

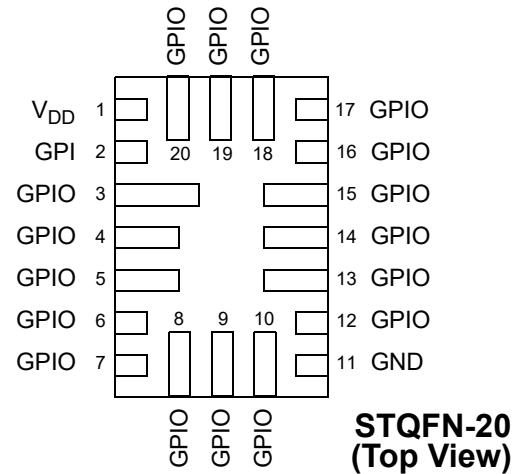
### Features

- Logic & Mixed Signal Circuits
- Highly Versatile Macrocells
- Read Back Protection (Read Lock)
- 1.8 V ( $\pm 5\%$ ) to 5 V ( $\pm 10\%$ ) Supply
- Operating Temperature Range:  $-40\text{ }^{\circ}\text{C}$  to  $85\text{ }^{\circ}\text{C}$
- RoHS Compliant / Halogen-Free
- 20-pin STQFN: 2 x 3 x 0.55 mm, 0.4 mm pitch

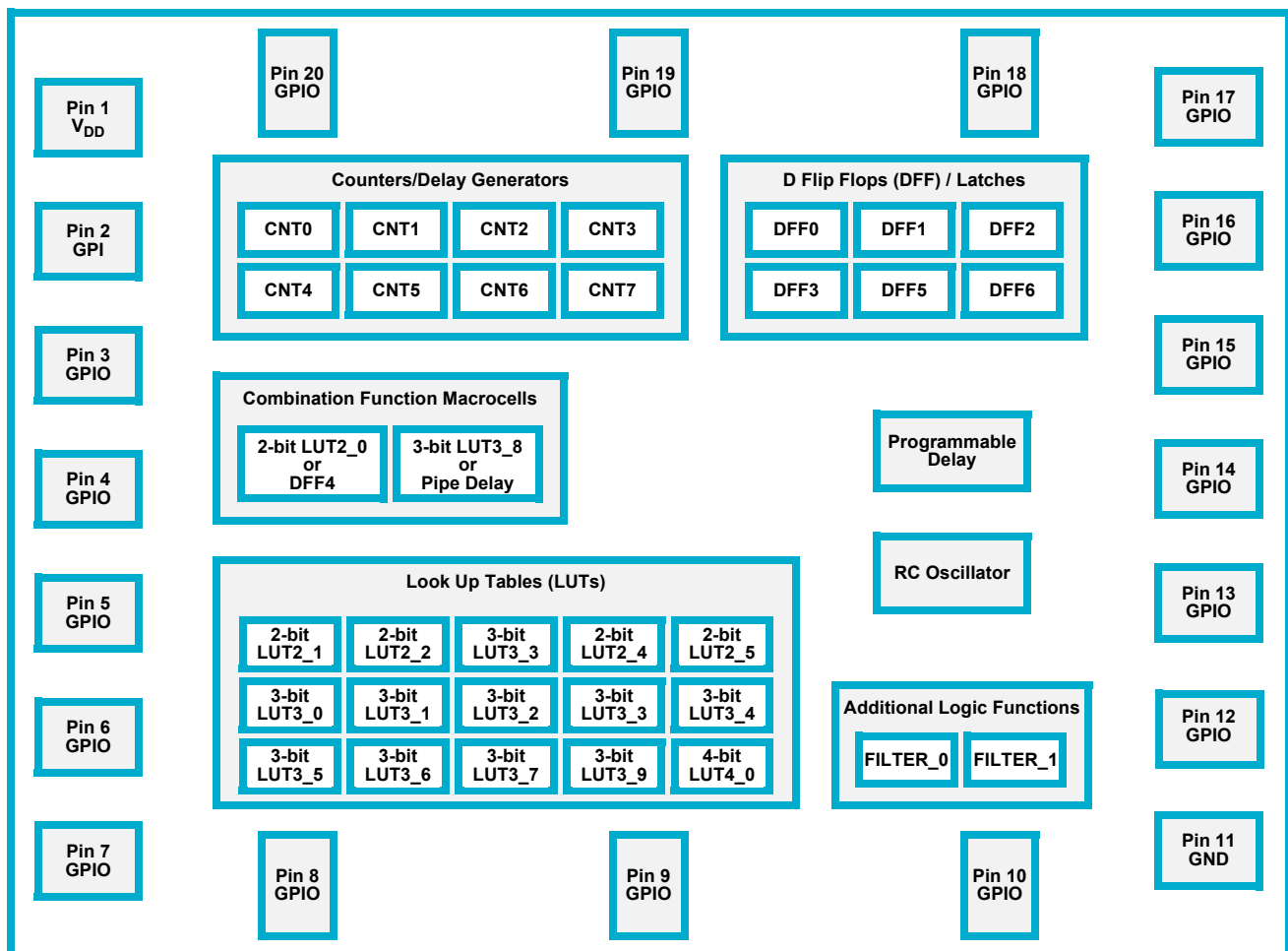
### Applications

- Personal Computers and Servers
- PC Peripherals
- Consumer Electronics
- Data Communications Equipment
- Handheld and Portable Electronics

### Pin Configuration



### Block Diagram



## 1.0 Overview

The SLG46722 provides a small, low power component for commonly used mixed-signal functions. The user creates their circuit design by programming the one time Non-Volatile Memory (NVM) to configure the interconnect logic, the I/O Pins and the macrocells of the SLG46722. This highly versatile device allows a wide variety of mixed-signal functions to be designed within a very small, low power single integrated circuit. The macrocells in the device include the following:

- Fifteen Combinatorial Look Up Tables (LUTs)
  - Five 2-bit LUTs
  - Nine 3-bit LUTs
  - One 4-bit LUT
- Two Combination Function Macrocell
  - One Selectable FF/Latch or 2-bit LUT
  - One Selectable Pipe Delay or 3-bit LUT
    - Pipe Delay – 16 stage / 3 output
- Eight Counter / Delay Generators (CNT/DLY)
  - Two 14-bit delay/counter
  - One 14-bit delay/counter with external clock/reset
  - Three 8-bit delays/counters
  - Two 8-bit delays/counters with external clock/reset
- Six D Flip-Flop / Latches (DFF)
- Pipe Delay – 16 stage/3 output (Part of Combination Function Macrocell)
- Programmable Delay
- Additional Logic Functions – 2 Deglitch Filters
- RC Oscillator (RC OSC)

## 2.0 Pin Description

### 2.1 Functional and Programming Pin Description

| Pin # | Pin Name        | Function                              | Programming Function                  |
|-------|-----------------|---------------------------------------|---------------------------------------|
| 1     | V <sub>DD</sub> | Power Supply                          | Power Supply                          |
| 2     | GPI             | General Purpose Input                 | V <sub>PP</sub> (Programming Voltage) |
| 3     | GPIO            | General Purpose I/O                   | Reset                                 |
| 4     | GPIO            | General Purpose I/O                   | N/A                                   |
| 5     | GPIO            | General Purpose I/O                   | N/A                                   |
| 6     | GPIO            | General Purpose I/O                   | N/A                                   |
| 7     | GPIO            | General Purpose I/O                   | N/A                                   |
| 8     | GPIO            | General Purpose I/O                   | N/A                                   |
| 9     | GPIO            | General Purpose I/O                   | N/A                                   |
| 10    | GPIO            | General Purpose I/O                   | N/A                                   |
| 11    | GND             | Ground                                | Ground                                |
| 12    | GPIO            | General Purpose I/O                   | N/A                                   |
| 13    | GPIO            | General Purpose I/O                   | N/A                                   |
| 14    | GPIO            | General Purpose I/O                   | N/A                                   |
| 15    | GPIO            | General Purpose I/O                   | N/A                                   |
| 16    | GPIO            | General Purpose I/O                   | Programming Mode Control              |
| 17    | GPIO            | General Purpose I/O                   | Programming ID Pin                    |
| 18    | GPIO            | General Purpose I/O                   | Programming SDIO Pin                  |
| 19    | GPIO            | General Purpose I/O                   | Programming SRDWB Pin                 |
| 20    | GPIO            | General Purpose I/O or External Clock | Programming SCL Pin                   |

### 3.0 User Programmability

The SLG46722 is a user programmable device with One-Time-Programmable (OTP) memory elements that are able to construct combinatorial logic elements. Three of the I/O Pins provide a connection for the bit patterns into the OTP on board memory. A programming development kit allows the user the ability to create initial devices.

Once the design is finalized, the programming code (.gpx file) is forwarded to Renesas Electronics Corporation to integrate into a production process.

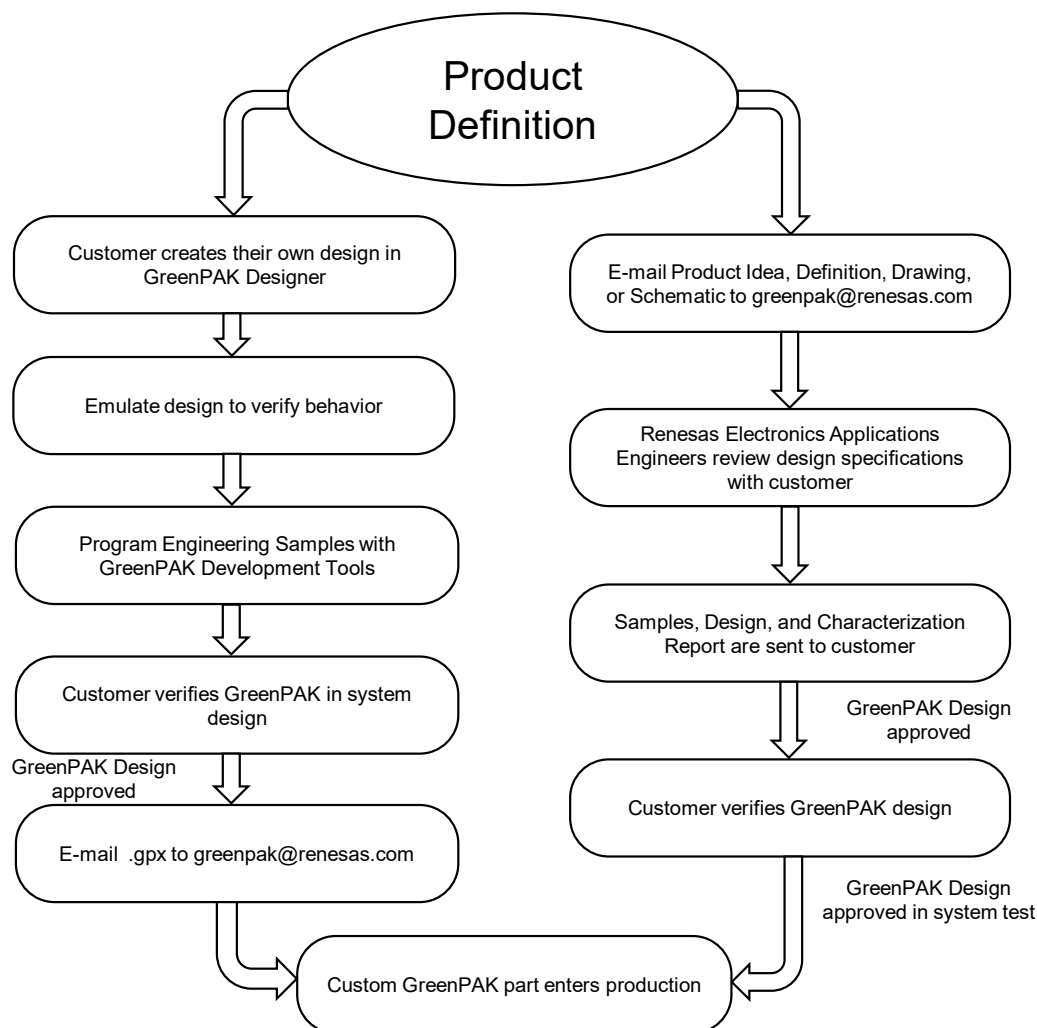


Figure 1. Steps to create a custom GreenPAK device

## 4.0 Ordering Information

| Part Number | Type                                    |
|-------------|-----------------------------------------|
| SLG46722V   | 20-pin STQFN                            |
| SLG46722VTR | 20-pin STQFN - Tape and Reel (3k units) |

Note 1: Use SLG46722V to order. Shipments are automatically in Tape and Reel.

Note 2: "TR" suffix is no longer used. It is a legacy naming convention shown here only for informational purposes.

## 5.0 Electrical Specifications

### 5.1 Absolute Maximum Conditions

| Parameter                                   |              | Min.      | Max.           | Unit |
|---------------------------------------------|--------------|-----------|----------------|------|
| Supply Voltage on $V_{DD}$ relative to GND  |              | -0.5      | 7              | V    |
| DC Input Voltage                            |              | GND - 0.5 | $V_{DD} + 0.5$ | V    |
| Maximum Average or DC Current (Through pin) | Push-Pull 1x | --        | 8              | mA   |
|                                             | Push-Pull 2x | --        | 10             |      |
|                                             | OD 1x        | --        | 8              |      |
|                                             | OD 2x        | --        | 12             |      |
|                                             | OD 4x        | --        | 25             |      |
| Current at Input Pin                        |              | -1.0      | 1.0            | mA   |
| Storage Temperature Range                   |              | -65       | 150            | °C   |
| Junction Temperature                        |              | --        | 150            | °C   |
| ESD Protection (Human Body Model)           |              | 2000      | --             | V    |
| ESD Protection (Charged Device Model)       |              | 1300      | --             | V    |
| Moisture Sensitivity Level                  |              | 1         |                |      |

### 5.2 Electrical Characteristics (1.8 V $\pm 5\%$ $V_{DD}$ )

| Symbol    | Parameter                      | Condition/Note                                         | Min.  | Typ.  | Max.  | Unit |
|-----------|--------------------------------|--------------------------------------------------------|-------|-------|-------|------|
| $V_{DD}$  | Supply Voltage                 |                                                        | 1.71  | 1.80  | 1.89  | V    |
| $T_A$     | Operating Temperature          |                                                        | -40   | 25    | 85    | °C   |
| $V_{IH}$  | HIGH-Level Input Voltage       | Logic Input                                            | 1.100 | --    | --    | V    |
|           |                                | Logic Input with Schmitt Trigger                       | 1.270 | --    | --    | V    |
|           |                                | Low-Level Logic Input                                  | 0.980 | --    | --    | V    |
| $V_{IL}$  | LOW-Level Input Voltage        | Logic Input                                            | --    | --    | 0.690 | V    |
|           |                                | Logic Input with Schmitt Trigger                       | --    | --    | 0.440 | V    |
|           |                                | Low-Level Logic Input                                  | --    | --    | 0.520 | V    |
| $I_{LKG}$ | Input Leakage (Absolute Value) |                                                        | --    | 1     | 1000  | nA   |
| $V_{OH}$  | HIGH-Level Output Voltage      | Push-Pull 1X, Open Drain PMOS 1X, $I_{OH} = 100 \mu A$ | 1.690 | 1.789 | --    | V    |
|           |                                | Push-Pull 2X, Open Drain PMOS 2X, $I_{OH} = 100 \mu A$ | 1.700 | 1.794 | --    | V    |
| $V_{OL}$  | LOW-Level Output Voltage       | Push-Pull 1X, $I_{OL} = 100 \mu A$                     | --    | 0.008 | 0.030 | V    |
|           |                                | Push-Pull 2X, $I_{OL} = 100 \mu A$                     | --    | 0.004 | 0.010 | V    |
|           |                                | Open Drain NMOS 1X, $I_{OL} = 100 \mu A$               | --    | 0.005 | 0.020 | V    |
|           |                                | Open Drain NMOS 2X, $I_{OL} = 100 \mu A$               | --    | 0.003 | 0.010 | V    |
|           |                                | Open Drain NMOS 4X, $I_{OL} = 100 \mu A$               | --    | 0.003 | 0.004 | V    |

| Symbol       | Parameter                                                                            | Condition/Note                                                          | Min.  | Typ.   | Max.         | Unit          |
|--------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------|--------|--------------|---------------|
| $I_{OH}$     | HIGH-Level Output Current<br>(see Note 1)                                            | Push-Pull 1X, Open Drain PMOS 1X,<br>$V_{OH} = V_{DD} - 0.2$            | 1.066 | 1.703  | --           | mA            |
|              |                                                                                      | Push-Pull 2X, Open Drain PMOS 1X,<br>$V_{OH} = V_{DD} - 0.2$            | 2.216 | 3.406  | --           | mA            |
| $I_{OL}$     | LOW-Level Output Current<br>(see Note 1)                                             | Push-Pull 1X,<br>$V_{OL} = 0.15$ V                                      | 0.917 | 1.689  | --           | mA            |
|              |                                                                                      | Push-Pull 2X,<br>$V_{OL} = 0.15$ V                                      | 1.834 | 3.378  | --           | mA            |
|              |                                                                                      | Open Drain NMOS 1X,<br>$V_{OL} = 0.15$ V                                | 1.375 | 2.534  | --           | mA            |
|              |                                                                                      | Open Drain NMOS 2X,<br>$V_{OL} = 0.15$ V                                | 2.750 | 5.068  | --           | mA            |
|              |                                                                                      | Open Drain NMOS Super Drive,<br>$V_{OL} = 0.15$ V                       | 5.500 | 10.136 | --           | mA            |
| $I_{VDD}$    | Maximum Average or DC<br>Current Through $V_{DD}$ Pin<br>(Per chip side, see Note 2) | $T_J = 85^\circ\text{C}$                                                | --    | --     | 45           | mA            |
|              |                                                                                      | $T_J = 110^\circ\text{C}$                                               | --    | --     | 22           | mA            |
| $I_{GND}$    | Maximum Average or DC<br>Current Through GND Pin<br>(Per chip side, see Note 2)      | $T_J = 85^\circ\text{C}$                                                | --    | --     | 84           | mA            |
|              |                                                                                      | $T_J = 110^\circ\text{C}$                                               | --    | --     | 40           | mA            |
| $V_O$        | Maximal Voltage Applied to<br>any PIN in High-Impedance<br>State                     |                                                                         | --    | --     | $V_{DD}+0.3$ | V             |
| $T_{SU}$     | Startup Time                                                                         | From $V_{DD}$ rising past $PON_{THR}$                                   | --    | 0.3    | --           | ms            |
| $PON_{THR}$  | Power On Threshold                                                                   | $V_{DD}$ Level Required to Start Up the Chip                            | 1.096 | 1.353  | 1.528        | V             |
| $POFF_{THR}$ | Power Off Threshold                                                                  | $V_{DD}$ Level Required to Switch Off the<br>Chip                       | 0.759 | 0.933  | 1.125        | V             |
| $R_{PULL}$   | Pull Up or Pull Down<br>Resistance                                                   | 1 M for Pull Up: $V_{IN} = GND$ ;<br>for Pull Down: $V_{IN} = V_{DD}$   | --    | 1      | --           | M $\Omega$    |
|              |                                                                                      | 100 k for Pull Up: $V_{IN} = GND$ ;<br>for Pull Down: $V_{IN} = V_{DD}$ | --    | 100    | --           | k $\Omega$    |
|              |                                                                                      | 10 k for Pull Up: $V_{IN} = GND$ ;<br>for Pull Down: $V_{IN} = V_{DD}$  | --    | 10     | --           | k $\Omega$    |
| $C_{VDD}$    | Decoupling Capacitor                                                                 | Capacitor Value at $V_{DD}$                                             | --    | 0.1    | --           | $\mu\text{F}$ |

Note 1: DC or average current through any pin should not exceed value given in Absolute Maximum Conditions.

Note 2: The GreenPAK's power rails are divided in two sides. Pins 2, 3, 4, 5, 6, 7, 8, 9 and 10 are connected to one side, pins 12, 13, 14, 15, 16, 17, 18, 19 and 20 to another.

## 5.3 Electrical Characteristics (3.3 V $\pm 10$ % $V_{DD}$ )

| Symbol    | Parameter                                                                      | Condition/Note                                     | Min.   | Typ.   | Max.         | Unit |
|-----------|--------------------------------------------------------------------------------|----------------------------------------------------|--------|--------|--------------|------|
| $V_{DD}$  | Supply Voltage                                                                 |                                                    | 3.0    | 3.3    | 3.6          | V    |
| $T_A$     | Operating Temperature                                                          |                                                    | -40    | 25     | 85           | °C   |
| $V_{IH}$  | HIGH-Level Input Voltage                                                       | Logic Input                                        | 1.780  | --     | --           | V    |
|           |                                                                                | Logic Input with Schmitt Trigger                   | 2.130  | --     | --           | V    |
|           |                                                                                | Low-Level Logic Input                              | 1.130  | --     | --           | V    |
| $V_{IL}$  | LOW-Level Input Voltage                                                        | Logic Input                                        | --     | --     | 1.210        | V    |
|           |                                                                                | Logic Input with Schmitt Trigger                   | --     | --     | 0.950        | V    |
|           |                                                                                | Low-Level Logic Input                              | --     | --     | 0.690        | V    |
| $I_{LKG}$ | Input Leakage (Absolute Value)                                                 |                                                    | --     | 1      | 1000         | nA   |
| $V_{OH}$  | HIGH-Level Output Voltage                                                      | Push-Pull 1X, Open Drain PMOS 1X, $I_{OH} = 3$ mA  | 2.735  | 3.120  | --           | V    |
|           |                                                                                | Push-Pull 2X, Open Drain PMOS 2X, $I_{OH} = 3$ mA  | 2.870  | 3.210  | --           | V    |
| $V_{OL}$  | LOW-Level Output Voltage                                                       | Push-Pull 1X, $I_{OL} = 3$ mA                      | --     | 0.130  | 0.228        | V    |
|           |                                                                                | Push-Pull 2X, $I_{OL} = 3$ mA                      | --     | 0.060  | 0.108        | V    |
|           |                                                                                | Open Drain NMOS 1X, $I_{OL} = 3$ mA                | --     | 0.080  | 0.147        | V    |
|           |                                                                                | Open Drain NMOS 2X, $I_{OL} = 3$ mA                | --     | 0.040  | 0.080        | V    |
|           |                                                                                | Open Drain NMOS 4X, $I_{OL} = 3$ mA                | --     | 0.027  | 0.034        | V    |
| $I_{OH}$  | HIGH-Level Output Current (see Note 1)                                         | Push-Pull 1X, Open Drain PMOS 1X, $V_{OH} = 2.4$ V | 6.045  | 12.080 | --           | mA   |
|           |                                                                                | Push-Pull 2X, Open Drain PMOS 2X, $V_{OH} = 2.4$ V | 11.522 | 24.160 | --           | mA   |
| $I_{OL}$  | LOW-Level Output Current (see Note 1)                                          | Push-Pull 1X, $V_{OL} = 0.4$ V                     | 4.875  | 8.244  | --           | mA   |
|           |                                                                                | Push-Pull 2X, $V_{OL} = 0.4$ V                     | 9.750  | 16.488 | --           | mA   |
|           |                                                                                | Open Drain NMOS 1X, $V_{OL} = 0.4$ V               | 7.313  | 12.370 | --           | mA   |
|           |                                                                                | Open Drain NMOS 2X, $V_{OL} = 0.4$ V               | 14.541 | 24.740 | --           | mA   |
|           |                                                                                | Open Drain NMOS Super Drive, $V_{OL} = 0.4$ V      | 25.801 | 49.480 | --           | mA   |
| $I_{VDD}$ | Maximum Average or DC Current Through $V_{DD}$ Pin (Per chip side, see Note 2) | $T_J = 85$ °C                                      | --     | --     | 45           | mA   |
|           |                                                                                | $T_J = 110$ °C                                     | --     | --     | 22           | mA   |
| $I_{GND}$ | Maximum Average or DC Current Through GND Pin (Per chip side, see Note 2)      | $T_J = 85$ °C                                      | --     | --     | 84           | mA   |
|           |                                                                                | $T_J = 110$ °C                                     | --     | --     | 40           | mA   |
| $V_O$     | Maximal Voltage Applied to any PIN in High-Impedance State                     |                                                    | --     | --     | $V_{DD}+0.3$ | V    |

| Symbol                                                                                                                                                                                                                                                                                                      | Parameter                       | Condition/Note                                                          | Min.  | Typ.  | Max.  | Unit       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------------------------------------|-------|-------|-------|------------|
| $T_{SU}$                                                                                                                                                                                                                                                                                                    | Startup Time                    | From $V_{DD}$ rising past $PON_{THR}$                                   | --    | 0.3   | --    | ms         |
| $PON_{THR}$                                                                                                                                                                                                                                                                                                 | Power On Threshold              | $V_{DD}$ Level Required to Start Up the Chip                            | 1.096 | 1.353 | 1.528 | V          |
| $POFF_{THR}$                                                                                                                                                                                                                                                                                                | Power Off Threshold             | $V_{DD}$ Level Required to Switch Off the Chip                          | 0.759 | 0.933 | 1.125 | V          |
| $R_{PULL}$                                                                                                                                                                                                                                                                                                  | Pull Up or Pull Down Resistance | 1 M for Pull Up: $V_{IN} = GND$ ;<br>for Pull Down: $V_{IN} = V_{DD}$   | --    | 1     | --    | M $\Omega$ |
|                                                                                                                                                                                                                                                                                                             |                                 | 100 k for Pull Up: $V_{IN} = GND$ ;<br>for Pull Down: $V_{IN} = V_{DD}$ | --    | 100   | --    | k $\Omega$ |
|                                                                                                                                                                                                                                                                                                             |                                 | 10 k for Pull Up: $V_{IN} = GND$ ;<br>for Pull Down: $V_{IN} = V_{DD}$  | --    | 10    | --    | k $\Omega$ |
| $C_{VDD}$                                                                                                                                                                                                                                                                                                   | Decoupling Capacitor            | Capacitor Value at $V_{DD}$                                             | --    | 0.1   | --    | $\mu F$    |
| <p>Note 1: DC or average current through any pin should not exceed value given in Absolute Maximum Conditions.</p> <p>Note 2: The GreenPAK's power rails are divided in two sides. Pins 2, 3, 4, 5, 6, 7, 8, 9 and 10 are connected to one side, pins 12, 13, 14, 15, 16, 17, 18, 19 and 20 to another.</p> |                                 |                                                                         |       |       |       |            |

