



THE DATASHEET OF MC33079DT



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/ μs
- Low distortion: 0.002%
- Large output voltage swing: +14.3 V/-14.6 V
- Excellent frequency stability
- ESD protection 2 kV

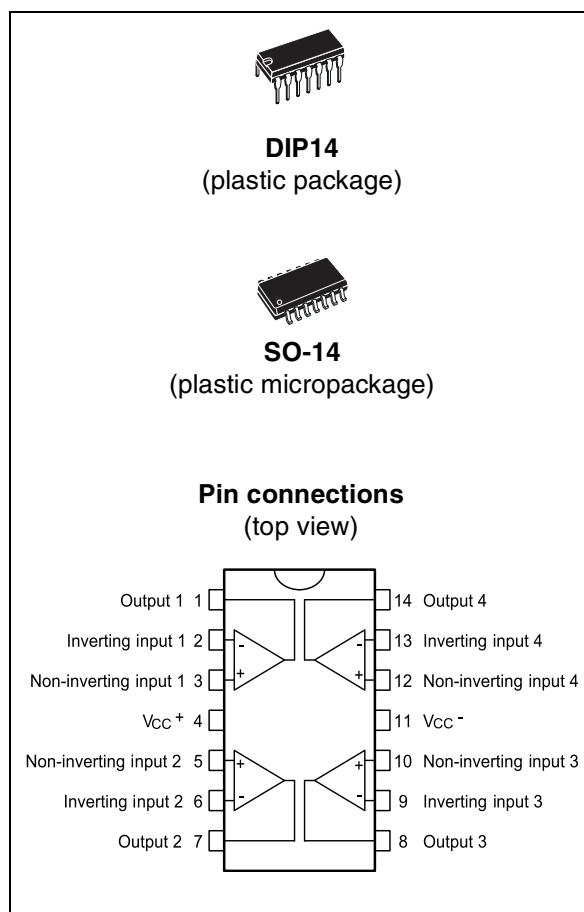
Description

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/ μs slew rate).

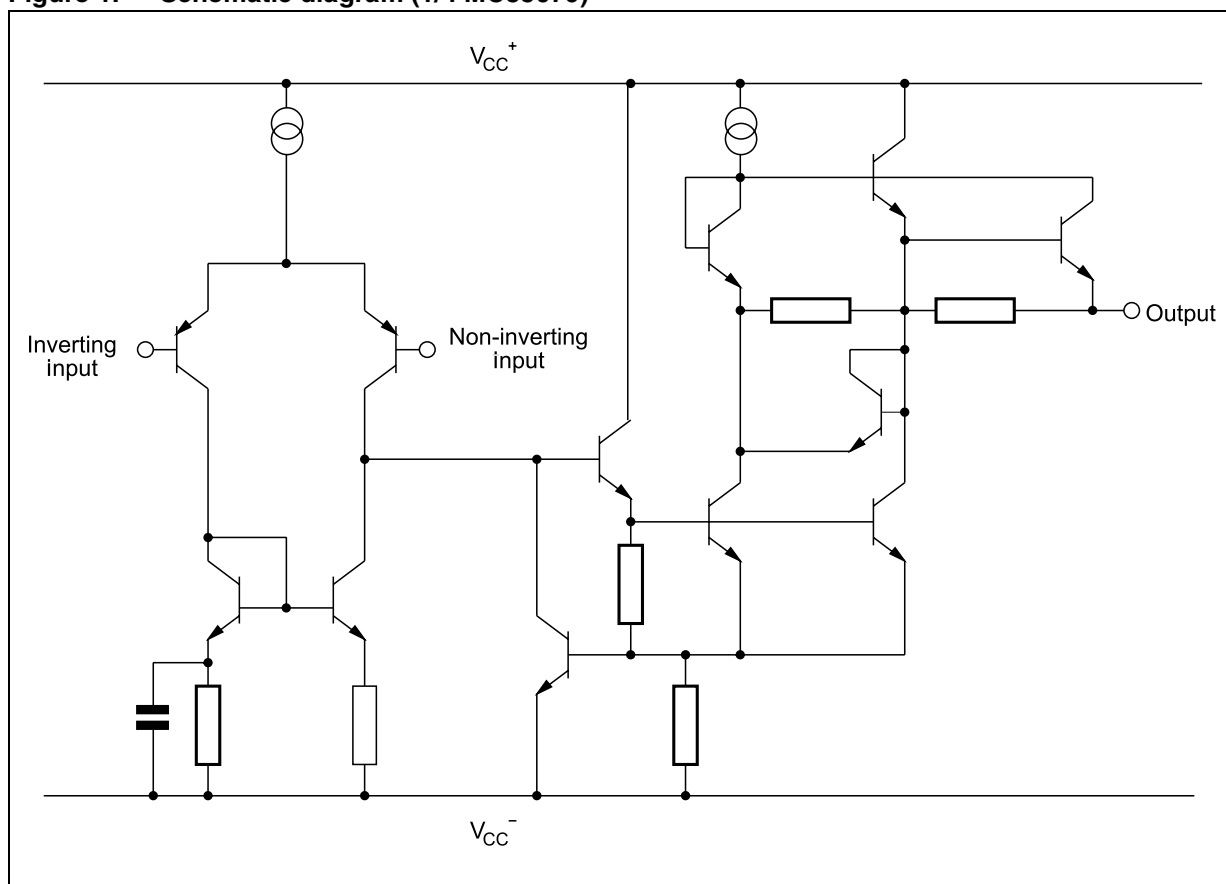
In addition the MC33079 device has a very low distortion (0.002%) and excellent phase/gain margins.

