

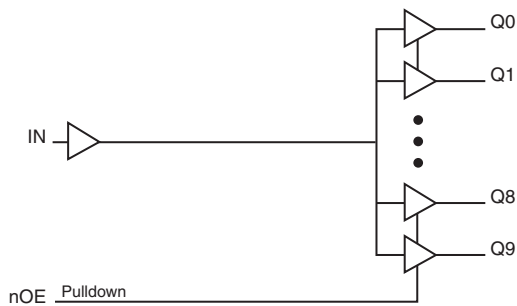
## GENERAL DESCRIPTION

The 83210 is a low skew, 1-to-10 HSTL Fanout Buffer. The class II HSTL outputs are balanced push-pull in design, capable of delivering 16mA into a 10pF load. This class allows both source series termination and symmetrically double parallel termination.

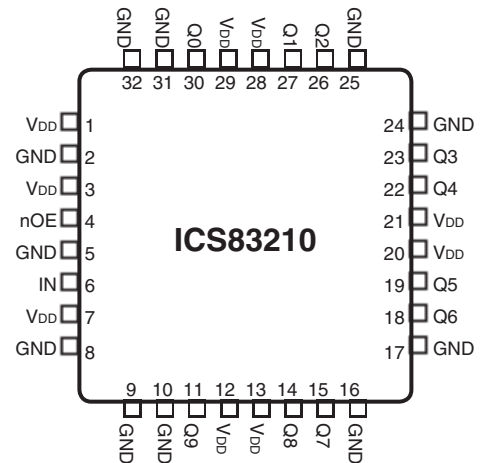
## FEATURES

- Ten single-ended HSTL outputs
- One single-ended HSTL clock input
- Maximum input frequency: 150MHz
- Output skew: 110ps (maximum)
- Part-to-part skew: 2ns (maximum)
- 1.5V power supply
- 0°C to 85°C ambient operating temperature
- Available in lead-free (RoHS 6) package

## BLOCK DIAGRAM



## PIN ASSIGNMENT



**32-Lead TQFP**  
7mm x 7mm x 1.0mm package body  
**Y package**  
Top View

**TABLE 1. PIN DESCRIPTIONS**

| Number                                       | Name                                         | Type   |          | Description                                                                                                                                       |
|----------------------------------------------|----------------------------------------------|--------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1, 3, 7, 12, 13,<br>20, 21, 28, 29           | V <sub>DD</sub>                              | Power  |          | Power supply pins.                                                                                                                                |
| 2, 5, 8, 9, 10,<br>16, 17, 24, 25, 31, 32    | GND                                          | Power  |          | Power supply ground.                                                                                                                              |
| 4                                            | nOE                                          | Input  | Pulldown | Output enable/disable input pin. When LOW, outputs Qx outputs are enabled. When HIGH, Qx outputs are disabled low. LVCMOS/LVTTL interface levels. |
| 5                                            | IN                                           | Input  |          | Single-ended reference clock input. HSTL interface levels.                                                                                        |
| 11, 14, 15,<br>18, 19, 22,<br>23, 26, 27, 30 | Q9, Q8, Q7, Q6,<br>Q5, Q4, Q3, Q2,<br>Q1, Q0 | Output |          | Single-ended HSTL clock outputs.                                                                                                                  |

NOTE: *Pulldown* refers 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    |
| R <sub>PULLDOWN</sub> | Input Pulldown Resistor |                 |         | 51      |         | kΩ    |
| C <sub>OUT</sub>      | Output Pin Capacitance  |                 |         | 4.5     | 6       | pF    |
| R <sub>OUT</sub>      | Output Impedance        |                 |         | 20      |         | Ω     |

# 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 $V_{DD} + 0.5V$ |
| Package Thermal Impedance, $\theta_{JA}$ | 75.5°C/W (0 mps)         |
| 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 3A. POWER SUPPLY DC CHARACTERISTICS,  $V_{DD} = 1.5V \pm 8\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$**

| Symbol    | Parameter                | Test Conditions                  | Minimum | Typical | Maximum | Units |
|-----------|--------------------------|----------------------------------|---------|---------|---------|-------|
| $V_{DD}$  | Power Supply Voltage     |                                  | 1.38    | 1.5     | 1.62    | V     |
| $I_{DD}$  | Power Supply Current     | Outputs Loaded @ 62.5MHz         |         | 215     | 250     | mA    |
| $I_{DDQ}$ | Quiescent Supply Current | $V_{IN} = 0V$ , outputs disabled |         |         | 1       | mA    |

