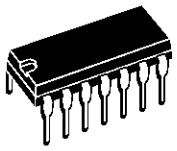
SGS-THOMSON MICROELECTRONICS

# MC33079

## LOW NOISE QUAD OPERATIONAL AMPLIFIERS

- 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 INTERNAL PROTECTION

- MACROMODEL INCLUDED IN THIS SPECIFICATION



**N**
**DIP14**
(Plastic Package)

**D**
**SO14**
(Plastic Micropackage)

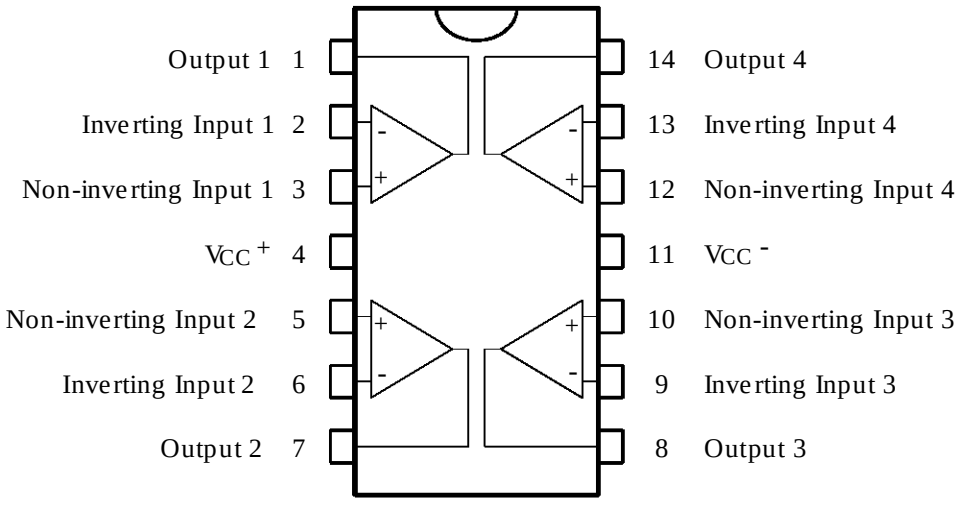
### DESCRIPTION

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.

