

# 4.5Ω Single Bilateral SPST Analog Switch

## 1 FEATURES

- **RS2166-Q1 AEC-Q100 Qualification is Ongoing**
- **Bandwidth: 300MHz**
- **High Speed: Typically 30ns**
- **Supply Range: +1.8V to +5.5V**
- **Low ON-State Resistance: 4.5Ω(TYP)**
- **Rail-to-Rail Operation**
- **TTL/CMOS Compatible**
- **Extended Industrial Temperature Range: -40°C to +125°C**
- **Packages: SC70-5**

## 2 APPLICATIONS

- **Wireless Devices**
- **Audio and Video Signal Routing**
- **Portable Computing**
- **Wearable Devices**
- **Signal Gating, Chopping, Modulation or Demodulation (Modem)**
- **Cell Phones**

## 3 DESCRIPTIONS

The RS2166-Q1 is a bidirectional 1-channel single-pole single-throw (SPST) analog switch, which is designed to operate from 1.8V to 5.5V.

The RS2166-Q1 device can handle both analog and digital signals. It features bandwidth (300MHz) and low on-resistance (4.5Ω TYP).

Each switch section has its own enable-input control (SEL). A high-level voltage applied to SEL turns on the associated switch section.

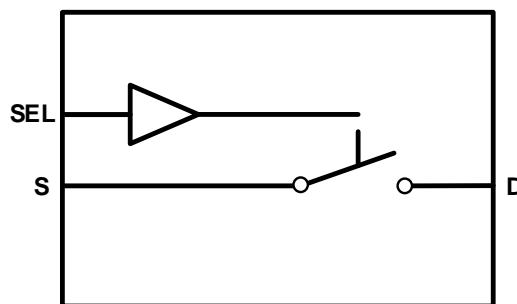
Applications include signal gating, chopping, modulation or demodulation (modem), and signal multiplexing for analog-to-digital and digital-to-analog conversion systems.

**Device Information (1)**

PART NUMBER	PACKAGE	BODY SIZE(NOM)
RS2166-Q1	SC70-5	2.00mm×1.25mm

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

## 4 FUNCTIONAL DIAGRAMS OF RS2166-Q1



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## 5 REVISION HISTORY

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

VERSION	Change Date	Change Item
A.0	2025/10/14	Preliminary version completed

Preliminary version

**6 PACKAGE/ORDERING INFORMATION <sup>(1)</sup>**

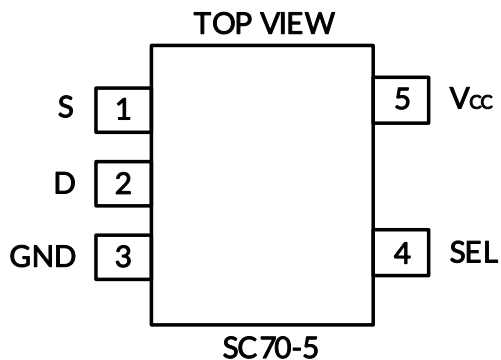
PRODUCT	ORDERING NUMBER	PACKAGE LEAD	TEMPERATURE RANGE	Lead finish/Ball material <sup>(2)</sup>	MSL Peak Temp <sup>(3)</sup>	PACKAGE MARKING <sup>(4)</sup>	PACKAGE OPTION
RS2166-Q1	RS2166AXC5-Q1	SC70-5 <sup>(5)</sup>	-40°C ~125°C	NiPdAu	MSL1-260°-Unlimited	2166A	Tape and Reel, 3000

**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) Lead finish/Ball material. Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.
- (3) Runic classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F. Please align with Runic if your end application is quite critical to the preconditioning setting or if you have special requirement.
- (4) 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.
- (5) Equivalent to SOT353.

Preliminary version

## 7 PIN CONFIGURATIONS



### 7.1 Pin Description

NAME	PIN	I/O	DESCRIPTION
	SC70-5		
S	1	I/O	Bidirectional signal to be switched
D	2	I/O	Bidirectional signal to be switched
GND	3	-	Ground
SEL	4	I	Controls the switch (L = OFF, H = ON)
V <sub>cc</sub>	5	-	Power Supply

(1) I = Input, O = Output.

### 7.2 Function Table

SELECT INPUTS	SWITCH STATUS
SEL	
High	All Switches ON
Low	All Switches OFF

NOTE: Input and output pins are identical and interchangeable. Any may be considered an input or output; signals pass equally well in both directions.

