4.5Ω Single Bilateral SPST Analog Switch

1 FEATURES

- **RS2166A-Q1 AEC-Q100 Qualification is Ongoing**
- **High Bandwidth: 340MHz**
- **High Speed:**
  - **t_{pd}: 2ns at V_{CC}=2.3V to 5.5V Typically**
  - **t_{on}: 4ns at V_{CC}=5V Typically**
  - **t_{off}: 3.5ns at V_{CC}=5V Typically**
- **Supply Range: 1.65V to 5.5V**
- **Low ON-State Resistance: 4.5Ω(TYP)**
- **Rail-to-Rail Operation**
- **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 RS2166A-Q1 is a bidirectional 1-channel single-pole single-throw (SPST) analog switch, which is designed to operate from 1.65V to 5.5V.

The RS2166A-Q1 device can handle both analog and digital signals. It features bandwidth (340MHz) 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.

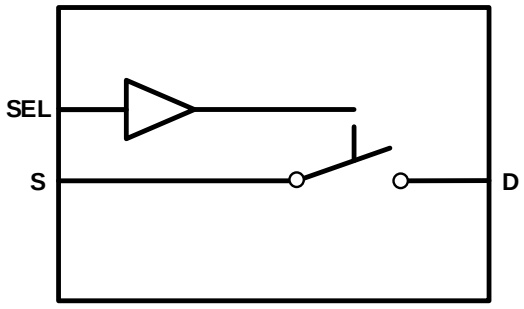
Applications include signal gating, chopping, modulation or demodulation (modem), and signal multiplexing for analog-to-digital and digital-to-analog conversion systems.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE(NOM)
RS2166A-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 RS2166A-Q1



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5 REVISION HISTORY

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

VERSION	Change Date	Change Item
A.0	2025/10/14	Preliminary version completed
A.0.1	2026/11/02	1. Modify the Product Name from RS2166-Q1 to RS2166A-Q1 2. Update SPECIFICATIONS 3. Update PARAMETER MEASUREMENT INFORMATION

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6 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	PACKAGE LEAD	TEMPERATURE RANGE	Lead finish/Ball material (2)	MSL Peak Temp (3)	PACKAGE MARKING (4)	PACKAGE OPTION
RS2166A-Q1	RS2166AXC5-Q1	SC70-5 (5)	-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.

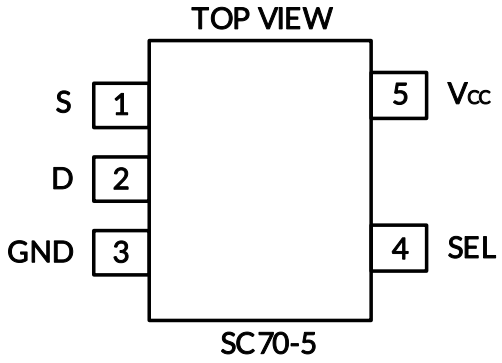
(3) RUNIC classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F. Please align with RUNIC if your end application is quite critical to the preconditioning setting or if you have special requirement.

(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.

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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_{CC}	5	-	Power Supply

(1) I = Input, O = Output.

7.2 Function Table

SELECT INPUTS	SWITCH STATUS
SEL	
High	ON
Low	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.

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8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

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

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CC}	Supply Voltage (2)		-0.5	6	V
V_{IN}	Input Voltage (2) (3)		-0.5	6	
V_O	Switch I/O Voltage (2) (3) (4)		-0.5	V_{CC}+0.5	
I_{IK}	Control input clamp current	V_I<0		-50	mA
$I_{I/OK}$	I/O port diode current	$V_{I/O}$ < 0 or $V_{I/O}$ > V_{CC}		-50	
I_T	On-state switch current	V_{IO}=0 to V_{CC}	-50	50	
	Continuous current through V_{CC} or GND		-100	100	
θ_{JA}	Package thermal impedance (5)	SC70-5		380	°C/W
T_J	Junction Temperature (6)		-40	150	°C
T_{stg}	Storage temperature		-65	150	

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods can affect device reliability.
(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 $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. 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
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM), per AEC Q100-002 (1)	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_{CC}	Supply Voltage	1.65	5.5	V
T_A	Operating temperature	-40	125	°C

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8.4 Electrical Characteristics

