

Low noise dual operational amplifier

Features

■ Low voltage noise: 4.5 nV/\Hz

■ High gain bandwidth product: 15 MHz

■ High slew rate: 7 V/µs■ Low distortion: 0.002%

■ Excellent frequency stability

■ ESD protection 2 kV

Applications

Audio systems

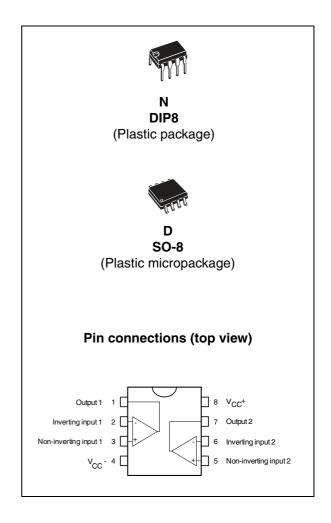
Preamplification, filtering

Description

The LM833 is a monolithic dual operational amplifier particularly well-suited to audio applications.

It offers low voltage noise (4.5 nV/ $\dot{H}z$) and high frequency performances (15 MHz gain bandwidth product, 7 V/ μ s slew rate).

In addition, the LM833 has a very low distortion (0.002%) and excellent phase/gain margins.



1 Absolute maximum ratings

Table 1. Key parameters and their absolute maximum ratings

Symbol	Parameter	Value	Unit
V _{CC}	Supply voltage	±18 or +36	V
V _{id}	Differential input voltage ⁽¹⁾	±30	V
V _i	Input voltage ⁽¹⁾	±15	V
l _{in}	Input current ⁽²⁾ : V _{in} driven negative Input current ⁽³⁾ : V _{in} driven positive above AMR value	5 mA in DC or 50 mA in AC (duty cycle = 10%, T=1s)	mA
	Output short-circuit duration	Infinite	s
T _j	Junction temperature	+150	°C
T _{stg}	Storage temperature	-65 to +150	°C
Ptot	Maximum power dissipation ⁽⁴⁾	500	mW
	HBM: human body model ⁽⁵⁾	2	kV
ESD	MM: machine model ⁽⁶⁾	200	V
	CDM: charged device model ⁽⁷⁾	1.5	kV

- 1. Either or both input voltages must not exceed the magnitude of Vcc+ or Vcc-.
- 2. This input current only exists when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistor becoming forward-biased and thereby acting as input diode clamp. In addition to this diode action, there is NPN parasitic action on the IC chip. This transistor action can cause the output voltages of the Op-amps to go to the V_{CC} voltage level (or to ground for a large overdrive) for the time during which an input is driven negative.
 This is not destructive and normal output is restored for input voltages above -0.3 V.
- The junction base/substrate of the input PNP transistor polarized in reverse must be protected by a resistor in series with the inputs to limit the input current to 400 μA max (R = (Vin - 36 V)/400 μA).
- 4. Power dissipation must be considered to ensure maximum junction temperature (Tj) is not exceeded.
- 5. Human body model: 100 pF discharged through a 1.5 $k\Omega$ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
- 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), done for all couples of pin combinations with other pins floating.
- Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to the ground.

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
V _{CC}	Supply voltage	±2.5 to ±15	V
T _{oper}	Operating free-air temperature range	-40 to 105	°C

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Typical application schematics 2

 V_{CC}^+ Non-inverting Inverting O Input Input V_{CC}^{-}

Figure 1. Schematic diagram (1/2 LM833)

Electrical characteristics LM833

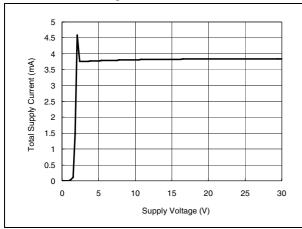
3 Electrical characteristics

Table 3. V_{CC+} = +15 V, V_{CC-} = -15 V, T_{amb} = 25° C (unless otherwise specified)

