

Features

- Spread spectrum for EMI reduction
 - Wide spread % option
 - Center spread: from $\pm 0.125\%$ to $\pm 1\%$, $\pm 0.125\%$ step size
 - Down spread: -0.25% to -2% with -0.25% step size
 - Spread profile option: Triangular, Hershey-kiss, Random
- Programmable rise/fall time for EMI reduction: 8 options, 0.25 to 40 ns
- Any frequency between 1 MHz and 150 MHz accurate to 6 decimal places
- 100% pin-to-pin drop-in replacement to quartz-based XO's
- Excellent total frequency stability as low as ± 20 ppm
- Operating temperature from -55°C to 125°C .
- Low power consumption of 4.0 mA typical at 1.8V
- Pin1 modes: Standby, output enable, or spread disable
- Fast startup time of 5 ms
- LVCMOS output
- Industry-standard packages
 - QFN: 2.0×1.6 , 2.5×2.0 , 3.2×2.5 mm²
- RoHS and REACH compliant, Pb-free, Halogen-free and Antimony-free

Applications

- ADAS camera
- ADAS ECU
- High speed serial link

Electrical Specifications

Table 1. Electrical Characteristics

All Min and Max limits are specified over temperature and rated operating voltage with 15 pF output load unless otherwise stated. Typical values are at 25°C and 3.3V supply voltage.

| Parameters | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|--------|------|------|------|--------------------|--|
| Frequency Range | | | | | | |
| Output Frequency Range | f | 1 | – | 150 | MHz | |
| Frequency Stability and Aging | | | | | | |
| Frequency Stability | F_stab | -20 | – | +20 | ppm | Inclusive of initial tolerance at 25°C , 1st year aging at 25°C , and variations over operating temperature, rated power supply voltage. Spread = Off. |
| | | -25 | – | +25 | ppm | |
| | | -50 | – | +50 | ppm | |
| Operating Temperature Range | | | | | | |
| Operating Temperature Range | T_use | -40 | – | +85 | $^{\circ}\text{C}$ | Industrial, AEC-Q100 Grade 3 |
| | | -40 | – | +105 | $^{\circ}\text{C}$ | Extended Industrial, AEC-Q100 Grade 2 |
| | | -40 | – | +125 | $^{\circ}\text{C}$ | Automotive, AEC-Q100 Grade 1 |
| | | -55 | – | +125 | $^{\circ}\text{C}$ | Extended Automotive, AEC-Q100 |
| Supply Voltage and Current Consumption | | | | | | |
| Supply Voltage | Vdd | 1.62 | 1.8 | 1.98 | V | |
| | | 2.25 | 2.5 | 2.75 | V | |
| | | 2.52 | 2.8 | 3.08 | V | |
| | | 2.7 | 3.0 | 3.3 | V | |
| | | 2.97 | 3.3 | 3.63 | V | |
| | | 2.25 | – | 3.63 | V | |
| Current Consumption | Idd | – | 6.5 | 9.0 | mA | No load condition, f = 148.5 MHz, Vdd = 2.5V to 3.3V |
| | | – | 5.5 | 7.0 | mA | No load condition, f = 148.5 MHz, Vdd = 1.8V |
| OE Disable Current | I_OD | – | 5.5 | – | mA | f = 148.5 MHz, Vdd = 2.5V to 3.3V, OE = GND, Output in high-Z state |
| | | – | 5.1 | – | mA | f = 148.5 MHz, Vdd = 1.8V, OE = GND, Output in high-Z state |
| Standby Current | I_std | – | 2.6 | – | μA | $\overline{\text{ST}}$ = GND, Vdd = 2.5V to 3.3V, Output is weakly pulled down |
| | | – | 0.9 | – | μA | $\overline{\text{ST}}$ = GND, Vdd = 1.8V, Output is weakly pulled down |

