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Product Specification

XBLW INA180/INA181

Zero Drift Bidirectional Current Detection Amplifier

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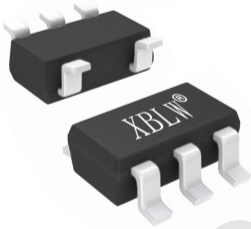
Descriptions

INA181 and INA180 are wideband, zero-drift, bidirectional current detection amplifiers, mainly used in battery monitoring, power management,Overcurrent detection, etc. The circuit can induce the voltage drop on the shunt resistor at a common-mode voltage ranging from -0.2V to 30V. The INA181 and INA180 circuits are integrated with a matching resistor gain network with four fixed gain options: 20 V/V, 50 V/V, 100 V/V and 200 V/V.

The INA181 and INA180 circuits are powered by a single source from 2.7V to 5.5V with a maximum supply current of 260μA.

Feature

- Rail to rail output
- Offset voltage:
  - ±150μV (maximum), VCM=0V
  - ±500μV (maximum), VCM=12V
- Accuracy and zero drift characteristics:
  - Gain error: ±1% (Max)
  - Offset drift: 1μV/°C (maximum)
  - Gain drift: 20ppm/°C (Max))
- Output voltage gain:
  - 20V/V（INA181 A1、INA180 A1、B1）
  - 50V/V（INA181 A2、INA180 A2、B2）
  - 100V/V（INA181 A3、INA180 A3、B3）
  - 200V/V（INA181 A4、INA180 A4、B4）
- High bandwidth:
  - 350kHz（INA181 A1、INA180 A1、B1）
- Package form:
  - INA180：SOT23-5
  - INA181：SOT23-6



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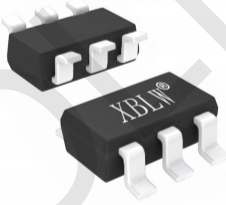


SOT23-6

Applications

- Motor control
- Lighting control
- Solar inverters
- Overcurrent detection
- Power management
- Battery monitoring

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
INA180A1IDBVR	SOT23-5	18ID	Tape	3000Pcs/Reel
INA180A2IDBVR	SOT23-5	1A8D	Tape	3000Pcs/Reel
INA180A3IDBVR	SOT23-5	1A9D	Tape	3000Pcs/Reel
INA180A4IDBVR	SOT23-5	1AAD	Tape	3000Pcs/Reel
INA180B1IDBVR	SOT23-5	18RD	Tape	3000Pcs/Reel
INA180B2IDBVR	SOT23-5	1ABD	Tape	3000Pcs/Reel
INA180B3IDBVR	SOT23-5	1ACD	Tape	3000Pcs/Reel
INA180B4IDBVR	SOT23-5	1ADD	Tape	3000Pcs/Reel
INA181A1IDBVR	SOT23-6	18JD	Tape	3000Pcs/Reel
INA181A2IDBVR	SOT23-6	1AED	Tape	3000Pcs/Reel
INA181A3IDBVR	SOT23-6	1AFD	Tape	3000Pcs/Reel
INA181A4IDBVR	SOT23-6	1AGD	Tape	3000Pcs/Reel

