

Low noise quad operational amplifier

Datasheet -production data

Features

■ Low voltage noise: 4.5 nV/√Hz

High gain bandwidth product: 15 MHz

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

■ Large output voltage swing: +14.3 V/-14.6 V

■ Excellent frequency stability

ESD protection 2 kV

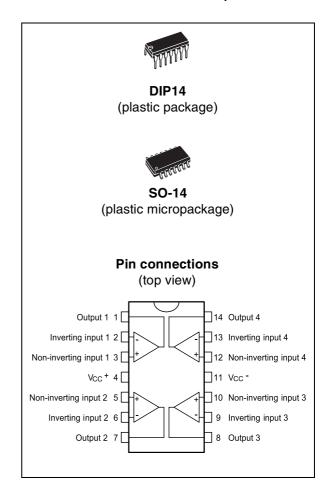
Description

The MC33079 device is a monolithic quad operational amplifier particularly well suited for audio applications.

It offers low voltage noise (4.5 nV/ $\sqrt{\text{Hz}}$) and high frequency performance (15 MHz gain bandwidth product, 7 V/ μ s slew rate).

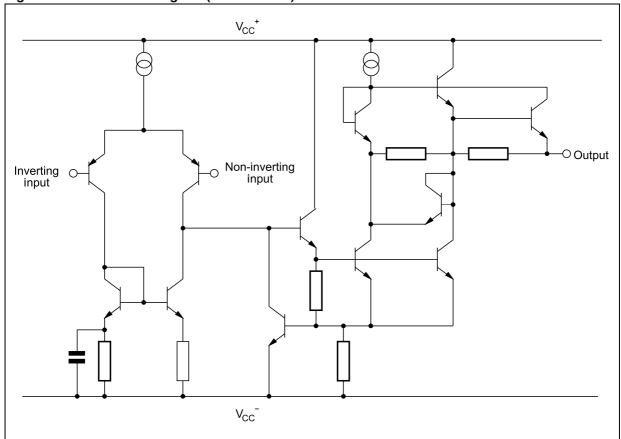
In addition the MC33079 device has a very low distortion (0.002%) and excellent phase/gain margins.

The output stage allows a large output voltage swing and symmetrical source and sink currents.



1 Schematic diagram (1/4 MC33079)

Figure 1. Schematic diagram (1/4 MC33079)



2 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings (AMR)

Table 1.	Absolute maximum ratings (Amri)			
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	
	Output short-circuit duration	Infinite	s	
Tj	Junction temperature	+150	°C	
T _{stg}	Storage temperature	-65 to +150	°C	
R _{thja}	Thermal resistance junction-to-ambient ⁽²⁾ , ⁽³⁾ DIP14 SO-14	80 105	°C/W	
R _{thjc}	Thermal resistance junction-to-case ⁽²⁾ , ⁽³⁾ DIP14 SO-14	33 31	°C/W	
	HBM: human body model ⁽⁴⁾	2	kV	
ESD	MM: machine model ⁽⁵⁾	200	V	
	CDM: charged device model ⁽⁶⁾	1.5	kV	

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

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 125	°C
V _{icm}	Input common mode voltage range ($\Delta V_{io}/\Delta T$ = 5 mV, V_{o} = 0 V)	±13 to ±14	V



Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuits on all amplifiers.

^{3.} R_{th} are typical values.

^{4.} 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.

^{5.} Machine model: a 200 pF cap 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 ground.

