



# LOW SKEW, 1-TO-5, DIFFERENTIAL-TO-2.5V, 3.3V LVPECL/ECL FANOUT BUFFER

**ICS853014**

## General Description



The ICS853014 is a low skew, high performance 1-to-5, 2.5V/3.3V Differential-to-LVPECL/ECL Fanout Buffer and a member of the HiPerClockS™ family of High Performance Clock Solutions from IDT. The ICS853014 has two selectable clock

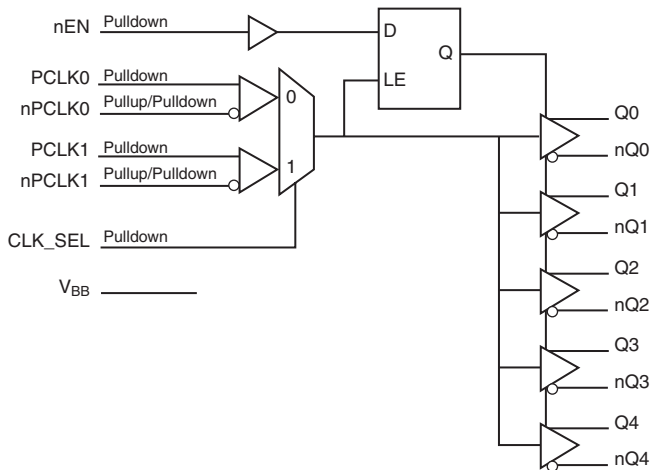
inputs.

Guaranteed output and part-to-part skew characteristics make the ICS853014 ideal for those applications demanding well defined performance and repeatability.

## Features

- Five differential LVPECL/ECL outputs
- Two selectable differential LVPECL clock inputs
- PCLKx, nPCLKx pairs can accept the following differential input levels: LVPECL, LVDS, CML, SSTL
- Maximum output frequency: > 2GHz
- Output skew: 13ps (typical)
- Part-to-part skew: 60ps (typical)
- Propagation delay: 460ps (typical)
- LVPECL mode operating voltage supply range:  $V_{CC} = 2.375V$  to  $3.8V$ ,  $V_{EE} = 0V$
- ECL mode operating voltage supply range:  $V_{CC} = 0V$ ,  $V_{EE} = -3.8V$  to  $-2.375V$
- $-40^{\circ}C$  to  $85^{\circ}C$  ambient operating temperature
- Available in both standard (RoHS 5) and lead-free (RoHS 6) packages

## Block Diagram



## Pin Assignment

Q0	1	20	V <sub>CC</sub>
nQ0	2	19	nEN
Q1	3	18	V <sub>CC</sub>
nQ1	4	17	nPCLK1
Q2	5	16	PCLK1
nQ2	6	15	V <sub>BB</sub>
Q3	7	14	nPCLK0
nQ3	8	13	PCLK0
Q4	9	12	CLK_SEL
nQ4	10	11	V <sub>EE</sub>

**ICS853014**

**20-Lead TSSOP**

**6.5mm x 4.4mm x 0.925mm package body**

**G Package**

**Top View**

**Table 1. Pin Descriptions**

Number	Name	Type		Description
1, 2	Q0, nQ0	Output		Differential output pair. LVPECL/ECL interface levels.
3, 4	Q1, nQ1	Output		Differential output pair. LVPECL/ECL interface levels.
5, 6	Q2, nQ2	Output		Differential output pair. LVPECL/ECL interface levels.
7, 8	Q3, nQ3	Output		Differential output pair. LVPECL/ECL interface levels.
9, 10	Q4, nQ4	Output		Differential output pair. LVPECL/ECL interface levels.
11	V <sub>EE</sub>	Power		Negative supply pin.
12	CLK_SEL	Input	Pulldown	Clock select input. When HIGH, selects PCLK1/nPCLK1 inputs. When LOW, selects PCLK0/nPCLK0 inputs. Single-ended LVPECL interface levels.
13	PCLK0	Input	Pulldown	Non-inverting differential LVPECL clock input.
14	nPCLK0	Input	Pullup/ Pulldown	Inverting differential LVPECL clock input. V <sub>CC</sub> /2 default when left floating.
15	V <sub>BB</sub>	Output		Bias voltage.
16	PCLK1	Input	Pulldown	Non-inverting differential LVPECL clock input.
17	nPCLK1	Input	Pullup/ Pulldown	Inverting differential LVPECL clock input. V <sub>CC</sub> /2 default when left floating.
18, 20	V <sub>CC</sub>	Power		Positive supply pins.
19	nEN	Input	Pulldown	Synchronizing clock enable. When LOW, clock outputs follow clock input. When HIGH, Qx outputs are forced low, nQx outputs are forced high. Single-ended LVPECL interface levels.

NOTE: *Pullup* 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
R <sub>PULLDOWN</sub>	Input Pulldown Resistor			75		k $\Omega$
R <sub>VCC/2</sub>	Pullup/Pulldown Resistors			50		k $\Omega$

## Function Tables

Table 3A. Control Input Function Table

Inputs			Outputs	
nEN	CLK_SEL	Selected Source	Q0:Q4	nQ0:nQ4
1	0	PCLK0, nPCLK0	Disabled; Low	Disabled; High
1	1	PCLK1, nPCLK1	Disabled; Low	Disabled; High
0	0	PCLK2, nPCLK2	Enabled	Enabled
0	1	PCLK3, nPCLK3	Enabled	Enabled

After nEN switches, the clock outputs are disabled or enabled following a falling input clock edge as shown in *Figure 1*.

In the active mode, the state of the outputs are a function of the PCLK0/nPCLK0 and PCLK1/nPCLK1 inputs as described in Table 3B.

