# Si52142

**SILICON LABS**

# PCI-EXPRESS GEN 1, GEN 2 & GEN 3 CLOCK TWO OUTPUT GENERATOR WITH 25 MHZ REFERENCE CLOCK

## Features

- PCI-Express Gen 1, Gen 2 & Gen 3 compliant
- Low power push-pull type differential output buffers
- Integrated resistors on differential clocks
- Dedicated output enable hardware pin for each clock
- Hardware selectable spread control
- Two PCI-Express clocks
- 25 MHz reference clock

- 25 MHz crystal input or clock input
- $I^2C$ support with readback capabilities
- Triangular spread spectrum profile for maximum electromagnetic interference (EMI) reduction
- Industrial temperature –40 to 85 $^\circ$C
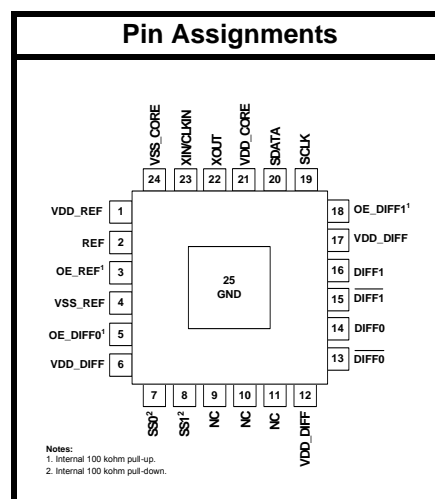- 3.3 V power supply
- 24-pin QFN package

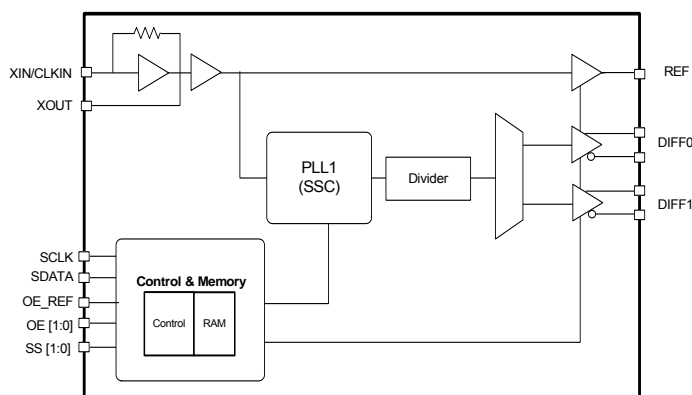**Ordering Information:**
See page 18

## Applications

- Network attached storage
- Multi-function printer
- Wireless access point
- Routers

## Description

The Si52142 is a spread-controlled PCIe clock generator that can source two PCIe clocks and a 25 MHz reference clock. The device has three hardware output enable control inputs for enabling the respective outputs on the fly while powered on along with the hardware input for spread spectrum and frequency control on outputs. In addition to the hardware control pins, $I^2C$ programmability is also available to promptly achieve optimum clock signal integrity through skew and edge rate control on true, compliment, or both differential outputs as well as amplitude control.

### Pin Assignments

| | | |
|---|---|---|
| 24 VSS_CORE | | 19 SCLK |
| 23 XIN/CLKIN | | 20 SDATA |
| 22 XOUT | | 21 VDD_CORE |

VDD_REF 1
REF 2
OE_REF[1] 3
VSS_REF 4
OE_DIFF0[1] 5
VDD_DIFF 6

25 GND

18 OE_DIFF1[1]
17 VDD_DIFF
16 DIFF1
15 DIFF1
14 DIFF0
13 DIFF0

7 SS0[2]
8 SS1[2]
9 NC
10 NC
11 NC
12 VDD_DIFF

**Notes:**
1. Internal 100 kohm pull-up.
2. Internal 100 kohm pull-down.

Patents pending

## Functional Block Diagram

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## 1.  Electrical Specifications

**Table 1. DC Electrical Specifications**

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| 3.3 V Operating Voltage | VDD core | 3.3 ± 5% | 3.135 | 3.3 | 3.465 | V |
| 3.3 V Input High Voltage | $V_{IH}$ | Control input pins | 2.0 | — | $V_{DD}$ + 0.3 | V |
| 3.3 V Input Low Voltage | $V_{IL}$ | Control input pins | $V_{SS}$ – 0.3 | — | 0.8 | V |
| Input High Voltage | $V_{IHI2C}$ | SDATA, SCLK | 2.2 | — | — | V |
| Input Low Voltage | $V_{ILI2C}$ | SDATA, SCLK | — | — | 1.0 | V |
| Input High Leakage Current | $I_{IH}$ | Except internal pull-down resistors, $0 < V_{IN} < V_{DD}$ | — | — | 5 | μA |
| Input Low Leakage Current | $I_{IL}$ | Except internal pull-up resistors, $0 < V_{IN} < V_{DD}$ | –5 | — | — | μA |
| 3.3 V Output High Voltage (SE) | $V_{OH}$ | $I_{OH}$ = –1 mA | 2.4 | — | — | V |
| 3.3 V Output Low Voltage (SE) | $V_{OL}$ | $I_{OL}$ = 1 mA | — | — | 0.4 | V |
| High-impedance Output Current | $I_{OZ}$ | | –10 | — | 10 | μA |
| Input Pin Capacitance | $C_{IN}$ | | 1.5 | — | 5 | pF |
| Output Pin Capacitance | $C_{OUT}$ | | | — | 6 | pF |
| Pin Inductance | $L_{IN}$ | | — | — | 7 | nH |
| Dynamic Supply Current | $I_{DD\_3.3V}$ | All outputs enabled. Differential clocks with 5" traces and 2 pF load. | — | — | 40 | mA |

