High-Precision,Rail-to-Rail I/O Operational Amplifier

General Description

The ET85511(single) and ET85512(dual) are high-precision, low-quiescent current amplifier which can offer high input impedance and rail-to-rail input and output. The amplifier uses auto-zeroing techniques to provide low offset voltage(2 μV type) and near zero-drift over time and temperature.

Either single or dual supplies can be used in the range from 2.3V to 5.5V (+1.15V to +2.75V).

The ET85511 is available in SC70-5,SOT23-5, MSOP8 and SOP8 packages.

The ET85512 is available in MSOP8 and SOP8 packages. All versions are specified for operation from -40°C to +125°C.

Features

- Low Offset Voltage: 2 μV(Type)
- Zero-Drift: 0.03 μV/°C
- Low Noise: 18 nV/√Hz
  - 0.1Hz to 10Hz Noise: 0.35 μVpp
- Excellent DC Precision:
  - Open-Loop Gain: 135dB
  - PSRR: 120dB
  - CMRR:120dB
- Gain Bandwidth: 2 MHz
- Quiescent Current: 220 μA(Type)
- Supply Range: +1.15V to +2.75V
- Rail-to-Rail Input and Output

Applications

- Bridge Amplifier
- Strain Gauges
- Transducer Applications
- Temperature Measurement
- Electronic Scales
- Medical instrumentation
- Resistance Temperature Detectors
- Handheld Test Equipment

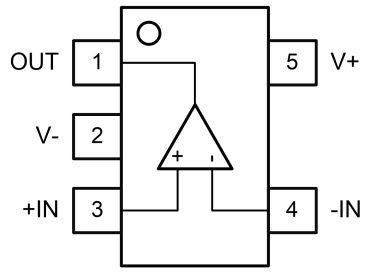
Device information

ET 8551 X① X②

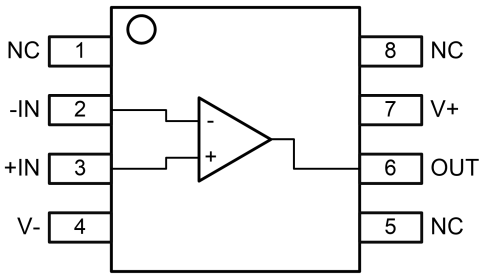
X① Channel number	
1	Single channel
2	Dual channel

X② Package	
M	SOP8
U	MSOP8
EA	SOT23-5
SCA	SC70-5

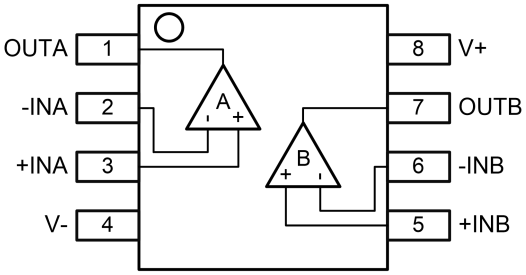
Pin Configuration



ET85511EA/SCA



ET85511M/U



ET85512M/U

Top View

Pin Function

	Pin Number	Symbol	Descriptions
ET85511EA ET85511SCA	1	OUT	Output
	2	V-	Negative supply
	3	+IN	Non-inverting input
	4	-IN	Inverting input
	5	V+	Positive supply

	Pin Number	Symbol	Descriptions
ET85511M ET85511U	1	NC	/
	2	-IN	Inverting input
	3	+IN	Non-inverting input
	4	V-	Negative supply
	5	NC	/
	6	OUT	Output
	7	V+	Positive supply
	8	NC	/

	Pin Number	Symbol	Descriptions
ET85512M ET85512U	1	OUTA	Output
	2	-INA	Inverting input
	3	+INA	Non-inverting input
	4	V-	Negative supply
	5	+INB	Non-inverting input
	6	-INB	Inverting input
	7	OUTB	Output
	8	V+	Positive supply