## 5.4 Electrical Characteristics (5 V $\pm 10\%$ V<sub>DD</sub>)

| Symbol           | Parameter                                                                             | Condition/Note                                            | Min.   | Typ.   | Max.                 | Unit |
|------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------|--------|--------|----------------------|------|
| V <sub>DD</sub>  | Supply Voltage                                                                        |                                                           | 4.5    | 5.0    | 5.5                  | V    |
| T <sub>A</sub>   | Operating Temperature                                                                 |                                                           | -40    | 25     | 85                   | °C   |
| V <sub>IH</sub>  | HIGH-Level Input Voltage                                                              | Logic Input                                               | 2.640  | --     | --                   | V    |
|                  |                                                                                       | Logic Input with Schmitt Trigger                          | 3.160  | --     | --                   | V    |
|                  |                                                                                       | Low-Level Logic Input                                     | 1.230  | --     | --                   | V    |
| V <sub>IL</sub>  | LOW-Level Input Voltage                                                               | Logic Input                                               | --     | --     | 1.840                | V    |
|                  |                                                                                       | Logic Input with Schmitt Trigger                          | --     | --     | 1.510                | V    |
|                  |                                                                                       | Low-Level Logic Input                                     | --     | --     | 0.780                | V    |
| I <sub>LKG</sub> | Input Leakage (Absolute Value)                                                        |                                                           | --     | 1      | 1000                 | nA   |
| V <sub>OH</sub>  | HIGH-Level Output Voltage                                                             | Push-Pull 1X, Open Drain PMOS 1X, I <sub>OH</sub> = 5 mA  | 4.190  | 4.780  | --                   | V    |
|                  |                                                                                       | Push-Pull 2X, Open Drain PMOS 2X, I <sub>OH</sub> = 5 mA  | 4.320  | 4.890  | --                   | V    |
| V <sub>OL</sub>  | LOW-Level Output Voltage                                                              | Push-Pull 1X, I <sub>OL</sub> = 5 mA                      | --     | 0.157  | 0.270                | V    |
|                  |                                                                                       | Push-Pull 2X, I <sub>OL</sub> = 5 mA                      | --     | 0.076  | 0.130                | V    |
|                  |                                                                                       | Open Drain NMOS 1X, I <sub>OL</sub> = 5 mA                | --     | 0.102  | 0.180                | V    |
|                  |                                                                                       | Open Drain NMOS 2X, I <sub>OL</sub> = 5 mA                | --     | 0.051  | 0.110                | V    |
|                  |                                                                                       | Open Drain NMOS 4X, I <sub>OL</sub> = 5 mA                | --     | 0.035  | 0.045                | V    |
| I <sub>OH</sub>  | HIGH-Level Output Current (see Note 1)                                                | Push-Pull 1X, Open Drain PMOS 1X, V <sub>OH</sub> = 2.4 V | 22.080 | 34.040 | --                   | mA   |
|                  |                                                                                       | Push-Pull 2X, Open Drain PMOS 2X, V <sub>OH</sub> = 2.4 V | 41.690 | 68.080 | --                   | mA   |
| I <sub>OL</sub>  | LOW-Level Output Current (see Note 1)                                                 | Push-Pull 1X, V <sub>OL</sub> = 0.4 V                     | 7.215  | 11.580 | --                   | mA   |
|                  |                                                                                       | Push-Pull 2X, V <sub>OL</sub> = 0.4 V                     | 13.831 | 23.160 | --                   | mA   |
|                  |                                                                                       | Open Drain NMOS 1X, V <sub>OL</sub> = 0.4 V               | 10.820 | 17.380 | --                   | mA   |
|                  |                                                                                       | Open Drain NMOS 2X, V <sub>OL</sub> = 0.4 V               | 17.343 | 34.760 | --                   | mA   |
|                  |                                                                                       | Open Drain NMOS Super Drive, V <sub>OL</sub> = 0.4 V      | 30.964 | 69.520 | --                   | mA   |
| I <sub>VDD</sub> | Maximum Average or DC Current Through V <sub>DD</sub> Pin (Per chip side, see Note 2) | T <sub>J</sub> = 85 °C                                    | --     | --     | 45                   | mA   |
|                  |                                                                                       | T <sub>J</sub> = 110 °C                                   | --     | --     | 22                   | mA   |
| I <sub>GND</sub> | Maximum Average or DC Current Through GND Pin (Per chip side, see Note 2)             | T <sub>J</sub> = 85 °C                                    | --     | --     | 84                   | mA   |
|                  |                                                                                       | T <sub>J</sub> = 110 °C                                   | --     | --     | 40                   | mA   |
| V <sub>O</sub>   | Maximal Voltage Applied to any PIN in High-Impedance State                            |                                                           | --     | --     | V <sub>DD</sub> +0.3 | V    |

| Symbol                                                                                                                                                                                                                                                                                                      | Parameter                       | Condition/Note                                                          | Min.  | Typ.  | Max.  | Unit       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------------------------------------|-------|-------|-------|------------|
| $T_{SU}$                                                                                                                                                                                                                                                                                                    | Startup Time                    | From $V_{DD}$ rising past $PON_{THR}$                                   | --    | 0.3   | --    | ms         |
| $PON_{THR}$                                                                                                                                                                                                                                                                                                 | Power On Threshold              | $V_{DD}$ Level Required to Start Up the Chip                            | 1.096 | 1.353 | 1.528 | V          |
| $POFF_{THR}$                                                                                                                                                                                                                                                                                                | Power Off Threshold             | $V_{DD}$ Level Required to Switch Off the Chip                          | 0.759 | 0.933 | 1.125 | V          |
| $R_{PULL}$                                                                                                                                                                                                                                                                                                  | Pull Up or Pull Down Resistance | 1 M for Pull Up: $V_{IN} = GND$ ;<br>for Pull Down: $V_{IN} = V_{DD}$   | --    | 1     | --    | M $\Omega$ |
|                                                                                                                                                                                                                                                                                                             |                                 | 100 k for Pull Up: $V_{IN} = GND$ ;<br>for Pull Down: $V_{IN} = V_{DD}$ | --    | 100   | --    | k $\Omega$ |
|                                                                                                                                                                                                                                                                                                             |                                 | 10 k for Pull Up: $V_{IN} = GND$ ;<br>for Pull Down: $V_{IN} = V_{DD}$  | --    | 10    | --    | k $\Omega$ |
| $C_{VDD}$                                                                                                                                                                                                                                                                                                   | Decoupling Capacitor            | Capacitor Value at $V_{DD}$                                             | --    | 0.1   | --    | $\mu F$    |
| <p>Note 1: DC or average current through any pin should not exceed value given in Absolute Maximum Conditions.</p> <p>Note 2: The GreenPAK's power rails are divided in two sides. Pins 2, 3, 4, 5, 6, 7, 8, 9 and 10 are connected to one side, pins 12, 13, 14, 15, 16, 17, 18, 19 and 20 to another.</p> |                                 |                                                                         |       |       |       |            |

## 5.5 IDD Estimator

Table 1. Typical Current estimated for each macrocell.

| Symbol | Parameter | Note                      | V <sub>DD</sub> = 1.8 V | V <sub>DD</sub> = 3.3 V | V <sub>DD</sub> = 5.0 V | Unit |
|--------|-----------|---------------------------|-------------------------|-------------------------|-------------------------|------|
| I      | Current   | Chip Quiescent            | 0.5                     | 0.8                     | 1.0                     | μA   |
|        |           | OSC 25 kHz, predivide = 1 | 3.2                     | 5.1                     | 7.3                     | μA   |
|        |           | OSC 25 kHz, predivide = 8 | 3.0                     | 4.4                     | 6.0                     | μA   |
|        |           | OSC 2 MHz, predivide = 1  | 38.5                    | 78.2                    | 136.2                   | μA   |
|        |           | OSC 2 MHz, predivide = 8  | 18.3                    | 25.7                    | 35.5                    | μA   |

## 5.6 Timing Estimator

Table 2. Typical Delay estimated for each macrocell.

| Symbol | Parameter | Note                                    | V <sub>DD</sub> = 1.8 V |         | V <sub>DD</sub> = 3.3 V |         | V <sub>DD</sub> = 5.0 V |         | Unit |
|--------|-----------|-----------------------------------------|-------------------------|---------|-------------------------|---------|-------------------------|---------|------|
|        |           |                                         | rising                  | falling | rising                  | falling | rising                  | falling |      |
| tpd    | Delay     | Digital Input without Schmitt Trigger   | 42                      | 45      | 17                      | 19      | 12                      | 13      | ns   |
| tpd    | Delay     | Digital Input with Schmitt Trigger      | 42                      | 43      | 16                      | 17      | 18                      | 12      | ns   |
| tpd    | Delay     | Low Voltage Digital input               | 45                      | 428     | 17                      | 177     | 12                      | 120     | ns   |
| tpd    | Delay     | Digital input-- PMOS                    | 42                      | -       | 17                      | -       | 12                      | -       | ns   |
| tpd    | Delay     | Digital input-- NMOS                    | -                       | 80      | -                       | 27      | -                       | 18      | ns   |
| tpd    | Delay     | Output enable from pin, OE Hi-Z to 1    | 53                      | -       | 21                      | -       | 15                      | -       | ns   |
| tpd    | Delay     | Output enable from pin, OE Hi-Z to 0    | 50                      | -       | 20                      | -       | 14                      | -       | ns   |
| tpd    | Delay     | LUT2bit(LATCH)                          | 34                      | 33      | 14                      | 13      | 10                      | 9       | ns   |
| tpd    | Delay     | LATCH(LUT2bit)                          | 30                      | 34      | 14                      | 13      | 10                      | 9       | ns   |
| tpd    | Delay     | LUT3bit(LATCH)                          | 38                      | 37      | 18                      | 15      | 13                      | 10      | ns   |
| tpd    | Delay     | LATCH+nRESET(LUT3bit)                   | 45                      | 42      | 21                      | 17      | 15                      | 12      | ns   |
| tpd    | Delay     | LUT4bit                                 | 28                      | 33      | 14                      | 13      | 10                      | 9       | ns   |
| tpd    | Delay     | LUT2bt                                  | 19                      | 26      | 10                      | 10      | 7                       | 7       | ns   |
| tpd    | Delay     | LUT3bit                                 | 28                      | 34      | 14                      | 13      | 10                      | 9       | ns   |
| tpd    | Delay     | CNT/DLY                                 | 40                      | 38      | 18                      | 15      | 13                      | 11      | ns   |
| tpd    | Delay     | P_DLY1C                                 | 380                     | 377     | 166                     | 163     | 123                     | 120     | ns   |
| tpd    | Delay     | P_DLY2C                                 | 720                     | 718     | 314                     | 312     | 233                     | 231     | ns   |
| tpd    | Delay     | P_DLY3C                                 | 1061                    | 1060    | 462                     | 460     | 343                     | 341     | ns   |
| tpd    | Delay     | P_DLY4C                                 | 1396                    | 1400    | 609                     | 609     | 451                     | 451     | ns   |
| tpd    | Delay     | Filter                                  | 200                     | 200     | 78                      | 78      | 53                      | 53      | ns   |
| tpd    | Delay     | ACMP (5mV across inputs)                | 3000                    | 3000    | 2000                    | 2000    | 2000                    | 2000    | ns   |
| tw     | width     | I/O with 1X push pull (min transmitted) | 20                      | 20      | 20                      | 20      | 20                      | 20      | ns   |
| tw     | width     | filter (min transmitted)                | 150                     | 150     | 55                      | 55      | 35                      | 35      | ns   |

## 5.7 Typical Counter/Delay Offset Measurements

Table 3. Typical Counter/Delay Offset Measurements.

| Parameter               | RC OSC Freq | RC OSC Power | V <sub>DD</sub> = 1.8 V | V <sub>DD</sub> = 3.3 V | V <sub>DD</sub> = 5.0 V | Unit |
|-------------------------|-------------|--------------|-------------------------|-------------------------|-------------------------|------|
| offset                  | 25 kHz      | auto         | 19                      | 14                      | 12                      | μs   |
| offset                  | 2 MHz       | auto         | 7                       | 4                       | 4                       | μs   |
| frequency settling time | 25 kHz      | auto         | 19                      | 14                      | 12                      | μs   |

**Table 3. Typical Counter/Delay Offset Measurements.**

| Parameter               | RC OSC Freq      | RC OSC Power | V <sub>DD</sub> = 1.8 V | V <sub>DD</sub> = 3.3 V | V <sub>DD</sub> = 5.0 V | Unit |
|-------------------------|------------------|--------------|-------------------------|-------------------------|-------------------------|------|
| frequency settling time | 2 MHz            | auto         | 14                      | 14                      | 14                      | μs   |
| variable (CLK period)   | 25 kHz           | forced       | 0-40                    | 0-40                    | 0-40                    | μs   |
| variable (CLK period)   | 2 MHz            | forced       | 0-0.5                   | 0-0.5                   | 0-0.5                   | μs   |
| tpd (non-delayed edge)  | 25 kHz/<br>2 MHz | either       | 35                      | 14                      | 10                      | ns   |

## 5.8 Expected Delays and Widths

**Table 4. Expected Delays and Widths for Programmable Delay (typical).**

| Symbol | Parameter     | Note                                                       | V <sub>DD</sub> = 1.8 V | V <sub>DD</sub> = 3.3 V | V <sub>DD</sub> = 5.0 V | Unit |
|--------|---------------|------------------------------------------------------------|-------------------------|-------------------------|-------------------------|------|
| time1  | Width, 1 cell | mode:(any)edge detect, edge detect output                  | 325                     | 150                     | 110                     | ns   |
| time1  | Width, 2 cell | mode:(any)edge detect, edge detect output                  | 740                     | 300                     | 225                     | ns   |
| time1  | Width, 3 cell | mode:(any)edge detect, edge detect output                  | 1020                    | 450                     | 340                     | ns   |
| time1  | Width, 4 cell | mode:(any)edge detect, edge detect output                  | 1350                    | 600                     | 450                     | ns   |
| time2  | Delay, 1 cell | mode:(any)edge detect, edge detect output                  | 44                      | 18                      | 14                      | ns   |
| time2  | Delay, 2 cell | mode:(any)edge detect, edge detect output                  | 44                      | 18                      | 14                      | ns   |
| time2  | Delay, 3 cell | mode:(any)edge detect, edge detect output                  | 44                      | 18                      | 14                      | ns   |
| time2  | Delay, 4 cell | mode:(any)edge detect, edge detect output                  | 44                      | 18                      | 14                      | ns   |
| time1  | Width, 1 cell | mode: delayed (any)edge detect, delayed edge detect output | 340                     | 150                     | 110                     | ns   |
| time1  | Width, 2 cell | mode: delayed (any)edge detect, delayed edge detect output | 670                     | 300                     | 220                     | ns   |
| time1  | Width, 3 cell | mode: delayed (any)edge detect, delayed edge detect output | 1000                    | 450                     | 335                     | ns   |
| time1  | Width, 4 cell | mode: delayed (any)edge detect, delayed edge detect output | 1340                    | 600                     | 450                     | ns   |
| time2  | Delay, 1 cell | mode: delayed (any)edge detect, delayed edge detect output | 570                     | 220                     | 140                     | ns   |
| time2  | Delay, 2 cell | mode: delayed (any)edge detect, delayed edge detect output | 570                     | 220                     | 140                     | ns   |
| time2  | Delay, 3 cell | mode: delayed (any)edge detect, delayed edge detect output | 570                     | 220                     | 140                     | ns   |
| time2  | Delay, 4 cell | mode: delayed (any)edge detect, delayed edge detect output | 570                     | 220                     | 140                     | ns   |
| time2  | Delay, 1 cell | mode: both edge delay, edge detect output                  | 382                     | 375                     | 126                     | ns   |
| time2  | Delay, 2 cell | mode: both edge delay, edge detect output                  | 713                     | 169                     | 237                     | ns   |
| time2  | Delay, 3 cell | mode: both edge delay, edge detect output                  | 1045                    | 318                     | 350                     | ns   |
| time2  | Delay, 4 cell | mode: both edge delay, edge detect output                  | 1370                    | 466                     | 460                     | ns   |
| time2  | Delay, 1 cell | mode: both edge delay, delayed edge detect output          | 900                     | 613                     | 250                     | ns   |
| time2  | Delay, 2 cell | mode: both edge delay, delayed edge detect output          | 1250                    | 520                     | 360                     | ns   |
| time2  | Delay, 3 cell | mode: both edge delay, delayed edge detect output          | 1600                    | 680                     | 480                     | ns   |
| time2  | Delay, 4 cell | mode: both edge delay, delayed edge detect output          | 1900                    | 815                     | 600                     | ns   |

## 5.9 Typical Pulse Width Performance

**Table 5. Typical Pulse Width Performance.**

| Parameter            | V <sub>DD</sub> = 1.8 V | V <sub>DD</sub> = 3.3 V | V <sub>DD</sub> = 5.0 V | Unit |
|----------------------|-------------------------|-------------------------|-------------------------|------|
| Filtered Pulse Width | < 150                   | < 55                    | < 35                    | ns   |

## 6.0 Summary of Macrocell Function

### 6.1 I/O Pins

- Digital Input (low voltage or normal voltage, with or without Schmitt Trigger)
- Open Drain Outputs
- Push Pull Outputs
- 10 k $\Omega$ /100 k $\Omega$ /1 M $\Omega$  pull-up/pull-down resistors
- 40mA Open Drain Superdrive output

### 6.2 Connection Matrix

- Digital matrix for circuit connections based on user design

### 6.3 Combinational Logic Look Up Tables (LUTs – 15 total)

- Five 2-bit Lookup Tables
- Nine 3-bit Lookup Tables
- One 4-bit Lookup Tables

### 6.4 Combination Function Macrocell (2 total)

- One Selectable FF/Latch or 2-bit LUT
- One Selectable Pipe Delay or 3-bit LUT

### 6.5 Delays/Counters (8 total)

- Two 14-bit delay/counter: Range 1-16384 clock cycles
- One 14-bit delay/counter with external clock/reset: Range 1-16384 clock cycles
- Three 8-bit delays/counters: Range 1-255 clock cycles
- Two 8-bit delays/counters with external clock/reset: Range 1-255 clock cycles

### 6.6 Digital Storage Elements (6 total)

- Six D Flip-Flops or Latches

### 6.7 Pipe Delay (Part of Combination Function Macrocell)

- 16 stage / 3 output
- One 1 stage fixed output
- Two 1-16 stage selectable outputs.

### 6.8 Programmable Delay

- 125 ns/250 ns/375 ns/500 ns @ 3.3 V
- Includes Edge Detection function

### 6.9 Additional Logic Functions (2 total)

- Two Deglitch filter macrocells

### 6.10 RC Oscillator

- 25 kHz and 2 MHz selectable frequency
- First stage divider (4): OSC/1, OSC/2, OSC/4, and OSC/8
- Second stage divider (5): OSC/1, OSC/4, selectable (OSC/8, OSC/12, OSC/24, or OSC/64), OSC/3, and additional OSC/3 (from selectable output)

## 7.0 I/O Pins

The SLG46722 has a total of 18 multi-function I/O pins which can function as either a user defined Input or Output, as well as serving as a special function (such as outputting the voltage reference), or serving as a signal for programming of the on-chip Non Volatile Memory (NVM).

Normal Mode pin definitions are as follows:

- Pin 2: general purpose input
- Pin 3: general purpose input or output
- Pin 4: general purpose input or output
- Pin 5: general purpose input or output
- Pin 6: general purpose input or output
- Pin 7: general purpose input or output
- Pin 8: general purpose input or output
- Pin 9: general purpose input or output
- Pin 10: general purpose input or output
- Pin 12: general purpose input or output
- Pin 13: general purpose input or output
- Pin 14: general purpose input or output
- Pin 15: general purpose input or output
- Pin 16: general purpose input or output
- Pin 17: general purpose input or output
- Pin 18: general purpose input or output
- Pin 19: general purpose input or output
- Pin 20: general purpose input or output or external clock

Programming Mode pin definitions are as follows;

- Pin 1:  $V_{DD}$  power supply
- Pin 2:  $V_{PP}$  programming voltage
- Pin 11: ground
- Pin 16: programming mode control
- Pin 17: programming ID pin
- Pin 18: programming SDIO pin
- Pin 19: programming SRDWB pin
- Pin 20: programming SCL pin

Of the 18 user defined I/O pins on the SLG46722, all but one of the pins (Pin 2) can serve as both digital input and digital output. Pin 2 can only serve as a digital input pin.

### 7.1 Input Modes

Each I/O pin can be configured as a digital input pin with/without buffered Schmitt Trigger, or can also be configured as a low voltage digital input.

### 7.2 Output Modes

Pins 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19 and 20 can all be configured as digital output pins.

### 7.3 Pull Up/Down Resistors

All I/O pins have the option for user selectable resistors connected to the input structure. The selectable values on these resistors are 10 k $\Omega$ , 100 k $\Omega$  and 1 M $\Omega$ . In the case of Pin 2, the resistors are fixed to a pull-down configuration. In the case of all other I/O pins, the internal resistors can be configured as either pull-up or pull-downs.

## 7.4 I/O Register Settings

### 7.4.1 PIN 2 Register Settings

**Table 6. PIN 2 Register Settings**

| Signal Function                          | Register Bit Address | Register Definition                                                                                                                  |
|------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| PIN 2 Mode Control                       | <845:844>            | 00: Digital Input without Schmitt Trigger<br>01: Digital Input with Schmitt Trigger<br>10: Low Voltage Digital Input<br>11: Reserved |
| PIN 2 Pull Down Resistor Value Selection | <847:846>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                       |

### 7.4.2 PIN 3 Register Settings

**Table 7. PIN 3 Register Settings**

| Signal Function                             | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|---------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 3 Mode Control                          | <850:848>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 3 Pull Up/Down Resistor Value Selection | <852:851>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 3 Pull Up/Down Resistor Selection       | <853>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 3 Driver Strength Selection             | <854>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.3 PIN 4 Register Settings

Table 8. PIN 4 Register Settings

| Signal Function                             | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|---------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 4 Mode Control                          | <857:855>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 4 Pull Up/Down Resistor Value Selection | <859:858>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 4 Pull Up/Down Resistor Selection       | <860>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 4 Driver Strength Selection             | <861>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.4 PIN 5 Register Settings

Table 9. PIN 5 Register Settings

| Signal Function                             | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|---------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 5 Mode Control                          | <864:862>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 5 Pull Up/Down Resistor Value Selection | <866:865>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 5 Pull Up/Down Resistor Selection       | <867>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 5 Driver Strength Selection             | <868>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.5 PIN 6 Register Settings

**Table 10. PIN 6 Register Settings**

| Signal Function                             | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|---------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 6 Mode Control                          | <871:869>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 6 Pull Up/Down Resistor Value Selection | <873:872>            | 00: Floating<br>01: 10 k $\Omega$ Resistor<br>10: 100 k $\Omega$ Resistor<br>11: 1 M $\Omega$ Resistor                                                                                                                      |
| PIN 6 Pull Up/Down Resistor Selection       | <874>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 6 Driver Strength Selection             | <875>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.6 PIN 7 Register Settings

**Table 11. PIN 7 Register Settings**

| Signal Function                             | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|---------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 7 Mode Control                          | <878:876>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 7 Pull Up/Down Resistor Value Selection | <880:879>            | 00: Floating<br>01: 10 k $\Omega$ Resistor<br>10: 100 k $\Omega$ Resistor<br>11: 1 M $\Omega$ Resistor                                                                                                                      |
| PIN 7 Pull Up/Down Resistor Selection       | <881>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 7 Driver Strength Selection             | <882>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.7 PIN 8 Register Settings

**Table 12. PIN 8 Register Settings**

| Signal Function                             | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|---------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 8 Mode Control                          | <885:883>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 8 Pull Up/Down Resistor Value Selection | <887:886>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 8 Pull Up/Down Resistor Selection       | <888>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 8 Driver Strength Selection             | <889>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.8 PIN 9 Register Settings

**Table 13. PIN 9 Register Settings**

| Signal Function                             | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|---------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 9 Mode Control                          | <892:890>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 9 Pull Up/Down Resistor Value Selection | <894:893>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 9 Pull Up/Down Resistor Selection       | <895>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 9 Driver Strength Selection             | <896>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.9 PIN 10 Register Settings

**Table 14. PIN 10 Register Settings**

| Signal Function                                    | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|----------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 10 Mode Control                                | <899:897>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 10 Pull Up/Down Resistor Value Selection       | <901:900>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 10 Pull Up/Down Resistor Selection             | <902>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 10 Driver Strength Selection                   | <903>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| PIN 10 Super Drive (4X, NMOS Open Drain) Selection | <904>                | 0: Super Drive Off<br>1: Super Drive On (if <897:899> = '101')                                                                                                                                                              |

## 7.4.10 PIN 12 Register Settings

**Table 15. PIN 12 Register Settings**

| Signal Function                                    | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|----------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 12 Mode Control                                | <907:905>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 12 Pull Up/Down Resistor Value Selection       | <909:908>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 12 Pull Up/Down Resistor Selection             | <910>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 12 Driver Strength Selection                   | <911>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| PIN 12 Super Drive (4X, NMOS Open Drain) Selection | <912>                | 0: Super Drive Off<br>1: Super Drive On (if <907:905> = '101')                                                                                                                                                              |

## 7.4.11 PIN 13 Register Settings

**Table 16. PIN 13 Register Settings**

| Signal Function                              | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|----------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 13 Mode Control                          | <915:913>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 13 Pull Up/Down Resistor Value Selection | <917:916>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 13 Pull Up/Down Resistor Selection       | <918>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 13 Driver Strength Selection             | <919>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.12 PIN 14 Register Settings

**Table 17. PIN 14 Register Settings**

| Signal Function                              | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|----------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 14 Mode Control                          | <922:920>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 14 Pull Up/Down Resistor Value Selection | <924:923>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 14 Pull Up/Down Resistor Selection       | <925>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 14 Driver Strength Selection             | <926>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.13 PIN 15 Register Settings

**Table 18. PIN 15 Register Settings**

| Signal Function                              | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|----------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 15 Mode Control                          | <929:927>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 15 Pull Up/Down Resistor Value Selection | <931:930>            | 00: Floating<br>01: 10 k $\Omega$ Resistor<br>10: 100 k $\Omega$ Resistor<br>11: 1 M $\Omega$ Resistor                                                                                                                      |
| PIN 15 Pull Up/Down Resistor Selection       | <932>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 15 Driver Strength Selection             | <933>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.14 PIN 16 Register Settings

**Table 19. PIN 16 Register Settings**

| Signal Function                              | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|----------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 16 Mode Control                          | <936:934>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 16 Pull Up/Down Resistor Value Selection | <938:937>            | 00: Floating<br>01: 10 k $\Omega$ Resistor<br>10: 100 k $\Omega$ Resistor<br>11: 1 M $\Omega$ Resistor                                                                                                                      |
| PIN 16 Pull Up/Down Resistor Selection       | <939>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 16 Driver Strength Selection             | <940>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.15 PIN 17 Register Settings

**Table 20. PIN 17 Register Settings**

| Signal Function                              | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|----------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 17 Mode Control                          | <943:941>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 17 Pull Up/Down Resistor Value Selection | <945:944>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 17 Pull Up/Down Resistor Selection       | <946>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 17 Driver Strength Selection             | <947>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.16 PIN 18 Register Settings

**Table 21. PIN 18 Register Settings**

| Signal Function                              | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|----------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 18 Mode Control                          | <950:948>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 18 Pull Up/Down Resistor Value Selection | <952:951>            | 00: Floating<br>01: 10 kΩ Resistor<br>10: 100 kΩ Resistor<br>11: 1 MΩ Resistor                                                                                                                                              |
| PIN 18 Pull Up/Down Resistor Selection       | <953>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 18 Driver Strength Selection             | <954>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.17 PIN 19 Register Settings

**Table 22. PIN 19 Register Settings**

| Signal Function                              | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|----------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 19 Mode Control                          | <957:955>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 19 Pull Up/Down Resistor Value Selection | <959:958>            | 00: Floating<br>01: 10 k $\Omega$ Resistor<br>10: 100 k $\Omega$ Resistor<br>11: 1 M $\Omega$ Resistor                                                                                                                      |
| PIN 19 Pull Up/Down Resistor Selection       | <960>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 19 Driver Strength Selection             | <961>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.4.18 PIN 20 Register Settings

**Table 23. PIN 20 Register Settings**

| Signal Function                              | Register Bit Address | Register Definition                                                                                                                                                                                                         |
|----------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PIN 20 Mode Control                          | <964:962>            | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| PIN 20 Pull Up/Down Resistor Value Selection | <966:965>            | 00: Floating<br>01: 10 k $\Omega$ Resistor<br>10: 100 k $\Omega$ Resistor<br>11: 1 M $\Omega$ Resistor                                                                                                                      |
| PIN 20 Pull Up/Down Resistor Selection       | <967>                | 0: Pull Down Resistor<br>1: Pull Up Resistor                                                                                                                                                                                |
| PIN 20 Driver Strength Selection             | <968>                | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

## 7.5 GPI IO Structure

### 7.5.1 GPI IO Structure (for Pin 2)

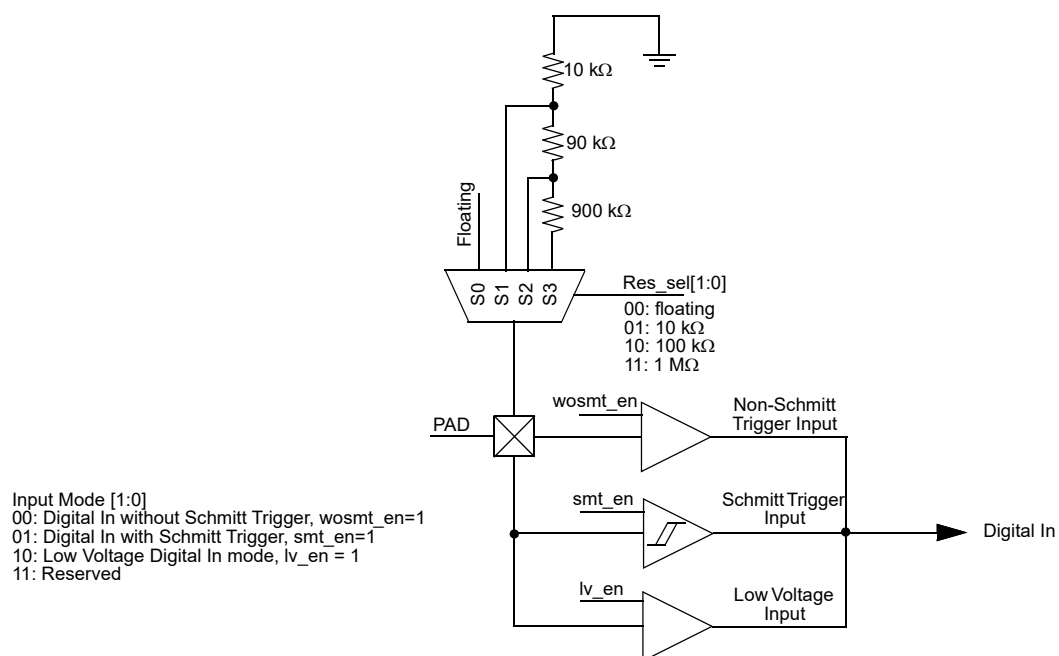


Figure 2. PIN 2 GPI IO Structure Diagram

## 7.6 Register OE IO Structure

### 7.6.1 Register OE IO Structure (for Pins 3, 4, 5, 6, 7, 8, 9, 13, 14, 15, 16, 17, 18, 19, 20)

Mode [2:0]  
 000: Digital In without Schmitt Trigger, wosmt\_en=1, OE = 0  
 001: Digital In with Schmitt Trigger, smt\_en=1, OE = 0  
 010: Low Voltage Digital In mode, lv\_en = 1, OE = 0  
 011: Reserved  
 100: push-pull mode, pp\_en=1, OE = 1  
 101: NMOS open drain mode, odn\_en=1, OE = 1  
 110: PMOS open drain mode, odp\_en=1, OE = 1  
 111: Reserved