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**Table 2. AC Electrical Specifications**

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|-----------|--------|-----------|-----|-----|-----|------|
| **Crystal** | | | | | | |
| Long-term Accuracy | $L_{ACC}$ | Measured at VDD/2 differential | — | — | 250 | ppm |
| **Clock Input** | | | | | | |
| CLKIN Duty Cycle | $T_{DC}$ | Measured at VDD/2 | 47 | — | 53 | % |
| CLKIN Rise and Fall Times | $T_R/T_F$ | Measured between 0.2 $V_{DD}$ and 0.8 $V_{DD}$ | 0.5 | — | 4.0 | V/ns |
| CLKIN Cycle to Cycle Jitter | $T_{CCJ}$ | Measured at VDD/2 | — | — | 250 | ps |
| CLKIN Long Term Jitter | $T_{LTJ}$ | Measured at VDD/2 | — | — | 350 | ps |
| Input High Voltage | $V_{IH}$ | XIN/CLKIN pin | 2 | — | VDD+0.3 | V |
| Input Low Voltage | $V_{IL}$ | XIN/CLKIN pin | — | — | 0.8 | V |
| Input High Current | $I_{IH}$ | XIN/CLKIN pin, VIN = VDD | — | — | 35 | µA |
| Input Low Current | $I_{IL}$ | XIN/CLKIN pin, 0 < VIN <0.8 | –35 | — | — | µA |
| **DIFF at 0.7 V** | | | | | | |
| DIFF Duty Cycle | $T_{DC}$ | Measured at 0 V differential | 45 | — | 55 | % |
| Any DIFF Clock Skew from the earliest bank to the latest bank | $T_{SKEW(window)}$ | Measured at 0 V differential | — | — | 50 | ps |
| DIFF Cycle to Cycle Jitter | $T_{CCJ}$ | Measured at 0 V differential | — | 35 | 50 | ps |
| Output PCIe Gen1 REFCLK Phase Jitter | $RMS_{GEN1}$ | Includes PLL BW 1.5–22 MHz, ζ = 0.54, Td=10 ns, Ftrk=1.5 MHz with BER = 1E-12 | 0 | 40 | 108 | ps |
| Output PCIe Gen2 REFCLK Phase Jitter | $RMS_{GEN2}$ | Includes PLL BW 8–16 MHz, Jitter Peaking = 3 dB, ζ = 0.54, Td=12 ns, Low Band, F < 1.5 MHz | 0 | 2 | 3.0 | ps |
| Output PCIe Gen2 REFCLK Phase Jitter | $RMS_{GEN2}$ | Includes PLL BW 8–16 MHz, Jitter Peaking = 3 dB, ζ = 0.54, Td=12 ns, High Band, 1.5 MHz < F < Nyquist | 0 | 2 | 3.1 | ps |
| Output Phase Jitter Impact— PCIe Gen3 | $RMS_{GEN3}$ | Includes PLL BW 2 – 4 MHz, CDR = 10 MHz) | 0 | 0.5 | 1.0 | ps |
| DIFF Long Term Accuracy | $L_{ACC}$ | Measured at 0 V differential | — | — | 100 | ppm |
| DIFF Rising/Falling Slew Rate | $T_R / T_F$ | Measured differentially from ±150 mV | 1 | — | 8 | V/ns |
| Voltage High | $V_{HIGH}$ | | — | — | 1.15 | V |
| Voltage Low | $V_{LOW}$ | | –0.3 | — | — | V |
| Crossing Point Voltage at 0.7 V Swing | $V_{OX}$ | | 300 | — | 550 | mV |

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## Table 2. AC Electrical Specifications (Continued)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **REF(25 MHz) at 3.3 V** | | | | | | |
| Duty Cycle | $T_{DC}$ | Measurement at 1.5 V | 45 | — | 55 | % |
| Rising and Falling Edge Rate | $T_R$ / $T_F$ | Measured between 0.8 and 2.0 V | 1.0 | — | 4.0 | V/ns |
| Cycle to Cycle Jitter | $T_{CCJ}$ | Measurement at 1.5 V | — | — | 300 | ps |
| Long Term Accuracy | $L_{ACC}$ | Measured at 1.5 V | — | — | 100 | ppm |
| **Enable/Disable and Set-Up** | | | | | | |
| Clock Stabilization from Power-up | $T_{STABLE}$ | | — | — | 1.8 | ms |
| Stopclock Set-up Time | $T_{SS}$ | | 10.0 | — | — | ns |