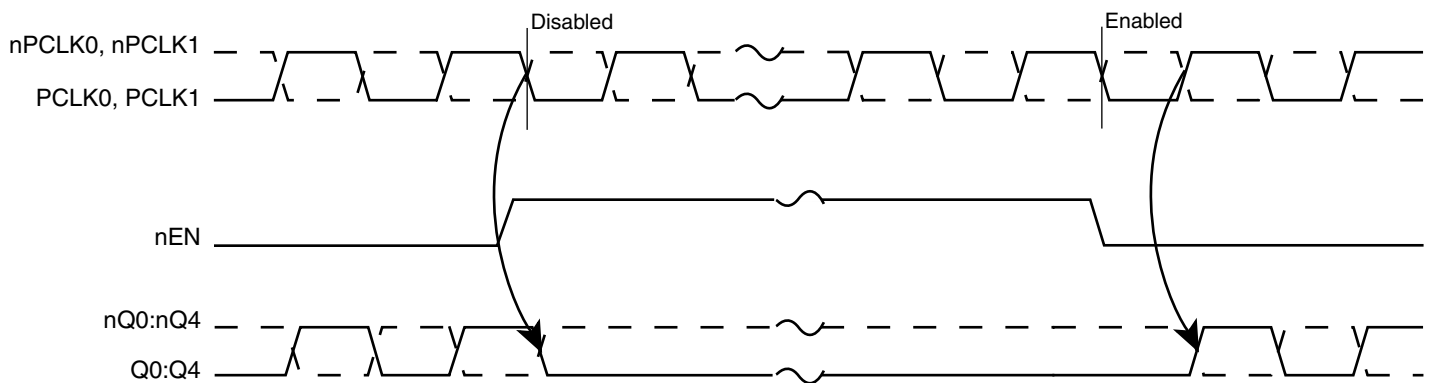


Figure 1. nEN Timing Diagram

Table 3B. Clock Input Function Table

Inputs		Outputs		Input to Output Mode	Polarity
PCLK0 or PCLK1	nPCLK0 or nPCLK1	Q0:Q4	nQ0:nQ4		
0	1	LOW	HIGH	Differential to Differential	Non-Inverting
1	0	HIGH	LOW	Differential to Differential	Non-Inverting
0	Biased; NOTE 1	LOW	HIGH	Single-Ended to Differential	Non-Inverting
1	Biased; NOTE 1	HIGH	LOW	Single-Ended to Differential	Non-Inverting
Biased; NOTE 1	0	HIGH	LOW	Single-Ended to Differential	Inverting
Biased; NOTE 1	1	LOW	HIGH	Single-Ended to Differential	Inverting

NOTE 1: Please refer to the Application Information section. *Wiring the Differential Input to Accept Single-ended Levels.*

## Absolute Maximum Ratings

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.

Item	Rating
Supply Voltage, $V_{CC}$	4.6V (LVPECL mode, $V_{EE} = 0V$ )
Negative Supply Voltage, $V_{EE}$	-4.6V (ECL mode, $V_{CC} = 0V$ )
Inputs, $V_I$ (LVPECL mode)	-0.5V to $V_{CC} + 0.5V$
Inputs, $V_I$ (ECL mode)	0.5V to $V_{EE} - 0.5V$
Outputs, $I_O$ Continuous Current Surge Current	50mA 100mA
$V_{BB}$ Sink/Source, $I_{BB}$	$\pm 0.5mA$
Operating Temperature Range, $T_A$	-40°C to +85°C
Package Thermal Impedance, $\theta_{JA}$	73.2°C/W (0 lfm)
Storage Temperature, $T_{STG}$	-65°C to 150°C

## DC Electrical Characteristics

Table 4A. Power Supply DC Characteristics,  $V_{CC} = 2.375V$  to  $3.8V$ ;  $V_{EE} = 0V$ ,  $T_A = -40^\circ C$  to  $85^\circ C$

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{CC}$	Positive Supply Voltage		2.375	3.3	3.8	V
$I_{EE}$	Power Supply Current				85	mA

**Table 4B. DC Characteristics,  $V_{CC} = 3.3V$ ;  $V_{EE} = 0V$ ,  $T_A = -40^{\circ}C$  to  $85^{\circ}C$** 

Symbol	Parameter	-40°C			25°C			80°C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$V_{OH}$	Output High Voltage; NOTE 1	2.175	2.275	2.38	2.225	2.295	2.375	2.22	2.295	2.365	V
$V_{OL}$	Output Low Voltage; NOTE 1	1.405	1.545	1.68	1.425	1.52	1.615	1.44	1.535	1.63	V
$V_{IH}$	Input High Voltage (CLK_SEL, nEN)	2.075		2.36	2.075		2.36	2.075		2.36	V
$V_{IL}$	Input Low Voltage (CLK_SEL, nEN)	1.43		1.765	1.43		1.765	1.43		1.765	V
$V_{BB}$	Output Voltage Reference; NOTE 2	1.86		1.98	1.86		1.98	1.86		1.98	V
$V_{CMR}$	Input High Voltage Common Mode Range; NOTE 3	1.2		3.3	1.2		3.3	1.2		3.3	V
$I_{IH}$	Input High Current	PCLK0, PCLK1 nPCLK0, nPCLK1		150			150			150	$\mu A$
$I_{IL}$	Input Low Current	PCLK0, PCLK1		-10			-10			-10	$\mu A$
		nPCLK0, nPCLK1		-150			-150			-150	$\mu A$

NOTE: Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.925V to -0.5V.

NOTE 1: Outputs terminated with  $50\Omega$  to  $V_{CC} - 2V$ .

NOTE 2: Single-ended input operation is limited.  $V_{CC} \geq 3V$  in LVPECL mode.

NOTE 3: Common mode voltage is defined as  $V_{IH}$  for the differential inputs.

NOTE 4: For single-ended applications, the maximum input voltage for PCLKx, nPCLKx is  $V_{CC} + 0.3V$ .

**Table 4C. LVPECL DC Characteristics,  $V_{CC} = 2.5V$ ;  $V_{EE} = 0V$ ,  $T_A = -40^{\circ}C$  to  $85^{\circ}C$** 

Symbol	Parameter	-40°C			25°C			80°C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$V_{OH}$	Output High Voltage; NOTE 1	1.375	1.475	1.58	1.425	1.495	1.57	1.42	1.495	1.565	V
$V_{OL}$	Output Low Voltage; NOTE 1	0.605	0.745	0.88	0.625	0.72	0.815	0.64	0.735	0.83	V
$V_{IH}$	Input High Voltage (CLK_SEL, nEN)	1.275		1.56	1.275		1.56	1.275		1.56	V
$V_{IL}$	Input Low Voltage (CLK_SEL, nEN)	0.63		0.965	0.63		0.965	0.63		0.965	V
$V_{CMR}$	Input High Voltage Common Mode Range; NOTE 2, 3	1.2		2.5	1.2		2.5	1.2		2.5	V
$I_{IH}$	Input High Current	PCLK0, PCLK1 nPCLK0, nPCLK1		150			150			150	$\mu A$
$I_{IL}$	Input Low Current	PCLK0, PCLK1		-10			-10			-10	$\mu A$
		nPCLK0, nPCLK1		-150			-150			-150	$\mu A$

NOTE: Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.925V to -0.5V.