Symbol	Parameter	Min.	Тур.	Max.	Unit
V _{io}	Input offset voltage ($R_s = 10 \Omega V_o = 0 V, V_{ic} = 0 V$)		0.3	5	mV
DV _{io}	Input offset voltage drift $R_s = 10 \Omega V_o = 0 V$, $T_{min.} \le T_{amb} \le T_{max.}$		2		μV/°C
I _{io}	Input offset current (V _o = 0 V, V _{ic} = 0 V)		25	200	nA
I _{ib}	Input bias current (V _o = 0 V, V _{ic} = 0 V)		300	1000	nA
V _{icm}	Input common mode voltage range	±12	±14		V
A _{vd}	Large signal voltage gain ($R_L = 2 \text{ k}\Omega$, $V_o = \pm 10 \text{ V}$)	90	100		dB
±V _{opp}	Output voltage swing (V_{id} = ±1 V) $R_L = 2.0 \text{ k}\Omega$ $R_L = 2.0 \text{ k}\Omega$ $R_L = 10 \text{ k}\Omega$ $R_L = 10 \text{ k}\Omega$ $R_L = 10 \text{ k}\Omega$	10 12	13.7 -14 13.9 -14.4	-10 -12	٧
CMR	Common-mode rejection ratio (V _{ic} = ±13 V)	80	100		dB
SVR	Supply voltage rejection ratio (V _{CC+} /V _{CC-} = +15 V/-15 V to +5 V/-5 V)	80	105		dB
I _{CC}	Supply current (V _o = 0 V, all amplifiers)		4	8	mA
SR	Slew rate ($V_i = -10 \text{ V to } +10 \text{ V}, R_L = 2 \text{ k}\Omega, A_V = +1$)	5	7		V/µs
GBP	Gain bandwidth product $(R_L = 2 \text{ k}\Omega, C_L = 100 \text{ pF}, f = 100 \text{ kHz})$	10	15		MHz
В	Unity gain bandwidth (open loop)		9		MHz
φm	Phase margin ($R_L = 2 k\Omega$)		60		Degrees
e _n	Equivalent input noise voltage ($R_S = 100 \Omega f = 1 \text{ kHz}$)		4.5		$\frac{\text{nV}}{\sqrt{\text{Hz}}}$
i _n	Equivalent input noise current (f = 1 kHz)		0.5		<u>pA</u> √Hz
THD	Total harmonic distortion (R _L = 2 k Ω f = 20 Hz to 20 kHz, V _o = 3 V _{rms} , A _V = +1)		0.002		%
V _{O1} /V _{O2}	Channel separation (f = 20 Hz to 20 kHz)		120		dB
FPB	Full power bandwidth ($V_0 = 27 V_{pp}$, $R_L = 2 k\Omega$, THD $\leq 1\%$)		120		kHz

Figure 2. Total supply current vs. supply voltage

Figure 3. Output voltage vs. supply voltage



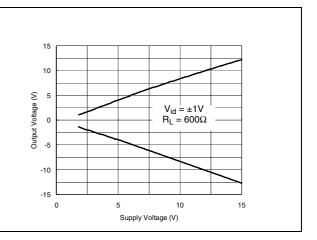
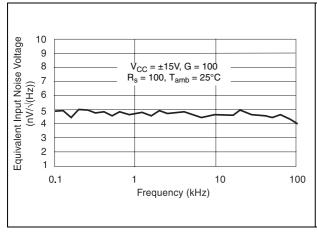


Figure 4. Equivalent input noise voltage vs. frequency

Figure 5. Output short circuit current vs. output voltage



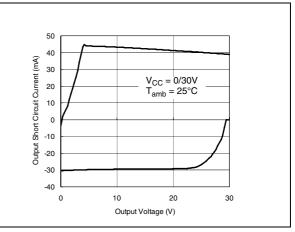
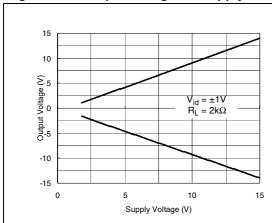
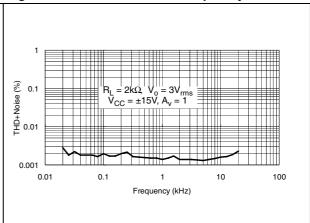


Figure 6. Output voltage vs. supply voltage Figure 7. THD+ noise vs. frequency



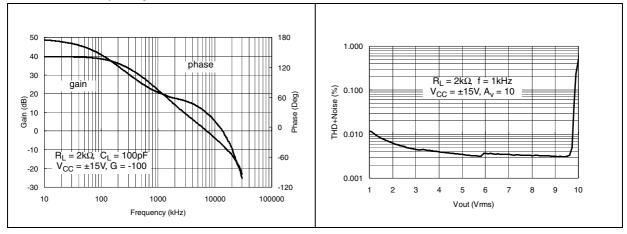


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Figure 8. Voltage gain and phase vs. frequency

Figure 9. THD + noise vs. Vout



LM833 Package information

4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK[®] is an ST trademark.

