

## Low Noise Quad Operational Amplifier

- Low voltage noise: **4.5nV/√Hz**
- High gain bandwidth product: **15MHz**
- High slew rate: **7V/μs**
- Low distortion: 0.002%
- Large output voltage swing: +14.3V/-14.6V
- Excellent frequency stability
- ESD protection 2kV
- Macromodel included in this specification

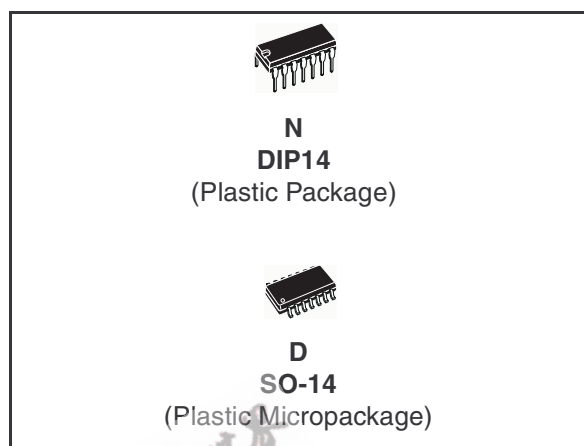
### Description

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

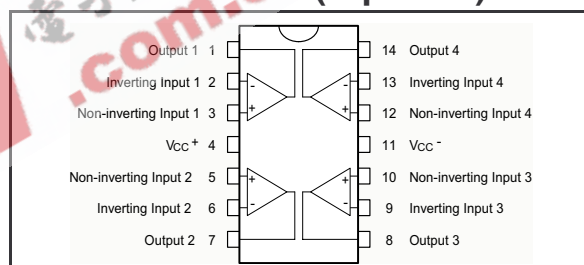
It offers low voltage noise (4.5nV/√Hz) and high frequency performances (15MHz Gain Bandwidth product, 7V/μs slew rate).

In addition the MC33079 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.



### Pin Connections (top view)



### Order Codes

| Part Number   | Temperature Range | Package                       | Packaging           | Marking |
|---------------|-------------------|-------------------------------|---------------------|---------|
| MC33079N      | -40, +105°C       | DIP14                         | Tube                |         |
| MC33079D/DT   |                   | SO-14                         | Tube or Tape & Reel |         |
| MC33079YD/YDT | -40, + 125°C      | SO14 (automotive grade level) | Tube or Tape & Reel | 33079Y  |

# 1 Absolute Maximum Ratings

**Table 1. Key parameters and their absolute maximum ratings**

| Symbol     | Parameter                             | Value             | Unit |
|------------|---------------------------------------|-------------------|------|
| $V_{CC}$   | Supply Voltage                        | $\pm 18$ or $+36$ | V    |
| $V_{id}$   | Differential Input Voltage - note (1) | $\pm 30$          | V    |
| $V_i$      | Input Voltage - see note 1            | $\pm 15$          | V    |
|            | Output Short Circuit Duration         | Infinite          | s    |
| $T_{oper}$ | Operating Free-Air Temperature Range  | -40 to 105        | °C   |
| $T_j$      | Junction Temperature                  | +150              | °C   |
| $T_{stg}$  | Storage Temperature                   | -65 to +150       | °C   |
| $P_{tot}$  | Maximum Power Dissipation - note (2)  | 500               | mW   |

