

## **Low Voltage Dual 1:4, 1:5 Differential Fanout Buffer ECL/PECL Compatible**

The MC100LVE210 is a low voltage, low skew dual differential ECL fanout buffer designed with clock distribution in mind. The device features two fanout buffers, a 1:4 and a 1:5 buffer, on a single chip. The device features fully differential clock paths to minimize both device and system skew. The dual buffer allows for the fanout of two signals through a single chip, thus reducing the skew between the two fundamental signals from a part-to-part skew down to an output-to-output skew. This capability reduces the skew by a factor of 4 as compared to using two LVE111's to accomplish the same task. The MC100LVE210 works from a -3.3V supply while the MC100E210 provides identical function and performance from a standard -4.5V 100E voltage supply.

- Dual Differential Fanout Buffers
- 200ps Part-to-Part Skew
- 50ps Typical Output-to-Output Skew
- Low Voltage ECL/PECL Compatible
- 28-lead PLCC Packaging

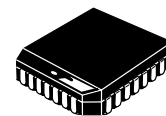
For applications which require a single-ended input, the  $V_{BB}$  reference voltage is supplied. For single-ended input applications the  $V_{BB}$  reference should be connected to the CLK input and bypassed to ground via a 0.01 $\mu$ f capacitor. The input signal is then driven into the CLK input.

To ensure that the tight skew specification is met it is necessary that both sides of the differential output are terminated into 50 $\Omega$ , even if only one side is being used. In most applications all nine differential pairs will be used and therefore terminated. In the case where fewer than nine pairs are used it is necessary to terminate at least the output pairs adjacent to the output pair being used in order to maintain minimum skew. Failure to follow this guideline will result in small degradations of propagation delay (on the order of 10-20ps) of the outputs being used, while not catastrophic to most designs this will result in an increase in skew. Note that the package corners isolate outputs from one another such that the guideline expressed above holds only for outputs on the same side of the package.

The MC100LVE210, as with most ECL devices, can be operated from a positive  $V_{CC}$  supply in PECL mode. This allows the LVE210 to be used for high performance clock distribution in +3.3V systems. Designers can take advantage of the LVE210's performance to distribute low skew clocks across the backplane or the board. In a PECL environment series or Thevenin line terminations are typically used as they require no additional power supplies, if parallel termination is desired a terminating voltage of  $V_{CC}-2.0V$  will need to be provided. For more information on using PECL, designers should refer to Motorola Application Note AN1406/D.

**MC100LVE210  
MC100E210**

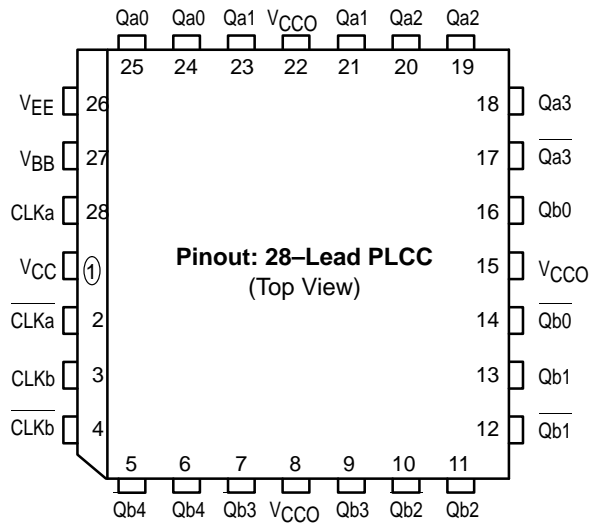
**LOW VOLTAGE  
DUAL 1:4, 1:5 DIFFERENTIAL  
FANOUT BUFFER**