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

PARAMETER	SYMBOL	CONDITIONS	V_{CC}	T_A	MIN(2)	TYP(3)	MAX(2)	UNIT
ANALOG SWITCH								
Analog Signal Range	V_S, V_D			FULL	0		V_{CC}	V
On-Resistance	R_{ON}	V_S = 0V to V_{CC}, I_{SD}= -10mA, Switch ON, See Figure 8	1.65V	+25°C		60	65	Ω
				FULL			70	Ω
			1.8V	+25°C		42	50	Ω
				FULL			60	Ω
			2.7V	+25°C		11	15	Ω
				FULL			18	Ω
			3.3V	+25°C		7.5	10	Ω
				FULL			13	Ω
			5V	+25°C		4.5	7.5	Ω
				FULL			9.5	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_S = 0V to V_{CC}, I_{SD} = -10mA, Switch ON, See Figure 8	1.65V	+25°C		51	53	Ω
				FULL			55	Ω
			1.8V	+25°C		38	46	Ω
				FULL			57	Ω
			2.7V	+25°C		6	7	Ω
				FULL			8	Ω
			3.3V	+25°C		3	4	Ω
				FULL			4.3	Ω
			5V	+25°C		2	3	Ω
				FULL			3.3	Ω
Source, Drain OFF Leakage Current	$I_{D(OFF)}$, $I_{S(OFF)}$	V_D = 0.3V, V_{CC} /2, V_S = V_{CC} /2, 0.3V, See Figure 9	1.65 to 5.5V	FULL			1	μA
Channel ON Leakage Current	$I_{D(ON)}$, $I_{S(ON)}$	V_D = 0.3V, Open V_S = Open, 0.3V, See Figure 10	1.65 to 5.5V	FULL			1	μA
DIGITAL CONTROL INPUTS (1)								
Input High Voltage	V_{IH}		1.65V to 1.95V	FULL	0.75V_{CC}			V
			2.3V to 5.5V	FULL	0.7 V_{CC}			V
Input Low Voltage	V_{IL}		1.65V to 1.95V	FULL			0.25V_{CC}	V
			2.3V to 5.5V	FULL			0.3V_{CC}	V
Input Leakage Current	I_{IN}	V_{IN} = V_{IO} or 0	1.65 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.

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Electrical Characteristics (continued)

V_{CC}= 5.0 V or 3.3V, FULL= −40°C to +125°C, Typical values are at T_A = +25°C (unless otherwise noted)

PARAMETER	SYMBOL	CONDITIONS		Vcc	T_A	MIN	TYP	MAX	UNIT
DYNAMIC CHARACTERISTICS									
Propagation delay	t_{pd}	t_{PLH} & t_{PHL}, R_L=500Ω, C_L=50pF, See Figure 13		1.65V to 1.95V	FULL		6	9	ns
				2.3V to 5.5V	FULL		2	2.4	
Turn-On Time	t_{ON}	t_{PZH} & t_{PZL}, R_L=500Ω, C_L=50pF, See Figure 14		1.65V	+25°C		14.5	17	ns
					FULL	6		28	
				1.8V	+25°C		12.5	13	
					FULL	5		20	
				2.7V	+25°C		7	8	
					FULL	2.5		12	
				3.3V	+25°C		5.5	6.5	
					FULL	2		10	
				5V	+25°C		4	5	
					FULL	1.5		7.5	
Turn-Off Time	t_{OFF}	t_{PLZ} & t_{PHZ}, R_L=500Ω, C_L=50pF, See Figure 14		1.65V	+25°C		10	13	ns
					FULL	5		21	
				1.8V	+25°C		8.5	12	
					FULL	4		18	
				2.7V	+25°C		5	7.5	
					FULL	2		12	
				3.3V	+25°C		4	6	
					FULL	1.5		9	
				5V	+25°C		3.5	4	
					FULL	1.5		6	
Off Isolation	O_{ISO}	R_L = 50Ω, Switch OFF See Figure 16	f = 10MHz		+25°C		-58		dB
			f = 1MHz		+25°C		-75		dB
-3dB Bandwidth	BW	Switch ON, R_L = 50Ω, See Figure 15		1.65V to 1.95V	+25°C		340		MHz
				2.3V to 5.5V	+25°C		340		MHz
Charge injection	Q_C	C_L = 0.1nF, See Figure 17		1.65V	+25°C		3.3		pC
				1.8V	+25°C		3.5		pC
				2.7V	+25°C		4		pC
				3.3V	+25°C		5		pC
				5V	+25°C		8		pC
Source OFF Capacitance	$C_{S(OFF)}$	V_S= V_{CC} /2 or GND, Switch OFF, See Figure 11			+25°C		9		pF
Source, Drain ON Capacitance	$C_{S(ON)}$, $C_{D(ON)}$	V_S= V_{CC} /2 or GND, Switch ON, See Figure 11			+25°C		16		pF
POWER REQUIREMENTS									
Power Supply Range	V_{CC}				FULL	1.65		5.5	V
Power Supply Current	I_{CC}	V_{IN} = GND or Vcc		5.5V	FULL			1	μA

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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.

