Configurable Multifunction Gate

NL7SZ98

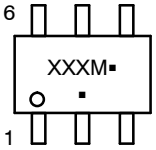
The NL7SZ98 is an advanced high−speed CMOS multifunction gate. The device allows the user to choose logic functions MUX, AND, OR, NAND, NOR, INVERT and BUFFER. The device has Schmitt−trigger inputs, thereby enhancing noise immunity.

Features

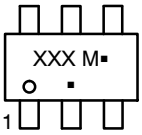
- Designed for 1.65 V to 5.5 V V_{CC} Operation
- 3.3 ns t_{PD} at V_{CC} = 5 V (Typ)
- Inputs/Outputs Overvoltage Tolerant up to 5.5 V
- I_{OFF} Supports Partial Power Down Protection
- Sink 24 mA at 3.0 V
- Available in SC−88, SC-74 and UDFN6 Packages
- Chip Complexity < 100 FETs
- −Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

MARKING DIAGRAMS

SC−88/SC70−6/ SOT−363 CASE 419B−02

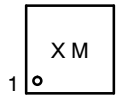


SC−74 CASE 318F−05



UDFN6, 1.45x1.0, 0.5P CASE 517AQ

UDFN6, 1x1, 0.35P CASE 517BX



XXX = Specific Device Code
M = Date Code*
▪ = Pb−Free Package

(Note: Microdot may be in either location or may not be present)

*Date Code orientation and/or position may vary depending upon manufacturing location.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

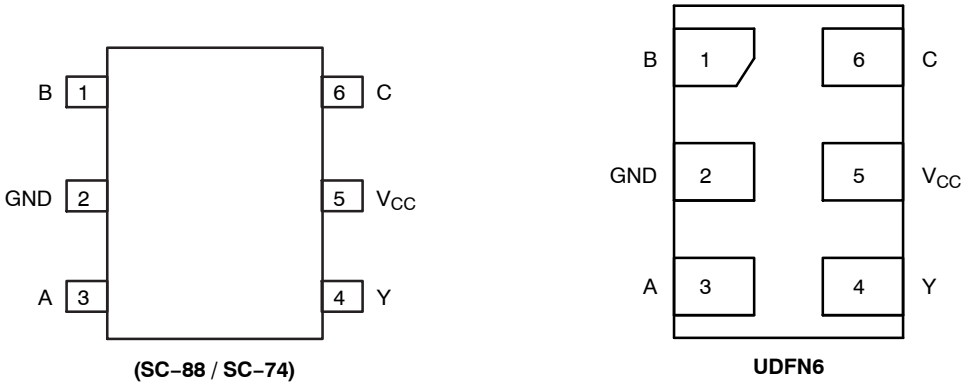


Figure 1. Pinout (Top View)

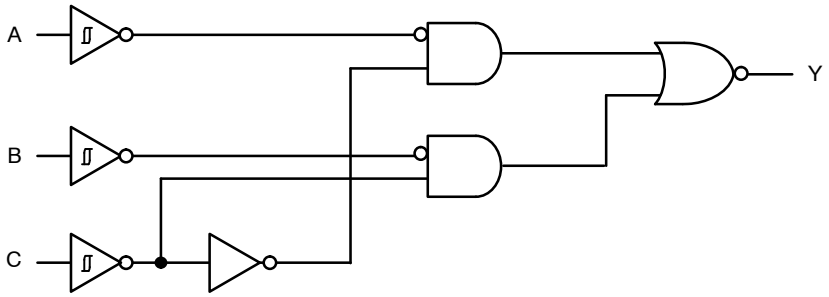


Figure 2. Function Diagram

PIN ASSIGNMENT

Pin	Function
1	B
2	GND
3	A
4	Y
5	V_{CC}
6	C

FUNCTION TABLE*

Input			Output
A	B	C	Y
L	L	L	H
L	L	H	H
L	H	L	L
L	H	H	H
H	L	L	H
H	L	H	L
H	H	L	L
H	H	H	L

*To select a logic function, please refer to “Logic Configurations section”.

