36V General-purpose Low power Comparators

General Description

The ET8903/ET8901 are dual, quad channel comparators with open-drain output that feature 250μA quiescent current, a wide range of supply voltages from 2.0V to 36V with rail-to-rail inputs helps to implement in a wide variety of applications where require critical response time, power-sensitive, high-voltage. The output of the ET8903/ET8901 could be connected to other open-collector outputs to achieve wired-AND relationship. All input and output pins can tolerate a continuous short-circuit fault condition to either rail.

The ET8903(dual) is offered in SOP8 package, The ET8901(quad) is offered in TSSOP14 and SOP14 packages, All devices are rated over -40°C to +125°C extended industrial temperature range.

Features

- 2.0V to 36V Single Supply or ±1.0V to ±18V Dual Supply
- Low Quiescent Current: 250μA@V_S = 5V
- Common-mode Input Voltage Range Includes Ground
- Differential Input Voltage Range Equal to Power Supply
- -40°C to 125°C Operation Temperature
- Available in packages: SOP8,TSSOP14,SOP14
- Output Compatible with TTL,MOS,CMOS Logic Levels

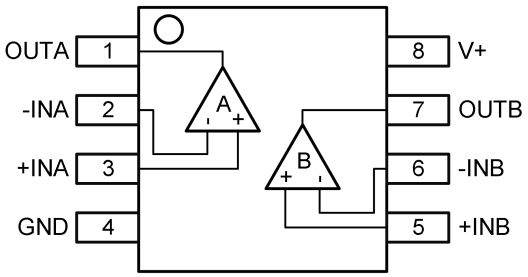
Applications

- Industrial Application
- Solar Inverter
- White Goods
- Battery Management System
- Medical Equipment

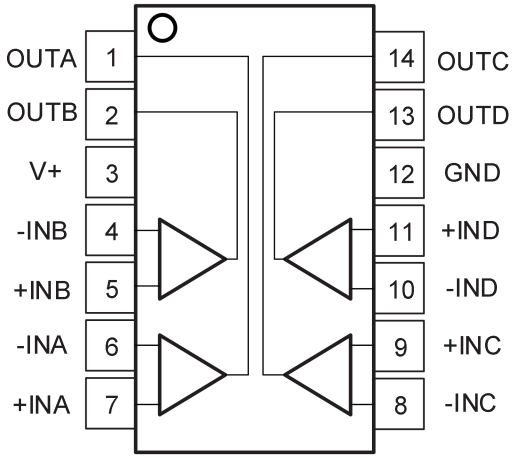
Device Information

Part No.	Package	Packing Option	MSL
ET8903M	SOP8	Tape and Reel , 4K	3
ET8901V	TSSOP14	Tape and Reel , 4K	3
ET8901M	SOP14	Tape and Reel , 4K	3

Pin Configuration



ET8903M



ET8901V/ET8901M

Top View

Pin Function

Pin Number ET8903M	Symbol	Descriptions
1,7	OUT	Output
4	GND	Ground
3,5	+IN	Non-inverting input
2,6	-IN	Inverting input
8	V+	Positive power supply

Pin Number ET8901V/ET8901M	Symbol	Descriptions
1,2,13,14	OUT	Output
3	V+	Positive power supply
4,6,8,10	-IN	Inverting input
5,7,9,11	+IN	Non-inverting input
12	GND	Ground

Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are only stress ratings, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions are not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

Symbol	Parameter	Value	Unit
V_S	Supply Voltage,V+ to GND	36	V
V_{ID}	Differential input voltage	±36	V
V_{IN}	Input voltage range (either input)	-0.3 to 38	V
I_{IN}	Input Current	-50	mA
V_O	Output Voltage	36	V
I_O	Output Current	20	mA
$T_{J(MAX)}$	Maximum Junction Temperature	+150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
V_{ESD}	Human body model (HBM), per ESDA/JEDEC JS-001-2017(1)	±1500	V
	Charged device model (CDM), per ESDA/JEDEC JS-002-2018(2)	±750	V

Note1: JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500V HBM is possible if necessary precautions are taken.
Note2: JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250V CDM is possible if necessary precautions are taken.

