

# Spread Spectrum Clock Generator

## Features

- 8- to 32-MHz input frequency range
- CY25818: 8–16 MHz
- CY25819: 16–32 MHz
- Separate modulated and unmodulated clocks
- Accepts clock, crystal, and resonator inputs
- Down spread modulation
- Power-down function
- Low-power dissipation
  - CY25818 = 33 mW-typ @ 8 MHz
  - CY25818 = 56 mW-typ @ 16 MHz
  - CY25819 = 36 mW-typ @ 16 MHz
  - CY25819 = 63 mW-typ @ 32 MHz
- Low cycle-to-cycle jitter
  - SSCLK = 250 ps-typ
  - REFCLK = 275 ps-typ
- Available in 8-pin (150-mil) SOIC package

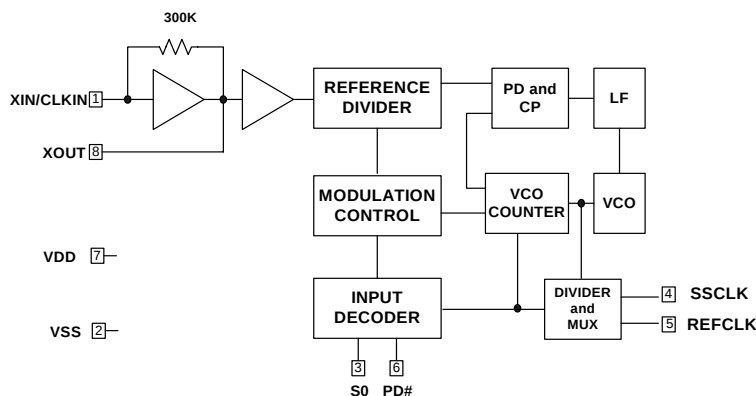
## Applications

- Printers and MFPs
- LCD panels and notebook PCs
- Digital copiers
- PDAs
- Automotive
- CD-ROM, VCD, and DVD
- Networking and LAN/WAN
- Scanners
- Modems
- Embedded digital systems

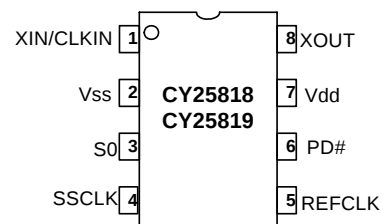
## Benefits

- Peak electromagnetic interference (EMI) reduction by 8–16 dB
- Fast time to market
- Cost reduction

## Block Diagram



## Pin Configuration



8-pin SOIC

## Pin Description

| Pin | Name    | Description                                                                                                                                                    |
|-----|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | XIN/CLK | Clock, Crystal, or Ceramic Resonator Input Pin.                                                                                                                |
| 2   | Vss     | Power Supply Ground.                                                                                                                                           |
| 3   | S0      | Digital Spread% Control Pin. 3-Level input (H-M-L). Default = M.                                                                                               |
| 4   | SSCLK   | Modulated Spread Spectrum Output Clock. The output frequency is referenced to input frequency. Refer to <i>Table 2</i> for the amount of modulation (Spread%). |
| 5   | REFCLK  | Unmodulated Reference Clock Output. The unmodulated output frequency is the same as the input frequency.                                                       |
| 6   | PD#     | Power-Down Control Pin. Default = H (Vdd).                                                                                                                     |
| 7   | Vdd     | Positive Power Supply.                                                                                                                                         |
| 8   | XOUT    | Clock, Crystal, or Ceramic Resonator Output Pin. Leave this pin unconnected if an external clock is used at X <sub>IN</sub> pin.                               |

## Overview

The Cypress CY25818/19 products are Spread Spectrum Clock Generator (SSCG) ICs used for the purpose of reducing EMI found in today's high-speed digital electronic systems. The devices use a Cypress proprietary phase-locked loop (PLL) and Spread Spectrum Clock (SSC) technology to synthesize and modulate the frequency of the input clock. By frequency modulating the clock, the measured EMI at the fundamental and harmonic frequencies is greatly reduced. This reduction in radiated energy can significantly reduce the cost of complying with regulatory agency requirements and improve time to market without degrading system performance.

The input frequency range is 8–16 MHz for the CY25818 and 16–32 MHz for the CY25819. Both products accept external clock, crystal, or ceramic resonator inputs.