LOGIC CONFIGURATIONS

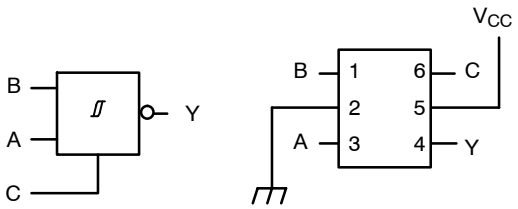


Figure 3. 2−Input MUX with Output Inverted

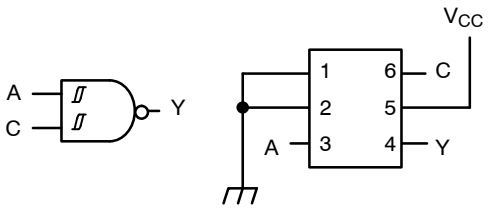


Figure 4. 2−Input NAND (When B = “L”)

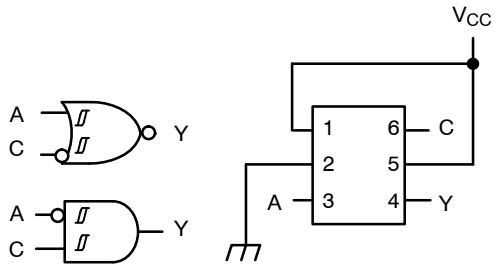


Figure 5. 2−Input NOR with Input C Inverted (When B = “H”)

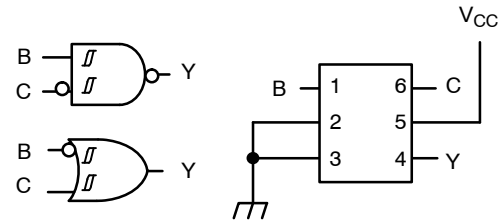


Figure 6. 2−Input NAND with Input C Inverted (When A = “L”)

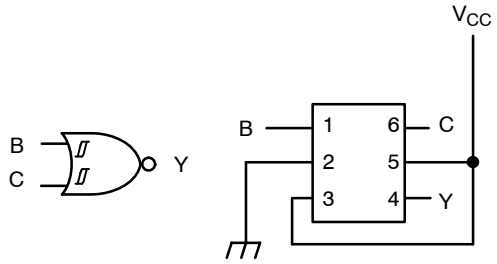


Figure 7. 2−Input NOR (When A =”H”)

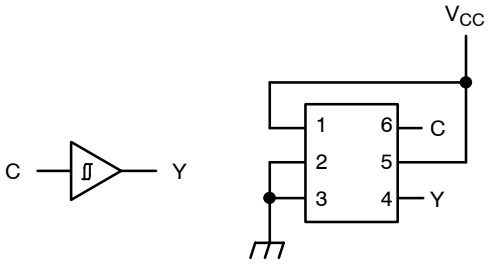


Figure 8. Buffer (When A = “L” and B = “H”)

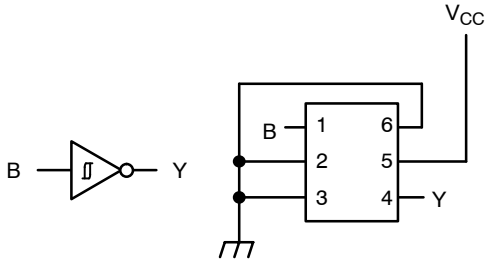


Figure 9. Inverter (When A = C = “L”)

