



TS971

RAIL TO RAIL VERY LOW NOISE SINGLE OPERATIONAL AMPLIFIER

PRODUCT PREVIEW

- VERY LOW NOISE LEVEL : $4\text{nV}/\sqrt{\text{Hz}}$
- ULTRA LOW DISTORTION : 0.003%
- HIGH DYNAMIC FEATURES (12MHz, 4V/ μs)
- OPERATING RANGE : 2.7V to 10V
- LARGE OUTPUT SWING
($\pm 2.4\text{V}$ @ $V_{\text{CC}} = \pm 2.5\text{V}$)
- ESD TOLERANCE : 2000V
- LATCH-UP IMMUNITY
- AVAILABLE IN **SOT23-5** MICROPACKAGE

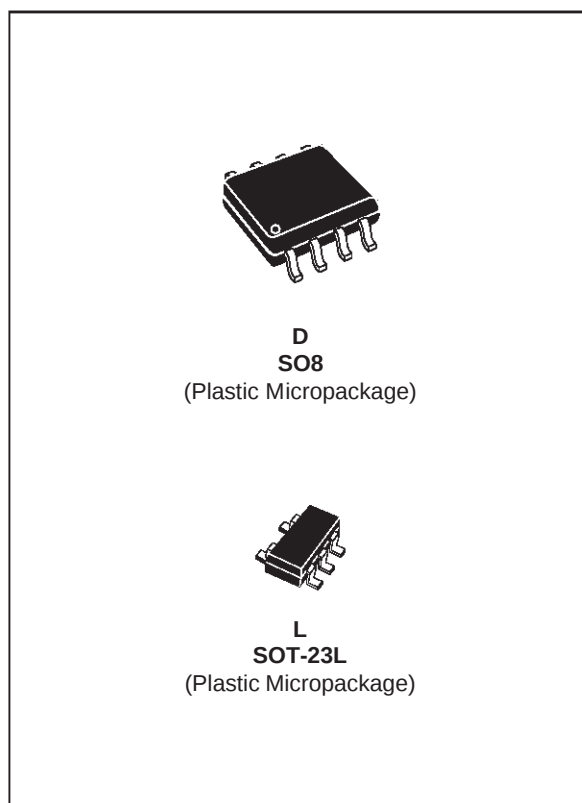
DESCRIPTION

The TS971 is a single operational amplifier able to operate with voltages as low as $\pm 1.35\text{V}$ and featuring output Rail to Rail. It offers a set of valuable characteristics that makes it particularly well-suited for every kind of portable and battery-supplied equipment in which low noise and low distortion are a key.

It is housed in the space-saving 5 pins SOT23-5 package which simplifies the board design because of the ability to be placed everywhere (outside dimensions are 2.8mm x 2.9mm)

APPLICATIONS

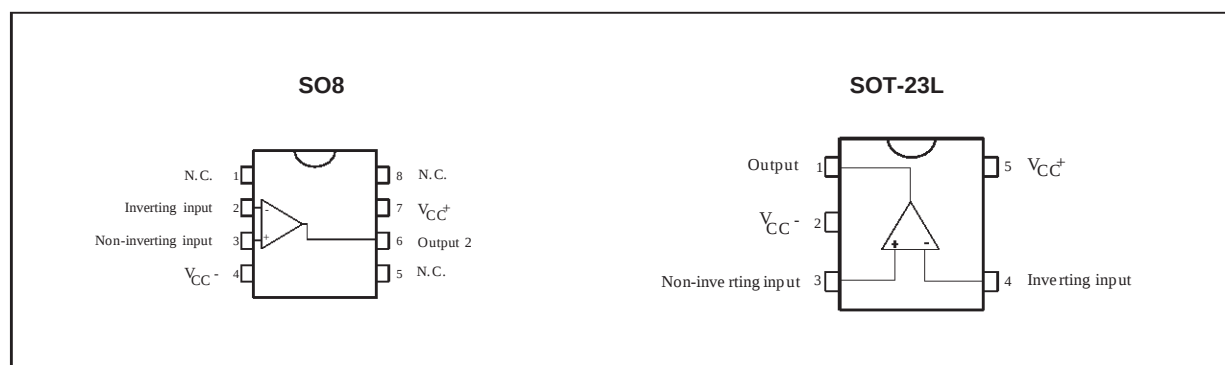
- Nomadics equipments (CD player, PDA, ...)
- Portable communication sets (phone, pager, ..)
- Instrumentation & sensing