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 | ± 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 |
| T_j | Junction temperature | +150 | °C |
| T_{stg} | Storage temperature | -65 to +150 | °C |
| R_{thja} | Thermal resistance junction-to-ambient ^{(2), (3)} | | °C/W |
| | DIP14 SO-14 | 80 105 | |
| R_{thjc} | Thermal resistance junction-to-case ^{(2), (3)} | | °C/W |
| | DIP14 SO-14 | 33 31 | |
| ESD | HBM: human body model ⁽⁴⁾ | 2 | kV |
| | 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}^- .
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 Ω 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.
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 | ± 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 |

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 ($V_{id} = \pm 1\text{ V}$) $R_L = 600\text{ }\Omega$ $R_L = 600\text{ }\Omega$ $R_L = 2.0\text{ k}\Omega$ $R_L = 2.0\text{ k}\Omega$ $R_L = 10\text{ k}\Omega$ $R_L = 10\text{ k}\Omega$ | 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/ μs |
| 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 |
| ϕ_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 ($R_S = 100\text{ }\Omega$, $f = 1\text{ kHz}$) | | 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 | | Ω |
| R_i | Input resistance ($V_{ic} = 0\text{ V}$) | | 175 | | k Ω |
| C_i | Input capacitance ($V_{ic} = 0\text{ V}$) | | 12 | | pF |

Figure 2. Supply current vs. supply voltage

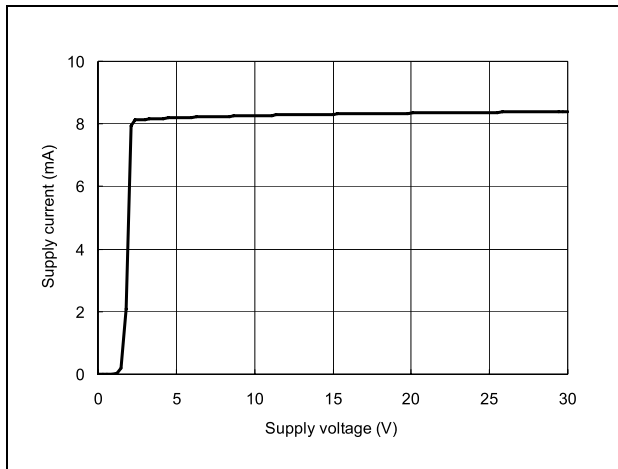


Figure 3. Output voltage vs. supply voltage ($V_{id} = \pm 1\text{ V}$, $R_L = 600\ \Omega$)

