1-Bit Dual-Supply Unidirectional Bus Transceiver

1 FEATURES

- **Power-Supply Range: V_{CCA} and V_{CCB}: 1.65V to 5.5V**
- **V_{CC} Isolation: If Either V_{CC} is at GND, Both Ports are in the High-Impedance State**
- **Low power consumption,4μA Max**
- **Output drive up to ±24mA@3.0V**
- **No Power-Supply Sequencing Required: Either V_{CCA} or V_{CCB} can be Ramped First**
- **I_{OFF}: Supports Partial-Power-Down Mode Operation**
- **Extended Temperature: -40°C to +125°C**

2 APPLICATIONS

- **Industrial**
- **Enterprise**
- **Telecom, such as VOIP**
- **Personal electronic**

3 DESCRIPTIONS

The RS1T34 is 1-bit non-inverting bus transceiver uses two separate configurable power supply rails. The A port is designed to track V_{CCA}, which supporting operating voltages from 1.65V to 5.5V, and the B port supporting operating voltages from 1.65V to 5.5V while it tracks the V_{CCB} supply. This allows for universal low-voltage unidirectional translation between any of the 1.8V, 2.5V,3.3V and 5V voltage nodes.

The RS1T34 is designed for asynchronous communication between two data buses. The A bus is input side, the B bus is output side.

The RS1T34 is fully specified for partial power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

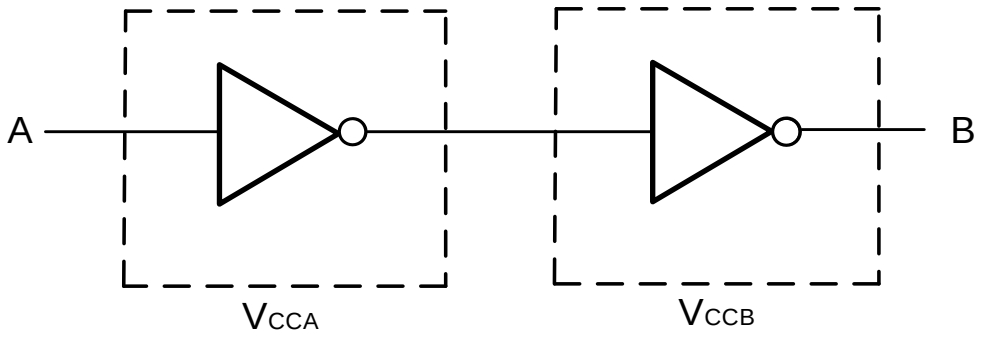
The RS1T34 is available in Green SOT23-5 and SOT353(SC70-5) packages. It operates over an ambient temperature range of -40°C to +125°C.

Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS1T34	SOT23-5(5)	2.92mm×1.60mm
	SC70-5 (SOT353) (5)	2.10mm×1.25mm

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

4 Functional Block Diagram



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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.1	2021/09/29	Initial version completed
A.2	2022/12/14	1. Update PACKAGE MARKING on Page 5@RevA.1 2. Update ESD Ratings on Page 4@RevA.1 3. Changed Recommended Operating Conditions and Timing Requirements and Operating Characteristics

6 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL (3)	PACKAGE OPTION
RS1T34	RS1T34XF5	-40°C ~+125°C	SOT23-5	1T34	MSL3	Tape and Reel,3000
	RS1T34XC5	-40°C ~+125°C	SOT353 (SC70-5)	1T34	MSL3	Tape and Reel,3000

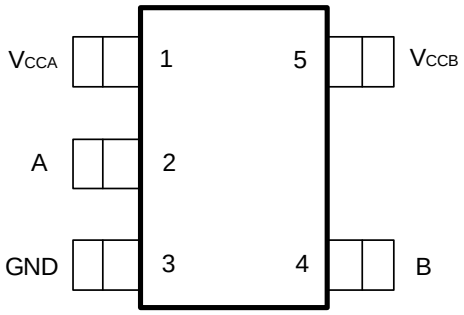
NOTE:

(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) 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.

