NL7WB66

Ultra-Small SPST Analog Switch

The NL7WB66 is a very low R_{ON} dual SPST analog switch. R_{ON} is 5.0 Ω (Typ) at 5.0 V. The device is offered in the very popular low cost US8 package. It is designed as a general purpose dual switch and can be used to switch either analog signals such as audio and video or digital signal such as TTL, CMOS, LVDS, ECL, or complex digital signals such as QPSK.

Features

- Excellent Performance RDS_{ON} = 5.0 Ω at 5.0 V
- High Speed Operation: t_{PD} = 0.25 ns (Max) at 5.0 V
- 1.65 to 5.5 V Operating Range
- Reduced Threshold Voltages for LVTTL on Control Pin
  - Eliminates the Need for Translators for Many Applications
  - TTL Compatibility when V_{CC} is 5.0 V
  - Can Operate with 1.8 V Inputs, if V_{CC} is 3.0
  - Also Meets Full CMOS Specifications
- Ultra−Low Charge Injection = 7.5 pC at 5.0 V
- Low Stand−by Power I_{CC} = 1.0 nA (Max) at T_A = 25°C
- Control Pins IN1, IN2, are Overvoltage Tolerant
- Pin for Pin Replacement TC7WB66, NC7WB66, 74LVC2G66
- ESD Protection:
  Machine Model >200 V,
  Human Body Model >2000 V
- Latchup Max Rating: 200 mA
- Pb−Free Package is Available

Typical Applications

- Cell Phones
- PDAs
- Digital Still Cameras
- Video
- Digital Video

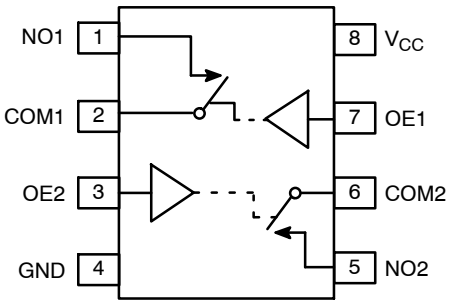

Figure 1. Pin Assignment Diagram

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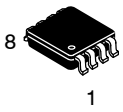
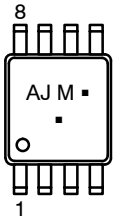
MARKING DIAGRAM



US8
US SUFFIX
CASE 493



AJ = Device Code
M = Date Code*
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*Date Code orientation may vary depending upon manufacturing location.

PIN ASSIGNMENT

Pin	Function	OVT
1	NO1	–
2	COM1	–
3	OE2	Yes
4	GND	–
5	NO2	–
6	COM2	–
7	OE1	Yes
8	V_{CC}	–

FUNCTION TABLE

On/Off Enable Input	State of Analog Switch
L	Off
H	On

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

MAXIMUM RATINGS

Symbol	Rating		Value	Unit
V_{CC}	DC Supply Voltage		−0.5 to +7.0	V
V_I	DC Input Voltage		−0.5 to +7.0	V
V_O	DC Output Voltage		−0.5 to +7.0	V
I_{IK}	DC Input Diode Current	V_I < GND	−50	mA
I_{OK}	DC Output Diode Current	V_O < GND	−50	mA
I_O	DC Output Sink Current		±50	mA
I_{CC}	DC Supply Current per Supply Pin		±100	mA
I_{GND}	DC Ground Current per 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		250	°C/W
P_D	Power Dissipation in Still Air at 85°C		250	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	Human Body Model (Note 2) Machine Model (Note 3) Charged Device Model (Note 4)	> 2000 > 200 N/A	V

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm−by−1 inch, 2−ounce copper trace with no air flow.
2. Tested to EIA/JESD22−A114−A.
3. Tested to EIA/JESD22−A115−A.
4. Tested to JESD22−C101−A.

RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics		Min	Max	Unit
V_{CC}	Positive DC Supply Voltage		1.65	5.5	V
V_{IN}	Digital Input Voltage (Enable)		GND	5.5	V
V_{IO}	Static or Dynamic Voltage Across an Off Switch		GND	V_{CC}	V
V_{IS}	Analog Input Voltage	NO COM	GND	V_{CC}	V
T_A	Operating Temperature Range, All Package Types		−55	+125	°C
t_r, t_f	Input Rise or Fall Time (Enable Input)	V_{CC} = 3.3 V ± 0.3 V V_{CC} = 5.0 V ± 0.5 V	0 0	100 20	ns/V