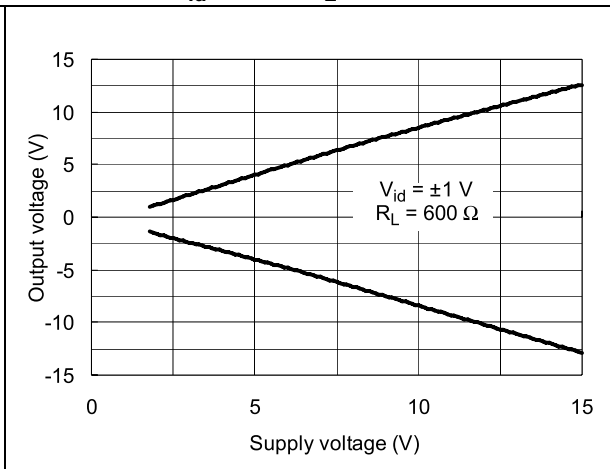


Figure 4. Equivalent input noise voltage vs. frequency

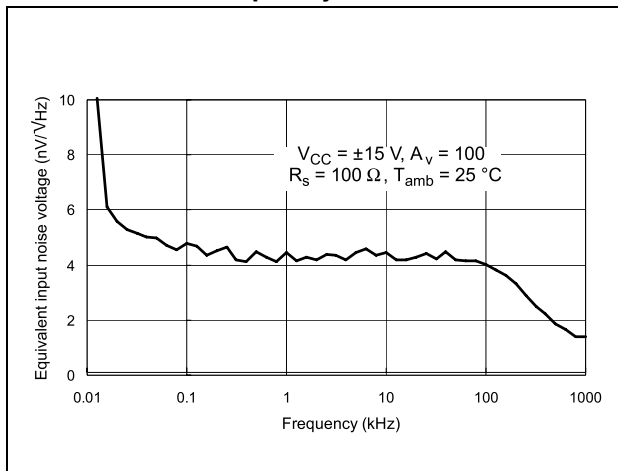


Figure 5. Output short-circuit current vs. output voltage

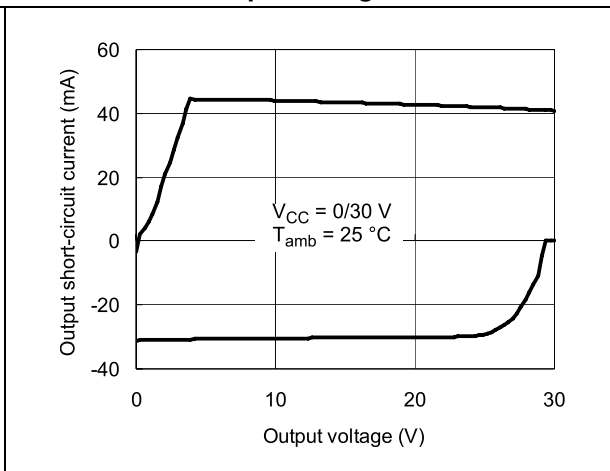


Figure 6. Output voltage vs. supply voltage ($V_{id} = \pm 1\text{ V}$, $R_L = 2\text{ k}\Omega$)

