

# Programmable High Frequency Crystal Oscillator with Spread Spectrum (SSXO) and No Spread Spectrum (XO) Option

## Features

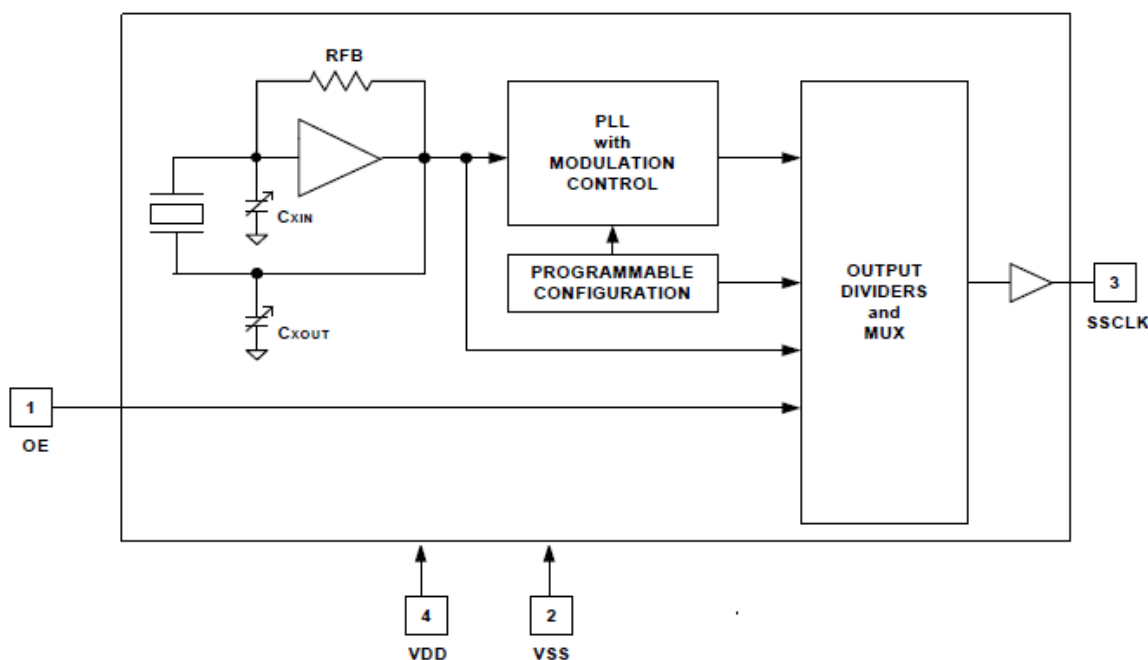
- Crystal Oscillator with Spread Spectrum Clock (SSXO)
- No Spread Spectrum (XO) Option
- Wide operating output clock frequency range of 10 to 166 MHz
- Programmable spread spectrum with nominal 31.5 kHz modulation frequency
- Center spread:  $\pm 0.25\%$  to  $\pm 2.0\%$
- Down spread:  $-0.5\%$  to  $-4.0\%$
- No spread:  $\pm 0.0\%$
- Integrated phase-locked loop (PLL)
- 85 ps typical cycle-to-cycle jitter with SSCLK = 133 MHz
- 3.3 V operation
- Output enable function
- Package available in 4-pin ceramic LCC SMD
- Pb-free package
- Industrial temperature from  $-40\text{ }^{\circ}\text{C}$  to  $85\text{ }^{\circ}\text{C}$

## Benefits

- Provides a wide range of spread percentages for maximum electromagnetic interference (EMI) reduction to meet regulatory agency electromagnetic compliance (EMC) requirements. Reduces development and manufacturing costs and time-to-market.
- This versatile programming feature enables the user to switch between SSXO (with Spread) and XO (without Spread) functions with ease.
- Internal PLL to generate up to 166 MHz output.
- Suitable for most PC, consumer, and networking applications
- Application compatibility in standard and low power systems
- In house programming of samples and prototype quantities is available using [CY3672-USB programming kit](#) and [CY3724 socket adapters](#). Production quantities are available through Cypress's value added distribution partners or by using third party programmers from BP Microsystems, and HiLo Systems, and others.

For a complete list of related resources, [click here](#).

