

## Low noise quad operational amplifier

Datasheet – production data

### Features

- Low voltage noise: 4.5 nV/ $\sqrt{\text{Hz}}$
- High gain bandwidth product: 15 MHz
- High slew rate: 7 V/ $\mu\text{s}$
- Low distortion: 0.002%
- Large output voltage swing: +14.3 V/-14.6 V
- Excellent frequency stability
- ESD protection 2 kV

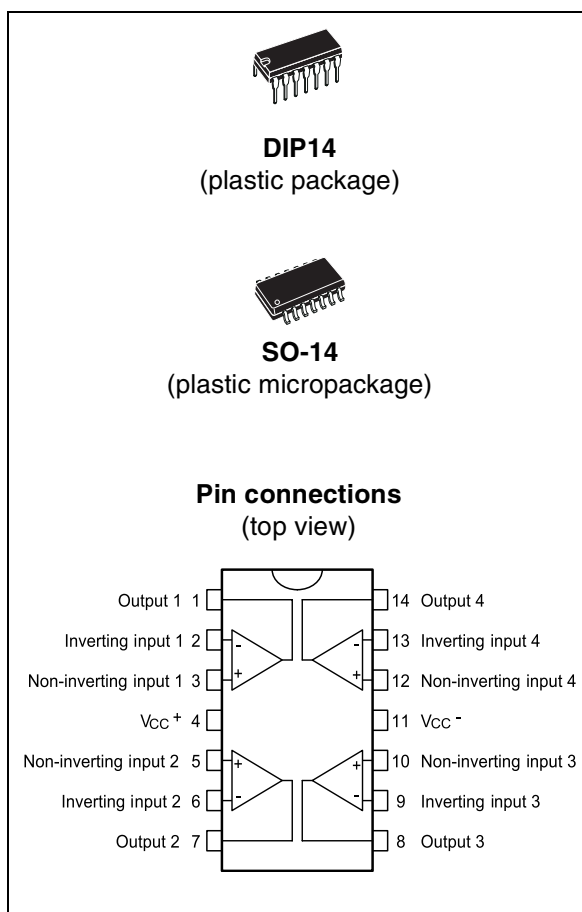
### Description

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/ $\mu\text{s}$  slew rate).

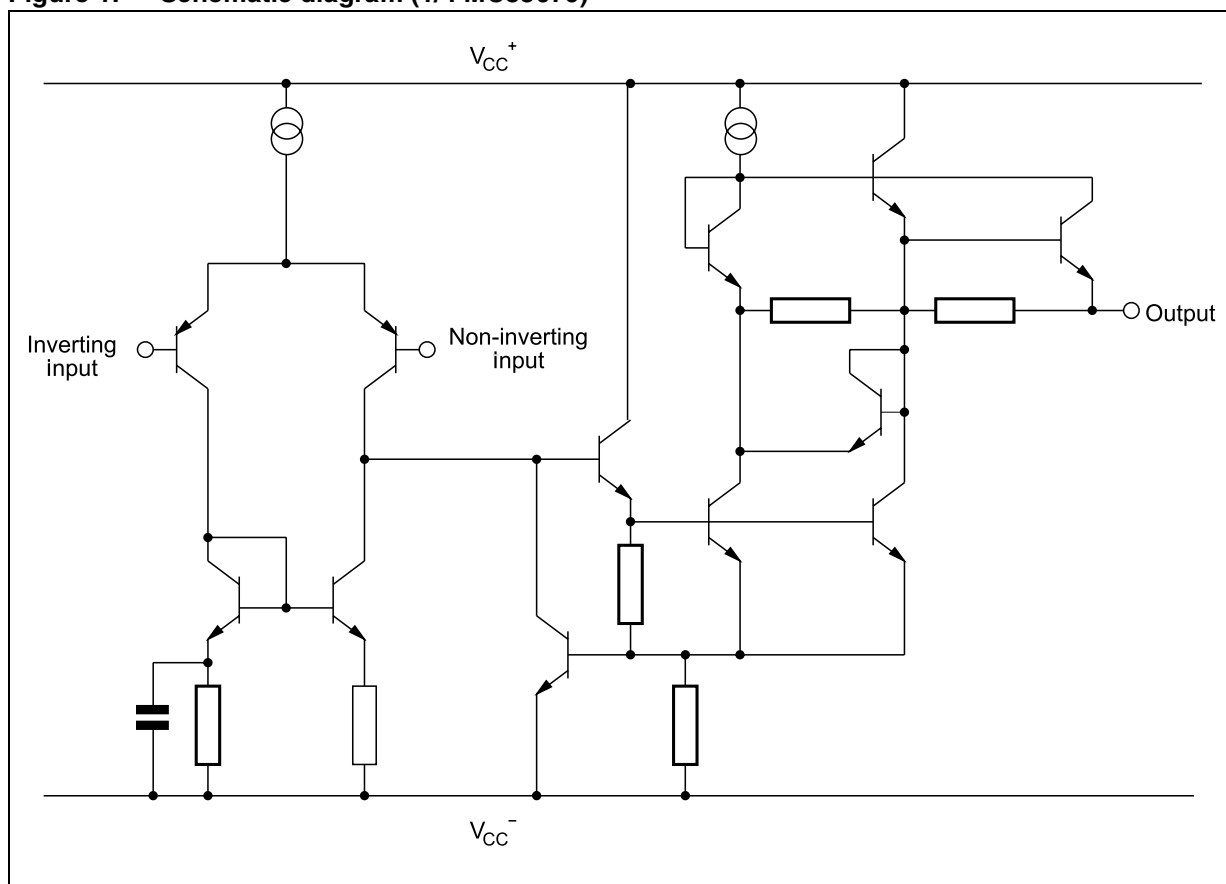
In addition the MC33079 device has a very low distortion (0.002%) and excellent phase/gain margins.

