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NB7L1008

2.5V / 3.3V 1:8 LVPECL Fanout Buffer

Multi−Level Inputs w/ Internal Termination

ON Semiconductor®

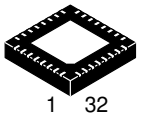
http://onsemi.com

Description

The NB7L1008 is a high performance differential 1:8 Clock/Data fanout buffer. The NB7L1008 produces eight identical output copies of Clock or Data operating up to 7 GHz or 12 Gb/s, respectively. As such, the NB7L1008 is ideal for SONET, GigE, Fiber Channel, Backplane and other Clock/Data distribution applications. The differential inputs incorporate internal 50 Ω termination resistors that are accessed through the VT pin. This feature allows the NB7L1008 to accept various logic standards, such as LVPECL, CML, LVDS logic levels. The V_{REFAC} reference output can be used to rebias capacitor−coupled differential or single−ended input signals. The 1:8 fanout design was optimized for low output skew applications. The NB7L1008 is a member of the GigaComm™ family of high performance clock products.

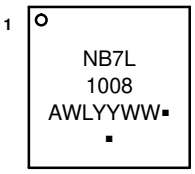
Features

- Typical Maximum Input Data Rate > 12 Gb/s Typical
- Data Dependent Jitter < 15 ps
- Maximum Input Clock Frequency > 7 GHz Typical
- Random Clock Jitter < 0.8 ps RMS
- Low Skew 1:8 LVPECL Outputs, < 20 ps max
- Multi−Level Inputs, accepts LVPECL, CML, LVDS
- 160 ps Typical Propagation Delay
- 50 ps Typical Rise and Fall Times
- Differential LVPECL Outputs, 750 mV Peak−to−Peak, Typical
- Operating Range: V_{CC} = 2.375 V to 3.6 V, GND = 0 V
- Internal Input Termination Resistors, 50 Ω
- V_{REFAC} Reference Output
- QFN−32 Package, 5 mm x 5 mm
- −40°C to +85°C Ambient Operating Temperature
- These are Pb−Free and Halide−Free Devices



QFN32
MN SUFFIX
CASE 488AM

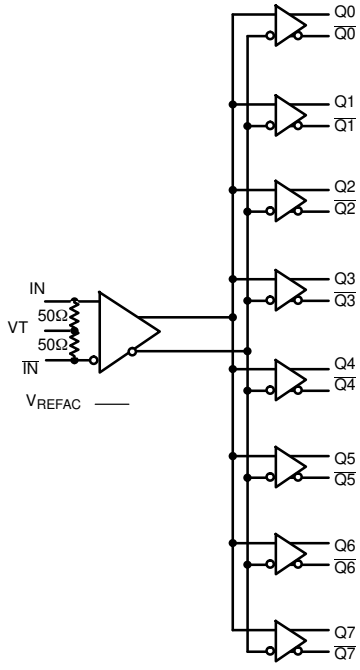
MARKING DIAGRAM



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

(Note: Microdot may be in either location)

SIMPLIFIED LOGIC DIAGRAM



ORDERING INFORMATION

See detailed ordering and shipping information on page 9 of this data sheet.

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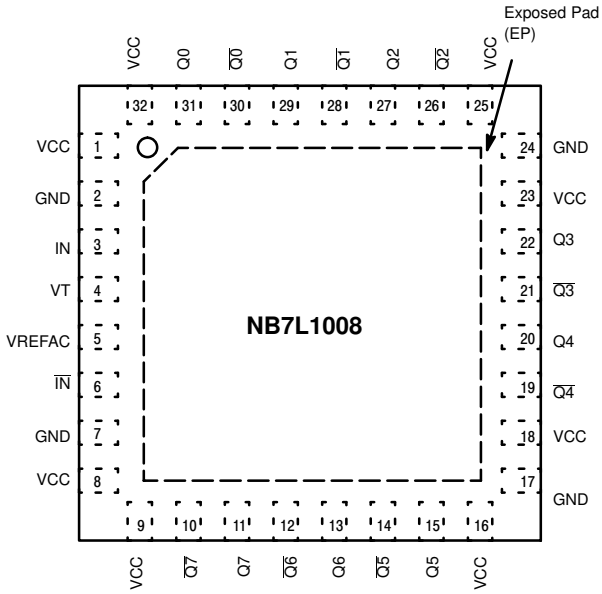


