

## CRYSTAL-LESS PCI-EXPRESS GEN1 DUAL OUTPUT CLOCK GENERATOR

### Features

- Crystal-less clock generator with integrated CMEMS
- PCI-Express Gen 1 compliant
- Two PCIe 100 MHz differential HCSL outputs
- One 25 MHz single-ended LVCMOS output
- Supports Serial (ATA) at 100 MHz
- Low power differential output buffers
- No termination resistors required for differential output clocks
- Triangular spread spectrum profile for maximum EMI reduction (Si50122-A2)
- Industrial Temperature -40 to 85 °C
- 2.5 V, 3.3 V Power supply
- Small package 10-pin TDFN (2.0 x 2.5 mm)
- Si50122-A1 does not support spread spectrum outputs
- Si50122-A2 supports 0.5% down spread outputs

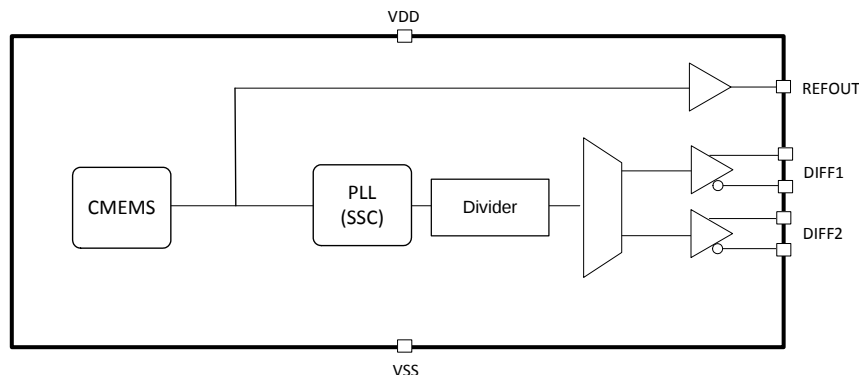
### Applications

- Network Attached Storage
- Multi-function Printer
- Digital TV
- Set top box
- Solid State Drives (SSD)
- Wireless Access Point
- Home Gateway
- Digital Video Camera

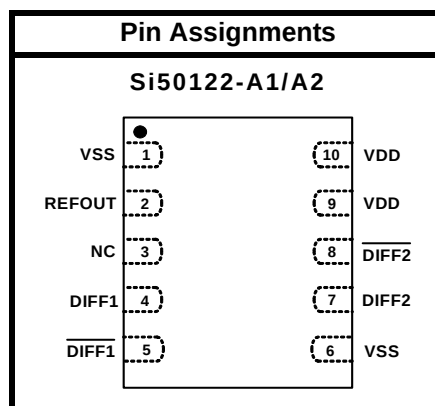
### Description

Si50122-A1/A2 is a high-performance, crystal-less PCIe clock generator that can generate two 100 MHz PCIe clock and one 25 MHz LVCMOS clock outputs. The differential clock outputs are compliant to PCIe Gen1 specifications. The ultra-small footprint (2.0 x 2.5 mm) and industry leading low-power consumption makes Si50122-A1/A2 the ideal clock solution for consumer and embedded applications where board space is limited and low power is needed.

### Functional Block Diagram



**Ordering Information:**  
See page 10



Patents pending



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## 1. Electrical Specifications

**Table 1. Recommended Operating Conditions**

| Parameter                     | Symbol   | Test Condition  | Min  | Typ | Max  | Unit |
|-------------------------------|----------|-----------------|------|-----|------|------|
| Supply Voltage (3.3 V Supply) | $V_{DD}$ | 3.3 V $\pm$ 10% | 2.97 | 3.3 | 3.63 | V    |
| Supply Voltage (2.5 V Supply) | $V_{DD}$ | 2.5 V $\pm$ 10% | 2.25 | 2.5 | 2.75 | V    |