ORDER CODES

Part Number	Temperature Range	Package		SOT Marking
		D	L	
TS971C	-20, +70°C	•	•	K120

PIN CONNECTIONS (top view)



June 1998

This is preliminary information on a new product now in development. Details are subject to change without notice.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	12	V
V_{id}	Differential Input Voltage - note 1	$\pm V_{CC}$	V
T_{oper}	Operating Free Air Temperature Range	-20 to +70	°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

Note : 1. Either or both input voltages must not exceed the magnitude of V_{CC}^+ or V_{CC}^-

OPERATING CONDITIONS

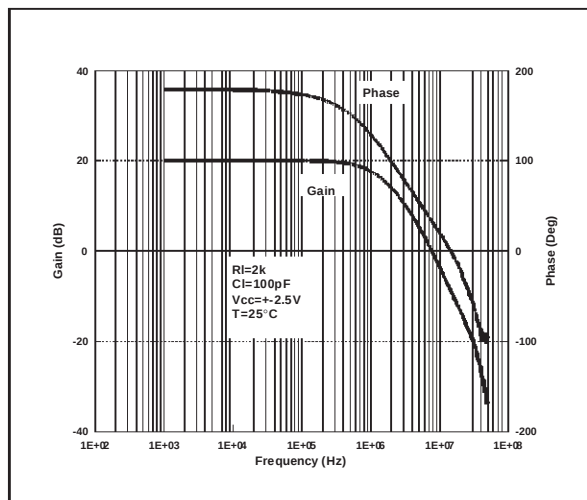
Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2.7 to 10	V

