1MHz, RRIO, CMOS Operational Amplifier

General Description

ET358 is low cost, voltage feedback amplifiers. The device can operate from 2.1V to 5.5V single supply, while consuming only 60μA quiescent current per Amplifier. It provides rail-to-rail input with a wide input common mode voltage range and rail-to-rail output voltage swing. This feature makes ET358 appropriate for buffering ASIC.

The ET358 offer a gain-bandwidth product of 1MHz and an ultra-low input bias current of 10pA. It is well suited for piezoelectric sensors, integrators and photodiode amplifiers.

The ET358 is designed into a wide range of applications, such as battery-powered instrumentation, safety monitoring, portable systems, and transducer interface circuits in low power systems.

It is available in SOP8/MSOP8/DFN8(2×2) packages.

Features

- Low offset voltage: ±4.5 mV (MAX)
- Ultra-Low Input Bias Current: 10 pA
- Unity-gain stable
- Gain-Bandwidth Product: 1 MHz
- Rail-to-rail input and output
- Supply Voltage Range: 2.1V to 5.5V
- Input Voltage Range: -0.1V to 5.6V with Vs=5.5V
- Low Supply Current: 60μA/Amplifier

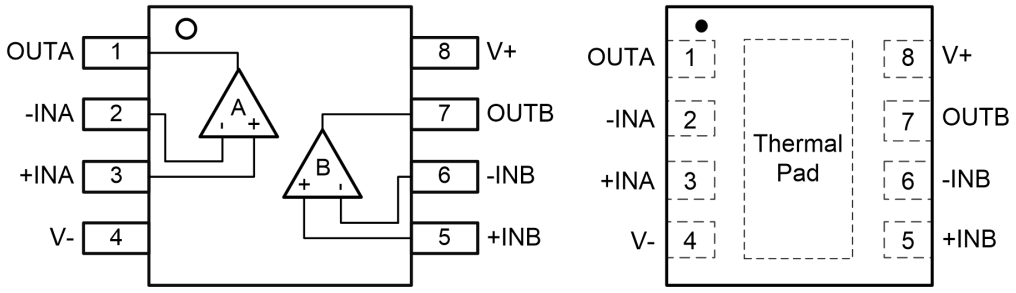
Applications

- ASIC Input or Output Amplifiers
- Piezoelectric Transducer Amplifiers
- Battery-Powered Equipment
- Portable Equipment
- Sensor Interfaces
- Medical Instrumentation
- Audio Outputs
- Smoke Detectors
- Notebook PCs

Device information

Part No.	Package	Packing Option	Marking	MSL
ET358M	SOP8	Tape and Reel , 4k/Reel	31M XXXXX	3
ET358U	MSOP8	Tape and Reel , 4k/Reel	31U XXXXX	3
ET358Y1	DFN8(2×2)	Tape and Reel , 3k/Reel	31Y XXXXX	1

Pin Configuration



SOP8/MSOP8 DFN8(2×2)

Top View

Pin Function

Pin Number ET358	Symbol	Descriptions
1,7	OUT	Output
4	V-	Negative supply
3,5	+IN	Non-inverting input
2,6	-IN	Inverting input
8	V+	Positive supply
-	Thermal Pad	Connect thermal pad to V-

Functional Description

Rail-to-Rail Input

When ET358 work at the power supply between 2.1V and 5.5V, the input common mode voltage range is from ($-V_S$) - 0.1V to ($+V_S$) + 0.1V.

Rail-to-Rail Output

The ET358 support rail-to-rail output operation. In single power supply application, for example, when $+V_S$ = 5V, $-V_S$ = GND, 100kΩ load resistor is tied from OUT pin to $V_S/2$, the typical output swing range is from 0.005V to 4.997V.

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+) - (V-)	0 to 6	V
V_{IC}	Common-mode Input Voltage(1)	(V-)-0.5 to (V+)+0.5	V
V_{ID}	Differential Input Voltage(1)	(V+) - (V-)+0.2	V
I_{IN}	Signal input terminals Current(1)	-10 to +10	mA
I_{SC}	Output short-circuit current(2)	Continuous	mA
V_{ESD}	ESD (Human Body Model)	±2500	V
	ESD (Charged Device Model)	±1000	V
T_{STG}	Storage Temperature Range	-65 to +150	°C
$T_{J(MAX)}$	Max Junction Temperature Range	+150	°C

Note1: Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.5 V beyond the supply rails should be current limited to 10 mA or less.

