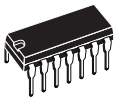
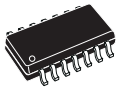
TS514, A

PRECISION QUAD OPERATIONAL AMPLIFIER

- LOW OFFSET VOLTAGE : 500µV max.
- LOW POWER CONSUMPTION
- SHORT CIRCUIT PROTECTION
- LOW DISTORTION, LOW NOISE
- HIGH GAIN-BANDWIDTH PRODUCT
- HIGH CHANNEL SEPARATION
- ESD INTERNAL PROTECTION
- **MACROMODEL** INCLUDED IN THIS SPECIFICATION



N
DIP14
(Plastic Package)



D
SO14
(Plastic Micropackage)

DESCRIPTION

The TS514 is a high performance quad operational amplifier with frequency and phase compensation built into the chip. The internal phase compensation allows stable operation as voltage follower in spite of its high gain-bandwidth products.

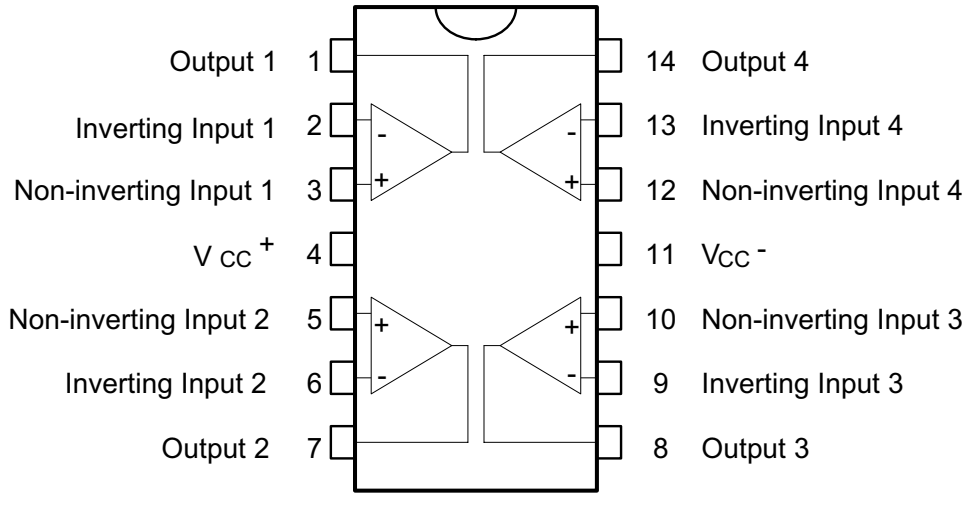
The circuit presents very stable electrical characteristics over the entire supply voltage range, and it particularly intended for professional and telecom applications (active filters, etc).

ORDER CODE

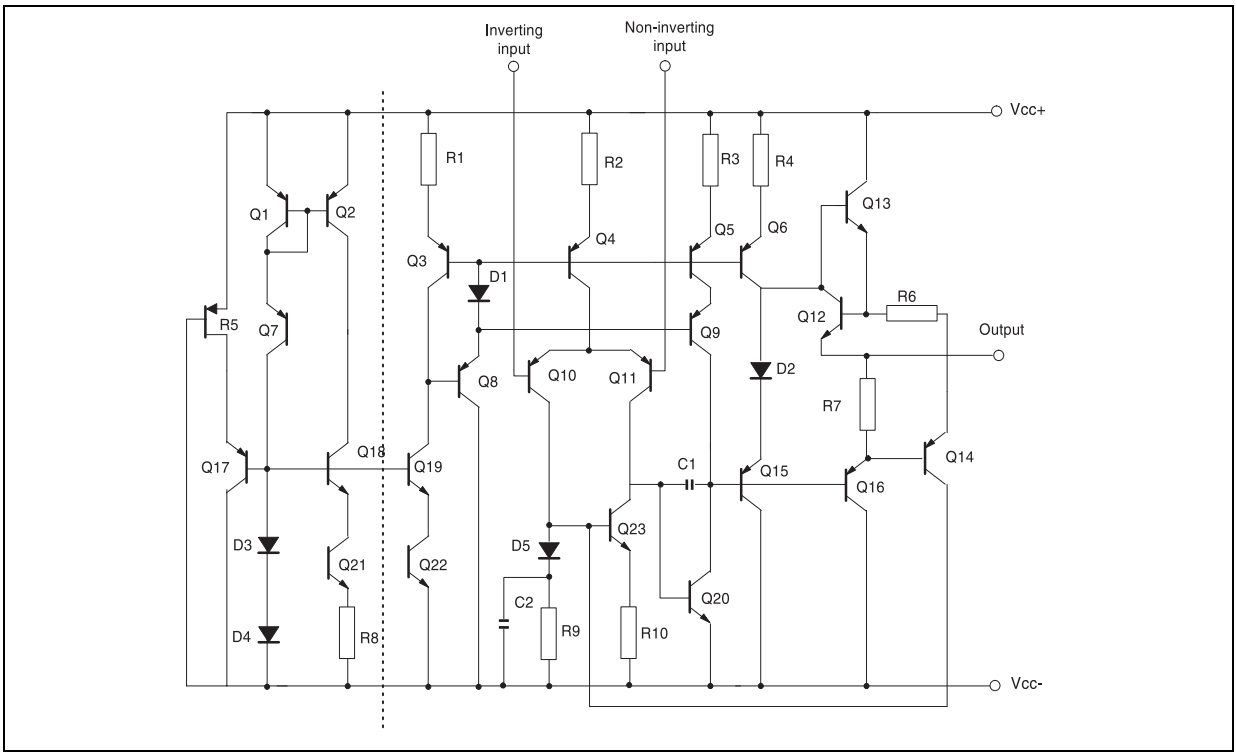
Part Number	Temperature Range	Package	
		N	D
TS514I	-40°C, +125°C	•	•
TS514AI	-40°C, +125°C	•	•

