERNEL);
        if (!board_mtd) {
                printk ("Unable to allocate NAND MTD device structure.\n");
                err = -ENOMEM;
                goto out;
        }

        /* map physical address */
        baseaddr = (unsigned long)ioremap(CHIP_PHYSICAL_ADDRESS, 1024);
        if(!baseaddr){
                printk("Ioremap to access NAND chip failed\n");
                err = -EIO;
                goto out_mtd;
        }

        /* Get pointer to private data */
        this = (struct nand_chip *) ();
        /* Link the private data with the MTD structure */
        board_mtd->priv = this;

        /* Set address of NAND IO lines */
        this->IO_ADDR_R = baseaddr;
        this->IO_ADDR_W = baseaddr;
        /* Reference hardware control function */
        this->hwcontrol = board_hwcontrol;
        /* Set command delay time, see datasheet for correct value */
        this->chip_delay = CHIP_DEPENDEND_COMMAND_DELAY;
        /* Assign the device ready function, if available */
        this->dev_ready = board_dev_ready;
        this->eccmode = NAND_ECC_SOFT;

        /* Scan to find existence of the device */
        if (nand_scan (board_mtd, 1)) {
                err = -ENXIO;
                goto out_ior;
        }

        add_mtd_partitions(board_mtd, partition_info, NUM_PARTITIONS);
        goto out;

out_ior:
        iounmap((void *)baseaddr);
out_mtd:
        kfree (board_mtd);
out:
        return err;
}
module_init(board_init);
```

Exit function

The exit function is only neccecary if the driver is compiled as a module. It releases all resources which are held by the chip driver and unregisters the partitions in the MTD layer.

```
#ifdef MODULE
static void __exit board_cleanup (void)
{
        /* Release resources, unregister device */
        nand_release (board_mtd);

        /* unmap physical address */
        iounmap((void *)baseaddr);

        /* Free the MTD device structure */
```

```
        kfree (board_mtd);
}
module_exit(board_cleanup);
#endif
```

Chapter 5. Advanced board driver functions

Table of Contents

This chapter describes the advanced functionality of the NAND driver. For a list of functions which can be overridden by the board driver see the documentation of the nand_chip structure.

Multiple chip control

The nand driver can control chip arrays. Therefor the board driver must provide an own select_chip function. This function must (de)select the requested chip. The function pointer in the nand_chip structure must be set before calling nand_scan(). The maxchip parameter of nand_scan() defines the maximum number of chips to scan for. Make sure that the select_chip function can handle the requested number of chips.

The nand driver concatenates the chips to one virtual chip and provides this virtual chip to the MTD layer.

Note: The driver can only handle linear chip arrays of equally sized chips. There is no support for parallel arrays which extend the buswidth.

GPIO based example

```
static void board_select_chip (struct mtd_info *mtd, int chip)
{
        /* Deselect all chips, set all nCE pins high */
        GPIO(BOARD_NAND_NCE) |= 0xff;
        if (chip >= 0)
                GPIO(BOARD_NAND_NCE) &= ~ (1 << chip);
}
```

Address lines based example. Its assumed that the nCE pins are connected to an address decoder.

```
static void board_select_chip (struct mtd_info *mtd, int chip)
{
        struct nand_chip *this = (struct nand_chip *) mtd->priv;

        /* Deselect all chips */
        this->IO_ADDR_R &= ~BOARD_NAND_ADDR_MASK;
        this->IO_ADDR_W &= ~BOARD_NAND_ADDR_MASK;
        switch (chip) {
        case 0:
                this->IO_ADDR_R |= BOARD_NAND_ADDR_CHIP0;
```

```
                this->IO_ADDR_W |= BOARD_NAND_ADDR_CHIP0;
                break;
        ....
        case n:
                this->IO_ADDR_R |= BOARD_NAND_ADDR_CHIPn;
                this->IO_ADDR_W |= BOARD_NAND_ADDR_CHIPn;
                break;
        }
}
```

Hardware ECC support

Functions and constants

The nand driver supports three different types of hardware ECC.

- NAND_ECC_HW3_256

  Hardware ECC generator providing 3 bytes ECC per 256 byte.

- NAND_ECC_HW3_512

  Hardware ECC generator providing 3 bytes ECC per 512 byte.

- NAND_ECC_HW6_512

  Hardware ECC generator providing 6 bytes ECC per 512 byte.

- NAND_ECC_HW8_512

  Hardware ECC generator providing 6 bytes ECC per 512 byte.

If your hardware generator has a different functionality add it at the appropriate place in nand_base.c

The board driver must provide following functions:

- enable_hwecc

  This function is called before reading / writing to the chip. Reset or initialize the hardware generator in this function. The function is called with an argument which let you distinguish between read and write operations.

- calculate_ecc

  This function is called after read / write from / to the chip. Transfer the ECC from the hardware to the buffer. If the option NAND_HWECC_SYNDROME is set then the function is only called on write. See below.

- correct_data

  In case of an ECC error this function is called for error detection and correction. Return 1 respectively 2 in case the error can be corrected. If the error is not correctable return -1. If your hardware generator matches the default algorithm of the nand_ecc software generator then use the correction function provided by nand_ecc instead of implementing duplicated code.

Hardware ECC with syndrome calculation

Many hardware ECC implementations provide Reed-Solomon codes and calculate an error syndrome on read. The syndrome must be converted to a standard Reed-Solomon syndrome before calling the error correction code in the generic Reed-Solomon library.

The ECC bytes must be placed immidiately after the data bytes in order to make the syndrome generator work. This is contrary to the usual layout used by software ECC. The seperation of data and out of band area is not longer possible. The nand driver code handles this layout and the remaining free bytes in the oob area are managed by the autoplacement code. Provide a matching oob-layout in this case. See rts_from4.c and diskonchip.c for implementation reference. In those cases we must also use bad block tables on FLASH, because the ECC layout is interferring with the bad block marker positions. See bad block table support for details.

Bad block table support

Most NAND chips mark the bad blocks at a defined position in the spare area. Those blocks must not be erased under any circumstances as the bad block information would be lost. It is possible to check the bad block mark each time when the blocks are accessed by reading the spare area of the first page in the block. This is time consuming so a bad block table is used.

The nand driver supports various types of bad block tables.

- Per device

  The bad block table contains all bad block information of the device which can consist of multiple chips.

- Per chip

  A bad block table is used per chip and contains the bad block information for this particular chip.

- Fixed offset

  The bad block table is located at a fixed offset in the chip (device). This applies to various DiskOnChip devices.

- Automatic placed

  The bad block table is automatically placed and detected either at the end or at the beginning of a chip (device)

- Mirrored tables

  The bad block table is mirrored on the chip (device) to allow updates of the bad block table without data loss.

nand_scan() calls the function nand_default_bbt(). nand_default_bbt() selects appropriate default bad block table desriptors depending on the chip information which was retrieved by nand_scan().

The standard policy is scanning the device for bad blocks and build a ram based bad block table which allows faster access than always checking the bad block information on the flash chip itself.

Flash based tables

It may be desired or neccecary to keep a bad block table in FLASH. For AG-AND chips this is mandatory, as they have no factory marked bad blocks. They have factory marked good blocks. The marker pattern is erased when the block is erased to be reused. So in case of powerloss before writing the pattern back to the chip this block would be lost and added to the bad blocks. Therefor we scan the chip(s) when we detect them the first time for good blocks and store this information in a bad block table before erasing any of the blocks.

The blocks in which the tables are stored are procteted against accidental access by marking them bad in the memory bad block table. The bad block table management functions are allowed to circumvernt this protection.

The simplest way to activate the FLASH based bad block table support is to set the option NAND_USE_FLASH_BBT in the option field of the nand chip structure before calling nand_scan(). For AG-AND chips is this done by default. This activates the default FLASH based bad block table functionality of the NAND driver. The default bad block table options are

- Store bad block table per chip
- Use 2 bits per block
- Automatic placement at the end of the chip
- Use mirrored tables with version numbers
- Reserve 4 blocks at the end of the chip

User defined tables

User defined tables are created by filling out a nand_bbt_descr structure and storing the pointer in the nand_chip structure member bbt_td before calling nand_scan(). If a mirror table is neccecary a second structure must be created and a pointer to this structure must be stored in bbt_md inside the nand_chip structure. If the bbt_md member is set to NULL then only the main table is used and no scan for the mirrored table is performed.

The most important field in the nand_bbt_descr structure is the options field. The options define most of the table properties. Use the predefined constants from nand.h to define the options.

- Number of bits per block

  The supported number of bits is 1, 2, 4, 8.

- Table per chip

  Setting the constant NAND_BBT_PERCHIP selects that a bad block table is managed for each chip in a chip array. If this option is not set then a per device bad block table is used.

- Table location is absolute

  Use the option constant NAND_BBT_ABSPAGE and define the absolute page number where the bad block table starts in the field pages. If you have selected bad block tables per chip and you have a multi chip array then the start page must be given for each chip in the chip array. Note: there is no scan for a table ident pattern performed, so the fields pattern, veroffs, offs, len can be left uninitialized

- Table location is automatically detected

  The table can either be located in the first or the last good blocks of the chip (device). Set NAND_BBT_LASTBLOCK to place the bad block table at the end of the chip (device). The bad block tables are marked and identified by a pattern which is stored in the spare area of the first page in the block which holds the bad block table. Store a pointer to the pattern in the pattern field. Further the length of the pattern has to be stored in len and the offset in the spare area must be given in the offs member of the nand_bbt_descr stucture. For mirrored bad block tables different patterns are mandatory.

- Table creation

  Set the option NAND_BBT_CREATE to enable the table creation if no table can be found during the scan. Usually this is done only once if a new chip is found.

- Table write support

  Set the option NAND_BBT_WRITE to enable the table write support. This allows the update of the bad block table(s) in case a block has to be marked bad due to wear. The MTD interface function block_markbad is calling the update function of the bad block table. If the write support is enabled then the table is updated on FLASH.

  Note: Write support should only be enabled for mirrored tables with version control.

- Table version control

  Set the option NAND_BBT_VERSION to enable the table version control. It's highly recommended to enable this for mirrored tables with write support. It makes sure that the risk of loosing the bad block table information is reduced to the loss of the information about the one worn out block which should be marked bad. The version is stored in 4 consecutive bytes in the spare area of the device. The position of the version number is defined by the member veroffs in the bad block table descriptor.

- Save block contents on write

  In case that the block which holds the bad block table does contain other useful information, set the option NAND_BBT_SAVECONTENT. When the bad block table is written then the whole block is read the bad block table is updated and the block is erased and everything is written back. If this option is not set only the bad block table is written and everything else in the block is ignored and erased.

- Number of reserved blocks

  For automatic placement some blocks must be reserved for bad block table storage. The number of reserved blocks is defined in the maxblocks member of the babd block table description structure. Reserving 4 blocks for mirrored tables should be a reasonable number. This also limits the number of blocks which are scanned for the bad block table ident pattern.

Spare area (auto)placement

The nand driver implements different possibilities for placement of filesystem data in the spare area,

- Placement defined by fs driver
- Automatic placement

The default placement function is automatic placement. The nand driver has built in default placement schemes for the various chiptypes. If due to hardware ECC functionality the default placement does not fit then the board driver can provide a own placement scheme.

File system drivers can provide a own placement scheme which is used instead of the default placement scheme.

Placement schemes are defined by a nand_oobinfo structure

