TS1871
TS1872
TS1874

1.8V, INPUT/OUTPUT RAIL TO RAIL LOW POWER OPERATIONAL AMPLIFIERS

- OPERATING AT V_{CC} **= 1.8V to 6V**
- RAIL TO RAIL **INPUT & OUTPUT**
- EXTENDED V_{icm} **(V_{ee} - 0.2V to V_{CC} + 0.2V)**
- LOW SUPPLY CURRENT **(400µA)**
- GAIN BANDWIDTH PRODUCT **(1.6MHz)**
- HIGH STABILITY
- ESD TOLERANCE **(2kV)**
- LATCH-UP IMMUNITY **(Class A)**
- AVAILABLE IN **SOT23-5 MICROPACKAGE**

DESCRIPTION

The TS187x (Single, Dual & Quad) is operational amplifier able to operate with voltages as low as 1.8V and features both I/O Rail to Rail.

The common mode input voltage extends 200mV @ 25°C beyond the supply voltages while the output voltage swing is within 100mV of each Rail for a 600Ω load resistor. This I/O Rail to Rail configuration gives the chance to the user to have the entire supply voltage range available. Offering 20mA min., 65mA typ. value and exhibiting an excellent speed-power ratio, 1.6MHz GBP & 400µA supply current, this Op-Amp is very well-suited for battery-supplied and portable applications.

Stability and minimum overshoot with capacitive loads is maintained by 53° typ. of phase margin with 100pF load capacitor @ 1.8V.

APPLICATIONS

- Battery-powered applications
- Portable communication devices (cell phone)
- Active filters
- Audio drivers
- Line drivers

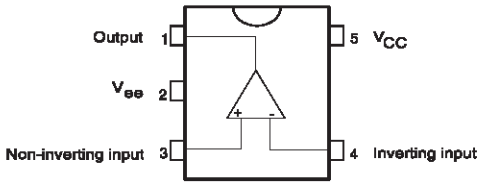
ORDER CODES

Part Number	Temperature Range	Package				SOT23 Marking
		N	D	P	L	
TS1871I/AI	-40, +125°C		•		•	K171/172
TS1872I/AI	-40, +125°C	•	•	•		
TS1874I/AI	-40, +125°C	•	•	•		

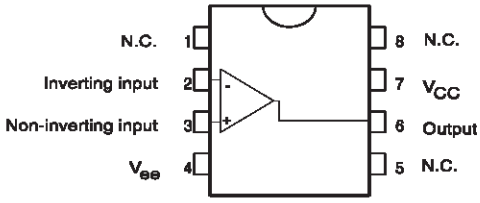
N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)
P = Thin Shrink Small Outline Package (TSSOP) - only available in Tape & Reel (PT)
L = Tiny Package (SOT23-5) - only available in Tape & Reel (LT)

PIN CONNECTIONS (top view)

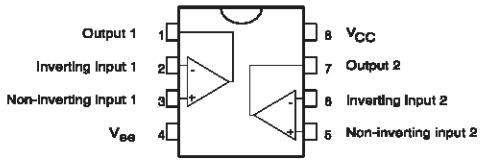
TS1871ILT



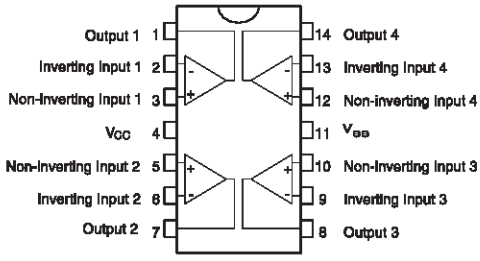
TS1871ID- TS1871IDT



TS1872IN-TS1872ID-TS1872IDT-TS1872IPT



TS1874IN-TS1874ID-TS1874IDT-TS1874IPT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage - note 1	7	V
V_{id}	Differential Input Voltage - note 2	–1	V
V_i	Input Voltage - note 3	-0.3 to V_{CC} +0.3	V
T_{oper}	Operating Free Air Temperature Range	-40 to +125	°C
T_{stg}	Storage Temperature	-65 to +150	°C
T_j	Maximum Junction Temperature	150	°C
R_{thjc}	Thermal Resistance Junction to Case - note 4 SOT23-5 DIP8 DIP14 SO8 SO14 TSSOP8 TSSOP14	 81 42 32 28 22 26 21	°C/W
R_{thja}	Thermal Resistance Junction to Ambient - SOT23-5	256	°C/W
ESD	Human Body Model	2	kV
	Latch-up Immunity	Class A	
	Lead Temperature (soldering, 10sec)	260	°C

Notes : 1. All voltage values, except differential voltage are with respect to network ground terminal.
2. Differential voltages are the non-inverting input terminal with respect to the inverting terminal.
3. The magnitude of input and output voltages must never exceed V_{CC} +0.3V.
4. Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuit on all amplifiers.

