

# Low Voltage 1:4 CMOS Clock Buffer

The MPC94551 is a CMOS 1:4 fanout buffer. The MPC94551 is ideal for applications requiring lower voltage.

## Features

- 1:4 CMOS fanout buffer
- 300 ps output to output skew
- I/O frequency up to 160 MHz operation
- Non-inverting output clock
- 3.3 V supply voltage
- Output Enable mode tri-states outputs
- -40°C to 85°C industrial temperature range
- Standard 8-lead SOIC package

## MPC94551

### 1:4 LVCMOS CLOCK BUFFER



**D SUFFIX**  
**8-LEAD SOIC PACKAGE**  
**CASE 751-06**



**EF SUFFIX**  
**8-LEAD SOIC PACKAGE**  
**Pb-FREE PACKAGE**  
**CASE 751-06**

## ORDERING INFORMATION

Device	Package
MPC94551D	SO-8
MPC94551DR2	SO-8
MPC94551EF	SO-8 (Pb-FREE)
MPC94551EFR2	SO-8 (Pb-FREE)

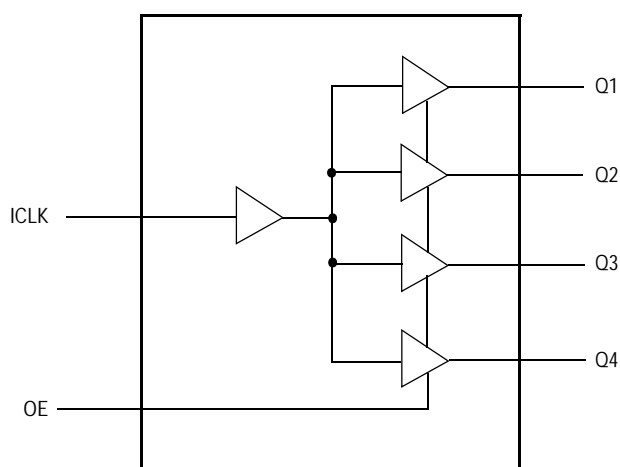


Figure 1. Logic Diagram

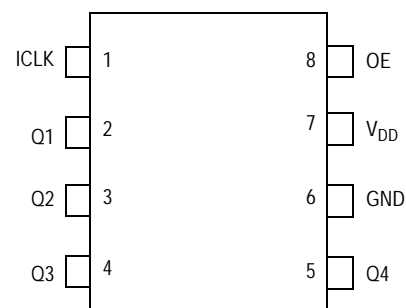


Figure 2. Pin Assignment

**Table 1. Pin Description**

Pin Number	Pin Name	Pin Type	Pin Description
1	ICLK	Input	Clock input, internal pull-up resistor
2	Q1	Output	Clock output <sup>(1)</sup>
3	Q2	Output	Clock output <sup>(1)</sup>
4	Q3	Output	Clock output <sup>(1)</sup>
5	Q4	Output	Clock output <sup>(1)</sup>
6	GND	Power	Connect to ground <sup>(2)</sup>
7	V <sub>DD</sub>	Power	Connect to 3.3 V <sup>(2)</sup>
8	OE	Input	Output enable, tri-states outputs when low, internal pull-up resistor

1. A 33  $\Omega$  series terminating resistor may be used on each clock output if the trace is longer than 1 inch.

2. A decoupling capacitor of 0.01  $\mu$ F should be connected between V<sub>DD</sub> on pin 7 and GND on pin 6, as close to the device as possible.

**Table 2. Absolute Maximum Ratings<sup>(1)</sup>**

Parameter	Rating	Unit
Power Supply Voltage, V <sub>DD</sub>	3.9	V
All Inputs and Outputs	-0.5 to V <sub>DD</sub> +0.5	V
Ambient Operating Temperature	-40 to +85	°C
Storage Temperature	-65 to +150	°C
Junction Temperature	175	°C
Soldering Temperature	260	°C

1. Stresses above the ratings listed below can cause permanent damage to the device. These ratings 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.

**Table 3. DC Characteristics** (V<sub>DD</sub> = 3.3 V  $\pm$  5%; Ambient Temperature = -40°C to 85°C)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Voltage	V <sub>DD</sub>		3.15		3.45	V
Input High Voltage <sup>(1)</sup> , ICLK	V <sub>IH</sub>		V <sub>DD</sub> /2 + 0.7		3.8	V
Input Low Voltage <sup>(1)</sup> , ICLK	V <sub>IL</sub>				V <sub>DD</sub> /2 - 0.7	V
Input High Voltage, OE	V <sub>IH</sub>		2		V <sub>DD</sub>	V
Input Low Voltage, OE	V <sub>IL</sub>				0.8	V
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 12 mA			0.4	V
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -12 mA	2.4			V
Operating Supply Current	I <sub>DD</sub>	No load, 135 MHz		30		mA
Nominal Output Impedance	Z <sub>O</sub>			27		$\Omega$
Internal Pull-up Resistor	R <sub>PU</sub>	ICLK		31		k $\Omega$
Input Capacitance	C <sub>IN</sub>	OE pin		5		pF
	C <sub>IN</sub>	ICLK		1		pF
Short Circuit Current	I <sub>OS</sub>			$\pm$ 50		mA

