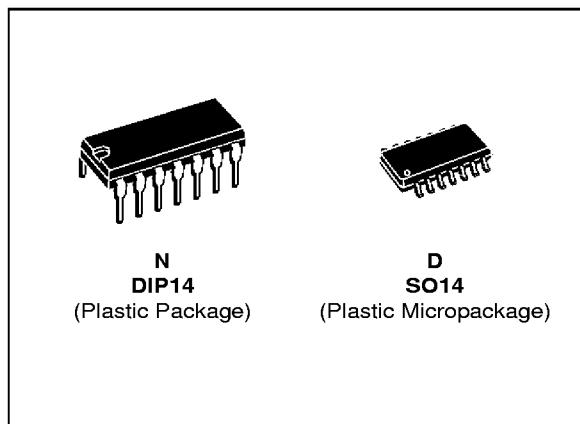


## VERY LOW POWER CMOS QUAD OPERATIONAL AMPLIFIERS

- ULTRA LOW CONSUMPTION :  $10\mu\text{A/op}$
- OUTPUT VOLTAGE CAN SWING TO GROUND
- EXCELLENT PHASE MARGIN ON CAPACITIVE LOADS
- STABLE AND LOW OFFSET VOLTAGE
- THREE INPUT OFFSET VOLTAGE SELECTIONS



### ORDER CODES

| Part Number   | Temperature Range | Package |   |
|---------------|-------------------|---------|---|
|               |                   | N       | D |
| TS27L4C/AC/BC | 0°C, +70°C        | ●       | ● |
| TS27L4I/AI/BI | -40°C, +125°C     | ●       | ● |
| TS27L4M/AM/BM | -55°C, +125°C     | ●       | ● |

**Example :** TS27M4ACN

### DESCRIPTION

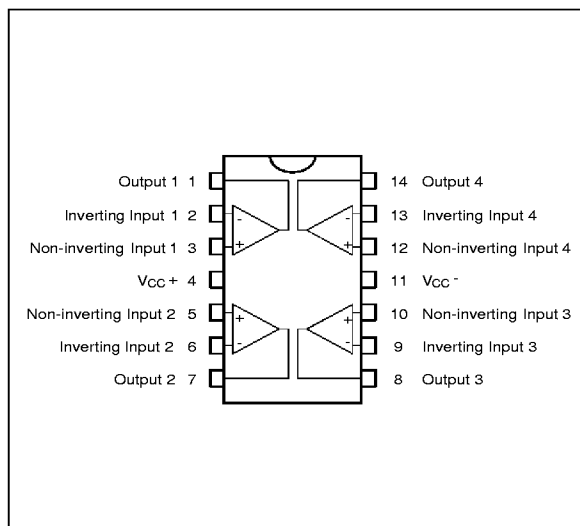
The TS274 series are low cost, low power quad operational amplifiers designed to operate with single or dual supplies. These operational amplifiers use the SGS-THOMSON silicon gate CMOS process allowing an excellent consumption-speed ratio. These series are ideally suited for low consumption applications.

Three power consumptions are available allowing to have always the best consumption-speed ratio :

