2.5 V/3.3 V 2:1:15 Differential ECL/PECL ÷1/÷2 Clock Driver

NB100LVEP222

The NB100LVEP222 is a low skew 2:1:15 differential ÷1/÷2 ECL fanout buffer designed with clock distribution in mind. The LVECL/LVPECL input signal pairs can be used in a differential configuration or single−ended (with V_{BB} output reference bypassed and connected to the unused input of a pair). Either of two fully differential clock inputs may be selected. Each of the four output banks of 2, 3, 4, and 6 differential pairs may be independently configured to fanout 1X or 1/2X of the input frequency. When the output banks are configured with the ÷1 mode, data can also be distributed. The LVEP222 specifically guarantees low output to output skew. Optimal design, layout, and processing minimize skew within a device and from lot to lot. This device is an improved version of the MC100LVE222 with higher speed capability and reduced skew.

The fsel pins and CLK_Sel pin are asynchronous control inputs. Any changes may cause indeterminate output states requiring an MR pulse to resynchronize any 1/2X outputs (See Figure 3). Unused output pairs should be left unterminated (open) to reduce power and switching noise.

The NB100LVEP222, as with most ECL devices, can be operated from a positive V_{CC}/V_{CC0} supply in LVPECL mode. This allows the LVEP222 to be used for high performance clock distribution in +2.5/3.3 V systems. In a PECL environment series or Thevenin line, terminations are typically used as they require no additional power supplies. For more information on using PECL, designers should refer to Application Note AN1406/D. For a SPICE model, refer to Application Note AN1560/D.

The V_{BB} pin, an internally generated voltage supply, is available to this device only. For single−ended LVPECL 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}/V_{CC0} 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. Single−ended CLK input operation is limited to a $V_{CC}/V_{CC0} \geq 3.0$ V in LVPECL mode, or $V_{EE} \leq -3.0$ V in NECL mode.

Features

- 20 ps Output−to−Output Skew
- 85 ps Part−to−Part Skew
- Selectable 1x or 1/2x Frequency Outputs
- LVPECL Mode Operating Range:
  V_{CC}/V_{CC0} = 2.375 V to 3.8 V with V_{EE} = 0 V
- NECL Mode Operating Range:
  V_{CC}/V_{CC0} = 0 V with V_{EE} = −2.375 V to −3.8 V
- Internal Input Pulldown Resistors
- Performance Upgrade to ON Semiconductor's MC100LVE222
- V_{BB} Output
- These Devices are Pb−Free, Halogen Free and are RoHS Compliant

ON Semiconductor®

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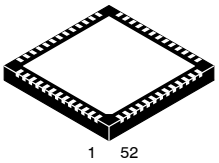
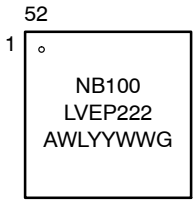


