

MC100LVE111

3.3V ECL 1:9 Differential Clock Driver

The MC100LVE111 is a low skew 1-to-9 differential driver, designed with clock distribution in mind. The MC100LVE111's function and performance are similar to the popular MC100E111, with the added feature of low voltage operation. It accepts one signal input, which can be either differential or single-ended if the V_{BB} output is used. The signal is fanned out to 9 identical differential outputs.

The LVE111 is specifically designed, modeled and produced with low skew as the key goal. Optimal design and layout serve to minimize gate to gate skew within a device, and empirical modeling is used to determine process control limits that ensure consistent t_{pd} distributions from lot to lot. The net result is a dependable, guaranteed low skew device.

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 on the same package side as the pair(s) being used on that side, in order to maintain minimum skew. Failure to do this will result in small degradations of propagation delay (on the order of 10–20 ps) of the output(s) being used which, while not being catastrophic to most designs, will mean a loss of skew margin.

The MC100LVE111, as with most other ECL devices, can be operated from a positive V_{CC} supply in PECL mode. This allows the LVE111 to be used for high performance clock distribution in +3.3 V systems. Designers can take advantage of the LVE111'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. For systems incorporating GTL, parallel termination offers the lowest power by taking advantage of the 1.2 V supply as a terminating voltage. 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.

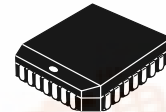
- 200 ps Part-to-Part Skew
- 50 ps Output-to-Output Skew
- ESD Protection: >2 KV HBM, >200 V MM
- The 100 Series Contains Temperature Compensation
- PECL Mode Operating Range: $V_{CC} = 3.0\ \text{V}$ to $3.8\ \text{V}$ with $V_{EE} = 0\ \text{V}$
- NECL Mode Operating Range: $V_{CC} = 0\ \text{V}$ with $V_{EE} = -3.0\ \text{V}$ to $-3.8\ \text{V}$
- Internal Input Pulldown Resistors
- Q Output will Default LOW with Inputs Open or at V_{EE}
- Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test
- Moisture Sensitivity Level 1
- For Additional Information, see Application Note AND8003/D
- Flammability Rating: UL-94 code V-0 @ 1/8",
- Oxygen Index 28 to 34
- Transistor Count = 250 devices



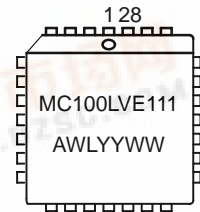
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MARKING DIAGRAM*



PLCC-28
FN SUFFIX
CASE 776



A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week

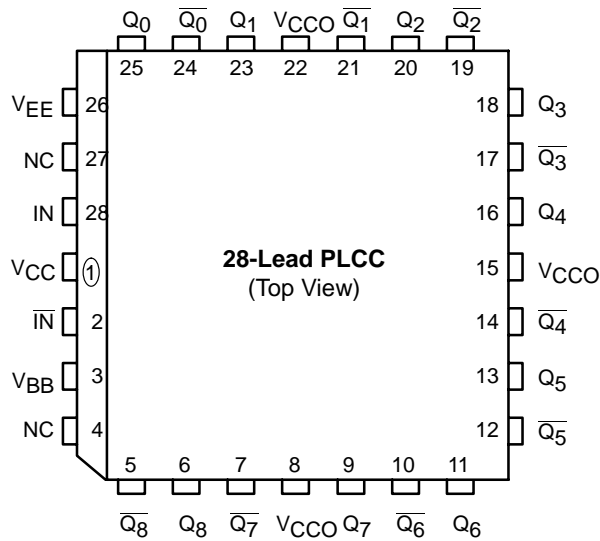
*For additional information, see Application Note AND8002/D

ORDERING INFORMATION

Device	Package	Shipping
MC100LVE111FN	PLCC-28	37 Units/Rail
MC100LVE111FNR2	PLCC-28	500 Units/Reel



