

## PRECISION DUAL OPERATIONAL AMPLIFIER

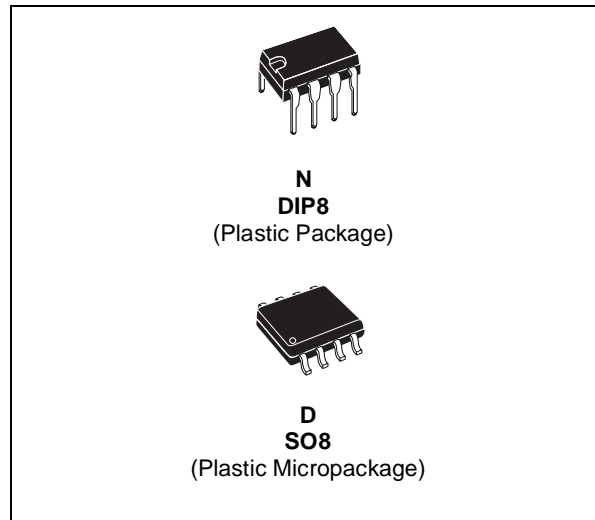
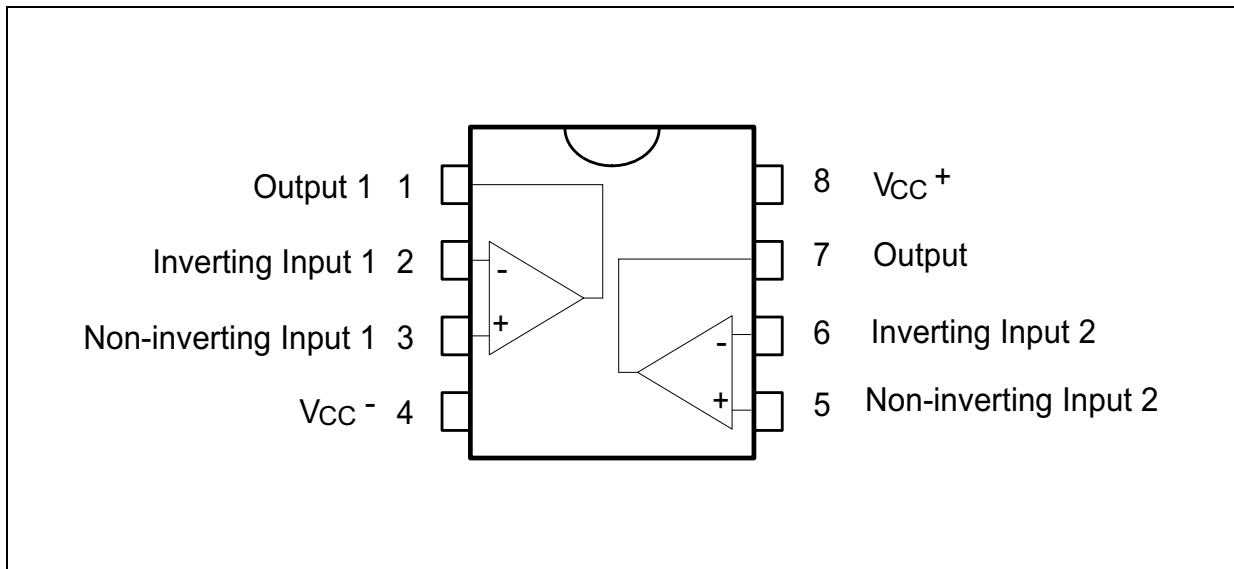
- LOW INPUT OFFSET VOLTAGE:  
500 $\mu$ V max.
- LOW POWER CONSUMPTION
- SHORT CIRCUIT PROTECTION
- LOW DISTORTION, LOW NOISE
- HIGH GAIN-BANDWIDTH PRODUCT:  
3MHz
- HIGH CHANNEL SEPARATION
- ESD INTERNAL PROTECTION
- LOW INPUT OFFSER CURRENT
  
- **MACROMODEL** INCLUDED IN THIS SPECIFICATION

### DESCRIPTION

The TS512 is a high performance dual 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 is particularly intended for professional and telecom applications (active filter, etc).

