DDR configuration tool for Microchip platforms

Technical Note

CONFIDENTIAL

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TERMS and ABBREVIATIONS

```
HIF               Host Interface
ODT               On-Die Termination
PUB               PHY utility block
SoC               System on a Chip
```

Requirements

The tools are developed using the `ruby` scripting language, which must be available.

The scripts may run under both `Linux` or `Windows`. The `Windows` environment may require installing the `WSL2` package to emulate `Linux`.

Supported platforms

This tool is supported form the following target SoC platforms:

- sparx5 (ARMv8 A53 dual-core)
- lan966x (ARMV7 A7 single-core)
- lan969x (ARMv8 A53 single-core)

Introduction

This software package contain a set of tools that can create DDR configurations specific to a target platform and board design. A board design defines the physical DDR memory system, such that the DDR controller needs a carefully crafted configuration to ensure a stable and effective operation.

The DDR controller supported is the *Synopsis uMCTL2* DesignWare component, accompanied with a *Synopsis PHY Utility Block*.

The supported platforms all use DDR3 or DDR3 + DDR4.

Workflow

The tool works by accepting a *configuration profile* as input, which can be transformed into a compact representation of the many configuration options the target, **specifically** generated for a given platform and board.

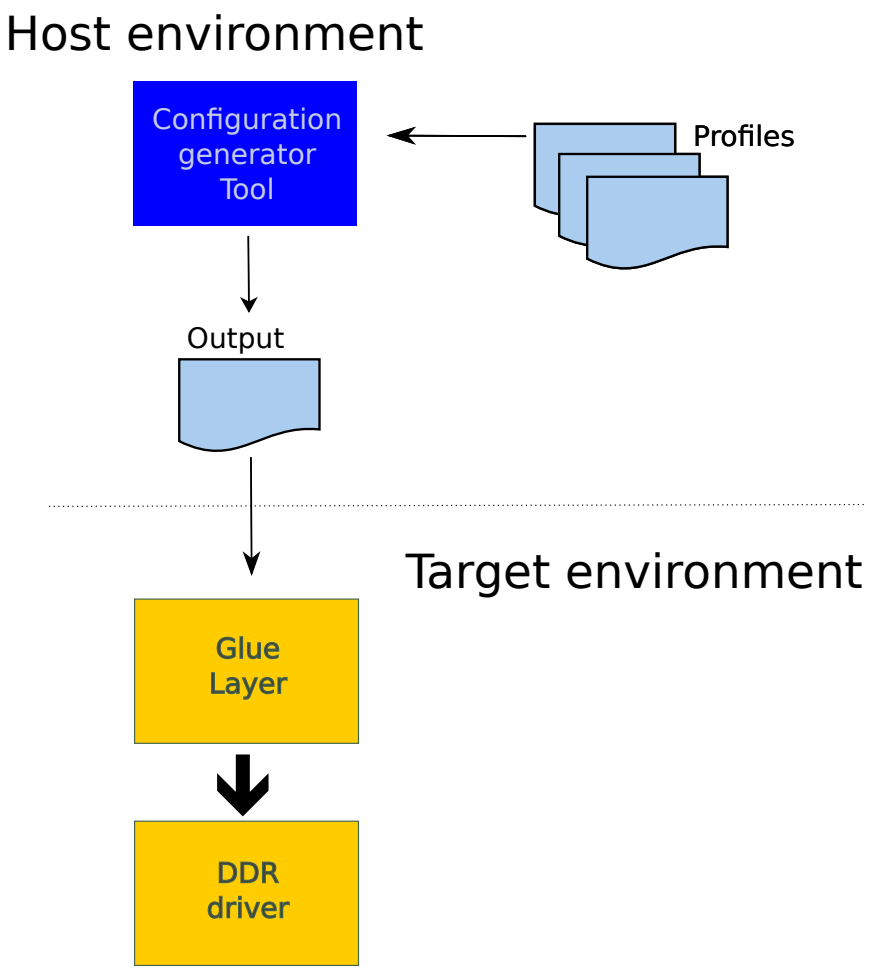
The output configuration may be represented in different formats, depending on the target platform.

The different formats are:

format	platform	comments
source	lan966x	The configuration is output to "C" code, and compiled into the target firmware.
devicetree	lan969x, sparx5	The configuration is output to device-tree format, which is added to a a target image (as a separate entity).
yaml	-none-	The configuration is stored in YAML format. The format can be used for documentation purposes as well as for comparing with other configurations.

The output representation is dictated by the target implementation of the actual target system DDR driver operating environment. Specifically, 'device tree' support may not be available on a given target (Example: `lan966x`).

The workflow of working with the DDR configuration is illustrated below:



Configuration parameters

At the top level, the following user-level parameters are available:

Keyword	Type	Description
`platform`	`sparx5 | lan966x | lan969x`	The name of the target platform SoC
`clock_speed`	`integer`	The clock speed of the DDR data bus. See later.

Keyword	Type	Description
`mem_size`	`integer`	Total Memory Size (in Mbytes)
`mem_type`	`DDR3 | DDR4`	The DDR memory type of the equipped DDR devices.
`device_bus_width`	`x8 | x16`	Bus width of the equipped DDR devices. `x8` support is experimental.
`active_ranks`	`integer`	The number of (active) ranks in the memory topology.
`ecc_mode`	`0 | 4`	The ECC mode to employ. ECC mode `0` implies ECC is disabled, mode `4` is "sec/ded over 1 beat"
`mem_profile`	`string`	The filename of a file defining DDR memory address generation. See later.
`_2T_mode`	`boolean`	Whether `2T` timing should be used
`board`	`string`	The filename of file containing board specific tuning parameters. See later.

Clock speed.

The *clock_speed* affects a lot of the calculated parameters for the memory controller.

Whether or not the clock speed can be changed or not, depends on the target system (and the actual driver implementation).

The current state of the clock speed is described below.

Platform	Supported clocks	Notes
`sparx5`	`2500 | 2000 | 1667 | 1250`	NB: DDR4 will only work at 1667 Mhz
`lan966x`	`1200`	Fixed clock
`lan969x`	`2400`	Fixed clock

Memory profile parameter *mem_profile*

In order to define the way HIF addresses are used to select ranks, groups and DDR devices, a separate YAML file is used. This configuration file may be used by several configurations (board designs) using similar physical DDR topology.

The *mem_profile* file defines the so-called "address map" registers (and sub-fields). An example is given below.

Note: The registers and sub-fields vary a little between platforms, so not all registers apply to all supported platforms. Refer to [1], section "2.11: Address Mapper".

