钛地半导体
Tudi Semiconductor

Product Specification

TUDI-TS922/TS922A

Rail-to-rail, high output current, dual operational amplifier

网址 www.sztdbdt.com

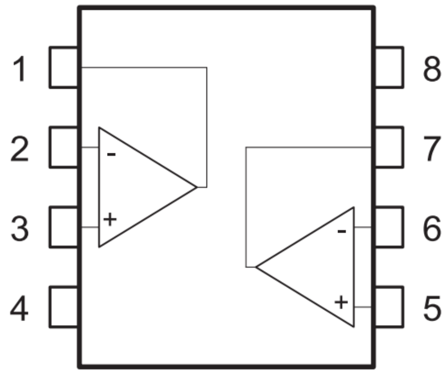
用芯智造·卓越品质

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 Ω loads)
- High-speed: 4 MHz, 1 V/μs
- Operating from 2.7 to 12 V
- Low input offset voltage: 900 μV max. (TS922A)
- ESD internal protection: 2 kV
- Latch-up immunity



Pin connections for SO8 and TSSOP8
(top view)

Applications

- Line drivers and actuator drivers
- Portable speakers
- Instrumentation with low noise as key factor
- Multimedia systems and portable equipments

Description

The TS922 and the TS922A devices are rail-to-rail dual BiCMOS operational amplifiers optimized and fully specified for 3 V and 5 V operations. These devices have high output currents which allow low-load impedances to be driven.
Very low noise, low distortion, low offset, and a high output current capability make these devices an excellent choice for high quality, low voltage, or battery operated audio systems.
The devices are stable for capacitive loads up to 500 pF

2 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings (AMR)

Symbol	Parameter		Value	Unit
V_{CC}	Supply voltage [(1)]		14	V
V_{id}	Differential input voltage [(2)]		±1	V
V_{in}	Input voltage [(3)]		(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
—	Soldering temperature (10 s), leaded version		250	°C
—	Soldering temperature (10 s), unleaded version		260	°C
R_{thja}	Thermal resistance junction-to-ambient [(4)]	Flip-chip	90	°C/W
		SO8	125	
		TSSOP8	120	
R_{thjc}	Thermal resistance junction-to-case [(4)]	SO8	40	
		TSSOP8	37	
ESD	HBM: human body model [(5)]		2000	V
	MM: machine model [(6)]		120	
	CDM: charged device model [(7)]		1500	
—	Latch-up immunity		200	mA
—	Output short-circuit duration		See note [(8)]	

1. *All voltage values, except the differential voltage are with respect to network ground terminal.*
2. *The differential voltage is 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 the input current.*
3. *Do not exceed 14 V.*
4. *Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuits on all amplifiers. These values are typical.*
5. *Human body model: 100 pF discharged through a 1.5 kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins 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 pin combinations with other pins floating.*
7. *Charged device model: all pins and plus package are charged together to the specified voltage and then discharged directly to ground.*
8. *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 2. Operating conditions