## Logic Block Diagram

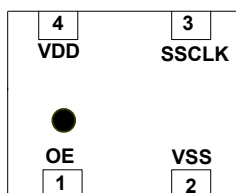


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## Pin Configuration

**Figure 1. 4-pin Ceramic SMD pinout**



## Pin Definitions

4-pin Ceramic SMD

Pin	Name	Description
1	OE	Output Enable pin: Active HIGH. If OE = 1, SSCLK is enabled
2	VSS	Power supply ground
3	SSCLK	Spread spectrum clock output (with or without spread)
4	VDD	3.3 V power supply

## Functional Description

The CY25701 is a Spread Spectrum Crystal Oscillator (SSXO) IC used to reduce the EMI found in today's high speed digital electronic systems.

The device uses a Cypress proprietary PLL and Spread Spectrum Clock (SSC) technology to synthesize and modulate the frequency of the embedded input crystal. By frequency modulating the clock, the measured EMI at the fundamental and harmonic frequencies are greatly reduced. This reduction in radiated energy significantly reduces the cost of complying with regulatory agency (EMC) requirements and improves time-to-market without degrading system performance.

The CY25701 uses a programmable configuration memory array to synthesize output frequency and spread percentage.

The spread percentage is programmed to center spread or down spread with various spread percentages. The range for center spread is from  $\pm 0.25\%$  to  $\pm 2.00\%$ . The range for down spread is from  $-0.5\%$  to  $-4.0\%$ . Contact the factory for smaller or larger spread percentage amounts if required. See [Table 2 on page 4](#) for spread selection and no spread values.

The frequency modulated SSCLK output is programmable from 10 to 166 MHz.

The CY25701 is available in a 4-pin ceramic SMD package with an operating temperature range of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

## Programming Description

### Factory and Field Programmable CY25701

Factory and field programming is available for samples and manufacturing by Cypress and its distributors. Submit your request to the local Cypress Field Application Engineer (FAE) or sales representative. Once the request is processed, you receive a new part number, samples, and data sheet with the programmed values. This part number is used for additional sample request and the production orders. Contact your local Cypress FAE or sales representative for details.

Additional information on the CY25701 is available at the Cypress web site [www.cypress.com](http://www.cypress.com).

### Output Frequency, SSCLK Output (SSCLK, pin 3)

The modulated frequency at the SSCLK output is produced by synthesizing from the embedded crystal oscillator frequency input. The range of synthesized clock is from 10 to 166 MHz.

### Spread Percentage (SSCLK, pin 3)

The SSCLK spread is programmable to various spread percentage values from  $\pm 0.25\%$  to  $\pm 2.0\%$  for center spread and from  $-0.5\%$  to  $-4.0\%$  for down spread. See [Table 2 on page 4](#) for available spread options. Enter  $\pm 0.0\%$  (No spread) for XO (crystal oscillator) without spread option.

### Frequency Modulation (SSCLK, pin 3)

The default frequency modulation is programmed at 31.5 kHz for all SSCLK frequencies from 10 to 166 MHz. Alternate frequency modulations at 30.1 kHz or 32.9 kHz are selectable using CyberClocks™ Online software. Contact the factory for other alternate modulation frequencies if required.

**Table 1. Programming Data Requirement**

Pin Function	Output Frequency	Spread Percent Code <sup>[1]</sup>	Frequency Modulation
Pin Name	SSCLK	SSCLK	SSCLK
Pin#	3	3	3
Units	MHz	%	kHz
Program Value	ENTER DATA	ENTER DATA	ENTER DATA 31.5

**Table 2. Spread Percent Selection**

Center Spread	Code	A	B	C	D	E	F	Z
	Percentage	±0.25%	±0.5%	±0.75%	±1.0%	±1.5%	±2.0%	±0.0%
Down Spread	Code	G	H	J	K	L	M	Z
	Percentage	−0.5%	−1.0%	−1.5%	−2.0%	−3.0%	−4.0%	±0.0%

## Absolute Maximum Ratings

Supply Voltage ( $V_{DD}$ ) ..... −0.5 V to +7.0 V  
 DC Input Voltage ..... −0.5 V to  $V_{DD} + 0.5$  V

Storage Temperature  
 (Non-condensing) ..... −55 °C to +100 °C  
 Junction Temperature ..... −40 °C to +125 °C  
 Data Retention at  $T_J = 125$  °C ..... > 10 years  
 Package Power Dissipation ..... 350 mW