```
struct nand_oobinfo {
        int     useecc;
        int     eccbytes;
        int     eccpos[24];
        int     oobfree[8][2];
};
```

- useecc

  The useecc member controls the ecc and placement function. The header file include/mtd/mtd-abi.h contains constants to select ecc and placement. MTD_NANDECC_OFF switches off the ecc complete. This is not recommended and available for testing and diagnosis only. MTD_NANDECC_PLACE selects caller defined placement, MTD_NANDECC_AUTOPLACE selects automatic placement.

- eccbytes

  The eccbytes member defines the number of ecc bytes per page.

- eccpos

  The eccpos array holds the byte offsets in the spare area where the ecc codes are placed.

- oobfree

  The oobfree array defines the areas in the spare area which can be used for automatic placement. The information is given in the format {offset, size}. offset defines the start of the usable area, size the length in bytes. More than one area can be defined. The list is terminated by an {0, 0} entry.

Placement defined by fs driver

The calling function provides a pointer to a nand_oobinfo structure which defines the ecc placement. For writes the caller must provide a spare area buffer along with the data buffer. The spare area buffer size is (number of pages) * (size of spare area). For reads the buffer size is (number of pages) * ((size of spare area) + (number of ecc steps per page) * sizeof (int)). The driver stores the result of the ecc check for each tuple in the spare buffer. The storage sequence is

<spare data page 0><ecc result 0>...<ecc result n>

...

<spare data page n><ecc result 0>...<ecc result n>

This is a legacy mode used by YAFFS1.

If the spare area buffer is NULL then only the ECC placement is done according to the given scheme in the nand_oobinfo structure.

Automatic placement

Automatic placement uses the built in defaults to place the ecc bytes in the spare area. If filesystem data have to be stored / read into the spare area then the calling function must provide a buffer. The buffer size per page is determined by the oobfree array in the nand_oobinfo structure.

If the spare area buffer is NULL then only the ECC placement is done according to the default builtin scheme.

User space placement selection

All non ecc functions like mtd->read and mtd->write use an internal structure, which can be set by an ioctl. This structure is preset to the autoplacement default.

```
	ioctl (fd, MEMSETOOBSEL, oobsel);
```

oobsel is a pointer to a user supplied structure of type nand_oobconfig. The contents of this structure must match the criteria of the filesystem, which will be used. See an example in utils/nandwrite.c.

Spare area autoplacement default schemes

256 byte pagesize

Offset	Content	Comment
0x00	ECC byte 0	Error correction code byte 0
0x01	ECC byte 1	Error correction code byte 1
0x02	ECC byte 2	Error correction code byte 2
0x03	Autoplace 0	
0x04	Autoplace 1	
0x05	Bad block marker	If any bit in this byte is zero, then this block is bad. This applies only to the first page in a block. In the remaining pages this byte is reserved
0x06	Autoplace 2	
0x07	Autoplace 3	

512 byte pagesize

Offset	Content	Comment
0x00	ECC byte 0	Error correction code byte 0 of the lower 256 Byte data in this page
0x01	ECC byte 1	Error correction code byte 1 of the lower 256 Bytes of data in this page
0x02	ECC byte 2	Error correction code byte 2 of the lower 256 Bytes of data in this page
0x03	ECC byte 3	Error correction code byte 0 of the upper 256 Bytes of data in this page
0x04	reserved	reserved
0x05	Bad block marker	If any bit in this byte is zero, then this block is bad. This applies only to the first page in a block. In the remaining pages this byte is reserved
0x06	ECC byte 4	Error correction code byte 1 of the upper 256 Bytes of data in this page
0x07	ECC byte 5	Error correction code byte 2 of the upper 256 Bytes of data in this page
0x08 - 0x0F	Autoplace 0 - 7	

2048 byte pagesize

Offset	Content	Comment

0x00	Bad block marker	If any bit in this byte is zero, then this block is bad. This applies only to the first page in a block. In the remaining pages this byte is reserved
0x01	Reserved	Reserved
0x02-0x27	Autoplace 0 - 37	
0x28	ECC byte 0	Error correction code byte 0 of the first 256 Byte data in this page
0x29	ECC byte 1	Error correction code byte 1 of the first 256 Bytes of data in this page
0x2A	ECC byte 2	Error correction code byte 2 of the first 256 Bytes data in this page
0x2B	ECC byte 3	Error correction code byte 0 of the second 256 Bytes of data in this page
0x2C	ECC byte 4	Error correction code byte 1 of the second 256 Bytes of data in this page
0x2D	ECC byte 5	Error correction code byte 2 of the second 256 Bytes of data in this page
0x2E	ECC byte 6	Error correction code byte 0 of the third 256 Bytes of data in this page
0x2F	ECC byte 7	Error correction code byte 1 of the third 256 Bytes of data in this page
0x30	ECC byte 8	Error correction code byte 2 of the third 256 Bytes of data in this page
0x31	ECC byte 9	Error correction code byte 0 of the fourth 256 Bytes of data in this page
0x32	ECC byte 10	Error correction code byte 1 of the fourth 256 Bytes of data in this page
0x33	ECC byte 11	Error correction code byte 2 of the fourth 256 Bytes of data in this page
0x34	ECC byte 12	Error correction code byte 0 of the fifth 256 Bytes of data in this page
0x35	ECC byte 13	Error correction code byte 1 of the fifth 256 Bytes of data in this page
0x36	ECC byte 14	Error correction code byte 2 of the fifth 256 Bytes of data in this page
0x37	ECC byte 15	Error correction code byte 0 of the sixt 256 Bytes of data in this page
0x38	ECC byte 16	Error correction code byte 1 of the sixt 256 Bytes of data in this page
0x39	ECC byte 17	Error correction code byte 2 of the sixt 256 Bytes of data in this page
0x3A	ECC byte 18	Error correction code byte 0 of the seventh 256 Bytes of data in this page
0x3B	ECC byte 19	Error correction code byte 1 of the seventh 256 Bytes of data in this page
0x3C	ECC byte 20	Error correction code byte 2 of the seventh 256 Bytes of data in this page
0x3D	ECC byte 21	Error correction code byte 0 of the eigth 256 Bytes of data in this page
0x3E	ECC byte 22	Error correction code byte 1 of the eigth 256 Bytes of data in this page
0x3F	ECC byte 23	Error correction code byte 2 of the eigth 256 Bytes of data in this page

Chapter 6. Filesystem support

The NAND driver provides all neccecary functions for a filesystem via the MTD interface.

Filesystems must be aware of the NAND pecularities and restrictions. One major restrictions of NAND Flash is, that you cannot write as often as you want to a page. The consecutive writes to a page, before erasing it again, are restricted to 1-3 writes, depending on the manufacturers specifications. This applies similar to the spare area.

Therefor NAND aware filesystems must either write in page size chunks or hold a writebuffer to collect smaller writes until they sum up to pagesize. Available NAND aware filesystems: JFFS2, YAFFS.

The spare area usage to store filesystem data is controlled by the spare area placement functionality which is described in one of the earlier chapters.

Chapter 7. Tools

The MTD project provides a couple of helpful tools to handle NAND Flash.

- flasherase, flasheraseall: Erase and format FLASH partitions
- nandwrite: write filesystem images to NAND FLASH
- nanddump: dump the contents of a NAND FLASH partitions

These tools are aware of the NAND restrictions. Please use those tools instead of complaining about errors which are caused by non NAND aware access methods.

Chapter 8. Constants

Table of Contents

This chapter describes the constants which might be relevant for a driver developer.

Chip option constants

Constants for chip id table

These constants are defined in nand.h. They are ored together to describe the chip functionality.