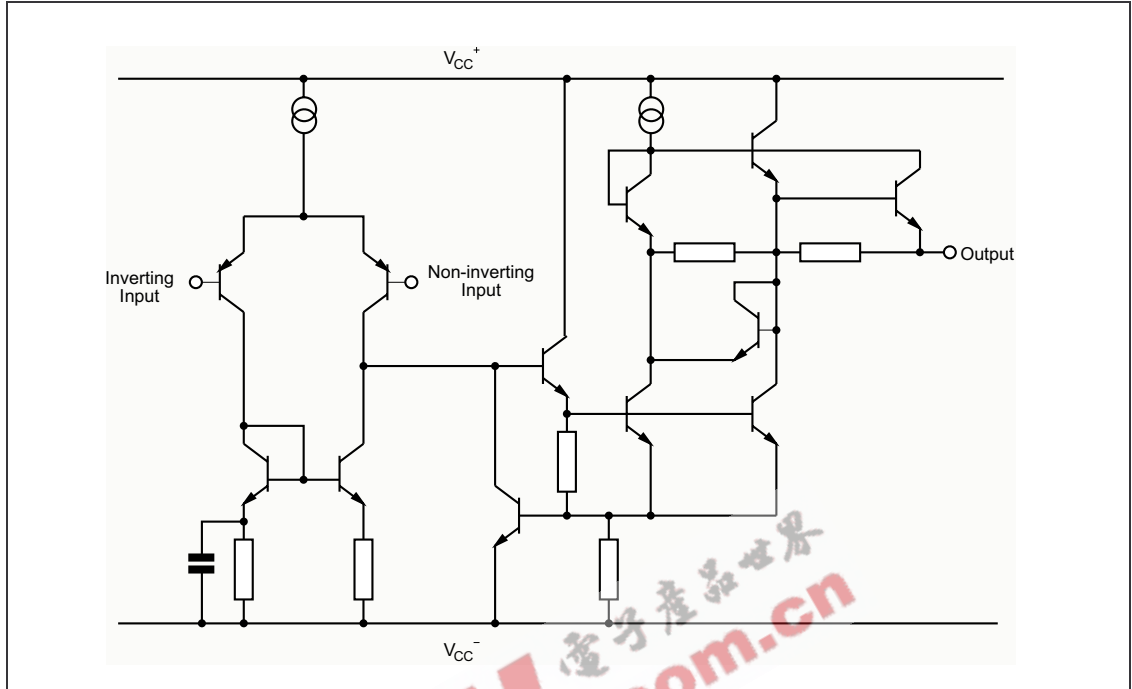
1. Either or both input voltages must not exceed the magnitude of  $V_{CC}^+$  or  $V_{CC}^-$ .
2. Power dissipation must be considered to ensure maximum junction temperature ( $T_j$ ) is not exceeded.

**Table 2. Operating conditions**

| Symbol   | Parameter      | Value                 | Unit |
|----------|----------------|-----------------------|------|
| $V_{CC}$ | Supply Voltage | $\pm 2.5$ to $\pm 15$ | V    |

