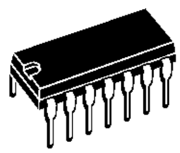
SGS-THOMSON MICROELECTRONICS

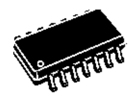
TS914

INPUT/OUTPUT **RAIL TO RAIL** QUAD CMOS OPERATIONAL AMPLIFIER

- **RAIL TO RAIL** INPUT AND OUTPUT VOLTAGE RANGES
- SINGLE (OR DUAL) SUPPLY OPERATION FROM **2.7V TO 16V** (±1.35V to ±8V)
- EXTREMELY LOW INPUT BIAS CURRENT : **1pA** TYP
- LOW INPUT OFFSET VOLTAGE : 5mV max.
- SPECIFIED FOR **600Ω** AND **100Ω** LOADS
- LOW SUPPLY CURRENT : 400µA/Ampli
- SPEED : 1.3MHz - 1.3V/µs



N
DIP14
(Plastic Package)

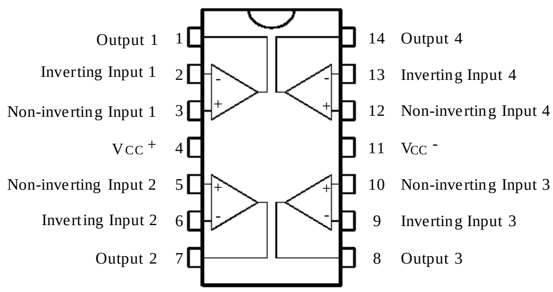


D
SO14
(Plastic Micropackage)

ORDER CODES

Part Number	Temperature Range	Package	
		N	D
TS914I/AI	-40, +125°C	•	•

PIN CONNECTIONS (top view)



DESCRIPTION

The TS914 is a RAIL TO RAIL quad CMOS operational amplifier designed to operate with a single 3V supply voltage.

The input voltage range V_{icm} includes the two supply rails V_{CC}^{+} and V_{CC}^{-}.

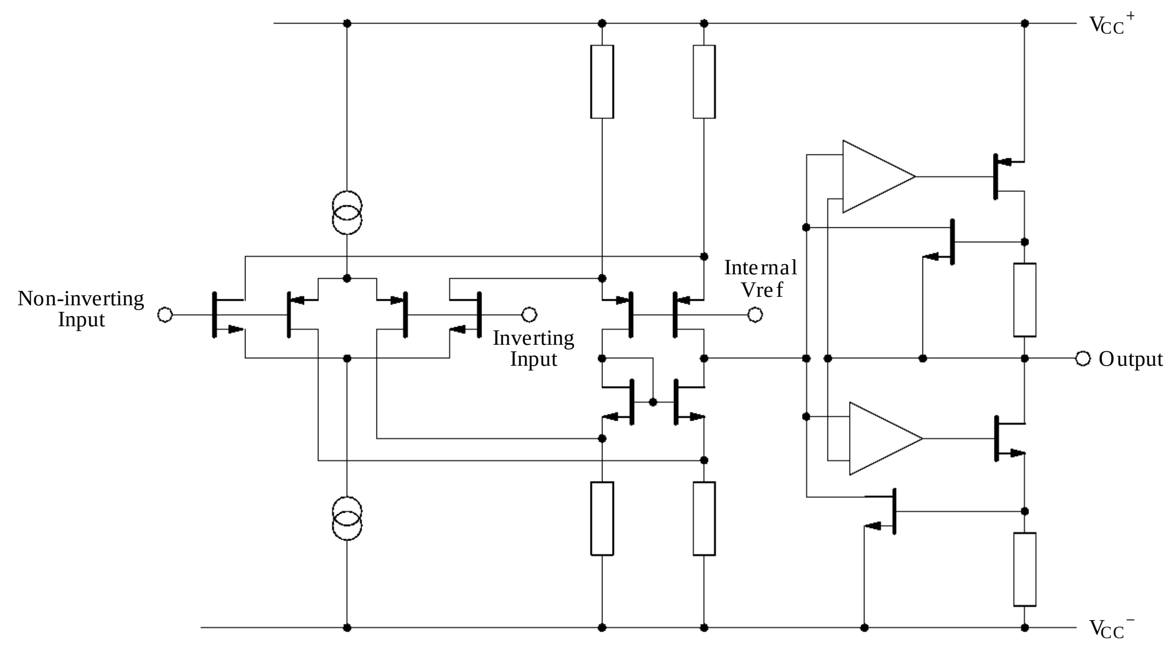
The output reaches :

- V_{CC}^{-} +50mV V_{CC}^{+} -50mV with R_L = 10kΩ
- V_{CC}^{-} +650mV V_{CC}^{+} -650mV with R_L = 600Ω

This product offers a broad supply voltage operating range from 2.7V to 16V and a supply current of only 400µA/amp. (V_{CC} = 10V).

