

# NS5B1G385

## Single (NO) Normally Open SPST Analog Switch

The NS5B1G385 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 open logic configuration meaning the switch is on (NO connected to COM) when IN is high. 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<sub>CC</sub> Operating Range: 2.0 V to 5.5 V
- Low On Resistance : R<sub>ON</sub>: 4.0 Ω Typical @ V<sub>CC</sub> = 4.5 V
- Minimal Propagation Delay : t<sub>pd</sub> < 0.5 ns
- Control Input Compatible with TTL Levels
- ESD Performance: Human Body Model > ±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



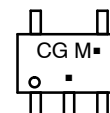
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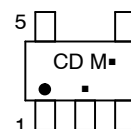
### MARKING DIAGRAMS



SC-70  
CASE 419A



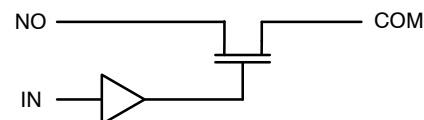
TSOP-5  
(SOT23-5)  
CASE 483



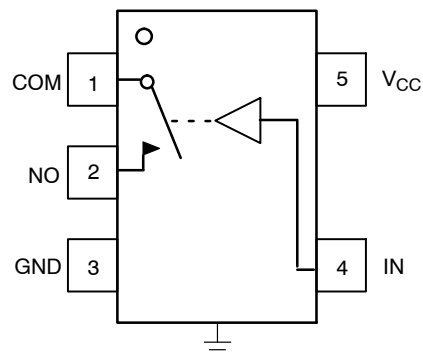
CG = For SC-70  
CD = For TSOP-5  
M = Date Code  
▪ = Pb-Free Package

(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.

# NS5B1G385

## PIN DESCRIPTION

PIN #	Name	Direction	Description
1	COM	I/O	Common Signal Line
2	NO	I/O	Normally Open Signal Line
3	GND	Input	Ground
4	IN	Input	Control Signal Line
5	V <sub>CC</sub>	Input	Voltage Supply

## TRUTH TABLE

IN Control Input	Function
L	NO Disconnected from COM
H	NO Connected to COM

## MAXIMUM RATINGS

Symbol	Pins	Rating	Value	Condition	Unit
V <sub>CC</sub>	V <sub>CC</sub>	Positive DC Supply Voltage	-0.5 to +7.0		V
V <sub>IS</sub>	NO or COM	Analog Signal Voltage	-0.5 to V <sub>CC</sub> + 0.5		V
V <sub>IN</sub>	IN	Control Input Voltage	-0.5 to +7.0		V
I <sub>IS_CON</sub>	NO or COM	Analog Signal Continuous Current	± 300	Closed Switch	mA
I <sub>IS_PK</sub>	NO or COM	Analog Signal Peak Current	± 500	10% Duty Cycle	mA
I <sub>IN</sub>	IN	Control Input Current	± 20		mA
T <sub>STG</sub>		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 <sub>CC</sub>	V <sub>CC</sub>	Positive DC Supply Voltage	2.0 to 5.5		V
V <sub>IS</sub>	NO or COM	Analog Signal Voltage	GND to V <sub>CC</sub>		V
V <sub>IN</sub>	IN	Control Input Voltage	GND to 5.5		V
T <sub>A</sub>		Operating Temperature Range	-40 to +85		°C
t <sub>r</sub> , t <sub>f</sub>		Input Rise or Fall Time	20	V <sub>CC</sub> = 3.3 V	ns/V
			10	V <sub>CC</sub> = 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

# NS5B1G385

## DC ELECTRICAL CHARACTERISTICS

### CONTROL INPUT (Typical: T = 25°C)

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

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

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
I <sub>NO</sub> (OFF)	NO	OFF State Leakage	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>NO</sub> = 1.0 V V <sub>COM</sub> = 4.5 V	5.5		±10	±100	nA
I <sub>COM</sub> (OFF)	COM	OFF State Leakage	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>NO</sub> = 4.5 V V <sub>COM</sub> = 1.0 V	5.5		±10	±100	nA
I <sub>CC</sub>	V <sub>CC</sub>	Quiescent Supply	V <sub>IN</sub> and V <sub>IS</sub> = V <sub>CC</sub> or GND I <sub>D</sub> = 0 A	2.0 – 5.5		±0.1	±1.0	μA
I <sub>OFF</sub>	IN	Power Off Leakage	V <sub>IN</sub> = 5.5 V or GND	0		±0.5	±1.0	μA