## 2 Schematic Diagram (1/4 MC33079)

Figure 1. Typical application schematic



### 3 ELECTRICAL CHARACTERISTICS

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

| Symbol        | Parameter  | Min.         | Typ.  | Max.         | Unit             |
|---------------|--|--------------|---|--------------|------------------|
| $V_{io}$      | Input Offset Voltage ( $V_o = 0V$ , $V_{ic} = 0V$ )<br>$T_{min.} \leq T_{amb} \leq T_{max.}$   |              |   | 2.5<br>3.5   | mV               |
| $DV_{io}$     | Input Offset Voltage Drift<br>$V_o = 0V$ , $V_{ic} = 0V$ , $T_{min.} \leq T_{amb} \leq T_{max.}$   |              | 2   |              | $\mu V/^\circ C$ |
| $I_{io}$      | Input Offset Current ( $V_o = 0V$ , $V_{ic} = 0V$ )<br>$T_{amb} = +25^\circ C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$  |              | 10  | 150<br>175   | nA               |
| $I_{ib}$      | Input Bias Current ( $V_o = 0V$ , $V_{ic} = 0V$ )<br>$T_{amb} = +25^\circ C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$  |              | 250   | 750<br>800   | nA               |
| $V_{icm}$     | Input Common Mode Voltage Range ( $\Delta V_{io} = 5mV$ , $V_o = 0V$ )   | $\pm 13$     | $\pm 14$                                      |              | V                |
| $A_{vd}$      | Large Signal Voltage Gain ( $R_L = 2k\Omega$ , $V_o = \pm 10V$ )<br>$T_{amb} = +25^\circ C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                       | 90<br>85     | 100   |              | dB               |
| $\pm V_{opp}$ | Output Voltage Swing ( $V_{id} = \pm 1V$ )<br>$R_L = 600\Omega$<br>$R_L = 600\Omega$<br>$R_L = 2.0k\Omega$<br>$R_L = 2.0k\Omega$<br>$R_L = 10k\Omega$<br>$R_L = 10k\Omega$ | 13.2<br>13.5 | 12.2<br>-12.7<br>14<br>-14.2<br>14.3<br>-14.6 | -13.2<br>-14 | V                |
| CMR           | Common-mode Rejection Ratio ( $V_{ic} = \pm 13V$ )   | 80           | 100   |              | dB               |
| SVR           | Supply Voltage Rejection Ratio ( $V_{CC}^+ / V_{CC}^- = +15V / -15V$ to $+5V / -5V$ )  | 80           | 105   |              | dB               |
| $I_o$         | Output Short Circuit Current ( $V_{id} = \pm 1V$ , Output to Ground)<br>Source<br>Sink   | 15<br>20     | 29<br>27                                      |              | mA               |
| $I_{CC}$      | Supply Current ( $V_o = 0V$ , All amplifiers)<br>$T_{amb} = +25^\circ C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$  |              | 8   | 10<br>12     | mA               |
| SR            | Slew Rate ( $V_i = -10V$ to $+10V$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $A_V = +1$ )   | 5            | 7   |              | $V/\mu s$        |
| GBP           | Gain Bandwidth Product ( $R_L = 2k\Omega$ , $C_L = 100pF$ , $f = 100kHz$ )   | 10           | 15  |              | MHz              |
| B             | Unity Gain Bandwidth (Open loop)   |              | 9   |              | MHz              |
| $A_m$         | Gain Margin ( $R_L = 2k\Omega$ ) $C_L = 0pF$<br>$C_L = 100pF$  |              | -11<br>-6                                     |              | dB               |

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

| Symbol          | Parameter   | Min. | Typ.     | Max. | Unit                   |
|-----------------|---|------|----------|------|------------------------|
| $\phi_m$        | Phase Margin ( $R_L = 2k\Omega$ , $C_L = 0pF$<br>$C_L = 100pF$ )  |      | 55<br>30 |      | Degrees                |
| $e_n$           | Equivalent Input Noise Voltage ( $R_S = 100\Omega$ , $f = 1kHz$ )   |      | 4.5      |      | $\frac{nV}{\sqrt{Hz}}$ |
| $i_n$           | Equivalent Input Noise Current ( $f = 1kHz$ )   |      | 0.5      |      | $\frac{pA}{\sqrt{Hz}}$ |
| THD             | Total Harmonic Distortion ( $R_L = 2k\Omega$ , $f = 20Hz$ to $20kHz$ ,<br>$V_o = 3V_{rms}$ , $A_V = +1$ ) |      | 0.002    |      | %                      |
| $V_{O1}/V_{O2}$ | Channel Separation ( $f = 20Hz$ to $20kHz$ )  |      | 120      |      | dB                     |
| FPB             | Full Power Bandwidth ( $V_o = 27V_{pp}$ , $R_L = 2k\Omega$ , THD $\leq 1\%$ )                             |      | 120      |      | kHz                    |
| $Z_o$           | Output Impedance ( $V_o = 0V$ , $f = 9MHz$ )  |      | 37       |      | $\Omega$               |
| $R_i$           | Input Resistance ( $V_{ic} = 0V$ )  |      | 175      |      | $k\Omega$              |
| $C_i$           | Input Capacitance ( $V_{ic} = 0V$ )   |      | 12       |      | pF                     |

