TP74LVC1G74 Series

Single D-type flip-flop with set and reset;positive edge trigger

Features

- Supports 5V VCC operation
- Inputs accept voltages to 5.5V
- Max t_{PD} of 7.9ns at 3.3V
- Low Power Consumption, I_Q=10μA (Max.)
- I_{OFF} Supports Live Insertion, Partial Power Down Mode, and Back Drive Protection
- ESD Protection Exceeds JESD 22
  -2000-V Human-Body Model (A114-A)
  -200-V Machine Model (A115-A)
  -1000-V Charged-Device Model (C101)

General Description

This single positive-edge-triggered D-type flip-flop is designed for 1.65V to 5.5V VCC operation.

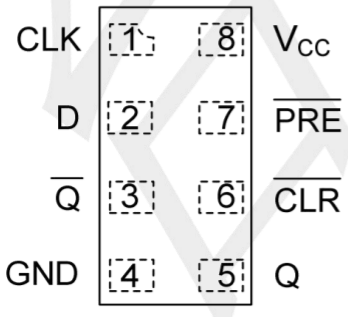
A low level at the preset($\overline{PRE}$) or clear ($\overline{CLR}$) input sets or resets the outputs, regardless of the levels of the other inputs .When $\overline{PRE}$ and $\overline{CLR}$ are inactive(high),data at the data (D) input meeting the setup time requirements is transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not related directly to the rise time of the clock pulse. Following the hold-time interval, data at the D input can be changed without affecting the levels at the outputs.

Ordering Information

ORDER NUMBER	PACKAGE DESCRIPTION	PACKAGE OPTION
TP74LVC1G74S8	SOP-8	Tape and Reel,3000
TP74LVC1G74M8	MSOP-8	Tape and Reel,3000
TP74LVC1G74V8	VSSOP-8	Tape and Reel,3000
TP74LVC1G74D8	DFN2010-8	Tape and Reel,5000

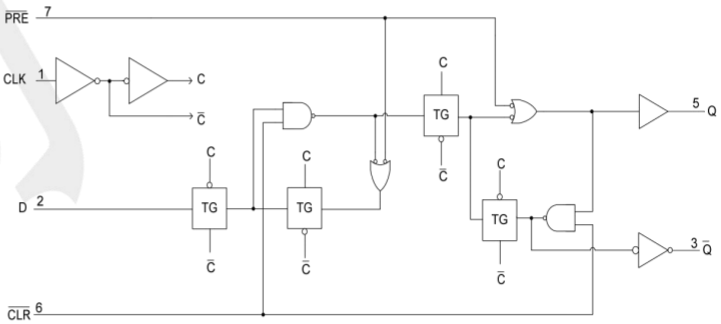
Pin Configuratio

SOP-8 / MSOP-8 / VSSOP-8



DFN2010-8

Logic Diagram



Function Table

INPUTS				OUTPUT	
$\overline{PRE}$	$\overline{CLR}$	CLK	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H*	H*
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q0	$\overline{Q}_0$

* This configuration is unstable, it does not persist when $\overline{PRE}$ or $\overline{CLR}$ returns to high level.

Absolute Maximum Ratings (unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNIT
Supply Voltage	V_{CC}		-0.5 ~ 6.5	V
Input Voltage	V_{IN}		-0.5 ~ 6.5	V
Voltage Range Applied to Any Output In The High-Impedance or Power-Off State	V_{OUT}		-0.5 ~ 6.5	V
Voltage Range Applied to Any Output In The High or Low State	V_{OUT}		-0.5 ~ V_{CC}+0.5	V
Input Clamp Current	I_{IK}	$V_{IN}<0$	-50	mA
Output Clamp Current	I_{OK}	$V_{OUT}<0$	-50	mA
Output Current	I_{OUT}		±50	mA
V_{CC} or GND Current	I_{CC}		±100	mA
Storage Temperature	T_{STG}		-65 ~ +150	°C