### PIN CONNECTIONS (top view)

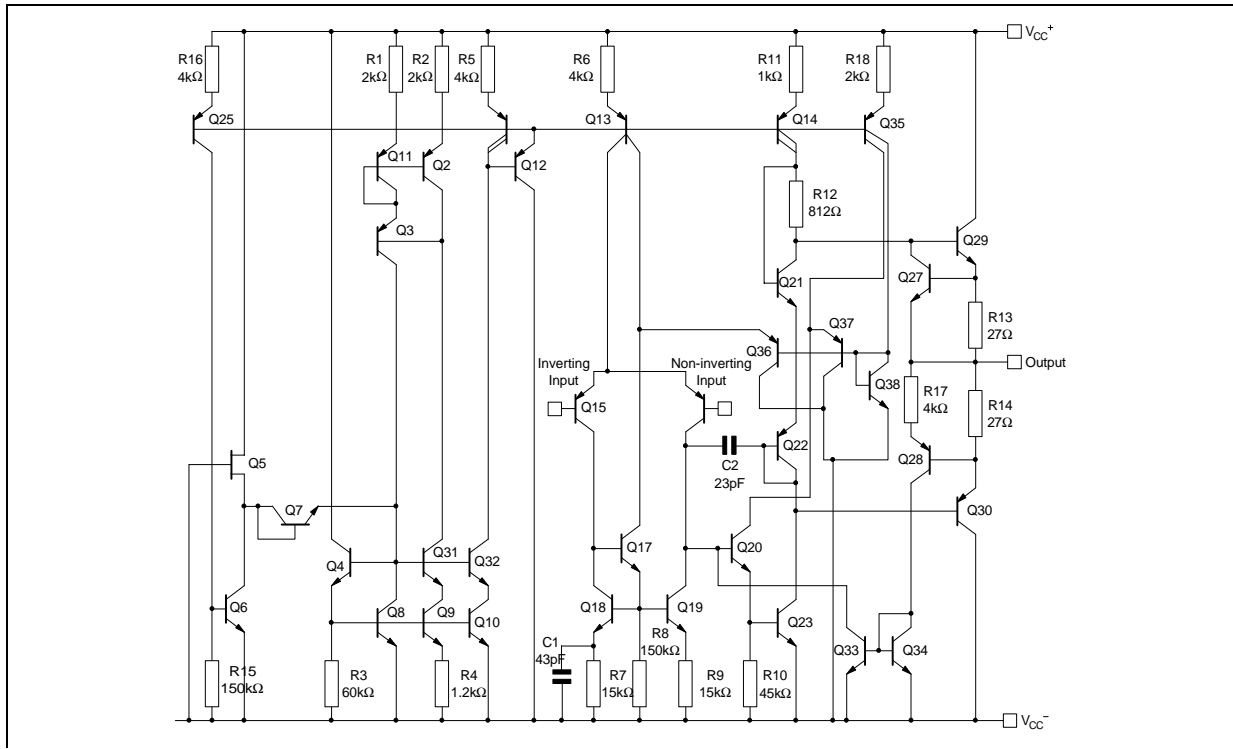


### ORDER CODE

Part Number	Temperature Range	Package	
		N	D
TS512I	-40°C, +125°C	•	•
TS512AI	-40°C, +125°C	•	•

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

**SCHEMATIC DIAGRAM (1/2 TS512)**



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	$\pm 18$	V
$V_i$	Input Voltage	$\pm V_{CC}$	
$V_{id}$	Differential Input Voltage	$\pm (V_{CC} - 1)$	
$T_{oper}$	Operating Free-Air Temperature Range	-40 to +125	$^{\circ}C$
$P_{tot}$	Power Dissipation at $T_{amb} = 70^{\circ}C$ <sup>1)</sup>	500	mW
$T_j$	Junction Temperature	+ 150	$^{\circ}C$
$T_{stg}$	Storage Temperature Range	-65 to +150	$^{\circ}C$