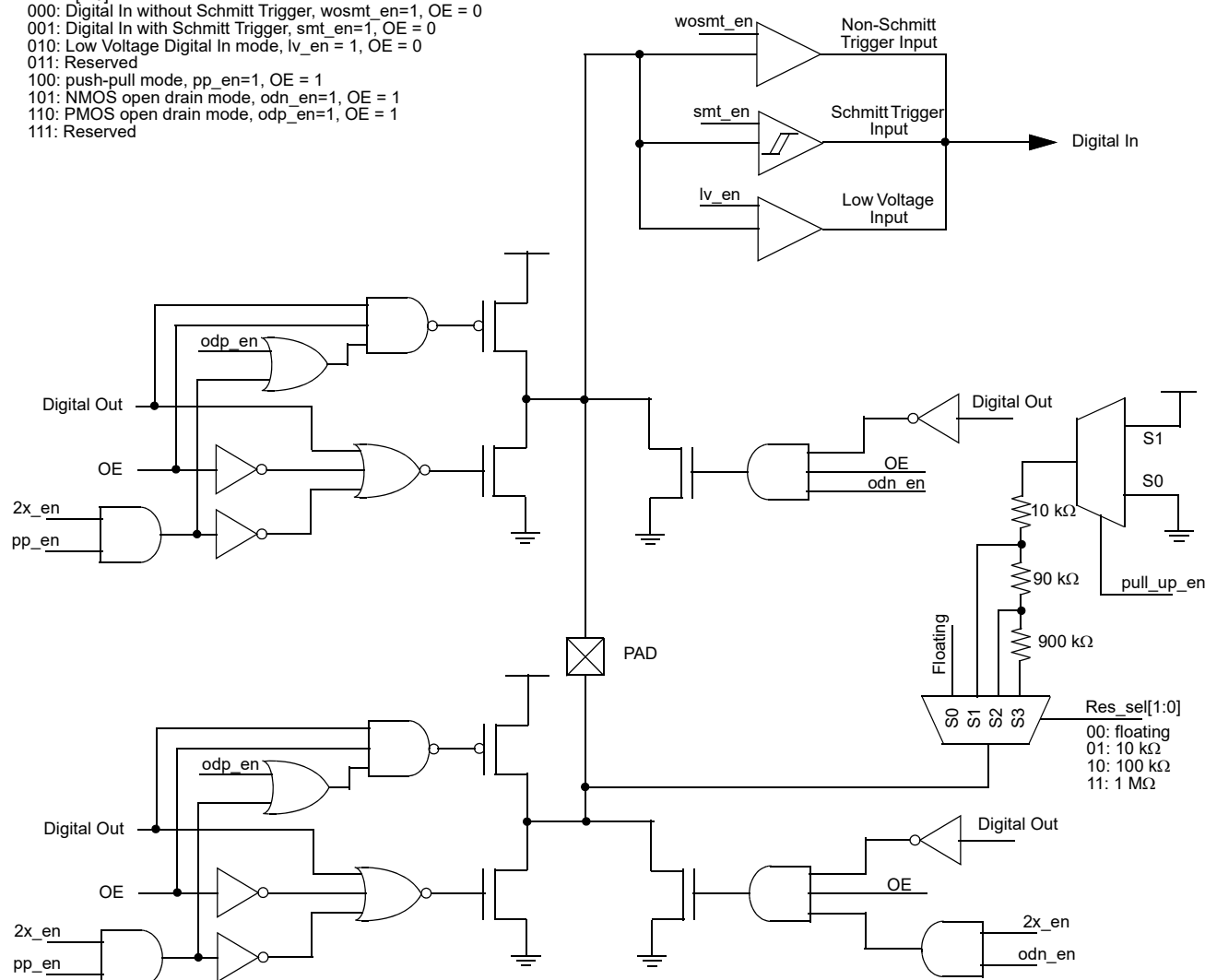


Figure 3. Register OE IO Structure Diagram

## 7.7 Register OE IO Structure with Super Driver

### 7.7.1 Register OE IO Structure with Super Driver (for Pins 10, 12)

Mode [2:0]  
 000: Digital In without Schmitt Trigger, wosmt\_en=1  
 001: Digital In with Schmitt Trigger, smt\_en=1  
 010: Low Voltage Digital In mode, lv\_en = 1  
 011: Reserved  
 100: push-pull mode, pp\_en=1  
 101: NMOS open drain mode, odn\_en=1  
 110: PMOS open drain mode, odp\_en=1  
 111: Reserved

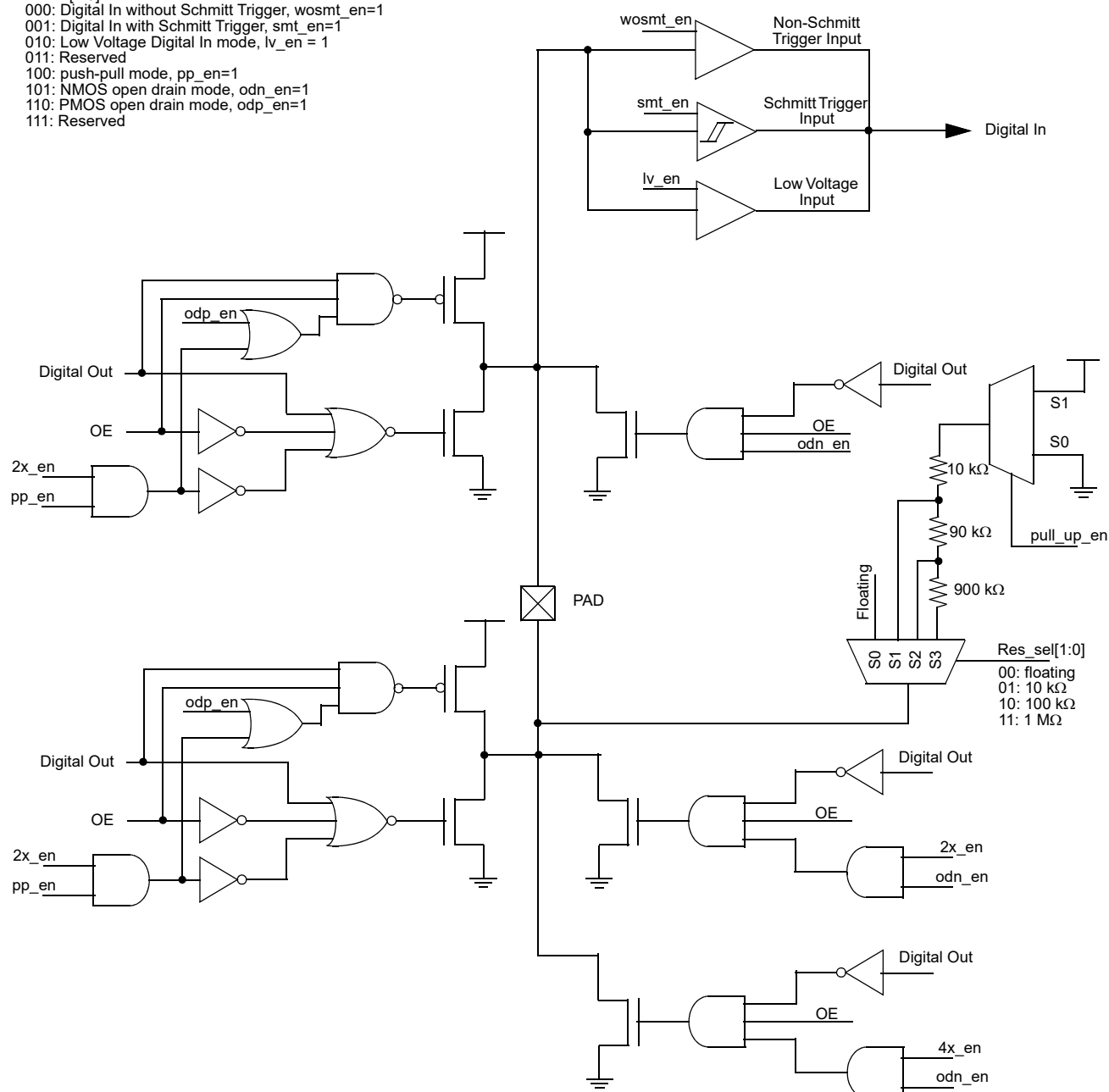


Figure 4. Register OE IO with Super Driver Structure Diagram

# 8.0 Connection Matrix

The Connection Matrix in the SLG46722 is used to create the internal routing for internal functions of the device once it is programmed. The registers are programmed from the one-time NVM cell during Test Mode Operation. All of the connection point for each logic cell within the SLG46722 has a specific digital bit code assigned to it that is either set to active “High” or inactive “Low” based on the design that is created. Once the 1024 register bits within the SLG46722 are programmed a fully custom circuit will be created.

The Connection Matrix has 64 inputs and 95 outputs. Each of the 64 inputs to the Connection Matrix is hard-wired to a particular source macrocell, including I/O pins, LUTs, other digital resources and  $V_{DD}$  and  $V_{SS}$ . The input to a digital macrocell uses a 6-bit register to select one of these 64 input lines.

For a complete list of the SLG46722’s register table, see Section 18.0 Appendix A - SLG46722 Register Definition.

| Matrix Input Signal Functions | N         |                            |                            |                            |   |                   |
|-------------------------------|-----------|----------------------------|----------------------------|----------------------------|---|-------------------|
| VSS                           | 0         |                            |                            |                            |   |                   |
| Pin 2 Digital In              | 1         |                            |                            |                            |   |                   |
| Pin 3 Digital In              | 2         |                            |                            |                            |   |                   |
| Pin 4 Digital In              | 3         |                            |                            |                            |   |                   |
| ⋮                             | ⋮         |                            |                            |                            |   |                   |
| Resetb_core                   | 62        |                            |                            |                            |   |                   |
| $V_{DD}$                      | 63        |                            |                            |                            |   |                   |
| Matrix Inputs                 | N         | 0                          | 1                          | 2                          | ⋮ | 93                |
|                               | Registers | reg<5:0>                   | reg<11:6>                  | reg<17:12>                 | ⋮ | reg<563:558>      |
|                               | Function  | PIN3 Digital Output Source | PIN4 Digital Output Source | PIN5 Digital Output Source | ⋮ | Input of Filter_1 |
| Matrix Outputs                |           |                            |                            |                            |   |                   |

Figure 5. Connection Matrix

## 8.1 Matrix Input Table

Table 24. Matrix Input Table

| N  | Matrix Input Signal Function                  | Matrix Decode |   |   |   |   |   |
|----|-----------------------------------------------|---------------|---|---|---|---|---|
|    |                                               | 5             | 4 | 3 | 2 | 1 | 0 |
| 0  | VSS                                           | 0             | 0 | 0 | 0 | 0 | 0 |
| 1  | pin2 digital Input                            | 0             | 0 | 0 | 0 | 0 | 1 |
| 2  | pin3 digital Input                            | 0             | 0 | 0 | 0 | 1 | 0 |
| 3  | pin4 digital Input                            | 0             | 0 | 0 | 0 | 1 | 1 |
| 4  | pin5 digital Input                            | 0             | 0 | 0 | 1 | 0 | 0 |
| 5  | pin6 digital Input                            | 0             | 0 | 0 | 1 | 0 | 1 |
| 6  | pin7 digital Input                            | 0             | 0 | 0 | 1 | 1 | 0 |
| 7  | pin8 digital Input                            | 0             | 0 | 0 | 1 | 1 | 1 |
| 8  | pin9 digital Input                            | 0             | 0 | 1 | 0 | 0 | 0 |
| 9  | pin10 digital Input                           | 0             | 0 | 1 | 0 | 0 | 1 |
| 10 | counter/delay0 output 14 bit                  | 0             | 0 | 1 | 0 | 1 | 0 |
| 11 | counter/delay1 output 14 bit w/ ext CK, reset | 0             | 0 | 1 | 0 | 1 | 1 |
| 12 | counter/delay2 output 8 bit w/ ext CK, reset  | 0             | 0 | 1 | 1 | 0 | 0 |
| 13 | counter/delay3 output 8 bit w/ ext CK, reset  | 0             | 0 | 1 | 1 | 0 | 1 |
| 14 | counter/delay4 output 8 bit                   | 0             | 0 | 1 | 1 | 1 | 0 |
| 15 | counter/delay5 output 8 bit                   | 0             | 0 | 1 | 1 | 1 | 1 |
| 16 | counter/delay6 output 8 bit                   | 0             | 1 | 0 | 0 | 0 | 0 |
| 17 | counter/delay 7 output 14 bit                 | 0             | 1 | 0 | 0 | 0 | 1 |
| 18 | DFF/LATCH_0 Q output with resetb or setb      | 0             | 1 | 0 | 0 | 1 | 0 |
| 19 | DFF/LATCH_0 nQ output with resetb or setb     | 0             | 1 | 0 | 0 | 1 | 1 |
| 20 | DFF/LATCH_1 output with resetb or setb        | 0             | 1 | 0 | 1 | 0 | 0 |
| 21 | DFF/LATCH_2 output with resetb or setb        | 0             | 1 | 0 | 1 | 0 | 1 |
| 22 | DFF/LATCH_3 output with resetb or setb        | 0             | 1 | 0 | 1 | 1 | 0 |
| 23 | DFF/LATCH_5 output                            | 0             | 1 | 0 | 1 | 1 | 1 |
| 24 | DFF/LATCH_6 output                            | 0             | 1 | 1 | 0 | 0 | 0 |
| 25 | LUT4_0 output                                 | 0             | 1 | 1 | 0 | 0 | 1 |
| 26 | LUT3_0 output                                 | 0             | 1 | 1 | 0 | 1 | 0 |
| 27 | LUT3_1 output                                 | 0             | 1 | 1 | 0 | 1 | 1 |
| 28 | LUT3_2 output                                 | 0             | 1 | 1 | 1 | 0 | 0 |
| 29 | LUT3_3 output                                 | 0             | 1 | 1 | 1 | 0 | 1 |
| 30 | LUT3_4 output                                 | 0             | 1 | 1 | 1 | 1 | 0 |
| 31 | LUT3_5 output                                 | 0             | 1 | 1 | 1 | 1 | 1 |
| 32 | LUT3_6 output                                 | 1             | 0 | 0 | 0 | 0 | 0 |
| 33 | LUT3_7 output                                 | 1             | 0 | 0 | 0 | 0 | 1 |
| 34 | LUT3_8 output (1st stage pipe 1 delay output) | 1             | 0 | 0 | 0 | 1 | 0 |
| 35 | LUT3_9 output                                 | 1             | 0 | 0 | 0 | 1 | 1 |
| 36 | LUT2_0 output (DFF/LATCH_4 output)            | 1             | 0 | 0 | 1 | 0 | 0 |
| 37 | LUT2_1 output                                 | 1             | 0 | 0 | 1 | 0 | 1 |

**Table 24. Matrix Input Table**

| N  | Matrix Input Signal Function                        | Matrix Decode |   |   |   |   |   |
|----|-----------------------------------------------------|---------------|---|---|---|---|---|
|    |                                                     | 5             | 4 | 3 | 2 | 1 | 0 |
| 38 | LUT2_2 output                                       | 1             | 0 | 0 | 1 | 1 | 0 |
| 39 | LUT2_3 output                                       | 1             | 0 | 0 | 1 | 1 | 1 |
| 40 | LUT2_4 output                                       | 1             | 0 | 1 | 0 | 0 | 0 |
| 41 | LUT2_5 output                                       | 1             | 0 | 1 | 0 | 0 | 1 |
| 42 | pipe1 delay output0                                 | 1             | 0 | 1 | 0 | 1 | 0 |
| 43 | pipe1 delay output1                                 | 1             | 0 | 1 | 0 | 1 | 1 |
| 44 | Edge detect output                                  | 1             | 0 | 1 | 1 | 0 | 0 |
| 45 | Programmable delay with edge detector               | 1             | 0 | 1 | 1 | 0 | 1 |
| 46 | internal oscillator output                          | 1             | 0 | 1 | 1 | 1 | 0 |
| 47 | internal oscillator divided by 4 output             | 1             | 0 | 1 | 1 | 1 | 1 |
| 48 | internal oscillator divided by 8, 12, 24, 64 output | 1             | 1 | 0 | 0 | 0 | 0 |
| 49 | internal oscillator divided by 3 output             | 1             | 1 | 0 | 0 | 0 | 1 |
| 50 | pin12 digital Input                                 | 1             | 1 | 0 | 0 | 1 | 0 |
| 51 | pin13 digital Input                                 | 1             | 1 | 0 | 0 | 1 | 1 |
| 52 | pin14 digital Input                                 | 1             | 1 | 0 | 1 | 0 | 0 |
| 53 | pin15 digital Input                                 | 1             | 1 | 0 | 1 | 0 | 1 |
| 54 | pin16 digital Input                                 | 1             | 1 | 0 | 1 | 1 | 0 |
| 55 | pin17 digital Input                                 | 1             | 1 | 0 | 1 | 1 | 1 |
| 56 | pin18 digital Input                                 | 1             | 1 | 1 | 0 | 0 | 0 |
| 57 | pin19 digital Input                                 | 1             | 1 | 1 | 0 | 0 | 1 |
| 58 | pin20 digital Input                                 | 1             | 1 | 1 | 0 | 1 | 0 |
| 59 | filter_0 output                                     | 1             | 1 | 1 | 0 | 1 | 1 |
| 60 | matrix input<48> divide by 3                        | 1             | 1 | 1 | 1 | 0 | 0 |
| 61 | filter_1 output                                     | 1             | 1 | 1 | 1 | 0 | 1 |
| 62 | Reset_core as matrix input                          | 1             | 1 | 1 | 1 | 1 | 0 |
| 63 | V <sub>DD</sub>                                     | 1             | 1 | 1 | 1 | 1 | 1 |

## 8.2 Matrix Output Table

Table 25. Matrix Output Table

| Register Bit Address | Matrix Output Signal Function                                          | Matrix Output Number |
|----------------------|------------------------------------------------------------------------|----------------------|
| reg<5:0>             | Matrix Out: PIN3 Digital Output Source                                 | 0                    |
| reg<11:6>            | Matrix Out: PIN4 Digital Output Source                                 | 1                    |
| reg<17:12>           | Matrix Out: PIN5 Digital Output Source                                 | 2                    |
| reg<23:18>           | Matrix Out: PIN6 Digital Output Source                                 | 3                    |
| reg<29:24>           | Matrix Out: PIN7 Digital Output Source                                 | 4                    |
| reg<35:30>           | Matrix Out: PIN8 Digital Output Source                                 | 5                    |
| reg<41:36>           | Matrix Out: PIN9 Digital Output Source                                 | 6                    |
| reg<47:42>           | Matrix Out: PIN10 Digital Output Source (Super Drive)                  | 7                    |
| reg<53:48>           | Matrix Out: Input for delay0 or Counter0 external clock                | 8                    |
| reg<59:54>           | Matrix Out: Input for delay1 or counter1 reset input                   | 9                    |
| reg<65:60>           | Matrix Out: Input for Counter1 external clock or delay1 external clock | 10                   |
| reg<71:66>           | Matrix Out: Input for delay2 or counter2 reset input                   | 11                   |
| reg<77:72>           | Matrix Out: Input for Counter2 external clock or delay2 external clock | 12                   |
| reg<83:78>           | Matrix Out: Input for delay3 or counter3 reset input                   | 13                   |
| reg<89:84>           | Matrix Out: Input for Counter3 external clock or delay3 external clock | 14                   |
| reg<95:90>           | Matrix Out: Input for delay4 or Counter4 external clock                | 15                   |
| reg<101:96>          | Matrix Out: Input for delay5 or Counter5 external clock                | 16                   |
| reg<107:102>         | Matrix Out: Input for delay6 or Counter6 external clock                | 17                   |
| reg<113:108>         | Matrix Out: Input for delay7 or Counter7 external clock                | 18                   |
| reg<119:114>         | Matrix Out: Clock Input of DFF0                                        | 19                   |
| reg<125:120>         | Matrix Out: Data Input of DFF0                                         | 20                   |
| reg<131:126>         | Matrix Out: Resetb (Setb) of DFF0                                      | 21                   |
| reg<137:132>         | Matrix Out: Clock Input of DFF1                                        | 22                   |
| reg<143:138>         | Matrix Out: Data Input of DFF1                                         | 23                   |
| reg<149:144>         | Matrix Out: Resetb (Setb) of DFF1                                      | 24                   |
| reg<155:150>         | Matrix Out: Clock Input of DFF2                                        | 25                   |
| reg<161:156>         | Matrix Out: Data Input of DFF2                                         | 26                   |
| reg<167:162>         | Matrix Out: Resetb (Setb) of DFF2                                      | 27                   |
| reg<173:168>         | Matrix Out: Clock Input of DFF3                                        | 28                   |
| reg<179:174>         | Matrix Out: Data Input of DFF3                                         | 29                   |
| reg<185:180>         | Matrix Out: Resetb (Setb) of DFF3                                      | 30                   |
| reg<191:186>         | Matrix Out: Clock Input of DFF5                                        | 31                   |
| reg<197:192>         | Matrix Out: Data Input of DFF5                                         | 32                   |
| reg<203:198>         | Matrix Out: Clock Input of DFF6                                        | 33                   |
| reg<209:204>         | Matrix Out: Data Input of DFF6                                         | 34                   |
| reg<215:210>         | Matrix Out: In0 of LUT4_0                                              | 35                   |
| reg<221:216>         | Matrix Out: In1 of LUT4_0                                              | 36                   |
| reg<227:222>         | Matrix Out: In2 of LUT4_0                                              | 37                   |

**Table 25. Matrix Output Table**

| Register Bit Address | Matrix Output Signal Function                     | Matrix Output Number |
|----------------------|---------------------------------------------------|----------------------|
| reg<233:228>         | Matrix Out: In3 of LUT4_0                         | 38                   |
| reg<239:234>         | Matrix Out: In0 of LUT3_0                         | 39                   |
| reg<245:240>         | Matrix Out: In1 of LUT3_0                         | 40                   |
| reg<251:246>         | Matrix Out: In2 of LUT3_0                         | 41                   |
| reg<257:252>         | Matrix Out: In0 of LUT3_1                         | 42                   |
| reg<263:258>         | Matrix Out: In1 of LUT3_1                         | 43                   |
| reg<269:264>         | Matrix Out: In2 of LUT3_1                         | 44                   |
| reg<275:270>         | Matrix Out: In0 of LUT3_2                         | 45                   |
| reg<281:276>         | Matrix Out: In1 of LUT3_2                         | 46                   |
| reg<287:282>         | Matrix Out: In2 of LUT3_2                         | 47                   |
| reg<293:288>         | Matrix Out: In0 of LUT3_3                         | 48                   |
| reg<299:294>         | Matrix Out: In1 of LUT3_3                         | 49                   |
| reg<305:300>         | Matrix Out: In2 of LUT3_3                         | 50                   |
| reg<311:306>         | Matrix Out: In0 of LUT3_4                         | 51                   |
| reg<317:312>         | Matrix Out: In1 of LUT3_4                         | 52                   |
| reg<323:318>         | Matrix Out: In2 of LUT3_4                         | 53                   |
| reg<329:324>         | Matrix Out: In0 of LUT3_5                         | 54                   |
| reg<335:330>         | Matrix Out: In1 of LUT3_5                         | 55                   |
| reg<341:336>         | Matrix Out: In2 of LUT3_5                         | 56                   |
| reg<347:342>         | Matrix Out: In0 of LUT3_6                         | 57                   |
| reg<353:348>         | Matrix Out: In1 of LUT3_6                         | 58                   |
| reg<359:354>         | Matrix Out: In2 of LUT3_6                         | 59                   |
| reg<365:360>         | Matrix Out: In0 of LUT3_7                         | 60                   |
| reg<371:366>         | Matrix Out: In1 of LUT3_7                         | 61                   |
| reg<377:372>         | Matrix Out: In2 of LUT3_7                         | 62                   |
| reg<383:378>         | Matrix Out: In0 of LUT3_8 or Input of Pipe delay  | 63                   |
| reg<389:384>         | Matrix Out: In1 of LUT3_8 or Resetb of Pipe delay | 64                   |
| reg<395:390>         | Matrix Out: In2 of LUT3_8 or Clock of Pipe delay  | 65                   |
| reg<401:396>         | Matrix Out: In0 of LUT3_9                         | 66                   |
| reg<407:402>         | Matrix Out: In1 of LUT3_9                         | 67                   |
| reg<413:408>         | Matrix Out: In2 of LUT3_9                         | 68                   |
| reg<419:414>         | Matrix Out: In0 of LUT2_0 or Clock Input of DFF4  | 69                   |
| reg<425:420>         | Matrix Out: In1 of LUT2_0 or Data Input of DFF4   | 70                   |
| reg<431:426>         | Matrix Out: In0 of LUT2_1                         | 71                   |
| reg<437:432>         | Matrix Out: In1 of LUT2_1                         | 72                   |
| reg<443:438>         | Matrix Out: In0 of LUT2_2                         | 73                   |
| reg<449:444>         | Matrix Out: In1 of LUT2_2                         | 74                   |
| reg<455:450>         | Matrix Out: In0 of LUT2_3                         | 75                   |
| reg<461:456>         | Matrix Out: In1 of LUT2_3                         | 76                   |

**Table 25. Matrix Output Table**

| Register Bit Address | Matrix Output Signal Function                            | Matrix Output Number |
|----------------------|----------------------------------------------------------|----------------------|
| reg<467:462>         | Matrix Out: In0 of LUT2_4                                | 77                   |
| reg<473:468>         | Matrix Out: In1 of LUT2_4                                | 78                   |
| reg<439:474>         | Matrix Out: In0 of LUT2_5                                | 79                   |
| reg<485:480>         | Matrix Out: In1 of LUT2_5                                | 80                   |
| reg<491:486>         | Matrix Out: Input for programmable delay & edge detector | 81                   |
| reg<497:492>         | Matrix Out: Power down for osc                           | 82                   |
| reg<503:498>         | Matrix Out: Pin12 Digital Output Source (Super Drive)    | 83                   |
| reg<509:504>         | Matrix Out: Pin13 Digital Output Source                  | 84                   |
| reg<515:510>         | Matrix Out: Pin14 Digital Output Source                  | 85                   |
| reg<521:516>         | Matrix Out: Pin15 Digital Output Source                  | 86                   |
| reg<527:522>         | Matrix Out: Pin16 Digital Output Source                  | 87                   |
| reg<533:528>         | Matrix Out: Pin17 Digital Output Source                  | 88                   |
| reg<539:534>         | Matrix Out: Pin18 Digital Output Source                  | 89                   |
| reg<545:540>         | Matrix Out: Pin19 Digital Output Source                  | 90                   |
| reg<551:546>         | Matrix Out: Pin20 Digital Output Source                  | 91                   |
| reg<557:552>         | Matrix Out: Input of filter_0                            | 92                   |
| reg<563:558>         | Matrix Out: Input of filter_1                            | 93                   |
| reg<569:564>         | Reserved                                                 | 94                   |

## 9.0 Combinatorial Logic

Combinatorial logic is supported via fifteen Lookup Tables (LUTs) within the SLG46722. There are five 2-bit LUTs, nine 3-bit LUTs, and one 4-bit LUT. The device also includes two Combination Function Macrocells that can be used as LUTs. For more details, please see Section 10.0 Combination Function Macrocells.

Inputs/Outputs for the fifteen LUTs are configured from the connection matrix with specific logic functions being defined by the state of NVM bits. The outputs of the LUTs can be configured to any user defined function, including the following standard digital logic devices (AND, NAND, OR, NOR, XOR, XNOR).

### 9.1 2-Bit LUT

The five 2-bit LUTs each take in two input signals from the connection matrix and produce a single output, which goes back into the connection matrix.