QFN−52
MN SUFFIX
CASE 485M

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

Device	Package	Shipping
NB100LVEP222MNG	QFN−52 (Pb−Free)	260 Units / Tray

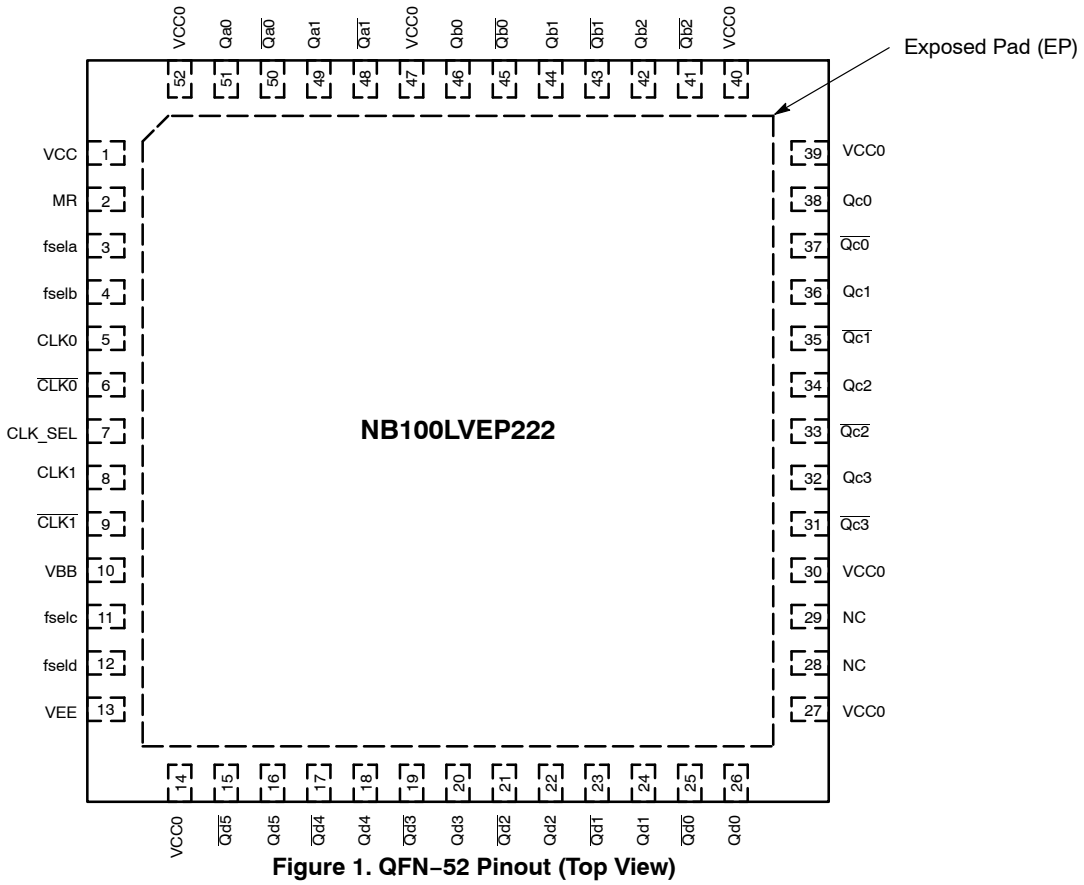


Figure 1. QFN−52 Pinout (Top View)

Table 1. PIN DESCRIPTION

PIN	FUNCTION
CLK0*, $\overline{\text{CLK0}}$**	ECL Differential Input Clock
CLK1*, $\overline{\text{CLK1}}$**	ECL Differential Input Clock
CLK_Sel*	ECL Clock Select
MR*	ECL Master Reset
Qa0:1, $\overline{\text{Qa0:1}}$	ECL Differential Outputs
Qb0:2, $\overline{\text{Qb0:2}}$	ECL Differential Outputs
Qc0:3, $\overline{\text{Qc0:3}}$	ECL Differential Outputs
Qd0:5, $\overline{\text{Qd0:5}}$	ECL Differential Outputs
fseln*	ECL ÷1 or ÷2 Select
V_{BB}	Reference Voltage Output
V_{CC}, V_{CC0}	Positive Supply, V_{CC} = V_{CC0}
V_{EE}***	Negative Supply
NC	No Connect

* Pins will default LOW when left open.
** Pins will default HIGH when left open.
***The thermally conductive exposed pad on the bottom of the package is electrically connected to V_{EE} internally.

