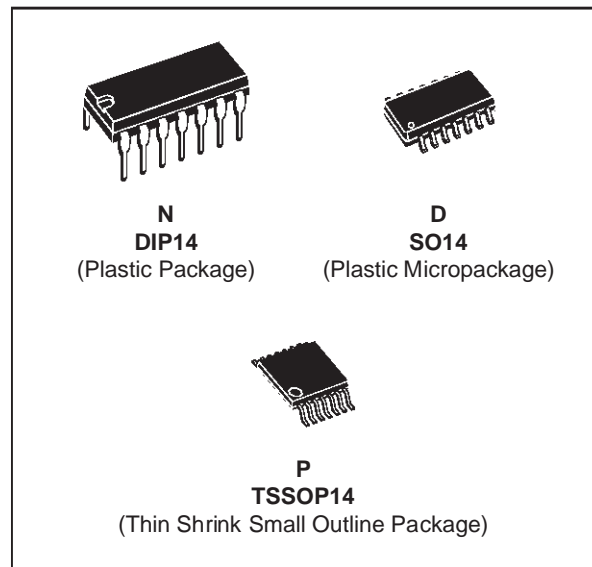




# TS27L4C,I,M

## 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



### 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)

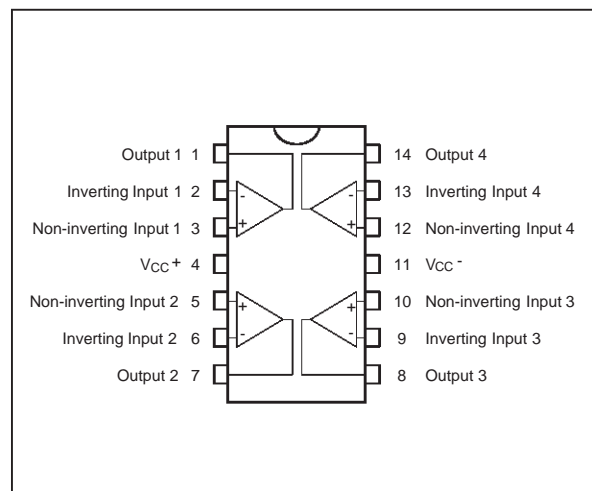
These CMOS amplifiers offer very high input impedance and extremely low input currents. The major advantage versus JFET devices is the very low input currents drift with temperature (see figure 2).

### ORDER CODES

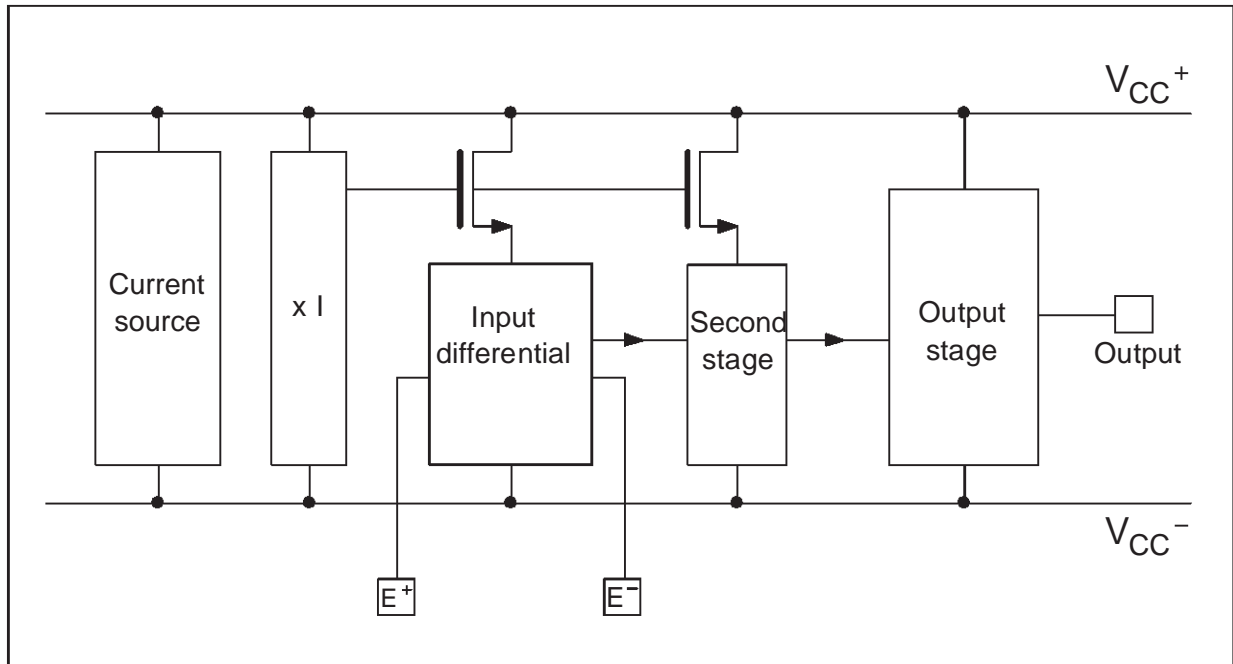
Part Number	Temperature Range	Package		
		N	D	P
TS27L4C/AC/BC	$0^{\circ}\text{C}, +70^{\circ}\text{C}$	●	●	●
TS27L4I/AI/BI	$-40^{\circ}\text{C}, +125^{\circ}\text{C}$	●	●	●
TS27L4M/AM/BM	$-55^{\circ}\text{C}, +125^{\circ}\text{C}$	●	●	●

