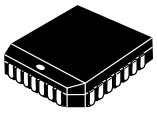
MC100LVE310

3.3V ECL 2:8 Differential Fanout Buffer

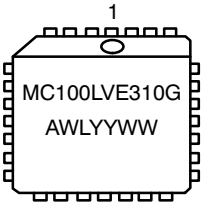
ON Semiconductor®

http://onsemi.com



PLCC−28
FN SUFFIX
CASE 776

MARKING DIAGRAM*



A	= Assembly Location
WL	= Wafer Lot
YY	= Year
WW	= Work Week
G	= Pb−Free Package

*For additional marking information, refer to Application Note AND8002/D.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

Description

The MC100LVE310 is a low voltage, low skew 2:8 differential ECL fanout buffer designed with clock distribution in mind. The device features fully differential clock paths to minimize both device and system skew. The LVE310 offers two selectable clock inputs to allow for redundant or test clocks to be incorporated into the system clock trees.

To ensure that the tight skew specification is met it is necessary that both sides of the differential output are terminated into 50 Ω, even if only one side is being used. In most applications all eight differential pairs will be used and therefore terminated. In the case where fewer than eight 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 – 20 ps) 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.

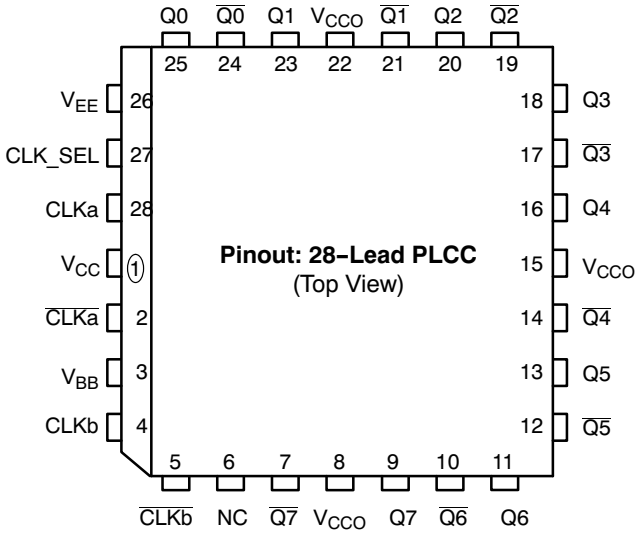
The MC100LVE310, as with most ECL devices, can be operated from a positive V_{CC} supply in LVPECL mode. This allows the LVE310 to be used for high performance clock distribution in +3.3 V systems. Designers can take advantage of the LVE310's performance to distribute low skew clocks across the backplane 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} – 2.0 V will need to be provided. For more information on using PECL, designers should refer to Application Note AN1406/D.

The V_{BB} pin, an internally generated voltage supply, is available to this device only. For single-ended input conditions, the unused differential input is connected to V_{BB} as a switching reference voltage. V_{BB} may also rebias AC coupled inputs. When used, decouple V_{BB} and V_{CC} via a 0.01 μF capacitor and limit current sourcing or sinking to 0.5 mA. When not used, V_{BB} should be left open.

Features

- 200 ps Part−to−Part Skew
- 50 ps Output−to−Output Skew
- PECL Mode Operating Range:
  V_{CC} = 3.0 V to 3.8 V with V_{EE} = 0 V
- NECL Mode Operating Range:
  V_{CC} = 0 V with V_{EE} = −3.0 V to −3.8 V
- Q Output will Default LOW with All Inputs Open or at V_{EE}
- The 100 Series Contains Temperature Compensation
- Pb−Free Packages are Available*

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



Warning: All V_{CC}, V_{CCO}, and V_{EE} pins must be externally connected to Power Supply to guarantee proper operation.