## Table 3. Absolute Maximum Conditions

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Main Supply Voltage | $V_{DD\_3.3V}$ | Functional | — | — | 4.6 | V |
| Input Voltage | $V_{IN}$ | Relative to $V_{SS}$ | –0.5 | — | 4.6 | $V_{DC}$ |
| Temperature, Storage | $T_S$ | Non-functional | –65 | — | 150 | °C |
| Temperature, Operating Ambient | $T_A$ | Functional | –40 | — | 85 | °C |
| Temperature, Junction | $T_J$ | Functional | — | — | 150 | °C |
| Dissipation, Junction to Case | $\varnothing_{JC}$ | JEDEC (JESD 51) | — | — | 35 | °C/W |
| Dissipation, Junction to Ambient | $\varnothing_{JA}$ | JEDEC (JESD 51) | — | — | 37 | °C/W |
| ESD Protection (Human Body Model) | $ESD_{HBM}$ | JEDEC (JESD 22-A114) | 2000 | — | — | V |
| Flammability Rating | UL-94 | UL (Class) | | V–0 | | |
| Moisture Sensitivity Level | MSL | JEDEC (J-STD-020) | | 2 | | |
| **Note:** While using multiple power supplies, the voltage on any input or I/O pin cannot exceed the power pin during power-up. Power supply sequencing is not required. | | | | | | |

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# 2. Functional Description

## 2.1. Crystal Recommendations

The clock device requires a parallel resonance crystal. Substituting a series resonance crystal causes the clock device to operate at the wrong frequency and violates the ppm specification. For most applications there is a 300 ppm frequency shift between series and parallel crystals due to incorrect loading.

**Table 4. Crystal Recommendations**

| Frequency (Fund) | Cut | Loading | Load Cap | Shunt Cap (max) | Motional (max) | Tolerance (max) | Stability (max) | Aging (max) |
|---|---|---|---|---|---|---|---|---|
| 25 MHz | AT | Parallel | 12–15 pF | 5 pF | 0.016 pF | 35 ppm | 30 ppm | 5 ppm |

### 2.1.1. Crystal Loading

Crystal loading plays a critical role in achieving low ppm performance. To realize low ppm performance, use the total capacitance the crystal sees to calculate the appropriate capacitive loading (CL).

Figure 1 shows a typical crystal configuration using the two trim capacitors. It is important that the trim capacitors are in series with the crystal. It is not true that load capacitors are in parallel with the crystal and are approximately equal to the load capacitance of the crystal.
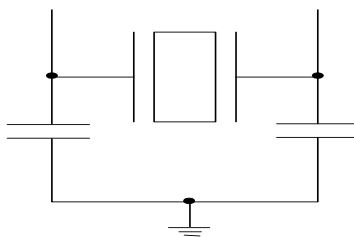


**Figure 1. Crystal Capacitive Clarification**

### 2.1.2. Calculating Load Capacitors

In addition to the standard external trim capacitors, consider the trace capacitance and pin capacitance to calculate the crystal loading correctly. Again, the capacitance on each side is in series with the crystal. The total capacitance on both side is twice the specified crystal load capacitance (CL). Trim capacitors are calculated to provide equal capacitive loading on both sides.
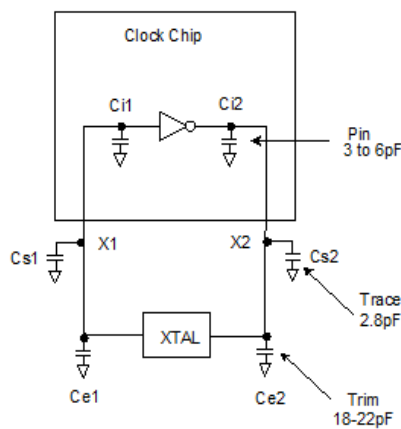


**Figure 2. Crystal Loading Example**

Use the following formulas to calculate the trim capacitor values for Ce1 and Ce2.

**Load Capacitance (each side)**

$$Ce = 2 \times CL - (Cs + Ci)$$

**Total Capacitance (as seen by the crystal)**

$$CLe = \frac{1}{\left( \dfrac{1}{Ce1 + Cs1 + Ci1} + \dfrac{1}{Ce2 + Cs2 + Ci2} \right)}$$

- CL: Crystal load capacitance
- CLe: Actual loading seen by crystal using standard value trim capacitors
- Ce: External trim capacitors
- Cs: Stray capacitance (terraced)
- Ci : Internal capacitance (lead frame, bond wires, etc.)