NOTE 1: Outputs terminated with  $50\Omega$  to  $V_{CC} - 2V$ .

NOTE 2: Common mode voltage is defined as  $V_{IH}$  for the differential inputs.

NOTE 3: For single-ended applications, the maximum input voltage for PCLKx, nPCLKx is  $V_{CC} + 0.3V$ .

Table 4D. ECL DC Characteristics,  $V_{CC} = 0V$ ;  $V_{EE} = -3.8V$  to  $-2.375V$ ,  $T_A = -40^{\circ}C$  to  $85^{\circ}C$ 

Symbol	Parameter	$-40^{\circ}C$			$25^{\circ}C$			$80^{\circ}C$			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$V_{OH}$	Output High Voltage; NOTE 1	-1.125	-1.025	-0.92	-1.075	-1.005	-0.93	-1.08	-1.005	-0.935	V
$V_{OL}$	Output Low Voltage; NOTE 1	-1.895	-1.755	-1.62	-1.875	-1.78	-1.685	-1.86	-1.765	-1.67	V
$V_{IH}$	Input High Voltage (CLK_SEL, nEN)	-1.225		-0.94	-1.225		-0.94	-1.225		-0.94	V
$V_{IL}$	Input Low Voltage (CLK_SEL, nEN)	-1.87		-1.535	-1.87		-1.535	-1.87		-1.535	V
$V_{BB}$	Output Voltage Reference; NOTE 2	-1.44		-1.32	-1.44		-1.32	-1.44		-1.32	V
$V_{CMR}$	Input High Voltage Common Mode Range; NOTE 3	$V_{EE}+1.2$		0	$V_{EE}+1.2$		0	$V_{EE}+1.2$		0	V
$I_{IH}$	Input High Current	PCLK0, PCLK1 nPCLK0, nPCLK1		150			150			150	$\mu A$
$I_{IL}$	Input Low Current	PCLK0, PCLK1	-10		-10			-10			$\mu A$
		nPCLK0, nPCLK1	-150		-150			-150			$\mu A$

NOTE: Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary  $+0.925V$  to  $-0.5V$ .

NOTE 1: Outputs terminated with  $50\Omega$  to  $V_{CC} -2V$ .

NOTE 2: Single-ended input operation is limited.  $V_{CC} \geq 3V$  in LVPECL mode.

NOTE 3: Common mode voltage is defined as  $V_{IH}$  for the differential inputs.

NOTE 4: For single-ended applications, the maximum input voltage for PCLKx, nPCLKx is  $V_{CC} + 0.3V$ .

## AC Electrical Characteristics

**Table 5. AC Characteristics,  $V_{CC} = -3.8V$  to  $-2.375V$  or ,  $V_{CC} = 2.375V$  to  $3.8V$ ;  $V_{EE} = 0V$ ,  $T_A = -40^{\circ}C$  to  $85^{\circ}C$**

Symbol	Parameter	-40°C			25°C			80°C			Units	
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
$f_{MAX}$	Output Frequency		>2			>2			>2		GHz	
$t_{PD}$	Propagation Delay; NOTE 1	355	440	525	376	460	550	400	500	595	ps	
$t_{sk(o)}$	Output Skew; NOTE 2, 5		13	25		13	25		13	25	ps	
$t_{sk(pp)}$	Part-to-Part Skew; NOTE 3, 5			105			105			130	ps	
$V_{PP}$	Peak-to-Peak Input Voltage; NOTE 4	150	800	1800	150	800	1800	150	800	1800	mV	
$t_R / t_F$	Output Rise/Fall Time	20% to 80%	90	150	210	90	150	210	90	150	210	ps
$t_S$	Clock Enable Setup Time	100	50		100	50		100	50		ps	
$t_H$	Clock Enable Hold Time	200	140		200	140		200	140		ps	

NOTE: All parameters are measured at  $f \leq 1GHz$ , unless otherwise noted.

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 differential input crossing point to the differential output crossing point.

NOTE 2: Defined as skew between outputs at the same supply voltage and with equal load conditions.

Measured at the output differential cross points.

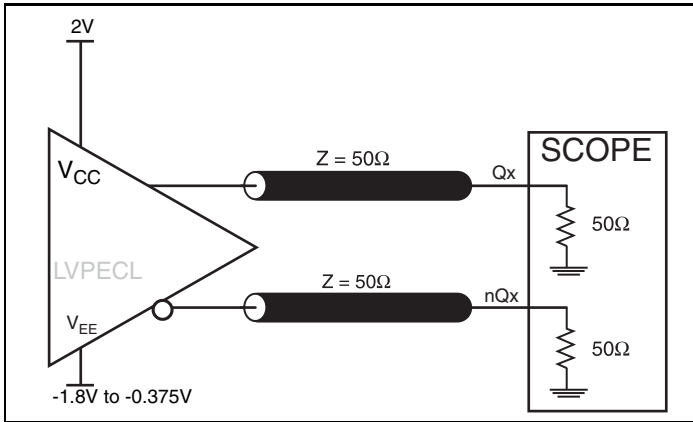
NOTE 3: Defined as skew between outputs on different devices operating at the same supply voltages and with equal load conditions.

Using the same type of inputs on each device, the outputs are measured at the differential cross points.

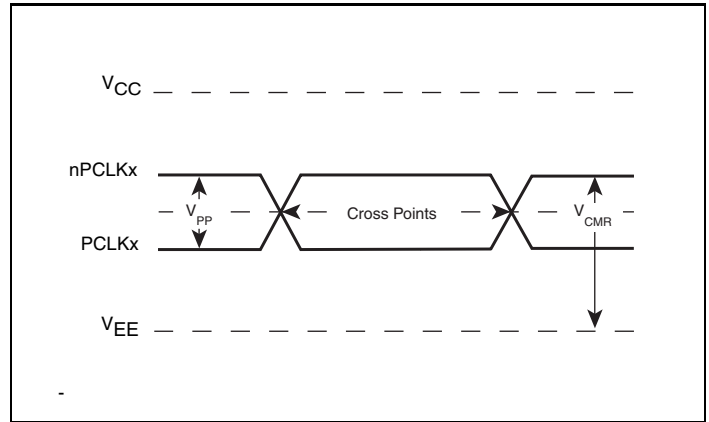
NOTE 4: The VCMR and VPP levels should be such that input low voltage never goes below  $V_{EE}$ .

