NLSF3T125

Quad Bus Buffer
with 3-State Control Inputs

The NLSF3T125 is a high speed CMOS quad bus buffer fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

The NLSF3T125 requires the 3-state control input ($\overline{OE}$) to be set High to place the output into the high impedance state.

The T125 inputs are compatible with TTL levels. This device can be used as a level converter for interfacing 3.3 V to 5.0 V, because it has full 5.0 V CMOS level output swings.

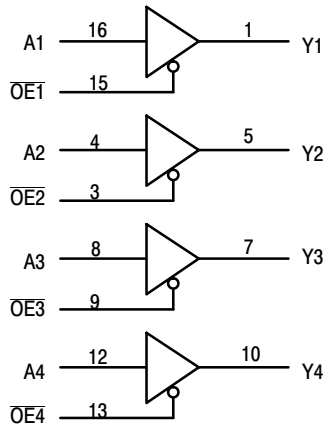
The NLSF3T125 input structures provide protection when voltages between 0 V and 5.5 V are applied, regardless of the supply voltage. The output structures also provide protection when V_{CC} = 0 V. These input and output structures help prevent device destruction caused by supply voltage - input/output voltage mismatch, battery backup, hot insertion, etc.

The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output. The inputs tolerate voltages up to 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems.

- High Speed: t_{PD} = 3.8 ns (Typ) at V_{CC} = 5.0 V
- Low Power Dissipation: I_{CC} = 4.0 μA (Max) at T_A = 25°C
- TTL-Compatible Inputs: V_{IL} = 0.8 V; V_{IH} = 2.0 V
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2.0 V to 5.5 V Operating Range
- Low Noise: V_{OLP} = 0.8 V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: HBM > 2000 V; Machine Model > 200 V
- Chip Complexity: 72 FETs or 18 Equivalent Gates

LOGIC DIAGRAM

Active-Low Output Enables



FUNCTION TABLE

NLSF3T125		
Inputs		Output
A	$\overline{OE}$	Y
H	L	H
L	L	L
X	H	Z

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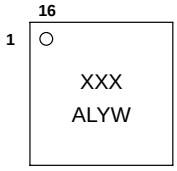
QFN-16
CASE 485G

MARKING DIAGRAM



(TOP VIEW)

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

ORDERING INFORMATION

Device	Package	Shipping
NLSF3T125MNR2	QFN	3000 Units/ Tape & Reel

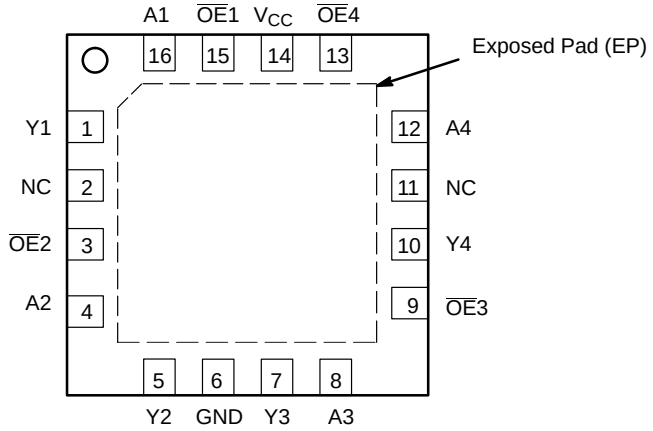


Figure 1. QFN - 16 Pinout (Top View)

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	– 0.5 to + 7.0	V
V_{in}	DC Input Voltage	– 0.5 to + 7.0	V
V_{out}	DC Output Voltage Output in 3-State High or Low State	– 0.5 to + 7.0 – 0.5 to V_{CC} + 0.5	V
I_{IK}	Input Diode Current	- 20	mA
I_{OK}	Output Diode Current (V_{OUT} < GND; V_{OUT} > V_{CC})	± 20	mA
I_{out}	DC Output Current, per Pin	± 25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	± 75	mA
P_D	Power Dissipation in Still Air, QFN Packages	500	mW
T_{stg}	Storage Temperature	– 65 to + 150	°C

* Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute- maximum- rated conditions is not implied.

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range GND ≤ (V_{in} or V_{out}) ≤ V_{CC}.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage		4.5	5.5	V
V_{in}	DC Input Voltage		0	5.5	V
V_{out}	DC Output Voltage	Output in 3-State High or Low State	0 0	5.5 V_{CC}	V
T_A	Operating Temperature		- 40	+ 85	°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 5.0 V ±0.5 V	0	20	ns/V

