



## High Performance Communication Buffer

### General Description

The **ICS91305** is a high performance, low skew, low jitter clock driver. It uses a phase lock loop (PLL) technology to align, in both phase and frequency, the REF input with the CLKOUT signal. It is designed to distribute high speed clocks in communication systems operating at speeds from 10 to 133 MHz.

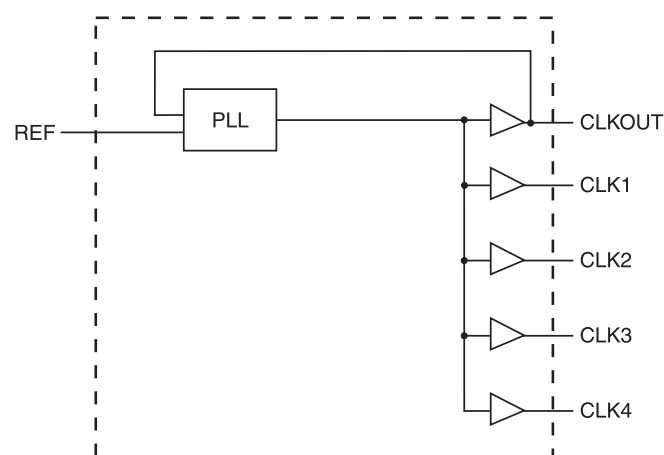
**ICS91305** is a zero delay buffer that provides synchronization between the input and output. The synchronization is established via CLKOUT feed back to the input of the PLL. Since the skew between the input and output is less than +/- 350 pS, the part acts as a zero delay buffer.

The **ICS91305** comes in an eight pin 150 mil SOIC package. It has five output clocks. In the absence of REF input, will be in the power down mode. In this mode, the PLL is turned off and the output buffers are pulled low. Power down mode provides the lowest power consumption for a standby condition.

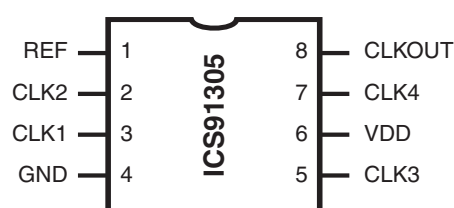
### Features

- Zero input - output delay
- Frequency range 10 - 133 MHz (3.3V)
- 5V tolerant input REF
- High loop filter bandwidth ideal for Spread Spectrum applications.
- Less than 200 ps Jitter between outputs
- Skew controlled outputs
- Skew less than 250 ps between outputs
- Available in 8 pin 150 mil SOIC & 173 mil TSSOP packages
- 3.3V  $\pm 10\%$  operation

### Block Diagram



### Pin Configuration



**8 pin SOIC & TSSOP**

## Pin Descriptions

| PIN NUMBER | PIN NAME            | TYPE | DESCRIPTION  |
|------------|---------------------|------|--|
| 1          | REF <sup>2</sup>    | IN   | Input reference frequency, 5V tolerant input.        |
| 2          | CLK2 <sup>3</sup>   | OUT  | Buffered clock output                                |
| 3          | CLK1 <sup>3</sup>   | OUT  | Buffered clock output                                |
| 4          | GND                 | PWR  | Ground   |
| 5          | CLK3 <sup>3</sup>   | OUT  | Buffered clock output                                |
| 6          | VDD                 | PWR  | Power Supply (3.3V)                                  |
| 7          | CLK4 <sup>3</sup>   | OUT  | Buffered clock output                                |
| 8          | CLKOUT <sup>3</sup> | OUT  | Buffered clock output. Internal feedback on this pin |

### Notes:

1. Guaranteed by design and characterization. Not subject to 100% test.
2. Weak pull-down
3. Weak pull-down on all outputs