Figure 1. 32−Lead QFN Pinout (Top View)

Table 1. PIN DESCRIPTION

Pin	Name	I/O	Description
3, 6	IN, $\overline{IN}$	LVPECL, CML, LVDS Input	Non−inverted / Inverted Differential Clock/Data Input. Note 1
4	VT		Internal 50 Ω Termination Pin for IN and $\overline{IN}$
2, 7 17,24	GND		Negative Supply Voltage, Note 2
1, 8, 9, 16, 18, 23, 25, 32	V_{CC}		Positive Supply Voltage, Note 2
31, 30, 29, 28, 27, 26, 22, 21, 20, 19, 15, 14, 13, 12, 11, 10	Q0, $\overline{Q0}$, Q1, $\overline{Q1}$, Q2, $\overline{Q2}$, Q3, $\overline{Q3}$, Q4, $\overline{Q4}$, Q5, $\overline{Q5}$, Q6, $\overline{Q6}$, Q7, $\overline{Q7}$	LVPECL	Non−inverted / Inverted Differential Output.
5	VREFAC		Output Voltage Reference for Capacitor−Coupled Inputs, only
−	EP	−	The Exposed Pad (EP) on the QFN−32 package bottom is thermally connected to the die for improved heat transfer out of package. The exposed pad must be attached to a heat−sinking conduit. The pad is electrically connected to GND and is recommended to be electrically connected to GND on the PC board.

1. In the differential configuration when the input termination pin (V_T) is connected to a common termination voltage or left open, and if no signal is applied on IN/$\overline{IN}$, then the device will be susceptible to self−oscillation.
2. All V_{CC} and GND pins must be externally connected to the same power supply voltage to guarantee proper device operation.

Table 2. ATTRIBUTES

Characteristics		Value
ESD Protection	Human Body Model Machine Model	> 2 kV > 200 V
Moisture Sensitivity (Note 3) Indefinite Time of the Drypack	QFN−32	Level 1
Flammability Rating	Oxygen Index: 28 to 34	UL 94 V−0 @ 0.125 in
Transistor Count		263
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test		

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

Table 3. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V_{CC}	Positive Power Supply	GND = 0 V		4.0	V
V_{IN}	Input Voltage	GND = 0 V		−0.5 to V_{CC}	V
V_{INPP}	Differential Input Voltage |IN − $\overline{IN}$|			1.89	V
I_{IN}	Input Current Through R_T (50 Ω Resistor)			±40	mA
I_{out}	Output Current	Continuous Surge		34 40	mA
$I_{VFREFAC}$	V_{REFAC} Sink/Source Current			±1.5	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 4) TGSD 51−6 (2S2P Multilayer Test Board) with Filled Thermal Vias	500 lfpm	QFN−32	27	°C/W
θ_{JC}	Thermal Resistance (Junction−to−Case)	Standard Board	QFN−32	12	°C/W
T_{sol}	Wave Solder Pb−Free			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.

4. JEDEC standard multilayer board − 2S2P (2 signal, 2 power) with 8 filled thermal vias under exposed pad.

Table 4. DC CHARACTERISTICS – LVPECL OUTPUT V_{CC} = 2.375 V to 3.6 V; GND = 0V TA = –40°C to 85°C (Note 6)