Address map definition example

```
addrmap0:
  ADDRMAP_CS_BIT0: 31
addrmap1:
  ADDRMAP_BANK_B0: 24
  ADDRMAP_BANK_B1: 24
  ADDRMAP_BANK_B2: 24
addrmap2:
  ADDRMAP_COL_B2: 0
  ADDRMAP_COL_B3: 0
  ADDRMAP_COL_B4: 0
  ADDRMAP_COL_B5: 0
addrmap3:
  ADDRMAP_COL_B6: 0
  ADDRMAP_COL_B7: 0
  ADDRMAP_COL_B8: 0
  ADDRMAP_COL_B9: 0
addrmap4:
  ADDRMAP_COL_B10: 31
  ADDRMAP_COL_B11: 31
addrmap5:
  ADDRMAP_ROW_B0: 4
  ADDRMAP_ROW_B1: 4
  ADDRMAP_ROW_B2_10: 4
  ADDRMAP_ROW_B11: 4
addrmap6:
  ADDRMAP_ROW_B12: 4
  ADDRMAP_ROW_B13: 4
  ADDRMAP_ROW_B14: 4
  ADDRMAP_ROW_B15: 4
  LPDDR3_6GB_12GB: 0
addrmap7:
  ADDRMAP_ROW_B16: 15
  ADDRMAP_ROW_B17: 15
addrmap8:
  ADDRMAP_BG_B0: 63
  ADDRMAP_BG_B1: 63
```

Memory profile parameter *board*

In order to control memory settings relating to `ODT` and general board tuning, this file can be used to define **all** parameters where a specific is needed which is different from the default or by this tool calculated value. As such, this file can be used to override specific parameters.

Board file example (lan966x)

```
dfitmg0:
  - DFI_T_CTRL_DELAY: 4
  - DFI_RDDATA_USE_DFI_PHY_CLK: 0
  - DFI_T_RDDATA_EN: 3
  - DFI_WRDATA_USE_DFI_PHY_CLK: 0
  - DFI_TPHY_WRDATA: 1
  - DFI_TPHY_WRLAT: 2
mr1:
  - RTT_2: 1
```

All supported registers and sub-fields can be defined. See the full list of supported registers below.

Generating a DDR configuration file

When generating a DDR configuration file, you will be using the *./scripts/gen_cfg.rb* script, and supplying the input profile file name as the first argument.

cfg_gen.rb argument syntax

```
$ ./scripts/gen_cfg.rb --help
Usage: cfg_gen.rb [options] [config-file]
    -d, --debug                      Enable debug messages
    -v, --verbose                    Enable verbose messages
    -f, --format <format>            Use format (devicetree, yaml, source)
```

An example run could be:

cfg_gen.rb example run

```
./scripts/gen_cfg.rb -f source configs/profiles/lan969x.yaml > config.c
```

And the output would be:

```
// SPDX-License-Identifier: (GPL-2.0+ OR MIT)
/*
 * Copyright (C) 2023 Microchip Technology Inc. and its subsidiaries.
 *
 */

#include <ddr_config.h>

const struct ddr_config lan969x_ddr_config = {
        .info = {
                .name = "lan969x 2023-02-27-14:45:24 d66ca1fcc1ec-dirty",
                .speed = 2400,
                .size = 0x40000000,
                .bus_width = 16,
        },
        .main = {
                .crcparctl1 = 0x00001000,
                .dbictl = 0x00000001,
                .dfimisc = 0x00000040,
                .dfitmg0 = 0x038c820a,
                .dfitmg1 = 0x00040201,
                .dfiupd0 = 0x40400003,
                .dfiupd1 = 0x004000ff,
                .ecccfg0 = 0x003f7f40,
                .init0 = 0x00020248,
                .init1 = 0x00e80000,
                .init3 = 0x0a340501,
                .init4 = 0x00180200,
                .init5 = 0x00110000,
                .init6 = 0x00000400,
                .init7 = 0x00000899,
                .mstr = 0x81040010,
                .pccfg = 0x00000000,
                .pwrctl = 0x00000000,
                .rfshctl0 = 0x00210010,
                .rfshctl3 = 0x00000000,
        },

        .timing = {
                .dramtmg0 = 0x11132913,
                .dramtmg1 = 0x0004051b,
                .dramtmg12 = 0x1a000010,
                .dramtmg2 = 0x0608050d,
                .dramtmg3 = 0x0000400c,
                .dramtmg4 = 0x08030409,
                .dramtmg5 = 0x07070404,
                .dramtmg8 = 0x05040c07,
                .dramtmg9 = 0x0003040a,
                .odtcfg = 0x06000610,
                .rfshtmg = 0x006200d3,
        },

        .mapping = {
                .addrmap0 = 0x0000001f,
                .addrmap1 = 0x003f1818,
```

```
                .addrmap2 = 0x00000000,
                .addrmap3 = 0x00000000,
                .addrmap4 = 0x00001f1f,
                .addrmap5 = 0x04040404,
                .addrmap6 = 0x04040404,
                .addrmap7 = 0x00000f0f,
                .addrmap8 = 0x00003f1a,
        },

        .phy = {
                .dcr = 0x0000040c,
                .dsgcr = 0x0064401b,
                .dtcr0 = 0x8000b0cf,
                .dtcr1 = 0x00010a37,
                .dxccr = 0x00c01884,
                .pgcr2 = 0x000147a2,
                .schcr1 = 0x00000000,
                .zq0pr = 0x0007bb00,
                .zq1pr = 0x0007bb00,
                .zq2pr = 0x00000000,
                .zqcr = 0x00058f00,
        },

        .phy_timing = {
                .dtpr0 = 0x0827100a,
                .dtpr1 = 0x28250119,
                .dtpr2 = 0x000701b1,
                .dtpr3 = 0x03000101,
                .dtpr4 = 0x01a50808,
                .dtpr5 = 0x00361009,
                .ptr0 = 0x4ae25710,
                .ptr1 = 0x74f4950e,
                .ptr2 = 0x00083def,
                .ptr3 = 0x1b192000,
                .ptr4 = 0x1003a000,
        },

};
```

Some platforms use the alternative `devicetree` format, but the procedure is the same as for `C` source.

You can also use the `yaml` format. It is especially useful for comparing alternate configurations using the *diff_cfg.rb* script. YAML configurations can also be output to `source` or `devicetree` configurations later with the *fmt_cfg.rb* script.

Supported DDR configuration registers

The supported DDR configuration registers are a subset of the full UMCTL2 DDR controller registers. The registers supported in this tool have been identified to contain options that typically may need customization.