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)**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply voltage	$\pm 18$ or $+36$	V
$V_{id}$	Differential input voltage <sup>(1)</sup>	$\pm 30$	V
$V_i$	Input voltage <sup>(1)</sup>	$\pm 15$	V
	Output short-circuit duration	Infinite	s
$T_j$	Junction temperature	+150	°C
$T_{stg}$	Storage temperature	-65 to +150	°C
$R_{thja}$	Thermal resistance junction-to-ambient <sup>(2), (3)</sup>		°C/W
	DIP14 SO-14	80 105	
$R_{thjc}$	Thermal resistance junction-to-case <sup>(2), (3)</sup>		°C/W
	DIP14 SO-14	33 31	
ESD	HBM: human body model <sup>(4)</sup>	2	kV
	MM: machine model <sup>(5)</sup>	200	V
	CDM: charged device model <sup>(6)</sup>	1.5	kV

1. Either or both input voltages must not exceed the magnitude of  $V_{CC}^+$  or  $V_{CC}^-$ .
2. 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  $\Omega$ ), done for all couples of pin combinations with other pins floating.
6. Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to ground.

**Table 2. Operating conditions**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply voltage	$\pm 2.5$ to $\pm 15$	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)	$\pm 13$ to $\pm 14$	V

### 3 Electrical characteristics

**Table 3. Electrical characteristics at  $V_{CC}^+ = +15\text{ V}$ ,  $V_{CC}^- = -15\text{ V}$ ,  $T_{amb} = 25\text{ }^\circ\text{C}$  (unless otherwise specified)**

