钍地半导体
Tudi Semiconductor

Product Specification

TUDI-TS1871/TS1872/TS1874

1.8 V input/output, rail-to-rail, low power operational amplifiers

网址 www.sztdbdt.com

用芯智造·卓越品质

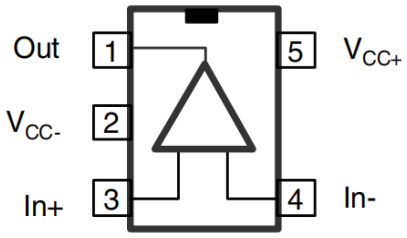
semiconductor device manufacturer

- Design
- research and development
- production
- and sales

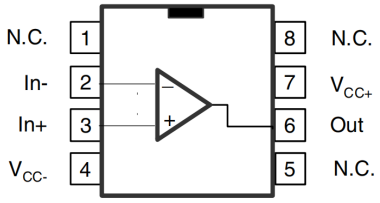
Features

- Operating range from VCC = 1.8 to 6 V
- Rail-to-rail input and output
- Extended Vicm (VCC- - 0.2 V to VCC+ + 0.2 V)
- Low supply current (400 µA)
- Gain bandwidth product (1.6 MHz)
- High unity gain stability
- ESD tolerance (2 kV)
- Latch-up immunity
- Available in – SOT23-5 micropackage
- MiniSO-8, SO-8, SO-14
- TSSOP8, TSSOP14 package

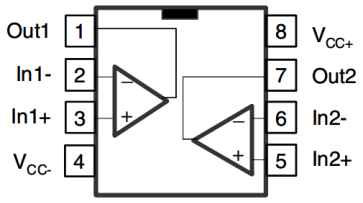
TS1871ILT



TS1871ID/IDT



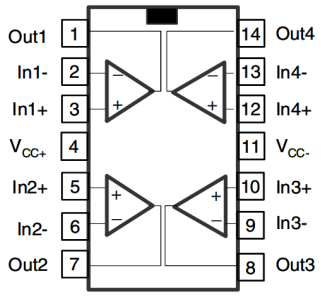
TS1872ID/IDT-TS1872IST-TS1872IPT



Applications

- Battery powered applications (toys)
- Portable communication devices (cell phones)
- Audio drivers (headphone drivers)
- Laptop/notebook computers

TS1874ID/IDT-TS1874IPT



Description

The TS187x (single, dual and quad) device can operate with voltages as low as 1.8 V. They feature both input and output rail-to-rail.
The common mode input voltage extends 200 mV beyond the supply voltages at 25 ° C, while the output voltage swing is within 100 mV of each rail with a 600 load resistor. The devices consume typically 400 µA per channel while offering
1.6 MHz of gain bandwidth product. The amplifiers provide a high output drive capability at typically 65 mA loads.
These features make the TS187x family ideal for sensor interface, battery supplied and portable applications.

1 Absolute maximum ratings and operating conditions

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage(1)	7	V
V_{id}	Differential input voltage(2)	±1	V
V_{in}	Input voltage	V_{CC-} -0.3 to V_{CC+} +0.3	V
T_{stg}	Storage temperature	-65 to +150	°C
T_j	Maximum junction temperature	150	°C
R_{thja}	Thermal resistance junction-to-ambient(3) SOT23-5 MiniSO-8 SO-8 SO-14 TSSOP8 TSSOP14	 250 190 125 103 120 100	°C/W
R_{thjc}	Thermal resistance junction-to-case SOT23-5 MiniSO-8 SO-8 SO-14 TSSOP8 TSSOP14	 81 39 40 31 37 32	°C/W
ESD	HBM: human body model(4)	2	kV
	MM: machine model(5)	200	V
	CDM: charged device model(6)	1.5	kV
	Latch-up immunity	200	mA
	Lead temperature (soldering, 10 sec.)	250	°C
	Output short-circuit duration	See(7)	

1. All voltage values, except differential voltage, are with respect to network terminal.
2. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal. If V_{id} > ±1 V, the maximum input current must not exceed ±1 mA. When V_{id} > ±1 V, add an input series resistor to limit the input current.
3. Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuits on all amplifiers.
4. Human body model: a 100 pF capacitor is charged to the specified voltage, then discharged through a 1.5 kΩ resistor between two pins of the device. This is done for all couples of connected pin combinations while the other pins are floating.
5. Machine model: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω). This is done for all couples of connected pin combinations while the other pins are floating.
6. Charged device model: all pins and package are charged together to the specified voltage and then discharged directly to ground through only one pin. This is done for all pins.
7. Short-circuits from the output to V_{CC} can cause excessive heating. The maximum output current is approximately 80 mA, independent of the magnitude of V_{CC}. Destructive dissipation can result from simultaneous short-circuits on all amplifiers.