Note2: Short-circuit to ground, one amplifier per package.

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	SOP8	Thermal Characteristics, Thermal Resistance, Junction-to-Air	150	°C/W
	MSOP8		210	°C/W
	DFN8(2×2)		80	°C/W

Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_S	Supply Voltage: (V+) - (V-)	2.1(±1.05) ~ 5.5(±2.75)	V
T_A	Operating Temperature Range	-40 ~ +125	°C

Electrical Characteristics

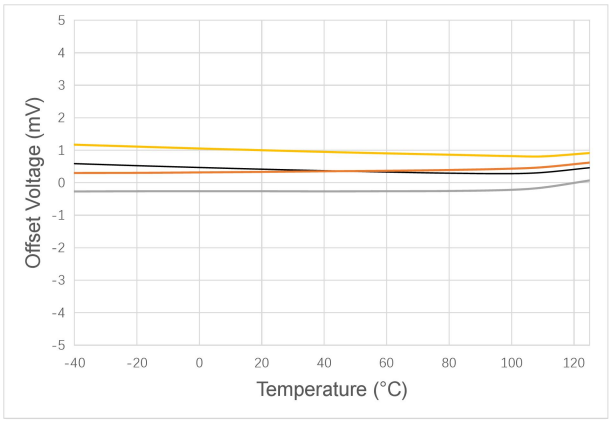
At T_A=+25°C, V_S=5V, R_L=100kΩ connected to V_S/2, and V_{OUT}=V_S/2, -40°C to +125°C, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
V_{OS}	Input offset Voltage	V_{CM} = V_S/2		±0.8	±4.5	mV
I_B	Input Bias Current			±10		pA
I_{OS}	Input Offset Current			±10		pA
V_{CM}	Input Common Mode Voltage Range	V_S=5.5V	-0.1		5.6	V
CMRR	Common-Mode Rejection Ratio	V_S = 5.5 V, V_{CM}= -0.1V to 4V	62	70		dB
		V_S = 5.5 V, V_{CM} = -0.1 V to 5.6 V,	55	68		
A_{OL}	Open-Loop Voltage Gain	R_L=5kΩ, V_{OUT}=0.1V to 4.9V	70	80		dB
		R_L=100kΩ, V_{OUT}=0.035V to 4.965V	80	84		
$\Delta V_{OS}/\Delta T$	Input Offset Voltage Drift			2.7		μV/°C
OUTPUT CHARACTERISTICS						
V_{OH}	Output Voltage Swing from Rail	R_L=100kΩ	4.980	4.997		V
V_{OL}		R_L=100kΩ		5	20	mV
V_{OH}		R_L=10kΩ	4.970	4.992		V
V_{OL}		R_L=10kΩ		8	30	mV
I_{SOURSE}	Output Current	R_L=10Ω to V_S/2	60	85		mA
I_{SINK}			60	75		mA
POWER SUPPLY						
V_S	Specified Voltage Range		2.1		5.5	V
PSRR	Power Supply Rejection Ratio	V_S=2.5V to 5.5V, V_{CM}=0.5V	60	82		dB
I_Q	Quiescent Current /Amp.	V_S=5V, V_{CM}=2.5V		60	85	μA
DYNAMIC PERFORMANCE						
GBP	Gain-Bandwith Product			1		MHz
SR	Slew Rate	G=+1, 2 V Output Step		0.6		V/μs
tor	Overload recovery time	VIN × G = VS		2.6		μs
t_S[(2)]	Setting Time to 0.1%	G=+1, 2 V Output Step		5.3		μs
NOISE PERFORMANCE						
E_n	Input voltage noise (peak to peak)	f = 0.1 Hz to 10 Hz		6		μV_{PP}
e_n	Input Voltage Noise Density	f=1kHz		25		nV/√Hz
		f=10kHz		20		nV/√Hz

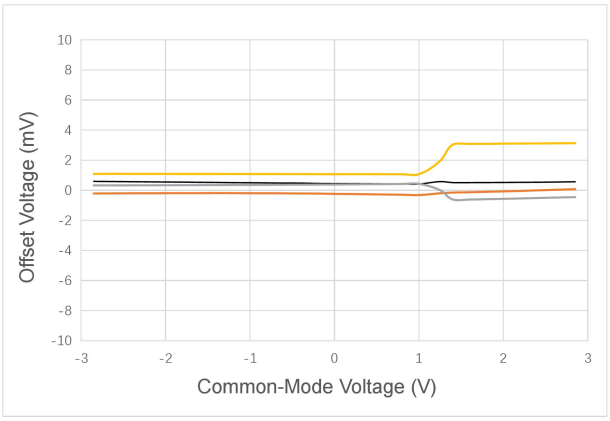
Note2:Guaranteed by design.

