

Ultra Low ON-Resistance, Low Voltage, SPDT Analog Switch

1 FEATURES

- **-3dB Bandwidth: 30MHz**
- **High Speed, Typically 50ns**
- **Supply Range: +1.8V to +5.5V**
- **Low ON-State Resistance, 0.6Ω(TYP)**
- **Break-Before-Make Switching**
- **Rail-to-Rail Operation**
- **TTL/CMOS Compatible**
- **Extended Industrial Temperature Range: -40°C to +125°C**
- **Micro SIZE PACKAGES: SC70-6, SOT23-6, MSOP8**

2 APPLICATIONS

- **Wearable Devices**
- **Battery-Operated Equipment**
- **Signal Gating, Chopping, Modulation or Demodulation (Modem)**
- **Portable Computing**
- **Cell Phones**

3 DESCRIPTIONS

The RS2103 is a single-pole double-throw (SPDT) analog switch that is designed to operate from 1.8 V to 5.5 V.

The RS2103 device can handle both analog and digital signals. It features fast switching speeds (50ns) and low on-resistance (0.6Ω TYP).

Applications include signal gating, chopping, modulation or demodulation (modem), and signal multiplexing for analog-to-digital and digital-to-analog conversion systems.

Device Information ⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE(NOM)
RS2103	SC70-6	2.10mm x 1.25mm
	SOT23-6	2.90mm x 1.60mm
	MSOP8	3.00mm x 3.00mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

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4 Revision History

Note: Page numbers for previous revisions may differ from page numbers in the current version.

VERSION	Change Date	Change Item
C.2	2018/11/13	official version datasheet
C.3	2024/03/25	1. Added MSL on Page 2@RevC.2 2. Modify packaging naming 3. Added TAPE AND REEL INFORMATION 4. Update PACKAGE/ORDERING INFORMATION

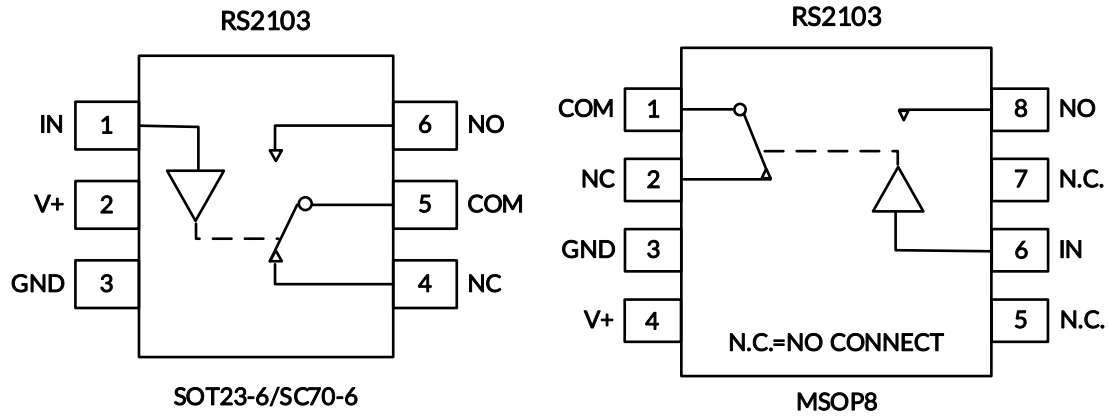
5 PACKAGE/ORDERING INFORMATION ⁽¹⁾

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING ⁽²⁾	MSL ⁽³⁾	PACKAGE OPTION
RS2103	RS2103XC6	-40°C ~125°C	SC70-6 ⁽⁴⁾	2103	MSL3	Tape and Reel,3000
	RS2103XH	-40°C ~125°C	SOT23-6	2103	MSL3	Tape and Reel,3000
	RS2103XM	-40°C ~125°C	MSOP8	RS2103	MSL3	Tape and Reel,4000

NOTE:

- (1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.
- (2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.
- (3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.
- (4) Equivalent to SOT363.

6 Pin Configuration and Functions (Top View)



6.1 PIN DESCRIPTION

NAME	PIN		FUNCTION
	SOT23-6/SC70-6	MSOP8	
IN	1	6	Digital Control Pin
V+	2	4	Power Supply
GND	3	3	Ground
NC	4	2	Normally-Closed Terminal
COM	5	1	Common Terminal
NO	6	8	Normally-Open Terminal

6.2 FUNCTION TABLE

LOGIC	NO	NC
0	OFF	ON
1	ON	OFF

7 SPECIFICATIONS

7.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

SYMBOL	PARAMETER	MIN	MAX	UNIT
V+	Supply Voltage	-0.3	6	V
V _{IN}	Analog, Digital Voltage Range	-0.3	(V+)+0.3	
I _{IN}	Continuous Current NO, NC, or COM	-500	+500	mA
I _{PEAK}	Peak Current NO, NC, or COM	-800	+800	
θ _{JA}	Package thermal impedance ⁽²⁾	SOT23-6	230	°C/W
		MSOP8	170	
		SC70-6	265	
T _J	Junction Temperature ⁽³⁾		150	°C
T _{stg}	Storage Temperature	-65	+150	
T _L	Lead Temperature (Soldering, 10s)		260	

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) The package thermal impedance is calculated in accordance with JESD-51.

(3) The maximum power dissipation is a function of T_{J(MAX)}, R_{θJA}, and T_A. The maximum allowable power dissipation at any ambient temperature is P_D = (T_{J(MAX)} - T_A) / R_{θJA}. All numbers apply for packages soldered directly onto a PCB.