Electrical characteristics MC33079

3 Electrical characteristics

Table 3. Electrical characteristics at 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 ($V_0 = 0 \text{ V}, V_{ic} = 0 \text{ V}$) $T_{min} \le T_{amb} \le T_{max}$			2.5 3.5	mV
$\Delta V_{io}/\Delta T$	Input offset voltage drift $V_o = 0 \text{ V}, V_{ic} = 0 \text{ V}, T_{min} \le T_{amb} \le T_{max}$		2		μV/°C
I _{io}	Input offset current ($V_o = 0 \text{ V}, V_{ic} = 0 \text{ V}$) $T_{min} \le T_{amb} \le T_{max}$		10	150 175	nA
I _{ib}	Input bias current ($V_o = 0 \text{ V}, V_{ic} = 0 \text{ V}$) $T_{min} \le T_{amb} \le T_{max}$		250	750 800	nA
A _{vd}	Large signal voltage gain ($R_L = 2 \text{ k}\Omega$, $V_0 = \pm 10 \text{ V}$) $T_{min} \le T_{amb} \le T_{max}$	90 85	100		dB
±V _{opp}	Output voltage swing (V_{id} = ±1 V) $R_L = 600 \ \Omega$ $R_L = 600 \ \Omega$ $R_L = 2.0 \ k\Omega$ $R_L = 2.0 \ k\Omega$ $R_L = 10 \ k\Omega$ $R_L = 10 \ k\Omega$	13.2	12.2 -12.7 14 -14.2 14.3 -14.6	-13.2 -14	V
CMR	Common-mode rejection ratio $(V_{ic} = \pm 13 \text{ V})$	80	100		dB
SVR	Supply voltage rejection ratio $(V_{CC}^+ / V_{CC}^- = +15 \text{ V} / -15 \text{ V} \text{ to } +5 \text{ V} / -5 \text{ V})$	80	105		dB
I _o	Output short-circuit current ($V_{id} = \pm 1 V$, output to ground) Source Sink	15 20	29 37		mA
I _{CC}	Supply current ($V_o = 0$ V, all amplifiers) $T_{min} \le T_{amb} \le T_{max}$		8	10 12	mA
SR	Slew rate (V _i = -10 V to +10 V, R _L = 2 k Ω C _L = 100 pF, 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
A _m	Gain margin ($R_L = 2 \text{ k}\Omega$) $C_L = 0 \text{ pF}$ $C_L = 100 \text{ pF}$		-11 -6		dB
φm	Phase margin ($R_L = 2 \text{ k}\Omega$) $C_L = 0 \text{ pF}$ $C_L = 100 \text{ pF}$		55 30		Degrees
e _n	Equivalent input noise voltage ($R_S = 100 \Omega f = 1 \text{ kHz}$)		4.5		<u>nV</u> √Hz
i _n	Equivalent input noise current (f = 1 kHz)		0.5		<u>pA</u> √Hz

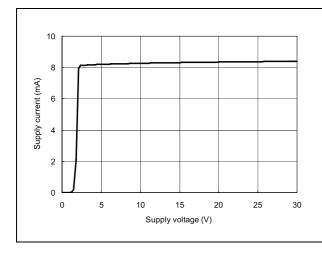
Table 3. Electrical characteristics at V_{CC}^+ = +15 V, V_{CC}^- = -15 V, T_{amb} = 25 °C (unless otherwise specified) (continued)

Symbol	Parameter	Min.	Тур.	Max.	Unit	
THD	Total harmonic distortion (R $_L$ = 2 kQ 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)					
FPB	Full power bandwidth ($V_0 = 27 V_{pp}$, $R_L = 2 k\Omega$, THD $\leq 1\%$)			kHz		
Z _o	Output impedance (V _o = 0 V, f = 9 MHz)		37		Ω	
R _i	Input resistance (V _{ic} = 0 V)		175		kΩ	
C _i	Input capacitance (V _{ic} = 0 V)		12		pF	

Electrical characteristics MC33079

Figure 2. Supply current vs. supply voltage Figure 3.

Figure 3. Output voltage vs. supply voltage $(V_{id} = \pm 1 \ V, \ R_L = 600 \ \Omega)$



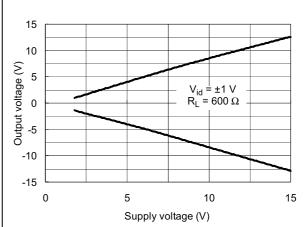
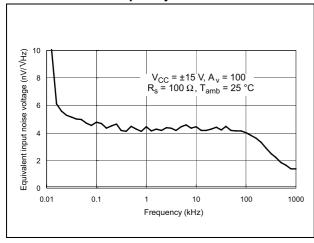


Figure 4. Equivalent input noise voltage vs. frequency

Figure 5. Output short-circuit current vs. output voltage



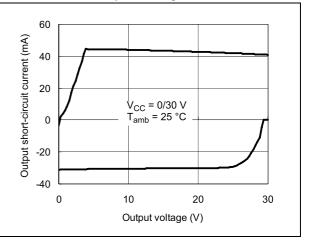
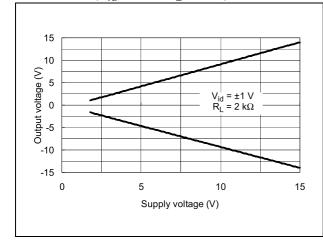
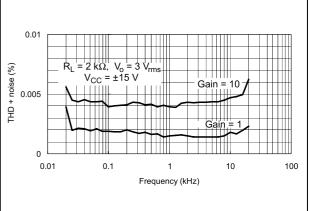