MAXIMUM RATINGS

Symbol	Parameter		Value	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) Tri−State Mode (Note 1) Power−Down Mode (V_{CC} = 0 V)	−0.5 to V_{CC} + 0.5 −0.5 to +6.5 −0.5 to +6.5	V
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 Secs		260	°C
T_J	Junction Temperature Under Bias		+150	°C
θ_{JA}	Thermal Resistance (Note 2)	SC−88 SC−74 UDFN6	377 320 154	°C/W
P_D	Power Dissipation in Still Air	SC−88 SC−74 UDFN6	332 390 812	mW
MSL	Moisture Sensitivity		Level 1	
F_R	Flammability Rating Oxygen	Oxygen Index: 28 to 34	UL 94 V−0 @ 0.125 in	
V_{ESD}	ESD Withstand Voltage (Note 3)	Human Body Mode Charged Device Model	>2000 >200	V
$I_{LATCHUP}$	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 10 mm−by−1 inch, 2 ounce copper trace no air flow per JESD51−7.
3. 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}	DC Input Voltage		0	5.5	V
V_{OUT}	DC Output Voltage	Active−Mode (High or Low State) Tri−State Mode (Note 1) Power−Down Mode (V_{CC} = 0 V)	0	5.5	V
T_A	Operating Free−Air Temperature		−55	+125	°C
t_r, t_f	Input Rise or Fall Rate	V_{CC} = 1.65 V to 1.95 V V_{CC} = 2.3 V to 2.7 V V_{CC} = 3.0 V to 3.6 V V_{CC} = 4.5 V to 5.5 V	0 0 0 0	No Limit No Limit No Limit No Limit	nS/V

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.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	T_A = 25°C			−40°C ≤ T_A ≤ 85°C		−55°C ≤ T_A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V_{T+}	Positive Input Threshold Voltage		1.65	–	–	1.4	–	1.4	–	1.4	V
			2.3	–	–	1.8	–	1.8	–	1.8	
			3.0	–	–	2.2	–	2.2	–	2.2	
			4.5	–	–	3.1	–	3.1	–	3.1	
			5.5	–	–	3.6	–	3.6	–	3.6	
V_{T-}	Negative Input Threshold Voltage		1.65	0.2	–	–	0.2	–	0.2	–	V
			2.3	0.4	–	–	0.4	–	0.4	–	
			3.0	0.6	–	–	0.6	–	0.6	–	
			4.5	1.0	–	–	1.0	–	1.0	–	
			5.5	1.2	–	–	1.2	–	1.2	–	
V_H	Negative Input Threshold Voltage		1.65	0.1	0.48	0.9	0.1	0.9	0.1	0.9	V
			2.3	0.25	0.75	1.1	0.25	1.1	0.25	1.1	
			3.0	0.4	0.93	1.2	0.4	1.2	0.4	1.2	
			4.5	0.6	1.2	1.5	0.6	1.5	0.6	1.5	
			5.5	0.7	1.4	1.7	0.7	1.7	0.7	1.7	
V_{OH}	High−Level Output Voltage	I_{OH} = −50 μA	1.65 to 5.5	V_{CC} − 0.1	V_{CC}	–	V_{CC} − 0.1	–	V_{CC} − 0.1	–	V
	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −4 mA	1.65	1.20	1.52	–	1.20	–	1.20	–	
		I_{OH} = −8 mA	2.3	1.9	2.1	–	1.9	–	1.9	–	
		I_{OH} = −16 mA	3	2.4	2.7	–	2.4	–	2.4	–	
		I_{OH} = −24 mA	3	2.3	2.5	–	2.3	–	2.3	–	
		I_{OH} = −32 mA	4.5	3.8	4	–	3.8	–	3.8	–	
V_{OL}	Low−Level Output Voltage	I_{OL} = 100 μA	1.65 to 5.5	–	–	0.1	–	0.1	–	0.1	V
	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 4 mA	1.65	–	0.08	0.45	–	0.45	–	0.45	
		I_{OL} = 8 mA	2.3	–	0.2	0.3	–	0.3	–	0.4	
		I_{OL} = 16 mA	3	–	0.28	0.4	–	0.4	–	0.5	
		I_{OL} = 24 mA	3	–	0.38	0.55	–	0.55	–	0.55	
		I_{OL} = 32 mA	4.5	–	0.42	0.55	–	0.55	–	0.65	
I_{IN}	Input Leakage Current	V_{IN} = 5.5 V or GND	1.65 to 5.5	–	–	+0.1	–	+1.0	–	+1.0	μA
I_{OFF}	Power Off Leakage Current	V_{IN} = 5.5 V or V_{OUT} = 5.5 V	0	–	–	1.0	–	10	–	10	μA
I_{CC}	Quiescent Supply Current	V_{IN} = 5.5 V or GND	5.5	–	–	1.0	–	10	–	10	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