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

3 Electrical characteristics

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage	TS922			3	mV
		TS922A			0.9	
		TS922EIJT			1.5	
		$T_{min} \leq T_{amb} \leq T_{max}$, TS922			5	
		$T_{min} \leq T_{amb} \leq T_{max}$, TS922A			1.8	
		$T_{min} \leq T_{amb} \leq T_{max}$, TS922EIJT			2.5	
$\Delta V_{io}/\Delta T$	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current	$V_{out} = V_{CC}/2$		1	30	nA
		$T_{min} \leq T_{amb} \leq T_{max}$			30	
I_{ib}	Input bias current	$V_{out} = V_{CC}/2$		15	100	
		$T_{min} \leq T_{amb} \leq T_{max}$			100	
V_{OH}	High level output voltage	R_L = 10 kΩ	2.90			V
		$T_{min} \leq T_{amb} \leq T_{max}$	2.90			
		R_L = 600 Ω	2.87			
		$T_{min} \leq T_{amb} \leq T_{max}$	2.87			
		R_L = 32 Ω		2.63		
V_{OL}	Low level output voltage	R_L = 10 kΩ			50	mV
		$T_{min} \leq T_{amb} \leq T_{max}$			50	
		R_L = 600 Ω			100	
		$T_{min} \leq T_{amb} \leq T_{max}$			100	
		R_L = 32 Ω		180		
A_{vd}	Large signal voltage gain	R_L = 10 kΩ, V_{out} = 2 V_{p-p}		200		V/mV
		$T_{min} \leq T_{amb} \leq T_{max}$	70			
		R_L = 600 Ω, V_{out} = 2 V_{p-p}		35		
		$T_{min} \leq T_{amb} \leq T_{max}$	15			
		R_L = 32 Ω, V_{out} = 2 V_{p-p}		16		
I_{CC}	Total supply current	No load, $V_{out} = V_{CC}/2$		2	3	mA
		$T_{min} \leq T_{amb} \leq T_{max}$			3.2	
GBP	Gain bandwidth product	R_L = 600 Ω		4		MHz
CMR	Common mode rejection ratio	V_{icm} = 0 to 3 V	60	80		dB
		$T_{min} \leq T_{amb} \leq T_{max}$	56			
SVR	Supply voltage rejection ratio	V_{CC} = 2.7 to 3.3 V	60	85		dB
		$T_{min} \leq T_{amb} \leq T_{max}$	60			
I_o	Output short-circuit current		50	80		mA

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
SR	Slew rate		0.7	1.3		V/μs
ϕm	Phase margin at unit gain	R_L = 600 Ω, C_L = 100 pF		68		Degrees
G_m	Gain margin	R_L = 600 Ω, C_L = 100 pF		12		dB
e_n	Equivalent input noise voltage	f = 1 kHz		9		nV/√Hz
THD	Total harmonic distortion	V_{out} = 2 V_{p-p}, f = 1 kHz, A_v = 1, R_L = 600 Ω		0.005		%
C_s	Channel separation			120		dB

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

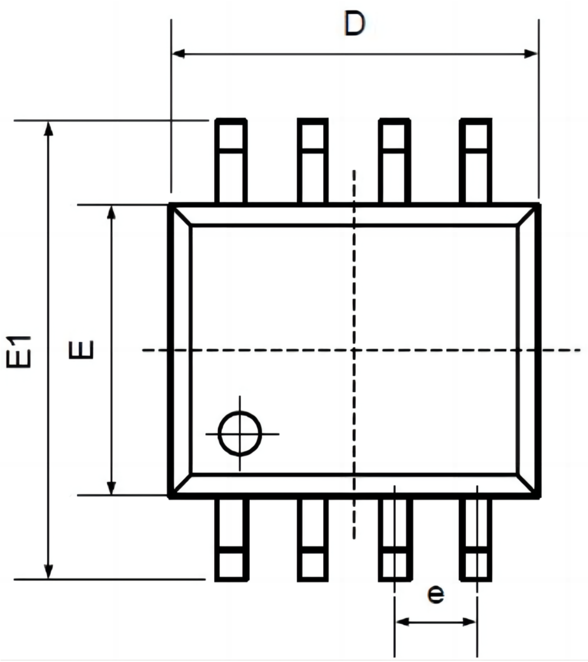
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage	TS922			3	mV
		TS922A			0.9	
		TS922EIJT			1.5	
		$T_{min} \le T_{amb} \le T_{max}$, TS922			5	
		$T_{min} \le T_{amb} \le T_{max}$, TS922A			1.8	
		$T_{min} \le T_{amb} \le T_{max}$, TS922EIJT			2.5	
$\Delta V_{io}/\Delta T$	Input offset voltage drift			2		μV/°C
I_{io}	Input offset current	V_{out} = $V_{CC}/2$		1	30	nA
		$T_{min} \le T_{amb} \le T_{max}$			30	
I_{ib}	Input bias current	V_{out} = $V_{CC}/2$		15	100	
		$T_{min} \le T_{amb} \le T_{max}$			100	
V_{OH}	High level output voltage	R_L= 10 kΩ	4.9			V
		$T_{min} \le T_{amb} \le T_{max}$	4.9			
		R_L = 600 Ω	4.85			
		$T_{min} \le T_{amb} \le T_{max}$	4.85			
		R_L = 32 Ω		4.4		
V_{OL}	Low level output voltage	R_L= 10 kΩ			50	mV
		$T_{min} \le T_{amb} \le T_{max}$			50	
		R_L = 600 Ω			120	
		$T_{min} \le T_{amb} \le T_{max}$			120	
		R_L = 32 Ω		300		
A_{vd}	Large signal voltage gain	R_L= 10 kΩ, V_{out} = 2 V_{p-p}		200		V/mV
		$T_{min} \le T_{amb} \le T_{max}$	70			
		R_L = 600 Ω, V_{out} = 2 V_{p-p}		35		
		$T_{min} \le T_{amb} \le T_{max}$	20			
		R_L = 32 Ω, V_{out} = 2 V_{p-p}		16		
I_{cc}	Total supply current	No load, V_{out} = $V_{CC}/2$		2	3	mA
		$T_{min} \le T_{amb} \le T_{max}$			3.2	