7 PIN CONFIGURATIONS



SOT23-5/SOT353(SC70-5)

7.1 PIN DESCRIPTION

PIN	NAME	TYPE (1)	FUNCTION
SOT23-5/SOT353(SC70-5)			
1	V_{CCA}	P	A Port Supply Voltage.1.65V ≤ V_{CCA} ≤ 5.5V
2	A	I	Input A. Reference to V_{CCA}.
3	GND	–	Ground.
4	B	O	Output B. Reference to V_{CCB}.
5	V_{CCB}	P	B Port Supply Voltage.1.65V ≤ V_{CCB} ≤ 5.5V.

(1) I=input, O=output, P=power.

7.2 Function Table (2)

INPUT (1)	OUTPUT
A PORT (3)	B PORT (3)
H	H
L	L

Note:
(1) The input circuit of the data I/O is always active.
(2) When either V_{CCA} or V_{CCB} is at GND level, the device goes into suspend mode.
(3) H=High voltage level, L=Low voltage level.

8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

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

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CCA} (3)	Supply Voltage Range		-0.5	6.5	V
V_{CCB} (3)	Supply Voltage Range		-0.5	6.5	V
V_I (2)	Input Voltage Range	A port	-0.5	6.5	V
V_O (2)	Voltage range applied to any output in the high-impedance or power-off state	B port	-0.5	V_{CCB}+0.5	V
I_{IK}	Input clamp current	V_I<0		-50	mA
I_{OK}	Output clamp current	Vo<0		-50	mA
I_O	Continuous output current			±50	mA
	Continuous current through V_{CCA}, V_{CCB} or GND			±100	mA
θ_{JA}	Package thermal impedance (4)	SOT23-5		230	°C/W
		SOT353(SC70-5)		376	
T_J	Junction temperature (5)		-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 may affect device reliability.
(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
(3) The value of V_{CCA} and V_{CCB} are provided in the recommended operating conditions table.
(4) The package thermal impedance is calculated in accordance with JESD-51.
(5) 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 ANSI/ESDA/JEDEC JS-001(1)	±2000	V
		Charged-device model (CDM), per ANSI/ESDA/JEDEC JS-002(2)	±1500	V
		Machine Model (MM)	±200	V

(1) JEDEC document JEP155 states that 500 V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250 V CDM allows safe manufacturing with a standard ESD control process.

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

V_{CCA} is the supply voltage associated with the input port. V_{CCB} is the supply voltage associated with the output port.

PARAMETER		V_{CCA} (1)	V_{CCB} (2)	MIN	TYP	MAX	UNIT
Supply voltage (1)	V_{CCA}			1.65		5.5	V
	V_{CCB}			1.65		5.5	
High-level input Voltage	V_{IH} (4)	1.65V to 1.95V		V_{CCA} x0.75			V
		2.3V to 2.7V		V_{CCA} x0.7			
		3V to 3.6V		V_{CCA} x0.7			
		4.5V to 5.5V		V_{CCA} x0.7			
Low-level input Voltage	V_{IL} (4)	1.65V to 1.95V				V_{CCA} x0.35	V
		2.3V to 2.7V				V_{CCA} x0.3	
		3V to 3.6V				V_{CCA} x0.3	
		4.5V to 5.5V				V_{CCA} x0.3	
Input voltage	V_I			0		5.5	V
Output voltage	V_O			0		V_{CCB}	V
High-level output current (I_{OH})			1.65V to 1.95V			-4	mA
			2.3V to 2.7V			-8	
			3V to 3.6V			-24	
			4.5V to 5.5V			-32	
Low-level output current (I_{OL})			1.65V to 1.95V			4	mA
			2.3V to 2.7V			8	
			3V to 3.6V			24	
			4.5V to 5.5V			32	
Input transition rise or fall rate(Δt/Δv)	Data inputs (3)	1.65V to 1.95V				20	ns/V
		2.3V to 2.7V				20	
		3V to 3.6V				10	
		4.5V to 5.5V				5	
T_A Operating free-air temperature				-40		125	°C

(1) V_{CCA} is the V_{CC} associated with the data input port.
(2) V_{CCB} is the V_{CC} associated with the output port.
(3) All unused or driven (floating) data inputs (I/Os) of the device must be held at logic HIGH or LOW (preferably V_{CCI} or GND) to ensure proper device operation and minimize power.
(4) For V_{CCA} values not specified in the data sheet, V_{IH} min = V_{CCA} × 0.7 V, V_{IL} max = V_{CCA} × 0.3 V.