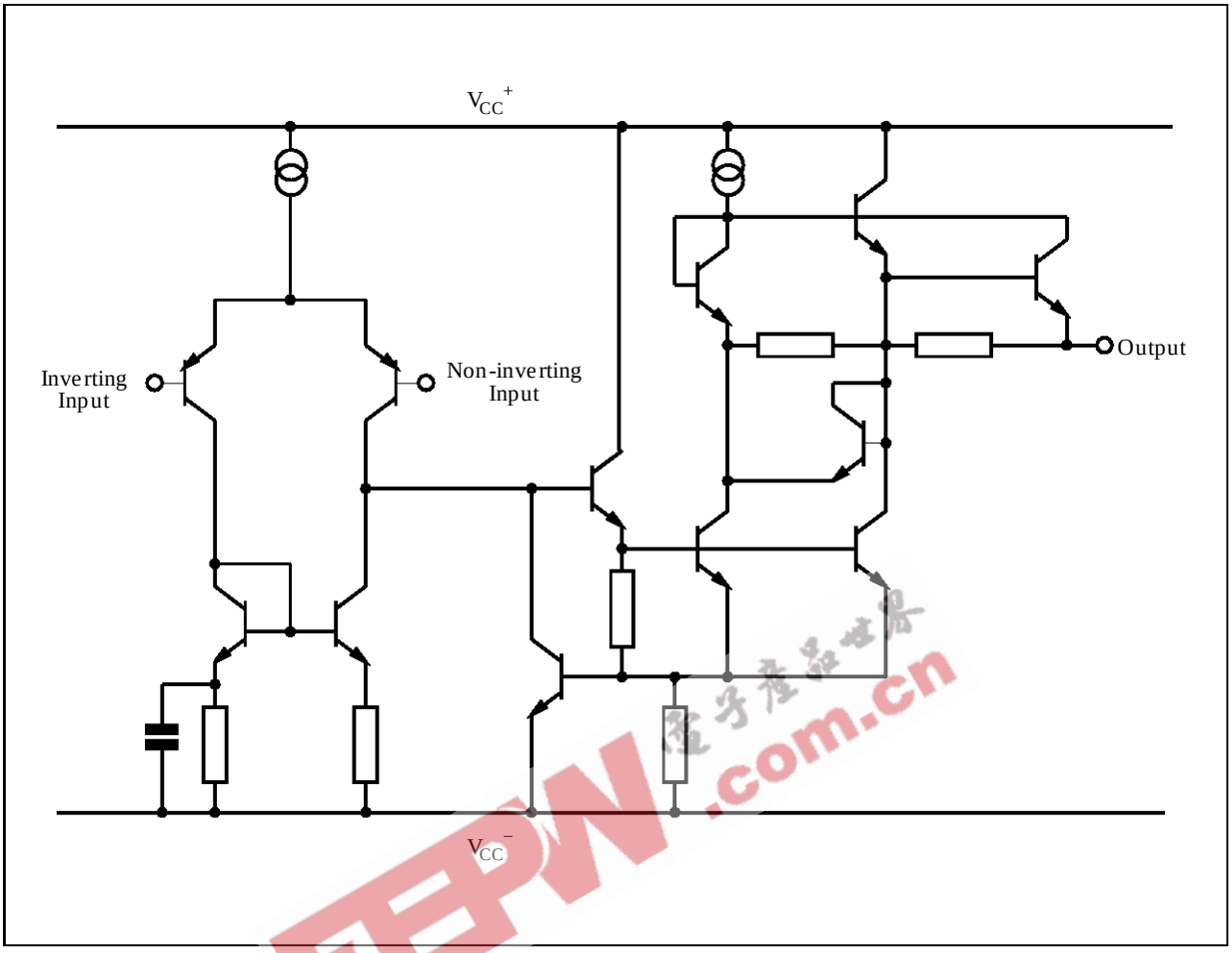
### ORDER CODES

| Part Number | Temperature Range | Package | |
|---|---|---|---|
| | | N | D |
| MC33079 | -40, +105°C | • | • |

### PIN CONNECTIONS (top view)



## SCHEMATIC DIAGRAM (1/4 MC33079)




## ABSOLUTE MAXIMUM RATINGS

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

**Notes :** 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

## OPERATING CONDITIONS

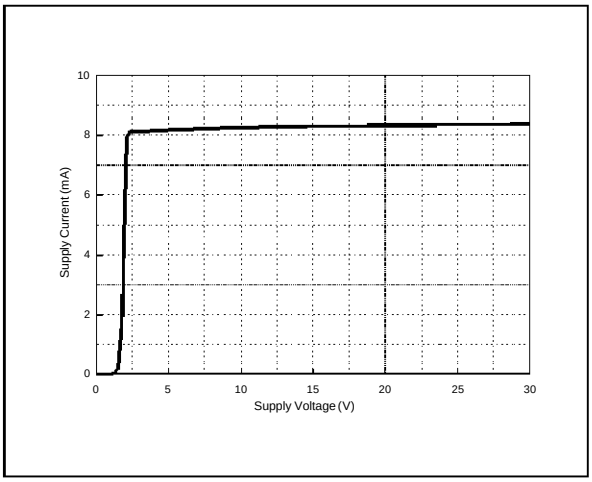
| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CC}$ | Supply Voltage | ±2.5 to ±15 | V |

