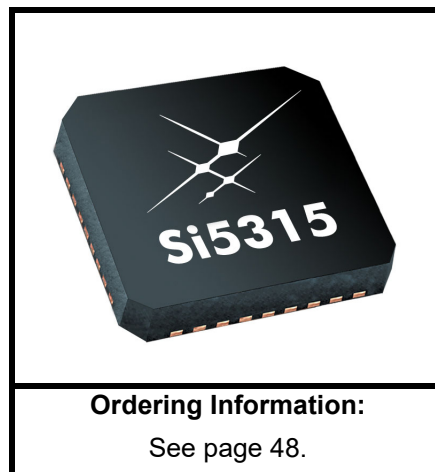




# SYNCHRONOUS ETHERNET/TELECOM JITTER ATTENUATING CLOCK MULTIPLIER

### Features

- Provides jitter attenuation and frequency translation between SONET/PDH and Ethernet
- Supports ITU-T G.8262 Synchronous Ethernet equipment slave clock (EEC option 1 and 2) requirements with optional Stratum 3 compliant timing card clock source
- Two clock inputs/two clock outputs
- Input frequency range: 8 kHz–644 MHz
- Output frequency range: 8 kHz–644 MHz
- Ultra low jitter:  
0.23 ps RMS (1.875–20 MHz)  
0.47 ps RMS (12 kHz–20 MHz)
- Simple pin control interface
- Selectable loop bandwidth for jitter attenuation: 60 to 8.4 kHz
- Automatic/Manual hitless switching and holdover during loss of inputs clock
- Programmable output clock signal format: LVPECL, LVDS, CML or CMOS
- 40 MHz crystal or XO reference
- Single supply: 1.8, 2.5, or 3.3 V
- On-chip voltage regulator with high PSRR
- Loss of lock and loss of signal alarms
- Small size: 6 x 6 mm, 36-QFN
- Wide temperature range: –40 to +85 °C



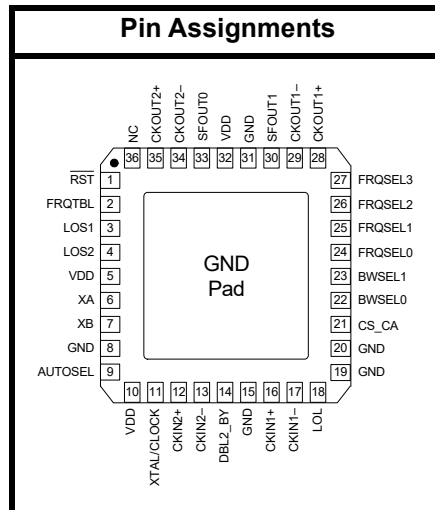
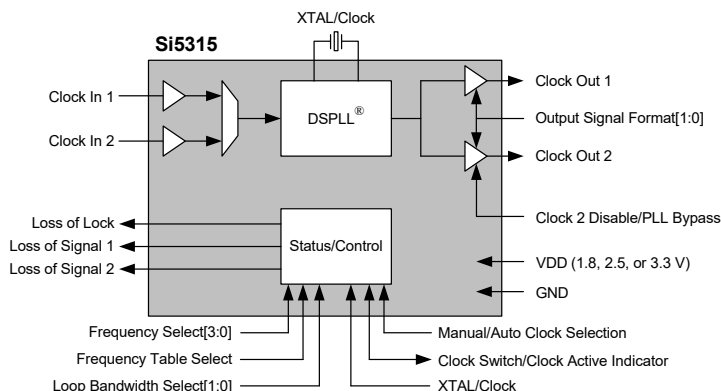
### Applications

- Synchronous Ethernet line cards
- SONET OC-3/12/48 line cards
- PON OLT/ONU
- Carrier Ethernet switches/routers
- MSAN / DSLAM
- T1/E1/DS3/E3 line cards

### Description

The Si5315 is a jitter-attenuating clock multiplier for Gb and 10G Synchronous Ethernet, SONET/SDH, and PDH (T1/E1) applications. The Si5315 supports SyncE EEC options 1 and 2 when paired with a timing card that implements the required wander filter. The Si5315 accepts dual clock inputs ranging from 8 kHz to 644.53 MHz and generates two equal frequency-multiplied clock outputs ranging from 8 kHz to 644.53 MHz. The input clock frequency and clock multiplication ratio are selectable from a table of popular SyncE and T1/E1 rates. The Si5315 is based on Skyworks Solutions' third-generation DSPLL® technology, which provides any-frequency synthesis and jitter attenuation in a highly integrated PLL solution that eliminates the need for external VCXO and loop filter components. The DSPLL loop bandwidth is user programmable, providing jitter performance optimization at the application level.

### Functional Block Diagram





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# Si5315

## 1. Electrical Specifications

**Table 1. Recommended Operating Conditions**

( $V_{DD} = 1.8 \pm 5\%$ ,  $2.5 \pm 10\%$ , or  $3.3 \text{ V} \pm 10\%$ ,  $T_A = -40$  to  $85 \text{ }^\circ\text{C}$ )

| Parameter         | Symbol   | Test Condition | Min  | Typ | Max  | Unit             |
|-------------------|----------|----------------|------|-----|------|------------------|
| Temperature Range | $T_A$    |                | -40  | 25  | 85   | $^\circ\text{C}$ |
| Supply Voltage    | $V_{DD}$ | 3.3 V nominal  | 2.97 | 3.3 | 3.63 | V                |
|                   |          | 2.5 V nominal  | 2.25 | 2.5 | 2.75 | V                |
|                   |          | 1.8 V nominal  | 1.71 | 1.8 | 1.89 | V                |

**Note:** All minimum and maximum specifications are guaranteed and apply across the recommended operating conditions. Typical values apply at nominal supply voltages and an operating temperature of  $25 \text{ }^\circ\text{C}$  unless otherwise noted.

**Table 2. DC Characteristics**

( $V_{DD} = 1.8 \pm 5\%$ ,  $2.5 \pm 10\%$ , or  $3.3 \text{ V} \pm 10\%$ ,  $T_A = -40$  to  $85 \text{ }^\circ\text{C}$ )

| Parameter   | Symbol      | Test Condition  | Min | Typ | Max      | Units            |
|---|-------------|---|-----|-----|----------|------------------|
| Supply Current (Supply current is independent of $V_{DD}$ ) | $I_{DD}$    | LVPECL Format<br>644.53125 MHz Out<br>All CKOUTs Enabled <sup>1</sup>   | —   | 251 | 279      | mA               |
|   |             | LVPECL Format<br>644.53125 MHz Out<br>Only 1 CKOUT Enabled <sup>1</sup> | —   | 217 | 243      | mA               |
|   |             | CMOS Format<br>25.00 MHz Out<br>All CKOUTs Enabled <sup>2</sup>         | —   | 204 | 234      | mA               |
|   |             | CMOS Format<br>25.00 MHz Out<br>Only CKOUT1 Enabled <sup>2</sup>        | —   | 194 | 220      | mA               |
| <b>CKINn Input Pins</b>                                     |             |   |     |     |          |                  |
| Input Common Mode Voltage (Input Threshold Voltage)         | $V_{ICM}$   | $1.8 \text{ V} \pm 5\%$   | 0.9 | —   | 1.4      | V                |
|   |             | $2.5 \text{ V} \pm 10\%$  | 1.0 | —   | 1.7      | V                |
|   |             | $3.3 \text{ V} \pm 10\%$  | 1.1 | —   | 1.95     | V                |
| Input Resistance  | $CKN_{RIN}$ | Single-ended  | 20  | 40  | 60       | $\text{k}\Omega$ |
| Input Voltage Level Limits                                  | $CKN_{VIN}$ |   | 0   | —   | $V_{DD}$ | V                |

**Notes:**

- Refers to Si5315A speed grade.
- Refers to Si5315B speed grade.
- This is the amount of leakage that the 3L inputs can tolerate from an external driver. See Figure 3 on page 11.

**Table 2. DC Characteristics (Continued)** $(V_{DD} = 1.8 \pm 5\%, 2.5 \pm 10\%, \text{ or } 3.3 \text{ V} \pm 10\%, T_A = -40 \text{ to } 85 \text{ }^\circ\text{C})$ 

| Parameter  | Symbol        | Test Condition                                     | Min                 | Typ             | Max             | Units     |
|--|---------------|--|---------------------|-----------------|-----------------|-----------|
| Single-ended Input Voltage Swing   | $V_{ISE}$     | $f_{CKIN} \leq 212.5 \text{ MHz}$<br>See Figure 2. | 0.2                 | —               | —               | $V_{PP}$  |
|  |               | $f_{CKIN} > 212.5 \text{ MHz}$<br>See Figure 2.    | 0.25                | —               | —               | $V_{PP}$  |
| Differential Input Voltage Swing   | $V_{ID}$      | $f_{CKIN} \leq 212.5 \text{ MHz}$<br>See Figure 2. | 0.2                 | —               | —               | $V_{PP}$  |
|  |               | $f_{CKIN} > 212.5 \text{ MHz}$<br>See Figure 2.    | 0.25                | —               | —               | $V_{PP}$  |
| <b>CKOUTn Output Clocks</b>  |               |  |                     |                 |                 |           |
| Common Mode  | $V_{OCM}$     | LVPECL 100 $\Omega$ load<br>line-to-line           | $V_{DD} - 1.42$     | —               | $V_{DD} - 1.25$ | V         |
| Differential Output Swing  | $V_{OD}$      | LVPECL 100 $\Omega$ load<br>line-to-line           | 1.1                 | —               | 1.9             | $V_{PP}$  |
| Single Ended Output Swing  | $V_{SE}$      | LVPECL 100 $\Omega$ load<br>line-to-line           | 0.5                 | —               | 0.93            | $V_{PP}$  |
| Differential Output Voltage  | $CKO_{VD}$    | CML 100 $\Omega$ load<br>line-to-line              | 350                 | 425             | 500             | $mV_{PP}$ |
| Common Mode Output Voltage   | $CKO_{VCM}$   | CML 100 $\Omega$ load<br>line-to-line              | —                   | $V_{DD} - 0.36$ | —               | V         |
| Differential Output Voltage  | $CKO_{VD}$    | LVDS 100 $\Omega$ load<br>line-to-line             | 500                 | 700             | 900             | $mV_{PP}$ |
|  |               | Low swing LVDS 100 $\Omega$ load<br>line-to-line   | 350                 | 425             | 500             | $mV_{PP}$ |
| Common Mode Output Voltage   | $CKO_{VCM}$   | LVDS 100 $\Omega$ load<br>line-to-line             | 1.125               | 1.2             | 1.275           | V         |
| Differential Output Resistance   | $CKO_{RD}$    | CML, LVPECL, LVDS,<br>Disable                      | —                   | 200             | —               | $\Omega$  |
| Output Voltage Low   | $CKO_{VOLLH}$ | CMOS   | —                   | —               | 0.4             | V         |
| Output Voltage High  | $CKO_{VOHLH}$ | $V_{DD} = 1.71 \text{ V}$<br>CMOS                  | $0.8 \times V_{DD}$ | —               | —               | V         |
| <b>Notes:</b>  |               |  |                     |                 |                 |           |
| 1. Refers to Si5315A speed grade.  |               |  |                     |                 |                 |           |
| 2. Refers to Si5315B speed grade.  |               |  |                     |                 |                 |           |
| 3. This is the amount of leakage that the 3L inputs can tolerate from an external driver. See Figure 3 on page 11. |               |  |                     |                 |                 |           |

# Si5315

**Table 2. DC Characteristics (Continued)**

( $V_{DD} = 1.8 \pm 5\%$ ,  $2.5 \pm 10\%$ , or  $3.3 \text{ V} \pm 10\%$ ,  $T_A = -40$  to  $85 \text{ }^\circ\text{C}$ )

| Parameter  | Symbol            | Test Condition   | Min                  | Typ | Max                  | Units         |
|--|-------------------|--|----------------------|-----|----------------------|---------------|
| Output Drive Current   | CKO <sub>IO</sub> | CMOS<br>Driving into CKO <sub>VOL</sub> for out-<br>put low or CKO <sub>VOH</sub> for out-<br>put high. CKOUT+ and<br>CKOUT– shorted externally. |                      |     |                      |               |
|  |                   | $V_{DD} = 1.71 \text{ V}$  | 7.5                  | —   | —                    | mA            |
|  |                   | $V_{DD} = 2.97 \text{ V}$  | 32                   | —   | —                    | mA            |
| <b>2-Level LVCMOS Input Pins</b>   |                   |  |                      |     |                      |               |
| Input Voltage Low  | $V_{IL}$          | $V_{DD} = 1.71 \text{ V}$  | —                    | —   | 0.5                  | V             |
|  |                   | $V_{DD} = 2.25 \text{ V}$  | —                    | —   | 0.7                  | V             |
|  |                   | $V_{DD} = 2.97 \text{ V}$  | —                    | —   | 0.8                  | V             |
| Input Voltage High   | $V_{IH}$          | $V_{DD} = 1.89 \text{ V}$  | 1.4                  | —   | —                    | V             |
|  |                   | $V_{DD} = 2.25 \text{ V}$  | 1.8                  | —   | —                    | V             |
|  |                   | $V_{DD} = 3.63 \text{ V}$  | 2.5                  | —   | —                    | V             |
| Input Low Current  | $I_{IL}$          |  | —                    | —   | 50                   | $\mu\text{A}$ |
| Input High Current   | $I_{IH}$          |  | —                    | —   | 50                   | $\mu\text{A}$ |
| Weak Internal Input Pull-up Resistor   | $R_{PUP}$         |  | —                    | 75  | —                    | k $\Omega$    |
| Weak Internal Input Pull-down Resistor   | $R_{PDN}$         |  | —                    | 75  | —                    | k $\Omega$    |
| <b>3-Level Input Pins</b>  |                   |  |                      |     |                      |               |
| Input Voltage Low  | $V_{ILL}$         |  | —                    | —   | $0.15 \times V_{DD}$ | V             |
| Input Voltage Mid  | $V_{IMM}$         |  | $0.45 \times V_{DD}$ | —   | $0.55 \times V_{DD}$ | V             |
| Input Voltage High   | $V_{IHH}$         |  | $0.85 \times V_{DD}$ | —   | —                    | V             |
| Input Low Current  | $I_{ILL}$         | See note 3.  | –20                  | —   | —                    | $\mu\text{A}$ |
| Input Mid Current  | $I_{IMM}$         | See note 3.  | –2                   | —   | 2                    | $\mu\text{A}$ |
| Input High Current   | $I_{IHH}$         | See note 3.  | —                    | —   | 20                   | $\mu\text{A}$ |
| <b>Notes:</b>  |                   |  |                      |     |                      |               |
| 1. Refers to Si5315A speed grade.  |                   |  |                      |     |                      |               |
| 2. Refers to Si5315B speed grade.  |                   |  |                      |     |                      |               |
| 3. This is the amount of leakage that the 3L inputs can tolerate from an external driver. See Figure 3 on page 11. |                   |  |                      |     |                      |               |

**Table 2. DC Characteristics (Continued)** $(V_{DD} = 1.8 \pm 5\%, 2.5 \pm 10\%, \text{ or } 3.3 \text{ V} \pm 10\%, T_A = -40 \text{ to } 85 \text{ }^\circ\text{C})$ 

| Parameter  | Symbol              | Test Condition                                     | Min            | Typ | Max | Units            |
|--|---------------------|--|----------------|-----|-----|------------------|
| <b>LVC MOS Output Pins</b>   |                     |  |                |     |     |                  |
| Output Voltage Low   | $V_{OL}$            | $I_O = 2 \text{ mA}$<br>$V_{DD} = 1.62 \text{ V}$  | —              | —   | 0.4 | V                |
|  |                     | $I_O = 2 \text{ mA}$<br>$V_{DD} = 2.97 \text{ V}$  | —              | —   | 0.4 | V                |
| Output Voltage High  | $V_{OH}$            | $I_O = -2 \text{ mA}$<br>$V_{DD} = 1.62 \text{ V}$ | $V_{DD} - 0.4$ | —   | —   | V                |
|  |                     | $I_O = -2 \text{ mA}$<br>$V_{DD} = 2.97 \text{ V}$ | $V_{DD} - 0.4$ | —   | —   | V                |
| Disabled Leakage Current   | $I_{OZ}$            | $\overline{RST} = 0$                               | -100           | —   | 100 | $\mu\text{A}$    |
| <b>Single-Ended Reference Clock Input Pin XA (XB with Cap to Gnd)</b>  |                     |  |                |     |     |                  |
| Input Resistance   | $XA_{RIN}$          | XTAL/CLOCK = M                                     | —              | 12  | —   | $\text{k}\Omega$ |
| Input Voltage Level Limits   | $XA_{VIN}$          |  | 0              | —   | 1.2 | V                |
| Input Voltage Swing  | $XA_{VPP}$          |  | 0.5            | —   | 1.2 | $V_{PP}$         |
| <b>Differential Reference Clock Input Pins (XA/XB)</b>   |                     |  |                |     |     |                  |
| Input Resistance   | $XA/XB_{RIN}$       | XTAL/CLOCK = M                                     | —              | 12  | —   | $\text{k}\Omega$ |
| Differential Input Voltage Level Limits  | $XA/XB_{VIN}$       |  | 0              | —   | 1.2 | V                |
| Input Voltage Swing  | $XA_{VPP}/XB_{VPP}$ |  | 0.5            | —   | 2.4 | $V_{PP}$         |
| <b>Notes:</b>  |                     |  |                |     |     |                  |
| 1. Refers to Si5315A speed grade.  |                     |  |                |     |     |                  |
| 2. Refers to Si5315B speed grade.  |                     |  |                |     |     |                  |
| 3. This is the amount of leakage that the 3L inputs can tolerate from an external driver. See Figure 3 on page 11. |                     |  |                |     |     |                  |

# Si5315

**Table 3. AC Characteristics**

( $V_{DD} = 1.8 \pm 5\%$ ,  $2.5 \pm 10\%$ , or  $3.3 V \pm 10\%$ ,  $T_A = -40$  to  $85\text{ }^\circ\text{C}$ )

| Parameter   | Symbol      | Test Condition   | Min   | Typ | Max      | Units |
|---|-------------|--|-------|-----|----------|-------|
| Input Frequency   | $CKN_F$     |  | 0.008 | —   | 644.53   | MHz   |
| <b>CKINn Input Pins</b>   |             |  |       |     |          |       |
| Input Duty Cycle (Minimum Pulse Width)  | $CKN_{DC}$  | Whichever is smaller <sup>1</sup>  | 40    | —   | 60       | %     |
|   |             |  | 2     | —   | —        | ns    |
| Input Capacitance   | $CKN_{CIN}$ |  | —     | —   | 3        | pF    |
| Input Rise/Fall Time  | $CKN_{TRF}$ | 20–80%<br>See Figure 2   | —     | —   | 11       | ns    |
| <b>CKOUTn Output Pins</b>   |             |  |       |     |          |       |
| Output Frequency (Output not configured for CMOS or disable)                    | $CKO_{OF}$  | Note 2   | 0.008 | —   | 644.53   | MHz   |
|   |             | Note 3   | 0.008 | —   | 125      | MHz   |
| Maximum Output Frequency in CMOS Format   | $CKO_{FMC}$ |  | —     | —   | 161.13   | MHz   |
| Output Rise/Fall (20–80%) at 644.5313 MHz                                       | $CKO_{TRF}$ | Output not configured for CMOS or disabled, see Figure 2                     | —     | 230 | 350      | ps    |
| Single Ended Output Rise/Fall (20–80%)  | $CKO_{TRF}$ | CMOS Output<br>$V_{DD} = 1.62$<br>Cl <sub>load</sub> = 5 pF                  | —     | —   | 8        | ns    |
|   |             | CMOS Output<br>$V_{DD} = 2.97$<br>Cl <sub>load</sub> = 5 pF                  | —     | —   | 2        | ns    |
| Output Duty Cycle Differential Uncertainty                                      | $CKO_{DC}$  | 100 $\Omega$ Load<br>Line to Line<br>Measured at 50% Point<br>(not for CMOS) | —     | —   | $\pm 40$ | ps    |
| <b>LVCNOS Pins</b>  |             |  |       |     |          |       |
| Input Capacitance   | $C_{in}$    |  | —     | —   | 3        | pF    |
| <b>Notes:</b>   |             |  |       |     |          |       |
| 1. Assumes N3 does not equal 1. IF N3 = 1, $CKN_{DC} = 50\text{ }\mu\text{s}$ . |             |  |       |     |          |       |
| 2. Refers to Si5315A speed grade.   |             |  |       |     |          |       |
| 3. Refers to Si5315B speed grade.   |             |  |       |     |          |       |



