



TS951

LOW POWER RAIL TO RAIL SINGLE OPERATIONAL AMPLIFIER

- INPUT AND OUTPUT RAIL TO RAIL
- OPERATING FROM 2.7V to 12V
- HIGH SPEED (3MHz, 1V/ μ s)
- LOW CONSUMPTION (0.9mA @3V)
- AVAILABLE IN **SOT23-5 MICROPACKAGE**
- ESD PROTECTION : 2000V
- LATCH-UP FREE

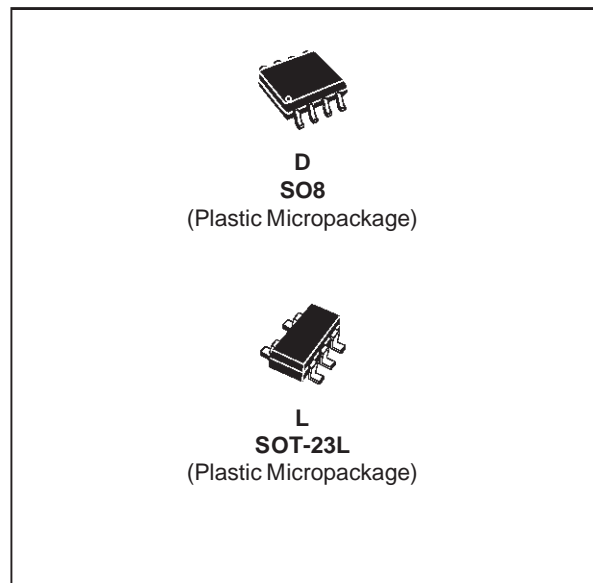
DESCRIPTION

The TS951 is a RAIL TO RAIL single BiCMOS operational amplifier optimized and fully specified for 3V and 5V operations.

It is housed in the space-saving 5 pins SOT23-5 package that makes it well-suited for battery-powered systems. This micropackage simplifies the board design because of the ability to be placed everywhere (outside dimensions are : 2.8mm x 2.9mm)

APPLICATIONS

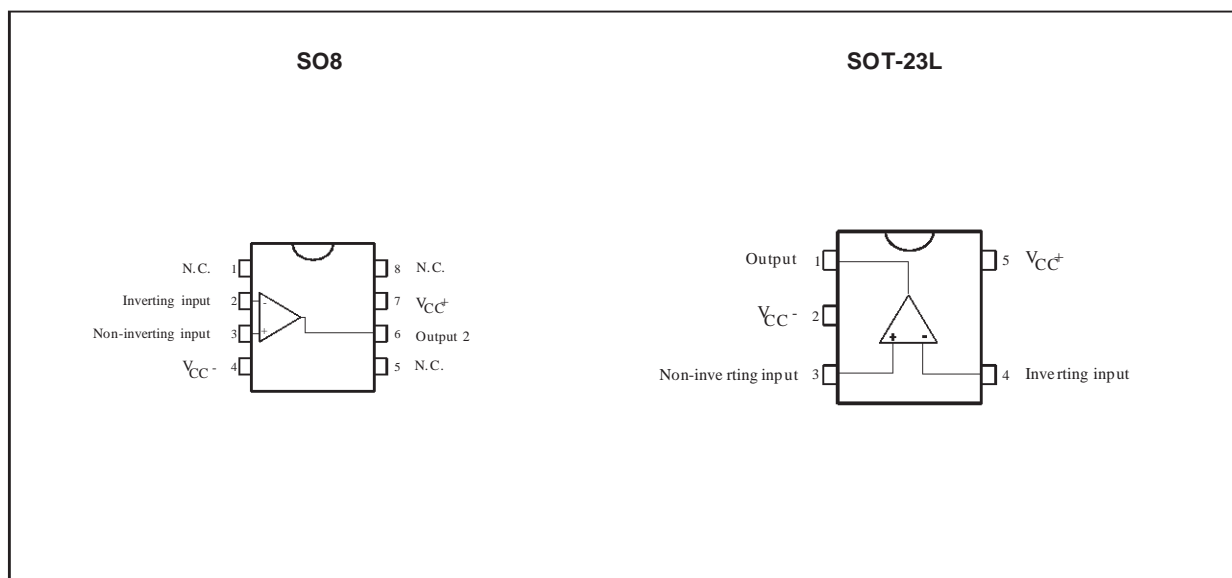
- nomadics equipments (CD player, PDA ...)
- portable communication sets (phone, pager ...)
- instrumentation & sensing



