KODENSHI AUK

SJ432xx

Programmable Voltage Reference

Description

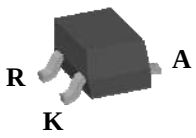
The SJ432 series are 3-terminal precision shunt regulators that are programmable over a wide voltage range of 1.24V to 16V with ±0.5%, ±1.0% tolerance. The SJ432 series have a low dynamic impedance of 0.25Ω. These features make the SJ432 series an excellent replacement for zener diodes in numerous applications circuits that require a precision reference voltage.

Features

- Programmable output voltage from 1.24V to 16V
- Voltage reference tolerance : ±0.5%, ±1.0%
- Cathode current capability of 80 μA to 30mA
- High quality ESD protected : ESD rating – Typ. 4kV(HBM Mode)
  – Typ. 400V(MM Mode)

◈ Pin Assignment

(Top View)



PKG : SOT-23

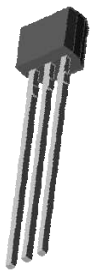
Apply Device : SJ432xS

(Marking Side View)

PKG : TO-92

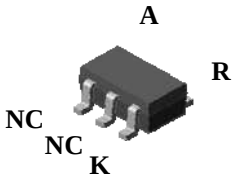
Apply Device : SJ432x

(Marking Side View)



PKG : TO-92M

Apply Device : SJ432xM

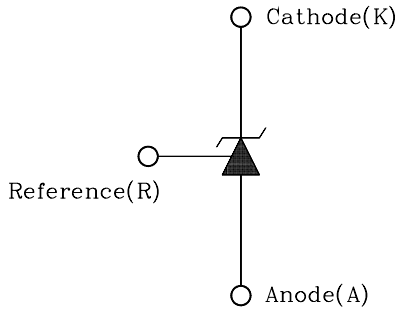


PKG : SOT-25

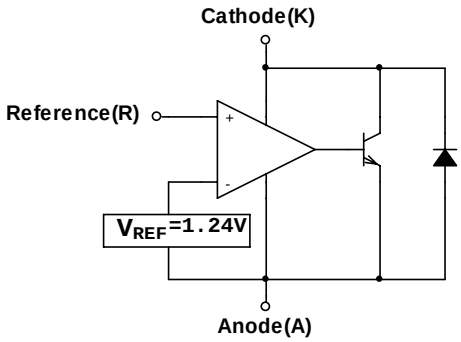
Apply Device : SJ432xN

[K : Cathode, A: Anode, R : Reference]

Symbol



Functional block diagram



◈ Ordering Information

Vref Tolerance	PKG Type	Device Name	Marking
±1%	TO-92	SJ432A	SJ432A
	TO-92M	SJ432AM	SJ432A
	SOT-23	SJ432AS	2GA□ 1)
	SOT-25	SJ432AN	2NA□ 1)
±0.5%	TO-92	SJ432B	SJ432B
	TO-92M	SJ432BM	SJ432B
	SOT-23	SJ432BS	2GB□ 1)
	SOT-25	SJ432BN	2NB□ 1)

Note 1) □ : Year & Week Code

Absolute maximum ratings

[Ta=25℃]

Characteristic		Symbol	Rating	Unit
Cathode to Anode voltage		V_{KA}	20	V
Cathode current		I_K	30	mA
Reference input current		I_{ref}	3	mA
Power Dissipation	SOT-23(Note1)	P_D	350	mW
	TO-92M(Note2)		400	mW
	SOT-25(Note1)		400	mW
	TO-92(Note2)		625	mW
Junction Temperature		T_J	150	℃
Operating temperature range		T_{opr}	-40 ~ +85	℃
Storage temperature range		T_{stg}	-55 ~ +150	℃

Note 1 : Mounted on a glass epoxy PCB board (20 × 20mm).T_A=25℃

Note 2 : T_A=25℃

Recommended operating conditions

Characteristic	Symbol	Rating		Unit
		Min.	Max.	
Cathode to Anode voltage	V_{KA}	V_{ref}	18	V
Cathode current	I_K	0.1	25	mA