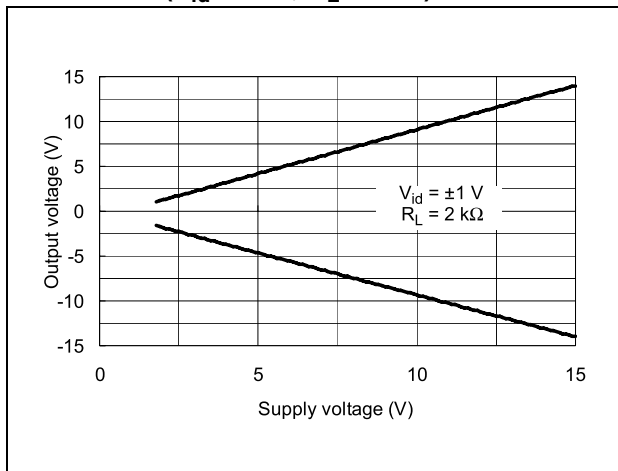


Figure 7. THD + noise vs. frequency

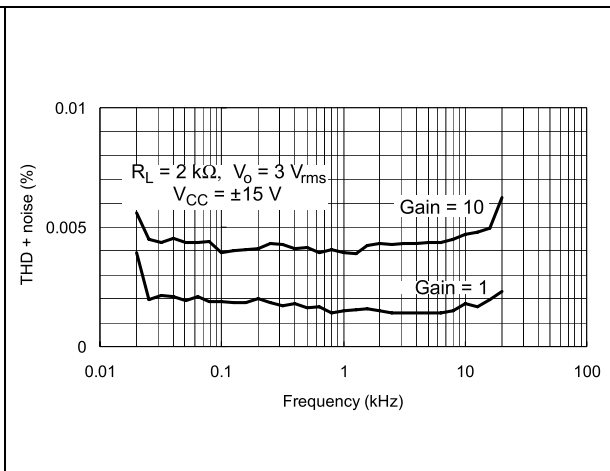


Figure 8. Voltage gain and phase vs. frequency

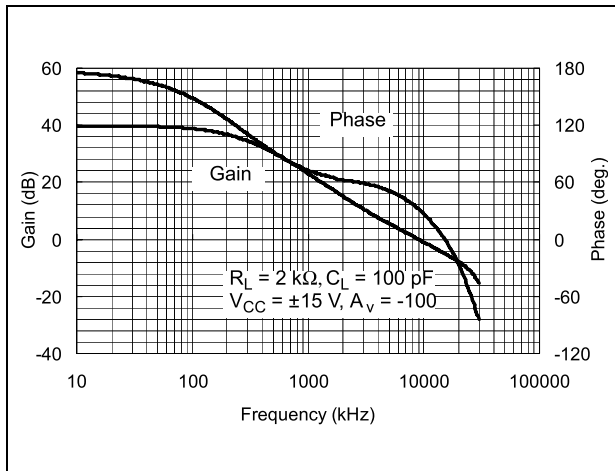
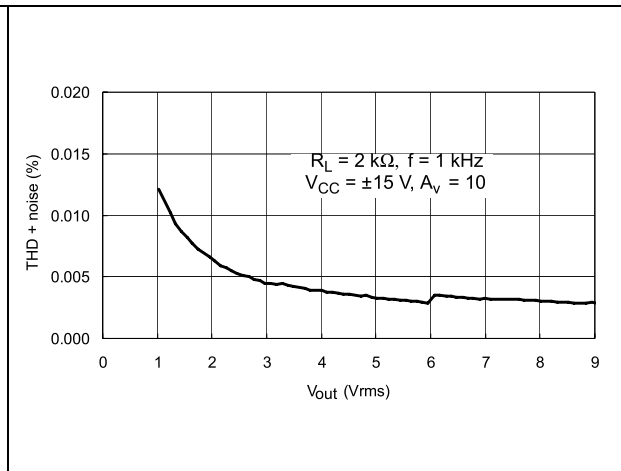


Figure 9. Total harmonic distortion vs. output voltage



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. ECOPACK is an ST trademark.