```
/* Chip can not auto increment pages */
#define NAND_NO_AUTOINCR        0x00000001
/* Buswitdh is 16 bit */
#define NAND_BUSWIDTH_16        0x00000002
/* Device supports partial programming without padding */
#define NAND_NO_PADDING         0x00000004
/* Chip has cache program function */
#define NAND_CACHEPRG           0x00000008
/* Chip has copy back function */
#define NAND_COPYBACK           0x00000010
/* AND Chip which has 4 banks and a confusing page / block
 * assignment. See Renesas datasheet for further information */
#define NAND_IS_AND             0x00000020
/* Chip has a array of 4 pages which can be read without
 * additional ready /busy waits */
#define NAND_4PAGE_ARRAY        0x00000040
```

Constants for runtime options

These constants are defined in nand.h. They are ored together to describe the functionality.

```
/* Use a flash based bad block table. This option is parsed by the
 * default bad block table function (nand_default_bbt). */
#define NAND_USE_FLASH_BBT      0x00010000
/* The hw ecc generator provides a syndrome instead a ecc value on read
 * This can only work if we have the ecc bytes directly behind the
 * data bytes. Applies for DOC and AG-AND Renesas HW Reed Solomon generators */
#define NAND_HWECC_SYNDROME     0x00020000
```

ECC selection constants

Use these constants to select the ECC algorithm.

```
/* No ECC. Usage is not recommended ! */
#define NAND_ECC_NONE           0
/* Software ECC 3 byte ECC per 256 Byte data */
#define NAND_ECC_SOFT           1
/* Hardware ECC 3 byte ECC per 256 Byte data */
#define NAND_ECC_HW3_256        2
/* Hardware ECC 3 byte ECC per 512 Byte data */
#define NAND_ECC_HW3_512        3
/* Hardware ECC 6 byte ECC per 512 Byte data */
#define NAND_ECC_HW6_512        4
/* Hardware ECC 6 byte ECC per 512 Byte data */
#define NAND_ECC_HW8_512        6
```

Hardware control related constants

These constants describe the requested hardware access function when the boardspecific hardware control function is called

```
/* Select the chip by setting nCE to low */
#define NAND_CTL_SETNCE         1
/* Deselect the chip by setting nCE to high */
#define NAND_CTL_CLRNCE         2
/* Select the command latch by setting CLE to high */
#define NAND_CTL_SETCLE         3
/* Deselect the command latch by setting CLE to low */
#define NAND_CTL_CLRCLE         4
/* Select the address latch by setting ALE to high */
#define NAND_CTL_SETALE         5
/* Deselect the address latch by setting ALE to low */
#define NAND_CTL_CLRALE         6
/* Set write protection by setting WP to high. Not used! */
#define NAND_CTL_SETWP          7
/* Clear write protection by setting WP to low. Not used! */
#define NAND_CTL_CLRWP          8
```

Bad block table related constants

These constants describe the options used for bad block table descriptors.

```
/* Options for the bad block table descriptors */

/* The number of bits used per block in the bbt on the device */
#define NAND_BBT_NRBITS_MSK     0x0000000F
#define NAND_BBT_1BIT           0x00000001
#define NAND_BBT_2BIT           0x00000002
#define NAND_BBT_4BIT           0x00000004
#define NAND_BBT_8BIT           0x00000008
/* The bad block table is in the last good block of the device */
#define NAND_BBT_LASTBLOCK      0x00000010
/* The bbt is at the given page, else we must scan for the bbt */
#define NAND_BBT_ABSPAGE        0x00000020
/* The bbt is at the given page, else we must scan for the bbt */
#define NAND_BBT_SEARCH         0x00000040
/* bbt is stored per chip on multichip devices */
#define NAND_BBT_PERCHIP        0x00000080
/* bbt has a version counter at offset veroffs */
#define NAND_BBT_VERSION        0x00000100
/* Create a bbt if none axists */
#define NAND_BBT_CREATE         0x00000200
/* Search good / bad pattern through all pages of a block */
#define NAND_BBT_SCANALLPAGES   0x00000400
/* Scan block empty during good / bad block scan */
#define NAND_BBT_SCANEMPTY      0x00000800
/* Write bbt if neccecary */
#define NAND_BBT_WRITE          0x00001000
/* Read and write back block contents when writing bbt */
#define NAND_BBT_SAVECONTENT    0x00002000
```

Chapter 9. Structures

Table of Contents

This chapter contains the autogenerated documentation of the structures which are used in the NAND driver and might be relevant for a driver developer. Each struct member has a short description which is marked with an [XXX] identifier. See the chapter "Documentation hints" for an explanation.

Name

struct nand_hw_control — Control structure for hardware controller (e.g ECC generator) shared among independent devices

Synopsis

```
struct nand_hw_control {
  spinlock_t lock;
  struct nand_chip * active;
  wait_queue_head_t wq;
};
```

Members

lock

> protection lock

active

> the mtd device which holds the controller currently

wq

> wait queue to sleep on if a NAND operation is in progress used instead of the per chip wait queue when a hw controller is available

---

Name

struct nand_ecc_ctrl — Control structure for ecc

Synopsis

```
struct nand_ecc_ctrl {
  nand_ecc_modes_t mode;
  int steps;
  int size;
  int bytes;
  int total;
  int prepad;
  int postpad;
  struct nand_ecclayout * layout;
  void (* hwctl) (struct mtd_info *mtd, int mode);
  int (* calculate) (struct mtd_info *mtd,const uint8_t *dat,uint8_t *ecc_code);
  int (* correct) (struct mtd_info *mtd, uint8_t *dat,uint8_t *read_ecc,uint8_t *calc_ecc);
  int (* read_page_raw) (struct mtd_info *mtd,struct nand_chip *chip,uint8_t *buf, int page);
  void (* write_page_raw) (struct mtd_info *mtd,struct nand_chip *chip,const uint8_t *buf);
```

```
  int (* read_page) (struct mtd_info *mtd,struct nand_chip *chip,uint8_t *buf, int page);
  int (* read_subpage) (struct mtd_info *mtd,struct nand_chip *chip,uint32_t offs, uint32_t len,uint8_t *buf);
  void (* write_page) (struct mtd_info *mtd,struct nand_chip *chip,const uint8_t *buf);
  int (* read_oob) (struct mtd_info *mtd,struct nand_chip *chip,int page,int sndcmd);
  int (* write_oob) (struct mtd_info *mtd,struct nand_chip *chip,int page);
};
```

Members

mode

ecc mode

steps

number of ecc steps per page

size

data bytes per ecc step

bytes

ecc bytes per step

total

total number of ecc bytes per page

prepad

padding information for syndrome based ecc generators

postpad

padding information for syndrome based ecc generators

layout

ECC layout control struct pointer

hwctl

function to control hardware ecc generator. Must only be provided if an hardware ECC is available

calculate

function for ecc calculation or readback from ecc hardware

correct

function for ecc correction, matching to ecc generator (sw/hw)

read_page_raw

function to read a raw page without ECC

write_page_raw

function to write a raw page without ECC

read_page

function to read a page according to the ecc generator requirements

read_subpage

function to read parts of the page covered by ECC.

write_page

function to write a page according to the ecc generator requirements read_oob

function to read chip OOB data

write_oob

function to write chip OOB data

Name

struct nand_buffers — buffer structure for read/write

Synopsis