**Example** : TS27M4ACN

### PIN CONNECTIONS (top view)



**BLOCK DIAGRAM**



**MAXIMUM RATINGS**

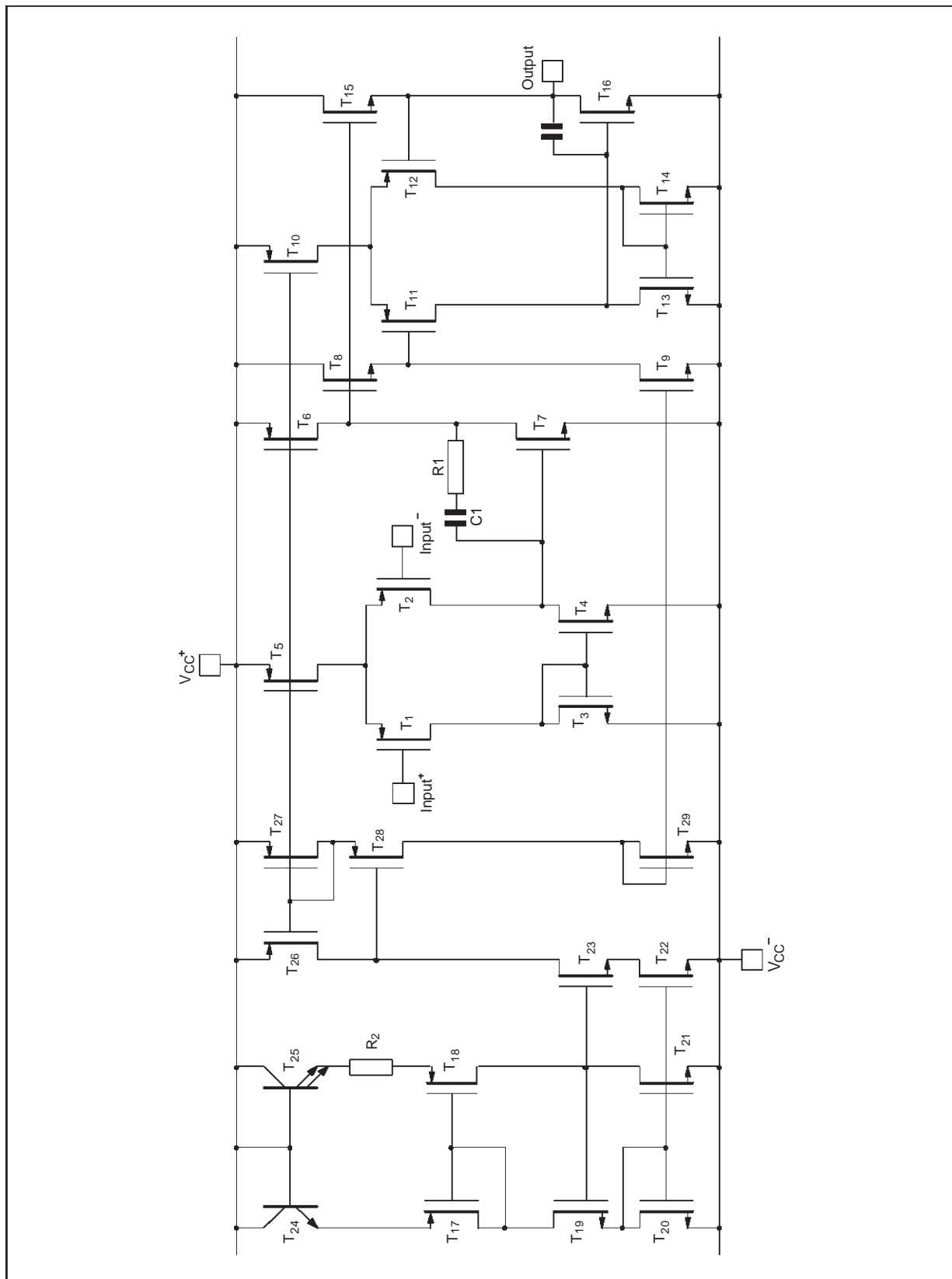
Symbol	Parameter	Value	Unit
$V_{CC}^+$	Supply Voltage - (note 1)	18	V
$V_{id}$	Differential Input Voltage - (note 2)	$\pm 18$	V
$V_i$	Input Voltage - (note 3)	-0.3 to 18	V
$I_O$	Output Current for $V_{CC}^+ \geq 15V$	$\pm 30$	mA
$I_{in}$	Input Current	$\pm 5$	mA
$T_{oper}$	Operating Free-Air Temperature Range	TS27L4C/AC/BC TS27L4I/AI/BI TS27L4M/AM/BM 0 to +70 -40 to +125 -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 TS27L4M/AM/BM			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$V_{io}$	Input Offset Voltage $V_O = 1.4V$ , $V_{ic} = 0V$ TS27L4C/I/M TS27L4AC/AI/AM TS27L4BC/BI/BM $T_{min.} \leq T_{amb} \leq T_{max.}$ TS27L4C/I/M TS27L4AC/AI/AM TS27L4BC/BI/BM		1.1 0.9 0.25	10 5 2 12 6.5 3		1.1 0.9 0.25	10 5 2 12 6.5 3.5	mV
$DV_{io}$	Input Offset Voltage Drift		0.7			0.7		$\mu V/^{\circ}C$
$I_{io}$	Input Offset Current - (note 1) $V_{ic} = 5V$ , $V_o = 5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		1	100		1	200	pA
$I_{ib}$	Input Bias Current - (note 1) $V_{ic} = 5V$ , $V_o = 5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		1	150		1	300	pA