**Table 3. AC Characteristics (Continued)**(V<sub>DD</sub> = 1.8 ±5%, 2.5 ±10%, or 3.3 V ±10%, T<sub>A</sub> = -40 to 85 °C)

| Parameter   | Symbol               | Test Condition   | Min                                       | Typ  | Max | Units    |
|---|----------------------|--|---|------|-----|----------|
| <b>LVC MOS Output Pins</b>  |                      |  |   |      |     |          |
| Rise/Fall Times   | t <sub>RF</sub>      | CLOAD = 20 pf<br>See Figure 2  | —   | 25   | —   | ns       |
| LOS <sub>n</sub> Trigger Window                                       | LOS <sub>TRIG</sub>  | From last CKIN <sub>n</sub> ↑ to<br>internal detection of LOS <sub>n</sub> | —   | —    | 750 | μs       |
| Time to Clear LOL after LOS<br>Cleared                                | t <sub>CLRLOL</sub>  | ↓ LOS to ↓ LOL<br>Assume Fold=Fnew,<br>Stable XA-XB reference              | —   | 10   | —   | ms       |
| <b>PLL Performance</b>  |                      |  |   |      |     |          |
| Output Clock Skew   | t <sub>SKEW</sub>    | ↑ of CKOUT <sub>n</sub> to ↑ CKOUT <sub>n</sub>                            | —   | —    | 100 | ps       |
| Phase Change Due to<br>Temperature Variation                          | t <sub>TEMP</sub>    | Maximum phase change from<br>-40 to +85 °C                                 | —   | 300  | 500 | ps       |
| Lock Time   | t <sub>LOCKHW</sub>  | ↑ $\overline{\text{RST}}$ with valid CKIN to ↓ LOL;<br>BW = 100 Hz         | —   | 1200 | —   | ms       |
| Closed Loop Jitter Peaking  | J <sub>PK</sub>      |  | —   | 0.05 | 0.1 | dB       |
| Jitter Tolerance  | J <sub>TOL</sub>     |  | See 4.2.3. "Jitter Tolerance" on page 18. |      |     | ns pk-pk |
| Minimum Reset Pulse Width   | t <sub>RSTMIN</sub>  |  | 1   | —    | —   | μs       |
| Output Clock Initial Phase Step                                       | t <sub>P_STEP</sub>  | During clock switch CKIN ≥ 19.44<br>MHz                                    | —   | 100  | 200 | ps       |
| Holdover Frequency Historical<br>Averaging Time                       | t <sub>HISTAVG</sub> |  | —   | 6.7  | —   | sec      |
| Holdover Frequency Historical<br>Delay Time                           | t <sub>HISTDEL</sub> |  | —   | 26.2 | —   | ms       |
| Spurious Noise  | SP <sub>SPUR</sub>   | Max spur @ n x f3<br>(n ≥ 1, n x f3 < 100 MHz)                             | —   | -75  | —   | dBc      |
| <b>Notes:</b>   |                      |  |   |      |     |          |
| 1. Assumes N3 does not equal 1. IF N3 = 1, CKN <sub>DC</sub> = 50 μs. |                      |  |   |      |     |          |
| 2. Refers to Si5315A speed grade.                                     |                      |  |   |      |     |          |
| 3. Refers to Si5315B speed grade.                                     |                      |  |   |      |     |          |

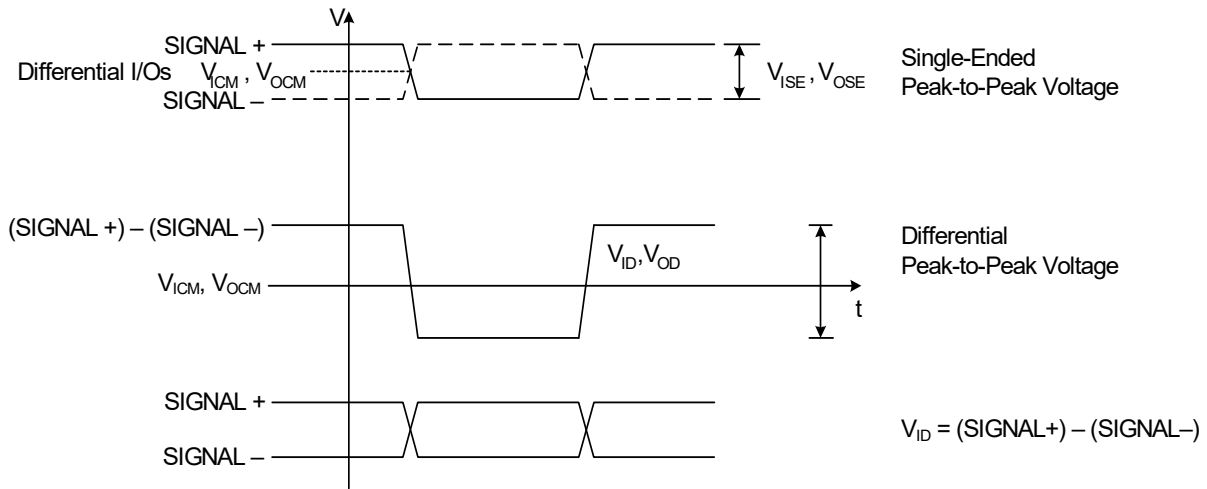
**Table 4. Jitter Generation**

( $V_{DD} = 1.8 \pm 5\%$ ,  $2.5 \pm 10\%$ , or  $3.3 \text{ V} \pm 10\%$ ,  $T_A = -40$  to  $85 \text{ }^\circ\text{C}$ )

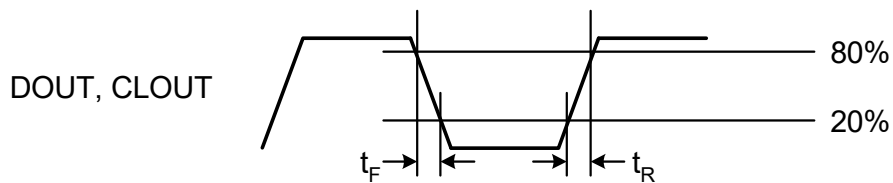
| Parameter                 | Symbol    | Test Condition <sup>1,2,3,4</sup> |                       | Min | Typ   | Max   | GR-253 Spec   | Unit                     |
|---------------------------|-----------|-----------------------------------|-----------------------|-----|-------|-------|---|--------------------------|
|                           |           | Measurement Filter (MHz)          | DSPLL BW <sup>1</sup> |     |       |       |   |                          |
| Jitter Gen OC-192         | $J_{GEN}$ | 0.02–80                           | 167 Hz <sup>5</sup>   | —   | 0.483 | 0.628 | N/A   | $\text{ps}_{\text{rms}}$ |
|                           |           | 4–80                              | 167 Hz <sup>5</sup>   | —   | 0.302 | 0.392 | N/A   | $\text{ps}_{\text{rms}}$ |
|                           |           | 0.05–80                           | 167 Hz <sup>5</sup>   | —   | 0.467 | 0.607 | $1.0 \text{ ps}_{\text{rms}}$<br>( $0.01 U_{\text{I,rms}}$ )  | $\text{ps}_{\text{rms}}$ |
| Jitter Gen OC-48          | $J_{GEN}$ | 0.012–20                          | 167 Hz <sup>5</sup>   | —   | 0.470 | 0.611 | $4.02 \text{ ps}_{\text{rms}}$<br>( $0.01 U_{\text{I,rms}}$ ) | $\text{ps}_{\text{rms}}$ |
|                           |           |                                   | 111 Hz <sup>6</sup>   | —   | 0.565 | 0.734 | $4.02 \text{ ps}_{\text{rms}}$<br>( $0.01 U_{\text{I,rms}}$ ) | $\text{ps}_{\text{rms}}$ |
| IEEE 802.3 GbE RMS Jitter | $J_{GEN}$ | 1.875–20                          | 83 Hz <sup>6</sup>    | —   | 0.232 | 0.301 |   | $\text{ps}_{\text{rms}}$ |

**Notes:**

1. BWSEL [1:0] loop bandwidth settings provided in Table 9 on page 20.
2. 40 MHz fundamental mode crystal used as XA/XB input.
3.  $V_{DD} = 2.5 \text{ V}$
4.  $T_A = 85 \text{ }^\circ\text{C}$
5. Si5315A test condition:  $f_{\text{IN}} = 19.44 \text{ MHz}$ ,  $f_{\text{OUT}} = 156.25 \text{ MHz}$ , LVPECL clock input: 1.19 Vppd with 0.5 ns rise/fall time (20–80%), LVPECL clock output.
6. Si5315B test condition:  $f_{\text{IN}} = 19.44 \text{ MHz}$ ,  $f_{\text{OUT}} = 125 \text{ MHz}$ , LVPECL clock input: 1.19 Vppd with 0.5 ns rise/fall time (20–80%), LVPECL clock output.



**Figure 1. CKIN Voltage Characteristics**



**Figure 2. Rise/Fall Time Characteristics**

### 1.1. Three-Level (3L) Input Pins (No External Resistors)

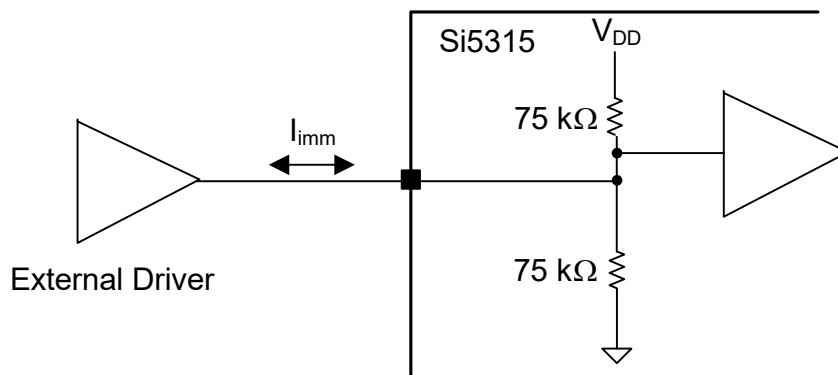


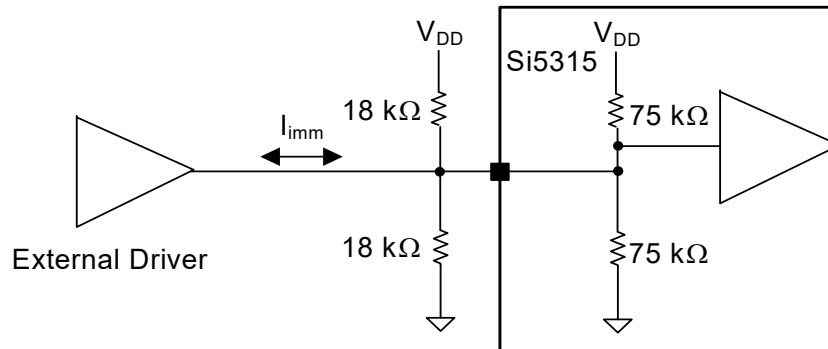
Figure 3. Three-Level Input Pins

Table 5. Three-Level Input Pins (No External Resistors)

| Parameter          | Symbol    | Min                  | Max                  |
|--------------------|-----------|----------------------|----------------------|
| Input Voltage Low  | $V_{ill}$ | —                    | $0.15 \times V_{DD}$ |
| Input Voltage Mid  | $V_{imm}$ | $0.45 \times V_{DD}$ | $0.55 \times V_{DD}$ |
| Input Voltage High | $V_{ihh}$ | $0.85 \times V_{DD}$ | —                    |
| Input Low Current  | $I_{ill}$ | $-6\ \mu\text{A}$    | —                    |
| Input Mid Current  | $I_{imm}$ | $-2\ \mu\text{A}$    | $2\ \mu\text{A}$     |
| Input High Current | $I_{ihh}$ | —                    | $6\ \mu\text{A}$     |

**Note:** The above currents are the amount of leakage that the 3L inputs can tolerate from an external driver.

## 1.2. Three-Level (3L) Input Pins (With External Resistors)



One of eight resistors from a Panasonic EXB-D10C183J (or similar) resistor pack

**Figure 4. Three Level Input Pins**

**Table 6. Three-Level Input Pins (With External Resistors)**

| Parameter          | Symbol    | Min         | Max         |
|--------------------|-----------|-------------|-------------|
| Input Low Current  | $I_{ill}$ | -30 $\mu$ A | —           |
| Input Mid Current  | $I_{imm}$ | -11 $\mu$ A | -11 $\mu$ A |
| Input High Current | $I_{ihh}$ | —           | -30 $\mu$ A |

**Note:** The above currents are the amount of leakage that the 3L inputs can tolerate from an external driver.

- Any resistor pack may be used.
  - The Panasonic EXB-D10C183J is an example.
  - PCB layout is not critical.
- Resistor packs are only needed if the leakage current of the external driver exceeds the listed currents.
- If a pin is tied to ground or  $V_{DD}$ , no resistors are needed.
- If a pin is left open (no connect), no resistors are needed.

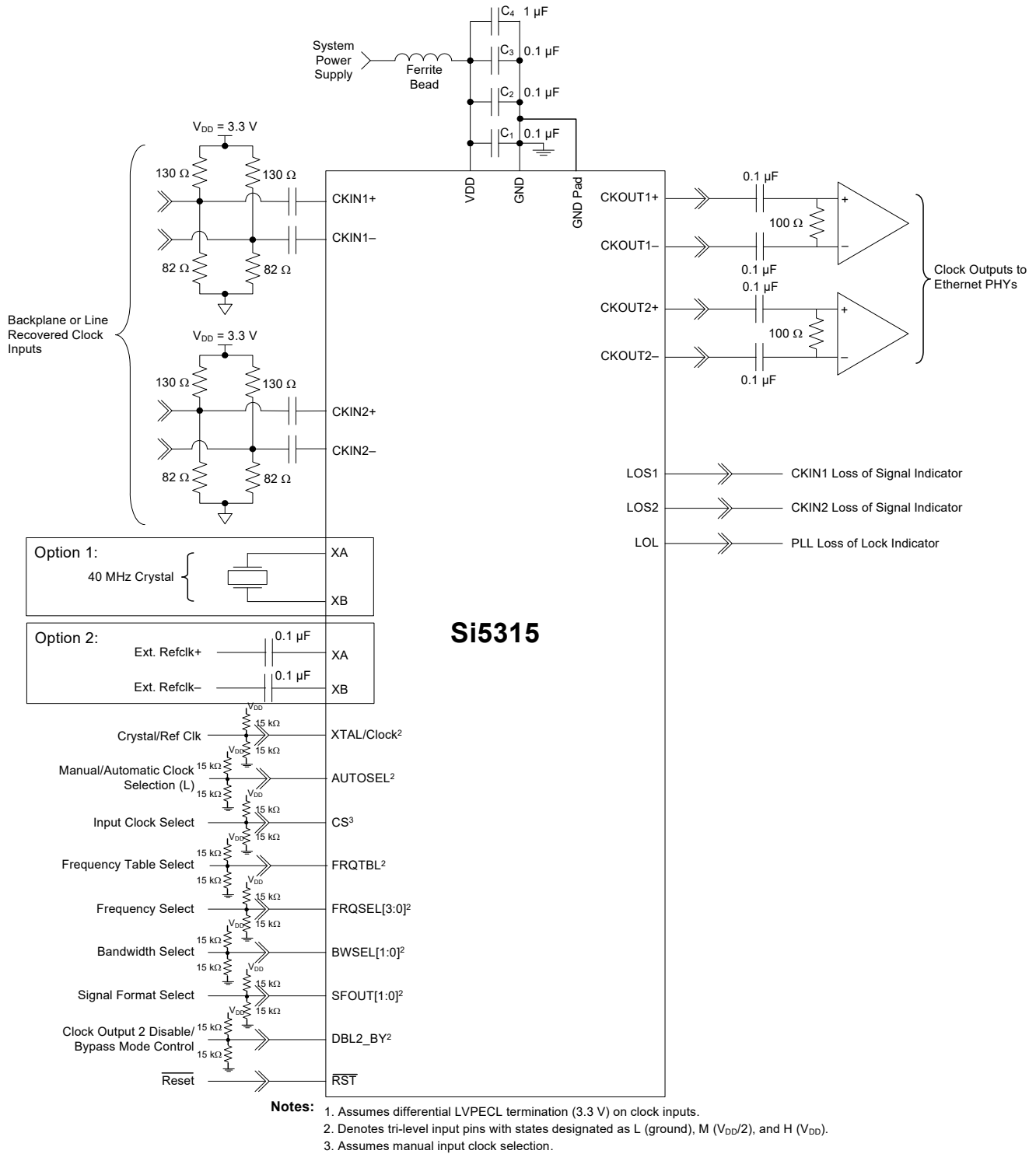
**Table 7. Thermal Characteristics** $(V_{DD} = 1.8 \pm 5\%, 2.5 \pm 10\%, \text{ or } 3.3 \text{ V} \pm 10\%, T_A = -40 \text{ to } 85 \text{ }^\circ\text{C})$ 

| Parameter                              | Symbol        | Test Condition | Min | Typ | Max | Unit               |
|--|---------------|----------------|-----|-----|-----|--------------------|
| Thermal Resistance Junction to Ambient | $\theta_{JA}$ | Still Air      | —   | 32  | —   | $^\circ\text{C/W}$ |
| Thermal Resistance Junction to Case    | $\theta_{JC}$ | Still Air      | —   | 14  | —   | $^\circ\text{C/W}$ |

**Table 8. Absolute Maximum Limits**

| Parameter  | Symbol      | Value                      | Unit |
|--|-------------|----------------------------|------|
| DC Supply Voltage  | $V_{DD}$    | -0.5 to 3.8                | V    |
| LVC MOS Input Voltage  | $V_{DIG}$   | -0.3 to ( $V_{DD} + 0.3$ ) | V    |
| CKINn Voltage Level Limits   | $CKN_{VIN}$ | 0 to $V_{DD}$              | V    |
| XA/XB Voltage Level Limits   | $XA_{VIN}$  | 0 to 1.2                   | V    |
| Operating Junction Temperature   | $T_{JCT}$   | -55 to 150                 | C    |
| Storage Temperature Range  | $T_{STG}$   | -55 to 150                 | C    |
| ESD HBM Tolerance (100 pF, 1.5 k $\Omega$ ); All pins except CKIN+/CKIN-   |             | 2                          | kV   |
| ESD MM Tolerance; All pins except CKIN+/CKIN-  |             | 150                        | V    |
| ESD HBM Tolerance (100 pF, 1.5 k $\Omega$ ); CKIN+/CKIN-   |             | 750                        | V    |
| ESD MM Tolerance; CKIN+/CKIN-  |             | 100                        | V    |
| Latch-Up Tolerance   |             | JESD78 Compliant           |      |
| <b>Note:</b> Permanent device damage may occur if the Absolute Maximum Ratings are exceeded. Functional operation should be restricted to the conditions as specified in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods of time may affect device reliability. |             |                            |      |

## 2. Typical Application Circuit



**Figure 5. Si5315 Typical Application Circuit**

### 3. System Level Overview

The Si5315 provides clock translation, jitter attenuation, and clock distribution for high-performance Synchronous Ethernet\* line card timing applications.

**\*Note:** The Si5315 supports SyncE EEC options 1 and 2 when paired with a timing card that implements the required wander filtering and Stratum 3 compliant reference clock. For detailed information, refer to “AN420: SyncE and IEEE 1588: Sync Distribution for a Unified Network”.

The Si5315 provides clock translation, jitter attenuation, and clock distribution for high-performance Synchronous Ethernet line card timing applications. The device accepts two clock inputs ranging from 8 kHz to 644.53 MHz and generates two equal frequency, low jitter clock outputs ranging from 8 kHz to 644.53 MHz. For ease of use, the Si5315 is pin controlled to enable simple device configuration of frequency plans, PLL loop bandwidth, and input clock selection. The DSPLL locks to one of two input reference clocks and provides over 200 frequency translations to synchronize output clocks for Ethernet, SONET/SDH, and PDH line cards. The Si5315 implements internal state machines to control hitless switching between input clocks and holdover. Status alarms, loss of signal (LOS) and loss of lock (LOL) are provided on output pins to indicate a change in device status.

This device is designed for systems with line cards that are synchronized to a redundant, centralized telecom or Ethernet backplane. The Si5315 synchronizes to backplane clocks and generates a multiplied, jitter attenuated Ethernet/SONET/SDH clock or PDH clock. A typical system application is shown in Figure 6. The Si5315 translates a 19.44 MHz clock from the telecom backplane to an Ethernet or SONET/SDH clock frequency to the PHY and filters the jitter to ensure compliance with related ITU-T and Telcordia standards.