4.1 DIP14 package information

Figure 10. DIP14 package outline

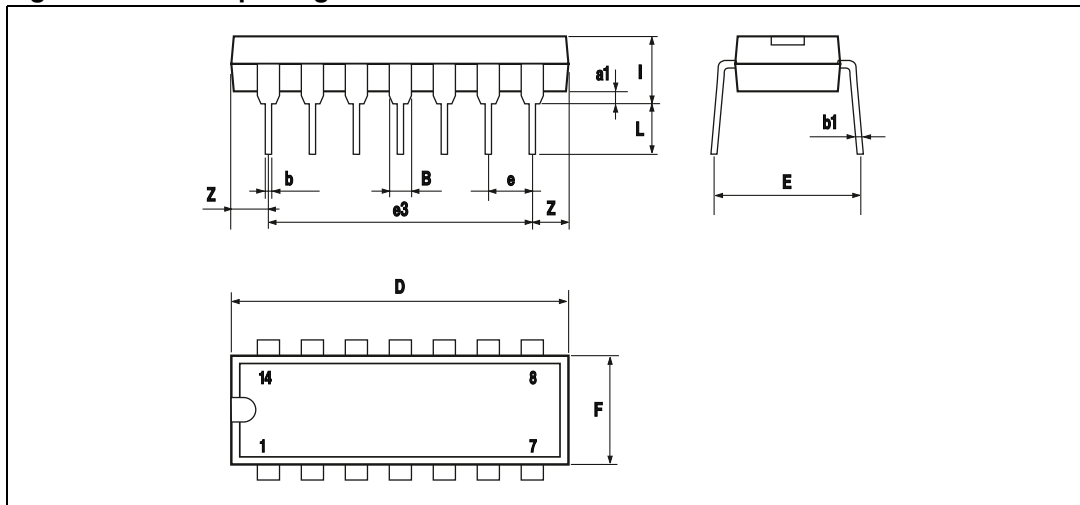


Table 4. DIP14 package mechanical data

| 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 |
| l | | | 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

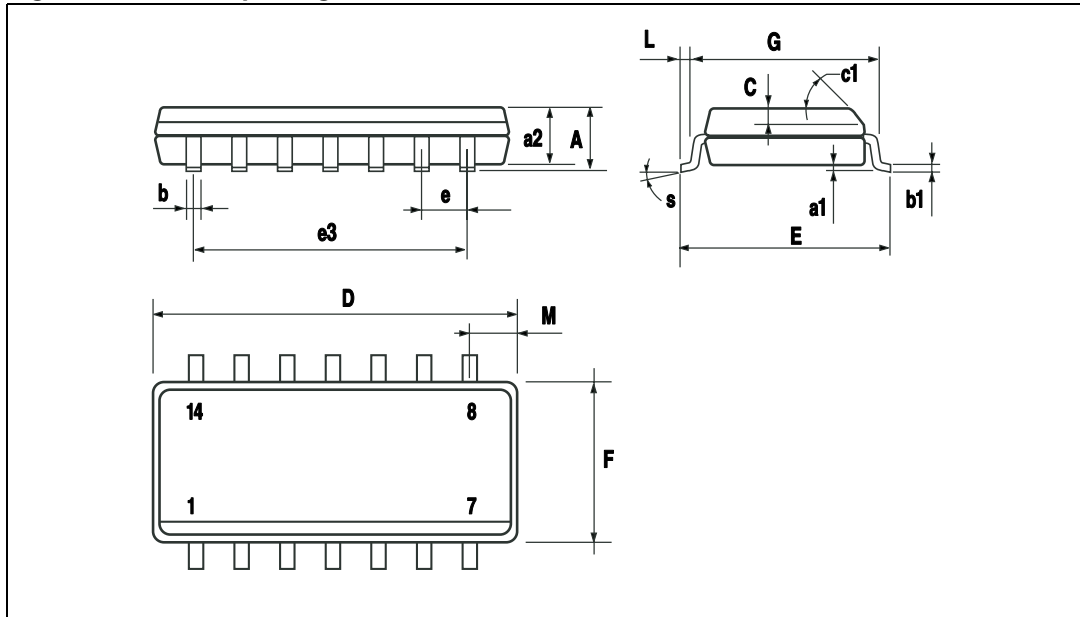


Table 5. SO-14 package mechanical data

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

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