The CY25818/19 provide separate modulated (SSCLK) and unmodulated reference (REFCLK) clock outputs which are the same frequency as the input clock frequency. Down spread frequency modulation can be selected by the user, based on three discrete values of Spread%. A separate power down function is also provided.

The CY25818/19 products are available in an 8-pin SOIC (150-mil) package with a commercial operating temperature range of 0–70°C. Contact Cypress for availability of –40 to +85°C industrial temperature range operation or TSSOP package versions. Refer to the CY25568, CY25811, CY25812, and CY25814 products for other functions such as clock multiplication of 1×, 2×, or 4× to generate a wide range of Spread Spectrum output clocks from 4 to 128 MHz.

## Input Frequency Range and Selection

CY25818/19 input frequency range is 8–32 MHz. This range is divided into two segments, as given in *Table 1*.

**Table 1. Input and Output Frequency Selection**

| Product | Input/Output Frequency Range |
|---------|------------------------------|
| CY25818 | 8–16 MHz                     |
| CY25819 | 16–32 MHz                    |

## Spread% Selection

CY25818/19 SSCG products provide Down-Spread frequency modulation. The amount of Spread% is selected by using 3-Level S0 digital input. Spread% values are given in *Table 2*.

**Table 2. Spread% Selection**

| XIN (MHz) | Product | S0 = 1   | S0 = 0   | S0 = M   |
|-----------|---------|----------|----------|----------|
|           |         | Down (%) | Down (%) | Down (%) |
| 8–10      | CY25818 | –3.0     | –2.2     | –0.7     |
| 10–12     | CY25818 | –2.7     | –1.9     | –0.6     |
| 12–14     | CY25818 | –2.5     | –1.8     | –0.6     |
| 14–16     | CY25818 | –2.3     | –1.7     | –0.5     |
| 16–20     | CY25819 | –3.0     | –2.2     | –0.7     |
| 20–24     | CY25819 | –2.7     | –1.9     | –0.6     |
| 24–28     | CY25819 | –2.5     | –1.8     | –0.6     |
| 28–32     | CY25819 | –2.3     | –1.7     | –0.5     |

### 3-Level Digital Inputs

S0 digital input is designed to sense three logic levels designated as HIGH “1,” LOW “0,” and MIDDLE “M.” With this 3-Level digital input logic, the 3-Level logic is able to detect three different logic levels.

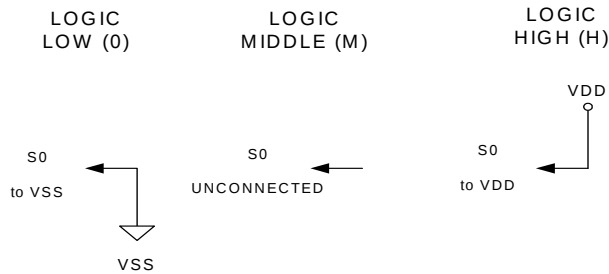
The S0 pin includes an on-chip 20K (10K/10K) resistor divider. No external application resistors are needed to implement 3-Level logic, as follows.

Logic Level “0”: 3-Level logic pin connected to GND.

Logic Level “M”: 3-Level logic pin left floating (no connection.)

Logic Level “1”: 3-Level logic pin connected to Vdd.

Figure 1 illustrates how to implement 3-Level Logic.



**Figure 1. 3-Level Logic**

### Modulation Rate

Spread Spectrum Clock Generators utilize frequency modulation (FM) to distribute energy over a specific band of frequencies. The maximum frequency of the clock (fmax) and minimum frequency of the clock (fmin) determine this band of frequencies. The time required to transition from fmin to fmax and back to fmin is the period of the Modulation Rate, Tmod. The Modulation Rates of SSCG clocks are generally referred to in terms of frequency, and fmod = 1/Tmod.

The input clock frequency, fin, and the internal divider determine the Modulation Rate.

In the case of CY25818/19 devices, the (Spread Spectrum) Modulation Rate, fmod, is given by the following formula:

$$f_{\text{mod}} = f_{\text{IN}} / \text{DR}$$

where fmod is the Modulation Rate, fin is the Input Frequency, and DR is the Divider Ratio, as given in Table 3.