7.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human-body model (HBM)	±1000	V
		Machine model (MM)	±100	



ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

7.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNIT
V _{CC}	Supply Voltage	1.8	5.5	V
T _A	Operating temperature	-40	+125	°C

7.4 ELECTRICAL CHARACTERISTICS

V+ = 5.0 V, T_A = -40°C to 125°C (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	V+	T _A	MIN ⁽²⁾	TYP ⁽³⁾	MAX ⁽²⁾	UNITS
ANALOG SWITCH								
Analog Signal Range	V _{NO} , V _{NC} , V _{COM}			FULL	0		V+	V
On-Resistance	R _{ON}	0 ≤ (V _{NO} or V _{NC}) ≤ V+, I _{COM} = -10mA, Switch ON, See Figure 4	5V	+25°C		0.6	1.0	Ω
				FULL			1.2	Ω
			3.3V	+25°C		1.0	1.5	Ω
				FULL			1.7	Ω
On-Resistance Match Between Channels	ΔR _{ON}	0 ≤ (V _{NO} or V _{NC}) ≤ V+, I _{COM} = -10mA, Switch ON, See Figure 4	5V	+25°C		0.04	0.1	Ω
				FULL			0.12	Ω
			3.3V	+25°C		0.04	0.1	Ω
				FULL			0.12	Ω
On-Resistance Flatness	R _{FLAT(ON)}	0 ≤ (V _{NO} or V _{NC}) ≤ V+, I _{COM} = -10mA, Switch ON, See Figure 4	5V	+25°C		0.18	0.3	Ω
				FULL			0.4	Ω
			3.3V	+25°C		0.54	0.7	Ω
				FULL			0.8	Ω
NC,NO OFF Leakage Current	I _{NC(OFF)} , I _{NO(OFF)}	V _{NO} or V _{NC} = 0.3V, V+/2 V _{COM} = V+/2, 0.3V See Figure 5	1.8 to 5.5V	FULL			1	μA
NC,NO,COM ON Leakage Current	I _{NC(ON)} , I _{NO(ON)} , I _{COM(ON)}	V _{NO} or V _{NC} = 0.3V, Open V _{COM} = Open, 0.3V See Figure 6	1.8 to 5.5V	FULL			1	μA
DIGITAL CONTROL INPUTS ⁽¹⁾								
Input High Voltage	V _{INH}		5V	FULL	1.5			V
			3.3V	FULL	1.3			V
Input Low Voltage	V _{INL}		5V	FULL			0.6	V
			3.3V	FULL			0.5	V
Input Leakage Current	I _{IN}	V _{IN} = V _{IO} or 0	1.8 to 5.5V	FULL			1	μA

(1) All unused digital inputs of the device must be held at V_{IO} or GND to ensure proper device operation.

(2) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.

(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

ELECTRICAL CHARACTERISTICS (continued)

V₊ = 5.0 V, TEMP = -40°C to 125°C (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	V ₊	TEMP	MIN	TYP	MAX	UNITS
DYNAMIC CHARACTERISTICS								
Turn-On Time	t _{ON}	V _{COM} = V ₊ , R _L = 300Ω, C _L = 35pF, See Figure 8	5V 3.3V	+25°C		50 50		ns
Turn-Off Time	t _{OFF}	V _{COM} = V ₊ , R _L = 300Ω, C _L = 35pF, See Figure 8	5V 3.3V	+25°C		15 17		ns
Break-Before-Make Time Delay	t _{BBM}	V _{NO1} = V _{NC1} = V _{NO2} = V _{NC2} = 3V, R _L = 300Ω, C _L = 35pF, See Figure 9	5V 3.3V	+25°C		10 11		ns
Off Isolation	O _{ISO}	R _L = 50Ω, Switch OFF, See Figure 11	f = 100KHz	+25°C		-68		dB
			f = 10KHz	+25°C		-86		dB
-3dB Bandwidth	BW	Switch ON, R _L = 50Ω See Figure 10		+25°C		30		MHz
NC, NO OFF Capacitance	C _{NC(OFF)} , C _{NO(OFF)}	V _{NC} or V _{NO} = V ₊ /2 or GND, Switch OFF See Figure 7		+25°C		80		pF
NC, NO, COM ON Capacitance	C _{NC(ON)} , C _{NO(ON)} , C _{COM(ON)}	V _{NC} or V _{NO} = V ₊ /2 or GND, Switch ON See Figure 7		+25°C		350		pF
POWER REQUIREMENTS								
Power Supply Range	V ₊			FULL	1.8		5.5	V
Power Supply Current	I ₊	V _{IN} = GND or V ₊	5.5V	FULL			1	μA