**Table 4.**  $V_{CC}^+ = +15V$ ,  $V_{CC}^- = -15V$ ,  $T_{amb} = 25^\circ C$  (unless otherwise specified)

| Symbol       | Conditions                                     | Value | Unit      |
|--------------|--|-------|-----------|
| $V_{io}$     |  | 0     | mV        |
| $A_{vd}$     | $R_L = 2k\Omega$ , $V_o = \pm 10V$             | 100   | dB        |
| $I_{CC}$     | No load, per operator                          | 2     | mA        |
| $V_{icm}$    | $\Delta V_{io} = 5mV$ , $V_O = 0V$             | 28    | V         |
| $V_{opp}$    | $R_L = 2k\Omega$                               | 28.2  | V         |
| $I_{sink}$   | $V_O = 0V$                                     | 37    | mA        |
| $I_{source}$ | $V_O = 0V$                                     | 29    | mA        |
| GBP          | $R_L = 2k\Omega$ , $C_L = 100pF$               | 15    | MHz       |
| SR           | $R_L = 10k\Omega$ , $C_L = 100pF$ , $A_V = +1$ | 7     | $V/\mu s$ |
| $\phi_m$     | $R_L = 2k\Omega$ , $C_L = 0pF$                 | 55    | Degrees   |

Figure 2. Supply current vs. supply voltage

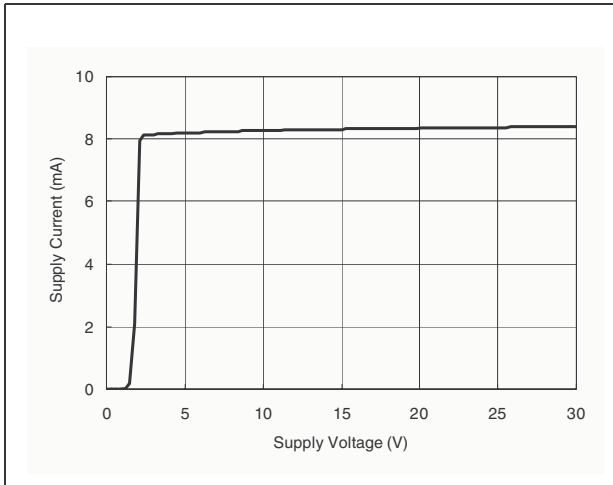


Figure 3. Output voltage vs. supply voltage

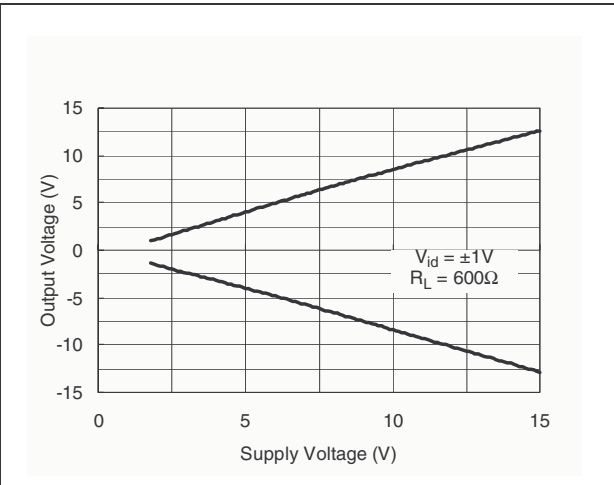


Figure 4. Equivalent input noise voltage vs. frequency

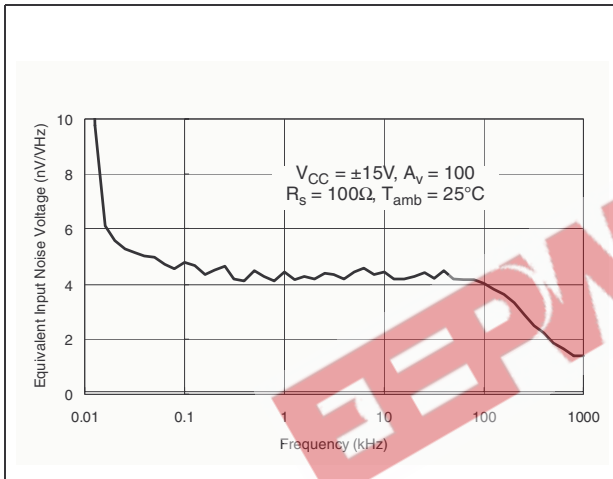


Figure 5. Output short circuit current vs. output voltage

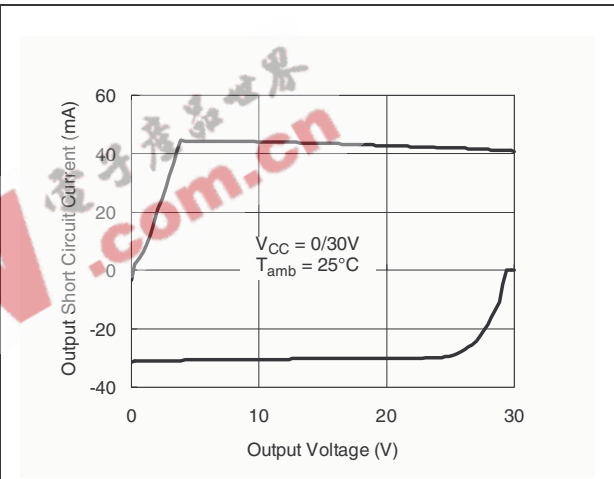


Figure 6. Output voltage vs. supply voltage

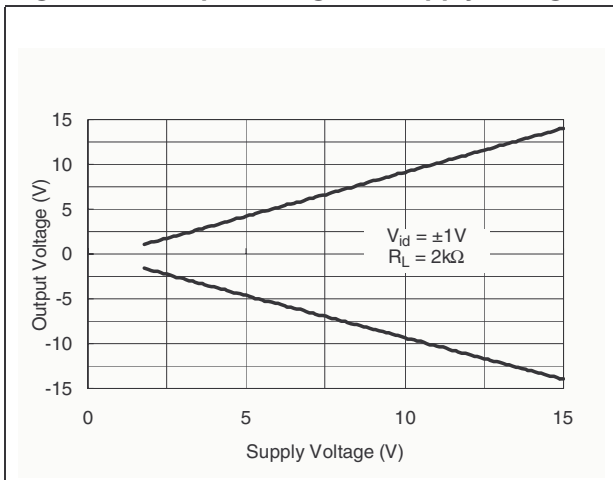


Figure 7. THD + Noise vs. frequency

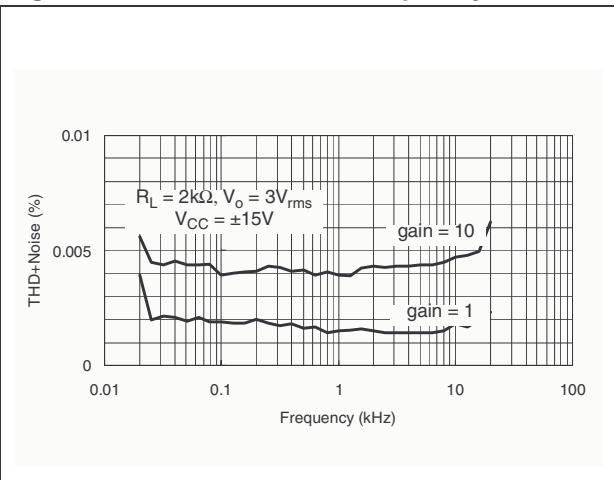
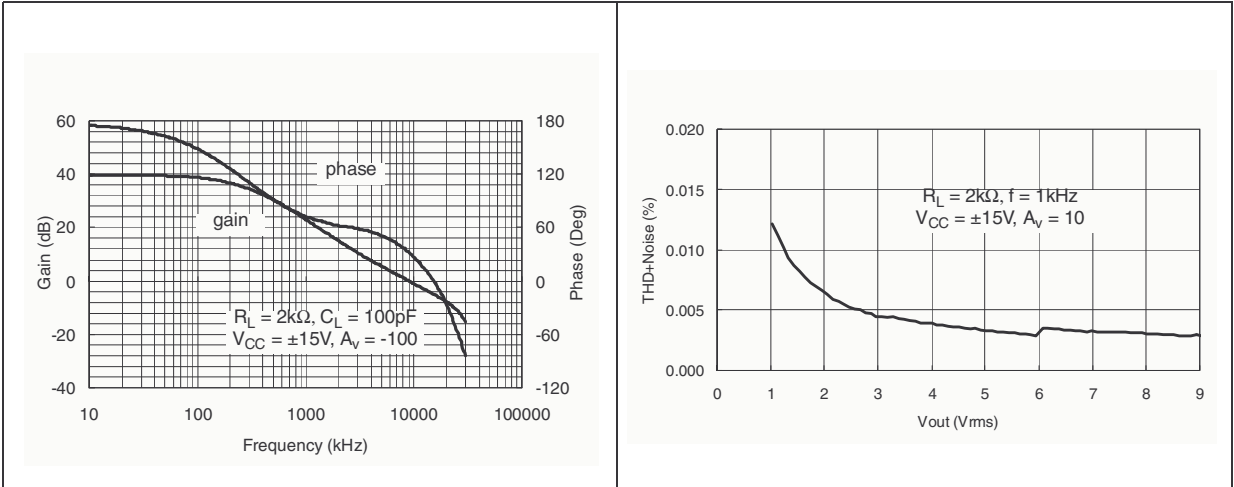