**TABLE 3B. LVCMOS / LVTTTL DC CHARACTERISTICS,  $V_{DD} = 1.5V \pm 8\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$**

| Symbol   | Parameter          | Test Conditions | Minimum            | Typical | Maximum            | Units   |
|----------|--------------------|-----------------|--------------------|---------|--------------------|---------|
| $V_{IH}$ | Input High Voltage | nOE             | $0.7 \cdot V_{DD}$ |         | $V_{DD} + 0.3$     | V       |
| $V_{IL}$ | Input Low Voltage  | nOE             | -0.3               |         | $0.3 \cdot V_{DD}$ | V       |
| $I_{IH}$ | Input High Current | nOE             |                    |         | 150                | $\mu A$ |
| $I_{IL}$ | Input Low Current  | nOE             | -5                 |         |                    | $\mu A$ |

**TABLE 3C. HSTL DC CHARACTERISTICS,  $V_{DD} = 1.5V \pm 8\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$**

| Symbol   | Parameter           | Test Conditions  | Minimum | Typical | Maximum        | Units |
|----------|---------------------|------------------|---------|---------|----------------|-------|
| $V_{IH}$ | Input High Voltage  | IN               | 0.85    |         | 1.8            | V     |
| $V_{IL}$ | Input Low Voltage   | IN               | -0.3    |         | 0.65           | V     |
| $V_{OH}$ | Output High Voltage | $I_{OH} = -16mA$ | 1.0     |         | $V_{DD} + 0.3$ | V     |
| $V_{OL}$ | Output Low Voltage  | $I_{OL} = 16mA$  | -0.3    |         | 0.4            | V     |

**TABLE 4. AC CHARACTERISTICS,  $V_{DD} = 1.5V \pm 8\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$** 

| Symbol      | Parameter                              | Test Conditions       | Minimum | Typical | Maximum | Units |
|-------------|----------------------------------------|-----------------------|---------|---------|---------|-------|
| $f_{IN}$    | Input Frequency                        |                       |         |         | 150     | MHz   |
| $t_{PLH}$   | Propagation Delay, Low-to-High; NOTE 1 |                       | 1.0     |         | 5.5     | ns    |
| $t_{PHL}$   | Propagation Delay, High-to-Low NOTE 1  |                       | 1.0     |         | 5.5     | ns    |
| $tsk(o)$    | Output Skew; NOTE 2, 4                 |                       |         |         | 110     | ps    |
| $tsk(pp)$   | Part-to-Part Skew; NOTE 3, 4           |                       |         |         | 2       | ns    |
| $t_{EN}$    | Output Enable Time                     |                       |         |         | 7       | ns    |
| $t_{DIS}$   | Output Disable Time                    |                       |         |         | 7       | ns    |
| $t_R / t_F$ | Output Rise/Fall Time                  | 20% to 80%            | 250     |         | 1.3     | ns    |
| odc         | Output Duty Cycle                      | $F_{out} \leq 100MHz$ | 48      |         | 52      | %     |
|             |                                        | $F_{out} > 100MHz$    | 45      |         | 55      | %     |

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 lfpm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

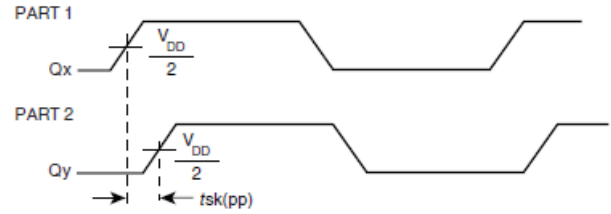
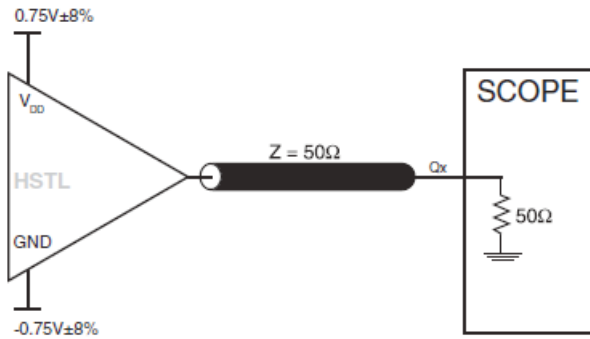
NOTE 1: Measured from the  $V_{DD}/2$  of the input to  $V_{DD}/2$  of the output.

