

NS5B1G384

Single (NC) Normally Closed SPST Analog Switch

The NS5B1G384 is Single Pole Single Throw (SPST) high-speed TTL-compatible switch. The low resistance and capacitance characteristics of this switch make it ideal for low-distortion audio, video, and data routing applications. The switch has a normally closed logic configuration meaning the switch is on (NC connected to COM) when IN is low. These switches are available in 5-pin SC-70 and 5-pin TSOP-5 (SOT23-5) packages for operation over the industrial (-40°C to +85°C) temperature range.

Features

- V_{CC} Operating Range: 2.0 V to 5.5 V
- Low On Resistance : R_{ON} : 4.0 Ω Typical @ $V_{CC} = 4.5$ V
- Minimal Propagation Delay : $t_{pd} < 0.5$ ns
- Control Input Compatible with TTL Levels
- ESD Performance: Human Body Model $> \pm 2$ kV
- 5-Pin SC-70 or 5-Pin TSOP-5 Packages Available
- These are Pb-Free Devices

Typical Applications

- Audio, Video, and High-Speed Data Switching
- Mobile Phones
- Portable Devices
- Desktop & Notebook Computing



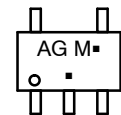
ON Semiconductor®

<http://onsemi.com>

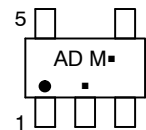
MARKING DIAGRAMS



SC-70
CASE 419A



TSOP-5
(SOT23-5)
CASE 483



AG = For SC-70

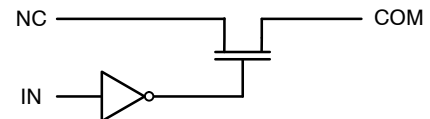
AD = For TSOP-5

M = Date Code

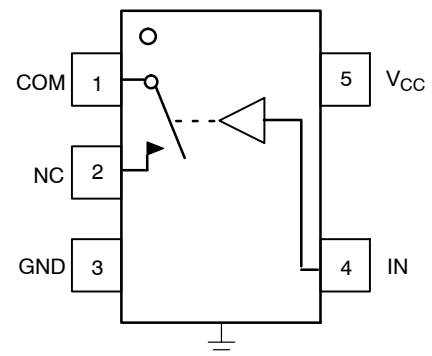
▪ = Pb-Free Package

(Note: Microdot may be in either location)

LOGIC DIAGRAM



PIN ASSIGNMENTS



ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

NS5B1G384

PIN DESCRIPTION

PIN #	Name	Direction	Description
1	COM	I/O	Common Signal Line
2	NC	I/O	Normally Closed Signal Line
3	GND	Input	Ground
4	IN	Input	Control Signal Line
5	V _{CC}	Input	Voltage Supply

TRUTH TABLE

IN Control Input	Function
L	NC Connected to COM
H	NC Disconnected from COM

MAXIMUM RATINGS

Symbol	Pins	Rating	Value	Condition	Unit
V _{CC}	V _{CC}	Positive DC Supply Voltage	-0.5 to +7.0		V
V _{IS}	NC or COM	Analog Signal Voltage	-0.5 to V _{CC} + 0.5		V
V _{IN}	IN	Control Input Voltage	-0.5 to +7.0		V
I _{IS_CON}	NC or COM	Analog Signal Continuous Current	± 300	Closed Switch	mA
I _{IS_PK}	NC or COM	Analog Signal Peak Current	± 500	10% Duty Cycle	mA
I _{IN}	IN	Control Input Current	± 20		mA
T _{STG}		Storage Temperature Range	-65 to 150		°C

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.

RECOMMENDED OPERATING CONDITIONS

Symbol	Pins	Parameter	Value	Condition	Unit
V _{CC}	V _{CC}	Positive DC Supply Voltage	2.0 to 5.5		V
V _{IS}	NC or COM	Analog Signal Voltage	GND to V _{CC}		V
V _{IN}	IN	Control Input Voltage	GND to 5.5		V
T _A		Operating Temperature Range	-40 to +85		°C
t _r , t _f		Input Rise or Fall Time	20	V _{CC} = 3.3 V	ns/V
			10	V _{CC} = 5.0 V	

Minimum and maximum values are guaranteed through test or design across the **Recommended Operating Conditions**, where applicable. Typical values are listed for guidance only and are based on the particular conditions listed for each section, where applicable. These conditions are valid for all values found in the characteristics tables unless otherwise specified in the test conditions.