Table 3. Operating conditions

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	1.8 to 6	V
V_{icm}	Common-mode input voltage range T_{oper} = 25 °C, 1.8 ≤ V_{CC} ≤ 6 V T_{min} < T_{oper} < T_{max}, 1.8 ≤ V_{CC} ≤ 6 V	V_{CC-} - 0.2 to V_{CC+} + 0.2 V_{CC-} to V_{CC+}	V
T_{oper}	Operating free air temperature range	-40 to + 125	°C

2 Electrical characteristics

Table 4. Electrical characteristics measured at V_{CC+} = +1.8 V with V_{CC-} = 0 V, C_L and R_L connected to $V_{CC}/2$, and T_{amb} = 25 °C (unless otherwise specified)(1)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage	$V_{icm} = V_{out} = V_{CC}/2$ TS1871A/2A/4A $T_{min} \le T_{amb} \le T_{max}$ TS1871/2/4 $T_{min} \le T_{amb} \le T_{max}$		 0.1	 1 1.5 3 6	mV
ΔV_{io}	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current	$V_{icm} = V_{out} = V_{CC}/2$(2) $T_{min} \le T_{amb} \le T_{max}$		3	30 60	nA
I_{ib}	Input bias current	$V_{icm} = V_{out} = V_{CC}/2$(2) $T_{min} \le T_{amb} \le T_{max}$		40	125 150	nA
CMR	Common mode rejection ratio 20 log ($\Delta V_{ic}/\Delta V_{io}$)	$0 \le V_{icm} \le V_{CC}$, $V_{out} = V_{CC}/2$ $T_{min} \le T_{amb} \le T_{max}$	55 52	77		dB
A_{vd}	Large signal voltage gain	V_{out} = 0.5 to 1.3 V R_L = 2 kΩ R_L = 600 Ω	 77 70	 91 84		dB
V_{OH}	High level output voltage	V_{id} = 100 mV R_L = 2 kΩ R_L = 600 Ω $T_{min} \le T_{amb} \le T_{max}$, R_L = 2 kΩ $T_{min} \le T_{amb} \le T_{max}$, R_L = 600 Ω	 1.65 1.62 1.65 1.62	 1.77 1.74		V
V_{OL}	Low level output voltage	V_{id} = -100 mV R_L = 2 kΩ R_L = 600 Ω $T_{min} \le T_{amb} \le T_{max}$, R_L = 2 kΩ $T_{min} \le T_{amb} \le T_{max}$, R_L = 600 Ω		 30 46	 100 150 100 150	mV
I_o	Output source current	V_{id} = 100 mV, $V_O = V_{CC-}$	20	58		mA
	Output sink current	V_{id} = -100 mV, $V_O = V_{CC+}$	20	68		
I_{CC}	Supply current (per amplifier)	$V_{out} = V_{CC}/2$ A_{VCL} = 1, no load $T_{min} \le T_{amb} \le T_{max}$		400	560 600	µA
GBP	Gain bandwidth product	R_L = 10 kΩ, C_L = 100 pF, f = 100 kHz	0.9	1.6		MHz
SR	Slew rate	R_L = 10 kΩ, C_L = 100 pF, A_V = 1	0.38	0.54		V/µs
ϕm	Phase margin	C_L = 100 pF		53		Degrees
e_n	Input voltage noise	f = 1 kHz		27		nV/√Hz
THD	Total harmonic distortion			0.01		%

1. All parameter limits at temperatures different from 25 °C are guaranteed by correlation.
2. Maximum values include unavoidable inaccuracies of the industrial tests.