## Absolute Maximum Ratings

|                               |                                |
|-------------------------------|--------------------------------|
| Supply Voltage                | 7.0 V                          |
| Logic Inputs (Except REF)     | GND –0.5 V to $V_{DD} + 0.5$ V |
| Logic Input REF               | GND –0.5 V to GND + 5.5 V      |
| Ambient Operating Temperature | 0°C to +70°C                   |
| Storage Temperature           | –65°C to +150°C                |

Stresses above those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These ratings are stress specifications only and functional operation of the device at these or any other conditions above those listed in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

## Electrical Characteristics at 3.3V

$V_{DD} = 3.0 - 3.6$  V,  $T_A = 0 - 70^\circ$  C unless otherwise stated

| DC Characteristics               |          |  |     |      |       |         |
|----------------------------------|----------|--|-----|------|-------|---------|
| PARAMETER                        | SYMBOL   | TEST CONDITIONS  | MIN | TYP  | MAX   | UNITS   |
| Input Low Voltage                | $V_{IL}$ |  |     |      | 0.8   | V       |
| Input High Voltage               | $V_{IH}$ |  | 2.0 |      |       | V       |
| Input Low Current                | $I_{IL}$ | $V_{IN} = 0$ V   |     | 19   | 50.0  | $\mu$ A |
| Input High Current               | $I_{IH}$ | $V_{IN} = V_{DD}$  |     | 0.10 | 100.0 | $\mu$ A |
| Output Low Voltage <sup>1</sup>  | $V_{OL}$ | $I_{OL} = 25$ mA   |     | 0.25 | 0.4   | V       |
| Output High Voltage <sup>1</sup> | $V_{OH}$ | $I_{OH} = 25$ mA   | 2.4 | 2.9  |       | V       |
| Power Down Supply Current        | $I_{DD}$ | REF = 0 MHz  |     | 0.3  | 50.0  | $\mu$ A |
| Supply Current                   | $I_{DD}$ | Unloaded outputs at 66.66 MHz<br>SEL inputs at $V_{DD}$ or GND |     | 30.0 | 40.0  | mA      |

### Notes:

1. Guaranteed by design and characterization. Not subject to 100% test.
2. All Skew specifications are measured with a 50 $\Omega$  transmission line, load terminated with 50 $\Omega$  to 1.4V.
3. Duty cycle measured at 1.4V.
4. Skew measured at 1.4V on rising edges. Loading must be equal on outputs.

## Switching Characteristics

| PARAMETER   | SYMBOL    | CONDITION  | MIN            | TYP | MAX          | UNITS       |
|---|-----------|--|----------------|-----|--------------|-------------|
| Output period   | t1        | With CL = 30pF   | 100.00<br>(10) |     | 7.5<br>(133) | ns<br>(MHz) |
| Input period  | t1        | With CL = 30pF   | 100.00<br>(10) |     | 7.5<br>(133) | ns<br>(MHz) |
| Duty Cycle <sup>1</sup>   | Dt1       | Measured at 1.4V; CL = 30pF                              | 40.0           | 50  | 60           | %           |
| Duty Cycle <sup>1</sup>   | Dt2       | Measured at VDD/2 Fout <66.6MHz                          | 45             | 50  | 55           | %           |
| Rise Time <sup>1</sup>  | tr1       | Measured between 0.8V and 2.0V;<br>CL=30pF               |                | 1.2 | 1.5          | ns          |
| Fall Time <sup>1</sup>  | tf1       | Measured between 2.0V and 0.8V;<br>CL=30pF               |                | 1.2 | 1.5          | ns          |
| Rise Time <sup>1</sup>  | tr1       | Measured between 0.8V and 2.0V;<br>CL=5pF                | 1              |     |              | ns          |
| Fall Time <sup>1</sup>  | tf1       | Measured between 2.0V and 0.8V;<br>CL=5pF                | 1              |     |              | ns          |
| Delay, REF Rising<br>Edge to CLKOUT<br>Rising Edge <sup>1,2</sup> | Dr1       | Measured at 1.4V   |                | 0   | ±350         | ps          |
| Output to Output<br>Skew <sup>1</sup>                             | Tskew     | All outputs equally loaded,<br>CL = 20pF                 |                |     | 250          | ps          |
| Device to Device<br>Skew <sup>1</sup>                             | Tdsk-Tdsk | Measured at VDD/2 on the CLKOUT pins<br>of devices       |                | 0   | 700          | ps          |
| Cycle to Cycle<br>Jitter <sup>1</sup>                             | Tcyc-Tcyc | Measured at 66.66 MHz, loaded outputs                    |                |     | 200          | ps          |
| PLL Lock Time <sup>1</sup>  | tLOCK     | Stable power supply, valid clock presented<br>on REF pin |                |     | 1.0          | ms          |
| Jitter; Absolute<br>Jitter <sup>1</sup>                           | Tjabs     | @ 10,000 cycles<br>CL = 30pF                             | -100           | 70  | 100          | ps          |
| Jitter; 1 - Sigma <sup>1</sup>                                    | Tj1s      | @ 10,000 cycles<br>CL = 30pF                             |                | 14  | 30           | ps          |