N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)

PIN CONNECTIONS (top view)



SCHEMATIC DIAGRAM (1/4 TS514)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	±18	V
V_i	Input Voltage (positive) (negative)	$+V_{CC}$ $-V_{CC}$ - 0.5	
V_{id}	Differential Input Voltage	$\pm(V_{CC} - 1)$	
T_{oper}	Operating Free-Air Temperature Range	-40 to +125	°C
p_{tot}	Power Dissipation at T_{amb} = 70°C	400	mW
T_{stg}	Storage Temperature Range	-65 to +150	°C

ELECTRICAL CHARACTERISTICS

V_{CC} = ±15V, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
I_{cc}	Supply Current		1.4	2.4	mA
I_{ib}	Input Bias Current $T_{min} \le T_{op} \le T_{max}$		50	150 300	nA
R_i	Input Resistance, f = 1kHz		1		MΩ
V_{io}	Input Offset Voltage TS514 TS514A $T_{min} \le T_{op} \le T_{max}$ TS514 TS514A		0.5	2.5 0.5 4 1.5	mV
ΔV_{io}	Input Offset Voltage Drift $T_{min} \le T_{op} \le T_{max}$		5		µV/°C
I_{io}	Input Offset Current $T_{min} \le T_{op} \le T_{max}$		5	20 40	nA
ΔI_{io}	Input Offset Current Drift $T_{min} \le T_{op} \le T_{max}$		0.08		$\frac{nA}{°C}$
I_{os}	Output Short Circuit Current		23		mA
A_{vd}	Large Signal Voltage Gain R_L = 2kΩ V_{cc} = ±15V V_{cc} = ± 4V	90	100 95		dB
GBP	Gain-bandwidth Product, f = 100kHz	1.8	3		MHz
e_n	Equivalent Input Noise Voltage, f = 1kHz Rs = 50Ω Rs = 1kΩ Rs = 10kΩ		8 10 18	15	$\frac{nV}{\sqrt{Hz}}$
THD	Total Harmonic Distortion A_V = 20dB R_L = 2kΩ V_o = $2V_{pp}$ f = 1kHz		0.03	0.1	%
$\pm V_{opp}$	Output Voltage Swing R_L = 2kΩ V_{cc} = ±15V V_{cc} = ± 4V	±13	±3		V
V_{opp}	Large Signal Voltage Swing R_L = 10kΩ f = 10kHz		28		V_{pp}
SR	Slew Rate Unity Gain, RL = 2kΩ	0.8	1.5		V/µs
CMR	Common Mode Rejection Ratio V_{ic} = 10V	90			dB
SVR	Supply Voltage Rejection Ratio dV_{ic} = 10V f = 100Hz	90			dB
V_{o1}/V_{o2}	Channel Separation, f = 1kHz		120		dB

MACROMODEL

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** Standard Linear Ics Macromodels, 1993.
** CONNECTIONS :
* 1 INVERTING INPUT
* 2 NON-INVERTING INPUT
* 3 OUTPUT
* 4 POSITIVE POWER SUPPLY
* 5 NEGATIVE POWER SUPPLY