```
struct nand_buffers {
  uint8_t ecccalc[NAND_MAX_OOBSIZE];
  uint8_t ecccode[NAND_MAX_OOBSIZE];
  uint8_t databuf[NAND_MAX_PAGESIZE + NAND_MAX_OOBSIZE];
};
```

Members

ecccalc[NAND_MAX_OOBSIZE]

buffer for calculated ecc

ecccode[NAND_MAX_OOBSIZE]

buffer for ecc read from flash

databuf[NAND_MAX_PAGESIZE + NAND_MAX_OOBSIZE]

buffer for data - dynamically sized

Description

Do not change the order of buffers. databuf and oobrbuf must be in consecutive order.

Name

struct nand_chip — NAND Private Flash Chip Data

Synopsis

```
struct nand_chip {
  void __iomem * IO_ADDR_R;
  void __iomem * IO_ADDR_W;
  uint8_t (* read_byte) (struct mtd_info *mtd);
  u16 (* read_word) (struct mtd_info *mtd);
  void (* write_buf) (struct mtd_info *mtd, const uint8_t *buf, int len);
  void (* read_buf) (struct mtd_info *mtd, uint8_t *buf, int len);
  int (* verify_buf) (struct mtd_info *mtd, const uint8_t *buf, int len);
  void (* select_chip) (struct mtd_info *mtd, int chip);
  int (* block_bad) (struct mtd_info *mtd, loff_t ofs, int getchip);
  int (* block_markbad) (struct mtd_info *mtd, loff_t ofs);
  void (* cmd_ctrl) (struct mtd_info *mtd, int dat,unsigned int ctrl);
  int (* dev_ready) (struct mtd_info *mtd);
  void (* cmdfunc) (struct mtd_info *mtd, unsigned command, int column, int page_addr);
  int (* waitfunc) (struct mtd_info *mtd, struct nand_chip *this);
  void (* erase_cmd) (struct mtd_info *mtd, int page);
  int (* scan_bbt) (struct mtd_info *mtd);
  int (* errstat) (struct mtd_info *mtd, struct nand_chip *this, int state, int status, int page);
  int (* write_page) (struct mtd_info *mtd, struct nand_chip *chip,const uint8_t *buf, int page, int cached, int raw);
  int chip_delay;
  unsigned int options;
  int page_shift;
  int phys_erase_shift;
  int bbt_erase_shift;
  int chip_shift;
```

```
  int numchips;
  uint64_t chipsize;
  int pagemask;
  int pagebuf;
  int subpagesize;
  uint8_t cellinfo;
  int badblockpos;
  nand_state_t state;
  uint8_t * oob_poi;
  struct nand_hw_control * controller;
  struct nand_ecclayout * ecclayout;
  struct nand_ecc_ctrl ecc;
  struct nand_buffers * buffers;
  struct nand_hw_control hwcontrol;
  struct mtd_oob_ops ops;
  uint8_t * bbt;
  struct nand_bbt_descr * bbt_td;
  struct nand_bbt_descr * bbt_md;
  struct nand_bbt_descr * badblock_pattern;
  void * priv;
};
```

Members

IO_ADDR_R

[BOARDSPECIFIC] address to read the 8 I/O lines of the flash device

IO_ADDR_W

[BOARDSPECIFIC] address to write the 8 I/O lines of the flash device

read_byte

[REPLACEABLE] read one byte from the chip

read_word

[REPLACEABLE] read one word from the chip

write_buf

[REPLACEABLE] write data from the buffer to the chip

read_buf

[REPLACEABLE] read data from the chip into the buffer

verify_buf

[REPLACEABLE] verify buffer contents against the chip data

select_chip

[REPLACEABLE] select chip nr

block_bad

[REPLACEABLE] check, if the block is bad

block_markbad

[REPLACEABLE] mark the block bad

cmd_ctrl

[BOARDSPECIFIC] hardwarespecific funtion for controlling ALE/CLE/nCE. Also used to write command and address

dev_ready

[BOARDSPECIFIC] hardwarespecific function for accesing device ready/busy line If set to NULL no access to ready/busy is available and the ready/busy information is read from the chip status register cmdfunc

[REPLACEABLE] hardwarespecific function for writing commands to the chip

waitfunc

[REPLACEABLE] hardwarespecific function for wait on ready

erase_cmd

[INTERN] erase command write function, selectable due to AND support

scan_bbt

[REPLACEABLE] function to scan bad block table

errstat

[OPTIONAL] hardware specific function to perform additional error status checks (determine if errors are correctable)

write_page

[REPLACEABLE] High-level page write function

chip_delay

[BOARDSPECIFIC] chip dependent delay for transfering data from array to read regs (tR)

options

[BOARDSPECIFIC] various chip options. They can partly be set to inform nand_scan about special functionality. See the defines for further explanation

page_shift

[INTERN] number of address bits in a page (column address bits)

phys_erase_shift

[INTERN] number of address bits in a physical eraseblock

bbt_erase_shift

[INTERN] number of address bits in a bbt entry

chip_shift

[INTERN] number of address bits in one chip

numchips

[INTERN] number of physical chips

chipsize

[INTERN] the size of one chip for multichip arrays

pagemask

[INTERN] page number mask = number of (pages / chip) - 1

pagebuf

[INTERN] holds the pagenumber which is currently in data_buf

subpagesize

[INTERN] holds the subpagesize

cellinfo

[INTERN] MLC/multichip data from chip ident badblockpos

[INTERN] position of the bad block marker in the oob area

state

[INTERN] the current state of the NAND device

oob_poi

poison value buffer

controller

[REPLACEABLE] a pointer to a hardware controller structure which is shared among multiple independend devices

ecclayout

[REPLACEABLE] the default ecc placement scheme

ecc

[BOARDSPECIFIC] ecc control ctructure

buffers

buffer structure for read/write

hwcontrol

platform-specific hardware control structure

ops

oob operation operands

bbt

[INTERN] bad block table pointer

bbt_td

[REPLACEABLE] bad block table descriptor for flash lookup

bbt_md

[REPLACEABLE] bad block table mirror descriptor

badblock_pattern

[REPLACEABLE] bad block scan pattern used for initial bad block scan

priv

[OPTIONAL] pointer to private chip date

Name

struct nand_flash_dev — NAND Flash Device ID Structure

Synopsis

```
struct nand_flash_dev {
  char * name;
  int id;
  unsigned long pagesize;
  unsigned long chipsize;
  unsigned long erasesize;
  unsigned long options;
};
```

Members

name

Identify the device type

id

device ID code

pagesize

Pagesize in bytes. Either 256 or 512 or 0 If the pagesize is 0, then the real pagesize and the eraseize are determined from the extended id bytes in the chip

chipsize

Total chipsize in Mega Bytes

erasesize

Size of an erase block in the flash device.

options

Bitfield to store chip relevant options

Name

struct nand_manufacturers — NAND Flash Manufacturer ID Structure

Synopsis

```
struct nand_manufacturers {
  int id;
  char * name;
};
```

Members

id

manufacturer ID code of device.

name

Manufacturer name

Name

struct nand_bbt_descr — bad block table descriptor

Synopsis

```
struct nand_bbt_descr {
  int options;
  int pages[NAND_MAX_CHIPS];
  int offs;
  int veroffs;
  uint8_t version[NAND_MAX_CHIPS];
  int len;
  int maxblocks;
  int reserved_block_code;
  uint8_t * pattern;
};
```

Members

options

options for this descriptor

pages[NAND_MAX_CHIPS]

the page(s) where we find the bbt, used with option BBT_ABSPAGE when bbt is searched, then we store the found bbts pages here. Its an array and supports up to 8 chips now

offs

offset of the pattern in the oob area of the page

veroffs

offset of the bbt version counter in the oob are of the page

version[NAND_MAX_CHIPS]

version read from the bbt page during scan

len

length of the pattern, if 0 no pattern check is performed

maxblocks

maximum number of blocks to search for a bbt. This number of blocks is reserved at the end of the device where the tables are written.

reserved_block_code

if non-0, this pattern denotes a reserved (rather than bad) block in the stored bbt

pattern

pattern to identify bad block table or factory marked good / bad blocks, can be NULL, if len = 0

Description

Descriptor for the bad block table marker and the descriptor for the pattern which identifies good and bad blocks. The assumption is made that the pattern and the version count are always located in the oob area of the first block.

Name

struct platform_nand_chip — chip level device structure

Synopsis