Table 5. Electrical characteristics measured at V_{CC} = +3 V with V_{CC-} = 0 V, C_L and R_L connected to $V_{CC}/2$, and T_{amb} = 25 °C (unless otherwise specified)(1)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage	$V_{icm} = V_{out} = V_{CC}/2$ TS1871A/2A/4A $T_{min} \le T_{amb} \le T_{max}$ TS1871/2/4 $T_{min} \le T_{amb} \le T_{max}$		 0.1	 1 1.5 3 6	mV
ΔV_{io}	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current	$V_{icm} = V_{out} = V_{CC}/2$(2) $T_{min} \le T_{amb} \le T_{max}$		3	30 60	nA
I_{ib}	Input bias current	$V_{icm} = V_{out} = V_{CC}/2$(2) $T_{min} \le T_{amb} \le T_{max}$		4	125 150	nA
CMR	Common mode rejection ratio 20 log ($\Delta V_{ic}/\Delta V_{io}$)	$0 \le V_{icm} \le V_{CC}$, $V_{out} = V_{CC}/2$ $T_{min} \le T_{amb} \le T_{max}$	60 57	80		dB
A_{vd}	Large signal voltage gain	V_{out} = 0.5 to 2.5 V R_L = 2 kΩ R_L = 600 Ω	 80 74	 94 88		dB
V_{OH}	High level output voltage	V_{id} = 100 mV R_L = 2 kΩ R_L = 600 Ω $T_{min} \le T_{amb} \le T_{max}$, R_L = 2 kΩ $T_{min} \le T_{amb} \le T_{max}$, R_L = 600 Ω	 2.82 2.80 2.82 2.80	 2.95 2.95		V
V_{OL}	Low level output voltage	V_{id} = -100 mV R_L = 2 kΩ R_L = 600 Ω $T_{min} \le T_{amb} \le T_{max}$, R_L = 2 kΩ $T_{min} \le T_{amb} \le T_{max}$, R_L = 600 Ω		 39 58	 120 160 120 160	mV
I_o	Output source current	V_{id} = 100 mV, $V_O = V_{CC-}$	20	60		mA
	Output sink current	V_{id} = -100 mV, $V_O = V_{CC+}$	20	70		
I_{CC}	Supply current (per amplifier)	$V_{out} = V_{CC}/2$ A_{VCL} = 1, no load $T_{min} \le T_{amb} \le T_{max}$		450	650 690	µA
GBP	Gain bandwidth product	R_L = 10 kΩ, C_L = 100 pF, f = 100 kHz	1	1.7		MHz
SR	Slew rate	R_L = 10 kΩ, C_L = 100 pF, A_V = 1	0.42	0.6		V/µs
ϕm	Phase margin	C_L = 100 pF		53		Degrees
e_n	Input voltage noise	f = 1 kHz		27		nV/√Hz
THD	Total harmonic distortion			0.01		%

1. All parameter limits at temperatures different from 25 °C are guaranteed by correlation.
2. Maximum values include unavoidable inaccuracies of the industrial tests.

Table 6. Electrical characteristics measured at V_{CC} = +5 V with V_{CC-} = 0 V, C_L and R_L connected to $V_{CC}/2$, and T_{amb} = 25 °C (unless otherwise specified)(1)

