NLSF457

Special Function Logic Gate

Description

The NLSF457 is a single special function gate in tiny footprint package.

Features

- Designed for 1.65 V to 5.5 V V_{CC} Operation
- 2.7 ns t_{PD} at 5 V (typ)
- Inputs/Outputs Over–Voltage Tolerant up to 5.5 V
- I_{OFF} Supports Partial Power Down Protection
- Source/Sink 24 mA at 3.0 V
- Available in 1.45 mm x 1.0 mm UDFN8 Package
- Chip Complexity < 100 FETs
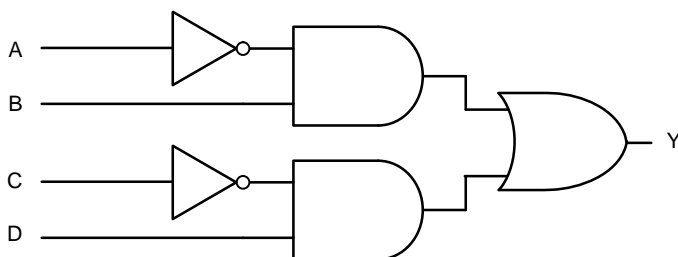- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant
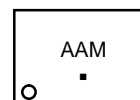
Figure 1. Logic Diagram

ON Semiconductor®

UDFN8, 1.45x1, 0.35P
CASE 517EB

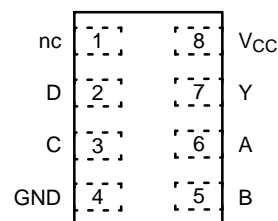**MARKING DIAGRAM**

AAM
.
O

AA = Specific Device Code
M = Assembly Operation Code*
. = Pb–Free Package
(Note: Microdot may be in either location)
*Assembly Operation Code orientation and/or may vary depending upon manufacturing location.

PIN ASSIGNMENT

nc	1		8	V_{CC}
D	2		7	Y
C	3		6	A
GND	4		5	B

Pin	Name	Description
1	nc	No Connect
2	D	Input
3	C	Input
4	GND	Ground
5	B	Input
6	A	Input
7	Y	Output
8	V_{CC}	Power Supply

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

Table 1. FUNCTION TABLE

Input				Output
A	B	C	D	Y
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

MAXIMUM RATINGS

Symbol	Parameter		Ratings	Unit
V_{CC}	DC Supply Voltage		−0.5 to +6.5	V
V_{IN}	DC Input Voltage		−0.5 to +6.5	V
V_{OUT}	DC Output Voltage	Active−Mode (High or Low State)	−0.5 to V_{CC}+0.5	V
		Tri−State Mode (Note 1)	−0.5 to +6.5	
		Power−Down Mode (V_{CC} = 0 V)	−0.5 to +6.5	
I_{IK}	DC Input Diode Current	V_{IN} < GND	−50	mA
I_{OK}	DC Output Diode Current	V_{OUT} < GND	−50	mA
I_{OUT}	DC Output Source/Sink Current		±50	mA
I_{CC} or I_{GND}	DC Supply Current Per Supply Pin or Ground Pin		±100	mA
T_{STG}	Storage Temperature Range		−65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
T_J	Junction Temperature Under Bias		+150	°C
θ_{JA}	Thermal Resistance (Note 2)	UDFN8	150	°C/W
P_D	Power Dissipation in Still Air at 125°C	UDFN8	833	mW
MSL	Moisture Sensitivity		Level 1	
F_R	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V−0 @ 0.125 in	
V_{ESD}	ESD Withstand Voltage (Note 3)	Charged Device Model	> 2000	V
		Human Body Model	> 1000	
$I_{LATCHUP}$	Latchup Performance (Note 4)		±100	mA

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.
1. Applicable to devices with outputs that may be tri−stated.
2. Measured with minimum pad spacing on an FR4 board, using 10mm − by − 1inch, 2 ounce copper trace no air flow.
3. HBM tested to ANSI/ESDA/JEDEC JS−001−2017. CDM tested to EIA/JESD22−C101−F. JEDEC recommends that ESD qualification to EIA/JESD22−A115−A (Machine Model) be discontinued per JEDEC/JEP172A.
4. Tested to EIA/JESD78 Class II.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	Positive DC Supply Voltage		1.65	5.5	V
V_{IN}	Digital Input Voltage		0	5.5	V
V_{OUT}	Output Voltage	Active Mode (High or Low State)	0	V_{CC}	V
		Tri−State Mode (Note 1)	0	5.5	
		Power Down Mode (V_{CC} = 0 V)	0	5.5	
T_A	Operating Free−Air Temperature		−55	+125	°C
t_r, t_f	Input Transition Rise or Fall Rate	V_{CC} = 1.65 V to 1.95 V	0	20	nS/V
		V_{CC} = 2.3 V to 2.7 V	0	20	
		V_{CC} = 3.0 V to 3.6 V	0	10	
		V_{CC} = 4.5 V to 5.5 V	0	5	