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}	Input Voltage	(V-)-0.5 to (V+)+0.5	V
V_{ID}	Differential Input Voltage	±5	V
V_{ESD}	ESD (Human Body Model)	8	kV
	ESD (Charged-Device Model)	2	kV
T_{STG}	Storage Temperature Range	-65 to +150	°C
$T_{J(MAX)}$	Max Junction Temperature Range	+150	°C

Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_S	Supply Voltage: (V+) - (V-)	2.3(±1.15) ~ 5.5(±2.75)	V
T_A	Operating Temperature Range	-40 ~ +125	°C

Electrical Characteristics

V_S = +5 V, T_A = 25°C, R_L = 10 kΩ connected to V_S/2, and V_{CM} = V_{OUT} = V_S/2 (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
V_{OS}	Input offset voltage			2	10	μV
$\Delta V_{OS}/\Delta T$	Input offset voltage vs temperature	T_A = -40°C to 125°C		0.03		μV/°C
I_B	Input bias current	V_{CM}=V_S/2		±100	±600	pA
I_{OS}	Input offset current			±100	±600	pA
PSRR	Input offset voltage vs power supply	V_S = +2.3V to +5.5V	100	120		dB
		T_A = -40°C to 125°C	90			dB
V_{CM}	Common-mode voltage range	T_A = -40°C to 125°C	V-		V+	V
CMRR	Common-Mode Rejection Ratio	V- < V_{CM} < V+	100	120		dB
		T_A = -40°C to 125°C	90			dB
A_{OL}	Open-loop voltage gain	(V-) +0.3 < V_O < (V+) -0.3	120	135		dB
		T_A = -40°C to 125°C	110			dB
NOISE						
E_n	Input voltage noise (peak to peak)	f = 0.1 Hz to 10 Hz		350		nV_{PP}
e_n	Input voltage noise density	f = 1 kHz		18		nV/√Hz
DYNAMIC PERFORMANCE						
GBP	Gain-bandwidth product			2		MHz
SR	Slew rate	G =±1		1		V/μs
t_{OR}	Overload recovery time	V_{IN} × gain = V_S		50		μs
OUTPUT CHARACTERISTICS						
V_O	Voltage output swing from supply rail	R_L = 10 kΩ		5	12	mV
		T_A = -40°C to 125°C			18	
I_{SOURCE}	Output Current	Source Current	60	70		mA
		T_A = -40°C to 125°C	55			
I_{SINK}		Sink Current	55	60		
		T_A = -40°C to 125°C	50			
POWER SUPPLY						
I_Q	Quiescent current per amplifier			220	280	μA
		T_A = -40°C to 125°C			350	

Electrical Characteristics (Continued)

V_S = +2.7 V, T_A = 25°C, R_L = 10 kΩ connected to V_S/2, and V_{CM} = V_{OUT} = V_S/2 (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
V_{OS}	Input offset voltage			4	15	μV
$\Delta V_{OS}/\Delta T$	Input offset voltage vs temperature	T_A = -40°C to 125°C		0.03		μV/°C
I_B	Input bias current	V_{CM}=V_S/2		±100	±500	pA
I_{OS}	Input offset current			±100	±500	pA
PSRR	Input offset voltage vs power supply	V_S = +2.3V to +5.5V	100	120		dB
		T_A = -40°C to 125°C	90			dB
V_{CM}	Common-mode voltage range	T_A = -40°C to 125°C	V-		V+	V
CMRR	Common-Mode Rejection Ratio	V- < V_{CM} < V+	100	120		dB
		T_A = -40°C to 125°C	90	110		dB
A_{OL}	Open-loop voltage gain	(V-) +0.3 < V_O < (V+) -0.3	110	135		dB
		T_A = -40°C to 125°C	100			dB
NOISE						
E_n	Input voltage noise (peak to peak)	f = 0.1 Hz to 10 Hz		380		nV_{PP}
e_n	Input voltage noise density	f = 1 kHz		20		nV/√Hz
DYNAMIC PERFORMANCE						
GBP	Gain-bandwidth product			2		MHz
SR	Slew rate	G =±1		0.8		V/μs
t_{OR}	Overload recovery time	V_{IN} × gain = V_S		50		μs
OUTPUT CHARACTERISTICS						
V_O	Voltage output swing from supply rail	R_L = 10 kΩ		4	12	mV
		T_A = -40°C to 125°C			18	
I_{SOURCE}	Output Current	Source Current	15	20		mA
		T_A = -40°C to 125°C	12			
I_{SINK}		Sink Current	15	20		
		T_A = -40°C to 125°C	12			
POWER SUPPLY						
I_Q	Quiescent current per amplifier			210	270	μA
		T_A = -40°C to 125°C			350	

