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SN74LV1T86 Series

2-input single supply translating EXCLUSIVE-OR gate

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Features

- Single supply voltage translator at 1.8 V, 2.5 V, 3.3 V and 5.0 V
- Operate from 1.8V to 5.5V
- ±25mA Output Drive
- Low Power Current: Icc=10μA (Max.)
- ESD Protection Exceeds JESD 22
  -2000-V Human-Body Model (A114-A)
  -200-V Machine Model (A115-A)
  -1000-V Charged-Device Model (C101)

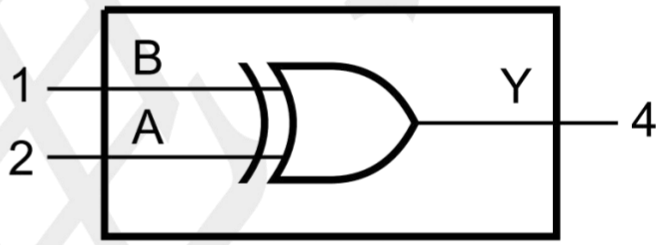
Applications

- AV Receiver
- Audio Dock:Portable
- Blu-ray Player and Home Theater
- Embedded PC
- Personal Digital Assistant(PDA)
- Power:Telecom/Server AC/DC Supply:Single Controller:Analog and Digital
- Solid State Drive(SSD):Client and Enterprise
- Wireless Headset,Keyboard,and Mouse

General Description

The is a single, level translating 2-input Exclusive-OR gate . The low threshold inputs support 1.8 V input logic at VCC = 3.3 V and can be used in 1.8 V to 3.3 V level up translation.In addition, the 5 V tolerant input pins enable level down translation (3.3 V to 2.5 V output atVCC = 2.5 V).

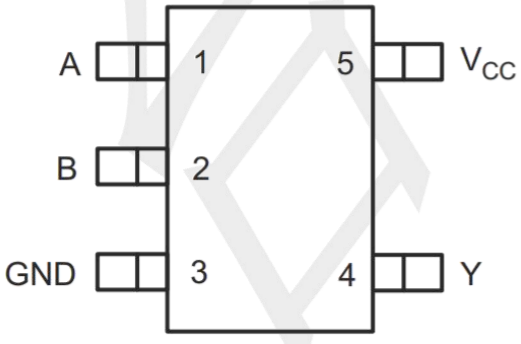
Logic Diagram



Ordering Information

ORDER NUMBER	PACKAGE DESCRIPTION	PACKAGE OPTION
SN74LV1T86DBVR-TP	SOT23-5	Tape and Reel,3000
SN74LV1T86DCKR-TP	SOT353	Tape and Reel,3000

Pin Configuratio



SOT23-5 / SOT353

Function Table

Input		Output
A	**B**	**Y**
L	L	L
L	H	H
H	L	H
H	H	L

Notes: H = HIGH voltage level; L = LOW voltage level.

Absolute Maximum Ratings

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-0.5	+7.0	V
V_I	input voltage		-0.5	+7.0	V
V_O	output voltage	output HIGH or LOW state	-0.5	V_{CC} + 0.5	V
		output in power-off state	-0.5	4.6	V
I_{IK}	input clamping current	V_I < 0 V	-20	--	mA
I_{OK}	output clamping current	V_O < 0 V or V_O > V_{CC}	--	±20	mA
I_O	output current	V_O = 0 V to V_{CC}	--	±25	mA
I_{CC}	supply current		--	50	mA
I_{GND}	ground current		-50	--	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	T_{amb} = -40 °C to +125 °C	--	250	mW

Notes:

1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2.The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

Recommended Operating Conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		1.6	5.0	5.5	V
V_I	input voltage		0	--	5.5	V
V_O	output voltage	output HIGH or LOW state	0	--	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 1.8 V to 5.0 V	--	--	20	ns/V

STATIC CHARACTERISTICS (T_A=25°C, unless otherwise specified)