7.5 TYPICAL CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

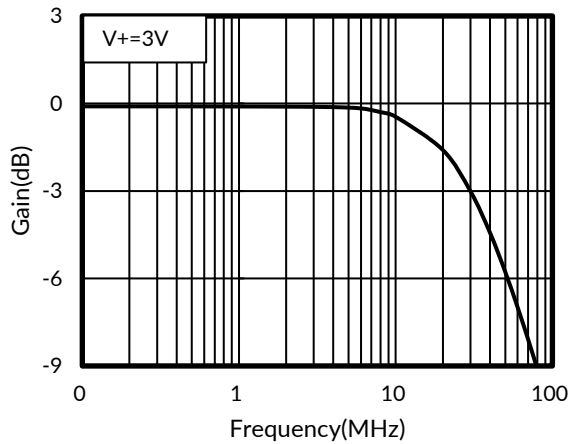


Figure 1. Bandwidth

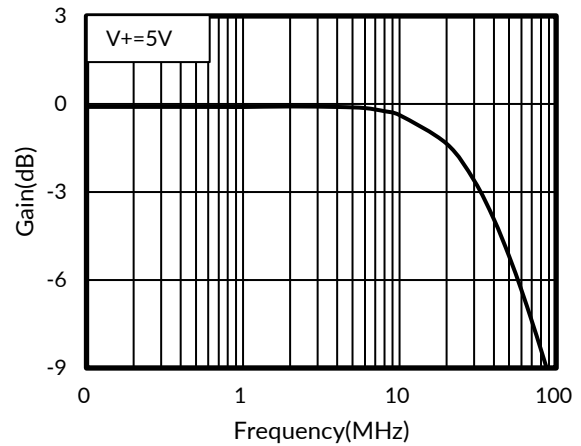


Figure 2. Bandwidth

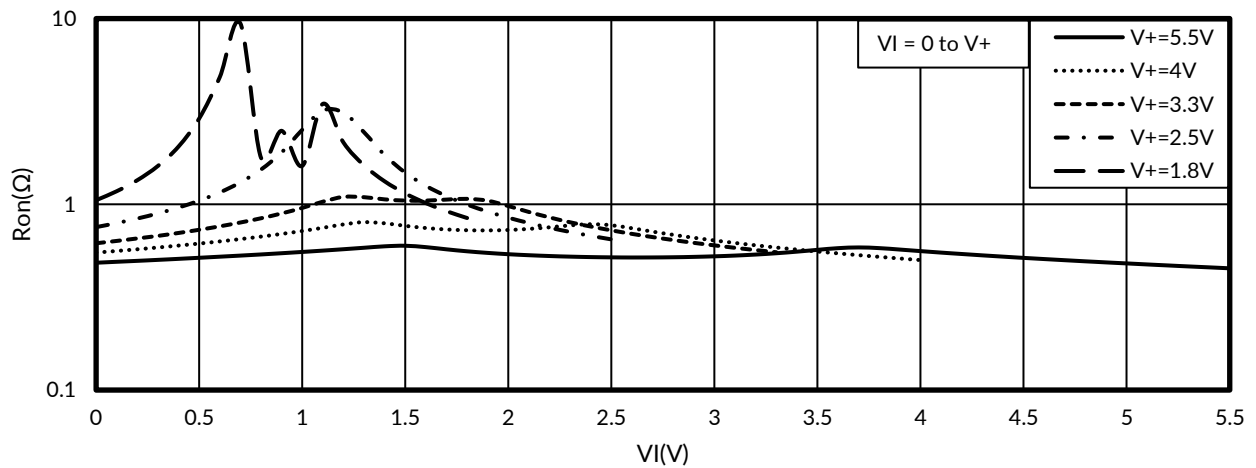


Figure 3. Typical r_{on} as a Function of Input Voltage

8 Parameter Measurement Information

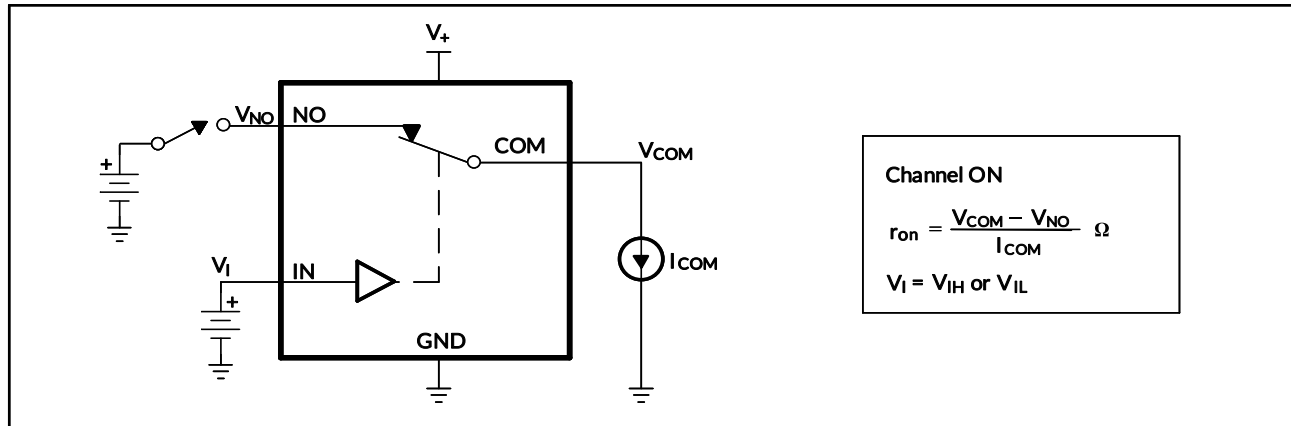


Figure 4. ON-State Resistance (r_{on})