Table 2. FUNCTION TABLE

	Function	
Input	L	H
MR	Active	Reset
CLK_Sel	CLK0	CLK1
fseln	÷1	÷2

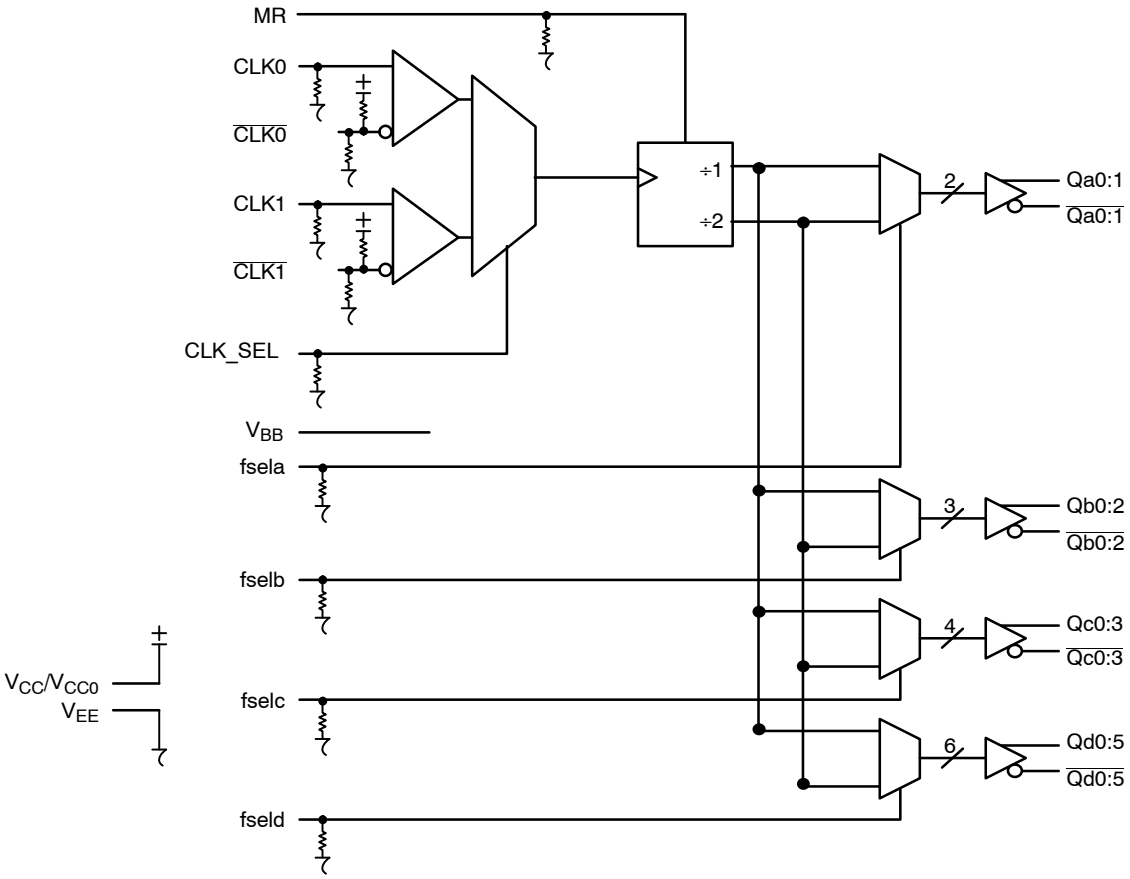


Figure 2. Logic Diagram

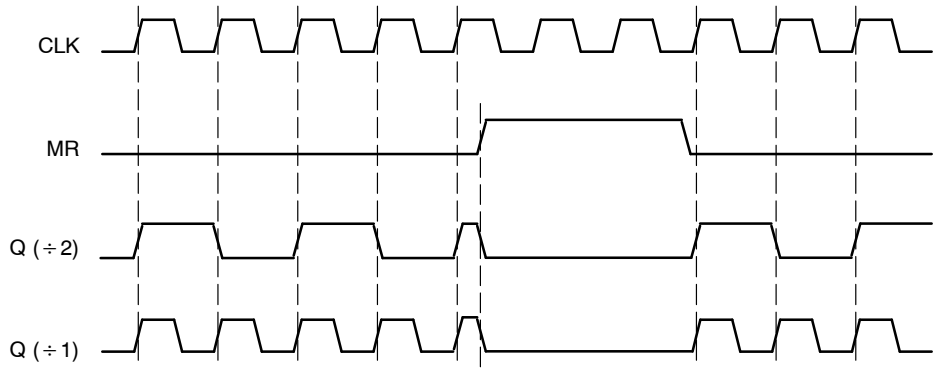


Figure 3. Master Reset (MR) Timing Diagram

Table 3. ATTRIBUTES

Characteristics	Value
Internal Input Pulldown Resistor	75 kΩ
Internal Input Pullup Resistor	37.5 kΩ
ESD Protection Human Body Model Machine Model Charged Device Model	 > 2 kV > 200 V > 2 kV
Moisture Sensitivity, Indefinite Time Out of Drypack (Note 1)	Pb−Free Pkg
QFN−52	Level 2
Flammability Rating Oxygen Index: 28 to 34	 UL 94 V−O @ 0.125 in
Transistor Count	821 Devices
Meets or Exceeds JEDEC Spec EIA/JESD78 IC Latchup Test	

1. For additional information, refer to Application Note AND8003/D.

Table 4. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V_{CC}/V_{CC0}	PECL Mode Power Supply	V_{EE} = 0 V		6	V
V_{EE}	NECL Mode Power Supply	V_{CC}/V_{CC0} = 0 V		−6	V
V_I	PECL Mode Input Voltage NECL Mode Input Voltage	V_{EE} = 0 V V_{CC}/V_{CC0} = 0 V	$V_I \le V_{CC}/V_{CC0}$ $V_I \ge V_{EE}$	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) (Note)	0 lfpm 500 lfpm	QFN−52 QFN−52	25 19.6	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction−to−Case) (Note)	2S2P	QFN−52	21	°C/W
T_{sol}	Wave Solder	< 2 to 3 sec @ 248°C		265	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Table 5. LVPECL DC CHARACTERISTICS V_{CC} = V_{CC0} = 2.5 V; V_{EE} = 0 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	100	125	150	104	130	156	112	140	168	mA
V_{OH}	Output HIGH Voltage (Note 3)	1355	1480	1605	1355	1480	1605	1355	1480	1605	mV
V_{OL}	Output LOW Voltage (Note 3)	555	680	900	555	680	900	555	680	900	mV
