

## GENERAL DESCRIPTION

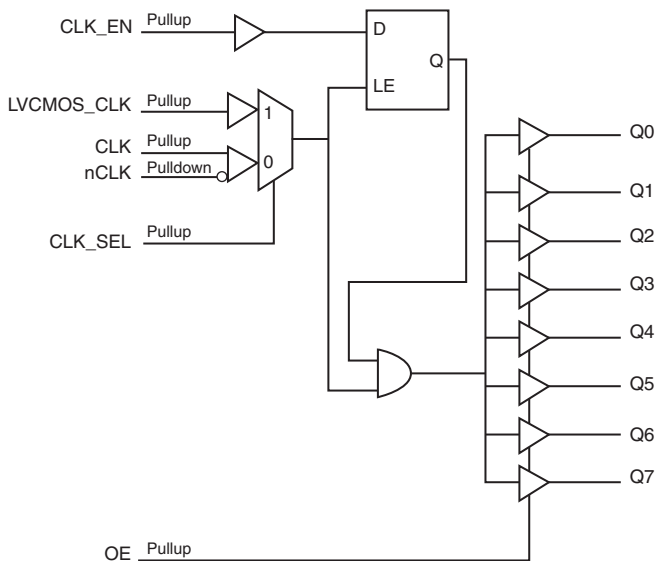
The 8308I is a low-skew, 1-to-8 Fanout Buffer. The 8308I has two selectable clock inputs. The CLK, nCLK pair can accept most differential input levels. The LVCMOS\_CLK can accept LVCMOS or LVTTTL input levels. The low impedance LVCMOS/LVTTTL outputs are designed to drive 50Ω series or parallel terminated transmission lines. The effective fanout can be increased from 8 to 16 by utilizing the ability of the outputs to drive two series terminated transmission lines.

The 8308I is characterized for 3.3V core/3.3V output, 3.3V core/2.5V output or 2.5V core/2.5V output operation. Guaranteed output and part-part skew characteristics make the 8308I ideal for those clock distribution applications requiring well defined performance and repeatability.

## FEATURES

- Eight LVCMOS/LVTTTL outputs, (7Ω typical output impedance)
- Selectable LVCMOS\_CLK or differential CLK, nCLK inputs
- CLK, nCLK pair can accept the following differential input levels: LVPECL, LVDS, LVHSTL, SSTL, HCSL
- Maximum Output Frequency: 350MHz
- Output Skew: (3.3V± 5%): 100ps (maximum)
- Part to Part Skew: (3.3V± 5%): 1ns (maximum)
- Supply Voltage Modes:  
(Core/Output)  
3.3V/3.3V  
3.3V/2.5V  
2.5V/2.5V
- -40°C to 85°C ambient operating temperature
- Available in lead-free (RoHS 6) package

## BLOCK DIAGRAM



## PIN ASSIGNMENT

|                  |    |    |                  |
|------------------|----|----|------------------|
| Q0               | 1  | 24 | V <sub>DDO</sub> |
| GND              | 2  | 23 | Q2               |
| CLK_SEL          | 3  | 22 | GND              |
| LVC MOS_CLK      | 4  | 21 | Q3               |
| CLK              | 5  | 20 | V <sub>DDO</sub> |
| nCLK             | 6  | 19 | Q4               |
| CLK_EN           | 7  | 18 | GND              |
| OE               | 8  | 17 | Q5               |
| V <sub>DD</sub>  | 9  | 16 | V <sub>DDO</sub> |
| GND              | 10 | 15 | Q6               |
| Q1               | 11 | 14 | GND              |
| V <sub>DDO</sub> | 12 | 13 | Q7               |

**8308I**  
**24-Lead, 173-MIL TSSOP**  
 4.4mm x 7.8mm x 0.925mm body package  
**G Package**  
 Top View

**TABLE 1. PIN DESCRIPTIONS**

| Number                           | Name                              | Type   |          | Description  |
|----------------------------------|-----------------------------------|--------|----------|--|
| 1, 11, 13, 15,<br>17, 19, 21, 23 | Q0, Q1, Q7, Q6,<br>Q5, Q4, Q3, Q2 | Output |          | Clock outputs. LVCMOS / LVTTTL interface levels.   |
| 2, 10, 14, 18, 22                | GND                               | Power  |          | Power supply ground.   |
| 3                                | CLK_SEL                           | Input  | Pullup   | Clock select input. Selects LVCMOS clock input when HIGH. Selects CLK, nCLK inputs when LOW. See Table 3A. LVCMOS / LVTTTL interface levels. |
| 4                                | LVCMOS_CLK                        | Input  | Pullup   | Clock input. LVCMOS / LVTTTL interface levels.   |
| 5                                | CLK                               | Input  | Pullup   | Non-inverting differential clock input.  |
| 6                                | nCLK                              | Input  | Pulldown | Inverting differential clock input.  |
| 7                                | CLK_EN                            | Input  | Pullup   | Clock enable. LVCMOS / LVTTTL interface levels.  |
| 8                                | OE                                | Input  | Pullup   | Output enable. LVCMOS / LVTTTL interface levels. See Table 3B.   |
| 9                                | V <sub>DD</sub>                   | Power  |          | Power supply pin.  |
| 12, 16, 20, 24                   | V <sub>DDO</sub>                  | Power  |          | Output supply pins.  |

NOTE: *Pullup* and *Pulldown* refer to internal input resistors. See Table 2, Pin Characteristics, for typical values.

**TABLE 2. PIN CHARACTERISTICS**

| Symbol                | Parameter                                  | Test Conditions | Minimum | Typical | Maximum | Units |
|-----------------------|--|-----------------|---------|---------|---------|-------|
| C <sub>IN</sub>       | Input Capacitance                          |                 |         | 4       |         | pF    |
| C <sub>PD</sub>       | Power Dissipation Capacitance (per output) |                 |         | 12      |         | pF    |
| R <sub>PULLUP</sub>   | Input Pullup Resistor                      |                 |         | 51      |         | kΩ    |
| R <sub>PULLDOWN</sub> | Input Pulldown Resistor                    |                 |         | 51      |         | kΩ    |
| R <sub>OUT</sub>      | Output Impedance                           |                 | 5       | 7       | 12      | Ω     |

**TABLE 3A. CLOCK SELECT FUNCTION TABLE**

| Control Input | Clock Input            |
|---------------|------------------------|
| CLK_SEL       |                        |
| 0             | CLK, nCLK is selected  |
| 1             | LVCMOS_CLK is selected |