Note: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

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	V_{CC}		1.65	--	5.5	V
Input Voltage	V_{IN}		0	--	5.5	V
Output Voltage	V_{OUT}		0	--	V_{CC}	V
Input Transition Rise or Fall Rate	Δt/Δv	V_{CC}=1.8V±0.15V,2.5V±0.2V	--	--	20	ns/V
		V_{CC}=3.3V±0.3V	--	--	10	ns/V
		V_{CC}=5V±0.5V	--	--	5	ns/V
Operating Temperature	T_A		-40	--	+125	°C

Note: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

OPERATING CHARACTERISTICS (f=10MHz, TA =25°C , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Capacitance	C_{IN}	V_{CC} =3.3V, V_{IN}=V_{CC} or GND	--	5	--	pF
Power Dissipation Capacitance	C_{PD}	V_{CC}=1.8V	--	35	--	pF
		V_{CC}=2.5V	--	35	--	pF
		V_{CC}=3.3V	--	37	--	pF
		V_{CC}=5.0V	--	40	--	pF

STATIC CHARACTERISTICS (Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	T_A=25°C			T_A=-40°C~+125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
High-level Input Voltage	V_{IH}	V_{CC}=1.65V to 1.95V	0.65× V_{CC}	--	--	0.65× V_{CC}	--	--	V
		V_{CC}=2.3V to 2.7V	1.7	--	--	1.7	--	--	V
		V_{CC}=3V to 3.6V	2	--	--	2	--	--	V
		V_{CC}=4.5V to 5.5V	0.7× V_{CC}	--	--	0.7× V_{CC}	--	--	V
Low-level Input Voltage	V_{IL}	V_{CC}=1.65V to 1.95V	--	--	0.35× V_{CC}	--	--	0.35× V_{CC}	V
		V_{CC}=2.3V to 2.7V	--	--	0.7	--	--	0.7	V
		V_{CC}=3V to 3.6V	--	--	0.8	--	--	0.8	V
		V_{CC}=4.5V to 5.5V	--	--	0.3× V_{CC}	--	--	0.3× V_{CC}	V
High-level Output Current	I_{OH}	V_{CC}=1.65V	--	--	-4	--	--	-4	mA
		V_{CC}=2.3V	--	--	-8	--	--	-8	mA
		V_{CC}=3V	--	--	-16	--	--	-16	mA
			--	--	-24	--	--	-24	mA
		V_{CC}=4.5V	--	--	-32	--	--	-32	mA
Low-level Output Current	I_{OL}	V_{CC}=1.65V	--	--	4	--	--	4	mA
		V_{CC}=2.3V	--	--	8	--	--	8	mA
		V_{CC}=3V	--	--	16	--	--	16	mA
			--	--	24	--	--	24	mA
		V_{CC}=4.5V	--	--	32	--	--	32	mA

STATIC CHARACTERISTICS(Cont.) (Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	T_A=25°C			T_A=-40°C~+125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
High-Level Output Voltage	V_{OH}	VCC=1.65V to 5.5V, I_{OH}=-100μA	V_{CC}-0.1	--	--	V_{CC}-0.1	--	--	V
		V_{CC}=1.65V, I_{OH}=-4mA	1.2	--	--	0.95	--	--	V
		V_{CC}=2.3V, I_{OH}=-8mA	1.9	--	--	1.7	--	--	V
		V_{CC}=3V, I_{OH}=-16mA	2.4	--	--	2.1	--	--	V
		V_{CC}=3V, I_{OH}=-24mA	2.3	--	--	2	--	--	V
		V_{CC}=4.5V, I_{OH}=-32mA	3.8	--	--	3.4	--	--	V
Low-Level Output Voltage	V_{OL}	VCC=1.65V to 5.5V, IOL=100uA	--	--	0.1	--	--	0.1	V
		V_{CC}=1.65V, I_{OL}=4mA	--	--	0.45	--	--	0.7	V
		V_{CC}=2.3V, I_{OL}=8mA	--	--	0.3	--	--	0.45	V
		V_{CC}=3V, I_{OL}=16mA	--	--	0.4	--	--	0.6	V
		V_{CC}=3V, I_{OL}=24mA	--	--	0.55	--	--	0.8	V
		V_{CC}=4.5V, I_{OL}=32mA	--	--	0.55	--	--	0.8	V
Input Leakage Current	$I_{I(LEAK)}$	V_{CC}=0V ~ 5.5V, V_{IN}=5.5V or GND	--	--	±5	--	--	±5	μA
Power OFF Leakage Current	I_{off}	V_{CC}=0V, V_{IN} or V_{OUT}=5.5V	--	--	±10	--	--	±10	μA
Quiescent Supply Current	I_Q	V_{CC}=1.65V to 5.5V, V_{IN}=5.5V or GND I_{OUT}=0	--	--	10	--	--	10	μA
Additional Quiescent Supply Current Per Input Pin	ΔI_Q	V_{CC}=3V to 5.5V, One input at V_{CC}-0.6V, Other inputs at V_{CC} or GND	--	--	500	--	--	500	μA