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	SOP8	Thermal Characteristics, Thermal Resistance, Junction-to-Air	125	°C/W
	TSSOP14		112	°C/W
	SOP14		115	°C/W

Electrical Characteristics

At T_A = 25°C and V_S = 5V,unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
OFFSET VOLTAGE						
V_{OS}	Input Offset Voltage	V_S = 5 V to 36V, T_A = 25°C		±1	±7	mV
		V_S = 5 V to 36V, T_A = -40°C to +125°C		±2	±10	mV
INPUT BIAS CURRENT						
I_B	Input Bias Current(3)	$I_{IN(+)}$-$I_{IN(-)}$, V_{CM}=0 V with Output in Linear range		22		nA
I_{OS}	Input Offset Current(3)	$I_{IN(+)}$-$I_{IN(-)}$, V_{CM}=0 V		1		nA
INPUT VOLTAGE						
V_{CM}	Common-mode Voltage Range	V_S = 30V(4)	-0.3		V_S -1.4	V
OPEN-LOOP GAIN						
A_{VD}	Large-signal Differential-voltage Amplification(3)	V_S = 15V, V_O = 1.4V to 11.4V, R_L ≥ 15 kΩ to V_S, T_A = 25°C		25	100	V/mV
OUTPUT						
V_{OL}	Low Output Voltage Swing	V_{ID} = -1 V, I_{OL} = 4 mA		150	370	mV
I_{OH}	High-level Output Current	V_{ID} = 1 V, V_{OH} = 5 V		0.1		nA
I_{OL}	Low-level Output Current	V_{ID} = -1 V, V_{OL} = 1.5 V	6	16		mA
POWER SUPPLY						
V_S	Specified Voltage		2.0		36	V
I_{CC}	Supply Current (per comparator)	V_O = 2.5 V, No load, V_S = 5 V		0.25	0.5	mA
		V_O = 2.5 V, No load, V_S = MAX		0.3	0.6	mA
SWITCHING CHARACTERISTICS						
T_{PD}	Propagation delay time high-to-low	V_{OD} = 20 mV, C_L = 15 pF		420		ns
		V_{OD} = 100 mV, C_L = 15 pF		250		ns
T_{FALL}	Fall time	V_{OD} = 20 mV, C_L = 15 pF		40		ns
		V_{OD} = 100 mV, C_L = 15 pF		40		ns

Note3: Guaranteed by design.

Note4: The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V_S -1.4 V at 25°C, but either or both inputs can go to 36 V without damage, independent of the magnitude of V_S.

Functional Description

Operating Voltage

The ET8903 / ET8901 family of 36V General-purpose low power comparators is fully specified and ensured for operation from 2.0 to 36V and offers an excellent speed-to-power combination with propagation delay of 1us and a quiescent supply current of 250μA. The open-drain output allows the user to configure the output logic low voltage (V_{OL}) and allows the comparator to be used in AND functionality.

Maximizing performance through proper layout

To achieve the maximum performance of the extremely high input impedance and low offset voltage of the ET8903 / ET8901 devices, care is needed in laying out the circuit board. The PCB surface must remain clean and free of moisture to avoid leakage currents between adjacent traces. Surface coating of the circuit board reduces surface moisture and provides a humidity barrier，reducing parasitic resistance on the board. The use of guard rings around the comparator inputs further reduces leakage currents. Figure 1 shows proper guard ring configuration and the top view of a surface-mount layout. The guard ring does not need to be a specific width, but it should form a continuous loop around both input. By setting the guard ring voltage equal to the voltage at the non-inverting input, parasitic capacitance is minimized as well. For further reduction of leakage currents, components can be mounted to the PCB using Teflon stand off insulators.

Other potential sources of offset error are thermo-electric voltages on the circuit board. This voltage, also called Seebeck voltage, occurs at the junction of two dissimilar metals and is proportional to the temperature of the junction. The most common metallic junctions on a circuit board are solder-to-board trace and solder-tocomponent lead. If the temperature of the PCB at one end of the component is different from the temperature at the other end, the resulting Seebeck voltages are not equal, resulting in a thermal voltage error. This thermocouple error can be reduced by using dummy components to match the thermoelectric error source.

Placing the dummy component as close as possible to its partner ensures both Seebeck voltages are equal, thus canceling the thermocouple error. Maintaining a constant ambient temperature on the circuit board further reduces this error. The use of a ground plane helps distribute heat throughout the board and reduces EMI noise Pickup.