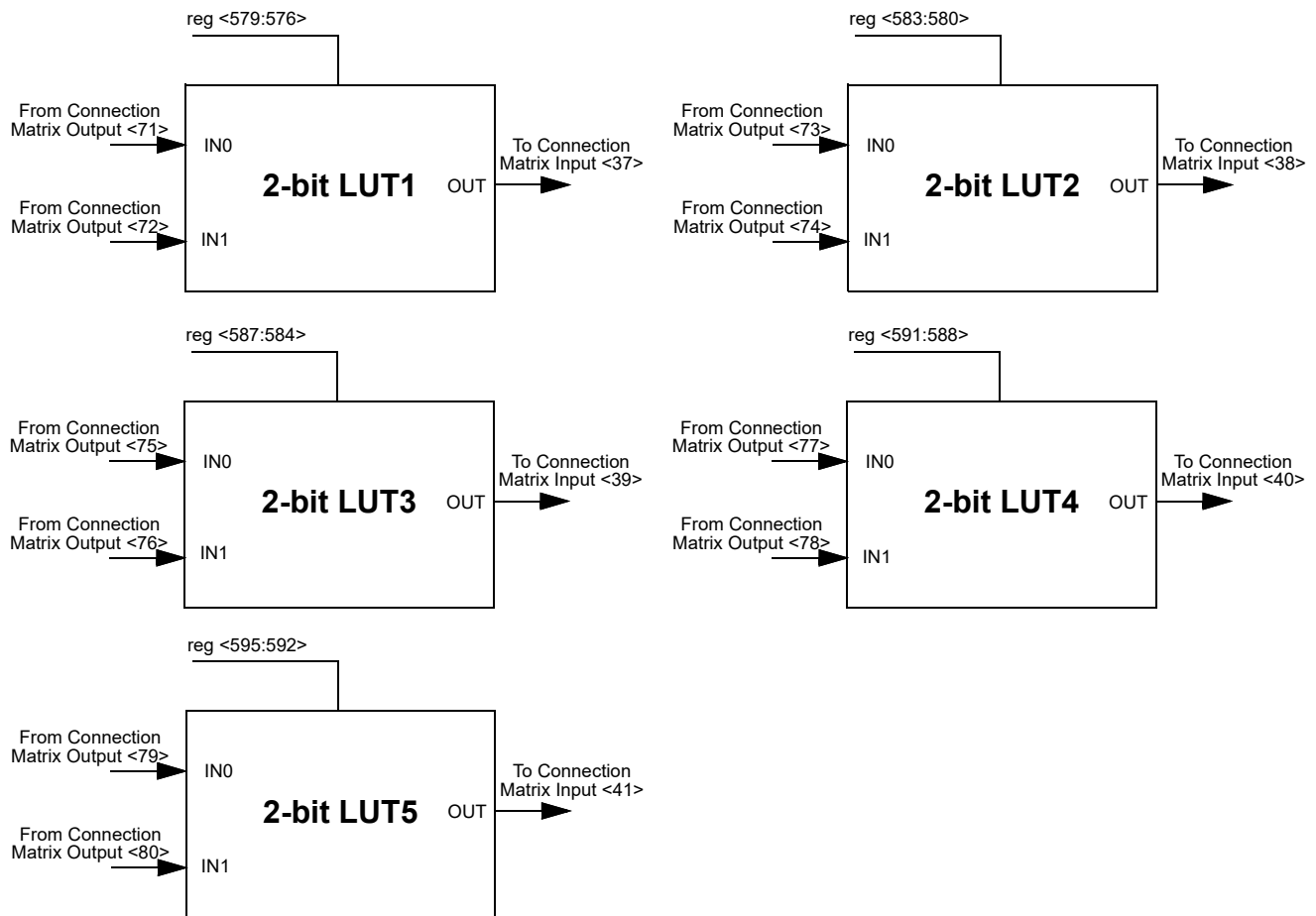


Figure 6. 2-bit LUTs

**Table 26. 2-bit LUT1 Truth Table.**

| IN1 | IN0 | OUT       |
|-----|-----|-----------|
| 0   | 0   | reg <576> |
| 0   | 1   | reg <577> |
| 1   | 0   | reg <578> |
| 1   | 1   | reg <579> |

**Table 27. 2-bit LUT2 Truth Table.**

| IN1 | IN0 | OUT       |
|-----|-----|-----------|
| 0   | 0   | reg <580> |
| 0   | 1   | reg <581> |
| 1   | 0   | reg <582> |
| 1   | 1   | reg <583> |

**Table 28. 2-bit LUT3 Truth Table.**

| IN1 | IN0 | OUT       |
|-----|-----|-----------|
| 0   | 0   | reg <584> |
| 0   | 1   | reg <585> |
| 1   | 0   | reg <586> |
| 1   | 1   | reg <587> |

**Table 29. 2-bit LUT4 Truth Table.**

| IN1 | IN0 | OUT       |
|-----|-----|-----------|
| 0   | 0   | reg <588> |
| 0   | 1   | reg <589> |
| 1   | 0   | reg <590> |
| 1   | 1   | reg <591> |

**Table 30. 2-bit LUT5 Truth Table.**

| IN1 | IN0 | OUT       |
|-----|-----|-----------|
| 0   | 0   | reg <592> |
| 0   | 1   | reg <593> |
| 1   | 0   | reg <594> |
| 1   | 1   | reg <595> |

Each 2-bit LUT uses a 4-bit register signal to define their output functions;

*2-Bit LUT1 is defined by reg<579:576>*

*2-Bit LUT2 is defined by reg<583:580>*

*2-Bit LUT3 is defined by reg<587:584>*

*2-Bit LUT4 is defined by reg<591:588>*

*2-Bit LUT5 is defined by reg<595:592>*

The table below shows the register bits for the standard digital logic devices (AND, NAND, OR, NOR, XOR, XNOR) that can be created within each of the four 2-bit LUT logic cells.

**Table 31. 2-bit LUT Standard Digital Functions.**

| Function | MSB |   |   | LSB |
|----------|-----|---|---|-----|
| AND-2    | 1   | 0 | 0 | 0   |
| NAND-2   | 0   | 1 | 1 | 1   |
| OR-2     | 1   | 1 | 1 | 0   |
| NOR-2    | 0   | 0 | 0 | 1   |
| XOR-2    | 0   | 1 | 1 | 0   |
| XNOR-2   | 1   | 0 | 0 | 1   |

## 9.2 3-Bit LUT

The nine 3-bit LUTs each take in three input signals from the connection matrix and produce a single output, which goes back into the connection matrix.

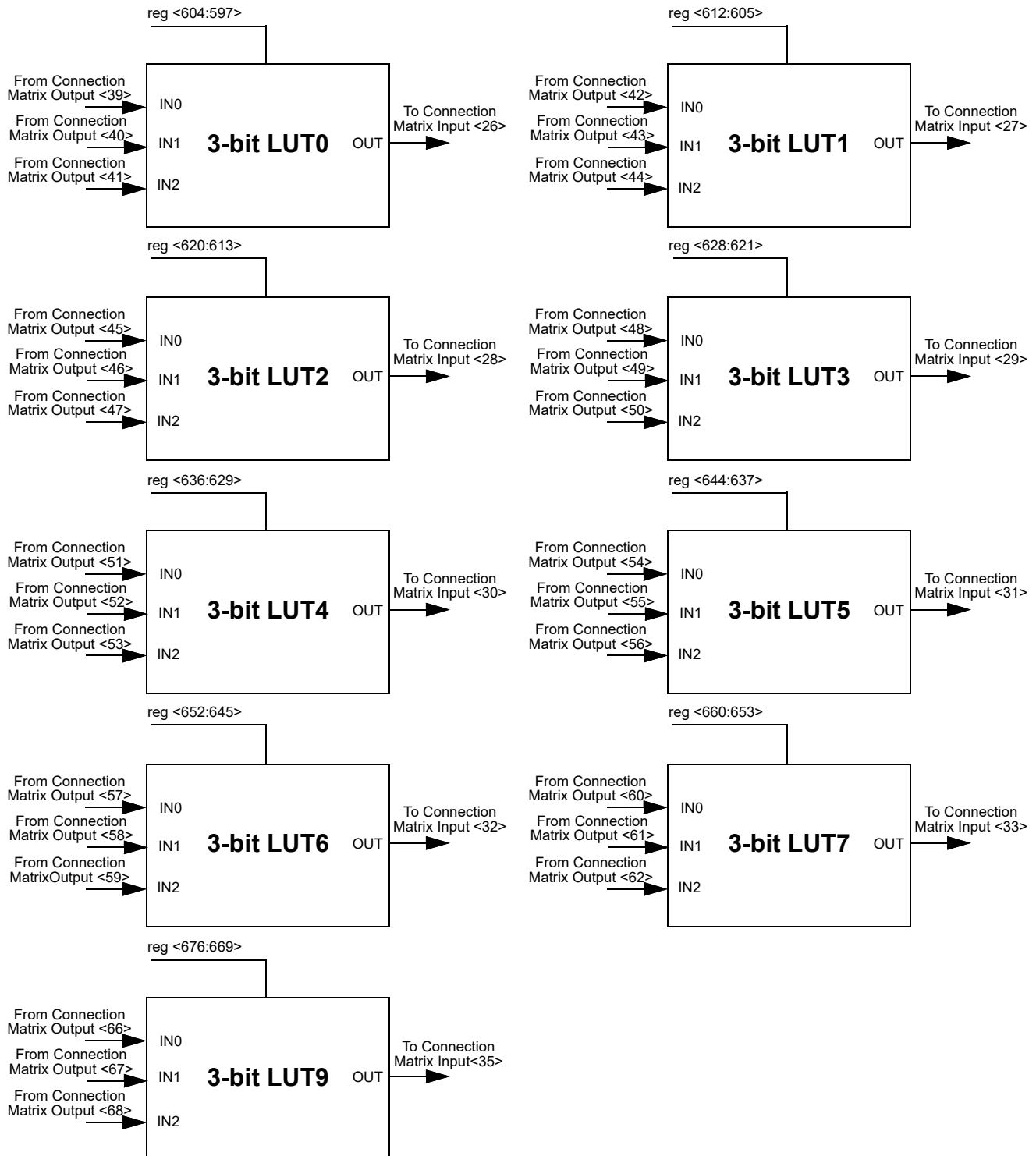


Figure 7. 3-bit LUTs

**Table 32. 3-bit LUT0 Truth Table.**

| IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----------|
| 0   | 0   | 0   | reg <597> |
| 0   | 0   | 1   | reg <598> |
| 0   | 1   | 0   | reg <599> |
| 0   | 1   | 1   | reg <600> |
| 1   | 0   | 0   | reg <601> |
| 1   | 0   | 1   | reg <602> |
| 1   | 1   | 0   | reg <603> |
| 1   | 1   | 1   | reg <604> |

**Table 33. 3-bit LUT1 Truth Table.**

| IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----------|
| 0   | 0   | 0   | reg <605> |
| 0   | 0   | 1   | reg <606> |
| 0   | 1   | 0   | reg <607> |
| 0   | 1   | 1   | reg <608> |
| 1   | 0   | 0   | reg <609> |
| 1   | 0   | 1   | reg <610> |
| 1   | 1   | 0   | reg <611> |
| 1   | 1   | 1   | reg <612> |

**Table 34. 3-bit LUT2 Truth Table.**

| IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----------|
| 0   | 0   | 0   | reg <613> |
| 0   | 0   | 1   | reg <614> |
| 0   | 1   | 0   | reg <615> |
| 0   | 1   | 1   | reg <616> |
| 1   | 0   | 0   | reg <617> |
| 1   | 0   | 1   | reg <618> |
| 1   | 1   | 0   | reg <619> |
| 1   | 1   | 1   | reg <620> |

**Table 35. 3-bit LUT3 Truth Table.**

| IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----------|
| 0   | 0   | 0   | reg <621> |
| 0   | 0   | 1   | reg <622> |
| 0   | 1   | 0   | reg <623> |
| 0   | 1   | 1   | reg <624> |
| 1   | 0   | 0   | reg <625> |
| 1   | 0   | 1   | reg <626> |
| 1   | 1   | 0   | reg <627> |
| 1   | 1   | 1   | reg <628> |

**Table 36. 3-bit LUT4 Truth Table.**

| IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----------|
| 0   | 0   | 0   | reg <629> |
| 0   | 0   | 1   | reg <630> |
| 0   | 1   | 0   | reg <631> |
| 0   | 1   | 1   | reg <632> |
| 1   | 0   | 0   | reg <633> |
| 1   | 0   | 1   | reg <634> |
| 1   | 1   | 0   | reg <635> |
| 1   | 1   | 1   | reg <636> |

**Table 37. 3-bit LUT5 Truth Table.**

| IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----------|
| 0   | 0   | 0   | reg <637> |
| 0   | 0   | 1   | reg <638> |
| 0   | 1   | 0   | reg <639> |
| 0   | 1   | 1   | reg <640> |
| 1   | 0   | 0   | reg <641> |
| 1   | 0   | 1   | reg <642> |
| 1   | 1   | 0   | reg <643> |
| 1   | 1   | 1   | reg <644> |

**Table 38. 3-bit LUT6 Truth Table.**

| IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----------|
| 0   | 0   | 0   | reg <645> |
| 0   | 0   | 1   | reg <646> |
| 0   | 1   | 0   | reg <647> |
| 0   | 1   | 1   | reg <648> |
| 1   | 0   | 0   | reg <649> |
| 1   | 0   | 1   | reg <650> |
| 1   | 1   | 0   | reg <651> |
| 1   | 1   | 1   | reg <652> |

**Table 39. 3-bit LUT7 Truth Table.**

| IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----------|
| 0   | 0   | 0   | reg <653> |
| 0   | 0   | 1   | reg <654> |
| 0   | 1   | 0   | reg <655> |
| 0   | 1   | 1   | reg <656> |
| 1   | 0   | 0   | reg <657> |
| 1   | 0   | 1   | reg <658> |
| 1   | 1   | 0   | reg <659> |
| 1   | 1   | 1   | reg <660> |

**Table 40. 3-bit LUT9 Truth Table.**

| IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----------|
| 0   | 0   | 0   | reg <669> |
| 0   | 0   | 1   | reg <670> |
| 0   | 1   | 0   | reg <671> |
| 0   | 1   | 1   | reg <672> |
| 1   | 0   | 0   | reg <673> |
| 1   | 0   | 1   | reg <674> |
| 1   | 1   | 0   | reg <675> |
| 1   | 1   | 1   | reg <676> |

Each 3-bit LUT uses a 8-bit register signal to define their output functions;

*3-Bit LUT1 is defined by reg<604:597>*

*3-Bit LUT2 is defined by reg<612:605>*

*3-Bit LUT3 is defined by reg<620:613>*

*3-Bit LUT4 is defined by reg<628:621>*

*3-Bit LUT5 is defined by reg<636:629>*

*3-Bit LUT6 is defined by reg<644:637>*

*3-Bit LUT7 is defined by reg<652:645>*

*3-Bit LUT8 is defined by reg<660:653>*

*3-Bit LUT9 is defined by reg<676:669>*

The table below shows the register bits for the standard digital logic devices (AND, NAND, OR, NOR, XOR, XNOR) that can be created within each of the six 3-bit LUT logic cells.

**Table 41. 3-bit LUT Standard Digital Functions.**

| Function | MSB |   |   |   |   |   |   | LSB |
|----------|-----|---|---|---|---|---|---|-----|
| AND-3    | 1   | 0 | 0 | 0 | 0 | 0 | 0 | 0   |
| NAND-3   | 0   | 1 | 1 | 1 | 1 | 1 | 1 | 1   |
| OR-3     | 1   | 1 | 1 | 1 | 1 | 1 | 1 | 0   |
| NOR-3    | 0   | 0 | 0 | 0 | 0 | 0 | 0 | 1   |
| XOR-3    | 1   | 0 | 0 | 1 | 0 | 1 | 1 | 0   |
| XNOR-3   | 0   | 1 | 1 | 0 | 1 | 0 | 0 | 1   |

### 9.3 4-Bit LUT

The one 4-bit LUT takes in four input signals from the connection matrix and produces a single output, which goes back into the connection matrix.

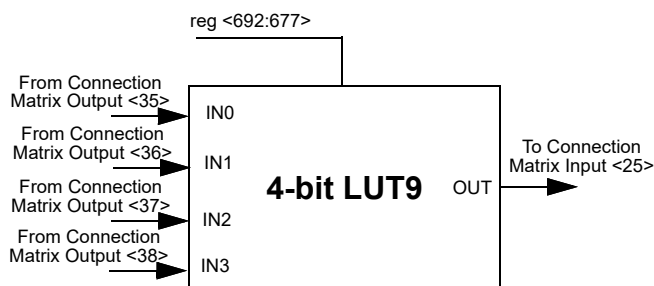


Figure 8. 2-bit LUTs

Table 42. 4-bit LUT0 Truth Table.

| IN3 | IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----|-----------|
| 0   | 0   | 0   | 0   | reg <677> |
| 0   | 0   | 0   | 1   | reg <678> |
| 0   | 0   | 1   | 0   | reg <679> |
| 0   | 0   | 1   | 1   | reg <680> |
| 0   | 1   | 0   | 0   | reg <681> |
| 0   | 1   | 0   | 1   | reg <682> |
| 0   | 1   | 1   | 0   | reg <683> |
| 0   | 1   | 1   | 1   | reg <684> |
| 1   | 0   | 0   | 0   | reg <685> |
| 1   | 0   | 0   | 1   | reg <686> |
| 1   | 0   | 1   | 0   | reg <687> |
| 1   | 0   | 1   | 1   | reg <688> |
| 1   | 1   | 0   | 0   | reg <689> |
| 1   | 1   | 0   | 1   | reg <690> |
| 1   | 1   | 1   | 0   | reg <691> |
| 1   | 1   | 1   | 1   | reg <692> |

The 4-bit LUT uses a 16-bit register signal to define the output function;

*4-Bit LUT0 is defined by reg<692:677>*

The table below shows the register bits for the standard digital logic devices (AND, NAND, OR, NOR, XOR, XNOR) that can be created within the 4-bit LUT logic cell.

Table 43. 4-bit LUT Standard Digital Functions

| Function | MSB |   |   |   |   |   |   |   |   |   |   |   |   |   |   | LSB |
|----------|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----|
| AND-4    | 1   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0   |
| NAND-4   | 0   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1   |
| OR-4     | 1   | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0   |
| NOR-4    | 0   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1   |
| XOR-4    | 0   | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0   |
| XNOR-4   | 1   | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1   |

## 10.0 Combination Function Macrocells

The SLG46722 has two combination function macrocells that can serve more than one logic or timing function. In each case, they can serve as a Look Up Table (LUT), or as another logic or timing function. See the list below for the functions that can be implemented in these macrocells;

- One macrocell that can serve as either 2-bit LUT or as D Flip Flop
- One macrocell that can serve as either 3-bit LUT or as Pipe Delay

Inputs/Outputs for the two combination function macrocells are configured from the connection matrix with specific logic functions being defined by the state of NVM bits. When used as a LUT to implement combinatorial logic functions, the outputs of the LUTs can be configured to any user defined function, including the following standard digital logic devices (AND, NAND, OR, NOR, XOR, XNOR).

### 10.1 2-Bit LUT or D Flip Flop Macrocells

There is one macrocell that can serve as either a 2-bit LUT or as a D Flip Flop. When used to implement LUT function, the 2-bit LUT takes in two input signals from the connection matrix and produce a single output, which goes back into the connection matrix. When used to implement D Flip Flop function, the two input signals from the connection matrix go to the data (d) and clock (clk) inputs for the Flip Flop, with the output going back to the connection matrix.

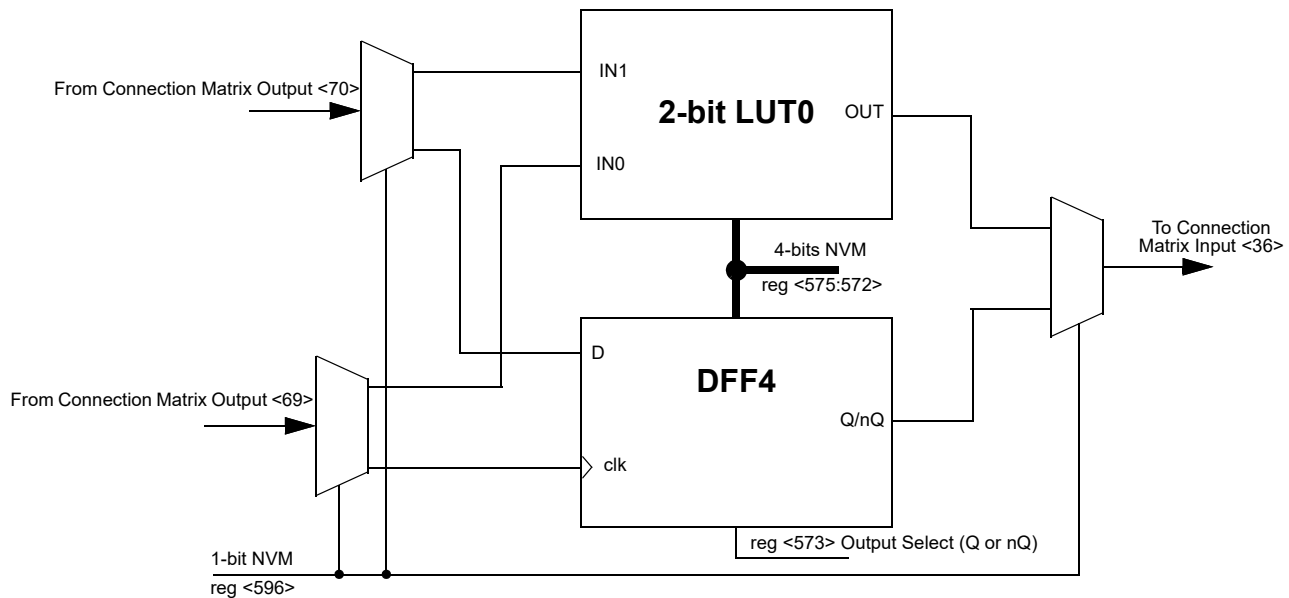


Figure 9. 2-bit LUT0 or DFF4

#### 10.1.1 2-Bit LUT or D Flip Flop Macrocells Used as 2-Bit LUTs

Table 44. 2-bit LUT0 Truth Table.

| IN1 | IN0 | OUT       |
|-----|-----|-----------|
| 0   | 0   | reg <572> |
| 0   | 1   | reg <573> |
| 1   | 0   | reg <574> |
| 1   | 1   | reg <575> |

Each Macrocell, when programmed for a LUT function, uses a 4-bit register to define their output function:

*2-Bit LUT0 is defined by reg<575:572>*

## 10.1.2 2-Bit LUT or D Flip Flop Macrocells Used as D Flip Flop Register Settings

**Table 45. DFF4 Register Settings**

| Signal Function              | Register Bit Address | Register Definition                  |
|------------------------------|----------------------|--------------------------------------|
| LUT2_0 or DFF4 Select        | 596                  | 0: LUT2_0<br>1: DFF4                 |
| DFF4 or Latch Select         | 572                  | 0: DFF function<br>1: Latch function |
| DFF4 Output Select           | 573                  | 0: Q output<br>1: nQ output          |
| DFF4 Initial Polarity Select | 574                  | 0: Low<br>1: High                    |

## 10.2 3-Bit LUT or Pipe Delay Macrocell

There is one macrocell that can serve as either a 3-bit LUT or as a Pipe Delay.

When used to implement LUT functions, the 3-bit LUT take in three input signals from the connection matrix and produces a single output, which goes back into the connection matrix.

When used as a pipe delay, there are three inputs signals from the matrix, Input (IN), Clock (CLK) and Reset (RST). The pipe delay cell is built from 16 D Flip-Flop logic cells that provide the three delay options, two of which are user selectable. The DFF cells are tied in series where the output (Q) of each delay cell goes to the next DFF cell. The first delay option (OUT2) is fixed at the output of the first flip-flop stage. The other two outputs (OUT0 and OUT1) provide user selectable options for 1 – 16 stages of delay. There are delay output points for each set of the OUT0 and OUT1 outputs to a 4-input mux that is controlled by reg <664:661> for OUT0 and reg <668:665> for OUT1. The 4-input mux is used to control the selection of the amount of delay.

The overall time of the delay is based on the clock used in the SLG46722 design. Each DFF cell has a time delay of the inverse of the clock time (either external clock or the RC Oscillator within the SLG46722). The sum of the number of DFF cells used will be the total time delay of the Pipe Delay logic cell.

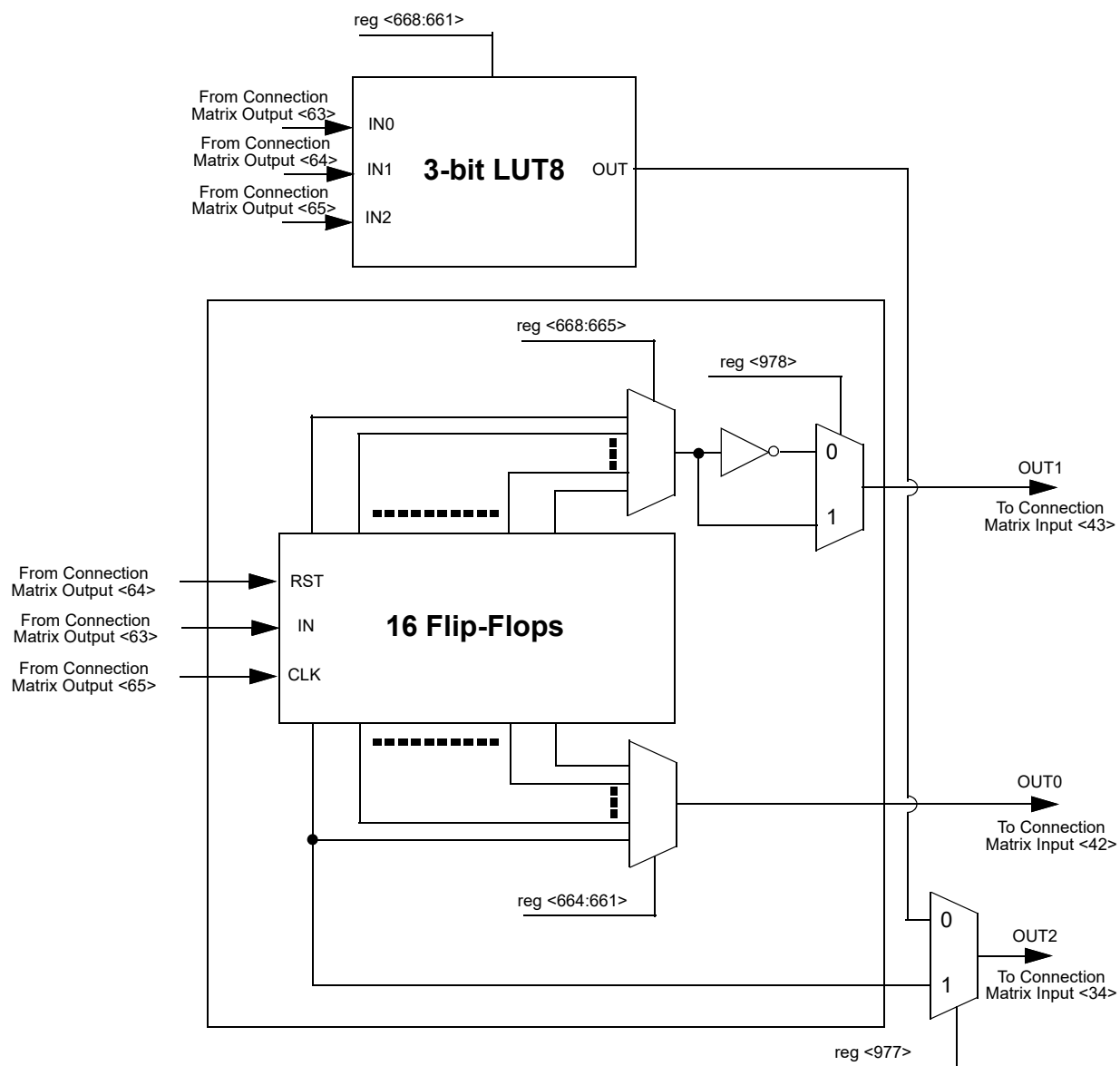


Figure 10. 3-bit LUT8 or Pipe Delay

## 10.2.1 3-Bit LUT or Pipe Delay Macrocells Used as 3-Bit LUTs

**Table 46. 3-bit LUT8 Truth Table.**

| IN2 | IN1 | IN0 | OUT       |
|-----|-----|-----|-----------|
| 0   | 0   | 0   | reg <661> |
| 0   | 0   | 1   | reg <662> |
| 0   | 1   | 0   | reg <663> |
| 0   | 1   | 1   | reg <664> |
| 1   | 0   | 0   | reg <665> |
| 1   | 0   | 1   | reg <666> |
| 1   | 1   | 0   | reg <667> |
| 1   | 1   | 1   | reg <668> |

Each Macrocell, when programmed for a LUT function, uses a 8-bit register to define their output function:

*3-Bit LUT8 is defined by reg<668:661>*

## 10.2.2 3-Bit LUT or Pipe Delay Macrocells Used as Pipe Delay Register Settings

**Table 47. Pipe Delay Register Settings**

| Signal Function                     | Register Bit Address | Register Definition                 |
|-------------------------------------|----------------------|-------------------------------------|
| LUT3_8 or Pipe Delay Output Select  | reg<977>             | 0: LUT3_8<br>1: 1 Pipe Delay Output |
| OUT0 select                         | reg<664:661>         |                                     |
| OUT1 select                         | reg<668:665>         |                                     |
| Pipe delay OUT1 Polarity Select Bit | reg<978>             | 0: Non-inverted<br>1: Inverted      |

## 11.0 Digital Storage Elements (DFFs/Latches)

There are six D Flip Flop / Latches (DFF/Latch logic cells within the SLG46722 available for design. The source and destination of the inputs and outputs for the DFF/Latches are configured from the connection matrix. All DFF/Latch macrocells have user selection for initial state. DFF0 has the option to connect both the Q and Q Bar outputs to the connection matrix, DFF1, DFF2, DFF3, DFF5 and DFF6 can only connect the Q output to the matrix. The macrocells DFF0, DFF1, DFF2 and DFF3 have an additional input from the matrix that can serve as a nSet or nReset function to the macrocell.

Note that one of the Combination Function Macrocells (LUT 2\_0 / DFF4) can also operate as a DFF or a 2-bit LUT please see Section 10.1 2-Bit LUT or D Flip Flop Macrocells for the description of this Combination Function macrocell.

