

# 1 TO 4 CLOCK BUFFER

# ICS551

## Description

The ICS551 is a low cost, high-speed single input to four output clock buffer. Part of IDT's ClockBlocks™ family, this is our lowest cost, small clock buffer.

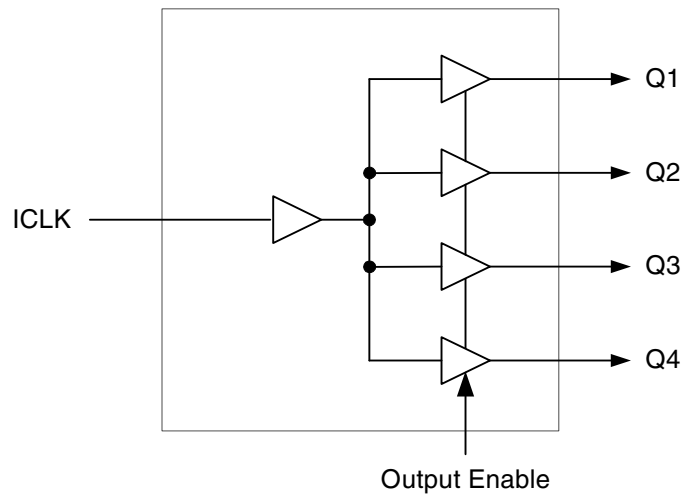
See the ICS552-02B for monolithic dual version of the ICS551 in a 20 pin QSOP.

IDT makes many non-PLL and PLL based low skew output devices as well as Zero Delay Buffers to synchronize clocks. Contact IDT for all of your clocking needs.

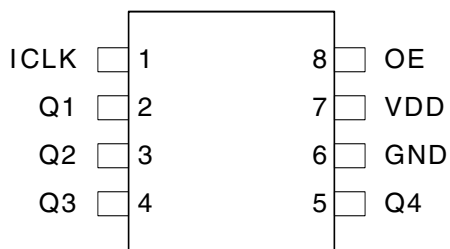
## Features

- Low skew (250 ps) outputs
- Pb-free packaging
- Low cost clock buffer
- Packaged in 8-pin SOIC
- Input/Output clock frequency up to 160 MHz
- Non-inverting output clock
- Ideal for networking clocks
- Operating Voltages of 3.3 and 5.0 V
- Output Enable mode tri-states outputs
- Advanced, low power CMOS process
- Commercial and industrial temperature versions

## Block Diagram



## Pin Assignment



8 Pin (150 mil) SOIC

## Pin Descriptions

| Pin Number | Pin Name | Pin Type | Pin Description  |
|------------|----------|----------|--|
| 1          | ICLK     | Input    | Clock input. Internal pull-up resistor.                                |
| 2          | Q1       | Output   | Clock output 1.  |
| 3          | Q2       | Output   | Clock output 2.  |
| 4          | Q3       | Output   | Clock output 3.  |
| 5          | Q4       | Output   | Clock output 4.  |
| 6          | GND      | Power    | Connect to ground.   |
| 7          | VDD      | Power    | Connect to 3.3 V or 5.0 V.   |
| 8          | OE       | Input    | Output Enable. Tri-states outputs when low. Internal pull-up resistor. |

## External Components

A minimum number of external components are required for proper operation. A decoupling capacitor of 0.01  $\mu$ F should be connected between VDD on pin 7 and GND on pin 6, as close to the device as possible. A 33 $\Omega$  series terminating resistor may be used on each clock output if the trace is longer than 1 inch.

## Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the ICS551. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

| Item                                      | Rating              |
|---|---------------------|
| Supply Voltage, VDD                       | 7 V                 |
| All Inputs and Outputs                    | -0.5 V to VDD+0.5 V |
| Ambient Operating Temperature, Commercial | 0 to +70° C         |
| Ambient Operating Temperature, Industrial | -40 to +85° C       |
| Storage Temperature                       | -65 to +150° C      |
| Junction Temperature                      | 125° C              |
| Soldering Temperature                     | 260° C              |

## Recommended Operation Conditions

| Parameter   | Min. | Typ. | Max. | Units |
|---|------|------|------|-------|
| Ambient Operating Temperature                     | -40  | –    | +85  | °C    |
| Power Supply Voltage (measured in respect to GND) | +3.0 |      | +5.5 | V     |

## DC Electrical Characteristics

VDD=3.3 V ±10% , Ambient temperature -40 to +85 °C, unless stated otherwise

| Parameter                        | Symbol          | Conditions               | Min.      | Typ. | Max.      | Units |
|----------------------------------|-----------------|--------------------------|-----------|------|-----------|-------|
| Operating Voltage                | VDD             |                          | 3.0       |      | 3.6       | V     |
| Input High Voltage, ICLK         | V <sub>IH</sub> | Note 1                   | VDD/2+0.7 |      | 3.8       | V     |
| Input Low Voltage, ICLK          | V <sub>IL</sub> | Note 1                   |           |      | VDD/2-0.7 | V     |
| Input High Voltage, OE           | V <sub>IH</sub> |                          | 2         |      | VDD       | V     |
| Input Low Voltage, OE            | V <sub>IL</sub> |                          |           |      | 0.8       | V     |
| Output High Voltage              | V <sub>OH</sub> | I <sub>OH</sub> = -25 mA | 2.4       |      |           | V     |
| Output Low Voltage               | V <sub>OL</sub> | I <sub>OL</sub> = 25 mA  |           |      | 0.4       | V     |
| Output High Voltage (CMOS Level) | V <sub>OH</sub> | I <sub>OH</sub> = -12 mA | VDD-0.4   |      |           | V     |
| Operating Supply Current         | IDD             | No load, 135 MHz         |           | 18   |           | mA    |
| Nominal Output Impedance         | Z <sub>O</sub>  |                          |           | 20   |           | Ω     |
| Internal Pull-up Resistor        | R <sub>PU</sub> | OE                       |           | 500  |           | kΩ    |
| Input Capacitance                | C <sub>IN</sub> | OE pin                   |           | 5    |           | pF    |
| Short Circuit Current            | I <sub>OS</sub> |                          |           | ±50  |           | mA    |

VDD = 5 V ±10% , Ambient temperature -40 to +85 °C, unless stated otherwise

| Parameter                        | Symbol          | Conditions               | Min.    | Typ. | Max.    | Units |
|----------------------------------|-----------------|--------------------------|---------|------|---------|-------|
| Operating Voltage                | VDD             |                          | 4.5     |      | 5.5     | V     |
| Input High Voltage, ICLK         | V <sub>IH</sub> | Note 1                   | VDD/2+1 |      | 5.5     | V     |
| Input Low Voltage, ICLK          | V <sub>IL</sub> | Note 1                   |         |      | VDD/2-1 | V     |
| Input High Voltage, OE           | V <sub>IH</sub> |                          | 2       |      | VDD     | V     |
| Input Low Voltage, OE            | V <sub>IL</sub> |                          |         |      | 0.8     | V     |
| Output High Voltage              | V <sub>OH</sub> | I <sub>OH</sub> = -35 mA | 2.4     |      |         | V     |
| Output Low Voltage               | V <sub>OL</sub> | I <sub>OL</sub> = 35 mA  |         |      | 0.4     | V     |
| Output High Voltage (CMOS Level) | V <sub>OH</sub> | I <sub>OH</sub> = -12 mA | VDD-0.4 |      |         | V     |
| Operating Supply Current         | IDD             | No load, 135 MHz         |         | 35   |         | mA    |
| Nominal Output Impedance         | Z <sub>O</sub>  |                          |         | 20   |         | Ω     |
| Internal Pull-up Resistor        | R <sub>PU</sub> | OE                       |         | 220  |         | kΩ    |
| Input Capacitance                | C <sub>IN</sub> | OE pin                   |         | 5    |         | pF    |
| Short Circuit Current            | I <sub>OS</sub> |                          |         | ±80  |         | mA    |

Notes: 1. Nominal switching threshold is VDD/2.