Symbol	Characteristic	Min	Typ	Max	Unit
POWER SUPPLY CURRENT					
I_{CC}	Power Supply Current, Inputs and Outputs Open		165	215	mA
LVPECL OUTPUTS (Note 5, Figure 11)					
V_{OH}	Output HIGH Voltage V_{CC} = 3.3V V_{CC} = 2.5V	V_{CC} – 1025 2275 1475		V_{CC} – 775 2525 1725	mV
V_{OL}	Output LOW Voltage V_{CC} = 3.3V V_{CC} = 2.5V	V_{CC} – 2000 1300 500		V_{CC} – 1500 1800 1000	mV
DIFFERENTIAL INPUTS DRIVEN SINGLE–ENDED (Notes 7 and 8) (Figures 7 and 9)					
V_{IH}	Single–Ended Input HIGH Voltage	V_{th} + 100		V_{CC}	mV
V_{IL}	Single–Ended Input LOW Voltage	GND		V_{th} – 100	mV
V_{th}	Input Threshold Reference Voltage Range	1100		V_{CC} – 100	mV
V_{ISE}	Single–Ended Input Voltage (V_{IH} – V_{IL})	200		1200	mV
V_{REFAC}					
V_{REFAC}	Output Reference Voltage @ 100 μA for Capacitor – Coupled Inputs, Only V_{CC} = 3.3 V V_{CC} = 2.5 V	 V_{CC} – 1150 V_{CC} – 1150	 V_{CC} – 1050 V_{CC} – 1050	 V_{CC} – 950 V_{CC} – 950	mV
DIFFERENTIAL INPUTS DRIVEN DIFFERENTIALLY (IN, $\overline{IN}$) (Note 9) (Figures 5 and 8)					
V_{IHD}	Differential Input HIGH Voltage	1100		V_{CC}	mV
V_{ILD}	Differential Input LOW Voltage	GND		V_{IHD} – 100	mV
V_{ID}	Differential Input Voltage (V_{IHD} – V_{ILD})	100		1200	mV
I_{IH}	Input HIGH Current	–150	40	+150	μA
I_{IL}	Input LOW Current	–150	0	+150	μA
TERMINATION RESISTORS					
R_{TIN}	Internal Input Termination Resistor	45	50	55	Ω

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. LVPECL outputs loaded with 50 Ω to V_{CC} – 2 V for proper operation.
6. Input and output parameters vary 1:1 with V_{CC}.
7. V_{th}, V_{IH}, $V_{IL,}$, and V_{ISE} parameters must be complied with simultaneously.
8. V_{th} is applied to the complementary input when operating in single–ended mode.
9. V_{IHD}, V_{ILD}, V_{ID} and V_{CMR} parameters must be complied with simultaneously.

Table 5. AC CHARACTERISTICS V_{CC} = 2.375 V to 3.6 V; GND = 0V TA = –40°C to 85°C (Note 10)

Symbol	Characteristic	Min	Typ	Max	Unit
f_{DATA}	Maximum Operating Input Data Rate (Note 17)	10	12		Gb/s
f_{INCLK}	Maximum Input Clock Frequency, $V_{OUTPP} \geq$ 400 mV (Note 17)	5	7		GHz
V_{OUTPP}	Output Voltage Amplitude (see Figures 2 and 6, Notes 11, 17) $f_{in} \leq$ 5 GHz	400			mV
V_{CMR}	Input Common Mode Range (Differential Configuration, Note 12, Figure 10)	600		V_{CC} – 50	mV
t_{PLH}, t_{PHL}	Propagation Delay to Output Differential, IN/$\overline{IN}$ to Qn/$\overline{Qn}$	100	160	220	ps
t_{PLH} TC	Propagation Delay Temperature Coefficient –40°C to +85°C		25		fs/°C
t_{DC}	Output Clock Duty Cycle $f_{in} \leq$ 5 GHz	45	49/51	55	%
t_{SKEW}	Within Device Skew (Note 13) Device to Device Skew (Note 14)			20 100	ps
T_{jitter}	Clock Jitter RMS, 1000 Cycles (Note 17) $f_{in} \leq$ 6 GHz Data Dependent Jitter (DDJ) (Note 17) ≤ 10 Gb/s		0.2 3	0.8 15	ps
T_{jitter} (additive)	622 MHz @ Integration Range of 12 kHz to 20 MHz		0.025		ps
V_{INPP}	Input Voltage Swing (Differential Configuration) (Note 16) (Figure 6)	100		1200	mV
t_r, t_f	Output Rise/Fall Times (20% – 80%) Qn, $\overline{Qn}$	20	50	80	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.