Typical Characteristics

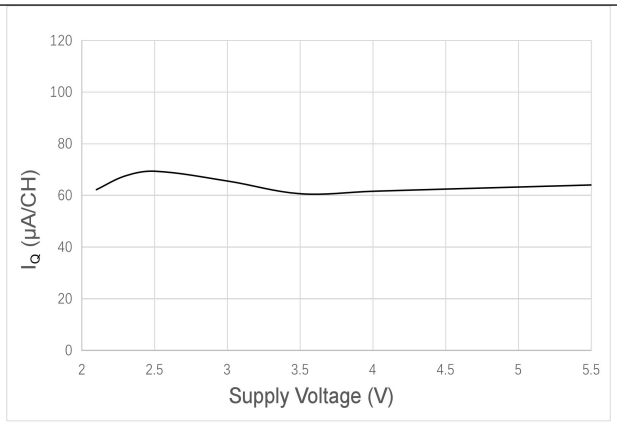
V_S = 5 V(±2.5V), V_{CM} = V_{OUT} = V_S/2, and R_L = 100kΩ connected to V_S/2,T_A = 25°C (unless otherwise noted)



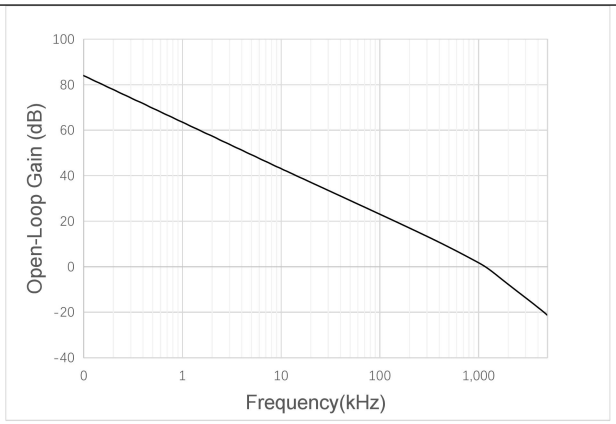
Offset Voltage vs Temperature



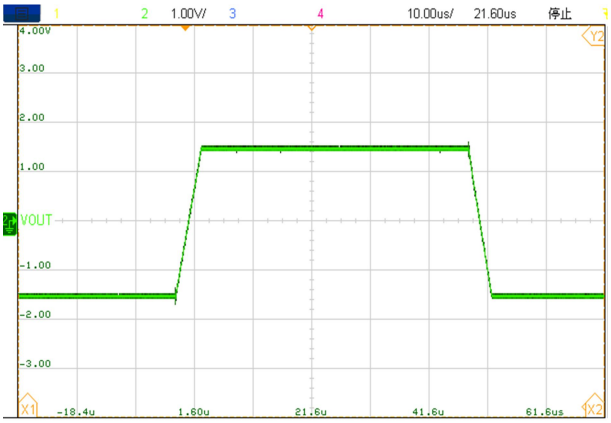