## 8 SPECIFICATIONS

### 8.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

SYMBOL	PARAMETER		MIN	MAX	UNIT
V <sub>CC</sub>	Supply Voltage <sup>(2)</sup>		-0.3	6.0	V
V <sub>IN</sub>	Input Voltage <sup>(2) (3)</sup>		-0.3	6.0	
V <sub>O</sub>	Switch I/O Voltage <sup>(2) (3) (4)</sup>		-0.3	V <sub>CC</sub> +0.3	
I <sub>IK</sub>	Control input clamp current	V <sub>I</sub> <0		-50	mA
I <sub>I/O</sub>	I/O port diode current	V <sub>I/O</sub> < 0 or V <sub>I/O</sub> > V <sub>CC</sub>		-50	
I <sub>T</sub>	On-state switch current	V <sub>IO</sub> =0 to V <sub>CC</sub>	-50	50	
	Continuous current through V <sub>CC</sub> or GND		-100	100	
θ <sub>JA</sub>	Package thermal impedance <sup>(5)</sup>	SC70-5		380	°C/W
T <sub>J</sub>	Junction Temperature <sup>(6)</sup>		-40	150	°C
T <sub>stg</sub>	Storage temperature		-65	150	

(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) All voltages are with respect to ground, unless otherwise specified.

(3) The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

(4) This value is limited to 5.5 V maximum.

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

(6) The maximum power dissipation is a function of T<sub>J(MAX)</sub>, R<sub>θJA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any ambient temperature is P<sub>D</sub> = (T<sub>J(MAX)</sub> - T<sub>A</sub>) / R<sub>θJA</sub>. All numbers apply for packages soldered directly onto a PCB.

### 8.2 ESD Ratings

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

			VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human-Body Model (HBM), per AEC Q100-002 <sup>(1)</sup>	TBD	V
		Charged-Device Model (CDM), per AEC Q100-011	TBD	
		Latch-Up (LU), per AEC Q100-004	TBD	mA

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.



### 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.

### 8.3 Recommended Operating Conditions

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

SYMBOL	PARAMETER	MIN	MAX	UNIT
V <sub>CC</sub>	Supply Voltage	1.8	5.5	V
T <sub>A</sub>	Operating temperature	-40	+125	°C

## 8.4 Electrical Characteristics

$V_{CC} = 5.0\text{ V or }3.3\text{V}$ , FULL=  $-40^{\circ}\text{C to }+125^{\circ}\text{C}$ , Typical values are at  $T_A = +25^{\circ}\text{C}$ . (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	$V_{CC}$	$T_A$	MIN <sup>(2)</sup>	TYP <sup>(3)</sup>	MAX <sup>(2)</sup>	UNIT
<b>ANALOG SWITCH</b>								
Analog Signal Range	$V_S, V_D$			FULL	0		$V_{CC}$	V
On-Resistance	$R_{ON}$	$V_S = V_{CC} / 2$ , $I_{SD} = -10\text{mA}$ , Switch ON, See Figure 4	5V	+25°C		4.5	8	$\Omega$
				FULL			8.5	$\Omega$
			3.3V	+25°C		7	10	$\Omega$
				FULL			10.5	$\Omega$
On-Resistance Flatness	$R_{FLAT(ON)}$	$0 \leq (V_S) \leq V_{CC} / 2$ , $I_{SD} = -10\text{mA}$ , Switch ON, See Figure 4	5V	+25°C		2	3	$\Omega$
				FULL			3.3	$\Omega$
			3.3V	+25°C		3	4	$\Omega$
				FULL			4.3	$\Omega$
Source, Drain OFF Leakage Current	$I_{D(OFF)}, I_{S(OFF)}$	$V_D = 0.3\text{V}, V_{CC} / 2, V_S = V_{CC} / 2$ , 0.3V See Figure 5	1.8 to 5.5V	FULL			1	$\mu\text{A}$
Channel ON Leakage Current	$I_{D(ON)}, I_{S(ON)}$	$V_D = 0.3\text{V}$ , Open $V_S = \text{Open}$ , 0.3V See Figure 6	1.8 to 5.5V	FULL			1	$\mu\text{A}$
<b>DIGITAL CONTROL INPUTS <sup>(1)</sup></b>								
Input High Voltage	$V_{IH}$		5V	FULL	1.5			V
			3.3V	FULL	1.3			V
Input Low Voltage	$V_{IL}$		5V	FULL			0.6	V
			3.3V	FULL			0.5	V
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{IO} \text{ or } 0$	1.8 to 5.5V	FULL			1	$\mu\text{A}$