ELECTRICAL CHARACTERISTICS

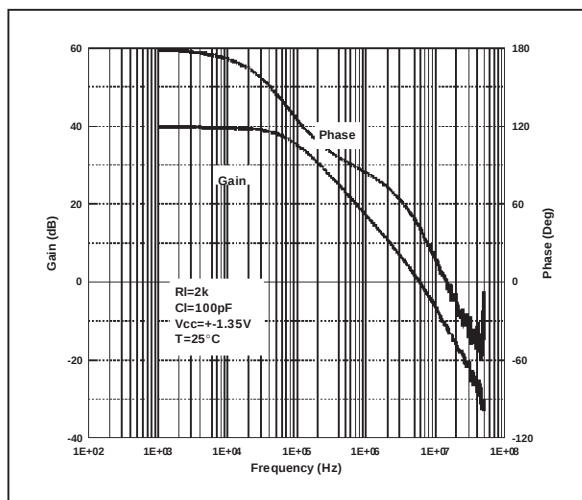
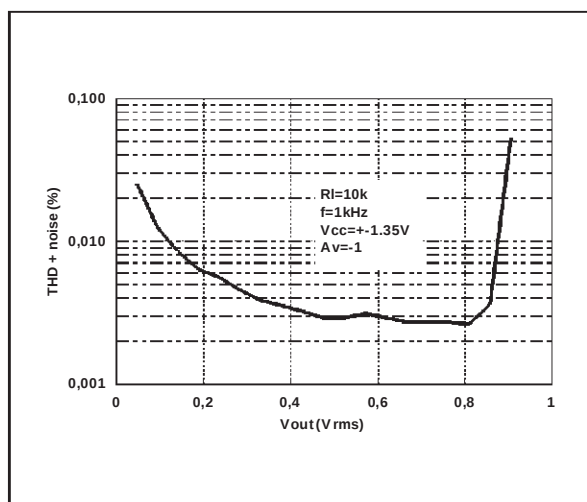
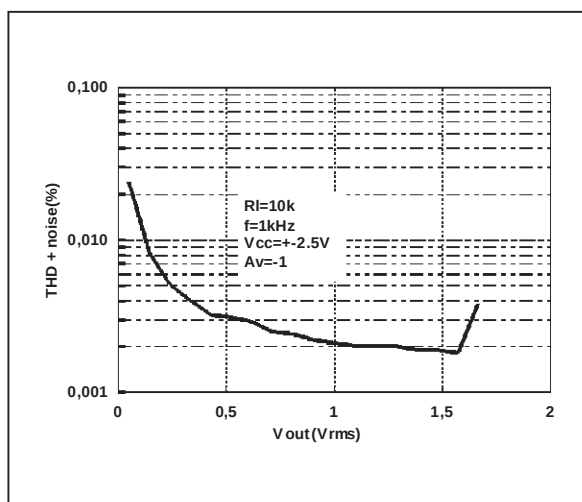
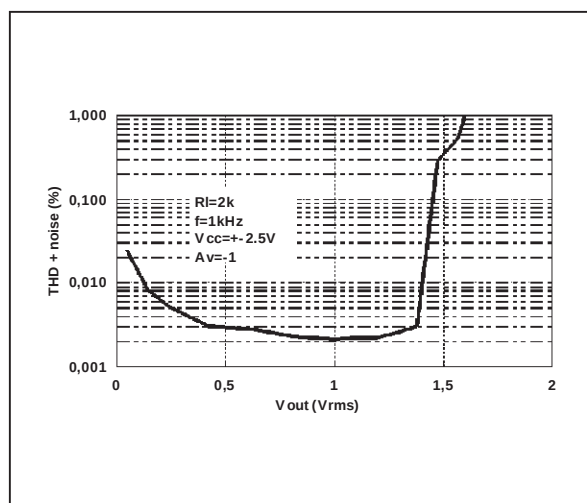
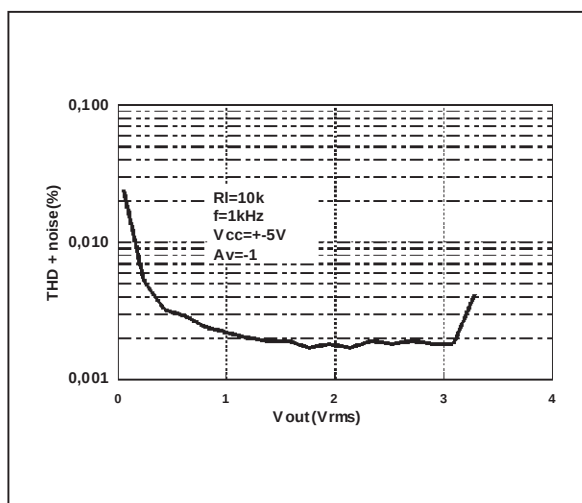
$V_{CC}^+ = 2.5V$, $V_{CC}^- = -2.5V$, $T_{amb} = 25^\circ C$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage $T_{min.} < T_{amb} < T_{max.}$		1	5 7	mV
DV_{io}	Input Offset Voltage Drift $V_{ic} = 0V$, $V_o = 0V$		5		$\mu V/^\circ C$
I_{io}	Input Offset Current $T_{min.} < T_{amb} < T_{max.}$ $V_{ic} = 0V$, $V_o = 0V$		10	150 T.B.D.	nA
I_{ib}	Input Bias Current $T_{min.} < T_{amb} < T_{max.}$ $V_{ic} = 0V$, $V_o = 0V$		250	750 T.B.D.	nA
V_{icm}	Common Mode Input Voltage Range		± 1.5		V
CMR	Common Mode Rejection Ratio $V_{ic} = \pm 1.35V$	60	85		dB
SVR	Supply Voltage Rejection Ratio $V_{CC} = \pm 2V$ to $\pm 3V$	60	70		dB
V_{oh}	High Level Output Voltage $R_L = 2k$	2	2.4		V
V_{ol}	Low Level Output Voltage $R_L = 2k$		-2.4	-2	V
A_{vd}	Large Signal Voltage Gain $R_L = 2k$	70	80		dB
GBP	Gain Bandwidth Product $f = 100kHz$, $R_L = 2k\Omega$, $C_L = 100pF$	8.5	12		MHz
SR	Slew Rate $A_v = 1$, $V_{in} = \pm 1V$	2.8	4		V/ μs
ϕ_m	Phase Margin at Unity Gain $R_L = 2k\Omega$, $C_L = 100pF$		60		Degrees
Gm	Gain Margin $R_L = 2k\Omega$, $C_L = 100pF$		10		dB
I_{CC}	Supply Current Unity gain - no load		2	2.8	mA
e_n	Equivalent Input Noise Voltage $f = 100kHz$		4		$\frac{nV}{\sqrt{Hz}}$
THD	Total Harmonic Distortion $f = 1kHz$, $A_v = -1$, $R_L = 10k$		0.003		%