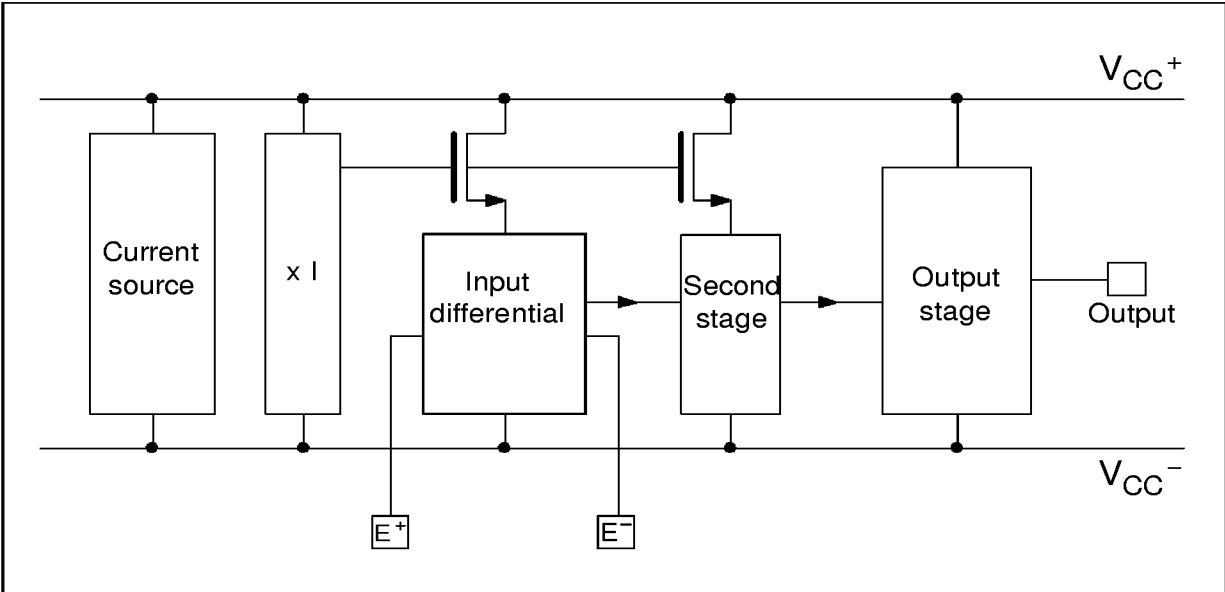
- $I_{CC} = 10\mu\text{A/amp.}$  : TS27L4 (very low power)
- $I_{CC} = 150\mu\text{A/amp.}$  : TS27M4 (low power)
- $I_{CC} = 1\text{mA/amp.}$  : TS274 (high speed)

These CMOS amplifiers offer very high input impedance and extremely low input currents. The major advantage versus JFET devices is the very low input currents drift with temperature (see figure 2).