(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)**
 $V_{CC} = 5.0\text{ V or }3.3\text{ V}$ , FULL =  $-40^{\circ}\text{C to }+125^{\circ}\text{C}$ , Typical values are at  $T_A = +25^{\circ}\text{C}$  (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS	$V_{CC}$	$T_A$	MIN	TYP	MAX	UNIT
<b>DYNAMIC CHARACTERISTICS</b>								
Turn-On Time	$t_{ON}$	$V_S = V_{CC}$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 7	5V	+25°C		30		ns
			3.3V			40		
Turn-Off Time	$t_{OFF}$	$V_S = V_{CC}$ , $R_L = 300\Omega$ , $C_L = 35\text{pF}$ , See Figure 7	5V	+25°C		25		ns
			3.3V			30		
-3dB Bandwidth	BW	Switch ON, $R_L = 50\Omega$ , See Figure 8		+25°C		300		MHz
Off Isolation	$O_{ISO}$	$R_L = 50\Omega$ , Switch OFF, See Figure 9		+25°C		-52		dB
				+25°C		-71		dB
Source, Drain OFF Capacitance	$C_{S(OFF)}$ , $C_{D(OFF)}$	$V_S = V_{CC} / 2$ or GND, Switch OFF		+25°C		5		pF
Source, Drain ON Capacitance	$C_{S(ON)}$ , $C_{D(ON)}$	$V_S = V_{CC} / 2$ or GND, Switch ON		+25°C		15		pF
<b>POWER REQUIREMENTS</b>								
Power Supply Range	$V_{CC}$			FULL	1.8		5.5	V
Power Supply Current	$I_{CC}$	$V_{IN} = \text{GND or } V_{CC}$	5.5V	FULL			1	$\mu\text{A}$

