钍地半导体
Tudi Semiconductor

Product Specification

TUDI-TS951/TS952/TS954

Input/output rail-to-rail low-power operational amplifiers

网址 www.sztdbdt.com

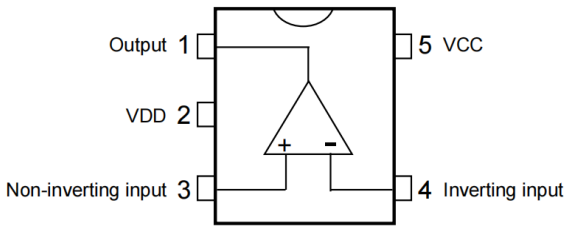
用芯智造·卓越品质

semiconductor device manufacturer

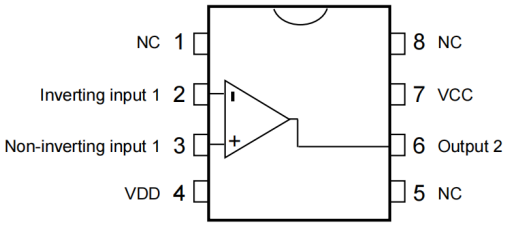
- Design
- research and development
- production
- and sales

Features

- Rail-to-rail input common mode voltage range
- Rail-to-rail output voltage swing
- Operates from 2.7 V to 12 V
- High-speed (3 MHz, 1 V/µs)
- Low consumption (0.9 mA at 3 V)
- Supply voltage rejection ratio: 80 dB
- Latch-up immunity
- Available in SOT23-5 micropackage, SO8, TSSOP8, SO14, and TSSOP14 packages



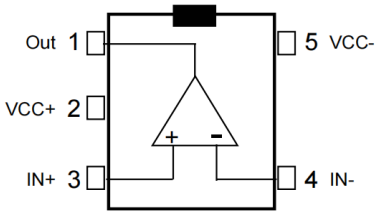
TS951ILT



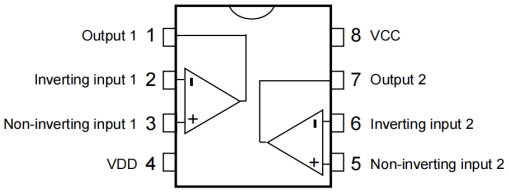
TS951ID

Applications

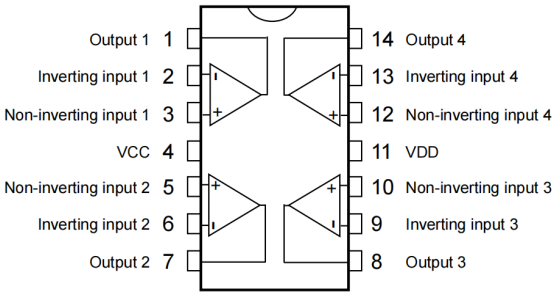
- Industrial and automotive signal conditioning
- Active filtering
- Medical instrumentation
- Digital-to-analog converter buffers
- Portable headphone speaker drivers



TS951RIYLT



TS952ID, TS952IPT



TS954ID, TS954IPT

Description

The TS951, TS952 and TS954 family of devices are rail-to-rail BiCMOS operational amplifiers optimized and fully specified for 3 V and 5 V operation.
The TS951 device is housed in the space-saving 5-pin SOT23 package that makes it well suited for battery powered systems. This micropackage simplifies the PC board design because of its ability to be placed in tight spaces (outside dimensions are: 2.8 mm x 2.9 mm).

1 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings

Symbol	Parameter		Value	Unit
V_{CC}	Supply voltage (1)		14	V
V_{id}	Differential input voltage (2)		±1	
V_{in}	Input voltage (3)		V_{DD} - 0.3 to V_{CC} + 0.3	
T_{stg}	Storage temperature range		-65 to 150	°C
T_j	Maximum junction temperature		150	
R_{thja}	Thermal resistance junction-to-ambient (4)	SOT23-5	250	°C/W
		SO8	125	
		TSSOP8	120	
		SO14	103	
		TSSOP14	100	
R_{thjc}	Thermal resistance junction-to-case (4)	SOT23-5	81	
		SO8	40	
		TSSOP8	37	
		SO14	31	
		TSSOP14	32	
ESD	HBM: human body model (5)	TS951	1	kV
		TS952	2	
		TS954	3	
	MM: machine model (6)		120	V
	CDM: charged device model (7)	TS951	1.5	kV
		TS952	1.5	
		TS954	1	
	Latch-up immunity		200	mA
	Lead temperature (soldering, 10 s)		260	°C