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	Min	Max	
V_{IH}	HIGH-level input voltage	V_{CC} = 1.65 V to 1.8 V	0.94	--	1.0	--	1.0	--	V
		V_{CC} = 2.0 V	0.99	--	1.03	--	1.03	--	V
		V_{CC} = 2.25 V to 2.5 V	1.135	--	1.18	--	1.18	--	V
		V_{CC} = 2.75 V	1.21	--	1.23	--	1.23	--	V
		V_{CC} = 3.0 V to 3.3 V	1.35	--	1.37	--	1.37	--	V
		V_{CC} = 3.6 V	1.47	--	1.48	--	1.48	--	V
		V_{CC} = 4.5 V to 5.0 V	2.02	--	2.03	--	2.03	--	V
		V_{CC} = 5.5 V	2.10	--	2.11	--	2.11	--	V
V_{IL}	LOW-level input voltage	V_{CC} = 1.65 V to 2.0 V	--	0.58	--	0.55	--	0.55	V
		V_{CC} = 2.25 V to 2.75 V	--	0.75	--	0.71	--	0.71	V
		V_{CC} = 3.0 V to 3.6 V	--	0.80	--	0.65	--	0.65	V
		V_{CC} = 4.5 V to 5.5 V	--	0.80	--	0.80	--	0.80	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL};							
		V_{CC} = 1.65 V to 5.5 V; I_O = -20 μA	V_{CC} - 0.1	--	V_{CC} - 0.1	--	V_{CC} - 0.1	--	V
		V_{CC} = 1.65 V; I_O = -2 mA	1.28	--	1.21	--	1.21	--	V
		V_{CC} = 1.8 V; I_O = -2 mA	1.5	--	1.45	--	1.45	--	V
		V_{CC} = 2.3 V; I_O = -2.3 mA	2.0	--	2.0	--	2.0	--	V
		V_{CC} = 2.3 V; I_O = -3 mA	2.0	--	1.93	--	1.93	--	V
		V_{CC} = 2.5 V; I_O = -3 mA	2.25	--	2.15	--	2.15	--	V
		V_{CC} = 3.0 V; I_O = -3 mA	2.78	--	2.7	--	2.7	--	V
		V_{CC} = 3.0 V; I_O = -5.5 mA	2.6	--	2.49	--	2.49	--	V
		V_{CC} = 3.3 V; I_O = -5.5 mA	2.9	--	2.8	--	2.8	--	V
		V_{CC} = 4.5 V; I_O = -4 mA	4.2	--	4.1	--	4.1	--	V
		V_{CC} = 4.5 V; I_O = -8 mA	4.1	--	3.95	--	3.95	--	V
		V_{CC} = 5.0 V; I_O = -8 mA	4.6	--	4.5	--	4.5	--	V

STATIC CHARACTERISTICS (Cont.)

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	Min	Max	
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}							
		V_{CC} = 1.65 V to 5.5 V; I_O = 20 μA	--	0.1	--	0.1	--	0.1	V
		V_{CC} = 1.65 V; I_O = 2 mA	--	0.2	--	0.25	--	0.25	V
		V_{CC} = 2.3 V; I_O = 2.3 mA	--	0.1	--	0.15	--	0.15	V
		V_{CC} = 2.3 V; I_O = 3 mA	--	0.15	--	0.2	--	0.2	V
		V_{CC} = 3.0 V; I_O = 3 mA	--	0.1	--	0.15	--	0.15	V
		V_{CC} = 3.0 V; I_O = 5.5 mA	--	0.2	--	0.252	--	0.252	V
		V_{CC} = 4.5 V; I_O = 4 mA	--	0.15	--	0.2	--	0.2	V
		V_{CC} = 4.5 V; I_O = 8 mA	--	0.3	--	0.35	--	0.35	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 0 V to 5.5 V	--	±0.1	--	±1	--	±1	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 1.8 V, 2.5 V, 3.3 V, 5.0 V	--	1	--	10	--	10	μA
ΔI_{CC}	additional supply current	per input pin; V_{CC} = 1.8 V; V_I = 0.3 V or 1.1 V; I_O = 0 A; other pins at V_{CC} or GND	--	10	--	10	--	10	μA
		per input pin; V_{CC} = 5.5 V; V_I = 0.3 V or 3.4 V; I_O = 0 A; other pins at V_{CC} or GND	--	1.35	--	1.5	--	1.5	mA

DYNAMIC CHARACTERISTICS (T_A=25°C, unless otherwise specified)