NOTE 5: This parameter is defined in accordance with JEDEC Standard 65.

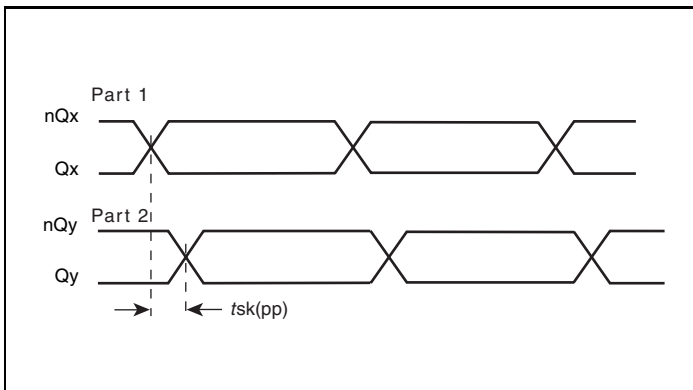
### Parameter Measurement Information



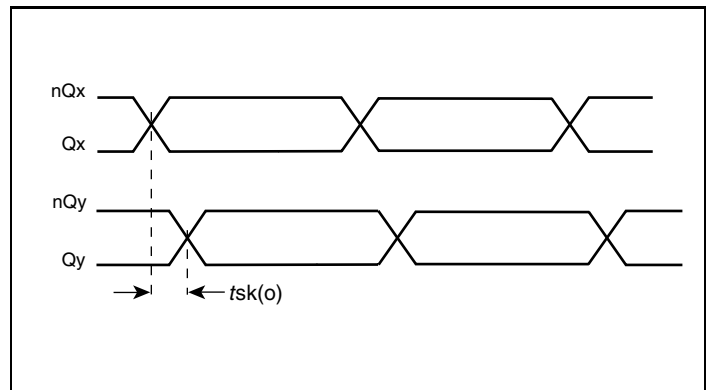
LVPECL Output Load AC Test Circuit



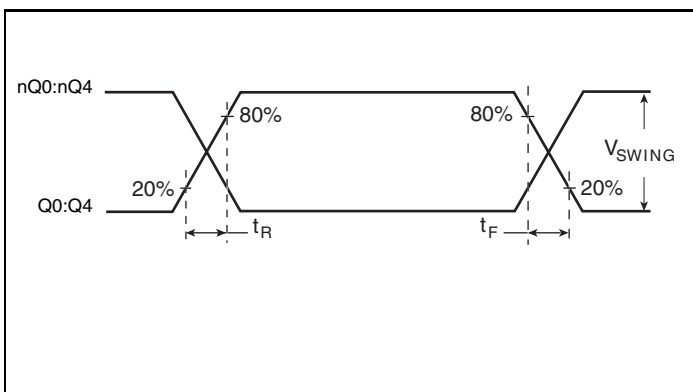
Differential Input Level



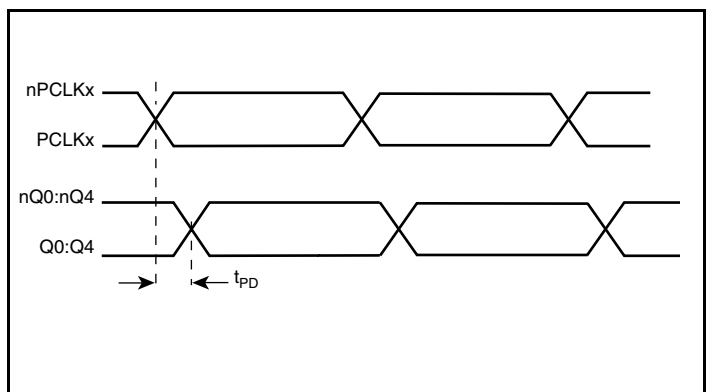
Part-to-Part Skew



Output Skew



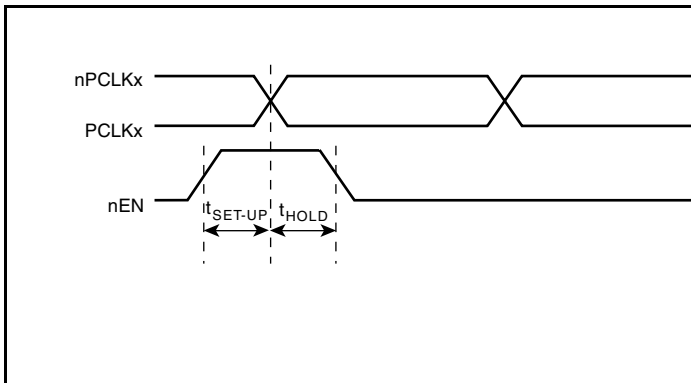
Output Rise/Fall Time



Propagation Delay



## Parameter Measurement Information, continued



Setup and Hold Time

## Application Information

### Wiring the Differential Input to Accept Single Ended Levels

Figure 2 shows how the differential input can be wired to accept single ended levels. The reference voltage  $V_{REF} = V_{CC}/2$  is generated by the bias resistors R1, R2 and C1. This bias circuit should be located as close as possible to the input pin. 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 only 2.5V and  $V_{CC} = 3.3V$ ,  $V_{REF}$  should be 1.25V and  $R2/R1 = 0.609$ .