## ELECTRICAL CHARACTERISTICS

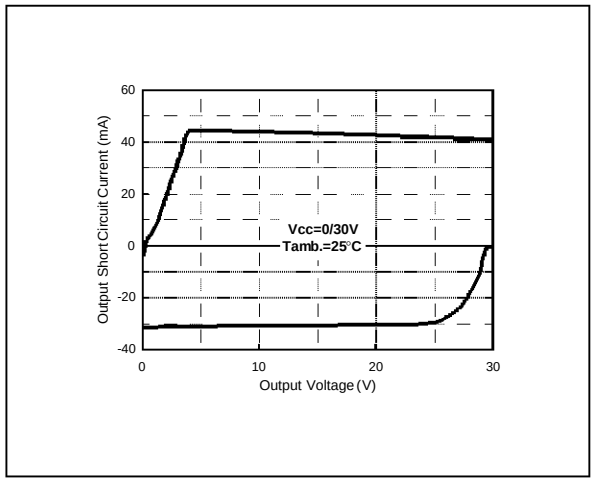
$V_{CC}^+$ = +15V, $V_{CC}^-$ = -15V, $T_{amb}$ = 25°C (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{io}$ | Input Offset Voltage ($V_o$ = 0V, $V_{ic}$ = 0V)<br>$T_{min.} \le T_{amb} \le T_{max.}$ | | | 2.5<br>3.5 | mV |
| $DV_{io}$ | Input Offset Voltage Drift<br>$V_{ic}$ = 0V, $V_o$ = 0V, $T_{min.} \le T_{amb} \le T_{max.}$ | | 2 | | µV/°C |
| $I_{io}$ | Input Offset Current ($V_{ic}$ = 0V, $V_O$ = 0V)<br>$T_{amb}$ = +25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | | 10 | 150<br>175 | nA |
| $I_{ib}$ | Input Bias Current ($V_{ic}$ = 0V, $V_O$ = 0V)<br>$T_{amb}$ = +25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | | 250 | 750<br>800 | nA |
| $V_{icm}$ | Common Mode Input Voltage Range ($\Delta V_{IO}$ = 5mV, $V_O$ = 0V) | ±13 | ±14 | | V |
| $A_{vd}$ | Large Signal Voltage Gain ($R_L$ = 2kΩ, $V_O$ = ±10V)<br>$T_{amb}$ = +25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | 90<br>85 | 100 | | dB |
| $\pm V_{opp}$ | Output Voltage Swing ($V_{id}$ = ±1V)<br>$R_L$ = 600Ω<br>$R_L$ = 600Ω<br>$R_L$ = 2.0kΩ<br>$R_L$ = 2.0kΩ<br>$R_L$ = 10kΩ<br>$R_L$ = 10kΩ | <br><br><br>13.2<br><br>13.5 | <br>12.2<br>-12.7<br><br>14<br>-14.2<br><br>14.3<br>-14.6 | <br><br><br><br>-13.2<br><br>-14 | V |
| CMR | Common Mode Rejection Ratio ($V_{ic}$ = ±13V) | 80 | 100 | | dB |
| SVR | Supply Voltage Rejection Ratio<br>$V_{CC}^+ / V_{CC}^-$ = +15V / -15V to +5V / -5V | 80 | 105 | | dB |
| $I_o$ | Output Short Circuit Current ($V_{id}$ = ±1V, Output to Ground)<br>Source<br>Sink | <br>15<br>20 | <br>29<br>37 | | mA |
| $I_{CC}$ | Supply current ($V_O$ = 0V, All Amplifiers)<br>$T_{amb}$ = +25°C<br>$T_{min.} \le T_{amb} \le T_{max.}$ | | 8 | 10<br>12 | mA |
| SR | Slew Rate<br>$V_i$ = -10V to +10V, $R_L$ = 2kΩ, $C_L$ = 100pF, $A_V$ = +1 | 5 | 7 | | V/µs |
| GBP | Gain Bandwidth Product (f = 100kHz, $R_L$ = 2kΩ, $C_L$ = 100pF) | 10 | 15 | | MHz |
| B | Unity Gain Bandwidth (Open loop) | | 9 | | MHz |
| $A_m$ | Gain Margin ($R_L$ = 2kΩ) $C_L$ = 0pF<br>$C_L$ = 100pF | | -11<br>-6 | | dB |
| ∅m | Phase Margin ($R_L$ = 2kΩ) $C_L$ = 0pF<br>$C_L$ = 100pF | | 55<br>30 | | Degrees |
| $e_n$ | Equivalent Input Noise Voltage ($R_S$ = 100Ω, 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<br>$R_L$ = 2kΩ, f = 20Hz to 20kHz, $V_O$ = $3V_{rms}$, $A_V$ = +1 | | 0.002 | | % |
| $V_{O1}/V_{O2}$ | Channel Separation (f = 20Hz to 20kHz) | | 120 | | dB |
| FPB | Full Power Bandwidth ($V_O$ = $27V_{pp}$, $R_L$ = 2kΩ, THD ≤ 1%) | | 120 | | kHz |
| $Z_o$ | Output Impedance ($V_O$ = 0V, f = 9MHz) | | 37 | | Ω |
| $R_i$ | Input Resistance ($V_{ic}$ = 0V) | | 175 | | kΩ |
| $C_i$ | Input Capacitance ($V_{ic}$ = 0V) | | 12 | | pF |