Figure 8. Voltage gain and phase vs. frequency Figure 9. Total harmonic distortion vs. output voltage



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## 4 Macromodels

*Note: Note: Please consider following remarks before using this macromodel:*

*All models are a trade-off between accuracy and complexity (i.e. simulation time).*

*Macromodels are not a substitute to breadboarding; rather, they confirm the validity of a design approach and help to select surrounding component values.*

*A macromodel emulates the NOMINAL performance of a TYPICAL device within SPECIFIED OPERATING CONDITIONS (i.e. temperature, supply voltage, etc.). Thus the macromodel is often not as exhaustive as the datasheet, its goal is to illustrate the main parameters of the product.*

*Data issued from macromodels used outside of its specified conditions (Vcc, Temperature, etc) or even worse: outside of the device operating conditions (Vcc, Vicm, etc) are not reliable in any way.*

```

** Standard Linear Ics Macromodels, 1993.
** CONNECTIONS :
* 1 INVERTING INPUT
* 2 NON-INVERTING INPUT
* 3 OUTPUT
* 4 POSITIVE POWER SUPPLY
* 5 NEGATIVE POWER SUPPLY
.SUBCKT MC33079 1 3 2 4 5 (analog)
*****
.MODEL MDTH D IS=1E-8 KF=2.286238E-16 CJO=10F
* INPUT STAGE
CIP 2 5 1.200000E-11
CIN 1 5 1.200000E-11
EIP 10 5 2 5 1
EIN 16 5 1 5 1
RIP 10 11 2.363636E+00
RIN 15 16 2.363636E+00
RIS 11 15 1.224040E+01
DIP 11 12 MDTH 400E-12
DIN 15 14 MDTH 400E-12
VOFP 12 13 DC 0
VOFN 13 14 DC 0
IPOL 13 5 1.100000E-04
CPS 11 15 2.35E-09
DINN 17 13 MDTH 400E-12
VIN 17 5 1.000000E+00
DINR 15 18 MDTH 400E-12
VIP 4 18 1.000000E+00
FCP 4 5 VAFP 1.718182E+01
FCN 5 4 VAFN 1.718182E+01
FIBP 2 5 VAFN 4.545455E-03
FIBN 5 1 VAFP 4.545455E-03
* AMPLIFYING STAGE
FIP 5 19 VAFP 9.545455E+02
FIN 5 19 VAFN 9.545455E+02