### 8.5 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.

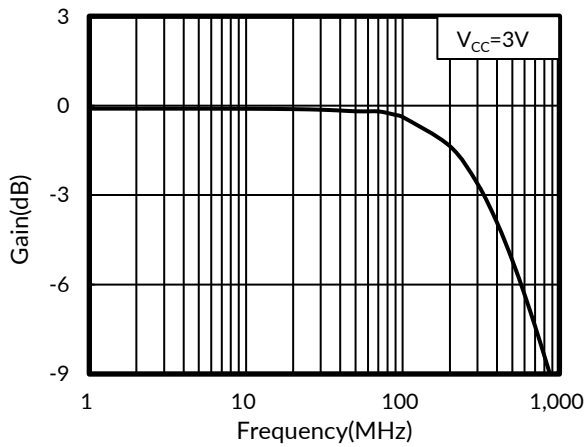


Figure 1. Bandwidth vs Frequency

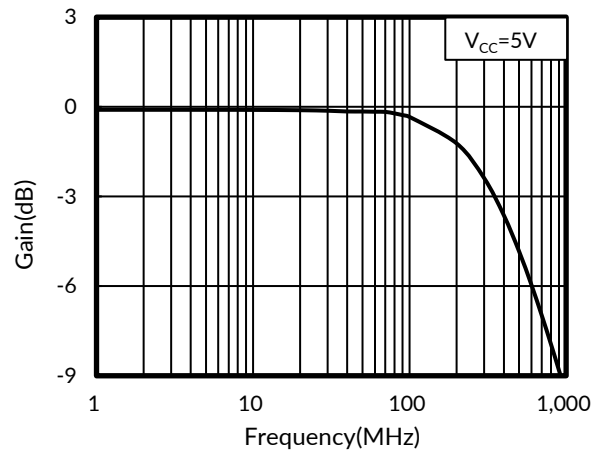


Figure 2. Bandwidth vs Frequency

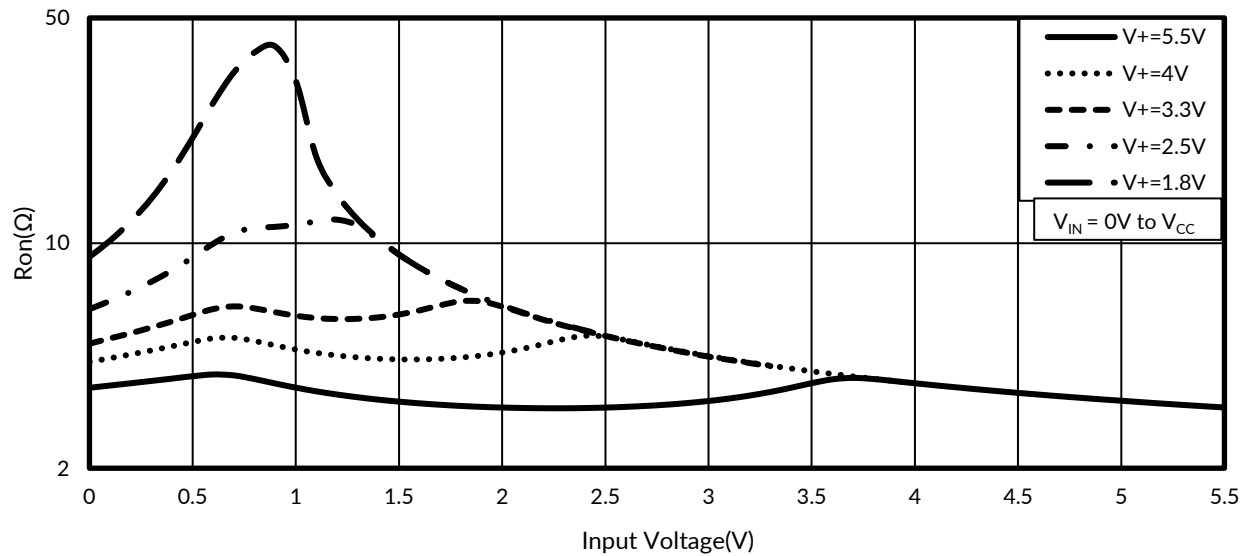
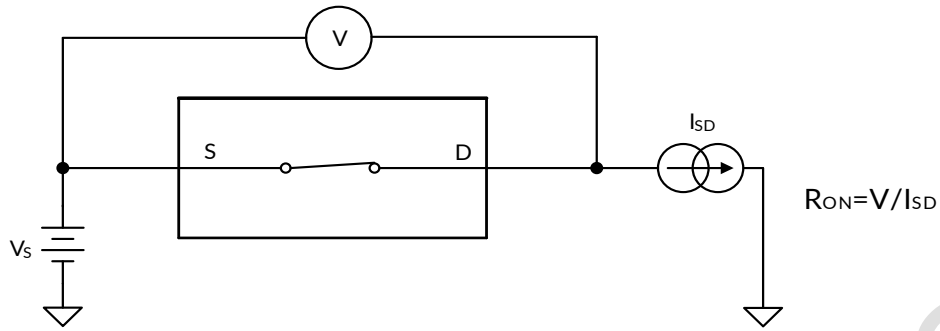


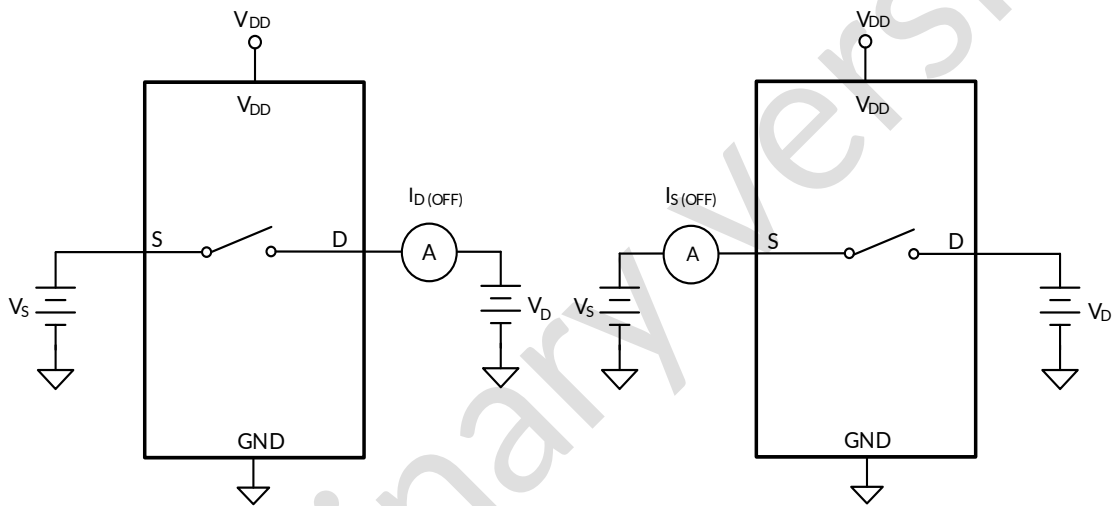
Figure 3. Typical Ron as a Function of Input Voltage

