4.5Ω Single Bilateral SPST Analog Switch

FEATURES

- **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: SOT23-5, SOT353(SC70-5)**

APPLICATIONS

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

DESCRIPTION

The RS2166 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 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.
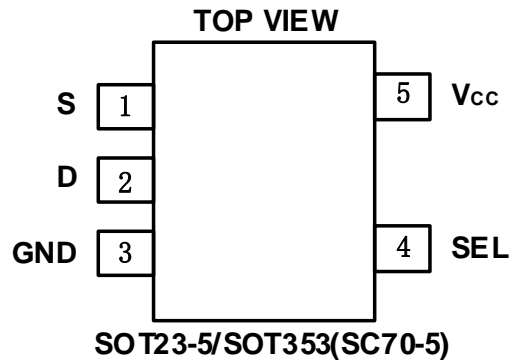
Device Information [1]

PART NUMBER	PACKAGE	BODY SIZE(NOM)
RS2166	SOT23-5	2.90mm×1.60mm
	SC70-5	2.00mm×1.25mm

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

Functional Diagrams of RS2166

PIN CONFIGURATIONS

TOP VIEW

S	1		5	**Vcc**
D	2			
GND	3		4	**SEL**

SOT23-5/SOT353(SC70-5)
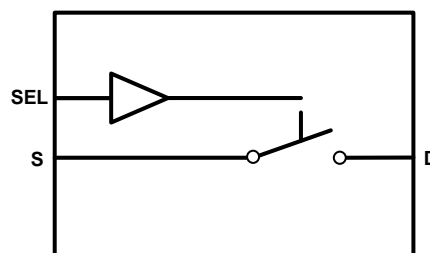
PIN DESCRIPTION

NAME	PIN	I/O	DESCRIPTION
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)
Vcc	5	-	Power Supply

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.

SPECIFICATIONS

Absolute Maximum Ratings

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

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CC}	Supply Voltage [2]		-0.3	6.0	V
V_{IN}	Input Voltage [2][3]		-0.3	6.0	
V_O	Switch I/O Voltage [2][3][4]		-0.3	V_{CC}+0.3	
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	
T_J	Junction Temperature			150	°C
T_{stg}	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.

ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM)	±2000	V
		Machine Model (MM)	±300	V

Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted) [3]

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

Thermal Information

THERMAL METRIC		RS2166		UNIT
		5PINS		
		SOT23-5	SOT353(SC70-5)	
$R_{\Theta JA}$	Junction-to-ambient thermal resistance	273.8	214.7	°C/W
$R_{\Theta JC(top)}$	Junction-to-case(top) thermal resistance	126.8	127.1	°C/W
$R_{\Theta JB}$	Junction-to-board thermal resistance	85.9	60.0	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	10.9	33.4	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	84.9	59.8	°C/W
$R_{\Theta JC(bot)}$	Junction-to-case(bottom) thermal resistance	N/A	NA	°C/W

PACKAGE/ORDERING INFORMATION

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING [1]	PACKAGE OPTION
RS2166	RS2166XF5	-40°C ~+125°C	SOT23-5	2166	Tape and Reel,3000
	RS2166XC5	-40°C ~+125°C	SOT353(SC70-5)	2166X	Tape and Reel,3000

（1）NOTE: X = Date Code

MARKING INFORMATION

2166X

Date code
Product name
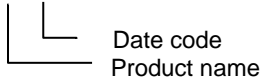
ELECTRICAL CHARACTERISTICS

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	VDD	T_A	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_S, V_D			FULL	0		V_{CC}	V
On-Resistance	R_{ON}	$V_S = V_{CC}/2$, I_{SD}= -10mA, Switch ON, See Figure 1	5V	+25°C		4.5	8	Ω
				FULL			8.5	Ω
			3.3V	+25°C		7	10	Ω
				FULL			10.5	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	$0 ≤ (V_S) ≤ V_{CC}/2$, I_{SD} = -10mA, Switch ON, See Figure 1	5V	+25°C		2	3	Ω
				FULL			3.3	Ω
			3.3V	+25°C		3	4	Ω
				FULL			4.3	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 2	1.8 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 3	1.8 to 5.5V	FULL			1	µA
DIGITAL CONTROL INPUTS [1]								
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} 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.