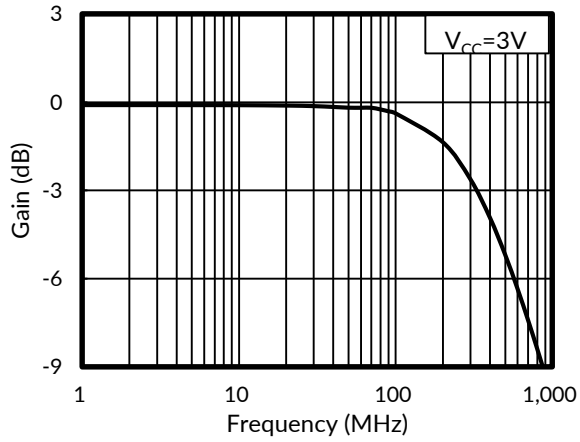


Figure 1. Bandwidth vs Frequency

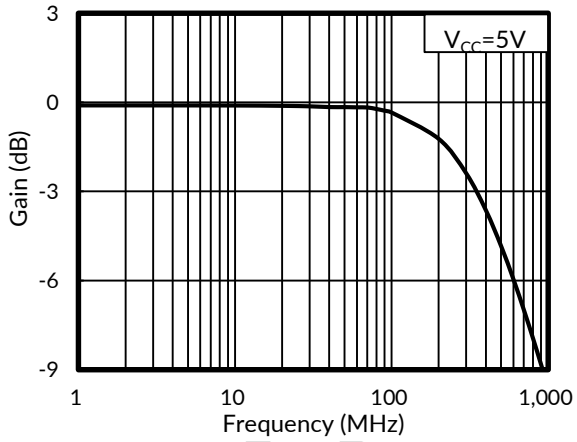


Figure 2. Bandwidth vs Frequency

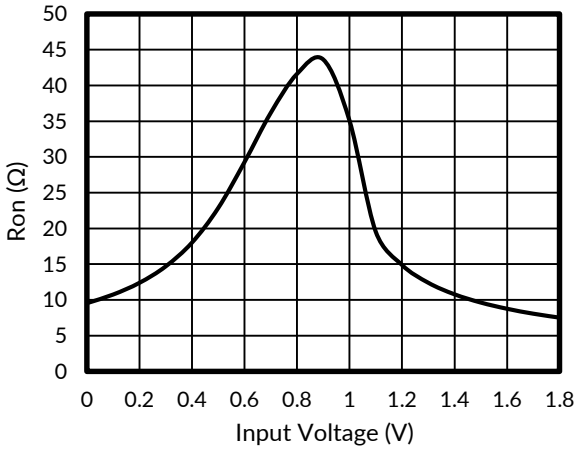


Figure 3. Typical Ron as a Function of Input Voltage (V_{CC}= 1.8 V)