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 input terminal. If V_{id} > ±1 V, the maximum input current must not exceed ±1 mA. In this case (V_{id} > ±1 V), an input series resistor must be added to limit input current.*
3. *Do not exceed 14 V.*
4. *Short-circuits can cause excessive heating and destructive dissipation. R_{th} are typical values.*
5. *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.*
6. *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.*
7. *Charged device model: all pins and the package are charged together to the specified voltage and then discharged directly to ground through only one pin. This is done for all pins.*

Table 2. **Operating conditions**

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	2.7 to 12	V
V_{icm}	Common mode input voltage range	V_{DD} - 0.2 to V_{CC} + 0.2	
T_{oper}	Operating free air temperature range	-40 to 125	°C

2 Electrical characteristics

Table 3. **Electrical characteristics at V_{CC} = 3 V, V_{DD} = 0 V, R_L connected to $V_{CC}/2$, T_{amb} = 25 °C (unless otherwise specified)**

Symbol	Parameter		Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage				6	mV
	$T_{min} \le T_{amb} \le T_{max}$				8	
$\Delta V_{io}/\Delta T$	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current			1	30	nA
		$T_{min} \le T_{amb} \le T_{max}$			80	
I_{ib}	Input bias current	$V_{icm} = V_{CC}/2$		35	100	
		$T_{min} \le T_{amb} \le T_{max}$			200	
CMR	Common mode rejection ratio		50	80		dB
SVR	Supply voltage rejection ratio, V_{CC} = 2.7 V to 3.3 V		60	80		
A_{vd}	Large signal voltage gain, V_o = 2 V_{pk-pk}, R_L = 600 Ω			80		
V_{OH}	High level output voltage, R_L = 600 Ω		2.8	2.9		V
V_{OL}	Low level output voltage, R_L = 600 Ω			80	250	mV
I_{sc}	Output short-circuit current		10			mA
I_{CC}	Supply current (per amplifier), no load, $V_{icm} = V_{CC}/2$			0.9	1.3	
GBP	Gain bandwidth product, R_L = 2 kΩ			3		MHz
SR	Slew rate			1		V/µs
Øm	Phase margin at unit gain, R_L = 600 Ω, C_L = 100 pF			60		Degrees
Gm	Gain margin, R_L = 600 Ω, C_L = 100 pF			10		dB
e_n	Equivalent input noise voltage, f = 1 kHz			25		nV / √Hz
THD	Total harmonic distortion, V_{out} = 4 V_{pk-pk}, F = 10 kHz, A_V = 2, R_L = 10 kΩ			0.01		%

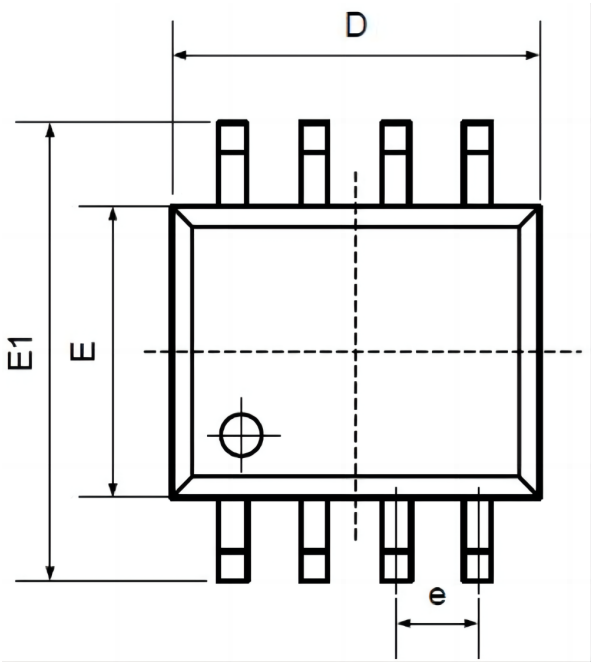
Table 4. Electrical characteristics at V_{CC} = 5 V, V_{DD} = 0 V, R_L connected to $V_{CC}/2$, T_{amb} = 25 °C (unless otherwise specified)