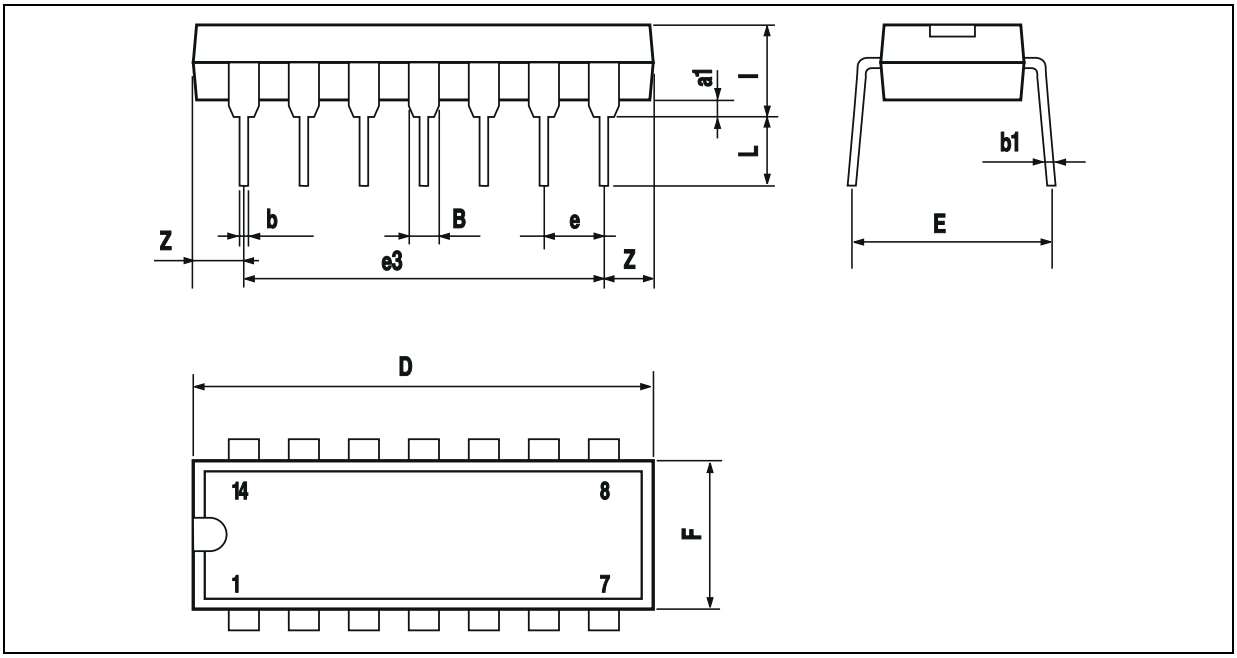
.SUBCKT TS514 1 3 2 4 5 (analog)
*******************************************************
.MODEL MDTH D IS=1E-8 KF=6.647807E-16
CJO=10F
* INPUT STAGE
CIP 2 5 1.000000E-12
CIN 1 5 1.000000E-12
EIP 10 5 2 5 1
EIN 16 5 1 5 1
RIP 10 11 1.300000E+01
RIN 15 16 1.300000E+01
RIS 11 15 6.437882E+01
DIP 11 12 MDTH 400E-12
DIN 15 14 MDTH 400E-12
VOFP 12 13 DC 0
VOFN 13 14 DC 0
IPOL 13 5 2.000000E-05
CPS 11 15 9.75E-10
DINN 17 13 MDTH 400E-12
VIN 17 5 0.000000e+00
DINR 15 18 MDTH 400E-12
VIP 4 18 1.500000E+00
FCP 4 5 VOFP 1.525000E+01
FCN 5 4 VOFN 1.525000E+01
FIBP 2 5 VOFN 5.000000E-03
FIBN 5 1 VOFP 5.000000E-03
* AMPLIFYING STAGE
FIP 5 19 VOFP 1.125000E+03
FIN 5 19 VOFN 1.125000E+03
RG1 19 5 6.512062E+05
RG2 19 4 6.512062E+05
CC 19 29 1.500000E-08
HZTP 30 29 VOFP 8.944787E+02
HZTN  5 30 VOFN 8.944787E+02
DOPM 19 22 MDTH 400E-12
DONM 21 19 MDTH 400E-12
HOPM 22 28 VOUT 6.521739E+03
VIPM 28 4 1.500000E+02
HONM 21 27 VOUT 6.521739E+03
VINM 5 27 1.500000E+02
GCOMP 5 4 4 5 7.485029E-04
RPM1 5 80 1E+09
RPM2 4 80 1E+09
GAVPH 5 82 19 80 2.99E-03
RAVPHGH 82 4 668
RAVPHGB 82 5 668
RAVPHDH 82 83 1000
RAVPHDB 82 84 1000