Package information LM833

4.1 DIP8 package information

Figure 10. DIP8 package mechanical drawing

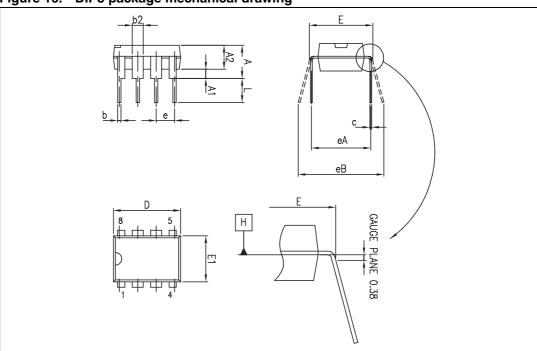


Table 4. DIP8 package mechanical data

	Dimensions					
Ref.	Millimeters			Inches		
	Min.	Тур.	Max.	Min.	Тур.	Max.
Α			5.33			0.210
A1	0.38			0.015		
A2	2.92	3.30	4.95	0.115	0.130	0.195
b	0.36	0.46	0.56	0.014	0.018	0.022
b2	1.14	1.52	1.78	0.045	0.060	0.070
С	0.20	0.25	0.36	0.008	0.010	0.014
D	9.02	9.27	10.16	0.355	0.365	0.400
E	7.62	7.87	8.26	0.300	0.310	0.325
E1	6.10	6.35	7.11	0.240	0.250	0.280
е		2.54			0.100	
eA		7.62			0.300	
еВ			10.92			0.430
L	2.92	3.30	3.81	0.115	0.130	0.150

4.2 SO-8 package information

Figure 11. SO-8 package mechanical drawing

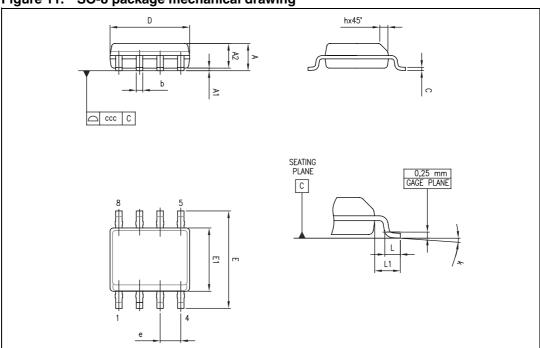


Table 5. SO-8 package mechanical data

	Dimensions					
Ref.		Millimeters			Inches	
	Min.	Тур.	Max.	Min.	Тур.	Max.
Α			1.75			0.069
A1	0.10		0.25	0.004		0.010
A2	1.25			0.049		
b	0.28		0.48	0.011		0.019
С	0.17		0.23	0.007		0.010
D	4.80	4.90	5.00	0.189	0.193	0.197
Е	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
е		1.27			0.050	
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
L1		1.04			0.040	
k	0		8°	1°		8°
ccc			0.10			0.004

Ordering information LM833

5 Ordering information

Table 6. Order codes

Part number	Temperature range Package		Packing	Marking
LM833N	-40, +105° C	DIP8	Tube	LM833N
LM833D/DT	-40, +105 C	SO-8	Tube or tape & reel	833

LM833 Revision History

6 Revision History

Table 7. Document revision history

Date	Revision	Changes
01-Nov-2001	1	Initial release.
01-Jul-2005	2	PPAP references inserted in the datasheet see <i>Table on page 1</i> . ESD protection inserted in <i>Table 1 on page 2</i> .
20-Aug-2009	3	Document reformatted. Minor text changes. Updated packages in <i>Chapter 4: Package information</i> . Removed automotive grade versions (LM833YD/DT) from <i>Chapter 5: Ordering information</i>

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