The operation of the D Flip-Flop and Latch will follow the functional descriptions below:

DFF: CLK is rising edge triggered, then  $Q = D$ ; otherwise Q will not change

Latch: if CLK = 0, then  $Q = D$

if CLK = 1, then Q will not change

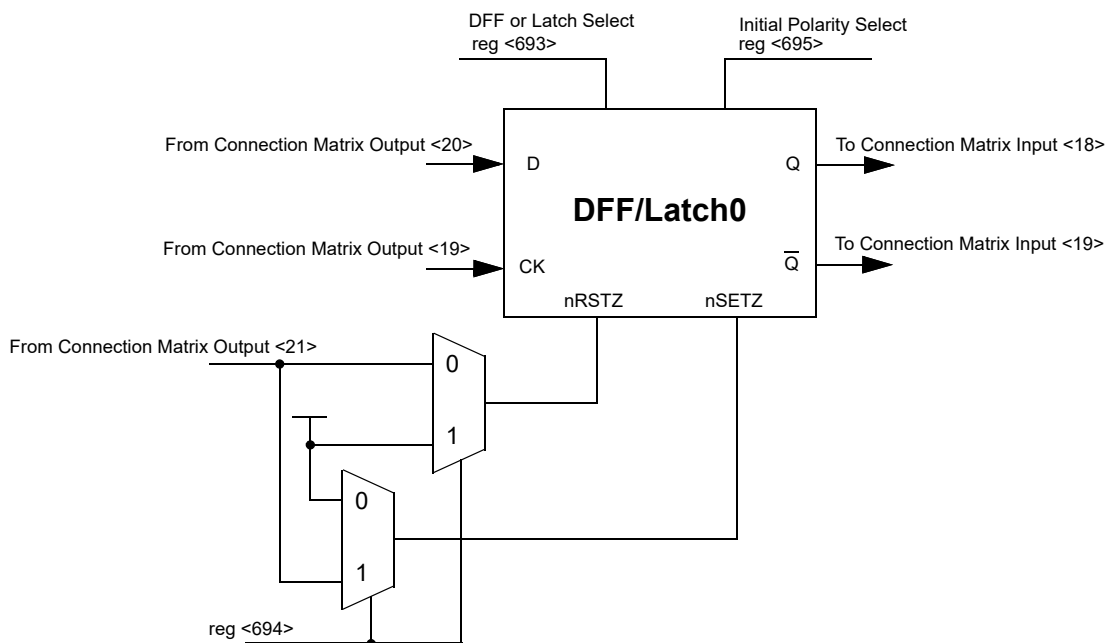


Figure 11. DFF/Latch0

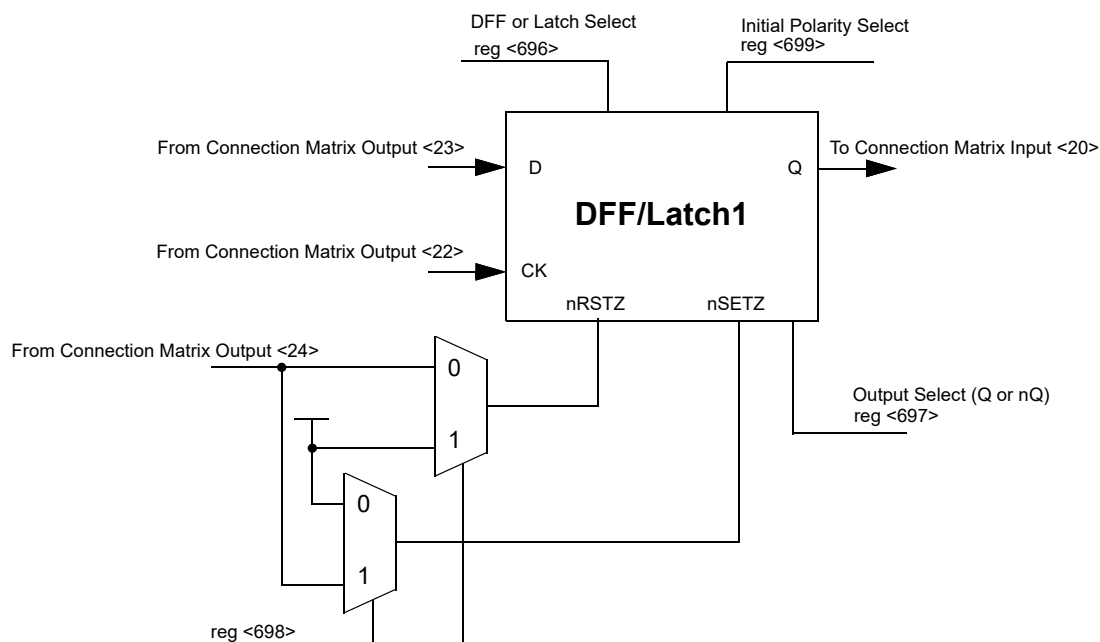


Figure 12. DFF/Latch1

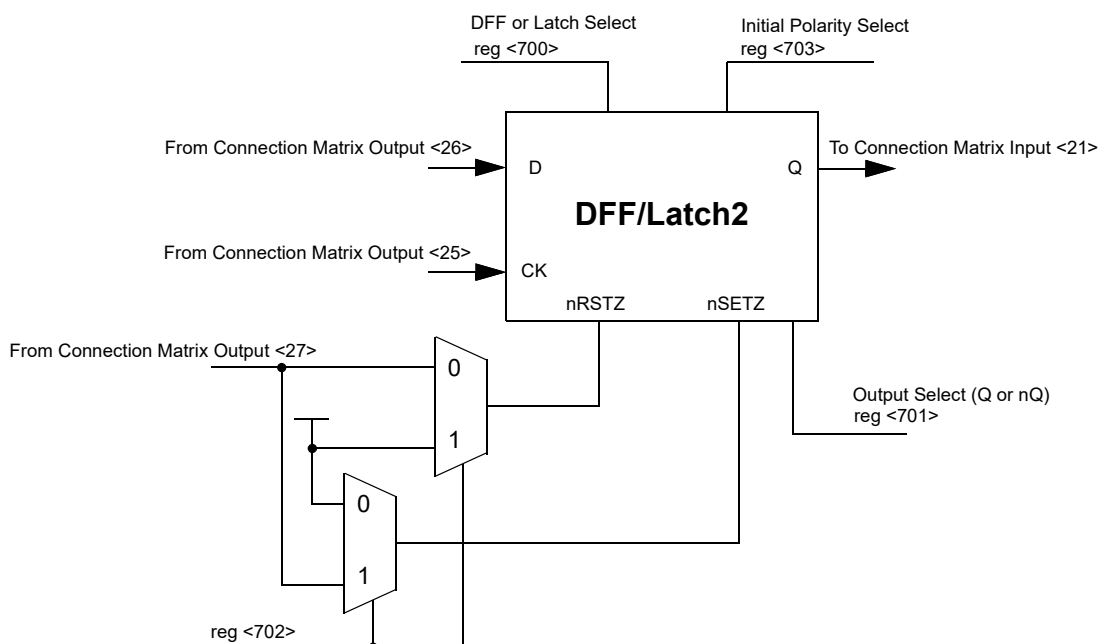


Figure 13. DFF/Latch2

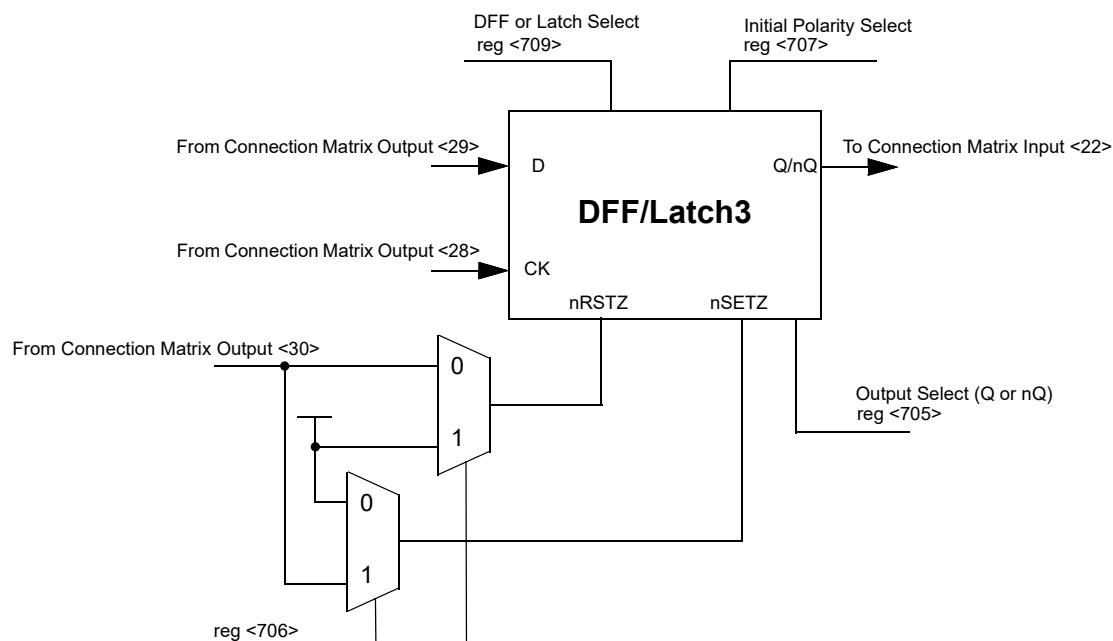


Figure 14. DFF/Latch3

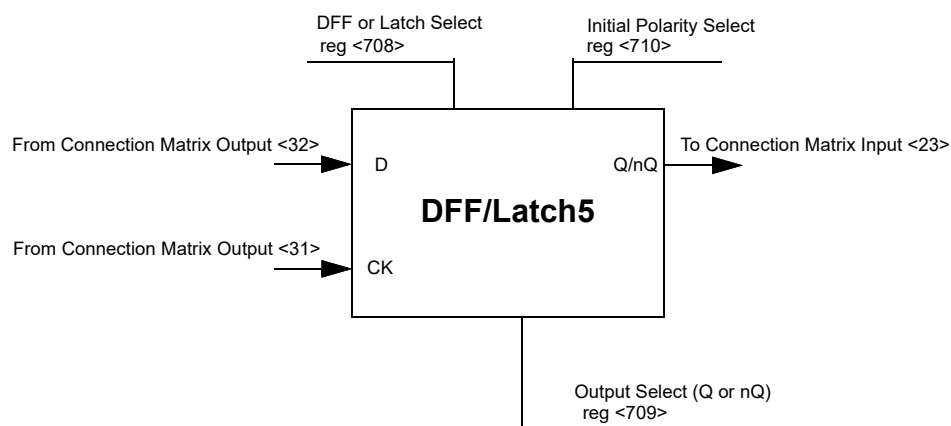


Figure 15. DFF/Latch5

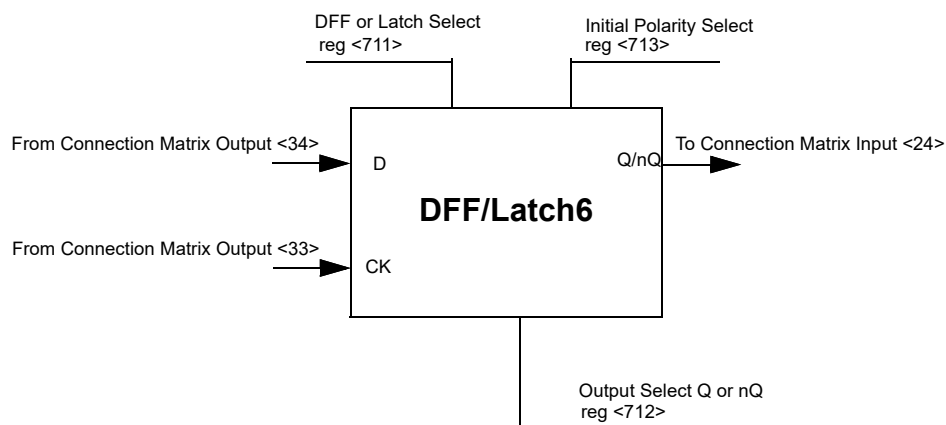


Figure 16. DFF/Latch6

## 11.1 Initial Polarity Operations

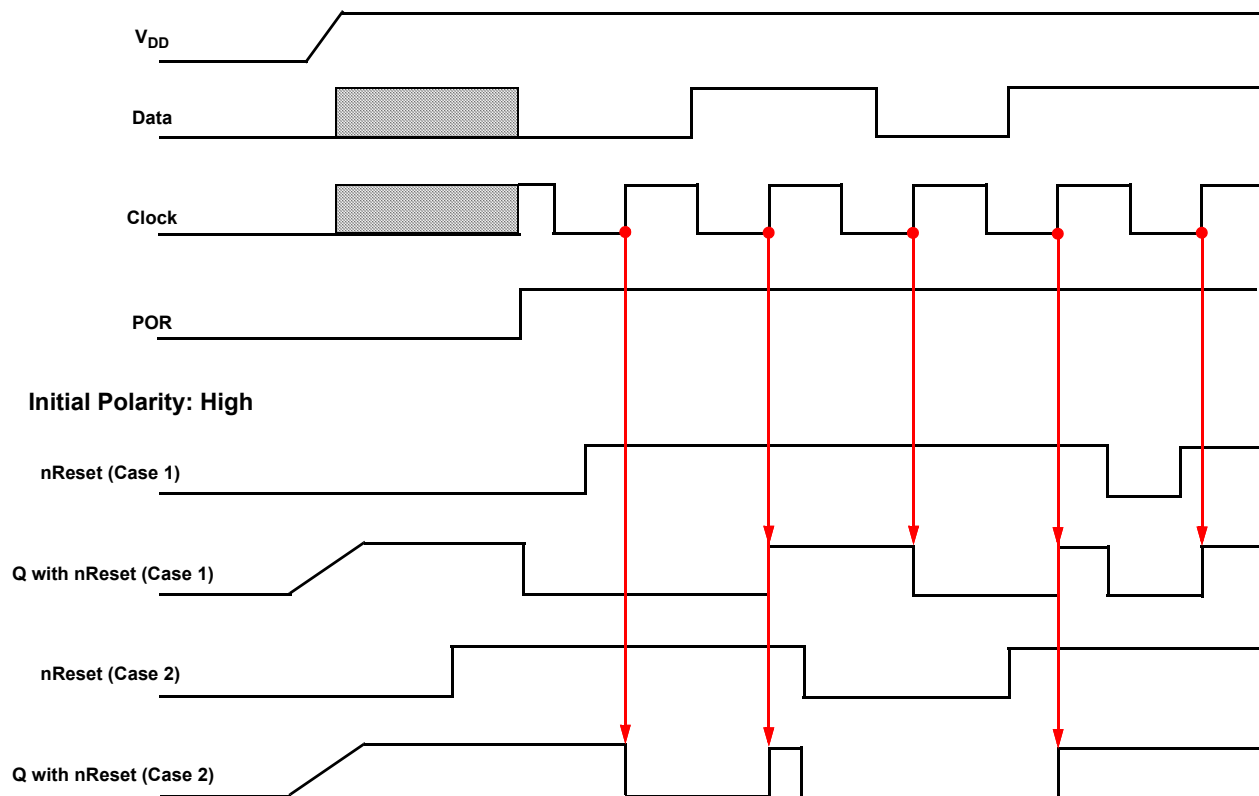


Figure 17. DFF Polarity Operations

## 12.0 Counters/Delay Generators (CNT/DLY)

There are eight configurable counters/delay generators in the SLG46722. Two of these counters/delay generators are 14-bit (CNT/DLY 0 and 1), and six of the counters/delay generators are 8-bit (CNT/DLY 2, 3, 4, 5, 6, 7). For flexibility, each of these macrocells has a large selection of internal and external clock sources, as well as the option to chain from the output of the previous (N-1) CNT/DLY macrocell, to implement longer count / delay circuits.

Three of the counter/delay generator macrocells (CNT/DLY, 1,2,3) have two inputs from the connection matrix, one for Delay Input/Reset Input (Delay\_In/Reset\_In), and one for an external counter/clock source. Five of the counter/delay generator macrocells (CNT/DLY 0, 4, 5, 6, 7) have one input from the connection matrix, which has a shared function of either a Delay Input or an external clock input.