## AC Electrical Characteristics

VDD = 3.3 V ±10%, Ambient Temperature -40 to +85 °C, unless stated otherwise

| Parameter              | Symbol          | Conditions            | Min. | Typ. | Max. | Units |
|------------------------|-----------------|-----------------------|------|------|------|-------|
| Input Frequency        |                 |                       | 0    |      | 160  | MHz   |
| Output Frequency       |                 | 15 pF load, Note 4    |      |      | 160  | MHz   |
| Output Clock Rise Time | t <sub>OR</sub> | 0.8 to 2.0 V          |      |      | 1.0  | ns    |
| Output Clock Fall Time | t <sub>OF</sub> | 2.0 to 0.8 V          |      |      | 1.0  | ns    |
| Propagation Delay      | Note 1          | 135 MHz               | 2    | 4    | 8    | ns    |
| Output to Output Skew  | Note 2          | Rising edges at VDD/2 |      |      | 250  | ps    |

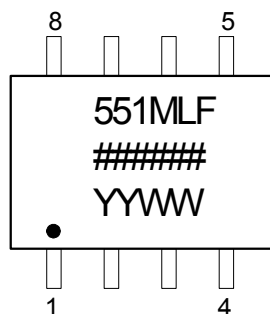
VDD = 5 V ±10%, Ambient Temperature -40 to +85 °C, unless stated otherwise

| Parameter              | Symbol          | Conditions            | Min. | Typ. | Max. | Units |
|------------------------|-----------------|-----------------------|------|------|------|-------|
| Input Frequency        |                 |                       | 0    |      | 135  | MHz   |
| Output Frequency       |                 | 15 pF load, Note 4    |      |      | 135  | MHz   |
| Output Clock Rise Time | t <sub>OR</sub> | 0.8 to 2.0 V          |      |      | 1.0  | ns    |
| Output Clock Fall Time | t <sub>OF</sub> | 2.0 to 0.8 V          |      |      | 1.0  | ns    |
| Propagation Delay      | Note 1          | 135 MHz               | 1.5  | 3    | 6    | ns    |
| Output to Output Skew  | Note 2          | Rising edges at VDD/2 |      |      | 250  | ps    |

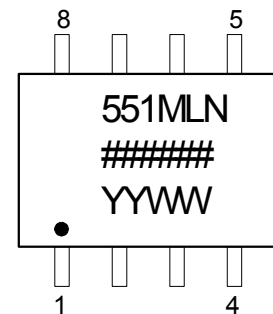
Notes:

1. With rail to rail input clock.
2. Between any 2 outputs with equal loading.
3. Duty cycle on outputs will match incoming clock duty cycle. Consult IDT for tight duty cycle clock generators.
4. With external series resistor of 33Ω positioned close to each output pin.

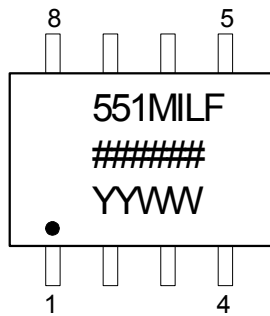
### Marking Diagram (ICS551MLF)