## Operating Conditions

Parameter	Description	Min	Typ	Max	Unit
$V_{DD}$	Supply voltage	3.00	3.30	3.60	V
$T_A$	Ambient temperature (commercial)	−20	—	70	°C
$T_A$	Ambient temperature (industrial)	−40	—	85	°C
$C_{LOAD}$	Max. load capacitance at pin 3	—	—	15	pF
$F_{SSCLK}$	SSCLK output frequency, $C_{LOAD} = 15$ pF	10	—	166	MHz
$F_{MOD}$	Spread Spectrum Modulation Frequency	30.0	31.5	33.0	kHz
$T_{PU}$	Power up time for $V_{DD}$ to reach minimum specified voltage (power ramp must be monotonic)	0.05	—	500	ms

**Note**

1. ±0.0% or Code "Z" for XO (No-Spread) option.

## DC Electrical Characteristics

Parameter	Description	Condition	Min	Typ	Max	Unit
$I_{OH}$	Output high current (pin 3)	$V_{OH} = V_{DD} - 0.5\text{ V}$ , $V_{DD} = 3.3\text{ V}$ (source)	10	12	–	mA
$I_{OL}$	Output low current (pin 3)	$V_{OL} = 0.5\text{ V}$ , $V_{DD} = 3.3\text{ V}$ (sink)	10	12	–	mA
$V_{IH}$	Input high voltage (pin 1)	CMOS levels, 70% of $V_{DD}$	$0.7 \times V_{DD}$	–	$V_{DD}$	V
$V_{IL}$	Input low voltage (pin 1)	CMOS levels, 30% of $V_{DD}$	–	–	$0.3 \times V_{DD}$	V
$I_{IH}$	Input high current (pin 1)	$V_{in} = V_{DD}$	–	–	10	$\mu\text{A}$
$I_{IL}$	Input low current (pin 1)	$V_{in} = V_{SS}$	–	–	10	$\mu\text{A}$
$I_{OZ}$	Output leakage current (pin 3)	Three-state output, $OE = 0$	–10	–	10	$\mu\text{A}$
$C_{IN}^{[2]}$	Input capacitance (pin 1)	Pin 1, or OE	–	5	7	pF
$I_{VDD}$	Supply current	$V_{DD} = 3.3\text{ V}$ , SSCLK = 10 to 166 MHz, $C_{LOAD} = 0$ , $OE = V_{DD}$	–	–	50	mA
$\Delta f/f$	Initial accuracy at room temp.	$T_A = 25\text{ }^\circ\text{C}$ , 3.3 V	–25	–	25	ppm
	Freq. stability over temp. range	$T_A = -20\text{ }^\circ\text{C}$ to $70\text{ }^\circ\text{C}$ , 3.3 V	–25	–	25	ppm
	Freq. stability over voltage range	3.0 to 3.6 V	–12	–	12	ppm
	Aging	$T_A = 25\text{ }^\circ\text{C}$ , First year	–5	–	5	ppm

## AC Electrical Characteristics

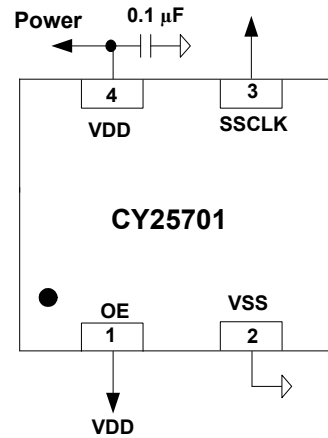
Parameter <sup>[2]</sup>	Description	Condition	Min	Typ	Max	Unit
DC	Output Duty Cycle	SSCLK, Measured at $V_{DD}/2$	45	50	55	%
$t_R$	Output Rise Time	20%–80% of $V_{DD}$ , $C_L = 15\text{ pF}$	–	–	2.7	ns
$t_F$	Output Fall Time	20%–80% of $V_{DD}$ , $C_L = 15\text{ pF}$	–	–	2.7	ns
$T_{CCJ1}^{[3]}$	Cycle-to-Cycle Jitter SSCLK (Pin 3)	SSCLK $\geq 133\text{ MHz}$ , Measured at $V_{DD}/2$	–	85	200	ps
		25 MHz $\leq$ SSCLK $< 133\text{ MHz}$ , Measured at $V_{DD}/2$	–	215	400	ps
		SSCLK $< 25\text{ MHz}$ , Measured at $V_{DD}/2$	–	–	1% of 1/SSCK	s
$T_{OE1}$	Output Disable Time (pin1 = OE)	Time from falling edge on OE to stopped outputs (Asynchronous)	–	150	350	ns
$T_{OE2}$	Output Enable Time (pin1 = OE)	Time from rising edge on OE to outputs at a valid frequency (Asynchronous)	–	150	350	ns
$T_{LOCK}$	PLL Lock Time	Time for SSCLK to reach valid frequency	–	–	10	ms