1. Power dissipation must be considered to ensure maximum junction temperature ( $T_j$ ) is not exceeded.

**ELECTRICAL CHARACTERISTICS** $V_{CC} = \pm 15V$ ,  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
$I_{CC}$	Supply Current		0.7	1.2	mA
$I_{ib}$	Input Bias Current $T_{min} \leq T_{op} \leq T_{max}$		50	150 300	nA
$R_i$	Input Resistance, $f = 1kHz$		1		M $\Omega$
$V_{io}$	Input Offset Voltage  TS512 TS512A  $T_{min} \leq T_{op} \leq T_{max}$  TS512 TS512A		0.5	2.5 0.5  3.5 1.5	mv
$\Delta V_{io}$	Input Offset Voltage Drift $T_{min} \leq T_{op} \leq T_{max}$		2		$\mu V/^{\circ}C$
$I_{io}$	Input Offset Current $T_{min} \leq T_{op} \leq T_{max}$		5	20 40	nA
$\Delta I_{io}$	Input Offset Current Drift $T_{min} \leq T_{op} \leq T_{max}$		0.08		$\frac{nA}{^{\circ}C}$
$I_{os}$	Output Short Circuit Current		23		mA
$A_{vd}$	Large Signal Voltage Gain $R_L = 2k\Omega$  $V_{CC} = \pm 15V$ $V_{CC} = \pm 4V$	90	100 95		dB
GBP	Gain-bandwidth Product, $f = 100kHz$	1.8	3		MHz
$e_n$	Equivalent Input Noise Voltage, $f = 1kHz$ $R_s = 50\Omega$ $R_s = 1k\Omega$ $R_s = 10k\Omega$		8 10 18		$\frac{nV}{\sqrt{Hz}}$
THD	Total Harmonic Distortion $A_v = 20dB$ $V_o = 2V_{pp}$  $R_L = 2k\Omega$ $f = 1kHz$		0.03		%
$\pm V_{opp}$	Output Voltage Swing $R_L = 2k\Omega$  $V_{CC} = \pm 15V$ $V_{CC} = \pm 4V$	$\pm 13$	$\pm 3$		V
$V_{opp}$	Large Signal Voltage Swing $R_L = 10k\Omega$  $f = 10kHz$		28		$V_{pp}$
SR	Slew Rate Unity Gain, $R_L = 2k\Omega$	0.8	1.5		V/ $\mu s$
CMR	Common Mode Rejection Ratio $V_{ic} = \pm 10V$	90			dB
SVR	Supply Voltage Rejection Ratio	90			dB
$V_{o1}/V_{o2}$	Channel Separation,  $f = 1kHz$		120		dB

## TS512, A

### MACROMODEL

\*\* Standard Linear Ics Macromodels, 1993.

\*\* CONNECTIONS :

- \* 1 INVERTING INPUT
- \* 2 NON-INVERTING INPUT
- \* 3 OUTPUT
- \* 4 POSITIVE POWER SUPPLY
- \* 5 NEGATIVE POWER SUPPLY

.SUBCKT TS512 1 3 2 4 5 (analog)

\*\*\*\*\*

.MODEL MDTH D IS=1E-8 KF=6.565195E-17  
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 2.600000E+01  
RIN 15 16 2.600000E+01  
RIS 11 15 1.061852E+02  
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 1.000000E-05  
CPS 11 15 12.47E-10  
DINN 17 13 MDTH 400E-12  
VIN 17 5 1.500000E+00  
DINR 15 18 MDTH 400E-12  
VIP 4 18 1.500000E+00  
FCP 4 5 VOFP 3.400000E+01  
FCN 5 4 VOFN 3.400000E+01