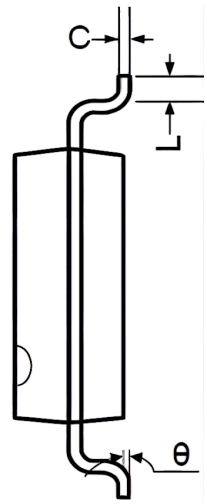
Symbol	Parameter		Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage				6	mV
	$T_{min} \le T_{amb} \le T_{max}$				8	
$\Delta V_{io}/\Delta T$	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current	$V_{icm} = V_{CC}/2$		1	30	nA
		$T_{min} \le T_{amb} \le T_{max}$			80	
I_{ib}	Input bias current	$V_{icm} = V_{CC}/2$		35	100	
		$T_{min} \le T_{amb} \le T_{max}$			200	
CMR	Common mode rejection ratio		50	80		dB
SVR	Supply voltage rejection ratio, V_{CC} = 2.7 V to 3.3 V		60	80		
A_{vd}	Large signal voltage gain, V_o = 2 V_{pk-pk}, R_L = 600 Ω			86		
V_{OH}	High level output voltage, R_L = 600 Ω		4.7	4.8		V
V_{OL}	Low level output voltage, R_L = 600 Ω			80	300	mV
I_{sc}	Output short-circuit current		10			mA
I_{CC}	Supply current (per amplifier), no load, $V_{icm} = V_{CC}/2$			0.95	1.4	
GBP	Gain bandwidth product, R_L = 2 kΩ			3		MHz
SR	Slew rate			1		V/µs
Øm	Phase margin at unit gain, R_L = 600 Ω, C_L = 100 pF			60		Degrees
Gm	Gain margin, R_L = 600 Ω, C_L = 100 pF			10		dB
e_n	Equivalent input noise voltage, f = 1 kHz			25		nV / √Hz
THD	Total harmonic distortion, V_{out} = 4 V_{pk-pk}, F = 10 kHz, A_V = 2, R_L = 10 kΩ			0.01		%

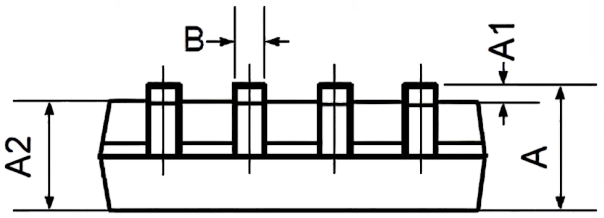
Order information

Order Number	Package	Package Quantity	Marking On The park
TS951IDT-TUDI	SOP8	Tape,Reel,2500	TS951IDT
TS951ILT-TUDI	SOT23	Tape,Reel,3000	TS951ILT
TS951IYLT-TUDI	SOT23	Tape,Reel,3000	TS951IYLT
TS952IDT-TUDI	SOP8	Tape,Reel,2500	TS952IDT
TS952IN-TUDI	DIP8	Tube,50,A box of 2000	TS952IN
TS952IPT-TUDI	TSSOP8	Tape,Reel,2500	TS952IPT
TS954IDT-TUDI	SOP8	Tape,Reel,2500	TS954IDT