**TABLE 3B. OE SELECT FUNCTION TABLE**

| Control Input | Output Operation                     |
|---------------|--------------------------------------|
| OE            |                                      |
| 0             | Outputs Q0:Q7 are in Hi-Z (disabled) |
| 1             | Outputs Q0:Q7 are active (enabled)   |

**TABLE 3C. CLOCK INPUT FUNCTION TABLE**

| Inputs  |            |                |                | Outputs | Input to Output Mode         | Polarity      |
|---------|------------|----------------|----------------|---------|------------------------------|---------------|
| CLK_SEL | LVCMOS_CLK | CLK            | nCLK           | Q0:Q7   |                              |               |
| 0       | —          | 0              | 1              | LOW     | Differential to Single Ended | Non Inverting |
| 0       | —          | 1              | 0              | HIGH    | Differential to Single Ended | Non Inverting |
| 0       | —          | 0              | Biased; NOTE 1 | LOW     | Single Ended to Single Ended | Non Inverting |
| 0       | —          | 1              | Biased; NOTE 1 | HIGH    | Single Ended to Single Ended | Non Inverting |
| 0       | —          | Biased; NOTE 1 | 0              | HIGH    | Single Ended to Single Ended | Inverting     |
| 0       | —          | Biased; NOTE 1 | 1              | LOW     | Single Ended to Single Ended | Inverting     |
| 1       | 0          | —              | —              | LOW     | Single Ended to Single Ended | Non Inverting |
| 1       | 1          | —              | —              | HIGH    | Single Ended to Single Ended | Non Inverting |

NOTE 1: Please refer to the Application Information section, "Wiring the Differential Input to Accept Single Ended Levels".

**ABSOLUTE MAXIMUM RATINGS**

|  |                           |
|--|---------------------------|
| Supply Voltage, $V_{DD}$                 | 4.6V                      |
| Inputs, $V_I$                            | -0.5V to $V_{DD} + 0.5V$  |
| Outputs, $V_O$                           | -0.5V to $V_{DDO} + 0.5V$ |
| Package Thermal Impedance, $\theta_{JA}$ | 70°C/W (0 lfm)            |
| Storage Temperature, $T_{STG}$           | -65°C to 150°C            |

NOTE: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These ratings are stress specifications only. Functional operation of product at these conditions or any conditions beyond those listed in the *DC Characteristics* or *AC Characteristics* is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

**TABLE 4A. POWER SUPPLY DC CHARACTERISTICS,  $V_{DD} = V_{DDO} = 3.3V \pm 5\%$ ,  $T_A = -40^\circ$  TO  $85^\circ$** 

| Symbol    | Parameter             | Test Conditions | Minimum | Typical | Maximum | Units |
|-----------|-----------------------|-----------------|---------|---------|---------|-------|
| $V_{DD}$  | Power Supply Voltage  |                 | 3.135   | 3.3     | 3.465   | V     |
| $V_{DDO}$ | Output Supply Voltage |                 | 3.135   | 3.3     | 3.465   | V     |
| $I_{DD}$  | Power Supply Current  |                 |         |         | 46      | mA    |
| $I_{DDO}$ | Output Supply Current |                 |         |         | 11      | mA    |

**TABLE 4B. POWER SUPPLY DC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $V_{DDO} = 2.5V \pm 5\%$ ,  $T_A = -40^\circ$  TO  $85^\circ$** 

| Symbol    | Parameter             | Test Conditions | Minimum | Typical | Maximum | Units |
|-----------|-----------------------|-----------------|---------|---------|---------|-------|
| $V_{DD}$  | Power Supply Voltage  |                 | 3.135   | 3.3     | 3.465   | V     |
| $V_{DDO}$ | Output Supply Voltage |                 | 2.375   | 2.5     | 2.625   | V     |
| $I_{DD}$  | Power Supply Current  |                 |         |         | 46      | mA    |
| $I_{DDO}$ | Output Supply Current |                 |         |         | 10      | mA    |

**TABLE 4C. POWER SUPPLY DC CHARACTERISTICS,  $V_{DD}, V_{DDO} = 2.5V \pm 5\%$ ,  $T_A = -40^\circ$  TO  $85^\circ$** 

| Symbol    | Parameter             | Test Conditions | Minimum | Typical | Maximum | Units |
|-----------|-----------------------|-----------------|---------|---------|---------|-------|
| $V_{DD}$  | Power Supply Voltage  |                 | 2.375   | 2.5     | 2.625   | V     |
| $V_{DDO}$ | Output Supply Voltage |                 | 2.375   | 2.5     | 2.625   | V     |
| $I_{DD}$  | Power Supply Current  |                 |         |         | 43      | mA    |
| $I_{DDO}$ | Output Supply Current |                 |         |         | 10      | mA    |

**TABLE 4D. DC CHARACTERISTICS,  $V_{DD} = V_{DDO} = 3.3V \pm 5\%$ ,  $T_A = -40^\circ$  TO  $85^\circ$** 

| Symbol    | Parameter                            | Test Conditions                     | Minimum   | Typical | Maximum         | Units   |
|-----------|--------------------------------------|-------------------------------------|-----------|---------|-----------------|---------|
| $V_{IH}$  | Input High Voltage                   | LVC MOS                             | 2         |         | $V_{DD} + 0.3$  | V       |
| $V_{IL}$  | Input Low Voltage                    | LVC MOS_CLK                         | -0.3      |         | 1.3             | V       |
|           |                                      | CLK_EN, OE                          |           |         | 0.8             | V       |
| $I_{IN}$  | Input Current                        | $V_{IN} = V_{DD}$ or $V_{IN} = GND$ |           |         | 300             | $\mu A$ |
| $V_{OH}$  | Output High Voltage; NOTE 1          | $I_{OH} = -24mA$                    | 2.4       |         |                 | V       |
| $V_{OL}$  | Output Low Voltage; NOTE 1           | $I_{OL} = 24mA$                     |           |         | 0.55            | V       |
|           |                                      | $I_{OL} = 12mA$                     |           |         | 0.30            | V       |
| $V_{PP}$  | Peak-to-Peak Input Voltage           | CLK, nCLK                           | 0.15      |         | 1.3             | V       |
| $V_{CMR}$ | Input Common Mode Voltage; NOTE 2, 3 | CLK, nCLK                           | GND + 0.5 |         | $V_{DD} - 0.85$ | V       |

NOTE 1: Outputs capable of driving  $50\Omega$  transmission lines terminated with  $50\Omega$  to  $V_{DDO}/2$ .