**Table 2. DC Electrical Specifications**

| Parameter                             | Symbol    | Test Condition               | Min  | Typ  | Max  | Unit |
|---------------------------------------|-----------|------------------------------|------|------|------|------|
| Operating Voltage ( $V_{DD} = 3.3$ V) | $V_{DD}$  | 3.3 V $\pm$ 10%              | 2.97 | 3.30 | 3.63 | V    |
| Operating Voltage ( $V_{DD} = 2.5$ V) | $V_{DD}$  | 2.5 V $\pm$ 10%              | 2.25 | 2.5  | 2.75 | V    |
| Operating Supply Current              | $I_{DD}$  | Full Active; 3.3 V $\pm$ 10% | —    | 20   | 23   | mA   |
|                                       |           | Full Active; 2.5 V $\pm$ 10% | —    | 18   | 21   | mA   |
| Input Pin Capacitance                 | $C_{IN}$  | Input Pin Capacitance        | —    | 3    | 5    | pF   |
| Output Pin Capacitance                | $C_{OUT}$ | Output Pin Capacitance       | —    | —    | 5    | pF   |

Table 3. AC Electrical Specifications

| Parameter                                                                                                | Symbol         | Test Condition                                   | Min  | Typ  | Max  | Unit |
|----------------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------|------|------|------|------|
| <b>DIFF Clocks</b>                                                                                       |                |                                                  |      |      |      |      |
| Duty Cycle                                                                                               | $T_{DC}$       | Measured at 0 V differential                     | 45   | —    | 55   | %    |
| Skew                                                                                                     | $T_{SKEW}$     | Measured at 0 V differential                     | —    | —    | 100  | ps   |
| Output Frequency                                                                                         | $F_{OUT}$      | $V_{DD} = 3.3\text{ V}$                          | —    | 100  | —    | MHz  |
| Frequency Accuracy                                                                                       | $F_{ACC}$      | All output clocks                                | —    | —    | 100  | ppm  |
| Slew rate                                                                                                | $t_{r/f2}$     | Measured differentially from $\pm 150\text{ mV}$ | 0.6  | —    | 5.0  | V/ns |
| PCIe Gen1 Pk-Pk Jitter                                                                                   | $Pk-Pk_{GEN1}$ | PCIe Gen 1,<br>$V_{DD} = 3.3\text{ V} \pm 10\%$  | —    | 20.7 | 35   | ps   |
| PCIe Gen1 Pk-Pk Jitter                                                                                   | $Pk-Pk_{GEN1}$ | PCIe Gen 1,<br>$V_{DD} = 2.5\text{ V} \pm 10\%$  | —    | 25   | 40   | ps   |
| Crossing Point Voltage at 0.7 V Swing                                                                    | $V_{OX}$       |                                                  | 300  | —    | 550  | mV   |
| Voltage High                                                                                             | $V_{HIGH}$     |                                                  | —    | —    | 1.15 | V    |
| Voltage Low                                                                                              | $V_{LOW}$      |                                                  | -0.3 | —    | —    | V    |
| Spread Range                                                                                             | $S_{RNG}$      | Down Spread, -A2 only                            | —    | —    | -0.5 | %    |
| Modulation Frequency                                                                                     | $F_{MOD}$      | -A2 only                                         | 30   | 31.5 | 33   | kHz  |
| <b>25 MHz at 3.3 V</b>                                                                                   |                |                                                  |      |      |      |      |
| Duty Cycle                                                                                               | $T_{DC}$       | Measurement at 1.5 V                             | 45   | —    | 55   | %    |
| Output Rise Time                                                                                         | $t_r$          | $C_L = 10\text{ pF}$ , 20% to 80%                | —    | 1.2  | 3.0  | ns   |
| Output Fall Time                                                                                         | $t_f$          | $C_L = 10\text{ pF}$ , 20% to 80%                | —    | 1.2  | 3.0  | ns   |
| Cycle to Cycle Jitter                                                                                    | $T_{CCJ}$      | Measurement at 1.5 V                             | —    | —    | 250  | ps   |
| Long Term Accuracy                                                                                       | $L_{ACC}$      | Measured at 1.5 V                                | —    | —    | 100  | ppm  |
| <b>Powerup Time</b>                                                                                      |                |                                                  |      |      |      |      |
| Clock Stabilization from Powerup                                                                         | $T_{STABLE}$   | First power up to first output                   | —    | —    | 10   | ms   |
| <b>*Note:</b> Visit <a href="http://www.pcisig.com">www.pcisig.com</a> for complete PCIe specifications. |                |                                                  |      |      |      |      |