## 2.2. OE Clarification

The OE pins are active high inputs used to enable and disable the output clocks. To enable the output clock, the OE pin needs to be logic high and the I$^2$C output enable bit needs to be logic high. There are two methods to disable the output clocks: the OE is pulled to a logic low, or the I$^2$C enable bit is set to a logic low. The OE pins is required to be driven at all time and even though it has an internally 100 k$\Omega$ resistor.

## 2.3. OE Assertion

The OE signals are active high input used for synchronous stopping and starting the output clocks respectively while the rest of the clock generator continues to function. The assertion of the OE signal by making it logic high causes stopped respective output clocks to resume normal operation. No short or stretched clock pulses are produced when the clock resumes. The maximum latency from the assertion to active outputs is no more than two to six output clock cycles.

## 2.4. OE Deassertion

When the OE pin is deasserted by making its logic low, the corresponding output clocks are stopped cleanly, and the final output state is driven low.

## 2.5. SS[1:0] Clarification

SS[1:0] are active inputs used to select differential output frequency and enable spread of –0.5% on all DIFF outputs as per Table 5.

**Table 5. SS0 and SS1 Frequency/Spread Selection**

| SS1 | SS0 | Differential Frequency | Differential Spread | Configuration |
|-----|-----|-----------------------|---------------------|---------------|
| 0 | 0 | 100 MHz | Spread Off | Default |
| 0 | 1 | 100 MHz | –0.50% | |
| 1 | 0 | 125 MHz | Spread Off | |
| 1 | 1 | 200 MHz | Spread Off | |

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# 3. Test and Measurement Setup

This diagram shows the test load configuration for the differential clock signals.
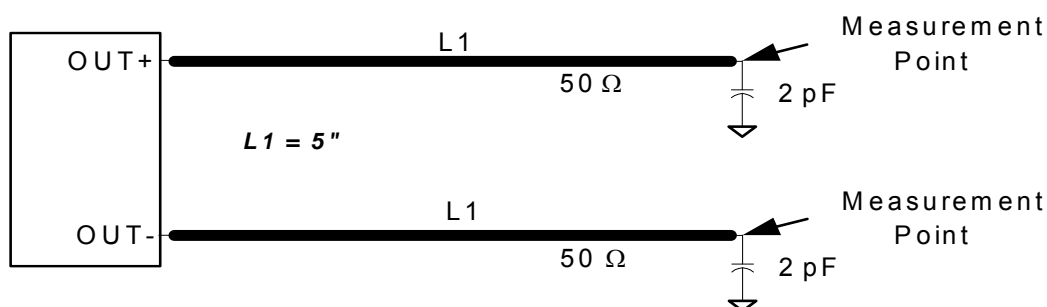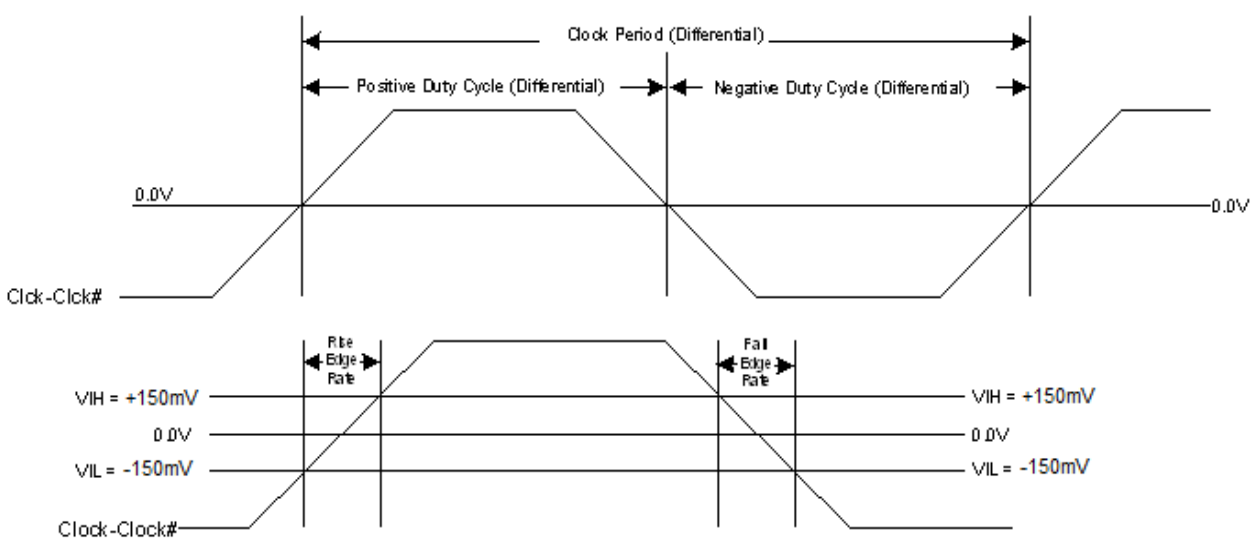