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		V+	TEMP	MIN	TYP	MAX	UNITS
DYNAMIC CHARACTERISTICS									
Turn-On Time	t_{ON}	$V_S = V_{CC}$, $R_L = 300Ω$, $C_L = 35pF$, See Figure 4		5V	+25°C		30		ns
				3.3V			40		
Turn-Off Time	t_{OFF}	$V_S = V_{CC}$, $R_L = 300Ω$, $C_L = 35pF$, See Figure 4		5V	+25°C		25		ns
				3.3V			30		
-3dB Bandwidth	BW	Switch ON, $R_L = 50Ω$, See Figure 5			+25°C		300		MHz
Off Isolation	O_{ISO}	$R_L = 50Ω$, Switch OFF, See Figure 6	f = 10MHz		+25°C		-52		dB
			f = 1MHz		+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
POWER REQUIREMENTS									
Power Supply Range	V_{CC}				FULL	1.8		5.5	V
Power Supply Current	I_{CC}	V_{IN} = GND or Vcc		5.5V	FULL			1	µA

TYPICAL CHARACTERISTICS

BANDWIDTH

BANDWIDTH

Typical r_{on} as a Function of Input Voltage (VI) for VI = 0 to Vcc

—— V+=5.5V   ••••• V+=4V   — — V+=3.3V   — • — V+=2.5V   —— • V+=1.8V
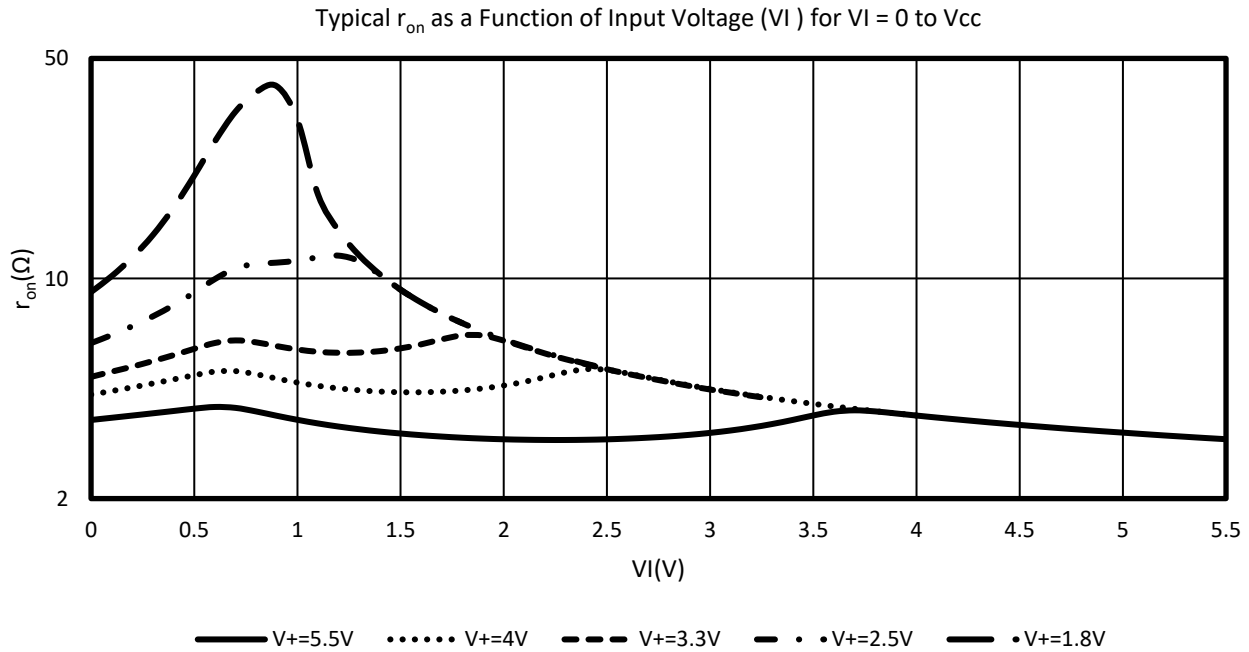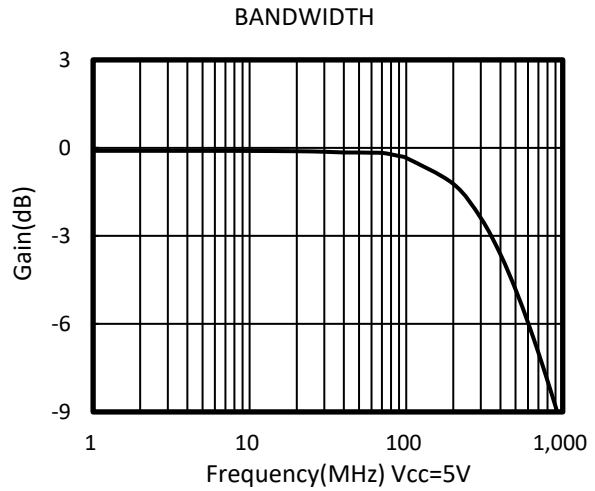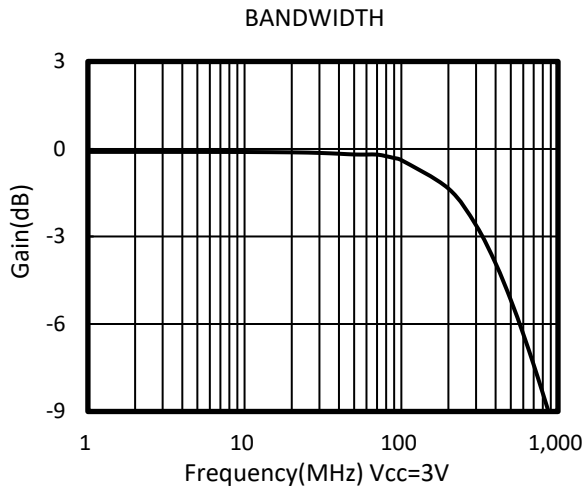
Parameter Measurement Information
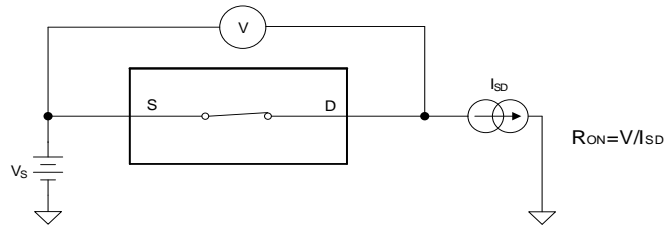
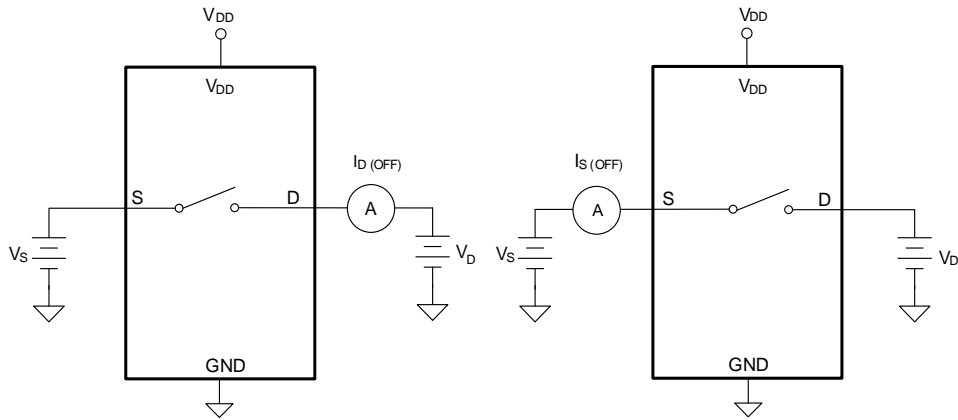**Figure 1. ON-State Resistance (R_{ON})**