Package SOP8

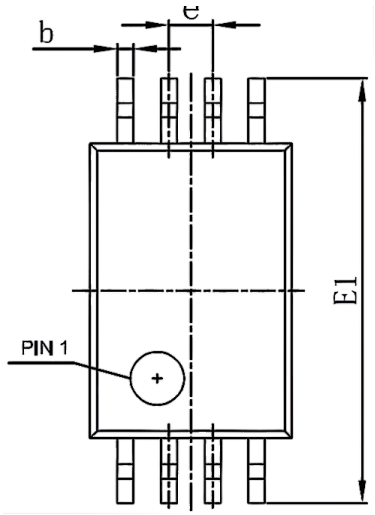


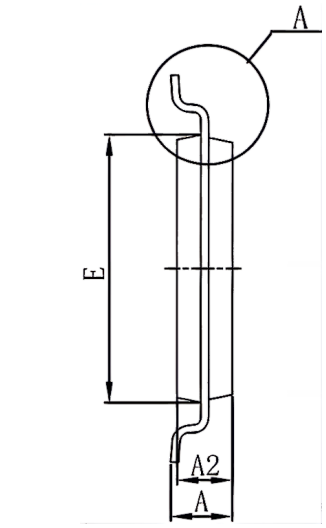


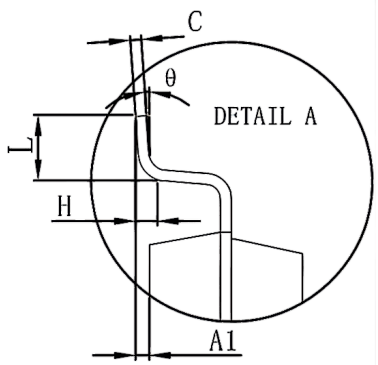


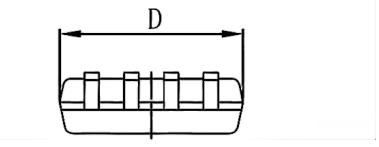
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP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

Package TSSOP8



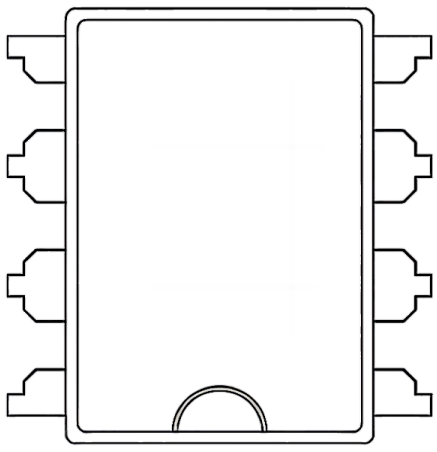


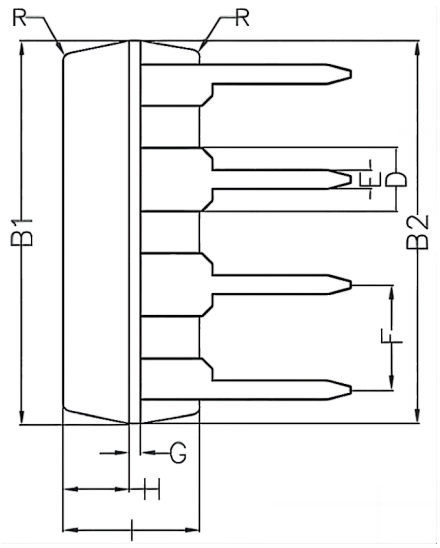


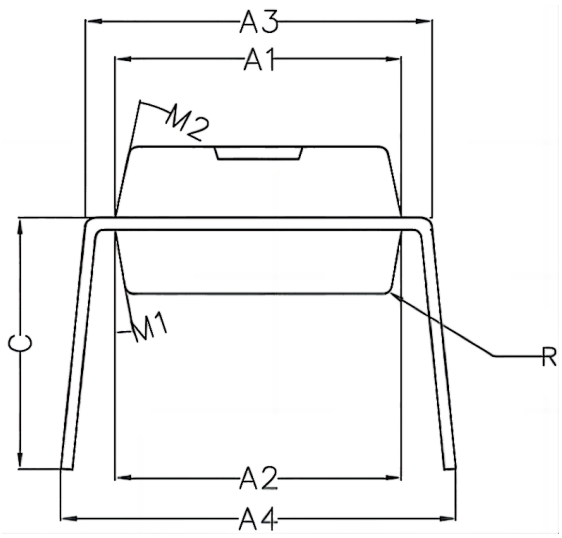


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
C	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.200		0.047
A2	0.800	1.000	0.031	0.039
A1	0.050	0.150	0.002	0.006
e	0.65(BSC)		0.026(BSC)	
L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