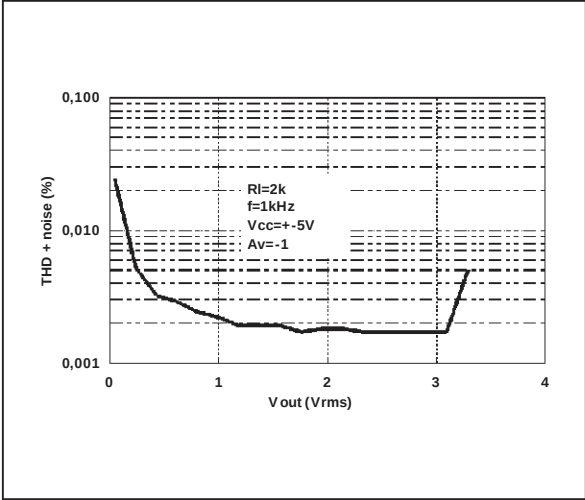
VOLTAGE GAIN AND PHASE vs FREQUENCY



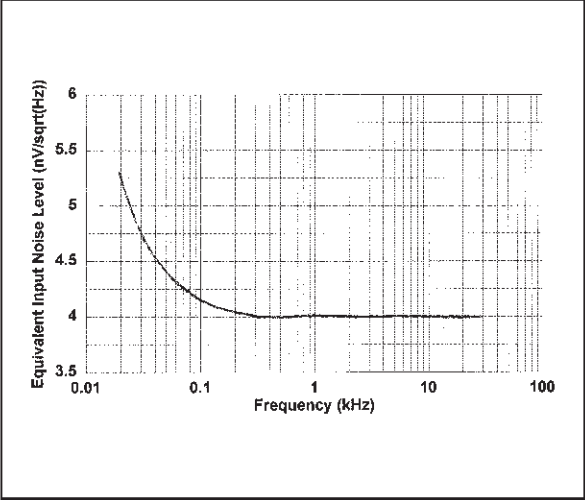
VOLTAGE GAIN AND PHASE vs FREQUENCY

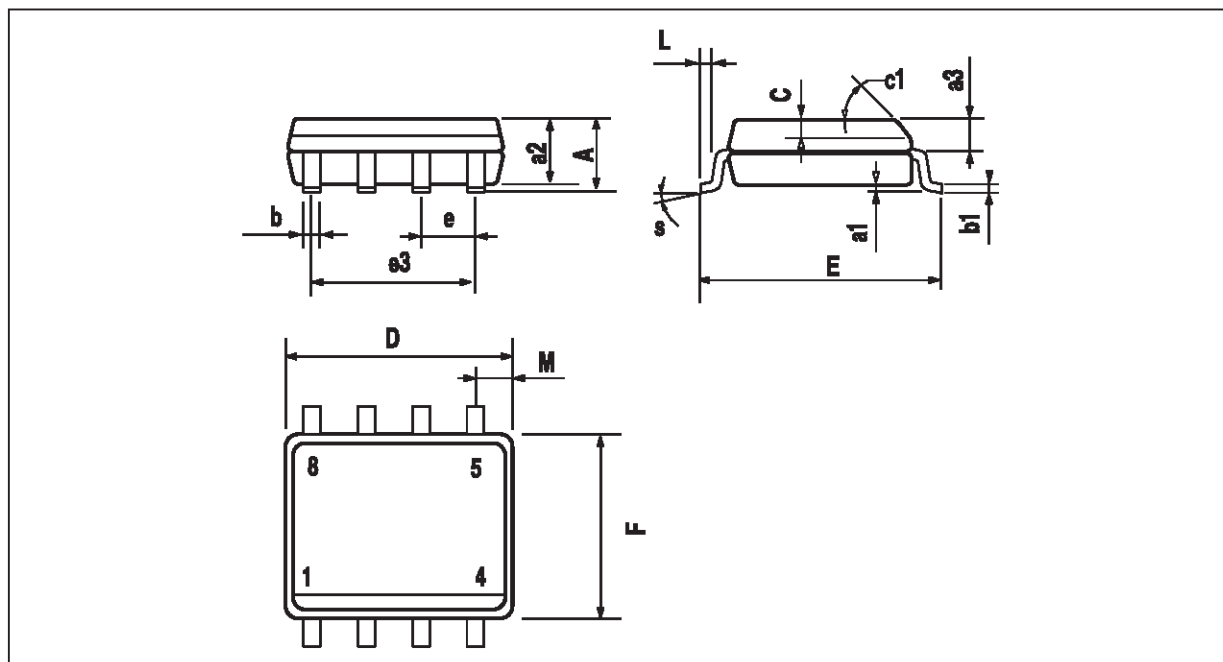
THD + NOISE vs V_{OUT} THD + NOISE vs V_{OUT} THD + NOISE vs V_{OUT} THD + NOISE vs V_{OUT} 