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t_{pd}	propagation delay	A, B to Y; see								
		V_{CC} = 1.8 V; C_L = 15 pF	--	7.3	11.7	--	13.3	--	14.3	ns
		V_{CC} = 1.8 V; C_L = 30 pF	--	8.4	12.9	--	14.7	--	15.8	ns
		V_{CC} = 2.5 V; C_L = 15 pF	--	5.1	7.7	--	8.8	--	9.5	ns
		V_{CC} = 2.5 V; C_L = 30 pF	--	5.8	8.6	--	9.8	--	10.6	ns
		V_{CC} = 3.3 V; C_L = 15 pF	--	4.2	6.2	--	7.0	--	7.6	ns
		V_{CC} = 3.3 V; C_L = 30 pF	--	4.8	6.9	--	7.8	--	8.4	ns
		V_{CC} = 5.0 V; C_L = 15 pF	--	3.4	4.6	--	5.1	--	5.4	ns
		V_{CC} = 5.0 V; C_L = 30 pF	--	3.9	5.1	--	5.8	--	6.1	ns
C_I	input capacitance	V_I = V_{CC} or GND; V_{CC} = 3.3 V	--	1.5	10	--	10	--	10	pF
C_O	output capacitance	V_O = V_{CC} or GND; V_{CC} = 3.3 V	--	2.5	--	--	--	--	---	pF
C_{PD}	power dissipation capacitance	per buffer; V_I = GND to V_{CC}; C_L = 30 pF; f = 10 MHz								
		V_{CC} = 1.8 V	--	4.2	--	--	--	--	--	pF
		V_{CC} = 2.5 V	--	5.6	--	--	--	--	--	pF
		V_{CC} = 3.3 V	--	7.4	--	--	--	--	--	pF
		V_{CC} = 5.0 V	--	11.5	--	--	--	--	--	pF

[1]tpd is the same as tPLH and tPHL.

[2]CPD is used to determine the dynamic power dissipation (PD in μW). PD = CPD × VCC 2 × fi × N + ∑(CL × VCC 2 × fo) where:

fi = input frequency in MHz; fo = output frequency in MHz;

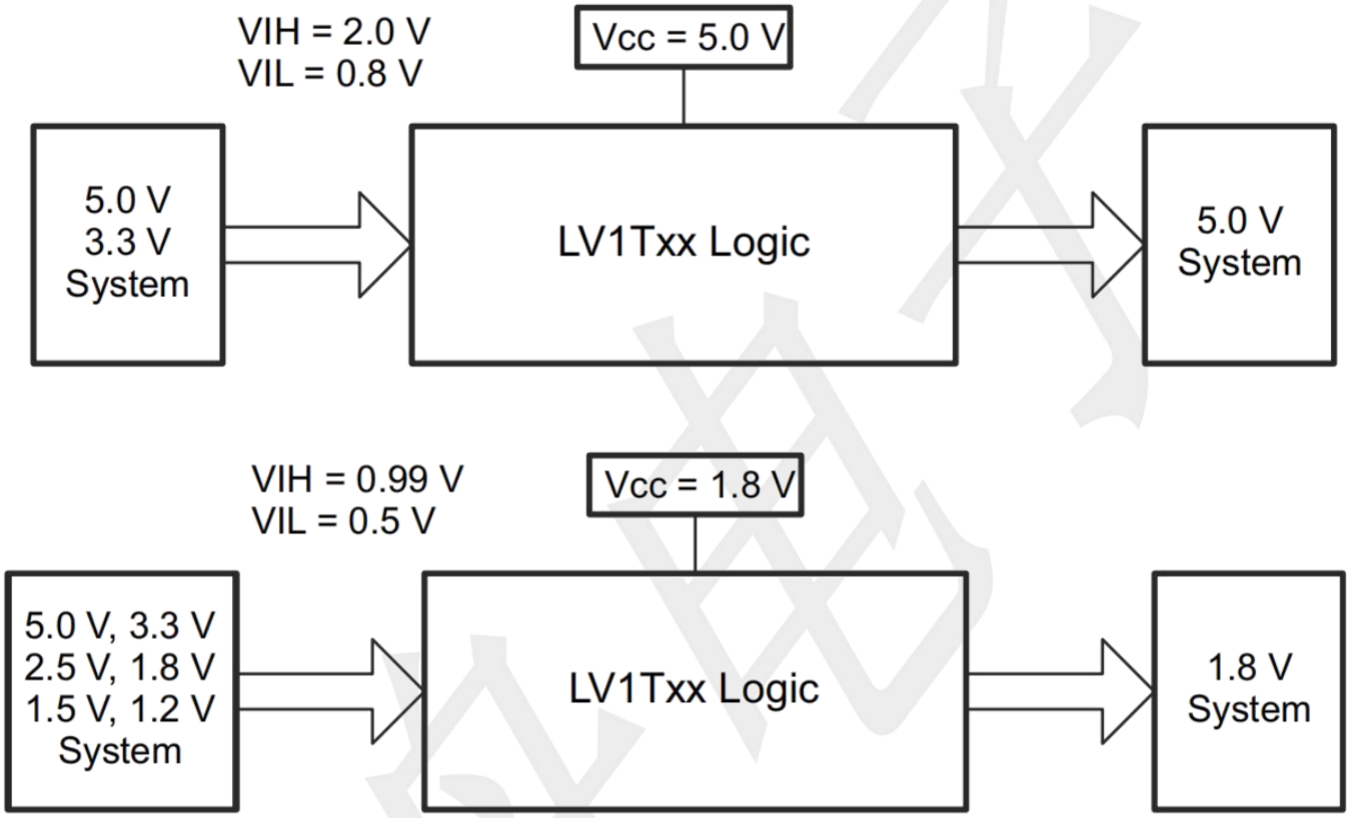
CL = output load capacitance in pF; VCC = supply voltage in V;