$V_{OH}$	High Level Output Voltage $V_{id} = 100mV$ , $R_L = 1M\Omega$ $T_{min.} \leq T_{amb} \leq T_{max.}$	8.8 8.7	9		8.8 8.6	9		V
$V_{OL}$	Low Level Output Voltage $V_{id} = -100mV$			50			50	mV
$A_{vd}$	Large Signal Voltage Gain $V_o = 1V$ to $6V$ , $R_L = 1M\Omega$ , $V_{ic} = 5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$	60 45	100		60 40	100		V/mV
GBP	Gain Bandwidth Product $A_v = 40dB$ , $R_L = 1M\Omega$ , $C_L = 100pF$ $f_{in} = 10kHz$		0.1			0.1		MHz
CMR	Common Mode Rejection Ratio $V_o = 1.4V$ , $V_{ic} = 1V$ to $7.4V$	65	80		65	80		dB
SVR	Supply Voltage Rejection Ratio $V_{CC}^+ = 5V$ to $10V$ , $V_o = 1.4V$	60	80		60	80		dB
$I_{CC}$	Supply Current (per amplifier) $A_v = 1$ , no load, $V_o = 5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		10	15 17		10	15 18	$\mu A$
$I_o$	Output Short Circuit Current $V_{id} = 100mV$ , $V_o = 0V$		60			60		mA
$I_{sink}$	Output Sink Current $V_{id} = -100mV$ , $V_o = V_{CC}$		45			45		mA
SR	Slew-Rate at Unity Gain $R_L = 1M\Omega$ , $C_L = 100pF$ , $V_i = 3$ to $7V$		0.04			0.04		V/ $\mu s$
$\phi_m$	Phase Margin at Unity Gain $A_v = 40dB$ , $R_L = 1M\Omega$ , $C_L = 100pF$		45			45		Degrees
$K_{ov}$	Overshoot Factor		30			30		%
$e_n$	Equivalent Input Noise Voltage $f = 1kHz$ , $R_S = 100\Omega$		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