Note: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

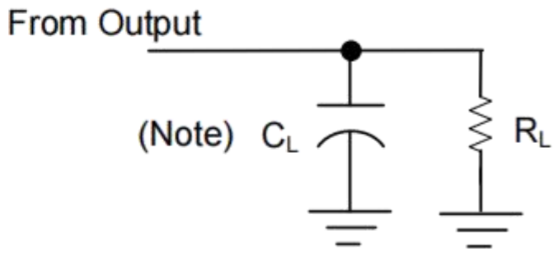
TIMING REQUIREMENTS

PARAMETER	SYMBOL	TEST CONDITIONS		T_A=25°C			T_A=-40°C~+125°C			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
Clock Frequency	f_{clock}	V_{CC}=1.8V		--	--	60	--	--	55	MHz
		V_{CC}=2.5V		--	--	105	--	--	85	MHz
		V_{CC}=3.3V		--	--	120	--	--	95	MHz
		V_{CC}=5.0V		--	--	160	--	--	120	MHz
Pulse Duration	t_w	V_{CC}=1.8V	CLK	6.2	--	--	6.2	--	--	ns
			PRE or CLR Low	6.2	--	--	6.2	--	--	ns
		V_{CC}=2.5V	CLK	2.7	--	--	2.7	--	--	ns
			PRE or CLR Low	2.7	--	--	2.7	--	--	ns
		V_{CC}=3.3V	CLK	2.7	--	--	2.7	--	--	ns
			PRE or CLR Low	2.7	--	--	2.7	--	--	ns
		V_{CC}=5.0V	PRE or CLR Low	2	--	--	2	--	--	ns
				2	--	--	2	--	--	ns
Setup Time Before CLK↑ From Data to PRE or CLR Inactive	t_{su}	V_{CC}=1.8V	CLK	2.9	--	--	2.9	--	--	ns
			PRE or CLR Low	1.9	--	--	1.9	--	--	ns
		V_{CC}=2.5V	CLK	1.7	--	--	1.7	--	--	ns
			PRE or CLR Low	1.4	--	--	1.4	--	--	ns
		V_{CC}=3.3V	CLK	1.3	--	--	1.3	--	--	ns
			PRE or CLR Low	1.2	--	--	1.2	--	--	ns
		V_{CC}=5.0V	CLK	1.1	--	--	1.1	--	--	ns
			PRE or CLR Low	1	--	--	1	--	--	ns
Hold time, Data After CLK↑	t_h	V_{CC}=1.8V		1.5	--	--	1.5	--	--	ns
		V_{CC}=2.5V		1	--	--	1	--	--	ns
		V_{CC}=3.3V		1	--	--	1	--	--	ns
		V_{CC}=5.0V		1	--	--	1	--	--	ns

SWITCHING CHARACTERISTICS (See Fig. 1 and Fig. 2 for test circuit and waveforms.)

