Single 2-Input AND Gate with Open Drain Output

General Description

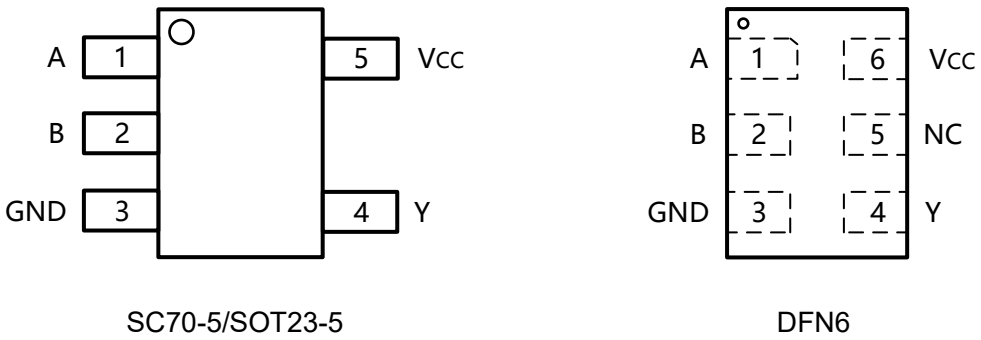
The ET74LVC1G09 is a single 2-input AND gate with open-drain output. It performs the Boolean function Y=A * B or Y = $\overline{\overline{A}+\overline{B}}$ in positive logic. For digital operation this device must have an external pull-up resistor to establish a logic High-level. This device has power-down protective circuit, preventing device destruction when it is powered down.

Features

- Designed for 1.65V to 5.5V V_{CC} Operation
- Over-voltage Tolerant Inputs Accept Voltages to 5.5V
- 32mAOutput Sink Capability
- Near-zero Static Supply Current Substantially Reduces System Power Requirements
- These Devices are Pb-Free and RoHS Compliant
- ESD Protection Complies with JESD22 Standard
  -- HBM: ±4000V Pass (JEDEC JS-001)
  -- CDM: ±1000V Pass (JEDEC JS-002)
- Latch-up Performance Exceeds ±100mA per JEDEC JESD78F
- Part No. and Package Information

Part No.	Package	Packing Option	MSL
ET74LVC1G09	SC70-5 (1.3mm × 2.1mm)	Tape and Reel, 3K/Reel	1
ET74LVC1G09T	SOT23-5 (1.6mm × 2.9mm)	Tape and Reel, 3K/Reel	3
ET74LVC1G09Y	DFN6 (1.0mm × 1.5mm)	Tape and Reel, 3K/Reel	1

Pin Configuration



SC70-5/SOT23-5 DFN6

Figure1. Pin Configuration

Pin Function

SC70-5/SOT23-5

Pin No.	Pin Name	Function
1	A	Input A
2	B	Input B
3	GND	Ground
4	Y	Output
5	VCC	Supply Voltage

DFN6

Pin No.	Pin Name	Function
1	A	Input A
2	B	Input B
3	GND	Ground
4	Y	Output
5	NC	No Connect
6	VCC	Supply Voltage

Block Diagram

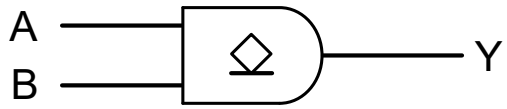


Figure2. Logic Symbol

Functional Table

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

Absolute Maximum Ratings

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage		-0.5 to 6.5	V
V_I	DC Input Voltage (1)		-0.5 to 6.5	V
V_O	DC Output Voltage Output in Higher or Low State		-0.5 to 6.5	V
I_{IK}	DC Input Diode Current, V_I < GND		-50	mA
I_{OK}	DC Output Diode Current, V_O < GND		-50	mA
I_O	DC Output Sink Current		±50	mA
I_{CC}	DC Supply Current per Supply Pin		100	mA
I_{GND}	DC Ground Current per Supply Pin		-100	mA
T_{STG}	Storage Temperature Range		-65 to 150	°C
V_{ESD}	ESD Classification	Human Body Model (2)	±4000	V
		Charged Device Model (3)	±1000	
I_{LU}	Max Latch Up Current Above V_{CC} and GND at 125°C (4)		±100	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Note1: I_O absolute maximum rating must be observed.