Table 1. Electrical Characteristics (continued)

| Parameters | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---------------------------------------|----------|------|------|------|------------|---|
| LVC MOS Output Characteristics | | | | | | |
| Duty Cycle | DC | 45 | – | 55 | % | |
| Rise/Fall Time | Tr, Tf | – | 1.3 | 2.5 | ns | Vdd = 1.8V, 20% - 80%, default drive strength |
| | | – | – | 2 | ns | Vdd = 2.25V - 3.63V, 20% - 80%, default drive strength |
| Output High Voltage | VOH | 90% | – | – | Vdd | IOH = -4 mA (Vdd = 3.0V or 3.3V) IOH = -3 mA (Vdd = 2.8V and Vdd = 2.5V) IOH = -2 mA (Vdd = 1.8V) |
| Output Low Voltage | VOL | – | – | 10% | Vdd | IOL = 4 mA (Vdd = 3.0V or 3.3V) IOL = 3 mA (Vdd = 2.8V and Vdd = 2.5V) IOL = 2 mA (Vdd = 1.8V) |
| Input Characteristics | | | | | | |
| Input High Voltage | VIH | 70% | – | – | Vdd | Pin 1, OE or \overline{ST} |
| Input Low Voltage | VIL | – | – | 30% | Vdd | Pin 1, OE or \overline{ST} |
| Input Pull-up Impedance | Z_in | – | 87 | – | k Ω | Pin 1, OE logic high or logic low, or \overline{ST} logic high |
| | | – | 8 | – | M Ω | Pin 1, \overline{ST} logic low |
| Startup and Resume Timing | | | | | | |
| Startup Time | T_start | – | – | 5 | ms | Measured from the time Vdd reaches its rated minimum value |
| Enable/Disable Time | T_oe | – | – | 215 | ns | f = 148.5 MHz. For other frequencies, T_oe = 100 ns + 3 * cycles |
| Resume Time | T_resume | – | – | 5 | ms | Measured from the time ST pin crosses 50% threshold |
| Spread Enable Time | T_sde | – | – | 4 | μ s | Measured from the time SD pin crosses 50% threshold |
| Spread Disable Time | T_sdde | – | – | 50 | μ s | Measured from the time SD pin crosses 50% threshold |
| Jitter | | | | | | |
| Cycle-to-cycle jitter | T_ccj | – | 10.5 | – | ps | f = 148.5 MHz, Vdd = 2.5 to 3.3V, Spread = ON(or OFF) |
| | | – | 12.5 | – | ps | f = 148.5 MHz, Vdd = 1.8V, Spread = ON(or OFF) |

Table 2. Spread Spectrum %^[1]

| Ordering Code | Center Spread (%) | Down Spread (%) |
|---------------|-------------------|-----------------|
| A | ±0.125 | -0.25 |
| B | ±0.250 | -0.50 |
| C | ±0.390 | -0.78 |
| D | ±0.515 | -1.04 |
| E | ±0.640 | -1.29 |
| F | ±0.765 | -1.55 |
| G | ±0.905 | -1.84 |
| H | ±1.030 | -2.10 |
| I | ±1.155 | -2.36 |
| J | ±1.280 | -2.62 |
| K | ±1.420 | -2.91 |
| L | ±1.545 | -3.18 |
| M | ±1.670 | -3.45 |
| N | ±1.795 | -3.71 |
| O | ±1.935 | -4.01 |
| P | ±2.060 | -4.28 |

Table 3. Spread Profile^[2]

| Spread Profile |
|----------------|
| Triangular |
| Hershey-kiss |
| Random |

Notes:

1. Contact SiTime for availability of these spread options at -40 to 105°C, -40 to 125°C or -55 to 125°C temperature ranges.
2. In both Triangular and Hershey-kiss profiles, modulation rate is employed with a frequency of ~31.25 kHz. In random profile, modulation rate is ~ 8.6 kHz