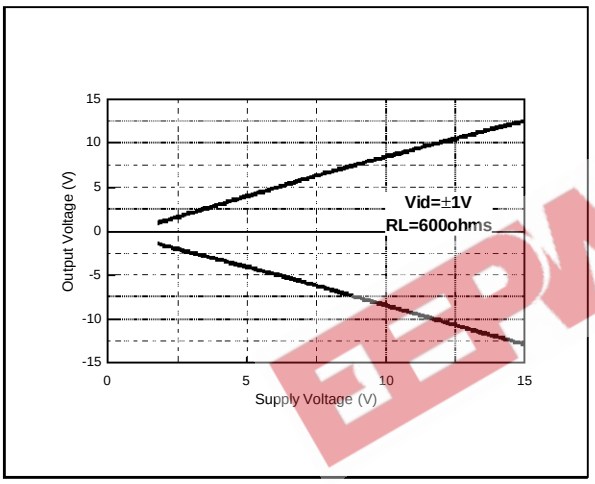
## SUPPLY CURRENT vs SUPPLY VOLTAGE



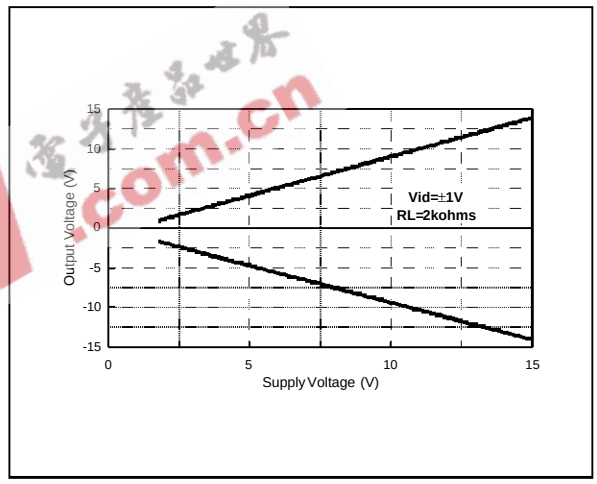

## OUTPUT SHORT CIRCUIT CURRENT vs OUTPUT VOLTAGE



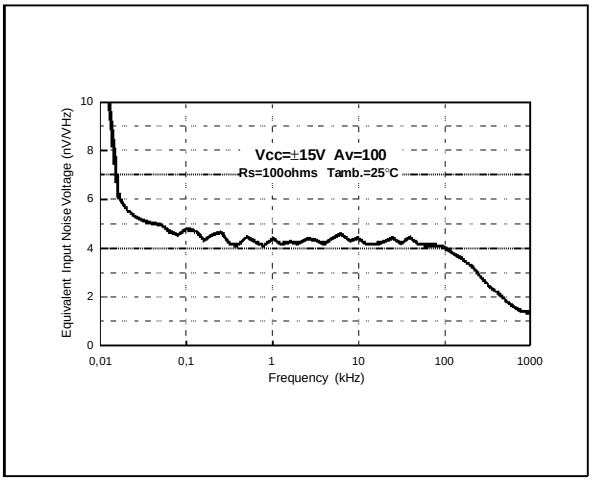

## OUTPUT VOLTAGE vs SUPPLY VOLTAGE



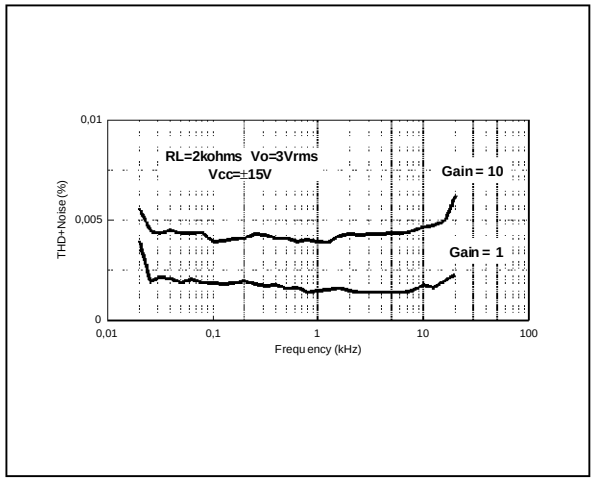

## OUTPUT VOLTAGE vs SUPPLY VOLTAGE



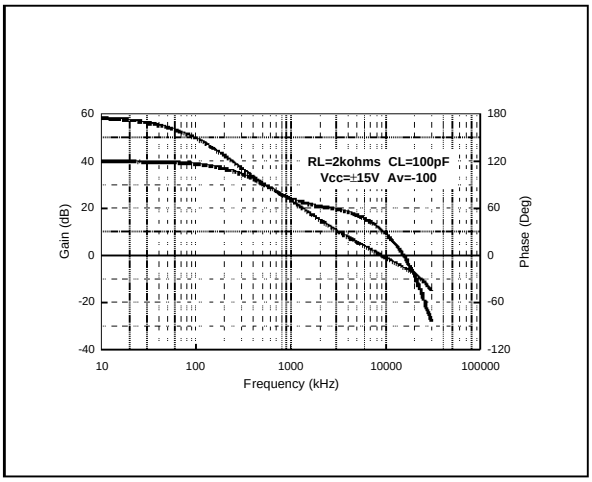

## EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY



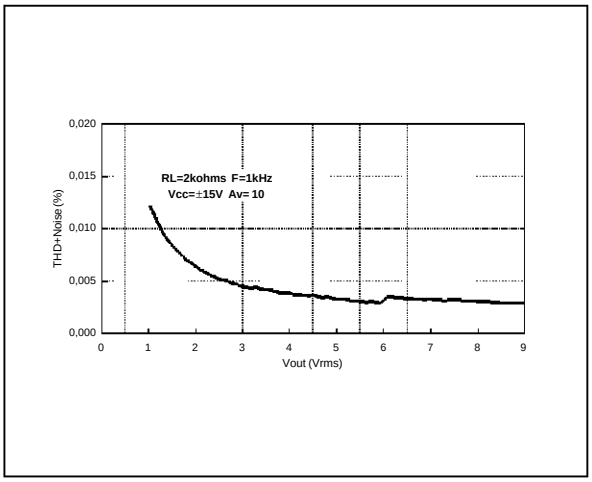

## THD + NOISE vs FREQUENCY



## VOLTAGE GAIN AND PHASE vs FREQUENCY




## TOTAL HARMONIC DISTORTION vs OUTPUT VOLTAGE



## MACROMODEL

- LOW VOLTAGE NOISE : **4.5nV/$\sqrt{Hz}$**
- 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 INTERNAL PROTECTION

```
** 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 VOFP 1.718182E+01
FCN 5 4 VOFN 1.718182E+01
FIBP 2 5 VOFN 4.545455E-03
FIBN 5 1 VOFP 4.545455E-03
* AMPLIFYING STAGE
FIP 5 19 VOFP 9.545455E+02
FIN 5 19 VOFN 9.545455E+02
CC 19 29 1.500000E-08
HZTP 30 29 VOFP 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 8.156606 8E-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
```