10. All outputs must be loaded with external 50 Ω to V_{CC} – 2 V.
11. Output voltage swing is a single−ended measurement operating in differential mode.
12. $VIHD_{MIN} \geq$ 1100 mV.
13. Within device skew compares coincident edges.
14. Device to device skew is measured between outputs under identical transition
15. Additive CLOCK jitter with 50% duty cycle clock signal input.
16. Input voltage swing is a single−ended measurement operating in differential mode.
17. V_{CC} of 2.5–3.3, input = 800 mv_{p-p}

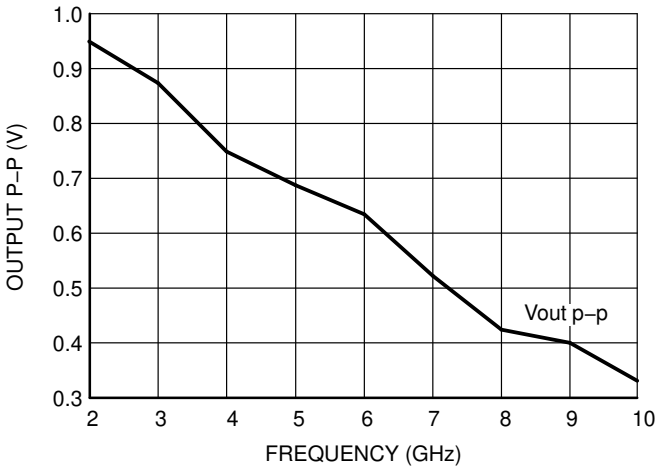


Figure 2. Typical $V_{OUT\ P-P}$ vs. Frequency at 25°C

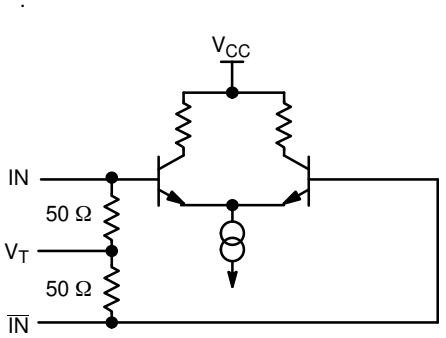


Figure 3. Input Structure

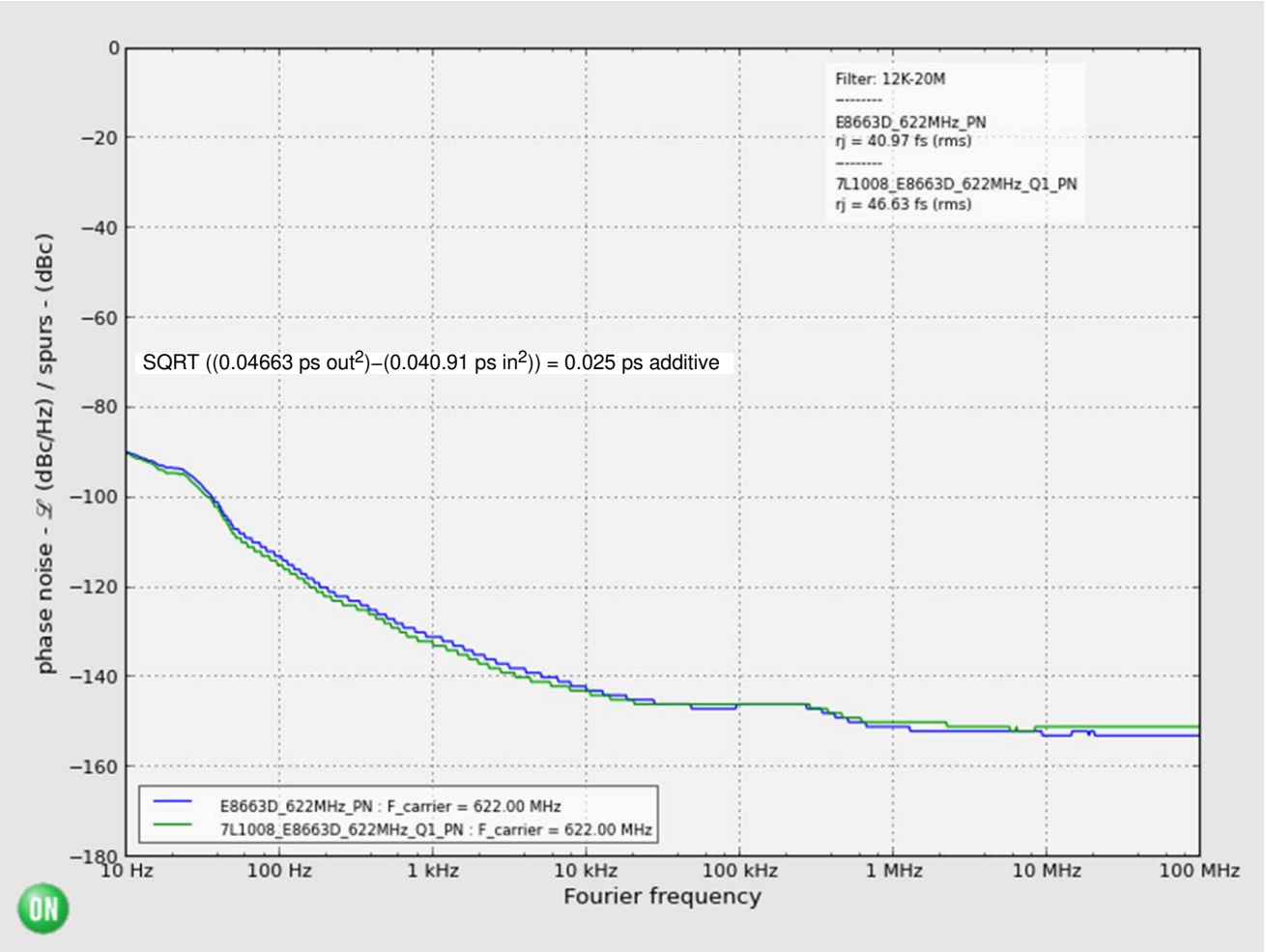


Figure 4. Additive Phase Jitter RMS from 12 kHz to 20 MHz @ 622 MHz, Typical 0.025 ps