8.4 Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (1) (2)

PARAMETER		CONDITIONS	V_{CCA}	V_{CCB}	TEMP	MIN(3)	TYP(4)	MAX(3)	UNIT
V_{OH}		I_{OH} = –100μA V_I=V_{IH}	1.65V to 4.5V	1.65V to 4.5V	Full	V_{CCB} - 0.1			V
		I_{OH} = –4mA V_I =V_{IH}	1.65V	1.65V		1.2			
		I_{OH} = –8mA V_I =V_{IH}	2.3V	2.3V		1.9			
		I_{OH} = –24mA V_I =V_{IH}	3V	3V		2.4			
		I_{OH} = –32mA V_I =V_{IH}	4.5V	4.5V		3.8			
V_{OL}		I_{OL} = 100μA V_I =V_{IL}	1.65V to 4.5V	1.65V to 4.5V				0.1	V
		I_{OL} = 4mA V_I =V_{IL}	1.65V	1.65V				0.45	
		I_{OL} = 8mA V_I =V_{IL}	2.3V	2.3V				0.3	
		I_{OL} = 24mA V_I =V_{IL}	3V	3V				0.55	
		I_{OL} = 32mA V_I =V_{IL}	4.5V	4.5V				0.55	
I_I	Input leakage current	V_I = V_{CCA} or GND	1.65V to 5.5V	1.65V to 5.5V	+25°C			±1	μA
					Full			±2	
I_{off}	A or B Port	V_I or V_O= 0 to 5.5V	0V	0V to 5.5V	+25°C			±1	μA
					Full			±2	
			0V to 5.5V	0V	+25°C			±1	μA
					Full			±2	
I_{CCA}	V_{CCA} supply current	V_I = V_{CCA} or GND (5) I_O = 0	1.65V to 5.5V	1.65V to 5.5V	Full			3	μA
			5V	0V	Full			2	
			0V	5V	Full			-2	
I_{CCB}	V_{CCB} supply current	V_I = V_{CCA} or GND (5) I_O = 0	1.65V to 5.5V	1.65V to 5.5V	Full			3	μA
			5V	0V	Full			-2	
			0V	5V	Full			2	
I_{CCA} + I_{CCB}	Combined supply current	V_I = V_{CCA} or GND I_O = 0	1.65V to 5.5V	1.65V to 5.5V	Full			4	μA
ΔI_{CCA}	A port	One A port at V_{CCA} – 0.6 V, B port = open	3V to 5.5V	3V to 5.5V	Full			50	μA
ΔI_{CCB}	B port	One B port at V_{CCB} – 0.6 V, A port = open	3V to 5.5V	3V to 5.5V	Full			50	μA
C_I	Input capacitance	V_I= GND or V_{CCA}	0V to 3.6V	0V to 3.6V	+25°C		8.5		pF
C_{IO}	Output capacitance	V_O=GND	0V to 3.6V	0V to 3.6V	+25°C		8.5		pF

(1) V_{CCA} is the V_{CC} associated with the input port.
(2) V_{CCB} is the V_{CC} associated with the output port.
(3) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.
(4) 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.
(5) Hold all unused data inputs of the device at V_{CCI} or GND to assure proper device operation.

8.5 Timing Requirements

8.5.1 V_{CCA}=1.8V±0.15 V

over recommended operating free-air temperature range, Full=-40°C to 125°C.

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEMP	V_{CCB}=1.8V ±0.15V (1)		V_{CCB}=2.5V ±0.2V (1)		V_{CCB}=3.3V ±0.3V (1)		V_{CCB}=5V ±0.5V (1)		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	Full	3.5	24.6	2.6	17.2	2	18.6	1.6	18.5	ns
t_{PHL}				3.3	18.4	2.6	15.5	2.1	16.4	2	16.8	

(1) This parameter is ensured by design and/or characterization and is not tested in production.

8.5.2 V_{CCA}=2.5V±0.2 V

over recommended operating free-air temperature range, Full=-40°C to 125°C.