Package DIP8

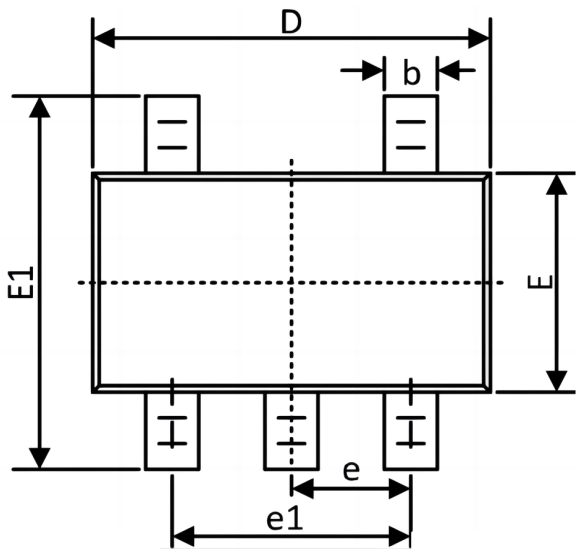


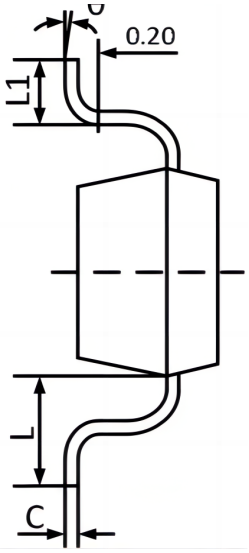


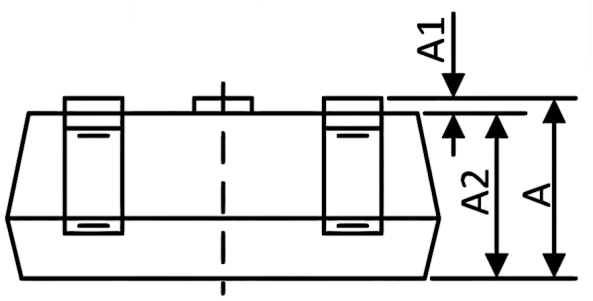


Symbol	Min	Non	Max
A1	6.28	6.33	6.38
A2	6.33	6.38	6.43
A3	7.52	7.62	7.72
A4	7.80	8.40	9.00
B1	9.15	9.20	9.25
B2	9.20	9.25	9.30
C		5.57	
D		1.52	
E	0.43	0.45	0.47
F		2.54	
G		0.25	
H	1.54	1.59	1.64
工	3.22	3.27	3.32
R		0.20	
M1	9°	10°	11°
M2	11°	12°	13°

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°

Important statement:

●TUDI Semiconductor reserves the right to modify the product manual without prior notice! Before placing an order, customers need to confirm whether the obtained information is the latest version and verify the completeness of the relevant information.

●Any semi-guide product is subject to failure or malfunction under specified conditions. It is the buyer's responsibility to comply with safety standards when using TUDI Semiconductor products for system design and whole machine manufacturing.And take the appropriate safety measures to avoid the potential in the risk of loss of personal injury or loss of property situation!

●TUDI Semiconductor products have not been licensed for life support, military, and aerospace applications,and therefore TUDI Semiconductor is not responsible for any consequences arising from the use of this product in these areas.

●If any or all TUDI Semiconductor products (including technical data, services) described or contained in this document are subject to any applicable local export control laws and regulations, they may not be exported without an export license from the relevant authorities in accordance with such laws.

●The specifications of any and all TUDI Semiconductor products described or contained in this document specify the performance, characteristics, and functionality of said products in their standalone state, but do not guarantee the performance, characteristics, and functionality of said products installed in Customer's products or equipment. In order to verify symptoms and conditions that cannot be evaluated in a standalone device, the Customer should ultimately evaluate and test the device installed in the Customer's product device.

●TUDI Semiconductor documentation is only allowed to be copied without any alteration of the content and with the relevant authorization.TUDI Semiconductor assumes no responsibility or liability for altered documents.

●TUDI Semiconductor is committed to becoming the preferred semiconductor brand for customers, and TUDI Semiconductor will strive to provide customers with better performance and better quallity products.