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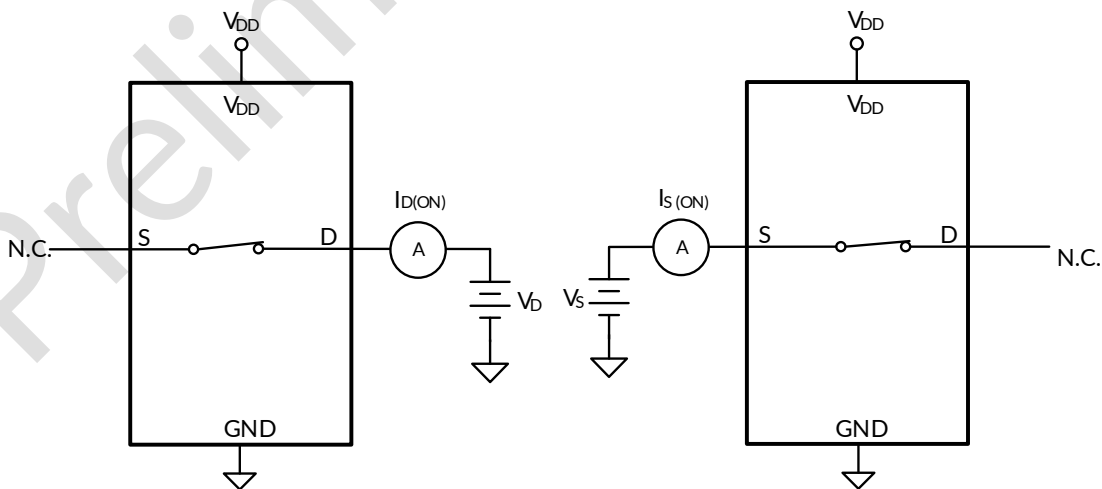
## 9 PARAMETER MEASUREMENT INFORMATION



**Figure 4. ON-State Resistance ( $R_{ON}$ )**



**Figure 5. OFF-State Leakage Current ( $I_{D(OFF)}$ ,  $I_{S(OFF)}$ )**



**Figure 6. ON-State Leakage Current ( $I_{D(ON)}$ ,  $I_{S(ON)}$ )**

PARAMETER MEASUREMENT INFORMATION (continued)

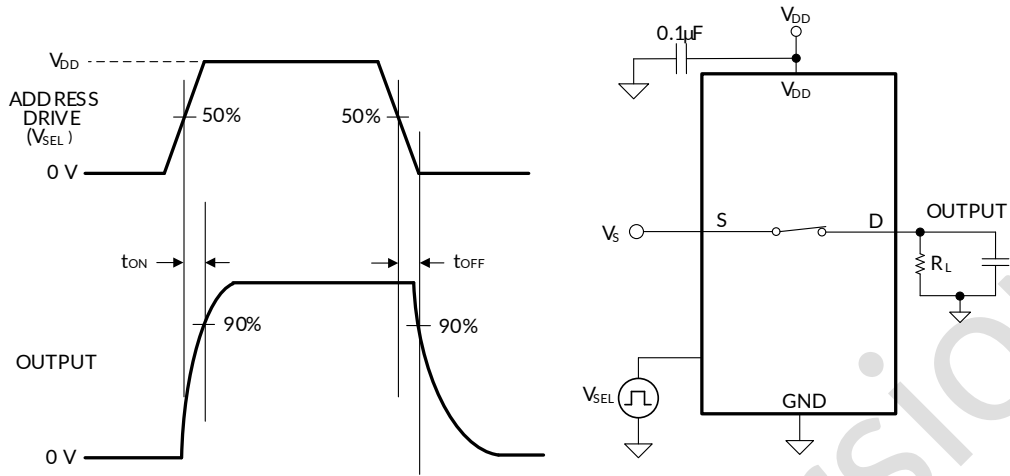


Figure 7. Turn-On ( $t_{ON}$ ) and Turn-Off Time ( $t_{OFF}$ )