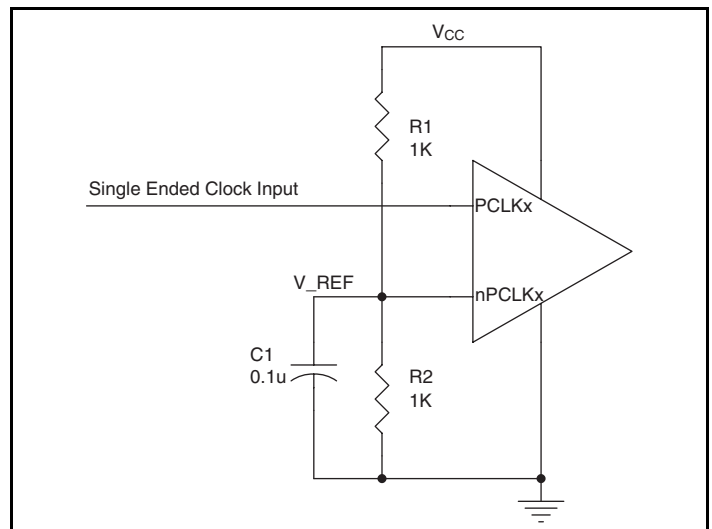
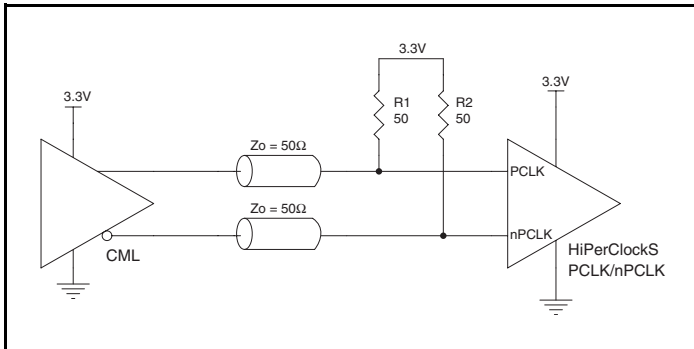


Figure 2. Single-Ended Signal Driving Differential Input

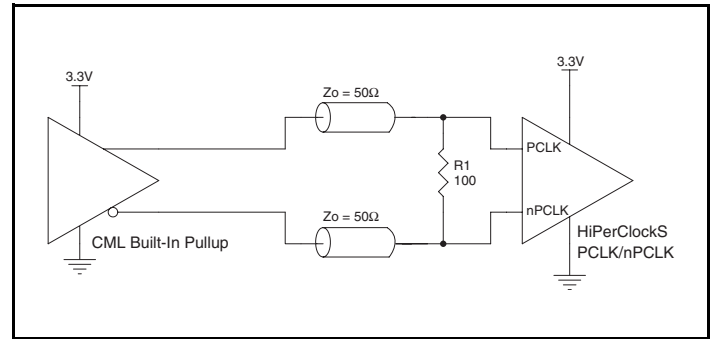
### LVPECL Clock Input Interface

The PCLK/nPCLK accepts LVPECL, LVDS, CML, SSTL and other differential signals. Both  $V_{SWING}$  and  $V_{OH}$  must meet the  $V_{PP}$  and  $V_{CMR}$  input requirements. Figures 3A to 3E show interface examples for the HiPerClockS PCLK/nPCLK input driven by the

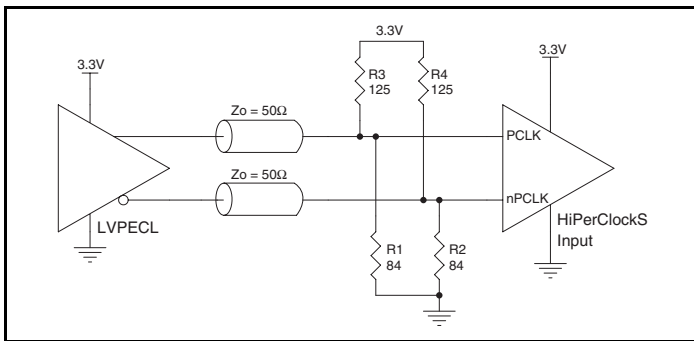
most common driver types. The input interfaces suggested here are examples only. If the driver is from another vendor, use their termination recommendation. Please consult with the vendor of the driver component to confirm the driver termination requirements.



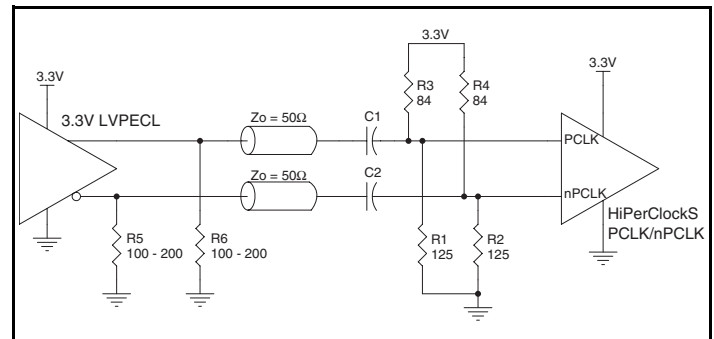
**Figure 3A. HiPerClockS PCLK/nPCLK Input Driven by an Open Collector CML Driver**



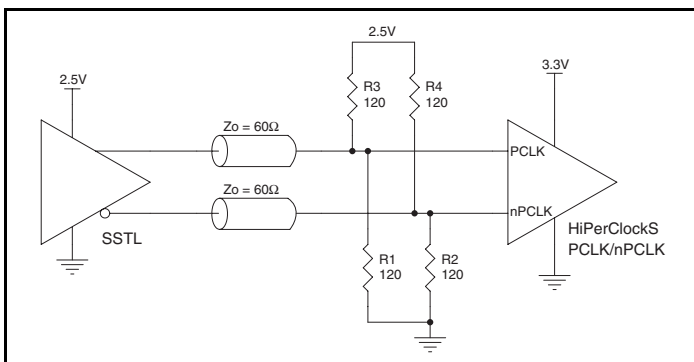
**Figure 3B. HiPerClockS PCLK/nPCLK Input Driven by a Built-In Pullup CML Driver**



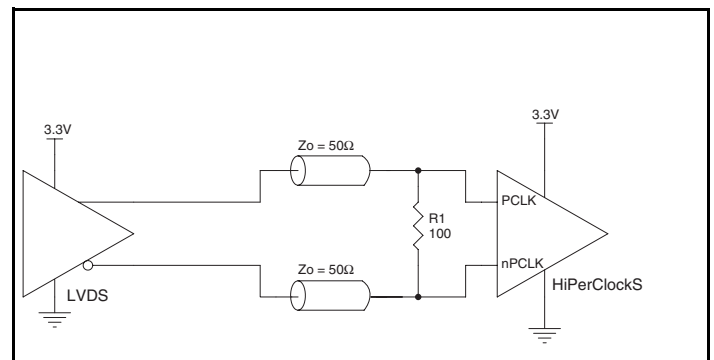
**Figure 3C. HiPerClockS PCLK/nPCLK Input Driven by a 3.3V LVPECL Driver**