Electrical Characteristics (Ta=25℃, unless otherwise noted.)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Reference voltage (Fig.1)	V_{ref}	$V_{KA}=V_{ref}$, I_K=10mA	SJ432Bx	1.234	1.240	1.246	V
			SJ432Ax	1.228		1.252	
Reference input voltage deviation over temperature (Fig.1, Note1,2)	ΔV_{ref}	$V_{KA}=V_{ref}$, I_K=10mA @ -40˚C ≤ Ta ≤ 85˚C		-	10	20	mV
Ratio of delta reference input voltage to delta cathode voltage (Fig.2)	$\frac{\Delta V_{ref}}{\Delta V_{KA}}$	I_K=10mA Vref ≤ V_{KA} ≤ 16V	$\triangle V_{ref}=V_{ref(16V)}-V_{ref}$	-	-1.0	-2.7	mV/V
			$\triangle V_{KA}=V_{KA(16V)}-V_{ref}$				
Reference current (Fig.2)	I_{ref}	I_K=10mA R1=10KΩ, R2=∞		-	1.0	1.5	μA
Reference input current deviation over temperature (Fig.2, Note 1,2)	ΔI_{ref}	I_K=10mA R1=10KΩ, R2=∞ @ -40˚C ≤ Ta ≤ 85˚C		-	0.04	0.08	μA
Minimum cathode current for regulation	$I_{K(MIN)}$	$V_{KA}=V_{ref}$		-	55	80	μA
Off-state cathode current (Fig.3)	$I_{K(off)}$	V_{KA}=16V, V_{ref}=0V		-	5	50	nA
Dynamic impedance (Fig.1, Note3)	Z_{KA}	$V_{KA}=V_{ref}$, f ≤ 1.0KHz 0.1mA ≤ I_K ≤ 25mA		-	0.25	0.4	Ω

Fig. 1 Test circuit for $V_{KA}=V_{ref}$

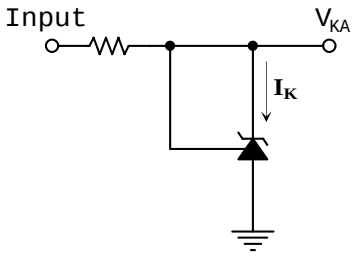


Fig. 2 Test circuit for $V_{KA}>V_{ref}$

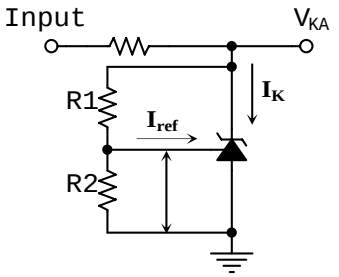
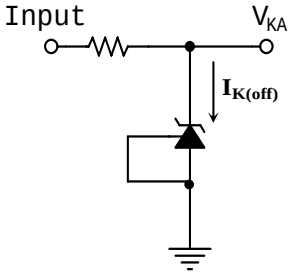


Fig. 3 Test circuit for $I_{K(off)}$

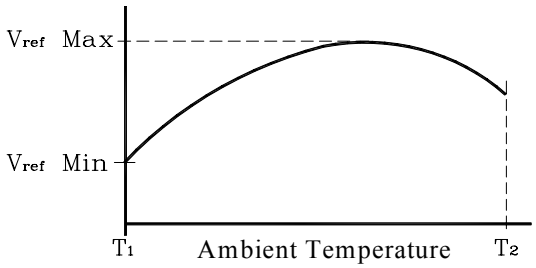


$$V_{KA} = V_{ref} \times (1 + \frac{R_1}{R_2}) + I_{ref} \times R_1$$

Note.

1. Ambient temperature range: T_{LOW} = -40℃, T_{High} = 85℃

2. The deviation parameters △V_{ref} and △I_{ref} are defined as the difference between the maximum value and minimum value obtained over the full operating ambient temperature range that applied.