ORDER CODES

Part Number	Temperature Range	Package		SOT Marking
		L	D	
TS9511	-40, +125°C	•	•	K101

PIN CONNECTIONS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage - note 1	12	V
V _{id}	Differential Input Voltage - note 2	±1	V
V _{in}	Input Voltage - note 3	-0.3 to 12.3	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	81	°C/W
R _{thja}	Thermal Resistance Junction to Ambient	256	°C/W
	Output Short Circuit Duration	see note 4	

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

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

ELECTRICAL CHARACTERISTICS

$V_{CC}^+ = +3V$, $T_{amb} = 25^{\circ}C$ (unless otherwise specified)

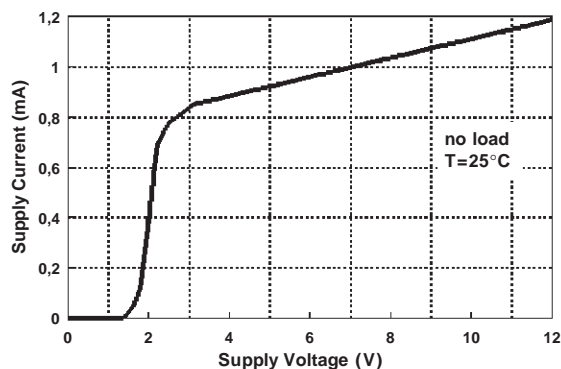
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage $T_{min.} \leq T_{amb} \leq T_{max.}$			6 8	mV
DV_{io}	Input Offset Voltage Drift		2		$\mu V/^{\circ}C$
I_{io}	Input Offset Current $T_{min.} \leq T_{amb} \leq T_{max.}$		1	30 80	nA
I_{ib}	Input Bias Current $V_{icm} = 1.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		35	100 200	nA
V_{OH}	High Level Output Voltage $R_L = 600\Omega$	2.8	2.9		V
V_{OL}	Low Level Output Voltage $R_L = 600\Omega$		80	250	mV
A_{vd}	Large Signal Voltage Gain $V_{out} = 2V_{pk-pk}$ $R_L = 600\Omega$		10		V/mV
CMR	Common Mode Rejection Ratio	50	80		dB
SVR	Supply Voltage Rejection Ratio $V_{CC} = 2.7V$ to $3.3V$	55	80		dB
I_{sink}	Output Sink Current	10	25		mA
I_{source}	Output Source Current	10	22		mA
GBP	Gain Bandwidth Product $R_L = 2k\Omega$		3		MHz
SR	Slew Rate		1		V/ μs
ϕ_m	Phase Margin at Unity Gain $R_L = 600\Omega$, $C_L = 100pF$		60		Degrees
G_m	Gain Margin $R_L = 600\Omega$, $C_L = 100pF$		10		dB
I_{CC}	Supply Current No load, $V_{out} = V_{CC/2}$		0.9	1.3	mA
e_n	Equivalent Input Noise Voltage $f = 1kHz$		25		$\frac{nV}{\sqrt{Hz}}$
THD	Total Harmonic Distortion $V_{out} = 4V_{pk-pk}$, $f = 10kHz$ $A_v = 2$, $R_L = 10k$		0.01		%