Figure 1. Logic Diagram and Pinout Assignment

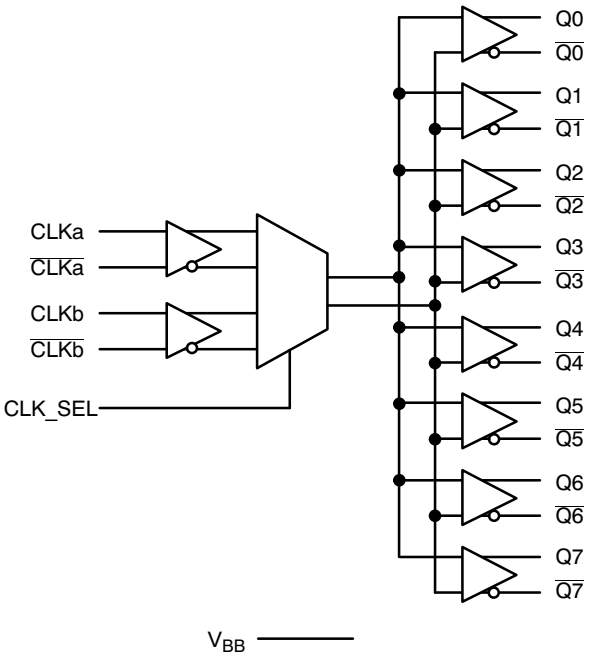


Figure 2. Logic Symbol

Table 1. PIN DESCRIPTION

PIN	FUNCTION
CLKa, $\overline{CLKa}$; ,CLKb $\overline{CLKb}$	ECL Differential Input Clocks
Q0:7, $\overline{Q0:7}$	ECL Differential Outputs
CLK_SEL	ECL Input Clock Select
V_{BB}	Reference Voltage Output
V_{CC}, V_{CCO}	Positive Supply
V_{EE}	Negative Supply
NC	No Connect

Table 2. TRUTH TABLE

CLK_SEL	Input Clock
L	CLKa Selected
H	CLKb Selected

Table 3. ATTRIBUTES

Characteristics		Value	
Internal Input Pulldown Resistor		YES	
Internal Input Pullup Resistor		N/A	
ESD Protection	Human Body Model Machine Model	> 2 kV > 200 V	
Moisture Sensitivity, Indefinite Time Out of Drypack (Note 1)		Pb Pkg	Pb−Free Pkg
	PLCC−28	Level 1	Level 3
Flammability Rating	Oxygen Index: 28 to 34	UL 94 V−0 @ 0.125 in	
Transistor Count		212 Devices	
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test			

1. For additional information, see Application Note AND8003/D.

Table 4. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V_{CC}	PECL Mode Power Supply	V_{EE} = 0 V		8 to 0	V
V_{EE}	NECL Mode Power Supply	V_{CC} = 0 V		−8 to 0	V
V_I	PECL Mode Input Voltage NECL Mode Input Voltage	V_{EE} = 0 V V_{CC} = 0 V	$V_I \le V_{CC}$ $V_I \ge V_{EE}$	6 to 0 −6 to 0	V V
I_{out}	Output Current	Continuous Surge		50 100	mA mA
I_{BB}	V_{BB} Sink/Source			± 0.5	mA
T_A	Operating Temperature Range			−40 to +85	°C
T_{stg}	Storage Temperature Range			−65 to +150	°C
θ_{JA}	Thermal Resistance (Junction−to−Ambient)	0 lfpm 500 lfpm	PLCC−28 PLCC−28	63.5 43.5	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction−to−Case)	Standard Board	PLCC−28	22 to 26 ± 5%	°C/W
T_{sol}	Wave Solder Pb Pb−Free			265 265	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Table 5. LVPECL DC CHARACTERISTICS V_{CC} = 3.3 V, V_{EE} = 0 V (Note 2)

		−40°C			25°C			85°C			
Symbol	Characteristic	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Unit
I_{EE}	Power Supply Current		55	60		55	60		65	70	mA
V_{OH}	Output HIGH Voltage (Note 3)	2215	2295	2420	2275	2345	2420	2275	2345	2420	mV
V_{OL}	Output LOW Voltage (Note 3)	1470	1605	1745	1490	1595	1680	1490	1595	1680	mV
V_{IH}	Input HIGH Voltage (Single−Ended)	2135		2420	2135		2420	2135		2420	mV
V_{IL}	Input LOW Voltage (Single−Ended)	1490		1825	1490		1825	1490		1825	mV
V_{BB}	Output Voltage Reference	1.92		2.04	1.92		2.04	1.92		2.04	V
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4)	1.8		2.9	1.8		2.9	1.8		2.9	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	0.5			0.5			0.5			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

2. Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary ± 0.3 V.
3. Outputs are terminated through a 50 Ω resistor to V_{CC} − 2 V.
4. V_{IHCMR} min varies 1:1 with V_{EE}, max varies 1:1 with V_{CC}. V_{IHCMR} is defined as the range within which the V_{IH} level may vary, with the device still meeting the propagation delay specification. The V_{IL} level must be such that the peak to peak voltage is less than 1.0 V and greater than or equal to V_{PP}(min).