The configuration register set is currently different for the *lan966x* and the *lan969x*/*sparx5* driver, due to differences in the base IP version and IP configuration parameters.

register	lan966x	lan969x	sparx5
ADDRMAP0	yes	yes	yes
ADDRMAP1	yes	yes	yes
ADDRMAP2	yes	yes	yes
ADDRMAP3	yes	yes	yes
ADDRMAP4	yes	yes	yes
ADDRMAP5	yes	yes	yes
ADDRMAP6	yes	yes	yes
ADDRMAP7	**no**	yes	yes
ADDRMAP8	**no**	yes	yes
CRCPARCTL1	**no**	yes	yes
DBICTL	**no**	yes	yes
DCR	yes	yes	yes
DFIMISC	yes	yes	yes
DFITMG0	yes	yes	yes
DFITMG1	yes	yes	yes
DFIUPD0	yes	yes	yes
DFIUPD1	yes	yes	yes
DRAMTMG0	yes	yes	yes
DRAMTMG1	yes	yes	yes
DRAMTMG12	**no**	yes	yes
DRAMTMG2	yes	yes	yes
DRAMTMG3	yes	yes	yes
DRAMTMG4	yes	yes	yes
DRAMTMG5	yes	yes	yes

DRAMTMG8	yes	yes	yes
DRAMTMG9	**no**	yes	yes
DSGCR	yes	yes	yes
DTCR	yes	**no**	**no**
DTCR0	**no**	yes	yes
DTCR1	**no**	yes	yes
DTPR0	yes	yes	yes
DTPR1	yes	yes	yes
DTPR2	yes	yes	yes
DTPR3	**no**	yes	yes
DTPR4	**no**	yes	yes
DTPR5	**no**	yes	yes
DXCCR	yes	yes	yes
ECCCFG0	yes	yes	yes
INIT0	yes	yes	yes
INIT1	yes	yes	yes
INIT3	yes	yes	yes
INIT4	yes	yes	yes
INIT5	yes	yes	yes
INIT6	**no**	yes	yes
INIT7	**no**	yes	yes
MSTR	yes	yes	yes
ODTCFG	yes	yes	yes
PCCFG	yes	yes	yes
PGCR2	yes	yes	yes
PTR0	yes	yes	yes
PTR1	yes	yes	yes

PTR2	yes	yes	yes
PTR3	yes	yes	yes
PTR4	yes	yes	yes
PWRCTL	yes	yes	yes
RFSHCTL0	yes	yes	yes
RFSHCTL3	yes	yes	yes
RFSHTMG	yes	yes	yes
SBRCTL	**no**	**no**	yes
SCHCR1	**no**	yes	yes
ZQ0CR0	yes	**no**	**no**
ZQ0CR1	yes	**no**	**no**
ZQ0PR	**no**	yes	yes
ZQ1CR0	yes	**no**	**no**
ZQ1CR1	yes	**no**	**no**
ZQ1PR	**no**	yes	yes
ZQ2PR	**no**	yes	yes
ZQCR	**no**	yes	yes

Register fields below are given including start and end bits. The value following in parenthesis is the default value.

ADDRMAP0

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
ADDRMAP_CS_BIT0	bit 4..0 (0)	bit 4..0 (0)	bit 4..0 (0)

ADDRMAP1

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
ADDRMAP_BANK_B2	bit 5..16 (0)	bit 5..16 (0)	bit 5..16 (0)

ADDRMAP_BANK_B1	bit 5..8 (0)	bit 5..8 (0)	bit 5..8 (0)
ADDRMAP_BANK_B0	bit 5..0 (0)	bit 5..0 (0)	bit 5..0 (0)

ADDRMAP2

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
ADDRMAP_COL_B5	bit 3..24 (0)	bit 3..24 (0)	bit 3..24 (0)
ADDRMAP_COL_B4	bit 3..16 (0)	bit 3..16 (0)	bit 3..16 (0)
ADDRMAP_COL_B3	bit 4..8 (0)	bit 4..8 (0)	bit 3..8 (0)
ADDRMAP_COL_B2	bit 3..0 (0)	bit 3..0 (0)	bit 3..0 (0)

ADDRMAP3

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
ADDRMAP_COL_B9	bit 4..24 (0)	bit 4..24 (0)	bit 4..24 (0)
ADDRMAP_COL_B8	bit 4..16 (0)	bit 4..16 (0)	bit 4..16 (0)
ADDRMAP_COL_B7	bit 4..8 (0)	bit 4..8 (0)	bit 4..8 (0)
ADDRMAP_COL_B6	bit 4..0 (0)	bit 4..0 (0)	bit 3..0 (0)

ADDRMAP4

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
ADDRMAP_COL_B11	bit 4..8 (0)	bit 4..8 (0)	bit 4..8 (0)
ADDRMAP_COL_B10	bit 4..0 (0)	bit 4..0 (0)	bit 4..0 (0)

ADDRMAP5

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
ADDRMAP_ROW_B11	bit 3..24 (0)	bit 3..24 (0)	bit 3..24 (0)

ADDRMAP_ROW_B2_10	bit 3..16 (0)	bit 3..16 (0)	bit 3..16 (0)
ADDRMAP_ROW_B1	bit 3..8 (0)	bit 3..8 (0)	bit 3..8 (0)
ADDRMAP_ROW_B0	bit 3..0 (0)	bit 3..0 (0)	bit 3..0 (0)

ADDRMAP6

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
ADDRMAP_ROW_B15	bit 3..24 (0)	bit 3..24 (0)	bit 3..24 (0)
ADDRMAP_ROW_B14	bit 3..16 (0)	bit 3..16 (0)	bit 3..16 (0)
ADDRMAP_ROW_B13	bit 3..8 (0)	bit 3..8 (0)	bit 3..8 (0)
ADDRMAP_ROW_B12	bit 3..0 (0)	bit 3..0 (0)	bit 3..0 (0)
LPDDR3_6GB_12GB			bit 31 (0)

ADDRMAP7

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
ADDRMAP_ROW_B16		bit 3..0 (0)	bit 3..0 (0)
ADDRMAP_ROW_B17		bit 3..8 (0)	bit 3..8 (0)

ADDRMAP8

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
ADDRMAP_BG_B0		bit 5..0 (0)	bit 5..0 (0)
ADDRMAP_BG_B1		bit 5..8 (0)	bit 5..8 (0)

CRCPARCTL1

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
PARITY_ENABLE		bit 0 (0)	bit 0 (0)

CRC_ENABLE		bit 4 (0)	bit 4 (0)
CRC_INC_DM		bit 7 (0)	bit 7 (0)
CAPARITY_DISABLE_BEFORE_SR		bit 12 (1)	bit 12 (1)