Note2: HBM tested per JEDEC JS-001;

Note3: CDM tested per JEDEC JS-002;

Note4: Latch up Current Maximum Rating tested per JEDEC JESD78F.

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	SC70-5	Thermal Characteristics, Thermal Resistance, Junction-to-Air	280	°C/W
	SOT23-5		180	
	DFN6		440	
P_D	SC70-5	Power Dissipation in Still Air at 85°C	230	mW
	SOT23-5		360	
	DFN6		150	

Recommended Operating Conditions

Symbol	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage Operating		1.65	5.5	V
V_I	DC Input Voltage		0	V_{CC}	V
V_O	DC Output Voltage (High or Low State)		0	V_{CC}	V
T_A	Operating Temperature Range		-40	125	°C
Δt/ΔV	Input Transition Rise or Fall Rate	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

Electrical Characteristics

DC Electrical Characteristics

Symbol	Parameter	Condition	V_{CC}(V)	T_A = 25°C			-40°C ≤ T_A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	High-Level Input Voltage		1.65~1.95	0.75V_{CC}			0.75V_{CC}		V
			2.3~2.7	0.7V_{CC}			0.7V_{CC}		
			3.0~3.6	0.7V_{CC}			0.7V_{CC}		
			4.5~5.5	0.7V_{CC}			0.7V_{CC}		
V_{IL}	Low-Level Input Voltage		1.65~1.95			0.25V_{CC}		0.25V_{CC}	V
			2.3~2.7			0.25V_{CC}		0.25V_{CC}	
			3.0~3.6			0.25V_{CC}		0.25V_{CC}	
			4.5~5.5			0.3V_{CC}		0.3V_{CC}	
V_{OL}	Low-Level Output Voltage	I_{OL} = 100uA	1.65~5.5		0.0	0.1		0.1	V
		I_{OL} = 3mA	1.65		0.08	0.24		0.24	
		I_{OL} = 8mA	2.3		0.20	0.3		0.3	
		I_{OL} = 16mA	3.0		0.28	0.4		0.4	
		I_{OL} = 24mA	3.0		0.38	0.55		0.55	
		I_{OL} = 32mA	4.5		0.42	0.55		0.55	
I_I	Input Leakage Current	V_I = 5.5V or GND	0~5.5		±0.1			±1.0	μA
ΔI_{CC}	Additional Quiescent Supply Current Per Input Pin	One Input at V_{CC} - 0.6V, Other Inputs at V_{CC} or GND	3~5.5			500		500	μA
I_{OFF}	Power Off Leakage Current	V_I or V_O = 5.5V	0			±1.0		±10	μA
I_{CC}	Quiescent Supply Current	V_I = 5.5V or GND, I_O = 0mA	5.5			1.0		10	μA
C_I	Input Capacitance	V_I = V_{CC} or GND	3.3		3.5				pF
C_O	Output Capacitance	V_I = V_{CC} or GND	3.3		4.5				pF

AC Electrical Characteristics

Symbol	Parameter	Condition	V_{CC}(V)	T_A = 25°C			-40°C ≤ T_A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	
t_{PZL} t_{PLZ}	Propagation delay from input (A or B) to output (Y), see Figure3 and Figure4	R_L = 1kΩ C_L = 30pF	1.8V ± 0.15V	3.0	8.0	11	3.0	15.0	ns
		R_L = 500Ω C_L = 30pF	2.5V ± 0.2V	1.0	5.0	7.5	1.0	11.0	
		R_L = 500Ω C_L = 50pF	3.3V ± 0.3V	1.5	4.5	7.5	1.5	10.0	
		R_L = 500Ω C_L = 50pF	5V ± 0.5V	0.8	3.2	6.0	0.8	8.5	

Capacitance Characteristics

Symbol	Parameter	Condition	Typ	Unit
C_{PD}	Power Dissipation Capacitance (5)	10MHz, V_{CC} = 1.8V	3	pF
		10MHz, V_{CC} = 2.5V	3	pF
		10MHz, V_{CC} = 3.3V	4	pF
		10MHz, V_{CC} = 5V	6	pF