V_{IH}	Input HIGH Voltage (Single−Ended) (Note 4)	1335		1620	1335		1620	1275		1620	mV
V_{IL}	Input LOW Voltage (Single−Ended) (Note 4)	555		900	555		900	555		900	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 5) (Figure 5)	1.2		2.5	1.2		2.5	1.2		2.5	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current CLK $\overline{CLK}$	0.5 −150			0.5 −150			0.5 −150			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.

2. Input and output parameters vary 1:1 with V_{CC}/V_{CC0}. V_{EE} can vary + 0.125 V to −1.3 V.
3. All loading with 50 Ω to V_{CC}/V_{CC0} − 2.0 V.
4. Do not use V_{BB} Pin #10 at V_{CC}/V_{CC0} < 3.0 V (see AND8066/D).
5. V_{IHCMR} min varies 1:1 with V_{EE}, V_{IHCMR} max varies 1:1 with V_{CC}/V_{CC0}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

Table 6. LVPECL DC CHARACTERISTICS V_{CC} = V_{CC0} = 3.3 V; V_{EE} = 0.0 V (Note 6)

Symbol	Characteristic	−40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current	100	125	150	104	130	156	112	140	168	mA
V_{OH}	Output HIGH Voltage (Note 7)	2155	2280	2405	2155	2280	2405	2155	2280	2405	mV
V_{OL}	Output LOW Voltage (Note 7)	1355	1480	1700	1355	1480	1700	1355	1480	1700	mV
V_{IH}	Input HIGH Voltage (Single−Ended)	2135		2420	2135		2420	2135		2420	mV
V_{IL}	Input LOW Voltage (Single−Ended)	1355		1700	1355		1700	1355		1700	mV
V_{BB}	Output Reference Voltage (Note 8)	1775	1875	1975	1775	1875	1975	1775	1875	1975	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 9) (Figure 5)	1.2		3.3	1.2		3.3	1.2		3.3	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current CLK $\overline{CLK}$	0.5 −150			0.5 −150			0.5 −150			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.