**Figure 3D. HiPerClockS PCLK/nPCLK Input Driven by a 3.3V LVPECL Driver with AC Couple**



**Figure 3E. HiPerClockS PCLK/nPCLK Input Driven by an SSTL Driver**



**Figure 3F. HiPerClockS PCLK/nPCLK Input Driven by a 3.3V LVDS Driver**

## Recommendations for Unused Output Pins

### Inputs:

#### PCLK/nPCLK INPUTS

For applications not requiring the use of a differential input, both the PCLK and nPCLK pins can be left floating. Though not required, but for additional protection, a 1k $\Omega$  resistor can be tied from PCLK to ground. For applications

#### LVC MOS Control Pins

All control pins have internal pull-ups or pull-downs; additional resistance is not required but can be added for additional protection. A 1k $\Omega$  resistor can be used.

### Outputs:

#### LVPECL Outputs

All unused LVPECL outputs can be left floating. We recommend that there is no trace attached. Both sides of the differential output pair should either be left floating or terminated.

## Termination for 3.3V LVPECL Outputs

The clock layout topology shown below is a typical termination for LVPECL outputs. The two different layouts mentioned are recommended only as guidelines.

FOUT and nFOUT are low impedance follower outputs that generate ECL/LVPECL compatible outputs. Therefore, terminating resistors (DC current path to ground) or current sources must be used for functionality. These outputs are designed to drive 50 $\Omega$

transmission lines. Matched impedance techniques should be used to maximize operating frequency and minimize signal distortion. *Figures 4A and 4B* show two different layouts which are recommended only as guidelines. Other suitable clock layouts may exist and it would be recommended that the board designers simulate to guarantee compatibility across all printed circuit and clock component process variations.

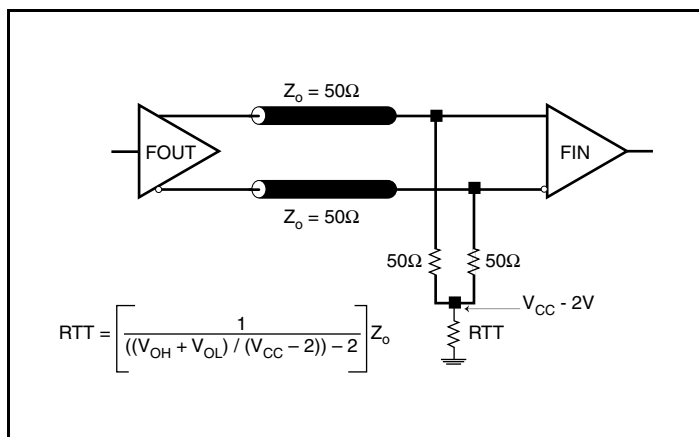


Figure 4A. 3.3V LVPECL Output Termination

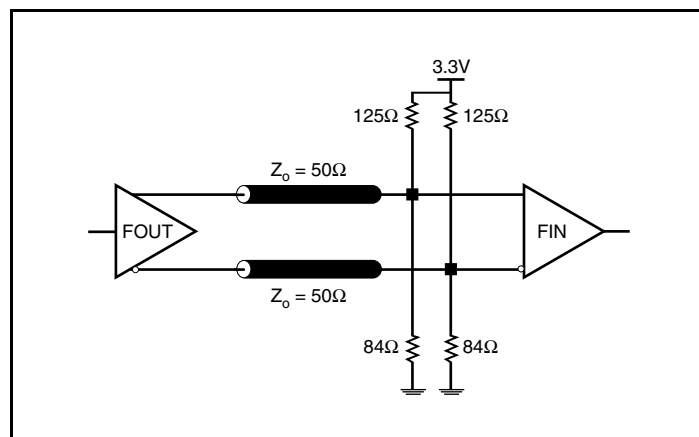


Figure 4B. 3.3V LVPECL Output Termination

### Termination for 2.5V LVPECL Outputs

Figure 5A and Figure 5B show examples of termination for 2.5V LVPECL driver. These terminations are equivalent to terminating 50Ω to  $V_{CC} - 2V$ . For  $V_{CC} = 2.5V$ , the  $V_{CC} - 2V$  is very close to

ground level. The R3 in Figure 5B can be eliminated and the termination is shown in Figure 5C.