PARAMETER	SYMBOL	TEST CONDITIONS	T_A=25°C			T_A=-40°C~+125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Maximum Frequency Response	f_{Max}	V_{CC}=1.8V	60	--	--	55	--	--	MHz
		V_{CC}=2.5V	105	--	--	85	--	--	MHz
		V_{CC}=3.3V	120	--	--	95	--	--	MHz
		V_{CC}=5.0V	160	--	--	120	--	--	MHz
Propagation Delay From Input (CLK) to Output(Q)	t_{PLH}/t_{PHL}	V_{CC}=1.8V	1.5	--	15.4	1.5	--	17.4	ns
		V_{CC}=2.5V	1.0	--	9.1	1.0	--	11.1	ns
		V_{CC}=3.3V	1.0	--	7.9	1.0	--	9.9	ns
		V_{CC}=5.0V	1.0	--	6.1	1.0	--	8.1	ns
Propagation Delay From Input (CLK) to Output(Q)	t_{PLH}/t_{PHL}	V_{CC}=1.8V	1.5	--	16.4	1.5	--	18.4	ns
		V_{CC}=2.5V	1.0	--	9.7	1.0	--	11.7	ns
		V_{CC}=3.3V	1.0	--	8.2	1.0	--	10.2	ns
		V_{CC}=5.0V	1.0	--	6.4	1.0	--	8.1	ns
Propagation Delay From Input (PRE or CLR) to Output (Q or Q)	t_{PLH}/t_{PHL}	V_{CC}=1.8V	1.5	--	14.9	1.5	--	16.9	ns
		V_{CC}=2.5V	1.0	--	9	1.0	--	11	ns
		V_{CC}=3.3V	1.0	--	7.9	1.0	--	9.9	ns
		V_{CC}=5.0V	1.0	--	6.1	1.0	--	8.1	ns

TEST CIRCUIT AND WAVEFORMS



TEST CIRCUIT

Note: C_L includes probe and jig capacitance.

Fig. 1 Load circuitry for switching times.

V_{CC}	Inputs		V_M	C_L	R_L
	V_{IN}	t_R, t_F			
1.8V	V_{CC}	≤2ns	$V_{CC}/2$	30pF	1KΩ
2.5V	V_{CC}	≤2ns	$V_{CC}/2$	30pF	500Ω
3.3V	3V	≤2.5ns	1.5V	50pF	500Ω
5V	V_{CC}	≤2.5ns	$V_{CC}/2$	50pF	500Ω