**FN SUFFIX  
PLASTIC PACKAGE  
CASE 776-02**



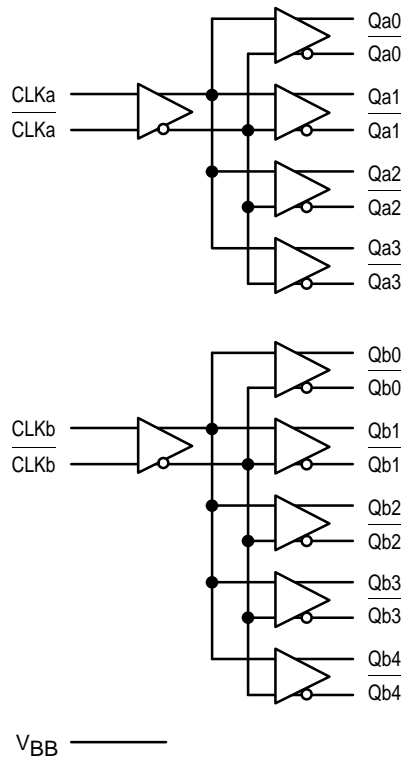
MC100LVE210 MC100E210



**PIN NAMES**

Pins	Function
CLKa, CLKb	Differential Input Pairs
Qa0:4, Qb0:3	Differential Outputs
VBB	VBB Output

**LOGIC SYMBOL**



**MC100LVE210**  
**ECL DC CHARACTERISTICS**

Symbol	Characteristic	-40°C			0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V <sub>OH</sub>	Output HIGH Voltage	-1.085	-1.005	-0.880	-1.025	-0.955	-0.880	-1.025	-0.955	-0.880	-1.025	-0.955	-0.880	V
V <sub>OL</sub>	Output LOW Voltage	-1.830	-1.695	-1.555	-1.810	-1.705	-1.620	-1.810	-1.705	-1.620	-1.810	-1.705	-1.620	V
V <sub>IH</sub>	Input HIGH Voltage	-1.165		-0.880	-1.165		-0.880	-1.165		-0.880	-1.165		-0.880	V
V <sub>IL</sub>	Input LOW Voltage	-1.810		-1.475	-1.810		-1.475	-1.810		-1.475	-1.810		-1.475	V
V <sub>BB</sub>	Output Reference Voltage	-1.38		-1.26	-1.38		-1.26	-1.38		-1.26	-1.38		-1.26	V
V <sub>EE</sub>	Power Supply Voltage	-3.0		-3.8	-3.0		-3.8	-3.0		-3.8	-3.0		-3.8	V
I <sub>IH</sub>	Input HIGH Current			150			150			150			150	μA
I <sub>EE</sub>	Power Supply Current			55			55			55			65	mA

**MC100LVE210**  
**PECL DC CHARACTERISTICS**

Symbol	Characteristic	-40°C			0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V <sub>OH</sub>	Output HIGH Voltage <sup>1</sup>	2.215	2.295	2.42	2.275	2.345	2.420	2.275	2.345	2.420	2.275	2.345	2.420	V
V <sub>OL</sub>	Output LOW Voltage <sup>1</sup>	1.47	1.605	1.745	1.490	1.595	1.680	1.490	1.595	1.680	1.490	1.595	1.680	V
V <sub>IH</sub>	Input HIGH Voltage <sup>1</sup>	2.135		2.420	2.135		2.420	2.135		2.420	2.135		2.420	V
V <sub>IL</sub>	Input LOW Voltage <sup>1</sup>	1.490		1.825	1.490		1.825	1.490		1.825	1.490		1.825	V
V <sub>BB</sub>	Output Reference Voltage <sup>1</sup>	1.92		2.04	1.92		2.04	1.92		2.04	1.92		2.04	V
V <sub>CC</sub>	Power Supply Voltage	3.0		3.8	3.0		3.8	3.0		3.8	3.0		3.8	V
I <sub>IH</sub>	Input HIGH Current			150			150			150			150	μA
I <sub>EE</sub>	Power Supply Current			55			55			55			65	mA

1. These values are for V<sub>CC</sub> = 3.3V. Level Specifications will vary 1:1 with V<sub>CC</sub>.

**MC100LVE210**  
**AC CHARACTERISTICS (V<sub>EE</sub> = V<sub>EE</sub> (min) to V<sub>EE</sub> (max); V<sub>CC</sub> = V<sub>CCO</sub> = GND)**