DEVICE JUNCTION TEMPERATURE VS. TIME TO 0.1% BOND FAILURES

Junction Temperature °C	Time, Hours	Time, Years
80	1,032,200	117.8
90	419,300	47.9
100	178,700	20.4
110	79,600	9.4
120	37,000	4.2
130	17,800	2.0
140	8,900	1.0

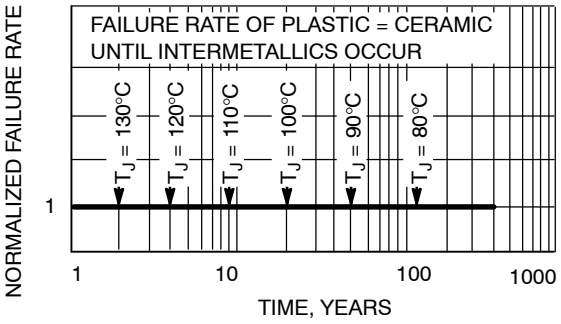


Figure 2. Failure Rate vs. Time Junction Temperature

DC CHARACTERISTICS – Digital Section (Voltages Referenced to GND)

Symbol	Parameter	Condition	V_{CC}	Guaranteed Max Limit			Unit
				25°C	–40 to 85°C	–55 to <125°C	
V_{IH}	High–level Input Voltage, Control Input		1.65 to 1.95 2.3 to 2.7 3.0 to 3.6 4.5 to 5.5	V_{CC} x 0.65 V_{CC} x 0.7 V_{CC} x 0.7 V_{CC} x 0.7	V_{CC} x 0.65 V_{CC} x 0.7 V_{CC} x 0.7 V_{CC} x 0.7	V_{CC} x 0.65 V_{CC} x 0.7 V_{CC} x 0.7 V_{CC} x 0.7	V
V_{IL}	Low–level Input Voltage, Control Input		1.65 to 1.95 2.3 to 2.7 3.0 to 3.6 4.5 to 5.5	V_{CC} x 0.35 V_{CC} x 0.3 V_{CC} x 0.3 V_{CC} x 0.3	V_{CC} x 0.35 V_{CC} x 0.3 V_{CC} x 0.3 V_{CC} x 0.3	V_{CC} x 0.35 V_{CC} x 0.3 V_{CC} x 0.3 V_{CC} x 0.3	V
I_{IN}	Maximum Input Leakage Current, Enable Inputs	V_{IN} = 5.5 V or GND	0 V to 5.5 V	±0.1	±1.0	±1.0	μA
I_{CC}	Maximum Quiescent Supply Current (per package)	Enable and VIS = VCC or GND	5.5	1.0	1.0	2.0	μA

DC ELECTRICAL CHARACTERISTICS – Analog Section

Symbol	Parameter	Condition	V_{CC}	Guaranteed Max Limit			Unit
				25°C	–40 to 85°C	–55 to <125°C	
R_{ON}	On–State Switch Resistance	$V_{IS} = V_{CC}$ I_S = 4 mA	1.65	30	30	30	Ω
		V_{IS} = GND I_S = 4 mA	1.65	15	15	15	
		$V_{IS} = V_{CC}$ I_S = 8 mA	2.3	20	20	20	
		V_{IS} = GND I_S = 8 mA	2.3	10	10	10	
		$V_{IS} = V_{CC}$ I_S = 24 mA	3.0	15	15	15	
		V_{IS} = GND I_S = 24 mA	3.0	7.0	7.0	7.0	
		$V_{IS} = V_{CC}$ I_S = 32 mA	4.5	10	10	10	
		V_{IS} = 2.4 I_S = 15 mA	4.5	8.0	8.0	8.0	
		V_{IS} = GND I_S = 32 mA	4.5	5.0	5.0	5.0	
$R_{ON(p)}$	Peak On–State Resistance	$V_{IS} = V_{CC}$ to GND, $V_{IN} = V_{IH}$ I_S = 4 mA	1.65	120	120	120	Ω
		I_S = 8 mA	2.3	30	30	30	
		I_S = 24 mA	3.0	20	20	20	
		I_S = 32 mA	4.5	15	15	15	
ΔR_{ON}	Difference of On–State Resistance between Switches	$V_{IS} = V_{CC}$ to GND, $V_{IN} = V_{IH}$ I_S = 4 mA	1.65	1.2	1.2	1.2	Ω
		I_S = 8 mA	2.3	1.3	1.3	1.3	
		I_S = 24 mA	3.0	1.5	1.5	1.5	
		I_S = 32 mA	4.5	2.0	2.0	2.0	
R_{FLAT}		$V_{IS} = V_{CC}$ to GND I_S = 4 mA	1.65	240	240	240	Ω
		I_S = 8 mA	2.3	60	60	60	
		I_S = 24 mA	3.0	14	14	14	
		I_S = 32 mA	4.5	5.0	5.0	5.0	
$I_{NO(OFF)}$	Off Leakage Current	$V_{IN} = V_{IL}$ V_{NO} = 1.0 V, V_{COM} = 4.5 V or V_{COM} = 1.0 V and V_{NO} 4.5 V	5.5	1.0	10	100	nA
$I_{COM(OFF)}$	Off Leakage Current	$V_{IN} = V_{IL}$ V_{NO} = 4.5 V or 1.0 V V_{COM} = 1.0 V or 4.5 V	5.5	1.0	10	100	nA