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEMP	V_{CCB}=1.8V ±0.15V (1)		V_{CCB}=2.5V ±0.2V (1)		V_{CCB}=3.3V ±0.3V (1)		V_{CCB}=5V ±0.5V (1)		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	Full	2.7	24.5	1.8	16.5	1.5	15.4	1.3	16.6	ns
t_{PHL}				2.5	18.4	1.6	12.7	1.5	11.3	1	10.4	

(1) This parameter is ensured by design and/or characterization and is not tested in production.

8.5.3 V_{CCA}=3.3V±0.3 V

over recommended operating free-air temperature range, Full=-40°C to 125°C.

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEMP	V_{CCB}=1.8V ±0.15V (1)		V_{CCB}=2.5V ±0.2V (1)		V_{CCB}=3.3V ±0.3V (1)		V_{CCB}=5V ±0.5V (1)		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	Full	2.5	23.2	1.6	16.2	0.8	15.2	0.8	15.1	ns
t_{PHL}				2.4	15.3	1.5	12.5	0.9	10.2	0.8	10	

(1) This parameter is ensured by design and/or characterization and is not tested in production.

8.5.4 V_{CCA}=5V±0.5 V

over recommended operating free-air temperature range, Full=-40°C to 125°C.

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEMP	V_{CCB}=1.8V ±0.15V (1)		V_{CCB}=2.5V ±0.2V (1)		V_{CCB}=3.3V ±0.3V (1)		V_{CCB}=5V ±0.5V (1)		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	Full	2.2	23.2	1.2	16.2	0.7	15.8	0.6	15.2	ns
t_{PHL}				2.1	14.1	1	11.4	0.8	10.4	0.6	9.5	

(1) This parameter is ensured by design and/or characterization and is not tested in production.

8.6 Operating Characteristics

T_A=25°C

PARAMETER (1)		CONDITIONS	V_{CCA}=V_{CCB} =1.8V	V_{CCA}=V_{CCB} =2.5V	V_{CCA}=V_{CCB} =3.3V	V_{CCA}=V_{CCB} =5V	UNIT
			TYP	TYP	TYP	TYP	
C_{pdA}	A-port input, B-port output	C_L=0, f=10MHz, t_r=t_f=5ns	3	4	6	9	pF
C_{pdB}	A-port input, B-port output	C_L=0, f=10MHz, t_r=t_f=5ns	14	16	21	32	pF

(1) Power dissipation capacitance per transceiver.

8.7 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.