Functional Description

Application Information

The ET8551X operational amplifier combines precision offset and drift with excellent overall performance, making it ideal for many precision applications. The precision offset drift of only 0.03 μV/°C provides stability over the entire temperature range. In addition, the device pairs excellent CMRR, PSRR, and AOL dc performance with outstanding low-noise operation. As with all amplifiers, applications with noisy or high-impedance power supplies require decoupling capacitors close to the device pins.in most cases, 0.1 uF capacitors are adequate.

Operating Characteristics

The ET8551X is specified for operation from 2.3 V to 5.5 V(±1.15 V to ±2.75 V). Many specifications apply from -40°C to +125°C.

Capacitive Load and Stability

The unity-gain follower (buffer) is the most sensitive configuration to capacitive loading. Direct capacitive loading reduces the phase margin of amplifiers and this results in ringing or even oscillation. Applications that require greater capacitive drive capability should use an isolation resistor between the output and the capacitive load like the circuit in Figure 1. The isolation resistor R_{ISO} ahd the load capacitor C_L, form a zero to increase stability. The bigger the R_{ISO} resistor value, the more stable Vout will be. Note that this method results in a loss of gain accuracy because R_{ISO} forms a voltage divider with the R_L.

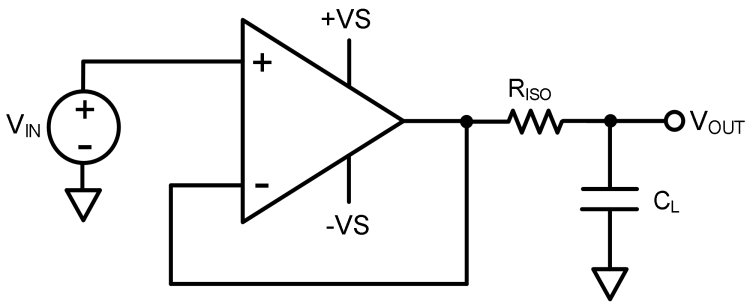
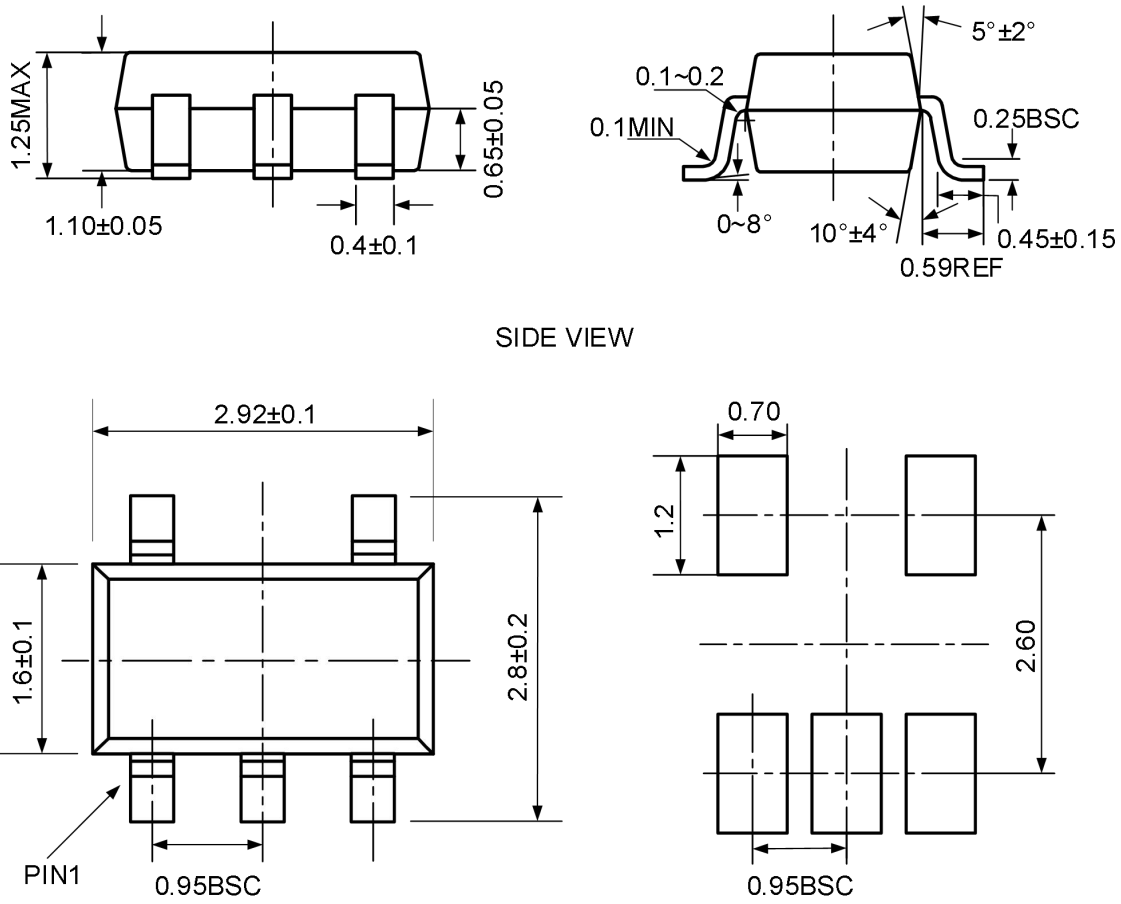