**Figure 3. 0.7 V Differential Load Configuration**



**Figure 4. Differential Measurement for Differential Output Signals (for AC Parameters Measurement)**
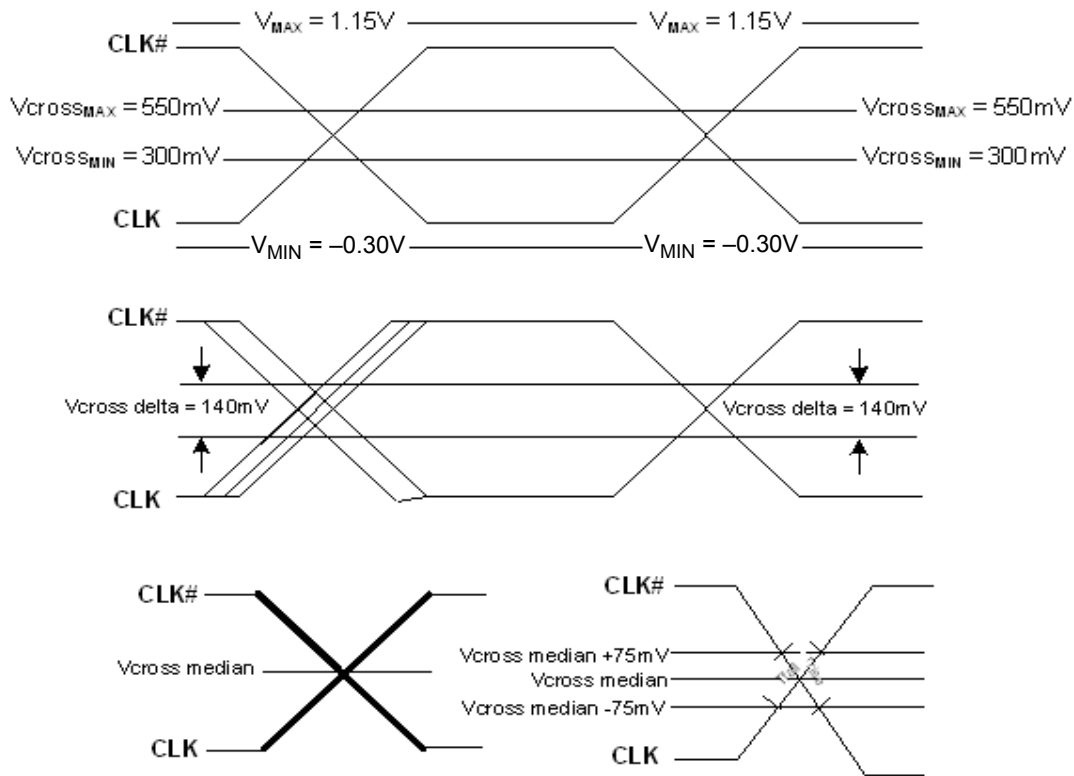
**Figure 5. Single-ended Measurement for Differential Output Signals
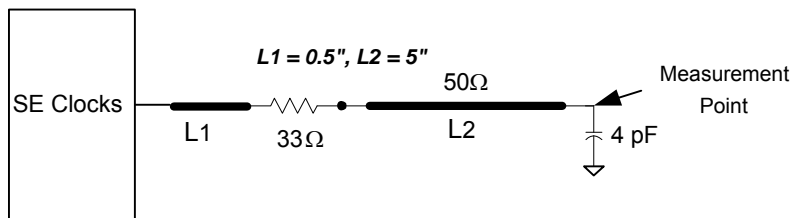(for AC Parameters Measurement)**



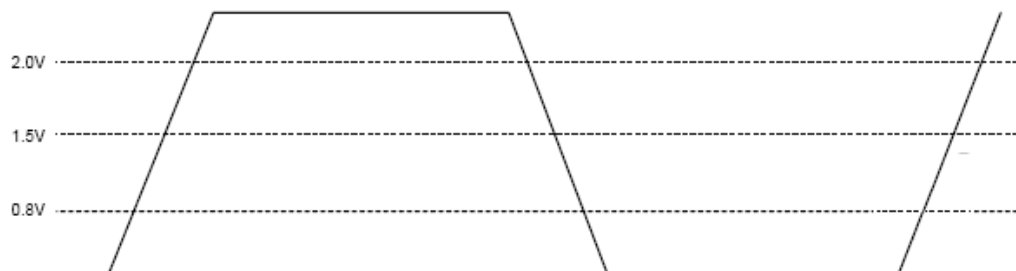**Figure 6. Single-ended Clocks with Single Load Configuration**



**Figure 7. Single-ended Output Signal (for AC Parameter Measurement)**

# 4. Control Registers

## 4.1. Serial Data Interface

To enhance the flexibility and function of the clock synthesizer, a two-signal serial interface is provided. Through the Serial Data Interface, various device functions, such as individual clock output buffers are individually enabled or disabled. The registers associated with the Serial Data Interface initialize to their default setting at power-up. The use of this interface is optional. Clock device register changes are normally made at system initialization, if any are required. The interface cannot be used during system operation for power management functions.