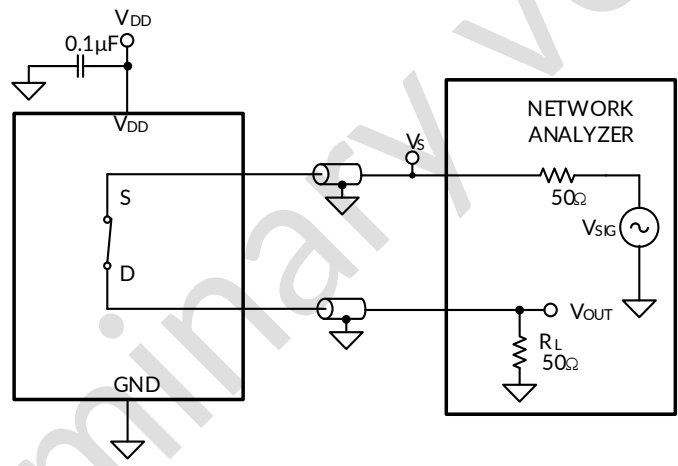


Figure 8. Bandwidth (BW)

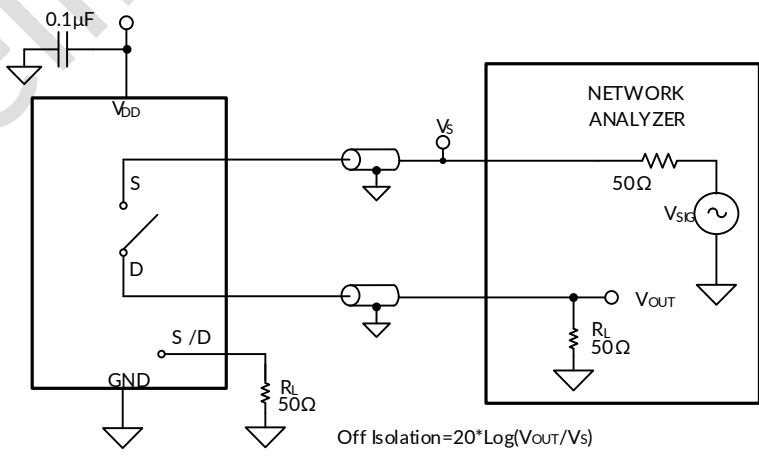
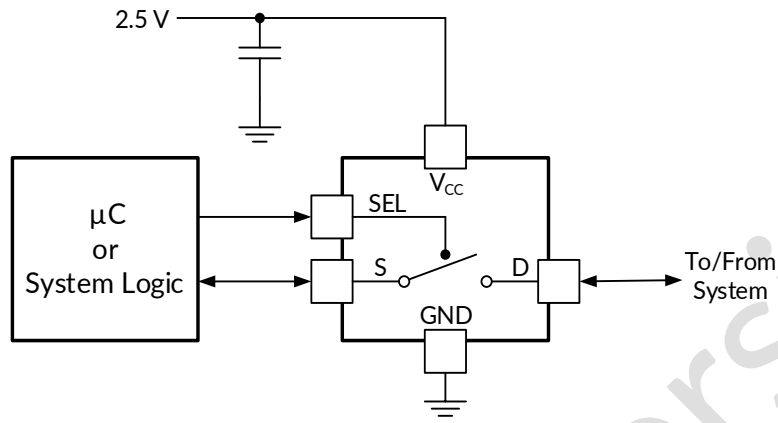


Figure 9. OFF Isolation ( $O_{iso}$ )