Source and sink output current capability is typically 75mA (at V_{CC} = 10V), fixed by an internal limitation circuit.

SCHEMATIC DIAGRAM (1/4 TS914)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{CC}	Supply Voltage - (note 1)		18	V
V_{id}	Differential Input Voltage - (note 2)		±18	V
V_i	Input Voltage - (note 3)		-0.3 to 18	V
I_{in}	Current on Inputs		±50	mA
I_o	Current on Outputs		±130	mA
T_{oper}	Operating Free Air Temperature Range	TS3V914I/AI	-40 to +125	°C
T_{stg}	Storage Temperature		-65 to +150	°C

Notes :
1. All voltage values, except differential voltage are with respect to network ground terminal.
2. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
3. The magnitude of input and output voltages must never exceed V_{CC}^{+} +0.3V.

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2.7 to 16	V
V_{icm}	Common Mode Input Voltage Range	V_{CC}^{-} -0.2 to V_{CC}^{+}+0.2	V

ELECTRICAL CHARACTERISTICS

$V_{CC}^+ = 10V$, $V_{CC}^- = 0V$, R_L,C_L connected to $V_{CC}/2$, $T_{amb} = 25^oC$ (unless otherwise specified)

Symbol	Parameter		TS914I/AI			Unit
			Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($V_{ic} = V_o = V_{CC}/2$) $T_{min.} \leq T_{amb} \leq T_{max.}$	TS914 TS914A TS914 TS914A			10 5 12 7	mV
DV_{io}	Input Offset Voltage Drift			5		µV/°C
I_{io}	Input Offset Current - (note 1) $T_{min.} \leq T_{amb} \leq T_{max.}$			1	100 200	pA
I_{ib}	Input Bias Current - (note 1) $T_{min.} \leq T_{amb} \leq T_{max.}$			1	150 300	pA
I_{CC}	Supply Current (per amplifier, $A_{VCL} = 1$, no load) $T_{min.} \leq T_{amb} \leq T_{max.}$			400	600 700	µA
CMR	Common Mode Rejection Ratio	$V_{ic} = 3$ to $7V$, $V_o = 5V$ $V_{ic} = 0$ to $10V$, $V_o = 5V$	50	75 70		dB
SVR	Supply Voltage Rejection Ratio ($V_{CC}^+ = 5$ to $10V$, $V_O = V_{CC}/2$)		50	80		dB
A_{vd}	Large Signal Voltage Gain ($R_L = 10k\Omega$, $V_O = 2.5V$ to $7.5V$) $T_{min.} \leq T_{amb} \leq T_{max.}$		20 15	60		V/mV
V_{OH}	High Level Output Voltage ($V_{id} = 1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$	 $R_L = 10k\Omega$ $R_L = 600\Omega$ $R_L = 100\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$	 9.85 9.2 9.8 9	 9.95 9.35 7.8		V
V_{OL}	Low Level Output Voltage ($V_{id} = -1V$) $T_{min.} \leq T_{amb} \leq T_{max.}$	 $R_L = 10k\Omega$ $R_L = 600\Omega$ $R_L = 100\Omega$ $R_L = 10k\Omega$ $R_L = 600\Omega$		 50 650 2300	 150 800 150 900	mV
I_o	Output Short Circuit Current ($V_{id} = \pm 1V$)	Source ($V_o = V_{CC}^-$) Sink ($V_o = V_{CC}^+$)	45 45	60 60		mA
GBP	Gain Bandwidth Product ($A_{VCL} = 100$, $R_L = 10k\Omega$, $C_L = 100pF$, $f = 100kHz$)			1.3		MHz
SR^+	Positive Slew Rate $A_{VCL} = 1$, $R_L = 10k\Omega$, $V_i = 2.5V$ to $7.5V$, $C_L = 100pF$			1.3		V/µs
SR^-	Negative Slew Rate			0.8		V/µs
∅m	Phase Margin			40		Degrees
e_n	Equivalent Input Noise Voltage ($R_s = 100\Omega$, $f = 1kHz$)			30		$\frac{nV}{\sqrt{Hz}}$
THD	Total Harmonic Distortion ($A_{VCL} = 1$, $R_L = 10k\Omega$, $C_L = 100pF$, $V_O = 4.75V$ to $5.25V$, $f = 1kHz$)			0.024		%
C_{in}	Input Capacitance			1.5		pF
V_{O1}/V_{O2}	Channel Separation (f = 1kHz)			120		dB