N = number of inputs switching;

∑(CL × VCC 2 × fo) = sum of the outputs.

LVxT Up and Down Translation Example

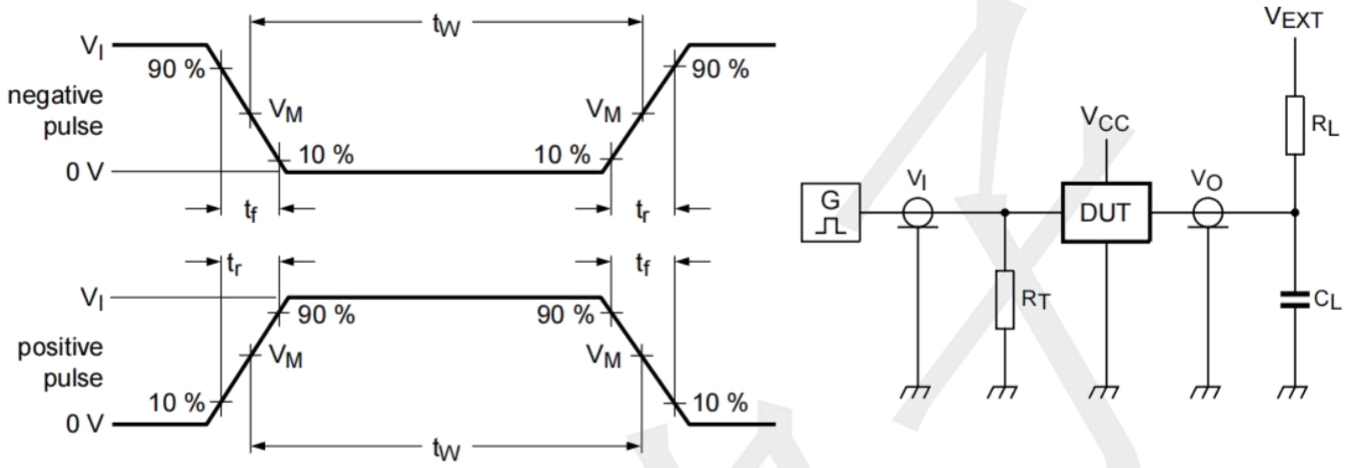
3.3-V V_{CC} – Inputs from 1.8 V and 2.5 V
5.0-V V_{CC} – Inputs from 2.5 V and 3.3 V



Test data

Supply voltage	Input			Load		V_{EXT}		
V_{CC}	V_I	$\Delta t/\Delta V$	f_{max}	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
1.8 V	V_{CC}	≤ 1.0 ns/V	15 MHz	15 pF, 30 pF	1MΩ	GND	GND	V_{CC}
2.5 V	V_{CC}	≤ 1.0 ns/V	25 MHz	15 pF, 30 pF	1MΩ	GND	GND	V_{CC}
3.3 V	3 V	≤ 1.0 ns/V	50 MHz	15 pF, 30 pF	1MΩ	GND	GND	V_{CC}
5.0 V	3 V	≤ 1.0 ns/V	50 MHz	15 pF, 30 pF	1MΩ	GND	GND	V_{CC}