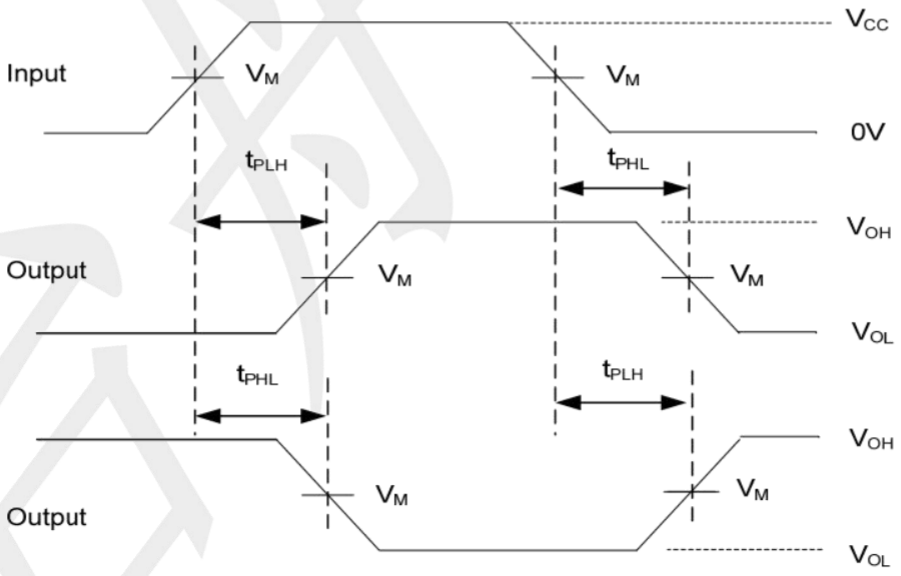
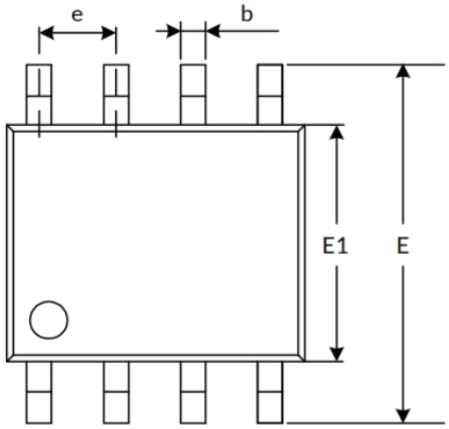
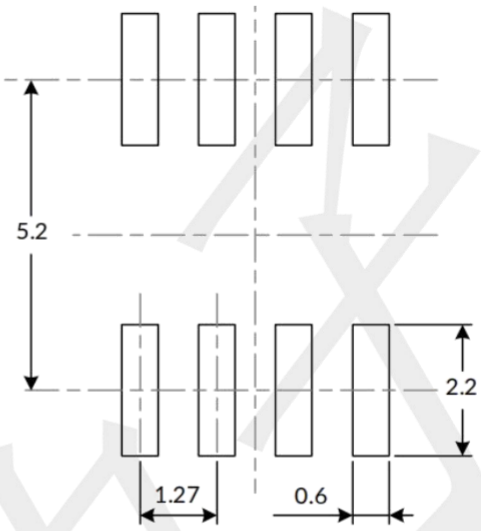


Fig. 2 Propagation delay times

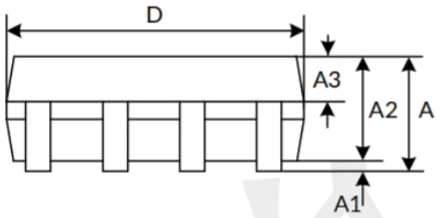
Package informantion

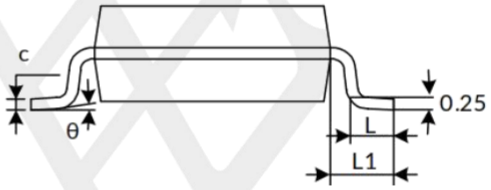
SOP-8





RECOMMENDED LAND PATTERN (Unit: mm)