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

TYPICAL CHARACTERISTICS

Figure 1 : Supply Current (each amplifier) versus Supply Voltage

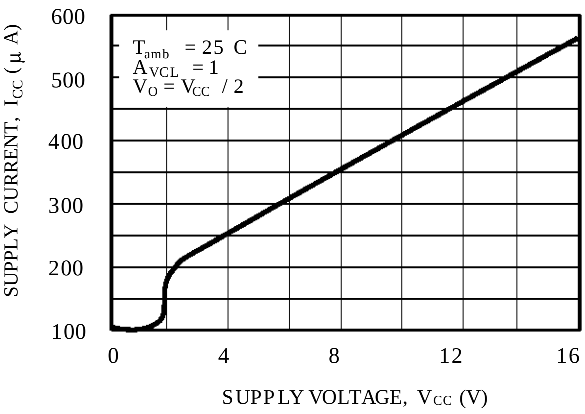


Figure 2 : Input Bias Current versus Temperature

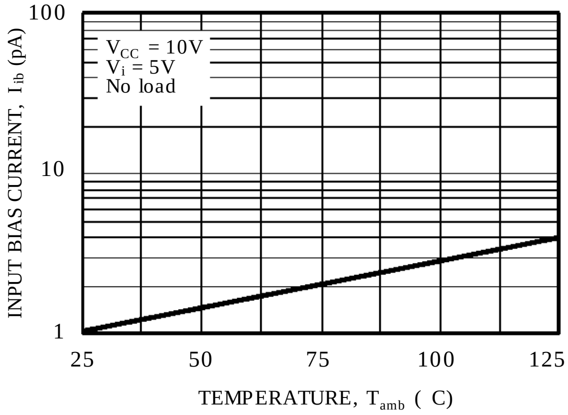


Figure 3a : High Level Output Voltage versus High Level Output Current

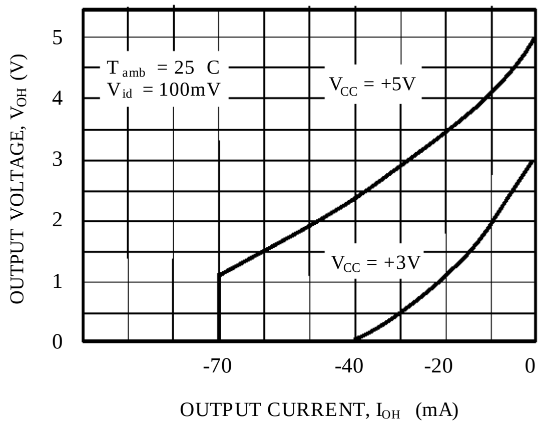


Figure 3b : High Level Output Voltage versus High Level Output Current