ESD PROTECTION

Pins	Description	Minimum Voltage
All Pins	Human Body Model	2 kV

NS5B1G384

DC ELECTRICAL CHARACTERISTICS

CONTROL INPUT (Typical: T = 25°C)

Symbol	Pins	Parameter	Test Conditions	V _{CC} (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
V _{IH}	IN	Control Input High		4.5 – 5.5	2.0			V
V _{IL}	IN	Control Input Low		4.5 – 5.5			0.8	V
I _{IN}	IN	Control Input Leakage	0 ≤ V _{IN} ≤ V _{CC}	5.0		±0.1	±0.5	μA

SUPPLY CURRENT AND LEAKAGE (Typical: T = 25°C)

Symbol	Pins	Parameter	Test Conditions	V _{CC} (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
I _{NC} (OFF)	NC	OFF State Leakage	V _{IN} = V _{IL} or V _{IH} V _{NC} = 1.0 V V _{COM} = 4.5 V	5.5		±10	±100	nA
I _{COM} (OFF)	COM	OFF State Leakage	V _{IN} = V _{IL} or V _{IH} V _{NC} = 4.5 V V _{COM} = 1.0 V	5.5		±10	±100	nA
I _{CC}	V _{CC}	Quiescent Supply	V _{IN} and V _{IS} = V _{CC} or GND I _D = 0 A	2.0 – 5.5		±0.1	±1.0	μA
I _{OFF}	IN	Power Off Leakage	V _{IN} = 5.5 V or GND	0		±0.5	±1.0	μA

ON RESISTANCE (Typical: T = 25°C)

Symbol	Pins	Parameter	Test Conditions	V _{CC} (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
R _{ON}	NC, COM	ON Resistance	V _{IS} = 0 V, I _{ON} = 30 mA V _{IS} = 0 V, I _{ON} = 64 mA V _{IS} = 2.4 V, I _{ON} = 15 mA	4.5 4.5 4.5		4.0 4.0 11.5	7.0 7.0 15	Ω

NS5B1G384

AC ELECTRICAL CHARACTERISTICS

TIMING/FREQUENCY (Typical: T = 25°C, R_L = 50 Ω, C_L = 35 pF, f = 1 MHz)

Symbol	Pins	Parameter	Test Conditions	V _{CC} (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
t _{ON}	IN to NC	Turn On Time	As Above, Figures 1 and 2	4.5			6.0	ns
t _{OFF}	IN to NC	Turn Off Time	As Above, Figures 1 and 2	4.5			2.0	ns
t _{PD}	NC to COM	Propagation Delay		4.5			0.5	ns
BW		-3dB Bandwidth	C _L = 5 pF, Figures 3 and 4	4.5		330		MHz

CAPACITANCE (Typical: T = 25°C, R_L = 50 Ω, C_L = 5 pF, f = 1 MHz)

Symbol	Pins	Parameter	Test Conditions	V _{CC} (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
C _{IN}	IN	Control Input		0 V		2.2		pF
C _{ON}	NC to COM	Through Switch	V _{IN} = 0V	4.5 V		12		pF
C _{OFF}	NC	Unselected Port	V _{IS} = 4.5 V, V _{IN} = 4.5 V	4.5 V		4.1		pF

DEVICE ORDERING INFORMATION

Device Order Number	Package Type	Tape & Reel Size [†]
NS5B1G384DFT2G	SC-70 (Pb-Free)	3000 / Tape & Reel
NS5B1G384DTT1G	TSOP-5 (Pb-Free)	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.

NS5B1G384

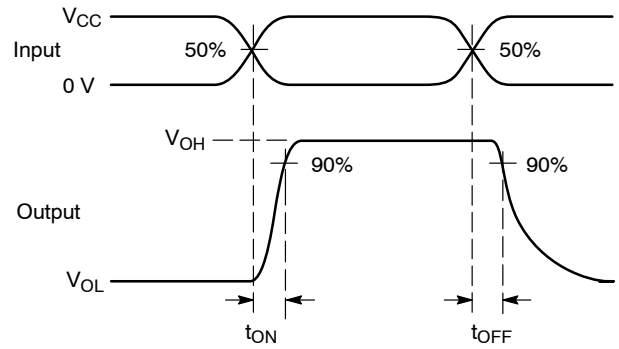
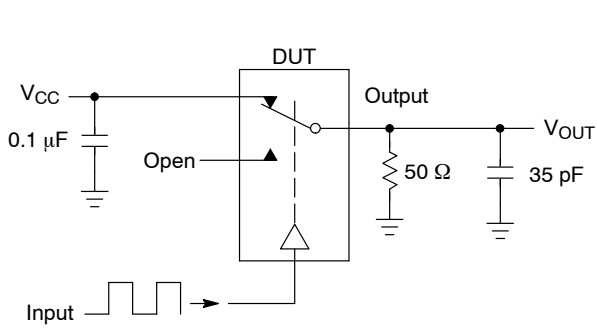