Note5: C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ where:

f_i = input frequency in MHz;

f_o = output frequency in MHz;

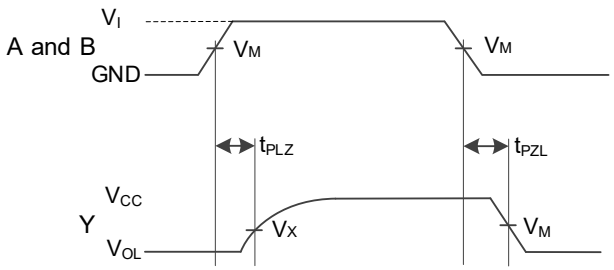
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

Test Waveform



Measurement points are given in Table1.

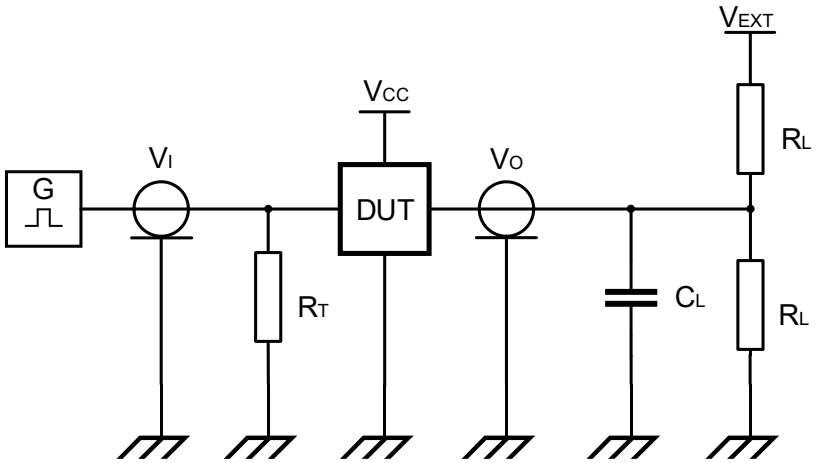
V_{OL} is typical output voltage levels that occur with the output load.

Figure3. Enable and Disable Time

Table1.Measurement Points

Supply Voltage	Input	Output	
V_{CC}	V_M	V_M	Vx
1.65V to 1.95V	0.5 × V_{CC}	0.5 × V_{CC}	V_{OL} + 0.15V
2.3V to 2.7V	0.5 × V_{CC}	0.5 × V_{CC}	V_{OL} + 0.15V
2.7V	1.5V	1.5V	V_{OL} + 0.3V
3.0V to 3.6V	1.5V	1.5V	V_{OL} + 0.3V
4.5V to 5.5V	0.5 × V_{CC}	0.5 × V_{CC}	V_{OL} + 0.3V

Test Circuit



Measurement points are given in Table2.

Definitions test circuit:

R_L = Load resistance;

C_L = Load capacitance including jig and probe capacitance;

R_T = Termination resistance should be equal to output impedance Z_O of the pulse generator;

V_{EXT} = External voltage for measuring switching times.