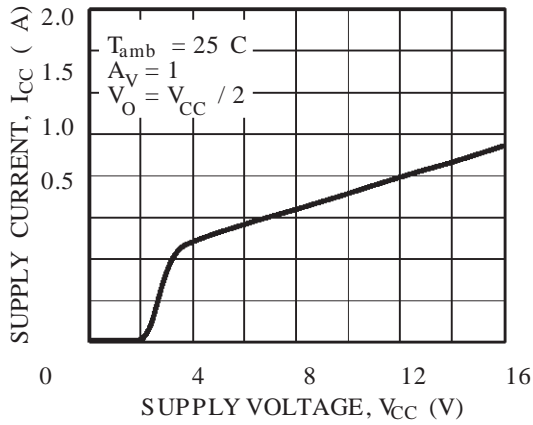


Figure 2 : Input Bias Current versus Free Air Temperature

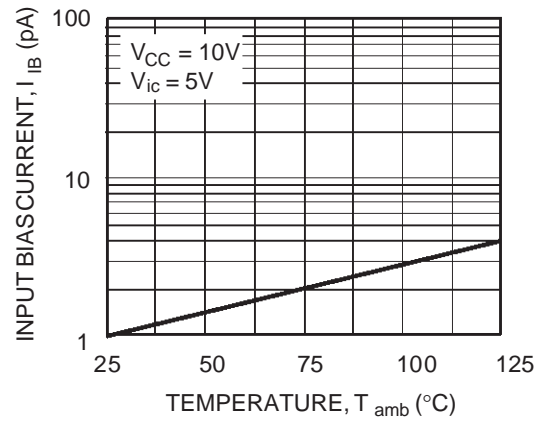


Figure 3a : High Level Output Voltage versus High Level Output Current

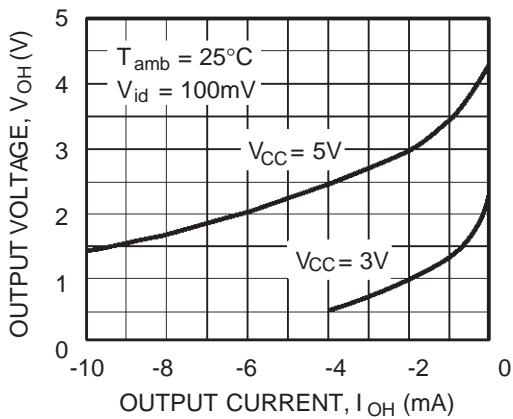


Figure 3b : High Level Output Voltage versus High Level Output Current

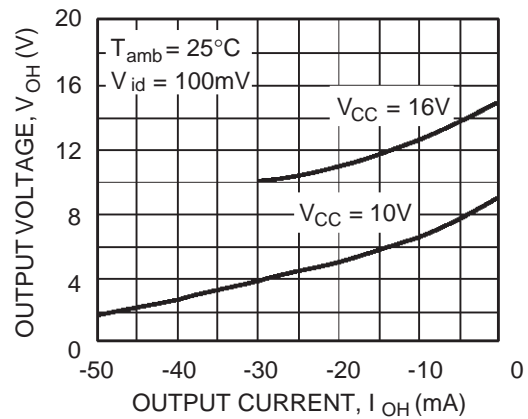


Figure 4a : Low Level Output Voltage versus Low Level Output Current

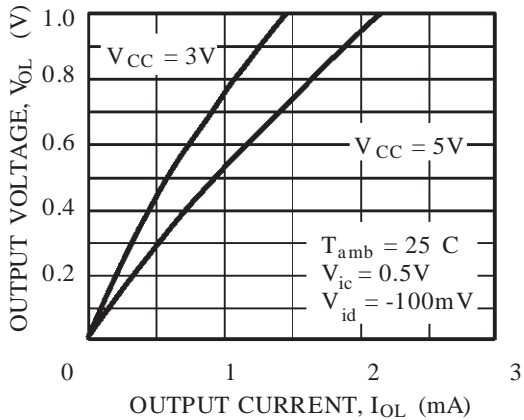
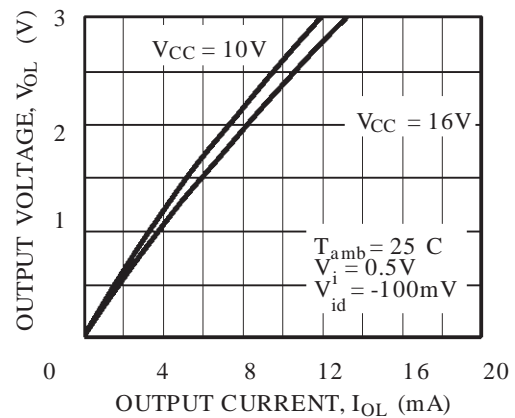


Figure 4b : Low Level Output Voltage versus Low Level Output Current



TYPICAL CHARACTERISTICS (continued)