See Parameter Measurement section, "3.3V Output Load AC Test Circuit".

NOTE 2: For single ended applications, the maximum input voltage for CLK, nCLK is  $V_{DD} + 0.3V$ .

NOTE 3: Common mode voltage is defined as  $V_{IH}$ .

**TABLE 4E. DC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $V_{DDO} = 2.5V \pm 5\%$ ,  $T_A = -40^\circ$  TO  $85^\circ$** 

| Symbol    | Parameter                            | Test Conditions                     | Minimum   | Typical | Maximum         | Units   |
|-----------|--------------------------------------|-------------------------------------|-----------|---------|-----------------|---------|
| $V_{IH}$  | Input High Voltage                   | LVC MOS                             | 2         |         | $V_{DD} + 0.3$  | V       |
| $V_{IL}$  | Input Low Voltage                    | LVC MOS_CLK                         | -0.3      |         | 1.3             | V       |
|           |                                      | CLK_EN, OE                          |           |         | 0.8             | V       |
| $I_{IN}$  | Input Current                        | $V_{IN} = V_{DD}$ or $V_{IN} = GND$ |           |         | 300             | $\mu A$ |
| $V_{OH}$  | Output High Voltage; NOTE 1          | $I_{OH} = -15mA$                    | 1.8       |         |                 | V       |
| $V_{OL}$  | Output Low Voltage; NOTE 1           | $I_{OL} = 15mA$                     |           |         | 0.6             | V       |
| $V_{PP}$  | Peak-to-Peak Input Voltage           | CLK, nCLK                           | 0.15      |         | 1.3             | V       |
| $V_{CMR}$ | Input Common Mode Voltage; NOTE 2, 3 | CLK, nCLK                           | GND + 0.5 |         | $V_{DD} - 0.85$ | V       |

NOTE 1: Outputs capable of driving  $50\Omega$  transmission lines terminated with  $50\Omega$  to  $V_{DDO}/2$ .

See Parameter Measurement section, "3.3V Output Load AC Test Circuit".

NOTE 2: For single ended applications, the maximum input voltage for CLK, nCLK is  $V_{DD} + 0.3V$ .

NOTE 3: Common mode voltage is defined as  $V_{IH}$ .

**TABLE 4F. DC CHARACTERISTICS,  $V_{DD}, V_{DDO} = 2.5V \pm 5\%$ ,  $T_A = -40^\circ$  TO  $85^\circ$** 

| Symbol    | Parameter                            | Test Conditions                     | Minimum   | Typical | Maximum         | Units   |
|-----------|--------------------------------------|-------------------------------------|-----------|---------|-----------------|---------|
| $V_{IH}$  | Input High Voltage                   | LVC MOS                             | 1.7       |         | $V_{DD} + 0.3$  | V       |
| $V_{IL}$  | Input Low Voltage                    | LVC MOS_CLK                         | -0.3      |         | 0.7             | V       |
|           |                                      | CLK_EN, OE                          |           |         | 0.7             | V       |
| $I_{IN}$  | Input Current                        | $V_{IN} = V_{DD}$ or $V_{IN} = GND$ |           |         | 300             | $\mu A$ |
| $V_{OH}$  | Output High Voltage; NOTE 1          | $I_{OH} = -15mA$                    | 1.8       |         |                 | V       |
| $V_{OL}$  | Output Low Voltage; NOTE 1           | $I_{OL} = 15mA$                     |           |         | 0.6             | V       |
| $V_{PP}$  | Peak-to-Peak Input Voltage           | CLK, nCLK                           | 0.15      |         | 1.3             | V       |
| $V_{CMR}$ | Input Common Mode Voltage; NOTE 2, 3 | CLK, nCLK                           | GND + 0.5 |         | $V_{DD} - 0.85$ | V       |

NOTE 1: Outputs capable of driving 50 $\Omega$  transmission lines terminated with 50 $\Omega$  to  $V_{DDO}/2$ .

See Parameter Measurement section, "3.3V Output Load AC Test Circuit".

NOTE 2: For single ended applications, the maximum input voltage for CLK, nCLK is  $V_{DD} + 0.3V$ .

NOTE 3: Common mode voltage is defined as  $V_{IH}$ .

**TABLE 5A. AC CHARACTERISTICS,  $V_{DD} = V_{DDO} = 3.3V \pm 5\%$ ,  $T_A = -40^\circ$  TO  $85^\circ$** 

| Symbol             | Parameter                       | Test Conditions                       | Minimum         | Typical | Maximum | Units |
|--------------------|---------------------------------|---------------------------------------|-----------------|---------|---------|-------|
| $f_{OUT}$          | Output Frequency                |                                       |                 |         | 350     | MHz   |
| $t_{PD}$           | Propagation Delay;              | CLK, nCLK; NOTE 1                     | $f \leq 350MHz$ | 2       | 4       | ns    |
|                    |                                 | LVC MOS_CLK; NOTE 2                   | $f \leq 350MHz$ | 2       | 4       | ns    |
| tsk(o)             | Output Skew; NOTE 3, 7          | Measured on rising edge @ $V_{DDO}/2$ |                 |         | 100     | ps    |
| tsk(pp)            | Part-to-Part Skew; NOTE 4, 7    | Measured on rising edge @ $V_{DDO}/2$ |                 |         | 1       | ns    |
| $t_R / t_F$        | Output Rise/Fall Time           | 0.8V to 2V                            | 0.2             |         | 1       | ns    |
| odc                | Output Duty Cycle               | $f \leq 150MHz$ , Ref = CLK, nCLK     | 45              |         | 55      | %     |
| $t_{PZL}, t_{PZH}$ | Output Enable Time; NOTE 5      |                                       |                 |         | 5       | ns    |
| $t_{PLZ}, t_{PHZ}$ | Output Disable Time; NOTE 5     |                                       |                 |         | 5       | ns    |
| $t_S$              | Clock Enable Setup Time; NOTE 6 | CLK_EN to CLK, nCLK                   |                 | 1       |         | ns    |
|                    |                                 | CLK_EN to LVC MOS_CLK                 |                 | 0       |         | ns    |
| $t_H$              | Clock Enable Hold Time; NOTE 6  | CLK, nCLK to CLK_EN                   |                 | 0       |         | ns    |
|                    |                                 | LVC MOS_CLK to CLK_EN                 |                 | 1       |         | ns    |

NOTE: Electrical parameters are guaranteed over the specified ambient operating temperature range, which is established when the device is mounted in a test socket with maintained transverse airflow greater than 500 lfm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

NOTE 1: Measured from the differential input crossing point to  $V_{DDO}/2$  of the output.