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

NOTE 3: Defined as skew between outputs on different devices operating at the same supply voltage, same temperature, same frequency and with equal load conditions at the same temperature. Using the same type of inputs on each device, the outputs are measured at  $V_{DD}/2$  of the output.

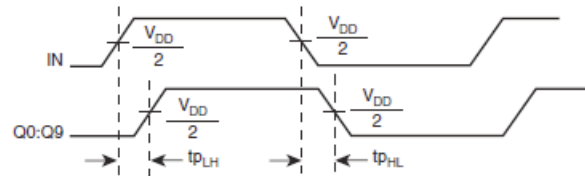
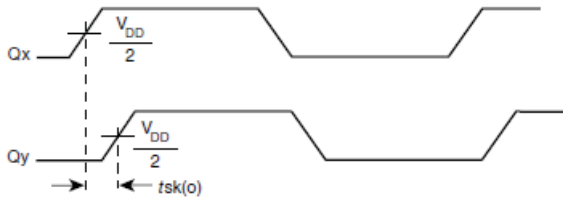
NOTE 4: This parameter is defined in accordance with JEDEC Standard 65.

# PARAMETER MEASUREMENT INFORMATION



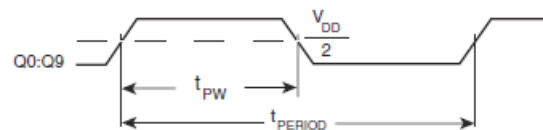
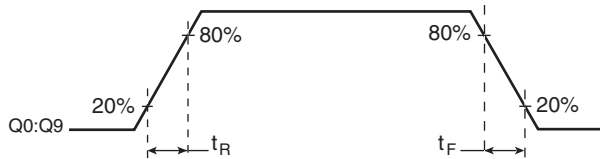
1.5V OUTPUT LOAD AC TEST CIRCUIT

PART-TO-PART SKEW



OUTPUT SKEW

PROPAGATION DELAY



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

OUTPUT RISE/FALL TIME

OUTPUT DUTY CYCLE/PULSE WIDTH/PERIOD

## APPLICATIONS INFORMATION

### RECOMMENDATIONS FOR UNUSED OUTPUT PINS

#### OUTPUTS:

##### HSTL OUTPUTS

All unused HSTL outputs can be left floating. We recommend that there is no trace attached.

## RELIABILITY INFORMATION

**TABLE 5.  $\theta_{JA}$  vs. AIR FLOW TABLE FOR 32 LEAD TQFP**

| $\theta_{JA}$ by Velocity (Meters per Second) |          |          |          |
|-----------------------------------------------|----------|----------|----------|
|                                               | 0        | 1        | 2.5      |
| Multi-Layer PCB, JEDEC Standard Test Boards   | 75.5°C/W | 65.8°C/W | 62.2°C/W |