Block Diagram

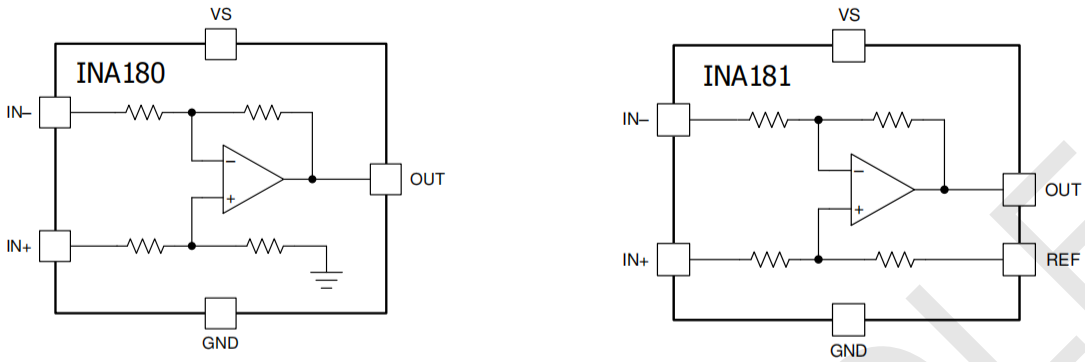


Figure 1 Functional block diagram of INA180 and INA181

Pin Configurations

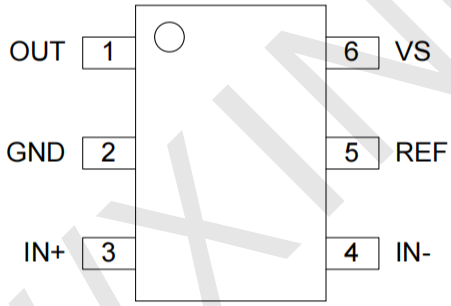


Figure 2 Pin arrangement diagram of INA181

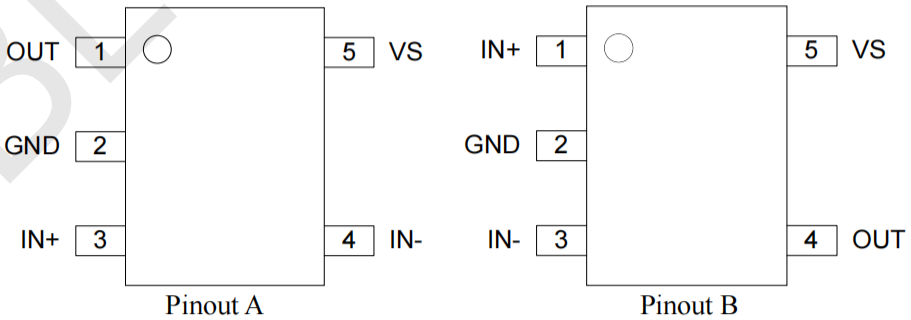


Figure 3 Pin arrangement diagram of INA180

Pin Description

Pin of lead			Symbol	Attribute	Function
INA181	INA180 Pin Out A	INA180 Pin out B			
1	1	4	OUT	O	Output voltage
2	2	2	GND	GND	Negative power supply or ground
3	3	1	IN+	I	Current detection amplifier in the same direction input
4	4	3	IN-	I	Reverse input of current detection amplifier
5	—	—	R_{EF}	I	Voltage of reference
6	5	5	V_S	V_{CC}	Positive power supply

Electrical characteristic

Absolute Maximum Ratings

Unless otherwise specified, T_{amb}=25 ° C

Parameter	Symbol	Min	Max	Unit
Power supply voltage	V_S	—	6	V
The input voltage is IN+, IN-	Difference (IN+)-(IN-)	-30	30	V
	Common mode (VCM)	GND-0.2	35	V
Current of output	I_{OUT}	—	8	mA
Maximum junction temperature	T_J	—	150	°C
Temperature of storage	T_{stg}	-65	150	°C
Welding temperature (10 seconds)	T_L	260		°C

ESD

Parameter	Symbol	Condition	Value	Unit
Grade of ESD	HBM	ANSI/ESDA/JEDEC JS-001	±3	kV

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Common mode input voltage	V_{CM}	-0.2	12	30	V
Power supply voltage	VS	2.7	5	5.5	V
Operating temperature	T_{amb}	-40	25	125	°C

Electrical Characteristics

(Unless otherwise specified, T_{amb}=25 ° C, V_{SENSE}=(VIN+) - (VIN-), V_S=5V, V_{IN+}=12V, V_{REF}=V_S/2)