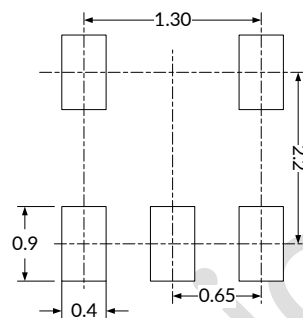
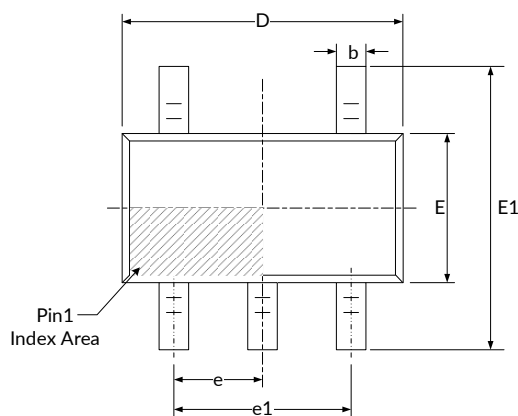
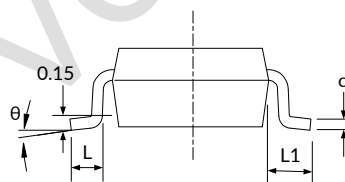
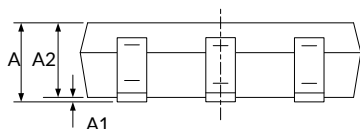
## 10 TYPICAL APPLICATION

The RS2166-Q1 can be used in any situation where an SPST switch would be used and a solid-state, voltage-controlled version is preferred. The RS2166-Q1 allows on and off control of analog and digital signals with a digital control signal. All input signals should remain between 0V and  $V_{CC}$  for optimal operation.



**Figure 10. Typical Application Schematic**

# 11 PACKAGE OUTLINE DIMENSIONS

**SC70-5 (4)**

**RECOMMENDED LAND PATTERN (Unit: mm)**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A <sup>(1)</sup>	0.850	1.050	0.033	0.041
A1	0.000	0.100	0.000	0.004
A2	0.800	1.000	0.031	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D <sup>(1)</sup>	2.020	2.120	0.079	0.084
E <sup>(1)</sup>	1.250	1.350	0.049	0.053
E1	2.200	2.400	0.087	0.094
e	0.650(BSC) <sup>(2)</sup>		0.026(BSC) <sup>(2)</sup>	
e1	1.300(BSC) <sup>(2)</sup>		0.051(BSC) <sup>(2)</sup>	
L	0.280	0.380	0.011	0.015
L1	0.500(REF) <sup>(3)</sup>		0.020(REF) <sup>(3)</sup>	
θ	0°	8°	0°	8°

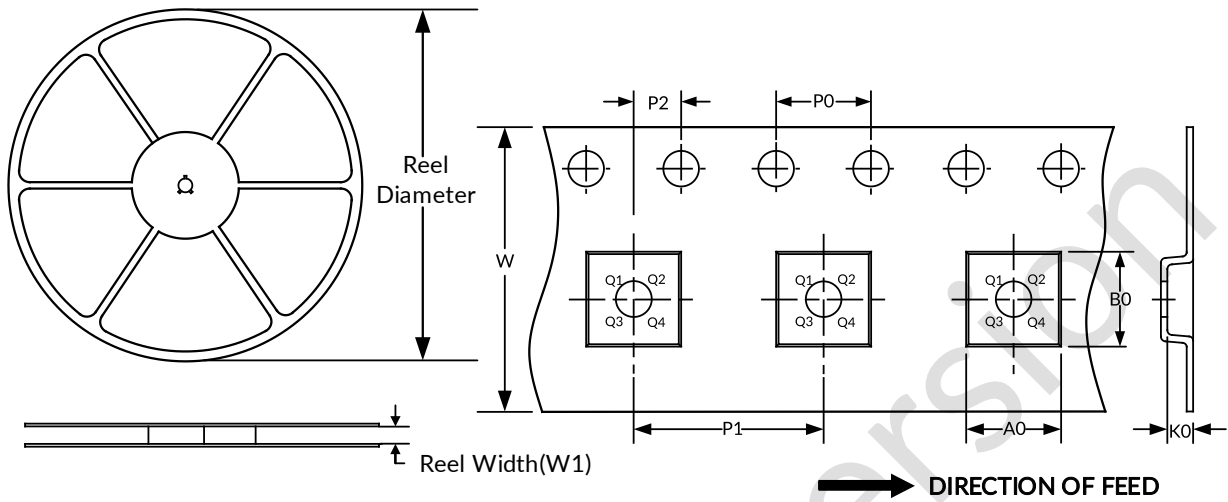
**NOTE:**

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. REF is the abbreviation for Reference.
4. This drawing is subject to change without notice.

## 12 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
SC70-5	7"	9.5	2.25	2.55	1.20	4.0	4.0	2.0	8.0	Q3

NOTE:

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

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