### Marking Diagram (ICS551MLN)



## Marking Diagram (ICS551MILF)

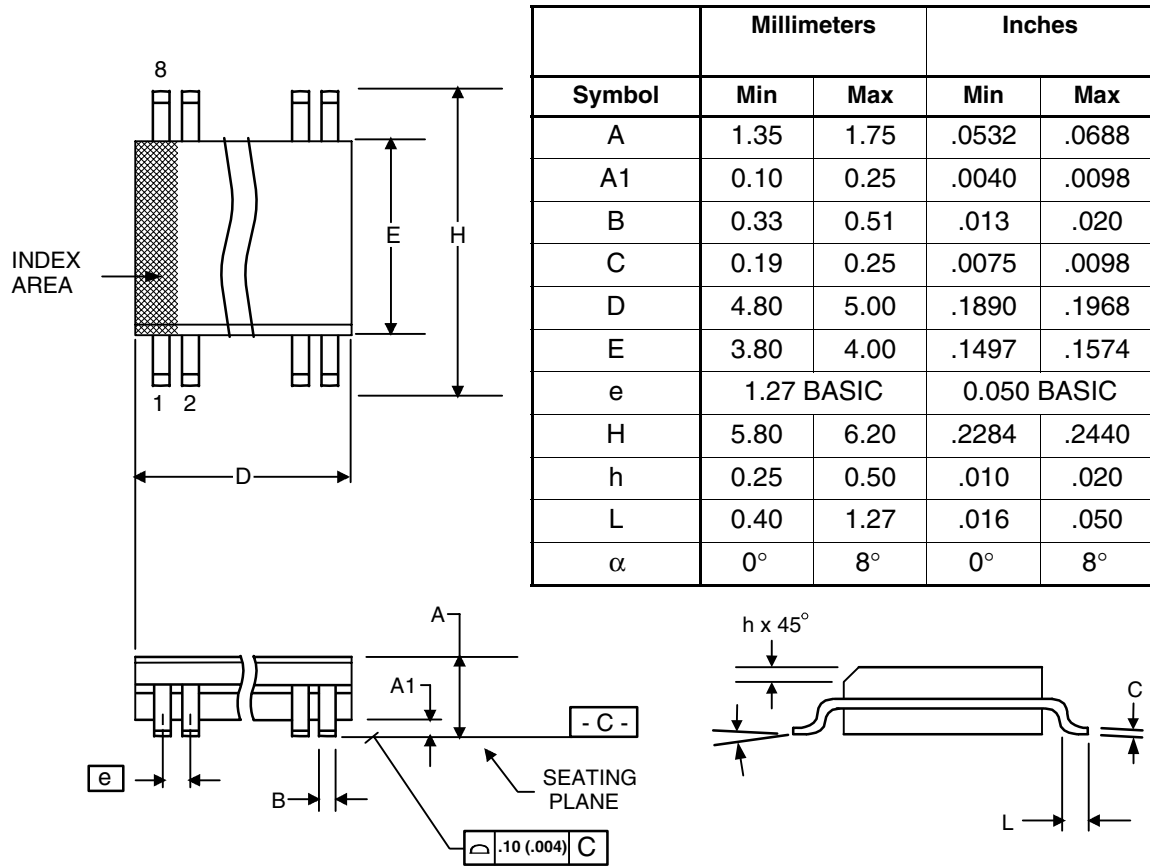


### Notes:

1. ##### is the lot number.
2. YYWW is the last two digits of the year and week that the part was assembled.
3. "LF" denotes Pb (lead) free package.
4. Bottom marking: (origin)  
Origin = country of origin if not USA.

### Package Outline and Package Dimensions (8-pin SOIC, 150 Mil. Narrow Body)

Package dimensions are kept current with JEDEC Publication No. 95



## Ordering Information

| Part / Order Number | Marking | Shipping Packaging | Package    | Temperature   |
|---------------------|---------|--------------------|------------|---------------|
| 551MLF              | 551MLF  | Tubes              | 8-pin SOIC | 0 to +70 °C   |
| 551MLFT             | 551MLF  | Tape and Reel      | 8-pin SOIC | 0 to +70 °C   |
| 551MLN              | 551MLN  | Tubes              | 8-pin SOIC | 0 to +70 °C   |
| 551MLNT             | 551MLN  | Tape and Reel      | 8-pin SOIC | 0 to +70 °C   |
| 551MILF             | 551MILF | Tubes              | 8-pin SOIC | -40 to +85 °C |
| 551MILFT            | 551MILF | Tape and Reel      | 8-pin SOIC | -40 to +85 °C |

**"LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant.**

**"LN" denotes parts that are Pb free and annealed.**

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