### ON RESISTANCE (Typical: T = 25°C)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
R <sub>ON</sub>	NO, COM	ON Resistance	V <sub>IS</sub> = 0 V, I <sub>ON</sub> = 30 mA V <sub>IS</sub> = 0 V, I <sub>ON</sub> = 64 mA V <sub>IS</sub> = 2.4 V, I <sub>ON</sub> = 15 mA	4.5 4.5 4.5		4.0 4.0 11.5	7.0 7.0 15	Ω

# NS5B1G385

## AC ELECTRICAL CHARACTERISTICS

**TIMING/FREQUENCY** (Typical: T = 25°C, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 35 pF, f = 1 MHz)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
t <sub>ON</sub>	IN to NO	Turn On Time	As Above, Figures 1 and 2	4.5			6.0	ns
t <sub>OFF</sub>	IN to NO	Turn Off Time	As Above, Figures 1 and 2	4.5			2.0	ns
t <sub>PD</sub>	NO to COM	Propagation Delay	As Above	4.5			0.5	ns
BW		-3dB Bandwidth	C <sub>L</sub> = 5 pF, Figures 3 and 4	4.5		330		MHz

**CAPACITANCE** (Typical: T = 25°C, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 5 pF, f = 1 MHz)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
C <sub>IN</sub>	IN	Control Input		0 V		2.2		pF
C <sub>ON</sub>	NO to COM	Through Switch	V <sub>IN</sub> = 0V	4.5 V		12		pF
C <sub>OFF</sub>	NO	Unselected Port	V <sub>IS</sub> = 4.5 V, V <sub>IN</sub> = 4.5 V	4.5 V		4.1		pF

## DEVICE ORDERING INFORMATION

Device Order Number	Package Type	Tape & Reel Size <sup>†</sup>
NS5B1G385DFT2G	SC-70 (Pb-Free)	3000 / Tape & Reel
NS5B1G385DTT1G	TSOP-5 (Pb-Free)	3000 / Tape & Reel

<sup>†</sup>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.

## NS5B1G385

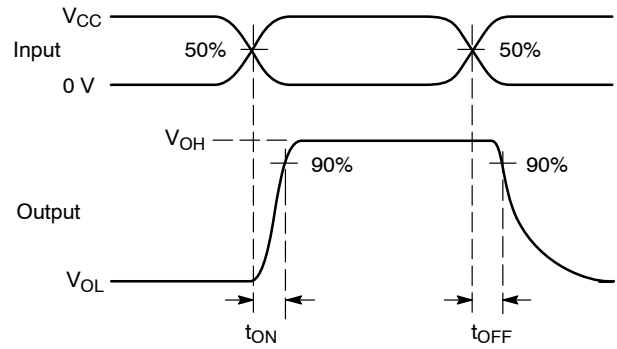
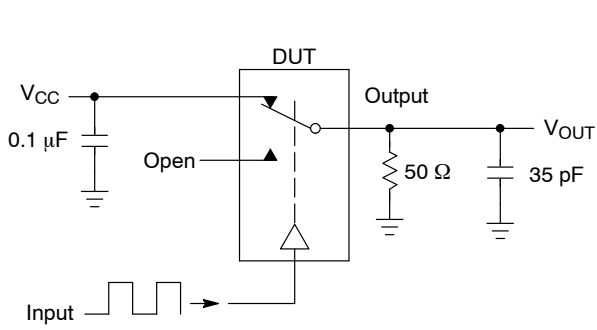