### PIN CONNECTIONS (top view)



BLOCK DIAGRAM



MAXIMUM RATINGS

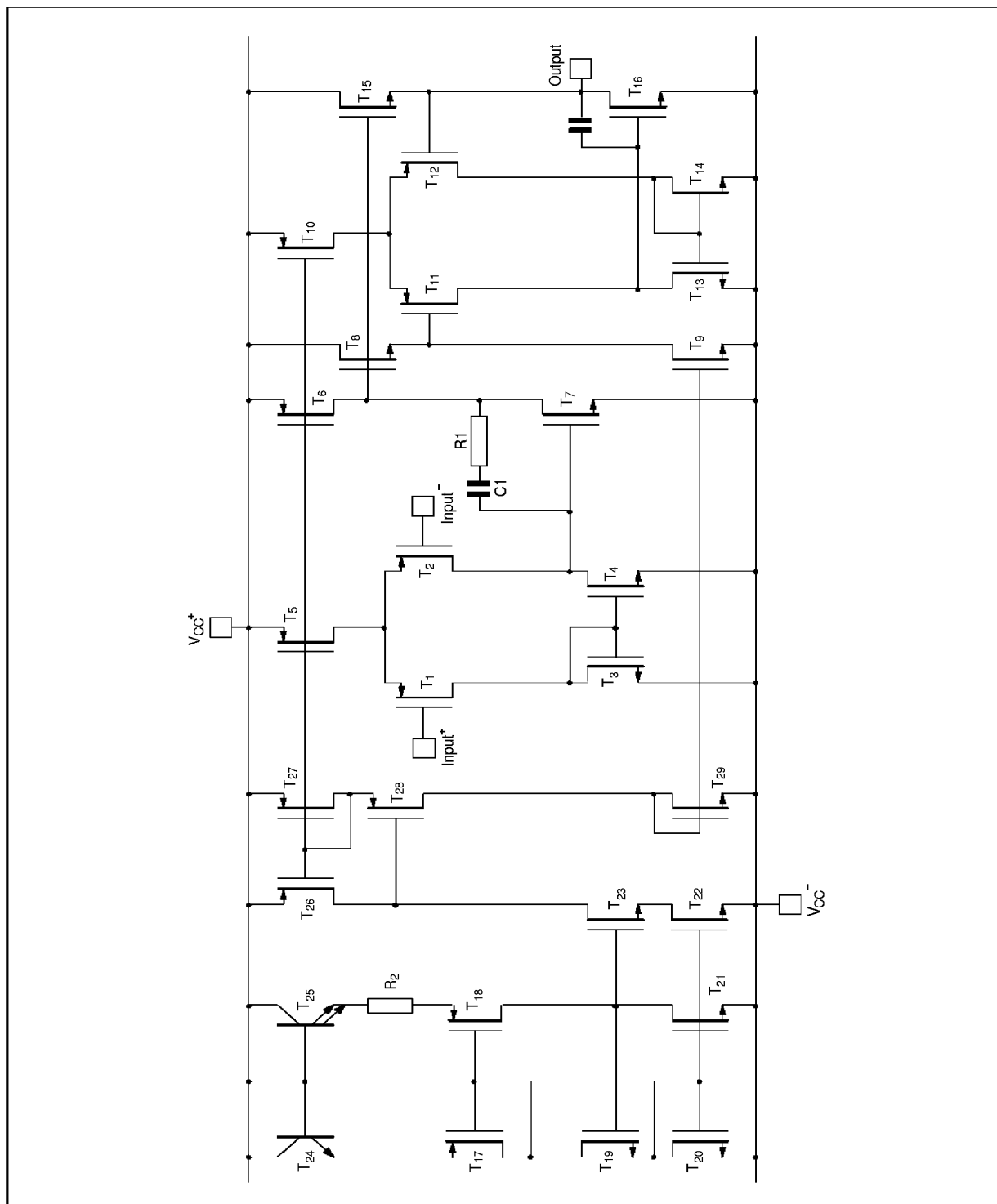
| Symbol       | Parameter                                                                               | Value                                  | Unit        |
|--------------|-----------------------------------------------------------------------------------------|----------------------------------------|-------------|
| $V_{CC}^{+}$ | Supply Voltage - (note 1)                                                               | 18                                     | V           |
| $V_{id}$     | Differential Input Voltage - (note 2)                                                   | $\pm 18$                               | V           |
| $V_i$        | Input Voltage - (note 3)                                                                | -0.3 to 18                             | V           |
| $I_O$        | Output Current for $V_{CC}^{+} \geq 15V$                                                | $\pm 30$                               | mA          |
| $I_{in}$     | Input Current                                                                           | $\pm 5$                                | mA          |
| $T_{oper}$   | Operating Free-Air Temperature Range<br>TS27L4C/AC/BC<br>TS27L4I/AI/BI<br>TS27L4M/AM/BM | 0 to +70<br>-40 to +125<br>-55 to +125 | $^{\circ}C$ |
| $T_{stg}$    | Storage Temperature Range                                                               | -65 to +150                            | $^{\circ}C$ |

Notes : 1. All voltage values, except differential voltage, are with respect to network ground terminal.  
2. Differential voltages are at the non-inverting input terminal with respect to the inverting input terminal.  
3. The magnitude of the input and the output voltages must never exceed the magnitude of the positive supply voltage.