6. Input and output parameters vary 1:1 with V_{CC}/V_{CC0}. V_{EE} can vary + 0.925 V to −0.5 V.
7. All loading with 50 Ω to V_{CC}/V_{CC0}−2.0 V.
8. Single−Ended input operation is limited V_{CC}/V_{CC0} ≥ 3.0 V in LVPECL mode.
9. V_{IHCMR} min varies 1:1 with V_{EE}, V_{IHCMR} max varies 1:1 with V_{CC}/V_{CC0}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

Table 7. LVNECL DC CHARACTERISTICS V_{CC} = V_{CC0} = 0.0 V; V_{EE} = −3.8 V to −2.375 V (Note 10)

Symbol	Characteristic	−40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current	100	125	150	104	130	156	112	140	168	mA
V_{OH}	Output HIGH Voltage (Note 11)	−1145	−1020	−895	−1145	−1020	−895	−1145	−1020	−895	mV
V_{OL}	Output LOW Voltage (Note 11)	−1945	−1820	−1600	−1945	−1820	−1600	−1945	−1820	−1600	mV
V_{IH}	Input HIGH Voltage (Single−Ended)	−1165		−880	−1165		−880	−1165		−880	mV
V_{IL}	Input LOW Voltage (Single−Ended)	−1945		−1600	−1945		−1600	−1945		−1600	mV
V_{BB}	Output Reference Voltage (Note 12)	−1525	−1425	−1325	−1525	−1425	−1325	−1525	−1425	−1325	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 13) (Figure 5)	V_{EE} + 1.2		0.0	V_{EE} + 1.2		0.0	V_{EE} + 1.2		0.0	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current CLK $\overline{CLK}$	0.5 −150			0.5 −150			0.5 −150			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.

10. Input and output parameters vary 1:1 with V_{CC}/V_{CC0}.
11. All loading with 50 Ω to V_{CC}/V_{CC0} − 2.0 V.
12. Single−Ended input operation is limited V_{EE} ≤ −3.0 V in NECL mode.
13. V_{IHCMR} min varies 1:1 with V_{EE}, V_{IHCMR} max varies 1:1 with V_{CC}/V_{CC0}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

Table 8. AC CHARACTERISTICS V_{CC} = V_{CC0} = 2.375 to 3.8 V; V_{EE} = 0.0 V or V_{CC} = V_{CC0} = 0.0 V; V_{EE} = −2.375 to −3.8 V (Note 14)

		−40°C			25°C			85°C			
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
V_{Opp}	Differential Output Voltage (Figure 4) f_{out} = 50 MHz	500	600		500	600		500	600		mV
	f_{out} = 0.8 GHz	550	650		525	650		500	650		
	f_{out} = 1.0 GHz	500	650		425	650		400	600		
t_{PLH} t_{PHL}	Propagation Delay (Differential Configuration) CLKx−Q_X	650	800	900	700	875	1000	850	975	1150	ps
	MR−Q_{XX}	700	900	1200	700	900	1200	700	900	1200	
t_{skew}	Within−Device Skew (Note 15) (÷1 Mode) − Qa[0:1]		10	40		10	40		10	40	ps
	− Qb[0:2]		10	40		10	40		10	40	
	− Qc[0:3]		20	60		20	60		20	60	
	− Qd[0:5]		10	40		10	40		10	40	
	− Qa_N, Qb_N, Qd_N		10	40		10	40		10	40	
	− All Outputs		20	60		20	60		20	60	
t_{skew}	Within−Device Skew (Note 15) (÷2 Mode) − Qa[0:1]		15	70		10	40		15	70	ps
	− Qb[0:2]		15	70		10	40		10	40	
	− Qc[0:3]		20	70		20	50		15	70	
	− Qd[0:5]		15	70		10	40		15	70	
	− Qa_N, Qb_N, Qd_N		15	70		10	40		15	70	
	− All Outputs		20	70		20	50		15	70	
t_{skew}	Device−to−Device Skew (Differential Configuration) (Note 16)		85	300		85	300		85	300	ps
t_{JITTER}	Random Clock Jitter (Figure 4) (RMS)		1	5		1	4		1	5	ps
V_{PP}	Input Swing (Differential Configuration) (Note 17) (Figure 5)	150	800	1200	150	800	1200	150	800	1200	mV
DCO	Output Duty Cycle	49.5	50	50.5	49.5	50	50.5	49.5	50	50.5	%
t_r/t_f	Output Rise/Fall Time 20%−80%	100	200	300	100	200	300	150	250	350	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.