**Table 4. Thermal Conditions**

| Parameter                        | Symbol        | Test Condition  | Min | Typ | Max  | Unit |
|----------------------------------|---------------|-----------------|-----|-----|------|------|
| 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    | $\theta_{JC}$ | JEDEC (JESD 51) | —   |     | 38.3 | °C/W |
| Dissipation, Junction to Ambient | $\theta_{JA}$ | JEDEC (JESD 51) | —   |     | 90.4 | °C/W |

**Table 5. Absolute Maximum Conditions**

| Parameter                                                                                                                                                                         | Symbol                | Test Condition              | Min  | Typ | Max | Unit            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------|------|-----|-----|-----------------|
| Main Supply Voltage                                                                                                                                                               | V <sub>DD_3.3 V</sub> |                             | —    |     | 4.6 | V               |
| Input Voltage                                                                                                                                                                     | V <sub>IN</sub>       | Relative to V <sub>SS</sub> | −0.5 |     | 4.6 | V <sub>DC</sub> |
| ESD Protection (Human Body Model)                                                                                                                                                 | ESD <sub>HBM</sub>    | JEDEC (JESD 22 - A114)      | 2000 |     | —   | V               |
| Flammability Rating                                                                                                                                                               | UL-94                 | UL (Class)                  | V−0  |     |     |                 |
| <b>Note:</b> While using multiple power supplies, the voltage on any input or I/O pin cannot exceed the power pin during powerup. Power supply sequencing is <i>not</i> required. |                       |                             |      |     |     |                 |

## 2. Test and Measurement Setup

Figure 1–Figure 3 show the test load configuration for the differential clock signals.