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	1.8 to 6	V
V_{icm}	Common Mode Input Voltage Range - note1	V_{ee} - 0.2 to V_{CC} + 0.2	V
V_{icm}	Common Mode Input Voltage Range - note2	V_{ee} to V_{CC}	V

Notes : 1. At 25°C, for 1.8 £ Vcc £ 6V, Vicm is extended to Vee - 0.2V, Vcc + 0.2V.
2. In full temperature range, both Rails can be reached when Vcc does not exceed 5.5V

ELECTRICAL CHARACTERISTICS

V_{CC} = **+1.8V**, V_{ee} = **0V**, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage TS1871/2/4 TS1871A/2A/4A		0.1	3 1	mV
DV_{io}	Input Offset Voltage Drift		2		mV/°C
I_{io}	Input Offset Current - note 1		3	28	nA
I_{ib}	Input Bias Current - note 1		40	125	nA
CMR	Common Mode Rejection Ratio 0 £ V_{icm} £ Vcc	55	77		dB
SVR	Supply Voltage Rejection Ratio V_{icm} = 0.5V	70	80		dB
A_{vd}	Large Signal Voltage Gain R_L = 2kW R_L = 600W	77 70	92 85		dB
V_{OH}	High Level Output Voltage R_L = 2kW R_L = 600W	1.65 1.62	1.77 1.74		V
V_{OL}	Low Level Output Voltage R_L = 2kW R_L = 600W		88 115	110 150	mV
I_o	Output Source Current V_{ID} = 100mV, V_O = V_{DD} Output Sink Current V_{ID} = -100mV, V_O = V_{CC}	20 20	65 65		mA
I_{CC}	Supply Current (per amplifier) AVCL = 1, no load		400	560	mA
GBP	Gain Bandwidth Product R_L = 10kW, C_L = 100pF, f = 100kHz	0.9	1.6		MHz
SR	Slew Rate R_L = 10kW, C_L = 100pF, AV = 1	0.38	0.54		V/ms
f m	Phase Margin C_L = 100pF		53		Degrees
en	Input Voltage Noise f = 1kHz		40		nV/ Hz
THD	Total Harmonic Distortion		0.01		%

Note : 1. Maximum values including unavoidable inaccuracies of the industrial test.

ELECTRICAL CHARACTERISTICS

V_{CC} = **+3V**, V_{ee} = **0V**, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage TS1871/2/4 TS1871A/2A/4A		0.1	3 1	mV
DV_{io}	Input Offset Voltage Drift		2		mV/°C
I_{io}	Input Offset Current - note 1		3	28	nA
I_{ib}	Input Bias Current - note 1		4	125	nA
CMR	Common Mode Rejection Ratio 0 £ V_{icm} £ Vcc	60	80		dB
SVR	Supply Voltage Rejection Ratio V_{icm} = $V_{CC/2}$	70	85		dB
A_{vd}	Large Signal Voltage Gain R_L = 2kW R_L = 600W	80 74	92 95		dB
V_{OH}	High Level Output Voltage R_L = 2kW R_L = 600W	2.82 2.80	2.95 2.95		V
V_{OL}	Low Level Output Voltage R_L = 2kW R_L = 600W		88 115	120 160	mV
I_o	Output Source Current V_{ID} = 100mV, V_O = V_{DD} Output Sink Current V_{ID} = -100mV, V_O = V_{CC}	20 20	80 80		mA
I_{CC}	Supply Current (per amplifier) AVCL = 1, no load		450	650	mA
GBP	Gain Bandwidth Product R_L = 10kW, C_L = 100pF, f = 100kHz	1	1.7		MHz
SR	Slew Rate R_L = 10kW, C_L = 100pF, AV = 1	0.42	0.6		V/ms
f m	Phase Margin C_L = 100pF		53		Degrees
en	Input Voltage Noise f = 1kHz		40		nV/ Hz
THD	Total Harmonic Distortion		0.01		%

Note : 1. Maximum values including unavoidable inaccuracies of the industrial test.