MC100LVE111



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

Figure 1. Pinout (Top View) and Logic Diagram

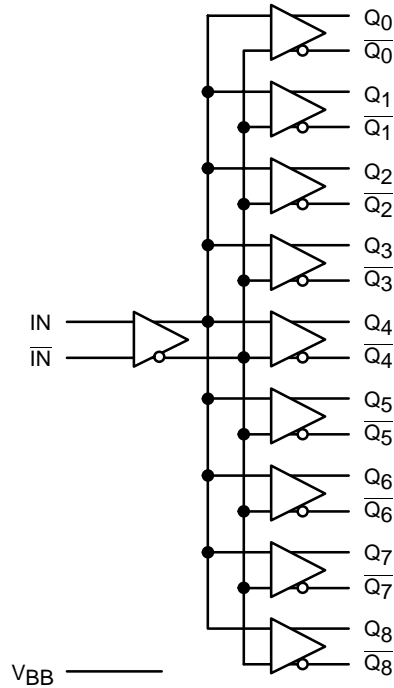


Figure 2. Logic Symbol

PIN DESCRIPTION

PIN	FUNCTION
IN, \overline{IN}	ECL Differential Input Pair
$Q_0, \overline{Q_0}$ – $Q_8, \overline{Q_8}$	ECL Differential Outputs
V_{BB}	Reference Voltage Output
V_{CC}, V_{CCO}	Positive Supply
V_{EE}	Negative Supply
NC	No Connect

MAXIMUM RATINGS (Note 1)

Symbol	Parameter	Condition 1	Condition 2	Rating	Units
V_{CC}	PECL Mode Power Supply	$V_{EE} = 0\text{ V}$		8 to 0	V
V_{EE}	NECL Mode Power Supply	$V_{CC} = 0\text{ V}$		–8 to 0	V
V_I	PECL Mode Input Voltage NECL Mode Input Voltage	$V_{EE} = 0\text{ V}$ $V_{CC} = 0\text{ V}$	$V_I \leq V_{CC}$ $V_I \geq V_{EE}$	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	$^{\circ}\text{C}$
T_{stg}	Storage Temperature Range			–65 to +150	$^{\circ}\text{C}$
θ_{JA}	Thermal Resistance (Junction to Ambient)	0 LFPM 500 LFPM	28 PLCC 28 PLCC	63.5 43.5	$^{\circ}\text{C}/\text{W}$ $^{\circ}\text{C}/\text{W}$
θ_{JC}	Thermal Resistance (Junction to Case)	std bd	28 PLCC	22 to 26 $\pm 5\%$	$^{\circ}\text{C}/\text{W}$
T_{sol}	Wave Solder	<2 to 3 sec @ 248 $^{\circ}\text{C}$		265	$^{\circ}\text{C}$

1. Maximum Ratings are those values beyond which device damage may occur.

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LVPECL DC CHARACTERISTICS $V_{CC}=3.3\text{ V}$; $V_{EE}=0.0\text{ V}$ (Note 2)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		55	66		55	66		65	78	mA
V_{OH}	Output HIGH Voltage (Note 3)	2215	2345	2420	2275	2345	2420	2275	2345	2420	mV
V_{OL}	Output LOW Voltage (Note 3)	1490	1595	1680	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) (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: Devices are designed to meet the DC specifications shown in the above table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 lpm is maintained.

2. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $\pm 0.3\text{ V}$.

3. Outputs are terminated through a 50 ohm resistor to $V_{CC}-2$ volts.

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 $V_{pp}(\text{min})$.

LVNECL DC CHARACTERISTICS $V_{CC}=0.0\text{ V}$; $V_{EE}=-3.3\text{ V}$ (Note 5)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current		55	66		55	66		65	78	mA
V_{OH}	Output HIGH Voltage (Note 6)	-1085	-955	-880	-1025	-955	-880	-1025	-955	-880	mV
V_{OL}	Output LOW Voltage (Note 6)	-1810	-1705	-1620	-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) (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: Devices are designed to meet the DC specifications shown in the above table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 lpm is maintained.

5. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $\pm 0.3\text{ V}$.

6. Outputs are terminated through a 50 ohm resistor to $V_{CC}-2$ volts.

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 $V_{pp}(\text{min})$.