**Table 3. Modulation Rate Divider Ratios**

| Product | Input Frequency Range | Divider Ratio (DR) |
|---------|-----------------------|--------------------|
| CY25818 | 8–16 MHz              | 256                |
| CY25819 | 16–32 MHz             | 512                |

### Maximum Ratings<sup>[1, 2]</sup>

Supply Voltage (Vdd): ..... + 5.5V

Input Voltage Relative to Vdd: ..... Vdd + 0.3V

Input Voltage Relative to Vss: ..... Vss + 0.3V

Operating Temperature: ..... 0°C to + 70°C

Storage Temperature: ..... –65°C to + 150°C

**Table 4. DC Electrical Characteristics** Vdd = 3.3V ±10%, TA = 0°C to +70°C and CL = 15 pF (unless otherwise noted)

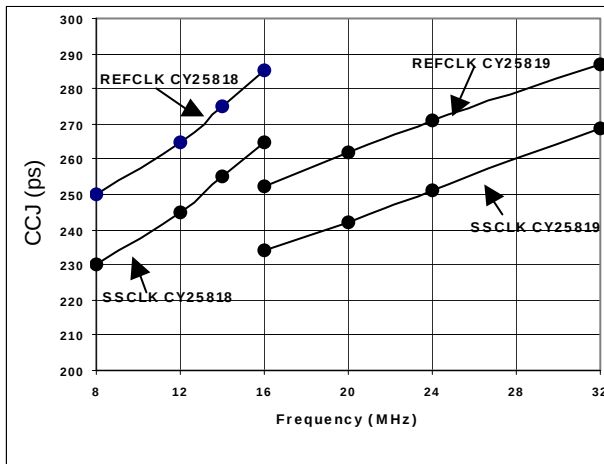
| Parameter | Description          | Conditions                               | Min.     | Typ.     | Max.     | Unit |
|-----------|----------------------|------------------------------------------|----------|----------|----------|------|
| Vdd       | Power Supply Range   |                                          | 2.97     | 3.3      | 3.63     | V    |
| VINH      | Input HIGH Voltage   | S0 Input                                 | 0.85 Vdd | Vdd      | Vdd      | V    |
| VINM      | Input MIDDLE Voltage | S0 Input                                 | 0.40 Vdd | 0.50 Vdd | 0.60 Vdd | V    |
| VINL      | Input LOW Voltage    | S0 Input                                 | 0.0      | 0.0      | 0.15 Vdd | V    |
| VOH1      | Output HIGH Voltage  | I <sub>OH</sub> = 4 ma, SSCLK and REFCLK | 2.4      | –        | –        | V    |
| VOH2      | Output HIGH Voltage  | I <sub>OH</sub> = 6 ma, SSCLK and REFCLK | 2.0      | –        | –        | V    |
| VOL1      | Output LOW Voltage   | I <sub>OL</sub> = 4 ma, SSCLK Output     | –        | –        | 0.4      | V    |
| VOL2      | Output LOW Voltage   | I <sub>OL</sub> = 10 ma, SSCLK Output    | –        | –        | 1.2      | V    |
| CIN1      | Input Capacitance    | XIN (Pin 1) and XOUT (Pin 8)             | 6.0      | 7.5      | 9.0      | pF   |
| CIN2      | Input Capacitance    | All Digital Inputs                       | 3.5      | 4.5      | 6.0      | pF   |
| IDD1      | Power Supply Current | F <sub>IN</sub> =8 MHz, no load          | –        | 10.0     | 12.5     | mA   |
| IDD3      | Power Supply Current | F <sub>IN</sub> =32 MHz, no load         | –        | 19.0     | 23.0     | mA   |
| IDD4      | Power Supply Current | PD# = Vss                                | –        | 150      | 250      | mA   |

**Table 5. Timing Electrical Characteristics** V<sub>DD</sub> = 3.3V ±10%, T<sub>A</sub> = 0°C to +70°C and C<sub>L</sub> = 15 pF (unless otherwise noted)

