**COMPHY\_112G**

**PLL Calibration**

**R1.0**

**Macro Architecture Specification**

For Internal Use Only

Design Version V1.0

**Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision** | **Author** | **Change List** | **Date** |
| V1.0 |  |  |  |
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# **Introduction**

This document describes the firmware of PLL calibration.

# **2. Interafces**

## **2.1 Firmware Interface Signal**

|  |  |  |
| --- | --- | --- |
| **Port Name** | **Dir** | **Description** |
| cmx\_PLL\_CAL\_EXT\_EN | O | External enable. |
| cmx\_EXT\_FORCE\_CAL\_DONE | I/O | Force to skip calibration. |
| lnx\_PLL\_CAL\_DONE\_LANE | I/O | PLL Calibration done. |
| lnx\_PLL\_CAL\_PASS\_LANE | I/O | PLL Calibration pass. |

## 

## **2.2 Digital Interface Signal**

|  |  |  |
| --- | --- | --- |
| **Port Name** | **Dir** | **Description** |
| PHY\_STATUS | O | The running status of PHY. |
| PLL\_AMP\_CAL\_TOP\_START | I/O | PLL AMP Cal Top Start. |
| PLL\_AMP\_CAL\_TOP\_DONE | I/O | PLL AMP Cal Top Done. |
|  |  |  |

## **2.3 Analog Interface Signal**

|  |  |  |
| --- | --- | --- |
| **Port Name** | **Dir** | **Description** |
| **PLLAMPCAL\_EN** | I | LCPLL Amplitude calibration enable 1: enable calibration 0: cal off, normal mode |
| **LCVCO\_DAC\_LSB[4:0]** | I | LCVCO swing amplitude lsb setting, will be changed during LCVCO amplitude calibration. Higher values means bigger amplitude. |
| **LCVCO\_DAC\_MSB[2:0]** | I | LCVCO swing amplitude msb setting, will be changed during LCVCO amplitude calibration. Higher values means bigger amplitude. |
| **PLLCAL\_EN** | I | LCPLL Frequency calibration enable: 1: enable cap bank frequency calibration, 0: calibration off, normal mode |
| **FBDIV[9:0]** | I | LCPLL feedback divider ratio, will be set to different number during PLL calibration |
| **LCCAP\_MSB[3:0]** | I | LCVCO cap bank settings. It’s adjusted during LCVCO frequency calibration. Higher values means more cap, lower VCO frequency.  Thermo code, default : 0000,0001,0011,0111,1111, when externally forced , more options,such as 0101,1011… |
| **LCCAP\_LSB[4:0]** | I | LCVCO LSB cap bank settings. It’s adjusted during LCVCO frequency calibration. Higher values means more cap, lower VCO frequency.  Binary code only. |
| **VCOAMP\_VTH\_SEL[3:0]** | I | Set VCO amplitudethreshold selection |
| **LCVCOCAL\_BUF\_EN** | I | On during normal amplitude calibration to reduce settilng time.  Off during slow amplitude calibration and in the end of each calibration. |
| **VCOAMP\_HI** | O | LCPLL peak detector output, 1: LCVCO amplitude is higher than threshold, 0: LCVCO amplitude is lower than threshold, threshold is set by register VCOAMP\_VTH\_SEL[3:0] |
| **FBC\_PLLCAL** | O | LCPLL feedback divider output, it’s divide down version of VCO output, it’s used in frequency calibration to decide LCVCO output frequency |
| **LD\_CAL\_DATA** | I | Load all calibration data to analog to current PLL running frequency |
| **VIND\_BAND\_SEL** | I | VCO running frequency range select (1: high 0: low) |
| **TEMPC\_MUX\_HOLD\_SEL[3:0]** | I | Used in fast start-up and speed change mode to cover temperature change |
| **TEMPC\_MUX \_SEL[3:0]** | I | Used in fast start-up and speed change mode to cover temperature change |

## **2.4 Time Flow**

# **Block Diagram**

**VCON**

**PFD**

**CP**

**UP**

**DN**

**FBDIV10B**

**FBDIV[9:0]**

**FBC\_PLLCAL**

**refclk**

**Red: Analog Inputs from Digital**

**Green: Analog Outputs to Digital**

AMPCAL\_EN

FREQCAL\_EN

**CAL\_EN**

**VCON\_REF**

LCVCO\_DAC\_LSB[4:0]

LCCAP\_MSB[3:0]

Fvco

E2C

PKDET

VCOAMP\_HI

REFDIV

VDD1P2

Purple: Calibration related Parameter

LCVCO\_DAC\_MSB[2:0]

LCCAP\_LSB[4:0]

**DAC**

LCVCOCAL\_BUF\_EN

# **FW Handling**

The firmware first initializes for the calibration, next starts the unicore for amplitude calibration and wait for the calibration to finish. It next measures the frequency and calibrates the frequency. After the calibration, the FW saves the calibration result.

## **4.1** **Flow Chart**



## **4.2 Code Size**

# **Features**

The calibration function has the following features.

1. Initialize registers;
2. Start the unicore;
3. Wait for the calibration to finish;
4. Save the calibration result.

# **Test Plan**

| **No** | **Description** |
| --- | --- |
| **1** | **Initialization** |
|  | **Verify the initialization.**  Check the registers needed to be initialized. Covered by local test. |
| **2** | **Calibration starts.** |
|  | **Verify the amplitude calibration starts.**  Check the PLL\_AMP\_CAL\_TOP\_START. Covered by local test. |
| **3** | **Frequency calibration.** |
|  | **Verify the frequency calibration.**  Check the saved frequency calibration values. |
| **4** | **Calibration done.** |
|  | **Verify the calibration done.**  Check the cmx\_CAL\_DONE. Covered by local test. |