Figure 1. t_{ON}/t_{OFF}

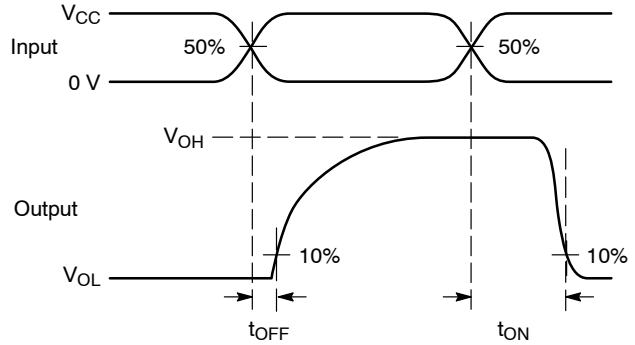
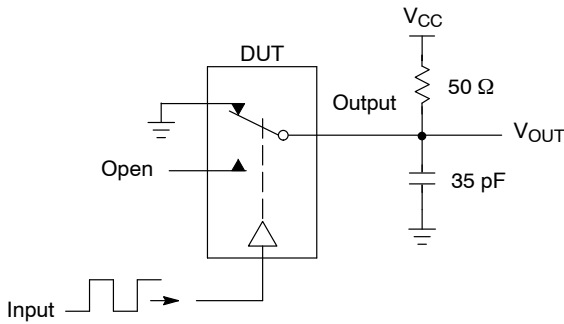
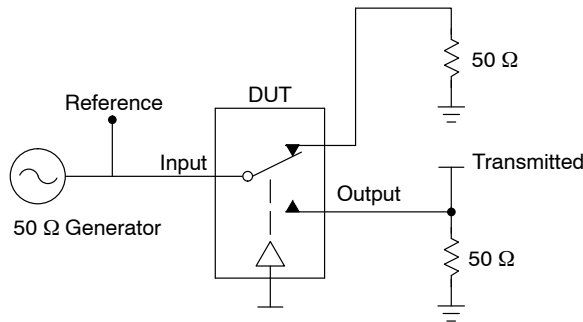


Figure 2. t_{ON}/t_{OFF}



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.

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

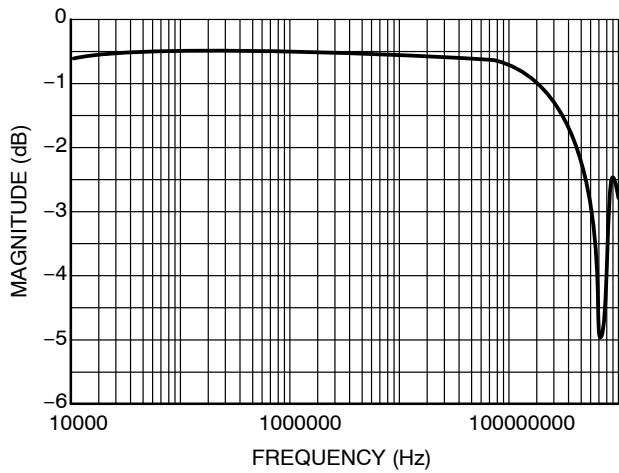
$$V_{ONL} = \text{On Channel Loss} = 20 \text{ Log} \left(\frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz to } 50 \text{ MHz}$$

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

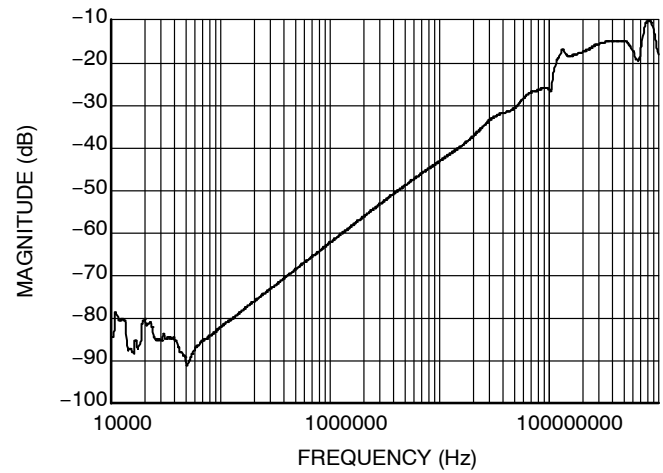
V_{CT} = Use V_{ISO} setup and test to all other switch analog input/outputs terminated with 50 Ω