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{io}$	Input offset voltage ( $V_o = 0\text{ V}$ , $V_{ic} = 0\text{ V}$ ) $T_{min} \leq T_{amb} \leq T_{max}$			2.5 3.5	mV
$\Delta V_{io}/\Delta T$	Input offset voltage drift $V_o = 0\text{ V}$ , $V_{ic} = 0\text{ V}$ , $T_{min} \leq T_{amb} \leq T_{max}$		2		$\mu\text{V}/^\circ\text{C}$
$I_{io}$	Input offset current ( $V_o = 0\text{ V}$ , $V_{ic} = 0\text{ V}$ ) $T_{min} \leq T_{amb} \leq T_{max}$		10	150 175	nA
$I_{ib}$	Input bias current ( $V_o = 0\text{ V}$ , $V_{ic} = 0\text{ V}$ ) $T_{min} \leq T_{amb} \leq T_{max}$		250	750 800	nA
$A_{vd}$	Large signal voltage gain ( $R_L = 2\text{ k}\Omega$ , $V_o = \pm 10\text{ V}$ ) $T_{min} \leq T_{amb} \leq T_{max}$	90 85	100		dB
$\pm V_{opp}$	Output voltage swing ( $V_{id} = \pm 1\text{ V}$ ) $R_L = 600\ \Omega$ $R_L = 600\ \Omega$ $R_L = 2.0\text{ k}\Omega$ $R_L = 2.0\text{ k}\Omega$ $R_L = 10\text{ k}\Omega$ $R_L = 10\text{ k}\Omega$	13.2 13.5	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 ( $V_{CC}^+ / V_{CC}^- = +15\text{ V} / -15\text{ V}$ to $+5\text{ V} / -5\text{ V}$ )	80	105		dB
$I_o$	Output short-circuit current ( $V_{id} = \pm 1\text{ V}$ , output to ground) Source Sink	15 20	29 37		mA
$I_{CC}$	Supply current ( $V_o = 0\text{ V}$ , all amplifiers) $T_{min} \leq T_{amb} \leq T_{max}$		8	10 12	mA
SR	Slew rate ( $V_i = -10\text{ V}$ to $+10\text{ V}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , $A_V = +1$ )	5	7		V/ $\mu\text{s}$
GBP	Gain bandwidth product ( $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , $f = 100\text{ kHz}$ )	10	15		MHz
B	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
$\phi_m$	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		$\frac{\text{nV}}{\sqrt{\text{Hz}}}$
$i_n$	Equivalent input noise current ( $f = 1\text{ kHz}$ )		0.5		$\frac{\text{pA}}{\sqrt{\text{Hz}}}$

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
THD	Total harmonic distortion ( $R_L = 2\text{ k}\Omega$ , $f = 20\text{ Hz to } 20\text{ kHz}$ , $V_o = 3\text{ V}_{rms}$ , $A_V = +1$ )		0.002		%
$V_{O1}/V_{O2}$	Channel separation ( $f = 20\text{ Hz to } 20\text{ kHz}$ )		120		dB
FPB	Full power bandwidth ( $V_o = 27\text{ V}_{pp}$ , $R_L = 2\text{ k}\Omega$ , $THD \leq 1\%$ )		120		kHz
$Z_o$	Output impedance ( $V_o = 0\text{ V}$ , $f = 9\text{ MHz}$ )		37		$\Omega$
$R_i$	Input resistance ( $V_{ic} = 0\text{ V}$ )		175		$\text{k}\Omega$
$C_i$	Input capacitance ( $V_{ic} = 0\text{ V}$ )		12		$\mu\text{F}$

Figure 2. Supply current vs. supply voltage

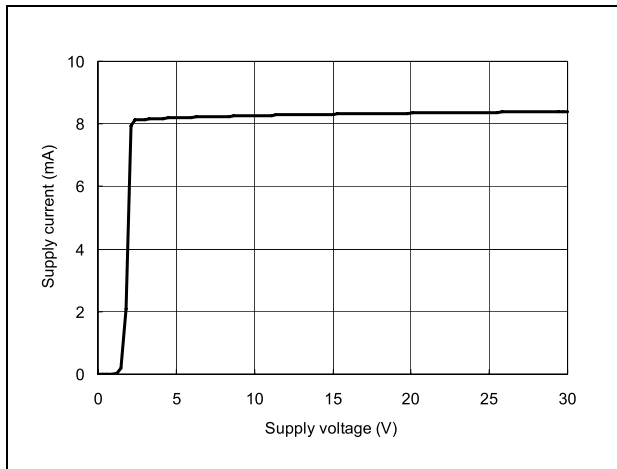


Figure 3. Output voltage vs. supply voltage ( $V_{id} = \pm 1\text{ V}$ ,  $R_L = 600\ \Omega$ )