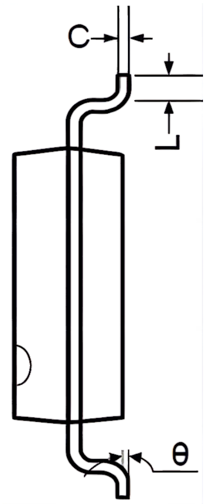
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
GBP	Gain bandwidth product	R_L = 600 Ω		4		MHz
CMR	Common mode rejection ratio	V_{icm} = 0 to 5 V	60	80		dB
		$T_{min} \leq T_{amb} \leq T_{max}$	56			
SVR	Supply voltage rejection ratio	V_{CC} = 4.5 to 5.5 V	60	85		
		$T_{min} \leq T_{amb} \leq T_{max}$	60			
I_o	Output short-circuit current		50	80		mA
SR	Slew rate		0.7	1.3		V/μs
ϕm	Phase margin at unit gain	R_L = 600 Ω, C_L =100 pF		68		Degrees
G_m	Gain margin			12		dB
e_n	Equivalent input noise voltage	f = 1 kHz		9		nV/√Hz
THD	Total harmonic distortion	V_{out} = 2 V_{p-p}, f = 1 kHz, A_v = 1, R_L = 600 Ω		0.005		%
C_s	Channel separation			120		dB

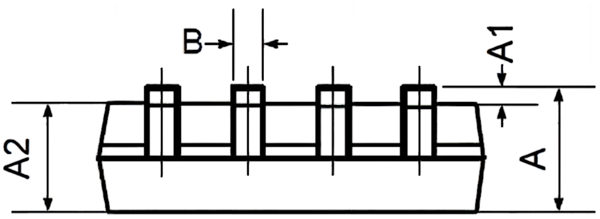
Order information

Order Number	Package	Package Quantity	Marking On The park
TS922AIDT-TUDI	SOP8	Tape,Reel,2500	TS922AIDT
TS922AIN-TUDI	DIP8	Tube,50,A box of 2000	TS922AIN
TS922IDT-TUDI	SOP8	Tape,Reel,2500	TS922IDT
TS922IN-TUDI	DIP8	Tube,50,A box of 2000	TS922IN
TS922IPT-TUDI	TSSOP8	Tape,Reel,2500	TS922IPT