DBICTL

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
DM_EN		bit 0 (1)	bit 0 (1)
WR_DBI_EN		bit 1 (0)	bit 1 (0)
RD_DBI_EN		bit 2 (0)	bit 2 (0)

DCR

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
UDIMM	bit 29 (0)	bit 29 (0)	bit 29 (0)
DDR2T	bit 28 (0)	bit 28 (0)	bit 28 (0)
NOSRA	bit 27 (0)	bit 27 (0)	bit 27 (0)
BYTEMASK	bit 7..10 (1)	bit 7..10 (1)	bit 7..10 (1)
MPRDQ	bit 7 (0)	bit 7 (0)	bit 7 (0)
PDQ	bit 2..4 (0)	bit 2..4 (0)	bit 2..4 (0)
DDR8BNK	bit 3 (1)	bit 3 (1)	bit 3 (1)
DDRMD	bit 2..0 (3)	bit 2..0 (3)	bit 2..0 (3)
DDRTYPE		bit 1..8 (0)	bit 1..8 (0)
RESERVED_26_18		bit 8..18 (0)	bit 8..18 (0)
UBG		bit 30 (0)	bit 30 (0)
RESERVED_31		bit 31 (0)	bit 31 (0)

DFIMISC

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
DFI_FREQUENCY	bit 4..8 (0)	bit 4..8 (0)	bit 4..8 (0)
DFI_INIT_START	bit 5 (0)	bit 5 (0)	bit 5 (0)
CTL_IDLE_EN	bit 4 (0)	bit 4 (0)	bit 4 (0)
DFI_INIT_COMPLETE_EN	bit 0 (1)	bit 0 (1)	bit 0 (1)
PHY_DBI_MODE		bit 1 (0)	bit 1 (0)
DIS_DYN_ADR_TRI		bit 6 (1)	

DFITMG0

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
DFI_T_CTRL_DELAY	bit 4..24 (7)	bit 4..24 (7)	bit 4..24 (7)
DFI_RDDATA_USE_DFI_PHY_CLK	bit 23 (0)	bit 23 (0)	bit 23 (0)
DFI_T_RDDATA_EN	bit 6..16 (2)	bit 6..16 (2)	bit 6..16 (2)
DFI_WRDATA_USE_DFI_PHY_CLK	bit 15 (0)	bit 15 (0)	bit 15 (0)
DFI_TPHY_WRDATA	bit 5..8 (0)	bit 5..8 (0)	bit 5..8 (0)
DFI_TPHY_WRLAT	bit 5..0 (2)	bit 5..0 (2)	bit 5..0 (2)

DFITMG1

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
DFI_T_PARIN_LAT	bit 1..24 (0)	bit 1..24 (0)	bit 1..24 (0)
DFI_T_WRDATA_DELAY	bit 4..16 (0)	bit 4..16 (0)	bit 4..16 (0)
DFI_T_DRAM_CLK_DISABLE	bit 4..8 (4)	bit 4..8 (4)	bit 4..8 (4)
DFI_T_DRAM_CLK_ENABLE	bit 4..0 (4)	bit 4..0 (4)	bit 4..0 (4)
DFI_T_CMD_LAT		bit 3..28 (0)	bit 3..28 (0)

DFIUPD0

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
DIS_AUTO_CTRLUPD	bit 31 (0)	bit 31 (0)	bit 31 (0)
DIS_AUTO_CTRLUPD_SRX	bit 30 (0)	bit 30 (0)	bit 30 (0)
CTRLUPD_PRE_SRX	bit 29 (0)	bit 29 (0)	bit 29 (0)
DFI_T_CTRLUP_MAX	bit 9..16 (64)	bit 9..16 (64)	bit 9..16 (64)
DFI_T_CTRLUP_MIN	bit 9..0 (3)	bit 9..0 (3)	bit 9..0 (3)

DFIUPD1

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
DFI_T_CTRLUPD_INTERVAL_MIN_X1024	bit 7..16 (1)	bit 7..16 (1)	bit 7..16 (1)
DFI_T_CTRLUPD_INTERVAL_MAX_X1024	bit 7..0 (1)	bit 7..0 (1)	bit 7..0 (1)

DRAMTMG0

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
WR2PRE	bit 6..24 (15)	bit 6..24 (15)	bit 6..24 (15)
T_FAW	bit 5..16 (16)	bit 5..16 (16)	bit 5..16 (16)
T_RAS_MAX	bit 6..8 (27)	bit 6..8 (27)	bit 6..8 (27)
T_RAS_MIN	bit 5..0 (15)	bit 5..0 (15)	bit 5..0 (15)

DRAMTMG1

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
T_XP	bit 4..16 (8)	bit 4..16 (8)	bit 4..16 (8)
RD2PRE	bit 5..8 (4)	bit 5..8 (4)	bit 5..8 (4)
T_RC	bit 6..0 (20)	bit 6..0 (20)	bit 6..0 (20)

DRAMTMG12

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
T_MRD_PDA		bit 4..0 (16)	bit 4..0 (16)
T_WR_MPR		bit 5..24 (26)	

DRAMTMG2

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
RD2WR	bit 5..8 (6)	bit 5..8 (6)	bit 5..8 (6)
WR2RD	bit 5..0 (13)	bit 5..0 (13)	bit 5..0 (13)
READ_LATENCY		bit 5..16 (5)	bit 5..16 (5)
WRITE_LATENCY		bit 5..24 (3)	bit 5..24 (3)

DRAMTMG3

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
T_MRD	bit 5..12 (4)	bit 5..12 (4)	bit 5..12 (4)
T_MOD	bit 9..0 (12)	bit 9..0 (12)	bit 9..0 (12)
T_MRW			bit 9..20 (5)

DRAMTMG4

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
T_RCD	bit 4..24 (5)	bit 4..24 (5)	bit 4..24 (5)
T_CCD	bit 3..16 (4)	bit 3..16 (4)	bit 3..16 (4)
T_RRD	bit 3..8 (4)	bit 3..8 (4)	bit 3..8 (4)
T_RP	bit 4..0 (5)	bit 4..0 (5)	bit 4..0 (5)

DRAMTMG5

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
T_CKSRX	bit 3..24 (5)	bit 3..24 (5)	bit 3..24 (5)
T_CKSRE	bit 6..16 (5)	bit 7..16 (5)	bit 3..16 (5)
T_CKESR	bit 5..8 (4)	bit 7..8 (4)	bit 5..8 (4)
T_CKE	bit 4..0 (3)	bit 4..0 (3)	bit 4..0 (3)