Offset Voltage vs Common-Mode Voltage



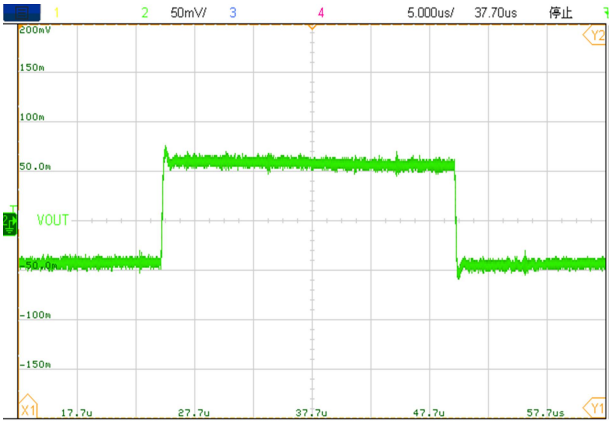
Quiescent Current vs Supply Voltage



Open-Loop Gain vs Frequency



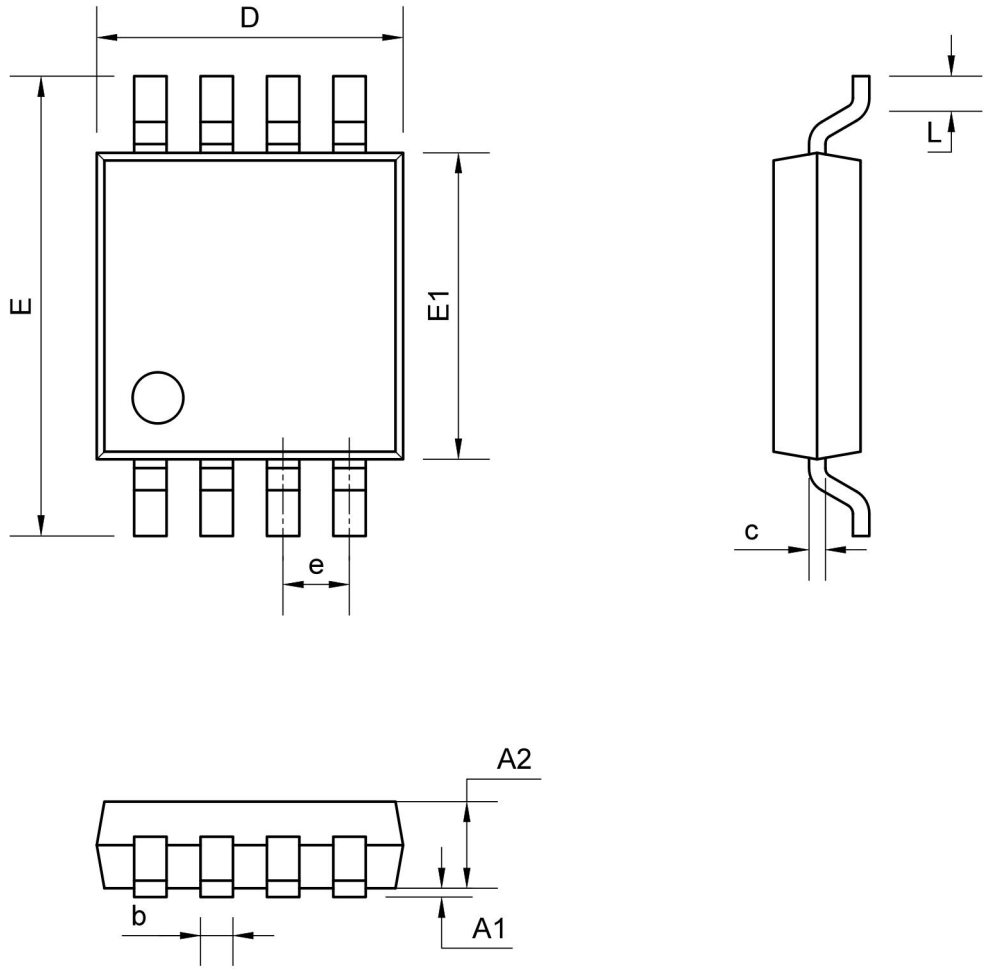
Large-Signal Step Response
(G = +1,R_L = 100 kΩ,C_L = 100 pF)



Small-Signal Step Response(100 mV)
(G = +1,R_L = 100 kΩ,C_L = 100 pF)