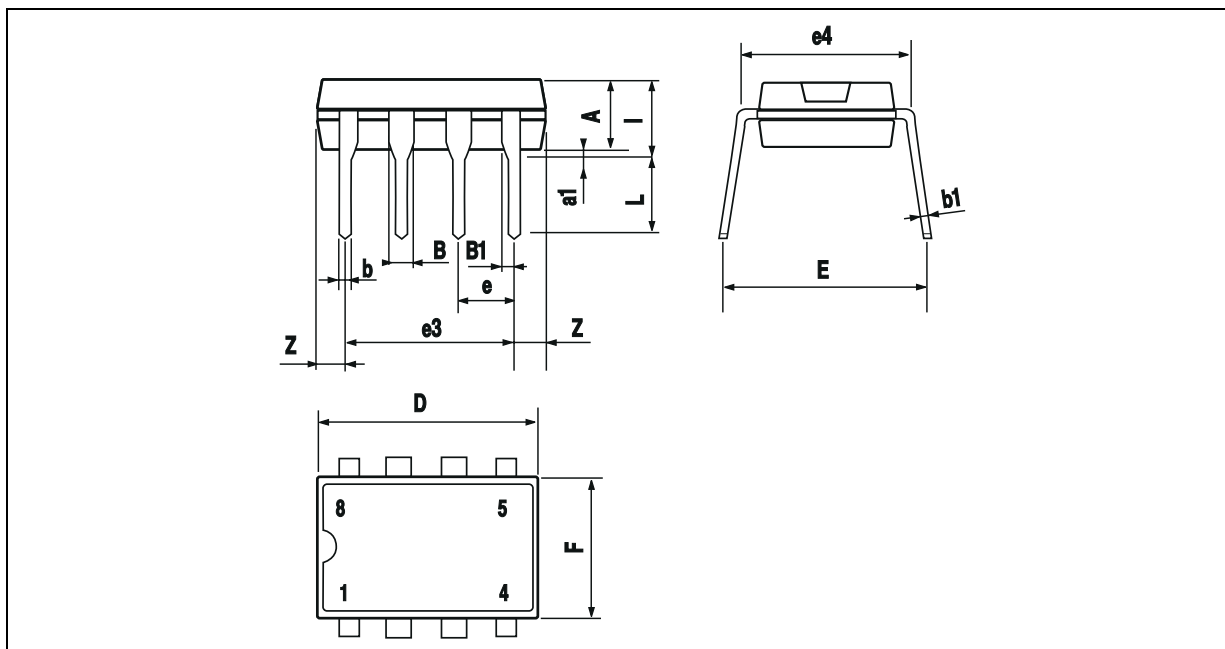
FIBP 2 5 VOFN 1.000000E-02  
FIBN 5 1 VOFP 1.000000E-02  
\* AMPLIFYING STAGE  
FIP 5 19 VOFP 9.000000E+02  
FIN 5 19 VOFN 9.000000E+02  
RG1 19 5 1.727221E+06  
RG2 19 4 1.727221E+06  
CC 19 5 6.000000E-09  
DOPM 19 22 MDTH 400E-12  
DONM 21 19 MDTH 400E-12  
HOPM 22 28 VOUT 6.521739E+03  
VIPM 28 4 1.500000E+02  
HONM 21 27 VOUT 6.521739E+03  
VINM 5 27 1.500000E+02  
GCOMP 5 4 4 5 6.485084E-04  
RPM1 5 80 1E+06  
RPM2 4 80 1E+06  
GAVPH 5 82 19 80 2.59E-03  
RAVPHGH 82 4 771  
RAVPHGB 82 5 771  
RAVPHDH 82 83 1000  
RAVPHDB 82 84 1000  
CAVPHH 4 83 0.331E-09  
CAVPHB 5 84 0.331E-09  
EOUT 26 23 82 5 1  
VOUT 23 5 0  
ROUT 26 3 6.498455E+01  
COUT 3 5 1.000000E-12  
DOP 19 25 MDTH 400E-12  
VOP 4 25 1.742230E+00  
DON 24 19 MDTH 400E-12  
VON 24 5 1.742230E+00  
.ENDS