OPERATING CONDITIONS

| Symbol       | Parameter                       | Value                   | Unit |
|--------------|---------------------------------|-------------------------|------|
| $V_{CC}^{+}$ | Supply Voltage                  | 3 to 16                 | V    |
| $V_{icm}$    | Common Mode Input Voltage Range | 0 to $V_{CC}^{+} - 1.5$ | V    |

## SCHEMATIC DIAGRAM (for 1/4 TS27L4)



## TS27L4C,I,M

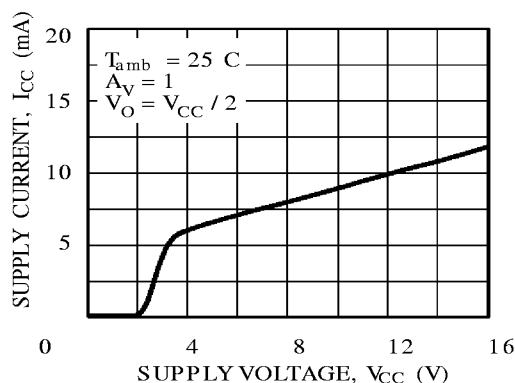
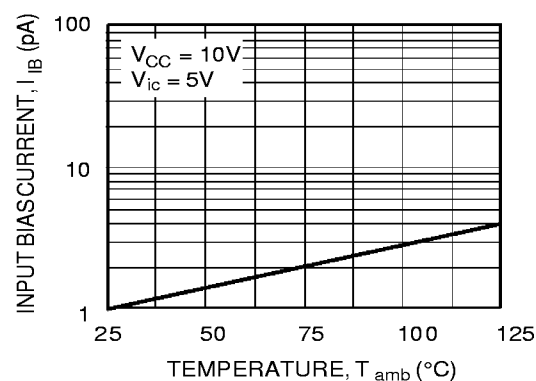
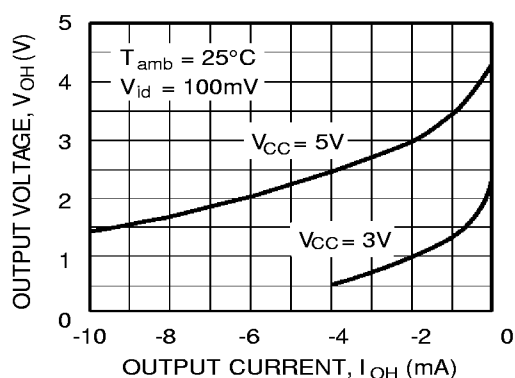
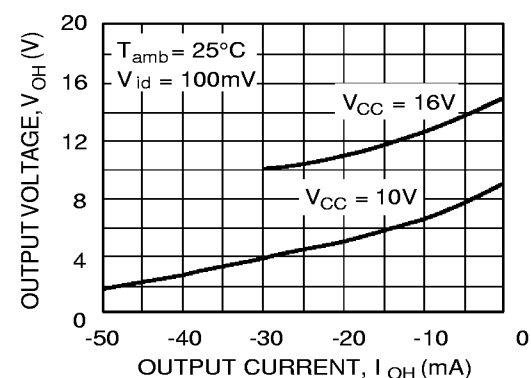
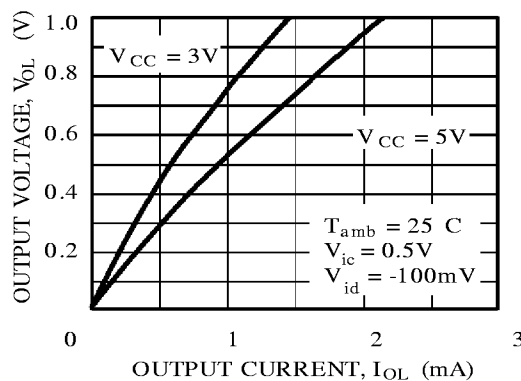
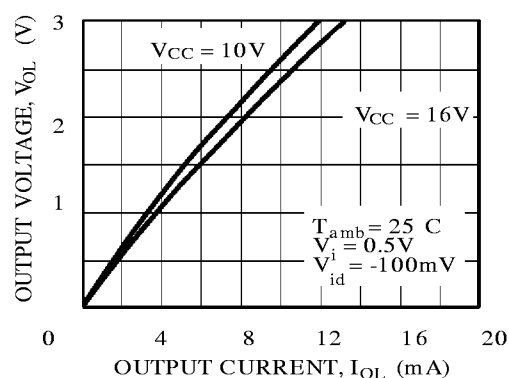
### ELECTRICAL CHARACTERISTICS

