钍地半导体
Tudi Semiconductor

Product Specification

TUDI-TS921

Rail-to-rail high output current single operational amplifier

网址 www.sztdbdt.com

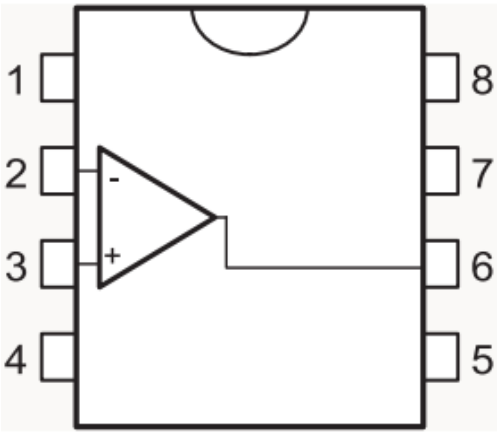
用芯智造·卓越品质

semiconductor device manufacturer

- Design
- research and development
- production
- and sales

Features

- Rail-to-rail input and output
- Low noise: 9 nV/√Hz
- Low distortion
- High output current: 80 mA (able to drive 32 loads)
- High-speed: 4 MHz, 1 V/s
- Operating from 2.7 V to 12 V
- ESD internal protection: 1.5 kV
- Latch-up immunity
- Macromodel included in this specification



Pin connections (top view)

Applications

- Headphone amplifier
- Piezoelectric speaker driver
- Sound cards, multimedia systems
- Line driver, actuator driver
- Servo amplifier
- Mobile phone and portable communication sets
- Instrumentation with low noise as key factor

Description

The TS921 device is a rail-to-rail single BiCMOS operational amplifier optimized and fully specified for 3 V and 5 V operation.
Its high output current allows low load impedances to be driven.
The TS921 device exhibits very low noise, low distortion and low offset. It has a high output current capability which makes this device an excellent choice for high quality, low voltage or battery operated audio systems.
The device is stable for capacitive loads up to 500 pF.

2 Absolute maximum ratings

Table 2. Key parameters and their absolute maximum ratings

Symbol	Parameter	Condition	Value	Unit
V_{CC}	Supply voltage(1)		14	V
V_{id}	Differential input voltage(2)		±1	V
V_i	Input voltage		V_{DD} - 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	SO-8 TSSOP8 DIP8	125 120 85	°C/W
R_{thjc}	Thermal resistance junction-to-case	SO-8 TSSOP8 DIP8	40 37 41	°C/W
ESD	Electrostatic discharge	HBM Human body model(3)	1.5	kV
		MM Machine model(4)	100	V
		CDM Charged device model	1.5	kV
	Output short-circuit duration		See(5)	
	Latch-up immunity		200	mA
	Soldering temperature	10 sec., standard package	250	°C
		10 sec., lead-free package	260	

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 serie resistor must be added to limit input current.
3. Human body model, 100 pF discharged through a 1.5 kΩ resistor into pin of device.
4. Machine model ESD, a 200 pF cap is charged to the specified voltage, then discharged directly into the IC with no external series resistor (internal resistor < 5 Ω), into pin to pin of device.
5. There is no short-circuit protection inside the device: 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	2.7 to 12	V
V_{icm}	Common mode input voltage range	V_{DD} - 0.2 to V_{CC} + 0.2	V
T_{oper}	Operating free air temperature range	-40 to +125	°C