Table 4. Pin Description

| Pin | Symbol | | Functionality |
|-----|--------------------------------|----------------|---|
| 1 | OE/ \overline{ST} / NC/SD | Output Enable | H ^[3] : specified frequency output L: output is high impedance. Only output driver is disabled. |
| | | Standby | H ^[3] : specified frequency output L: output is low (weak pull down). Device goes to sleep mode. Supply current reduced to I _{std} . |
| | | No Connect | Pin1 has no function (Any voltage between 0 and Vdd or Open) |
| | | Spread Disable | H: Spread = ON L: Spread = OFF |
| 2 | GND | Power | Electrical ground |
| 3 | OUT | Output | Oscillator output |
| 4 | VDD | Power | Power supply voltage ^[4] |

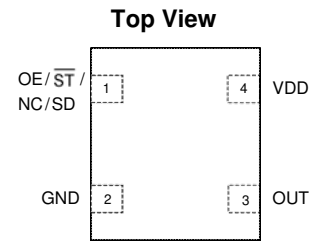


Figure 1. Pin Assignments

Notes:

- 3. In OE or \overline{ST} mode, a pull-up resistor of 10 k Ω or less is recommended if pin 1 is not externally driven. If pin 1 needs to be left floating, use the NC option.
- 4. A capacitor of value 0.1 μ F or higher between Vdd and GND is required.

Table 5. Absolute Maximum Limits

Attempted operation outside the absolute maximum ratings may cause permanent damage to the part. Actual performance of the IC is only guaranteed within the operational specifications, not at absolute maximum ratings.

| Parameter | Min. | Max. | Unit |
|--|------|------|--------------|
| Storage Temperature | -65 | 150 | $^{\circ}$ C |
| Vdd | -0.5 | 4 | V |
| Electrostatic Discharge | – | 2000 | V |
| Soldering Temperature (follow standard Pb free soldering guidelines) | – | 260 | $^{\circ}$ C |
| Junction Temperature ^[5] | – | 150 | $^{\circ}$ C |

Note:

- 5. Exceeding this temperature for extended period of time may damage the device.

Table 6. Maximum Operating Junction Temperature^[6]

| Max Operating Temperature (ambient) | Maximum Operating Junction Temperature |
|-------------------------------------|--|
| 85 $^{\circ}$ C | 95 $^{\circ}$ C |
| 105 $^{\circ}$ C | 115 $^{\circ}$ C |
| 125 $^{\circ}$ C | 135 $^{\circ}$ C |

Note:

- 6. Datasheet specifications are not guaranteed if junction temperature exceeds the maximum operating junction temperature.

Table 7. Environmental Compliance

| Parameter | Condition/Test Method |
|----------------------------|---------------------------|
| Mechanical Shock | MIL-STD-883F, Method 2002 |
| Mechanical Vibration | MIL-STD-883F, Method 2007 |
| Temperature Cycle | JESD22, Method A104 |
| Solderability | MIL-STD-883F, Method 2003 |
| Moisture Sensitivity Level | MSL1 @ 260 $^{\circ}$ C |

Timing Diagrams

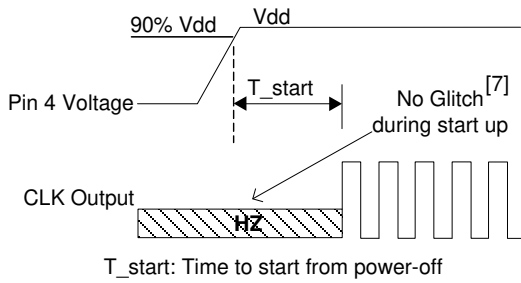


Figure 1. Startup Timing

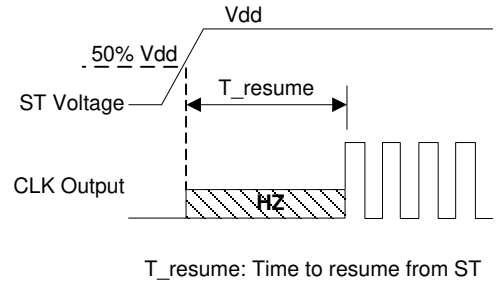


Figure 2. Standby Resume Timing (ST Mode Only)