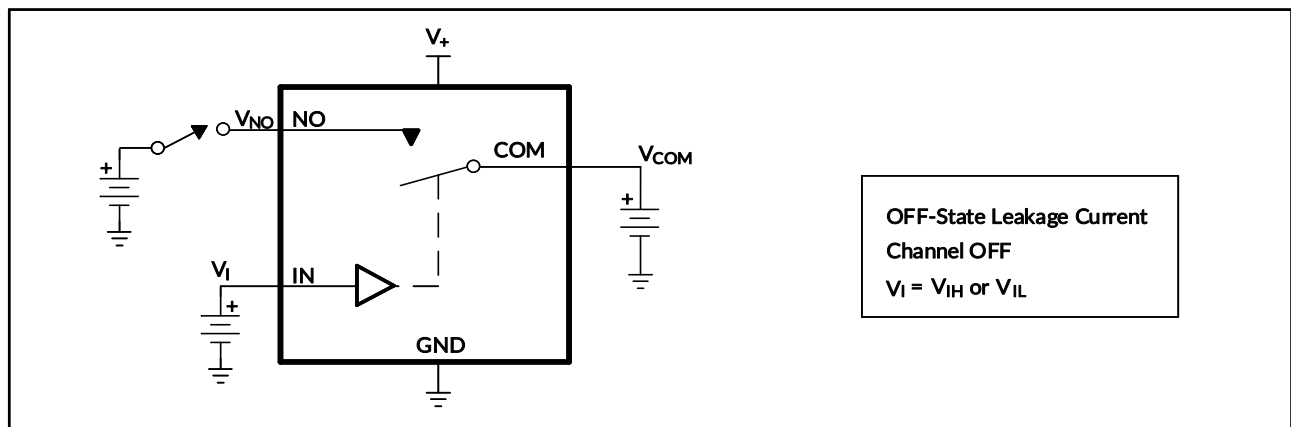


Figure 5. OFF-State Leakage Current ($I_{COM(OFF)}$, $I_{NO(OFF)}$)