### Notes

- Guaranteed by characterization, not fully tested.
- For more information on Jitter Specifications, please see whitepaper - Datasheet Jitter Specifications for Cypress Timing Products available at <http://www.cypress.com/?rID=12791>.

## Application Circuit

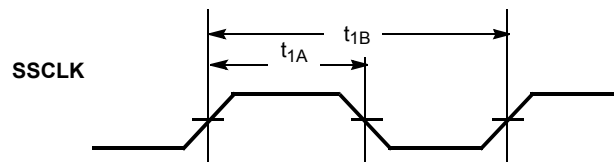
**Figure 2. Application Circuit Diagram**



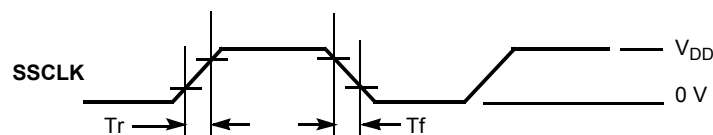
## Switching Waveforms

**Figure 3. Duty Cycle Waveform**

Duty Cycle Timing ( $DC = t_{1A}/t_{1B}$ )

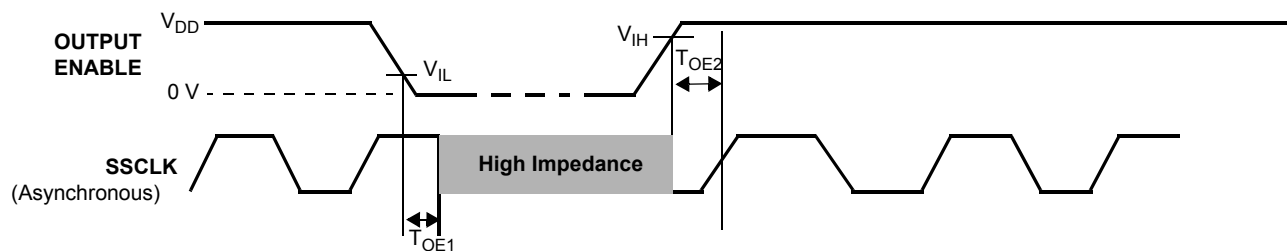


**Figure 4. Output Rise/Fall Time Waveform**

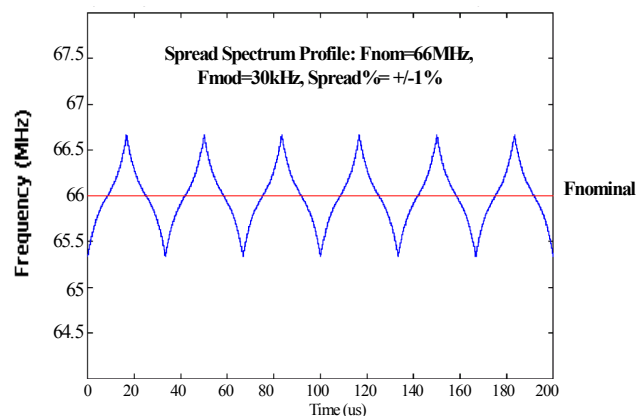
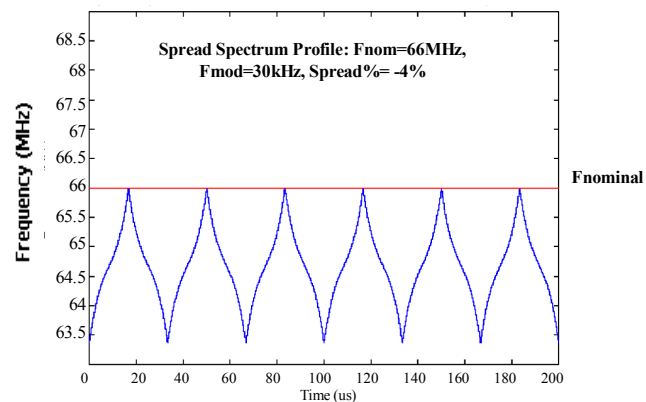
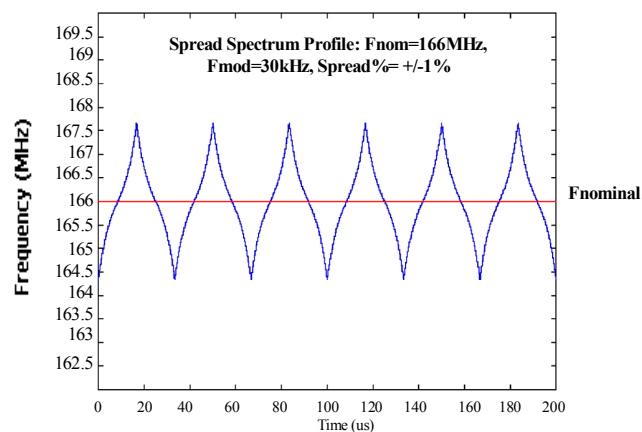
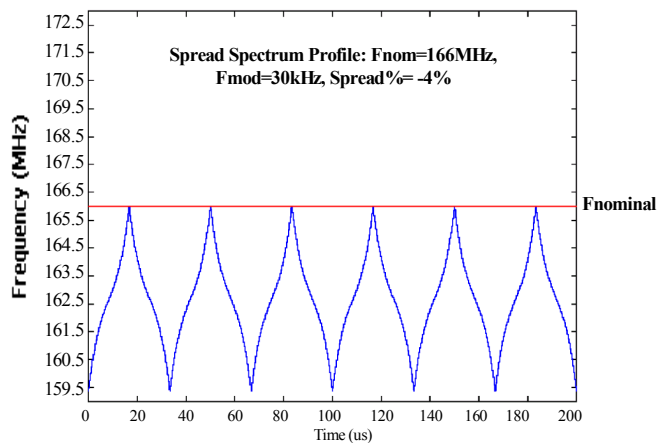


Output Rise time ( $T_r$ ) =  $(0.6 \times V_{DD})/SR1$  (or  $SR3$ )  
 Output Fall time ( $T_f$ ) =  $(0.6 \times V_{DD})/SR2$  (or  $SR4$ )  
 Refer to AC Electrical Characteristics table for SR (Slew Rate) values.