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

NLSF457

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = 25°C$ Min	Typ	Max	$T_A = -55°C$ to $+125°C$ Min	Max	Unit
V_{IH}	High–Level Input Voltage		1.65 to 1.95	0.65 x V_{CC}	–	–	0.65 x V_{CC}	–	V
			2.3 to 5.5	0.70 x V_{CC}	–	–	0.70 x V_{CC}	–	
V_{IL}	Low–Level Input Voltage		1.65 to 1.95	–	–	0.35 x V_{CC}	–	0.35 x V_{CC}	V
			2.3 to 5.5	–	–	0.30 x V_{CC}	–	0.30 x V_{CC}	
V_{OH}	High–Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = -100$ μA $I_{OH} = -4$ mA $I_{OH} = -8$ mA $I_{OH} = -12$ mA $I_{OH} = -16$ mA $I_{OH} = -24$ mA $I_{OH} = -32$ mA	1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5	$V_{CC} - 0.1$ 1.29 1.9 2.2 2.4 2.3 3.8	V_{CC} 1.4 2.1 2.4 2.7 2.5 4.0	–	$V_{CC} - 0.1$ 1.29 1.9 2.2 2.4 2.3 3.8	–	V
V_{OL}	Low–Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $I_{OL} = 100$ μA $I_{OL} = 4$ mA $I_{OL} = 8$ mA $I_{OL} = 12$ mA $I_{OL} = 16$ mA $I_{OL} = 24$ mA $I_{OL} = 32$ mA	1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5	–	0.08 0.2 0.22 0.28 0.38 0.42	0.1 0.24 0.3 0.4 0.4 0.55 0.55	–	0.1 0.24 0.3 0.4 0.4 0.55 0.55	V
I_{IN}	Input Leakage Current	$V_{IN} = 5.5$ V or GND	1.65 to 5.5	–	–	±0.1	–	±1.0	μA
I_{OFF}	Power Off Leakage Current	$V_{IN} = 5.5$ V or $V_{OUT} = 5.5$ V	0	–	–	1.0	–	10	μA
I_{CC}	Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5	–	–	1.0	–	10	μA

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0$ nS)

Symbol	Characteristic	Conditions	V_{CC} (V)	$T_A = 25°C$ Min	Typ	Max	$T_A = -55°C$ to $+125°C$ Min	Max	Unit
t_{PLH}, t_{PHL}	Propagation Delay, A to Y (Figures 3 and 4)	$R_L = 1$ MΩ, $C_L = 15$ pF	1.65 to 1.95	–	7.7	10	–	10.5	ns
		$R_L = 1$ MΩ, $C_L = 15$ pF	2.3 to 2.7	–	4.2	7.5	–	8.0	
		$R_L = 1$ MΩ, $C_L = 15$ pF	3.0 to 3.6	–	3.0	5.2	–	5.5	
		$R_L = 500$ Ω, $C_L = 50$ pF		–	3.5	5.7	–	6.0	
		$R_L = 1$ MΩ, $C_L = 15$ pF	4.5 to 5.5	–	2.3	4.5	–	4.8	
		$R_L = 500$ Ω, $C_L = 50$ pF		–	2.6	5.0	–	5.3	

CAPACITAVE CHARACTERISTICS (Input $t_r = t_f = 3.0$ nS)

Symbol	Parameter	Test Condition	Typical ($T_A = 25$ °C)	Unit
C_{IN}	Input Capacitance	$V_{CC} = 5.5$ V, $V_{IN} = 0$ V or V_{CC}	2.5	pF
C_{OUT}	Output Capacitance	$V_{CC} = 5.5$ V, $V_{IN} = 0$ V or V_{CC}	2.5	pF
C_{PD}	Power Dissipation Capacitance (Note 5)	10 MHz, $V_{CC} = 3.3$ V, $V_{IN} = 0$ V or V_{CC}	9	pF
		10 MHz, $V_{CC} = 5.5$ V, $V_{IN} = 0$ V or V_{CC}	11	

5. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the dynamic operating current consumption without load. Average operating current can be obtained by the equation $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. C_{PD} is used to determine the no–load dynamic power consumption: $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.
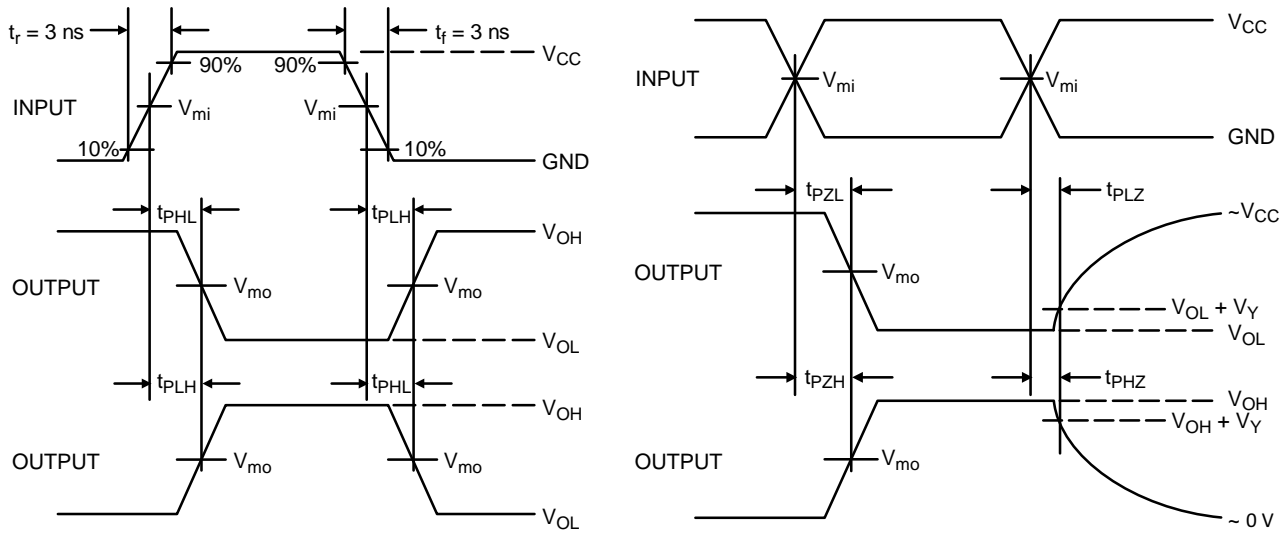
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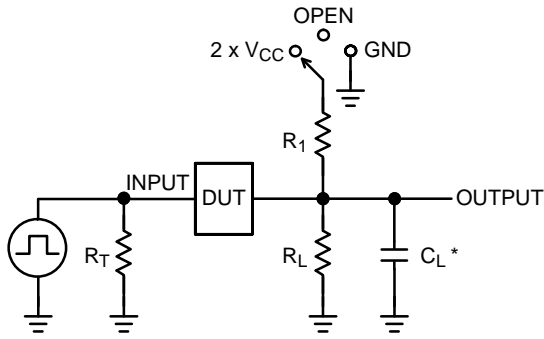
C_L includes probe and jig capacitance
R_T is Z_{OUT} of pulse generator (typicaly 50 Ω)
f = 1 MHz

Test	Switch Position	C_L, pF	R_L, Ω	R_1, Ω
t_{PLH} / t_{PHL}	Open	See AC Characteristics Table	
t_{PLZ} / t_{PZL}	2 x V_{CC}	50	500	500
t_{PHZ} / t_{PZH}	GND	50	500	500

Figure 2. Test Circuit

V_{CC}, V	V_{mi}, V	V_{mo}, V		V_Y, V
		t_{PLH}, t_{PHL}	t_{PZL}, t_{PLZ}, t_{PZH}, t_{PHZ}	
1.65 to 1.95	$V_{CC}/2$	$(V_{OH} - V_{OL})/2$	$V_{CC}/2$	0.15
2.3 to 2.7	$V_{CC}/2$	$(V_{OH} - V_{OL})/2$	$V_{CC}/2$	0.15
3.0 to 3.6	$V_{CC}/2$	$(V_{OH} - V_{OL})/2$	$V_{CC}/2$	0.3
4.5 to 5.5	$V_{CC}/2$	$(V_{OH} - V_{OL})/2$	$V_{CC}/2$	0.3

Figure 3. Switching Waveforms

NLSF457

ORDERING INFORMATION

Device	Package	Marking	Pin 1 Orientation (see bellow)	Shipping†
NLSF457MU3TCG	UDFN8, 1.45 x 1.0, 0.35P	AA	Q4	3000 / Tape & Reel

$\dagger$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.

* NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC − Q100 Qualified and PPAP Capable.

Pin 1 Orientation in Tape and Reel
Direction of Feed
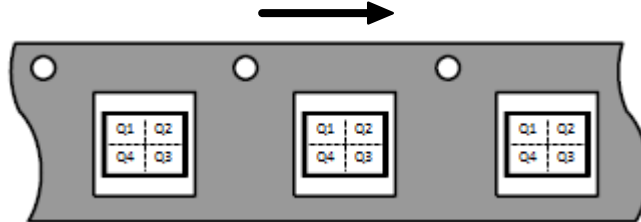
NLSF457

PACKAGE DIMENSIONS

UDFN8, 1.45x1, 0.35P
CASE 517EB
ISSUE O
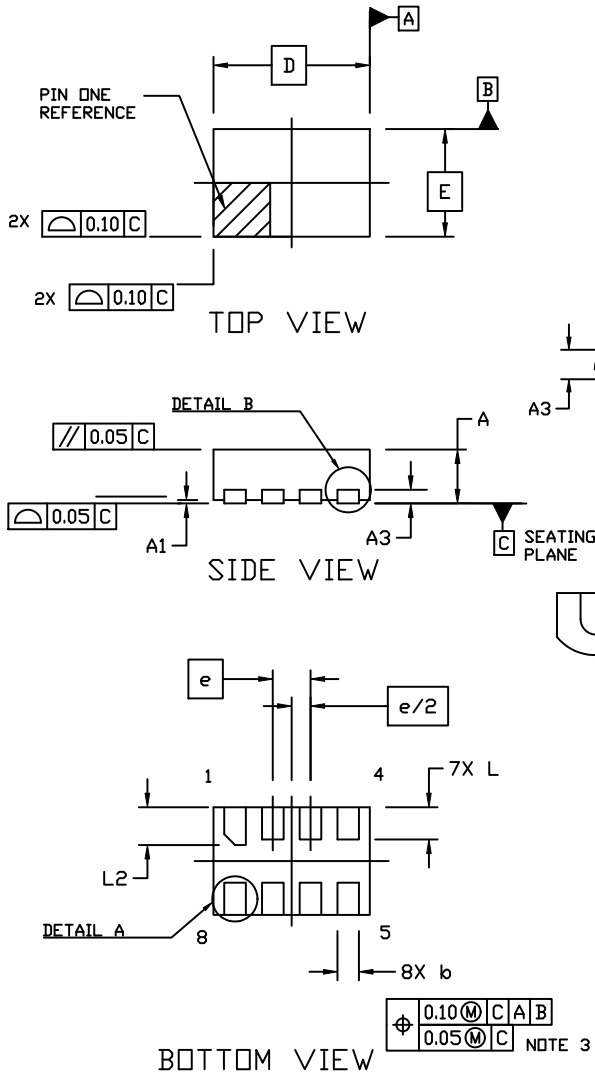
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

2. CONTROLLING DIMENSION: MILLIMETERS

3. DIMENSION b APPLIES TO THE PLATED TERMINALS AND IS MEASURED BETWEEN 0.15 AND 0.20 FROM THE TERMINAL TIPS.

4. PACKAGE DIMENSIONS EXCUSIVE OF BURRS AND MOLD FLASH.

TOP VIEW

SIDE VIEW

DETAIL B
ALTERNATE CONSTRUCTIONS

DETAIL A
ALTERNATE TERMINAL CONSTRUCTIONS

BOTTOM VIEW

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.45	0.50	0.55
A1	---	---	0.05
A3	0.13 REF		
b	0.15	0.20	0.25
D	1.35	1.45	1.55
E	0.90	1.00	1.10
e	0.35 BSC		
L	0.25	0.30	0.35
L1	0.05	0.10	0.15
L2	0.30	0.35	0.40
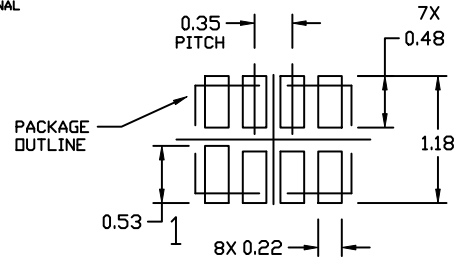
RECOMMENDED MOUNTING FOOTPRINT

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

PUBLICATION ORDERING INFORMATION