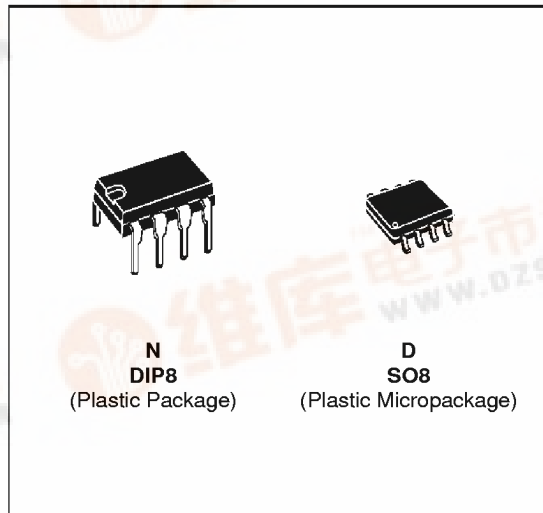




## TSH10

### 140MHz BANDWIDTH LOW NOISE SINGLE OPERATIONAL AMPLIFIER

- LOW NOISE :  $6\text{nV}/\sqrt{\text{Hz}}$
- GAIN BANDWIDTH PRODUCT : 140MHz
- UNITY GAIN STABLE
- SLEW RATE :  $150\text{V}/\mu\text{s}$
- STANDARD PIN OUT



#### DESCRIPTION

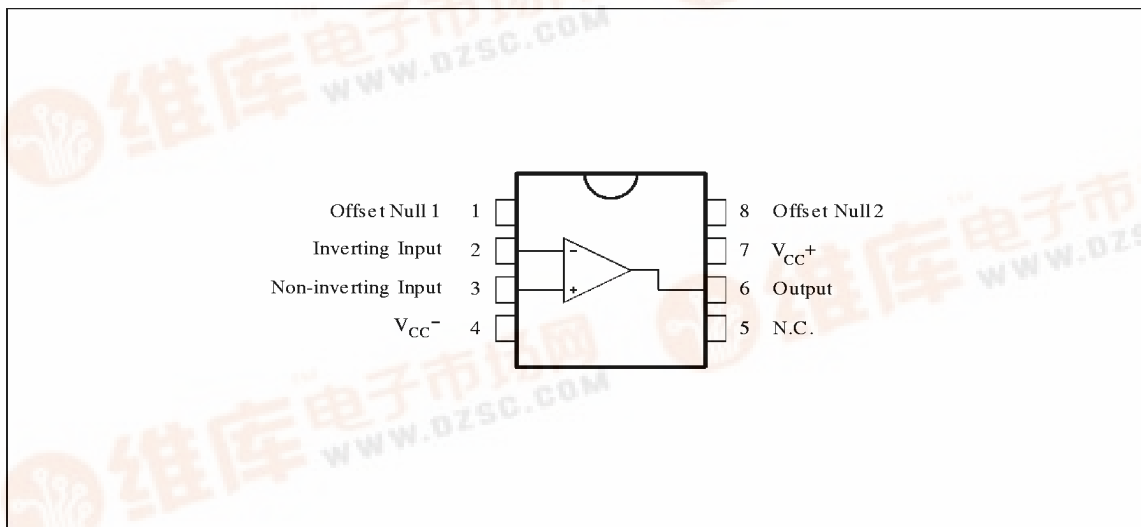
The TSH10 is a low cost wide bandwidth single operational amplifier featuring low input noise of  $6\text{nV}/\sqrt{\text{Hz}}$ . Other features as unity gain stability, fast settling time and high linearity make it suitable for any application requiring speed and precision as high resolution video or DAC buffer.