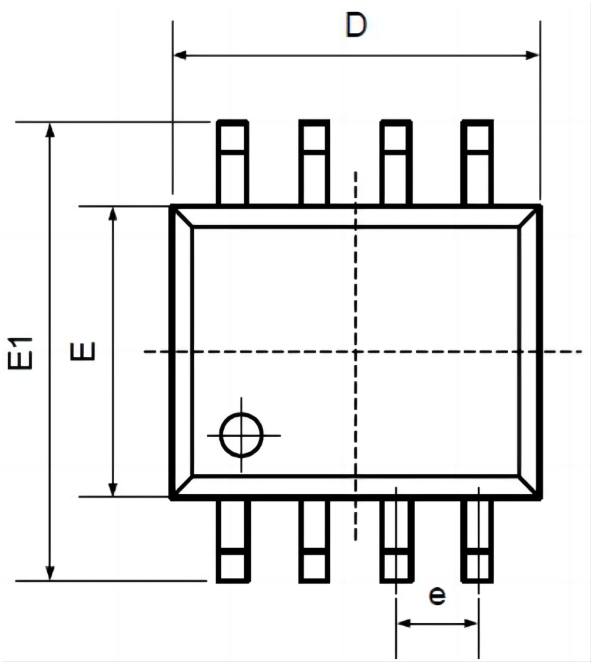
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage	$V_{icm} = V_{out} = V_{CC}/2$ TS1871A/2A/4A $T_{min} \le T_{amb} \le T_{max}$ TS1871/2/4 $T_{min} \le T_{amb} \le T_{max}$		 0.1	1 1.5 3 6	mV
ΔV_{io}	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current	$V_{icm} = V_{out} = V_{CC}/2$ (2) $T_{min} \le T_{amb} \le T_{max}$		3	30 60	nA
I_{ib}	Input bias current	$V_{icm} = V_{out} = V_{CC}/2$ (2) $T_{min} \le T_{amb} \le T_{max}$		70	130 150	nA
CMR	Common mode rejection ratio 20 log ($\Delta V_{ic}/\Delta V_{io}$)	$0 \le V_{icm} \le V_{CC}$, V_{out} not equal to $V_{CC}/2$ $T_{min} \le T_{amb} \le T_{max}$	65 62	85		dB
SVR	Supply voltage rejection ratio 20 log ($\Delta V_{cc}/\Delta V_{io}$)	V_{CC} = 1.8 to 5 V	70	90		dB
A_{vd}	Large signal voltage gain	V_{out} = 1 to 4 V R_L = 2 kΩ R_L = 600 Ω	 83 77	 97 91		dB
V_{OH}	High level output voltage	V_{id} = 100 mV R_L = 2 kΩ R_L = 600 Ω $T_{min} \le T_{amb} \le T_{max}$, R_L = 2 kΩ $T_{min} \le T_{amb} \le T_{max}$, R_L = 600 Ω	 4.80 4.75 4.80 4.75	 4.95 4.90		V
V_{OL}	Low level output voltage	V_{id} = -100 mV R_L = 2 kΩ R_L = 600 Ω $T_{min} \le T_{amb} \le T_{max}$, R_L = 2 kΩ $T_{min} \le T_{amb} \le T_{max}$, R_L = 600 Ω		 52 70	 130 188 130 188	mV
I_o	Output source current	V_{id} = 100 mV, $V_O = V_{CC-}$	20	65		mA
	Output sink current	V_{id} = -100 mV, $V_O = V_{CC+}$	20	80		
I_{CC}	Supply current (per amplifier)	$V_{out} = V_{CC}/2$ A_{VCL} = 1, no load $T_{min} \le T_{amb} \le T_{max}$		500	835 875	µA
GBP	Gain bandwidth product	R_L = 10 kΩ, C_L = 100 pF, f = 100 kHz	1	1.8		MHz
SR	Slew rate	R_L = 10 kΩ, C_L = 100 pF, A_V = 1	0.42	0.6		V/µs
ϕm	Phase margin	C_L = 100 pF		55		Degrees
e_n	Input voltage noise	f = 1 kHz		27		nV/√Hz
THD	Total harmonic distortion			0.01		%

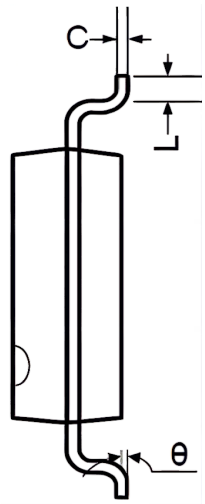
1. All parameter limits at temperatures different from 25 °C are guaranteed by correlation.
2. Maximum values include unavoidable inaccuracies of the industrial tests.