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V_{CC} (V)	T_A = 25°C			$T_A \le$ 85°C		$T_A \le$ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V_{IH}	Minimum High-Level Input Voltage		3.0 4.5 5.5	1.2 2.0 2.0			1.2 2.0 2.0		1.2 2.0 2.0		V
V_{IL}	Maximum Low-Level Input Voltage		3.0 4.5 5.5			0.53 0.8 0.8		0.53 0.8 0.8		0.53 0.8 0.8	V
V_{OH}	Minimum High-Level Output Voltage V_{IN} = V_{IH} or V_{IL}	V_{IN} = V_{IH} or V_{IL} I_{OH} = - 50 μA	3.0 4.5	2.9 4.4	3.0 4.5		2.9 4.4		2.9 4.4		V
		V_{IN} = V_{IH} or V_{IL} I_{OH} = - 4.0 mA I_{OH} = - 8.0 mA	3.0 4.5	2.58 3.94			2.48 3.80		2.34 3.66		
V_{OL}	Maximum Low-Level Output Voltage V_{IN} = V_{IH} or V_{IL}	V_{IN} = V_{IH} or V_{IL} I_{OL} = 50 μA	3.0 4.5		0.0 0.0	0.1 0.1		0.1 0.1		0.1 0.1	V
		V_{IN} = V_{IH} or V_{IL} I_{OL} = 4.0 mA I_{OL} = 8.0 mA	3.0 4.5			0.36 0.36		0.44 0.44		0.52 0.52	
I_{IN}	Maximum Input Leakage Current	V_{IN} = 5.5 V or GND	0 to 5.5			±0.1		±1.0		±1.0	μA
I_{CC}	Maximum Quiescent Supply Current	V_{IN} = V_{CC} or GND	5.5			2.0		20		40	μA
I_{CCT}	Quiescent Supply Current	Input: V_{IN} = 3.4 V	5.5			1.35		1.50		1.65	mA
I_{OZ}	Maximum 3-State Leakage Current	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND	5.5			±0.25		±2.5		±2.5	μA
I_{OPD}	Output Leakage Current	V_{OUT} = 5.5 V	0.0			0.5		5.0		10	μA

AC ELECTRICAL CHARACTERISTICS (Input t_r = t_f = 3.0 ns)

Symbol	Parameter	Test Conditions	T_A = 25°C			T_A = ≤ 85°C		$T_A \le$ 125°C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}, t_{PHL}	Maximum Propagation Delay, A to Y	V_{CC} = 3.3 ± 0.3 V C_L = 15 pF C_L = 50 pF		5.6 8.1	8.0 11.5	1.0 1.0	9.5 13.0		12.0 16.0	ns
		V_{CC} = 5.0 ± 0.5 V C_L = 15 pF C_L = 50 pF		3.8 5.3	5.5 7.5	1.0 1.0	6.5 8.5		8.5 10.5	
t_{PZL}, t_{PZH}	Maximum Output Enable TIme, $\overline{OE}$ to Y	V_{CC} = 3.3 ± 0.3 V C_L = 15 pF R_L = 1.0 kΩ C_L = 50 pF		5.4 7.9	8.0 11.5	1.0 1.0	9.5 13.0		11.5 15.0	ns
		V_{CC} = 5.0 ± 0.5 V C_L = 15 pF R_L = 1.0 kΩ C_L = 50 pF		3.6 5.1	5.1 7.1	1.0 1.0	6.0 8.0		7.5 9.5	
t_{PLZ}, t_{PHZ}	Maximum Output Disable Time, $\overline{OE}$ to Y	V_{CC} = 3.3 ± 0.3 V C_L = 50 pF R_L = 1.0 kΩ		9.5	13.2	1.0	15.0		18.0	ns
		V_{CC} = 5.0 ± 0.5 V C_L = 50 pF R_L = 1.0 kΩ		6.1	8.8	1.0	10.0		12.0	

AC ELECTRICAL CHARACTERISTICS (continued) (Input $t_r = t_f = 3.0$ ns)

Symbol	Parameter	Test Conditions	$T_A = 25°C$			$T_A = \leq 85°C$		$T_A \leq 125°C$		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t_{OSLH}, t_{OSHL}	Output-to-Output Skew	$V_{CC} = 3.3 \pm 0.3$ V $C_L = 50$ pF (Note 1)			1.5		1.5		2.0	ns
		$V_{CC} = 5.0 \pm 0.5$ V $C_L = 50$ pF (Note 1)			1.0		1.0		1.5	
C_{in}	Maximum Input Capacitance			4	10		10		10	pF
C_{out}	Maximum Three-State Output Capacitance (Output in High Impedance State)			6						pF

		Typical @ 25°C, $V_{CC} = 5.0$V	
C_{PD}	Power Dissipation Capacitance (Note 2)	14	pF

1. Parameter guaranteed by design. $t_{OSLH} = |t_{PLHm} - t_{PLHn}|$, $t_{OSHL} = |t_{PHLm} - t_{PHLn}|$.
2. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}/4$ (per buffer). C_{PD} is used to determine the no-load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

NOISE CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns, $C_L = 50$ pF, $V_{CC} = 5.0$ V)

Symbol	Characteristic	$T_A = 25°C$		Unit
		Typ	Max	
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	0.3	0.8	V
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	- 0.3	- 0.8	V
V_{IHD}	Minimum High Level Dynamic Input Voltage		3.5	V
V_{ILD}	Maximum Low Level Dynamic Input Voltage		1.5	V

SWITCHING WAVEFORMS

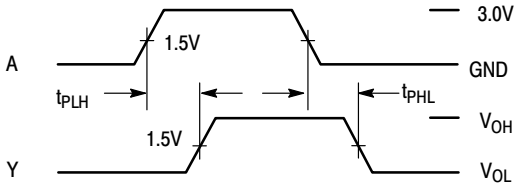


Figure 1.