Figure 1.  $t_{ON}/t_{OFF}$

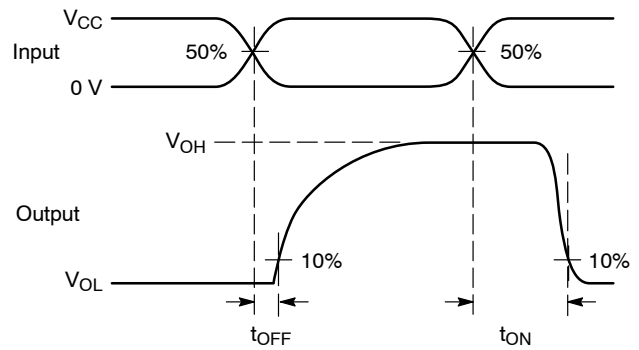
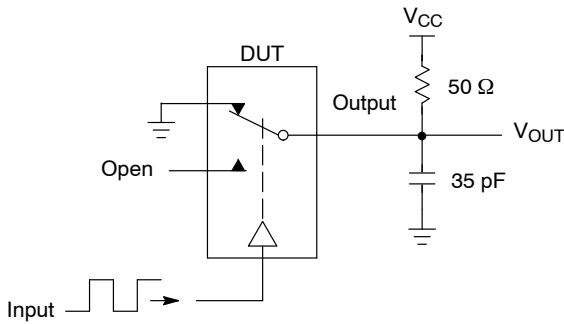
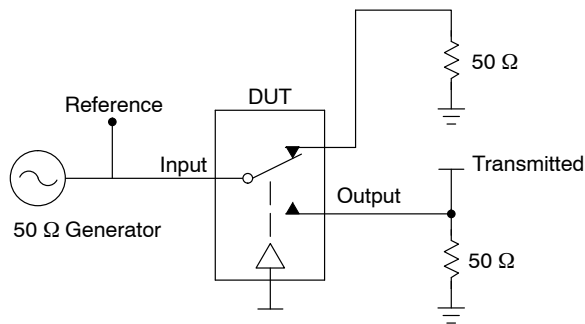


Figure 2.  $t_{ON}/t_{OFF}$



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.

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

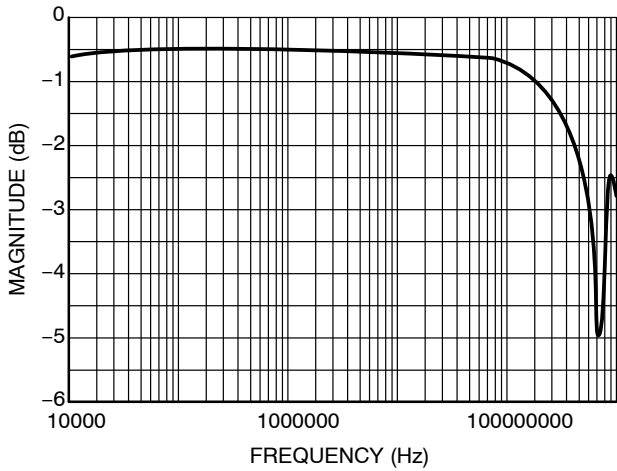
$$V_{ONL} = \text{On Channel Loss} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz to } 50 \text{ MHz}$$

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

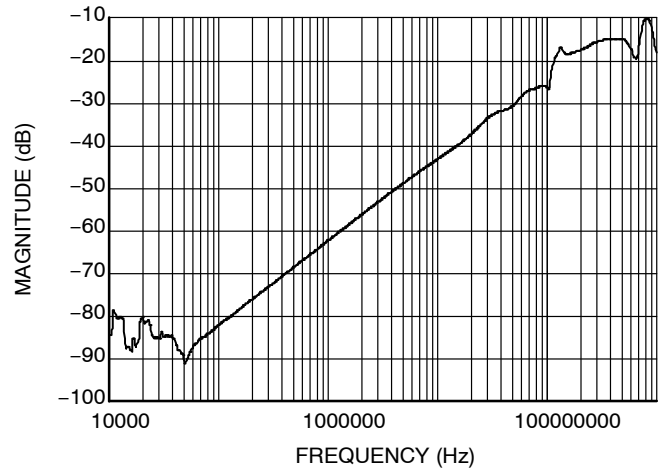
$V_{CT}$  = Use  $V_{ISO}$  setup and test to all other switch analog input/outputs terminated with 50 Ω