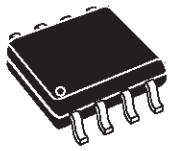
ELECTRICAL CHARACTERISTICS

V_{CC} = **+5V**, V_{ee} = **0V**, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage TS1871/2/4 TS1871A/2A/4A		0.1	3 1	mV
DV_{io}	Input Offset Voltage Drift		2		µV/°C
I_{io}	Input Offset Current - note 1		3	30	nA
I_{ib}	Input Bias Current - note 1		48	130	nA
CMR	Common Mode Rejection Ratio 0 £ V_{icm} £ Vcc	65	85		dB
SVR	Supply Voltage Rejection Ratio V_{icm} = $V_{CC/2}$	70	90		dB
A_{vd}	Large Signal Voltage Gain R_L = 2kW R_L = 600W	83 77	92 85		dB
V_{OH}	High Level Output Voltage R_L = 2kW R_L = 600W	4.80 4.75	4.95 4.90		V
V_{OL}	Low Level Output Voltage R_L = 2kW R_L = 600W		88 115	130 188	mV
I_o	Output Source Current V_{ID} = 100mV, V_O = V_{DD} Output Sink Current V_{ID} = -100mV, V_O = V_{CC}	20 20	80 80		mA
I_{CC}	Supply Current (per amplifier) AVCL = 1, no load		513	835	µA
GBP	Gain Bandwidth Product R_L = 10kW, C_L = 100pF, f = 100kHz	1	1.8		MHz
SR	Slew Rate R_L = 10kW, C_L = 100pF, AV = 1	0.42	0.6		V/µs
f m	Phase Margin C_L = 100pF		55		Degrees
en	Input Voltage Noise f = 1kHz		40		nV/ Hz
THD	Total Harmonic Distortion		0.01		%

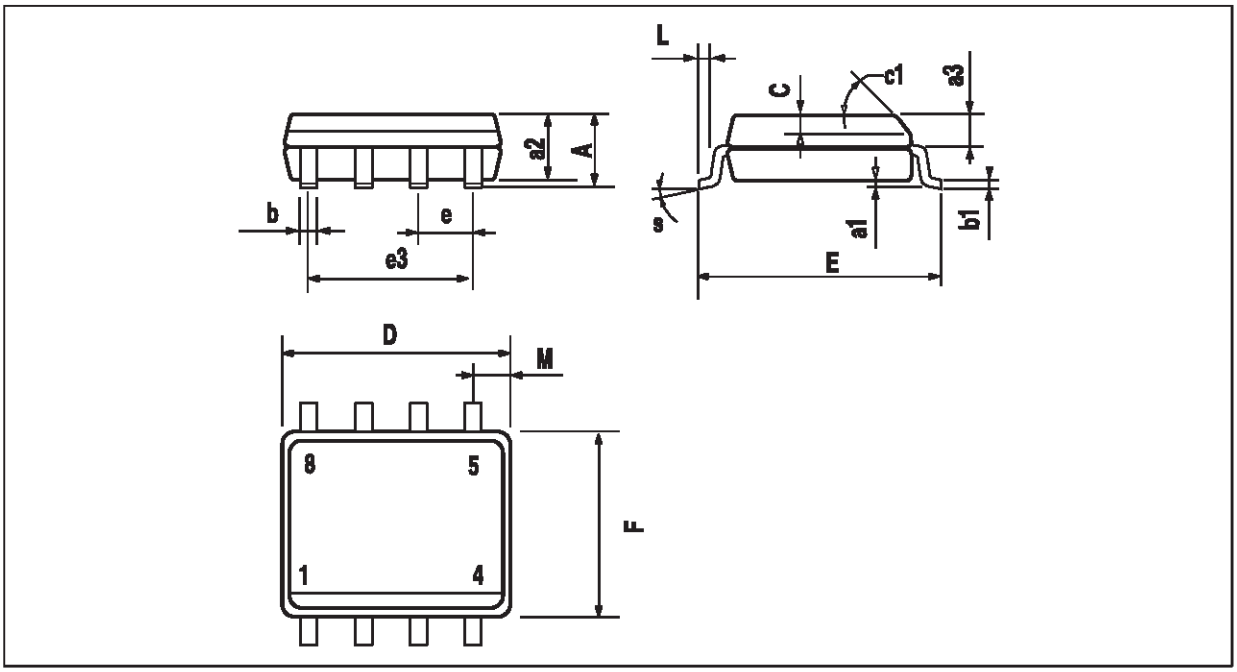
Note : 1. Maximum values including unavoidable inaccuracies of the industrial test.