NOTE 2: Measured from  $V_{DD}/2$  of the input to  $V_{DDO}/2$  of the output.

NOTE 3: Defined as skew between outputs at the same supply voltage and with equal load conditions.

Measured at  $V_{DDO}/2$ .

NOTE 4: Defined as skew between outputs on different devices operating at the same supply voltages and with equal load conditions. Using the same type of inputs on each device, the outputs are measured at  $V_{DDO}/2$ .

NOTE 5: These parameters are guaranteed by characterization. Not tested in production.

NOTE 6: Setup and Hold times are relative to the rising edge of the input clock.

NOTE 7: This parameter is defined in accordance with JEDEC Standard 65.

**TABLE 5B. AC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $V_{DDO} = 2.5V \pm 5\%$ ,  $T_A = -40^\circ$  TO  $85^\circ$** 

| Symbol             | Parameter                       | Test Conditions                          | Minimum                | Typical | Maximum | Units |
|--------------------|---------------------------------|--|------------------------|---------|---------|-------|
| $f_{OUT}$          | Output Frequency                |  |                        |         | 350     | MHz   |
| $t_{PD}$           | Propagation Delay;              | CLK, nCLK;<br>NOTE 1                     | $f \leq 350\text{MHz}$ | 2       | 4       | ns    |
|                    |                                 | LVC MOS_CLK;<br>NOTE 2                   | $f \leq 350\text{MHz}$ | 2       | 4       | ns    |
| $t_{sk(o)}$        | Output Skew; NOTE 3, 7          | Measured on rising edge @ $V_{DDO}/2$    |                        |         | 100     | ps    |
| $t_{sk(pp)}$       | Part-to-Part Skew; NOTE 4, 7    | Measured on rising edge @ $V_{DDO}/2$    |                        |         | 1       | ns    |
| $t_R / t_F$        | Output Rise/Fall Time           | 0.6V to 1.8V                             | 0.2                    |         | 1.0     | ns    |
| odc                | Output Duty Cycle               | $f \leq 150\text{MHz}$ , Ref = CLK, nCLK | 45                     |         | 55      | %     |
| $t_{PZL}, t_{PZH}$ | Output Enable Time; NOTE 5      |  |                        |         | 5       | ns    |
| $t_{PLZ}, t_{PHZ}$ | Output Disable Time; NOTE 5     |  |                        |         | 5       | ns    |
| $t_S$              | Clock Enable Setup Time; NOTE 6 | CLK_EN to CLK, nCLK                      |                        | 1       |         | ns    |
|                    |                                 | CLK_EN to LVC MOS_CLK                    |                        | 0       |         | ns    |
| $t_H$              | Clock Enable Hold Time; NOTE 6  | CLK, nCLK to CLK_EN                      |                        | 0       |         | ns    |
|                    |                                 | LVC MOS_CLK to CLK_EN                    |                        | 1       |         | ns    |

NOTE: Electrical parameters are guaranteed over the specified ambient operating temperature range, which is established when the device is mounted in a test socket with maintained transverse airflow greater than 500 lfm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

NOTE 1: Measured from the differential input crossing point to  $V_{DDO}/2$  of the output.

NOTE 2: Measured from  $V_{DD}/2$  of the input to  $V_{DDO}/2$  of the output.

NOTE 3: Defined as skew between outputs at the same supply voltage and with equal load conditions. Measured at  $V_{DDO}/2$ .

NOTE 4: Defined as skew between outputs on different devices operating at the same supply voltages and with equal load conditions. Using the same type of inputs on each device, the outputs are measured at  $V_{DDO}/2$ .

NOTE 5: These parameters are guaranteed by characterization. Not tested in production.

NOTE 6: Setup and Hold times are relative to the rising edge of the input clock.

NOTE 7: This parameter is defined in accordance with JEDEC Standard 65.

**TABLE 5C. AC CHARACTERISTICS,  $V_{DD} = V_{DDO} = 2.5V \pm 5\%$ ,  $T_A = -40^\circ$  TO  $85^\circ$** 

| Symbol             | Parameter                       | Test Conditions                          | Minimum                | Typical | Maximum | Units |
|--------------------|---------------------------------|--|------------------------|---------|---------|-------|
| $f_{OUT}$          | Output Frequency                |  |                        |         | 350     | MHz   |
| $t_{PD}$           | Propagation Delay;              | CLK, nCLK;<br>NOTE 1                     | $f \leq 350\text{MHz}$ | 1.5     | 4.2     | ns    |
|                    |                                 | LVC MOS_CLK;<br>NOTE 2                   | $f \leq 350\text{MHz}$ | 1.7     | 4.4     | ns    |
| $t_{sk(o)}$        | Output Skew; NOTE 3, 7          | Measured on rising edge @ $V_{DDO}/2$    |                        |         | 160     | ps    |
| $t_{sk(pp)}$       | Part-to-Part Skew; NOTE 4, 7    | Measured on rising edge @ $V_{DDO}/2$    |                        |         | 2       | ns    |
| $t_R / t_F$        | Output Rise/Fall Time           | 0.6V to 1.8V                             | 0.2                    |         | 1.0     | ns    |
| odc                | Output Duty Cycle               | $f \leq 150\text{MHz}$ , Ref = CLK, nCLK | 40                     |         | 60      | %     |
| $t_{PZL}, t_{PZH}$ | Output Enable Time; NOTE 5      |  |                        |         | 5       | ns    |
| $t_{PLZ}, t_{PHZ}$ | Output Disable Time; NOTE 5     |  |                        |         | 5       | ns    |
| $t_S$              | Clock Enable Setup Time; NOTE 6 | CLK_EN to CLK, nCLK                      | 1                      |         |         | ns    |
|                    |                                 | CLK_EN to LVC-MOS_CLK                    | 0                      |         |         | ns    |
| $t_H$              | Clock Enable Hold Time; NOTE 6  | CLK, nCLK to CLK_EN                      | 0                      |         |         | ns    |
|                    |                                 | LVC MOS_CLK to CLK_EN                    | 1                      |         |         | ns    |

NOTE: Electrical parameters are guaranteed over the specified ambient operating temperature range, which is established when the device is mounted in a test socket with maintained transverse airflow greater than 500 lfm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

NOTE 1: Measured from the differential input crossing point to  $V_{DDO}/2$  of the output.

NOTE 2: Measured from  $V_{DD}/2$  of the input to  $V_{DDO}/2$  of the output.