## 4.2. Data Protocol

The clock driver serial protocol accepts byte write, byte read, block write, and block read operations from the controller. For block write/read operation, access the bytes in sequential order from lowest to highest (most significant bit first) with the ability to stop after any complete byte is transferred. For byte write and byte read operations, the system controller can access individually indexed bytes. The offset of the indexed byte is encoded in the command code described in Table 1 on page 4.

The block write and block read protocol is outlined in Table 6 while Table 7 outlines byte write and byte read protocol. The slave receiver address is 11010110 (D6h).

**Table 6. Block Read and Block Write Protocol**

| Block Write Protocol | | Block Read Protocol | |
|---|---|---|---|
| Bit | Description | Bit | Description |
| 1 | Start | 1 | Start |
| 8:2 | Slave address—7 bits | 8:2 | Slave address—7 bits |
| 9 | Write | 9 | Write |
| 10 | Acknowledge from slave | 10 | Acknowledge from slave |
| 18:11 | Command Code—8 bits | 18:11 | Command Code—8 bits |
| 19 | Acknowledge from slave | 19 | Acknowledge from slave |
| 27:20 | Byte Count—8 bits | 20 | Repeat start |
| 28 | Acknowledge from slave | 27:21 | Slave address—7 bits |
| 36:29 | Data byte 1—8 bits | 28 | Read = 1 |
| 37 | Acknowledge from slave | 29 | Acknowledge from slave |
| 45:38 | Data byte 2—8 bits | 37:30 | Byte Count from slave—8 bits |
| 46 | Acknowledge from slave | 38 | Acknowledge |
| .... | Data Byte /Slave Acknowledges | 46:39 | Data byte 1 from slave—8 bits |
| .... | Data Byte N—8 bits | 47 | Acknowledge |
| .... | Acknowledge from slave | 55:48 | Data byte 2 from slave—8 bits |
| .... | Stop | 56 | Acknowledge |
| | | .... | Data bytes from slave/Acknowledge |
| | | .... | Data Byte N from slave–8 bits |
| | | .... | NOT Acknowledge |
| | | .... | Stop |

**Table 7. Byte Read and Byte Write Protocol**

| Byte Write Protocol | | Byte Read Protocol | |
|---|---|---|---|
| **Bit** | **Description** | **Bit** | **Description** |
| 1 | Start | 1 | Start |
| 8:2 | Slave address–7 bits | 8:2 | Slave address–7 bits |
| 9 | Write | 9 | Write |
| 10 | Acknowledge from slave | 10 | Acknowledge from slave |
| 18:11 | Command Code–8 bits | 18:11 | Command Code–8 bits |
| 19 | Acknowledge from slave | 19 | Acknowledge from slave |
| 27:20 | Data byte–8 bits | 20 | Repeated start |
| 28 | Acknowledge from slave | 27:21 | Slave address–7 bits |
| 29 | Stop | 28 | Read |
| | | 29 | Acknowledge from slave |
| | | 37:30 | Data from slave–8 bits |
| | | 38 | NOT Acknowledge |
| | | 39 | Stop |

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**Control Register 0.  Byte 0**

| Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|------|------|------|------|------|------|--------|------|------|
| **Name** | | | | | | REF_OE | | |
| **Type** | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |

Reset settings = 00000100

| Bit | Name | Function |
|------|------|----------|
| 7:3 | Reserved | |
| 2 | REF_OE | **Output Enable for REF.**<br>0: Output disabled.<br>1: Output enabled. |
| 1:0 | Reserved | |

**Control Register 1.  Byte 1**

| Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|------|------|------|------|------|------|------|------|------|
| **Name** | | | | | | | | |
| **Type** | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |

Reset settings = 00000000

| Bit | Name | Function |
|------|------|----------|
| 7:0 | Reserved | |

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**Control Register 2.  Byte 2**

| Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name | DIFF0_OE | DIFF1_OE | | | | | | |
| Type | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |

Reset settings = 11000000

| Bit | Name | Function |
|-----|------|----------|
| 7 | DIFF0_OE | **Output Enable for DIFF0.**<br>0: Output disabled.<br>1: Output enabled. |
| 6 | DIFF1_OE | **Output Enable for DIFF1.**<br>0: Output disabled.<br>1: Output enabled. |
| 5:0 | Reserved | |

**Control Register 3.  Byte 3**

| Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name | Rev Code[3:0] | | | | Vendor ID[3:0] | | | |
| Type | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |

Reset settings = 00001000

| Bit | Name | Function |
|-----|------|----------|
| 7:4 | Rev Code[3:0] | **Program Revision Code.** |
| 3:0 | Vendor ID[3:0] | **Vendor Identification Code.** |