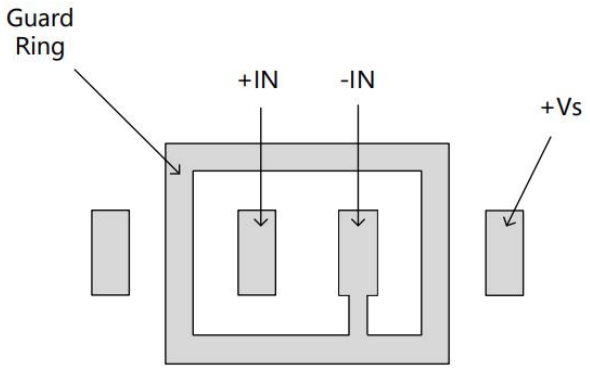
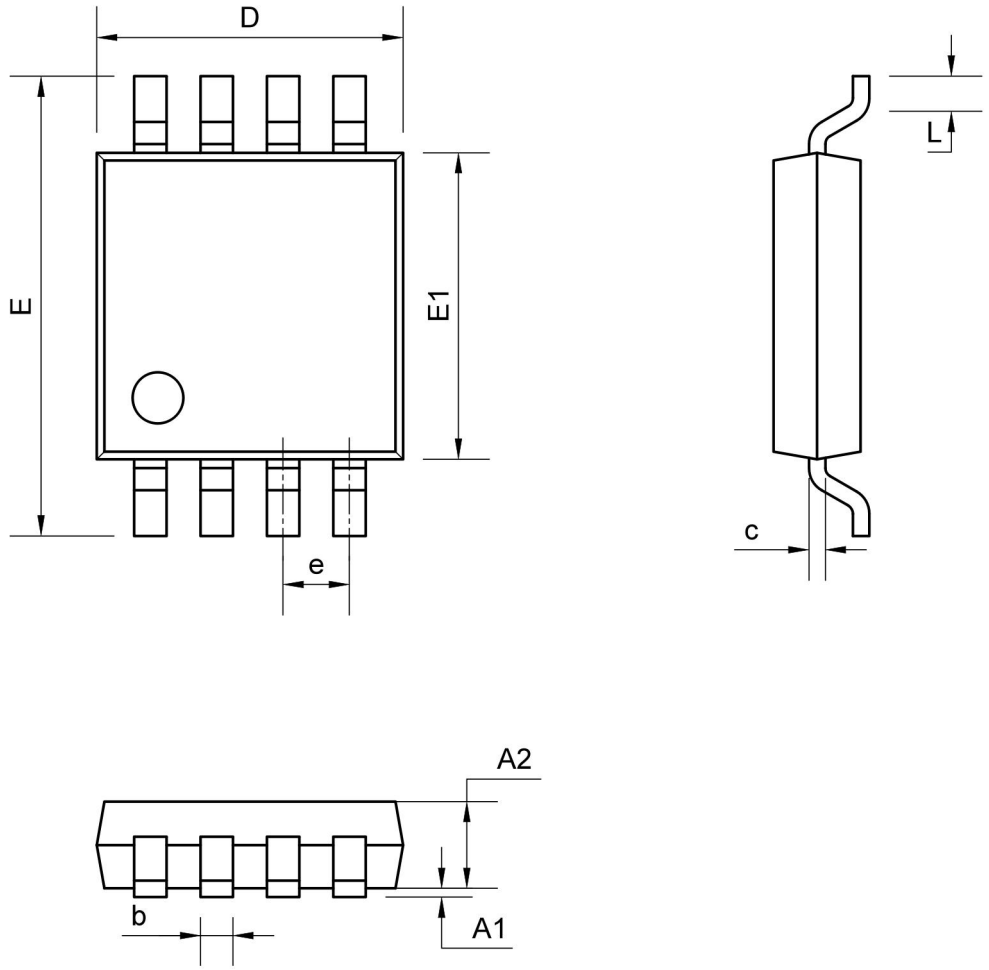