$\Delta V_{ref} = V_{ref}$ Max – V_{ref} Min

$\Delta T_a = T_2 - T_1$

The average temperature coefficient of the reference input voltage, αV_{ref} is defined as:

$$\alpha V_{ref}(\frac{ppm}{℃}) = \frac{(\frac{\Delta V_{ref}}{V_{ref}(T_a = 25℃)} \times 10^6)}{\Delta T_a}$$

αV_{ref} can be positive or negative depending on whether V_{ref} Min or V_{ref} Max occurs at the lower ambient temperature, refer to Fig. 8

Example : △V_{ref} = 10mV and the slope is positive,

△V_{ref} @ 25℃ = 1.24V

△T_a = 125℃

$$\alpha V_{ref}(\frac{ppm}{℃}) = \frac{(\frac{0.010}{1.241}) \times 10^6}{125} = 65 ppm/℃$$

3. The dynamic impedance Z_{KA} is defined as:

$$|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_K}$$

When the device is operating with two external resistors, R1 and R2, (refer to Fig.2) the total dynamic impedance of the circuit is given by:

$$|Z_{KA}'| = |Z_{KA}| \times (1 + \frac{R_1}{R_2})$$

Electrical Characteristics Curves (Continue)

Fig.4 I_K vs V_{KA} (1)

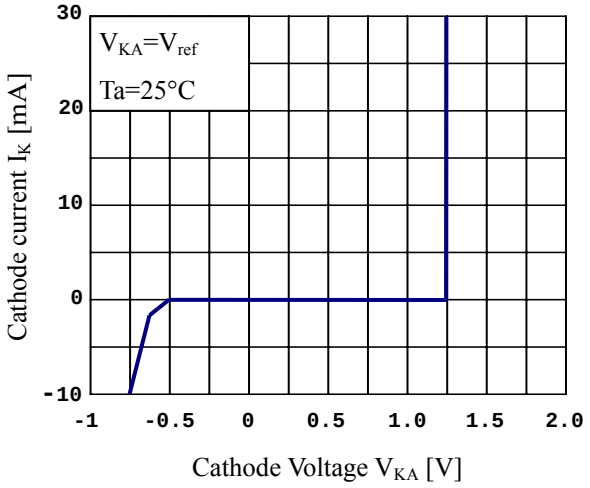


Fig.5 I_K vs V_{KA} (2)