#### TRANSISTOR COUNT

The transistor count for 83210 is: 218

# PACKAGE OUTLINE - Y SUFFIX FOR 32 LEAD TQFP

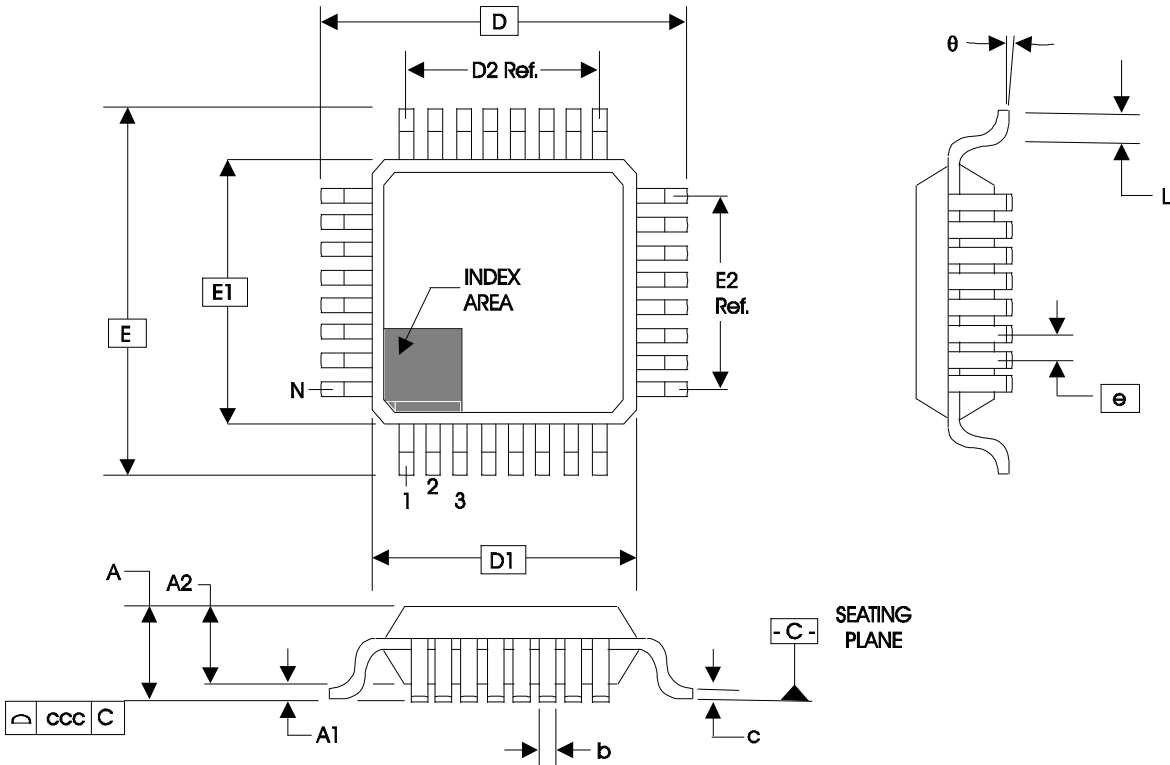


TABLE 6. PACKAGE DIMENSIONS

| JEDEC VARIATION<br>ALL DIMENSIONS IN MILLIMETERS |            |         |         |
|--------------------------------------------------|------------|---------|---------|
| SYMBOL                                           | ABA-HD     |         |         |
|                                                  | MINIMUM    | NOMINAL | MAXIMUM |
| N                                                | 32         |         |         |
| A                                                | --         | --      | 1.20    |
| A1                                               | 0.05       | --      | 0.15    |
| A2                                               | 0.95       | 1.00    | 1.05    |
| b                                                | 0.30       | 0.35    | 0.40    |
| c                                                | 0.09       | --      | 0.20    |
| D & E                                            | 9.00 BASIC |         |         |
| D1 & E1                                          | 7.00 BASIC |         |         |
| D2 & E2                                          | 5.60 Ref.  |         |         |
| e                                                | 0.80 BASIC |         |         |
| L                                                | 0.45       | 0.60    | 0.75    |
| $\theta$                                         | 0°         | --      | 7°      |
| ccc                                              | --         | --      | 0.10    |

Reference Document: JEDEC Publication 95, MS-026

**TABLE 7. ORDERING INFORMATION**

| Part/Order Number | Marking      | Package                  | Shipping Packaging | Temperature |
|-------------------|--------------|--------------------------|--------------------|-------------|
| 83210AYLF         | ICS83210AYLF | 32 lead "Lead-Free" TQFP | tray               | 0°C to 85°C |
| 83210AYLFT        | ICS83210AYLF | 32 lead "Lead-Free" TQFP | tape & reel        | 0°C to 85°C |

| REVISION HISTORY SHEET |       |      |                                                                                                                                     |         |
|------------------------|-------|------|-------------------------------------------------------------------------------------------------------------------------------------|---------|
| Rev                    | Table | Page | Description of Change                                                                                                               | Date    |
| A                      | T3C   | 3    | HSTL DC Characteristics Table - deleted NOTE 1, does not apply.                                                                     | 9/9/10  |
|                        | T4    | 4    | AC Characteristics Table - added thermal note.                                                                                      |         |
|                        |       | 7    | Updated Package Outline.                                                                                                            |         |
|                        | T7    | 8    | Ordering Information Table - Deleted "ICS" prefix from Part/Order Number column.<br>Changed DT format header/footer.                |         |
| A                      | T7    | 8    | Ordering Information - removed leaded devices.<br>Updated data sheet format.                                                        | 4/28/15 |
| A                      | T7    | 8    | Removed ICS from the part number where needed.<br>Ordering Information - Deleted LF note below table.<br>Updated Header and footer. | 3/10/16 |

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