TS1871ID-TS1872ID



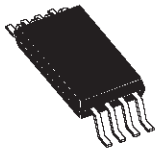
PACKAGE MECHANICAL DATA

8 PINS - PLASTIC MICROPACKAGE (SO)



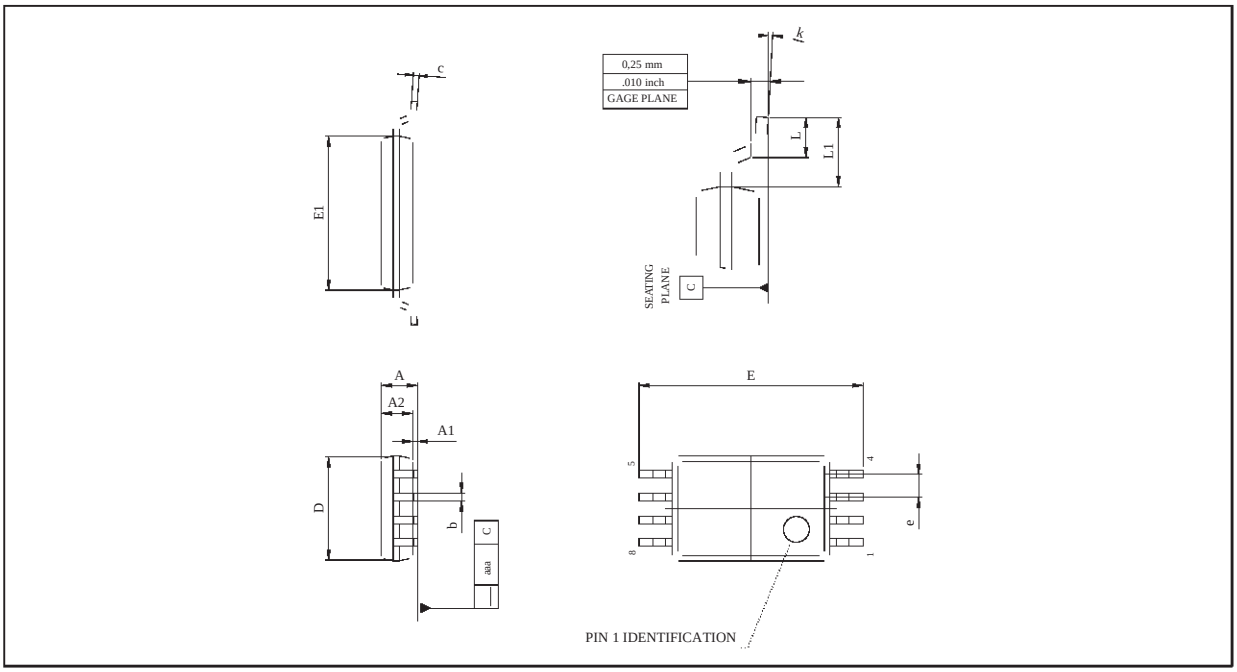
Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.150		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