Symbol	Characteristic	-40°C			0°C			25°C			85°C			Unit	Condition
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay to Output IN (differential) IN (single-ended)	475 400		675 700	475 400		675 700	500 450		700 750	500 450		700 750	ps	Note 1 Note 2
t <sub>skew</sub>	Within-Device Skew Q <sub>a</sub> →Q <sub>b</sub> Q <sub>a</sub> →Q <sub>a</sub> , Q <sub>b</sub> →Q <sub>b</sub> Part-to-Part Skew (Diff)		50 50	75 75 200		50 30	75 50 200		50 30	75 50 200		50 30	75 50 200	ps	Note 3
V <sub>PP</sub>	Minimum Input Swing	500			500			500			500			mV	Note 4
V <sub>CMR</sub>	Common Mode Range	-1.5		-0.4	-1.5		-0.4	-1.5		-0.4	-1.5		-0.4	V	Note 5
t <sub>r</sub> /t <sub>f</sub>	Output Rise/Fall Time	200		600	200		600	200		600	200		600	ps	20%–80%

- The differential propagation delay is defined as the delay from the crossing points of the differential input signals to the crossing point of the differential output signals. See *Definitions and Testing of ECLinPS AC Parameters* in Chapter 1 (page 1–12) of the Motorola High Performance ECL Data Book (DL140/D).
- The single-ended propagation delay is defined as the delay from the 50% point of the input signal to the 50% point of the output signal. See *Definitions and Testing of ECLinPS AC Parameters* in Chapter 1 (page 1–12) of the Motorola High Performance ECL Data Book (DL140/D).
- The within-device skew is defined as the worst case difference between any two similar delay paths within a single device.
- V<sub>PP</sub>(min) is defined as the minimum input differential voltage which will cause no increase in the propagation delay. The V<sub>PP</sub>(min) is AC limited for the LVE210 as a differential input as low as 50 mV will still produce full ECL levels at the output.
- V<sub>CMR</sub> is defined as the range within which the V<sub>IH</sub> level may vary, with the device still meeting the propagation delay specification. The V<sub>IL</sub> level must be such that the peak to peak voltage is less than 1.0 V and greater than or equal to V<sub>pp</sub>(min).

# MC100LVE210 MC100E210

## MC100E210

### ECL DC CHARACTERISTICS

Symbol	Characteristic	-40°C			0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V <sub>OH</sub>	Output HIGH Voltage	-1.085	-1.005	-0.880	-1.025	-0.955	-0.880	-1.025	-0.955	-0.880	-1.025	-0.955	-0.880	V
V <sub>OL</sub>	Output LOW Voltage	-1.830	-1.695	-1.555	-1.810	-1.705	-1.620	-1.810	-1.705	-1.620	-1.810	-1.705	-1.620	V
V <sub>IH</sub>	Input HIGH Voltage	-1.165		-0.880	-1.165		-0.880	-1.165		-0.880	-1.165		-0.880	V
V <sub>IL</sub>	Input LOW Voltage	-1.810		-1.475	-1.810		-1.475	-1.810		-1.475	-1.810		-1.475	V
V <sub>BB</sub>	Output Reference Voltage	-1.38		-1.26	-1.38		-1.26	-1.38		-1.26	-1.38		-1.26	V
V <sub>EE</sub>	Power Supply Voltage	-5.25		-4.2	-5.25		-4.2	-5.25		-4.2	-5.25		-4.2	V
I <sub>IH</sub>	Input HIGH Current			150			150			150			150	μA
I <sub>EE</sub>	Power Supply Current			55			55			55			65	mA