Parameter	Symbol	Test conditions	Min	Typ	Max	Unit
Input in						
Input offset voltage	V_{OS}	V_{SENSE}=0mV		±100	±500	μV
		V_{SENSE}=0mV ,V_{IN+} =0V	—	±25	±150	μV
Input offset voltage temperature drift	V_{OS} TC	V_{SENSE}=0mV,-40～125°C	—	0.2	1	μV/°C
Common mode input range	V_{CM}	-40～125°C	-0.2		30	V
Common mode inhibition ratio	C_{MRR}	V_{IN}+=0～30V ,V_{SENSE}=0mV, -40～125°C	84	100	—	dB
Input bias current	IB	V_{SENSE}=0mV, V_{IN}+ = 0 V	—	-6	—	μA
		V_{SENSE}=0mV		75		μA
Input offset current	I_{OS}	V_{SENSE}=0mV	—	0.05	—	μA
Power supply rejection ratio	P_{SRR}	V_S=+2.7～18V ,V_{IN}+=18V, V_{SENSE}=0mV	—	±8	±40	μV/V
NOISE RTI (referred to input)						
Input voltage noise density	en	f =1 kHz	—	40	—	nV /√Hz
Output						
Gain of gain	G	INA181A1/ INA180A1 ,B1	—	20	—	V/V
		INA181A2/ INA180A2 ,B2	—	50	—	V/V
		INA181A3/ INA180A3 ,B3	—	100	—	V/V
		INA181A4/ INA180A4 ,B4		200		V/V
Error of gain	EG	V_{OUT}=0.5V～VS-0.5V , -40～125°C	—	±0.1%	±1%	—
Gain error drift	EG TC	-40～125°C	—	1.5	20	ppm
Error of nonlinearity		V_{OUT}=0.5V to VS–0.5V		±0.01%		
Maximum capacitive load	C_{LOAD}	No sustained oscillation	—	1	—	nF
Swing to V_S power-supply rail	V_{SP}	R_{LOAD}=10kΩ toGND , -40～125°C	VS- 0.03	VS- 0.02		V
Swing to GND	V_{SN}	R_{LOAD}=10kΩ toGND , -40～125°C	—	VGND+ 0.0005	VGND +0.005	V

Frequency response						
Bandwidth	B_W	C_{LOAD}=10pF,INA181A1, INA180A1,B1	—	350	—	kHz
		C_{LOAD}=10pF, INA181A2 INA180A2,B2	—	210	—	kHz
		C_{LOAD}=10pF, INA181A3, INA180A3,B3	—	150	—	kHz
		C_{LOAD}=10pF,INA181A4 INA180A4,B4	—	105	—	kHz
Rate of swing	SR	INA181A1,INA180A1,B1	—	2	—	V/μs
		INA181A2,INA180A2,B2	—	4	—	V/μs
		INA181A3 ,INA180A3,B3	—	6	—	V/μs
		INA181A4,INA180A4,B4	—	8	—	V/μs
Power supply						
Power supply voltage	VS	—	2.7	—	5.5	V
Static current	IQ	INA181,INA180,V_{SENSE}=0 mV	—	175	260	μA
		INA181,INA180, V_{SENSE}=0 mV -40～125℃			300	μA

Curve of characteristic

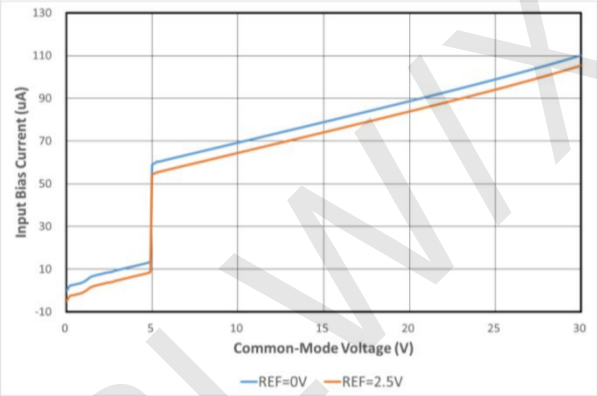


FIG. 4 Input bias current and input common mode voltage (VS=5V)