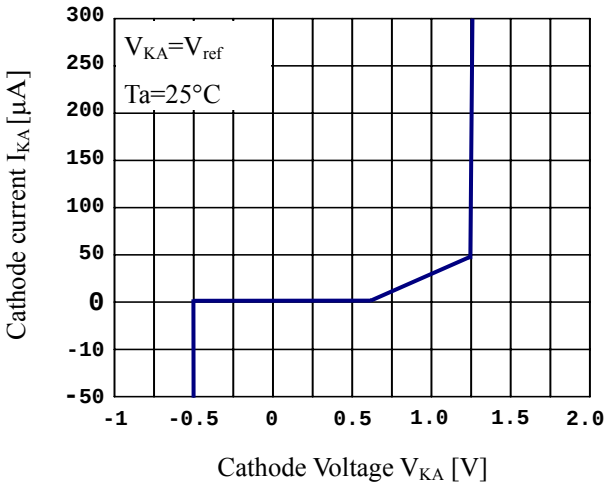


Fig.6 $I_{K(off)}$ vs V_{KA}

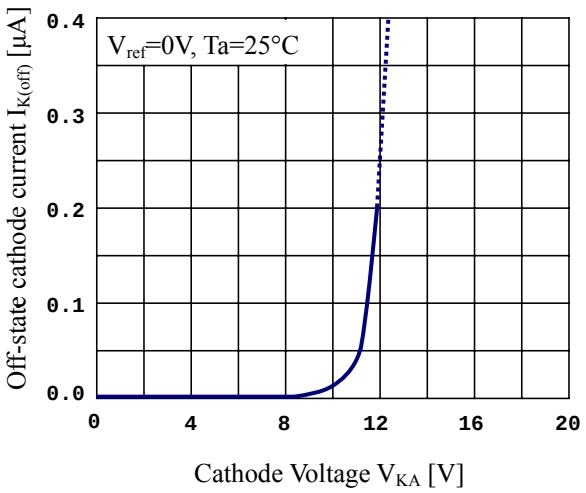


Fig.7 $\Delta V_{ref}/\Delta V_{KA}$ vs T_a

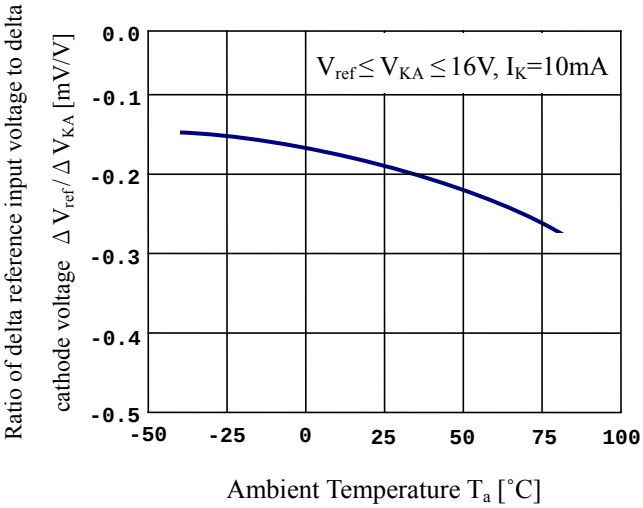


Fig.8 V_{ref} vs T_a

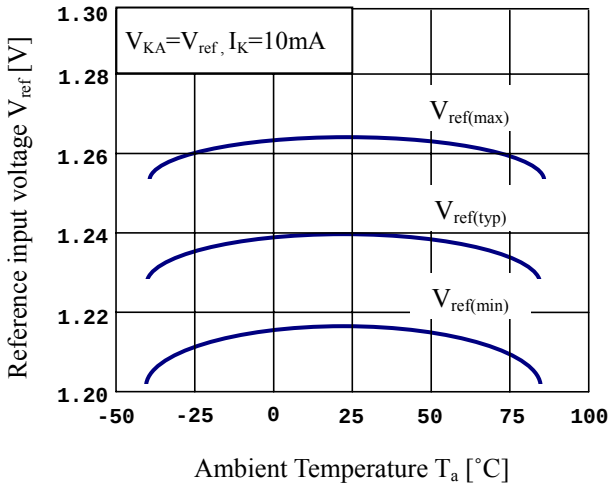
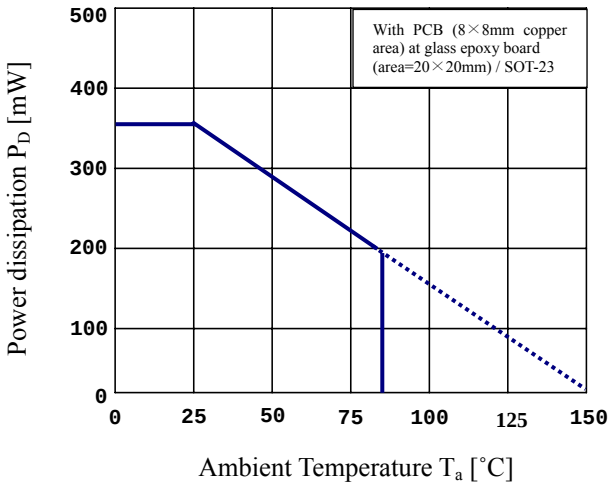


Fig.9 P_D vs T_a



Electrical Characteristics Curves

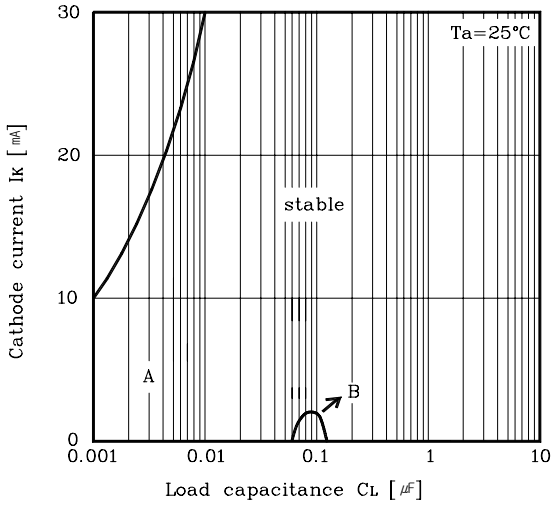
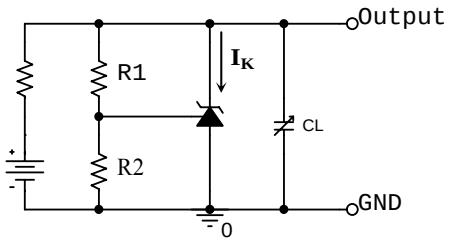