DRAMTMG8

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
T_XS_DLL_X32	bit 6..8 (68)	bit 6..8 (68)	bit 6..8 (68)
T_XS_X32	bit 6..0 (5)	bit 6..0 (5)	bit 6..0 (5)
T_XS_ABORT_X32		bit 6..16 (3)	bit 6..16 (3)
T_XS_FAST_X32		bit 6..24 (3)	bit 6..24 (3)

DRAMTMG9

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
WR2RD_S		bit 5..0 (13)	bit 5..0 (13)
T_RRD_S		bit 3..8 (4)	bit 3..8 (4)
T_CCD_S		bit 2..16 (4)	bit 2..16 (4)
DDR4_WR_PREAMBLE		bit 30 (0)	bit 30 (0)

DSGCR

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
CKEOE	bit 31 (1)		
RSTOE	bit 30 (1)	bit 21 (1)	bit 21 (1)

ODTOE	bit 29 (1)		
CKOE	bit 28 (1)		
ODTPDD	bit 3..24 (0)		
CKEPDD	bit 3..20 (0)		
SDRMODE	bit 19 (0)	bit 1..19 (0)	bit 1..19 (0)
RRMODE	bit 18 (0)		
ATOAE	bit 17 (0)	bit 17 (0)	bit 17 (0)
DTOOE	bit 16 (0)	bit 16 (0)	bit 16 (0)
DTOIOM	bit 15 (0)	bit 15 (0)	bit 15 (0)
DTOPDR	bit 14 (1)	bit 14 (1)	bit 14 (1)
DTOPDD	bit 13 (1)		
DTOODT	bit 12 (0)	bit 12 (0)	bit 12 (0)
PUAD	bit 3..8 (4)	bit 3..8 (0)	bit 3..8 (0)
BRRMODE	bit 7 (0)		
DQSGX	bit 6 (0)	bit 1..6 (0)	bit 1..6 (0)
CUAEN	bit 5 (0)	bit 5 (0)	bit 5 (0)
LPPLLPD	bit 4 (1)	bit 4 (1)	bit 4 (1)
LPIOPD	bit 3 (1)	bit 3 (1)	bit 3 (1)
ZUEN	bit 2 (1)		
BDISEN	bit 1 (1)	bit 1 (1)	bit 1 (1)
PUREN	bit 0 (1)	bit 0 (1)	bit 0 (1)
CTLZUEN		bit 2 (0)	bit 2 (0)
RESERVED_13		bit 13 (0)	bit 13 (0)
WRRMODE		bit 18 (1)	bit 18 (1)
RRRMODE		bit 22 (1)	bit 22 (1)
PHYZUEN		bit 23 (0)	bit 23 (0)
LPACIOPD		bit 24 (0)	

RESERVED_31_25		bit 6..25 (0)	
RESERVED_31_24			bit 7..24 (0)

DTCR

Applies to: lan966x

Field	lan966x	lan969x	sparx5
RFSHDT	bit 3..28 (9)		
RANKEN	bit 3..24 (15)		
DTEXD	bit 22 (0)		
DTDSTP	bit 21 (0)		
DTDEN	bit 20 (0)		
DTDBS	bit 3..16 (0)		
DTWDQMO	bit 14 (0)		
DTBDC	bit 13 (1)		
DTWBDDM	bit 12 (1)		
DTWDQM	bit 3..8 (5)		
DTCMPD	bit 7 (1)		
DTMPR	bit 6 (0)		
DTRANK	bit 1..4 (0)		
DTRPTN	bit 3..0 (7)		

DTCR0

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
DTRPTN		bit 3..0 (7)	bit 3..0 (7)
RESERVED_5_4		bit 1..4 (0)	bit 1..4 (0)
DTMPR		bit 6 (0)	bit 6 (0)
DTCMPD		bit 7 (1)	bit 7 (1)

RESERVED_10_8		bit 2..8 (0)	bit 2..8 (0)
DTDBS4		bit 11 (0)	bit 11 (0)
DTWBDDM		bit 12 (1)	bit 12 (1)
DTBDC		bit 13 (1)	bit 13 (1)
DTRDBITR		bit 1..14 (2)	bit 1..14 (2)
DTDBS		bit 3..16 (0)	bit 3..16 (0)
DTDEN		bit 20 (0)	bit 20 (0)
DTDSTP		bit 21 (0)	bit 21 (0)
DTEXD		bit 22 (0)	bit 22 (0)
RESERVED_23		bit 23 (0)	
DTDRS		bit 1..24 (0)	bit 1..24 (0)
RESERVED_27_26		bit 1..26 (0)	bit 1..26 (0)
RFSHDT		bit 3..28 (8)	bit 3..28 (8)
DTEXG			bit 23 (0)

DTCR1

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
BSTEN		bit 0 (1)	bit 0 (1)
RDLVLEN		bit 1 (1)	bit 1 (1)
RDPRMBL_TRN		bit 2 (1)	bit 2 (1)
RESERVED_3		bit 3 (0)	bit 3 (0)
RDLVLGS		bit 2..4 (3)	bit 2..4 (3)
RESERVED_7		bit 7 (0)	bit 7 (0)
RDLVLGDIFF		bit 2..8 (2)	bit 2..8 (2)
WLVLDPRD		bit 11 (1)	
DTRANK		bit 1..12 (0)	bit 1..12 (0)
RESERVED_15_14		bit 1..14 (0)	bit 1..14 (0)

RANKEN		bit 1..16 (3)	bit 1..16 (3)
RANKEN_RSVD		bit 13..18 (0)	bit 13..18 (0)
RESERVED_11			bit 11 (0)

DTPR0

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
TRC	bit 5..26 (50)		
TRRD	bit 3..22 (7)	bit 5..24 (7)	bit 5..24 (7)
TRAS	bit 5..16 (36)	bit 6..16 (36)	bit 6..16 (36)
TRCD	bit 3..12 (14)		
TRP	bit 3..8 (14)	bit 6..8 (14)	bit 6..8 (14)
TWTR	bit 3..4 (8)		
TRTP	bit 3..0 (8)	bit 3..0 (8)	bit 3..0 (8)
RESERVED_7_4		bit 3..4 (0)	bit 3..4 (0)
RESERVED_15		bit 15 (0)	bit 15 (0)
RESERVED_23		bit 23 (0)	bit 23 (0)
RESERVED_31_30		bit 1..30 (0)	bit 1..30 (0)

DTPR1

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
TAON_OFF_D	bit 1..30 (0)		
TWLO	bit 3..26 (8)		
TWLMRD	bit 5..20 (40)	bit 5..24 (40)	bit 5..24 (40)
TRFC	bit 8..11 (374)		
TFAW	bit 5..5 (38)	bit 7..16 (38)	bit 7..16 (38)
TMOD	bit 2..2 (4)	bit 2..8 (4)	bit 2..8 (4)