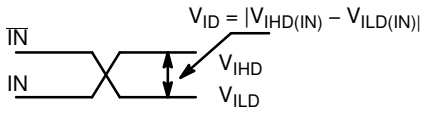


Figure 5. Differential Inputs Driven Differentially

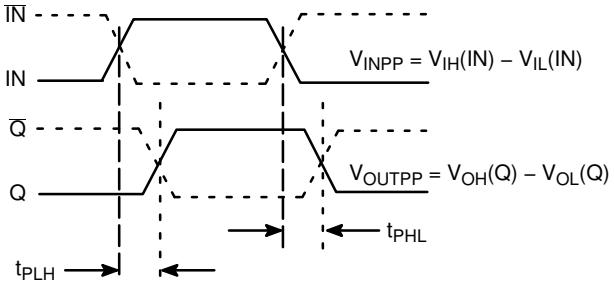


Figure 6. AC Reference Measurement

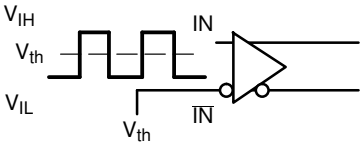


Figure 7. Differential Input Driven Single−Ended

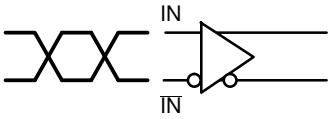


Figure 8. Differential Inputs Driven Differentially

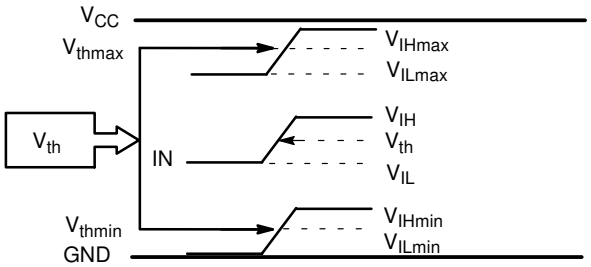


Figure 9. V_{th} Diagram

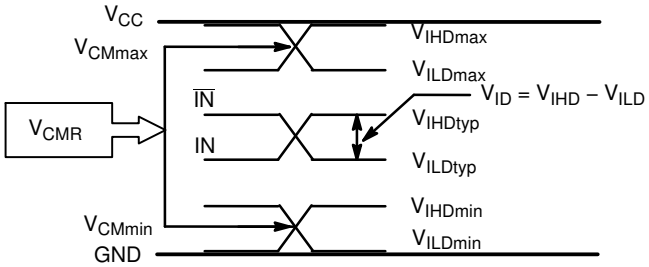


Figure 10. V_{CMR} Diagram

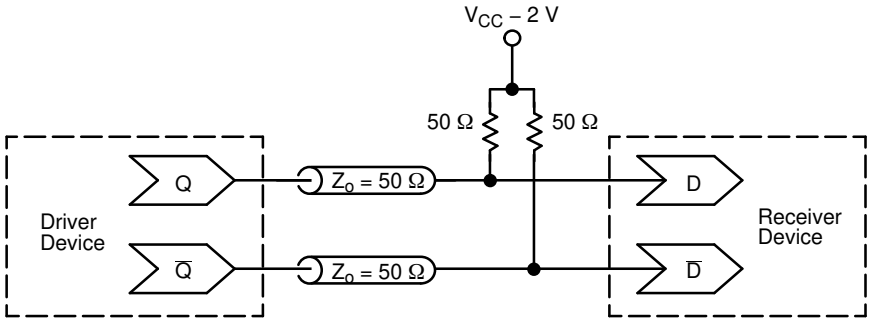


Figure 11. Typical Termination for Output Driver and Device Evaluation (See Application Note AND8173/D)