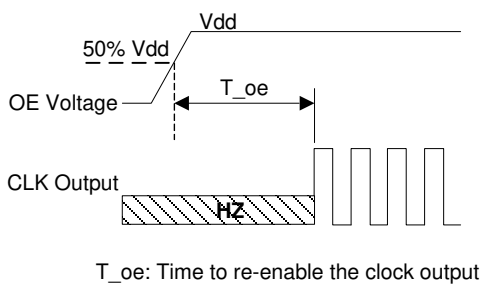


Figure 3. OE Enable Timing (OE Mode Only)

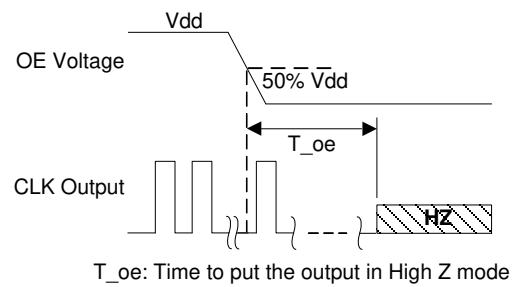


Figure 4. OE Disable Timing (OE Mode Only)

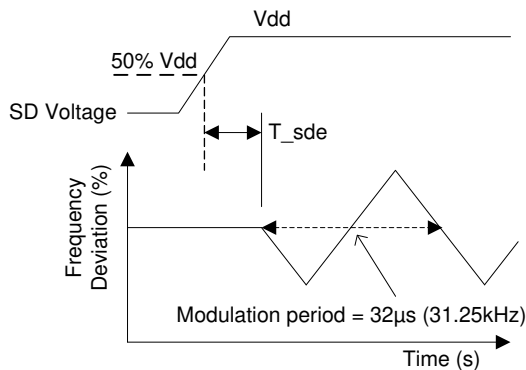


Figure 5. SD Enable Timing (SD Mode Only)

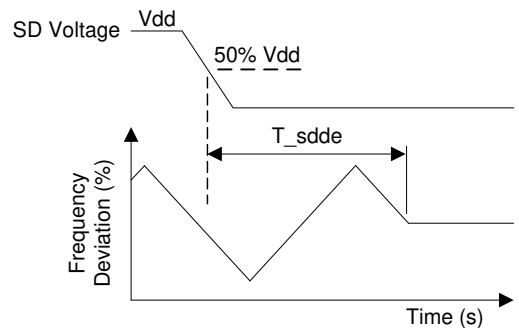


Figure 6. SD Diable Timing (SD Mode Only)

Note:
7. CS00119 has “no runt” pulses and “no glitch” output during startup or resume.

Rise/Fall Time (20% to 80%) vs C_{LOAD} Tables

Table 8. V_{DD} = 1.8V Rise/Fall Times for Specific C_{LOAD}

| Rise/Fall Time Typ (ns) | | | | | |
|------------------------------------|------|-------|-------|-------|-------|
| Drive Strength \ C _{LOAD} | 5 pF | 15 pF | 30 pF | 45 pF | 60 pF |
| L | 6.16 | 11.61 | 22.00 | 31.27 | 39.91 |
| A | 3.19 | 6.35 | 11.00 | 16.01 | 21.52 |
| R | 2.11 | 4.31 | 7.65 | 10.77 | 14.47 |
| B | 1.65 | 3.23 | 5.79 | 8.18 | 11.08 |
| T | 0.93 | 1.91 | 3.32 | 4.66 | 6.48 |
| E | 0.78 | 1.66 | 2.94 | 4.09 | 5.74 |
| U | 0.70 | 1.48 | 2.64 | 3.68 | 5.09 |
| F or "-": default | 0.65 | 1.30 | 2.40 | 3.35 | 4.56 |