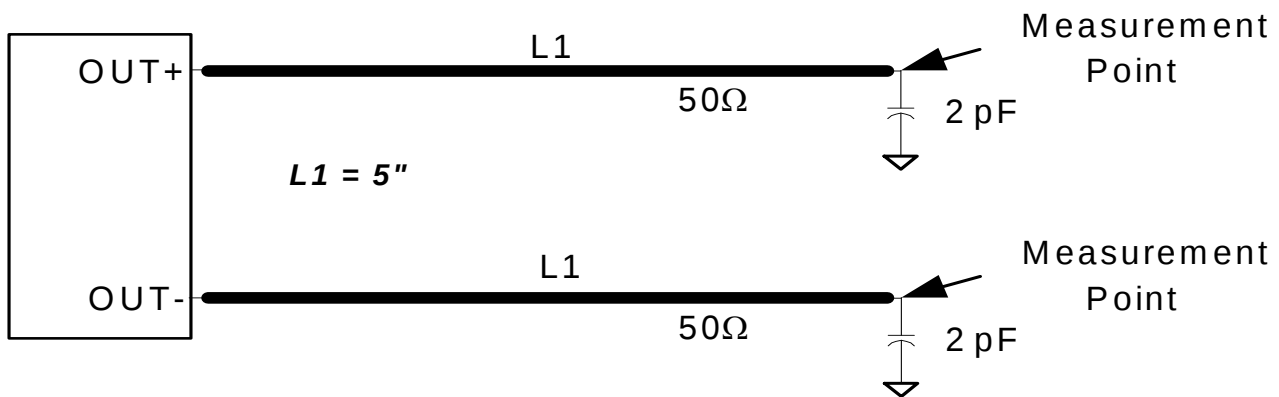


Figure 1. 0.7 V Differential Load Configuration

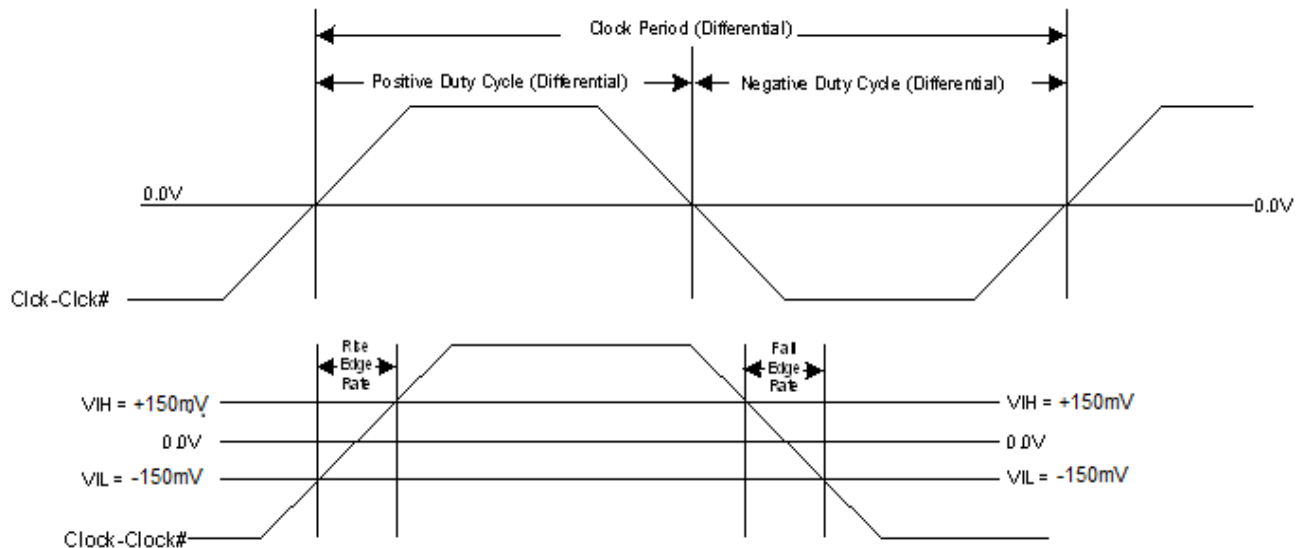
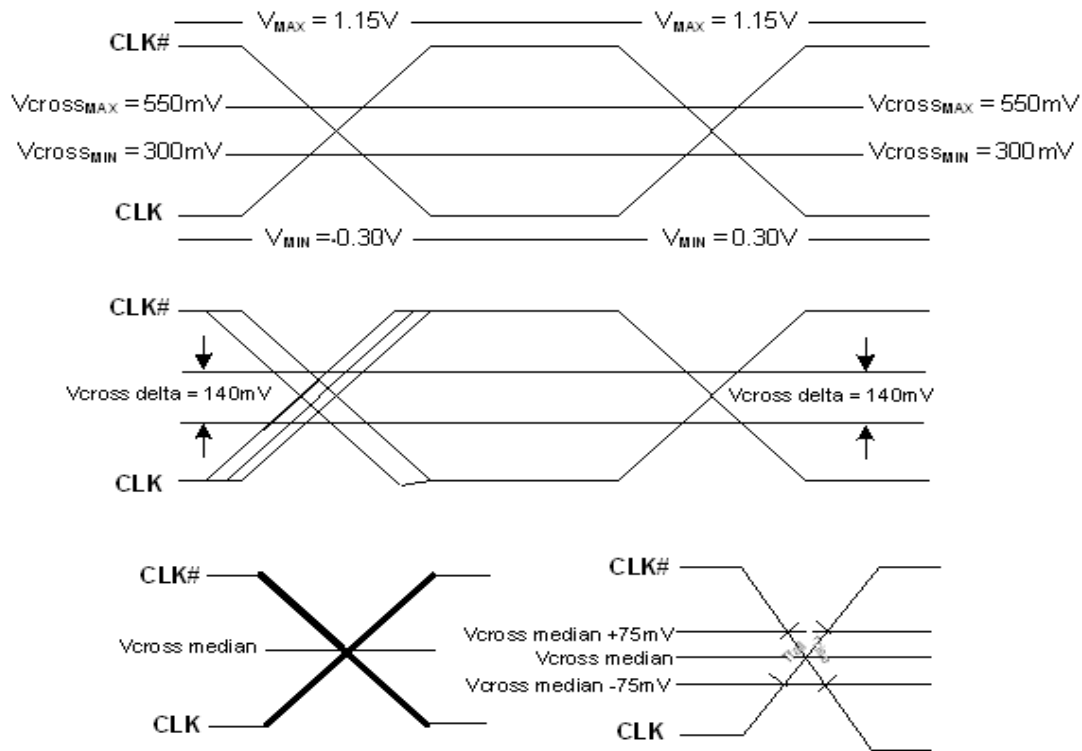
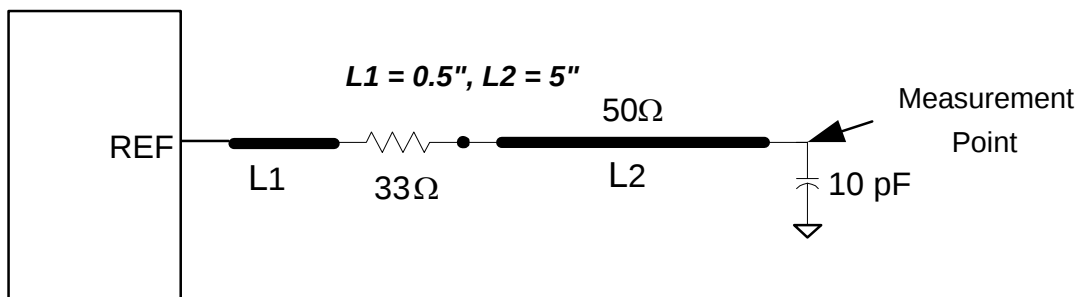