**Figure 5. Output Enable/Disable Timing Waveforms**



## Informational Graphs<sup>[4]</sup>



### Note

4. The "Informational Graphs" are meant to convey typical performance levels. No performance specifications are implied or guaranteed. Refer to the tables on pages three and four for device specifications.

## Ordering Information

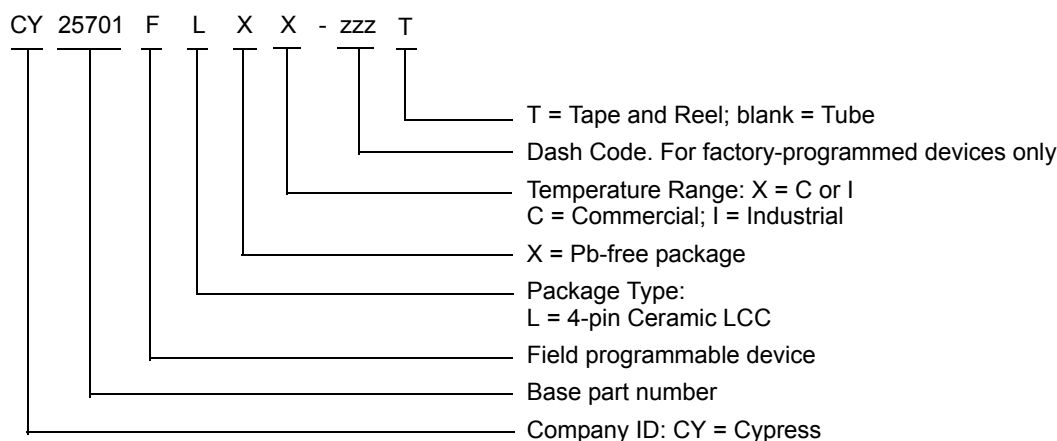
Part Number	Package Description	Product Flow
<b>Pb-free</b>		
CY25701FLXCT [5, 6]	4-pin Ceramic LCC SMD – Tape and Reel	Commercial, 0 °C to 70 °C
CY25701FLXIT [5, 6]	4-pin Ceramic LCC SMD – Tape and Reel	Industrial, –40 °C to 85 °C
<b>Programmer</b>		
CY3672-USB	Programming Kit	
CY3724 Socket Adapter	Socket adapter board, for programming CY25701	

## Possible Configurations

Some product offerings are factory programmed customer specific devices with customized part numbers. The Possible Configurations table shows the available device types, but not complete part numbers. Contact your local Cypress FAE or Sales Representative for more information.