Table 9. V_{DD} = 2.5V Rise/Fall Times for Specific C_{LOAD}

| Rise/Fall Time Typ (ns) | | | | | |
|------------------------------------|------|-------|-------|-------|-------|
| Drive Strength \ C _{LOAD} | 5 pF | 15 pF | 30 pF | 45 pF | 60 pF |
| L | 4.13 | 8.25 | 12.82 | 21.45 | 27.79 |
| A | 2.11 | 4.27 | 7.64 | 11.20 | 14.49 |
| R | 1.45 | 2.81 | 5.16 | 7.65 | 9.88 |
| B | 1.09 | 2.20 | 3.88 | 5.86 | 7.57 |
| T | 0.62 | 1.28 | 2.27 | 3.51 | 4.45 |
| E or "-": default | 0.54 | 1.00 | 2.01 | 3.10 | 4.01 |
| U | 0.43 | 0.96 | 1.81 | 2.79 | 3.65 |
| F | 0.34 | 0.88 | 1.64 | 2.54 | 3.32 |

Table 10. V_{DD} = 2.8V Rise/Fall Times for Specific C_{LOAD}

| Rise/Fall Time Typ | | | | | |
|------------------------------------|------|-------|-------|-------|-------|
| Drive Strength \ C _{LOAD} | 5 pF | 15 pF | 30 pF | 45 pF | 60 pF |
| L | 3.77 | 7.54 | 12.28 | 19.57 | 25.27 |
| A | 1.94 | 3.90 | 7.03 | 10.24 | 13.34 |
| R | 1.29 | 2.57 | 4.72 | 7.01 | 9.06 |
| B | 0.97 | 2.00 | 3.54 | 5.43 | 6.93 |
| T | 0.55 | 1.12 | 2.08 | 3.22 | 4.08 |
| E or "-": default | 0.44 | 1.00 | 1.83 | 2.82 | 3.67 |
| U | 0.34 | 0.88 | 1.64 | 2.52 | 3.30 |
| F | 0.29 | 0.81 | 1.48 | 2.29 | 2.99 |

Table 11. V_{DD} = 3.0V Rise/Fall Times for Specific C_{LOAD}

| Rise/Fall Time Typ (ns) | | | | | |
|------------------------------------|------|-------|-------|-------|-------|
| Drive Strength \ C _{LOAD} | 5 pF | 15 pF | 30 pF | 45 pF | 60 pF |
| L | 3.60 | 7.21 | 11.97 | 18.74 | 24.30 |
| A | 1.84 | 3.71 | 6.72 | 9.86 | 12.68 |
| R | 1.22 | 2.46 | 4.54 | 6.76 | 8.62 |
| B | 0.89 | 1.92 | 3.39 | 5.20 | 6.64 |
| T or "-": default | 0.51 | 1.00 | 1.97 | 3.07 | 3.90 |
| E | 0.38 | 0.92 | 1.72 | 2.71 | 3.51 |
| U | 0.30 | 0.83 | 1.55 | 2.40 | 3.13 |
| F | 0.27 | 0.76 | 1.39 | 2.16 | 2.85 |

Table 12. V_{DD} = 3.3V Rise/Fall Times for Specific C_{LOAD}

| Rise/Fall Time Typ (ns) | | | | | |
|------------------------------------|------|-------|-------|-------|-------|
| Drive Strength \ C _{LOAD} | 5 pF | 15 pF | 30 pF | 45 pF | 60 pF |
| L | 3.39 | 6.88 | 11.63 | 17.56 | 23.59 |
| A | 1.74 | 3.50 | 6.38 | 8.98 | 12.19 |
| R | 1.16 | 2.33 | 4.29 | 6.04 | 8.34 |
| B | 0.81 | 1.82 | 3.22 | 4.52 | 6.33 |
| T or "-": default | 0.46 | 1.00 | 1.86 | 2.60 | 3.84 |
| E | 0.33 | 0.87 | 1.64 | 2.30 | 3.35 |
| U | 0.28 | 0.79 | 1.46 | 2.05 | 2.93 |
| F | 0.25 | 0.72 | 1.31 | 1.83 | 2.61 |