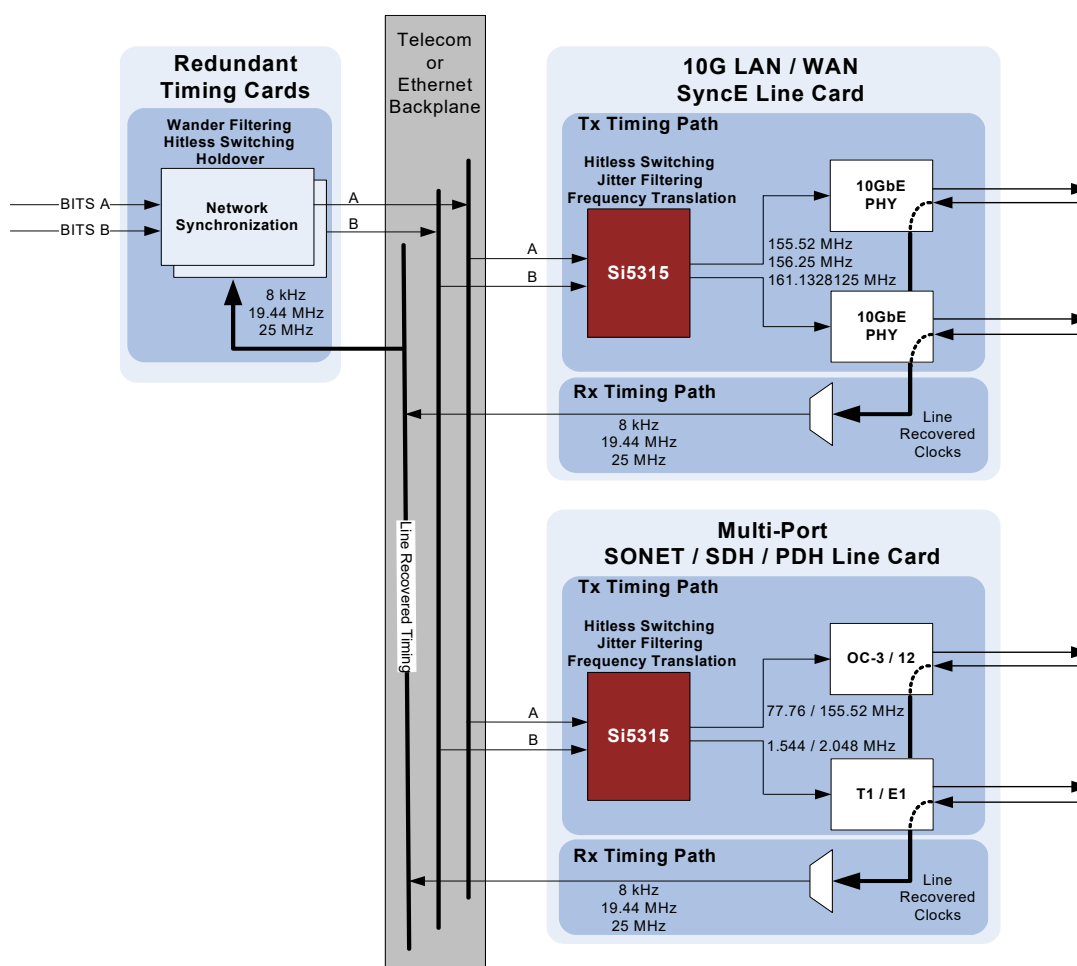


Figure 6. Typical Si5315 Application

## 4. Functional Description

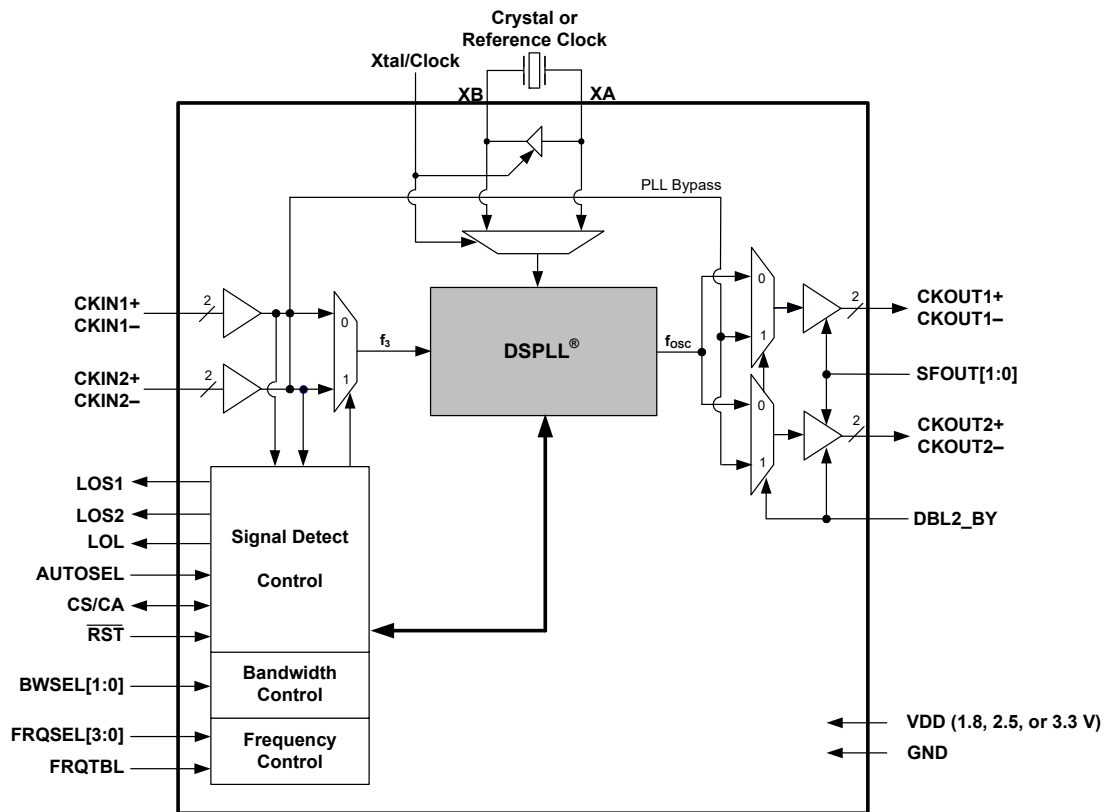


Figure 7. Detailed Block Diagram

### 4.1. Overview

The Si5315 is a jitter-attenuating precision clock multiplier for Synchronous Ethernet, SONET/SDH, and PDH (T1/E1) applications. The Si5315 accepts dual clock inputs ranging from 8 kHz to 644.53 MHz and generates two frequency-multiplied clock outputs ranging from 8 kHz to 644.53 MHz. The two input clocks are at the same frequency and the two output clocks are at the same frequency. The input clock frequency and clock multiplication ratio are selectable from a look up table of popular SyncE and T1/E1 rates.

The Si5315 is based on Skyworks Solutions' 3rd-generation DSPLL<sup>®</sup> technology, which provides any-frequency synthesis and jitter attenuation in a highly integrated PLL solution that eliminates the need for external VCXO and loop filter components. The Si5315 PLL loop bandwidth is selectable via the BWSEL[1:0] pins and supports a range from 60 to 8.4 kHz.

The Si5315 supports hitless switching between the two input clocks in compliance with ITU-T G.8262 and Telcordia GR-253-CORE and GR-1244-CORE. This feature greatly minimizes the propagation of phase transients to the clock outputs during an input clock transition (<200 ps typ). Manual and automatic revertive and non-revertive input clock switching options are available via the AUTOSEL input pin. The Si5315 monitors both input clocks for loss-of-signal and provides a LOS alarm when it detects missing pulses on either input clock. The device monitors the lock status of the PLL. The lock detect algorithm works by continuously monitoring the phase of the input clock in relation to the phase of the feedback clock. The Si5315 provides a holdover capability that allows the device to continue generation of a stable output clock when the selected input reference is lost.

The Si5315 has two differential clock outputs. The signal format of the clock outputs is programmable to support LVPECL, LVDS, CML, or CMOS loads. The second clock output can be powered down to minimize power consumption. For system-level debugging, a bypass mode is available which drives the output clock directly from the input clock, bypassing the internal DSPLL. The device operates from a single 1.8, 2.5, or 3.3 V supply.



## 4.2. PLL Performance

The Si5315 provides extremely low jitter generation, a well-controlled jitter transfer function, and high jitter tolerance due to the high level of integration.

### 4.2.1. Jitter Generation

Jitter generation is defined as the amount of jitter produced at the output of the device with a jitter free input clock. Generated jitter arises from sources within the VCO and other PLL components. Jitter generation is a function of the PLL bandwidth setting. Higher loop bandwidth settings may result in lower jitter generation, but may result in less attenuation of jitter that might be present on the input clock signal.

### 4.2.2. Jitter Transfer

Jitter transfer is defined as the ratio of output signal jitter to input signal jitter for a specified jitter frequency. The jitter transfer characteristic determines the amount of input clock jitter that passes to the outputs. The DSPLL technology used in the Si5315 provides tightly controlled jitter transfer curves because the PLL gain parameters are determined largely by digital circuits which do not vary over supply voltage, process, and temperature. In a system application, a well-controlled transfer curve minimizes the output clock jitter variation from board to board and provides more consistent system level jitter performance.

The jitter transfer characteristic is a function of the loop bandwidth setting. Lower bandwidth settings result in more jitter attenuation of the incoming clock, but may result in higher jitter generation. Figure 8 shows the jitter transfer curve mask.

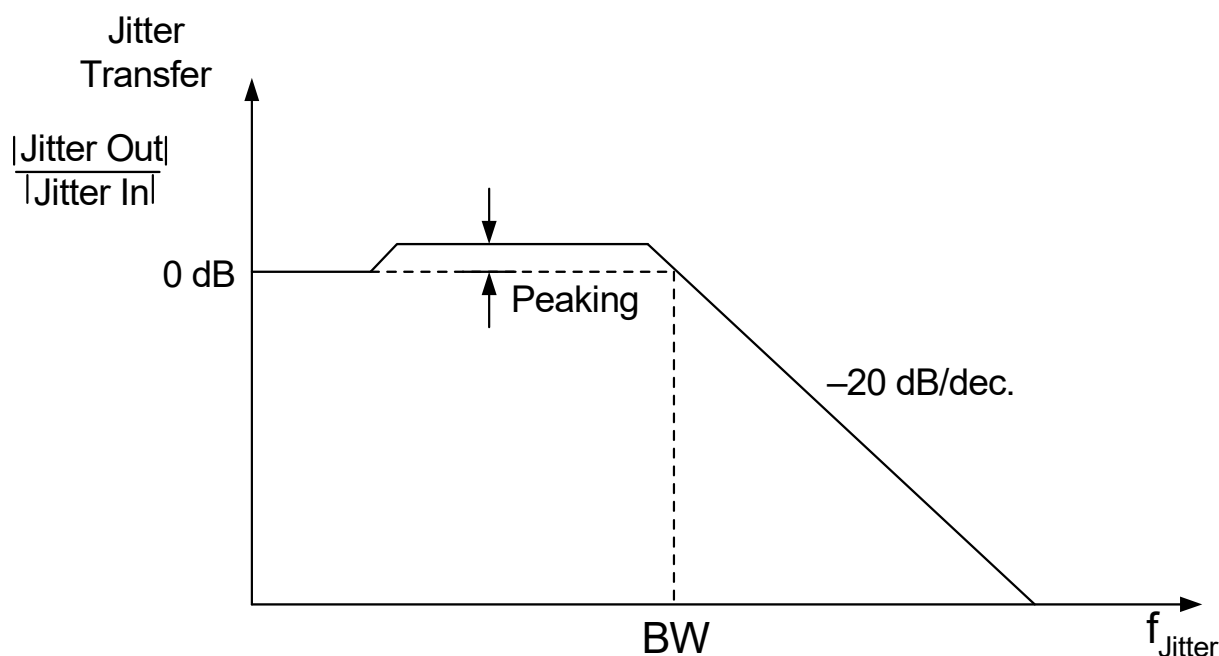
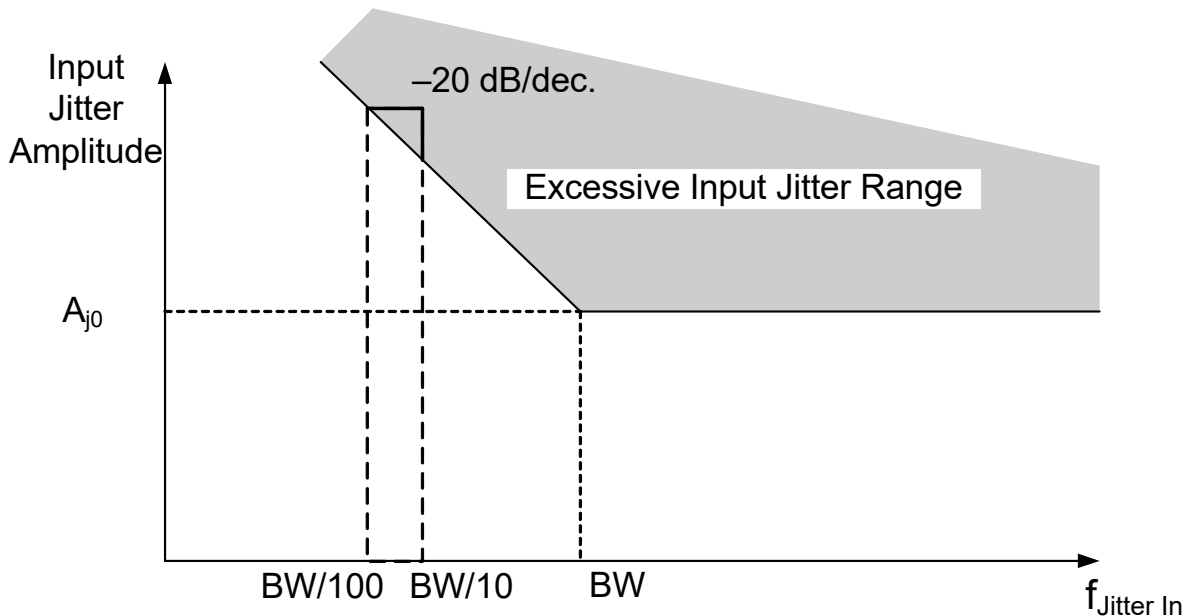


Figure 8. PLL Jitter Transfer Mask/Template

### 4.2.3. Jitter Tolerance

Jitter tolerance is defined as the maximum peak-to-peak sinusoidal jitter that can be present on the incoming clock before the DSPLL loses lock. The tolerance is a function of the jitter frequency, because tolerance improves for lower input jitter frequency.

The jitter tolerance of the DSPLL is a function of the loop bandwidth setting. Figure 9 shows the general shape of the jitter tolerance curve versus input jitter frequency. For jitter frequencies above the loop bandwidth, the tolerance is a constant value  $A_{j0}$ . Beginning at the PLL bandwidth, the tolerance increases at a rate of 20 dB/decade for lower input jitter frequencies.



**Figure 9. Jitter Tolerance Mask/Template**

The equation for the high frequency jitter tolerance can be expressed as a function of the PLL loop bandwidth (i.e., BW):

$$A_{j0} = \frac{5000}{BW} \text{ ns pk-pk}$$

For example, the jitter tolerance when  $f_{\text{in}} = 19.44 \text{ MHz}$ ,  $f_{\text{out}} = 161.13 \text{ MHz}$  and the loop bandwidth (BW) is 113 Hz:

$$A_{j0} = \frac{5000}{113} = 44.24 \text{ ns pk-pk}$$

### 4.2.4. Jitter Attenuation Performance

The Internal VCO uses the reference clock on the XA/XB pins as its reference for jitter attenuation. The XA/XB pins support either a crystal input or an input buffer single-ended or differential clock input, such that an external oscillator can become the reference source. In either case, the device accepts a wide margin in absolute frequency of the reference input. (See 5.5. "Holdover Mode" on page 32.) In holdover, the Si5315's output clock stability matches the reference supplied on the XA/XB pins. The external crystal or reference clock must be selected based on the stability requirements of the application if holdover is a key requirement.

However, care must be exercised in certain areas for optimum performance. For examples of connections to the XA/XB pins, refer to 7. "Crystal/Reference Clock Input" on page 38.

## 5. Frequency Plan Tables

For ease of use, the Si5315 is pin controlled to enable simple device configuration of the frequency plan and PLL loop bandwidth via a predefined look up table. The DSPLL has been optimized for each frequency multiplication and PLL loop bandwidth provided in Table 9 on page 20.

Many of the control inputs are three levels: High, Low, and Medium. High and Low are standard voltage levels determined by the supply voltage:  $V_{DD}$  and Ground. If the input pin is left floating, it is driven to nominally half of  $V_{DD}$ . Effectively, this creates three logic levels for these controls. See 1.2. "Three-Level (3L) Input Pins (With External Resistors)" on page 12 and 8. "Power Supply Filtering" on page 41 for additional information.

### 5.1. Frequency Multiplication Plan

The input to output clock multiplication is set by the 3-level FRQSEL[3:0] pins. The device provides a wide range of commonly used SyncE, SONET/SDH, and PDH frequency translations. The CKIN1 and CKIN2 inputs must be the same frequency as specified in Table 9. Both CKOUT1 and CKOUT2 outputs are at the same frequency.

#### 5.1.1. PLL Loop Bandwidth Plan

The Si5315's loop bandwidth ranges from 60 Hz to 8.4 kHz. For each frequency multiplication, its corresponding loop bandwidth is provided in a simple look up table. (See Table 9 on page 20.) The loop bandwidth (BW) is digitally programmable using the 3-level BWSEL [1:0] and FRQTBL input pins.

Table 9. Look Up Tables for Clock Multiplication and Loop Bandwidth Settings

| Plan # | f <sub>IN</sub><br>(MHz) | f <sub>OUT</sub><br>(MHz) | FRQTBL | FRQSEL<br>[3:0] | Loop Bandwidth Selection (Hz), BWSEL[1:0] |    |      |      |     |     |    |    |
|--------|--------------------------|---------------------------|--------|-----------------|---|----|------|------|-----|-----|----|----|
|        |                          |                           |        |                 | LM  | LH | ML   | MM   | MH  | HL  | HH |    |
| 1      | 0.008                    | 0.008                     | L      | LLLL            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 2      | 0.008                    | 1.544                     | L      | LLLM            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 3      | 0.008                    | 2.048                     | L      | LLLH            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 4      | 0.008                    | 8.192                     | L      | LLML            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 5      | 0.008                    | 19.44                     | L      | LLMM            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 6      | 0.008                    | 25                        | L      | LLMH            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 7      | 0.008                    | 32.768                    | L      | LLHL            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 8      | 0.008                    | 34.368                    | M      | LLLL            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 9      | 0.008                    | 38.88                     | M      | LLLM            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 10     | 0.008                    | 44.736                    | M      | LLLH            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 11     | 0.008                    | 51.84                     | M      | LLML            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 12     | 0.008                    | 65.536                    | M      | LLMM            | 257                                       | —  | —    | —    | —   | —   | —  | —  |
| 13     | 0.008                    | 77.76                     | M      | LLMH            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 14     | 0.008                    | 125                       | M      | LLHL            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 15     | 0.008                    | 155.52                    | H      | LLLL            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 16     | 0.008                    | 156.25                    | H      | LLLM            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 17     | 0.008                    | 311.04                    | H      | LLLH            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 18     | 0.008                    | 312.5                     | H      | LLML            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 19     | 0.008                    | 622.08                    | H      | LLMM            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 20     | 1.544                    | 0.008                     | L      | LLHM            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 21     | 1.544                    | 1.544                     | L      | LLHH            | —   | —  | 6047 | 1451 | 359 | 179 | 89 | 89 |
| 22     | 1.544                    | 2.048                     | L      | LMLL            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 23     | 1.544                    | 8.192                     | L      | LMLM            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |
| 24     | 1.544                    | 19.44                     | L      | LMLH            | 257                                       | 60 | —    | —    | —   | —   | —  | —  |

**Notes:**

1. F<sub>IN</sub> and F<sub>OUT</sub> frequency values may be rounded off. For exact multiplication ratios, please contact Skyworks Solutions.
2. Si5315A supports all frequency plans.
3. Si5315B supports output frequency plans up to 125 MHz.