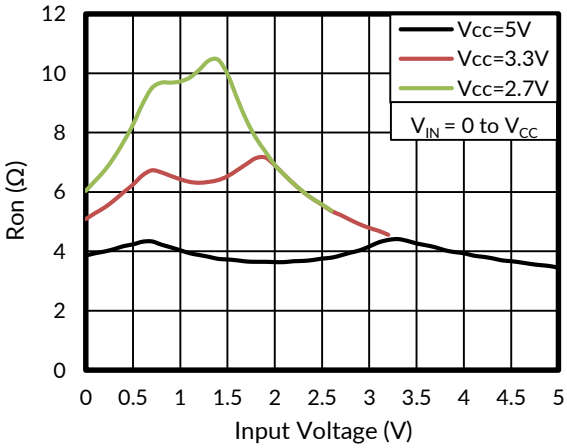


Figure 4. Typical Ron as a Function of Input Voltage

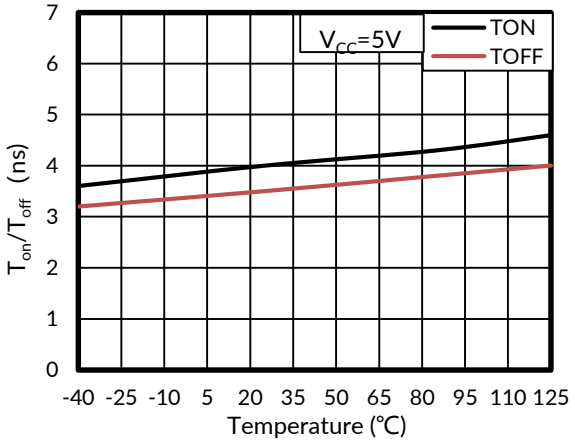


Figure 5. T_{on} and T_{off} vs Temperature

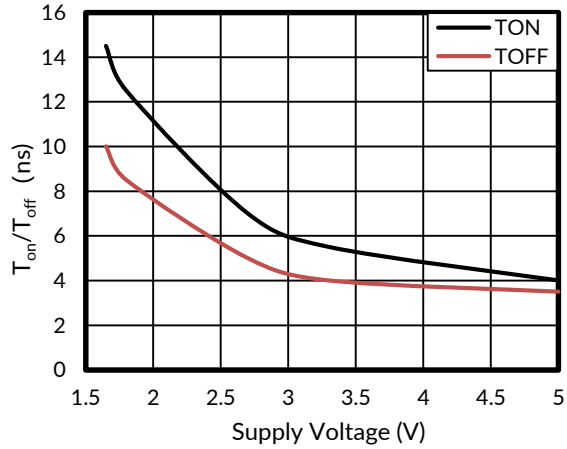


Figure 6. T_{on} and T_{off} vs Supply Voltage

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.

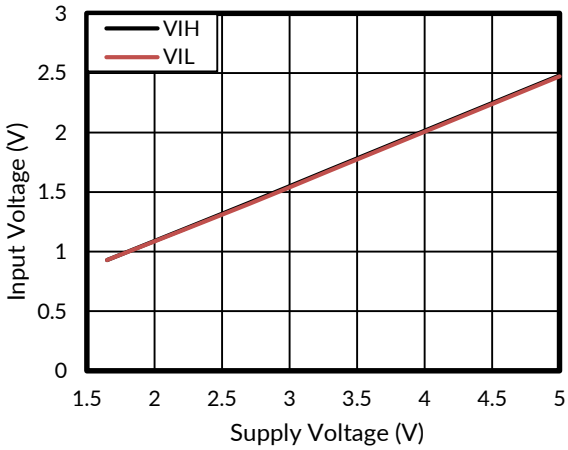


Figure 7. Logic-Level Threshold vs V_{CC}

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9 PARAMETER MEASUREMENT INFORMATION

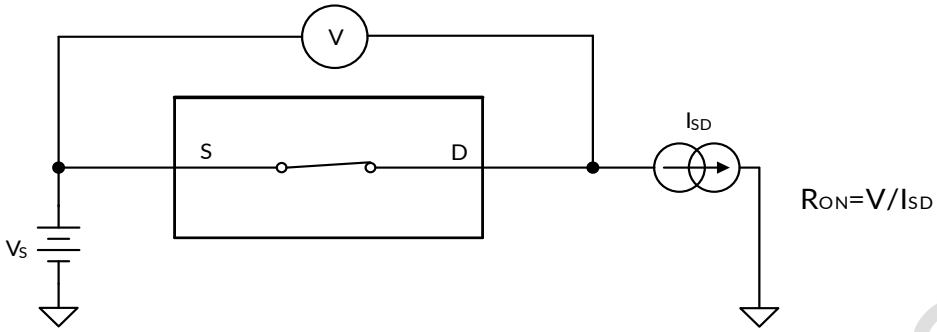


Figure 8. ON-State Resistance (R_{ON})