3 Electrical characteristics

Table 4. Electrical characteristics for V_{CC} = 3 V, V_{DD} = 0 V, V_{icm} = V_{CC}/2, R_L connected to V_{CC}/2, T_{amb} = 25 °C (unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage	at $T_{min.} \le T_{amb} \le T_{max}$			3 5	mV
ΔV_{io}	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current	V_{out} = 1.5 V		1	30	nA
I_{ib}	Input bias current	V_{out} = 1.5 V		15	100	nA
V_{OH}	High level output voltage	R_L = 600 Ω R_L = 32 Ω	2.87	 2.63		V
V_{OL}	Low level output voltage	R_L = 600 Ω R_L = 32 Ω		 180	100	mV
A_{vd}	Large signal voltage gain	V_{out} = 2 V_{pk-pk} R_L = 600 Ω R_L = 32 Ω		 35 16		V/mV
GBP	Gain bandwidth product	R_L = 600 Ω		4		MHz
I_{CC}	Supply current	No load, V_{out} = V_{CC}/2		1	1.5	mA
CMR	Common mode rejection ratio		60	80		dB
SVR	Supply voltage rejection ratio	V_{CC} = 2.7 to 3.3 V	60	80		dB
I_o	Output short-circuit current		50	80		mA
SR	Slew rate		0.7	1.3		V/µs
Pm	Phase margin at unit gain	R_L = 600 Ω, C_L =100 pF		68		Degrees
GM	Gain margin	R_L = 600 Ω, C_L =100 pF		12		dB
e_n	Equivalent input noise voltage	f = 1 kHz		9		$\frac{nV}{\sqrt{Hz}}$
THD	Total harmonic distortion	V_{out} = 2 V_{pk-pk}, f = 1 kHz, A_v = 1, R_L = 600 Ω		0.005		%

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage	at $T_{min.} \le T_{amb} \le T_{max}$			3 5	mV
ΔV_{io}	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current	V_{out} = 1.5 V		1	30	nA
I_{ib}	Input bias current	V_{out} = 1.5 V		15	100	nA
V_{OH}	High level output voltage	R_L = 600 Ω R_L = 32 Ω	4.85	4.4		V
V_{OL}	Low level output voltage	R_L = 600 Ω R_L = 32 Ω		300	120	mV
A_{vd}	Large signal voltage gain	V_{out} = 2 V_{pk-pk} R_L = 600 Ω R_L = 32 Ω		35 16		V/mV
GBP	Gain bandwidth product	R_L = 600 Ω		4		MHz
I_{CC}	Supply current	No load, V_{out} = V_{CC}/2		1	1.5	mA
CMR	Common mode rejection ratio		60	80		dB
SVR	Supply voltage rejection ratio	V_{CC} = 4.5 to 5.5 V	60	80		dB
I_o	Output short-circuit current		50	80		mA
SR	Slew rate		0.7	1.3		V/µs
Pm	Phase margin at unit gain	R_L = 600 Ω, C_L =100 pF		68		Degrees
GM	Gain margin	R_L = 600 Ω, C_L =100 pF		12		dB
e_n	Equivalent input noise voltage	f = 1 kHz		9		$\frac{nV}{\sqrt{Hz}}$
THD	Total harmonic distortion	V_{out} = 2 V_{pk-pk}, f = 1 kHz, A_v = 1, R_L = 600 Ω		0.005		%

4.2 Electrical characteristics from macromodelization

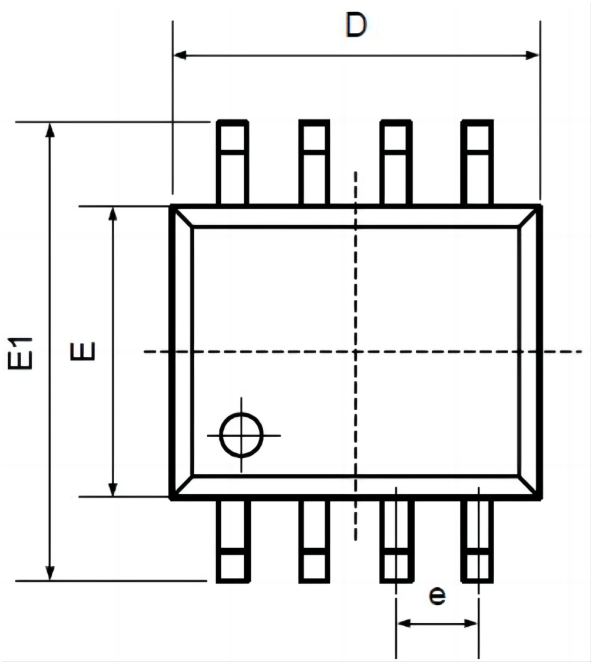
Table 6. Electrical characteristics resulting from macromodel simulation at V_{CC} = 3 V, V_{DD} = 0 V, R_L, C_L connected to $V_{CC/2}$, T_{amb} = 25 °C (unless otherwise specified)