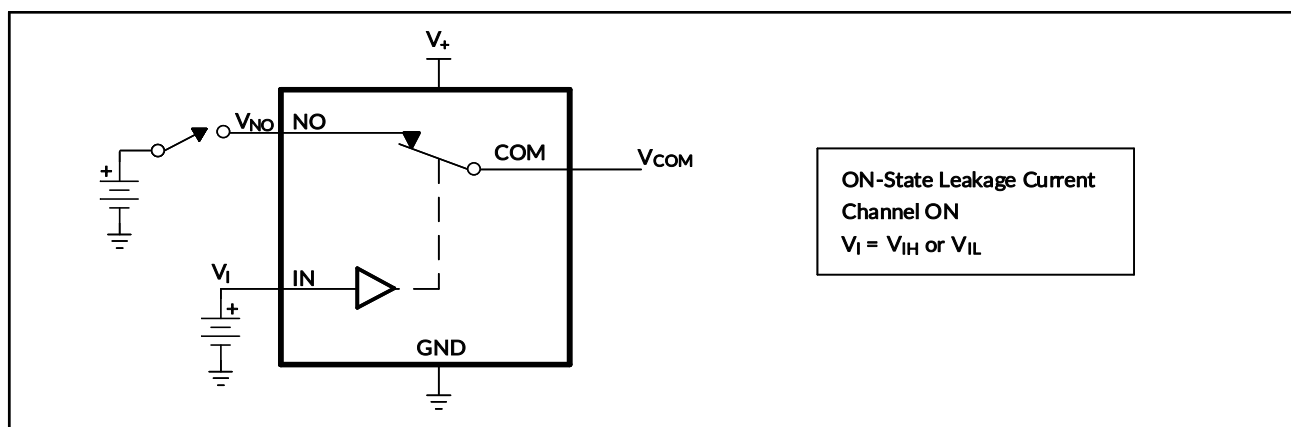
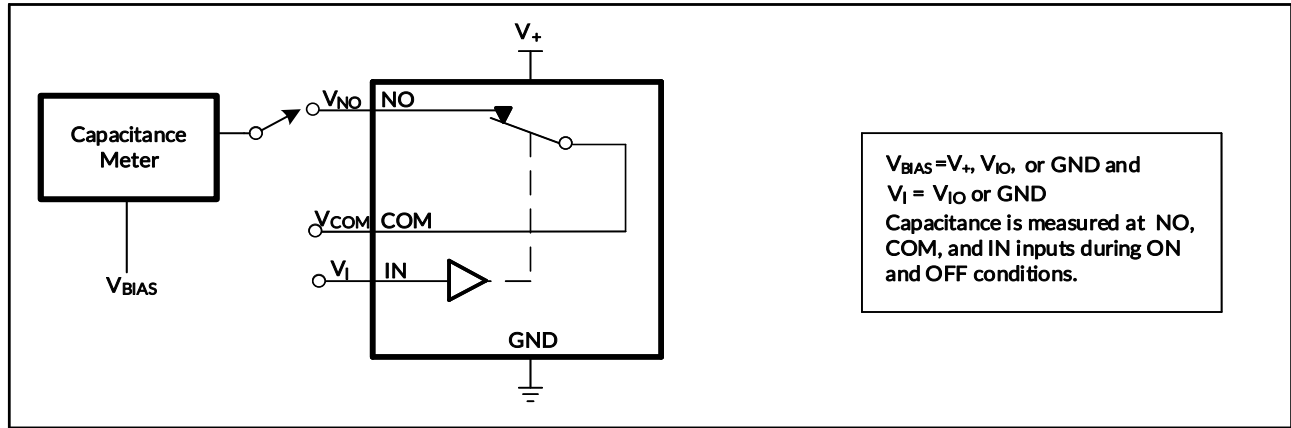
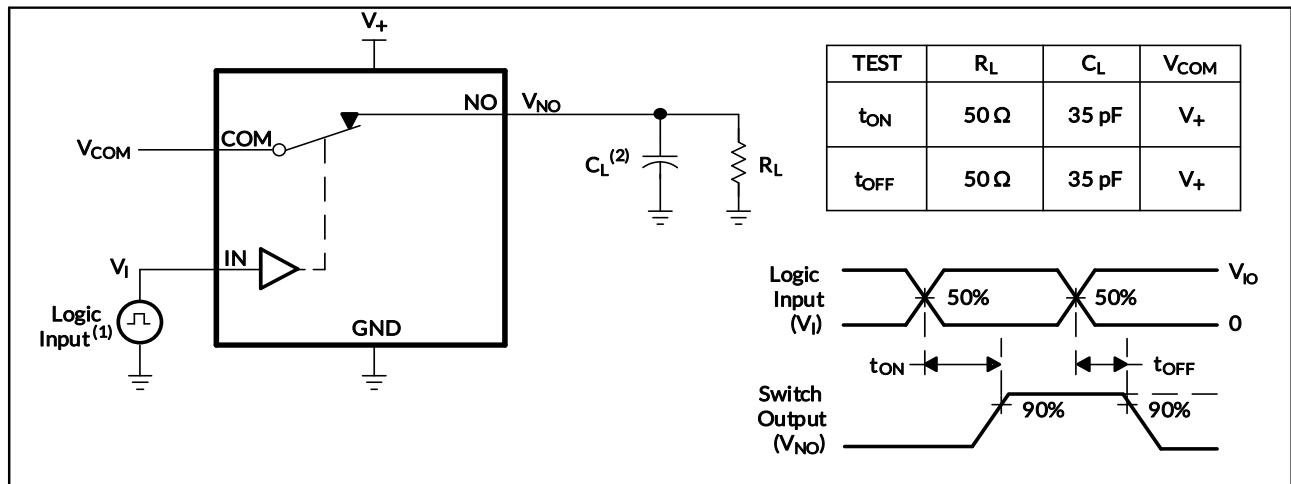
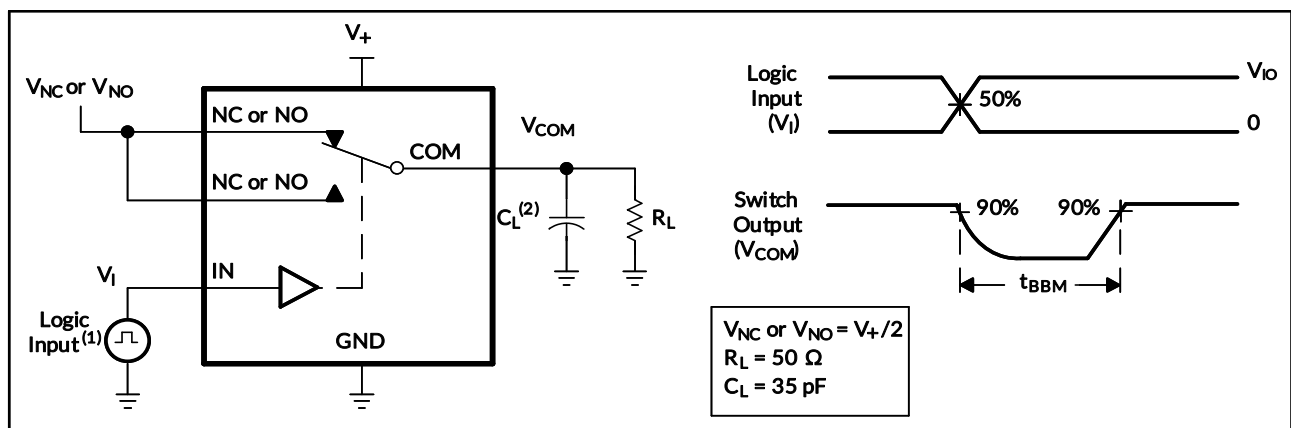
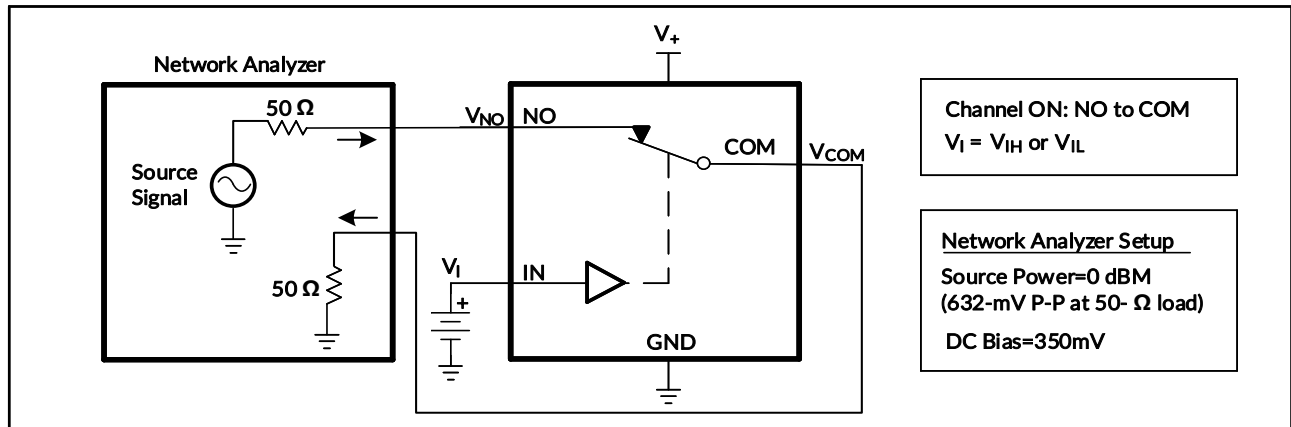
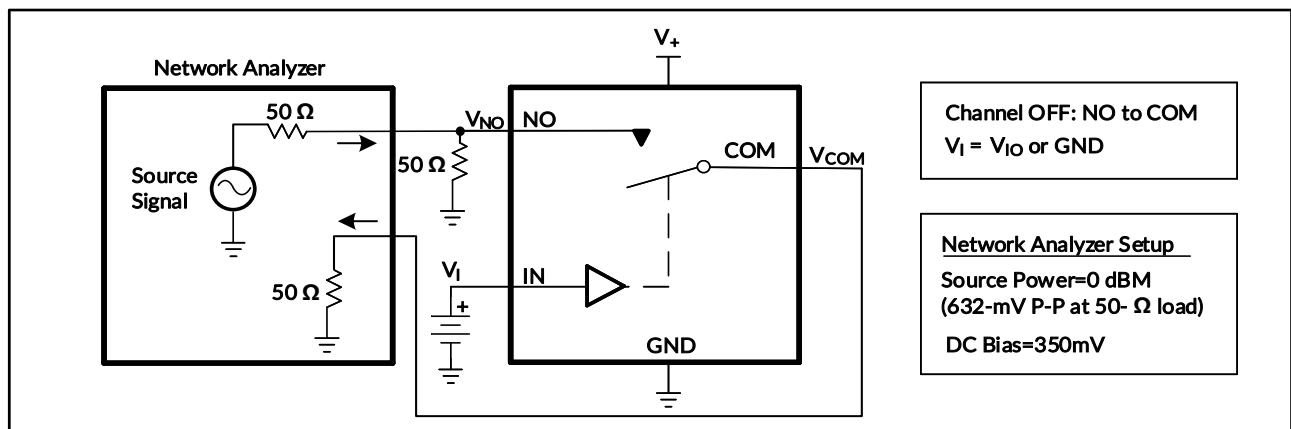
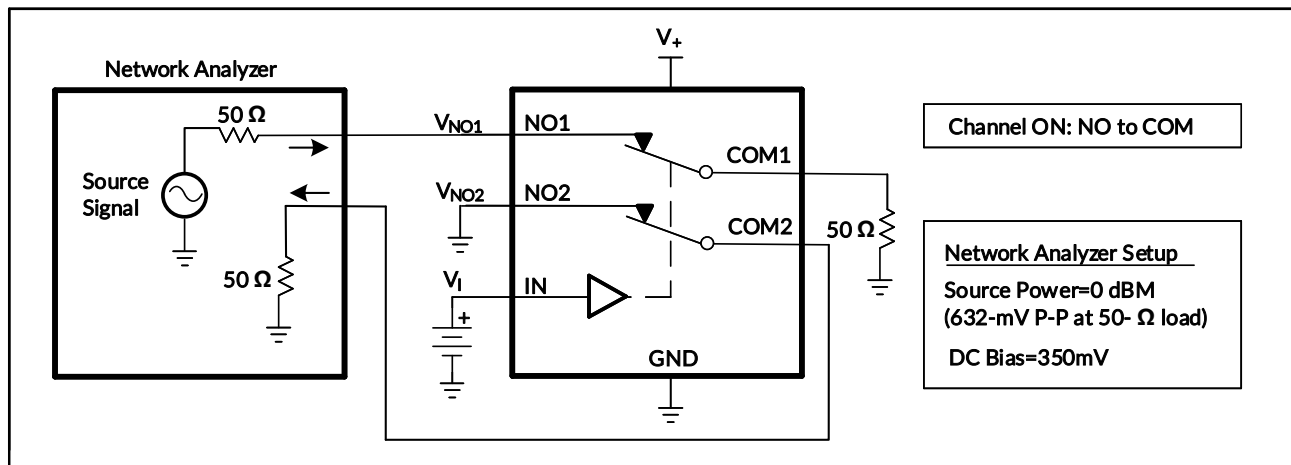