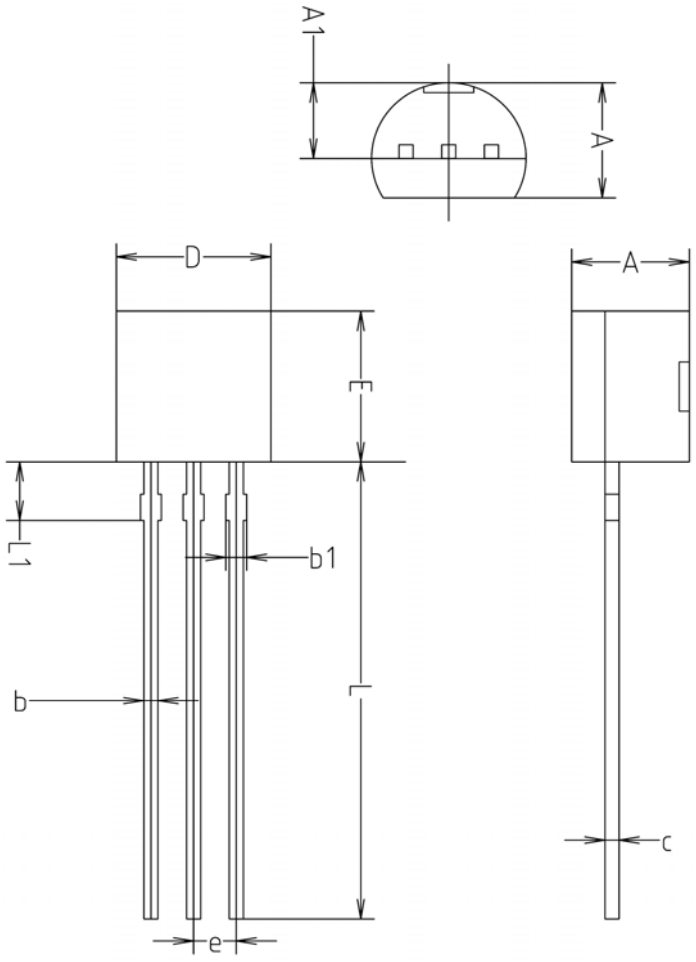
Fig.10 Stability Boundary Conditions



Unstable Regions	V_{KA}	R_1 [KΩ]	R_2 [KΩ]
A, B	V_{ref}	0	∞
A	10V	10	1.415

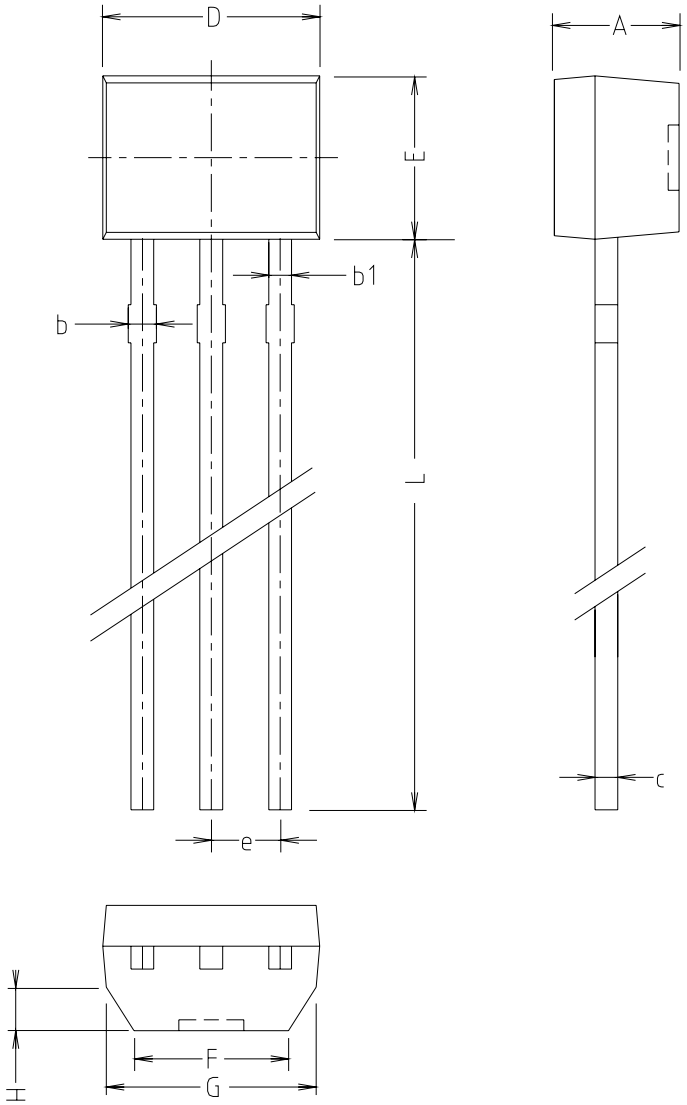
Fig.11 Test circuit for Fig. 10

◈TO-92 Outline Dimension(mm)



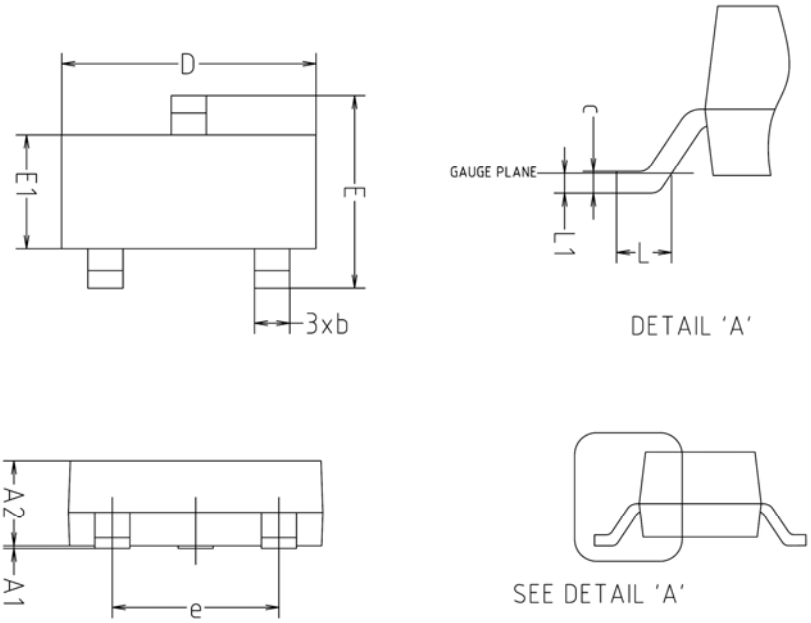
SYMBOL	MILLMETERS(mm)		
	MINIMUM	NOMINAL	MAXIMUM
A	3.40	3.50	3.66
A1	2.46	2.51	2.59
b	0.39	0.44	0.53
b1	0.39	–	0.63
c	0.35	0.42	0.47
D	4.48	4.60	4.70
E	4.48	4.60	4.70
e	1.17	1.27	1.37
L	13.70	14.00	14.77
L1	1.55	1.70	2.15

◈ TO-92M Outline Dimension (unit : mm)



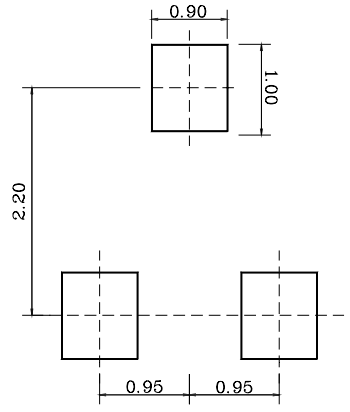
SYMBOL	MILLMETERS(mm)		
	MINIMUM	NOMINAL	MAXIMUM
A	2.20	2.30	2.40
b	–	0.50	–
b1	–	0.44	–
c	–	0.42	–
D	3.90	4.00	4.10
E	2.90	3.00	3.10
e	–	1.27	–
L	–	14.50	15.00
F	2.80	2.85	2.90
G	3.80	–	–
H	–	0.70	–