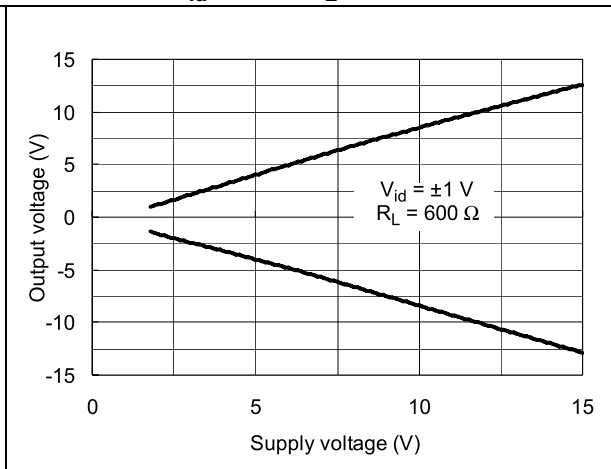


Figure 4. Equivalent input noise voltage vs. frequency

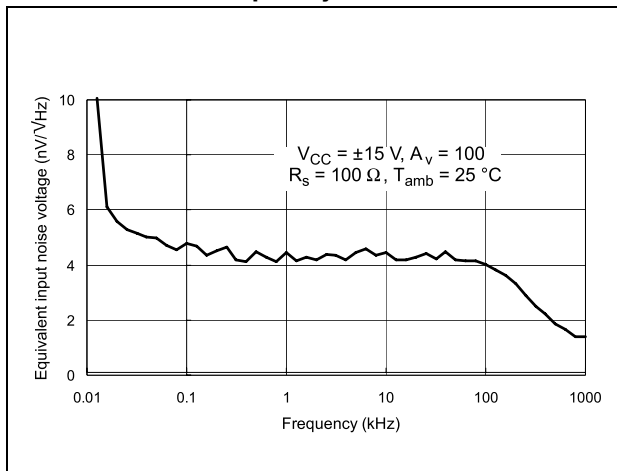


Figure 5. Output short-circuit current vs. output voltage

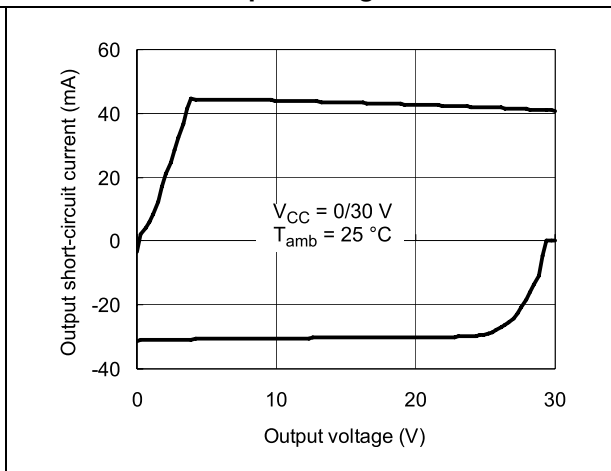


Figure 6. Output voltage vs. supply voltage ( $V_{id} = \pm 1\text{ V}$ ,  $R_L = 2\text{ k}\Omega$ )