Figure 5 : Open Loop Frequency Response and Phase Shift

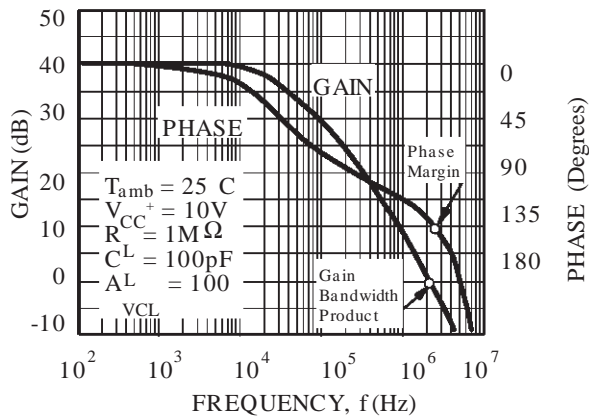


Figure 6 : Gain Bandwidth Product versus Supply Voltage

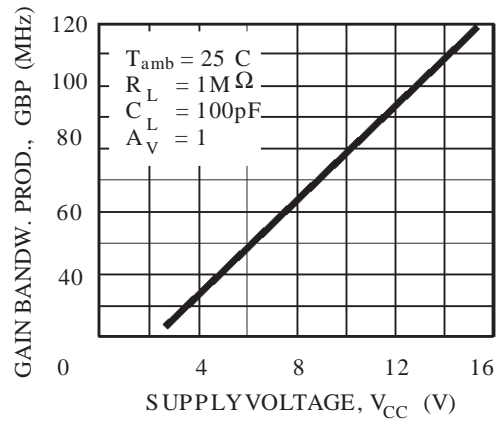


Figure 7 : Phase Margin versus Supply Voltage

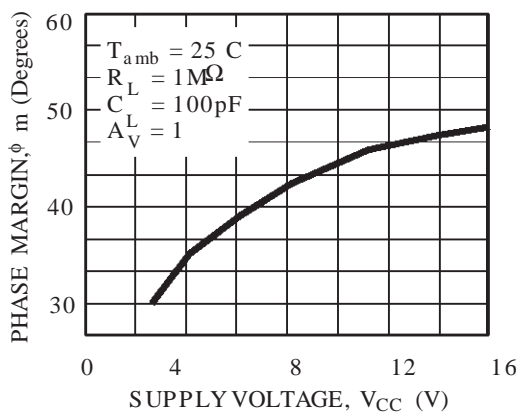