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

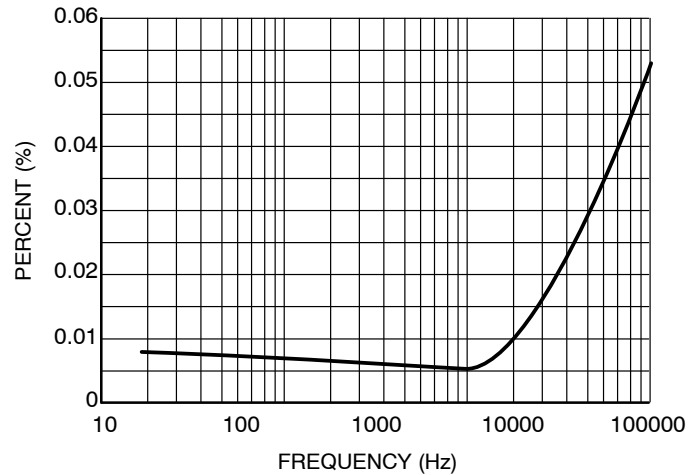
# NS5B1G385



**Figure 4. Typical Bandwidth @  $V_{CC} = 5.5$  V,  $25^{\circ}\text{C}$**



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

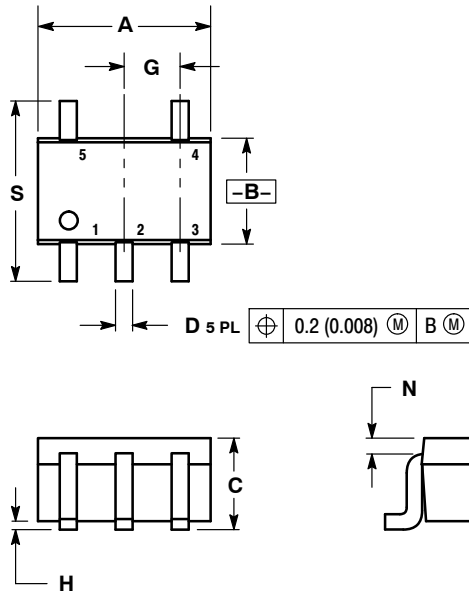


**Figure 6. Typical Total Harmonic Distortion @  $V_{CC} = 4.5$  V**

# NS5B1G385

## PACKAGE DIMENSIONS

SC-70, SOT-353, SC-88A  
CASE 419A-02  
ISSUE J



### NOTES:

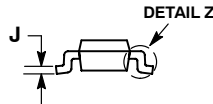
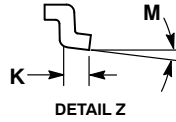
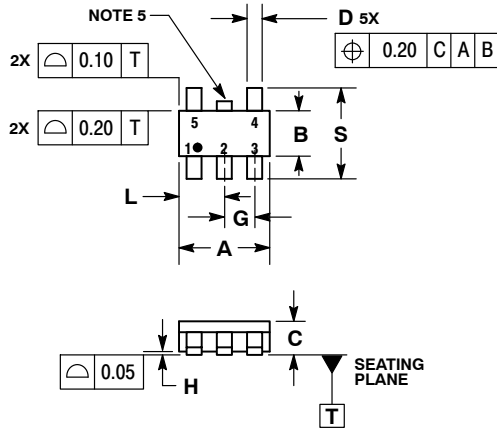
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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

# NS5B1G385

## PACKAGE DIMENSIONS

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

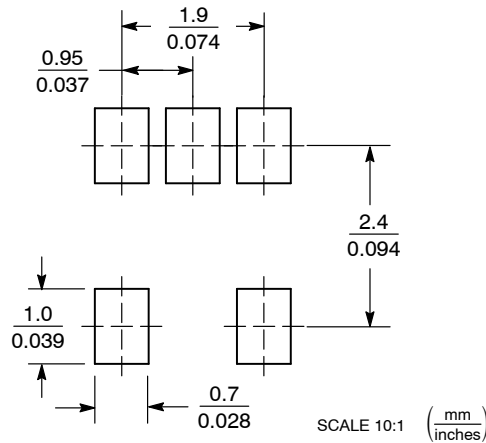


NOTES:

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.

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