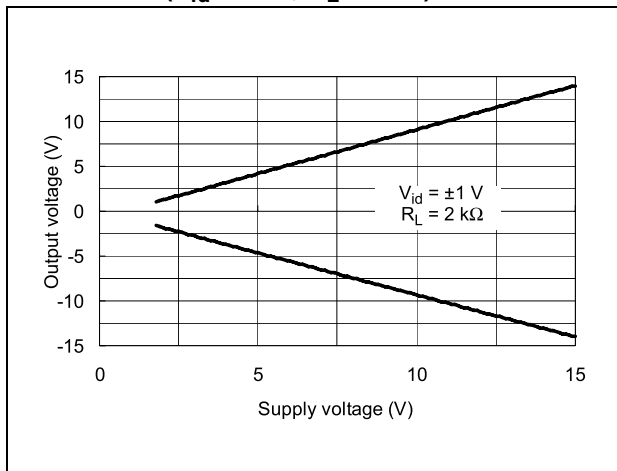
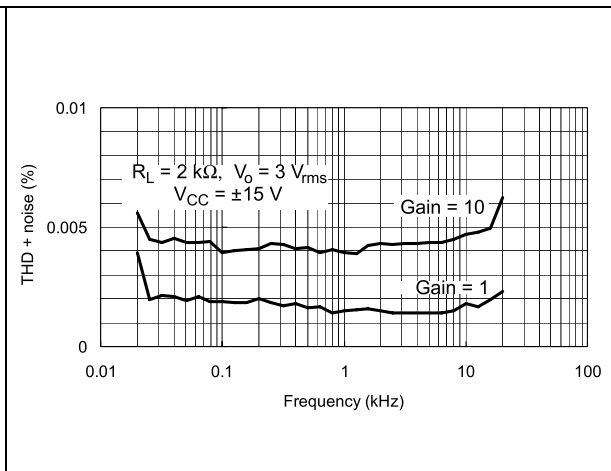
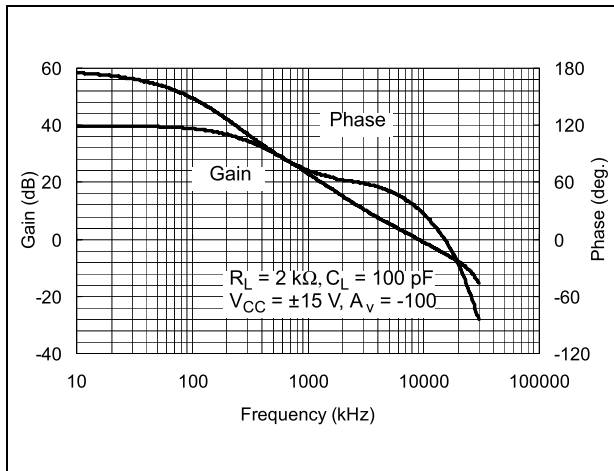


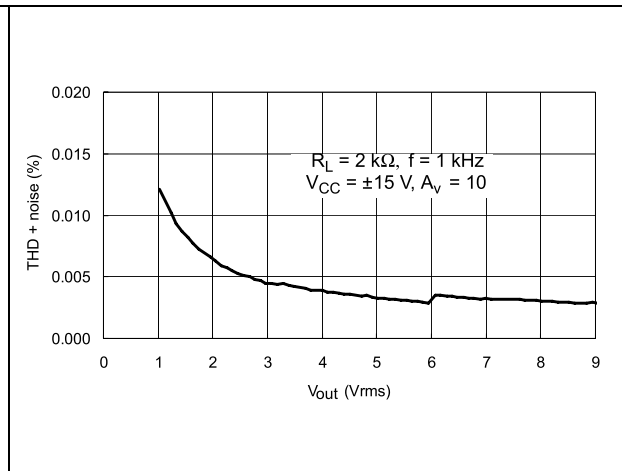
Figure 7. THD + noise vs. frequency



**Figure 8. Voltage gain and phase vs. frequency**



**Figure 9. Total harmonic distortion vs. output voltage**



## 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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 DIP14 package information