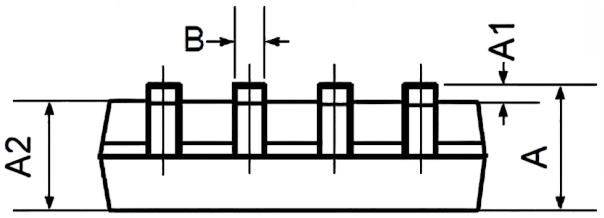
ORDERING INFORMATION

Order Number	Package	Package Quantity	Marking On The park	Temperature
TS1871IDT-TUDI	SOP8	Tape,Reel,2500	18711	-40℃ to+125℃
TS1871IAIDT-TUDI	SOP8	Tape,Reel,2500	1871AI	
TS1871ILT-TUDI	SOT23-5	Tape,Reel,3000	K171	
TS1871AILT-TUDI	SOT23-5	Tape,Reel,3000	K172	
TS1871IYLT-TUDI	SOT23-5	Tape,Reel,3000	K182	
TS1871AIYLT-TUDI	SOT23-5	Tape,Reel,3000	K183	
TS1872IDT-TUDI	SOP8	Tape,Reel,2500	1872I	
TS1872AIDT-TUDI	SOP8	Tape,Reel,2500	1872AI	
TS1872IYDT-TUDI	SOP8	Tape,Reel,2500	1872Y	
TS1872AIYDT-TUDI	SOP8	Tape,Reel,2500	1872AY	
TS1872IPT-TUDI	TSSOP8	Tape,Reel,2500	1872I	
TS1872AIPT-TUDI	TSSOP8	Tape,Reel,2500	1872A	
TS1872IYPT-TUDI	TSSOP8	Tape,Reel,2500	1872Y	
TS1872AIYPT-TUDI	TSSOP8	Tape,Reel,2500	872AY	
TS1872IST-TUDI	MSOP8	Tape,Reel,2500	K171	
TS1872AIST-TUDI	MSOP8	Tape,Reel,2500	K172	
TS1874IDT-TUDI	SOP14	Tape,Reel,2500	1874I	
TS1874AIDT-TUDI	SOP14	Tape,Reel,2500	1874AI	
TS1874IYDT-TUDI	SOP14	Tape,Reel,2500	TS1874Y	
TS1874AIYDT-TUDI	SOP14	Tape,Reel,2500	TS1874AY	
TS1874IPT-TUDI	TSSOP14	Tape,Reel,2500	1874I	
TS1874AIPT-TUDI	TSSOP14	Tape,Reel,2500	1874AI	
TS1874IYPT-TUDI	TSSOP14	Tape,Reel,2500	TS1874Y	
TS1874AIYPT-TUDI	TSSOP14	Tape,Reel,2500	TS1874AY	