Figure 6. Output voltage vs. supply voltage ($V_{id} = \pm 1$ V, $R_L = 2$ k Ω)

Figure 7. THD + noise vs. frequency



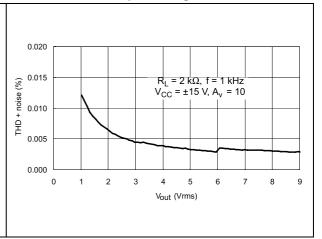


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Figure 8. Voltage gain and phase vs. frequency

60 180 40 120 Phase (deg.) <u>මු</u> 20 60 Gain 0 $R_L = 2 k\Omega, C_L = 100 pF_ V_{CC} = \pm 15 V, A_V = -100_-$ -20 -60 -40 -120 10 100 1000 10000 100000 Frequency (kHz)

Figure 9. Total harmonic distortion vs. output voltage



Package information MC33079

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.

4.1 DIP14 package information

Figure 10. DIP14 package outline

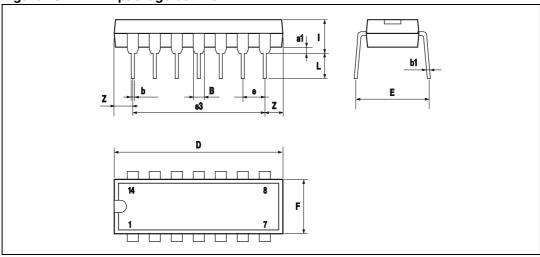


Table 4. DIP14 package mechanical data

	Dimensions					
Symbol		Millimeters			Inches	
	Min.	Тур.	Max.	Min.	Тур.	Max.
a1	0.51			0.020		
В	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
Е		8.5			0.335	
е		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

4.2 SO-14 package information

Figure 11. SO-14 package outline

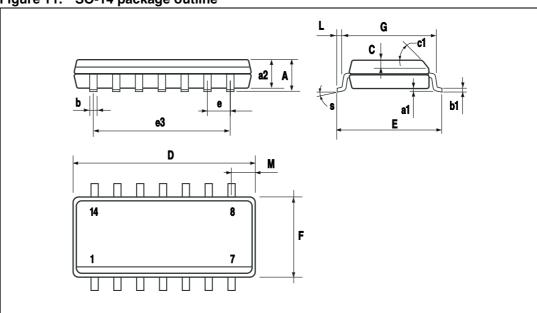


Table 5. SO-14 package mechanical data

	Dimensions						
Symbol	Millimeters			Inches			
	Min.	Тур.	Max.	Min.	Тур.	Max.	
Α			1.75			0.068	
a1	0.1		0.2	0.003		0.007	
a2			1.65			0.064	
b	0.35		0.46	0.013		0.018	
b1	0.19		0.25	0.007		0.010	
С		0.5			0.019		
c1			45°	(typ.)			
D	8.55		8.75	0.336		0.344	
Е	5.8		6.2	0.228		0.244	
е		1.27			0.050		
e3		7.62			0.300		
F	3.8		4.0	0.149		0.157	
G	4.6		5.3	0.181		0.208	
L	0.5		1.27	0.019		0.050	
М			0.68			0.026	
S			8° (ı	max.)			

5 Ordering information

Table 6. Order codes

Order code	Temperature range	Package	Packaging	Marking
MC33079N		DIP14	Tube	MC33079N
MC33079D MC33079DT	-40 °C to +125 °C	SO-14	Tube or tape and reel	33079
MC33079YDT ⁽¹⁾		SO-14 (automotive grade)	Tube or tape and reel	33079Y

Qualified and characterized according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 and Q 002 or equivalent.

6 Revision history

Table 7. Document revision history

Date	Revision	Changes
10-Oct-2001	1	Initial release.
23-Jun-2005	2	PPAP references inserted in the datasheet. See order codes table.
21-Nov-2007	3	Added R _{thja} , R _{thjc} and ESD values in <i>Table 1: Absolute maximum ratings (AMR)</i> . Added footnote for automotive grade order codes in order codes table. Updated document format.
13-Mar-2008	4	Corrected value for ESD HBM parameter. Removed section on Macromodel.
14-Nov-2012 5		Updated <i>Features</i> (removed "macromodel"). Updated title of <i>Figure 3</i> and <i>Figure 6</i> (added conditions). Updated ECOPACK text in <i>Section 4</i> . Updated temperature range to 125 °C in <i>Table 2</i> and <i>Table 6</i> . Updated MC33079YDT order code (status qualified), removed MC33079YD order code from <i>Table 6</i> . Minor corrections throughout document.

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