Figure 10. DIP14 package outline

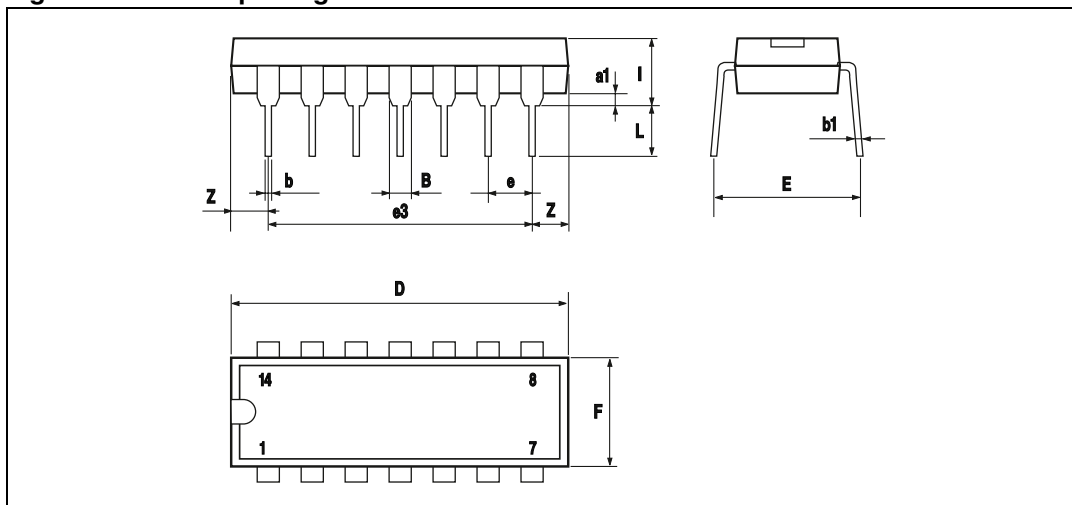


Table 4. DIP14 package mechanical data

Symbol	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		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

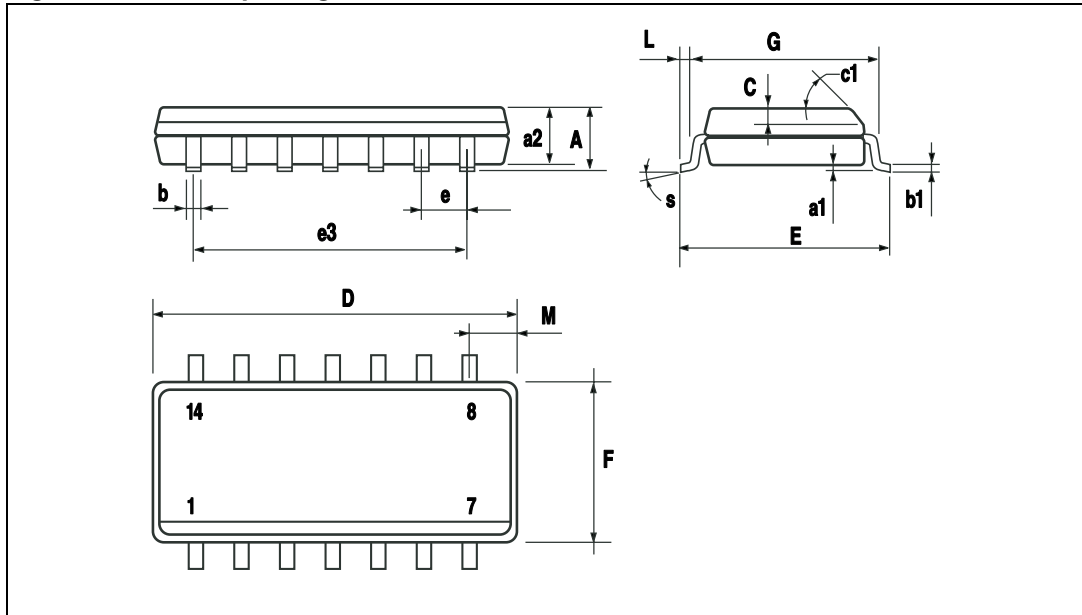


Table 5. SO-14 package mechanical data

Symbol	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			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
C		0.5			0.019	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		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
M			0.68			0.026
S	8° (max.)					

## 5 Ordering information

**Table 6. Order codes**

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

1. 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 <a href="#">Table 1: Absolute maximum ratings (AMR)</a> . 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 <a href="#">Features</a> (removed "macromodel"). Updated title of <a href="#">Figure 3</a> and <a href="#">Figure 6</a> (added conditions). Updated ECOPACK text in <a href="#">Section 4</a> . Updated temperature range to 125 °C in <a href="#">Table 2</a> and <a href="#">Table 6</a> . Updated MC33079YDT order code (status qualified), removed MC33079YD order code from <a href="#">Table 6</a> . Minor corrections throughout document.

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