Table 6. LVNECL DC CHARACTERISTICS V_{CC} = 5.0 V, V_{EE} = −3.3 V (Note 5)

		−40°C			25°C			85°C			
Symbol	Characteristic	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Unit
I_{EE}	Power Supply Current		55	60		55	60		65	70	mA
V_{OH}	Output HIGH Voltage (Note 6)	−1085	−1005	−880	−1025	−955	−880	−1025	−955	−880	mV
V_{OL}	Output LOW Voltage (Note 6)	−1830	−1695	−1555	−1810	−1705	−1620	−1810	−1705	−1620	mV
V_{IH}	Input HIGH Voltage (Single−Ended)	−1165		−880	−1165		−880	−1165		−880	mV
V_{IL}	Input LOW Voltage (Single−Ended)	−1810		−1475	−1810		−1475	−1810		−1475	mV
V_{BB}	Output Voltage Reference	−1.38		−1.26	−1.38		−1.26	−1.38		−1.26	V
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 7)	−1.5		−0.4	−1.5		−0.4	−1.5		−0.4	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	0.5			0.5			0.5			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

5. Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary ± 0.3 V.
6. Outputs are terminated through a 50 Ω resistor to V_{CC} − 2 V.
7. V_{IHCMR} min varies 1:1 with V_{EE}, max varies 1:1 with V_{CC}. V_{IHCMR} is defined as the range within which the V_{IH} level may vary, with the device still meeting the propagation delay specification. The V_{IL} level must be such that the peak to peak voltage is less than 1.0 V and greater than or equal to V_{PP}(min).

Table 7. AC CHARACTERISTICS V_{CC} = 3.3 V; V_{EE} = 0.0 V or V_{CC} = 0.0 V; V_{EE} = −3.3 V (Note 8)

		−40°C			25°C			85°C			
Symbol	Characteristic	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Unit
f_{max}	Maximum Toggle Frequency @ V_{out} >500 mV_{pp}	0.5	1.0		0.5	1.0		0.5	1.0		GHz
t_{PLH} t_{PHL}	Propagation Delay to Output IN (Differential Configuration) (Note 9) IN (Single−Ended) (Note 10)	 525 500		 725 750	 550 550		 750 800	 575 600		 775 850	ps
t_{skew}	Within−Device Skew (Note 11) Part−to−Part Skew (Differential Configuration)			75 250			50 200			50 200	ps
t_{JITTER}	Additive CLOCK Jitter (RMS) <0.5 GHz		1.5	2.0		1.5	2.0		1.5	2.0	ps
V_{PP}	Input Swing (Note12)	500		1000	500		1000	500		1000	mV
t_r/t_f	Output Rise/Fall Time (20%−80%)	200		600	200		600	200		600	ps

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

8. V_{EE} can vary ± 0.3 V.
9. 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.
10. 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.
11. The within−device skew is defined as the worst case difference between any two similar delay paths within a single device.
12. V_{PP}(min) is defined as the minimum input differential voltage which will cause no increase in the propagation delay. The V_{PP}(min) is AC limited for the LVE310 as a differential input as low as 50 mV will still produce full ECL levels at the output.

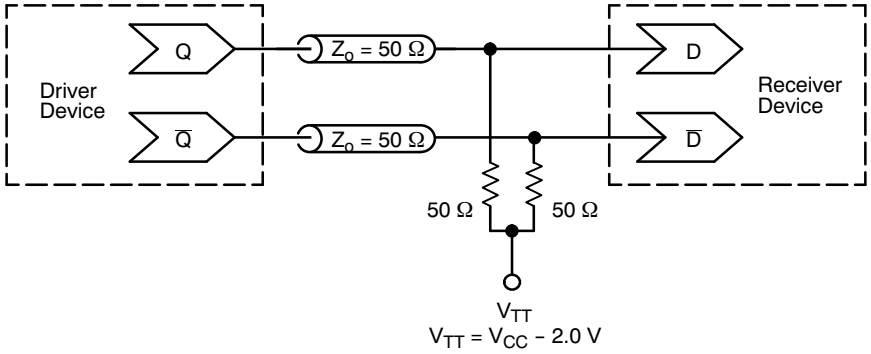


Figure 3. Typical Termination for Output Driver and Device Evaluation (See Application Note AND8020/D – Termination of ECL Logic Devices.)