```
struct platform_nand_chip {
  int nr_chips;
  int chip_offset;
  int nr_partitions;
  struct mtd_partition * partitions;
  struct nand_ecclayout * ecclayout;
  int chip_delay;
  unsigned int options;
  const char ** part_probe_types;
  void (* set_parts) (uint64_t size,struct platform_nand_chip *chip);
  void * priv;
};
```

Members

nr_chips

max. number of chips to scan for

chip_offset

chip number offset

nr_partitions

number of partitions pointed to by partitions (or zero)

partitions

mtd partition list

ecclayout

ecc layout info structure

chip_delay

R/B delay value in us

options

Option flags, e.g. 16bit buswidth

part_probe_types

NULL-terminated array of probe types

set_parts

platform specific function to set partitions

priv

hardware controller specific settings

Name

struct platform_nand_ctrl — controller level device structure

Synopsis

```
struct platform_nand_ctrl {
  int (* probe) (struct platform_device *pdev);
  void (* remove) (struct platform_device *pdev);
  void (* hwcontrol) (struct mtd_info *mtd, int cmd);
  int (* dev_ready) (struct mtd_info *mtd);
  void (* select_chip) (struct mtd_info *mtd, int chip);
  void (* cmd_ctrl) (struct mtd_info *mtd, int dat,unsigned int ctrl);
  void (* write_buf) (struct mtd_info *mtd,const uint8_t *buf, int len);
  void (* read_buf) (struct mtd_info *mtd,uint8_t *buf, int len);
  void * priv;
};
```

Members

probe

platform specific function to probe/setup hardware

remove

platform specific function to remove/teardown hardware

hwcontrol

platform specific hardware control structure

dev_ready

platform specific function to read ready/busy pin

select_chip

platform specific chip select function

cmd_ctrl

platform specific function for controlling ALE/CLE/nCE. Also used to write command and address

write_buf

platform specific function for write buffer

read_buf

platform specific function for read buffer

priv

private data to transport driver specific settings

Description

All fields are optional and depend on the hardware driver requirements

---

Name

struct platform_nand_data — container structure for platform-specific data

Synopsis

```
struct platform_nand_data {
  struct platform_nand_chip chip;
  struct platform_nand_ctrl ctrl;
};
```

Members

chip

chip level chip structure

ctrl

controller level device structure

Chapter 10. Public Functions Provided

Table of Contents

This chapter contains the autogenerated documentation of the NAND kernel API functions which are exported. Each function has a short description which is marked with an [XXX] identifier. See the chapter "Documentation hints" for an explanation.

Name

nand_scan_ident — [NAND Interface] Scan for the NAND device

Synopsis

```
int nand_scan_ident (mtd,
                     maxchips);

struct mtd_info *  mtd;
int                maxchips;
```

Arguments

mtd

MTD device structure

maxchips

Number of chips to scan for

Description

This is the first phase of the normal `nand_scan` function. It reads the flash ID and sets up MTD fields accordingly.

The mtd->owner field must be set to the module of the caller.

Name

nand_scan_tail — [NAND Interface] Scan for the NAND device

Synopsis

```
int nand_scan_tail (mtd);

struct mtd_info *  mtd;
```

Arguments

mtd

MTD device structure

Description

This is the second phase of the normal `nand_scan` function. It fills out all the uninitialized function pointers with the defaults and scans for a bad block table if appropriate.

Name

nand_scan — [NAND Interface] Scan for the NAND device

Synopsis

```
int nand_scan (mtd,
               maxchips);

struct mtd_info *  mtd;
int                maxchips;
```

Arguments

mtd

MTD device structure

maxchips

Number of chips to scan for

Description

This fills out all the uninitialized function pointers with the defaults. The flash ID is read and the mtd/chip structures are filled with the appropriate values. The mtd->owner field must be set to the module of the caller

---

Name

nand_release — [NAND Interface] Free resources held by the NAND device

Synopsis

```
void nand_release (mtd);

struct mtd_info *  mtd;
```

Arguments

mtd

MTD device structure

Name

nand_scan_bbt — [NAND Interface] scan, find, read and maybe create bad block table(s)

Synopsis

```
int nand_scan_bbt (mtd,
                   bd);

struct mtd_info *        mtd;
struct nand_bbt_descr *  bd;
```

Arguments

mtd

MTD device structure

bd

descriptor for the good/bad block search pattern

Description

The function checks, if a bad block table(s) is/are already available. If not it scans the device for manufacturer marked good / bad blocks and writes the bad block table(s) to the selected place.

The bad block table memory is allocated here. It must be freed by calling the nand_free_bbt function.

Name

nand_default_bbt — [NAND Interface] Select a default bad block table for the device

Synopsis

```
int nand_default_bbt (mtd);

struct mtd_info *  mtd;
```

Arguments

mtd

MTD device structure

Description

This function selects the default bad block table support for the device and calls the nand_scan_bbt function

---

Name

nand_calculate_ecc — [NAND Interface] Calculate 3-byte ECC for 256/512-byte block

Synopsis

```
int nand_calculate_ecc (mtd,
                        buf,
                        code);

struct mtd_info *      mtd;
const unsigned char *  buf;
unsigned char *        code;
```

Arguments

mtd

MTD block structure

buf

input buffer with raw data

code

output buffer with ECC

Name

__nand_correct_data — [NAND Interface] Detect and correct bit error(s)

Synopsis

```
int __nand_correct_data (buf,
                         read_ecc,
                         calc_ecc,
                         eccsize);

unsigned char *  buf;
unsigned char *  read_ecc;
unsigned char *  calc_ecc;
```

```
unsigned int    eccsize;
```

Arguments

buf

raw data read from the chip

read_ecc

ECC from the chip

calc_ecc

the ECC calculated from raw data

eccsize

data bytes per ecc step (256 or 512)

Description

Detect and correct a 1 bit error for eccsize byte block

Name

nand_correct_data — [NAND Interface] Detect and correct bit error(s)

Synopsis

```
int nand_correct_data (mtd,
                       buf,
                       read_ecc,
                       calc_ecc);

struct mtd_info *  mtd;
unsigned char *    buf;
unsigned char *    read_ecc;
unsigned char *    calc_ecc;
```

Arguments

mtd

MTD block structure

buf

raw data read from the chip

read_ecc

ECC from the chip

calc_ecc

the ECC calculated from raw data

Description

Detect and correct a 1 bit error for 256/512 byte block

Chapter 11. Internal Functions Provided

Table of Contents

nand_isbad_bbt — [NAND Interface] Check if a block is bad

This chapter contains the autogenerated documentation of the NAND driver internal functions. Each function has a short description which is marked with an [XXX] identifier. See the chapter "Documentation hints" for an explanation. The functions marked with [DEFAULT] might be relevant for a board driver developer.

Name

nand_release_device — [GENERIC] release chip

Synopsis

`void nand_release_device (mtd);`

`struct mtd_info * mtd;`

Arguments

mtd

MTD device structure

Description

Deselect, release chip lock and wake up anyone waiting on the device

---

Name

nand_read_byte — [DEFAULT] read one byte from the chip

Synopsis

`uint8_t nand_read_byte (mtd);`

`struct mtd_info * mtd;`

Arguments

mtd

MTD device structure

Description

Default read function for 8bit buswith

Name

nand_read_byte16 — [DEFAULT] read one byte endianess aware from the chip

Synopsis

`uint8_t nand_read_byte16 (mtd);`

`struct mtd_info * mtd;`

Arguments

mtd

MTD device structure

Description

Default read function for 16bit buswith with endianess conversion

---

Name

nand_read_word — [DEFAULT] read one word from the chip

Synopsis

```
u16 nand_read_word (mtd);

struct mtd_info *  mtd;
```

Arguments

mtd

MTD device structure

Description

Default read function for 16bit buswith without endianess conversion

---

Name

nand_select_chip — [DEFAULT] control CE line

Synopsis

```
void nand_select_chip (mtd,
                       chipnr);

struct mtd_info *  mtd;
int                chipnr;
```

Arguments

mtd

MTD device structure

chipnr

chipnumber to select, -1 for deselect

Description

Default select function for 1 chip devices.

Name

nand_write_buf — [DEFAULT] write buffer to chip

Synopsis

```
void nand_write_buf (mtd,
                     buf,
```

```
                          len);

struct mtd_info *  mtd;
const uint8_t *    buf;
int                len;
```

Arguments

mtd

MTD device structure

buf

data buffer

len

number of bytes to write

Description

Default write function for 8bit buswith

Name

nand_read_buf — [DEFAULT] read chip data into buffer

Synopsis

```
void nand_read_buf (mtd,
                    buf,
                    len);

struct mtd_info *  mtd;
uint8_t *          buf;
int                len;
```

Arguments

mtd

MTD device structure

buf

buffer to store date

len

number of bytes to read

Description

Default read function for 8bit buswith

Name

nand_verify_buf — [DEFAULT] Verify chip data against buffer

Synopsis