TS1872IPT



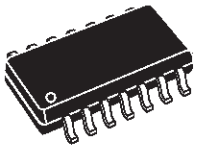
PACKAGE MECHANICAL DATA

8 PINS - THIN SHRINK SMALL OUTLINE PACKAGE (TSSOP)



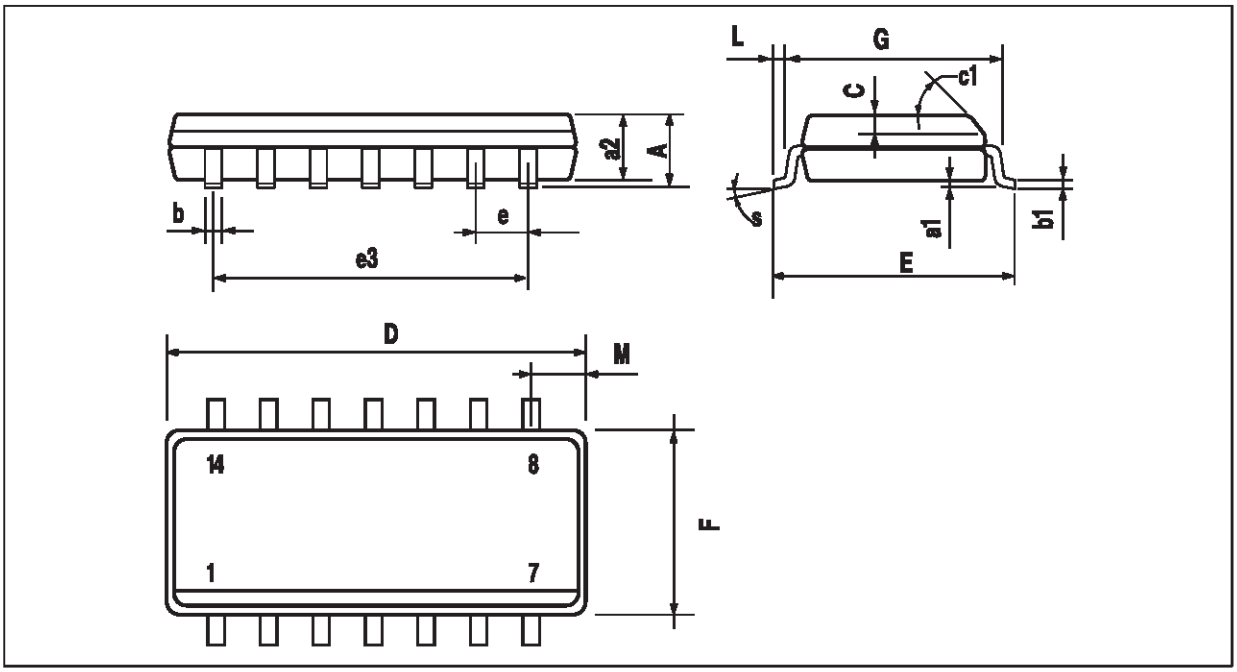
Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.05
A1	0.05		0.15	0.01		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.15
c	0.09		0.20	0.003		0.012
D	2.90	3.00	3.10	0.114	0.118	0.122
E		6.40			0.252	
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.025	
k	0°		8°	0°		8°
l	0.50	0.60	0.75	0.09	0.0236	0.030

TS1874ID



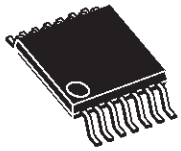
PACKAGE MECHANICAL DATA

14 PINS - PLASTIC MICROPACKAGE (SO)



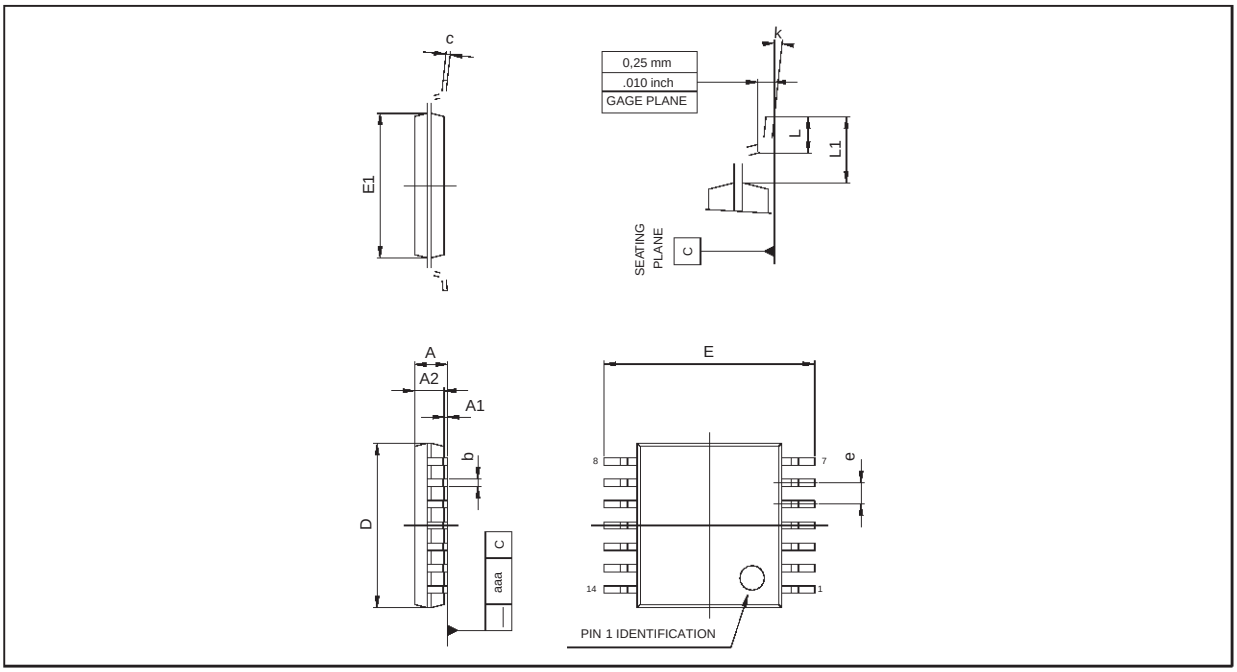
Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.2	0.004		0.008
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.334
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.150		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.020		0.050
M			0.68			0.027
S	8° (max.)					