Package SOP8

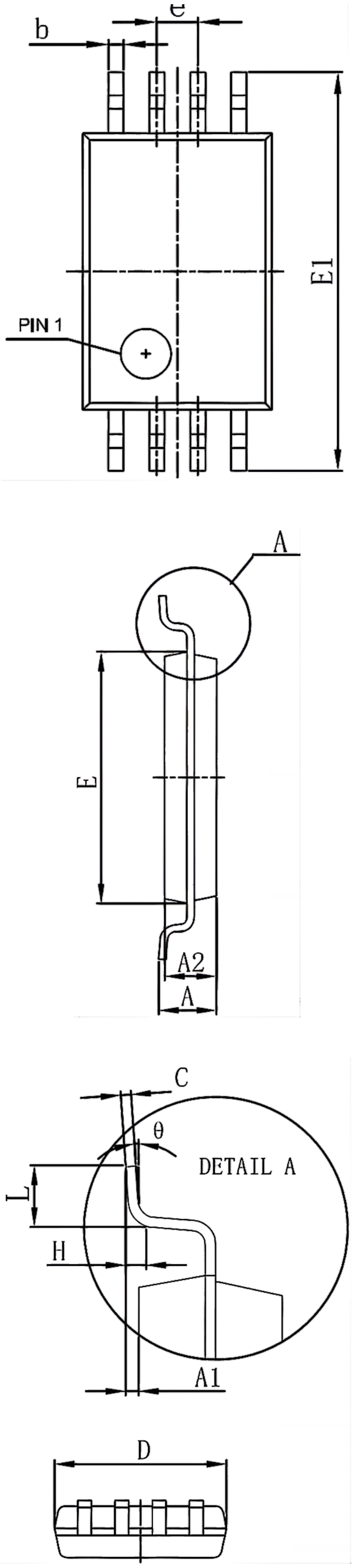






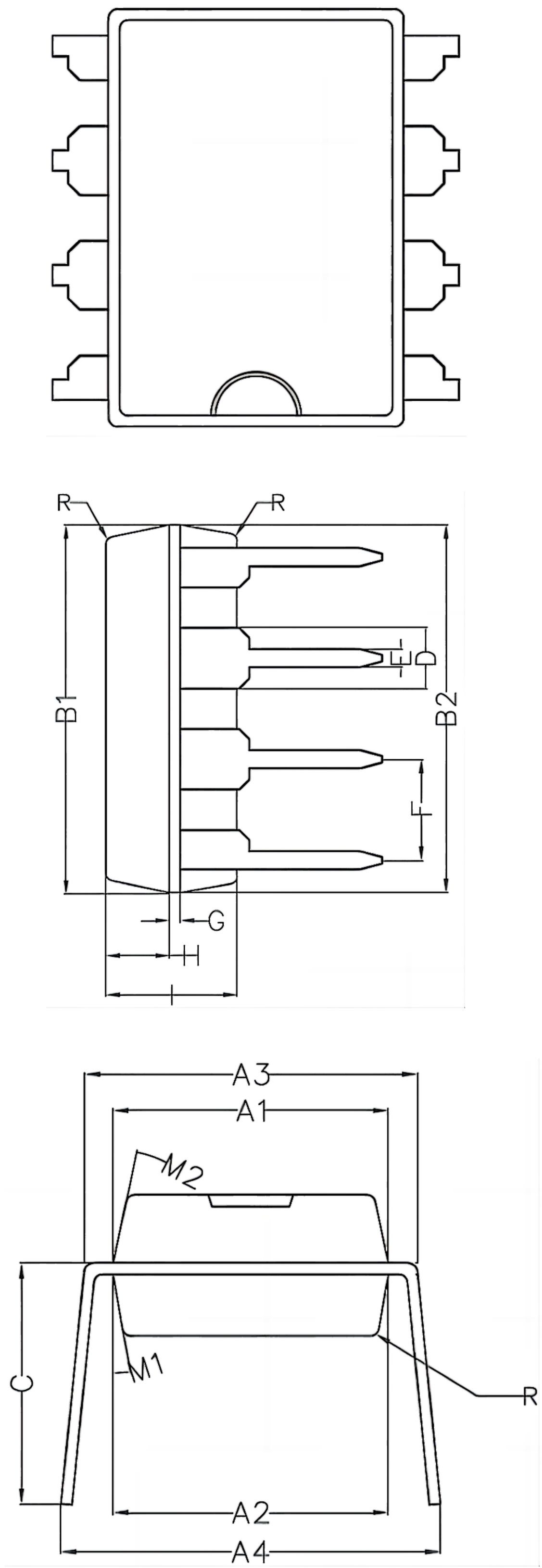
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP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

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