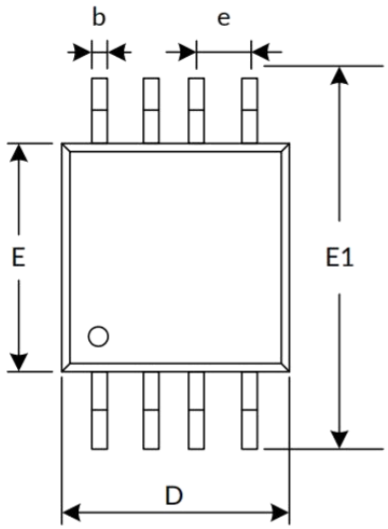


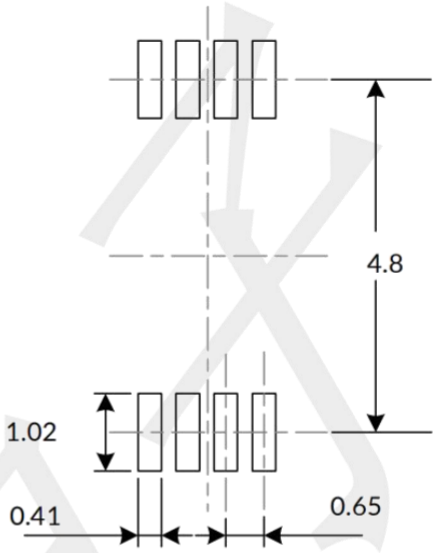


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.750		0.069
A1	0.100	0.250	0.004	0.010
A2	1.250	1.500	0.049	0.059
A3	0.600	0.700	0.024	0.028
b	0.360	0.490	0.014	0.019
c	0.190	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
E1	3.800	4.000	0.150	0.157
E	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.000	0.016	0.039
L1	1.050 (REF)		0.041 (REF)	
θ	0°	8°	0°	8°

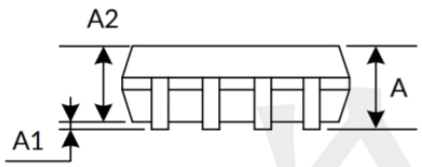
Package informantion

MSOP-8





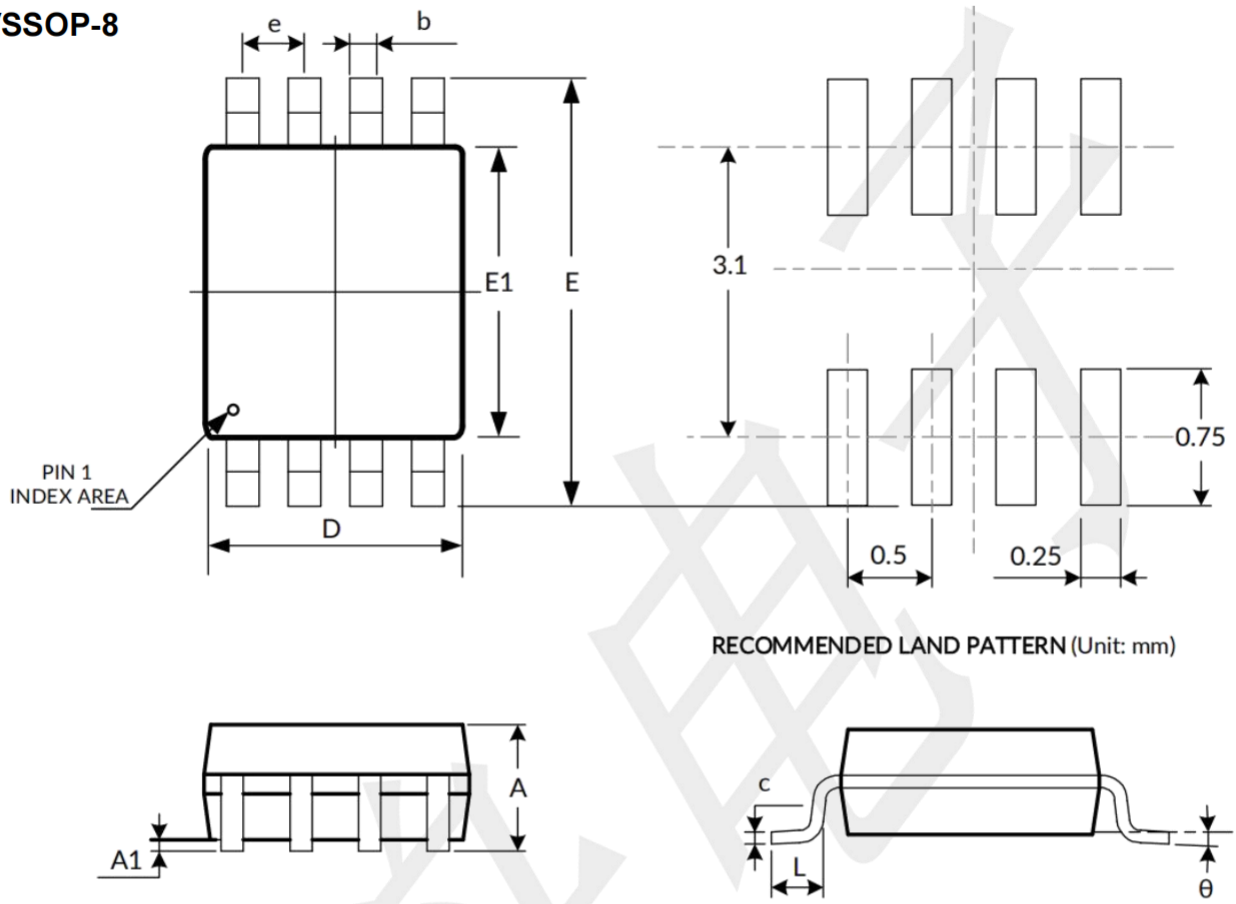
RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.650(BSC)		0.026(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