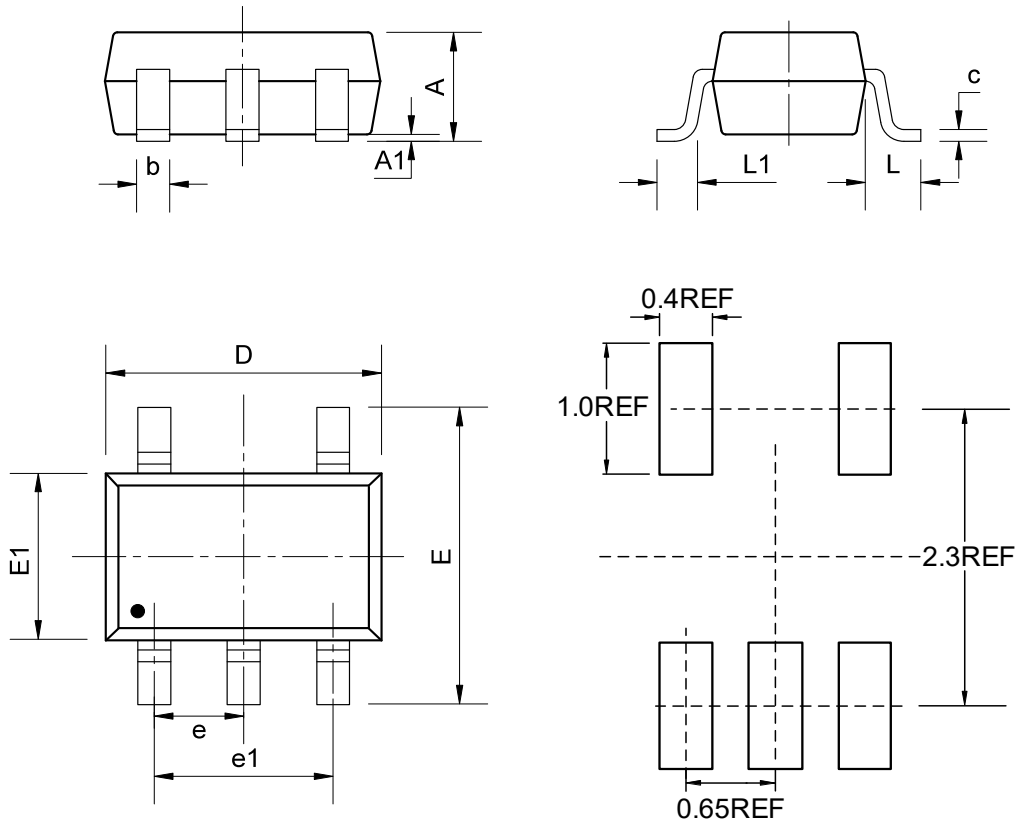
Figure4. Test Circuit for Measuring Switching Times

Table2.Test Data

Supply Voltage	Input		Load		V_{EXT}
V_{CC}	V_I	$t_r = t_f$	C_L	R_L	t_{PZL}, t_{PLZ}
1.65V to 1.95V	V_{CC}	3.0ns	30pF	1kΩ	2 × V_{CC}
2.3V to 2.7V	V_{CC}	3.0ns	30pF	500Ω	2 × V_{CC}
2.7V	2.7V	3.0ns	50pF	500Ω	6V
3.0V to 3.6V	2.7V	3.0ns	50pF	500Ω	6V
4.5V to 5.5V	V_{CC}	3.0ns	50pF	500Ω	2 × V_{CC}

Package Dimension

SC70-5 (1.3mm × 2.1mm)