TMRD	bit 1..0 (2)	bit 4..0 (6)	bit 4..0 (6)
RESERVED_7_5		bit 2..5 (0)	bit 2..5 (0)
RESERVED_15_11		bit 4..11 (0)	bit 4..11 (0)
RESERVED_31_30		bit 1..30 (0)	bit 1..30 (0)

DTPR2

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
TCCD	bit 31 (0)		
TRTW	bit 30 (0)	bit 28 (0)	bit 28 (0)
TRTODT	bit 29 (0)	bit 24 (0)	bit 24 (0)
TDLLK	bit 9..19 (512)		
TCKE	bit 3..15 (6)	bit 3..16 (6)	bit 3..16 (6)
TXP	bit 4..10 (26)		
TXS	bit 9..0 (512)	bit 9..0 (512)	bit 9..0 (512)
RESERVED_15_10		bit 5..10 (0)	bit 5..10 (0)
RESERVED_23_20		bit 3..20 (0)	bit 3..20 (0)
RESERVED_27_25		bit 2..25 (0)	bit 2..25 (0)
RESERVED_31_29		bit 2..29 (0)	bit 2..29 (0)

DTPR3

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
TDQSCK		bit 2..0 (1)	bit 2..0 (1)
RESERVED_7_3		bit 4..3 (0)	bit 4..3 (0)
TDQSCKMAX		bit 2..8 (1)	bit 2..8 (1)
RESERVED_15_11		bit 4..11 (0)	bit 4..11 (0)
TDLLK		bit 9..16 (384)	bit 9..16 (384)

TCCD		bit 2..26 (0)	bit 2..26 (0)
TOFDX		bit 2..29 (0)	bit 2..29 (0)

DTPR4

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
TXP		bit 4..0 (26)	bit 4..0 (26)
RESERVED_7_5		bit 2..5 (0)	bit 2..5 (0)
TWLO		bit 3..8 (8)	bit 3..8 (8)
RESERVED_15_12		bit 3..12 (0)	bit 3..12 (0)
TRFC		bit 9..16 (374)	bit 9..16 (374)
RESERVED_27_26		bit 1..26 (0)	bit 1..26 (0)
TAOND_TAOFD		bit 1..28 (0)	bit 1..28 (0)
RESERVED_31_30		bit 1..30 (0)	bit 1..30 (0)

DTPR5

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
TWTR		bit 4..0 (8)	bit 4..0 (8)
RESERVED_7_5		bit 2..5 (0)	bit 2..5 (0)
TRCD		bit 6..8 (14)	bit 6..8 (14)
RESERVED_15		bit 15 (0)	bit 15 (0)
TRC		bit 7..16 (50)	bit 7..16 (50)
RESERVED_31_24		bit 7..24 (0)	bit 7..24 (0)

DXCCR

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
DDPDRCDO	bit 3..28 (4)		

DDPDDCDO	bit 3..24 (4)		
DYNDXPDR	bit 23 (0)		
DYNDXPDD	bit 22 (0)		
UDQIOM	bit 21 (0)	bit 21 (0)	bit 21 (0)
UDQPDR	bit 20 (1)		
UDQPDD	bit 19 (1)		
UDQODT	bit 18 (0)		
MSBUDQ	bit 2..15 (0)	bit 2..15 (0)	bit 2..15 (0)
DQSNRES	bit 3..9 (12)	bit 3..9 (12)	bit 3..9 (12)
DQSRES	bit 3..5 (4)	bit 3..5 (4)	bit 3..5 (4)
DXPDR	bit 4 (0)		
DXPDD	bit 3 (0)		
MDLEN	bit 2 (1)	bit 2 (1)	bit 2 (1)
DXIOM	bit 1 (0)	bit 1 (0)	bit 1 (0)
DXODT	bit 0 (0)	bit 0 (0)	bit 0 (0)
DQSGLB		bit 1..3 (0)	bit 1..3 (0)
DXSR		bit 1..13 (0)	bit 1..13 (0)
RESERVED_19_18		bit 1..18 (0)	
QSCNTENCTL		bit 20 (0)	
QSCNTEN		bit 22 (1)	bit 22 (1)
DXDCCBYP		bit 23 (1)	bit 23 (1)
RESERVED_28_24		bit 4..24 (0)	bit 4..24 (0)
RKLOOP		bit 29 (1)	bit 29 (1)
X4DQSMD		bit 30 (0)	bit 30 (0)
X4MODE		bit 31 (0)	bit 31 (0)
RESERVED_20_18			bit 2..18 (0)

ECCCFG0

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
ECC_REGION_MAP_GRANU	bit 1..30 (0)	bit 1..30 (0)	
ECC_REGION_MAP_OTHER	bit 29 (0)	bit 29 (0)	
ECC_AP_ERR_THRESHOLD	bit 24 (0)	bit 24 (0)	
BLK_CHANNEL_IDLE_TIME_X32	bit 5..16 (63)	bit 5..16 (63)	
ECC_REGION_MAP	bit 6..8 (127)	bit 6..8 (127)	
ECC_REGION_REMAP_EN	bit 7 (0)	bit 7 (0)	
ECC_AP_EN	bit 6 (1)	bit 6 (1)	
DIS_SCRUB	bit 4 (0)	bit 4 (0)	bit 4 (0)
ECC_MODE	bit 2..0 (0)	bit 2..0 (0)	bit 2..0 (0)

INIT0

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
SKIP_DRAM_INIT	bit 1..30 (0)	bit 1..30 (0)	bit 1..30 (0)
POST_CKE_X1024	bit 9..16 (2)	bit 9..16 (2)	bit 9..16 (2)
PRE_CKE_X1024	bit 11..0 (78)	bit 11..0 (78)	bit 11..0 (78)

INIT1

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
DRAM_RSTN_X1024	bit 8..16 (0)	bit 8..16 (0)	bit 8..16 (0)
PRE_OCD_X32	bit 3..0 (0)	bit 3..0 (0)	bit 3..0 (0)

INIT3

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
MR	bit 15..16 (0)	bit 15..16 (0)	bit 15..16 (0)
EMR	bit 15..0 (1296)	bit 15..0 (1296)	bit 15..0 (1296)

INIT4

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
EMR2	bit 15..16 (0)	bit 15..16 (0)	bit 15..16 (0)
EMR3	bit 15..0 (0)	bit 15..0 (0)	bit 15..0 (0)

INIT5

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
DEV_ZQINIT_X32	bit 7..16 (16)	bit 7..16 (16)	bit 7..16 (16)
MAX_AUTO_INIT_X1024			bit 9..0 (4)