14. Measured with LVPECL 750 mV source, 50% duty cycle clock source. All outputs loaded with 50 Ω to V_{CC}/V_{CC0} − 2.0 V.
15. Skew is measured between outputs under identical transitions and operating conditions.
16. Device−to−Device skew for identical transitions at identical V_{CC}/V_{CC0} levels.
17. V_{PP} is the differential configuration input voltage swing required to maintain AC characteristics including t_{PD} and device−to−device skew.

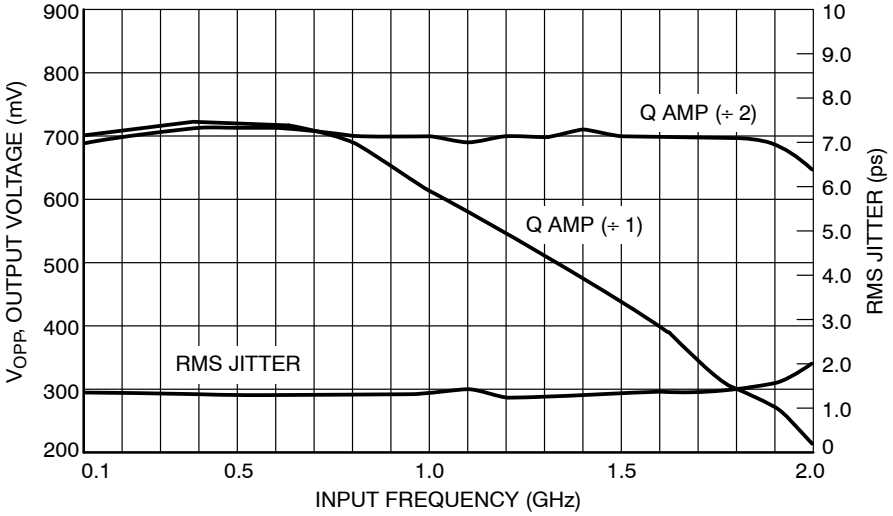


Figure 4. Output Voltage (V_{OPP}) versus Input Frequency and Random Clock Jitter (t_{JITTER}) @ 25°C

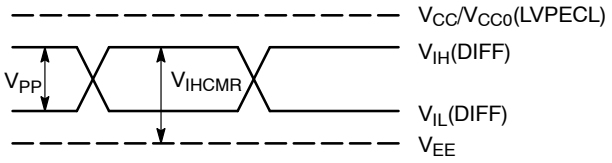


Figure 5. LVPECL Differential Input Levels

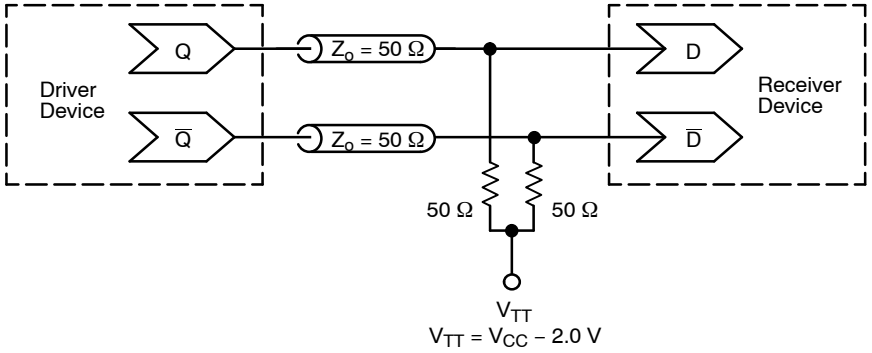


Figure 6. Typical Termination for Output Driver and Device Evaluation (See Application Note AND8020/D – Termination of ECL Logic Devices.)