Package Dimension

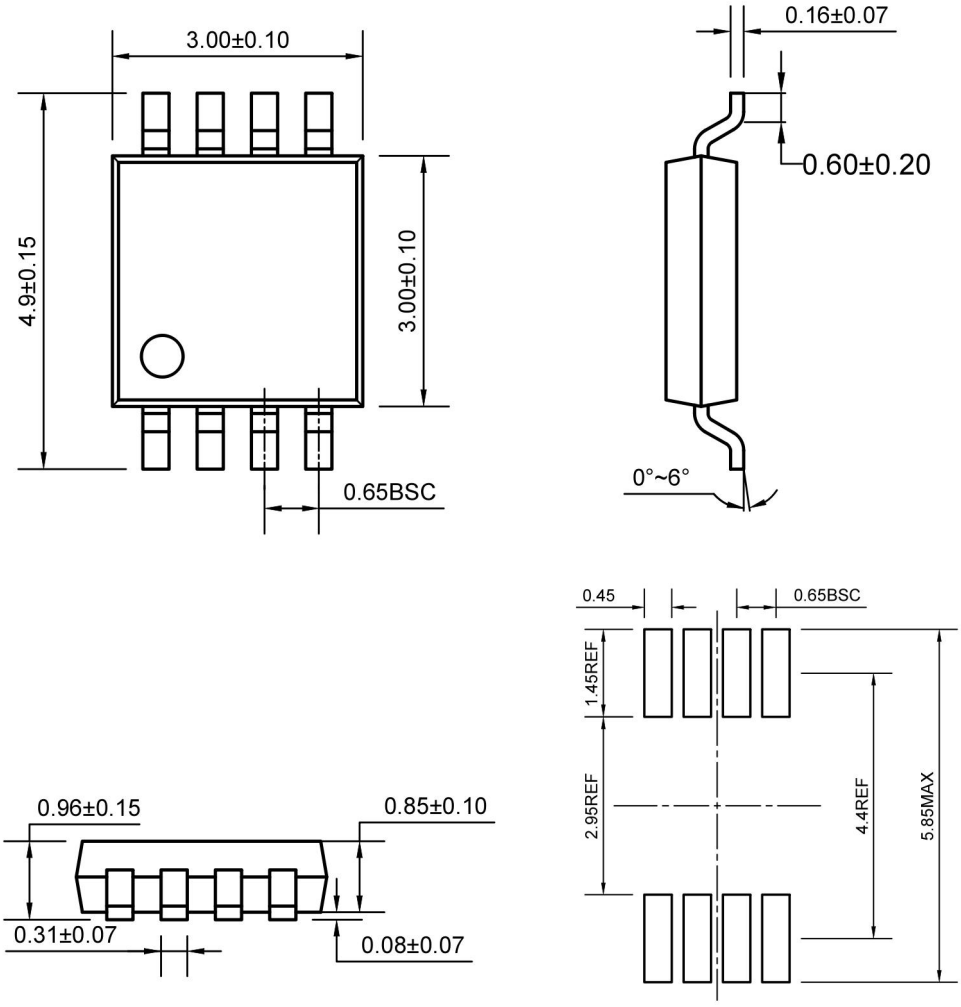
SOP8



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

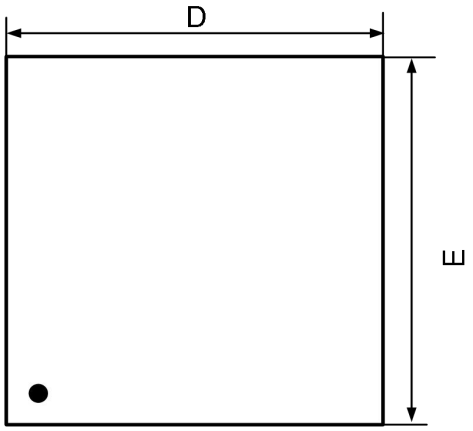
MSOP8



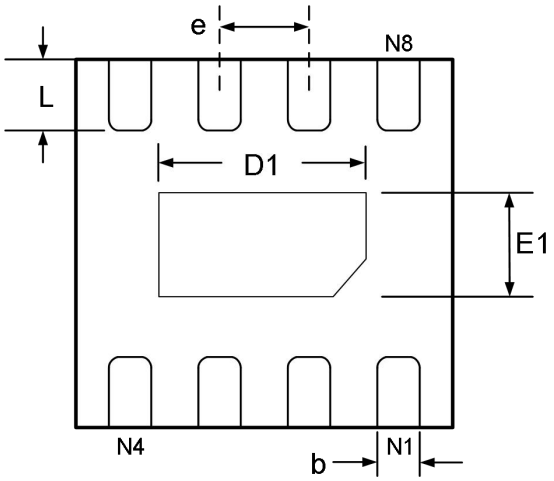
Recommended Land Pattern

Unit: mm

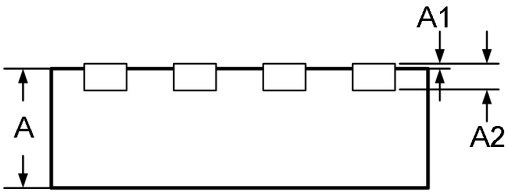
DFN8(2×2)