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

Symbol	Parameter	Test Conditions	Guaranteed Max Limit								Unit
			V_{CC} = 1.8 V ±0.15 V		V_{CC} = 2.5 V ±0.2 V		V_{CC} = 3.3 V ±0.3 V		V_{CC} = 5.0 V ±0.5 V		
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{ON}	Output Enable Time		2.3	10	1.6	5.6	1.5	4.4	1.3	3.9	ns
t_{OFF}	Output Disable Time		2.5	10.5	1.2	6.9	2.0	7.2	1.1	6.3	ns
t_{PD}	Propagation Delay Time		–	0.55	–	0.5	–	0.35	–	0.25	ns

		Typical @ 25°C, V_{CC} = 5.0 V	Unit
C_{IN}	Maximum Input Capacitance, Select Input	3.0	pF
C_{NO1} or C_{NO2}	Analog I/O (Switch Off)	10	
$C_{COM(OFF)}$	Common I/O (Switch Off)	10	
$C_{COM(ON)}$	Feed–through (Switch Off)	10	

ADDITIONAL APPLICATIONS CHARACTERISTICS (Voltage Reference to GND Unless Noted)

Symbol	Parameter	Condition	V_{CC} (V)	Typical 25°C	Unit
BW	Maximum On−Channel −3.0 dB Bandwidth or Minimum Frequency Response	V_{IS} = 0 dBm V_{IS} centered between V_{CC} and GND	2.0 3.0 4.5	102 180 186	MHz
V_{ONL}	Maximum Feed−Through On Loss	V_{IS} = 0 dBm @ 10 kHz V_{IS} centered between V_{CC} and GND	2.0 3.0 4.5	−2.2 −0.8 −0.4	dB
V_{ISO}	Off−Channel Isolation	f = 100 kHz V_{IS} = 1.0 V RMS V_{IS} centered between V_{CC} and GND	2.0 3.0 4.5	−73 −74 −75	dB
Q	Charge Injection Enable Input to Common I/O	V_{IS} = V_{CC} to GND, F_{IS} = 20 kHz t_r = t_f = 3.0 nS R_{IS} = 0 Ω, C_L = 100 pF	 3.0 5.5	 4.8 7.5	pC
THD	Total Harmonic Distortion TDH + Noise	F_{IS} = 10 Hz to 100 kHz, R_L = R_{gen} = 600 Ω, C_L = 50 pF V_{IS} = 3.0 V_{PP} Sine Wave V_{IS} = 5.0 V_{PP} Sine Wave	 3.0 5.5	 0.19 0.06	%

DEVICE ORDERING INFORMATION

Device Order Number	Device Nomenclature				Package Type	Tape and Reel Size
	Circuit Indicator	Technology	Device Function	Package Suffix		
NL7WB66US	NL	AS	2066	US	US8	178 mm (7″) 3000 Units / Tape & Reel
NL7WB66USG	NL	AS	2066	US	US8 (Pb−Free)	178 mm (7″) 3000 Units / 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.