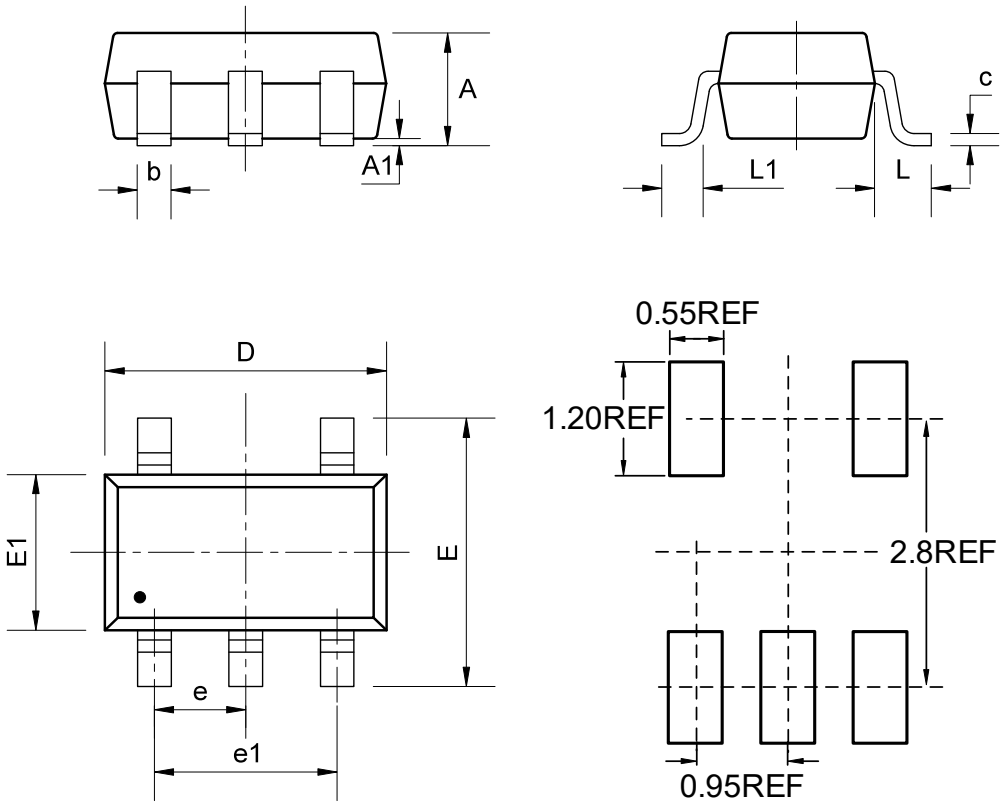


COMMON DIMENSIONS

(Unit: mm)

SYMBOL	MIN	NOM	MAX
A	-	-	1.10
A1	0.00	-	0.15
b	0.15	-	0.35
c	0.08	-	0.20
D	2.00	2.10	2.30
e	0.65BSC		
e1	1.30BSC		
E	2.15	2.30	2.50
E1	1.15	1.30	1.45
L	0.50REF		
L1	0.33REF		

SOT23-5 (1.6mm × 2.9mm)

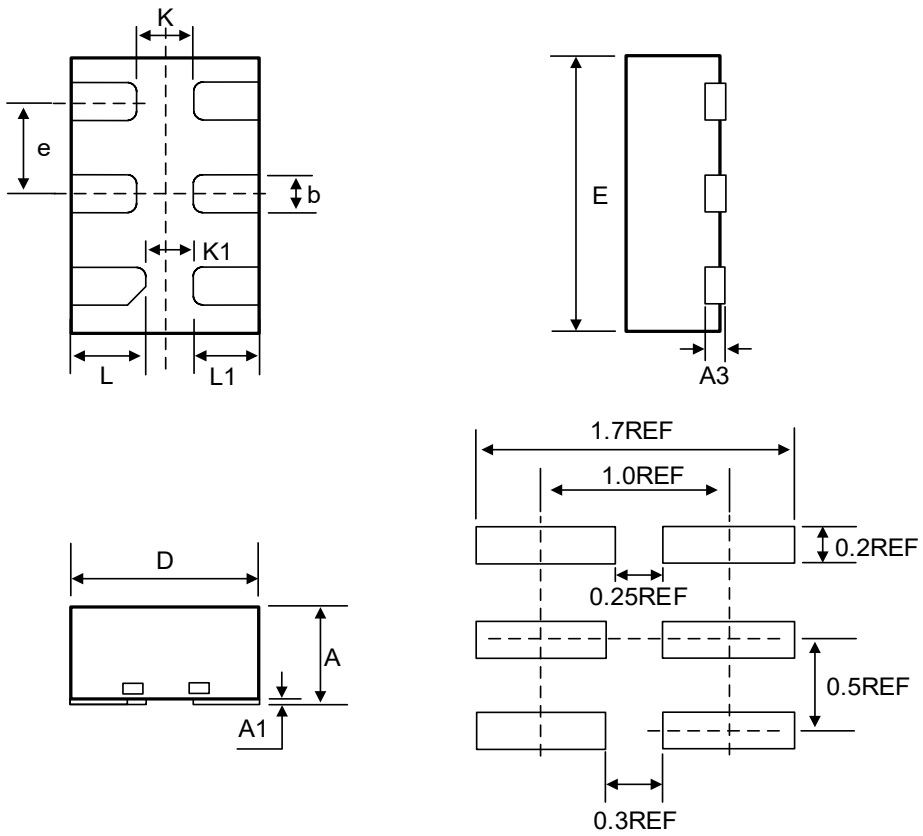


COMMON DIMENSIONS

(Unit: mm)

SYMBOL	MIN	NOM	MAX
A	-	-	1.45
A1	0.00	-	0.15
b	0.28	0.35	0.50
c	0.08	0.15	0.22
D	2.75	2.9	3.05
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
E	2.60	2.80	3.00
E1	1.45	1.6	1.75
L	0.60REF		
L1	0.30	0.45	0.60