**Control Register 4.  Byte 4**

| Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name | BC[7:0] | | | | | | | |
| Type | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |

Reset settings = 00000110

| Bit | Name | Function |
|-----|------|----------|
| 7:0 | BC[7:0] | **Byte Count Register.** |

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**Control Register 5. Byte 5**

| Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|
| Name | DIFF_Amp_Sel | DIFF_Amp_Cntl[2] | DIFF_Amp_Cntl[1] | DIFF_Amp_Cntl[0] | | | | |
| Type | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |

Reset settings = 11011000

| Bit | Name | Function |
|---|---|---|
| 7 | DIFF_Amp_Sel | **Amplitude Control for DIFF Differential Outputs.**<br>0: Differential outputs with Default amplitude.<br>1: Differential outputs amplitude is set by Byte 5[6:4]. |
| 6 | DIFF_Amp_Cntl[2] | **DIFF Differential Outputs Amplitude Adjustment.**<br>000: 300 mV  001: 400 mV  010: 500 mV    011: 600 mV<br>100: 700 mV  101: 800 mV  110: 900 mV    111: 1000 mV |
| 5 | DIFF_Amp_Cntl[1] | |
| 4 | DIFF_Amp_Cntl[0] | |
| 3:0 | Reserved | |

## 5. Pin Descriptions: 24-Pin QFN



**Notes:**
1. Internal 100 kohm pull-up.
2. Internal 100 kohm pull-down.
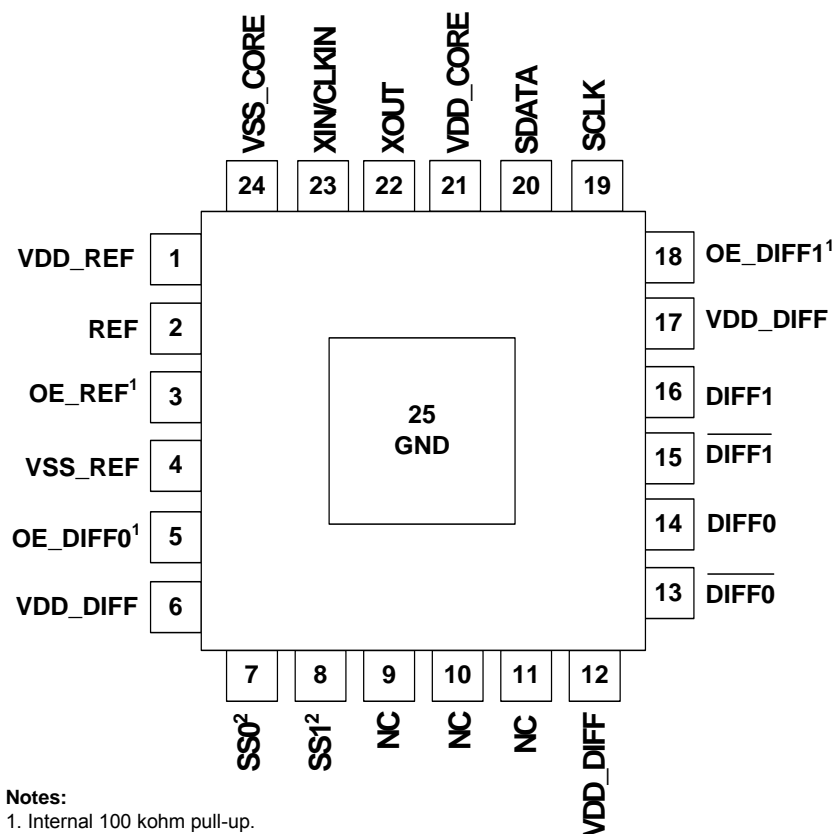
**Table 8. Si52142 24-Pin QFN Descriptions**

| Pin # | Name | Type | Description |
|---|---|---|---|
| 1 | VDD_REF | PWR | 3.3 V Power Supply |
| 2 | REF | O, SE | 3.3 V, 25 MHz crystal reference clock |
| 3 | OE_REF | I,PU | 3.3 V input to disable REF Clock (internal 100 kΩ pull-up). Refer to Table 1 on page 4 for OE specifications. |
| 4 | VSS_REF | GND | Ground |
| 5 | OE_DIFF0 | I,PU | 3.3 V input to disable DIFF0 (internal 100 kΩ pull-up). Refer to Table 1 on page 4 for OE specifications. |
| 6 | VDD_DIFF | PWR | 3.3 V Power Supply |
| 7 | SS0 | I, PD | 3.3 V tolerant latch-input for enabling Frequency/ Spread selection on DIFF0 and DIFF1 outputs. Refer to Table 1 on page 4 for SS[1:0] specifications. |
| 8 | SS1 | I, PD | |
| 9 | NC | NC | No Connect |
| 10 | NC | NC | No Connect |