```
int nand_verify_buf (mtd,
                     buf,
```

```
                        len);

struct mtd_info *  mtd;
const uint8_t *    buf;
int                len;
```

Arguments

mtd

MTD device structure

buf

buffer containing the data to compare

len

number of bytes to compare

Description

Default verify function for 8bit buswith

Name

nand_write_buf16 — [DEFAULT] write buffer to chip

Synopsis

```
void nand_write_buf16 (mtd,
                       buf,
                       len);

struct mtd_info *  mtd;
const uint8_t *    buf;
int                len;
```

Arguments

mtd

MTD device structure

buf

data buffer

len

number of bytes to write

Description

Default write function for 16bit buswith

Name

nand_read_buf16 — [DEFAULT] read chip data into buffer

Synopsis

```
void nand_read_buf16 (mtd,
                      buf,
```

len);

```
struct mtd_info *  mtd;
uint8_t *          buf;
int                len;
```

Arguments

mtd

MTD device structure

buf

buffer to store date

len

number of bytes to read

Description

Default read function for 16bit buswith

Name

nand_verify_buf16 — [DEFAULT] Verify chip data against buffer

Synopsis

```
int nand_verify_buf16 (mtd,
                       buf,
                       len);

struct mtd_info *  mtd;
const uint8_t *    buf;
int                len;
```

Arguments

mtd

MTD device structure

buf

buffer containing the data to compare

len

number of bytes to compare

Description

Default verify function for 16bit buswith

Name

nand_block_bad — [DEFAULT] Read bad block marker from the chip

Synopsis

```
int nand_block_bad (mtd,
                    ofs,
```

getchip);

```
struct mtd_info *  mtd;
loff_t             ofs;
int                getchip;
```

Arguments

mtd

MTD device structure

ofs

offset from device start

getchip

0, if the chip is already selected

Description

Check, if the block is bad.

Name

nand_default_block_markbad — [DEFAULT] mark a block bad

Synopsis

int **nand_default_block_markbad** (*mtd*,
ofs);

```
struct mtd_info *  mtd;
loff_t             ofs;
```

Arguments

mtd

MTD device structure

ofs

offset from device start

Description

This is the default implementation, which can be overridden by a hardware specific driver.

Name

nand_check_wp — [GENERIC] check if the chip is write protected

Synopsis

int **nand_check_wp** (*mtd*);

```
struct mtd_info *  mtd;
```

Arguments

mtd

MTD device structure Check, if the device is write protected

Description

The function expects, that the device is already selected

Name

nand_block_checkbad — [GENERIC] Check if a block is marked bad

Synopsis

```
int nand_block_checkbad (mtd,
                         ofs,
                         getchip,
                         allowbbt);

struct mtd_info *  mtd;
loff_t             ofs;
int                getchip;
int                allowbbt;
```

Arguments

mtd

MTD device structure

ofs

offset from device start

getchip

0, if the chip is already selected

allowbbt

1, if its allowed to access the bbt area

Description

Check, if the block is bad. Either by reading the bad block table or calling of the scan function.

Name

nand_command — [DEFAULT] Send command to NAND device

Synopsis

```
void nand_command (mtd,
                   command,
                   column,
                   page_addr);

struct mtd_info *  mtd;
unsigned int       command;
int                column;
int                page_addr;
```

Arguments

mtd

MTD device structure

command

the command to be sent

column

the column address for this command, -1 if none

page_addr

the page address for this command, -1 if none

Description

Send command to NAND device. This function is used for small page devices (256/512 Bytes per page)

Name

nand_command_lp — [DEFAULT] Send command to NAND large page device

Synopsis

```
void nand_command_lp (mtd,
                      command,
                      column,
                      page_addr);

struct mtd_info *  mtd;
unsigned int       command;
int                column;
int                page_addr;
```

Arguments

mtd

MTD device structure

command

the command to be sent

column

the column address for this command, -1 if none

page_addr

the page address for this command, -1 if none

Description

Send command to NAND device. This is the version for the new large page devices We dont have the separate regions as we have in the small page devices. We must emulate NAND_CMD_READOOB to keep the code compatible.

Name

nand_get_device — [GENERIC] Get chip for selected access

Synopsis

```
int nand_get_device (chip,
```

```
                          mtd,
                          new_state);

struct nand_chip *  chip;
struct mtd_info *   mtd;
int                 new_state;
```

Arguments

chip

the nand chip descriptor

mtd

MTD device structure

new_state

the state which is requested

Description

Get the device and lock it for exclusive access

Name

nand_wait — [DEFAULT] wait until the command is done

Synopsis

```
int nand_wait (mtd,
               chip);

struct mtd_info *   mtd;
struct nand_chip *  chip;
```

Arguments

mtd

MTD device structure

chip

NAND chip structure

Description

Wait for command done. This applies to erase and program only Erase can take up to 400ms and program up to 20ms according to general NAND and SmartMedia specs

---

Name

nand_read_page_raw — [Intern] read raw page data without ecc

Synopsis

```
int nand_read_page_raw (mtd,
                        chip,
                        buf,
                        page);

struct mtd_info *   mtd;
```

```
struct nand_chip *  chip;
uint8_t *           buf;
int                 page;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

buffer to store read data

page

-- undescribed --

Description

Not for syndrome calculating ecc controllers, which use a special oob layout

---

Name

nand_read_page_raw_syndrome — [Intern] read raw page data without ecc

Synopsis

```
int nand_read_page_raw_syndrome (mtd,
                                 chip,
                                 buf,
                                 page);
struct mtd_info *   mtd;
struct nand_chip *  chip;
uint8_t *           buf;
int                 page;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

buffer to store read data

page

-- undescribed --

Description

We need a special oob layout and handling even when OOB isn't used.

Name

nand_read_page_swecc — [REPLACABLE] software ecc based page read function

Synopsis

```
int nand_read_page_swecc (mtd,
                          chip,
                          buf,
                          page);

struct mtd_info *   mtd;
struct nand_chip *  chip;
uint8_t *           buf;
int                 page;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

buffer to store read data

page

-- undescribed --

Name

nand_read_subpage — [REPLACABLE] software ecc based sub-page read function

Synopsis

```
int nand_read_subpage (mtd,
                       chip,
                       data_offs,
                       readlen,
                       bufpoi);

struct mtd_info *   mtd;
struct nand_chip *  chip;
uint32_t            data_offs;
uint32_t            readlen;
uint8_t *           bufpoi;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

data_offs

offset of requested data within the page

readlen

data length

bufpoi

buffer to store read data

Name

nand_read_page_hwecc — [REPLACABLE] hardware ecc based page read function

Synopsis

```
int nand_read_page_hwecc (mtd,
                          chip,
                          buf,
                          page);

struct mtd_info *   mtd;
struct nand_chip *  chip;
uint8_t *           buf;
int                 page;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

buffer to store read data

page

-- undescribed --

Description

Not for syndrome calculating ecc controllers which need a special oob layout

---

Name

nand_read_page_hwecc_oob_first — [REPLACABLE] hw ecc, read oob first

Synopsis

```
int nand_read_page_hwecc_oob_first (mtd,
                                    chip,
                                    buf,
                                    page);

struct mtd_info *   mtd;
struct nand_chip *  chip;
uint8_t *           buf;
int                 page;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

buffer to store read data

page

-- undescribed --

Description

Hardware ECC for large page chips, require OOB to be read first. For this ECC mode, the write_page method is re-used from ECC_HW. These methods read/write ECC from the OOB area, unlike the ECC_HW_SYNDROME support with multiple ECC steps, follows the “infix ECC” scheme and reads/writes ECC from the data area, by overwriting the NAND manufacturer bad block markings.

Name

nand_read_page_syndrome — [REPLACABLE] hardware ecc syndrom based page read

Synopsis

```
int nand_read_page_syndrome (mtd,
                             chip,
                             buf,
                             page);

struct mtd_info *   mtd;
struct nand_chip *  chip;
uint8_t *           buf;
int                 page;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

buffer to store read data

page

-- undescribed --

Description

The hw generator calculates the error syndrome automatically. Therefor we need a special oob layout and handling.

Name

nand_transfer_oob — [Internal] Transfer oob to client buffer

Synopsis

```
uint8_t * nand_transfer_oob (chip,
                             oob,
```

```
                                   ops,
                                   len);

struct nand_chip *    chip;
uint8_t *             oob;
struct mtd_oob_ops *  ops;
size_t                len;
```

Arguments

chip

nand chip structure

oob

oob destination address

ops

oob ops structure

len

size of oob to transfer

Name

nand_do_read_ops — [Internal] Read data with ECC

Synopsis

```
int nand_do_read_ops (mtd,
                      from,
                      ops);

struct mtd_info *     mtd;
loff_t                from;
struct mtd_oob_ops *  ops;
```

Arguments

mtd

MTD device structure

from

offset to read from

ops

oob ops structure

Description

Internal function. Called with chip held.