#### ORDER CODES

Part Number	Temperature Range	Package	
		N	D
TSH10I	-40°C, 125°C	•	•

TSH10-01.TEL

#### PIN CONNECTIONS (top view)

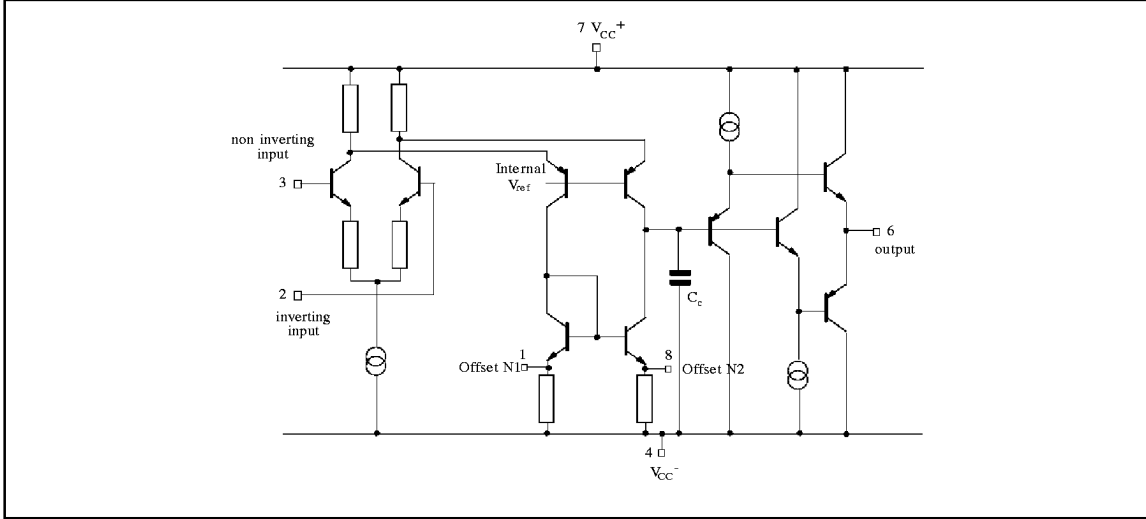


TSH10-01.EPS



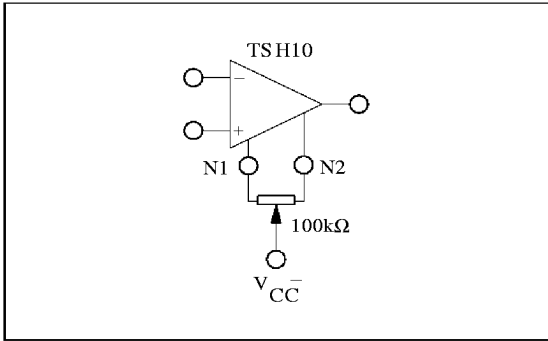
# TSH10

## SCHEMATIC DIAGRAM



TSH10-02.EPS

## INPUT OFFSET VOLTAGE NULL CIRCUIT



TSH10-03.EPS

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	$\pm 7$	V
$V_{id}$	Differential Input Voltage	$\pm 5$	V
$V_i$	Input Voltage Range	$\pm 5$	V
$I_{in}$	Current On Inputs Current On Offset Null Pins	$\pm 50$ $\pm 20$	mA
$T_{oper}$	Operating Free-Air Temperature Range	TSH10C TSH10I TSH10M 0 to +70 -40 to +105 -55 to +125	$^{\circ}C$
$T_{stg}$	Storage Temperature Range	-65 to 150	$^{\circ}C$

TSH10-02.TBL

## OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	$\pm 3$ to $\pm 6$	V
$V_{ic}$	Common Mode Input Voltage Range	$V_{CC-} + 2$ to $V_{CC+} - 1$	V