Figure 8 : Phase Margin versus Capacitive Load

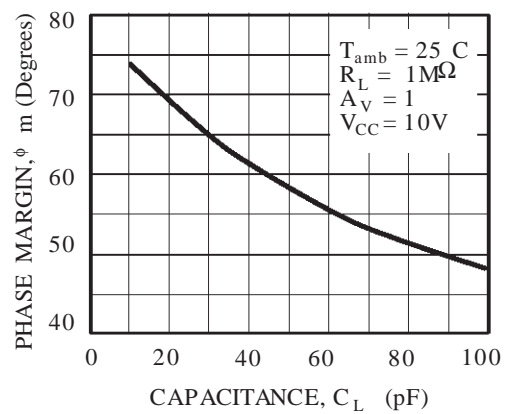


Figure 9 : Slew Rates versus Supply Voltage

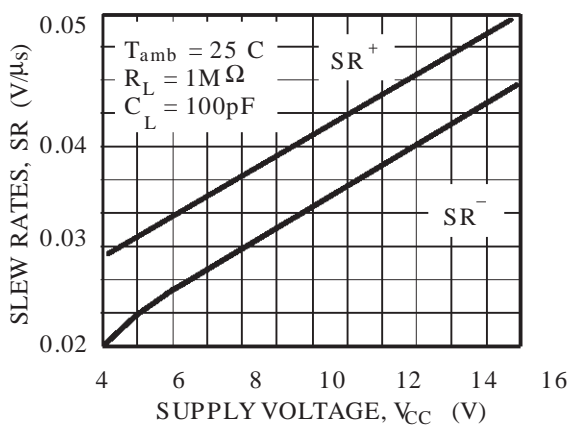
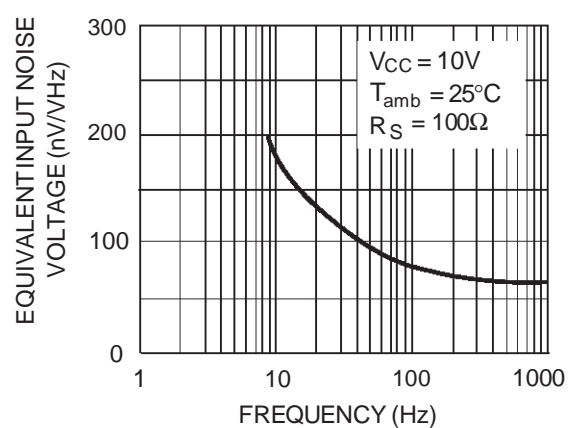
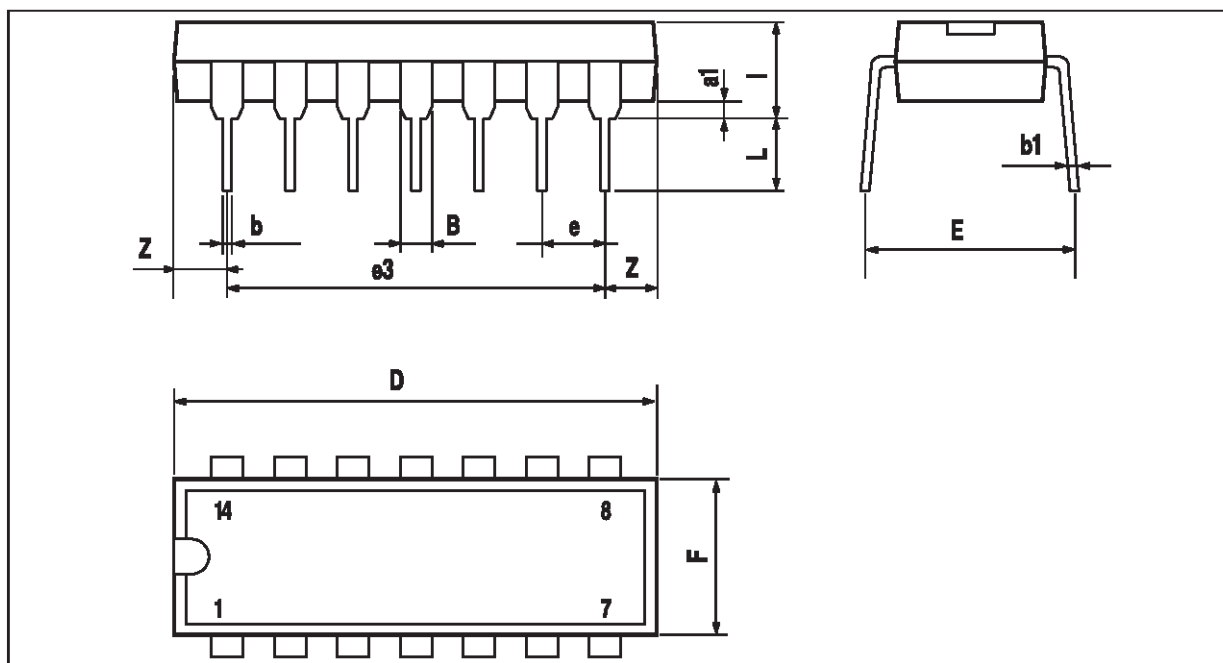