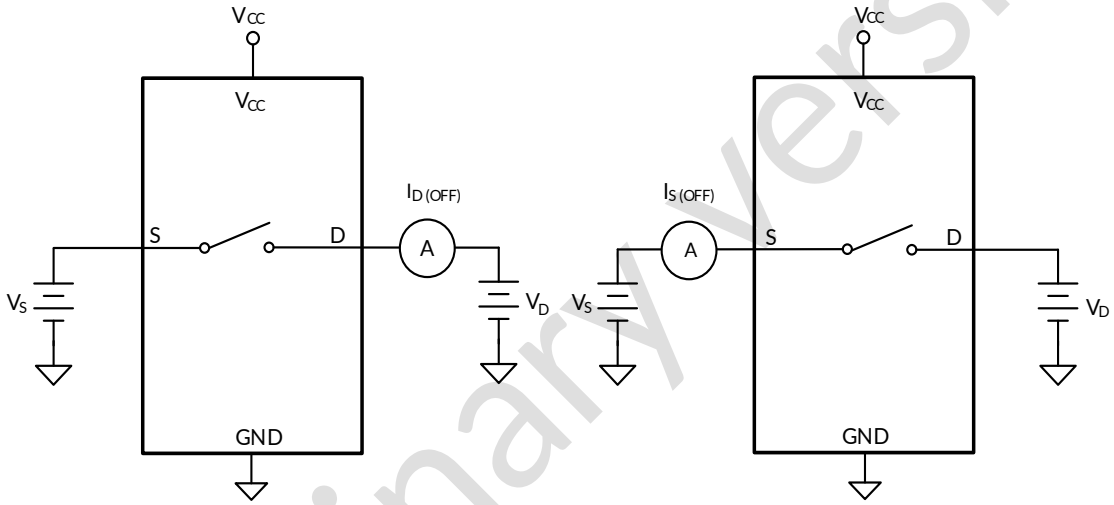


Figure 9. OFF-State Leakage Current ($I_{D\,(OFF)}$, $I_{S\,(OFF)}$)

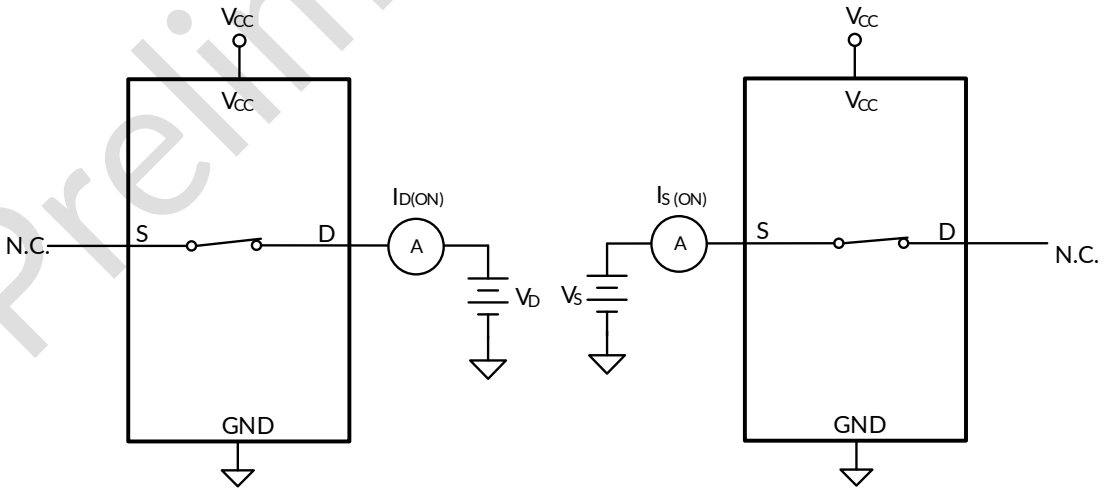
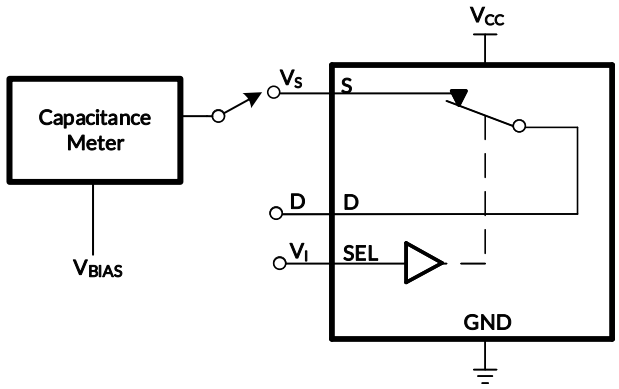


Figure 10. ON-State Leakage Current ($I_{D\,(ON)}$, $I_{S\,(ON)}$)

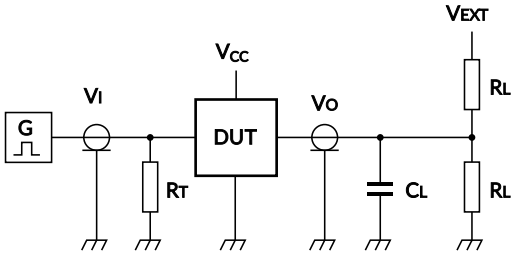
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PARAMETER MEASUREMENT INFORMATION (continued)



V_{BIAS} = V_{CC},V_{IO},or GND and
V_I = V_{IO} or GND
Capacitance is measured at S, D and SEL inputs during ON and OFF conditions.