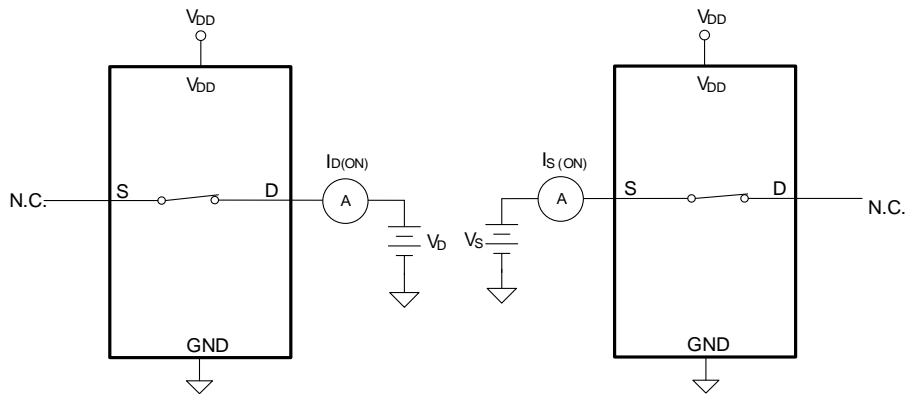**Figure 2.OFF-State Leakage Current ($I_{D(OFF)}$, $I_{S(OFF)}$)**

Figure 3. ON-State Leakage Current ($I_{D(ON)}$, $I_{S(ON)}$)
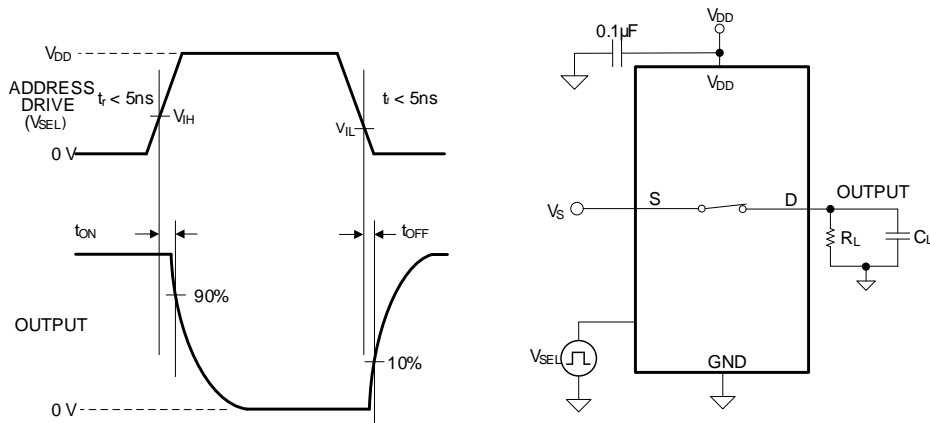
Parameter Measurement Information（continued）

Figure 4. Turn-On (t$_{ON}$) and Turn-Off Time (t$_{OFF}$)

Figure 5. Bandwidth (BW)

Off Isolation=20*Log(V$_{OUT}$/V$_S$)
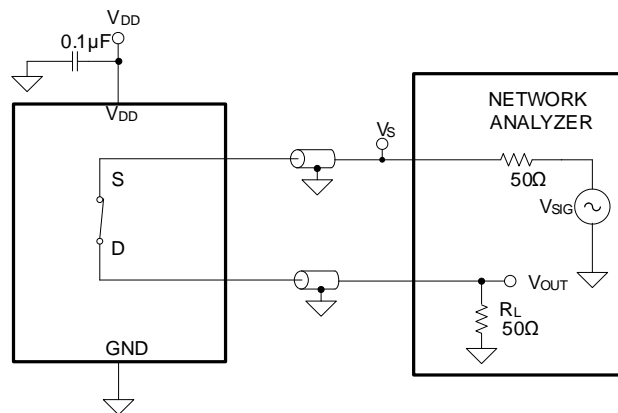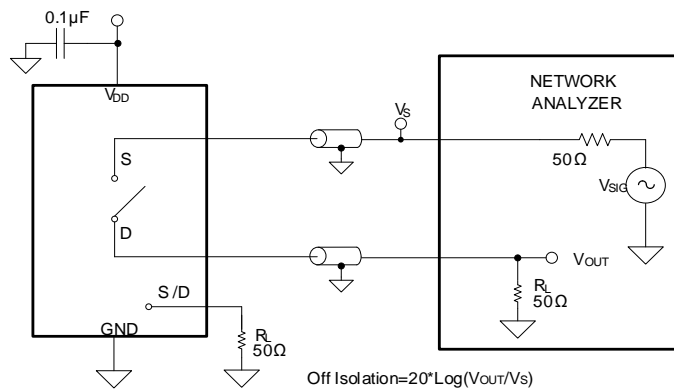
Figure 6. OFF Isolation (O$_{ISO}$)