$V_{CC}^+ = +10V$ ,  $V_{CC}^- = 0V$ ,  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

| Symbol          | Parameter                                                                                                                                        | TS27L4C/AC/BC |                    |                                | TS27L4I/AI/BI<br>TS27L4M/AM/BM |                    |                                  | Unit                   |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------|--------------------------------|--------------------------------|--------------------|----------------------------------|------------------------|
|                 |                                                                                                                                                  | Min.          | Typ.               | Max.                           | Min.                           | Typ.               | Max.                             |                        |
| $V_{io}$        | Input Offset Voltage<br>$V_o = 1.4V$ , $V_{ic} = 0V$<br>TS27L4C/I/M<br>TS27L4AC/AI/AM<br>TS27L4BC/BI/BM<br>$T_{min.} \leq T_{amb} \leq T_{max.}$ |               | 1.1<br>0.9<br>0.25 | 10<br>5<br>2<br>12<br>6.5<br>3 |                                | 1.1<br>0.9<br>0.25 | 10<br>5<br>2<br>12<br>6.5<br>3.5 | mV                     |
| $DV_{io}$       | Input Offset Voltage Drift                                                                                                                       |               | 0.7                |                                |                                | 0.7                |                                  | $\mu V/^{\circ}C$      |
| $I_{io}$        | Input Offset Current - (note 1)<br>$V_{ic} = 5V$ , $V_o = 5V$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                           |               | 1                  | 100                            |                                | 1                  | 200                              | pA                     |
| $I_{ib}$        | Input Bias Current - (note 1)<br>$V_{ic} = 5V$ , $V_o = 5V$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                             |               | 1                  | 150                            |                                | 1                  | 300                              | pA                     |
| $V_{OH}$        | High Level Output Voltage<br>$V_{id} = 100mV$ , $R_L = 1M\Omega$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                        | 8.8<br>8.7    | 9                  |                                | 8.8<br>8.6                     | 9                  |                                  | V                      |
| $V_{OL}$        | Low Level Output Voltage<br>$V_{id} = -100mV$                                                                                                    |               |                    | 50                             |                                |                    | 50                               | mV                     |
| $A_{vd}$        | Large Signal Voltage Gain<br>$V_o = 1V$ to $6V$ , $R_L = 1M\Omega$ , $V_{ic} = 5V$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                      | 60<br>45      | 100                |                                | 60<br>40                       | 100                |                                  | V/mV                   |
| GBP             | Gain Bandwidth Product<br>$A_v = 40dB$ , $R_L = 1M\Omega$ , $C_L = 100pF$<br>$f_{in} = 10kHz$                                                    |               | 0.1                |                                |                                | 0.1                |                                  | MHz                    |
| CMR             | Common Mode Rejection Ratio<br>$V_o = 1.4V$ , $V_{ic} = 1V$ to $7.4V$                                                                            | 65            | 80                 |                                | 65                             | 80                 |                                  | dB                     |
| SVR             | Supply Voltage Rejection Ratio<br>$V_{CC}^+ = 5V$ to $10V$ , $V_o = 1.4V$                                                                        | 60            | 80                 |                                | 60                             | 80                 |                                  | dB                     |
| $I_{CC}$        | Supply Current (per amplifier)<br>$A_v = 1$ , no load, $V_o = 5V$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                       |               | 10                 | 15<br>17                       |                                | 10                 | 15<br>18                         | $\mu A$                |
| $I_o$           | Output Short Circuit Current<br>$V_{id} = 100mV$ , $V_o = 0V$                                                                                    |               | 60                 |                                |                                | 60                 |                                  | mA                     |
| $I_{sink}$      | Output Sink Current<br>$V_{id} = -100mV$ , $V_o = V_{CC}$                                                                                        |               | 45                 |                                |                                | 45                 |                                  | mA                     |
| SR              | Slew-Rate at Unity Gain<br>$R_L = 1M\Omega$ , $C_L = 100pF$ , $V_i = 3$ to $7V$                                                                  |               | 0.04               |                                |                                | 0.04               |                                  | V/ $\mu s$             |
| $\phi_m$        | Phase Margin at Unity Gain<br>$A_v = 40dB$ , $R_L = 1M\Omega$ , $C_L = 100pF$                                                                    |               | 45                 |                                |                                | 45                 |                                  | Degrees                |
| $K_{ov}$        | Overshoot Factor                                                                                                                                 |               | 30                 |                                |                                | 30                 |                                  | %                      |
| $e_n$           | Equivalent Input Noise Voltage<br>$f = 1kHz$ , $R_S = 100\Omega$                                                                                 |               | 68                 |                                |                                | 68                 |                                  | $\frac{nV}{\sqrt{Hz}}$ |
| $V_{O1}/V_{O2}$ | Channel Separation                                                                                                                               |               | 120                |                                |                                | 120                |                                  | dB                     |