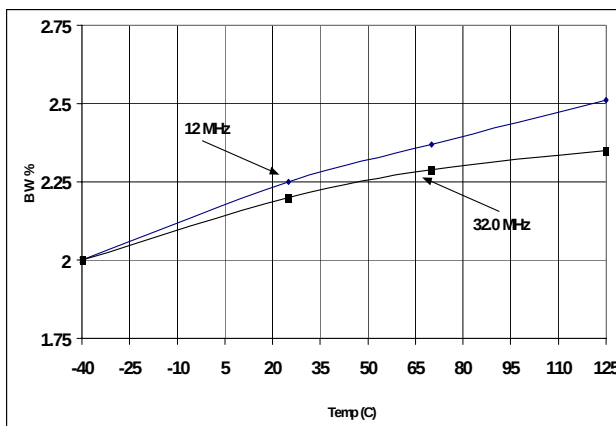
| Parameter | Description             | Conditions                                            | Min. | Typ. | Max. | Unit |
|-----------|-------------------------|-------------------------------------------------------|------|------|------|------|
| ICLKFR1   | Input Frequency Range   | CY25818                                               | 8    | –    | 16   | MHz  |
| ICLKFR2   | Input Frequency Range   | CY25819                                               | 16   | –    | 32   | MHz  |
| trise1    | Clock Rise Time         | SSCLK and REFCLK, 0.4V to 2.4V                        | 2.0  | 3.0  | 4.0  | ns   |
| tfall1    | Clock Fall Time         | SSCLK and REFCLK, 0.4V to 2.4V                        | 2.0  | 3.0  | 4.0  | ns   |
| CDCin     | Input Clock Duty Cycle  | X <sub>IN</sub>                                       | 20   | 50   | 80   | %    |
| CDCout    | Output Clock Duty Cycle | SSCLK and REFCLK @ 1.5V                               | 45   | 50   | 55   | %    |
| CCJss     | Cycle-to-Cycle Jitter   | SSCLK; F <sub>IN</sub> = F <sub>OUT</sub> = 8–32 MHz  |      | 250  | 350  | ps   |
| CCJref    | Cycle-to-Cycle Jitter   | REFCLK; F <sub>IN</sub> = F <sub>OUT</sub> = 8–32 MHz |      | 275  | 375  | ps   |

## Characteristics Curves

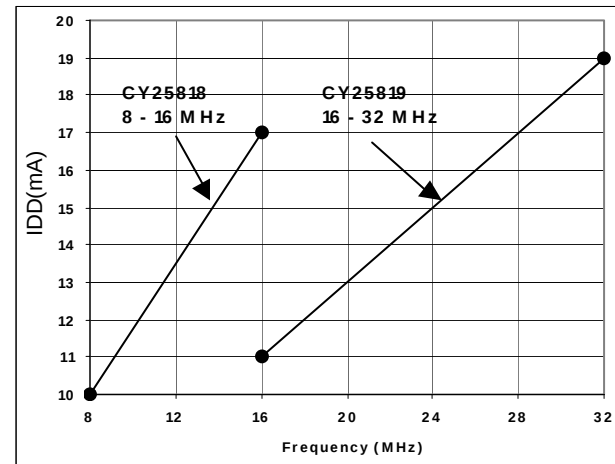
The following curves demonstrate the characteristic behavior of the CY25818/19 when tested over a number of environmental and application specific parameters. These are typical performance curves and are not meant to replace any parameter specified in *Table 4* and *Table 5*.



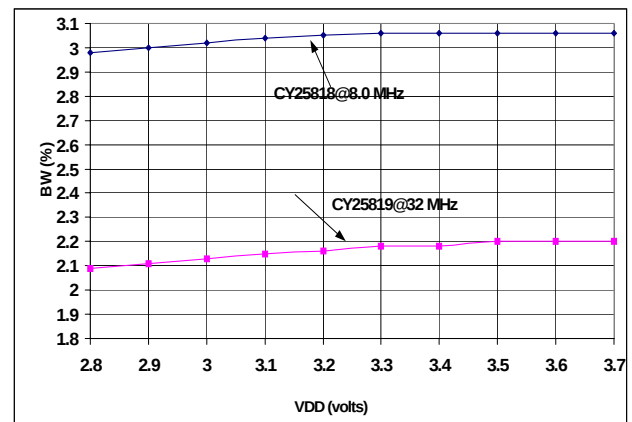
**Figure 2. CCJ (ps) vs. Frequency (MHz)**