Figure 6. ON-State Leakage Current ($I_{COM(ON)}$, $I_{NO(ON)}$)


Figure 7. Capacitance (C_I , $C_{COM(OFF)}$, $C_{COM(ON)}$, $C_{NO(OFF)}$, $C_{NO(ON)}$)

Figure 8. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

Figure 9. Break-Before-Make Time (t_{BBM})


Figure 10. Bandwidth (BW)

Figure 11. OFF Isolation (O_{ISO})

Figure 12. Crosstalk (X_{TALK})

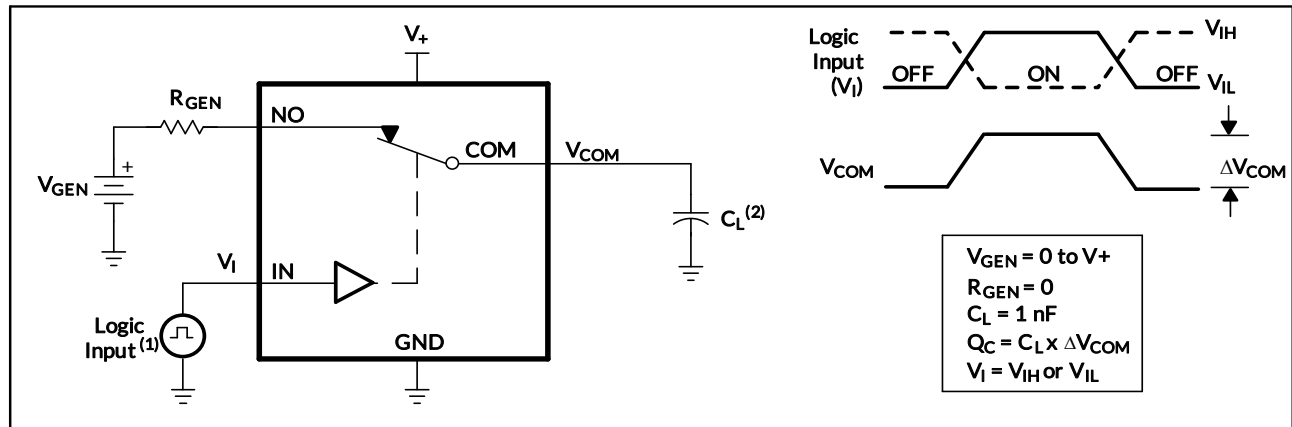


Figure 13. Charge Injection (Q_c)