TEST CIRCUIT AND WAVEFORMS



Test circuit for measuring switching times

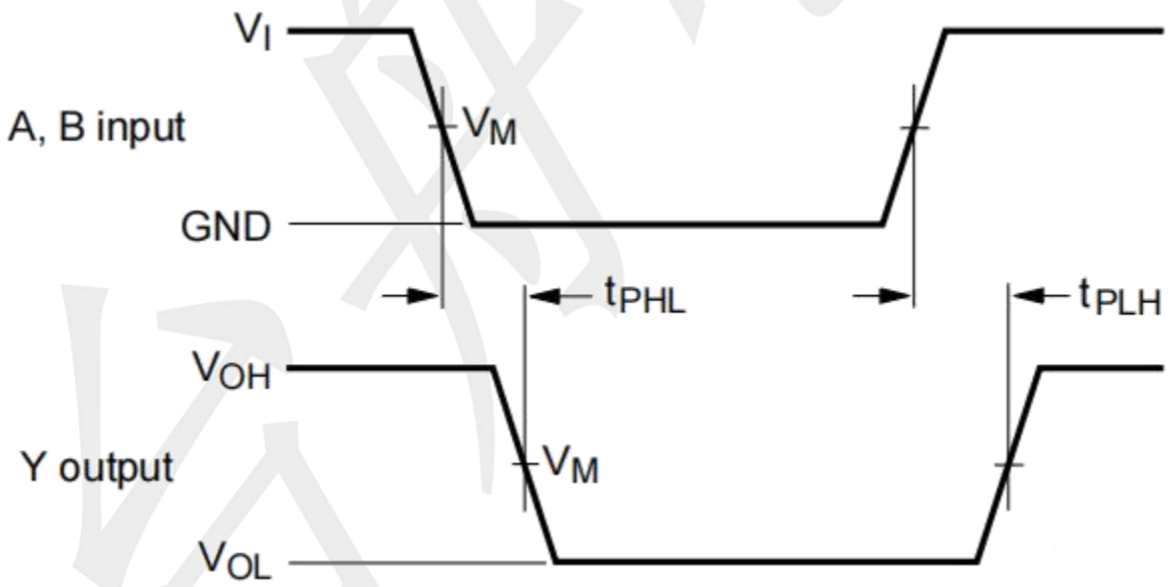
Definitions test circuit:

R_T = Termination resistance should be equal to output impedance Z_o 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.