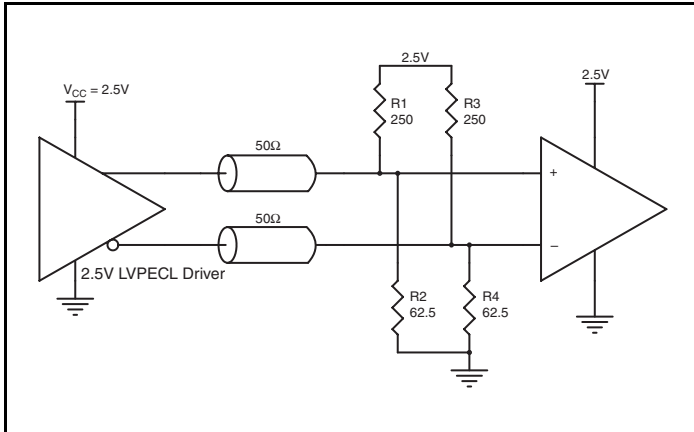


Figure 5A. 2.5V LVPECL Driver Termination Example

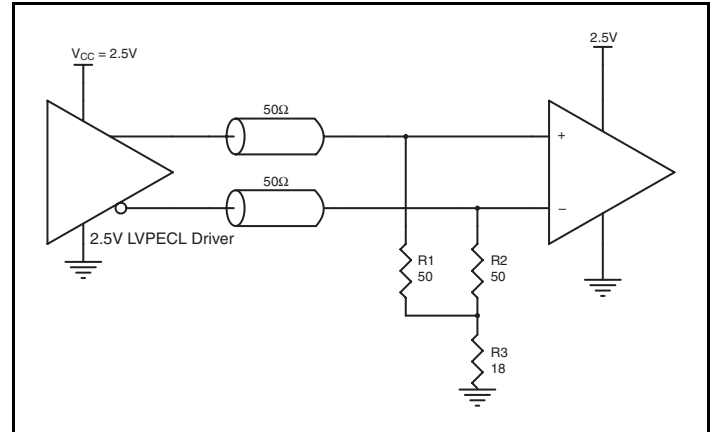


Figure 5B. 2.5V LVPECL Driver Termination Example

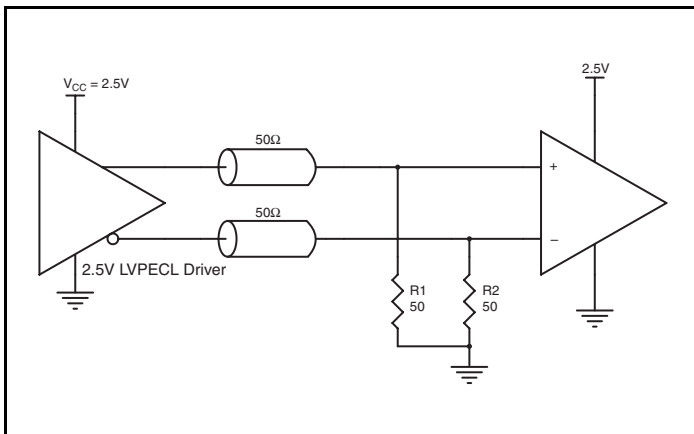


Figure 5C. 2.5V LVPECL Driver Termination Example



## Power Considerations

This section provides information on power dissipation and junction temperature for the ICS853014. Equations and example calculations are also provided.

### 1. Power Dissipation.

The total power dissipation for the ICS853014 is the sum of the core power plus the power dissipated in the load(s). The following is the power dissipation for  $V_{CC} = 3.8V$ , which gives worst case results.

NOTE: Please refer to Section 3 for details on calculating power dissipated in the load.

- Power (core)<sub>MAX</sub> =  $V_{CC\_MAX} * I_{EE\_MAX} = 3.8V * 85mA = 323mW$
- Power (outputs)<sub>MAX</sub> = **30.94mW/Loaded Output pair**  
If all outputs are loaded, the total power is  $5 * 30.94mW = 154.7mW$

**Total Power**<sub>MAX</sub> (3.8V, with all outputs switching) =  $323mW + 154.7mW = 477.7mW$

### 2. Junction Temperature.

Junction temperature,  $T_j$ , is the temperature at the junction of the bond wire and bond pad and directly affects the reliability of the device. The maximum recommended junction temperature for HiPerClockS devices is 125°C.

The equation for  $T_j$  is as follows:  $T_j = \theta_{JA} * Pd\_total + T_A$

$T_j$  = Junction Temperature

$\theta_{JA}$  = Junction-to-Ambient Thermal Resistance

$Pd\_total$  = Total Device Power Dissipation (example calculation is in section 1 above)

$T_A$  = Ambient Temperature

In order to calculate junction temperature, the appropriate junction-to-ambient thermal resistance  $\theta_{JA}$  must be used. Assuming 0 air flow and a multi-layer board, the appropriate value is 66.6°C/W per Table 6 below.

Therefore,  $T_j$  for an ambient temperature of 85°C with all outputs switching is:

$$85^\circ C + 0.478W * 66.6^\circ C/W = 116.8^\circ C. \text{ This is below the limit of } 125^\circ C.$$

This calculation is only an example.  $T_j$  will obviously vary depending on the number of loaded outputs, supply voltage, air flow and the type of board (single layer or multi-layer).

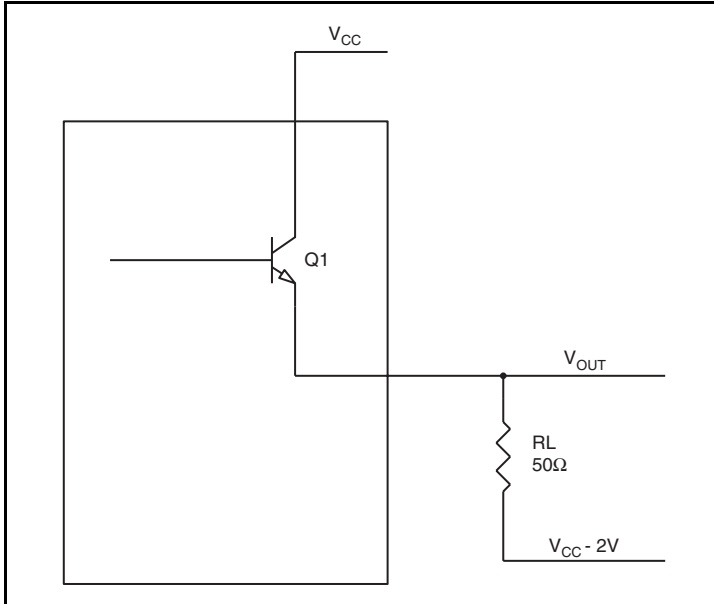
**Table 6. Thermal Resistance  $\theta_{JA}$  for 20 Lead TSSOP, Forced Convection**

Linear Feet per Minute	$\theta_{JA}$ by Velocity		
	0	200	500
Single-Layer PCB, JEDEC Standard Test Boards	114.5°C/W	98.0°C/W	88.0°C/W
Multi-Layer PCB, JEDEC Standard Test Boards	73.2°C/W	66.6°C/W	63.5°C/W

### 3. Calculations and Equations.

The purpose of this section is to derive the power dissipated into the load.

LVPECL output driver circuit and termination are shown in *Figure 7*.



**Figure 7. LVPECL Driver Circuit and Termination**

To calculate worst case power dissipation into the load, use the following equations which assume a  $50\Omega$  load, and a termination voltage of  $V_{CC} - 2V$ .

- For logic high,  $V_{OUT} = V_{OH\_MAX} = V_{CC\_MAX} - 0.935V$   
 $(V_{CC\_MAX} - V_{OH\_MAX}) = 0.935V$
- For logic low,  $V_{OUT} = V_{OL\_MAX} = V_{CC\_MAX} - 1.67V$   
 $(V_{CC\_MAX} - V_{OL\_MAX}) = 1.67V$

$Pd\_H$  is power dissipation when the output drives high.