**Note :** 1. Maximum values including unavoidable inaccuracies of the industrial test.

## TYPICAL CHARACTERISTICS

**Figure 1 :** Supply Current (each amplifier) versus Supply Voltage**Figure 2 :** Input Bias Current versus Free Air Temperature**Figure 3a :** High Level Output Voltage versus High Level Output Current**Figure 3b :** High Level Output Voltage versus High Level Output Current**Figure 4a :** Low Level Output Voltage versus Low Level Output Current**Figure 4b :** Low Level Output Voltage versus Low Level Output Current

TYPICAL CHARACTERISTICS (continued)

Figure 5 : Open Loop Frequency Response and Phase Shift

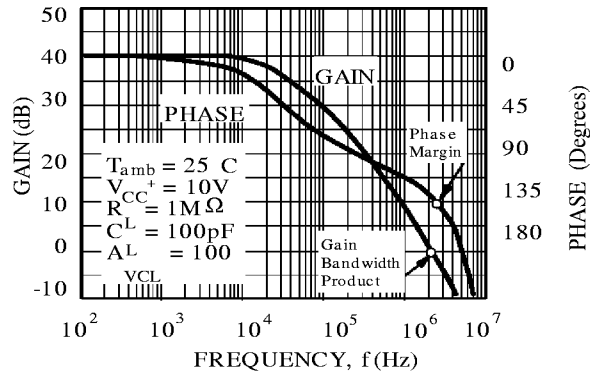


Figure 6 : Gain Bandwidth Product versus Supply Voltage

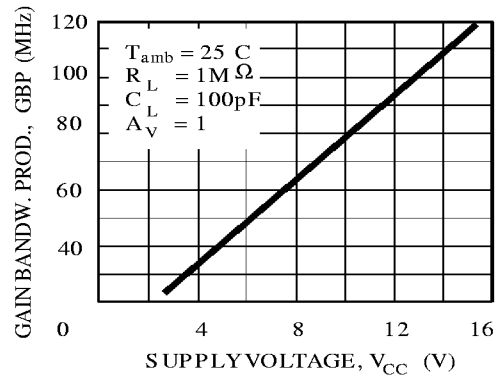


Figure 7 : Phase Margin versus Supply Voltage

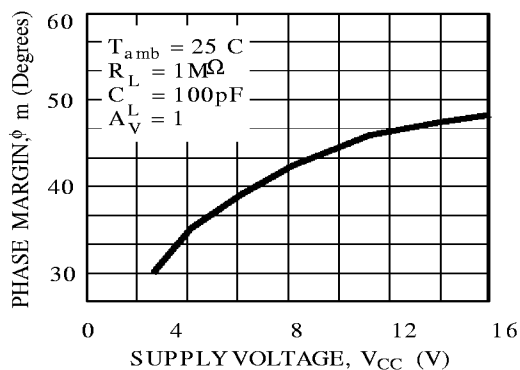


Figure 8 : Phase Margin versus Capacitive Load

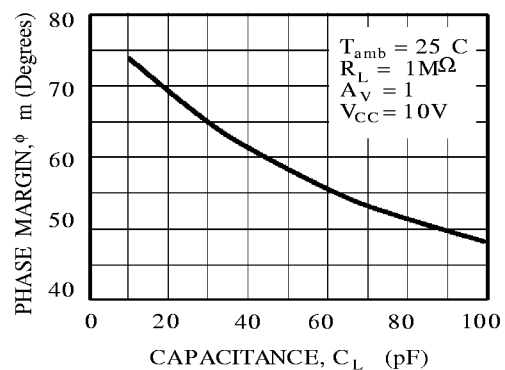


Figure 9 : Slew Rates versus Supply Voltage

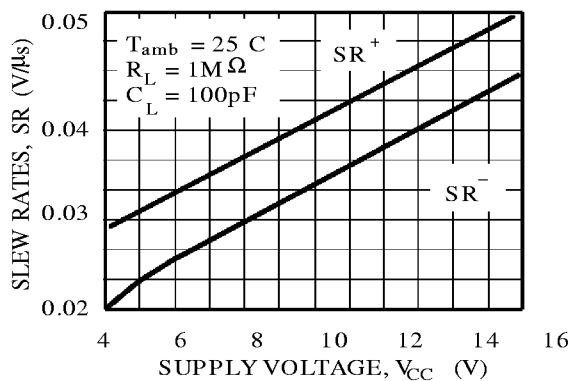
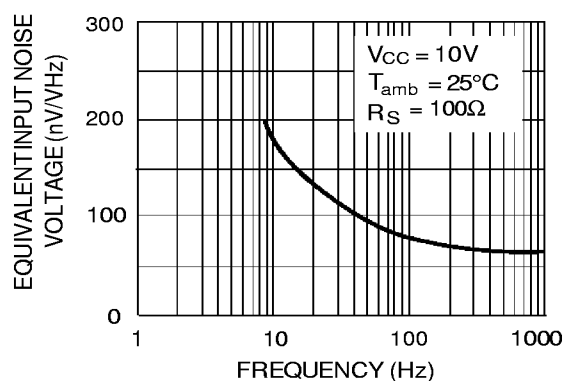
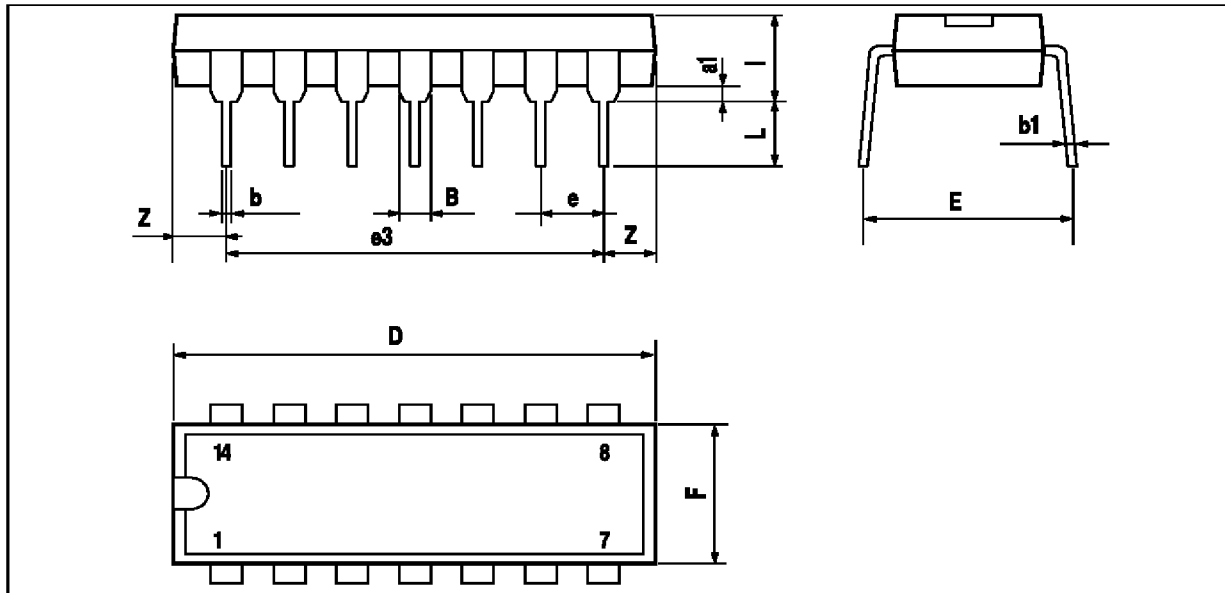