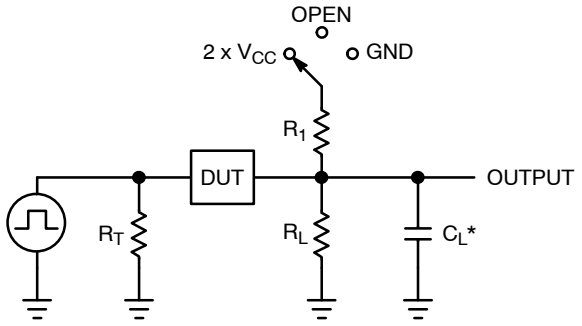
AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	T_A = 25°C			−40°C ≤ T_A ≤ 85°C		−55°C ≤ T_A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}, t_{PHL}	Propagation Delay, (A or B or C) to Y (Figures 10 and 11)	R_L = 1 kΩ, C_L = 30 pF	1.65 to 1.95	–	8.6	14.4	–	14.4	–	14.4	ns
		R_L = 500 Ω, CL = 30 pF	2.3 to 2.7	–	5.1	8.3	–	8.3	–	8.3	
		R_L = 500 Ω, C_L = 50 pF	3.0 to 3.6	–	3.9	6.3	–	6.3	–	6.3	
			4.5 to 5.5	–	3.3	5.1	–	5.1	–	5.1	

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	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}	4.0	pF
C_{PD}	Power Dissipation Capacitance (Note 5)	10 MHz, V_{CC} = 3.3 V, V_{IN} = 0 V or V_{CC} 10 MHz, V_{CC} = 5.0 V, V_{IN} = 0 V or V_{CC}	16 19.5	pF

5. 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: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. C_{PD} is used to determine the no−load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.



C_L includes probe and jig capacitance
R_T is Z_{OUT} of pulse generator (typically 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