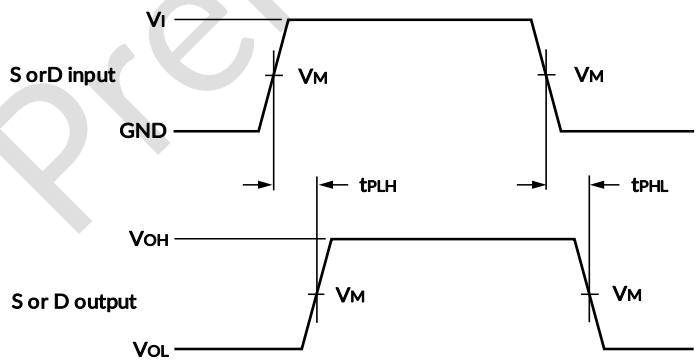
Figure 11. Capacitance (C_I, $C_{S(OFF)}$, $C_{S(ON)}$, $C_{D(ON)}$)



Supply voltage	Input		Load		VEXT		
V_{CC}	V_I	tr, tf	C_L	R_L	tPLH,tPHL	tPZH,tPHZ	tPZL,tPLZ
1.65V to 1.95V	V_{CC}	≤2.0ns	50pF	500Ω	open	GND	2×Vcc
2.3V to 2.7V	V_{CC}	≤2.0ns	50pF	500Ω	open	GND	2×Vcc
2.7V	V_{CC}	≤2.5ns	50pF	500Ω	open	GND	2×Vcc
3V to 3.6V	V_{CC}	≤2.5ns	50pF	500Ω	open	GND	2×Vcc
4.5V to 5.5V	V_{CC}	≤2.5ns	50pF	500Ω	open	GND	2×Vcc

Definitions test circuit:
R_T = Termination resistance should be equal to output impedance Zo of the pulse generator;
C_L = Load capacitance including jig and probe capacitance;
R_L = Load resistance;
V_{EXT} = External voltage for measuring switching times.

Figure 12. Test circuit for measuring switching times



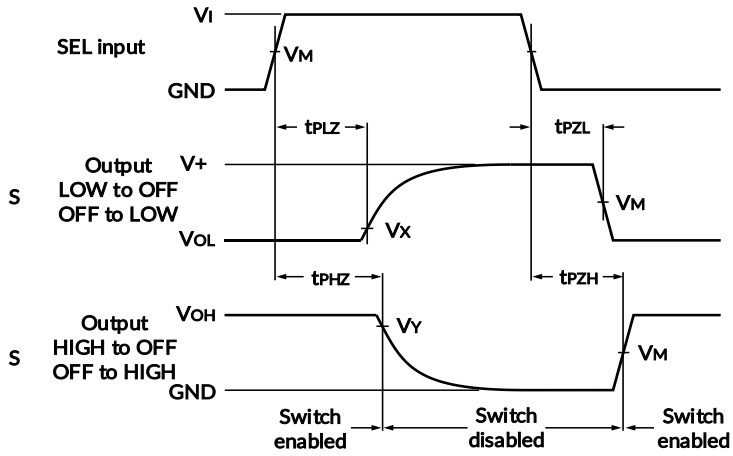
Supply voltage	Vcc	1.65 V to 5.5 V
Input	V_M	0.5 × Vcc
Output	V_M	0.5 × Vcc
	V_X	V_{OL} + 0.3V
	V_Y	V_{OH} - 0.3V

Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Figure 13. Propagation delay (t_{pd})

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PARAMETER MEASUREMENT INFORMATION (continued)



Supply voltage	V_{CC}	1.65 V to 5.5 V
Input	V_M	0.5 × V_{CC}
Output	V_M	0.5 × V_{CC}
	V_X	V_{OL} + 0.3V
	V_Y	V_{OH} - 0.3V

Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Figure 14. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

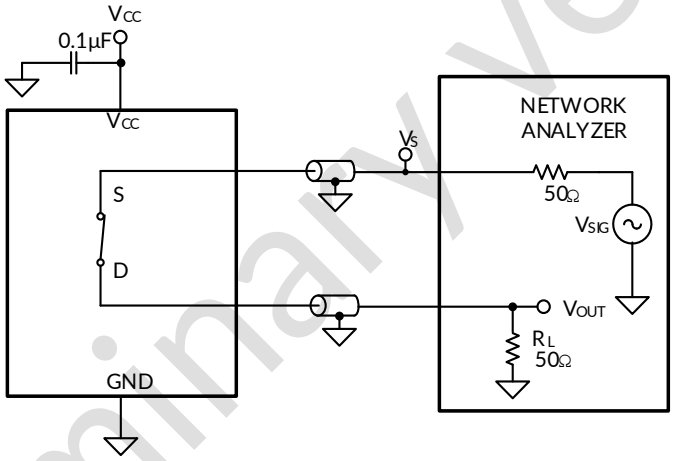


Figure 15. Bandwidth (BW)