THD + NOISE vs V_{OUT}



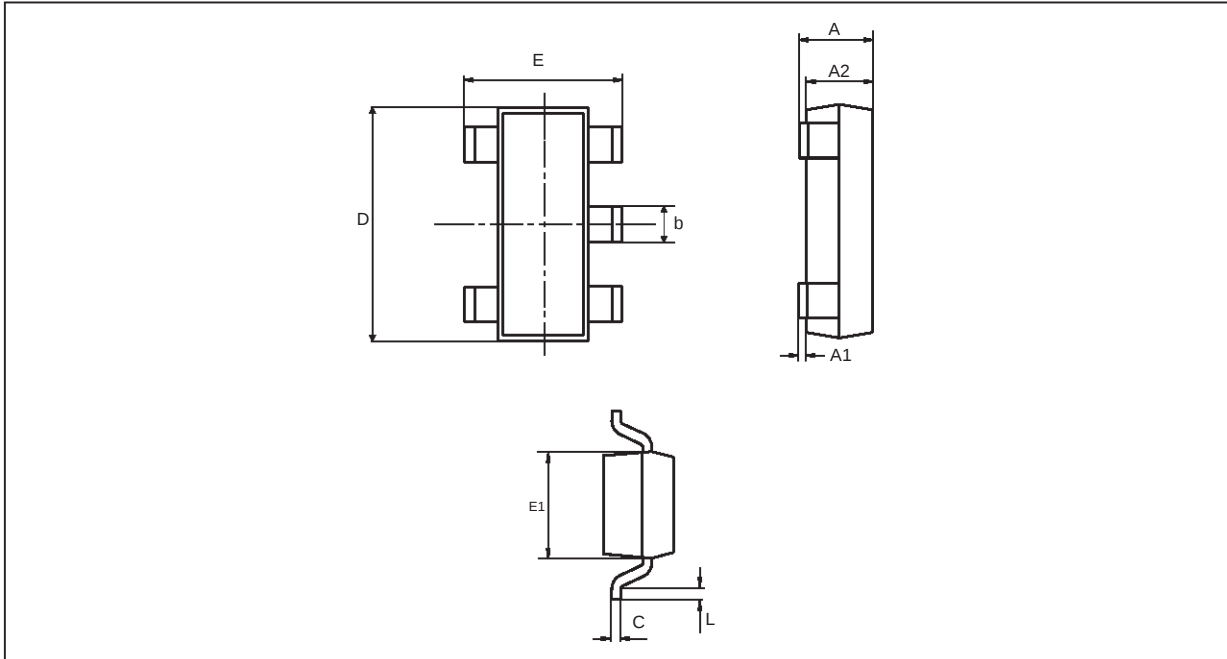
INPUT VOLTAGE NOISE vs FREQUENCY



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.)					

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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