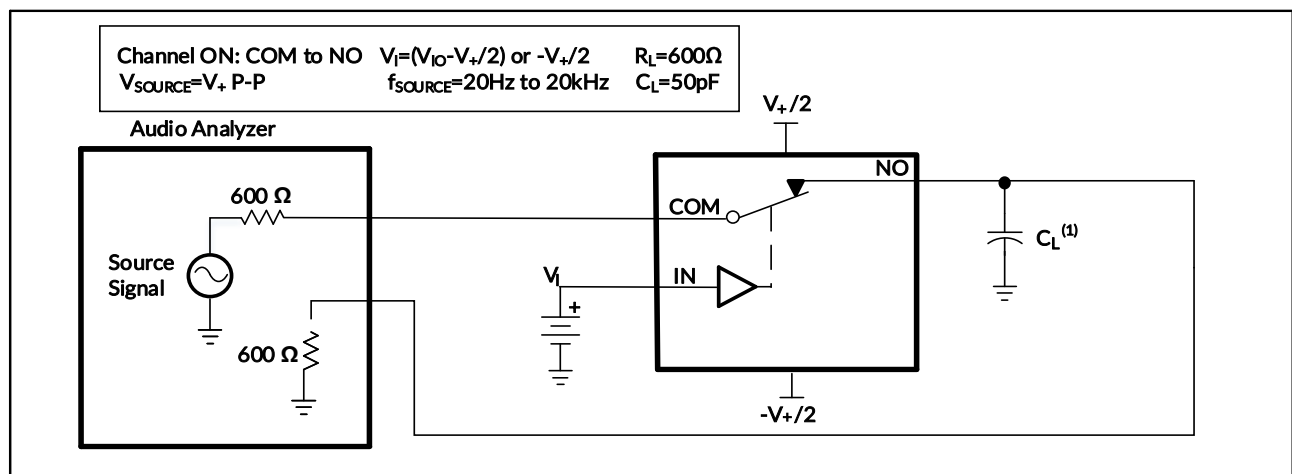
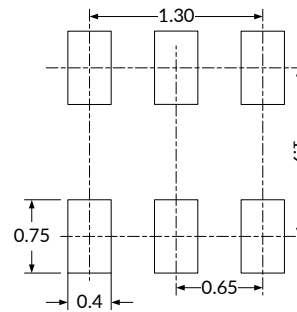
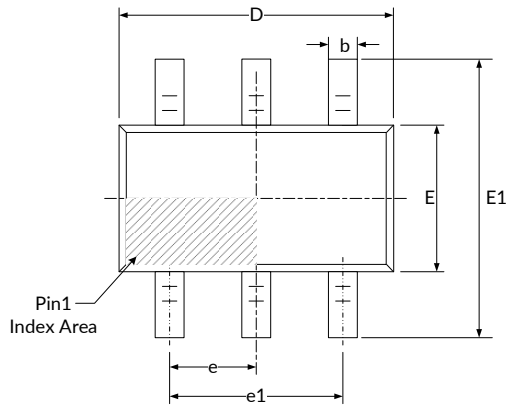


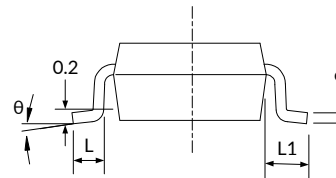
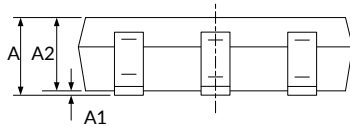
Figure 14. Total Harmonic Distortion (THD)

9 PACKAGE OUTLINE DIMENSIONS

SC70-6⁽³⁾



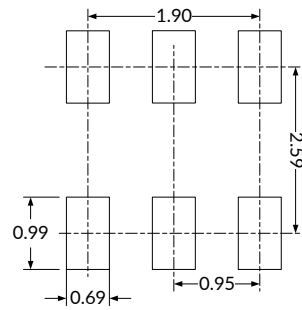
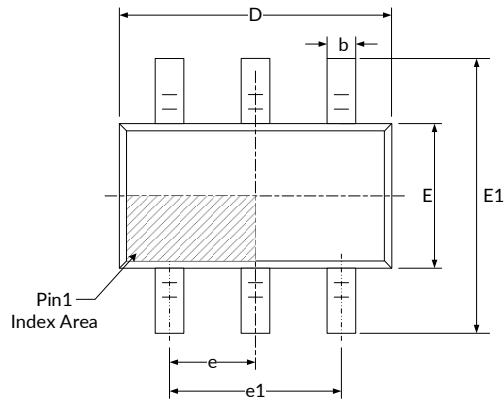
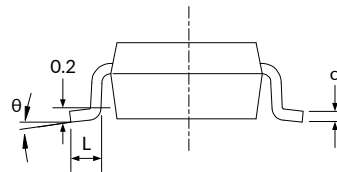
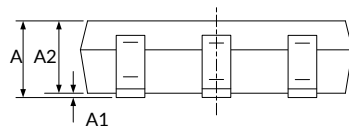
RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A ⁽¹⁾	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D ⁽¹⁾	2.000	2.200	0.079	0.087
E ⁽¹⁾	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650(BSC) ⁽²⁾		0.026(BSC) ⁽²⁾	
e1	1.300(BSC) ⁽²⁾		0.051(BSC) ⁽²⁾	
L	0.260	0.460	0.010	0.018
L1	0.525		0.021	
θ	0°	8°	0°	8°