Figure 1. Indirectly Driving Heavy Capacitive Load

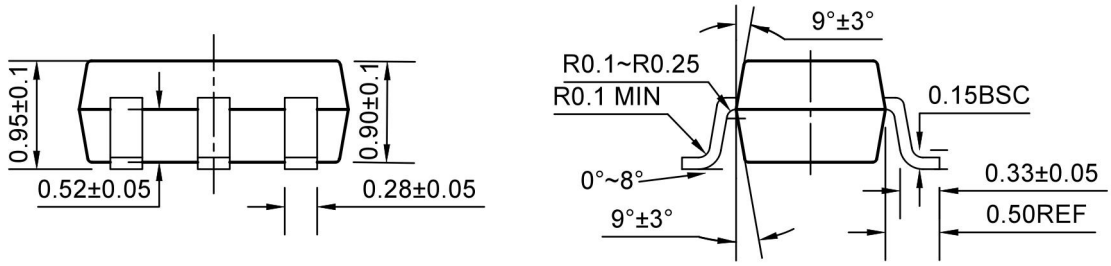
Package Dimension

SOT23-5

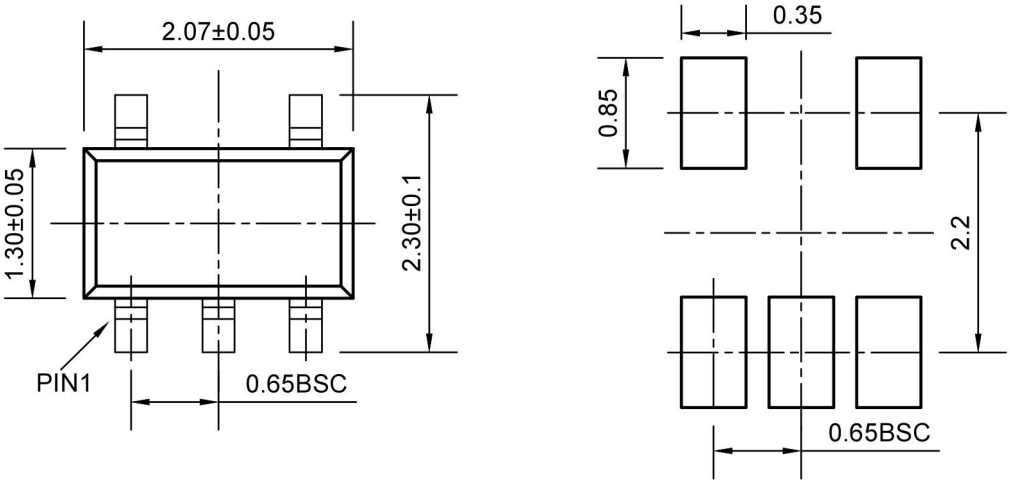


Unit: mm