Table 9. Look Up Tables for Clock Multiplication and Loop Bandwidth Settings (Continued)

| Plan # | f <sub>IN</sub><br>(MHz) | f <sub>OUT</sub><br>(MHz) | FRQTBL | FRQSEL<br>[3:0] | Loop Bandwidth Selection (Hz), BWSEL[1:0] |     |      |     |     |     |    |    |
|--------|--------------------------|---------------------------|--------|-----------------|---|-----|------|-----|-----|-----|----|----|
|        |                          |                           |        |                 | LM  | LH  | ML   | MM  | MH  | HL  | HH |    |
| 25     | 1.544                    | 25                        | L      | LMMML           | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 26     | 1.544                    | 32.768                    | L      | LMMM            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 27     | 1.544                    | 34.368                    | M      | LLHM            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 28     | 1.544                    | 38.88                     | M      | LLHH            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 29     | 1.544                    | 44.736                    | M      | LMLL            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 30     | 1.544                    | 51.84                     | M      | LMLM            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 31     | 1.544                    | 65.536                    | M      | LMLH            | 257                                       | —   | —    | —   | —   | —   | —  | —  |
| 32     | 1.544                    | 77.76                     | M      | LMMM            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 33     | 1.544                    | 125                       | M      | LMMM            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 34     | 1.544                    | 155.52                    | H      | LLMH            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 35     | 1.544                    | 156.25                    | H      | LLHL            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 36     | 1.544                    | 311.04                    | H      | LLHM            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 37     | 1.544                    | 312.5                     | H      | LLHH            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 38     | 1.544                    | 622.08                    | H      | LMLL            | 257                                       | 60  | —    | —   | —   | —   | —  | —  |
| 39     | 2.048                    | 0.008                     | L      | LMMH            | 2089                                      | 485 | 240  | 59  | —   | —   | —  | —  |
| 40     | 2.048                    | 1.544                     | L      | LMHL            | 1037                                      | 242 | 119  | —   | —   | —   | —  | —  |
| 41     | 2.048                    | 2.048                     | L      | LMHM            | —   | —   | 3949 | 959 | 238 | 118 | 59 | 59 |
| 42     | 2.048                    | 8.192                     | L      | LMHH            | —   | —   | 3949 | 959 | 238 | 118 | 59 | 59 |
| 43     | 2.048                    | 19.44                     | L      | LHLL            | —   | —   | 3946 | 958 | 238 | 118 | 59 | 59 |
| 44     | 2.048                    | 25                        | L      | LHLM            | 2087                                      | 485 | 240  | —   | —   | —   | —  | —  |
| 45     | 2.048                    | 32.768                    | L      | LHLH            | —   | —   | 3947 | 959 | 238 | 118 | 59 | 59 |
| 46     | 2.048                    | 34.368                    | M      | LMMH            | —   | —   | 3935 | 958 | 238 | 118 | 59 | 59 |
| 47     | 2.048                    | 38.88                     | M      | LMHL            | —   | —   | 3946 | 958 | 238 | 118 | 59 | 59 |
| 48     | 2.048                    | 44.736                    | M      | LMHM            | —   | —   | 3983 | 477 | 118 | 59  | —  | —  |
| 49     | 2.048                    | 51.84                     | M      | LMHH            | —   | —   | 3946 | 958 | 238 | 118 | 59 | 59 |

**Notes:**

1. F<sub>IN</sub> and F<sub>OUT</sub> frequency values may be rounded off. For exact multiplication ratios, please contact Skyworks Solutions.
2. Si5315A supports all frequency plans.
3. Si5315B supports output frequency plans up to 125 MHz.

Table 9. Look Up Tables for Clock Multiplication and Loop Bandwidth Settings (Continued)

| Plan # | f <sub>IN</sub><br>(MHz) | f <sub>OUT</sub><br>(MHz) | FRQTBL | FRQSEL<br>[3:0] | Loop Bandwidth Selection (Hz), BWSEL[1:0] |      |      |      |     |     |    |  |
|--------|--------------------------|---------------------------|--------|-----------------|---|------|------|------|-----|-----|----|--|
|        |                          |                           |        |                 | LM  | LH   | ML   | MM   | MH  | HL  | HH |  |
| 50     | 2.048                    | 65.536                    | M      | LHLL            | —   | 8185 | 3940 | 958  | 238 | 118 | —  |  |
| 51     | 2.048                    | 77.76                     | M      | LHLM            | —   | —    | 3946 | 958  | 238 | 118 | 59 |  |
| 52     | 2.048                    | 125                       | M      | LHLH            | 1037                                      | 242  | 119  | —    | —   | —   | —  |  |
| 53     | 2.048                    | 155.52                    | H      | LMLM            | —   | —    | 3946 | 958  | 238 | 118 | 59 |  |
| 54     | 2.048                    | 156.25                    | H      | LMLH            | 1037                                      | 242  | 119  | —    | —   | —   | —  |  |
| 55     | 2.048                    | 311.04                    | H      | LMML            | —   | —    | 3946 | 958  | 238 | 118 | 59 |  |
| 56     | 2.048                    | 312.5                     | H      | LMMM            | 1037                                      | 242  | 119  | —    | —   | —   | —  |  |
| 57     | 2.048                    | 622.08                    | H      | LMMH            | —   | —    | 3946 | 958  | 238 | 118 | 59 |  |
| 58     | 8.192                    | 0.008                     | L      | LHML            | 2089                                      | 485  | 240  | 59   | —   | —   | —  |  |
| 59     | 8.192                    | 1.544                     | L      | LHMM            | 1037                                      | 242  | 119  | —    | —   | —   | —  |  |
| 60     | 8.192                    | 2.048                     | L      | LHMH            | —   | —    | 6434 | 1541 | 381 | 190 | 95 |  |
| 61     | 8.192                    | 8.192                     | L      | LHHL            | —   | —    | 6434 | 1541 | 381 | 190 | 95 |  |
| 62     | 8.192                    | 19.44                     | L      | LHHM            | —   | —    | 3946 | 958  | 238 | 118 | 59 |  |
| 63     | 8.192                    | 25                        | L      | LHHH            | 2087                                      | 485  | 240  | —    | —   | —   | —  |  |
| 64     | 8.192                    | 32.768                    | L      | MLLL            | —   | —    | 6431 | 1541 | 381 | 190 | 95 |  |
| 65     | 8.192                    | 34.368                    | M      | LHML            | —   | 8163 | 3935 | 958  | 238 | 118 | —  |  |
| 66     | 8.192                    | 38.88                     | M      | LHMM            | —   | —    | 3946 | 958  | 238 | 118 | 59 |  |
| 67     | 8.192                    | 44.736                    | M      | LHMH            | —   | 3983 | 1944 | 477  | 118 | 59  | —  |  |
| 68     | 8.192                    | 51.84                     | M      | LHHL            | —   | —    | 3946 | 958  | 238 | 118 | 59 |  |
| 69     | 8.192                    | 65.536                    | M      | LHMM            | —   | —    | 6411 | 1539 | 381 | 190 | 95 |  |
| 70     | 8.192                    | 77.76                     | M      | LHHH            | —   | —    | 3946 | 958  | 238 | 118 | 59 |  |
| 71     | 8.192                    | 125                       | M      | MLLL            | 1037                                      | 242  | 119  | —    | —   | —   | —  |  |
| 72     | 19.44                    | 0.008                     | L      | MLLM            | 1759                                      | 409  | 202  | —    | —   | —   | —  |  |
| 73     | 19.44                    | 1.544                     | L      | MLLH            | —   | 2779 | 1362 | 335  | 83  | —   | —  |  |
| 74     | 19.44                    | 2.048                     | L      | MLML            | —   | 3348 | 1638 | 402  | 100 | —   | —  |  |

**Notes:**

1. F<sub>IN</sub> and F<sub>OUT</sub> frequency values may be rounded off. For exact multiplication ratios, please contact Skyworks Solutions.
2. Si5315A supports all frequency plans.
3. Si5315B supports output frequency plans up to 125 MHz.

Table 9. Look Up Tables for Clock Multiplication and Loop Bandwidth Settings (Continued)

| Plan # | f <sub>IN</sub><br>(MHz) | f <sub>OUT</sub><br>(MHz) | FRQTBL | FRQSEL<br>[3:0] | Loop Bandwidth Selection (Hz), BWSEL[1:0] |      |      |      |     |     |     |   |
|--------|--------------------------|---------------------------|--------|-----------------|---|------|------|------|-----|-----|-----|---|
|        |                          |                           |        |                 | LM  | LH   | ML   | MM   | MH  | HL  | HH  |   |
| 75     | 19.44                    | 8.192                     | L      | MLMM            | —   | 3348 | 1638 | 402  | 100 | —   | —   | — |
| 76     | 19.44                    | 19.44                     | L      | MLMH            | —   | —    | 7706 | 1832 | 452 | 225 | 112 | — |
| 77     | 19.44                    | 25                        | L      | MLHL            | —   | 2778 | 1362 | 335  | 83  | —   | —   | — |
| 78     | 19.44                    | 32.768                    | L      | MLHM            | —   | —    | 5022 | 1215 | 301 | 150 | 75  | — |
| 79     | 19.44                    | 34.368                    | M      | MLLM            | —   | 5662 | 2749 | 672  | 167 | 83  | —   | — |
| 80     | 19.44                    | 38.88                     | M      | MLLH            | —   | —    | 7703 | 1832 | 452 | 225 | 112 | — |
| 81     | 19.44                    | 44.736                    | M      | MLML            | —   | 5653 | 2747 | 672  | 167 | 83  | —   | — |
| 82     | 19.44                    | 51.84                     | M      | MLMM            | —   | —    | 7696 | 1832 | 452 | 225 | 112 | — |
| 83     | 19.44                    | 65.536                    | M      | MLMH            | 2618                                      | 607  | 300  | 74   | —   | —   | —   | — |
| 84     | 19.44                    | 77.76                     | M      | MLHL            | —   | —    | 7696 | 1832 | 452 | 225 | 112 | — |
| 85     | 19.44                    | 125                       | M      | MLHM            | 3960                                      | 913  | 450  | 111  | —   | —   | —   | — |
| 86     | 19.44                    | 155.52                    | H      | LMHL            | —   | —    | 7696 | 1832 | 452 | 225 | 112 | — |
| 87     | 19.44                    | 156.25                    | H      | LMHM            | 6003                                      | 1373 | 677  | 167  | —   | —   | —   | — |
| 88     | 19.44                    | 161.1328                  | H      | LMHH            | 484                                       | 113  | —    | —    | —   | —   | —   | — |
| 89     | 19.44                    | 311.04                    | H      | LHLL            | —   | —    | 7696 | 1832 | 452 | 225 | 112 | — |
| 90     | 19.44                    | 312.5                     | H      | LHLM            | 6003                                      | 1373 | 677  | 167  | —   | —   | —   | — |
| 91     | 19.44                    | 622.08                    | H      | LHLH            | —   | —    | 7696 | 1832 | 452 | 225 | 112 | — |
| 92     | 19.44                    | 644.5313                  | H      | LHML            | 103                                       | —    | —    | —    | —   | —   | —   | — |
| 93     | 25                       | 0.008                     | L      | MLHH            | —   | —    | 7045 | 1681 | 415 | 207 | 103 | — |
| 94     | 25                       | 1.544                     | L      | MMLL            | 6741                                      | 1529 | 753  | 186  | —   | —   | —   | — |
| 95     | 25                       | 2.048                     | L      | MMLM            | 1299                                      | 303  | 150  | —    | —   | —   | —   | — |
| 96     | 25                       | 8.192                     | L      | MMLH            | 6737                                      | 1529 | 753  | 186  | —   | —   | —   | — |
| 97     | 25                       | 19.44                     | L      | MMML            | —   | —    | 6551 | 1568 | 387 | 193 | 96  | — |
| 98     | 25                       | 25                        | L      | MMMM            | —   | —    | 7615 | 1812 | 447 | 223 | 111 | — |
| 99     | 25                       | 32.768                    | L      | MMMH            | 6737                                      | 1529 | 753  | 186  | —   | —   | —   | — |

**Notes:**

1. F<sub>IN</sub> and F<sub>OUT</sub> frequency values may be rounded off. For exact multiplication ratios, please contact Skyworks Solutions.
2. Si5315A supports all frequency plans.
3. Si5315B supports output frequency plans up to 125 MHz.

Table 9. Look Up Tables for Clock Multiplication and Loop Bandwidth Settings (Continued)

| Plan # | f <sub>IN</sub><br>(MHz) | f <sub>OUT</sub><br>(MHz) | FRQTBL | FRQSEL<br>[3:0] | Loop Bandwidth Selection (Hz), BWSEL[1:0] |      |      |      |     |     |     |   |
|--------|--------------------------|---------------------------|--------|-----------------|---|------|------|------|-----|-----|-----|---|
|        |                          |                           |        |                 | LM  | LH   | ML   | MM   | MH  | HL  | HH  |   |
| 100    | 25                       | 34.368                    | M      | MLHH            | 6722                                      | 1528 | 753  | 186  | —   | —   | —   | — |
| 101    | 25                       | 38.88                     | M      | MMLL            | 6729                                      | 1529 | 753  | 186  | —   | —   | —   | — |
| 102    | 25                       | 44.736                    | M      | MMLM            | 1298                                      | 303  | 150  | —    | —   | —   | —   | — |
| 103    | 25                       | 50                        | H      | HMLH            | —   | —    | 7880 | 1880 | 470 | 230 | 120 | — |
| 104    | 25                       | 51.84                     | M      | MMLH            | —   | 7988 | 3846 | 936  | 232 | 116 | —   | — |
| 105    | 25                       | 65.536                    | M      | MMML            | 1298                                      | 303  | 150  | —    | —   | —   | —   | — |
| 106    | 25                       | 77.76                     | M      | MMMM            | 6706                                      | 1528 | 753  | 186  | —   | —   | —   | — |
| 107    | 25                       | 125                       | M      | MMMH            | —   | —    | 7606 | 1811 | 447 | 223 | 111 | — |
| 108    | 25                       | 155.52                    | H      | LHMM            | 1298                                      | 303  | 150  | —    | —   | —   | —   | — |
| 109    | 25                       | 156.25                    | H      | LHMH            | —   | —    | 7606 | 1811 | 447 | 223 | 111 | — |
| 110    | 25                       | 161.1328                  | H      | LHHL            | —   | —    | 6106 | 1468 | 363 | 181 | 90  | — |
| 111    | 25                       | 311.04                    | H      | LHHM            | 1298                                      | 303  | 150  | —    | —   | —   | —   | — |
| 112    | 25                       | 312.5                     | H      | LHHH            | —   | —    | 7606 | 1811 | 447 | 223 | 111 | — |
| 113    | 25                       | 622.08                    | H      | MLLL            | 1298                                      | 303  | 150  | —    | —   | —   | —   | — |
| 114    | 25                       | 644.5313                  | H      | MLLM            | —   | —    | 6106 | 1468 | 363 | 181 | 90  | — |
| 115    | 32.768                   | 0.008                     | L      | MMHL            | 2089                                      | 485  | 240  | 59   | —   | —   | —   | — |
| 116    | 32.768                   | 1.544                     | L      | MMHM            | 1037                                      | 242  | 119  | —    | —   | —   | —   | — |
| 117    | 32.768                   | 2.048                     | L      | MMHH            | —   | —    | 7187 | 1714 | 423 | 211 | 105 | — |
| 118    | 32.768                   | 8.192                     | L      | MHLL            | —   | —    | 7632 | 1816 | 448 | 223 | 111 | — |
| 119    | 32.768                   | 19.44                     | L      | MHLM            | —   | —    | 3946 | 958  | 238 | 118 | 59  | — |
| 120    | 32.768                   | 25                        | L      | MHLH            | 2087                                      | 485  | 240  | —    | —   | —   | —   | — |
| 121    | 32.768                   | 32.768                    | L      | MHML            | —   | —    | 7632 | 1816 | 448 | 223 | 111 | — |
| 122    | 32.768                   | 34.368                    | M      | MMHL            | —   | 8163 | 3935 | 958  | 238 | 118 | —   | — |
| 123    | 32.768                   | 38.88                     | M      | MMHM            | —   | —    | —    | 958  | 238 | 118 | 59  | — |
| 124    | 32.768                   | 44.736                    | M      | MMHH            | —   | 3983 | 1944 | 477  | 118 | 59  | —   | — |

**Notes:**

1. F<sub>IN</sub> and F<sub>OUT</sub> frequency values may be rounded off. For exact multiplication ratios, please contact Skyworks Solutions.
2. Si5315A supports all frequency plans.
3. Si5315B supports output frequency plans up to 125 MHz.



Table 9. Look Up Tables for Clock Multiplication and Loop Bandwidth Settings (Continued)

| Plan # | f <sub>IN</sub><br>(MHz) | f <sub>OUT</sub><br>(MHz) | FRQTBL | FRQSEL<br>[3:0] | Loop Bandwidth Selection (Hz), BWSEL[1:0] |      |      |      |     |     |     |  |
|--------|--------------------------|---------------------------|--------|-----------------|---|------|------|------|-----|-----|-----|--|
|        |                          |                           |        |                 | LM  | LH   | ML   | MM   | MH  | HL  | HH  |  |
| 125    | 32.768                   | 51.84                     | M      | MHLL            | —   | —    | 3946 | 958  | 238 | 118 | 59  |  |
| 126    | 32.768                   | 65.536                    | M      | MHLM            | —   | —    | 7604 | 1815 | 448 | 223 | 111 |  |
| 127    | 32.768                   | 77.76                     | M      | MHLH            | —   | —    | 3946 | 958  | 238 | 118 | 59  |  |
| 128    | 32.768                   | 125                       | M      | MHML            | 1037                                      | 242  | 119  | —    | —   | —   | —   |  |
| 129    | 50                       | 25                        | L      | HHHH            | —   | —    | 7880 | 1880 | 470 | 230 | 120 |  |
| 130    | 50                       | 50                        | M      | HMLH            | —   | —    | 7770 | 1850 | 466 | 230 | 110 |  |
| 131    | 77.76                    | 0.008                     | L      | MHMM            | 2089                                      | 485  | 240  | 59   | —   | —   | —   |  |
| 132    | 77.76                    | 1.544                     | L      | MHMH            | —   | 2779 | 1362 | 335  | 83  | —   | —   |  |
| 133    | 77.76                    | 2.048                     | L      | MHHL            | —   | —    | 6804 | 1626 | 402 | 200 | 100 |  |
| 134    | 77.76                    | 19.44                     | L      | MHHM            | —   | —    | 7905 | 1879 | 464 | 231 | 115 |  |
| 135    | 77.76                    | 25                        | L      | MHHH            | —   | 2778 | 1362 | 335  | 83  | —   | —   |  |
| 136    | 77.76                    | 34.368                    | M      | MHMM            | —   | —    | 6798 | 1626 | 402 | 200 | 100 |  |
| 137    | 77.76                    | 38.88                     | M      | MHMH            | —   | —    | 7905 | 1879 | 464 | 231 | 115 |  |
| 138    | 77.76                    | 44.736                    | M      | MHHL            | —   | —    | 6756 | 1623 | 402 | 200 | 100 |  |
| 139    | 77.76                    | 51.84                     | M      | MHMH            | —   | —    | 7905 | 1879 | 464 | 231 | 115 |  |
| 140    | 77.76                    | 65.536                    | M      | MHHH            | —   | 2461 | 1208 | 298  | 74  | —   | —   |  |
| 141    | 77.76                    | 77.76                     | M      | HLLL            | —   | —    | 7905 | 1879 | 464 | 231 | 115 |  |
| 142    | 77.76                    | 125                       | M      | HLLM            | 5336                                      | 1220 | 602  | 148  | —   | —   | —   |  |
| 143    | 77.76                    | 155.52                    | H      | MLLH            | —   | —    | 7905 | 1879 | 464 | 231 | 115 |  |
| 144    | 77.76                    | 156.25                    | H      | MLML            | 6003                                      | 1373 | 677  | 167  | —   | —   | —   |  |
| 145    | 77.76                    | 161.1328                  | H      | MLMM            | 484                                       | 113  | —    | —    | —   | —   | —   |  |
| 146    | 77.76                    | 311.04                    | H      | MLMH            | —   | —    | 7905 | 1879 | 464 | 231 | 115 |  |
| 147    | 77.76                    | 312.5                     | H      | MLHL            | 6003                                      | 1373 | 677  | 167  | —   | —   | —   |  |
| 148    | 77.76                    | 622.08                    | H      | MLHM            | —   | —    | 7905 | 1879 | 464 | 231 | 115 |  |
| 149    | 77.76                    | 644.5313                  | H      | MLHH            | 484                                       | 113  | —    | —    | —   | —   | —   |  |

**Notes:**

1. F<sub>IN</sub> and F<sub>OUT</sub> frequency values may be rounded off. For exact multiplication ratios, please contact Skyworks Solutions.
2. Si5315A supports all frequency plans.
3. Si5315B supports output frequency plans up to 125 MHz.