TYPICAL APPLICATION

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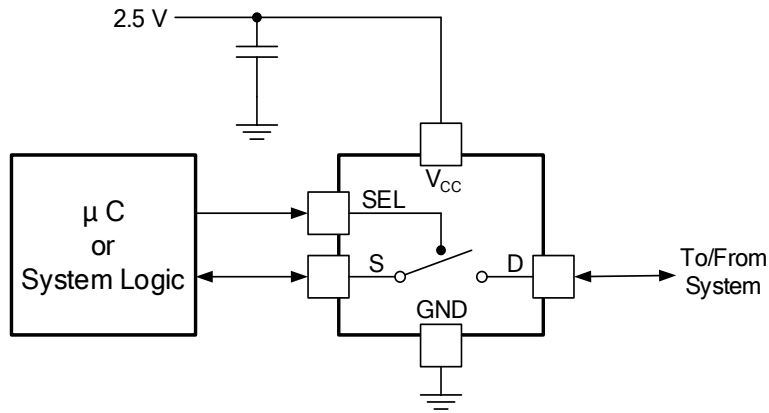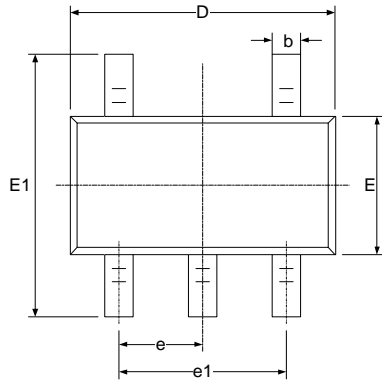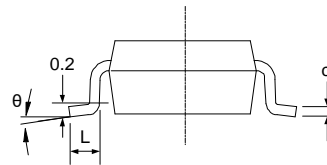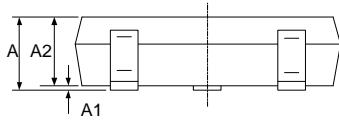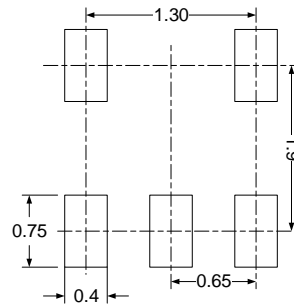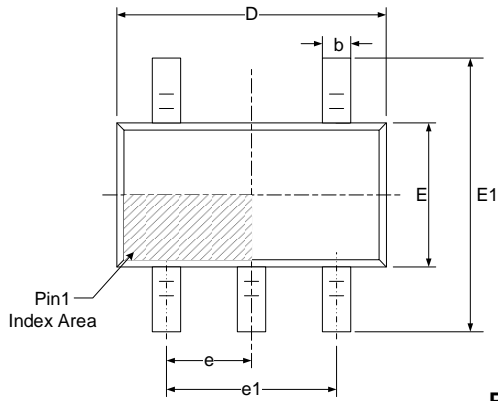

Figure 7. Typical Application Schematic

PACKAGE OUTLINE DIMENSIONS
SOT23-5
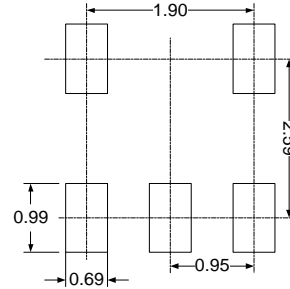
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	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	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOT353(SC70-5)

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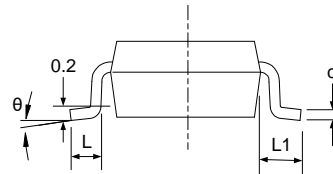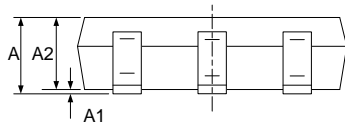
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650(BSC)		0.026(BSC)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

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PI5A3167CCEX SLAS3158MNR2G PI5A392AQE NX3L1T5157GMZ ADG714BCPZ-REEL7 DG333ALDW-T1-E3 ISL43113IB
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