TOP VIEW



BOTTOM VIEW



SIDE VIEW

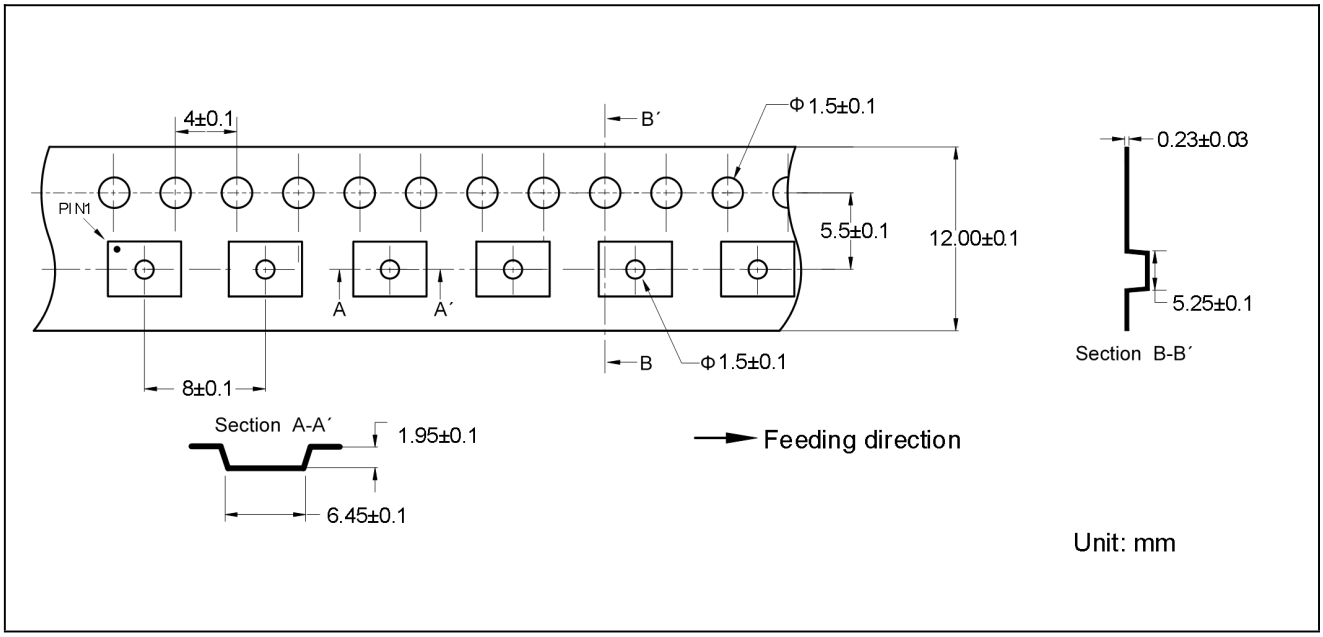
COMMON DIMENSIONS

(UNITS OF MEASURE=MILLIMETER)

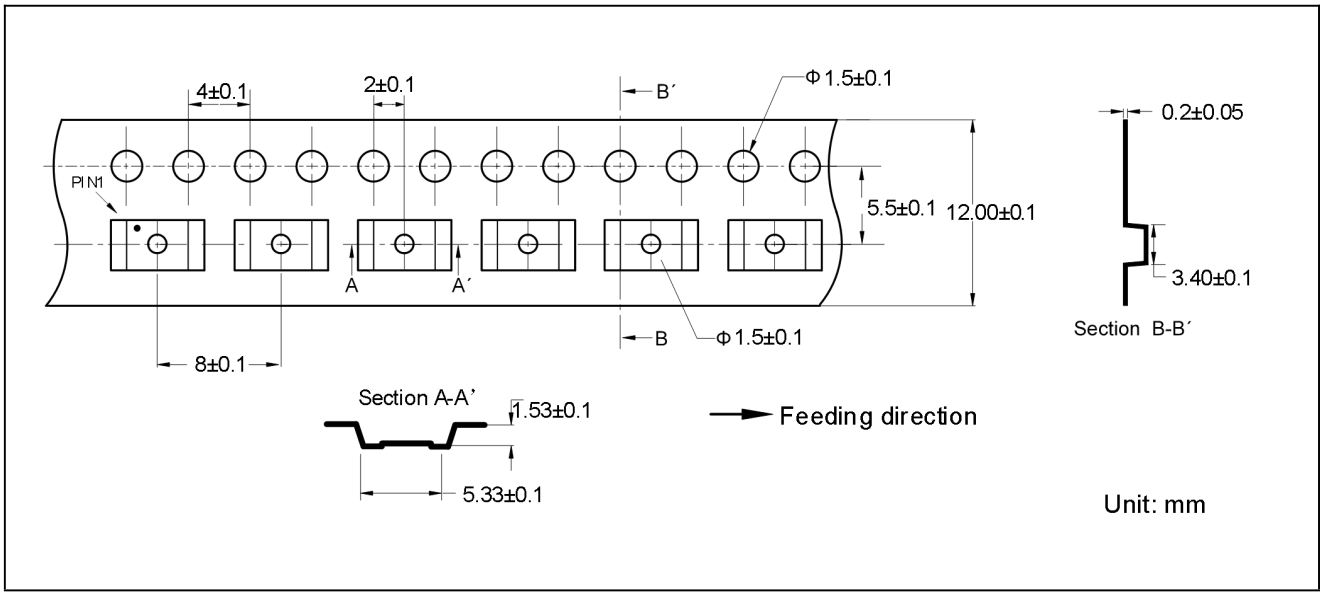
SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	-	0.05
A2		0.2 REF	
D	1.90	2.00	2.10
D1	1.10	-	1.70
E	1.90	2.00	2.10
E1	0.50	-	1.00
b	0.18	0.23	0.28
e		0.50 BSC	
L	0.20	0.30	0.40