NOTE 3: Defined as skew between outputs at the same supply voltage and with equal load conditions. Measured at  $V_{DDO}/2$ .

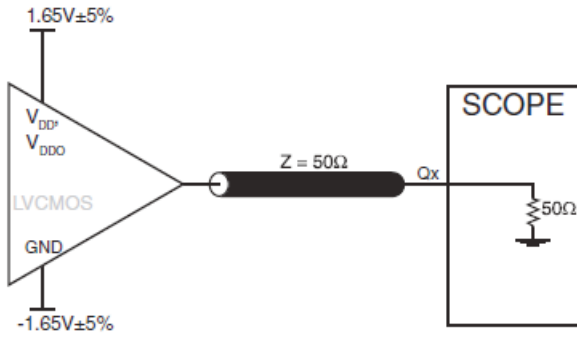
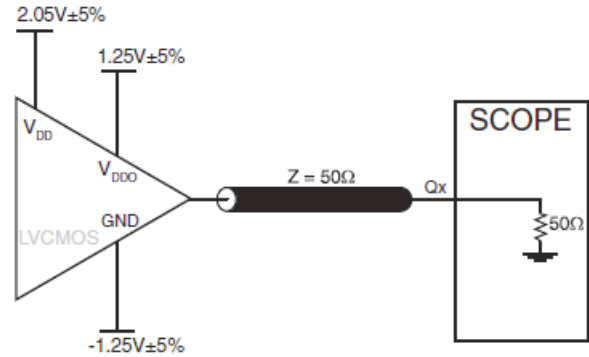
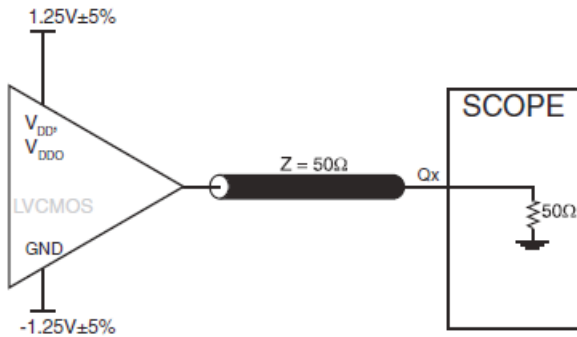
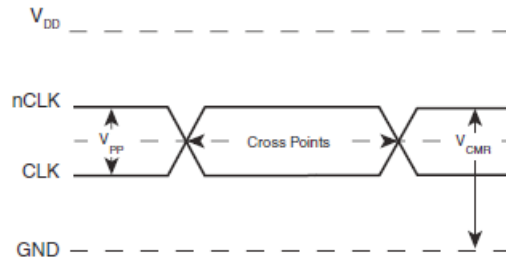
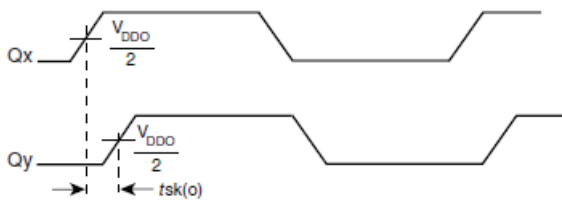
NOTE 4: Defined as skew between outputs on different devices operating at the same supply voltages and with equal load conditions. Using the same type of inputs on each device, the outputs are measured at  $V_{DDO}/2$ .

NOTE 5: These parameters are guaranteed by characterization. Not tested in production.

NOTE 6: Setup and Hold times are relative to the rising edge of the input clock.

NOTE 7: This parameter is defined in accordance with JEDEC Standard 65.

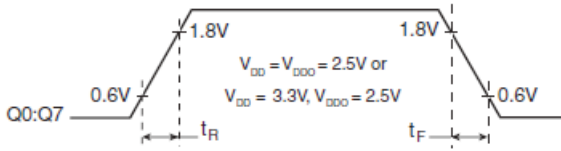
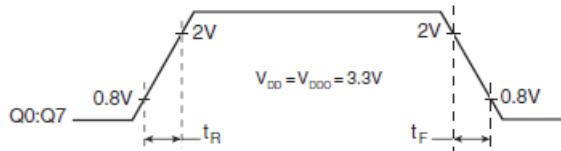
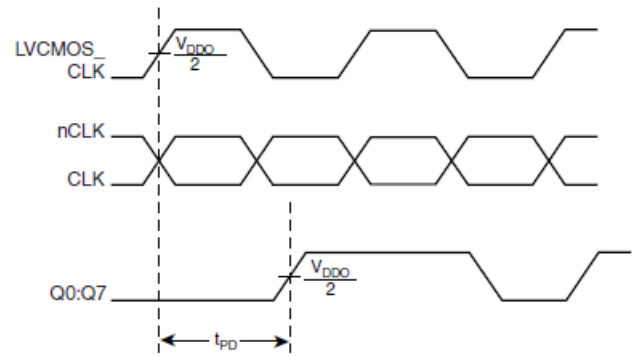
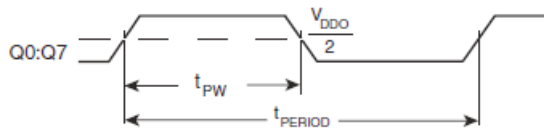
# PARAMETER MEASUREMENT INFORMATION


**3.3V CORE/3.3V OUTPUT LOAD AC TEST CIRCUIT**

**3.3V CORE/2.5V OUTPUT LOAD AC TEST CIRCUIT**

**2.5V CORE/2.5V OUTPUT LOAD AC TEST CIRCUIT**

**DIFFERENTIAL INPUT LEVEL**

**OUTPUT SKEW**

**PART-TO-PART SKEW**



## PARAMETER MEASUREMENT INFORMATION, CONTINUED


**OUTPUT RISE/FALL TIME**

**PROPAGATION DELAY**


$$odc = \frac{t_{PW}}{t_{PERIOD}} \times 100\%$$

**OUTPUT DUTY CYCLE/PULSE WIDTH/PERIOD**

## APPLICATION INFORMATION

### WIRING THE DIFFERENTIAL INPUT TO ACCEPT SINGLE ENDED LEVELS

Figure 1 shows how a differential input can be wired to accept single ended levels. The reference voltage  $V_{REF} = V_{DD}/2$  is generated by the bias resistors R1 and R2. The bypass capacitor (C1) is used to help filter noise on the DC bias. This bias circuit should be located as close to the input pin as possible. The ratio of R1 and R2 might need to be adjusted to position the  $V_{REF}$  in the center of the input voltage swing. For example, if the input clock swing is 2.5V and  $V_{DD} = 3.3V$ , R1 and R2 value should be adjusted to set  $V_{REF}$  at 1.25V. The values below are for when both the single-ended swing and  $V_{DD}$  are at the same voltage. This configuration requires that the sum of the output impedance of the driver ( $R_o$ ) and the series resistance ( $R_s$ ) equals the transmission line impedance. In addition, matched termination at the input will attenuate the signal in half. This can be done in one of two ways. First, R3 and R4 in parallel should equal the