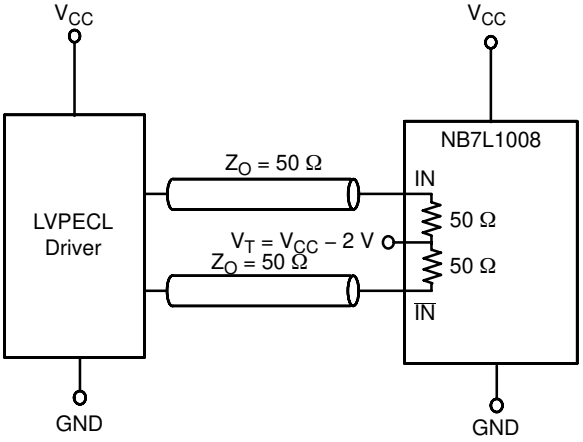


Figure 12. LVPECL Interface

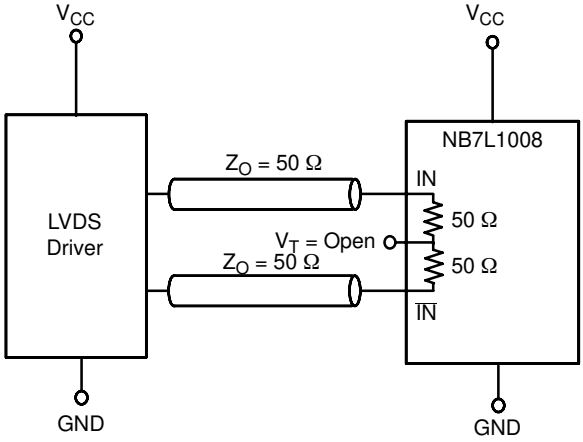


Figure 13. LVDS Interface

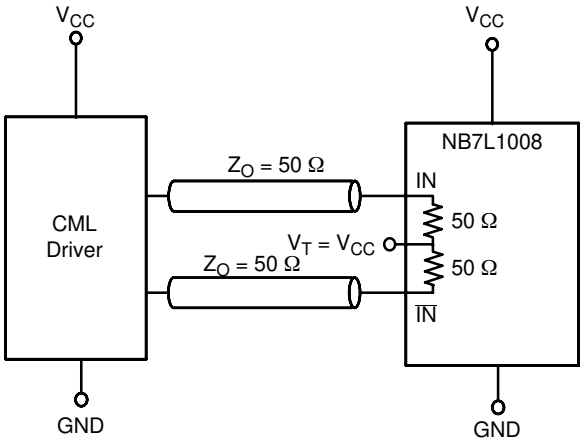


Figure 14. Standard 50 Ω Load CML Interface

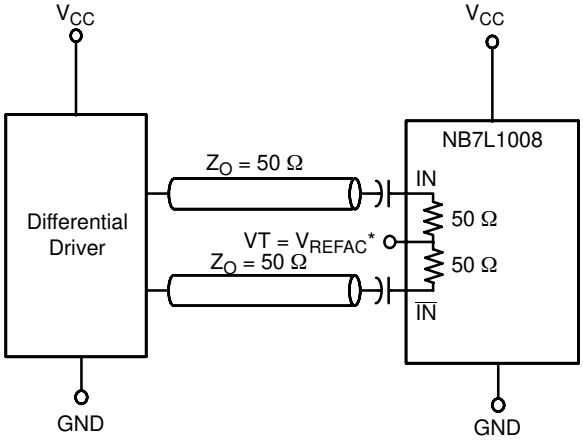


Figure 15. Capacitor−Coupled Differential Interface (V_T Connected to V_{REFAC})

*V_{REFAC} bypassed to ground with a 0.01 μF capacitor

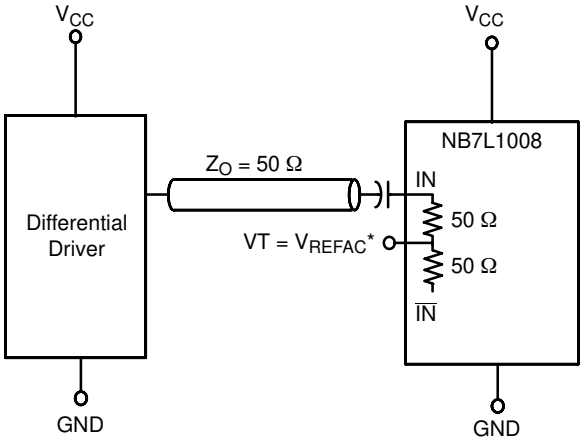


Figure 16. Capacitor−Coupled Single−Ended Interface (V_T Connected to V_{REFAC})