DFN6 (1.0mm × 1.5mm)



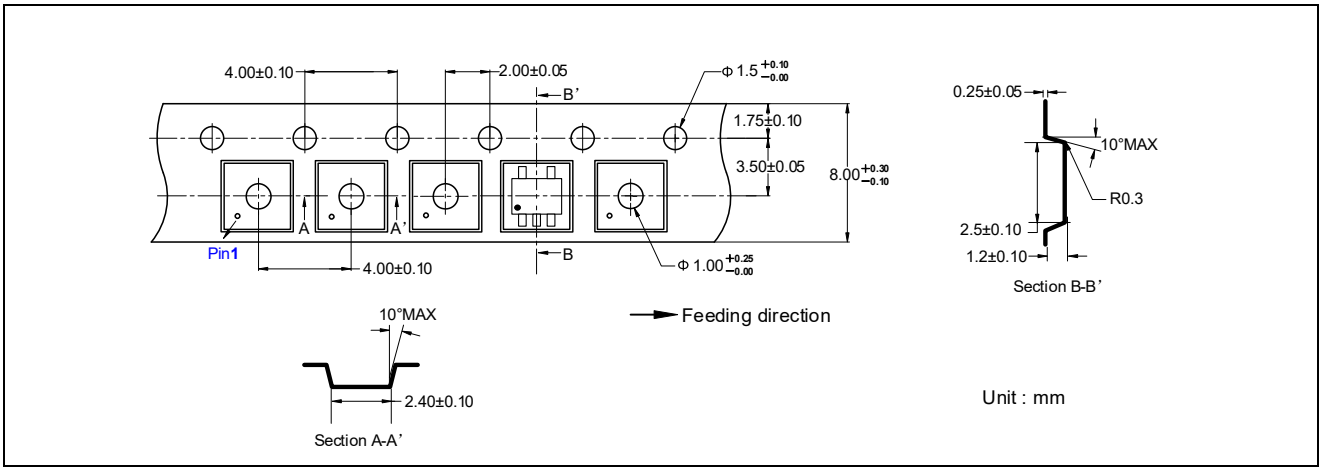
COMMON DIMENSIONS

(Unit: mm)

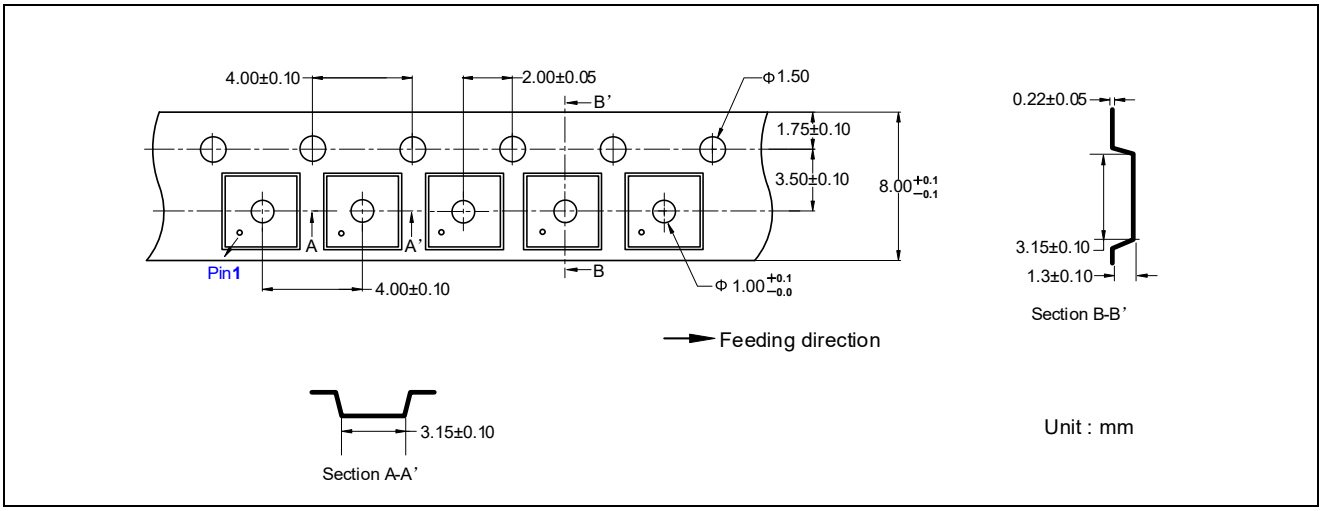
SYMBOL	MIN	NOM	MAX
A	0.50	--	0.60
A1	0.00	0.02	0.05
A3		0.10REF	
b	0.15	0.20	0.25
D	0.90	1.00	1.10
E	1.40	1.50	1.60
e		0.50BSC	
K		0.30REF	
K1		0.25REF	
L	0.35	0.40	0.45
L1	0.30	0.35	0.40