INIT6

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
MR5		bit 15..0 (0)	bit 15..0 (0)
MR4		bit 15..16 (0)	bit 15..16 (0)

INIT7

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
MR6		bit 15..0 (0)	bit 15..0 (0)

MSTR

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5

ACTIVE_RANKS	bit 1..24 (3)	bit 1..24 (3)	bit 1..24 (3)
BURST_RDWR	bit 3..16 (4)	bit 3..16 (4)	bit 3..16 (4)
DLL_OFF_MODE	bit 15 (0)	bit 15 (0)	bit 15 (0)
DATA_BUS_WIDTH	bit 1..12 (0)	bit 1..12 (0)	bit 1..12 (0)
EN_2T_TIMING_MODE	bit 10 (0)	bit 10 (0)	bit 10 (0)
BURSTCHOP	bit 9 (0)	bit 9 (0)	bit 9 (0)
DDR3	bit 0 (1)	bit 0 (1)	bit 0 (1)
DDR4		bit 4 (0)	bit 4 (0)
GEARDOWN_MODE		bit 11 (0)	bit 11 (0)
DEVICE_CONFIG		bit 1..30 (0)	bit 1..30 (0)
LPDDR2			bit 2 (0)
LPDDR3			bit 3 (0)

ODTCFG

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
WR_ODT_HOLD	bit 3..24 (4)	bit 3..24 (4)	bit 3..24 (4)
WR_ODT_DELAY	bit 4..16 (0)	bit 4..16 (0)	bit 4..16 (0)
RD_ODT_HOLD	bit 3..8 (4)	bit 3..8 (4)	bit 3..8 (4)
RD_ODT_DELAY	bit 4..2 (0)	bit 4..2 (0)	bit 4..2 (0)

PCCFG

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
BL_EXP_MODE	bit 8 (0)	bit 8 (0)	bit 8 (0)
PAGEMATCH_LIMIT	bit 4 (0)	bit 4 (0)	bit 4 (0)
GO2CRITICAL_EN	bit 0 (0)	bit 0 (0)	bit 0 (0)

PGCR2

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
DYNACPDD	bit 31 (0)		
LPMSTRC0	bit 30 (0)		
ACPDDC	bit 29 (0)		
SHRAC	bit 28 (0)		
DTPMXTMR	bit 7..20 (15)	bit 7..20 (0)	bit 7..20 (0)
FXDLAT	bit 19 (0)	bit 19 (0)	bit 19 (0)
NOBUB	bit 18 (0)		
TREFPRD	bit 17..0 (74880)	bit 17..0 (74880)	bit 17..0 (74880)
CSNCIDMUX		bit 18 (0)	bit 18 (0)
FXDLATINCR		bit 28 (0)	bit 28 (0)
RFSHMODE		bit 1..29 (0)	bit 1..29 (0)
RESERVED_31		bit 31 (0)	bit 31 (0)

PTR0

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
TPLLPD	bit 10..21 (534)	bit 10..21 (534)	bit 10..21 (534)
TPLLGS	bit 14..6 (2134)	bit 14..6 (2134)	bit 14..6 (2134)
TPHYRST	bit 5..0 (16)	bit 5..0 (16)	bit 5..0 (16)

PTR1

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
TPLLLOCK	bit 15..16 (53334)	bit 16..15 (53334)	bit 16..15 (53334)
TPLLRST	bit 12..0 (4800)	bit 12..0 (4800)	bit 12..0 (4800)

RESERVED_14_13		bit 1..13 (0)	bit 1..13 (0)

PTR2

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
TWLDLYS	bit 4..15 (16)	bit 4..15 (16)	bit 4..15 (16)
TCALH	bit 4..10 (15)	bit 4..10 (15)	bit 4..10 (15)
TCALS	bit 4..5 (15)	bit 4..5 (15)	bit 4..5 (15)
TCALON	bit 4..0 (15)	bit 4..0 (15)	bit 4..0 (15)
RESERVED_31_20		bit 11..20 (0)	bit 11..20 (0)

PTR3

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
TDINIT1	bit 9..20 (384)	bit 9..20 (384)	bit 9..20 (384)
TDINIT0	bit 19..0 (533334)	bit 19..0 (533334)	bit 19..0 (533334)
RESERVED_31_30		bit 1..30 (0)	bit 1..30 (0)

PTR4

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
TDINIT3	bit 9..18 (683)	bit 10..18 (800)	bit 10..18 (800)
TDINIT2	bit 17..0 (213334)	bit 17..0 (213334)	bit 17..0 (213334)
RESERVED_31_29		bit 2..29 (0)	bit 2..29 (0)

PWRCTL

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
DIS_CAM_DRAIN_SELFREF	bit 7 (0)	bit 7 (0)	bit 7 (0)

SELFREF_SW	bit 5 (0)	bit 5 (0)	bit 5 (0)
EN_DFI_DRAM_CLK_DISABLE	bit 3 (0)	bit 3 (0)	bit 3 (0)
POWERDOWN_EN	bit 1 (0)	bit 1 (0)	bit 1 (0)
SELFREF_EN	bit 0 (0)	bit 0 (0)	bit 0 (0)
MPSM_EN		bit 4 (0)	bit 4 (0)
DEEPPOWERDOWN_EN			bit 2 (0)

RFSHCTL0

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
REFRESH_MARGIN	bit 3..20 (2)	bit 3..20 (2)	bit 3..20 (2)
REFRESH_TO_X1_X32	bit 4..12 (16)	bit 4..12 (16)	
REFRESH_BURST	bit 5..4 (0)	bit 5..4 (0)	bit 4..4 (0)
PER_BANK_REFRESH			bit 2 (0)
REFRESH_TO_X32			bit 4..12 (16)

RFSHCTL3

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
REFRESH_UPDATE_LEVEL	bit 1 (0)	bit 1 (0)	bit 1 (0)
DIS_AUTO_REFRESH	bit 0 (0)	bit 0 (0)	bit 0 (0)
REFRESH_MODE		bit 2..4 (0)	bit 2..4 (0)

RFSHTMG

Applies to: lan966x lan969x sparx5

Field	lan966x	lan969x	sparx5
T_RFC_NOM_X1_X32	bit 11..16 (98)	bit 11..16 (98)	
T_RFC_MIN	bit 9..0 (140)	bit 9..0 (140)	bit 9..0 (140)
LPDDR3_TREFBW_EN			bit 15 (0)

T_RFC_NOM_X32			bit 11..16 (98)