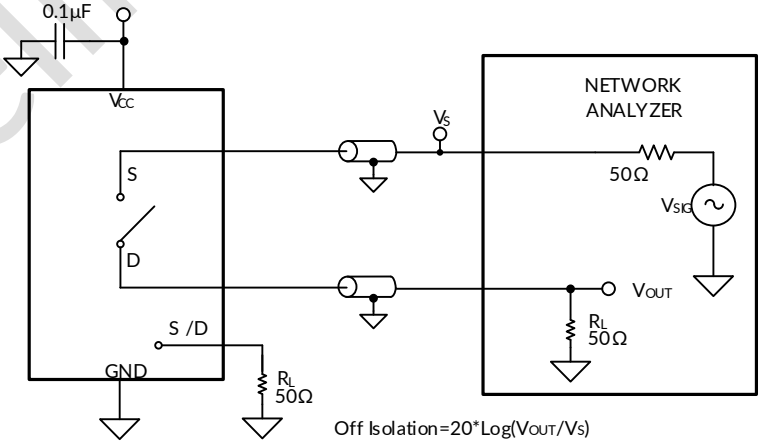


Figure 16. OFF Isolation (O_{ISO})

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PARAMETER MEASUREMENT INFORMATION (continued)

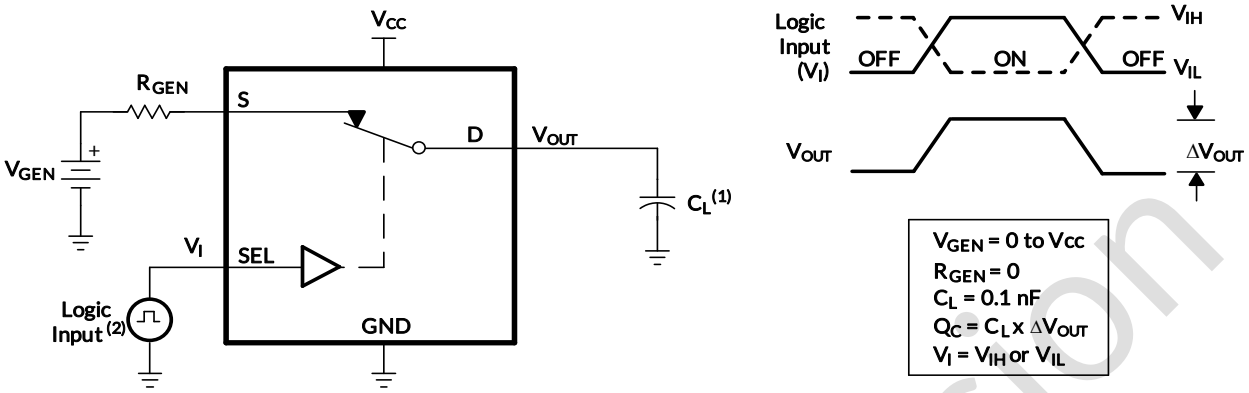


Figure 17. Charge Injection (Q_C)

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10 TYPICAL APPLICATION

The RS2166A-Q1 can be used in any situation where an SPST switch would be used and a solid-state, voltage-controlled version is preferred. The RS2166A-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.