*Note: Counters initialize with counter data=0 after POR.*

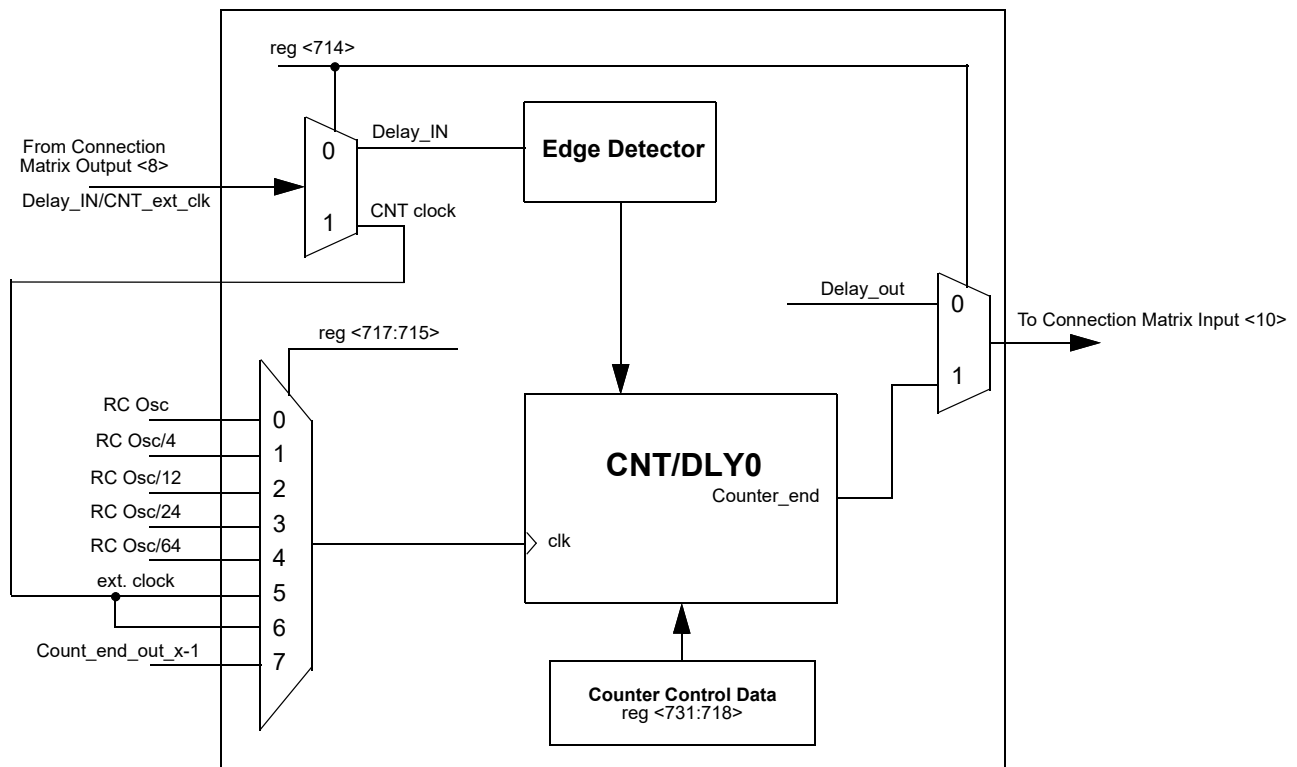


Figure 18. CNT/DLY0

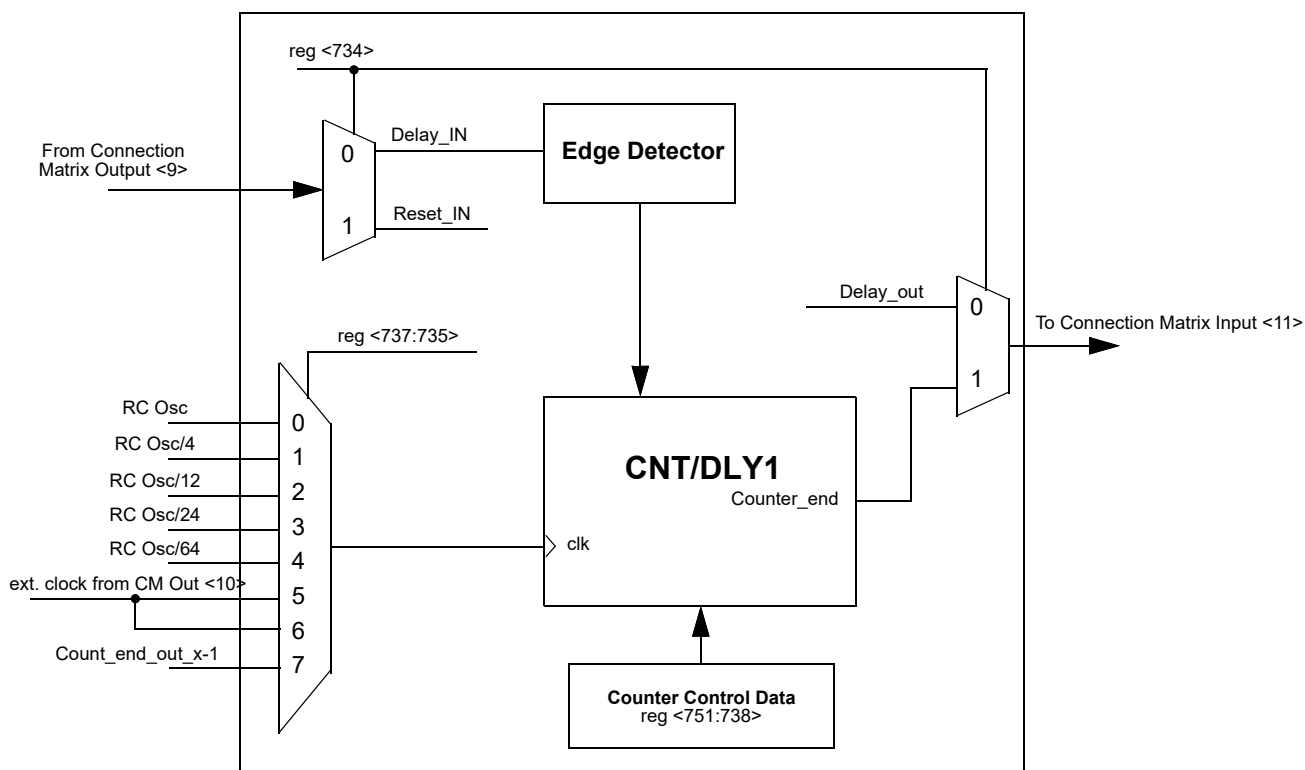


Figure 19. CNT/DLY1

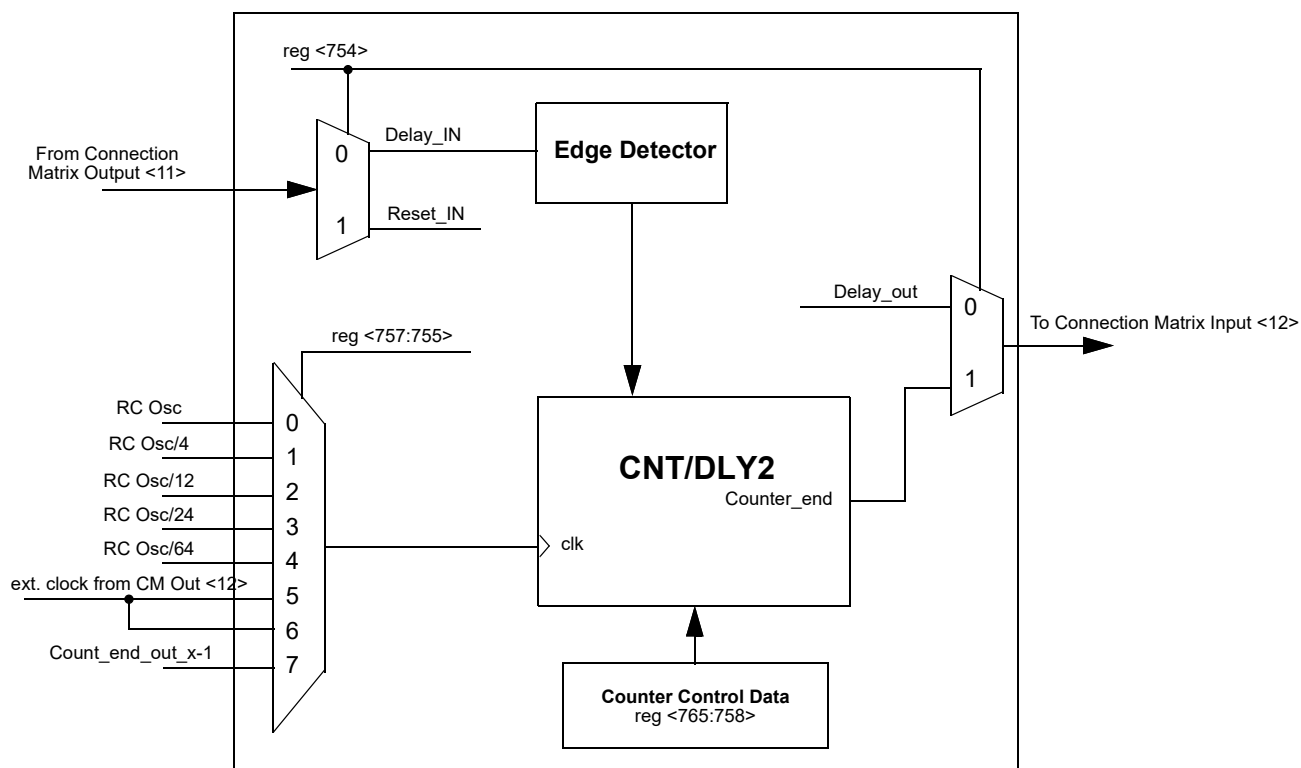


Figure 20. CNT/DLY2

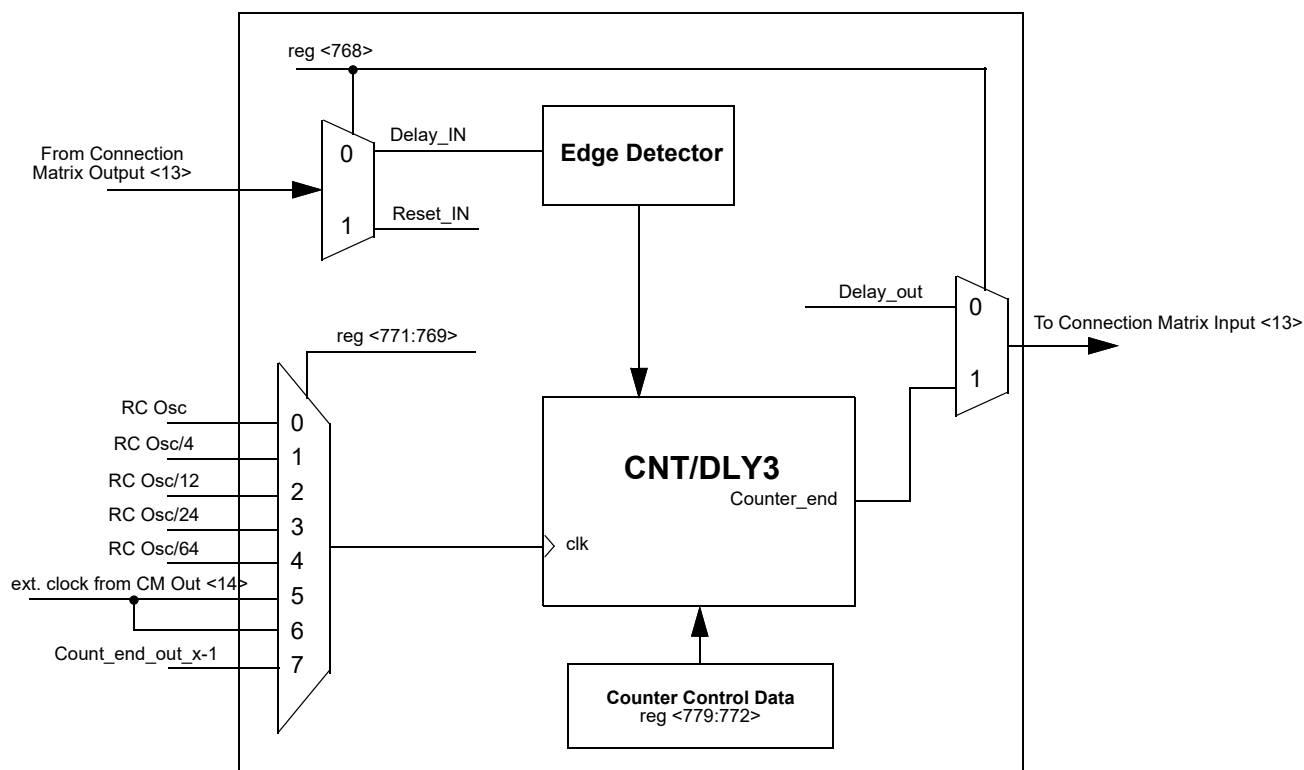


Figure 21. CNT/DLY3

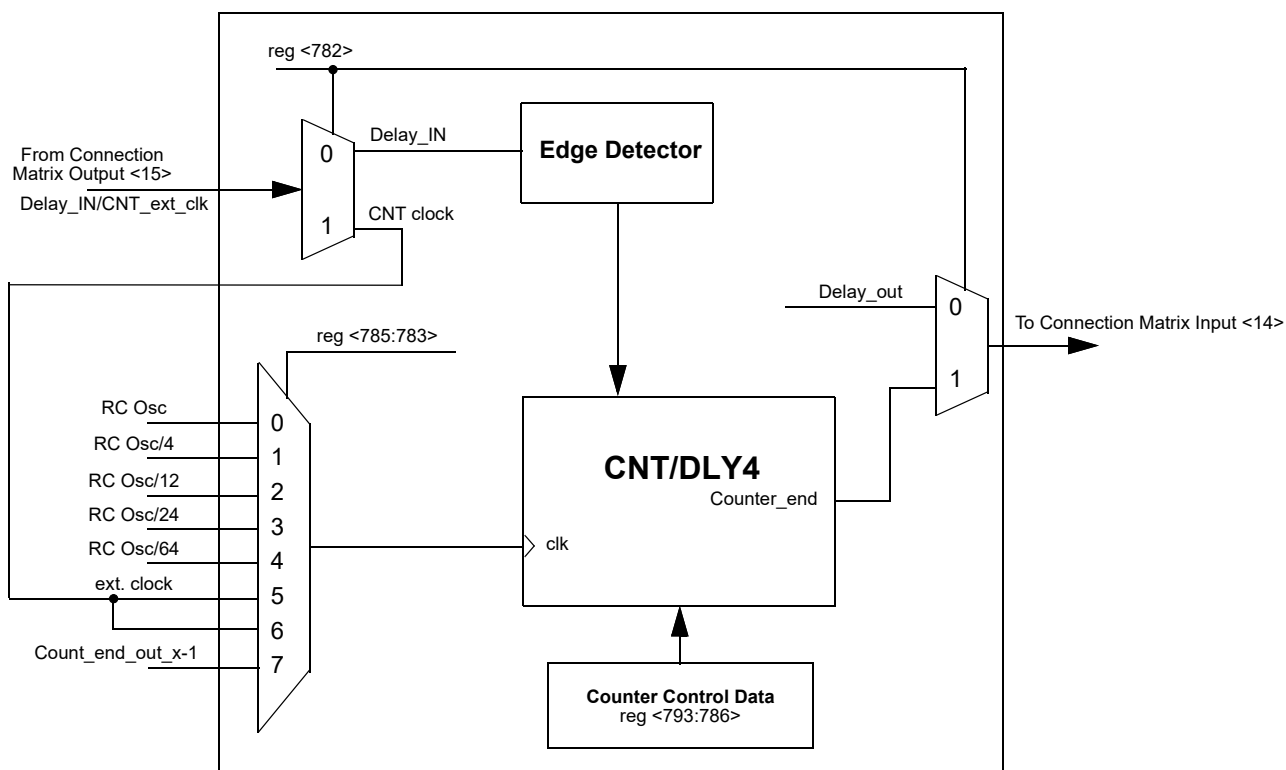


Figure 22. CNT/DLY4

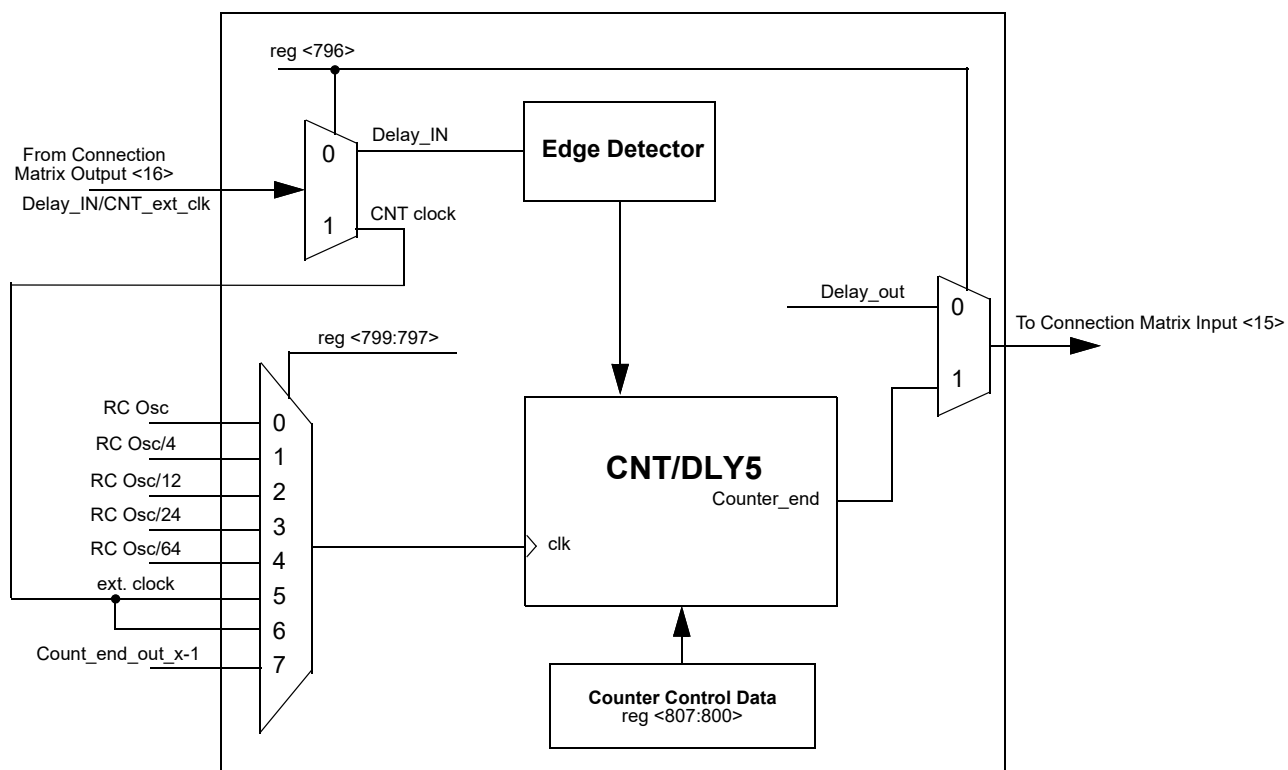


Figure 23. CNT/DLY5

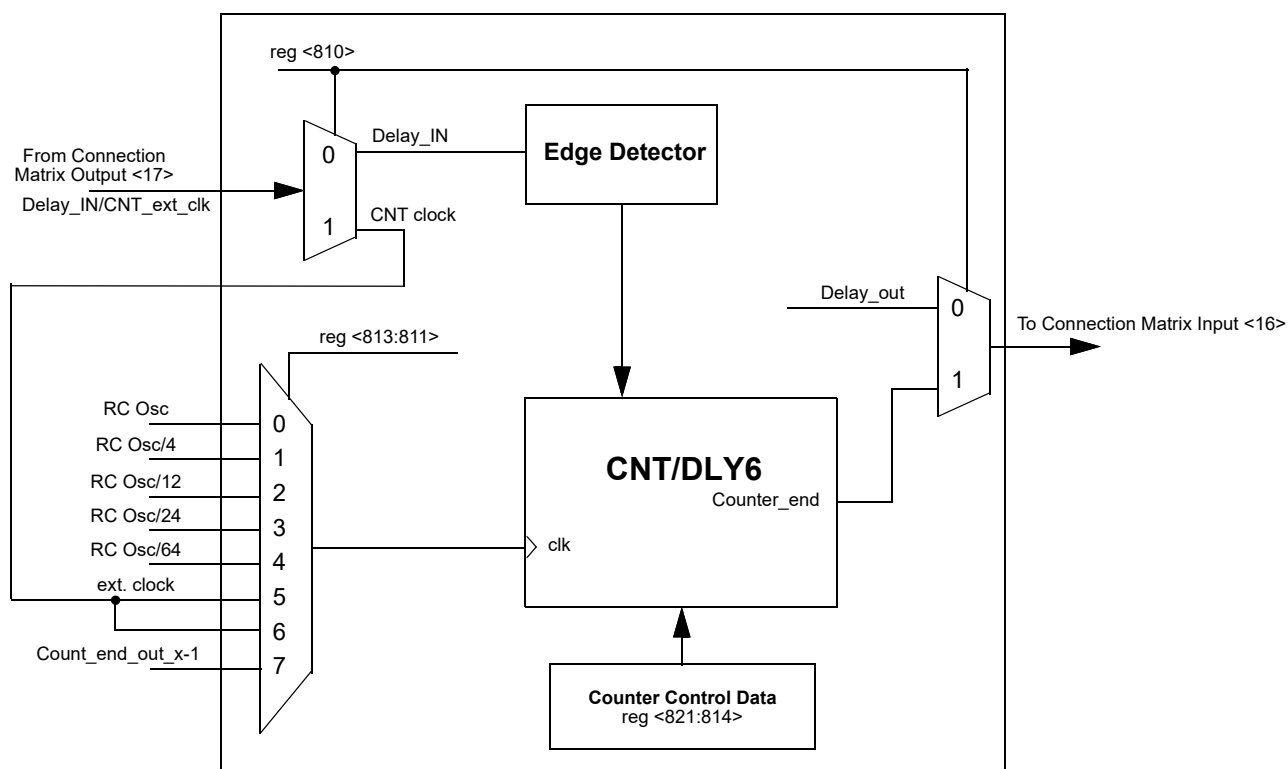


Figure 24. CNT/DLY6

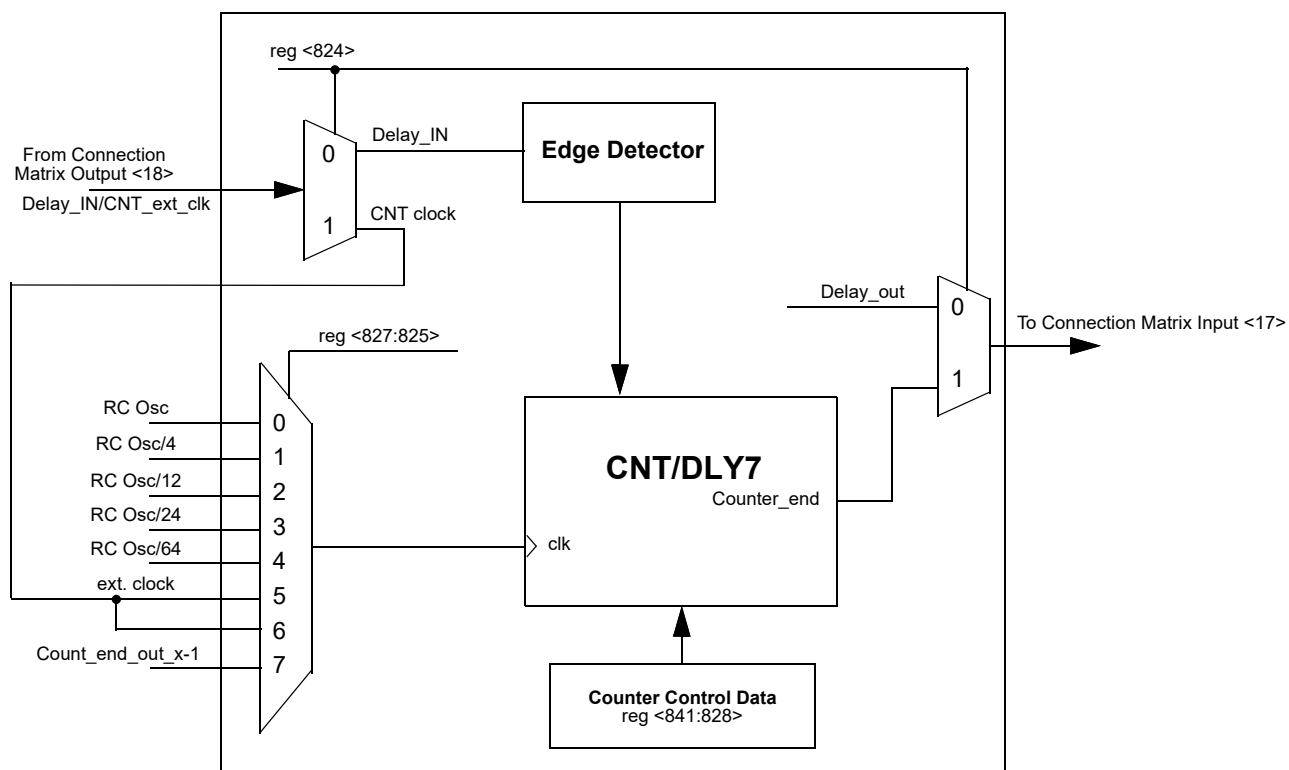


Figure 25. CNT/DLY7

## 12.1 CNT/DLY Timing Diagrams

Delay mode (edge select: both, counter data:3)

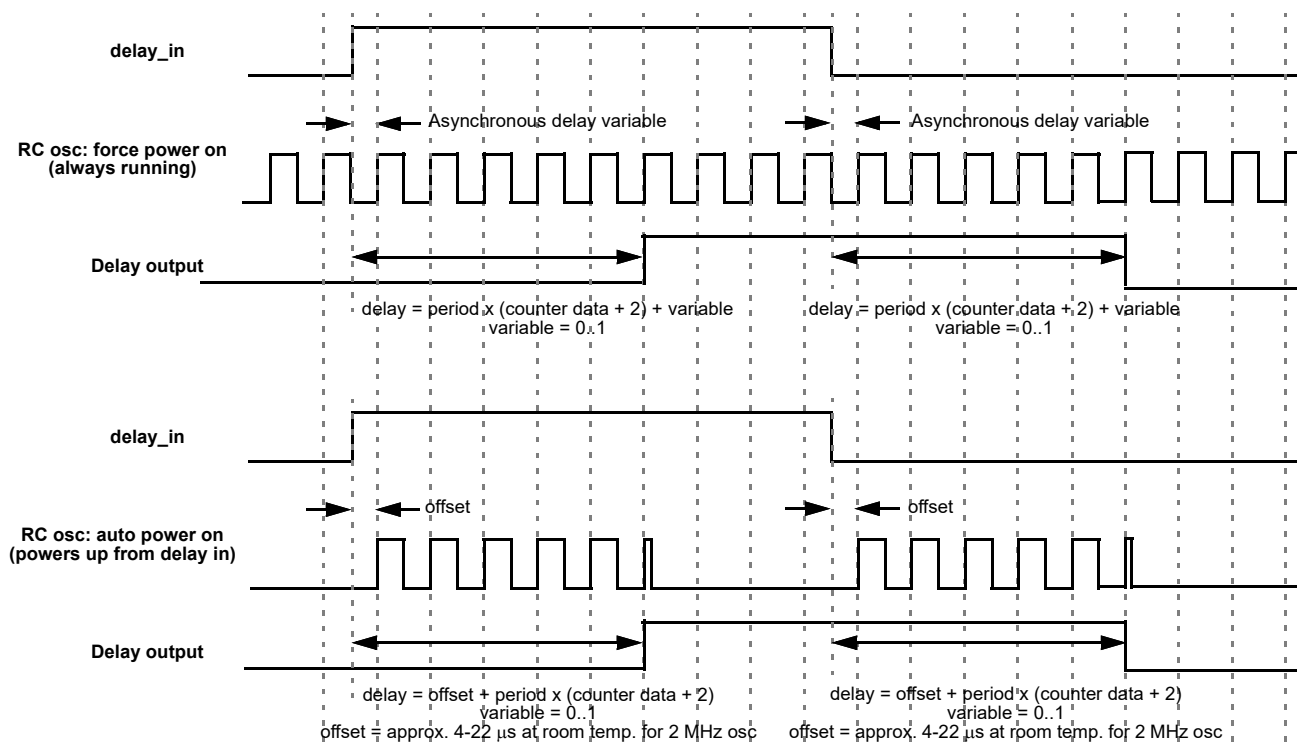


Figure 26. Delay Mode Timing

Count mode (count data:3), Counter reset (rising edge detect reset by delay\_in input)

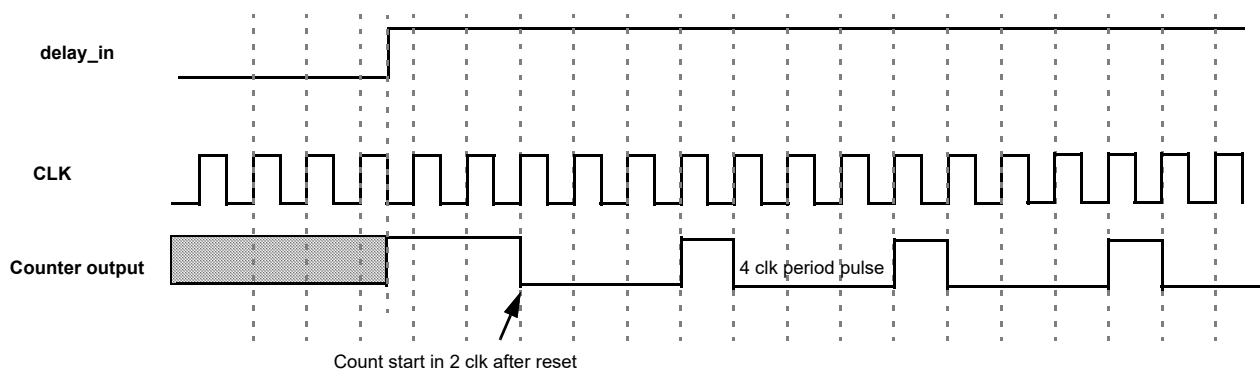


Figure 27. Counter Mode Timing

## 12.2 CNT/DLY0 Register Settings

**Table 48. CNT/DLY0 Register Settings**

| Signal Function                                                              | Register Bit Address | Register Definition                                                                                                                                             |
|------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Counter/Delay0 Mode Select                                                   | reg<714>             | 0: Delay Mode<br>1: Counter Mode                                                                                                                                |
| Counter/Delay0 Clock Source Select (external clock is only for counter mode) | reg<717:715>         | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 7 Overflow           |
| Counter0 Control Data/Delay0 Time Control                                    | reg<731:718>         | 1-16383: (delay time = (counter data + 2 + variable)/freq), where 0 < variable < 1                                                                              |
| Delay0 Mode Select                                                           | reg<733:732>         | 00: Delay on both falling and rising edges<br>01: Delay on falling edge only<br>10: Delay on rising edge only<br>11: No delay on either falling or rising edges |

## 12.3 CNT/DLY1 Register Settings

**Table 49. CNT/DLY1 Register Settings**

| Signal Function                                  | Register Bit Address | Register Definition                                                                                                                                                                                                                                                                     |
|--------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Counter/Delay1 Mode Select                       | reg<734>             | 0: Delay Mode<br>1: Counter Mode                                                                                                                                                                                                                                                        |
| Counter/Delay1 Clock Source select               | reg<737:735>         | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 0 Overflow                                                                                                                                   |
| Counter1 Control Data/Delay1 Time Control        | reg<751:738>         | 1-16383: (delay time = (counter data + 2 + variable)/freq), where 0 < variable < 1                                                                                                                                                                                                      |
| Delay1 Mode Select or asynchronous counter reset | reg<753:752>         | 00: Delay on both falling and rising edges (for delay & counter reset)<br>01: Delay on falling edge only (for delay & counter reset)<br>10: Delay on rising edge only (for delay & counter reset)<br>11: No delay on either falling or rising edges / high level reset for counter mode |

## 12.4 CNT/DLY2 Register Settings

**Table 50. CNT/DLY2 Register Settings**

| Signal Function            | Register Bit Address | Register Definition              |
|----------------------------|----------------------|----------------------------------|
| Counter/Delay2 Mode Select | reg<754>             | 0: Delay Mode<br>1: Counter Mode |

**Table 50. CNT/DLY2 Register Settings**

| Signal Function                                        | Register Bit Address | Register Definition                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Counter/Delay2<br>Clock Source select                  | reg<757:755>         | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 1 Overflow                                                                                                                                   |
| Counter2 Control<br>Data/Delay1 Time<br>Control        | reg<765:758>         | 1-255: (delay time = (counter data + 2 + variable)/freq),<br>where 0 < variable < 1                                                                                                                                                                                                     |
| Delay2 Mode Select<br>or asynchronous<br>counter reset | reg<767:766>         | 00: Delay on both falling and rising edges (for delay & counter reset)<br>01: Delay on falling edge only (for delay & counter reset)<br>10: Delay on rising edge only (for delay & counter reset)<br>11: No delay on either falling or rising edges / high level reset for counter mode |

## 12.5 CNT/DLY3 Register Settings

**Table 51. CNT/DLY3 Register Settings**

| Signal Function                                  | Register Bit Address | Register Definition                                                                                                                                                                                                                                                                     |
|--------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Counter/Delay3 Mode Select                       | reg<768>             | 0: Delay Mode<br>1: Counter Mode                                                                                                                                                                                                                                                        |
| Counter/Delay3 Clock Source select               | reg<771:769>         | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 2 Overflow                                                                                                                                   |
| Counter3 Control Data/Delay3 Time Control        | reg<779:772>         | 1-255: (delay time = (counter data + 2 + variable)/freq), where 0 < variable < 1                                                                                                                                                                                                        |
| Delay3 Mode Select or asynchronous counter reset | reg<781:780>         | 00: Delay on both falling and rising edges (for delay & counter reset)<br>01: Delay on falling edge only (for delay & counter reset)<br>10: Delay on rising edge only (for delay & counter reset)<br>11: No delay on either falling or rising edges / high level reset for counter mode |

## 12.6 CNT/DLY4 Register Settings

**Table 52. CNT/DLY4 Register Settings**

| Signal Function                                                              | Register Bit Address | Register Definition                                                                                                                                             |
|------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Counter/Delay4 Mode Select                                                   | reg<782>             | 0: Delay Mode<br>1: Counter Mode                                                                                                                                |
| Counter/Delay4 Clock Source Select (external clock is only for counter mode) | reg<785:783>         | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 3 Overflow           |
| Counter4 Control Data/Delay4 Time Control                                    | reg<793:786>         | 1-255: (delay time = (counter data + 2 + variable)/freq), where 0 < variable < 1                                                                                |
| Delay4 Mode Select                                                           | reg<795:794>         | 00: Delay on both falling and rising edges<br>01: Delay on falling edge only<br>10: Delay on rising edge only<br>11: No delay on either falling or rising edges |

## 12.7 CNT/DLY5 Register Settings

**Table 53. CNT/DLY5 Register Settings**

| Signal Function                                                              | Register Bit Address | Register Definition                                                                                                                                             |
|------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Counter/Delay5 Mode Select                                                   | reg<796>             | 0: Delay Mode<br>1: Counter Mode                                                                                                                                |
| Counter/Delay5 Clock Source Select (external clock is only for counter mode) | reg<799:797>         | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 4 Overflow           |
| Counter5 Control Data/Delay5 Time Control                                    | reg<807:800>         | 1-255: (delay time = (counter data + 2 + variable)/freq), where $0 < \text{variable} < 1$                                                                       |
| Delay5 Mode Select                                                           | reg<809:808>         | 00: Delay on both falling and rising edges<br>01: Delay on falling edge only<br>10: Delay on rising edge only<br>11: No delay on either falling or rising edges |

## 12.8 CNT/DLY6 Register Settings

**Table 54. CNT/DLY6 Register Settings**

| Signal Function                                                              | Register Bit Address | Register Definition                                                                                                                                             |
|------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Counter/Delay6 Mode Select                                                   | reg<810>             | 0: Delay Mode<br>1: Counter Mode                                                                                                                                |
| Counter/Delay6 Clock Source Select (external clock is only for counter mode) | reg<813:811>         | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 5 Overflow           |
| Counter6 Control Data/Delay6 Time Control                                    | reg<821:814>         | 1-255: (delay time = (counter data + 2 + variable)/freq), where $0 < \text{variable} < 1$                                                                       |
| Delay6 Mode Select                                                           | reg<823:822>         | 00: Delay on both falling and rising edges<br>01: Delay on falling edge only<br>10: Delay on rising edge only<br>11: No delay on either falling or rising edges |

## 12.9 CNT/DLY7 Register Settings

**Table 55. CNT/DLY7 Register Settings**

| Signal Function                                                                 | Register Bit Address | Register Definition                                                                                                                                             |
|---------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Counter/Delay7 Mode Select                                                      | reg<824>             | 0: Delay Mode<br>1: Counter Mode                                                                                                                                |
| Counter/Delay7 Clock Source Select<br>(external clock is only for counter mode) | reg<827:825>         | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 6 Overflow           |
| Counter7 Control Data/Delay7 Time Control                                       | reg<841:828>         | 1-16383: (delay time = (counter data + 2 + variable)/freq),<br>where 0 < variable < 1                                                                           |
| Delay7 Mode Select                                                              | reg<843:842>         | 00: Delay on both falling and rising edges<br>01: Delay on falling edge only<br>10: Delay on rising edge only<br>11: No delay on either falling or rising edges |

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### **13.0 Pipe Delay (PD)**

The SLG46722 has a pipe delay logic cell that is shared with the LUT3\_8 in one of the Combination Function macrocells. The user can select one of these functions to use in a design, but not both. Please see Section 10.2 3-Bit LUT or Pipe Delay Macrocell for the description of this Combination Function macrocell.

## 14.0 Programmable Delay / Edge Detector

The SLG46722 has a programmable time delay logic cell available that can generate a delay that is selectable from one of four timings (time1) configured in the GreenPAK Designer. The programmable time delay cell can generate one of four different delay patterns, rising edge detection, falling edge detection, both edge detection and both edge delay. These four patterns can be further modified with the addition of delayed edge detection, which adds an extra unit of delay as well as glitch rejection during the delay period. See the timing diagrams below for further information.

*Note: The input signal must be longer than the delay, otherwise it will be filtered out.*

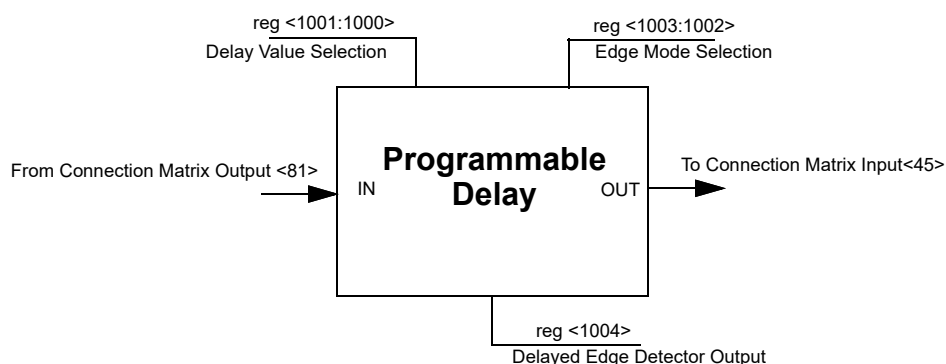


Figure 28. Programmable Delay

### 14.1 Programmable Delay Timing Diagram - Edge Detector Output

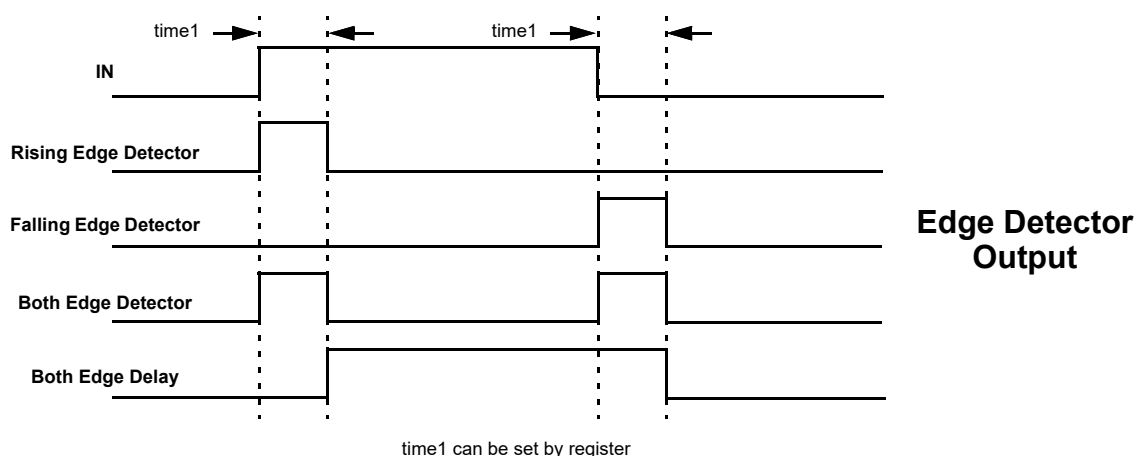


Figure 29. Edge Detector Output

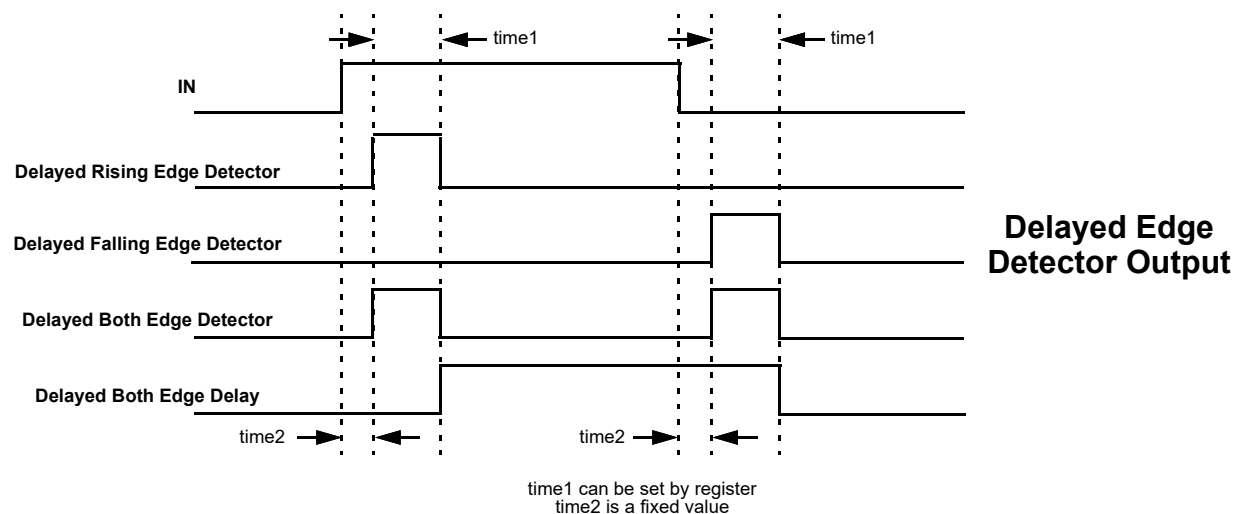


Figure 30. Delayed Edge Detector Output

Note: For delays and widths refer to Table 4.