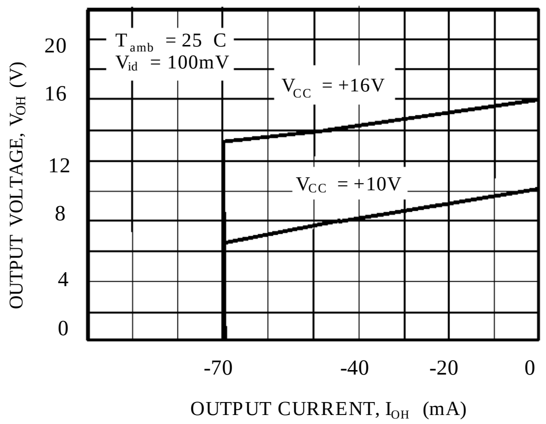


Figure 4a : Low Level Output Voltage versus Low Level Output Current

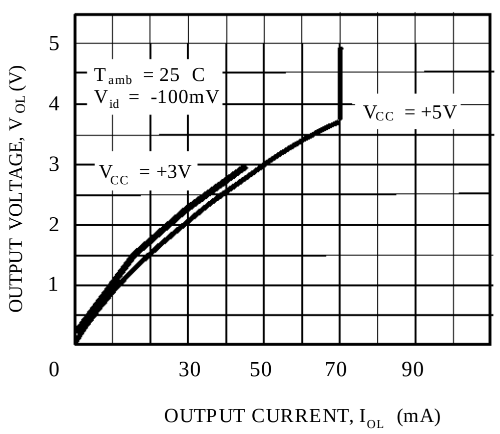


Figure 4b : Low Level Output Voltage versus Low Level Output Current

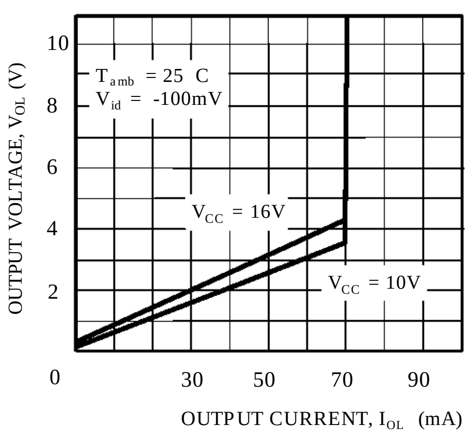


Figure 5a : Open Loop Frequency Response and Phase Shift

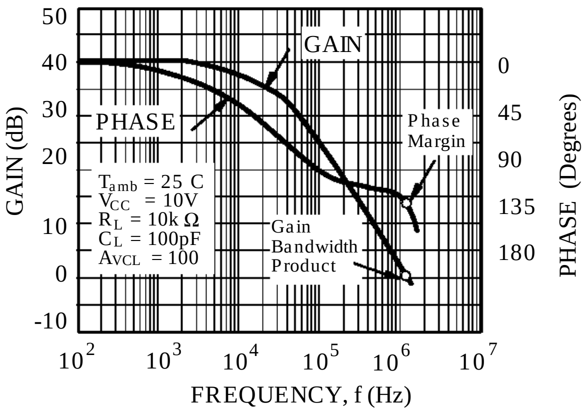


Figure 5b : Open Loop Frequency Response and Phase Shift

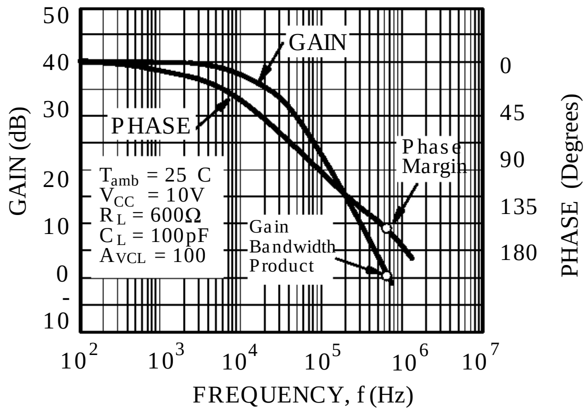