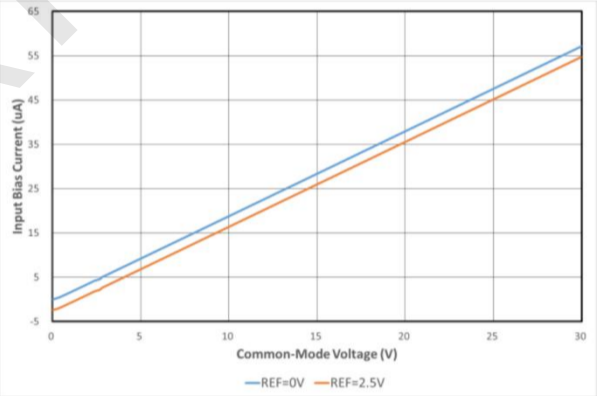


FIG. 5 Input bias current and input common mode voltage (VS=0V)

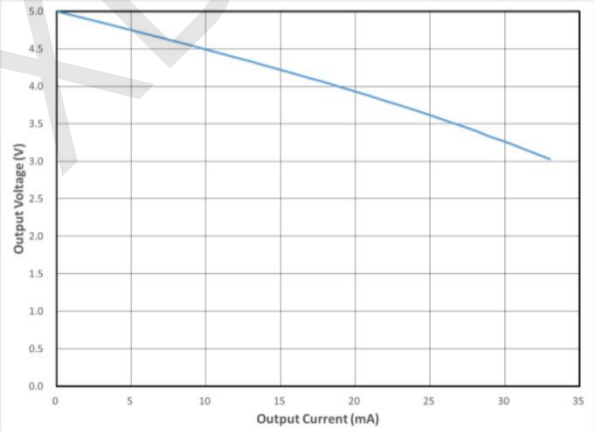


Figure 6 Output high level drive

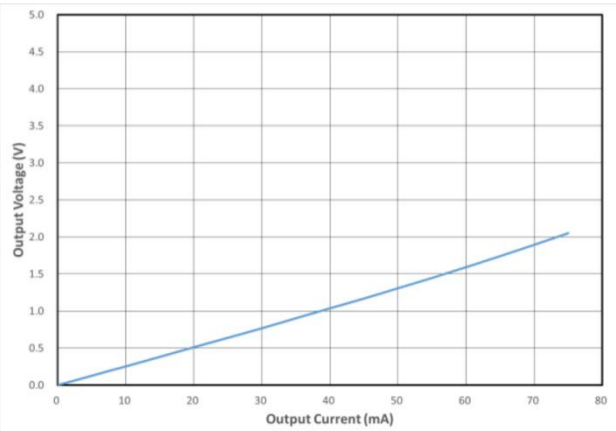


Figure 7 Output low level drive

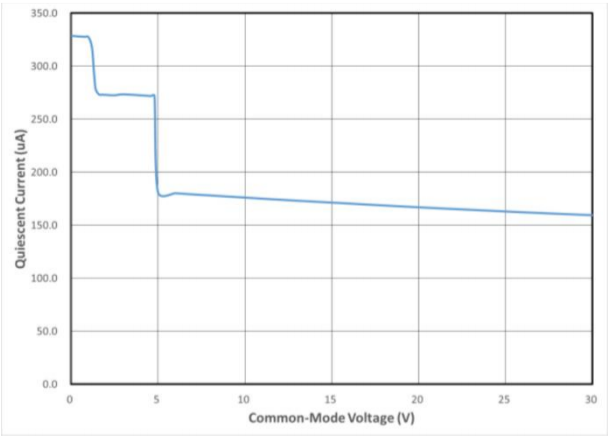


FIG. 8 Input common mode voltage and quiescent current (VS=5V)