Figure 1. Use a guard ring around sensitive pins

Package Dimension

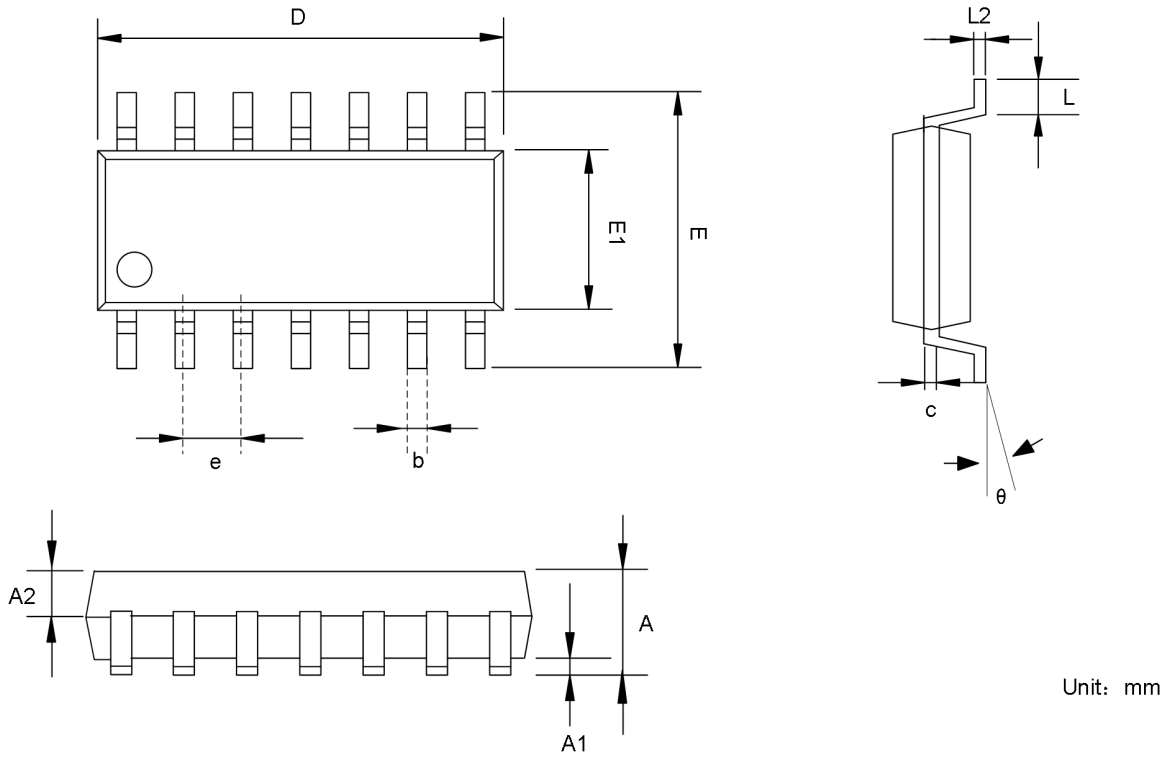
SOP8



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A1	0.15	—	0.22
A2	1.40	1.55	1.50
b		0.40 BSC	
c	0.20	—	0.25
D	4.85	4.90	4.95
E	5.99	6.04	6.09
E1	3.85	3.90	3.95
e		1.27 BSC	
L	0.50	0.60	0.70