Table 9. Look Up Tables for Clock Multiplication and Loop Bandwidth Settings (Continued)

| Plan # | f <sub>IN</sub><br>(MHz) | f <sub>OUT</sub><br>(MHz) | FRQTBL | FRQSEL<br>[3:0] | Loop Bandwidth Selection (Hz), BWSEL[1:0] |      |      |      |     |     |     |  |
|--------|--------------------------|---------------------------|--------|-----------------|---|------|------|------|-----|-----|-----|--|
|        |                          |                           |        |                 | LM  | LH   | ML   | MM   | MH  | HL  | HH  |  |
| 150    | 125                      | 0.008                     | L      | HLLL            | —   | —    | 7045 | 1681 | 415 | 207 | 103 |  |
| 151    | 125                      | 1.544                     | L      | HLLM            | 6741                                      | 1529 | 753  | 186  | —   | —   | —   |  |
| 152    | 125                      | 2.048                     | L      | HLLH            | 1299                                      | 303  | 150  | —    | —   | —   | —   |  |
| 153    | 125                      | 19.44                     | L      | HLML            | —   | —    | 6551 | 1568 | 387 | 193 | 96  |  |
| 154    | 125                      | 25                        | L      | HLMM            | —   | —    | 7862 | 1870 | 462 | 230 | 115 |  |
| 155    | 125                      | 34.368                    | M      | HLLH            | 6722                                      | 1528 | 753  | 186  | —   | —   | —   |  |
| 156    | 125                      | 38.88                     | M      | HLML            | 6729                                      | 1529 | 753  | 186  | —   | —   | —   |  |
| 157    | 125                      | 44.736                    | M      | HLMM            | 1298                                      | 303  | 150  | —    | —   | —   | —   |  |
| 158    | 125                      | 51.84                     | M      | HLMH            | —   | 7988 | 3846 | 936  | 232 | 116 | —   |  |
| 159    | 125                      | 65.536                    | M      | HLHL            | 1298                                      | 303  | 150  | —    | —   | —   | —   |  |
| 160    | 125                      | 77.76                     | M      | HLHM            | 6706                                      | 1528 | 753  | 186  | —   | —   | —   |  |
| 161    | 125                      | 125                       | M      | HLHH            | —   | —    | 7862 | 1870 | 462 | 230 | 115 |  |
| 162    | 125                      | 155.52                    | H      | MMLL            | 1298                                      | 303  | 150  | —    | —   | —   | —   |  |
| 163    | 125                      | 156.25                    | H      | MMLM            | —   | —    | 7862 | 1870 | 462 | 230 | 115 |  |
| 164    | 125                      | 161.1328                  | H      | MMLH            | —   | —    | 7718 | 1839 | 454 | 226 | 113 |  |
| 165    | 125                      | 311.04                    | H      | MMML            | 1298                                      | 303  | 150  | —    | —   | —   | —   |  |
| 166    | 125                      | 312.5                     | H      | MMMM            | —   | —    | 7862 | 1870 | 462 | 230 | 115 |  |
| 167    | 125                      | 622.08                    | H      | MMMH            | 1298                                      | 303  | 150  | —    | —   | —   | —   |  |
| 168    | 125                      | 644.5313                  | H      | MMHL            | —   | —    | 7718 | 1839 | 454 | 226 | 113 |  |
| 169    | 155.52                   | 0.008                     | L      | HLMH            | 2089                                      | 485  | 240  | 59   | —   | —   | —   |  |
| 170    | 155.52                   | 1.544                     | L      | HLHL            | —   | 2779 | 1362 | 335  | 83  | —   | —   |  |
| 171    | 155.52                   | 2.048                     | L      | HLHM            | —   | —    | 7606 | 1809 | 447 | 223 | 111 |  |
| 172    | 155.52                   | 19.44                     | L      | HLHH            | —   | —    | 7905 | 1879 | 464 | 231 | 115 |  |
| 173    | 155.52                   | 25                        | L      | HIMLL           | —   | 2778 | 1362 | 335  | 83  | —   | —   |  |
| 174    | 155.52                   | 77.76                     | H      | MMHM            | —   | —    | 7905 | 1879 | 464 | 231 | 115 |  |

**Notes:**

1. F<sub>IN</sub> and F<sub>OUT</sub> frequency values may be rounded off. For exact multiplication ratios, please contact Skyworks Solutions.
2. Si5315A supports all frequency plans.
3. Si5315B supports output frequency plans up to 125 MHz.

Table 9. Look Up Tables for Clock Multiplication and Loop Bandwidth Settings (Continued)

| Plan # | f <sub>IN</sub><br>(MHz) | f <sub>OUT</sub><br>(MHz) | FRQTBL | FRQSEL<br>[3:0] | Loop Bandwidth Selection (Hz), BWSEL[1:0] |      |      |      |     |     |     |   |
|--------|--------------------------|---------------------------|--------|-----------------|---|------|------|------|-----|-----|-----|---|
|        |                          |                           |        |                 | LM  | LH   | ML   | MM   | MH  | HL  | HH  |   |
| 175    | 155.52                   | 125                       | H      | MMHH            | 5336                                      | 1220 | 602  | 148  | —   | —   | —   | — |
| 176    | 155.52                   | 155.52                    | H      | MHLL            | —   | —    | 7905 | 1879 | 464 | 231 | 115 | — |
| 177    | 155.52                   | 156.25                    | H      | MHLM            | 6003                                      | 1373 | 677  | 167  | —   | —   | —   | — |
| 178    | 155.52                   | 161.1328                  | H      | MHLH            | 484                                       | 113  | —    | —    | —   | —   | —   | — |
| 179    | 155.52                   | 311.04                    | H      | MHML            | —   | —    | 7905 | 1879 | 464 | 231 | 115 | — |
| 180    | 155.52                   | 312.5                     | H      | MHMM            | 6003                                      | 1373 | 677  | 167  | —   | —   | —   | — |
| 181    | 155.52                   | 622.08                    | H      | MHHM            | —   | —    | 7905 | 1879 | 464 | 231 | 115 | — |
| 182    | 155.52                   | 644.5313                  | H      | MHHL            | 828                                       | 193  | 95   | —    | —   | —   | —   | — |
| 183    | 156.25                   | 0.008                     | L      | HMLM            | —   | —    | 6123 | 1469 | 363 | 181 | 90  | — |
| 184    | 156.25                   | 1.544                     | L      | HMLH            | 1627                                      | 379  | 187  | —    | —   | —   | —   | — |
| 185    | 156.25                   | 2.048                     | L      | HMLL            | 322                                       | 75   | —    | —    | —   | —   | —   | — |
| 186    | 156.25                   | 19.44                     | L      | HMLM            | —   | —    | 4852 | 1172 | 290 | 145 | 72  | — |
| 187    | 156.25                   | 25                        | L      | HMLH            | —   | —    | 7835 | 1864 | 460 | 229 | 114 | — |
| 188    | 156.25                   | 77.76                     | H      | MHHM            | 1625                                      | 379  | 187  | —    | —   | —   | —   | — |
| 189    | 156.25                   | 125                       | H      | MHHH            | —   | —    | 7835 | 1864 | 460 | 229 | 114 | — |
| 190    | 156.25                   | 155.52                    | H      | HLLL            | 322                                       | 75   | —    | —    | —   | —   | —   | — |
| 191    | 156.25                   | 156.25                    | H      | HLLM            | —   | —    | 7835 | 1864 | 460 | 229 | 114 | — |
| 192    | 156.25                   | 161.1328                  | H      | HLLH            | —   | —    | 7718 | 1839 | 454 | 226 | 113 | — |
| 193    | 156.25                   | 311.04                    | H      | HMLL            | 322                                       | 75   | —    | —    | —   | —   | —   | — |
| 194    | 156.25                   | 312.5                     | H      | HMLM            | —   | —    | 7835 | 1864 | 460 | 229 | 114 | — |
| 195    | 156.25                   | 622.08                    | H      | HMLH            | 322                                       | 75   | —    | —    | —   | —   | —   | — |
| 196    | 156.25                   | 644.5313                  | H      | HMLH            | —   | —    | 7718 | 1839 | 454 | 226 | 113 | — |
| 197    | 161.1328                 | 0.008                     | L      | HMLH            | 225                                       | —    | —    | —    | —   | —   | —   | — |
| 198    | 161.1328                 | 1.544                     | L      | HMLM            | 151                                       | —    | —    | —    | —   | —   | —   | — |
| 199    | 161.1328                 | 2.048                     | L      | HMLH            | 225                                       | —    | —    | —    | —   | —   | —   | — |

**Notes:**

1. F<sub>IN</sub> and F<sub>OUT</sub> frequency values may be rounded off. For exact multiplication ratios, please contact Skyworks Solutions.
2. Si5315A supports all frequency plans.
3. Si5315B supports output frequency plans up to 125 MHz.

Table 9. Look Up Tables for Clock Multiplication and Loop Bandwidth Settings (Continued)

| Plan # | f <sub>IN</sub><br>(MHz) | f <sub>OUT</sub><br>(MHz) | FRQTBL | FRQSEL<br>[3:0] | Loop Bandwidth Selection (Hz), BWSEL[1:0] |      |      |      |     |     |     |     |
|--------|--------------------------|---------------------------|--------|-----------------|---|------|------|------|-----|-----|-----|-----|
|        |                          |                           |        |                 | LM  | LH   | ML   | MM   | MH  | HL  | HH  |     |
| 200    | 161.1328                 | 19.44                     | L      | HHLL            | 679                                       | 159  | 78   | —    | —   | —   | —   | —   |
| 201    | 161.1328                 | 25                        | L      | HHLM            | 678                                       | 159  | 78   | —    | —   | —   | —   | —   |
| 202    | 161.1328                 | 77.76                     | H      | HLHM            | 678                                       | 159  | 78   | —    | —   | —   | —   | —   |
| 203    | 161.1328                 | 125                       | H      | HLHH            | —   | —    | 7179 | 1721 | 426 | 212 | 106 | 106 |
| 204    | 161.1328                 | 156.25                    | H      | HMLL            | —   | —    | 7019 | 1683 | 416 | 207 | 103 | 103 |
| 205    | 161.1328                 | 161.1328                  | H      | HMLM            | 332                                       | 78   | —    | —    | —   | —   | —   | —   |
| 206    | 161.1328                 | 312.5                     | H      | HMML            | 3873                                      | 892  | 440  | 109  | —   | —   | —   | —   |
| 207    | 161.1328                 | 644.5313                  | H      | HMMM            | 151                                       | —    | —    | —    | —   | —   | —   | —   |
| 208    | 644.5313                 | 0.008                     | L      | HHLH            | 880                                       | 206  | 101  | —    | —   | —   | —   | —   |
| 209    | 644.5313                 | 1.544                     | L      | HHML            | 413                                       | 96   | —    | —    | —   | —   | —   | —   |
| 210    | 644.5313                 | 2.048                     | L      | HHMM            | —   | 3373 | 1650 | 405  | 101 | —   | —   | —   |
| 211    | 644.5313                 | 19.44                     | L      | HHMH            | —   | 3641 | 1779 | 437  | 108 | —   | —   | —   |
| 212    | 644.5313                 | 25                        | L      | HHHL            | —   | —    | 7886 | 1875 | 463 | 231 | 115 | 115 |
| 213    | 644.5313                 | 77.76                     | H      | HMMH            | 828                                       | 193  | 95   | —    | —   | —   | —   | —   |
| 214    | 644.5313                 | 125                       | H      | HMHL            | —   | —    | 7732 | 1840 | 454 | 226 | 113 | 113 |
| 215    | 644.5313                 | 155.52                    | H      | HMHM            | 828                                       | 193  | 95   | —    | —   | —   | —   | —   |
| 216    | 644.5313                 | 156.25                    | H      | HMHH            | —   | —    | 7732 | 1840 | 454 | 226 | 113 | 113 |
| 217    | 644.5313                 | 161.1328                  | H      | HHLL            | —   | —    | 7895 | 1880 | 464 | 231 | 115 | 115 |
| 218    | 644.5313                 | 311.04                    | H      | HHLM            | 828                                       | 193  | 95   | —    | —   | —   | —   | —   |
| 219    | 644.5313                 | 312.5                     | H      | HHLH            | 206                                       | —    | —    | —    | —   | —   | —   | —   |
| 220    | 644.5313                 | 622.08                    | H      | HHML            | 120                                       | —    | —    | —    | —   | —   | —   | —   |
| 221    | 644.5313                 | 644.5313                  | H      | HMMM            | —   | —    | 7895 | 1880 | 464 | 231 | 115 | 115 |

**Notes:**

1. F<sub>IN</sub> and F<sub>OUT</sub> frequency values may be rounded off. For exact multiplication ratios, please contact Skyworks Solutions.
2. Si5315A supports all frequency plans.
3. Si5315B supports output frequency plans up to 125 MHz.

## 5.2. PLL Self-Calibration

An internal self-calibration (ICAL) is performed before operation to optimize loop parameters and jitter performance. While the self-calibration is being performed, the DSPLL is being internally controlled by the self-calibration state machine. The LOL alarm will be active during ICAL. The self-calibration time  $t_{LOCKHW}$  is given in Table 3, "AC Characteristics".

Any of the following events will trigger a self-calibration:

- Power-on-reset (POR)
- Release of the external reset pin  $\overline{RST}$  (transition of  $\overline{RST}$  from 0 to 1)
- Change in FRQSEL, FRQTBL, BWSEL, or XTAL/CLOCK pins
- Internal DSPLL registers out-of-range, indicating the need to relock the DSPLL

In any of the above cases, an internal self-calibration will be initiated if a valid input clock exists (no input alarm) and is selected as the active clock at that time. The external crystal or reference clock must also be present for the self-calibration to begin. If valid clocks are not present, the self-calibration state machine will wait until they appear, at which time the calibration will start. An output clock will be active while waiting for a valid input clock. The output clock frequency is based on the VCO range determined by FRQSEL and FRQTBL settings. This output clock will vary by  $\pm 20\%$ . If no output clock is desired prior to an ICAL, then the SFOUT pins should be kept at LM for 1.2 seconds until the output clock is stable.

After a successful self-calibration has been performed with a valid input clock, no subsequent self-calibrations are performed unless one of the above conditions are met. If the input clock is lost following self-calibration, the device enters holdover mode. When the input clock returns, the device relocks to the input clock without performing a self-calibration.

### 5.2.1. Input Clock Stability during Internal Self-Calibration

An exit from reset must occur when the selected CKINn clock is stable in frequency with a frequency value that is within the device operating range. The other CKINs must also either be stable in frequency or squelched during a reset.

### 5.2.2. Self-Calibration caused by Changes in Input Frequency

If the selected CKINn varies by 500 ppm or more in frequency since the last calibration, the device may initiate a self-calibration.

### 5.2.3. Device Reset

Upon powerup, the device internally executes a power-on-reset (POR) which resets the internal device logic. The pin  $\overline{RST}$  can also be used to initiate a reset. The device stays in this state until a valid CKINn is present, when it then performs a PLL Self-Calibration (See 5.2. "PLL Self-Calibration").

### 5.2.4. Recommended Reset Guidelines

Follow the recommended RESET guidelines in Table 10 when reset should be applied to a device.

**Table 10. Si5315 Pins and Reset**

| Pin # | Si5315 Pin Name | Must Reset after Changing |
|-------|-----------------|---------------------------|
| 2     | FRQTBL          | Yes                       |
| 11    | XTAL/CLOCK      | Yes                       |
| 22    | BWSEL0          | Yes                       |
| 23    | BWSEL1          | Yes                       |
| 24    | FRQSEL0         | Yes                       |
| 25    | FRQSEL1         | Yes                       |
| 26    | FRQSEL2         | Yes                       |
| 27    | FRQSEL3         | Yes                       |

## 5.2.5. Hitless Switching with Phase Build-Out

Skyworks Solutions switching technology performs "phase build-out" to minimize the propagation of phase transients to the clock outputs during input clock switching. All switching between input clocks occurs within the input multiplexer and phase detector circuitry. The phase detector circuitry continually monitors the phase difference between each input clock and the DSPLL output clock,  $f_{OSC}$ . The phase detector circuitry can lock to a clock signal at a specified phase offset relative to  $f_{OSC}$  so that the phase offset is maintained by the PLL circuitry.

At the time a clock switch occurs, the phase detector circuitry knows both the input-to-output phase relationship for the original input clock and for the new input clock. The phase detector circuitry locks to the new input clock at the new clock's phase offset so that the phase of the output clock is not disturbed. The phase difference between the two input clocks is absorbed in the phase detector's offset value, rather than being propagated to the clock output.

The switching technology virtually eliminates the output clock phase transients traditionally associated with clock rearrangement (input clock switching). The Maximum Time Interval Error (MTIE) and maximum slope for clock output phase transients during clock switching are given in (Table 3, "AC Characteristics"). These values fall significantly below the limits specified in the ITU-T G.8262, Telcordia GR-1244-CORE, and GR-253-CORE requirements.

## 5.3. Input Clock Control

This section describes the clock selection capabilities (manual input selection, automatic input selection, hitless switching, and revertive switching). When switching between two clocks, LOL may temporarily go high if the two clocks differ in frequency by more than 100 ppm.

### 5.3.1. Manual Clock Selection

Manual control of input clock selection is chosen via the CS\_CA pin according to Table 11 and Table 12.

**Table 11. Automatic/Manual Clock Selection**

| AUTOSEL | Clock Selection Mode    |
|---------|-------------------------|
| L       | Manual                  |
| M       | Automatic non-revertive |
| H       | Automatic revertive     |

**Table 12. Manual Input Clock Selection, AUTOSEL = L**

| CS_CA | Si5315<br>AUTOSEL = L |
|-------|-----------------------|
| 0     | CKIN1                 |
| 1     | CKIN2                 |

### 5.3.2. Automatic Clock Selection

The AUTOSEL input pin sets the input clock selection mode as shown in Table 11. Automatic switching is either revertive or non-revertive. Setting AUTOSEL to M or H, changes the CS\_CA pin to an output pin that indicates the state of the automatic clock selection.

**Table 13. Clock Active Indicators, AUTOSEL = M or H**

| CS_CA | Active Clock |
|-------|--------------|
| 0     | CKIN1        |
| 1     | CKIN2        |

The prioritization of clock inputs for automatic switching is shown in Table 14. This priority is hardwired in the devices.

**Table 14. Input Clock Priority for Auto Switching**

| Priority | Input Clocks |
|----------|--------------|
| 1        | CKIN1        |
| 2        | CKIN2        |
| 3        | Holdover     |

At power-on or reset, the valid CKINn with the highest priority (1 being the highest priority) is automatically selected. If no valid CKINn is available, the device suppresses the output clocks and waits for a valid CKINn signal. If the currently selected CKINn goes into an alarm state, the next valid CKINn in priority order is selected. If no valid CKINn is available, the device enters holdover.

Operation in revertive and non-revertive is different when a signal becomes valid:

Revertive (AUTOSEL = H): The device constantly monitors all CKINn. If a CKINn with a higher priority than the current active CKINn becomes valid, the active CKINn is changed to the CKINn with the highest priority.

Non-revertive (AUTOSEL = M): The active clock does not change until there is an alarm on the active clock. The device will then select the highest priority CKINn that is valid. Once in holdover, the device will switch to the first CKINn that becomes valid.

## 5.4. Alarms

Summary alarms are available to indicate the overall status of the input signals. Alarm outputs stay high until all the alarm conditions for that alarm output are cleared.

### 5.4.1. Loss-of-Signal

The device has loss-of-signal circuitry that continuously monitors CKINn for missing pulses. The LOS circuitry generates an internal LOSn\_INT output signal that is processed with other alarms to generate LOS1 and LOS2.

An LOS condition on CKIN1 causes the internal LOS1\_INT alarm to become active. Similarly, an LOS condition on CKINn causes the LOSn\_INT alarm to become active. Once a LOSn\_INT alarm is asserted on one of the input clocks, it remains asserted until that input clock is validated over a designated time period. The time to clear LOSn\_INT after a valid input clock appears is listed in Table 3, “AC Characteristics”. If another error condition on the same input clock is detected during the validation time then the alarm remains asserted and the validation time starts over.

#### 5.4.1.1. LOS Algorithm

The LOS circuitry divides down each input clock to produce an 8 kHz to 2 MHz signal. The LOS circuitry over samples this divided down input clock using a 40 MHz clock to search for extended periods of time without input clock transitions. If the LOS monitor detects twice the normal number of samples without a clock edge, a LOSn\_INT alarm is declared. Table 3, “AC Characteristics” gives the minimum and maximum amount of time for the LOS monitor to trigger.

#### 5.4.1.2. Lock Detect

The PLL lock detection algorithm indicates the lock status on the LOL output pin. The algorithm works by continuously monitoring the phase of the input clock in relation to the phase of the feedback clock. If the time between two consecutive phase cycle slips is greater than the retrigger time, the PLL is in lock. The LOL output has a guaranteed minimum pulse width as shown in (Table 3, “AC Characteristics”). The LOL pin is also held in the active state during an internal PLL calibration. The retrigger time is automatically set based on the PLL closed loop bandwidth (See Table 15).

**Table 15. Lock Detect Retrigger Time**

| PLL Bandwidth Setting (BW) | Retrigger Time (ms) |
|----------------------------|---------------------|
| 60–120 Hz                  | 53                  |
| 120–240 Hz                 | 26.5                |
| 240–480 Hz                 | 13.3                |
| 480–960 Hz                 | 6.6                 |
| 960–1920 Hz                | 3.3                 |
| 1920–3840 Hz               | 1.66                |
| 3840–7680 Hz               | 0.833               |

## 5.5. Holdover Mode

If an LOS condition exists on the selected input clock, the device enters holdover. In this mode, the device provides a stable output frequency until the input clock returns and is validated. When the device enters holdover, the internal oscillator is initially held to its last frequency value. Next, the internal oscillator slowly transitions to a historical average frequency value that was taken over a time window of 6,711 ms in size that ended 26 ms before the device entered holdover. This frequency value is taken from an internal memory location that keeps a record of previous DSPLL frequency values. By using a historical average frequency, input clock phase and frequency transients that may occur immediately preceding loss of clock or any event causing holdover do not affect the holdover frequency. Also, noise related to input clock jitter or internal PLL jitter is minimized.