## MC100E210

### PECL DC CHARACTERISTICS

Symbol	Characteristic	-40°C			0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V <sub>OH</sub>	Output HIGH Voltage <sup>1</sup>	3.915	3.995	4.12	3.975	4.045	4.12	3.975	4.045	4.12	3.975	4.045	4.12	V
V <sub>OL</sub>	Output LOW Voltage <sup>1</sup>	3.170	3.305	3.445	3.19	3.295	3.38	3.19	3.295	3.38	3.19	3.295	3.38	V
V <sub>IH</sub>	Input HIGH Voltage <sup>1</sup>	3.835		4.12	3.835		4.12	3.835		4.12	3.835		4.12	V
V <sub>IL</sub>	Input LOW Voltage <sup>1</sup>	3.190		3.525	3.190		3.525	3.190		3.525	3.190		3.525	V
V <sub>BB</sub>	Output Reference Voltage <sup>1</sup>	3.62		3.74	3.62		3.74	3.62		3.74	3.62		3.74	V
V <sub>CC</sub>	Power Supply Voltage	4.75		5.25	4.75		5.25	4.75		5.25	4.75		5.25	V
I <sub>IH</sub>	Input HIGH Current			150			150			150			150	μA
I <sub>EE</sub>	Power Supply Current			55			55			55			65	mA

1. These values are for V<sub>CC</sub> = 5.0V. Level Specifications will vary 1:1 with V<sub>CC</sub>.

## MC100E210

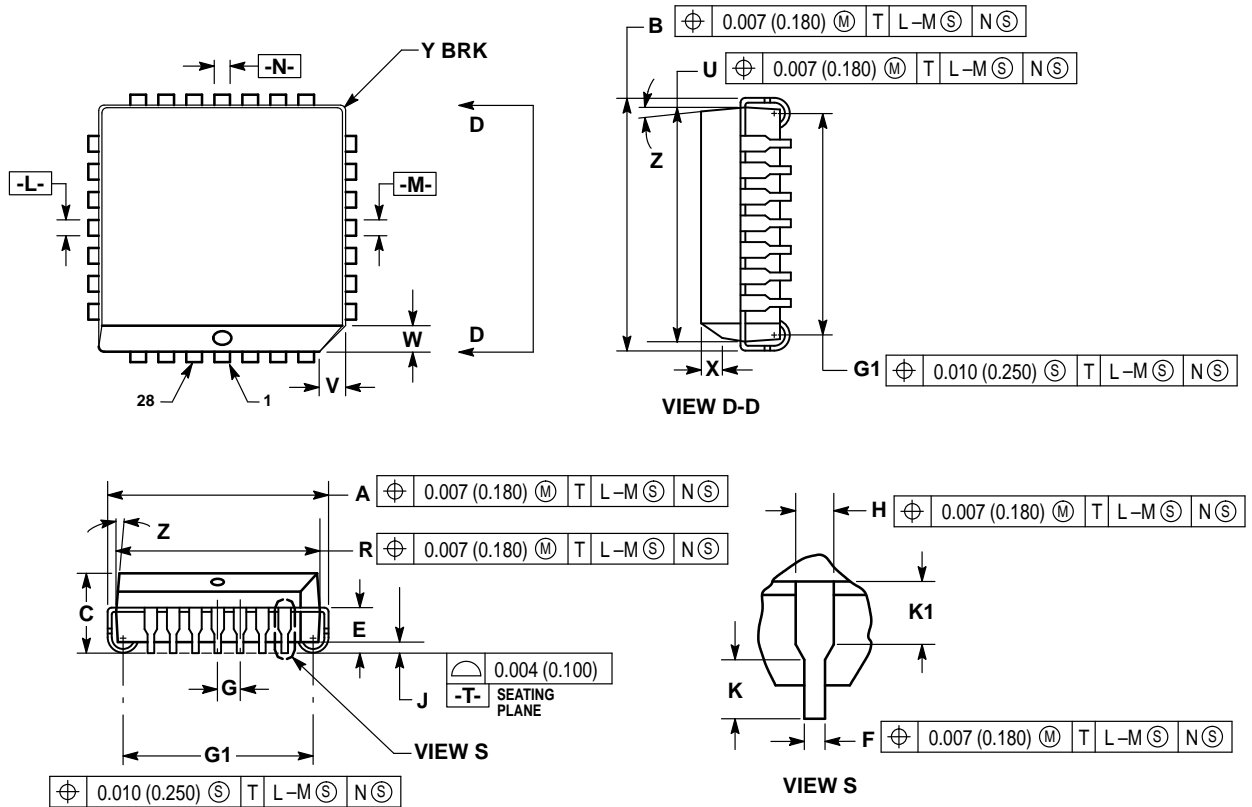
### AC CHARACTERISTICS (V<sub>EE</sub> = V<sub>EE</sub> (min) to V<sub>EE</sub> (max); V<sub>CC</sub> = V<sub>CCO</sub> = GND)