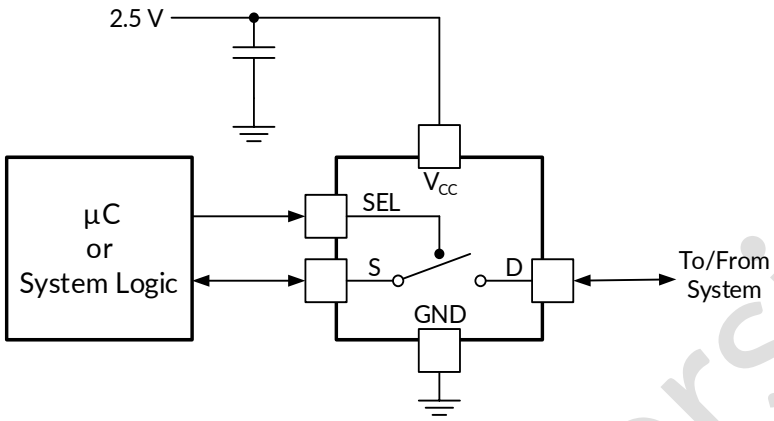
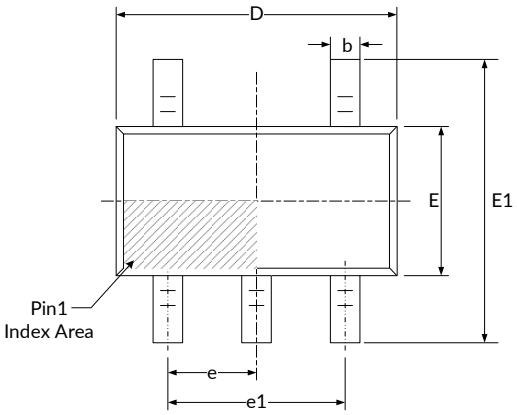


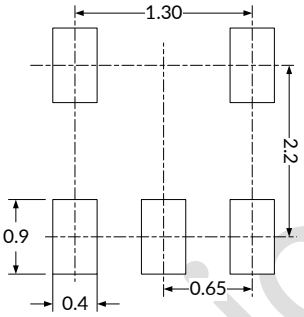
Figure 18. Typical Application Schematic

Preliminary version

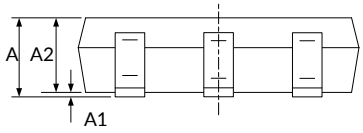
11 PACKAGE OUTLINE DIMENSIONS

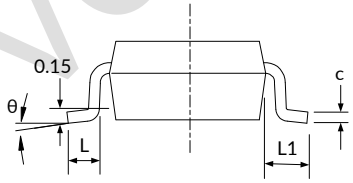
SC70-5 (4)





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	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 (1)	2.020	2.120	0.079	0.084
E (1)	1.250	1.350	0.049	0.053
E1	2.200	2.400	0.087	0.094
e	0.650(BSC) (2)		0.026(BSC) (2)	
e1	1.300(BSC) (2)		0.051(BSC) (2)	
L	0.280	0.380	0.011	0.015
L1	0.500(REF) (3)		0.020(REF) (3)	
θ	0°	8°	0°	8°

NOTE:

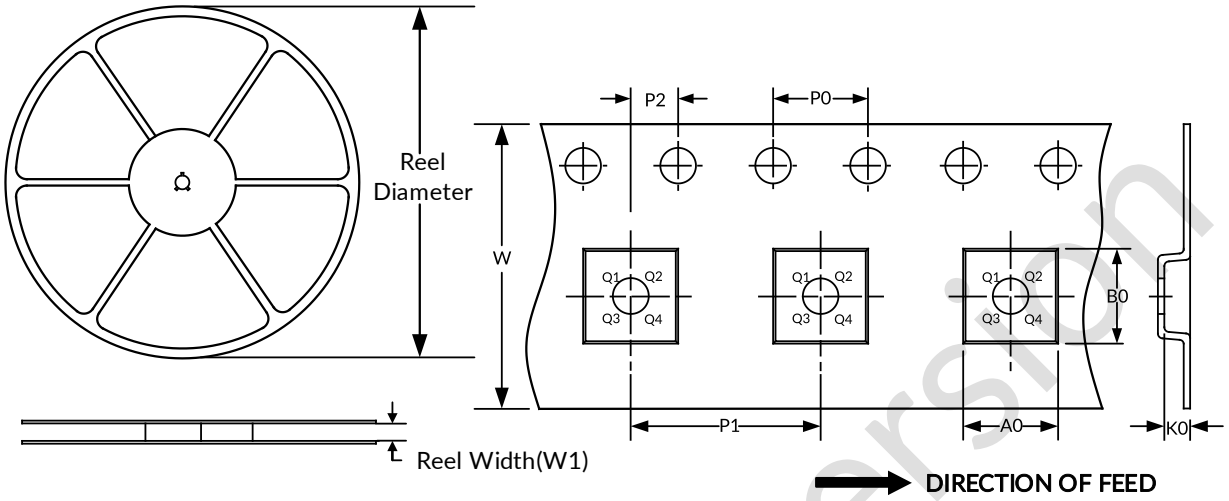
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. REF is the abbreviation for Reference.
4. This drawing is subject to change without notice.

Preliminary version

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.

Preliminary version

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