Figure 3. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/ V_{ONL}

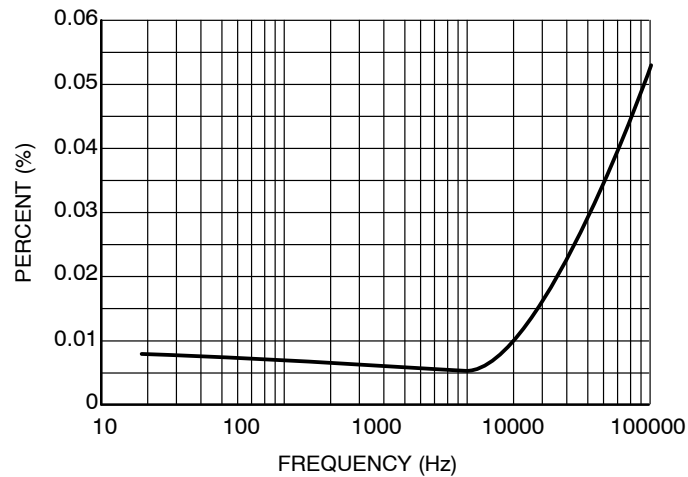
NS5B1G384



**Figure 4. Typical Bandwidth @ $V_{CC} = 5.5$ V,
25°C**



**Figure 5. Off-Channel Isolation @ $V_{CC} = 5.5$ V,
25°C**

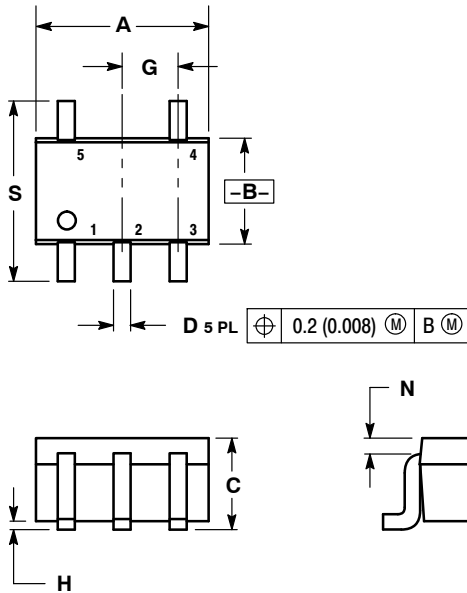


**Figure 6. Typical Total Harmonic Distortion @
 $V_{CC} = 4.5$ V**

NS5B1G384

PACKAGE DIMENSIONS

SC-88A (SC-70-5/SOT-353)
CASE 419A-02
ISSUE K



NOTES:

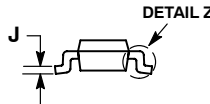
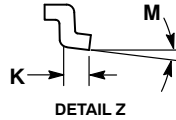
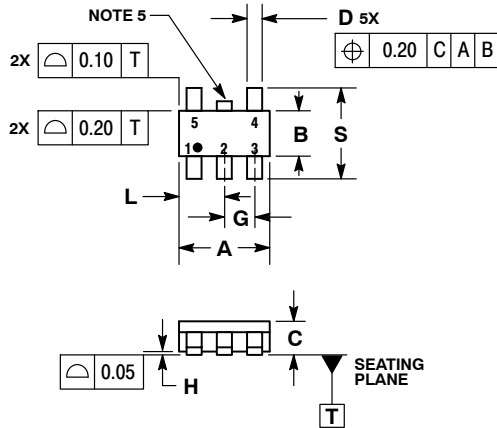
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

NS5B1G384

PACKAGE DIMENSIONS

TSOP-5, SOT23-5
CASE 483-02
ISSUE H

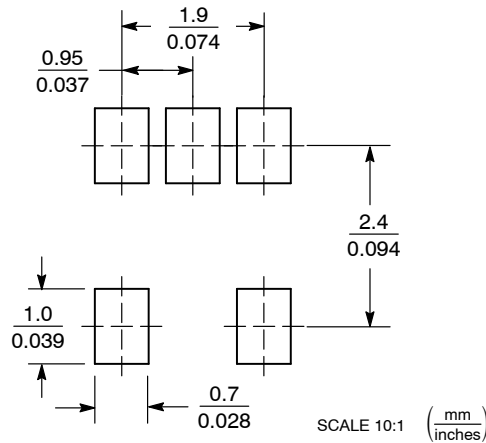


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

DIM	MILLIMETERS	
	MIN	MAX
A	3.00 BSC	
B	1.50 BSC	
C	0.90	1.10
D	0.25	0.50
G	0.95 BSC	
H	0.01	0.10
J	0.10	0.26
K	0.20	0.60
L	1.25	1.55
M	0° 10°	
S	2.50	3.00

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.

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com
Order Literature: <http://www.onsemi.com/orderlit>
For additional information, please contact your local Sales Representative