### ELECTRICAL CHARACTERISTICS

$V_{CC} = \pm 15V$ ,  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

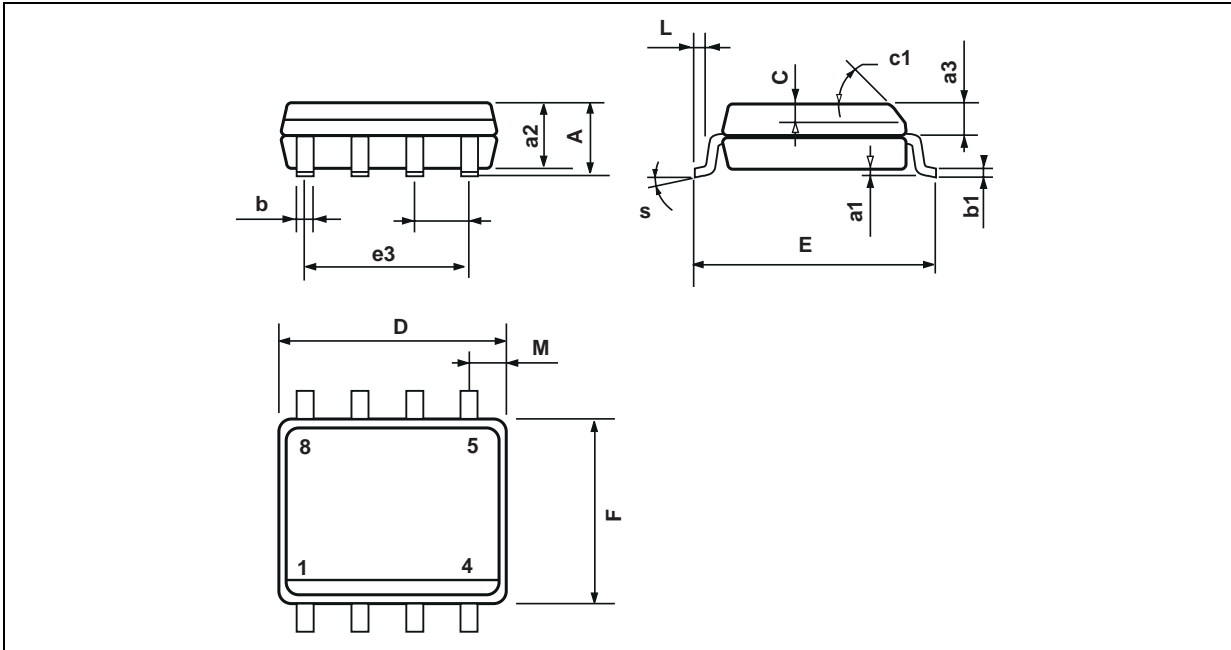
Symbol	Conditions	Value	Unit
$V_{io}$		0	mV
$A_{vd}$	$R_L = 2k\Omega$	100	V/mV
$I_{cc}$	No load, per operator	350	$\mu A$
$V_{icm}$		-13.5 to 13.5	V
$V_{OH}$	$R_L = 2k\Omega$	+13	V
$V_{OL}$	$R_L = 2k\Omega$	-13	V
$I_{sink}$	$V_o = 0V$	23	mA
$I_{source}$	$V_o = 0V$	23	mA
GBP	$R_L = 2k\Omega$ , $C_L = 100pF$	3	MHz
SR	$R_L = 2k\Omega$	1.4	V/ $\mu s$
$\varnothing m$	$R_L = 2k\Omega$ , $C_L = 100pF$	55	Degrees

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



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0.260
i			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

**PACKAGE MECHANICAL DATA**  
**8 PINS - PLASTIC MICROPACKAGE (SO)**



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.150		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

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