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

AN1642/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

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

QFN52 8x8, 0.5P
CASE 485M−01
ISSUE C

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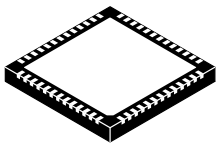
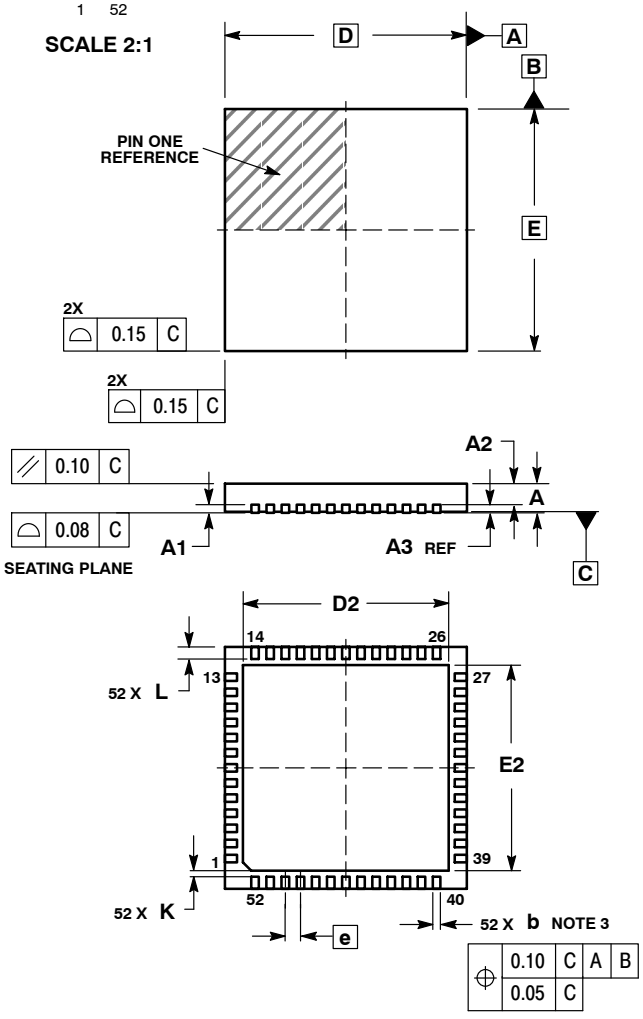


SCALE 2:1



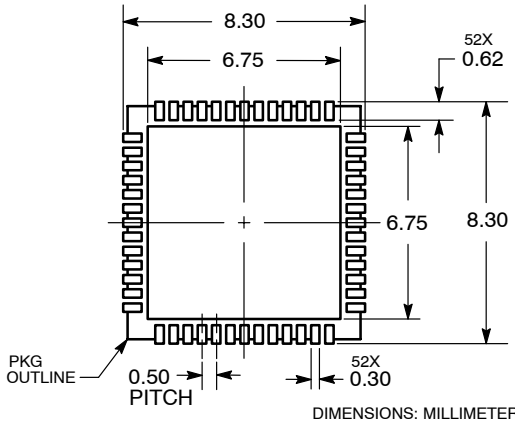
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS	
DIM	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A2	0.60	0.80
A3	0.20 REF	
b	0.18	0.30
D	8.00 BSC	
D2	6.50	6.80
E	8.00 BSC	
E2	6.50	6.80
e	0.50 BSC	
K	0.20	---
L	0.30	0.50

GENERIC MARKING DIAGRAM

XXXXXXXXX	= Device Code
A	= Assembly Site
WL	= Wafer Lot
YY	= Year
WW	= Work Week
G	= Pb−Free Package

RECOMMENDED SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

DOCUMENT NUMBER:	**98AON12057D**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**52 PIN QFN, 8X8, 0.5P**	**PAGE 1 OF 1**

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