ORDERING INFORMATION

Device	Package	Shipping†
MC100LVE310FN	PLCC−28	37 Units / Rail
MC100LVE310FNG	PLCC−28 (Pb−Free)	37 Units / Rail
MC100LVE310FNR2	PLCC−28	500 / Tape & Reel
MC100LVE310FNR2G	PLCC−28 (Pb−Free)	500 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Resource Reference of Application Notes

AN1405/D – ECL Clock Distribution Techniques

AN1406/D – Designing with PECL (ECL at +5.0 V)

AN1503/D – ECLinPS™ I/O SPiCE Modeling Kit

AN1504/D – Metastability and the ECLinPS Family

AN1568/D – Interfacing Between LVDS and ECL

AN1672/D – The ECL Translator Guide

AND8001/D – Odd Number Counters Design

AND8002/D – Marking and Date Codes

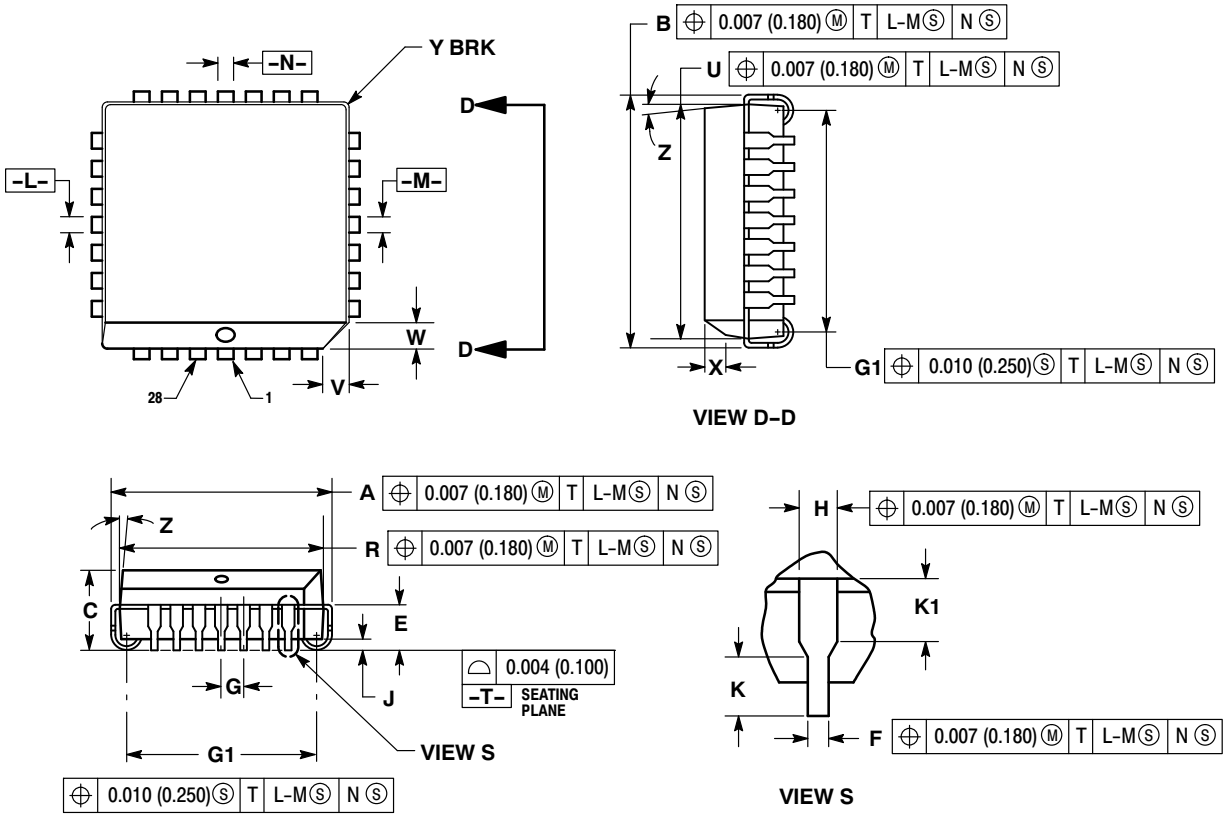
AND8020/D – Termination of ECL Logic Devices

AND8066/D – Interfacing with ECLinPS

AND8090/D – AC Characteristics of ECL Devices

PACKAGE DIMENSIONS

PLCC−28
FN SUFFIX
PLASTIC PLCC PACKAGE
CASE 776−02
ISSUE E



NOTES:
1. DATUMS −L−, −M−, AND −N− DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
2. DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM −T−, SEATING PLANE.
3. DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
5. CONTROLLING DIMENSION: INCH.
6. 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.
7. 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).

	INCHES		MILLIMETERS	
DIM	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°	2°	10°
G1	0.410	0.430	10.42	10.92
K1	0.040	---	1.02	---

ECLinPS is a trademark of Semiconductor Components Industries, LLC (SCILLC).

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5773−3850

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

MC100LVE310/D