```

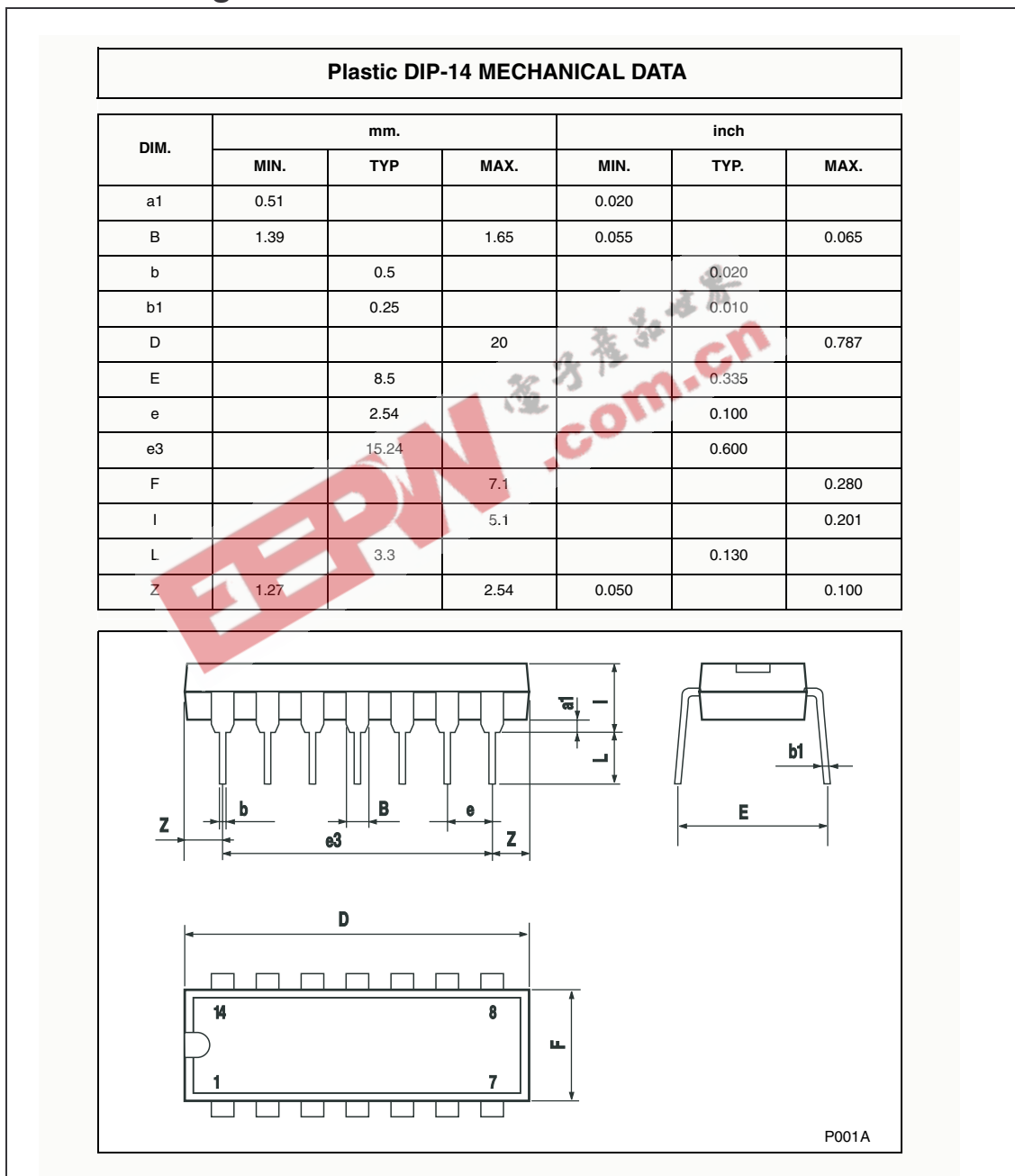


```
CC 19 29 1.500000E-08
HZTP 30 29 VOFF 1.523529E+02
HZTN 5 30 VOFN 1.523529E+02
DOPM 51 22 MDTH 400E-12
DONM 21 52 MDTH 400E-12
HOPM 22 28 VOUT 5.172414E+03
VIPM 28 4 1.500000E+02
HONM 21 27 VOUT 4.054054E+03
VINM 5 27 1.500000E+02
DBIDON1 19 53 MDTH 400E-12
V1 51 53 0.68
DBIDON2 54 19 MDTH 400E-12
V2 54 52 0.68
RG11 51 5 3.04E+05
RG12 51 4 3.04E+05
RG21 52 5 0.6072E+05
RG22 52 4 0.6072E+05
E1 50 40 51 0 1 E2 40 39 52 0 1
EDEC1 38 39 4 0 0.5
EDEC2 0 38 5 0 0.5
DOP 51 25 MDTH 400E-12
VOP 4 25 1.474575E+00
DON 24 52 MDTH 400E-12
VON 24 5 1.474575E+00
RAJUS 50 5 1E12
GCOMP 5 4 4 5 8.1566068E-04
RPM1 5 80 1E+06
RPM2 4 80 1E+06
GAVPH 5 82 50 80 3.26E-03
RAVPHGH 82 4 613
RAVPHGB 82 5 613
RAVPHDH 82 83 1000
RAVPHDB 82 84 1000
CAVPHH 4 83 0.159E-09
CAVPHB 5 84 0.159E-09
EOUT 26 23 82 5 1
VOUT 23 5 0
ROUT 26 3 4.780354E+01
COUT 3 5 1.000000E-12
.ENDS
```