Package SOP8

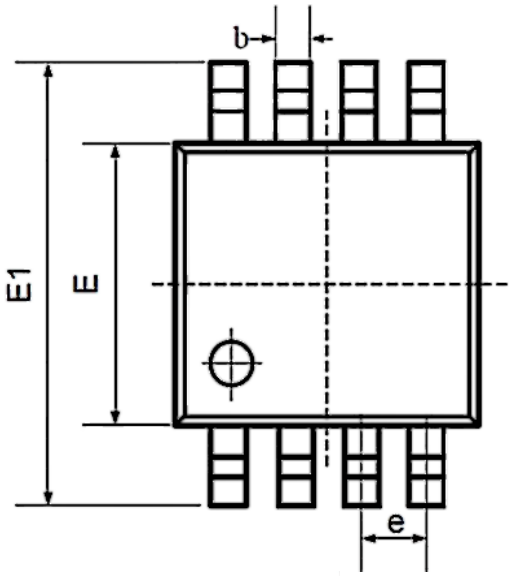


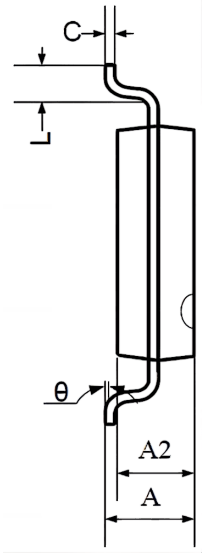


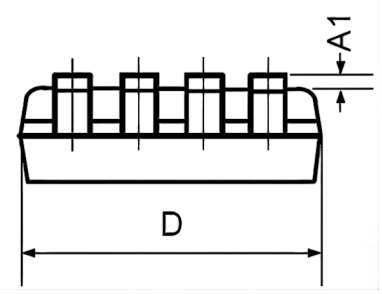


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Package MSOP8

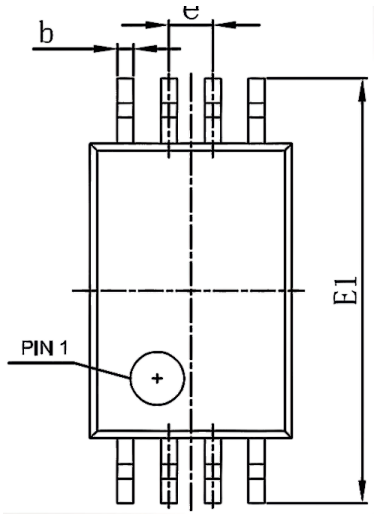


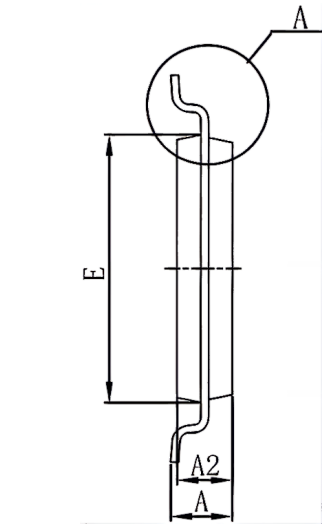


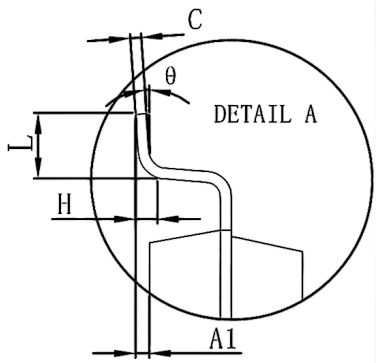


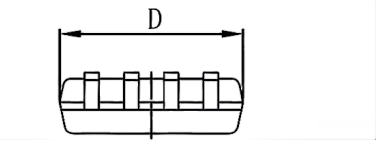
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.200	0.031	0.047
A1	0.000	0.200	0.000	0.008
A2	0.760	0.970	0.030	0.038
b	0.30 TYP		0.012 TYP	
C	0.15 TYP		0.006 TYP	
D	2.900	3.100	0.114	0.122
e	0.65 TYP		0.026 TYP	
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
L	0.410	0.650	0.016	0.026
θ	0°	6°	0°	6°

Package TSSOP8



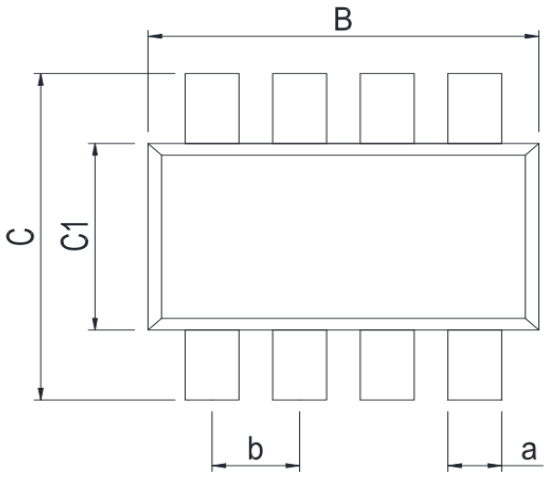


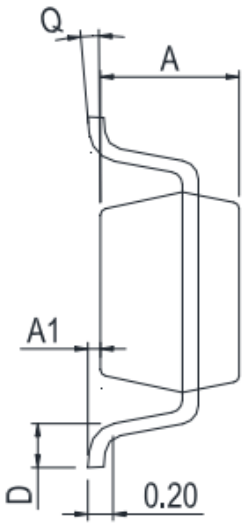




Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
C	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.200		0.047
A2	0.800	1.000	0.031	0.039
A1	0.050	0.150	0.002	0.006
e	0.65(BSC)		0.026(BSC)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°		1°	