If a highly stable reference, such as an oven-controlled crystal oscillator, is supplied at XA/XB, an extremely stable holdover can be achieved. If a crystal is supplied at the XA/XB port, the holdover stability will be limited by the stability of the crystal; Table 3, “AC Characteristics” gives the specifications related to the holdover function.

### 5.5.1. Recovery from Holdover

When the input clock signal returns, the device transitions from holdover to the selected input clock. The device performs hitless recovery from holdover. The clock transition from holdover to the returned input clock includes "phase buildout" to absorb the phase difference between the holdover clock phase and the input clock phase. See Table 3, “AC Characteristics” for specifications.

## 5.6. PLL Bypass Mode

The Si5315 supports a PLL bypass mode in which the selected input clock is fed directly to both enabled output buffers, bypassing the DSPLL. Internally, the bypass path is implemented with high-speed differential signaling; however, this path is not a low jitter path and will see significantly higher jitter on CKOUT. In PLL bypass mode, the input and output clocks will be at the same frequency. PLL bypass mode is useful in a laboratory environment to measure system performance with and without the jitter attenuation provided by the DSPLL. The DSBL2\_BY pin is used to select the PLL Bypass Mode according to Table 16. Bypass mode is not supported for CMOS clock outputs (SFOUT = LH).

**Table 16. DSBL2/BYPASS Pin Settings**

| DSBL2/BYPASS | Function                          |
|--------------|-----------------------------------|
| L            | CKOUT2 Enabled                    |
| M            | CKOUT2 Disabled                   |
| H            | PLL Bypass Mode w/ CKOUT2 Enabled |



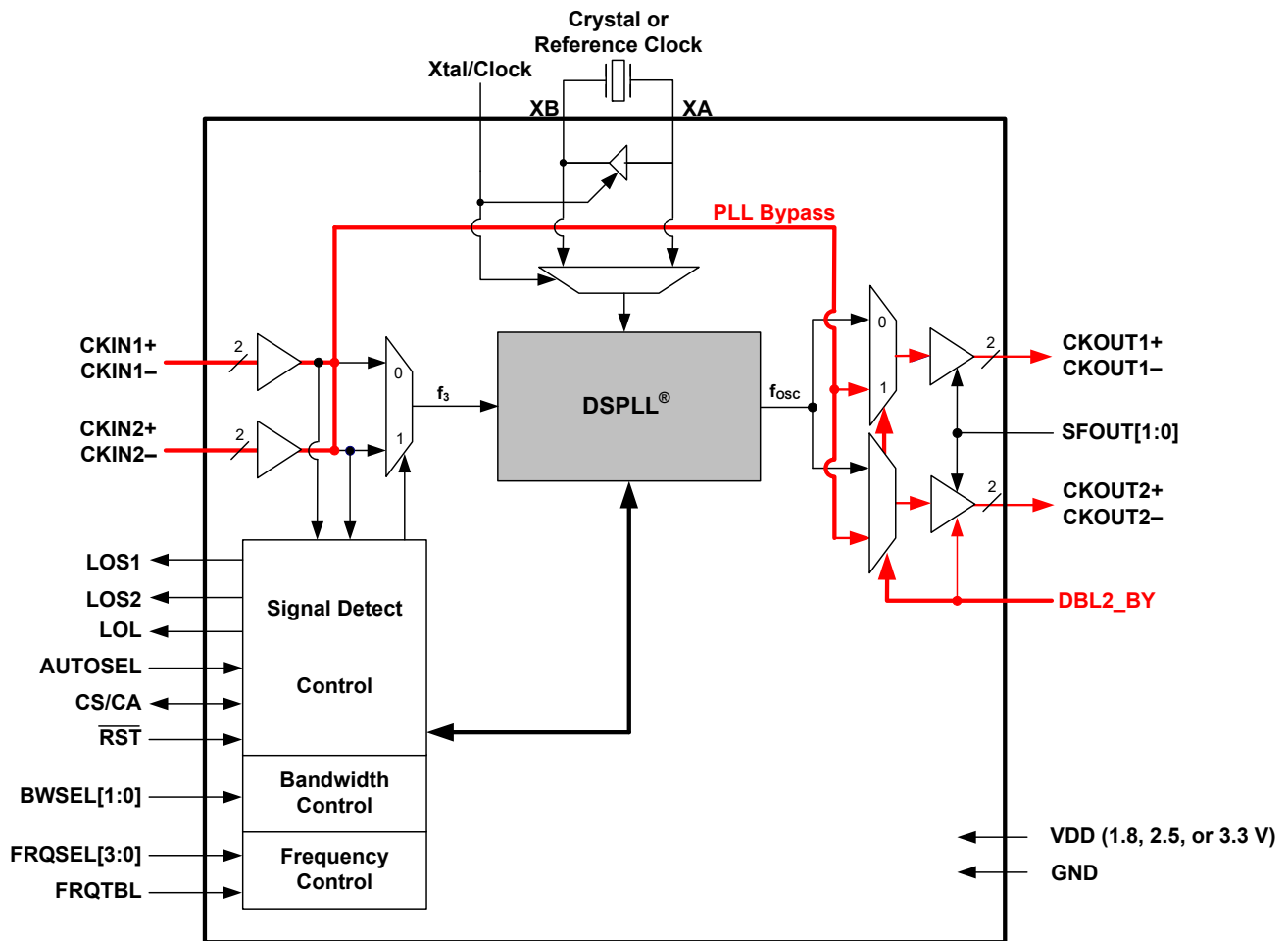


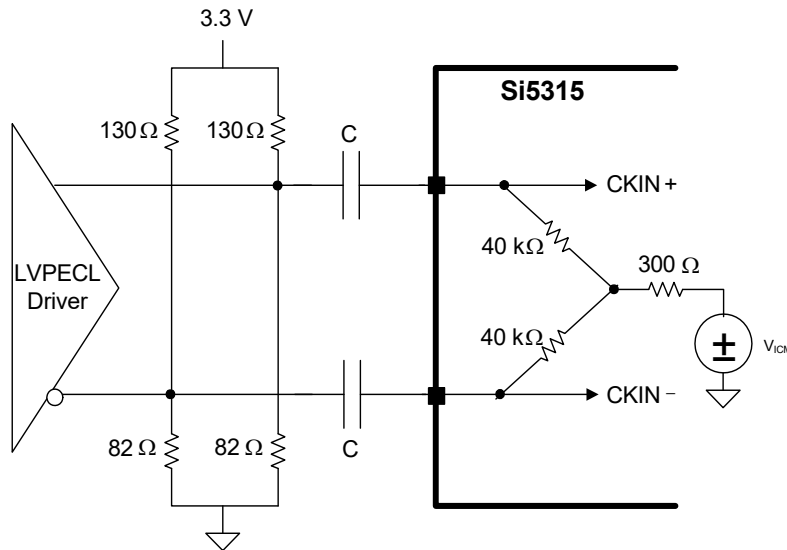
Figure 10. Bypass Signal

## 6. High-Speed I/O

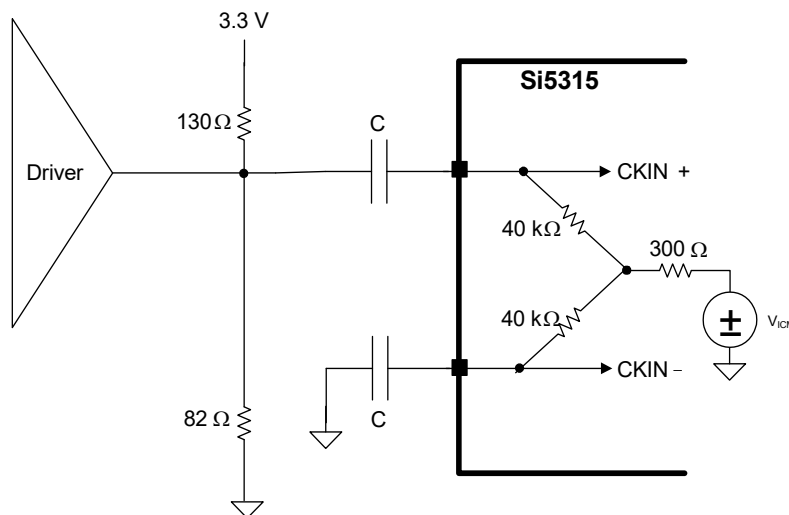
### 6.1. Input Clock Buffers

The Si5315 provides differential inputs for the CKINn clock inputs. These inputs are internally biased to a common mode voltage [see Table 2, “DC Characteristics”] and can be driven by either a single-ended or differential source. Figure 11 through Figure 14 show typical interface circuits for LVPECL, CML, LVDS, or CMOS input clocks. Note that the jitter generation improves for higher levels on CKINn (within the limits in Table 3, “AC Characteristics”).

AC coupling the input clocks is recommended because it removes any issue with common mode input voltages. However, either ac or dc coupling is acceptable. Figures 11 and 12 show various examples of different input termination arrangements. Unused inputs can be left unconnected.



**Figure 11. Differential LVPECL Termination**



**Figure 12. Single-ended LVPECL Termination**

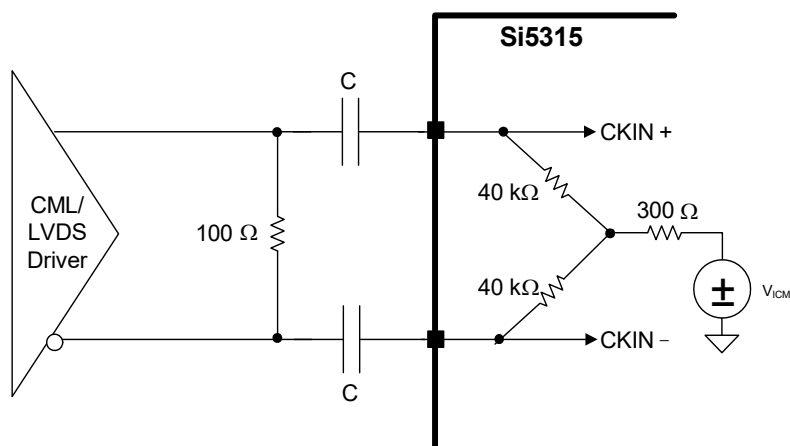
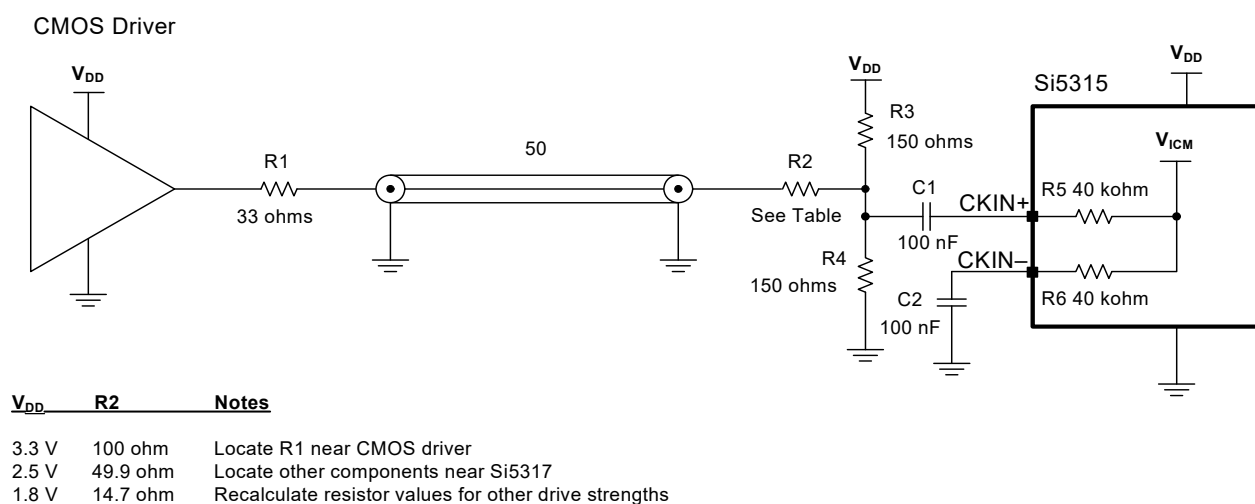


Figure 13. CML/LVDS Termination (1.8, 2.5, 3.3 V)



**Additional Notes:**

1. Attenuation circuit limits overshoot and undershoot.
2. Not to be used with non-square wave input clocks.

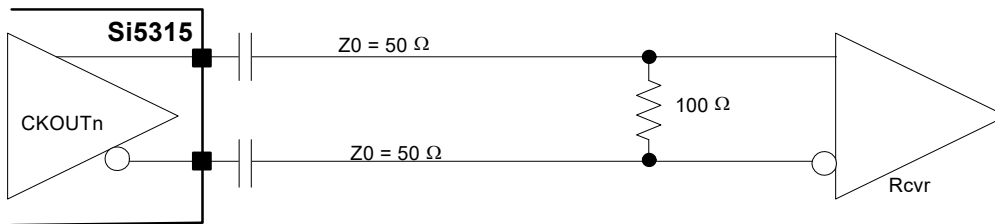
Figure 14. CMOS Termination (1.8, 2.5, 3.3 V)

## 6.2. Output Clock Drivers

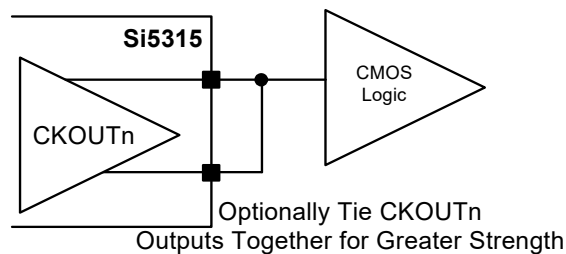
The Si5315 has a flexible output driver structure that can drive a variety of loads, including LVPECL, LVDS, CML, and CMOS formats. The signal format is selected for both CKOUT1 and CKOUT2 outputs using the SFOUT [1:0] pins. This modifies the output common mode and differential signal swing. See Table 2, “DC Characteristics” for output driver specifications. The SFOUT [1:0] pins are three-level input pins, with the states designated as L (ground), M ( $V_{DD}/2$ ), and H ( $V_{DD}$ ). Table 17 shows the signal formats based on the supply voltage and the type of load being driven.

**Table 17. Output Signal Format Selection (SFOUT)**

| SFOUT[1:0] | Signal Format  |
|------------|----------------|
| HL         | CML            |
| HM         | LVDS           |
| LH         | CMOS           |
| LM         | Disabled       |
| MH         | LVPECL         |
| ML         | Low-swing LVDS |
| All Others | Reserved       |

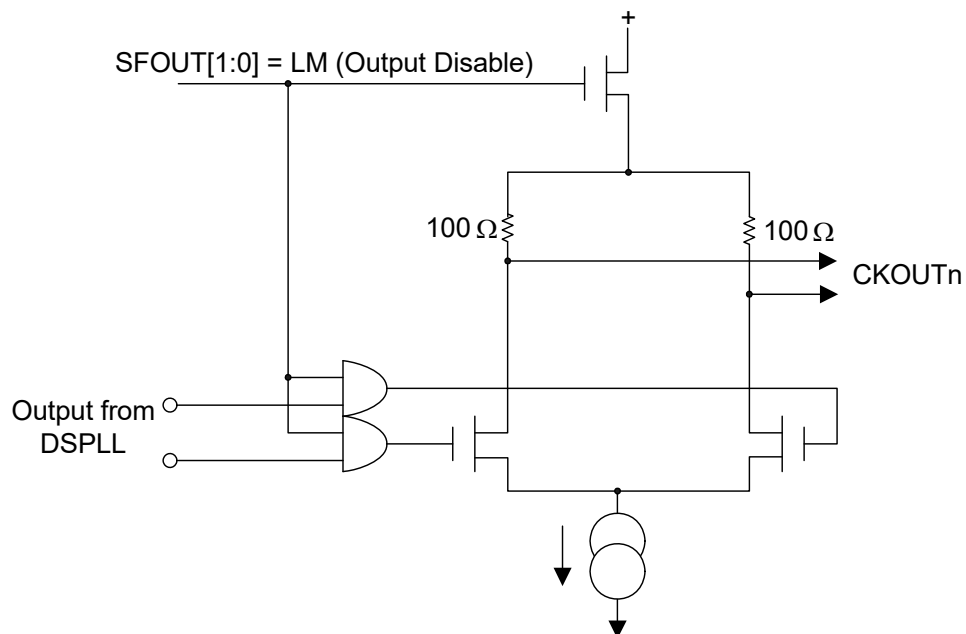


**Figure 15. Typical Differential Output Circuit**



**Figure 16. Typical CMOS Output Circuit (Tie CKOUTn+ and CKOUTn- Together)**

For the CMOS setting (SFOUT = LH), both output pins drive single-ended in-phase signals. The CKOUT+/- can be externally shorted together for greater drive strength specified in Table 2, “DC Characteristics”.

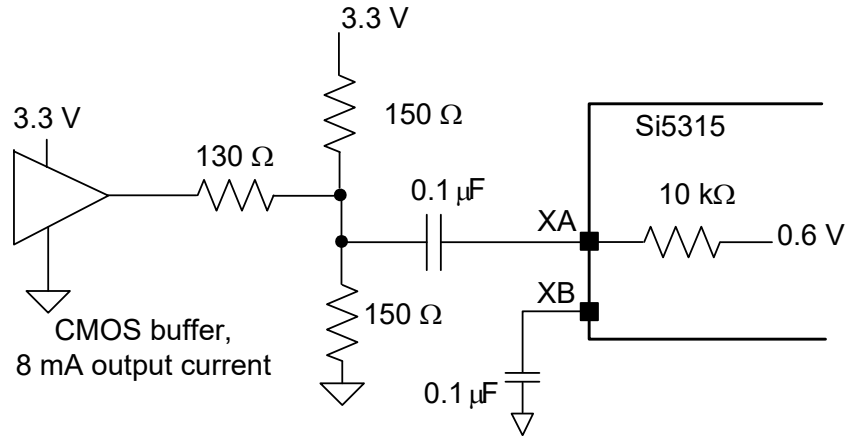


**Figure 17. Disable CKOUTn Structure**

The SFOUT [1:0] pins can also be used to disable both outputs. Disabling the output puts the CKOUTn+ and CKOUTn- pins in a high-impedance state relative to  $V_{DD}$  (common mode tri-state) while the two outputs remain connected to each other through a  $200\ \Omega$  on-chip resistance (differential impedance of  $200\ \Omega$ ). The maximum amount of internal circuitry is powered down, minimizing power consumption and noise generation. Recovery from the disable mode requires additional time as specified in Table 3, “AC Characteristics”.

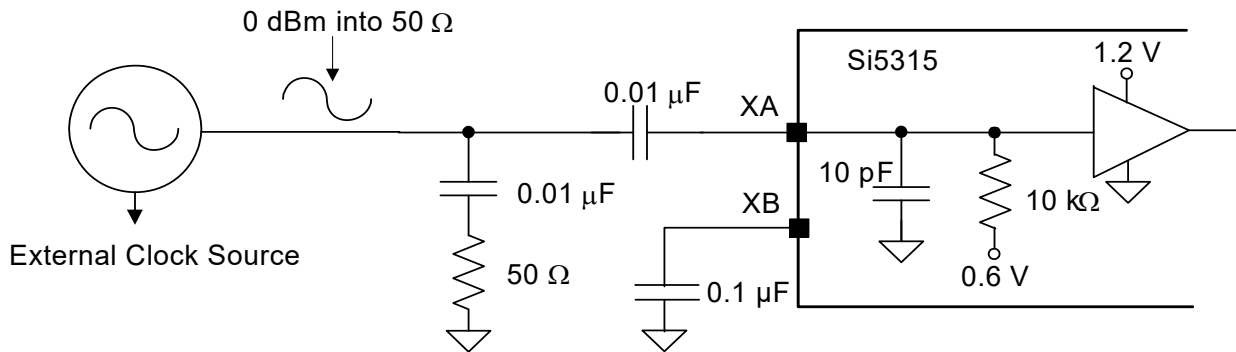
## 7. Crystal/Reference Clock Input

The device can use an external crystal or external clock as a reference. If an external clock is used, it must be ac coupled. With appropriate buffers, the same external reference clock can be applied to CKINn. Although the reference clock input can be driven single ended (See Figure 18), the best performance is with a crystal or low jitter, differential clock source. No external loading capacitors are required for normal crystal operation.