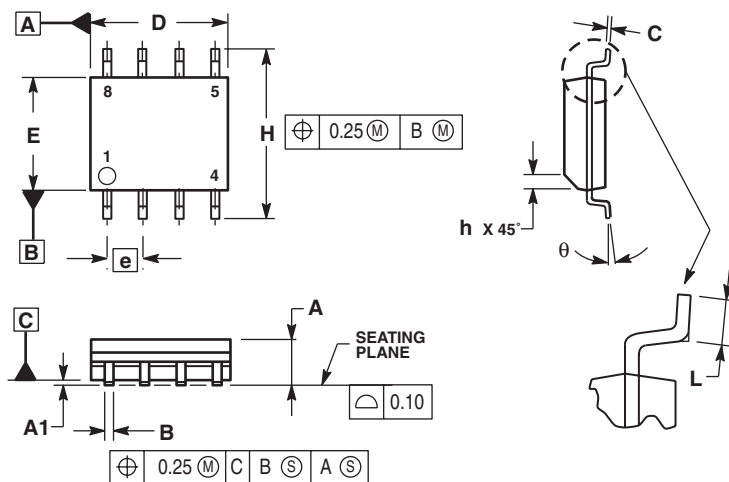
1. Nominal switching threshold is V<sub>DD</sub>/2.

**Table 4. AC Characteristics** ( $V_{DD} = 3.3 \text{ V} \pm 5\%$ ; Ambient Temperature =  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ )

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Frequency			0		160	MHz
Output Frequency <sup>(1)</sup>		15 pF load			160	MHz
Output Clock Rise Time	$t_{OR}$	0.8 V to 2.0 V			1.5	ns
Output Clock Fall Time	$t_{OF}$	2.0 V to 0.8 V			1.5	ns
Propagation Delay <sup>(2)</sup>		135 MHz	1.5	4	5	ns
Output to Output Skew <sup>(3)</sup>		Rising edges at $V_{DD}/2$			300	ps

1. Measured with an external series resistor of  $33\Omega$  positioned close to each output pin
2. Measured with rail to rail input clock
3. Measured between any 2 outputs with equal loading

## PACKAGE DIMENSIONS



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. DIMENSIONS ARE IN MILLIMETER.
  3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
  5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS	
	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
$\theta$	0°	7°

**D/EF SUFFIX  
SOIC PACKAGE  
CASE 751-06  
ISSUE T**

## ***How to Reach Us:***

### **Home Page:**

[www.freescale.com](http://www.freescale.com)

### **E-mail:**

[support@freescale.com](mailto:support@freescale.com)

### **USA/Europe or Locations Not Listed:**

Freescale Semiconductor  
Technical Information Center, CH370  
1300 N. Alma School Road  
Chandler, Arizona 85224  
+1-800-521-6274 or +1-480-768-2130  
[support@freescale.com](mailto:support@freescale.com)

### **Europe, Middle East, and Africa:**

Freescale Halbleiter Deutschland GmbH  
Technical Information Center  
Schatzbogen 7  
81829 Muenchen, Germany  
+44 1296 380 456 (English)  
+46 8 52200080 (English)  
+49 89 92103 559 (German)  
+33 1 69 35 48 48 (French)  
[support@freescale.com](mailto:support@freescale.com)

### **Japan:**

Freescale Semiconductor Japan Ltd.  
Headquarters  
ARCO Tower 15F  
1-8-1, Shimo-Meguro, Meguro-ku,  
Tokyo 153-0064  
Japan  
0120 191014 or +81 3 5437 9125  
[support.japan@freescale.com](mailto:support.japan@freescale.com)

### **Asia/Pacific:**

Freescale Semiconductor Hong Kong Ltd.  
Technical Information Center  
2 Dai King Street  
Tai Po Industrial Estate  
Tai Po, N.T., Hong Kong  
+800 2666 8080  
[support.asia@freescale.com](mailto:support.asia@freescale.com)

### **For Literature Requests Only:**

Freescale Semiconductor Literature Distribution Center  
P.O. Box 5405  
Denver, Colorado 80217  
1-800-441-2447 or 303-675-2140  
Fax: 303-675-2150  
[LDCForFreescaleSemiconductor@hibbertgroup.com](mailto:LDCForFreescaleSemiconductor@hibbertgroup.com)

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in Freescale Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals", must be validated for each customer application by customer's technical experts. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Freescale Semiconductor product could create a situation where personal injury or death may occur. Should Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Freescale Semiconductor was negligent regarding the design or manufacture of the part.

Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc. All other product or service names are the property of their respective owners.

© Freescale Semiconductor, Inc. 2005. All rights reserved.