#### 14.2 Programmable Delay Timing Diagram - Glitch Filtering For Edge Detector Output

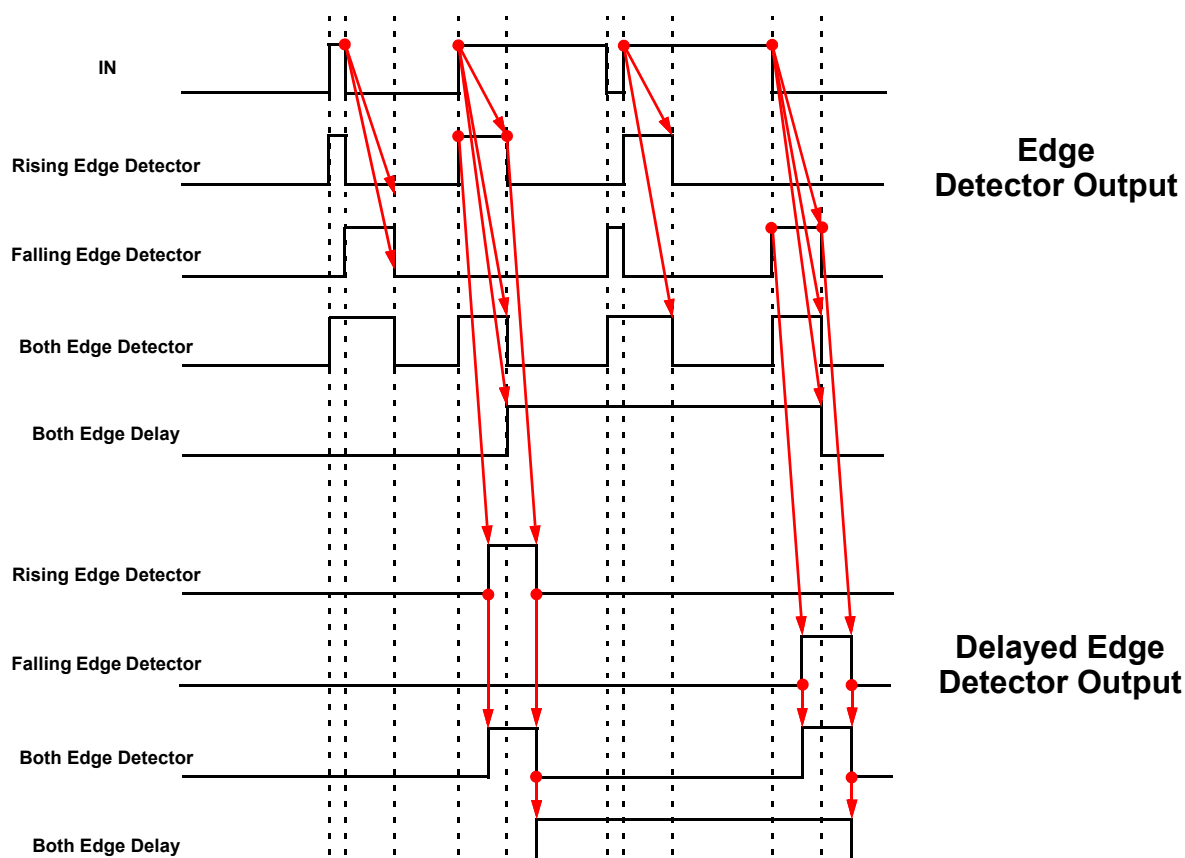


Figure 31. Glitch Filtering for Edge Detector Output

## 14.3 Programmable Delay Register Settings

**Table 56. Programmable Delay Register Settings**

| Signal Function                                                                                          | Register Bit Address | Register Definition                                                                                    |
|----------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------|
| Delay value select for programmable delay & edge detector ( $V_{DD} = 3.3\text{ V}$ , typical condition) | reg<1001:1000>       | 00: 125 ns<br>01: 250 ns<br>10: 375 ns<br>11: 500 ns                                                   |
| Select the edge mode of programmable delay & edge detector                                               | reg<1003:1002>       | 00: Rising Edge Detector<br>01: Falling Edge Detector<br>10: Both Edge Detector<br>11: Both Edge Delay |
| Select edge detector output mode                                                                         | reg<1004>            | 0: Edge Detector Output<br>1: Delayed Edge Detector Output                                             |

## 15.0 Additional Logic Functions

The SLG46722 has two additional logic functions that serve as deglitch filters.

### 15.1 Deglitch Filter

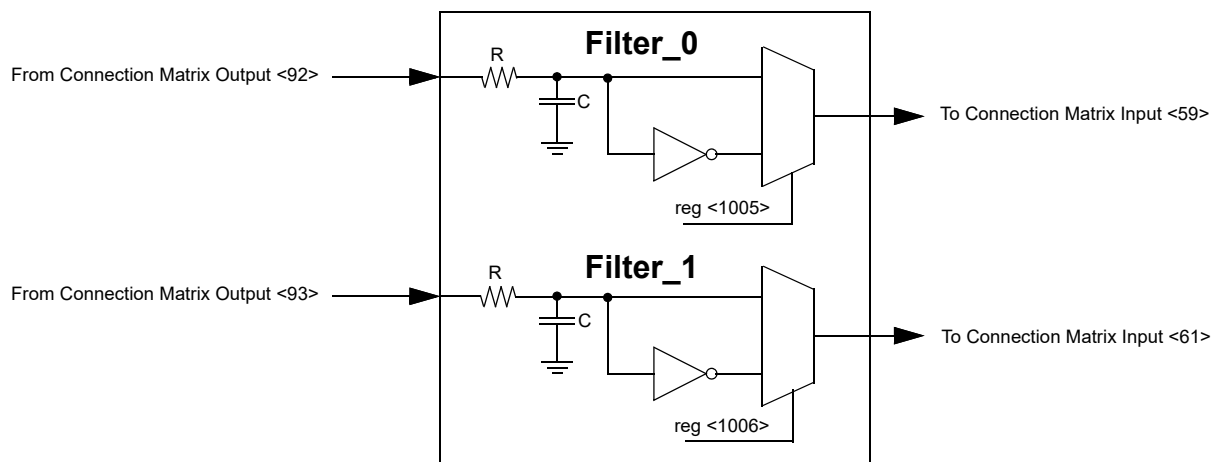


Figure 32. Deglitch Filter

## 16.0 RC Oscillator (RC Osc)

### 16.1 RC Oscillator Overview

The SLG46722 has two internal RC oscillators, one that runs at 25 kHz and one that runs at 2 MHz. The user can select one of these fundamental frequencies for the RC OSC Macrocell, or the fundamental frequency can also come from an external clock input (Pin 20). There are two divider stages that allow the user flexibility for introducing clock signals on various Connection Matrix Input lines. The first stage divider allows the selection of /1, /2, /4 or /8 divide down frequency from the fundamental. The second stage divider has an input of one frequency from the first stage divider, and outputs five different frequencies on Connection Matrix Input lines <45>, <46>, <47>, <48>, and <49>. See *Figure 33.* below for details of the frequencies for each of these five Connection Matrix Inputs.

If PWR DOWN input of oscillator is LOW, the oscillator will be turned on. If PWR DOWN input of oscillator is HIGH the oscillator will be turned off. The PWR DOWN signal has the highest priority.

### 16.2 RC OSC Block Diagram

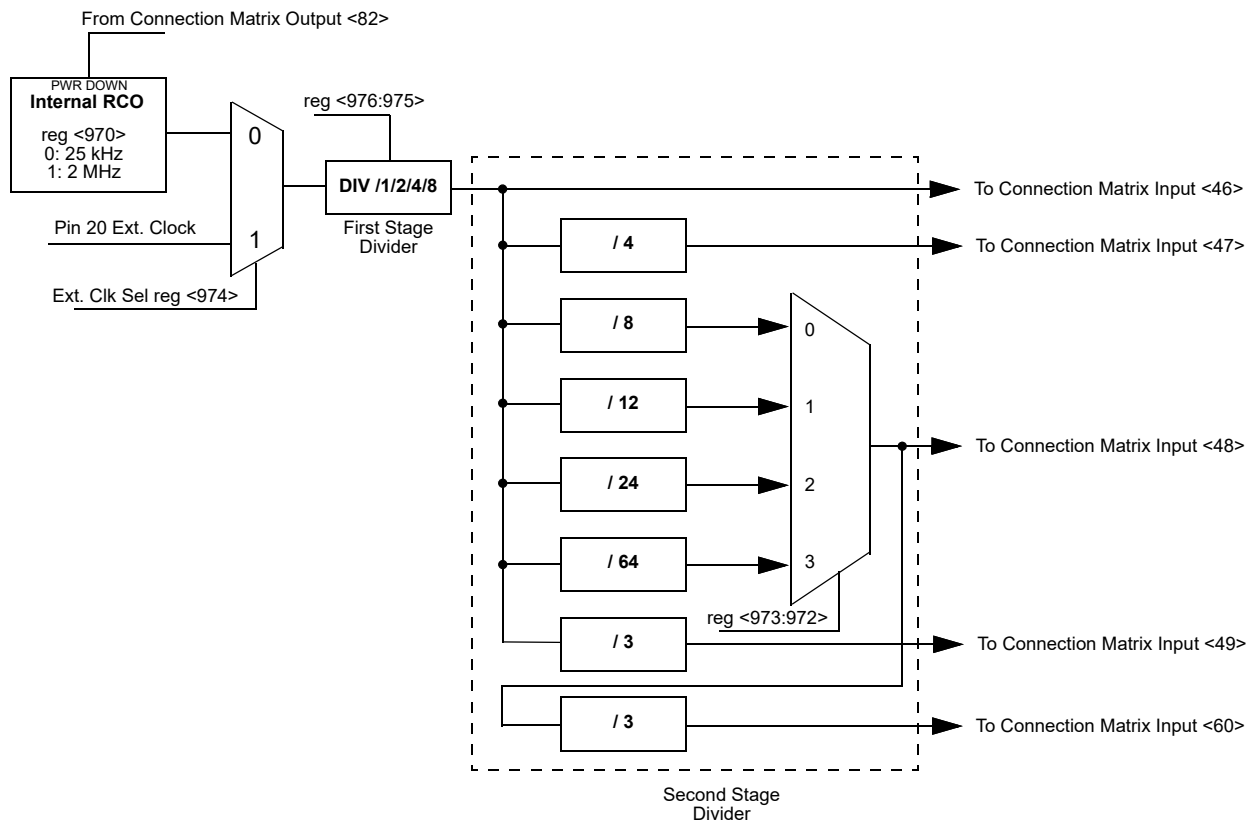


Figure 33. RC OSC Block Diagram

## 17.0 Power On Reset (POR)

### 17.1 POR Overview

The Power On Reset (POR) Macrocell will produce a high or “1” signal as an output when the device power supply ( $V_{DD}$ ) rises to approximately 1.4 V. The typical internal delay for POR to release POR\_IO will be  $1\text{ ms} + \alpha$  depending on the power slope, because there is adaptive power-up sequence. The next internal signal will be POR\_CORE and then POR\_IO\_DLY, each of which is further delayed by approximately  $1\text{ }\mu\text{s}$ . The rise of POR\_IO\_DLY will trigger the I/O pins to exit tri-state, and the device will become active.

### 17.2 POR Timing Diagram

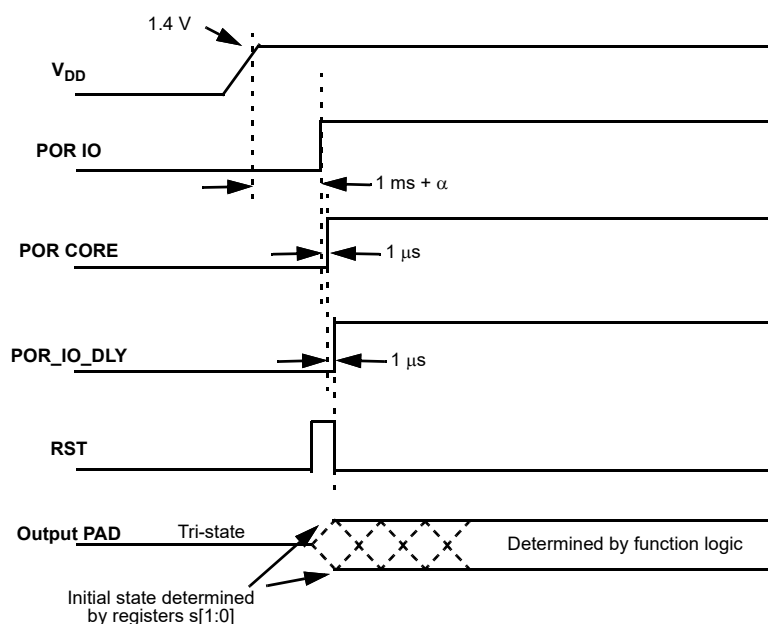


Figure 34. POR Timing Diagram

## 18.0 Appendix A - SLG46722 Register Definition

| Register Bit Address | Signal Function                                                        | Register Bit Definition |
|----------------------|------------------------------------------------------------------------|-------------------------|
| reg<5:0>             | Matrix Out: PIN3 Digital Output Source                                 |                         |
| reg<11:6>            | Matrix Out: PIN4 Digital Output Source                                 |                         |
| reg<17:12>           | Matrix Out: PIN5 Digital Output Source                                 |                         |
| reg<23:18>           | Matrix Out: PIN6 Digital Output Source                                 |                         |
| reg<29:24>           | Matrix Out: PIN7 Digital Output Source                                 |                         |
| reg<35:30>           | Matrix Out: PIN8 Digital Output Source                                 |                         |
| reg<41:36>           | Matrix Out: PIN9 Digital Output Source                                 |                         |
| reg<47:42>           | Matrix Out: PIN10 Digital Output Source (Super Drive)                  |                         |
| reg<53:48>           | Matrix Out: Input for delay0 or Counter0 external clock                |                         |
| reg<59:54>           | Matrix Out: Input for delay1 or counter1 reset input                   |                         |
| reg<65:60>           | Matrix Out: Input for Counter1 external clock or delay1 external clock |                         |
| reg<71:66>           | Matrix Out: Input for delay2 or counter2 reset input                   |                         |
| reg<77:72>           | Matrix Out: Input for Counter2 external clock or delay2 external clock |                         |
| reg<83:78>           | Matrix Out: Input for delay3 or counter3 reset input                   |                         |
| reg<89:84>           | Matrix Out: Input for Counter3 external clock or delay3 external clock |                         |
| reg<95:90>           | Matrix Out: Input for delay4 or Counter4 external clock                |                         |
| reg<101:96>          | Matrix Out: Input for delay5 or Counter5 external clock                |                         |
| reg<107:102>         | Matrix Out: Input for delay6 or Counter6 external clock                |                         |
| reg<113:108>         | Matrix Out: Input for delay7 or Counter7 external clock                |                         |
| reg<119:114>         | Matrix Out: Clock Input of DFF0                                        |                         |
| reg<125:120>         | Matrix Out: Data Input of DFF0                                         |                         |
| reg<131:126>         | Matrix Out: Resetb (Setb) of DFF0                                      |                         |
| reg<137:132>         | Matrix Out: Clock Input of DFF1                                        |                         |
| reg<143:138>         | Matrix Out: Data Input of DFF1                                         |                         |
| reg<149:144>         | Matrix Out: Resetb (Setb) of DFF1                                      |                         |
| reg<155:150>         | Matrix Out: Clock Input of DFF2                                        |                         |
| reg<161:156>         | Matrix Out: Data Input of DFF2                                         |                         |
| reg<167:162>         | Matrix Out: Resetb (Setb) of DFF2                                      |                         |
| reg<173:168>         | Matrix Out: Clock Input of DFF3                                        |                         |
| reg<179:174>         | Matrix Out: Data Input of DFF3                                         |                         |
| reg<185:180>         | Matrix Out: Resetb (Setb) of DFF3                                      |                         |
| reg<191:186>         | Matrix Out: Clock Input of DFF5                                        |                         |
| reg<197:192>         | Matrix Out: Data Input of DFF5                                         |                         |
| reg<203:198>         | Matrix Out: Clock Input of DFF6                                        |                         |
| reg<209:204>         | Matrix Out: Data Input of DFF6                                         |                         |
| reg<215:210>         | Matrix Out: In0 of LUT4_0                                              |                         |
| reg<221:216>         | Matrix Out: In1 of LUT4_0                                              |                         |
| reg<227:222>         | Matrix Out: In2 of LUT4_0                                              |                         |
| reg<233:228>         | Matrix Out: In3 of LUT4_0                                              |                         |

| Register Bit Address | Signal Function                                   | Register Bit Definition |
|----------------------|---------------------------------------------------|-------------------------|
| reg<239:234>         | Matrix Out: In0 of LUT3_0                         |                         |
| reg<245:240>         | Matrix Out: In1 of LUT3_0                         |                         |
| reg<251:246>         | Matrix Out: In2 of LUT3_0                         |                         |
| reg<257:252>         | Matrix Out: In0 of LUT3_1                         |                         |
| reg<263:258>         | Matrix Out: In1 of LUT3_1                         |                         |
| reg<269:264>         | Matrix Out: In2 of LUT3_1                         |                         |
| reg<275:270>         | Matrix Out: In0 of LUT3_2                         |                         |
| reg<281:276>         | Matrix Out: In1 of LUT3_2                         |                         |
| reg<287:282>         | Matrix Out: In2 of LUT3_2                         |                         |
| reg<293:288>         | Matrix Out: In0 of LUT3_3                         |                         |
| reg<299:294>         | Matrix Out: In1 of LUT3_3                         |                         |
| reg<305:300>         | Matrix Out: In2 of LUT3_3                         |                         |
| reg<311:306>         | Matrix Out: In0 of LUT3_4                         |                         |
| reg<317:312>         | Matrix Out: In1 of LUT3_4                         |                         |
| reg<323:318>         | Matrix Out: In2 of LUT3_4                         |                         |
| reg<329:324>         | Matrix Out: In0 of LUT3_5                         |                         |
| reg<335:330>         | Matrix Out: In1 of LUT3_5                         |                         |
| reg<341:336>         | Matrix Out: In2 of LUT3_5                         |                         |
| reg<347:342>         | Matrix Out: In0 of LUT3_6                         |                         |
| reg<353:348>         | Matrix Out: In1 of LUT3_6                         |                         |
| reg<359:354>         | Matrix Out: In2 of LUT3_6                         |                         |
| reg<365:360>         | Matrix Out: In0 of LUT3_7                         |                         |
| reg<371:366>         | Matrix Out: In1 of LUT3_7                         |                         |
| reg<377:372>         | Matrix Out: In2 of LUT3_7                         |                         |
| reg<383:378>         | Matrix Out: In0 of LUT3_8 or Input of Pipe delay  |                         |
| reg<389:384>         | Matrix Out: In1 of LUT3_8 or Resetb of Pipe delay |                         |
| reg<395:390>         | Matrix Out: In2 of LUT3_8 or Clock of Pipe delay  |                         |
| reg<401:396>         | Matrix Out: In0 of LUT3_9                         |                         |
| reg<407:402>         | Matrix Out: In1 of LUT3_9                         |                         |
| reg<413:408>         | Matrix Out: In2 of LUT3_9                         |                         |
| reg<419:414>         | Matrix Out: In0 of LUT2_0 or Clock Input of DFF4  |                         |
| reg<425:420>         | Matrix Out: In1 of LUT2_0 or Data Input of DFF4   |                         |
| reg<431:426>         | Matrix Out: In0 of LUT2_1                         |                         |
| reg<437:432>         | Matrix Out: In1 of LUT2_1                         |                         |
| reg<443:438>         | Matrix Out: In0 of LUT2_2                         |                         |
| reg<449:444>         | Matrix Out: In1 of LUT2_2                         |                         |
| reg<455:450>         | Matrix Out: In0 of LUT2_3                         |                         |
| reg<461:456>         | Matrix Out: In1 of LUT2_3                         |                         |
| reg<467:462>         | Matrix Out: In0 of LUT2_4                         |                         |
| reg<473:468>         | Matrix Out: In1 of LUT2_4                         |                         |
| reg<479:474>         | Matrix Out: In0 of LUT2_5                         |                         |
| reg<485:480>         | Matrix Out: In1 of LUT2_5                         |                         |

| Register Bit Address | Signal Function                                          | Register Bit Definition              |
|----------------------|----------------------------------------------------------|--------------------------------------|
| reg<491:486>         | Matrix Out: Input for programmable delay & edge detector |                                      |
| reg<497:492>         | Matrix Out: Power down for osc                           |                                      |
| reg<503:498>         | Matrix Out: Pin12 Digital Output Source (Super Drive)    |                                      |
| reg<509:504>         | Matrix Out: Pin13 Digital Output Source                  |                                      |
| reg<515:510>         | Matrix Out: Pin14 Digital Output Source                  |                                      |
| reg<521:516>         | Matrix Out: Pin15 Digital Output Source                  |                                      |
| reg<527:522>         | Matrix Out: Pin16 Digital Output Source                  |                                      |
| reg<533:528>         | Matrix Out: Pin17 Digital Output Source                  |                                      |
| reg<539:534>         | Matrix Out: Pin18 Digital Output Source                  |                                      |
| reg<545:540>         | Matrix Out: Pin19 Digital Output Source                  |                                      |
| reg<551:546>         | Matrix Out: Pin20 Digital Output Source                  |                                      |
| reg<557:552>         | Matrix Out: Input of filter_0                            |                                      |
| reg<563:558>         | Matrix Out: Input of filter_1                            |                                      |
| reg<569:564>         | Matrix Out: Reserved                                     |                                      |
| reg<571:570>         | Reserved                                                 |                                      |
| reg<575:572>         | LUT2_0 data or                                           |                                      |
|                      | reg<572> DFF4 or Latch select                            | 0: DFF function<br>1: Latch function |
|                      | reg<573> DFF4 output select                              | 0: Q output<br>1: nQ output          |
|                      | reg<574> DFF4 initial polarity select                    | 0: Low<br>1: High                    |
| reg<579:576>         | LUT2_1 data                                              |                                      |
| reg<583:580>         | LUT2_2 data                                              |                                      |
| reg<587:584>         | LUT2_3 data                                              |                                      |
| reg<591:588>         | LUT2_4 data                                              |                                      |
| reg<595:592>         | LUT2_5 data                                              |                                      |
| reg<596>             | LUT2_0 or DFF4 select                                    | 0: LUT2_0<br>1: DFF4                 |
| reg<604:597>         | LUT3_0 data                                              |                                      |
| reg<612:605>         | LUT3_1 data                                              |                                      |
| reg<620:613>         | LUT3_2 data                                              |                                      |
| reg<628:621>         | LUT3_3 data                                              |                                      |
| reg<636:629>         | LUT3_4 data                                              |                                      |
| reg<644:637>         | LUT3_5 data                                              |                                      |
| reg<652:645>         | LUT3_6 data                                              |                                      |
| reg<660:653>         | LUT3_7 data                                              |                                      |
| reg<668:661>         | LUT3_8 data or pipe number select                        |                                      |
|                      | reg<664: 661>: OUT0 select                               |                                      |
|                      | reg<668: 665>: OUT1 select                               |                                      |
| reg<676:669>         | LUT3_9 data                                              |                                      |
| reg<692:677>         | LUT4_0 data                                              |                                      |
| reg<693>             | DFF0 or Latch Select                                     | 0: DFF function<br>1: Latch function |

| Register Bit Address | Signal Function                                                                 | Register Bit Definition                                                                                                                               |
|----------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| reg<694>             | DFF0 rstb/setb select                                                           | 0: resetb from matrix out<br>1: setb from matrix out                                                                                                  |
| reg<695>             | DFF0 Initial polarity select                                                    | 0: Low<br>1: High                                                                                                                                     |
| reg<696>             | DFF1 or Latch Select                                                            | 0: DFF function<br>1: Latch function                                                                                                                  |
| reg<697>             | DFF1 output select (Q or nQ)                                                    | 0: Q output<br>1: nQ output                                                                                                                           |
| reg<698>             | DFF1 rstb/setb select                                                           | 1: setb from matrix out<br>0: resetb from matrix out                                                                                                  |
| reg<699>             | DFF1 Initial polarity select                                                    | 0: Low<br>1: High                                                                                                                                     |
| reg<700>             | DFF2 or Latch Select                                                            | 0: DFF function<br>1: Latch function                                                                                                                  |
| reg<701>             | DFF2 output select (Q or nQ)                                                    | 0: Q output<br>1: nQ output                                                                                                                           |
| reg<702>             | DFF2 rstb/setb select                                                           | 1: setb from matrix out<br>0: resetb from matrix out                                                                                                  |
| reg<703>             | DFF2 Initial polarity select                                                    | 0: Low<br>1: High                                                                                                                                     |
| reg<704>             | DFF3 or Latch Select                                                            | 0: DFF function<br>1: Latch function                                                                                                                  |
| reg<705>             | DFF3 output select (Q or nQ)                                                    | 0: Q output<br>1: nQ output                                                                                                                           |
| reg<706>             | DFF3 rstb/setb select                                                           | 1: setb from matrix out<br>0: resetb from matrix out                                                                                                  |
| reg<707>             | DFF3 Initial polarity select                                                    | 0: Low<br>1: High                                                                                                                                     |
| reg<708>             | DFF5 or Latch Select                                                            | 0: DFF function<br>1: Latch function                                                                                                                  |
| reg<709>             | DFF5 output select (Q or nQ)                                                    | 0: Q output<br>1: nQ output                                                                                                                           |
| reg<710>             | DFF5 Initial polarity select                                                    | 0: Low<br>1: High                                                                                                                                     |
| reg<711>             | DFF6 or Latch Select                                                            | 0: DFF function<br>1: Latch function                                                                                                                  |
| reg<712>             | DFF6 output select (Q or nQ)                                                    | 0: Q output<br>1: nQ output                                                                                                                           |
| reg<713>             | DFF6 Initial polarity select                                                    | 0: Low<br>1: High                                                                                                                                     |
| reg<714>             | Counter/Delay0 mode select                                                      | 0: Delay Mode<br>1: Counter Mode                                                                                                                      |
| reg<717:715>         | Counter/delay0 Clock Source Select<br>(external clock is only for counter mode) | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 7 Overflow |

| Register Bit Address | Signal Function                                  | Register Bit Definition                                                                                                                                                                                                                                                                 |
|----------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| reg<731:718>         | Counter0 Control Data/Delay0 Time Control        | 1-16383: (delay time = (counter data + 2 + variable)/freq), where 0 < variable < 1                                                                                                                                                                                                      |
| reg<733:732>         | Delay0 Mode Select                               | 00: Delay on both falling and rising edges<br>01: Delay on falling edge only<br>10: Delay on rising edge only<br>11: No delay on either falling or rising edges                                                                                                                         |
| reg<734>             | Counter/Delay1 mode select                       | 0: Delay Mode<br>1: Counter Mode                                                                                                                                                                                                                                                        |
| reg<737:735>         | Counter/delay1 Clock Source select               | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 0 Overflow                                                                                                                                   |
| reg<751:738>         | Counter1 Control Data/Delay1 Time Control        | 1-16383: (delay time = (counter data + 2 + variable)/freq), where 0 < variable < 1                                                                                                                                                                                                      |
| reg<753:752>         | Delay1 Mode Select or asynchronous counter reset | 00: Delay on both falling and rising edges (for delay & counter reset)<br>01: Delay on falling edge only (for delay & counter reset)<br>10: Delay on rising edge only (for delay & counter reset)<br>11: No delay on either falling or rising edges / high level reset for counter mode |
| reg<754>             | Counter/Delay2 Mode selection                    | 0: Delay Mode<br>1: Counter Mode                                                                                                                                                                                                                                                        |
| reg<757:755>         | Counter/delay2 Clock Source select               | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 1 Overflow                                                                                                                                   |
| reg<765:758>         | Counter2 Control Data/Delay2 Time Control        | 1-255: (delay time = (counter data + 2 + variable)/freq), where 0 < variable < 1                                                                                                                                                                                                        |
| reg<767:766>         | Delay2 Mode Select or asynchronous counter reset | 00: Delay on both falling and rising edges (for delay & counter reset)<br>01: Delay on falling edge only (for delay & counter reset)<br>10: Delay on rising edge only (for delay & counter reset)<br>11: No delay on either falling or rising edges / high level reset for counter mode |
| reg<768>             | Counter/Delay3 Mode selection                    | 0: Delay Mode<br>1: Counter Mode                                                                                                                                                                                                                                                        |