### Notes:

1. Guaranteed by design and characterization. Not subject to 100% test.
2. REF input has a threshold voltage of 1.4V
3. All parameters expected with loaded outputs

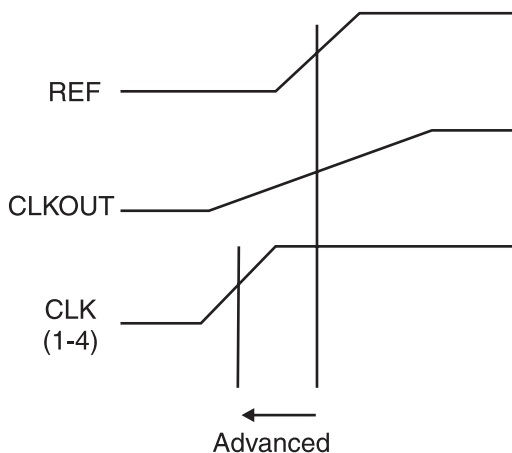
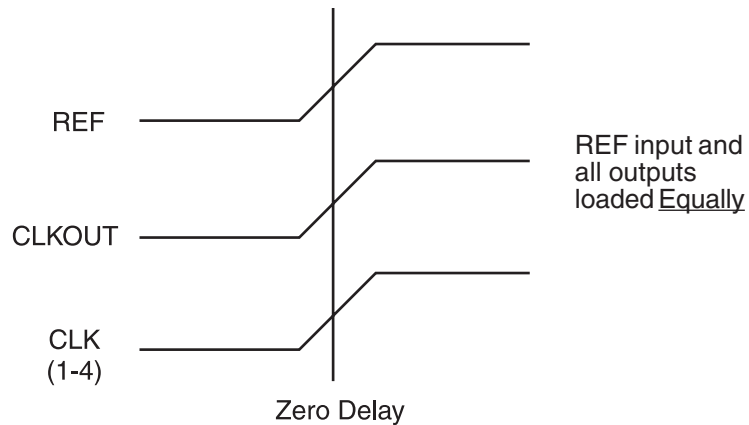
## Output to Output Skew

The skew between CLKOUT and the CLK(1-4) outputs is not dynamically adjusted by the PLL. Since CLKOUT is one of the inputs to the PLL, zero phase difference is maintained from REF to CLKOUT. If all outputs are equally loaded, zero phase difference will be maintained from REF to all outputs.

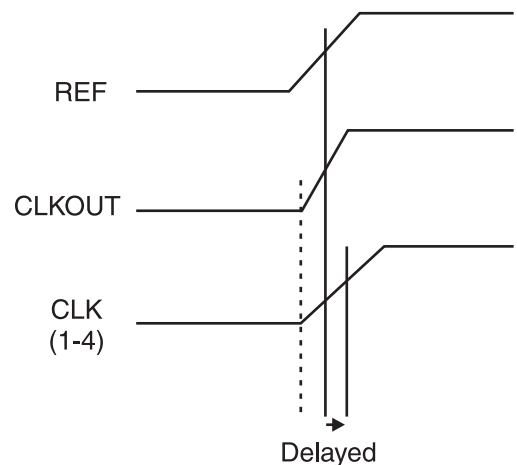
If applications requiring zero output-output skew, all the outputs must be equally loaded.