Name

nand_read — [MTD Interface] MTD compability function for nand_do_read_ecc

Synopsis

```
int nand_read (mtd,
```

```
                 from,
                 len,
                 retlen,
                 buf);

struct mtd_info *  mtd;
loff_t             from;
size_t             len;
size_t *           retlen;
uint8_t *          buf;
```

Arguments

mtd

MTD device structure

from

offset to read from

len

number of bytes to read

retlen

pointer to variable to store the number of read bytes

buf

the databuffer to put data

Description

Get hold of the chip and call nand_do_read

Name

nand_read_oob_std — [REPLACABLE] the most common OOB data read function

Synopsis

```
int nand_read_oob_std (mtd,
                       chip,
                       page,
                       sndcmd);

struct mtd_info *   mtd;
struct nand_chip *  chip;
int                 page;
int                 sndcmd;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

page

page number to read

sndcmd

flag whether to issue read command or not

Name

nand_read_oob_syndrome — [REPLACABLE] OOB data read function for HW ECC with syndromes

Synopsis

```
int nand_read_oob_syndrome (mtd,
                            chip,
                            page,
                            sndcmd);

struct mtd_info *   mtd;
struct nand_chip *  chip;
int                 page;
int                 sndcmd;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

page

page number to read

sndcmd

flag whether to issue read command or not

Name

nand_write_oob_std — [REPLACABLE] the most common OOB data write function

Synopsis

```
int nand_write_oob_std (mtd,
                        chip,
                        page);

struct mtd_info *   mtd;
struct nand_chip *  chip;
int                 page;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

page

page number to write

Name

nand_write_oob_syndrome — [REPLACABLE] OOB data write function for HW ECC with syndrome - only for large page flash !

Synopsis

```
int nand_write_oob_syndrome (mtd,
                             chip,
                             page);

struct mtd_info *   mtd;
struct nand_chip *  chip;
int                 page;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

page

page number to write

Name

nand_do_read_oob — [Intern] NAND read out-of-band

Synopsis

```
int nand_do_read_oob (mtd,
                      from,
                      ops);

struct mtd_info *     mtd;
loff_t                from;
struct mtd_oob_ops *  ops;
```

Arguments

mtd

MTD device structure

from

offset to read from

ops

oob operations description structure

Description

NAND read out-of-band data from the spare area

Name

nand_read_oob — [MTD Interface] NAND read data and/or out-of-band

Synopsis

```
int nand_read_oob (mtd,
                   from,
                   ops);

struct mtd_info *     mtd;
loff_t                from;
struct mtd_oob_ops *  ops;
```

Arguments

mtd

MTD device structure

from

offset to read from

ops

oob operation description structure

Description

NAND read data and/or out-of-band data

Name

nand_write_page_raw — [Intern] raw page write function

Synopsis

```
void nand_write_page_raw (mtd,
                          chip,
                          buf);

struct mtd_info *   mtd;
struct nand_chip *  chip;
const uint8_t *     buf;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

data buffer

Description

Not for syndrome calculating ecc controllers, which use a special oob layout

---

Name

nand_write_page_raw_syndrome — [Intern] raw page write function

Synopsis

```
void nand_write_page_raw_syndrome (mtd,
                                   chip,
                                   buf);

struct mtd_info *   mtd;
struct nand_chip *  chip;
const uint8_t *     buf;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

data buffer

Description

We need a special oob layout and handling even when ECC isn't checked.

Name

nand_write_page_swecc — [REPLACABLE] software ecc based page write function

Synopsis

```
void nand_write_page_swecc (mtd,
                            chip,
                            buf);

struct mtd_info *   mtd;
struct nand_chip *  chip;
const uint8_t *     buf;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

data buffer

Name

nand_write_page_hwecc — [REPLACABLE] hardware ecc based page write function

Synopsis

```
void nand_write_page_hwecc (mtd,
                            chip,
```

```
                                  buf);

struct mtd_info *   mtd;
struct nand_chip *  chip;
const uint8_t *     buf;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

data buffer

Name

nand_write_page_syndrome — [REPLACABLE] hardware ecc syndrom based page write

Synopsis

```
void nand_write_page_syndrome (mtd,
                               chip,
                               buf);

struct mtd_info *   mtd;
struct nand_chip *  chip;
const uint8_t *     buf;
```

Arguments

mtd

mtd info structure

chip

nand chip info structure

buf

data buffer

Description

The hw generator calculates the error syndrome automatically. Therefor we need a special oob layout and handling.

Name

nand_write_page — [REPLACEABLE] write one page

Synopsis

```
int nand_write_page (mtd,
                     chip,
                     buf,
                     page,
                     cached,
                     raw);
```

```
struct mtd_info *   mtd;
struct nand_chip *  chip;
const uint8_t *     buf;
int                 page;
int                 cached;
int                 raw;
```

Arguments

mtd

MTD device structure

chip

NAND chip descriptor

buf

the data to write

page

page number to write

cached

cached programming

raw

use _raw version of write_page

Name

nand_fill_oob — [Internal] Transfer client buffer to oob

Synopsis

```
uint8_t * nand_fill_oob (chip,
                         oob,
                         ops);

struct nand_chip *    chip;
uint8_t *             oob;
struct mtd_oob_ops *  ops;
```

Arguments

chip

nand chip structure

oob

oob data buffer

ops

oob ops structure

Name

nand_do_write_ops — [Internal] NAND write with ECC

Synopsis

```
int nand_do_write_ops (mtd,
                       to,
                       ops);

struct mtd_info *     mtd;
loff_t                to;
struct mtd_oob_ops *  ops;
```

Arguments

mtd

MTD device structure

to

offset to write to

ops

oob operations description structure

Description

NAND write with ECC

Name

nand_write — [MTD Interface] NAND write with ECC

Synopsis

```
int nand_write (mtd,
                to,
                len,
                retlen,
                buf);

struct mtd_info *  mtd;
loff_t             to;
size_t             len;
size_t *           retlen;
const uint8_t *    buf;
```

Arguments

mtd

MTD device structure

to

offset to write to

len

number of bytes to write

retlen

pointer to variable to store the number of written bytes

buf

the data to write

Description

NAND write with ECC

Name

nand_do_write_oob — [MTD Interface] NAND write out-of-band

Synopsis

```
int nand_do_write_oob (mtd,
                        to,
                        ops);

struct mtd_info *     mtd;
loff_t                to;
struct mtd_oob_ops *  ops;
```

Arguments

mtd

MTD device structure

to

offset to write to

ops

oob operation description structure

Description

NAND write out-of-band

Name

nand_write_oob — [MTD Interface] NAND write data and/or out-of-band

Synopsis

```
int nand_write_oob (mtd,
                     to,
                     ops);

struct mtd_info *     mtd;
loff_t                to;
struct mtd_oob_ops *  ops;
```

Arguments

mtd

MTD device structure

to

offset to write to

ops

oob operation description structure

Name

single_erase_cmd — [GENERIC] NAND standard block erase command function

Synopsis

```
void single_erase_cmd (mtd,
                       page);

struct mtd_info *  mtd;
int                page;
```

Arguments

mtd

MTD device structure

page

the page address of the block which will be erased

Description

Standard erase command for NAND chips

Name

multi_erase_cmd — [GENERIC] AND specific block erase command function

Synopsis

```
void multi_erase_cmd (mtd,
                      page);

struct mtd_info *  mtd;
int                page;
```

Arguments

mtd

MTD device structure

page

the page address of the block which will be erased

Description

AND multi block erase command function Erase 4 consecutive blocks

---

Name

nand_erase — [MTD Interface] erase block(s)

Synopsis

```
int nand_erase (mtd,
                instr);

struct mtd_info *    mtd;
```

```
struct erase_info *  instr;
```

Arguments

mtd

MTD device structure

instr

erase instruction

Description

Erase one ore more blocks

Name

nand_erase_nand — [Internal] erase block(s)

Synopsis

```
int nand_erase_nand (mtd,
                     instr,
                     allowbbt);

struct mtd_info *    mtd;
struct erase_info *  instr;
int                  allowbbt;
```