**Figure 3. Bandwidth% vs. Temperature**



**Figure 4. IDD (mA) vs. Frequency (MHz)**



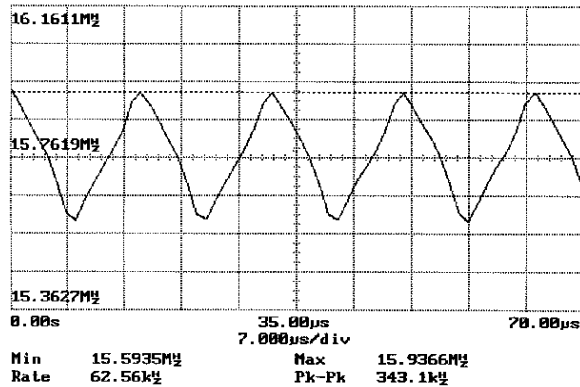
**Figure 5. Bandwidth% vs. VDD**

### Notes:

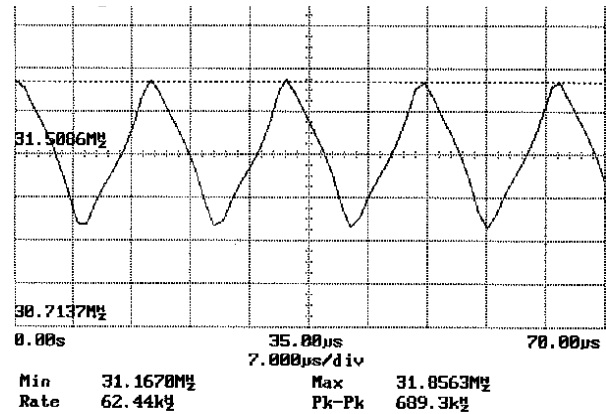
1. Single Power Supply: The voltage on any input or I/O pin cannot exceed the power pin during power-up.
2. Operation at any Absolute Maximum Rating is not implied.

## SSCG Profiles

CY25818/19 SSCG products use a non-linear “optimized” frequency profile as shown in *Figure 6* and *Figure 7*. The use of Cypress proprietary “optimized” frequency profile maintains flat energy distribution over the fundamental and higher order harmonics. This results in additional EMI reduction in electronic systems.