Dimensions and Patterns

| Package Size – Dimensions (Unit: mm) ^[8] | Recommended Land Pattern (Unit: mm) ^[9] |
|---|--|
| <p>2.0 x 1.6 x 0.75 mm</p> | |
| <p>2.5 x 2.0 x 0.75 mm</p> | |
| <p>3.2 x 2.5 x 0.75 mm</p> | |

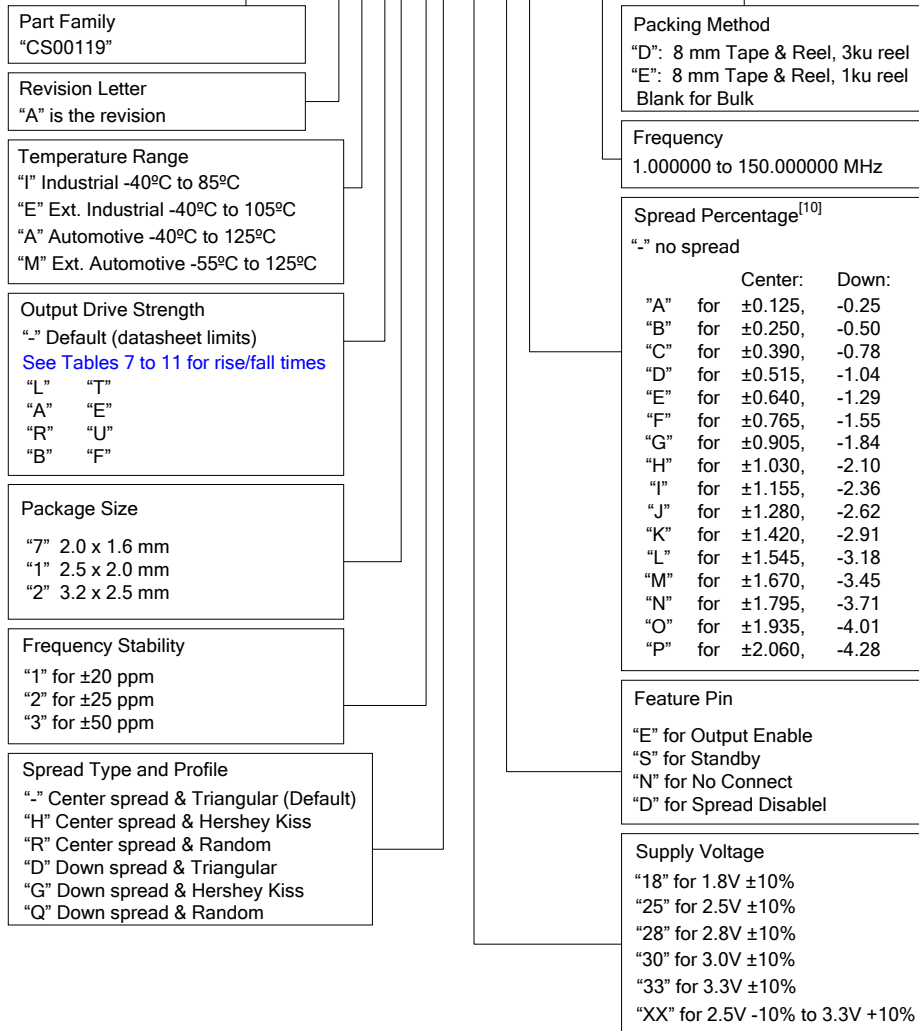
Notes:

- 8. Top marking: Y denotes manufacturing origin and XXXX denotes manufacturing lot number. The value of “Y” will depend on the assembly location of the device.
- 9. A capacitor of value 0.1 μF or higher between Vdd and GND is required.

Ordering Information

The Part No. Guide is for reference only. To customize and build an exact part number, use the SiTime **Part Number Generator**.

CS0119AA-71-18EA25.000625D



Notes:

10. Contact [SiTime](#) for availability of these spread options at -40 to 105°C, -40 to 125°C or -55 to 125°C temperature ranges