## 5 Package Mechanical Data

In order to meet environmental requirements, ST offers these devices in ECOPACK<sup>®</sup> packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).

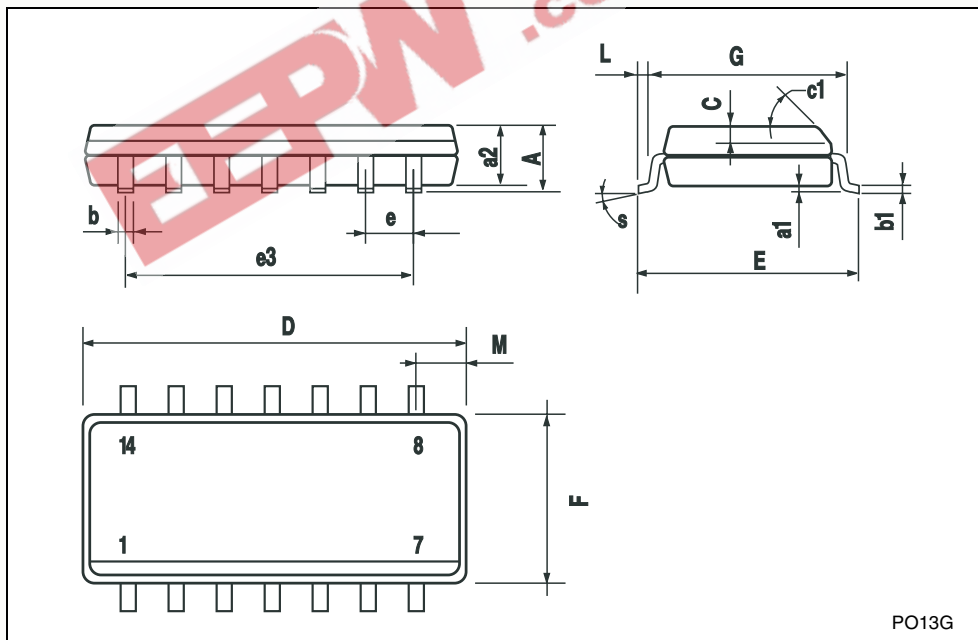
### 5.1 DIP14 Package



5.2 SO-14 Package

SO-14 MECHANICAL DATA

| DIM. | mm.        |      |      | inch  |       |       |
|------|------------|------|------|-------|-------|-------|
|      | 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    | B° (max.)  |      |      |       |       |       |



PO13G

## 6 Revision History

| Date         | Revision | Changes   |
|--------------|----------|---|
| October 2001 | 1        | Initial release.  |
| June 2005    | 2        | PPAP references inserted in the datasheet see table order code p1 |

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