Tape Information

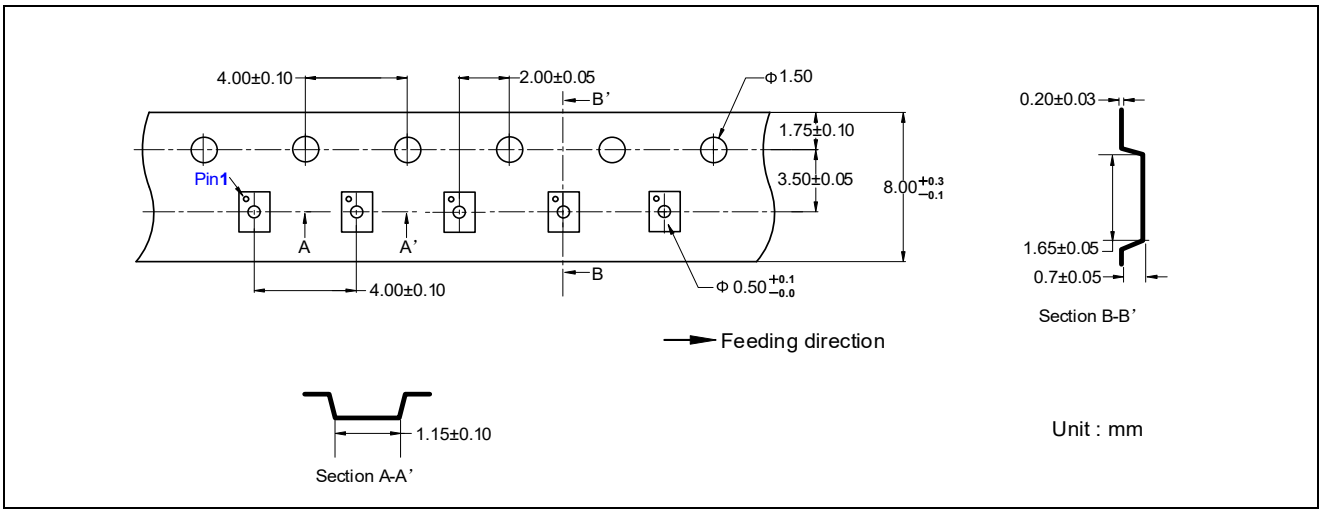
SC70-5 (1.3mm × 2.1mm)



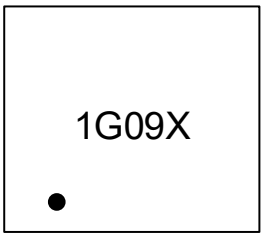
SOT23-5 (1.6mm × 2.9mm)



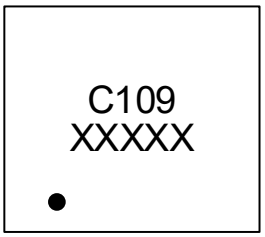
DFN6 (1.0mm × 1.5mm)



Marking Information



ET74LVC1G09
1G09 = Part Number
X = Tracking Number



ET74LVC1G09T
C109 = Part Number
XXXXX = Tracking Number

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2024-03-15	Preliminary Version	Wang anran	Tu guozhu	Liu jiaying
0.1	2025-05-27	Add Packing Option	Yang xiaoxu	Yang xiaoxu	Liu jiaying
0.2	2025-08-25	Update Format	Yang xiaoxu	Yang xiaoxu	Liu jiaying
1.0	2026-04-03	Update Format, Add Marking	Xu tao	Yang xiao xu	Liu jiaying