Arguments

mtd

MTD device structure

instr

erase instruction

allowbbt

allow erasing the bbt area

Description

Erase one ore more blocks

Name

nand_sync — [MTD Interface] sync

Synopsis

```
void nand_sync (mtd);

struct mtd_info *  mtd;
```

Arguments

mtd

MTD device structure

Description

Sync is actually a wait for chip ready function

Name

nand_block_isbad — [MTD Interface] Check if block at offset is bad

Synopsis

```
int nand_block_isbad (mtd,
                      offs);

struct mtd_info *  mtd;
loff_t             offs;
```

Arguments

mtd

MTD device structure

offs

offset relative to mtd start

Name

nand_block_markbad — [MTD Interface] Mark block at the given offset as bad

Synopsis

```
int nand_block_markbad (mtd,
                        ofs);

struct mtd_info *  mtd;
loff_t             ofs;
```

Arguments

mtd

MTD device structure

ofs

offset relative to mtd start

Name

nand_suspend — [MTD Interface] Suspend the NAND flash

Synopsis

```
int nand_suspend (mtd);

struct mtd_info *  mtd;
```

Arguments

mtd

MTD device structure

Name

nand_resume — [MTD Interface] Resume the NAND flash

Synopsis

```
void nand_resume (mtd);

struct mtd_info *  mtd;
```

Arguments

mtd

MTD device structure

Name

check_pattern — [GENERIC] check if a pattern is in the buffer

Synopsis

```
int check_pattern (buf,
                   len,
                   paglen,
                   td);

uint8_t *                 buf;
int                       len;
int                       paglen;
struct nand_bbt_descr *   td;
```

Arguments

buf

the buffer to search

len

the length of buffer to search

paglen

the pagelength

td

search pattern descriptor

Description

Check for a pattern at the given place. Used to search bad block tables and good / bad block identifiers. If the SCAN_EMPTY option is set then check, if all bytes except the pattern area contain 0xff

---

Name

check_short_pattern — [GENERIC] check if a pattern is in the buffer

Synopsis

```
int check_short_pattern (buf,
                         td);

uint8_t *                buf;
struct nand_bbt_descr *  td;
```

Arguments

buf

the buffer to search

td

search pattern descriptor

Description

Check for a pattern at the given place. Used to search bad block tables and good / bad block identifiers. Same as check_pattern, but no optional empty check

---

Name

read_bbt — [GENERIC] Read the bad block table starting from page

Synopsis

```
int read_bbt (mtd,
              buf,
              page,
              num,
              bits,
              offs,
              reserved_block_code);

struct mtd_info *  mtd;
uint8_t *          buf;
int                page;
int                num;
int                bits;
int                offs;
int                reserved_block_code;
```

Arguments

mtd

MTD device structure

buf

temporary buffer

page

the starting page

num

the number of bbt descriptors to read

bits

number of bits per block

offs

offset in the memory table

reserved_block_code

Pattern to identify reserved blocks

Description

Read the bad block table starting from page.

Name

read_abs_bbt — [GENERIC] Read the bad block table starting at a given page

Synopsis

```
int read_abs_bbt (mtd,
                  buf,
                  td,
                  chip);

struct mtd_info *        mtd;
uint8_t *                buf;
struct nand_bbt_descr *  td;
int                      chip;
```

Arguments

mtd

MTD device structure

buf

temporary buffer

td

descriptor for the bad block table

chip

read the table for a specific chip, -1 read all chips. Applies only if NAND_BBT_PERCHIP option is set

Description

Read the bad block table for all chips starting at a given page We assume that the bbt bits are in consecutive order.

Name

read_abs_bbts — [GENERIC] Read the bad block table(s) for all chips starting at a given page

Synopsis

```
int read_abs_bbts (mtd,
                   buf,
                   td,
                   md);

struct mtd_info *        mtd;
uint8_t *                buf;
struct nand_bbt_descr *  td;
```

```
struct nand_bbt_descr *  md;
```

Arguments

mtd

MTD device structure

buf

temporary buffer

td

descriptor for the bad block table

md

descriptor for the bad block table mirror

Description

Read the bad block table(s) for all chips starting at a given page We assume that the bbt bits are in consecutive order.

Name

create_bbt — [GENERIC] Create a bad block table by scanning the device

Synopsis

```
int create_bbt (mtd,
                buf,
                bd,
                chip);

struct mtd_info *        mtd;
uint8_t *                buf;
struct nand_bbt_descr *  bd;
int                      chip;
```

Arguments

mtd

MTD device structure

buf

temporary buffer

bd

descriptor for the good/bad block search pattern

chip

create the table for a specific chip, -1 read all chips. Applies only if NAND_BBT_PERCHIP option is set

Description

Create a bad block table by scanning the device for the given good/bad block identify pattern

---

Name

search_bbt — [GENERIC] scan the device for a specific bad block table

Synopsis

```
int search_bbt (mtd,
                buf,
                td);

struct mtd_info *        mtd;
uint8_t *                buf;
struct nand_bbt_descr *  td;
```

Arguments

mtd

MTD device structure

buf

temporary buffer

td

descriptor for the bad block table

Description

Read the bad block table by searching for a given ident pattern. Search is preformed either from the beginning up or from the end of the device downwards. The search starts always at the start of a block. If the option NAND_BBT_PERCHIP is given, each chip is searched for a bbt, which contains the bad block information of this chip. This is necessary to provide support for certain DOC devices.

The bbt ident pattern resides in the oob area of the first page in a block.

Name

search_read_bbts — [GENERIC] scan the device for bad block table(s)

Synopsis

```
int search_read_bbts (mtd,
                      buf,
                      td,
                      md);

struct mtd_info *        mtd;
uint8_t *                buf;
struct nand_bbt_descr *  td;
struct nand_bbt_descr *  md;
```

Arguments

mtd

MTD device structure

buf

temporary buffer

td

descriptor for the bad block table

md

descriptor for the bad block table mirror

Description

Search and read the bad block table(s)

Name

write_bbt — [GENERIC] (Re)write the bad block table

Synopsis

```
int write_bbt (mtd,
               buf,
               td,
               md,
               chipsel);

struct mtd_info *         mtd;
uint8_t *                 buf;
struct nand_bbt_descr *   td;
struct nand_bbt_descr *   md;
int                       chipsel;
```

Arguments

mtd

MTD device structure

buf

temporary buffer

td

descriptor for the bad block table

md

descriptor for the bad block table mirror

chipsel

selector for a specific chip, -1 for all

Description

(Re)write the bad block table

Name

nand_memory_bbt — [GENERIC] create a memory based bad block table

Synopsis

```
int nand_memory_bbt (mtd,
                     bd);

struct mtd_info *         mtd;
struct nand_bbt_descr *   bd;
```

Arguments

mtd

MTD device structure

bd

descriptor for the good/bad block search pattern

Description

The function creates a memory based bbt by scanning the device for manufacturer / software marked good / bad blocks

---

Name

check_create — [GENERIC] create and write bbt(s) if necessary

Synopsis

```
int check_create (mtd,
                  buf,
                  bd);

struct mtd_info *        mtd;
uint8_t *                buf;
struct nand_bbt_descr *  bd;
```

Arguments

mtd

MTD device structure

buf

temporary buffer

bd

descriptor for the good/bad block search pattern

Description

The function checks the results of the previous call to read_bbt and creates / updates the bbt(s) if necessary Creation is necessary if no bbt was found for the chip/device Update is necessary if one of the tables is missing or the version nr. of one table is less than the other

---

Name

mark_bbt_region — [GENERIC] mark the bad block table regions

Synopsis

```
void mark_bbt_region (mtd,
                      td);

struct mtd_info *        mtd;
struct nand_bbt_descr *  td;
```

Arguments

mtd

MTD device structure

td

bad block table descriptor

Description

The bad block table regions are marked as “bad” to prevent accidental erasures / writes. The regions are identified by the mark 0x02.

Name

nand_update_bbt — [NAND Interface] update bad block table(s)

Synopsis

```
int nand_update_bbt (mtd,
                      offs);

struct mtd_info *  mtd;
loff_t             offs;
```

Arguments

mtd

MTD device structure

offs

the offset of the newly marked block

Description

The function updates the bad block table(s)

Name

nand_isbad_bbt — [NAND Interface] Check if a block is bad

Synopsis

```
int nand_isbad_bbt (mtd,
                     offs,
                     allowbbt);

struct mtd_info *  mtd;
loff_t             offs;
int                allowbbt;
```

Arguments

mtd

MTD device structure

offs

offset in the device

allowbbt

allow access to bad block table region

Chapter 12. Credits

The following people have contributed to the NAND driver:

1. Steven J. Hill<sjhill@realitydiluted.com>
2. David Woodhouse<dwmw2@infradead.org>
3. Thomas Gleixner<tglx@linutronix.de>

A lot of users have provided bugfixes, improvements and helping hands for testing. Thanks a lot.

The following people have contributed to this document:

1. Thomas Gleixner<tglx@linutronix.de>