ELECTRICAL CHARACTERISTICS

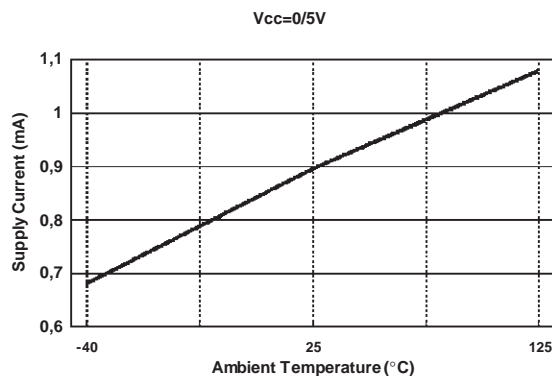
$V_{CC}^+ = +5V$, $T_{amb} = 25^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage $T_{min.} \leq T_{amb} \leq T_{max.}$			6 8	mV
DV_{io}	Input Offset Voltage Drift		2		$\mu V/^{\circ}C$
I_{io}	Input Offset Current $T_{min.} \leq T_{amb} \leq T_{max.}$		1	30 80	nA
I_{ib}	Input Bias Current $V_{icm} = 2.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		35	100 200	nA
V_{OH}	High Level Output Voltage $R_L = 600\Omega$	4.7	4.8		V
V_{OL}	Low Level Output Voltage $R_L = 600\Omega$		80	300	mV
A_{vd}	Large Signal Voltage Gain $V_{out} = 2V_{pk-pk}$ $R_L = 600\Omega$		20		V/mV
CMR	Common Mode Rejection Ratio	50	80		dB
SVR	Supply Voltage Rejection Ratio $V_{CC} = 3V$ to $5V$	55	80		dB
I_{sink}	Output Sink Current	10	25		mA
I_{source}	Output Source Current	10	22		mA
GBP	Gain Bandwidth Product $R_L = 2k\Omega$		3		MHz
SR	Slew Rate		1		V/ μs
ϕ_m	Phase Margin at Unity Gain $R_L = 600\Omega$, $C_L = 100pF$		60		Degrees
G_m	Gain Margin $R_L = 600\Omega$, $C_L = 100pF$		10		dB
I_{CC}	Supply Current No load, $V_{out} = V_{CC/2}$		0.95	1.4	mA
e_n	Equivalent Input Noise Voltage $f = 1kHz$		25		$\frac{nV}{\sqrt{Hz}}$
THD	Total Harmonic Distortion $V_{out} = 4V_{pk-pk}$, $f = 10kHz$ $A_v = 2$, $R_L = 10k$		0.01		%