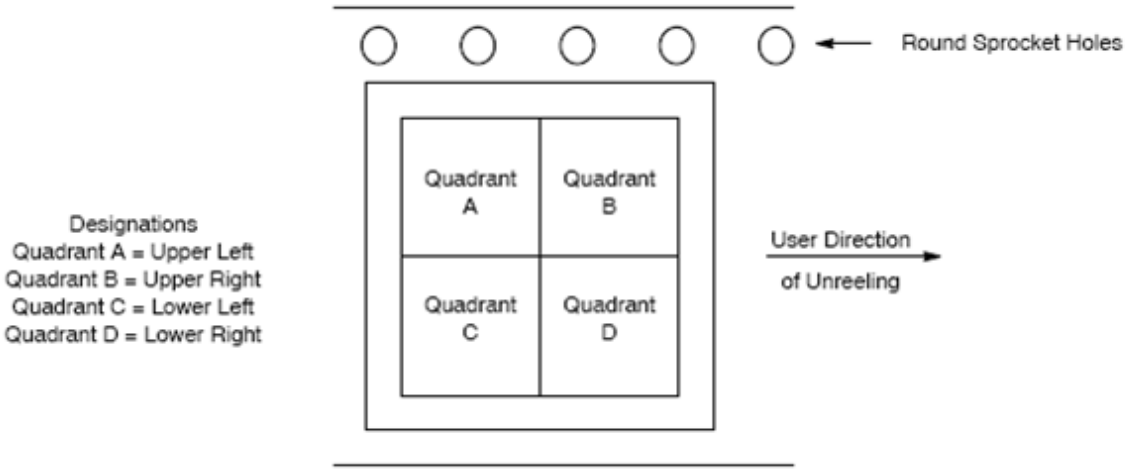


Figure 17. Tape and Reel Pin 1 Quadrant Orientation

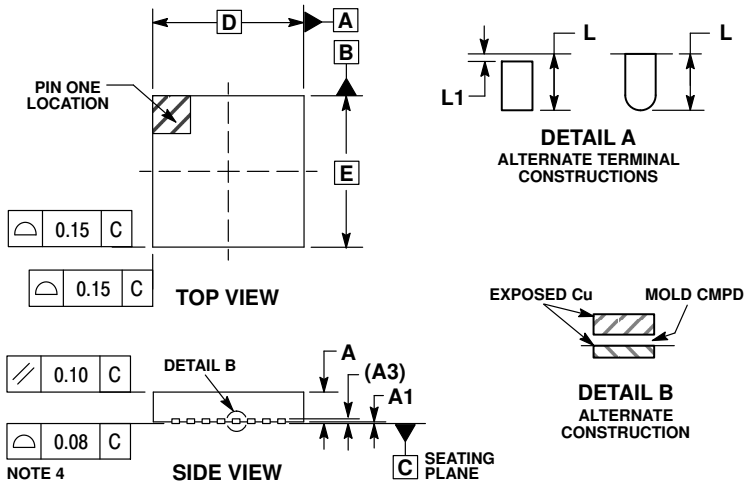
ORDERING INFORMATION

Device	Package	Shipping
NB7L1008MNG	QFN32 (Pb−Free/Halide−Free)	74 Units / Rail
NB7L1008MNTXG	QFN32 (Pb−Free/Halide−Free)	1000 / Tape & Reel (Pin 1 Orientation in Quadrant B, Figure 17)

†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.

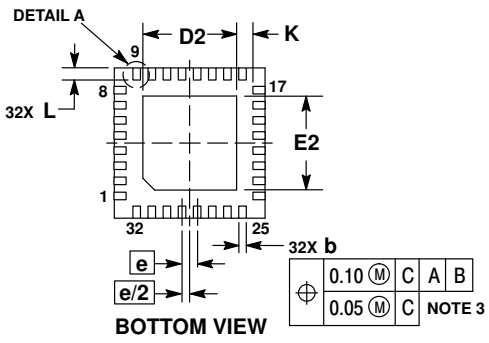
PACKAGE DIMENSIONS

QFN32 5x5, 0.5P
CASE 488AM
ISSUE A

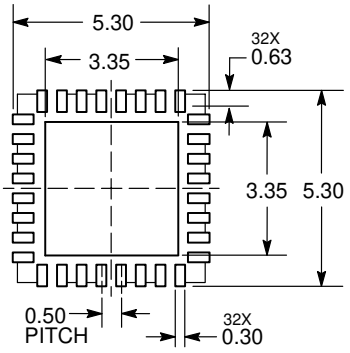


NOTES:
1. DIMENSIONS AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS	
DIM	MIN	MAX
A	0.80	1.00
A1	–––	0.05
A3	0.20 REF	
b	0.18	0.30
D	5.00 BSC	
D2	2.95	3.25
E	5.00 BSC	
E2	2.95	3.25
e	0.50 BSC	
K	0.20	–––
L	0.30	0.50
L1	–––	0.15



RECOMMENDED SOLDERING FOOTPRINT*



DIMENSION: MILLIMETERS

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

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