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**Table 8. Si52142 24-Pin QFN Descriptions (Continued)**

| Pin # | Name | Type | Description |
|---|---|---|---|
| 11 | NC | NC | No Connect |
| 12 | VDD_DIFF | PWR | 3.3 V power supply |
| 13 | $\overline{DIFF0}$ | O, DIF | 0.7 V, 100 MHz differential clock |
| 14 | DIFF0 | O, DIF | 0.7 V, 100 MHz differential clock |
| 15 | $\overline{DIFF1}$ | O, DIF | 0.7 V, 100 MHz differential clock |
| 16 | DIFF1 | O, DIF | 0.7 V, 100 MHz differential clock |
| 17 | VDD_DIFF | PWR | 3.3 V power supply |
| 18 | OE_DIFF1 | I,PU | 3.3 V input to disable DIFF1 (internal 100 kΩ pull-up). Refer to Table 1 on page 4 for OE specifications. |
| 19 | SCLK | I | SMBus compatible SCLOCK |
| 20 | SDATA | I/O | SMBus compatible SDATA |
| 21 | VDD_CORE | PWR | 3.3 V power supply |
| 22 | XOUT | O | 25.00 MHz Crystal output, Float XOUT if using only CLKIN (Clock input) |
| 23 | XIN/CLKIN | I | 25.00 MHz Crystal input or 3.3 V, 25 MHz Clock Input |
| 24 | VSS_CORE | GND | Ground |
| 25 | GND | GND | Ground for bottom pad of the IC |

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## 6. Ordering Guide

| Part Number | Package Type | Temperature |
|---|---|---|
| **Lead-free** | | |
| Si52142-A01AGM | 24-pin QFN | Industrial, –40 to 85 °C |
| Si52142-A01AGMR | 24-pin QFN—Tape and Reel | Industrial, –40 to 85 °C |

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# 7. Package Outline

Figure 8 illustrates the package details for the Si52142. Table 9 lists the values for the dimensions shown in the illustration.
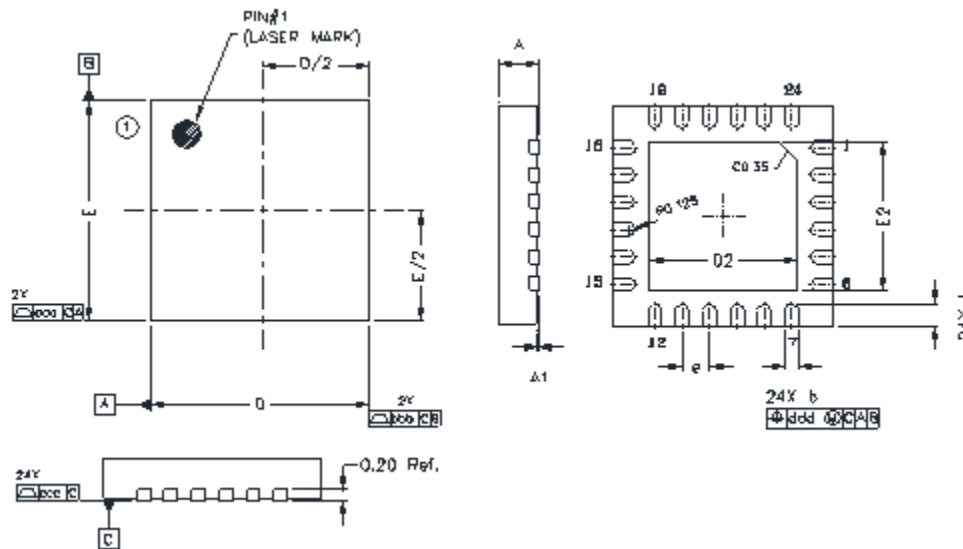


**Figure 8. 24-Pin Quad Flat No Lead (QFN) Package**

**Table 9. Package Diagram Dimensions**

| Symbol | Millimeters | | |
|:---:|:---:|:---:|:---:|
| | Min | Nom | Max |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | 0.025 | 0.05 |
| b | 0.20 | 0.25 | 0.30 |
| D | 4.00 BSC | | |
| D2 | 2.60 | 2.70 | 2.80 |
| e | 0.50 BSC | | |
| E | 4.00 BSC | | |
| E2 | 2.60 | 2.70 | 2.80 |
| L | 0.30 | 0.40 | 0.50 |
| aaa | 0.10 | | |
| bbb | 0.10 | | |
| ccc | 0.08 | | |
| ddd | 0.07 | | |

**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 VGGD-8.
4. Recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

# Si52142

## CONTACT INFORMATION

**Silicon Laboratories Inc.**

400 West Cesar Chavez
Austin, TX 78701
Tel: 1+(512) 416-8500
Fax: 1+(512) 416-9669
Toll Free: 1+(877) 444-3032

Please visit the Silicon Labs Technical Support web page:
https://www.silabs.com/support/pages/contacttechnicalsupport.aspx
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