NOTE:

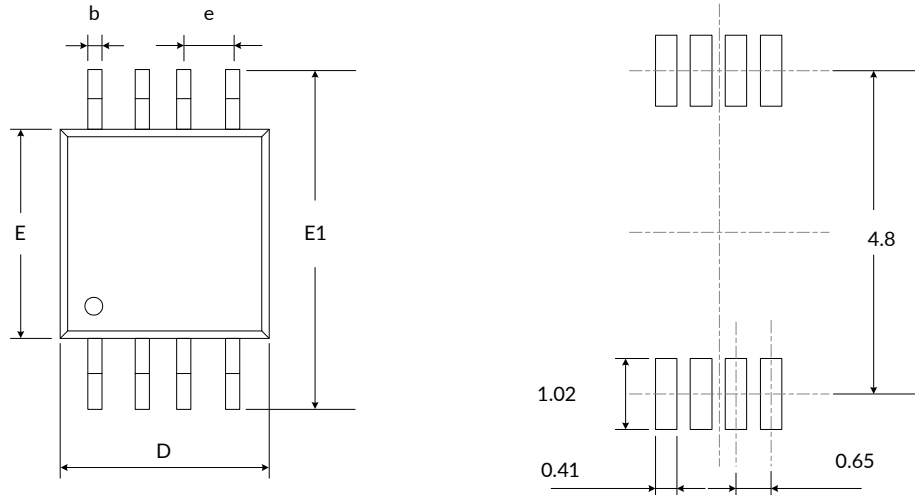
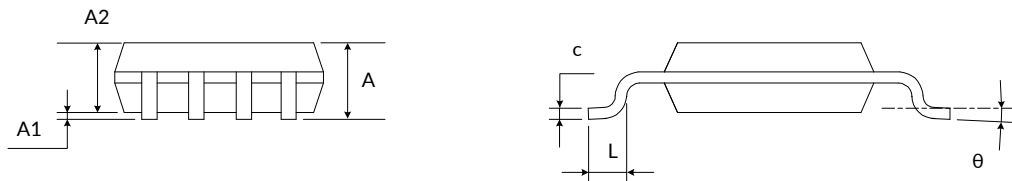
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

SOT23-6⁽³⁾

RECOMMENDED LAND PATTERN (Unit: mm)


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A ⁽¹⁾	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D ⁽¹⁾	2.820	3.020	0.111	0.119
E ⁽¹⁾	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC) ⁽²⁾		0.037(BSC) ⁽²⁾	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

NOTE:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

MSOP8⁽³⁾

RECOMMENDED LAND PATTERN (Unit: mm)


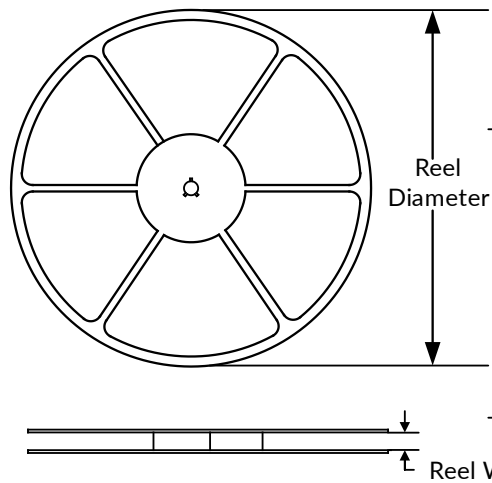
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A ⁽¹⁾	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D ⁽¹⁾	2.900	3.100	0.114	0.122
e	0.650(BSC) ⁽²⁾		0.026(BSC) ⁽²⁾	
E ⁽¹⁾	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

NOTE:

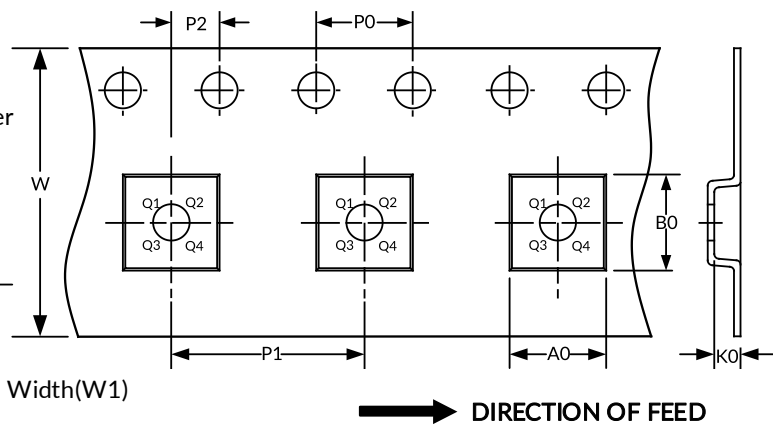
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

10 TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSION



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width(mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SC70-6	7"	9.5	2.40	2.50	1.20	4.0	4.0	2.0	8.0	Q3
SOT23-6	7"	9.5	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3
MSOP8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1

NOTE:

1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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