X = Don't Care

Figure 10. Test Circuit

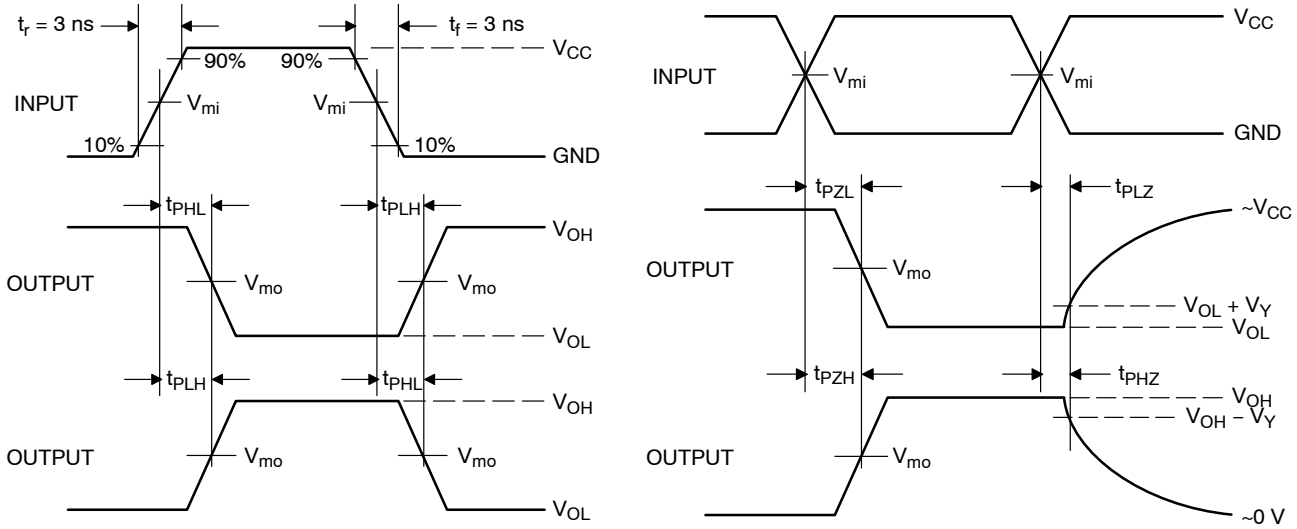


Figure 11. Switching Waveforms

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_{CC} / 2	V_{CC} / 2	0.15
2.3 to 2.7	V_{CC} / 2	V_{CC} / 2	V_{CC} / 2	0.15
3.0 to 3.6	V_{CC} / 2	V_{CC} / 2	V_{CC} / 2	0.3
4.5 to 5.5	V_{CC} / 2	V_{CC} / 2	V_{CC} / 2	0.3

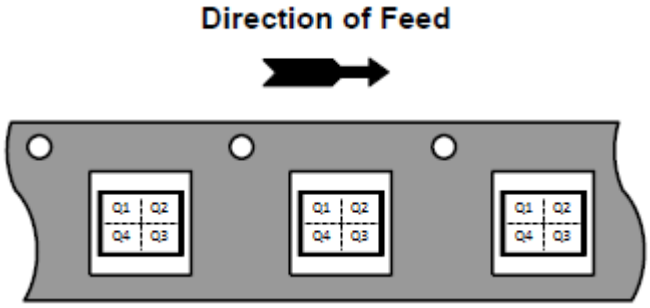
ORDERING INFORMATION

Device	Package	Specific Device Code	Pin 1 Orientation (See below)	Shipping†
NL7SZ98DFT2G	SC−88 (Pb−Free)	MP	Q4	3000 / Tape & Reel
NL7SZ98DFT2G−Q* (Please contact **onsemi**)	SC−88 (Pb−Free)	MP	Q4	3000 / Tape & Reel
NL7SZ98DBVT1G (Please contact **onsemi**)	SC−74 (Pb−Free)	AP	Q4	3000 / Tape & Reel
NL7SZ98MU1TCG (Please contact **onsemi**)	UDFN6, 1.45 x 1.0, 0.5P (Pb−Free)	TBD	Q4	3000 / Tape & Reel
NL7SZ98MU3TCG (Please contact **onsemi**)	UDFN6, 1.0 x 1.0, 0.35P (Pb−Free)	TBD	Q4	3000 / Tape & Reel

†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.

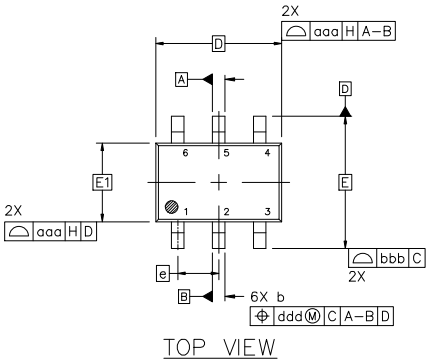
*−Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable.

Pin 1 Orientation in Tape and Reel

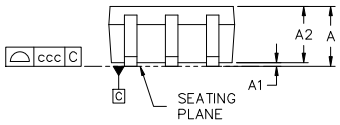


PACKAGE DIMENSIONS

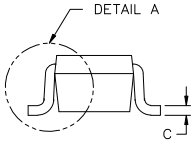
SC−88 2.00x1.25x0.90, 0.65P
CASE 419B−02
ISSUE Z



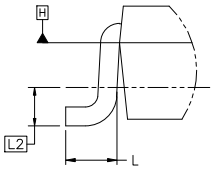
TOP VIEW



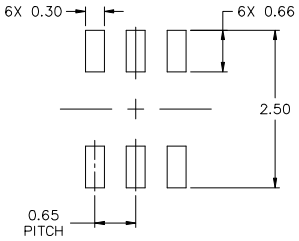
SIDE VIEW



END VIEW



DETAIL A
SCALE 2:1



RECOMMENDED MOUNTING FOOTPRINT*

* FOR ADDITIONAL INFORMATION ON OUR Pb−FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