TIMING INFORMATION

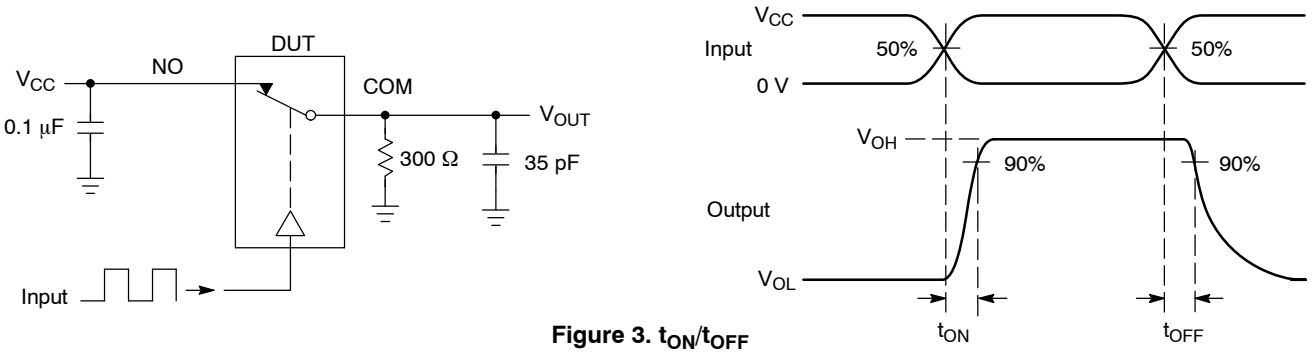


Figure 3. t_{ON}/t_{OFF}

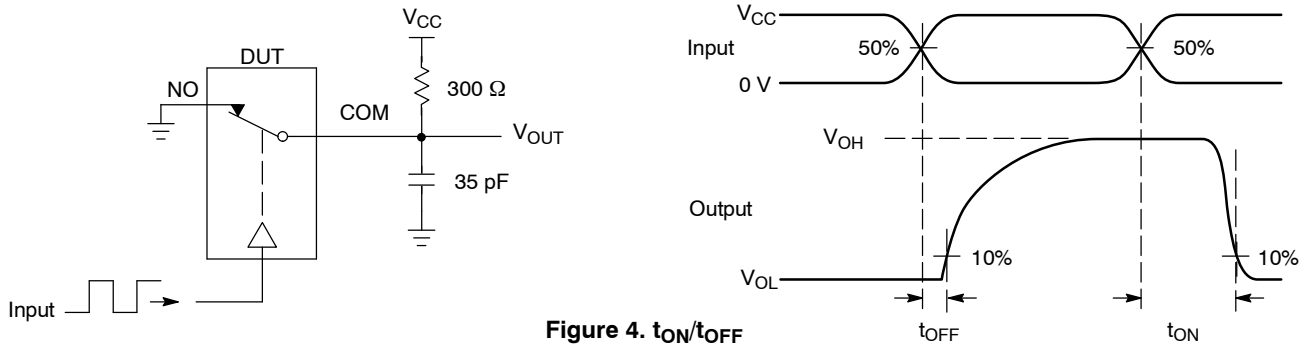
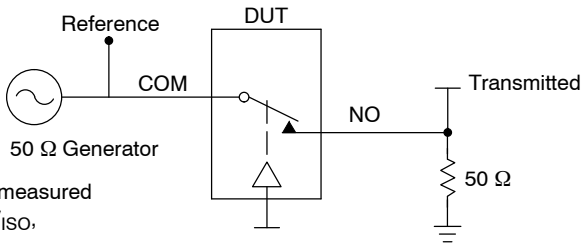


Figure 4. t_{ON}/t_{OFF}



Channel switch control/s test socket is normalized. Off isolation is measured across an off channel. On loss is the bandwidth of an On switch. V_{ISO}, Bandwidth and V_{ONL} are independent of the input signal direction.

V_{ISO} = Off Channel Isolation = 20 Log $\left(\frac{V_{OUT}}{V_{IN}}\right)$ for V_{IN} at 100 kHz

V_{ONL} = On Channel Loss = 20 Log $\left(\frac{V_{OUT}}{V_{IN}}\right)$ for V_{IN} at 100 kHz to 50 MHz