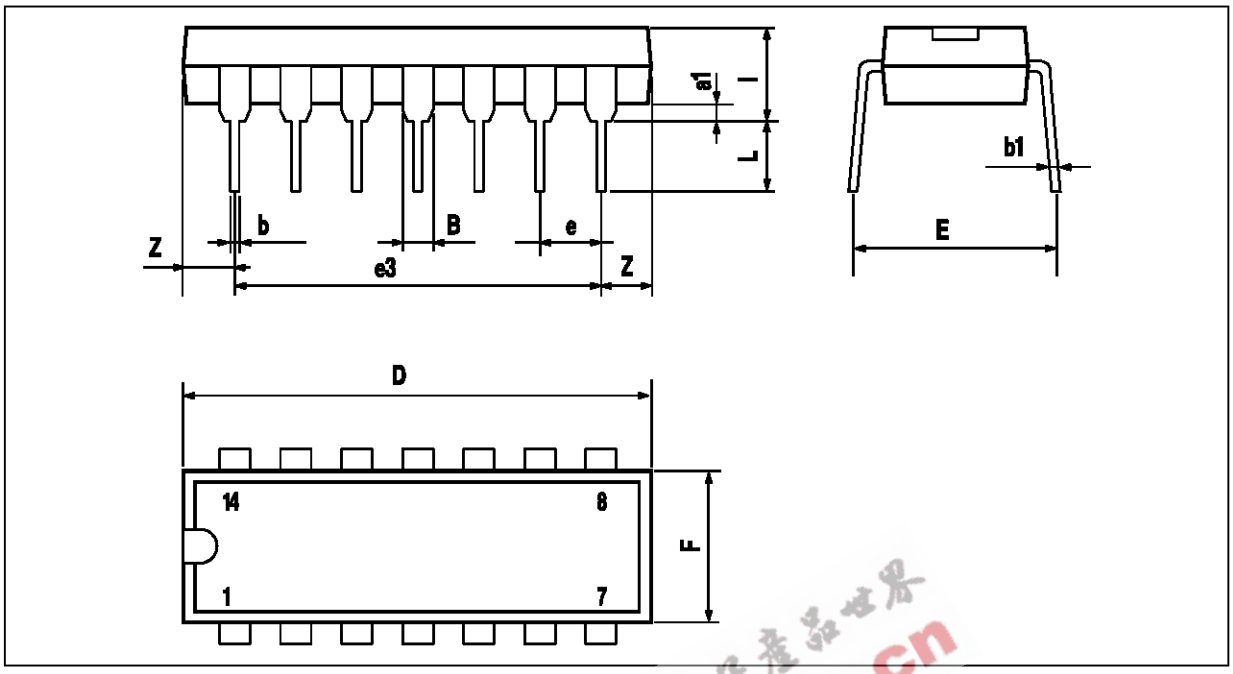
## ELECTRICAL CHARACTERISTICS

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

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

## PACKAGE MECHANICAL DATA

14 PINS - PLASTIC DIP



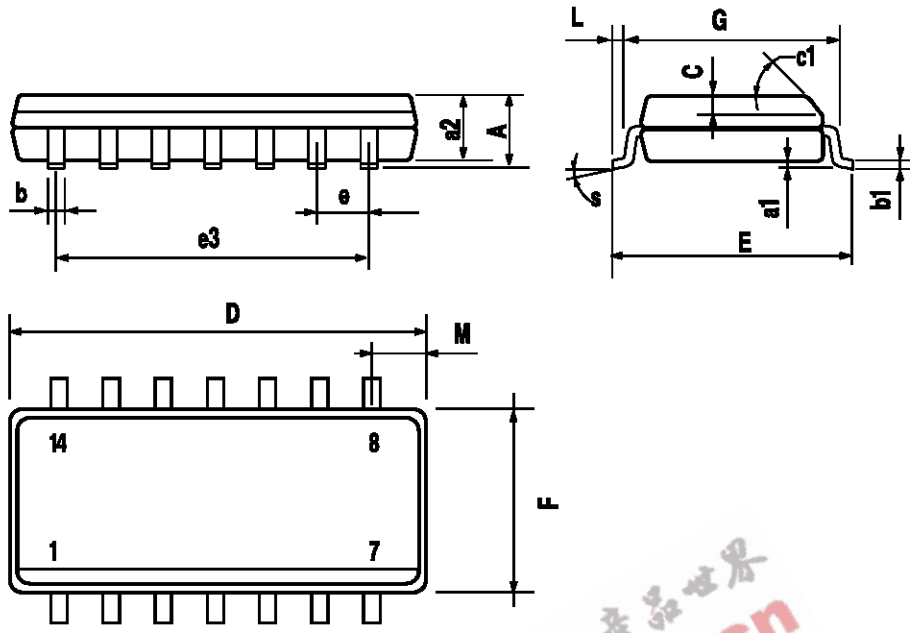

PM-DIP14.EPS

| 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 |

DIP14.TBL

## PACKAGE MECHANICAL DATA

14 PINS - PLASTIC MICROPACKAGE (SO)




PM-SO14.EPS

| Dimensions | Millimeters | | | Inches | | |
|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.008 |
| a2 | | | 1.6 | | | 0.063 |
| b | 0.35 | | 0.46 | 0.014 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.020 | |
| c1 | 45° (typ.) | | | | | |
| D | 8.55 | | 8.75 | 0.336 | | 0.334 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 7.62 | | | 0.300 | |
| F | 3.8 | | 4.0 | 0.150 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.020 | | 0.050 |
| M | | | 0.68 | | | 0.027 |
| S | 8° (max.) | | | | | |

SO14.TBL



ORDER CODE :