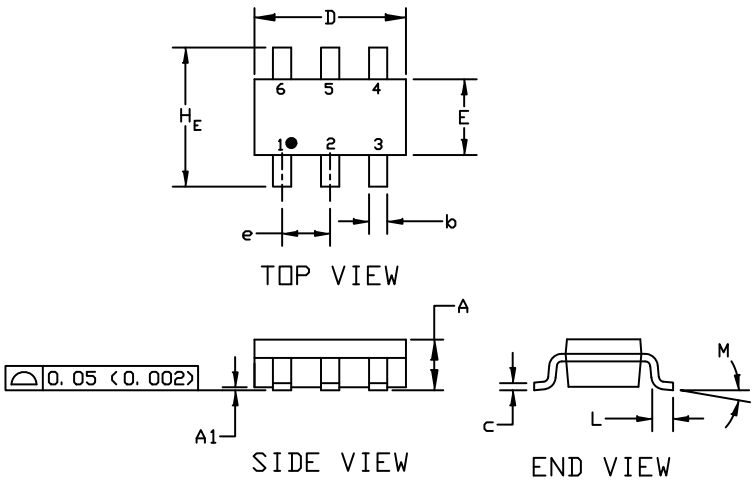
NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5−2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

	MILLIMETERS		
DIM	MIN.	NOM.	MAX.
A	−−−	−−−	1.10
A1	0.00	−−−	0.10
A2	0.70	0.90	1.00
b	0.15	0.20	0.25
c	0.08	0.15	0.22
D	2.00 BSC		
E	2.10 BSC		
E1	1.25 BSC		
e	0.65 BSC		
L	0.26	0.36	0.46
L2	0.15 BSC		
aaa	0.15		
bbb	0.30		
ccc	0.10		
ddd	0.10		

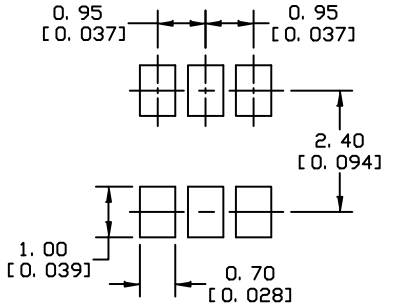
PACKAGE DIMENSIONS

SC−74
CASE 318F
ISSUE P



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994
2. CONTROLLING DIMENSION: INCHES
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.

	MILLIMETERS			INCHES		
DIM	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.90	1.00	1.10	0.035	0.039	0.043
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.25	0.37	0.50	0.010	0.015	0.020
c	0.10	0.18	0.26	0.004	0.007	0.010
D	2.90	3.00	3.10	0.114	0.118	0.122
E	1.30	1.50	1.70	0.051	0.059	0.067
e	0.85	0.95	1.05	0.034	0.037	0.041
H_E	2.50	2.75	3.00	0.099	0.108	0.118
L	0.20	0.40	0.60	0.008	0.016	0.024
M	0°	---	10°	0°	---	10°