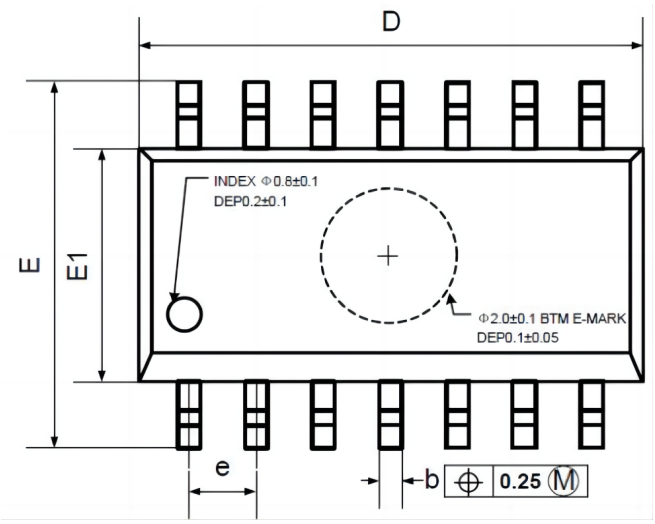
Package SOT23-8

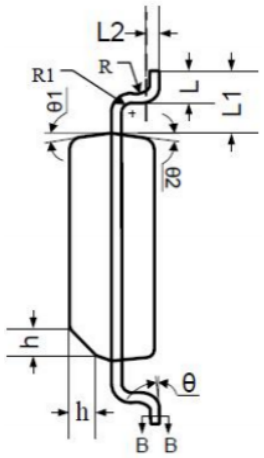


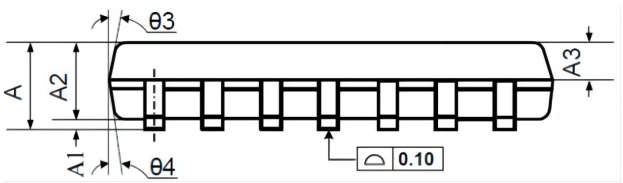


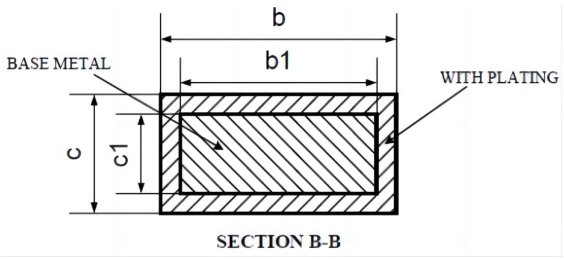
Symbol	Dimensions In Millimeters	
	Min	Max
A	1.050	1.150
A1	0.000	0.150
B	2.820	3.020
C	2.65	2.95
C1	1.5	1.7
D	0.300	0.600
Q	0°	8°
a	0.300	0.400
b	0.65 BSC	