Part Number	Package Description	Product Flow
<b>Pb-free</b>		
CY25701LXCzzzT [6, 7]	4-pin Ceramic LCC SMD – Tape and Reel	Commercial, 0 °C to 70 °C
CY25701LXIzzzT [6, 7]	4-pin Ceramic LCC SMD – Tape and Reel	Industrial, –40 °C to 85 °C

## Ordering Code Definitions

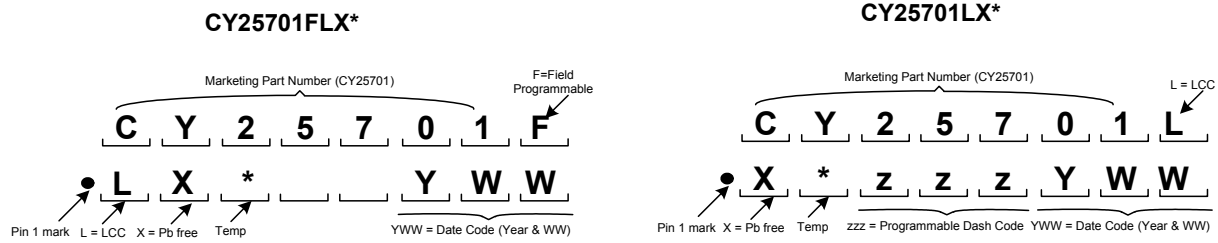


### Notes

5. "FLX" suffix is used for products programmed in the field by Cypress distributors.
6. Temp can be C (Commercial) or I (Industrial).
7. "ZZZ" denotes the assigned product dash number. This number is assigned by the factory after the output frequency and spread percent programming data is received from the customer. For more details, contact your local Cypress FAE or Sales Representative.