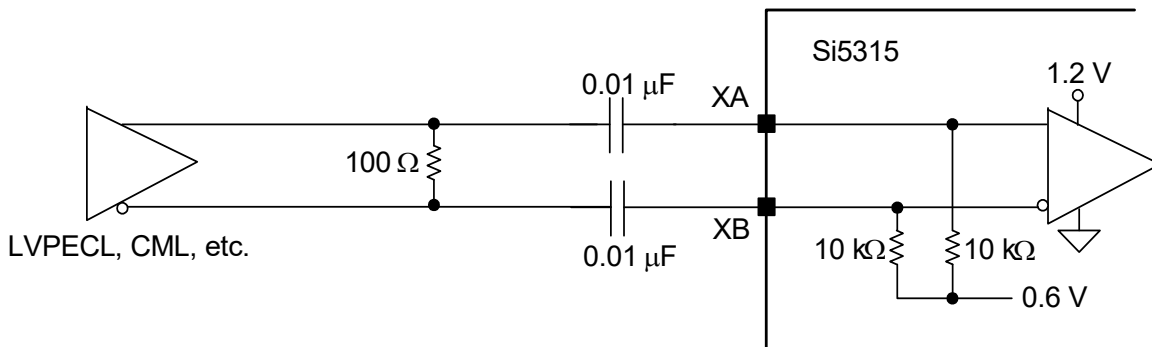


For 2.5 V operation, change 130  $\Omega$  to 82  $\Omega$ .

**Figure 18. CMOS External Reference Circuit**



**Figure 19. Sinewave External Reference Clock Input Example**



**Figure 20. Differential External Reference Clock Input Example**

## 7.1. Crystal/Reference Clock Selection

The Si5315 requires either a low-jitter external oscillator or a low-cost fundamental mode crystal to be connected to its XA/XB pins. This serves both as a jitter reference for jitter attenuation and as a reference oscillator for stability during holdover. The frequency the reference is not directly related to either the input or the output clock frequencies. The range of the reference frequency is from 37 to 41 MHz. For recommendations on the selection of the reference frequency and a list of approved crystals, see the application note AN591 which can be downloaded from <https://www.skyworksinc.com/en/Products/Timing>.

In holdover, the DSPLL remains locked to this external reference. Any changes in the frequency of this reference when the DSPLL is in holdover will be tracked by the output of the device. Note that crystals can have temperature sensitivities. Table 18 shows how the XTAL/CLOCK pin is used to select between a crystal and an external oscillator.

**Table 18. XA/XB Reference Sources**

| XTAL/CLOCK | Type                     |
|------------|--------------------------|
| M          | 37–41 MHz external clock |
| L          | 40 MHz crystal           |

Because the crystal is used as a jitter reference, rapid changes of the crystal temperature can temporarily disturb the output phase and frequency. For example, it is recommended that the crystal not be placed close to a fan that is being turned off and on. If a situation such as this is unavoidable, the crystal should be thermally isolated with an insulating cover.

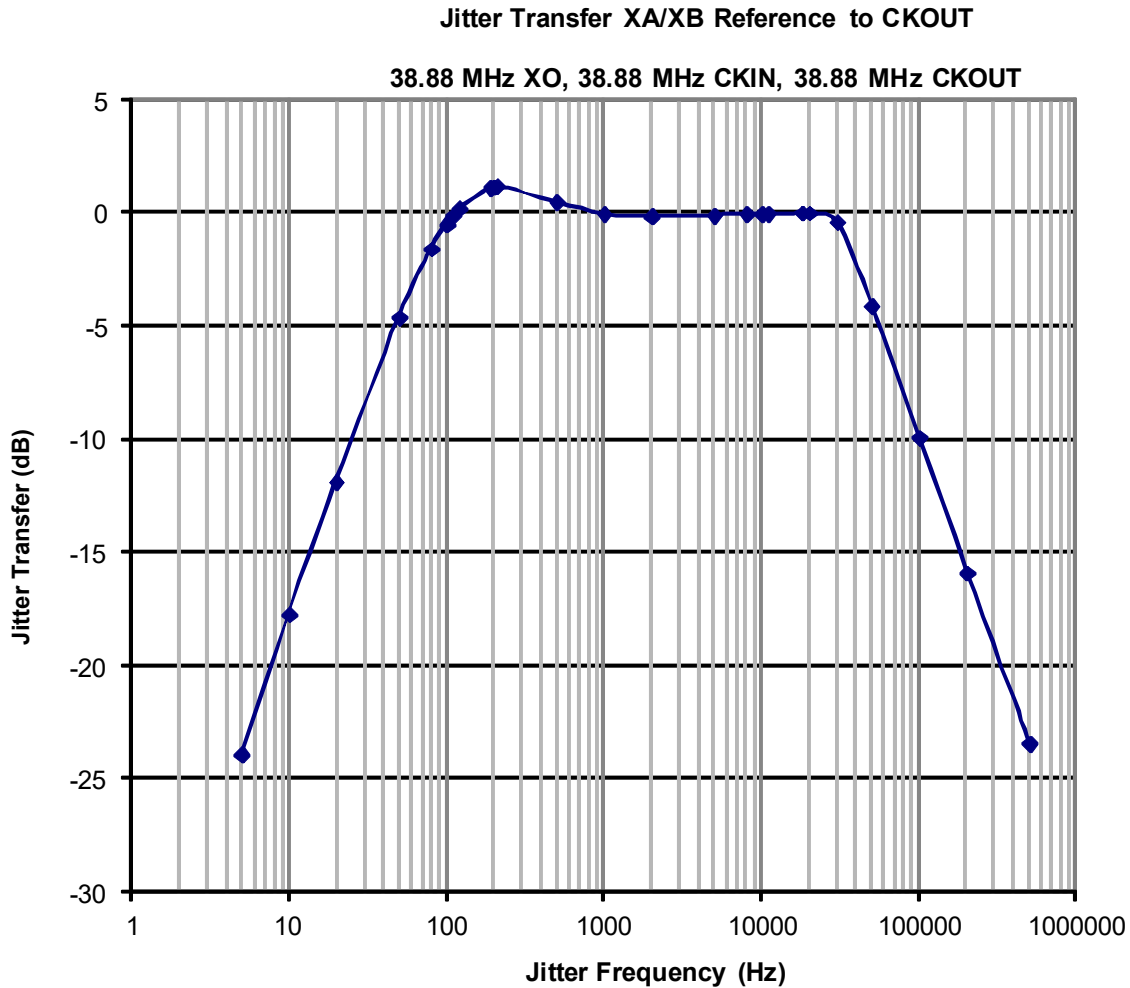
### 7.1.1. Reference Drift

During holdover, long-term and temperature related drift of the reference input result in a one-to-one drift of the output frequency. That is, the stability of the any-frequency output is identical to the drift of the reference frequency. This means that for the most demanding applications where the drift of a crystal is not acceptable, an external temperature compensated or ovenized oscillator will be required. Drift is not an issue unless the part is in holdover. Also, the initial accuracy of the reference oscillator (or crystal) is not relevant.

## 7.1.2. Reference Jitter

Jitter on the reference input has a roughly one-to-one transfer function to the output jitter over the bandwidth ranging from 100 Hz up to 30 kHz. If a crystal is used on the XA/XB pins, the reference will have low jitter if a suitable crystal is in use. If the XA/XB pins are connected to an external reference oscillator, the jitter of the external reference oscillator may contribute significantly to the output jitter.

A typical reference input-to-output jitter transfer function is shown in Figure 21.



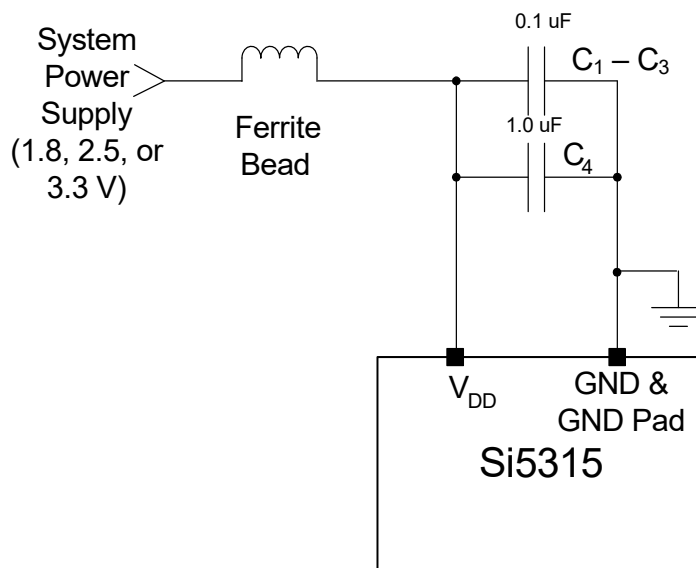
**Figure 21. Typical XA/XB Reference Jitter Transfer Function**



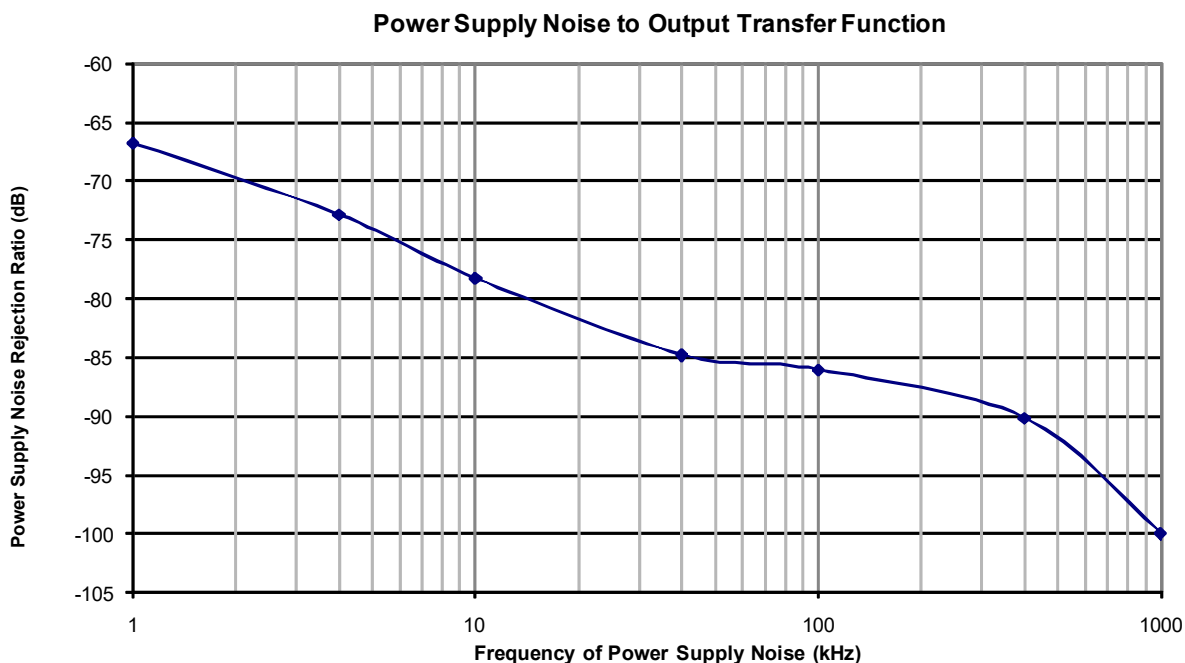
## 8. Power Supply Filtering

This device incorporates an on-chip voltage regulator with excellent PSRR to power the device from a supply voltage of 1.8, 2.5, or 3.3 V. The device requires minimal supply decoupling and no stringent layout or ground plane islands. Internal core circuitry is driven from the output of this regulator while I/O circuitry uses the external supply voltage directly. Table 3, “AC Characteristics” gives the sensitivity of the on-chip oscillator to changes in the supply voltage. Refer to the Si5315 evaluation board for an example.

**The center ground pad under the device must be electrically and thermally connected to the ground plane. See Figure 26, “Ground Pad Recommended Layout,” on page 50.**



**Figure 22. Typical Power Supply Bypass Network**



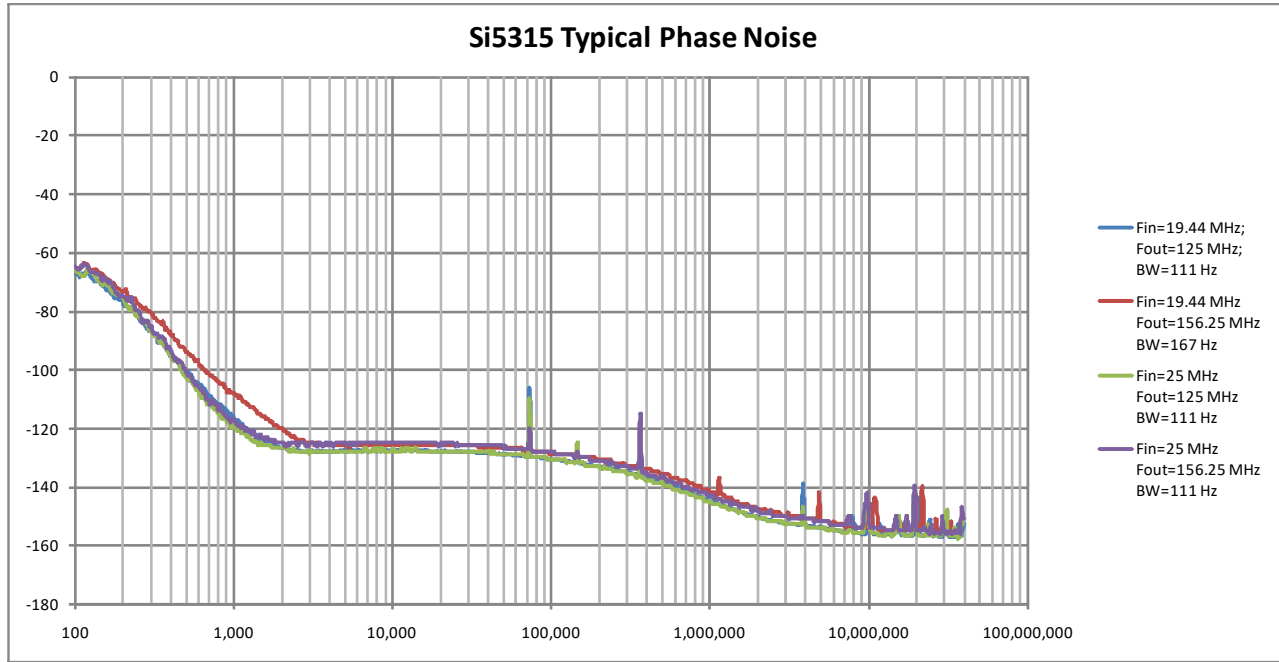
**Figure 23. Fout = 155 MHz with 112 Hz Loop Bandwidth, 100 mVp-p Supply Noise**

# Si5315

## 9. Typical Phase Noise Plots

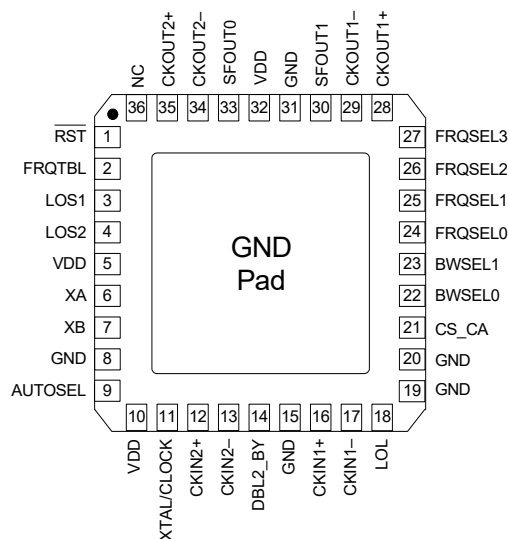
The following is a typical phase noise plot. The clock input source was a Rohde and Schwarz model SML03 RF Generator. The spectrum analyzer was either an Agilent model E5052B, model E4400A or model JS-500. The Si5315 operates at 3.3 V with an ac coupled differential PECL output and an ac coupled differential sine wave input from the RF generator at 0 dBm. Note that, as with any PLL, the output jitter that is below the loop BW is caused by the jitter at the input clock, not the Si5315. Except as noted, loop BWs of 60 to 240 Hz were in use.

### 9.1. 10G LAN SyncE Example



|  | Frequency Plan  |  |  |   |
|--|---|--|--|---|
|  | $F_{in}=19.44$ MHz<br>$F_{out}=156.25$ MHz<br>BW=167 Hz | $F_{in}=19.44$ MHz<br>$F_{out}=125$ MHz<br>BW=111 Hz | $F_{in}=25$ MHz<br>$F_{out}=156.25$ MHz<br>BW=111 Hz | $F_{in}=25$ MHz<br>$F_{out}=125$ MHz<br>BW=111 Hz |
| <b>Jitter Integration Filter Band</b>  | RMS Jitter (fs)   |  |  |   |
| <b>IEEE802.3 (1.875 to 20 MHz)</b>     | 232   | 240  | 251  | 240   |
| <b>SONET OC-192 (20 kHz to 80 MHz)</b> | 483   | 575  | 525  | 550   |
| <b>SONET OC-192 (4 to 80 MHz)</b>      | 302   | 303  | 300  | 294   |
| <b>SONET OC-192 (50 kHz to 80 MHz)</b> | 467   | 564  | 510  | 537   |
| <b>SONET OC-48 (12 kHz to 20 MHz)</b>  | 470   | 565  | 517  | 541   |
| <b>SONET OC-3 (12 kHz to 5 MHz)</b>    | 422   | 524  | 471  | 503   |
| <b>BroadBand (800 Hz to 80 MHz)</b>    | 511   | 584  | 533  | 557   |

## 10. Pin Descriptions: Si5315



Pin assignments are preliminary and subject to change.

**Table 19. Si5315 Pin Descriptions**

| Pin # | Pin Name                | I/O | Signal Level | Description   |
|-------|-------------------------|-----|--------------|---|
| 1     | $\overline{\text{RST}}$ | I   | LVC MOS      | <b>External Reset.</b><br>Active low input that performs external hardware reset of device. Resets all internal logic to a known state. Clock outputs are tristated during reset. After rising edge of $\overline{\text{RST}}$ signal, the Si5315 will perform an internal self-calibration when a valid input signal is present.<br>This pin has a weak pull-up. |
| 2     | FRQTBL                  | I   | 3-Level      | <b>Frequency Table Select.</b><br>Selects frequency table. (Table 9 on page 20.)<br>This pin has a weak pull-up and weak pull-down and defaults to M.<br>Some designs may require an external resistor voltage divider when driven by an active device that will tri-state.   |
| 3     | LOS1                    | O   | LVC MOS      | <b>CKIN1 Loss of Signal.</b><br>Active high loss-of-signal indicator for CKIN1. Once triggered, the alarm will remain active until CKIN1 is validated.<br>0 = CKIN1 present<br>1 = LOS on CKIN1   |
| 4     | LOS2                    | O   | LVC MOS      | <b>CKIN2 Loss of Signal.</b><br>Active high loss-of-signal indicator for CKIN2. Once triggered, the alarm will remain active until CKIN2 is validated.<br>0 = CKIN2 present<br>1 = LOS on CKIN2   |

Table 19. Si5315 Pin Descriptions (Continued)

| Pin #                 | Pin Name         | I/O             | Signal Level | Description  |   |        |    |        |    |        |
|-----------------------|------------------|-----------------|--------------|--|---|--------|----|--------|----|--------|
| 5, 10, 32             | V <sub>DD</sub>  | V <sub>DD</sub> | Supply       | <p><b>Supply.</b></p> <p>The device operates from a 1.8, 2.5, or 3.3 V supply. Bypass capacitors should be associated with the following V<sub>DD</sub> pins:</p> <table> <tr> <td>5</td> <td>0.1 μF</td> </tr> <tr> <td>10</td> <td>0.1 μF</td> </tr> <tr> <td>32</td> <td>0.1 μF</td> </tr> </table> <p>A 1.0 μF should also be placed as close to device as is practical.</p>   | 5 | 0.1 μF | 10 | 0.1 μF | 32 | 0.1 μF |
| 5                     | 0.1 μF           |                 |              |  |   |        |    |        |    |        |
| 10                    | 0.1 μF           |                 |              |  |   |        |    |        |    |        |
| 32                    | 0.1 μF           |                 |              |  |   |        |    |        |    |        |
| 7<br>6                | XB<br>XA         | I               | Analog       | <p><b>External Crystal or Reference Clock.</b></p> <p>External crystal should be connected to these pins to use internal oscillator based reference. Crystal or reference clock selection is set by the XTAL/CLOCK pin.</p>  |   |        |    |        |    |        |
| 8,<br>15,19,<br>20,31 | GND              | GND             | Supply       | <p><b>Ground.</b></p> <p>Must be connected to system ground. Minimize the ground path impedance for optimal performance of this device.</p>  |   |        |    |        |    |        |
| 9                     | AUTOSEL          | I               | 3-Level      | <p><b>Manual/Automatic Clock Selection.</b></p> <p>Three level input that selects the method of input clock selection to be used.</p> <p>L = Manual<br/>M = Automatic non-revertive<br/>H = Automatic revertive</p> <p>This pin has a weak pull-up and weak pull-down and defaults to M.</p> <p>Some designs may require an external resistor voltage divider when driven by an active device that will tri-state.</p>                                 |   |        |    |        |    |        |
| 11                    | XTAL/CLOCK       | I               | 3-Level      | <p><b>External Crystal or Reference Clock Rate.</b></p> <p>Three level input that selects the type and rate of external crystal or reference clock to be applied to the XA/XB port. This pin has both a weak pull-up and a weak pull-down and defaults to M.</p> <p>L = Crystal<br/>M = Clock (Default)<br/>H = Reserved</p> <p>Some designs may require an external resistor voltage divider when driven by an active device that will tri-state.</p> |   |        |    |        |    |        |
| 12<br>13              | CKIN2+<br>CKIN2– | I               |              | <p><b>Clock Input 2.</b></p> <p>Differential input clock. This input can also be driven with a single-ended signal. Input frequency selected from a table of values. The same frequency must be applied to CKIN1 and CKIN2.</p>  |   |        |    |        |    |        |