◈ SOT-23 Outline Dimension (unit : mm)

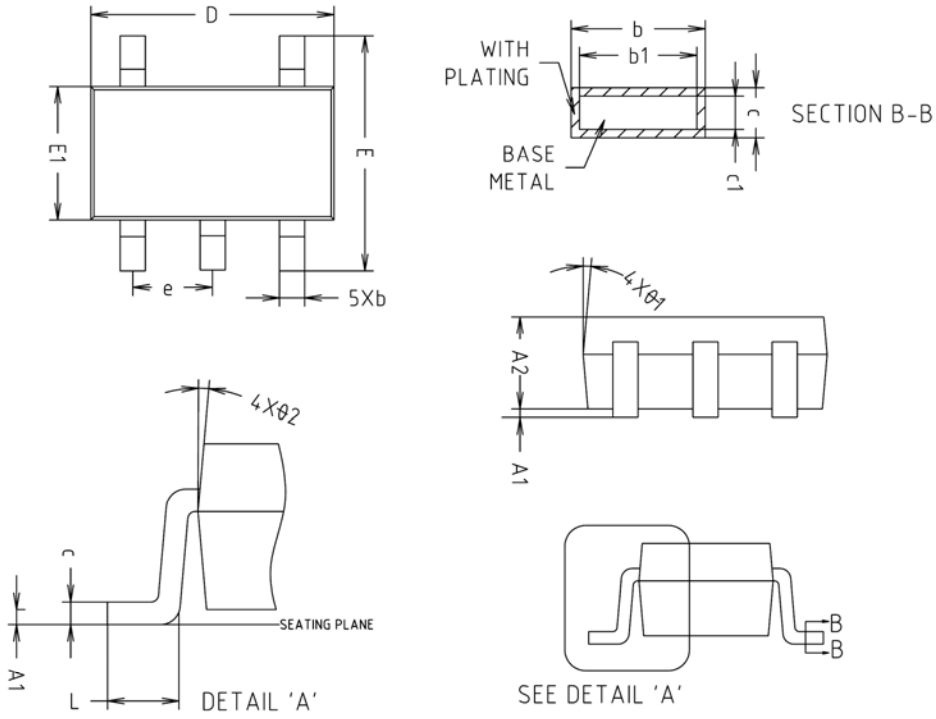


SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A1	0.00	-	0.10	
A2	0.82	-	1.02	
b	0.39	0.42	0.45	
c	0.09	0.12	0.15	
D	2.80	2.90	3.00	
E	2.20	2.40	2.60	
E1	1.20	1.30	1.40	
e	1.90BSC			
L	0.20	-	-	
L1	0.12BSC			

※ Recommend PCB solder land [Unit: mm]

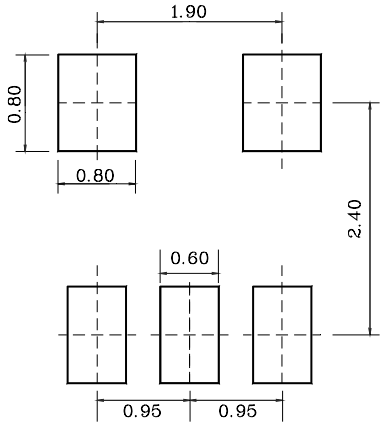


◈ SOT-25 Outline Dimension (unit : mm)



SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A1	0.000	0.050	0.100	
A2	1.000	1.100	1.200	
b	-	0.400	0.450	
b1	-	0.375	0.425	
c	0.110	0.150	0.190	
c1	0.085	0.125	0.165	
D	2.800	2.900	3.000	
E	2.600	2.800	3.000	
E1	1.500	1.600	1.700	
e	0.930	0.950	0.970	
L	0.400	-	-	
θ1	5° REF			
θ2	5° REF			

※ Recommend PCB solder land [Unit: mm]



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