Bandwidth (BW) = the frequency 3 dB below V_{ONL}

Figure 5. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/V_{ONL}

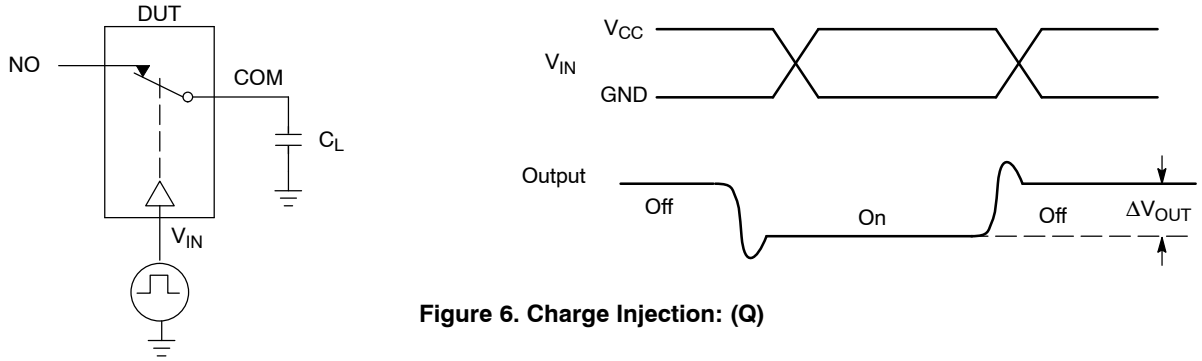
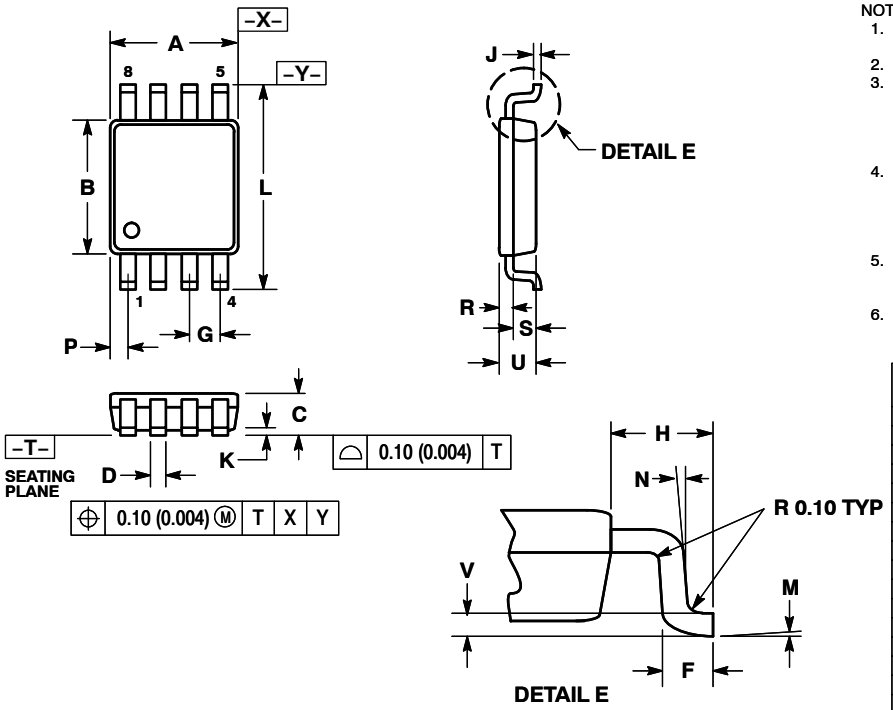


Figure 6. Charge Injection: (Q)

PACKAGE DIMENSIONS

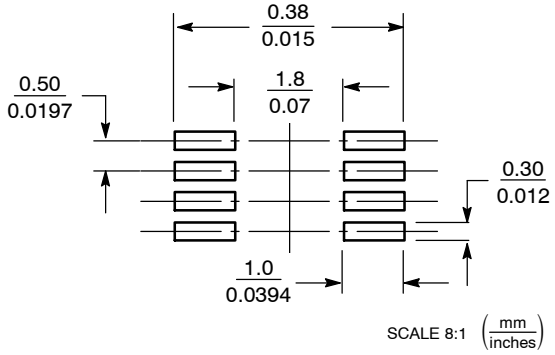
US8
US SUFFIX
CASE 493–02
ISSUE B



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION "A" DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR. MOLD FLASH. PROTRUSION AND GATE BURR SHALL NOT EXCEED 0.140 MM (0.0055") PER SIDE.
4. DIMENSION "B" DOES NOT INCLUDE INTER–LEAD FLASH OR PROTRUSION. INTER–LEAD FLASH AND PROTRUSION SHALL NOT E3XCEED 0.140 (0.0055") PER SIDE.
5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076–0.0203 MM. (300–800 ").
6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED ±0.0508 (0.0002 ").

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	1.90	2.10	0.075	0.083
B	2.20	2.40	0.087	0.094
C	0.60	0.90	0.024	0.035
D	0.17	0.25	0.007	0.010
F	0.20	0.35	0.008	0.014
G	0.50 BSC		0.020 BSC	
H	0.40 REF		0.016 REF	
J	0.10	0.18	0.004	0.007
K	0.00	0.10	0.000	0.004
L	3.00	3.20	0.118	0.126
M	0 °	6 °	0 °	6 °
N	5 °	10 °	5 °	10 °
P	0.23	0.34	0.010	0.013
R	0.23	0.33	0.009	0.013
S	0.37	0.47	0.015	0.019
U	0.60	0.80	0.024	0.031
V	0.12 BSC		0.005 BSC	

SOLDERING 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

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
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Fax: 303–675–2176 or 800–344–3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

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