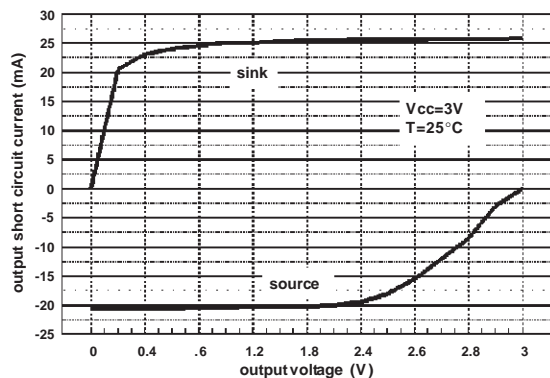
SUPPLY CURRENT VERSUS SUPPLY VOLTAGE



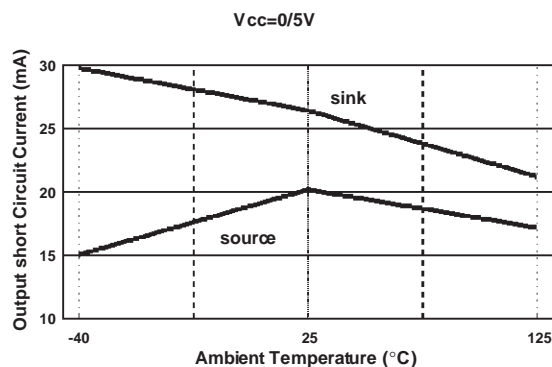
SUPPLY CURRENT VERSUS TEMPERATURE



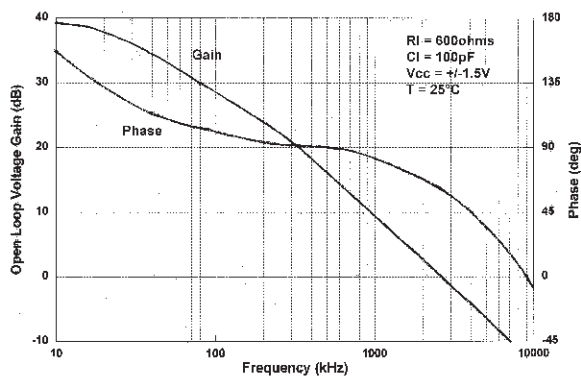
OUTPUT SHORT CIRCUIT CURRENT VERSUS OUTPUT VOLTAGE



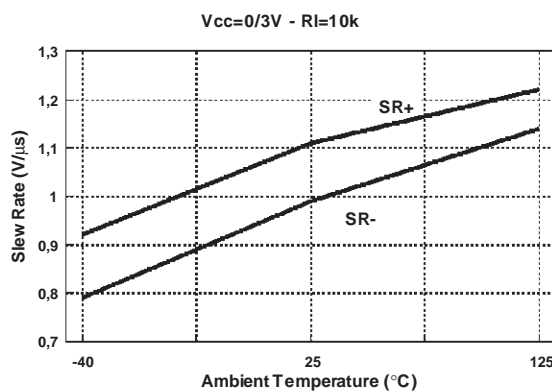
OUTPUT SHORT CIRCUIT CURRENT VERSUS TEMPERATURE



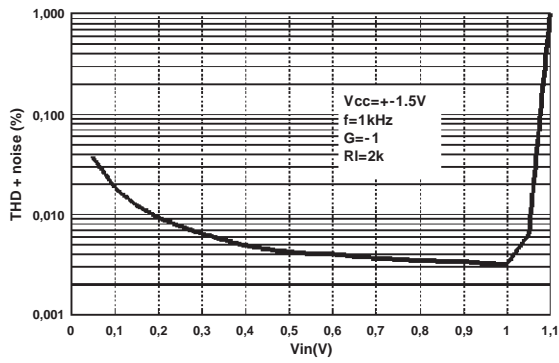
VOLTAGE GAIN AND PHASE VERSUS FREQUENCY



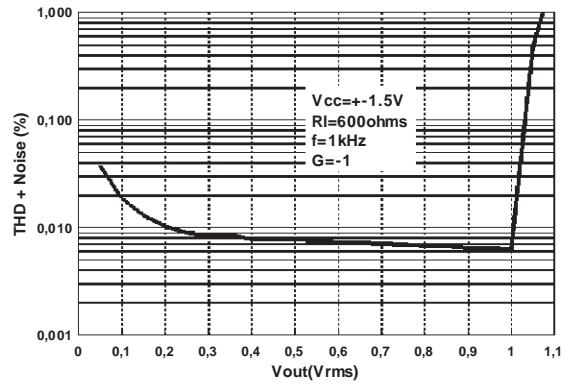
SLEW RATE VERSUS TEMPERATURE



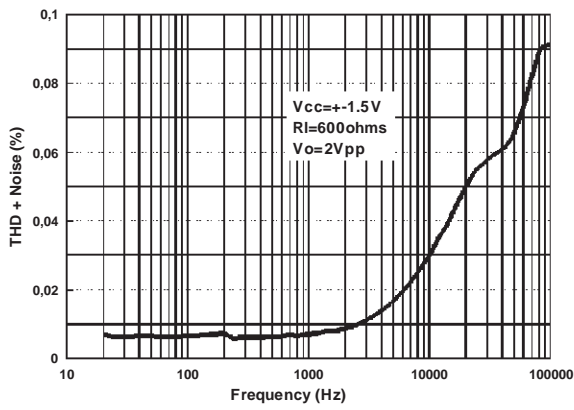