transmission line impedance. For most 50 applications, R3 and R4 can be 100Ω. The values of the resistors can be increased to reduce the loading for slower and weaker LVCMOS driver. When using single ended signaling, the noise rejection benefits of differential signaling are reduced. Even though the differential input can handle full rail LVCMOS signaling, it is recommended that the amplitude be reduced. The datasheet specifies a lower differential amplitude, however this only applies to differential signals. For single-ended applications, the swing can be larger, however  $V_{IL}$  cannot be less than  $-0.3V$  and  $V_{IH}$  cannot be more than  $V_{DD} + 0.3V$ . Though some of the recommended components might not be used, the pads should be placed in the layout. They can be utilized for debugging purposes. The datasheet specifications are characterized and guaranteed by using a differential signal.

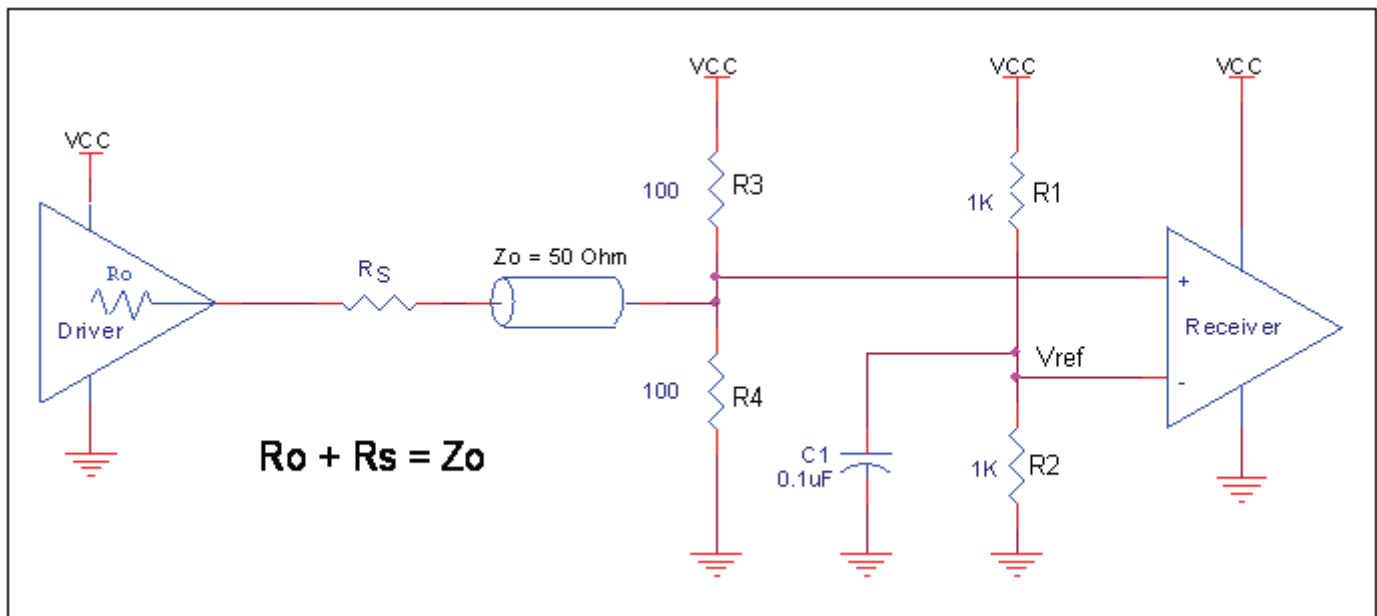
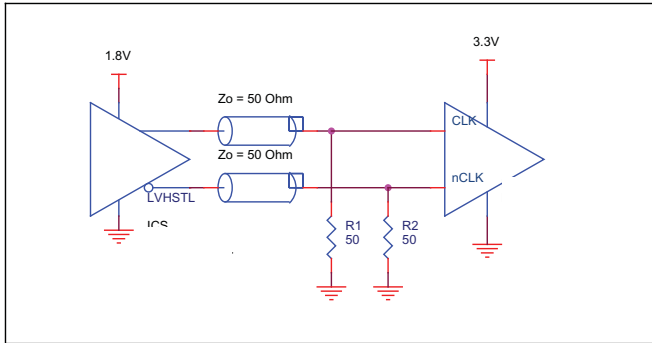


FIGURE 1. RECOMMENDED SCHEMATIC FOR WIRING A DIFFERENTIAL INPUT TO ACCEPT SINGLE-ENDED LEVELS

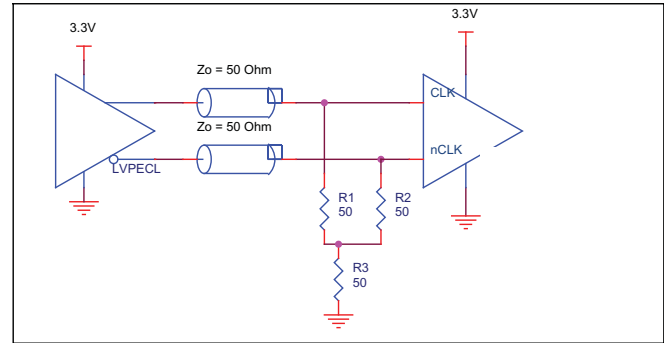
## DIFFERENTIAL CLOCK INPUT INTERFACE

The CLK /nCLK accepts LVDS, LVPECL, LVHSTL, SSTL, HCSTL and other differential signals. Both differential signals must meet the  $V_{PP}$  and  $V_{CMR}$  input requirements. Figures 2A to 2E show interface examples for the CLK/nCLK input driven by the most common driver types. The input interfaces suggested here are examples

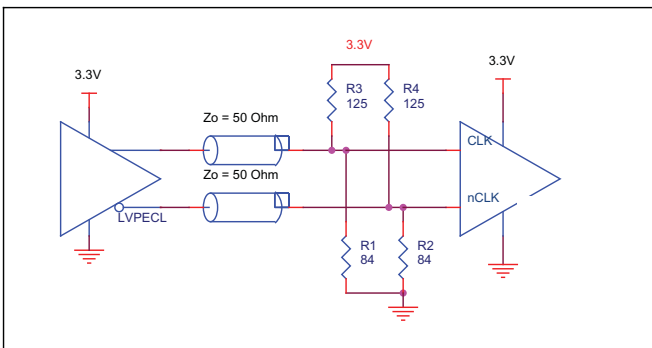
only. Please consult with the vendor of the driver component to confirm the driver termination requirements. For example in *Figure 2A*, the input termination applies for IDT LVHSTL drivers. If you are using an LVHSTL driver from another vendor, use their termination recommendation.