Typical application lines and instructions

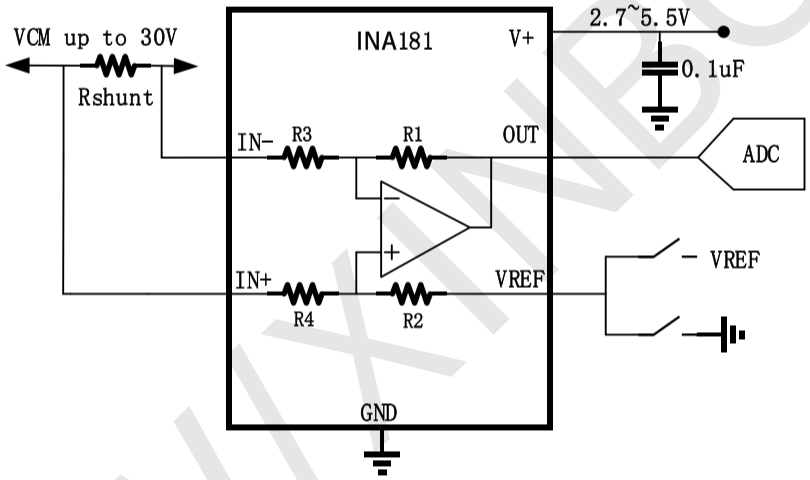


Figure 9 Typical application lines of INA181

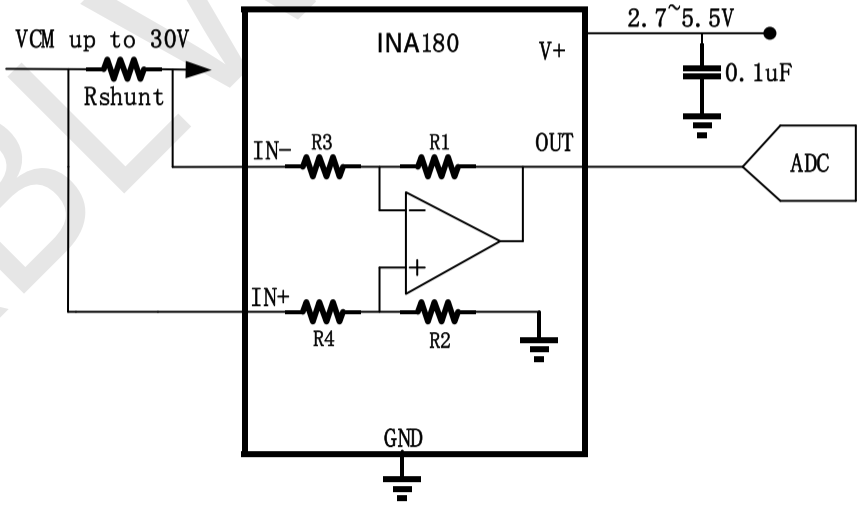


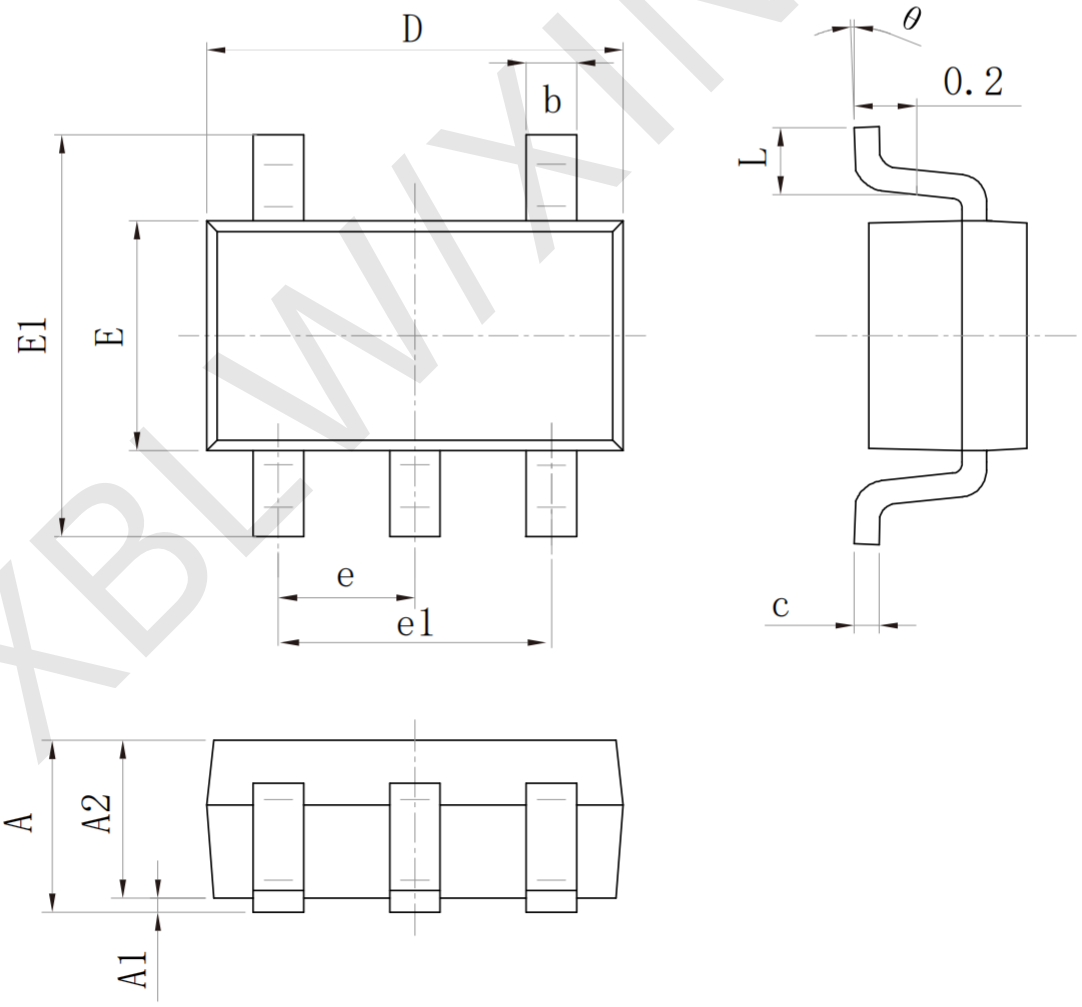
Figure 10 Typical application lines of INA180

Above, the basic application connection of INA181/INA180 is shown. Input pins IN+ and IN- should be directly connected to the detection resistor as much as possible,To minimize any resistance in series with the detection resistor. To ensure stability, it is necessary to use the power supply bypass capacitor, which is placed close to the device pin.

Package Information

- SOT23-5

SIZE / SYMBOL	Dimensions In Millimeters		SIZE / SYMBOL	Dimensions In Inches	
	MIN(mm)	MAX(mm)		MIN(in)	MAX(in)
A	1.050	1.250	A	0.041	0.049
A1	0.000	0.100	A1	0.000	0.004
A2	1.050	1.150	A2	0.041	0.045
b	0.300	0.500	b	0.012	0.020
c	0.100	0.200	c	0.004	0.008
D	2.820	3.020	D	0.111	0.119
E	1.500	1.700	E	0.059	0.067
E1	2.650	2.950	E1	0.104	0.116
e	0.95(BSC)		e	0.037(BSC)	
e1	1.800	2.000	e1	0.071	0.079
L	0.300	0.600	L	0.012	0.024
θ	0°	8°	θ	0°	8°