| Register Bit Address | Signal Function                                                                 | Register Bit Definition                                                                                                                                                                                                                                                                 |
|----------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| reg<771:769>         | Counter/delay3 Clock Source select                                              | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 2 Overflow                                                                                                                                   |
| reg<779:772>         | Counter3 Control Data/Delay3 Time Control                                       | 1-255: (delay time = (counter data + 2 + variable)/freq), where $0 < \text{variable} < 1$                                                                                                                                                                                               |
| reg<781:780>         | Delay3 Mode Select or asynchronous counter reset                                | 00: Delay on both falling and rising edges (for delay & counter reset)<br>01: Delay on falling edge only (for delay & counter reset)<br>10: Delay on rising edge only (for delay & counter reset)<br>11: No delay on either falling or rising edges / high level reset for counter mode |
| reg<782>             | Counter/Delay4 Mode Selection                                                   | 0: Delay Mode<br>1: Counter Mode                                                                                                                                                                                                                                                        |
| reg<785:783>         | Counter/delay4 Clock Source select                                              | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 3 Overflow                                                                                                                                   |
| reg<793:786>         | Counter4 Control Data/Delay4 Time Control                                       | 1-255: (delay time = (counter data + 2 + variable)/freq), where $0 < \text{variable} < 1$                                                                                                                                                                                               |
| reg<795:794>         | Delay4 Mode Select                                                              | 00: Delay on both falling and rising edges<br>01: Delay on falling edge only<br>10: Delay on rising edge only<br>11: No delay on either falling or rising edges                                                                                                                         |
| reg<796>             | Counter/Delay5 Mode Selection                                                   | 0: Delay Mode<br>1: Counter Mode                                                                                                                                                                                                                                                        |
| reg<799:797>         | Counter/delay5 Clock Source select<br>(external clock is only for counter mode) | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 4 Overflow                                                                                                                                   |
| reg<807:800>         | Counter5 Control Data/Delay5 Time Control                                       | 1-255: (delay time = (counter data + 2 + variable)/freq), where $0 < \text{variable} < 1$                                                                                                                                                                                               |
| reg<809:808>         | Delay5 Mode Select                                                              | 00: Delay on both falling and rising edges<br>01: Delay on falling edge only<br>10: Delay on rising edge only<br>11: No delay on either falling or rising edges                                                                                                                         |
| reg<810>             | Counter/Delay6 Mode Selection                                                   | 0: Delay Mode<br>1: Counter Mode                                                                                                                                                                                                                                                        |

| Register Bit Address | Signal Function                                                                 | Register Bit Definition                                                                                                                                                                                                     |
|----------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| reg<813:811>         | Counter/delay6 Clock Source select<br>(external clock is only for counter mode) | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 5 Overflow                                                                       |
| reg<821:814>         | Counter6 Control Data/Delay6 Time Control                                       | 1-255: (delay time = (counter data + 2 + variable)/freq),<br>where 0 < variable < 1                                                                                                                                         |
| reg<823:822>         | Delay6 Mode Select                                                              | 00: Delay on both falling and rising edges<br>01: Delay on falling edge only<br>10: Delay on rising edge only<br>11: No delay on either falling or rising edges                                                             |
| reg<824>             | Counter/Delay7 Mode Selection                                                   | 0: Delay Mode<br>1: Counter Mode                                                                                                                                                                                            |
| reg<827:825>         | Counter/Delay7 Mode Selection<br>(external clock is only for counter mode)      | 000: Internal OSC Clock<br>001: OSC/4<br>010: OSC/12<br>011: OSC/24<br>100: OSC/64<br>101: External Clock<br>110: Reserved<br>111: Counter 6 Overflow                                                                       |
| reg<841:828>         | Counter7 Control Data/Delay7 Time Control                                       | 1-16383: (delay time = (counter data + 2 + variable)/freq),<br>where 0 < variable < 1                                                                                                                                       |
| reg<843:842>         | Delay7 Mode Select                                                              | 00: Delay on both falling and rising edges<br>01: Delay on falling edge only<br>10: Delay on rising edge only<br>11: No delay on either falling or rising edges                                                             |
| <845:844>            | PIN2 mode control                                                               | 00: Digital Input without Schmitt Trigger<br>01: Digital Input with Schmitt Trigger<br>10: Low Voltage Digital Input<br>11: Reserved                                                                                        |
| <847:846>            | PIN2 pull down resistor value selection                                         | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <850:848>            | PIN3 mode control                                                               | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <852:851>            | PIN3 pull up/down resistor value selection                                      | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <853>                | PIN3 pull up/down resistor select                                               | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <854>                | PIN3 driver strength selection                                                  | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

| Register Bit Address | Signal Function                            | Register Bit Definition                                                                                                                                                                                                     |
|----------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <857:855>            | PIN4 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <859:889>            | PIN4 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <860>                | PIN4 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <861>                | PIN4 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| <864:862>            | PIN5 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <866:865>            | PIN5 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <867>                | PIN5 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <868>                | PIN5 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| <871:869>            | PIN6 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <873:872>            | PIN6 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <874>                | PIN6 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <875>                | PIN6 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

| Register Bit Address | Signal Function                            | Register Bit Definition                                                                                                                                                                                                     |
|----------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <878:876>            | PIN7 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <880:879>            | PIN7 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <881>                | PIN7 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <882>                | PIN7 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| <885:883>            | PIN8 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <887:886>            | PIN8 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <888>                | PIN8 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <889>                | PIN8 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| <892:890>            | PIN9 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <894:893>            | PIN9 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <895>                | PIN9 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <896>                | PIN9 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

| Register Bit Address | Signal Function                                  | Register Bit Definition                                                                                                                                                                                                     |
|----------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <899:897>            | PIN10 mode control                               | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <901:900>            | PIN10 pull up/down resistor value selection      | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <902>                | PIN10 pull up/down resistor select               | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <903>                | PIN10 driver strength selection                  | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| <904>                | PIN10 super drive(4X, NMOS open drain) selection | 0: super drive off<br>1: super drive on (if <899: 897> = 101)                                                                                                                                                               |
| <907:905>            | PIN12 mode control                               | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <909:908>            | PIN12 pull up/down resistor value selection      | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <910>                | PIN12 pull up/down resistor select               | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <911>                | PIN12 driver strength selection                  | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| <912>                | PIN12 super drive(4X, NMOS open drain) selection | 0: super drive off<br>1: super drive on (if <907: 905> = 101)                                                                                                                                                               |
| <915:913>            | PIN13 mode control                               | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <917:916>            | PIN13 pull up/down resistor value selection      | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <918>                | PIN13 pull up/down resistor select               | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <919>                | PIN13 driver strength selection                  | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

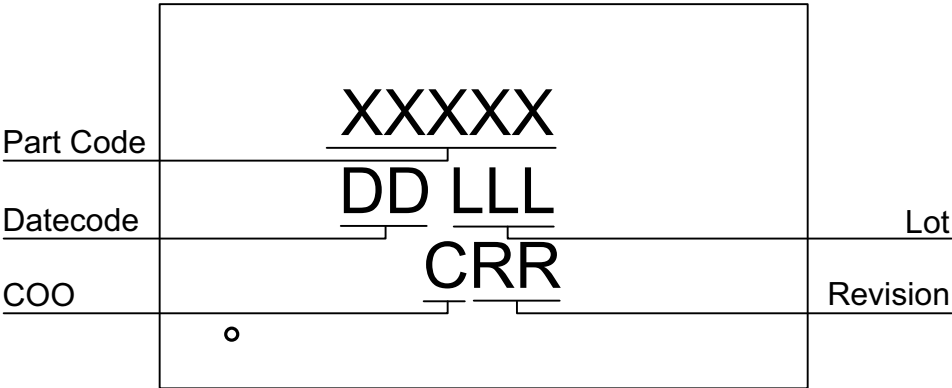
| Register Bit Address | Signal Function                             | Register Bit Definition                                                                                                                                                                                                     |
|----------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <922:920>            | PIN14 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <924:923>            | PIN14 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <925>                | PIN14 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <926>                | PIN14 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| <929:927>            | PIN15 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <931:930>            | PIN15 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <932>                | PIN15 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <933>                | PIN15 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| <936:934>            | PIN16 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <938:937>            | PIN16 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <939>                | PIN16 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <940>                | PIN16 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

| Register Bit Address | Signal Function                             | Register Bit Definition                                                                                                                                                                                                     |
|----------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <943:941>            | PIN17 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <945:944>            | PIN17 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <946>                | PIN17 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <947>                | PIN17 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| <950:948>            | PIN18 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <952:951>            | PIN18 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <953>                | PIN18 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <954>                | PIN18 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| <957:955>            | PIN19 mode control                          | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <959:958>            | PIN19 pull up/down resistor value selection | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <960>                | PIN19 pull up/down resistor select          | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <961>                | PIN19 driver strength selection             | 0: 1X<br>1: 2X                                                                                                                                                                                                              |

| Register Bit Address | Signal Function                                                                        | Register Bit Definition                                                                                                                                                                                                     |
|----------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <964:962>            | PIN20 mode control                                                                     | 000: Digital Input without Schmitt Trigger<br>001: Digital Input with Schmitt Trigger<br>010: Low Voltage Digital Input<br>011: Reserved<br>100: Push Pull<br>101: Open Drain NMOS<br>110: Open Drain PMOS<br>111: Reserved |
| <966:965>            | PIN20 pull up/down resistor value selection                                            | 00: floating<br>01: 10K<br>10: 100K<br>11: 1M                                                                                                                                                                               |
| <967>                | PIN20 pull up/down resistor select                                                     | 0: pull down resistor enable<br>1: pull up resistor enable                                                                                                                                                                  |
| <968>                | PIN20 driver strength selection                                                        | 0: 1X<br>1: 2X                                                                                                                                                                                                              |
| reg<969>             | Force RC oscillator on                                                                 | 0: Auto Power on<br>1: Force Power on                                                                                                                                                                                       |
| reg<970>             | RC Oscillator frequency control                                                        | 0: 25K<br>1: 2M                                                                                                                                                                                                             |
| reg<971>             | Reserved                                                                               |                                                                                                                                                                                                                             |
| reg<973:972>         | Internal Oscillator frequency divider control                                          | 00: OSC/8<br>01: OSC/12<br>10: OSC/24<br>11: OSC/64                                                                                                                                                                         |
| reg<974>             | External Clock Source Select                                                           | 0: Internal Oscillator<br>1: External Clock from Pin20                                                                                                                                                                      |
| reg<976:975>         | Osc clock pre-divider                                                                  | 00: Div1<br>01: Div2<br>10: Div4<br>11: Div8                                                                                                                                                                                |
| reg<977>             | LUT3_8 or pipe delay output select                                                     | 0: Lut3_8<br>1: 1 pipe delay output                                                                                                                                                                                         |
| reg<978>             | Pipe delay OUT1 polarity select bit                                                    | 0: non-inverted<br>1: inverted                                                                                                                                                                                              |
| reg<979>             | NVM data read disable                                                                  | 0: Disable (program data can be read)<br>1: Enable (Program data cannot be read)                                                                                                                                            |
| reg<980>             | NVM power down                                                                         | 0: None (or programming enable)<br>1: Power Down (or programming disable)                                                                                                                                                   |
| reg<981>             | GPIO quick charge enable                                                               | 0: Disable<br>1: Enable                                                                                                                                                                                                     |
| reg<983: 982>        | Reserved                                                                               |                                                                                                                                                                                                                             |
| reg<991:984>         | Reserved                                                                               |                                                                                                                                                                                                                             |
| reg<999:992>         | 8-bit Pattern ID                                                                       |                                                                                                                                                                                                                             |
| reg<1001:1000>       | Delay value select for programmable delay & edge detector (V <sub>DD</sub> 3.3 V, typ) | 00: 125 ns<br>01: 250 ns<br>10: 375 ns<br>11: 500 ns                                                                                                                                                                        |
| reg<1003:1002>       | Select the edge mode of programmable delay & edge detector                             | 00: rising edge detector<br>01: falling edge detector<br>10: both edge detector<br>11: both edge delay                                                                                                                      |

| Register Bit Address | Signal Function                    | Register Bit Definition                                    |
|----------------------|------------------------------------|------------------------------------------------------------|
| reg<1004>            | Select edge detector output mode   | 0: edge detector output<br>1: delayed edge detector output |
| reg<1005>            | Select polarity of filter_0 output | 0: non-inverted<br>1: inverted                             |
| reg<1006>            | Select polarity of filter_1 output | 0: non-inverted<br>1: inverted                             |
| reg<1007>            | Reserved                           |                                                            |
| reg<1013:1008 >      | Reserved                           |                                                            |
| reg<1014>            | Reserved                           |                                                            |
| reg<1015>            | Reserved                           |                                                            |
| reg<1023:1016>       | Reserved                           |                                                            |

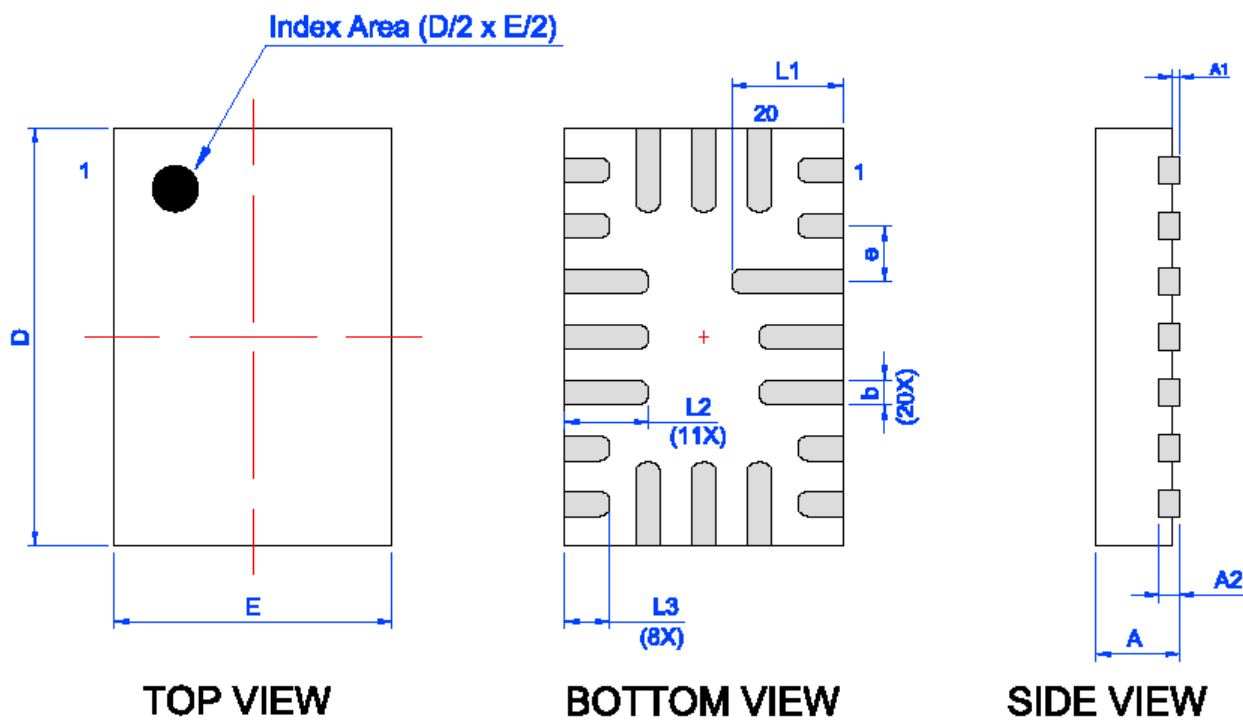
19.0 Package Top Marking System Definition



- XXXXX – Part ID Field: identifies the specific device configuration
- DD – Date Code Field: Coded date of manufacture
- LLL – Lot Code: Designates Lot #
- C – Assembly Site/COO: Specifies Assembly Site/Country of Origin
- RR – Revision Code: Device Revision

## 20.0 Package Drawing and Dimensions

STQFN 20L 2x3 mm 0.4P COL Package  
JEDEC MO-220, Variation WECE  
IC Net Weight: 0.015 g



Unit: mm

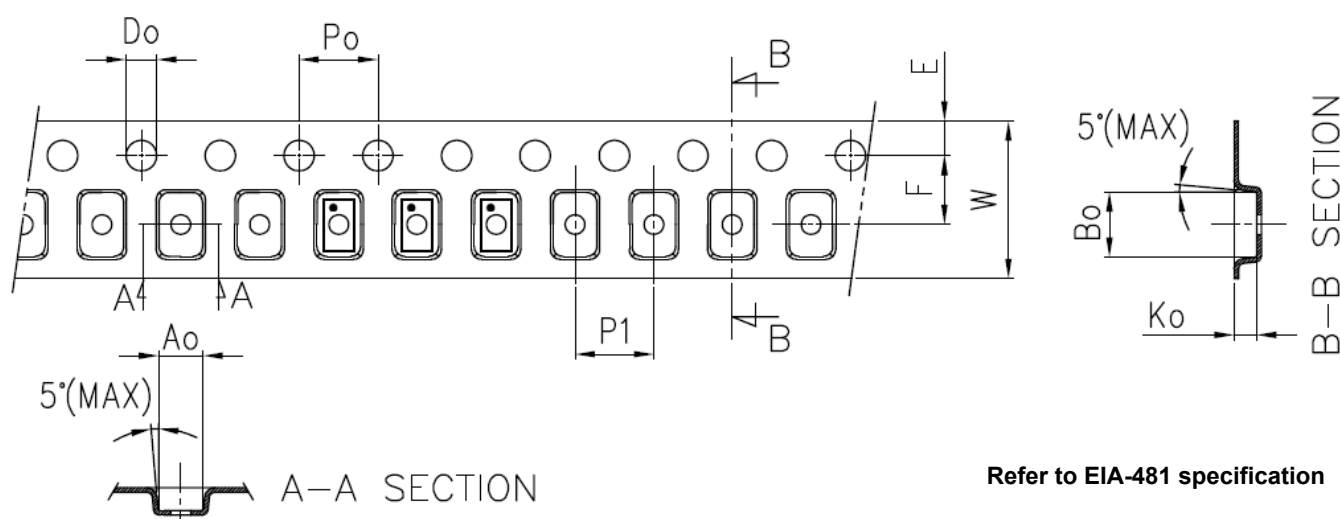
| Symbol | Min      | Nom. | Max   | Symbol | Min   | Nom.  | Max   |
|--------|----------|------|-------|--------|-------|-------|-------|
| A      | 0.50     | 0.55 | 0.60  | D      | 2.95  | 3.00  | 3.05  |
| A1     | 0.005    | -    | 0.050 | E      | 1.95  | 2.00  | 2.05  |
| A2     | 0.10     | 0.15 | 0.20  | L1     | 0.75  | 0.80  | 0.85  |
| b      | 0.13     | 0.18 | 0.23  | L2     | 0.55  | 0.60  | 0.65  |
| e      | 0.40 BSC |      |       | L3     | 0.275 | 0.325 | 0.375 |

# 21.0 Tape and Reel Specifications

| Package Type              | # of Pins | Nominal Package Size [mm] | Max Units |         | Reel & Hub Size [mm] | Leader (min) |             | Trailer (min) |             | Tape Width [mm] | Part Pitch [mm] |
|---------------------------|-----------|---------------------------|-----------|---------|----------------------|--------------|-------------|---------------|-------------|-----------------|-----------------|
|                           |           |                           | per Reel  | per Box |                      | Pockets      | Length [mm] | Pockets       | Length [mm] |                 |                 |
| STQFN 20L 2x3 mm 0.4P COL | 20        | 2 x 3 x 0.55              | 3,000     | 3,000   | 178 / 60             | 100          | 400         | 100           | 400         | 8               | 4               |

## 21.1 Carrier Tape Drawing and Dimensions

| Package Type              | Pocket BTM Length | Pocket BTM Width | Pocket Depth | Index Hole Pitch | Pocket Pitch | Index Hole Diameter | Index Hole to Tape Edge | Index Hole to Pocket Center | Tape Width |
|---------------------------|-------------------|------------------|--------------|------------------|--------------|---------------------|-------------------------|-----------------------------|------------|
|                           | A0                | B0               | K0           | P0               | P1           | D0                  | E                       | F                           | W          |
| STQFN 20L 2x3 mm 0.4P COL | 2.2               | 3.15             | 0.76         | 4                | 4            | 1.5                 | 1.75                    | 3.5                         | 8          |

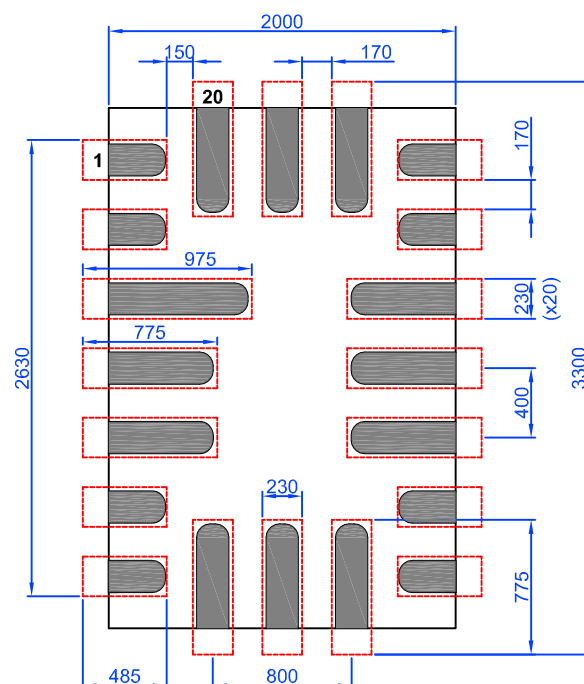
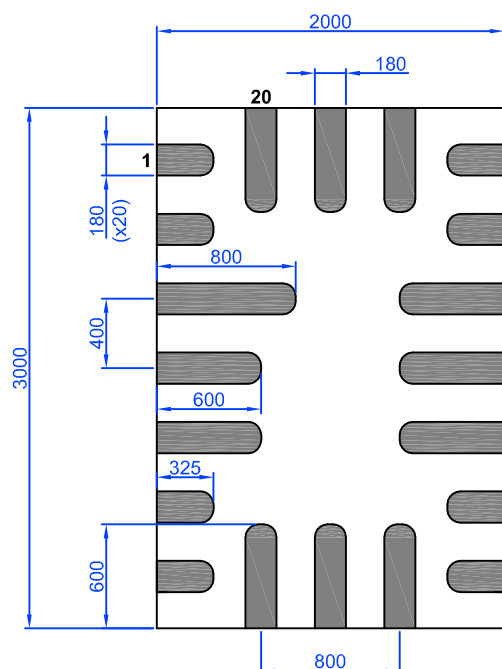


## 22.0 Recommended Land Pattern

 Exposed Pad  
(Top View)

 Recommended Land Pattern  
(Top View)

Units:  $\mu\text{m}$



## 23.0 Recommended Reflow Soldering Profile

Please see IPC/JEDEC J-STD-020: latest revision for reflow profile based on package volume of 3.30 mm<sup>3</sup> (nominal). More information can be found at [www.jedec.org](http://www.jedec.org).

## 24.0 Revision History

| Date       | Version | Change                                                                                                                                                                                                                                                                                                                                   |
|------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8/15/2023  | 1.20    | Updated tables Electrical Characteristics<br>Fixed typos                                                                                                                                                                                                                                                                                 |
| 3/10/2023  | 1.19    | Added notes to section Ordering Information                                                                                                                                                                                                                                                                                              |
| 3/4/2022   | 1.18    | Added R <sub>PUP</sub> and R <sub>PDWN</sub> in section Electrical Specifications<br>Renesas rebranding                                                                                                                                                                                                                                  |
| 11/16/2021 | 1.17    | Updated tables CNT/DLY Register Settings<br>Corrected registers [731:718], [751:738], [765:758], [779:772], [793:786], [807:800], [821:814], [841:828] in Appendix A - SLG46722 Register Definition<br>Added note for CNTs<br>Corrected registers [841:825], [821:811], [807:797], [793:783], [779:769], [765:755], [751:735], [731:715] |
| 10/29/2019 | 1.16    | Updated disclaimer<br>Fixed typos                                                                                                                                                                                                                                                                                                        |
| 11/14/2018 | 1.15    | Updated to Dialog style                                                                                                                                                                                                                                                                                                                  |
| 12/5/2017  | 1.14    | Fixed typos                                                                                                                                                                                                                                                                                                                              |
| 10/10/2017 | 1.13    | Updated Electrical Spec<br>Fixed typos                                                                                                                                                                                                                                                                                                   |
| 7/5/2017   | 1.12    | Fixed typos<br>Removed references to GPAK families<br>Updated Silego Website & Support<br>Updated Section Programmable Delay / Edge Detector<br>Updated Electrical Spec                                                                                                                                                                  |
| 5/31/2016  | 1.11    | Updated Silego Website & Support<br>Updated Programmable Delay information<br>Added PONT <sub>THR</sub> and POFF <sub>THR</sub> in Electrical Spec                                                                                                                                                                                       |
| 10/28/2015 | 1.10    | Updated Absolute maximum conditions                                                                                                                                                                                                                                                                                                      |
| 6/16/2015  | 1.09    | Fixed DFF Polarity Operations Diagram                                                                                                                                                                                                                                                                                                    |
| 4/9/2015   | 1.08    | Updated Tsu condition and value                                                                                                                                                                                                                                                                                                          |
| 1/14/2015  | 1.07    | Added IDD Estimator, Timing Estimator, Expected Delays sections                                                                                                                                                                                                                                                                          |
| 12/3/2014  | 1.06    | Updated Electrical Characteristics VIH/VIL/VOH/VOL values                                                                                                                                                                                                                                                                                |
| 8/29/2014  | 1.05    | Added Emulator Reset description for Pin 3<br>Updated Electrical Characteristics VIH/VIL/VOH/VOL values<br>Fixed table formatting for some tables                                                                                                                                                                                        |
| 8/06/2014  | 1.04    | Updated Electrical Characteristics VIH/VIL/VOH/VOL values                                                                                                                                                                                                                                                                                |
| 7/29/2014  | 1.03    | Fixed ESD information                                                                                                                                                                                                                                                                                                                    |
| 7/9/2014   | 1.02    | Fixed typo on Pin Configuration<br>Fixed LUT Standard Digital Function Tables                                                                                                                                                                                                                                                            |
| 7/7/2014   | 1.01    | Fixed Package Outline Drawing (removed incorrect side view)                                                                                                                                                                                                                                                                              |
| 7/3/2014   | 1.0     | Production Release                                                                                                                                                                                                                                                                                                                       |
| 3/18/2014  | 0.45    | Updated block diagrams and timing diagrams for clarity                                                                                                                                                                                                                                                                                   |
| 2/3/2014   | 0.44    | Fixed typos and Cleanup                                                                                                                                                                                                                                                                                                                  |
| 11/21/2013 | 0.43    | Added ESD Ratings and MSL to Absolute Maximum Conditions                                                                                                                                                                                                                                                                                 |
| 11/20/2013 | 0.42    | Updated Package Outline Drawing<br>Updated Tape and Reel Specifications<br>Added Recommended Land pattern                                                                                                                                                                                                                                |
| 10/9/2013  | 0.41    | Updated VIH for Logic Input                                                                                                                                                                                                                                                                                                              |
| 10/2/2013  | 0.4     | Updated VIH/VIL values                                                                                                                                                                                                                                                                                                                   |
| 9/11/13    | 0.31    | Adjusted RC OSC Block Diagram                                                                                                                                                                                                                                                                                                            |

| Date       | Version | Change                                          |
|------------|---------|-------------------------------------------------|
| 7/17/2013  | 0.3     | Added IO Structures                             |
| 5/7/2013   | 0.2     | Added newsections<br>Updated Tape and Reel spec |
| 11/14/2012 | 0.1     | Initial release                                 |

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## RoHS Compliance

Renesas Electronics Corporation's suppliers certify that its products are in compliance with the requirements of Directive 2011/65/EU of the European Parliament on the restriction of the use of certain hazardous substances in electrical and electronic equipment. RoHS certificates from our suppliers are available on request.

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