SOP14

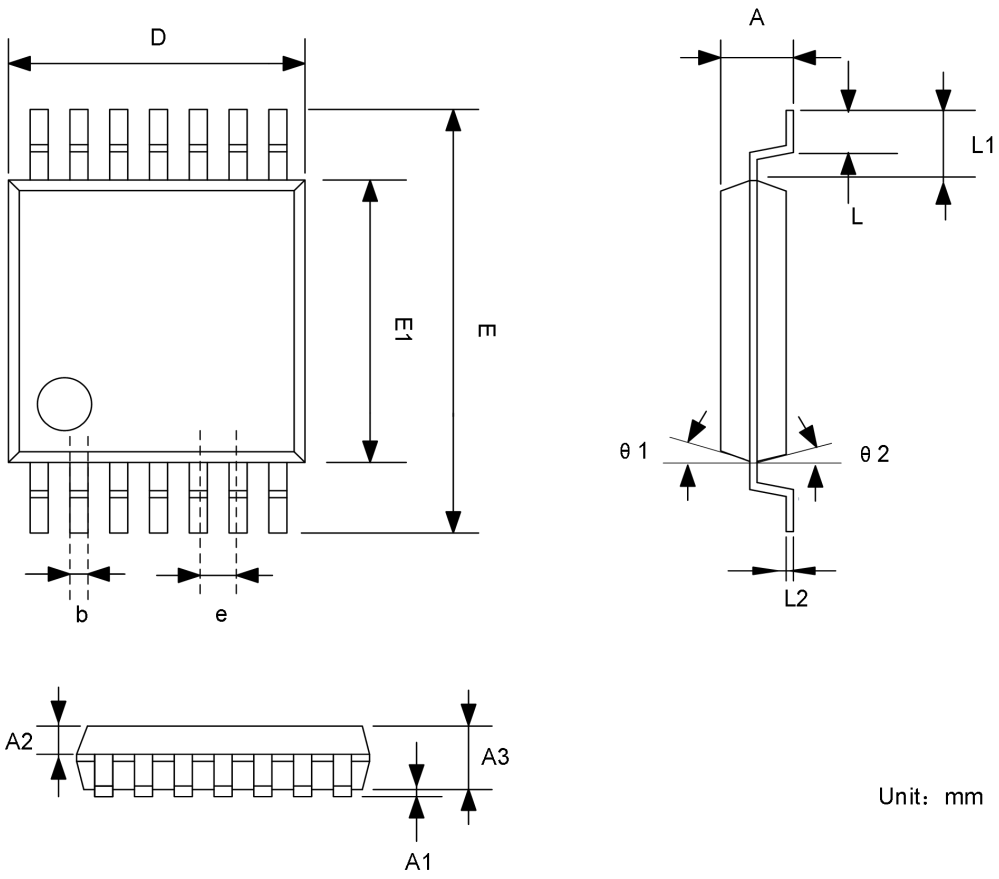


Unit：mm

COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	MAX
A	1.4	1.5
A1	0.1	0.2
A2	0.65	0.75
e	1.27 BSC	
c	0.203 BSC	
D	8.48	8.53
E	6.05	6.25
E1	3.75	3.85
b	0.406 BSC	
L	0.4	0.7
L2	0.203 BSC	
θ	0°	8°