Figure 10 : Input Voltage Noise versus Frequency



**PACKAGE MECHANICAL DATA**

14 PINS - PLASTIC DIP



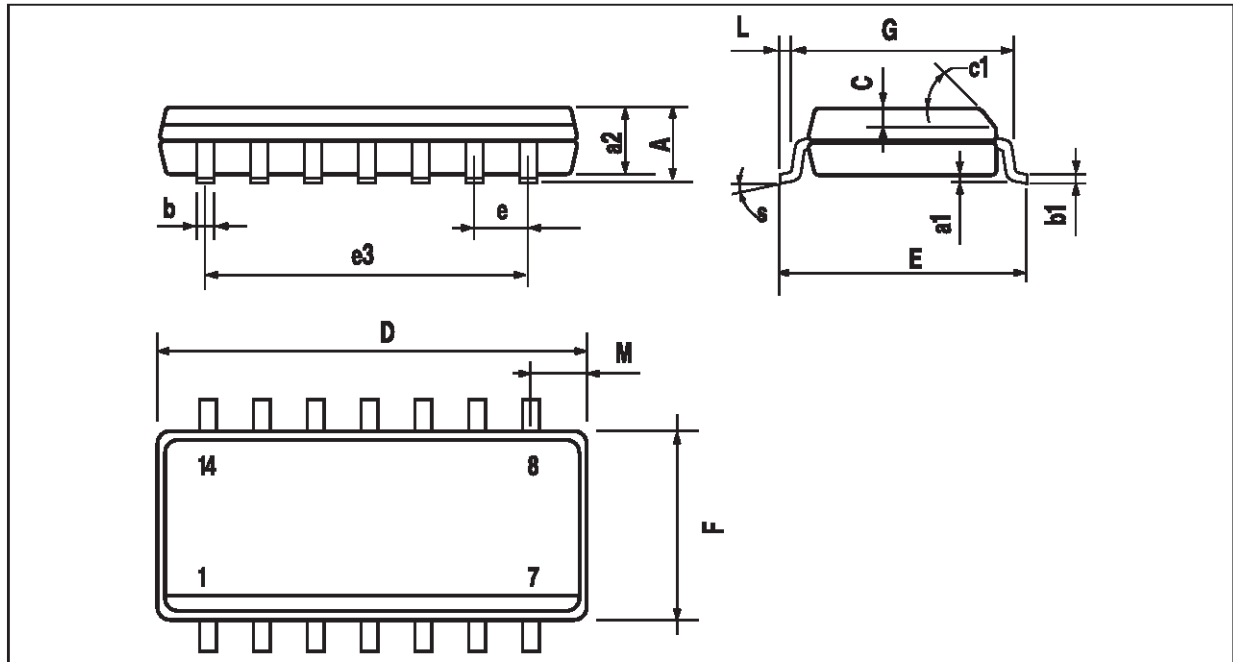
PM-DIP14.EPS

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

# TS27L4C,I,M

## PACKAGE MECHANICAL DATA 14 PINS - PLASTIC MICROPACKAGE (SO)



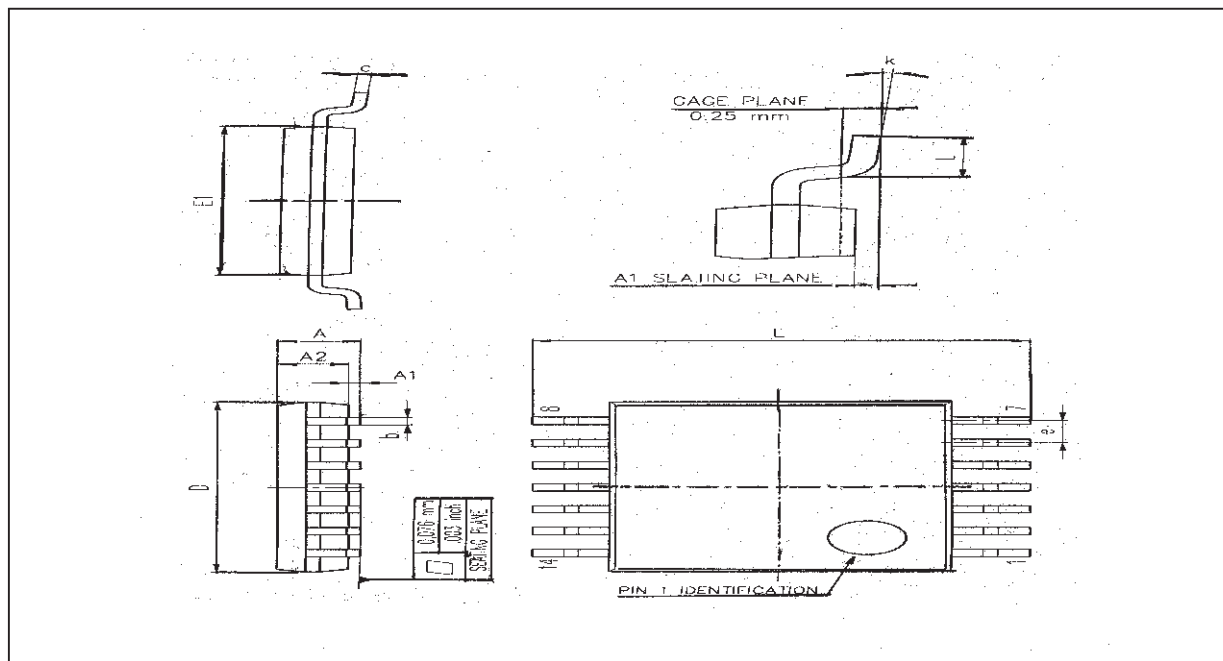
PM-SO14.EPS

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.)					

SO14.TBL



**PACKAGE MECHANICAL DATA**  
**14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE**



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.05
A1	0.05		0.15	0.01		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.15
c	0.09		0.20	0.003		0.012
D	4.90	5.00	5.10	0.192	0.196	0.20
E		6.40			0.252	
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.025	
k	0°		8°	0°		8°
l	0.50	0.60	0.75	0.09	0.0236	0.030

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