SBRCTL

Applies to:

sparx5

Field	lan966x	lan969x	sparx5
SCRUB_INTERVAL	bit 12..8 (255)	bit 12..8 (255)	bit 12..8 (255)
SCRUB_BURST	bit 2..4 (1)	bit 2..4 (1)	bit 2..4 (1)
SCRUB_MODE	bit 2 (0)	bit 2 (0)	bit 2 (0)
SCRUB_DURING_LOWPOWER	bit 1 (0)	bit 1 (0)	bit 1 (0)
SCRUB_EN	bit 0 (0)	bit 0 (0)	bit 0 (0)

SCHCR1

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
RESERVED_1_0		bit 1..0 (0)	bit 1..0 (0)
ALLRANK		bit 2 (0)	bit 2 (0)
RESERVED_3		bit 3 (0)	bit 3 (0)
SCBK		bit 1..4 (0)	bit 1..4 (0)
SCBG		bit 1..6 (0)	bit 1..6 (0)
SCADDR		bit 19..8 (0)	bit 19..8 (0)
SCRNK		bit 3..28 (0)	bit 3..28 (0)

ZQ0CR0

Applies to: lan966x

Field	lan966x	lan969x	sparx5
ZQ0_ZQPD	bit 31 (0)		
ZQ0_ZCALEN	bit 30 (1)		

ZQ0_ZCALBYP	bit 29 (0)		
ZQ0_ZDEN	bit 28 (0)		
ZQ0_ZDATA	bit 27..0 (330)		

ZQ0CR1

Applies to: lan966x

Field	lan966x	lan969x	sparx5
ZQ0_DFIPU1	bit 17 (0)		
ZQ0_DFIPU0	bit 16 (0)		
ZQ0_DFICCU	bit 14 (0)		
ZQ0_DFICU1	bit 13 (0)		
ZQ0_DFICU0	bit 12 (1)		
ZQ0_ZPROG	bit 7..0 (123)		

ZQ0PR

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
RESERVED_7_0		bit 7..0 (0)	
ZPROG_ASYM_DRV_PU		bit 3..8 (11)	bit 3..8 (11)
ZPROG_ASYM_DRV_PD		bit 3..12 (11)	bit 3..12 (11)
ZPROG_PU_ODT_ONLY		bit 3..16 (7)	bit 3..16 (7)
PU_DRV_ADJUST		bit 1..20 (0)	bit 1..20 (0)
PD_DRV_ADJUST		bit 1..22 (0)	bit 1..22 (0)
RESERVED_27_24		bit 3..24 (0)	
PU_ODT_ONLY		bit 28 (0)	
ZSEGBYP		bit 29 (0)	
ODT_ZDEN		bit 30 (0)	
DRV_ZDEN		bit 31 (0)	

ZQDIV			bit 7..0 (123)
ZCTRL_UPPER			bit 3..24 (0)
RESERVED_31_28			bit 3..28 (0)

ZQ1CR0

Applies to: lan966x

Field	lan966x	lan969x	sparx5
ZQ1_ZQPD	bit 31 (0)		
ZQ1_ZCALEN	bit 30 (1)		
ZQ1_ZCALBYP	bit 29 (0)		
ZQ1_ZDEN	bit 28 (0)		
ZQ1_ZDATA	bit 27..0 (330)		

ZQ1CR1

Applies to: lan966x

Field	lan966x	lan969x	sparx5
ZQ1_DFIPU1	bit 17 (0)		
ZQ1_DFIPU0	bit 16 (0)		
ZQ1_DFICCU	bit 14 (0)		
ZQ1_DFICU1	bit 13 (0)		
ZQ1_DFICU0	bit 12 (1)		
ZQ1_ZPROG	bit 7..0 (123)		

ZQ1PR

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
RESERVED_7_0		bit 7..0 (0)	
ZPROG_ASYM_DRV_PU		bit 3..8 (11)	bit 3..8 (11)
ZPROG_ASYM_DRV_PD		bit 3..12 (11)	bit 3..12 (11)

ZPROG_PU_ODT_ONLY		bit 3..16 (7)	bit 3..16 (7)
PU_DRV_ADJUST		bit 1..20 (0)	bit 1..20 (0)
PD_DRV_ADJUST		bit 1..22 (0)	bit 1..22 (0)
RESERVED_27_24		bit 3..24 (0)	
PU_ODT_ONLY		bit 28 (0)	
ZSEGBYP		bit 29 (0)	
ODT_ZDEN		bit 30 (0)	
DRV_ZDEN		bit 31 (0)	
ZQDIV			bit 7..0 (123)
ZCTRL_UPPER			bit 3..24 (0)
RESERVED_31_28			bit 3..28 (0)

ZQ2PR

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
RESERVED_7_0		bit 7..0 (0)	
ZPROG_ASYM_DRV_PU		bit 3..8 (0)	bit 3..8 (11)
ZPROG_ASYM_DRV_PD		bit 3..12 (0)	bit 3..12 (11)
ZPROG_PU_ODT_ONLY		bit 3..16 (0)	bit 3..16 (7)
PU_DRV_ADJUST		bit 1..20 (0)	bit 1..20 (0)
PD_DRV_ADJUST		bit 1..22 (0)	bit 1..22 (0)
RESERVED_27_24		bit 3..24 (0)	
PU_ODT_ONLY		bit 28 (0)	
ZSEGBYP		bit 29 (0)	
ODT_ZDEN		bit 30 (0)	
DRV_ZDEN		bit 31 (0)	
ZQDIV			bit 7..0 (123)
ZCTRL_UPPER			bit 3..24 (0)

RESERVED_31_28			bit 3..28 (0)

ZQCR

Applies to: lan969x sparx5

Field	lan966x	lan969x	sparx5
RESERVED_0		bit 0 (0)	bit 0 (0)
TERM_OFF		bit 1 (0)	bit 1 (0)
ZQPD		bit 2 (0)	bit 2 (0)
RESERVED_7_3		bit 4..3 (0)	bit 4..3 (0)
PGWAIT		bit 2..8 (5)	bit 2..8 (5)
ZCALT		bit 2..11 (1)	bit 2..11 (1)
AVGMAX		bit 1..14 (2)	bit 1..14 (2)
AVGEN		bit 16 (1)	bit 16 (1)
IODLMT		bit 7..17 (2)	bit 6..17 (2)
RESERVED_26_25		bit 1..25 (0)	
FORCE_ZCAL_VT_UPDATE		bit 27 (0)	bit 27 (0)
RESERVED_31_28		bit 3..28 (0)	
ASYM_DRV_EN			bit 24 (0)
PU_ODT_ONLY			bit 25 (0)
DIS_NON_LIN_COMP			bit 26 (1)
ZCTRL_UPPER			bit 3..28 (0)

References

- [1] DesignWare Cores Enhanced Universal DDR Memory Controller (uMCTL2) Databook