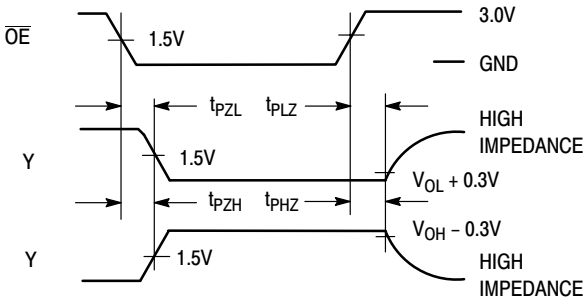
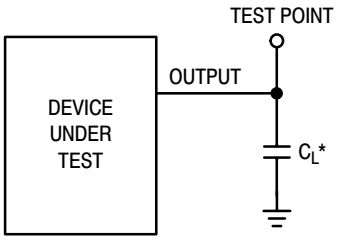
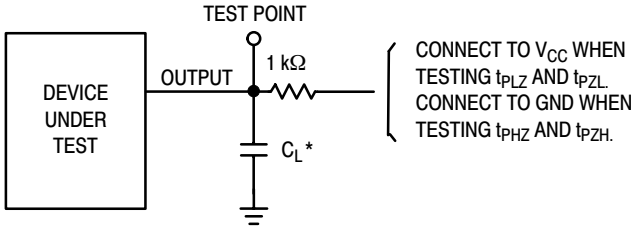


Figure 2.



*Includes all probe and jig capacitance

Figure 3. Test Circuit

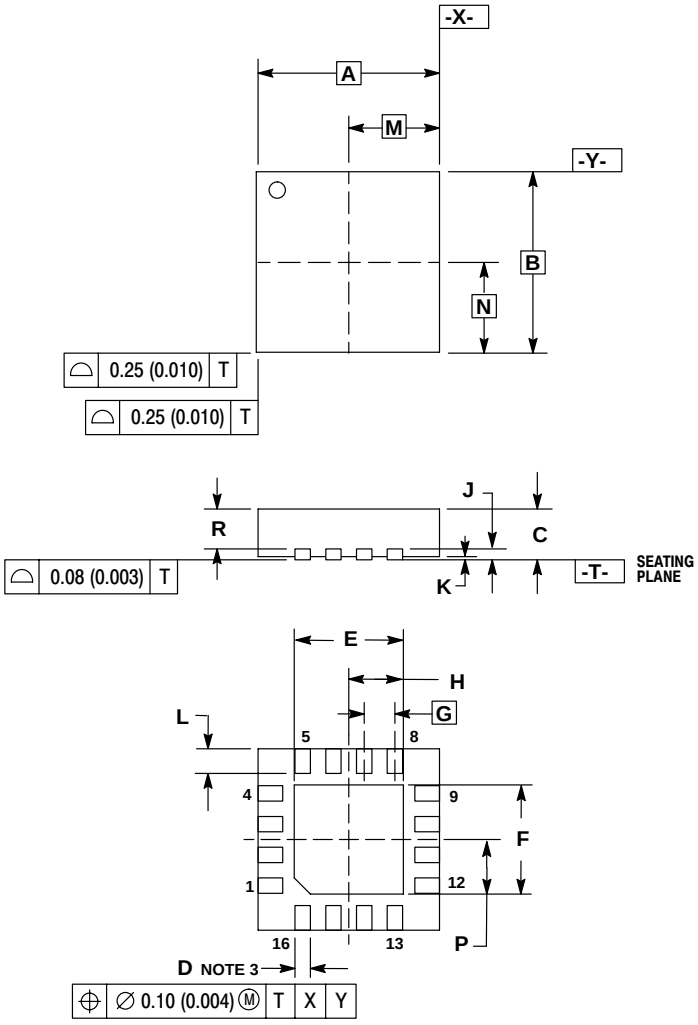


*Includes all probe and jig capacitance

Figure 4. Test Circuit

PACKAGE DIMENSIONS

16 PIN QFN
CASE 485G-01
ISSUE O



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D 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		INCHES	
DIM	MIN	MAX	MIN	MAX
A	3.00 BSC		0.118 BSC	
B	3.00 BSC		0.118 BSC	
C	0.80	1.00	0.031	0.039
D	0.23	0.28	0.009	0.011
E	1.75	1.85	0.069	0.073
F	1.75	1.85	0.069	0.073
G	0.50 BSC		0.020 BSC	
H	0.875	0.925	0.034	0.036
J	0.20 REF		0.008 REF	
K	0.00	0.05	0.000	0.002
L	0.35	0.45	0.014	0.018
M	1.50 BSC		0.059 BSC	
N	1.50 BSC		0.059 BSC	
P	0.875	0.925	0.034	0.036
R	0.60	0.80	0.024	0.031

Notes

PUBLICATION ORDERING INFORMATION

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