SC70-5



SIDE VIEW

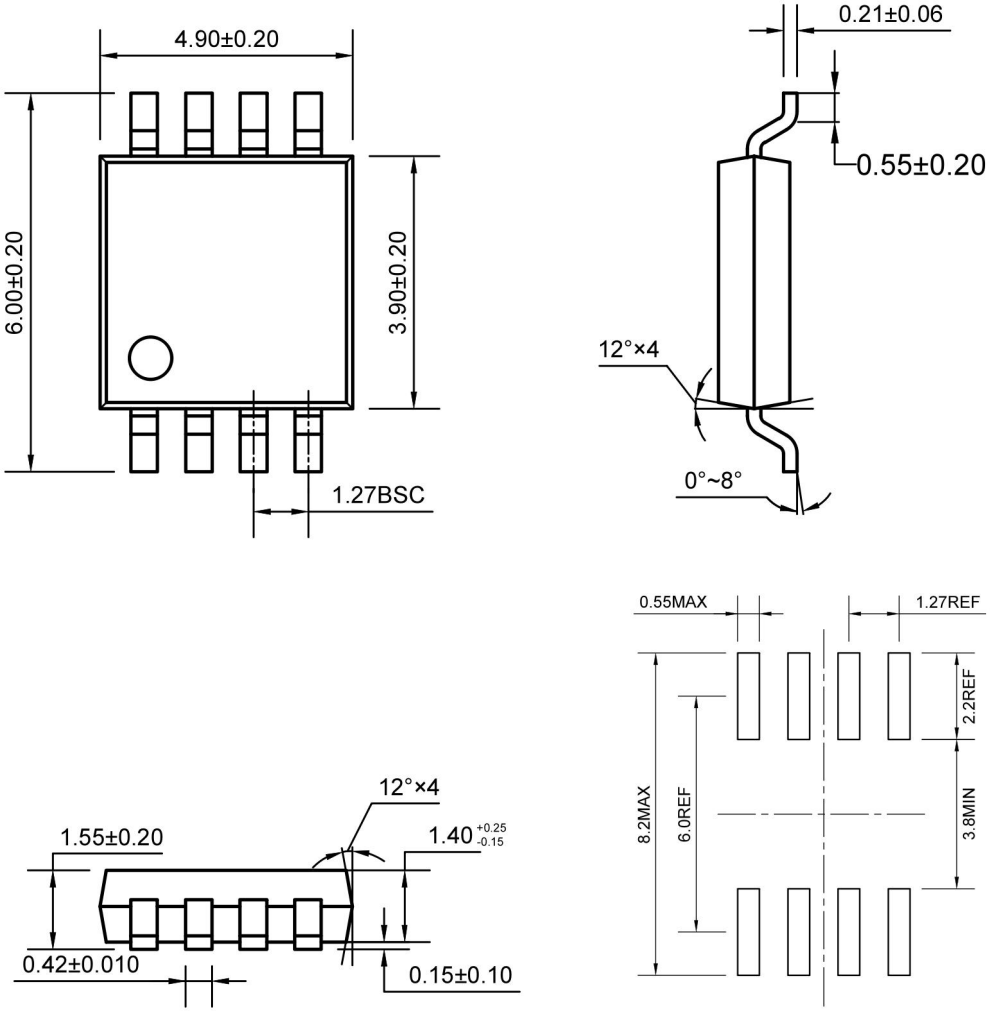


TOP VIEW

Recommended Land Pattern

Unit: mm

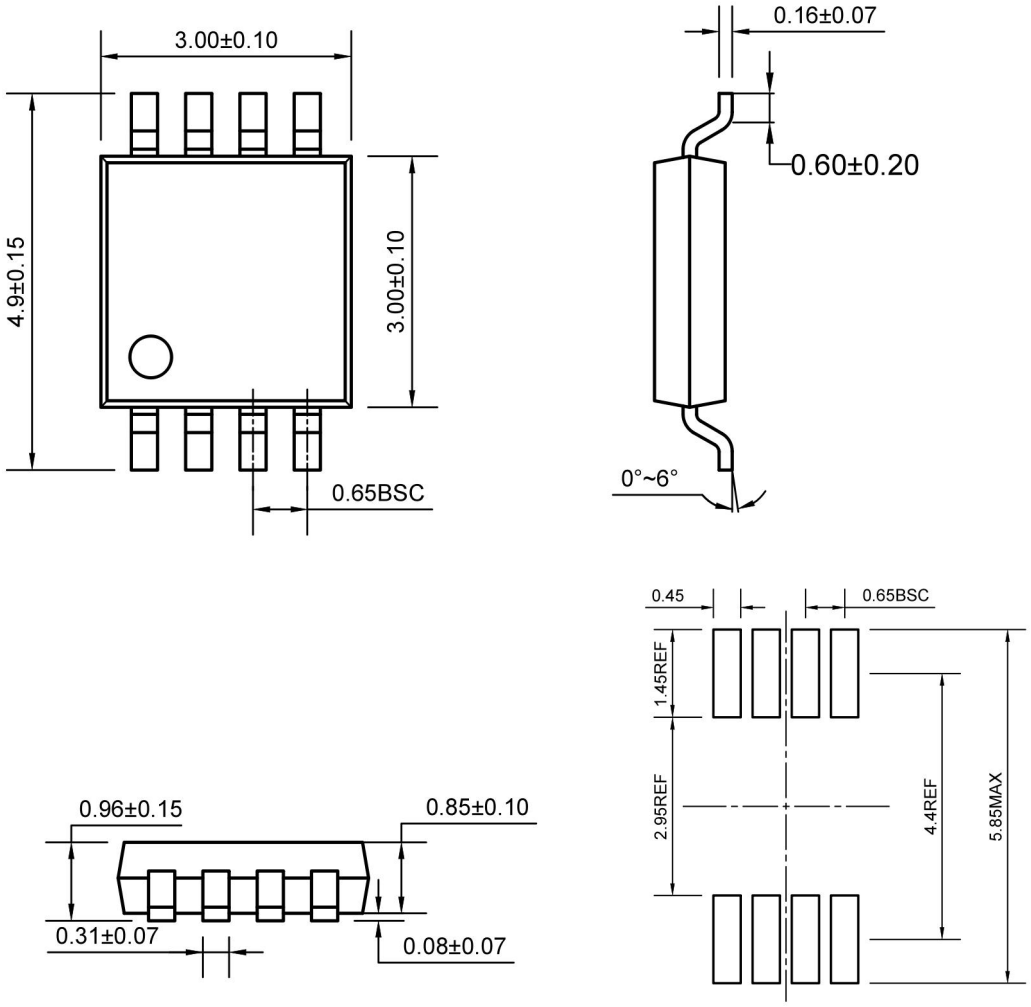
SOP8



Recommended Land Pattern

Unit: mm

MSOP8



Recommended Land Pattern

Unit: mm

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2025-04-02	Preliminary Version	Huyt	Wangxx	Liujy