Symbol	Characteristic	-40°C			0°C			25°C			85°C			Unit	Condition
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay to Output IN (differential) IN (single-ended)	475 400		675 700	475 400		675 700	500 450		700 750	500 450		700 750	ps	Note 1 Note 2
t <sub>skew</sub>	Within-Device Skew Q <sub>a</sub> →Q <sub>b</sub> Q <sub>a</sub> →Q <sub>a</sub> , Q <sub>b</sub> →Q <sub>b</sub> Part-to-Part Skew (Diff)		50 50	75 75 200		50 30	75 50 200		50 30	75 50 200		50 30	75 50 200	ps	Note 3
V <sub>PP</sub>	Minimum Input Swing	500			500			500			500			mV	Note 4
V <sub>CMR</sub>	Common Mode Range	-1.5		-0.4	-1.5		-0.4	-1.5		-0.4	-1.5		-0.4	V	Note 5
t <sub>r</sub> /t <sub>f</sub>	Output Rise/Fall Time	200		600	200		600	200		600	200		600	ps	20%–80%

- The differential propagation delay is defined as the delay from the crossing points of the differential input signals to the crossing point of the differential output signals. See *Definitions and Testing of ECLinPS AC Parameters* in Chapter 1 (page 1–12) of the Motorola High Performance ECL Data Book (DL140/D).
- The single-ended propagation delay is defined as the delay from the 50% point of the input signal to the 50% point of the output signal. See *Definitions and Testing of ECLinPS AC Parameters* in Chapter 1 (page 1–12) of the Motorola High Performance ECL Data Book (DL140/D).
- The within-device skew is defined as the worst case difference between any two similar delay paths within a single device.
- V<sub>PP</sub>(min) is defined as the minimum input differential voltage which will cause no increase in the propagation delay. The V<sub>PP</sub>(min) is AC limited for the E210 as a differential input as low as 50 mV will still produce full ECL levels at the output.
- V<sub>CMR</sub> is defined as the range within which the V<sub>IH</sub> level may vary, with the device still meeting the propagation delay specification. The V<sub>IL</sub> level must be such that the peak to peak voltage is less than 1.0 V and greater than or equal to V<sub>PP</sub>(min).

OUTLINE DIMENSIONS


FN SUFFIX  
 PLASTIC PLCC PACKAGE  
 CASE 776-02  
 ISSUE D



NOTES:

- DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
- DIM G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
- DIM R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM BY UP TO 0.012 (0.300). DIMENSIONS R AND U ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
- DIMENSION H DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE GREATER THAN 0.037 (0.940). THE DAMBAR INTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE SMALLER THAN 0.025 (0.635).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.485	0.495	12.32	12.57
B	0.485	0.495	12.32	12.57
C	0.165	0.180	4.20	4.57
E	0.090	0.110	2.29	2.79
F	0.013	0.019	0.33	0.48
G	0.050 BSC		1.27 BSC	
H	0.026	0.032	0.66	0.81
J	0.020	—	0.51	—
K	0.025	—	0.64	—
R	0.450	0.456	11.43	11.58
U	0.450	0.456	11.43	11.58
V	0.042	0.048	1.07	1.21
W	0.042	0.048	1.07	1.21
X	0.042	0.056	1.07	1.42
Y	—	0.020	—	0.50
Z	2°		10°	
G1	0.410	0.430	10.42	10.92
K1	0.040	—	1.02	—

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