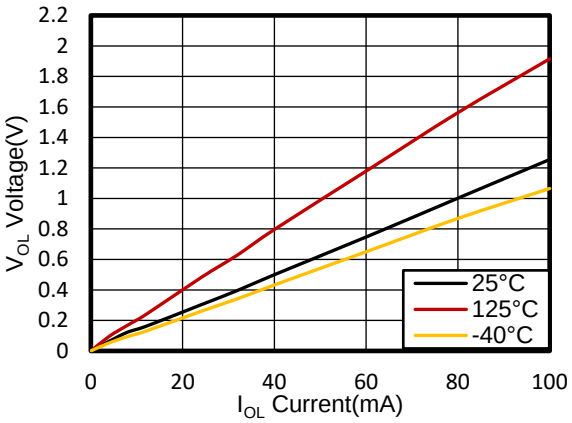


Figure 1. Voltage vs Current

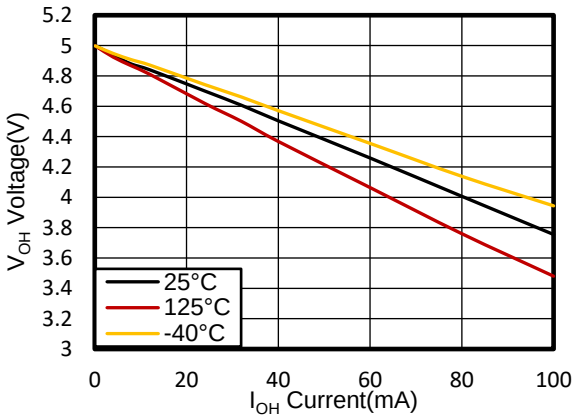
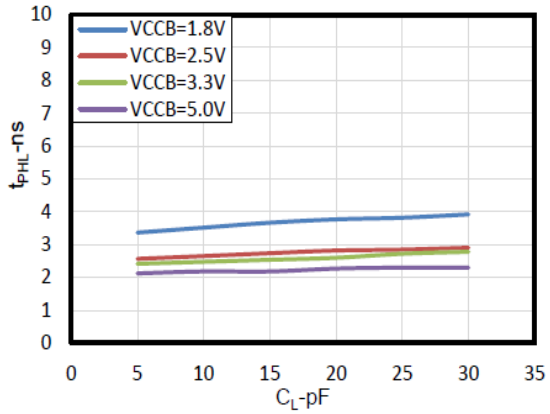
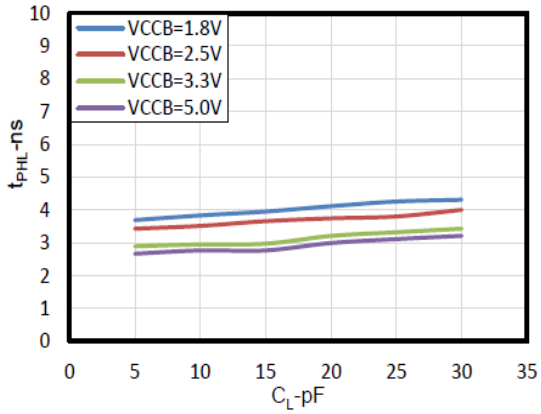


Figure 2. Voltage vs Current



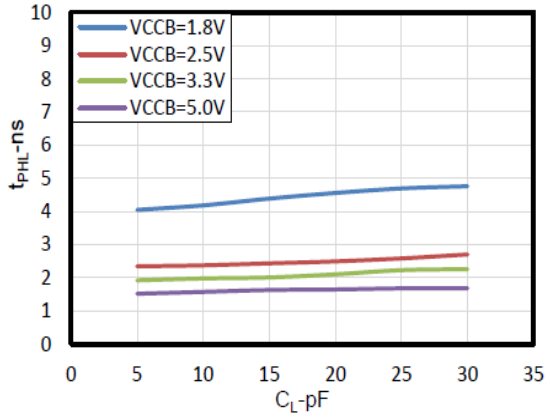
T_A = 25°C, V_{CCA} = 1.8 V

Figure 3. Typical Propagation Delay of High-to-Low (A to B) vs Load Capacitance



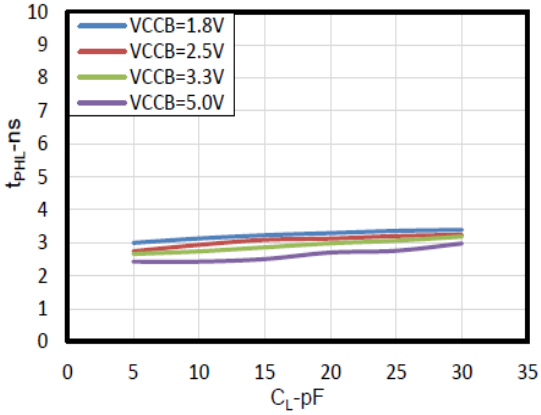
T_A = 25°C, V_{CCA} = 2.5 V

Figure 4. Typical Propagation Delay High-to-Low (A to B) vs Load Capacitance



T_A = 25°C, V_{CCA} = 3.3 V

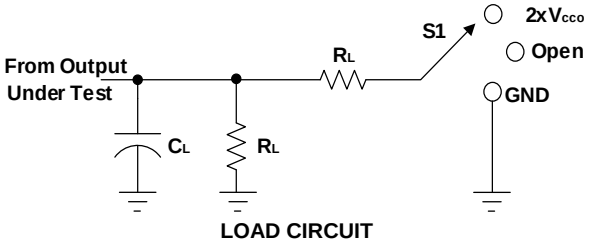
Figure 5. Typical Propagation Delay High-to-Low (A to B) vs Load Capacitance



T_A = 25°C, V_{CCA} = 5 V

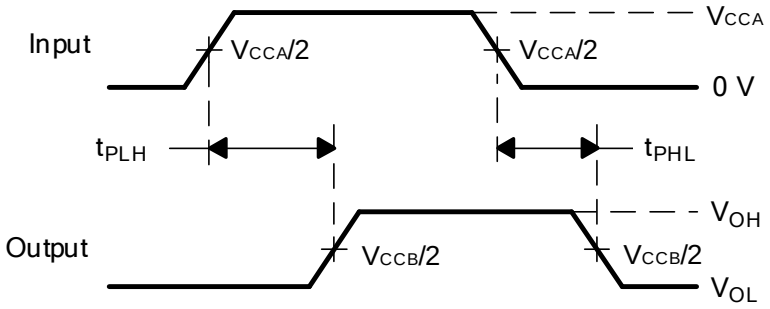
Figure 6. Typical Propagation Delay High-to-Low (A to B) vs Load Capacitance