Tape Information

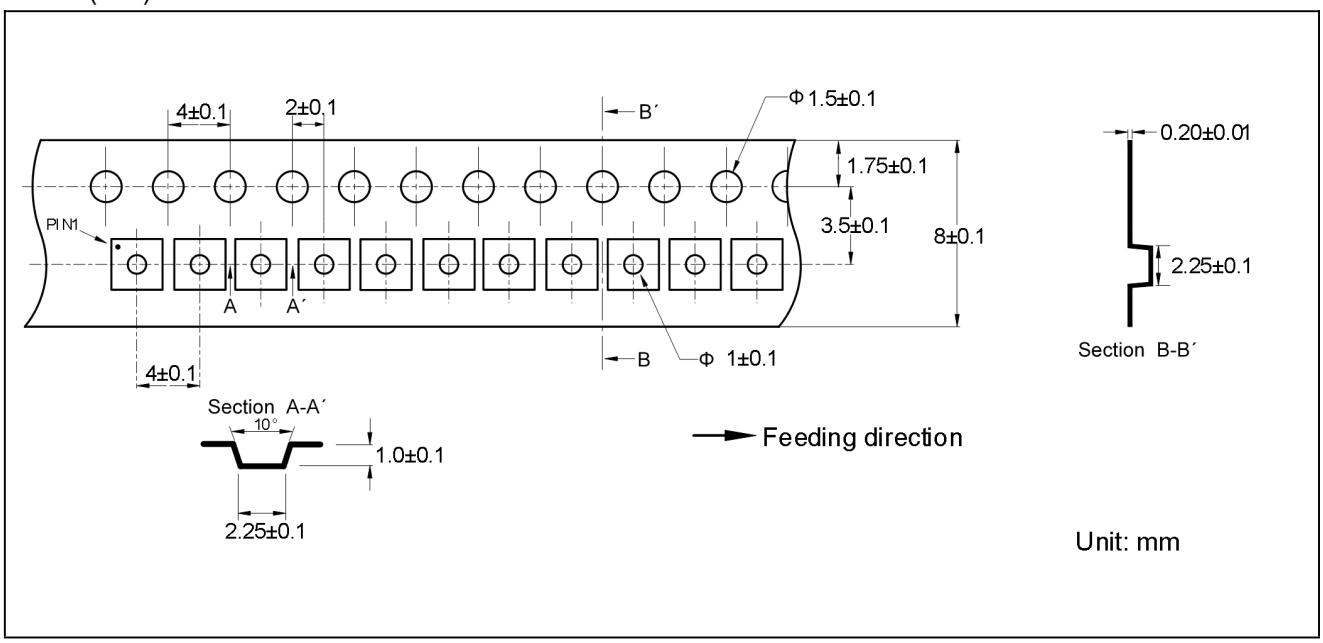
SOP8



MSOP8



DFN8(2×2)



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2024-01-31	Official version	Chenzx	Wanggp	Liujy
1.1	2024-12-03	Add I_Q test condition	Yinp	Chenh	Liujy
1.2	2026-04-22	Add DFN8(2*2) Package	Huyt	Chenh	Liujy