AC CHARACTERISTICS $V_{CC}=3.3\text{ V}$; $V_{EE}=0.0\text{ V}$ or $V_{CC}=0.0\text{ V}$; $V_{EE}=-3.3\text{ V}$ (Note 8)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
f_{max}	Maximum Toggle Frequency		> 1.5			> 1.5			> 1.5		GHz
t_{PLH} t_{PHL}	Propagation Delay to Output IN (differential) (Note 9) IN (single-ended) (Note 10)	400 350		650 700	440 390		630 680	445 395		635 685	ps
t_{skew}	Within-Device Skew (Note 11) Part-to-Part Skew (Diff)			50 250			50 200			50 200	ps
t_{JITTER}	Cycle-to-Cycle Jitter		0.2	< 1		0.2	< 1		0.2	< 1	ps
V_{PP}	Input Swing (Note 12)	500		1000	500		1000	500		1000	mV
t_r/t_f	Output Rise/Fall Time (20%–80%)	200		600	200		600	200		600	ps

8. V_{EE} can vary $\pm 0.3\text{ V}$.

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. $V_{pp}(\text{min})$ is defined as the minimum input differential voltage which will cause no increase in the propagation delay. The $V_{pp}(\text{min})$ is AC limited for the E111 as a differential input as low as 50 mV will still produce full ECL levels at the output.

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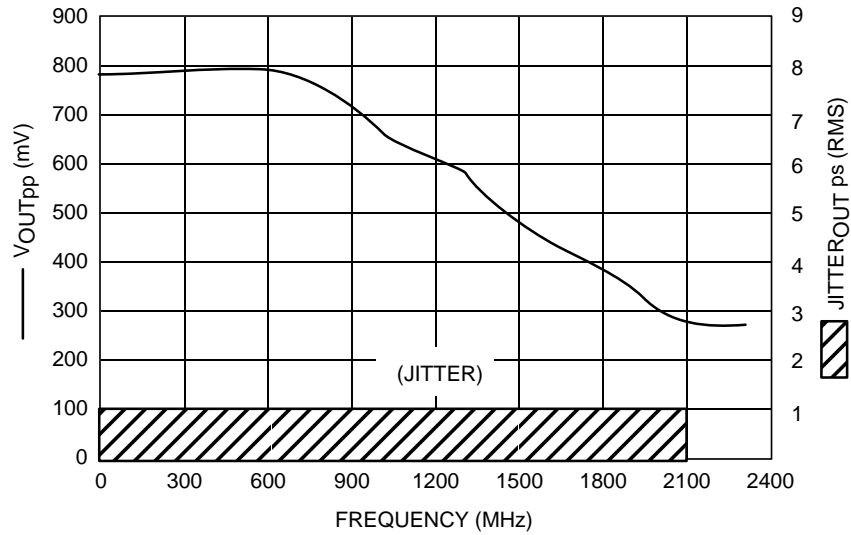


Figure 3. F_{max}/Jitter

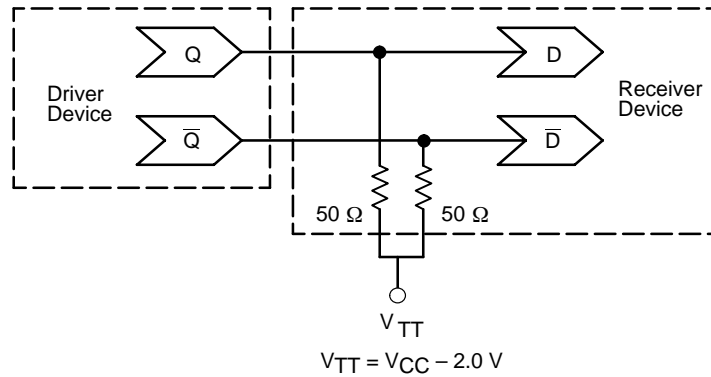


Figure 4. Typical Termination for Output Driver and Device Evaluation
(See Application Note AND8020 – Termination of ECL Logic Devices.)