$Pd\_L$  is the power dissipation when the output drives low.

$$Pd\_H = [(V_{OH\_MAX} - (V_{CC\_MAX} - 2V))/R_L] * (V_{CC\_MAX} - V_{OH\_MAX}) = [(2V - (V_{CC\_MAX} - V_{OH\_MAX}))/R_L] * (V_{CC\_MAX} - V_{OH\_MAX}) = [(2V - 0.935V)/50\Omega] * 0.935V = \mathbf{19.92mW}$$

$$Pd\_L = [(V_{OL\_MAX} - (V_{CC\_MAX} - 2V))/R_L] * (V_{CC\_MAX} - V_{OL\_MAX}) = [(2V - (V_{CC\_MAX} - V_{OL\_MAX}))/R_L] * (V_{CC\_MAX} - V_{OL\_MAX}) = [(2V - 1.67V)/50\Omega] * 1.67V = \mathbf{11.02mW}$$

$$\text{Total Power Dissipation per output pair} = Pd\_H + Pd\_L = \mathbf{30.94mW}$$

## Reliability Information

Table 7.  $\theta_{JA}$  vs. Air Flow Table for a 20 Lead TSSOP

$\theta_{JA}$ vs. Air Flow			
Linear Feet per Minute	0	200	500
Single-Layer PCB, JEDEC Standard Test Boards	114.5°C/W	98.0°C/W	88.0°C/W
Multi-Layer PCB, JEDEC Standard Test Boards	73.2°C/W	66.6°C/W	63.5°C/W

## Transistor Count

The transistor count for ICS853014 is: 373

Pin compatible with MC100LVEP14 and SY100EP14U

## Package Outline and Package Dimensions

### Package Outline - G Suffix for 20 Lead TSSOP

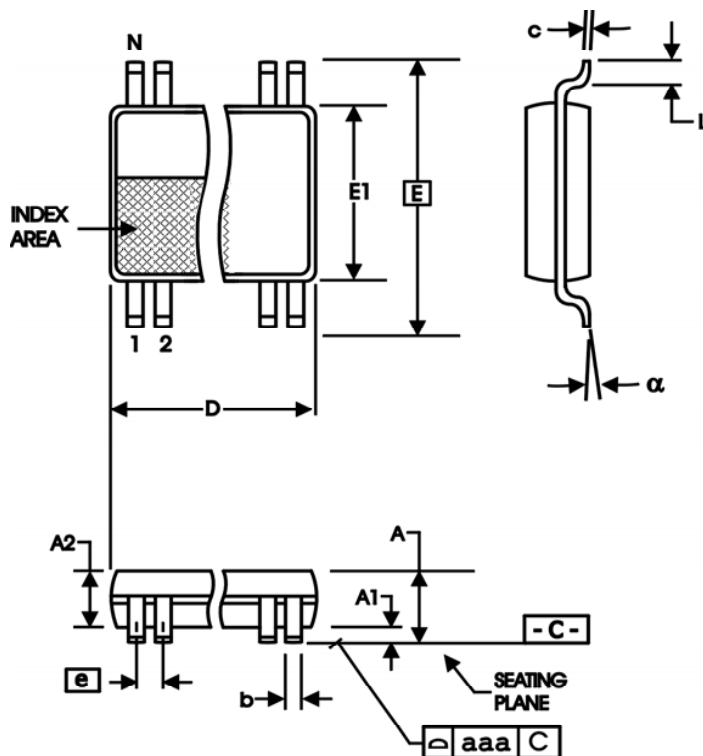


Table 8. Package Dimensions

All Dimensions in Millimeters		
Symbol	Minimum	Maximum
N	20	
A		1.20
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
c	0.09	0.20
D	6.40	6.60
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



## Ordering Information

Table 8. Ordering Information

Part/Order Number	Marking	Package	Shipping Packaging	Temperature
853014BG	ICS853014BG	20 Lead TSSOP	Tube	-40°C to 85°C
853014BGT	ICS853014BG	20 Lead TSSOP	2500 Tape & Reel	-40°C to 85°C
853014BGLF	ICS853014BGL	"Lead-Free" 20 Lead TSSOP	Tube	-40°C to 85°C
853014BGLFT	ICS853014BGL	"Lead-Free" 20 Lead TSSOP	2500 Tape & Reel	-40°C to 85°C

NOTE: Parts that are ordered with an "LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant.

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## Revision History Sheet

Rev	Table	Page	Description of Change	Date
B	T4B	4	3.3V LVPECL table - $V_{OH}$ values changed @ 85° to 2.22V min. and 2.295V typical from 2.295V min. and 2.33V typical.	9/10/03
	T4C	5	3.3V LVPECL table - $V_{OH}$ values changed @ 85° to 2.22V min. and 2.295V typical from 2.295V min. and 2.33V typical.	
	T4D	5	3.3V LVPECL table - $V_{OH}$ values changed @ 85° to 2.22V min. and 2.295V typical from 2.295V min. and 2.33V typical.	
		8 10	Revised LVPECL Output Termination drawings. Revised Figure 5D.	
C	T4B - T4D	4-5	LVPECL & ECL tables - deleted $V_{PP}$ row.	3/18/04
		6	AC Table - added $V_{PP}$ row and changed max. value from 1200mV to 1800mV.	
C	T9	1 16	Features Section - added Lead-Free bullet. Ordering Information Table - added Lead-Free part number.	5/13/05
D	4A	4	Power Supply DC Characteristics Table - changed $I_{EE}$ from 75mA max. to 85mA max. Updated format throughout the datasheet.	7/6/07
D		1	Corrected block diagram.	11/12/07
D	T8	16	Package Dimensions Table - corrected E dimension from 6.90mm Basic to 6.40mm Basic.	3/27/08
D	T8	17	Ordering Information Table - deleted ICS prefix from Part/Order Number column.	7/30/08
D	T1	2	Pin Description Table - Changed LVTTTL/LVCMOS to LVPECL for pins 12 & 19.	2/18/09
	T4B, T4C & T4D	5 & 6	DC Characteristics Tables - changed (single-ended) with (CLK_SEL, nEN) for $V_{IH}$ and $V_{IL}$ .	

ICS853014

LOW SKEW, 1-TO-5, DIFFERENTIAL-TO-2.5V, 3.3V LVPECL/ECL FANOUT BUFFER

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