Package SOP14



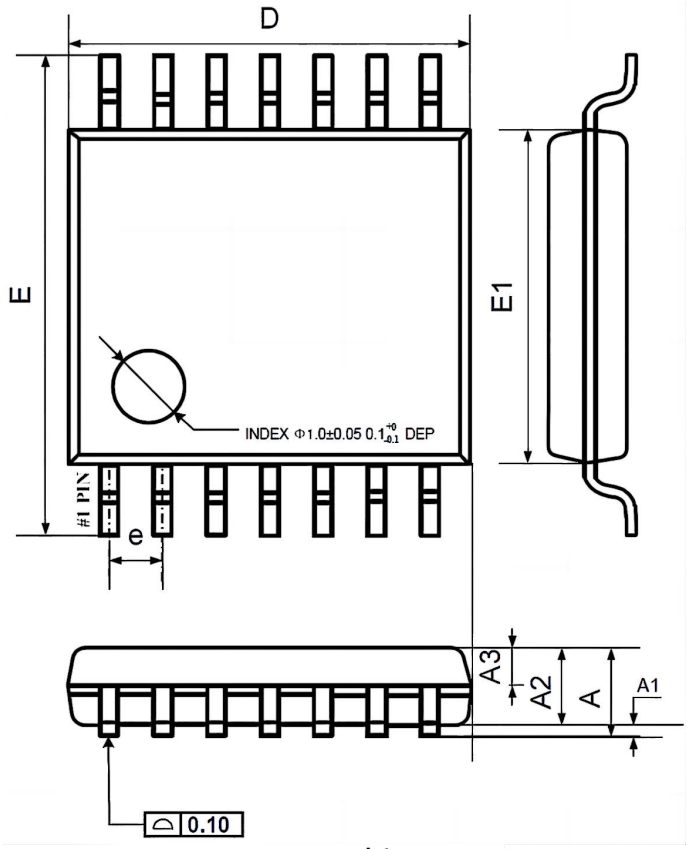


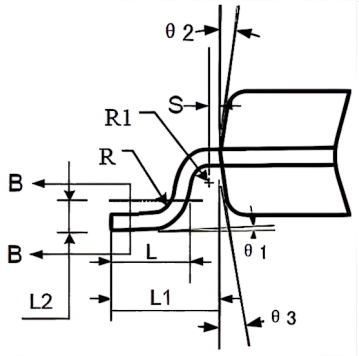


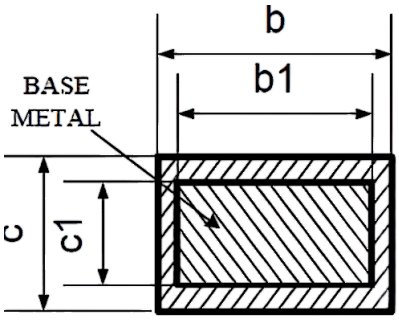


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
A3	0.55	0.65	0.75
b	0.36		0.49
b1	0.35	0.40	0.45
C	0.16		0.25
c1	0.15	0.20	0.25
D	8.53	8.63	8.73
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
L	0.45	0.60	0.80
L1	1.04 REF		
L2	0.25 BSC		
R	0.07		
R1	0.07		
h	0.30	0.40	0.50
θ	0°		8°
θ1	6°	8°	10°
θ2	6°	8°	10°
θ3	5°	7°	9°
θ4	5°	7°	9°

Package TSSOP14

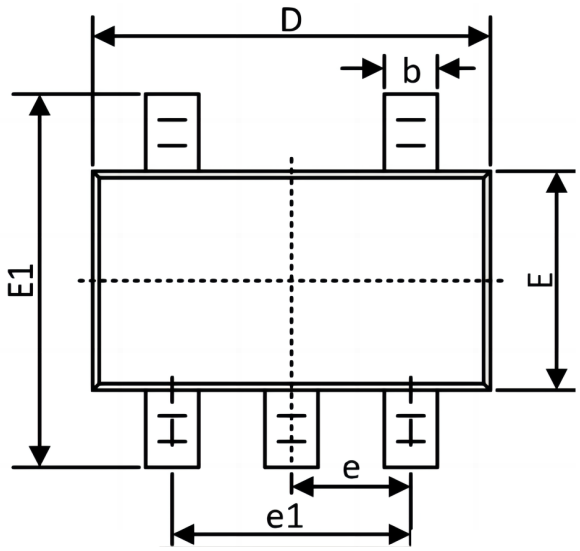


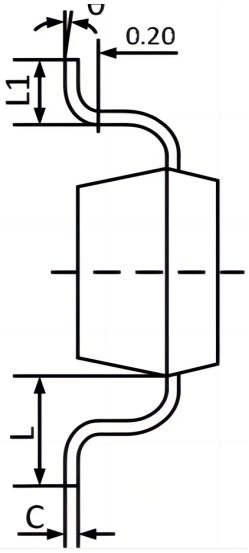


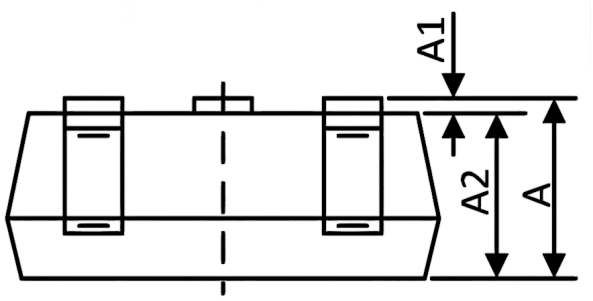


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	—	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	—	0.28
b1	0.20	0.22	0.24
C	0.10	—	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	—	—
R1	0.09	—	—
S	0.20	—	—
θ1	0°	—	8°
θ2	10°	12°	14°
θ3	10°	12°	14°

Package SOT23-5







Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.400	0.012	0.016
C	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.700REF		0.028REF	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

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