THD + NOISE VERSUS V_{out}



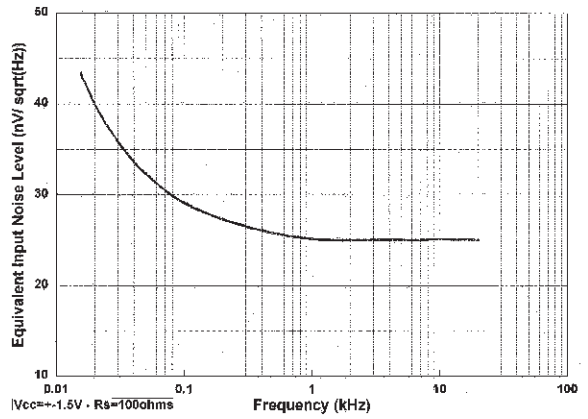
THD + NOISE VERSUS V_{out}



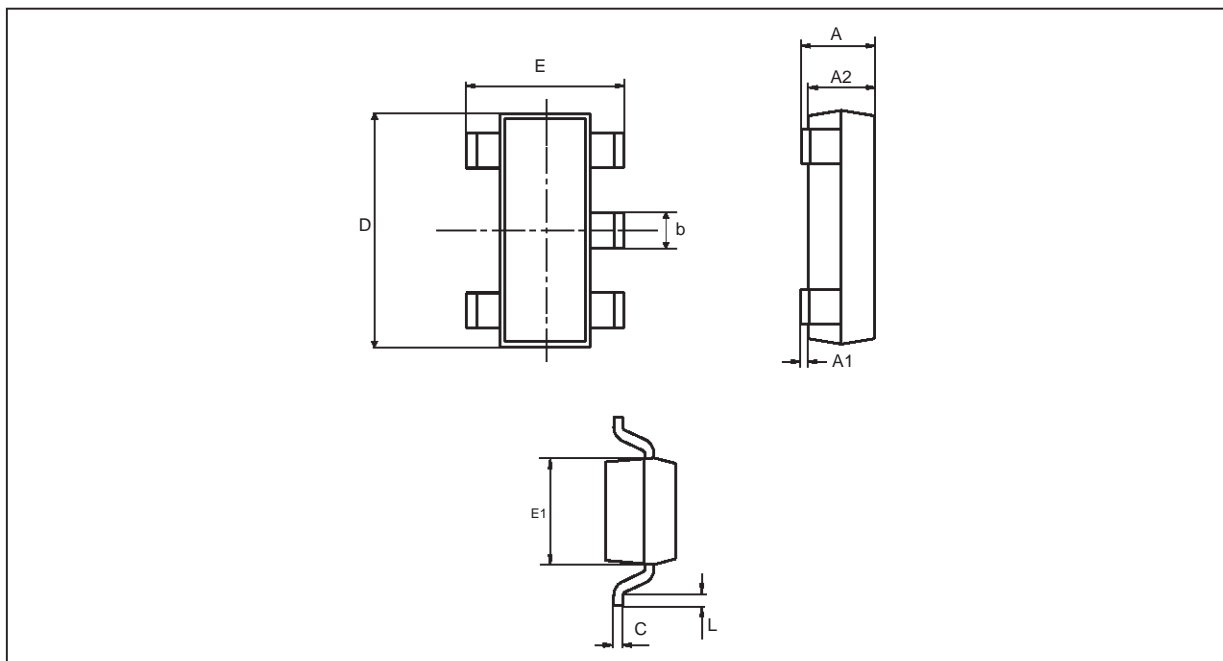
THD + NOISE VERSUS FREQUENCY



EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY

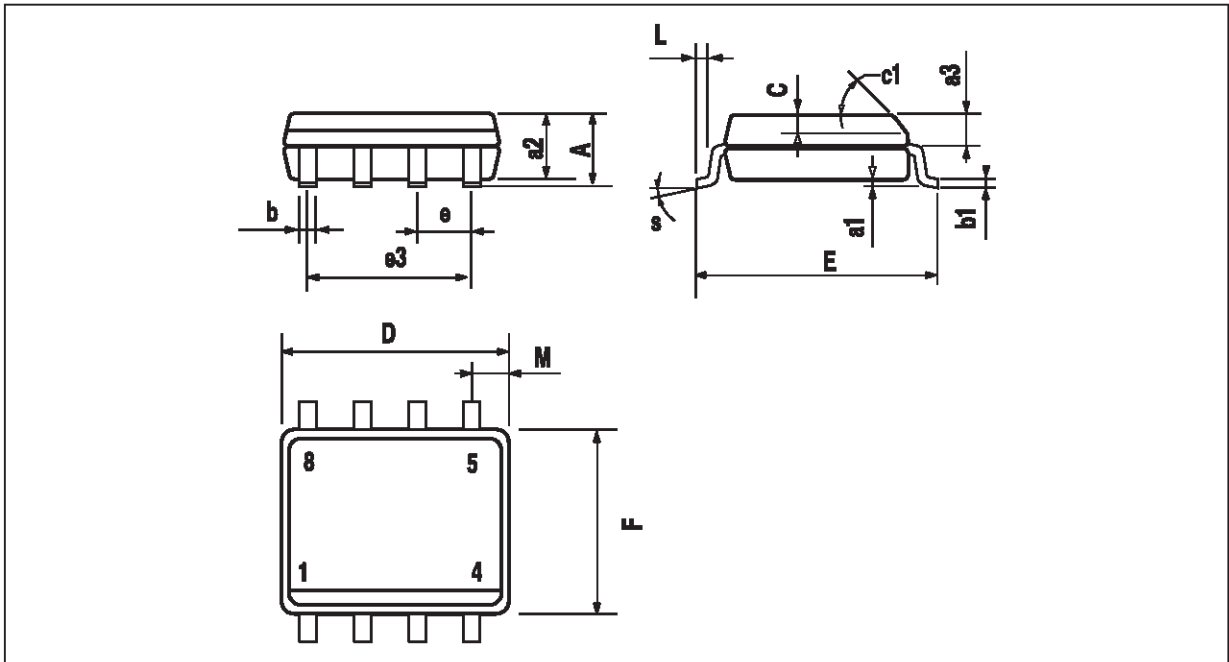


PACKAGE MECHANICAL DATA
5 PINS - TINY PACKAGE (SOT23)



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

PACKAGE MECHANICAL DATA
 8 PINS - PLASTIC MICROPACKAGE (SO)



Dim.	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.)					

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