Figure 6a : Gain Bandwidth Product versus Supply Voltage

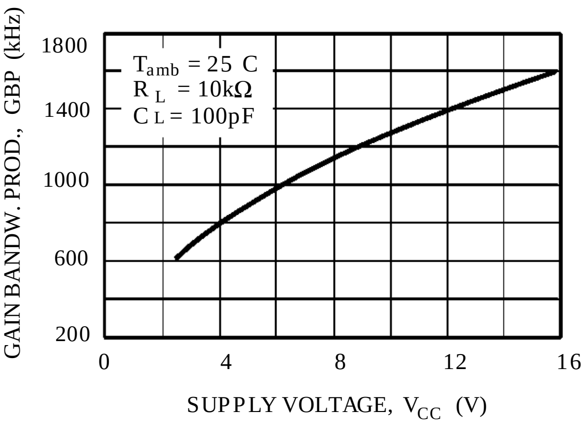


Figure 6b : Gain bandwidth Product versus Supply Voltage

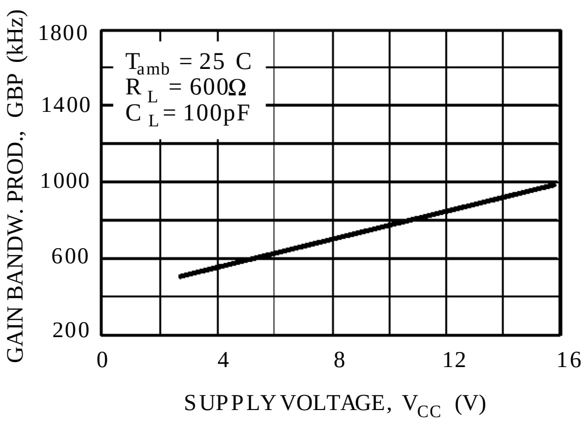


Figure 7a : Phase Margin versus Supply Voltage

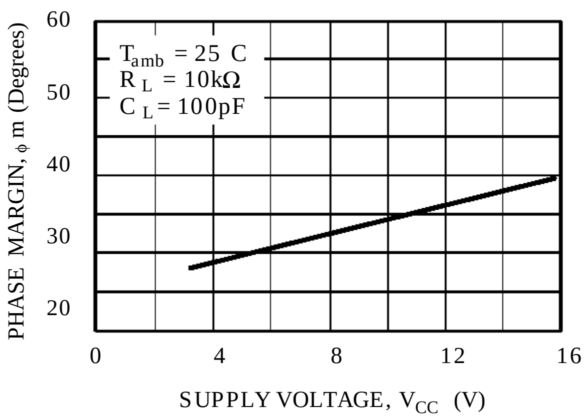


Figure 7b : Phase Margin versus Supply Voltage

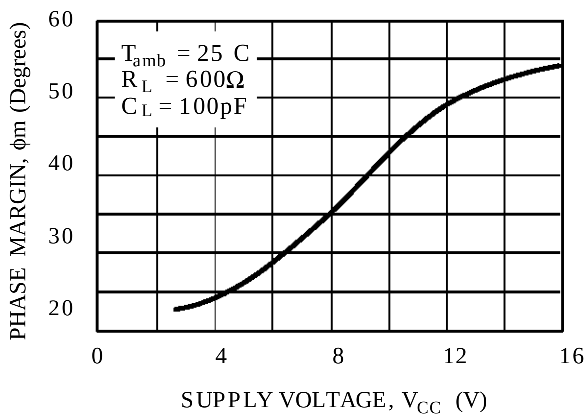
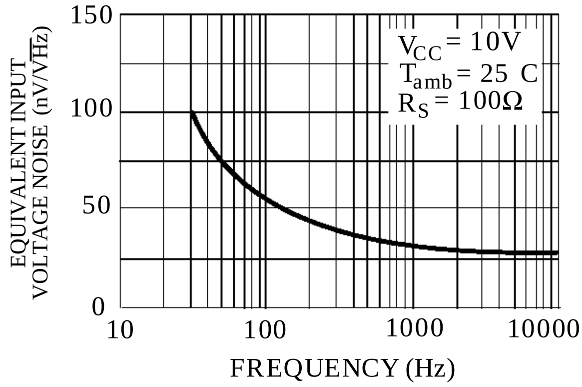
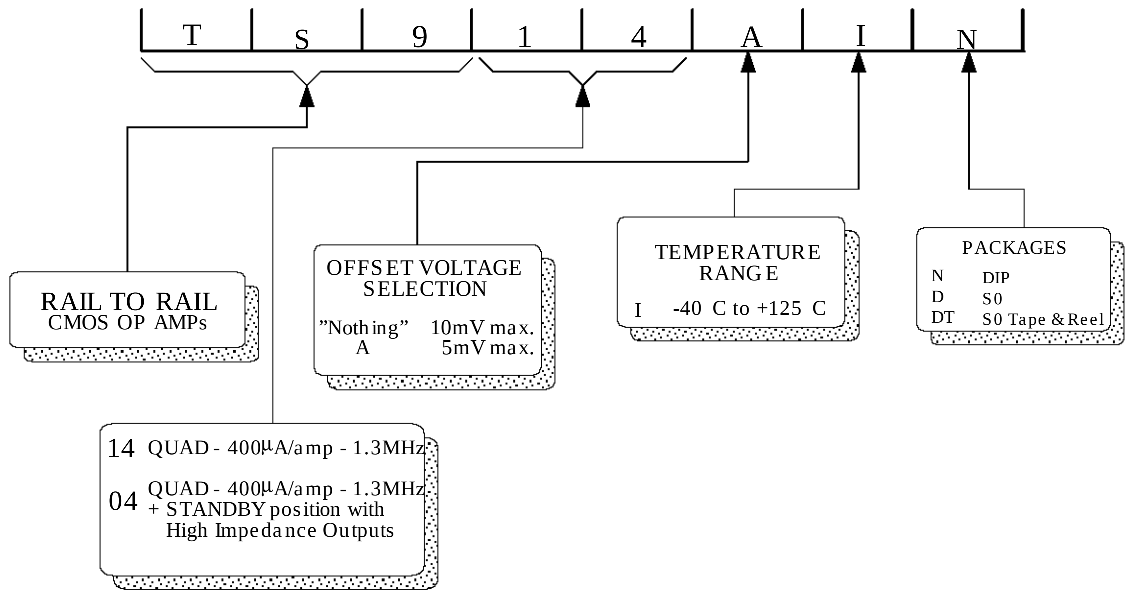