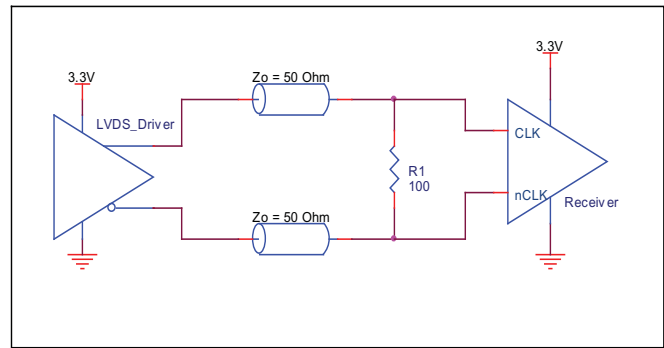
**FIGURE 2A. CLK/nCLK INPUT DRIVEN BY IDT'S LVHSTL DRIVER**



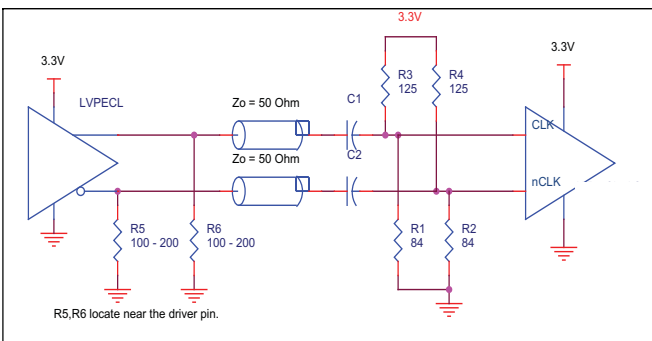
**FIGURE 2B. CLK/nCLK INPUT DRIVEN BY 3.3V LVPECL DRIVER**



**FIGURE 2C. CLK/nCLK INPUT DRIVEN BY 3.3V LVPECL DRIVER**



**FIGURE 2D. CLK/nCLK INPUT DRIVEN BY 3.3V LVDS DRIVER**



**FIGURE 2E. CLK/nCLK INPUT DRIVEN BY 3.3V LVPECL DRIVER WITH AC COUPLE**

## SCHEMATIC EXAMPLE

Figure 3 shows a schematic example of the 83081. In this example, the LVC MOS\_CLK input is selected. The decoupling

capacitors should be physically located near the power pin.

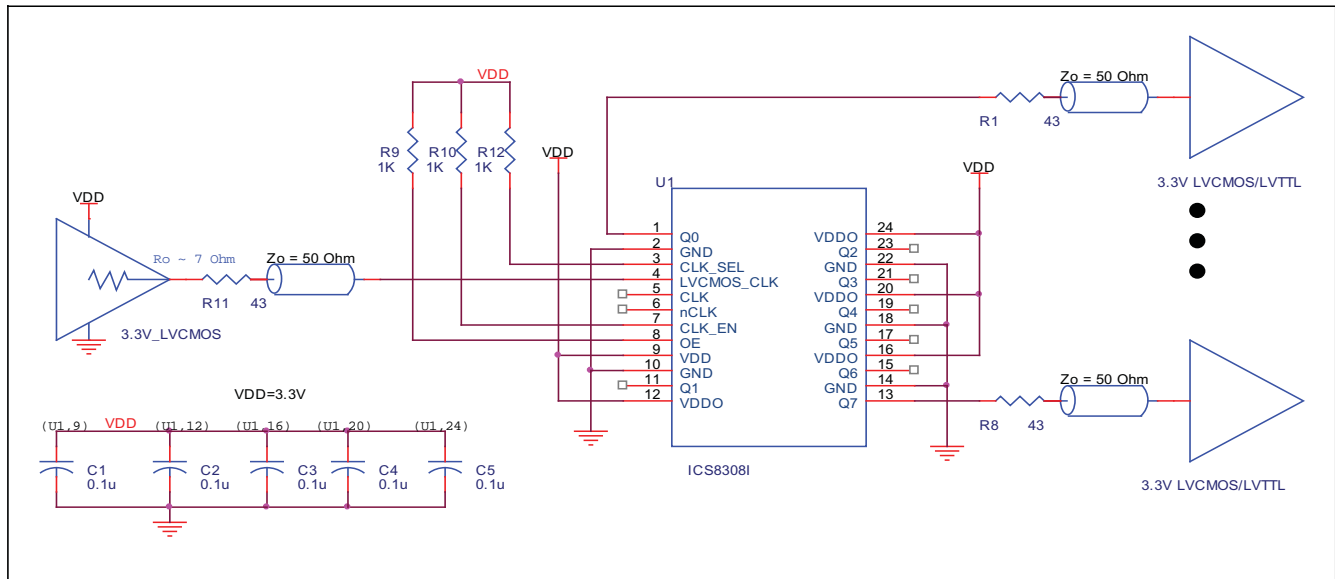


FIGURE 3. 83081 LVPECL BUFFER SCHEMATIC EXAMPLE

## RECOMMENDATIONS FOR UNUSED INPUT AND OUTPUT PINS

### INPUTS:

#### LVC MOS\_CLK INPUT

For applications not requiring the use of an LVC MOS\_CLK, it can be left floating. Though not required, but for additional protection, a 1kΩ resistor can be tied from the LVC MOS\_CLK input to ground.

#### CLK/nCLK INPUTS

For applications not requiring the use of the differential input, both CLK and nCLK can be left floating. Though not required, but for additional protection, a 1kΩ resistor can be tied from CLK to ground.

#### LVC MOS CONTROL PINS

All control pins have internal pullups or pulldowns; additional resistance is not required but can be added for additional protection. A 1kΩ resistor can be used.

### OUTPUTS:

#### LVC MOS OUTPUTS

All unused LVC MOS outputs can be left floating. There should be no trace attached.