**Figure 6. Actual Marking [8]**

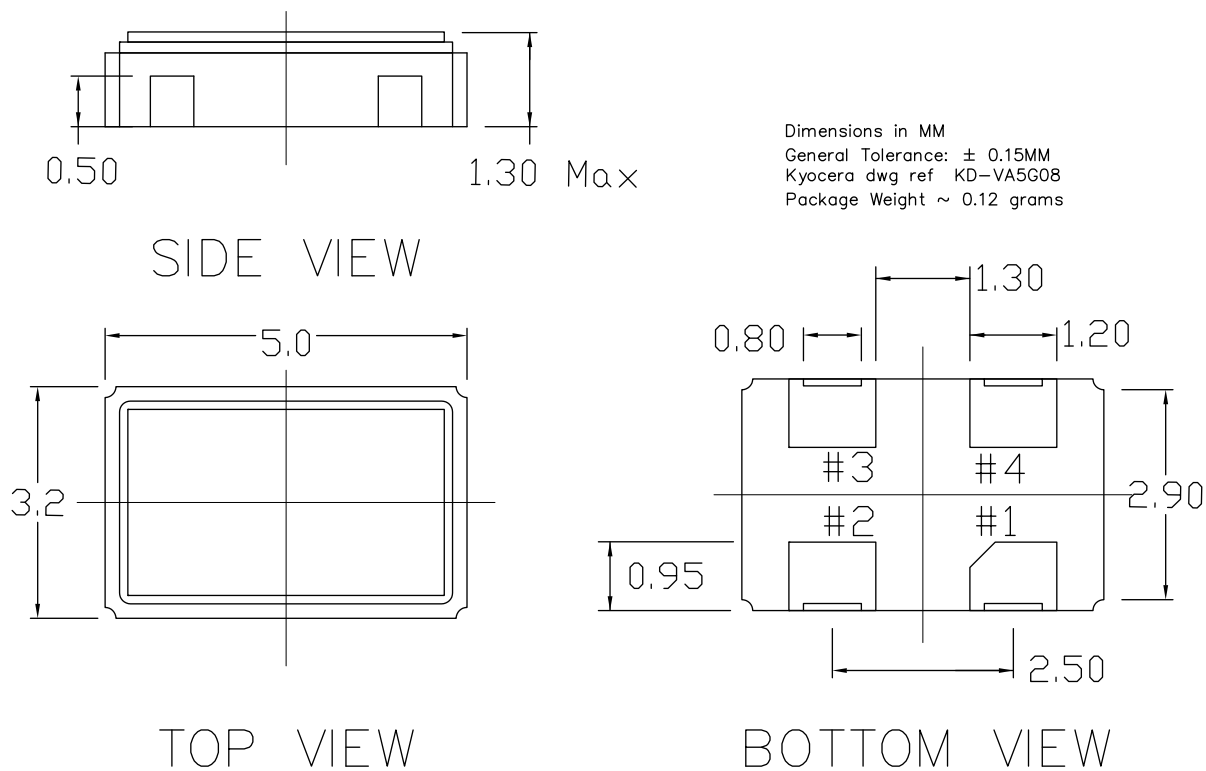


**Note**

8. Temp can be C (Commercial) or I (Industrial).

## Package Drawings and Dimensions

Figure 7. 4-pin Ceramic LCC (3.2 × 5.0 × 1.3 mm) LZ04A Package Outline, 001-02743



001-02743 \*G

## Acronyms

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
EMC	Electromagnetic Compliance
EMI	Electromagnetic Interference
FAE	Field Application Engineer
LCC	Leadless Chip Carrier
OE	Output Enable
PLL	Phase Locked Loop
SMD	Surface Mount Device
SSC	Spread Spectrum Clock
SSXO	Spread Spectrum Crystal Oscillator
XO	Crystal Oscillator

## Document Conventions

### Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
kHz	kilohertz
MHz	megahertz
μA	microampere
μF	microfarad
mA	milliampere
mm	millimeter
ms	millisecond
mW	milliwatt
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
ppm	parts per million
ps	picosecond
s	second
V	volt

## Document History Page

Document Title: CY25701, Programmable High Frequency Crystal Oscillator with Spread Spectrum (SSXO) and No Spread Spectrum (XO) Option Document Number: 001-07313				
REV.	ECN	Orig. of Change	Submission Date	Description of Change
**	442944	RGL	See ECN	New data sheet
*A	487736	KKVTMP	See ECN	Added Industrial temp
*B	1414203	DPF / VED	See ECN	Replaced the Package Drawing and Dimension figure on page seven and various copy edits; The reference to the software is now CyberClocks™ Online rather than CyberClocks software.
*C	2542310	AESA	07/24/08	Added Note "Not recommended for new designs." Added part number CY25701KFLXCT, CY25701KFLXIT, CY25701KLXCzzzT, and CY25701KLXIzzzT in <a href="#">Ordering Information</a> . Added note reference 5 to CY25701KFLXCT and CY25701KFLXIT, and note reference 6 to CY25701KLXCzzzT and CY25701KLXIzzzT. Updated to new template.
*D	2624529	CXQ / PYRS	12/18/08	Removed Note "Not recommended for new designs." Removed part number CY25701KFLXCT, CY25701KFLXIT, CY25701KLXCzzzT, and CY25701KLXIzzzT in <a href="#">Ordering Information</a> .
*E	2897744	CXQ	03/23/2010	Moved 'ZZZ' parts to Possible Configurations table Updated <a href="#">Package Drawings and Dimensions</a> .
*F	3381730	PURU	09/26/2011	Updated <a href="#">Benefits</a> (Replaced "CY3672 programming kit" with "CY3672-USB programming kit" and given hyperlink to the same as "http://www.cypress.com/?rID=44009" and also given hyperlink to "CY3724 socket adapters" as "http://www.cypress.com/?rID=37857"). Updated <a href="#">Logic Block Diagram</a> (Replaced the previous Logic Block Diagram with the present Logic Block Diagram). Added <a href="#">Ordering Code Definitions</a> . Updated <a href="#">Package Drawings and Dimensions</a> (Updated the next revision package outline for <a href="#">Figure 7</a> ). Added <a href="#">Acronyms</a> and <a href="#">Units of Measure</a> . Updated to new template.
*G	4556401	TAVA	10/30/2014	Updated <a href="#">Package Drawings and Dimensions</a> : spec 001-02743 – Changed revision from *E to *G.  Updated to new template.  Completing Sunset Review.

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