CAVPHH 4 83 0.352E-09
CAVPHB 5 84 0.352E-09
EOUT 26 23 82 5 1
VOUT 23 5 0
ROUT 26 3 150
COUT 3 5 1.000000E-12
DOP 19 25 MDTH 400E-12
VOP 4 25 1.785252E+00
DON 24 19 MDTH 400E-12
VON 24 5 1.785252E+00
.ENDS
```

ELECTRICAL CHARACTERISTICS

V_{cc} = ±15V, T_{amb} = 25°C (unless otherwise specified)

Symbol	Conditions	Value	Unit
V_{io}		0	mV
A_{vd}	R_L = 2kΩ	94	V/mV
I_{cc}	No load, per operator	325	µA
V_{icm}		-15 to 13.5	V
V_{OH}	R_L = 2kΩ	+13	V
V_{OL}	R_L = 2kΩ	-13	V
I_{sink}	V_o = 0V	24	mA
I_{source}	V_o = 0V	24	mA
GBP	R_L = 2kΩ, C_L = 100pF	3	MHz
SR	R_L = 2kΩ, C_L = 100pF	1.4	V/µs
∅m	R_L = 2kΩ, C_L = 100pF	55	Degrees

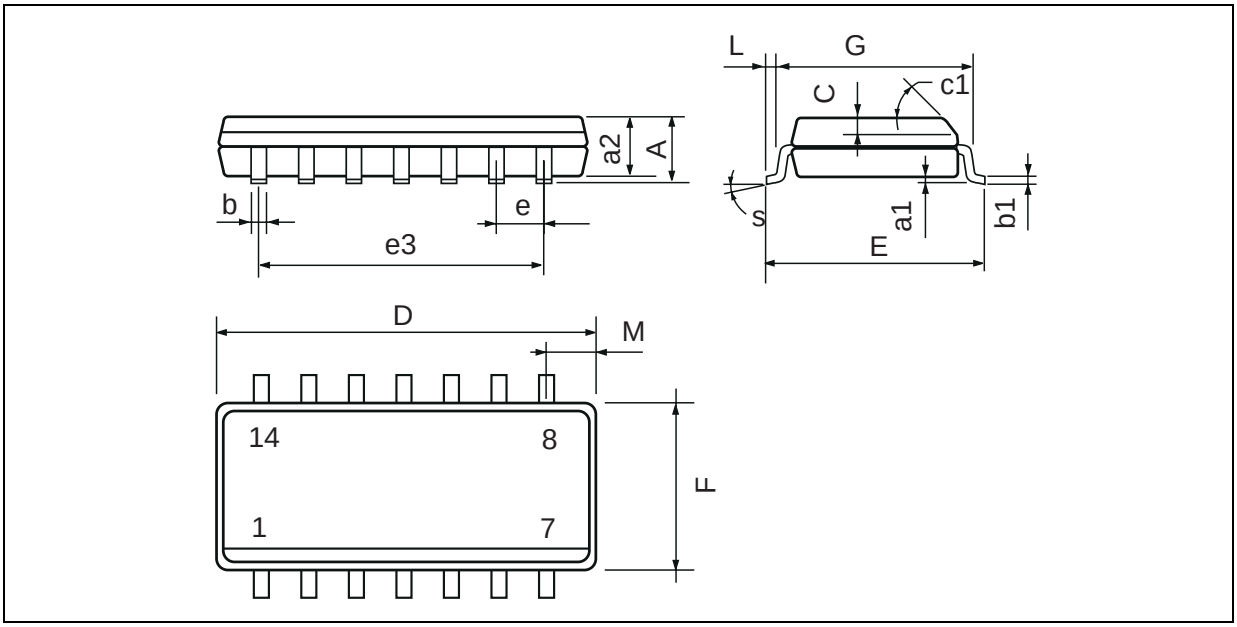
PACKAGE MECHANICAL DATA
14 PINS - PLASTIC DIP



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

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 (1)	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 (1)	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.)					

Note : (1) D and F do not include mold flash or protrusions - Mold flash or protrusions shall not exceed 0.15mm (.066 inc) ONLY FOR DATA BOOK.

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