9 Parameter Measurement Information



TEST	S1
t_{pd}	Open

V_{CC}	C_L	R_L	V_{TP}
1.8V±0.15V	15pF	2kΩ	0.15V
2.5V±0.2V	15pF	2kΩ	0.15V
3.3V±0.3V	15pF	2kΩ	0.3V
5V±0.5V	15pF	2kΩ	0.3V



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

NOTES: A.C_L includes probe and jig capacitance.
B.All input pulses are supplied by generators having the following characteristics: PRR≤10 MHz, Z_O = 50 Ω，dv/dt≥1V/ns.
C. The outputs are measured one at a time, with one transition per measurement.
D. t_{PLH} and t_{PHL} are the same as t_{pd}.
E. V_{CCA} is the V_{CC} associated with the input port.
F. All parameters and waveforms are not applicable to all devices.

Figure 7. Load Circuit and Voltage Waveforms

10 Application Information

The RS1T34 can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another.

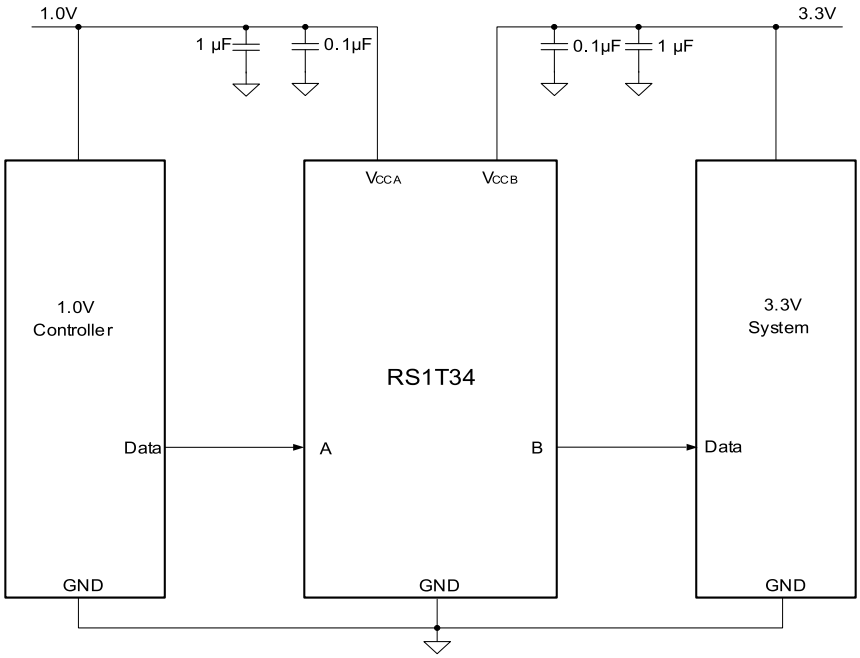
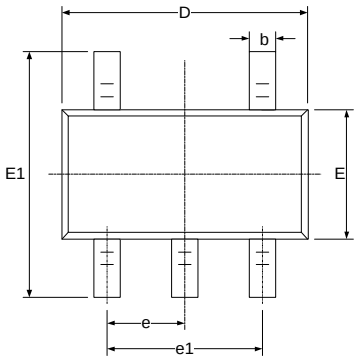
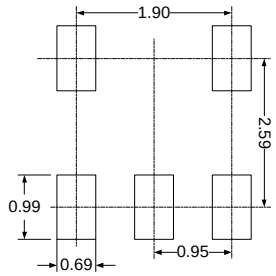