TSSOP14



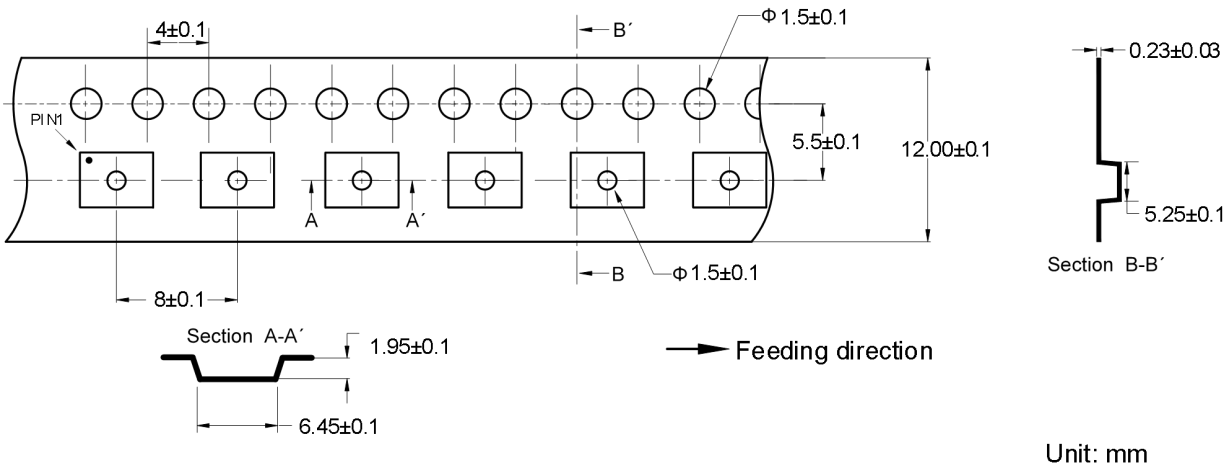
Unit：mm

COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

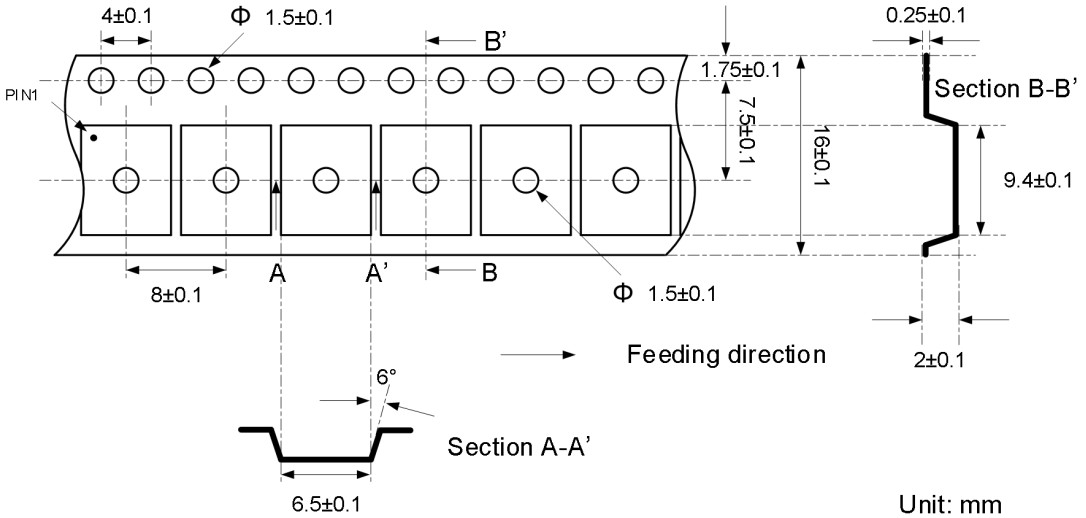
SYMBOL	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	0.08	0.11
A2	0.39	0.44	0.49
A3	0.95	1.00	1.05
e		0.65 BSC	
D	4.95	5.00	5.05
E	6.35	6.40	6.45
E1	4.35	4.40	4.45
b	0.20	—	0.29
L	0.55	0.60	0.65
L1		1.00 BSC	
L2	0.13	—	0.18
θ1	—	13°	—
θ2	—	12°	—

Tape Information

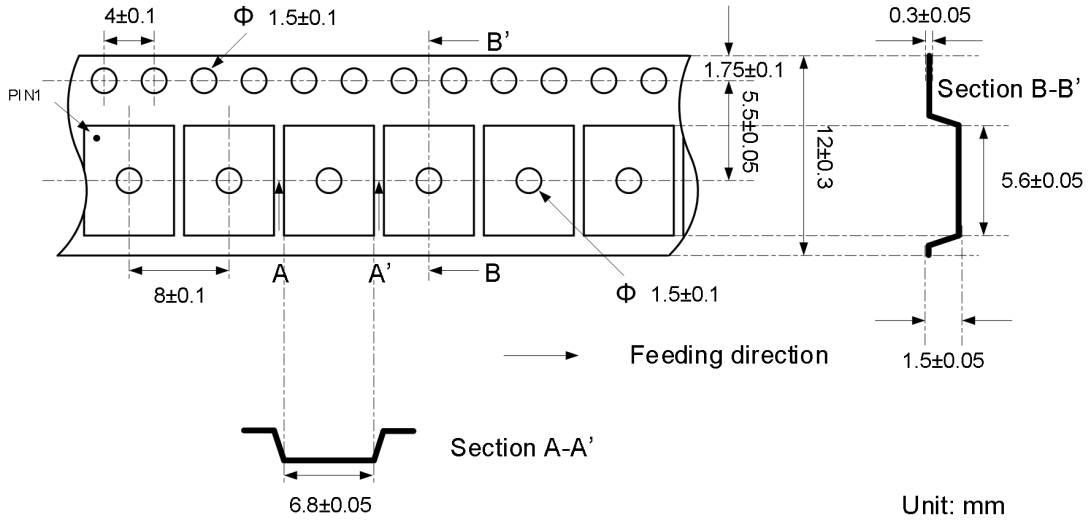
SOP8



SOP14

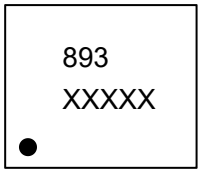


TSSOP14


4±0.1
Φ 1.5±0.1
B'
0.3±0.05
1.75±0.1
5.5±0.05
12±0.3
Section B-B'
5.6±0.05
PIN1
8±0.1
A
A'
B
Φ 1.5±0.1
Feeding direction
1.5±0.05
Section A-A'
6.8±0.05
Unit: mm

Marking Information

ET8903M

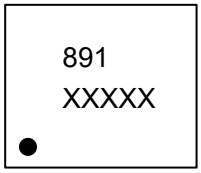


893 - Part Number

XXXXX - Tracking Number

Note：X (Tracking Number) is variable, according to the wafer lot number.

ET8901V/ET8901M



891 - Part Number

XXXXX - Tracking Number

Note：X (Tracking Number) is variable, according to the wafer lot number.

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2024-02-28	Original Version	Huyt	Shibo	Liujy