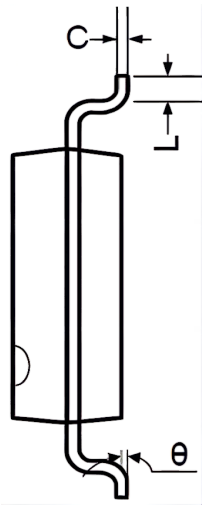
Symbol	Conditions	Value	Unit
V_{io}		0	mV
A_{vd}	R_L = 10 kΩ	200	V/mV
I_{CC}	No load, per operator	1.2	mA
V_{icm}		-0.2 to 3.2	V
V_{OH}	R_L = 10 kΩ	2.95	V
V_{OL}	R_L = 10 kΩ	25	mV
I_{sink}	V_O = 3 V	80	mA
I_{source}	V_O = 0 V	80	mA
GBP	R_L = 600 kΩ	4	MHz
SR	R_L = 10 kΩ, C_L = 100 pF	1.3	V/µs
ϕm	R_L = 600 kΩ	68	Degrees

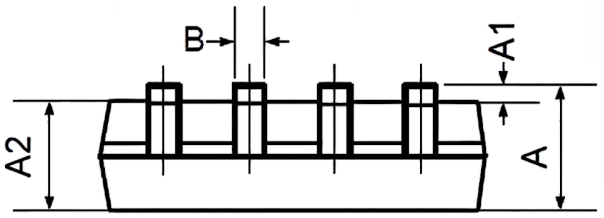
Order information

Order Number	Package	Package Quantity	Marking On The park
TS921IDT-TUDI	SOP8	Tape,Reel,2500	TS921IDT
TS921IPT-TUDI	TSSOP8	Tape,Reel,2500	TS921IPT

Package SOP8

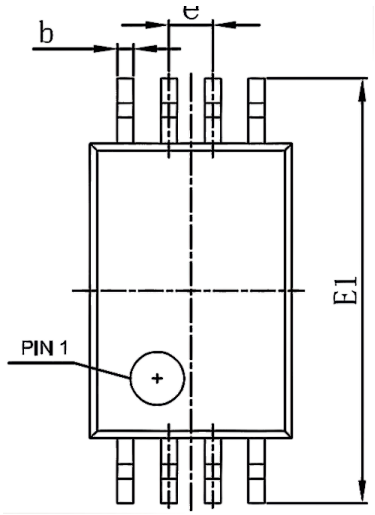


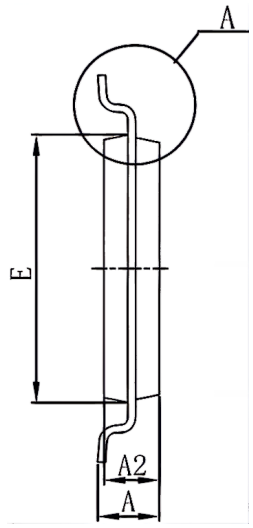


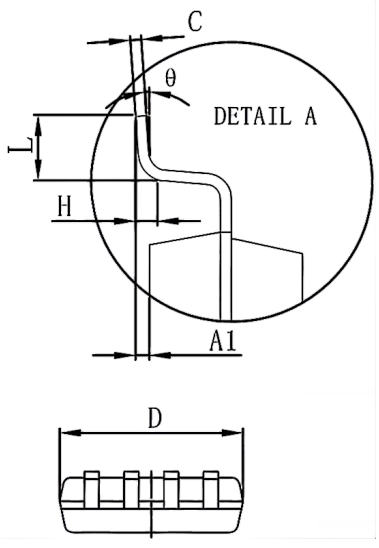


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP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

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