Table 19. Si5315 Pin Descriptions (Continued)

| Pin #    | Pin Name         | I/O | Signal Level | Description   |
|----------|------------------|-----|--------------|---|
| 14       | DBL2_BY          | I   | 3-Level      | <p><b>Output 2 Disable/Bypass Mode Control.</b><br/>Controls enable of CKOUT2 divider/output buffer path and PLL bypass mode.<br/>L = CKOUT2 enabled<br/>M = CKOUT2 disabled<br/>H = Bypass mode with CKOUT2 enabled. Bypass mode is not supported with CMOS clock outputs (SFOUT = LH).<br/>This pin has a weak pull-up and weak pull-down and defaults to M.<br/>Some designs may require an external resistor voltage divider when driven by an active device that will tri-state.</p>   |
| 16<br>17 | CKIN1+<br>CKIN1– | I   | Multi        | <p><b>Clock Input 1.</b><br/>Differential input clock. This input can also be driven with a single-ended signal. Input frequency selected from a table of values. The same frequency must be applied to CKIN1 and CKIN2.</p>  |
| 18       | LOL              | O   | LVC MOS      | <p><b>PLL Loss of Lock Indicator.</b><br/>This pin functions as the active high PLL loss of lock indicator.<br/>0 = PLL locked<br/>1 = PLL unlocked</p>   |
| 21       | CS_CA            | I/O | LVC MOS      | <p><b>Input Clock Select/Active Clock Indicator.</b><br/><b>Input:</b> If manual clock selection mode is chosen (AUTOSEL = L), this pin functions as the manual input clock selector. This input is internally deglitched to prevent inadvertent clock switching during changes in the CS input state.<br/>0 = Select CKIN1<br/>1 = Select CKIN2<br/>If configured as input, must be set high or low.<br/><b>Output:</b> If automatic clock selection mode is chosen (AUTOSEL = M or H), this pin indicates which of the two input clocks is currently the active clock. If alarms exist on both CKIN1 and CKIN2, indicating that the holdover state has been entered, CA will indicate the last active clock that was used before entering the hold state.<br/>0 = CKIN1 active input clock<br/>1 = CKIN2 active input clock</p> |
| 23<br>22 | BWSEL1<br>BWSEL0 | I   | 3-Level      | <p><b>Loop Bandwidth Select.</b><br/>Three level inputs that select the DSPLL closed loop bandwidth. See Table 9 on page 20 for available settings. These pins have both weak pull-ups and weak pull-downs and default to M.<br/>Some designs may require an external resistor voltage divider when driven by an active device that will tri-state.</p>   |

Table 19. Si5315 Pin Descriptions (Continued)

| Pin #                | Pin Name                                 | I/O | Signal Level | Description  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
|----------------------|--|-----|--------------|--|------------|---------------|----|----------|----|------|----|-----|----|--------|----|----------|----|----------------|----|------|----|---------|----|----------|
| 27<br>26<br>25<br>24 | FRQSEL3<br>FRQSEL2<br>FRQSEL1<br>FRQSEL0 | I   | 3-Level      | <p><b>Frequency Select.</b></p> <p>Three level inputs that select the input clock and clock multiplication ratio, depending on the FRQTBL setting. These pins have both weak pull-ups and weak pull-downs and default to M.</p> <p>Some designs may require an external resistor voltage divider when driven by an active device that will tri-state.</p>  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| 29<br>28             | CKOUT1–<br>CKOUT1+                       | O   | Multi        | <p><b>Clock Output 1.</b></p> <p>Differential output clock with a frequency selected from a table of values. Output signal format is selected by SFOUT pins. Output is differential for LVPECL, LVDS, and CML compatible modes. For CMOS format, both output pins drive identical single-ended clock outputs.</p>  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| 33<br>30             | SFOUT0<br>SFOUT1                         | I   | 3-Level      | <p><b>Signal Format Select.</b></p> <p>Three level inputs that select the output signal format (common mode voltage and differential swing) for both CKOUT1 and CKOUT2.</p> <table border="1"> <thead> <tr> <th>SFOUT[1:0]</th> <th>Signal Format</th> </tr> </thead> <tbody> <tr> <td>HH</td> <td>Reserved</td> </tr> <tr> <td>HM</td> <td>LVDS</td> </tr> <tr> <td>HL</td> <td>CML</td> </tr> <tr> <td>MH</td> <td>LVPECL</td> </tr> <tr> <td>MM</td> <td>Reserved</td> </tr> <tr> <td>ML</td> <td>LVDS—Low Swing</td> </tr> <tr> <td>LH</td> <td>CMOS</td> </tr> <tr> <td>LM</td> <td>Disable</td> </tr> <tr> <td>LL</td> <td>Reserved</td> </tr> </tbody> </table> <p>These pins have both weak pull-ups and weak pull-downs and default to M.</p> <p>Some designs may require an external resistor voltage divider when driven by an active device that will tri-state.</p> | SFOUT[1:0] | Signal Format | HH | Reserved | HM | LVDS | HL | CML | MH | LVPECL | MM | Reserved | ML | LVDS—Low Swing | LH | CMOS | LM | Disable | LL | Reserved |
| SFOUT[1:0]           | Signal Format                            |     |              |  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| HH                   | Reserved                                 |     |              |  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| HM                   | LVDS                                     |     |              |  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| HL                   | CML                                      |     |              |  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| MH                   | LVPECL                                   |     |              |  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| MM                   | Reserved                                 |     |              |  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| ML                   | LVDS—Low Swing                           |     |              |  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| LH                   | CMOS                                     |     |              |  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| LM                   | Disable                                  |     |              |  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| LL                   | Reserved                                 |     |              |  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| 34<br>35             | CKOUT2–<br>CKOUT2+                       | O   | Multi        | <p><b>Clock Output 2.</b></p> <p>Differential output clock with a frequency selected from a table of values. Output signal format is selected by SFOUT pins. Output is differential for LVPECL, LVDS, and CML compatible modes. For CMOS format, both output pins drive identical single-ended clock outputs.</p>  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| 36                   | NC                                       | —   | —            | <p><b>No Connect.</b></p> <p>Leave floating. Make no external connections to this pin for normal operation.</p>  |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |
| GND<br>PAD           | GND                                      | GND | Supply       | <p><b>Ground Pad.</b></p> <p>The ground pad must provide a low thermal and electrical impedance to a ground plane.</p>   |            |               |    |          |    |      |    |     |    |        |    |          |    |                |    |      |    |         |    |          |

Table 20. Si5315 Pull-Up/Pull-Down

| Pin # | Si5315                  | Pull |
|-------|-------------------------|------|
| 1     | $\overline{\text{RST}}$ | U    |
| 2     | FRQTBL                  | U, D |
| 9     | AUTOSEL                 | U, D |
| 11    | XTAL/<br>CLOCK          | U, D |
| 14    | DBL2_BY                 | U, D |
| 21    | CS_CA                   | U, D |
| 22    | BWSEL0                  | U, D |
| 23    | BWSEL1                  | U, D |
| 24    | FRQSEL0                 | U, D |
| 25    | FRQSEL1                 | U, D |
| 26    | FRQSEL2                 | U, D |
| 27    | FRQSEL3                 | U, D |
| 30    | SFOUT1                  | U, D |
| 33    | SFOUT0                  | U, D |

# Si5315

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## 11. Ordering Guide

| Ordering Part Number | Output Clock Freq Range | Pkg                | ROHS6, Pb-Free | Temp Range   |
|----------------------|-------------------------|--------------------|----------------|--------------|
| Si5315A-C-GM         | 8 kHz–644.53 MHz        | 36-Lead 6x6 mm QFN | Yes            | –40 to 85 °C |
| Si5315B-C-GM         | 8 kHz–125 MHz           | 36-Lead 6x6 mm QFN | Yes            | –40 to 85 °C |
| Si5315-EVB           | 8 kHz–644.53 MHz        | Evaluation Board   |                |              |

**Note:** Add an “R” at the end of the device to denote tape and reel options (i.e., Si5315A-C-GMR).



## 12. Package Outline: 36-Pin QFN

Figure 24 illustrates the package details for the Si5315. Table 21 lists the values for the dimensions shown in the illustration.

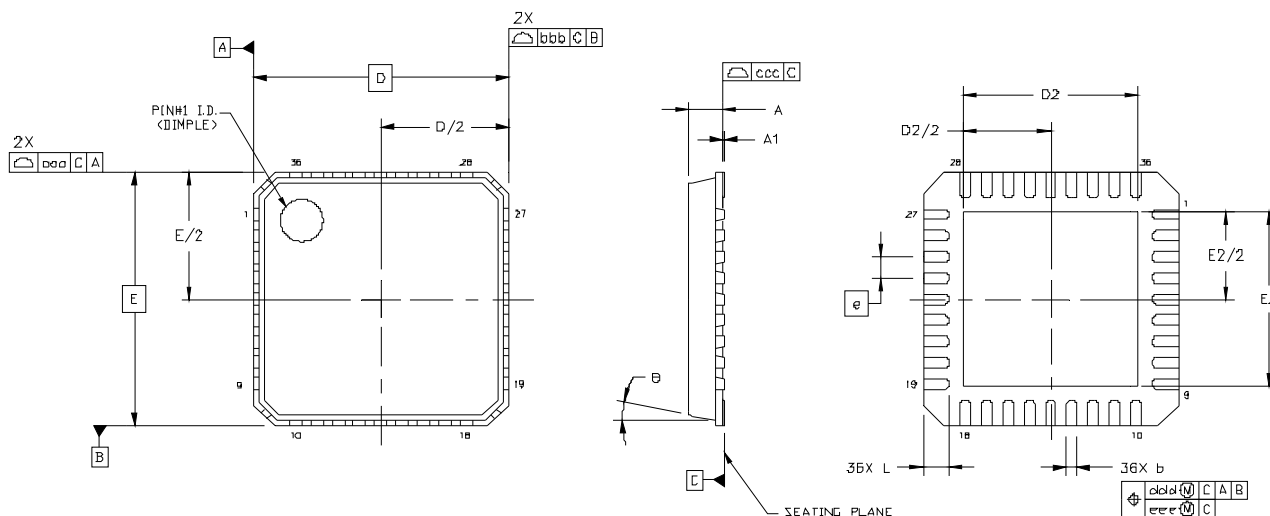


Figure 24. 36-Pin Quad Flat No-Lead (QFN)

Table 21. Package Dimensions

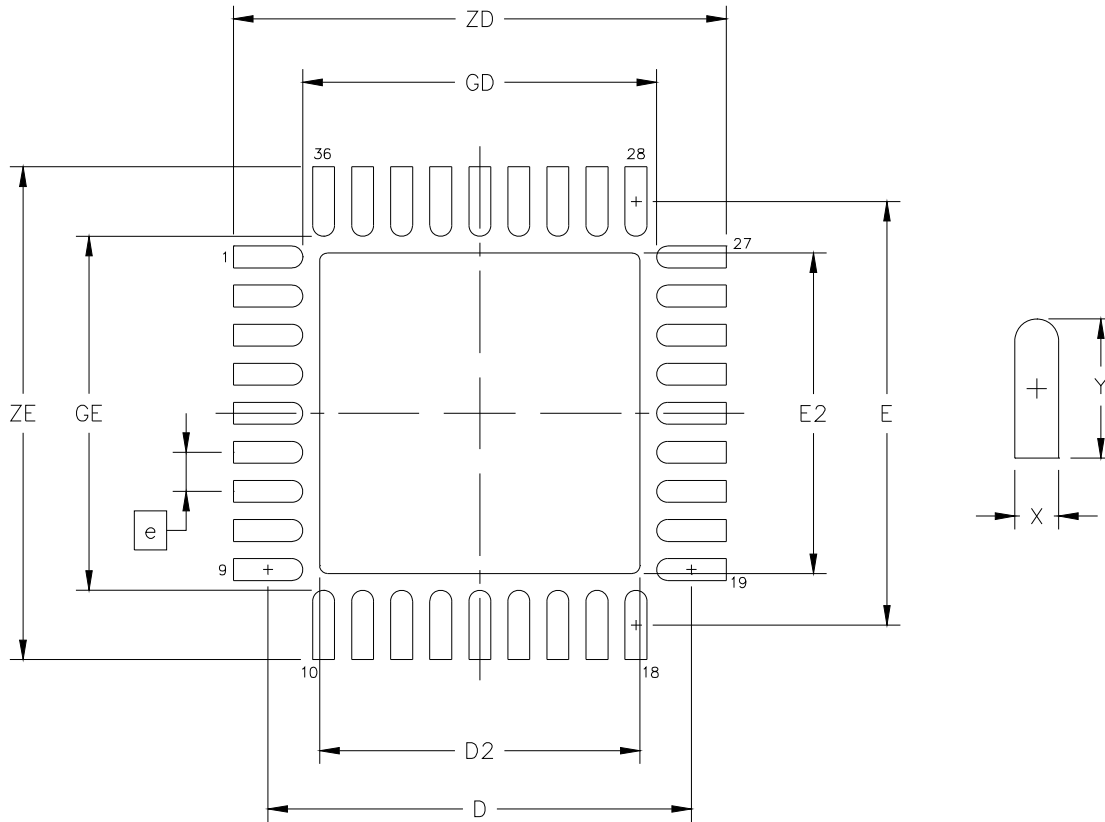
| Symbol | Millimeters |      |      | Symbol   | Millimeters |      |      |
|--------|-------------|------|------|----------|-------------|------|------|
|        | Min         | Nom  | Max  |          | Min         | Nom  | Max  |
| A      | 0.80        | 0.85 | 0.90 | L        | 0.50        | 0.60 | 0.70 |
| A1     | 0.00        | 0.02 | 0.05 | $\theta$ | —           | —    | 12°  |
| b      | 0.18        | 0.25 | 0.30 | aaa      | —           | —    | 0.10 |
| D      | 6.00 BSC    |      |      | bbb      | —           | —    | 0.10 |
| D2     | 3.95        | 4.10 | 4.25 | ccc      | —           | —    | 0.08 |
| e      | 0.50 BSC    |      |      | ddd      | —           | —    | 0.10 |
| E      | 6.00 BSC    |      |      | eee      | —           | —    | 0.05 |
| E2     | 3.95        | 4.10 | 4.25 |          |             |      |      |

**Notes:**

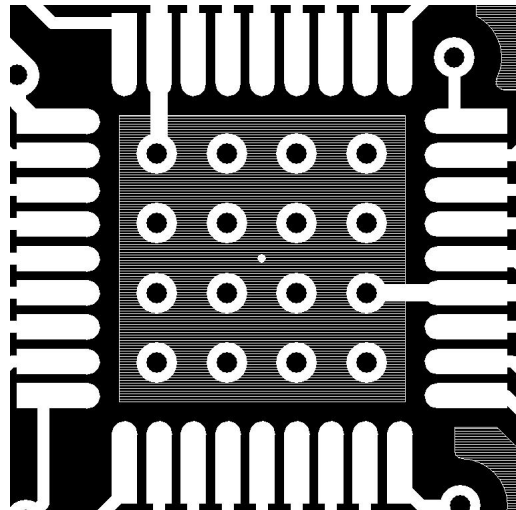
1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.
3. This drawing conforms to JEDEC outline MO-220, variation VJJD.
4. Recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

## 13. PCB Land Pattern

Figure 25 illustrates the PCB land pattern for the Si5315. Figure 26 illustrates the recommended ground pad layout. Table 22 lists the land pattern dimensions.



**Figure 25. PCB Land Pattern**



**Figure 26. Ground Pad Recommended Layout**

Table 22. PCB Land Pattern Dimensions

| Dimension | Min       | Max  |
|-----------|-----------|------|
| e         | 0.50 BSC. |      |
| E         | 5.42 REF. |      |
| D         | 5.42 REF. |      |
| E2        | 4.00      | 4.20 |
| D2        | 4.00      | 4.20 |
| GE        | 4.53      | —    |
| GD        | 4.53      | —    |
| X         | —         | 0.28 |
| Y         | 0.89 REF. |      |
| ZE        | —         | 6.31 |
| ZD        | —         | 6.31 |

**Notes (General):**

1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. Dimensioning and Tolerancing is per the ANSI Y14.5M-1994 specification.
3. This Land Pattern Design is based on IPC-SM-782 guidelines.
4. All dimensions shown are at Maximum Material Condition (MMC). Least Material Condition (LMC) is calculated based on a Fabrication Allowance of 0.05 mm.

**Notes (Solder Mask Design):**

1. All metal pads are to be non-solder mask defined (NSMD). Clearance between the solder mask and the metal pad is to be 60  $\mu\text{m}$  minimum, all the way around the pad.

**Notes (Stencil Design):**

1. A stainless steel, laser-cut and electro-polished stencil with trapezoidal walls should be used to assure good solder paste release.
2. The stencil thickness should be 0.125 mm (5 mils).
3. The ratio of stencil aperture to land pad size should be 1:1 for the perimeter pads.
4. A 4 x 4 array of 0.80 mm square openings on 1.05 mm pitch should be used for the center ground pad.

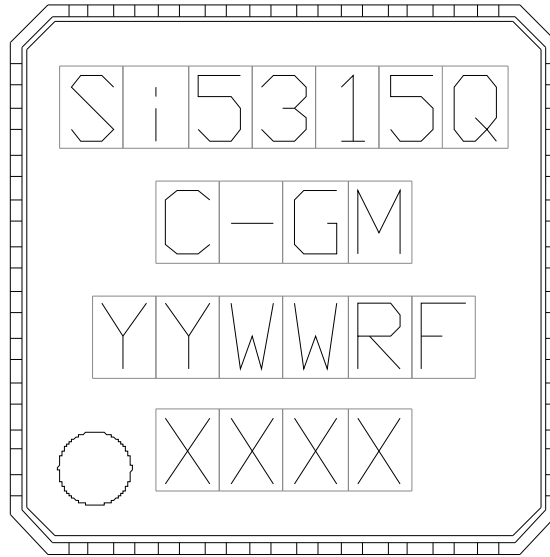
**Notes (Card Assembly):**

1. A No-Clean, Type-3 solder paste is recommended.
2. The recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

# Si5315

## 14. Top Marking

### 14.1. Si5315 Top Marking (QFN)



### 14.2. Top Marking Explanation

|                        |                            |   |
|------------------------|----------------------------|---|
| <b>Mark Method:</b>    | Laser                      |   |
| <b>Font Size:</b>      | 0.80 mm<br>Right-Justified |   |
| <b>Line 1 Marking:</b> | Si5315Q                    | Customer Part Number<br>Q = Speed Code: A, B<br>See Ordering Guide for options.   |
| <b>Line 2 Marking:</b> | C-GM                       | C = Product Revision<br>G = Temperature Range -40 to 85 °C (RoHS6)<br>M = QFN Package   |
| <b>Line 3 Marking:</b> | YYWWRF                     | YY = Year<br>WW = Work Week<br>R = Die Revision<br>F = Internal code<br>Assigned by the Assembly House. Corresponds to the year and work week of the mold date. |
| <b>Line 4 Marking:</b> | Pin 1 Identifier           | Circle = 0.75 mm Diameter<br>Lower-Left Justified   |
|                        | XXXX                       | Internal Code   |

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## DOCUMENT CHANGE LIST

### Revision 0.1 to Revision 0.2

- Expanded/added numerous operating sections to initial data sheet

### Revision 0.2 to Revision 0.25

- Updated features and application list
- Updated Section 1. "Electrical Specifications"
- Added voltage regulator block to Figure 7
- Revised footnotes in Table 9
- Removed plan #203 from Table 9
- Removed Figure 17. Crystal Oscillator with Feedback Resistor diagram from Section 7. "Crystal/Reference Clock Input"
- Added XA/XB jitter transfer plot to Section 7. "Crystal/Reference Clock Input"
- Added PSRR transfer function plot to Section 8. "Power Supply Filtering"
- Updated Typical phase noise plot and RMS jitter table in Section 9. "Typical Phase Noise Plots"

### Revision 0.25 to Revision 0.26

- Corrected Section 11. "Ordering Guide" Output Clock Frequency Range for Si5315B-C-GM to 8 kHz–125 MHz.

### Revision 0.26 to Revision 1.0

- Updated Table 2 on page 4.
- Updated Table 3 on page 8.
- Updated Table 7 on page 13.
- Moved "Typical Application Circuit" to page 14.
- Added reference to AN591.
- Bypass mode not supported with CMOS outputs.
- Changed G.8262 compliance language.
- Added frequency plans 103, 129, and 130.