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SIZE / SYMBOL	Dimensions In Millimeters		SIZE / SYMBOL	Dimensions In Inches	
	MIN (mm)	MAX (mm)		MIN (mm)	MAX (mm)
A	1.050	1.250	A	0.041	0.049
A1	0.000	0.100	A1	0.000	0.004
A2	1.050	1.150	A2	0.041	0.045
b	0.300	0.500	b	0.012	0.020
c	0.100	0.200	c	0.004	0.008
D	2.820	3.020	D	0.111	0.119
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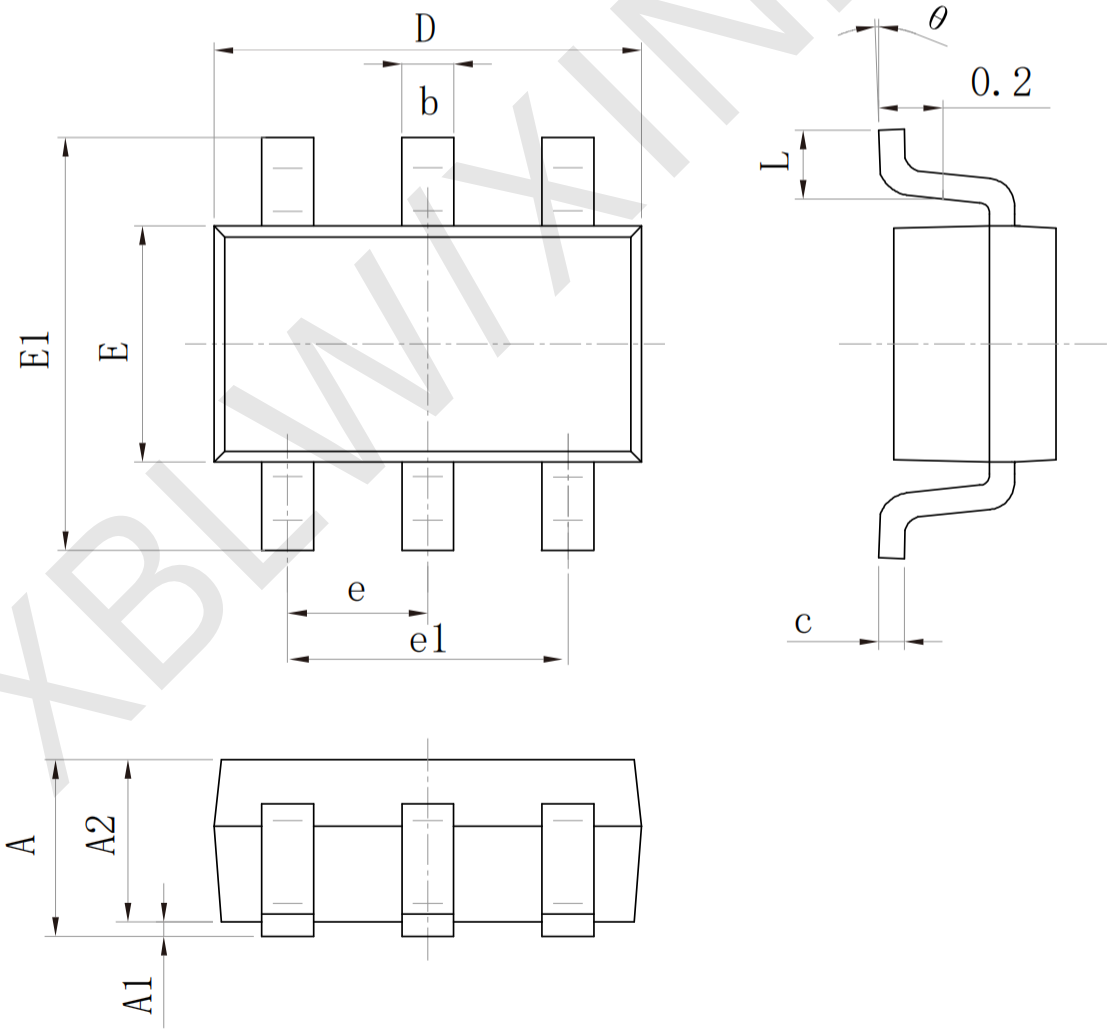
θ	0°	8°	θ	0°	8°



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Specification information

Version	Release Date	New/Revised Content
V1.0	2023/10	Initial Writing
V2.0	2025/05	Update Template
V2.1	2026/09	Update packaging size diagram identification