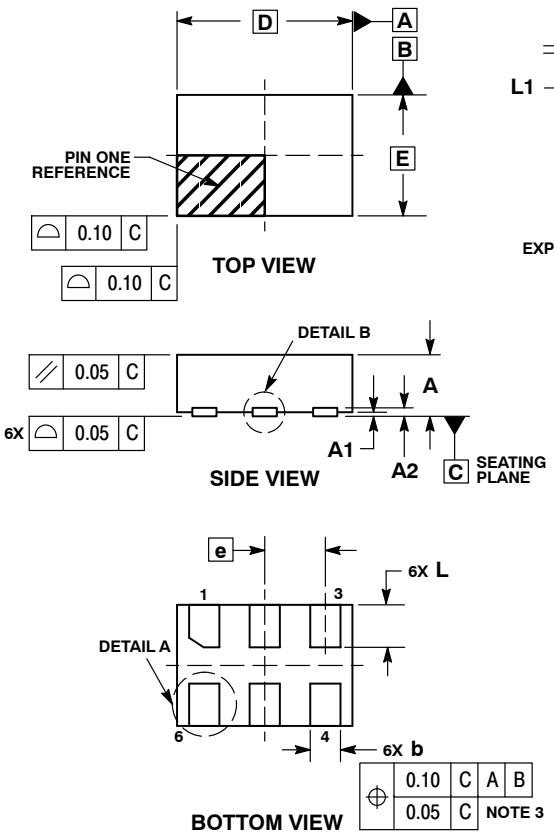


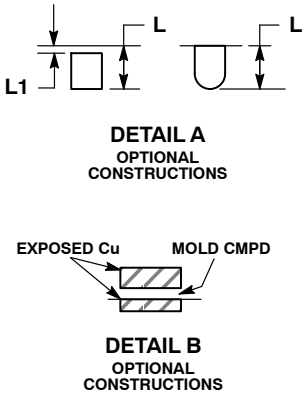
* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

SOLDERING FOOTPRINT

PACKAGE DIMENSIONS

UDFN6, 1.45x1.0, 0.5P
CASE 517AQ
ISSUE O

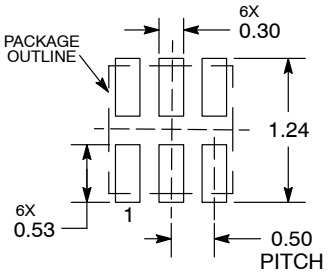




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.

	MILLIMETERS	
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A2	0.07 REF	
b	0.20	0.30
D	1.45 BSC	
E	1.00 BSC	
e	0.50 BSC	
L	0.30	0.40
L1	---	0.15

MOUNTING FOOTPRINT

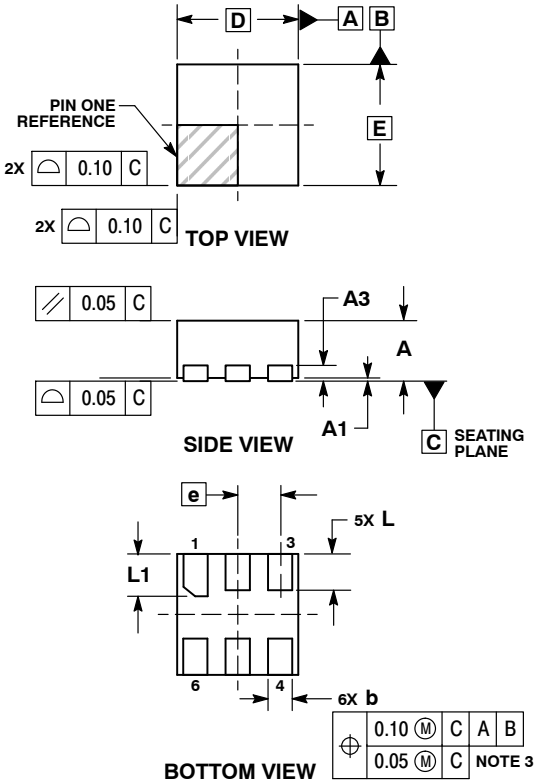


DIMENSIONS: MILLIMETERS

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

PACKAGE DIMENSIONS

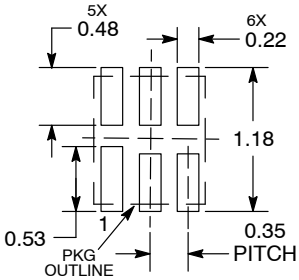
UDFN6, 1x1, 0.35P
CASE 517BX
ISSUE O



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 0.15 AND 0.20 MM FROM TERMINAL TIP.
4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

	MILLIMETERS	
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13 REF	
b	0.12	0.22
D	1.00 BSC	
E	1.00 BSC	
e	0.35 BSC	
L	0.25	0.35
L1	0.30	0.40

RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

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