Figure 8 : Input Voltage Noise versus Frequency

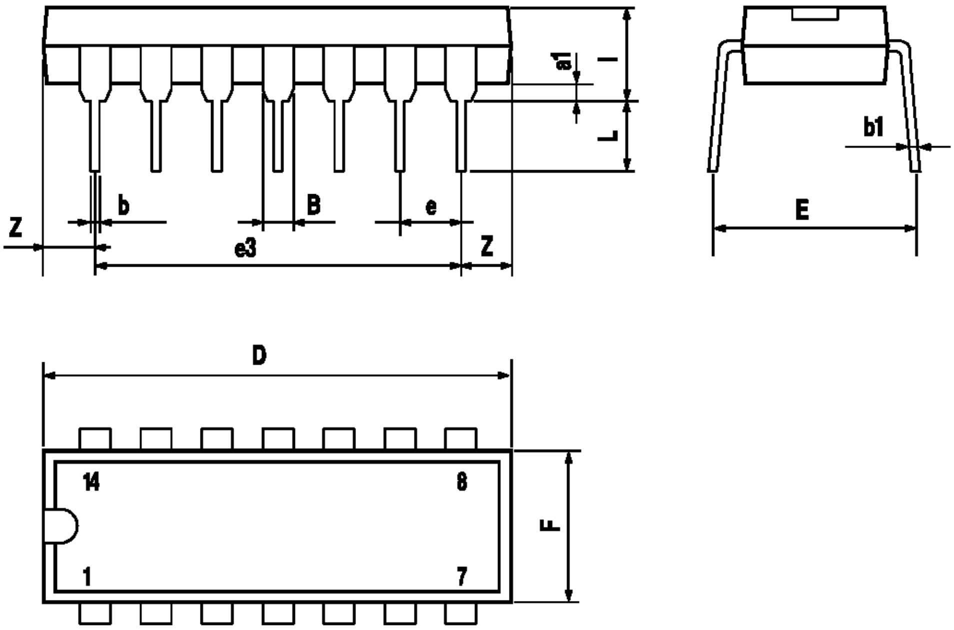


ORDERING INFORMATION



PACKAGE MECHANICAL DATA

14 PINS - PLASTIC DIP



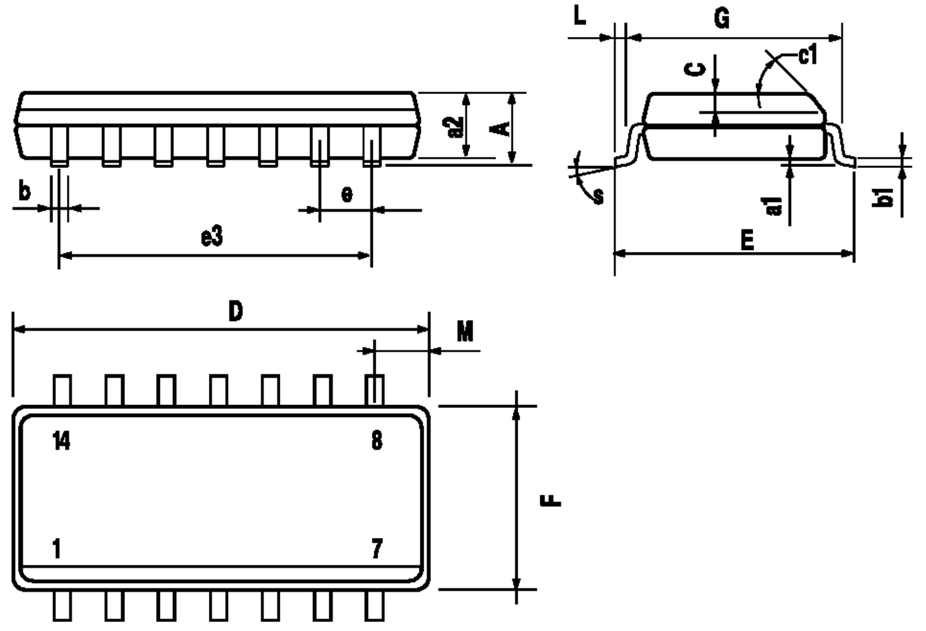
PM-DIP14.EPS

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^o (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^o (max.)					

SO14.TBL