If the CLK(1-4) outputs are less loaded than CLKOUT, CLK(1-4) outputs will lead it; and if the CLK(1-4) is more loaded than CLKOUT, CLK(1-4) will lag the CLKOUT.

Since the CLKOUT and the CLK(1-4) outputs are identical, they all start at the same time, but different loads cause them to have different rise times and different times crossing the measurement thresholds.

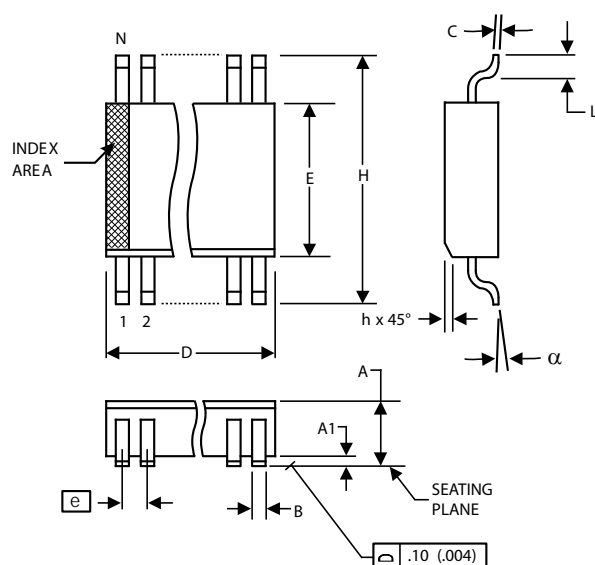


REF input and CLK(1-4) outputs loaded equally, with CLKOUT loaded More.



REF input and CLK(1-4) outputs loaded equally, with CLKOUT loaded Less.

### Timing diagrams with different loading configurations



150 mil (Narrow Body) SOIC

150 mil (Narrow Body) SOIC

| SYMBOL   | In Millimeters |      | In Inches      |       |
|----------|----------------|------|----------------|-------|
|          | MIN            | MAX  | MIN            | MAX   |
| A        | 1.35           | 1.75 | .0532          | .0688 |
| A1       | 0.10           | 0.25 | .0040          | .0098 |
| B        | 0.33           | 0.51 | .013           | .020  |
| C        | 0.19           | 0.25 | .0075          | .0098 |
| D        | SEE VARIATIONS |      | SEE VARIATIONS |       |
| E        | 3.80           | 4.00 | .1497          | .1574 |
| e        | 1.27 BASIC     |      | 0.050 BASIC    |       |
| H        | 5.80           | 6.20 | .2284          | .2440 |
| h        | 0.25           | 0.50 | .010           | .020  |
| L        | 0.40           | 1.27 | .016           | .050  |
| N        | SEE VARIATIONS |      | SEE VARIATIONS |       |
| $\alpha$ | 0°             | 8°   | 0°             | 8°    |

VARIATIONS

| N | D mm. |      | D (inch) |       |
|---|-------|------|----------|-------|
|   | MIN   | MAX  | MIN      | MAX   |
| 8 | 4.80  | 5.00 | .1890    | .1968 |

Reference Doc.: JEDEC Publication 95, MS-012  
10-0030

## Ordering Information

91305yMLFT

Example:

XXXX y M LFT

Designation for tape and reel packaging

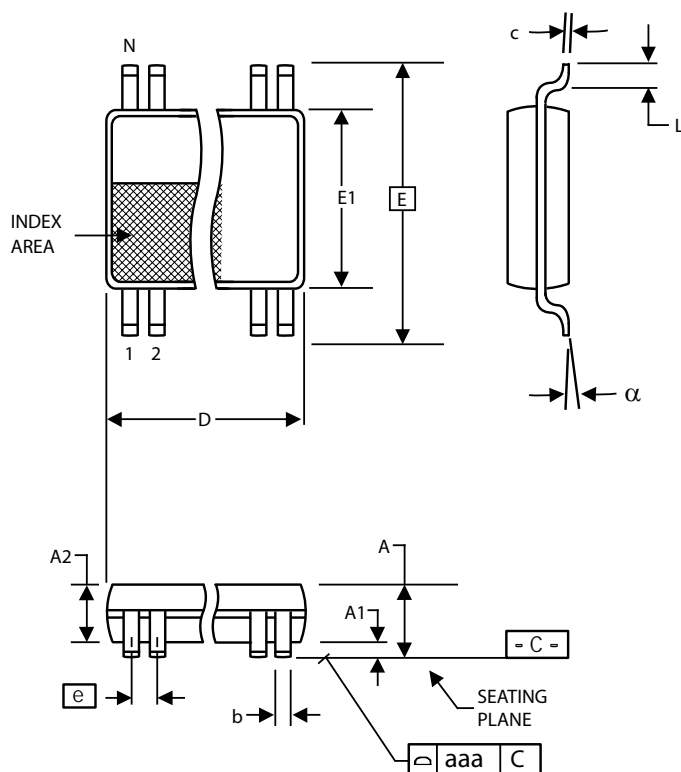
Lead Free, ROHS Compliant (Optional)

Package Type

M = SOIC

Revision Designator (will not correlate with datasheet revision)

Device Type



4.40 mm. Body, 0.65 mm. Pitch TSSOP  
(173 mil) (25.6 mil)

| SYMBOL | In Millimeters<br>COMMON DIMENSIONS |      | In Inches<br>COMMON DIMENSIONS |      |
|--------|-------------------------------------|------|--------------------------------|------|
|        | MIN                                 | MAX  | MIN                            | MAX  |
| A      | --                                  | 1.20 | --                             | .047 |
| A1     | 0.05                                | 0.15 | .002                           | .006 |
| A2     | 0.80                                | 1.05 | .032                           | .041 |
| b      | 0.19                                | 0.30 | .007                           | .012 |
| c      | 0.09                                | 0.20 | .0035                          | .008 |
| D      | SEE VARIATIONS                      |      | SEE VARIATIONS                 |      |
| E      | 6.40 BASIC                          |      | 0.252 BASIC                    |      |
| E1     | 4.30                                | 4.50 | .169                           | .177 |
| e      | 0.65 BASIC                          |      | 0.0256 BASIC                   |      |
| L      | 0.45                                | 0.75 | .018                           | .030 |
| N      | SEE VARIATIONS                      |      | SEE VARIATIONS                 |      |
| a      | 0°                                  | 8°   | 0°                             | 8°   |
| aaa    | --                                  | 0.10 | --                             | .004 |

VARIATIONS

| N | D mm. |      | D (inch) |      |
|---|-------|------|----------|------|
|   | MIN   | MAX  | MIN      | MAX  |
| 8 | 2.90  | 3.10 | .114     | .122 |

Reference Doc.: JEDEC Publication 95, MO-153

10-0035

## Ordering Information

91305yGLFT

Example:

XXXX y G LF T

Designation for tape and reel packaging

Lead Free, RoHS Compliant (Optional)

Package Type

G = TSSOP

Revision Designator (will not correlate with datasheet revision)

Device Type

## Revision History

| Rev. | Issue Date | Description                                  | Page # |
|------|------------|--|--------|
| G    | 8/6/2007   | Updated Rise/Fall Time.                      | 4      |
| H    | 12/2/2008  | Removed ICS prefix from ordering information | 6-7    |
|      |            |  |        |
|      |            |  |        |
|      |            |  |        |
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