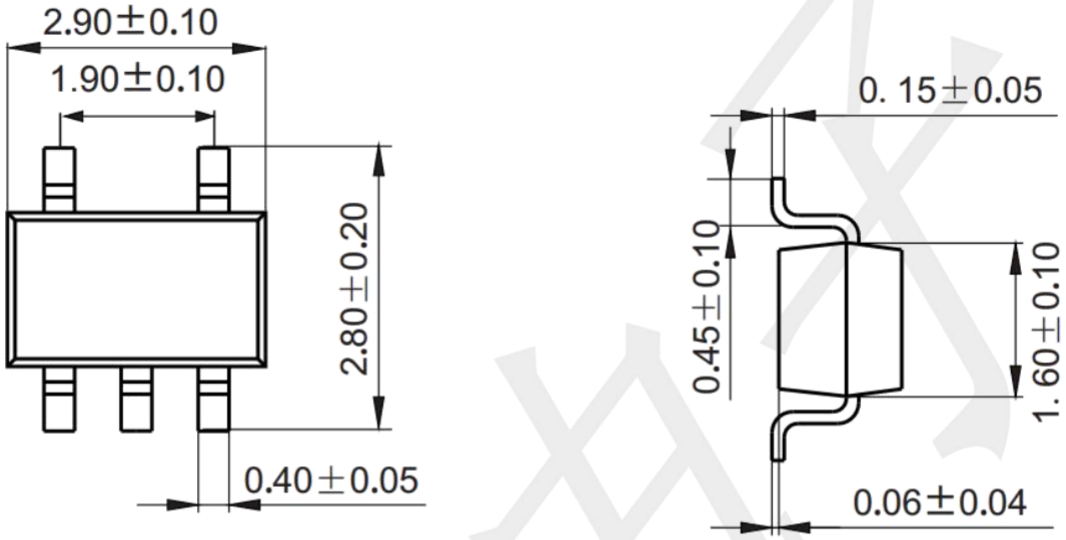


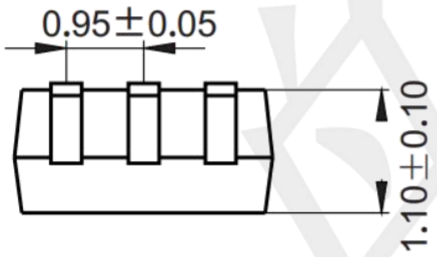
The input A to output Y propagation delays

VOL and VOH are typical voltage output levels that occur with the output load.

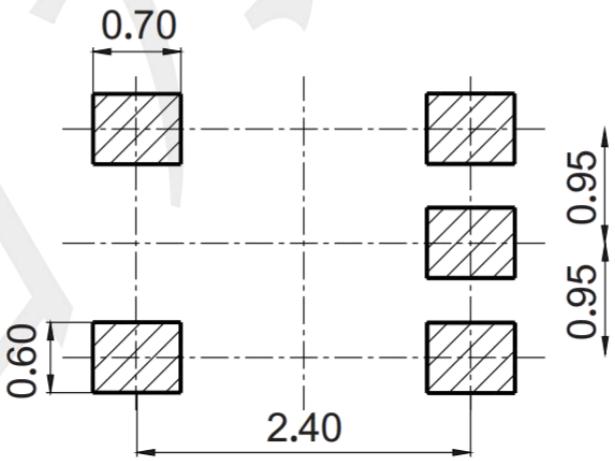
Package information (Unit: mm)

SOT23-5



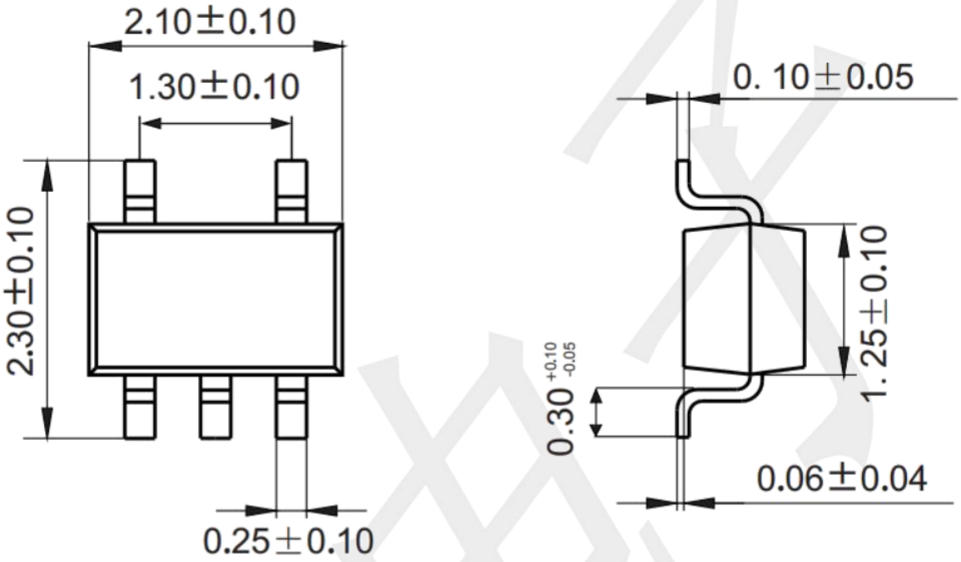


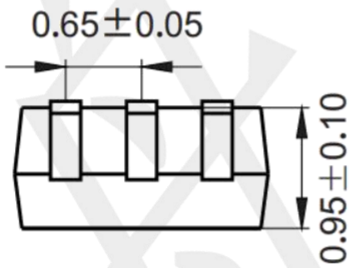
Mounting Pad Layout (unit: mm)



Package information (Unit: mm)

SOT353





Mounting Pad Layout (unit: mm)