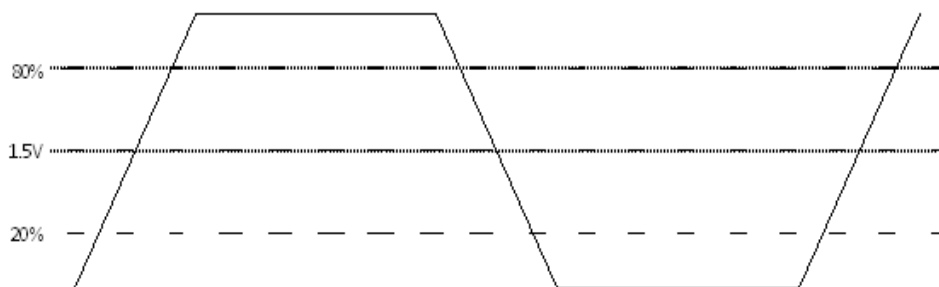
Figure 2. Differential Measurement for Differential Output Signals  
(for AC Parameters Measurement)



**Figure 3. Single-ended Measurement for Differential Output Signals (for AC Parameters Measurement)**



**Figure 4. Single-ended Clocks with Single Load Configuration**



**Figure 5. Single-ended Output Signal (for AC Parameter Measurement)**

### 3. Pin Descriptions

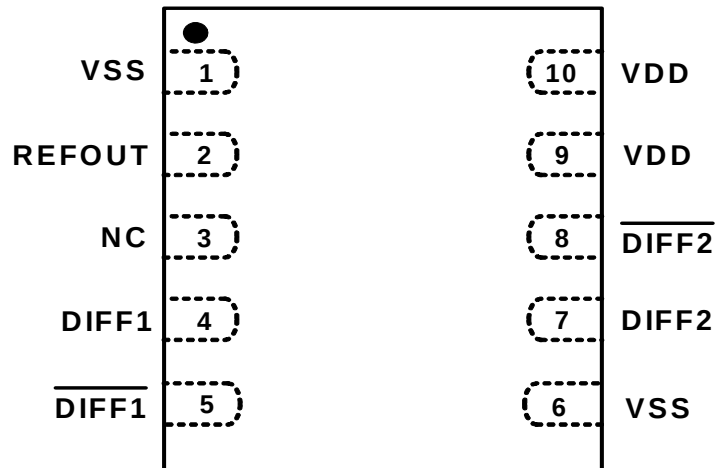


Figure 6. 10-Pin TDFN

Table 6. Si50122-Ax-GM 10-Pin TDFN Descriptions

| Pin # | Name                      | Type   | Description                                      |
|-------|---------------------------|--------|--------------------------------------------------|
| 1     | VSS                       | GND    | Connect to Ground                                |
| 2     | REFOUT                    | O, SE  | 25 MHz LVCMOS clock output                       |
| 3     | NC                        | NC     | No Connect; do not connect this pin to anything. |
| 4     | DIFF1                     | O, DIF | 0.7 V, 100 MHz differential clock output         |
| 5     | $\overline{\text{DIFF1}}$ | O, DIF | 0.7 V, 100 MHz differential clock output         |
| 6     | VSS                       | GND    | Connect to Ground                                |
| 7     | DIFF2                     | O, DIF | 0.7 V, 100 MHz differential clock output         |
| 8     | $\overline{\text{DIFF2}}$ | O, DIF | 0.7 V, 100 MHz differential clock output         |
| 9     | V <sub>DD</sub>           | PWR    | Power supply                                     |
| 10    | V <sub>DD</sub>           | PWR    | Power supply                                     |