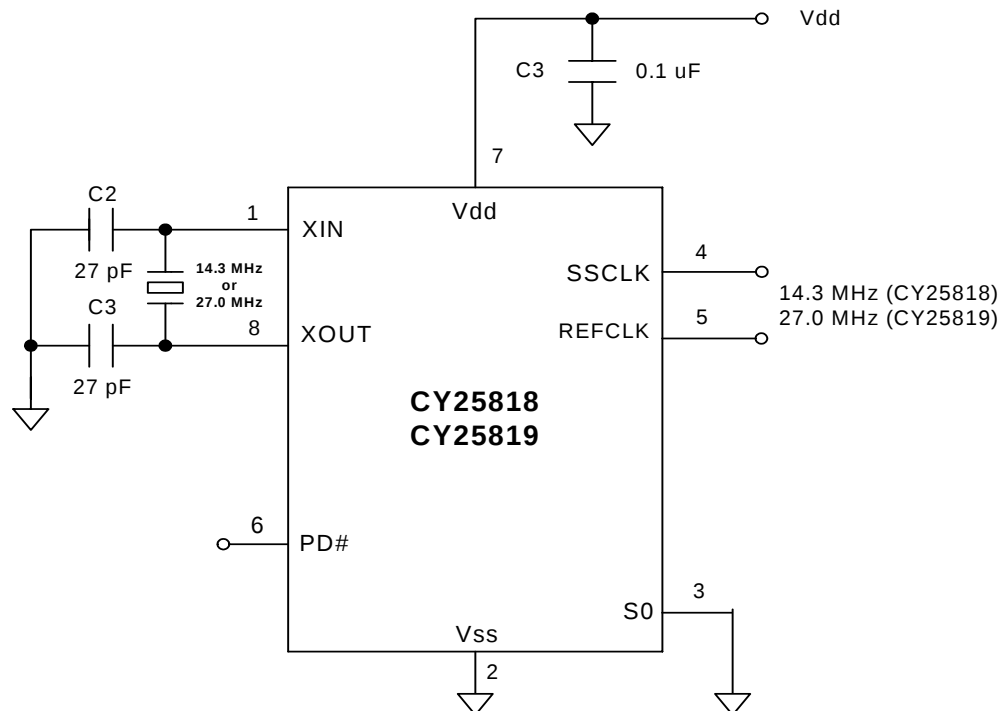


**Figure 6. CY25818 Spread Spectrum Profile (Frequency vs. Time)<sup>[3]</sup>**



**Figure 7. CY25819 Spread Spectrum Profile (Frequency vs. Time)<sup>[4]</sup>**

## Application Schematic



**Figure 8. Typical Application Schematic**

### Notes:

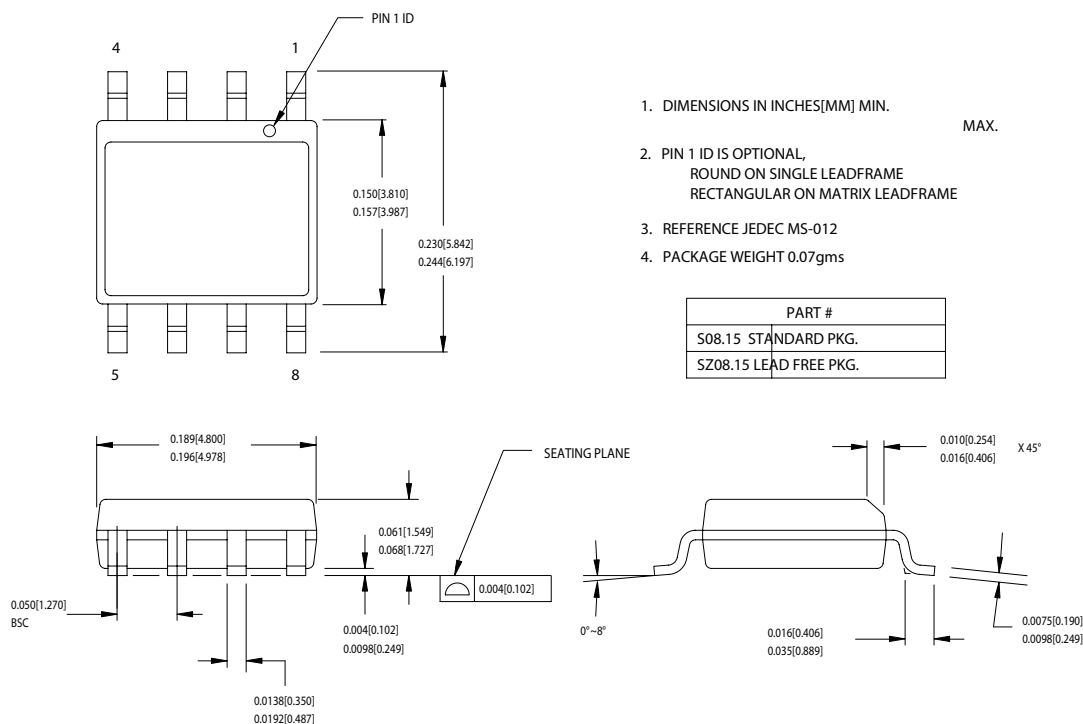
3.  $X_{IN}$  = 16.0 MHz;  $S0$  = 1;  $SSCLK$  = 16.0 MHz;  $BW$  = -2.14%.
4.  $X_{in}$  = 32.0 MHz;  $S0$  = 1;  $SSCLK$  = 32.0 MHz;  $BW$  = -2.15%

## Ordering Information

| Part Number      | Package Type             | Product Flow           |
|------------------|--------------------------|------------------------|
| CY25818SC        | 8-pin SOIC               | Commercial, 0° to 70°C |
| CY25818SCT       | 8-pin SOIC–Tape and Reel | Commercial, 0° to 70°C |
| CY25819SC        | 8-pin SOIC               | Commercial, 0° to 70°C |
| CY25819SCT       | 8-pin SOIC–Tape and Reel | Commercial, 0° to 70°C |
| <b>Lead-free</b> |                          |                        |
| CY25818SXC       | 8-pin SOIC               | Commercial, 0° to 70°C |
| CY25818SXCT      | 8-pin SOIC–Tape and Reel | Commercial, 0° to 70°C |
| CY25819SXC       | 8-pin SOIC               | Commercial, 0° to 70°C |
| CY25819SXCT      | 8-pin SOIC–Tape and Reel | Commercial, 0° to 70°C |

## Package Drawing and Dimensions

### 8-lead (150-Mil) SOIC S8



51-85066-°C

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**Document History Page**

| <b>Document Title: CY25818/19 Spread Spectrum Clock Generator</b><br><b>Document Number: 38-07362</b> |                |                   |                        |                                                            |
|-------------------------------------------------------------------------------------------------------|----------------|-------------------|------------------------|------------------------------------------------------------|
| <b>REV.</b>                                                                                           | <b>ECN NO.</b> | <b>Issue Date</b> | <b>Orig. of Change</b> | <b>Description of Change</b>                               |
| **                                                                                                    | 112462         | 03/21/02          | OXC                    | New Data Sheet                                             |
| *A                                                                                                    | 122701         | 12/28/02          | RBI                    | Added power up requirements to maximum rating information. |
| *B                                                                                                    | 448097         | See ECN           | RGL                    | Add Lead-free devices                                      |