Package informantion

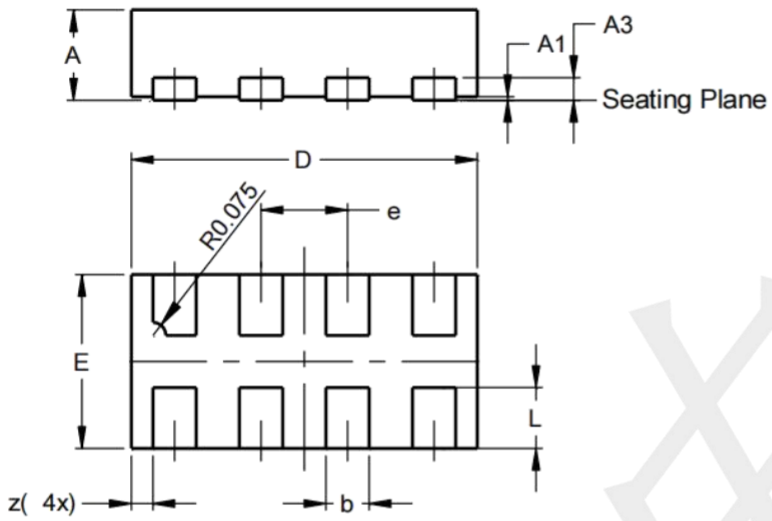
VSSOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.600	0.900	0.024	0.085
A1	0.000	0.100	0.000	0.004
b	0.170	0.250	0.007	0.010
c	0.100	0.200	0.004	0.008
D	1.900	2.100	0.075	0.083
e	0.500 (BSC)		0.020 (BSC)	
E	3.000	3.200	0.118	0.126
E1	2.200	2.400	0.087	0.095
L	0.200	0.350	0.008	0.014
θ	0°	6°	0°	6°

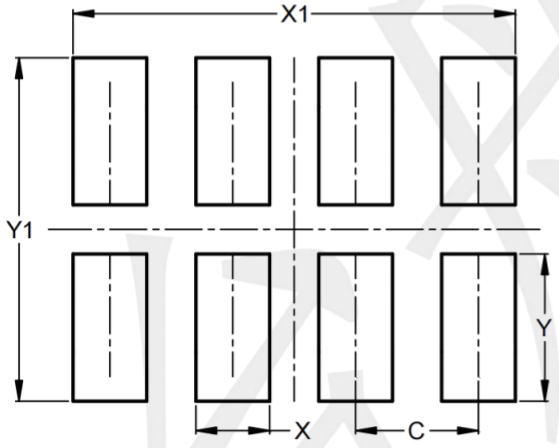
Package informantion

DFN2010-8



DFN2010-8			
Dim	Min	Max	Typ
A	--	0.60	--
A1	0.00	0.05	0.02
A3	--	--	0.13
b	0.20	0.30	0.25
D	1.850	2.15	2.00
E	0.85	1.15	1.00
e	--	--	0.50
L	0.30	0.40	0.35
z	--	--	0.125
All Dimensions in mm			

Suggested Pad Layout



Dimensions	Value (in mm)
C	0.500
X	0.300
X1	1.800
Y	0.600
Y1	1.400