Figure 8. Typical Application Circuit

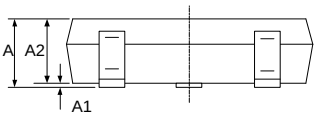
11 PACKAGE OUTLINE DIMENSIONS

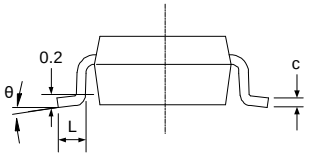
SOT23-5





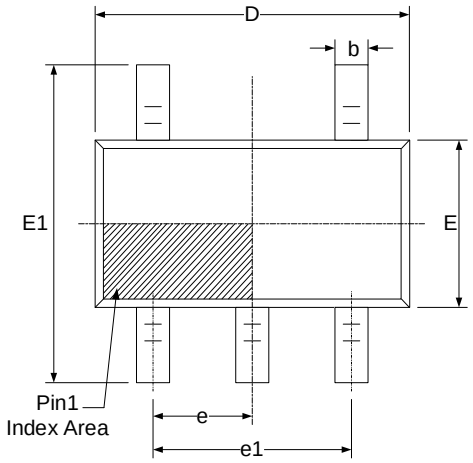
RECOMMENDED LAND PATTERN (Unit: mm)

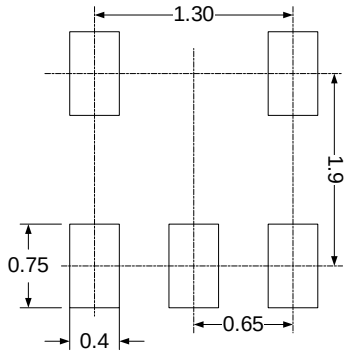




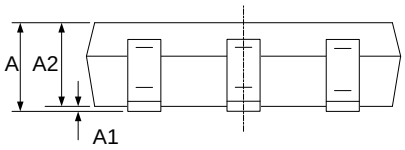
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 (BSC)		0.037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

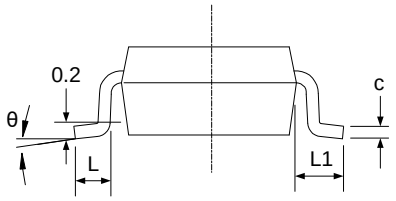
SOT353(SC70-5)





RECOMMENDED LAND PATTERN (Unit: mm)





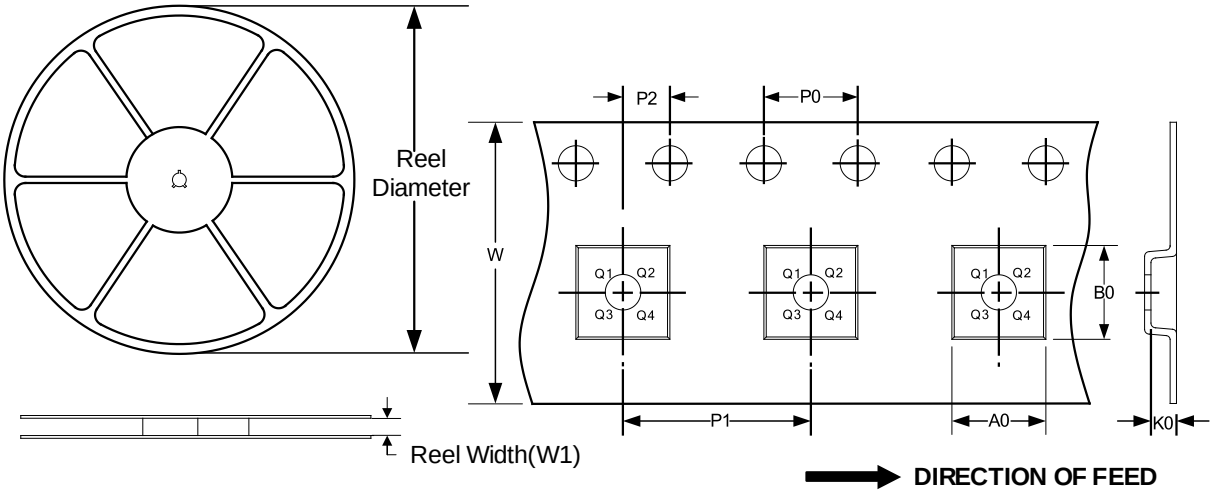
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 (BSC)		0.026 (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°

NOTE:

A. All linear dimension is in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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
SOT23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SOT353 (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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