TS1874IPT



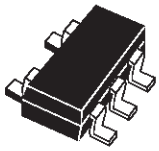
PACKAGE MECHANICAL DATA

14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE (TSSOP)



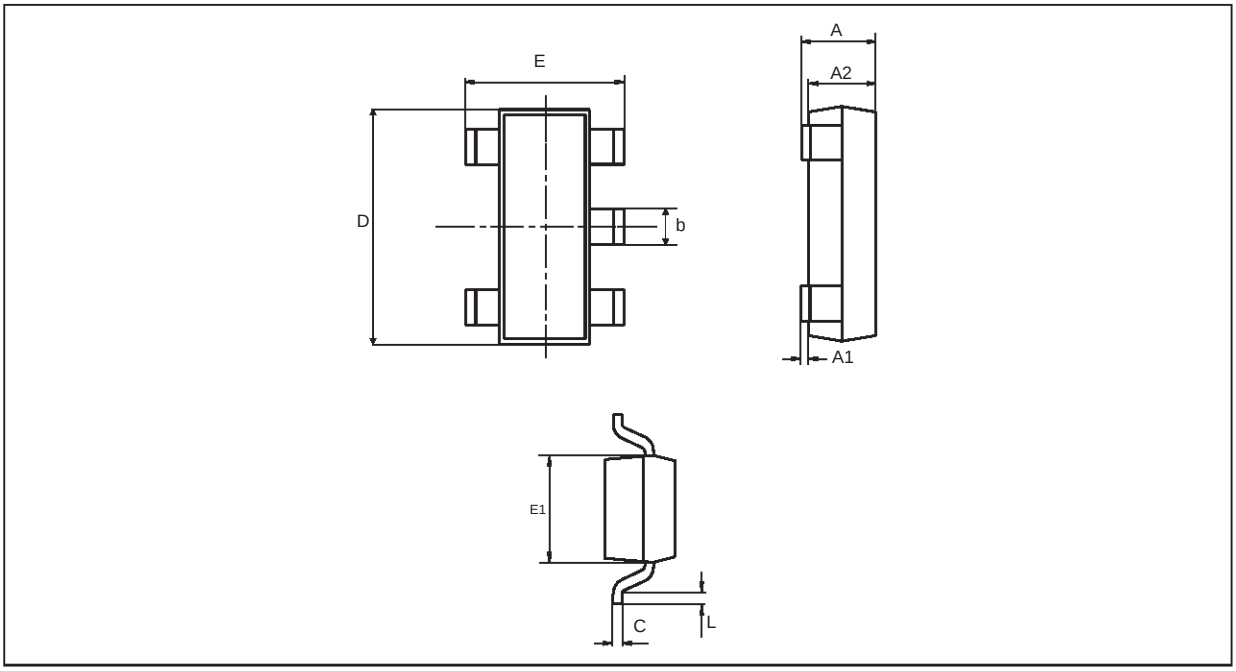
Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.05
A1	0.05		0.15	0.01		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.15
c	0.09		0.20	0.003		0.012
D	4.90	5.00	5.10	0.192	0.196	0.20
E		6.40			0.252	
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.025	
k	0^o		8^o	0^o		8^o
l	0.50	0.60	0.75	0.09	0.0236	0.030

TS1871ILT



PACKAGE MECHANICAL DATA

5 PINS -TINY PACKAGE (SOT23)



Dim.	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.90	1.45	0.034	0.057
A1	0	0.15		0.006
A2	0.90	1.30	0.034	0.051
b	0.35	0.50	0.013	0.020
C	0.09	0.20	0.003	0.008
D	2.80	3.00	0.110	0.118
E	2.60	3.00	0.102	0.118
E1	1.50	1.75	0.059	0.069
L	0.10	0.60	0.003	0.024

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