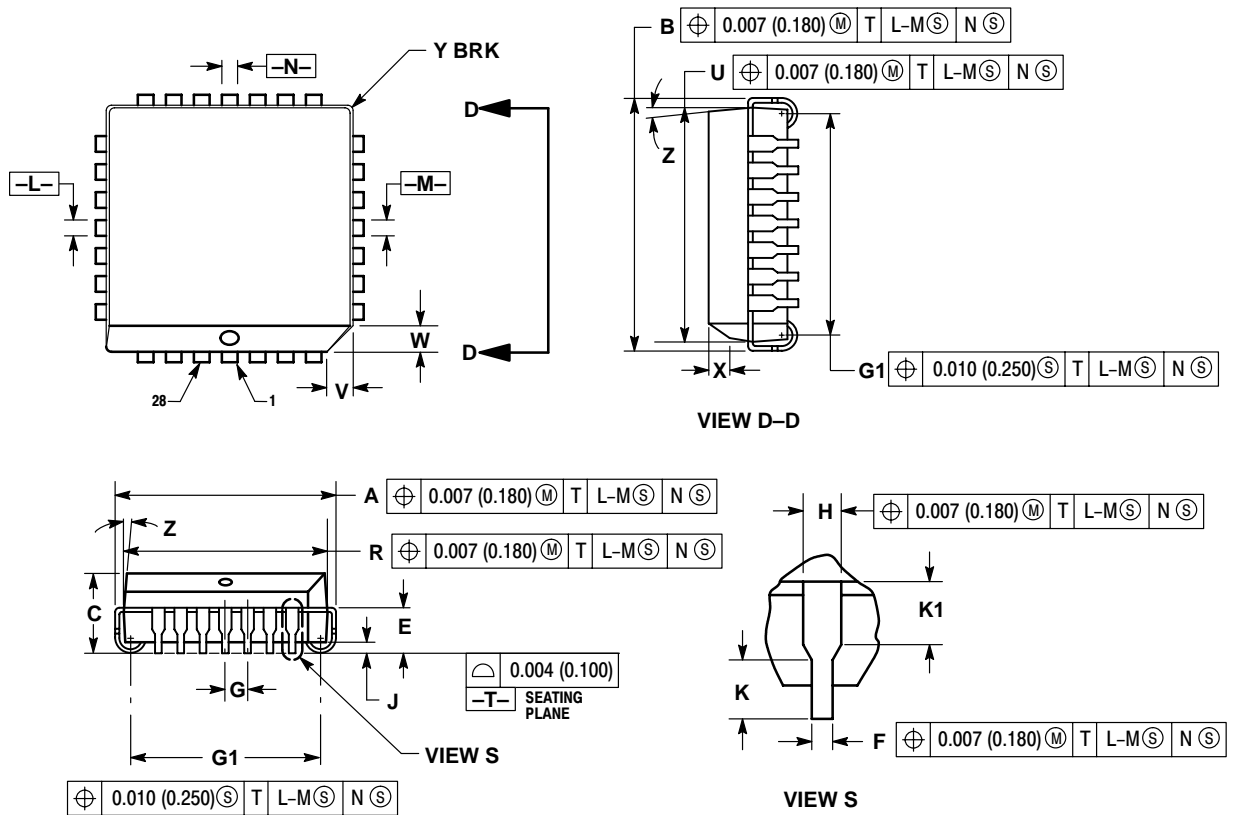
Resource Reference of Application Notes

- AN1404** – ECLinPS Circuit Performance at Non-Standard V_{IH} Levels
- AN1405** – ECL Clock Distribution Techniques
- AN1406** – Designing with PECL (ECL at +5.0 V)
- AN1503** – ECLinPS I/O SPICE Modeling Kit
- AN1504** – Metastability and the ECLinPS Family
- AN1560** – Low Voltage ECLinPS SPICE Modeling Kit
- AN1568** – Interfacing Between LVDS and ECL
- AN1596** – ECLinPS Lite Translator ELT Family SPICE I/O Model Kit
- AN1650** – Using Wire-OR Ties in ECLinPS Designs
- AN1672** – The ECL Translator Guide
- AND8001** – Odd Number Counters Design
- AND8002** – Marking and Date Codes
- AND8020** – Termination of ECL Logic Devices

MC100LVE111

PACKAGE DIMENSIONS

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



NOTES:

- DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
- DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
- DIMENSIONS 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°		2° 10°	
G1	0.410	0.430	10.42	10.92
K1	0.040	---	1.02	---

Notes

MC100LVE111

Notes

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