Figure 10 : Input Voltage Noise versus Frequency



**PACKAGE MECHANICAL DATA**  
14 PINS - PLASTIC DIP

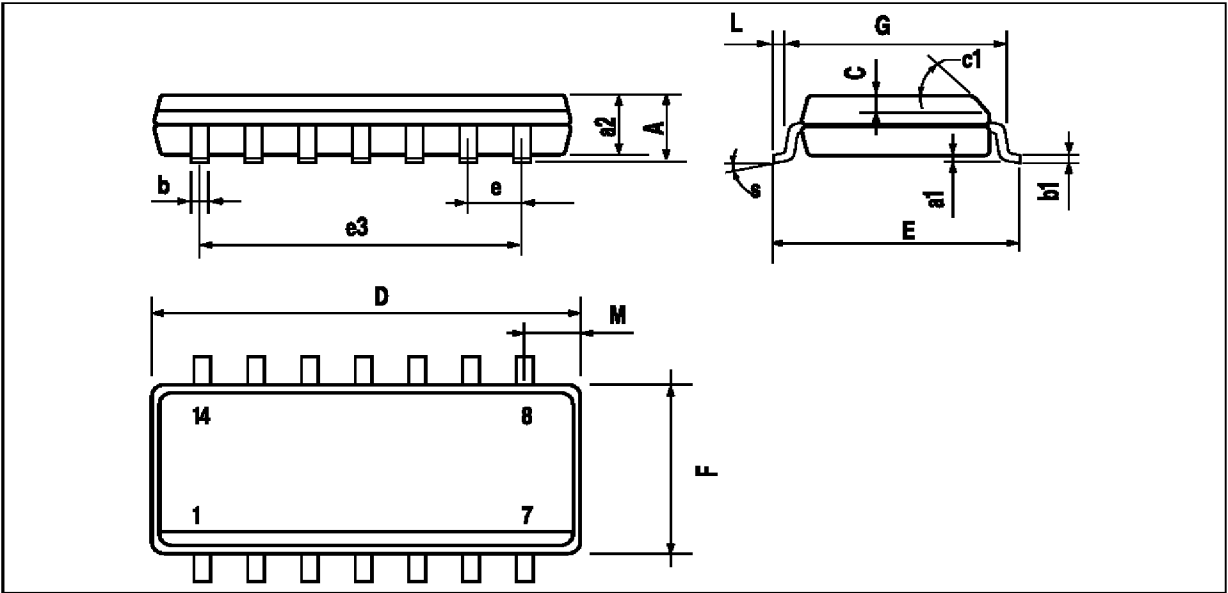


PM-DIP14.EPS

| Dim. | 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)



| Dim. | 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.)   |      |      |        |       |       |

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