## 4. Ordering Guide

| Part Number    | Spread Option | Package Type              | Temperature              |
|----------------|---------------|---------------------------|--------------------------|
| Si50122-A1-GM  | No Spread     | 10-pin TDFN               | Industrial, -40 to 85 °C |
| Si50122-A1-GMR | No Spread     | 10-pin TDFN—Tape and Reel | Industrial, -40 to 85 °C |
| Si50122-A2-GM  | -0.5% Spread  | 10-pin TDFN               | Industrial, -40 to 85 °C |
| Si50122-A2-GMR | -0.5% Spread  | 10-pin TDFN—Tape and Reel | Industrial, -40 to 85 °C |

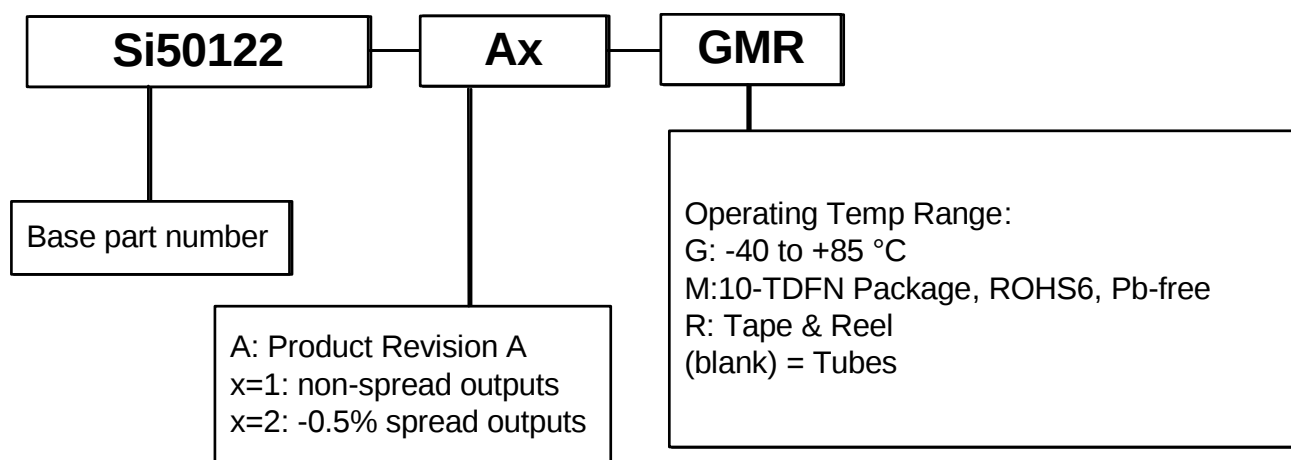


Figure 7. Ordering Information

## 5. Package Outlines

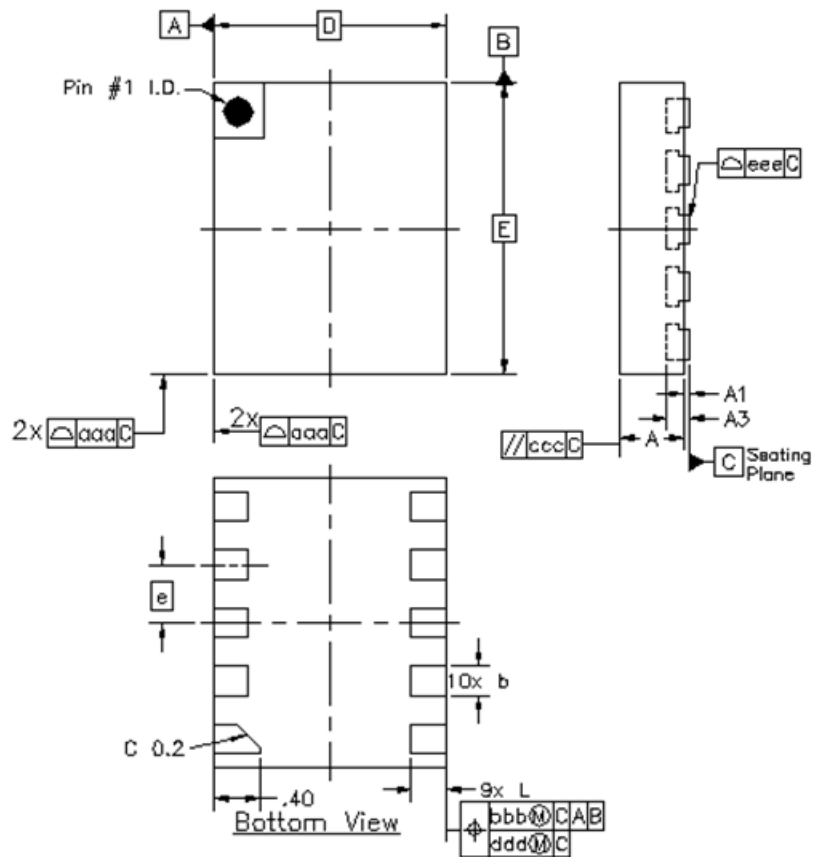
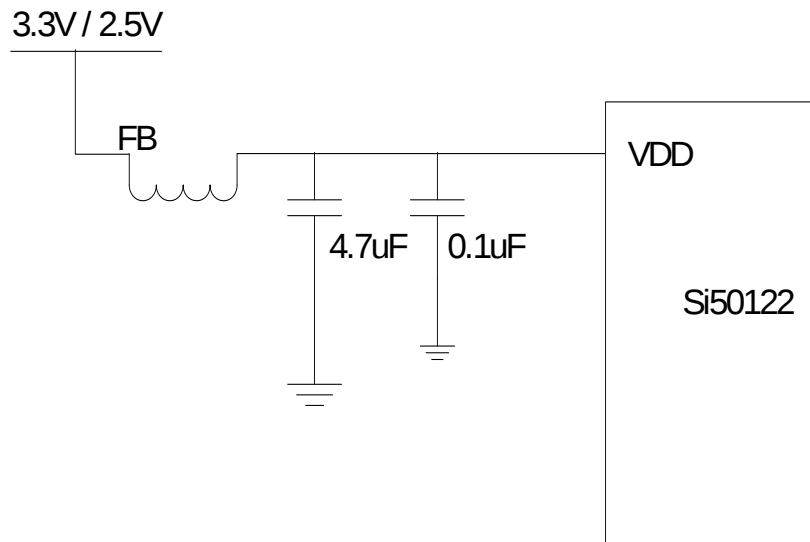


Figure 8. 10-Pin TDFN Package Drawing

**Table 7. Package Diagram Dimensions**

| Symbol                                                                                                                                                                                                                                                                                                                              | Min        | Nom  | Max  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|------|
| A                                                                                                                                                                                                                                                                                                                                   | 0.80       | 0.85 | 0.90 |
| A1                                                                                                                                                                                                                                                                                                                                  | 0.00       | —    | 0.05 |
| A3                                                                                                                                                                                                                                                                                                                                  | 0.203 REF. |      |      |
| b                                                                                                                                                                                                                                                                                                                                   | 0.20       | 0.25 | 0.30 |
| D                                                                                                                                                                                                                                                                                                                                   | 2.00 BSC.  |      |      |
| e                                                                                                                                                                                                                                                                                                                                   | 0.50 BSC   |      |      |
| E                                                                                                                                                                                                                                                                                                                                   | 2.50 BSC.  |      |      |
| L                                                                                                                                                                                                                                                                                                                                   | 0.35       | 0.4  | 0.45 |
| aaa                                                                                                                                                                                                                                                                                                                                 | 0.10       |      |      |
| bbb                                                                                                                                                                                                                                                                                                                                 | 0.10       |      |      |
| ccc                                                                                                                                                                                                                                                                                                                                 | 0.10       |      |      |
| ddd                                                                                                                                                                                                                                                                                                                                 | 0.05       |      |      |
| eee                                                                                                                                                                                                                                                                                                                                 | 0.08       |      |      |
| <b>Notes:</b><br>1. All dimensions shown are in millimeters (mm) unless otherwise noted.<br>2. Dimensioning and Tolerances per ANSI Y14.5M-1994.<br>3. Recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.<br>4. This drawing conforms to the JEDEC Solid State Outline MO-229. |            |      |      |

## 6. Recommended Design Guideline



**Figure 9. Recommended Application Schematic**

**Note:** FB Specifications: DC resistance 0.1–0.3  $\Omega$ , Impedance at 100 MHz  $\geq 1000 \Omega$ .



## ClockBuilder Pro

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