## Power On Sequence

There is no power on sequence requirement for the  $V_{DD}$  and  $V_{DDO}$ . If the  $V_{DDO}$  is turned on before the  $V_{DD}$  there will be unknown state at the outputs during initial condition when the  $V_{DDO}$  is on and  $V_{DD}$  is off.

## RELIABILITY INFORMATION

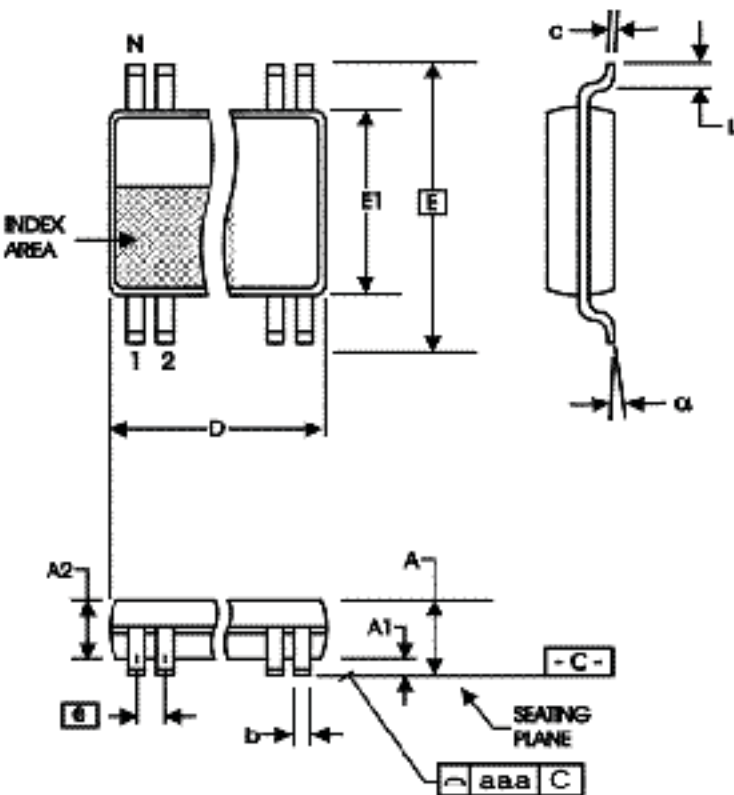
**TABLE 6.  $\theta_{JA}$  vs. AIR FLOW TABLE FOR 24 LEAD TSSOP**

| $\theta_{JA}$ by Velocity (Linear Feet per Minute) |        |        |        |
|--|--------|--------|--------|
|  | 0      | 200    | 500    |
| Multi-Layer PCB, JEDEC Standard Test Boards        | 70°C/W | 63°C/W | 60°C/W |

**TRANSISTOR COUNT**

The transistor count for 8308I is: 1040

## PACKAGE OUTLINE AND DIMENSIONS

**PACKAGE OUTLINE - G SUFFIX FOR 24 LEAD TSSOP**

**TABLE 7. PACKAGE DIMENSIONS**

| SYMBOL   | Millimeters |         |
|----------|-------------|---------|
|          | Minimum     | Maximum |
| N        | 24          |         |
| A        | --          | 1.20    |
| A1       | 0.05        | 0.15    |
| A2       | 0.80        | 1.05    |
| b        | 0.19        | 0.30    |
| c        | 0.09        | 0.20    |
| D        | 7.70        | 7.90    |
| E        | 6.40 BASIC  |         |
| E1       | 4.30        | 4.50    |
| e        | 0.65 BASIC  |         |
| L        | 0.45        | 0.75    |
| $\alpha$ | 0°          | 8°      |
| aaa      | --          | 0.10    |

REFERENCE DOCUMENT: JEDEC PUBLICATION 95, MO-153

**TABLE 8. ORDERING INFORMATION**

| Part/Order Number | Marking      | Package                   | Shipping Packaging | Temperature   |
|-------------------|--------------|---------------------------|--------------------|---------------|
| 8308AGILF         | ICS8308AGILF | 24 Lead "Lead-Free" TSSOP | tube               | -40°C to 85°C |
| 8308AGILFT        | ICS8308AGILF | 24 Lead "Lead-Free" TSSOP | tape & reel        | -40°C to 85°C |

| REVISION HISTORY SHEET |                        |       |   |          |
|------------------------|------------------------|-------|---|----------|
| Rev                    | Table                  | Page  | Description of Change   | Date     |
| A                      |                        | 11    | Added Schematic Layout  | 4/16/04  |
| B                      | T4B<br>T4E<br>T5B      | 1     | Features section - added mix supply voltage bullet.   | 10/20/04 |
|                        |                        | 3     | Added Mix Power Supply Table.   |          |
|                        |                        | 4     | Added Mix DC Characteristics Table.   |          |
|                        |                        | 6     | Added Mix AC Characteristics Table.   |          |
|                        |                        | 8     | Added Mix Output Load AC Test Circuit Diagram.  |          |
| B                      | T8                     | 14    | Ordering Information Table - added "Lead-Free" part number.   | 1/12/05  |
| B                      | T8                     | 1     | Corrected Block Diagram, added CLK_SEL.   | 7/25/05  |
|                        |                        | 10    | Added "Recommendations for Unused Input and Output Pins".   |          |
|                        |                        | 14    | Ordering Information Table - added Lead-Free note.  |          |
| B                      |                        | 1     | Pin Assignment - corrected package information from 300-MIL to 173-MIL.   | 8/4/06   |
| B                      | T3B                    | 2     | Added OE Select Function Table.   | 10/16/07 |
| C                      | T4F<br>T5A - T5C<br>T8 | 5     | DC Characteristics - corrected $V_{IH}$ min. from 2V to 1.7V; $V_{IL}$ max. from 1.3V to 0.7V.  | 7/16/09  |
|                        |                        | 5 - 7 | AC Characteristics - added thermal note.  |          |
|                        |                        | 14    | Ordering Information Table - deleted ICS prefix from Part/Order Number column.  |          |
| C                      | 10<br>12               |       | Updated Wiring the Differential Input to Accept Single-ended Levels application note.   | 3/23/11  |
|                        |                        |       | Added Power On Sequence application note.   |          |
| C                      | T8                     | 12    | Recommended for Unusted I/O Pins - changed CLK Input: to LVCMOS_CLK.  | 4/4/13   |
|                        |                        | 14    | deleted lead-free note.   |          |
| C                      |                        | 1     | Removed ICS from the part numbers throughout the datasheet.<br>Removed reference to leaded devices in features section.<br>Updated header and footer. | 12/10/15 |



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