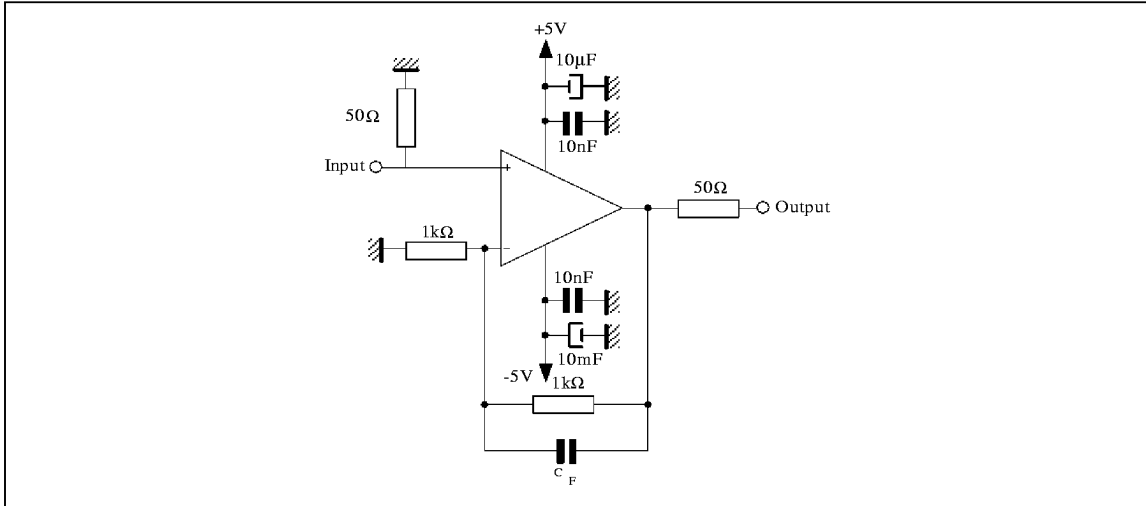
TSH10-03.TBL

**ELECTRICAL CHARACTERISTICS** $V_{CC} = \pm 5V$ ,  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{io}$	Input Offset Voltage		1	10	mV
$DV_{io}$	Input Offset Voltage Drift $T_{min} \leq T_{amb} \leq T_{max}$		20		$\mu V/^{\circ}C$
$I_{ib}$	Input Bias Current		5	30	$\mu A$
$I_{io}$	Input Offset Current		0.1	10	$\mu A$
$I_{CC}$	Supply Current, no load $V_{CC} = \pm 5V$		20	40	mA
$A_{vd}$	Large Signal Voltage Gain $V_o = \pm 2.5V$ $R_L = 100\Omega$	200	800		V/V
$V_{icm}$	Input Common Mode Voltage Range	-3 to +4	-3.5 to +4.5		V
CMR	Common Mode Rejection Ratio $V_{ic} = V_{icm \min.}$	55	100		dB
SVR	Supply Voltage Rejection Ratio $V_{CC} = \pm 5V$ to $\pm 3V$	45	70		dB
$V_o$	Output Voltage $R_L = 100\Omega$	$\pm 2.5$	+3.5 -3.7		V
$I_o$	Output Short Circuit Current $V_{id} = \pm 1V$ , $V_o = 0V$		$\pm 70$		mA
GBP	Gain Bandwidth Product $A_{VCL} = 100$ , $R_L = 100\Omega$ , $f = 7.5MHz$		140		MHz
SR	Slew Rate $V_{in} = \pm 2V$ , $A_{VCL} = 1$ , $R_L = 100\Omega$		150		V/ $\mu s$
$e_n$	Equivalent Input Voltage Noise $f = 1MHz$		6		$\frac{nV}{\sqrt{Hz}}$
$\phi_m$	Phase Margin $A_{VM} = 1$ , $R_L = 100\Omega$ , $C_L = 15pF$		40		Degrees

TSH10-04.TBL

## EVALUATION CIRCUIT



TSH10-04.EPS

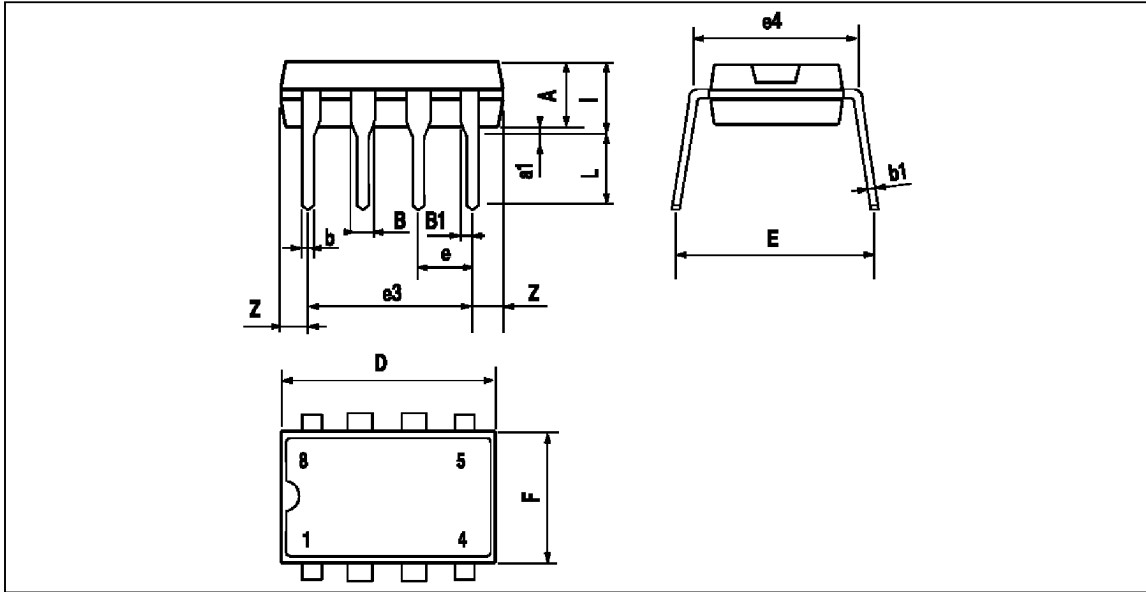
## PRINTED CIRCUIT LAYOUT

As for any high frequency device, a few rules must be observed when designing the PCB to get the best performances from this high speed op amp.

From the most to the least important points :

- Each power supply lead has to be bypassed to ground with a 10nF ceramic capacitor very close to the device and a 10μF tantalum capacitor.
- To provide low inductance and low resistance common return, use a ground plane or common point return for power and signal.
- All leads must be wide and as short as possible especially for op amp inputs. This is in order to decrease parasitic capacitance and inductance.
- Use small resistor values to decrease time constant with parasitic capacitance. Be aware on TSH10 device of the  $I_{io}$  error and input noise currents with high feedback resistor values.
- Choose component sizes as small as possible (SMD).
- On output, decrease capacitor load so as to avoid circuit stability being degraded which may cause oscillation. You can also add a serial resistor in order to minimise its influence.
- One can add in parallel with feedback resistor a few pF ceramic capacitor  $C_F$  adjusted to optimize the settling time.

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



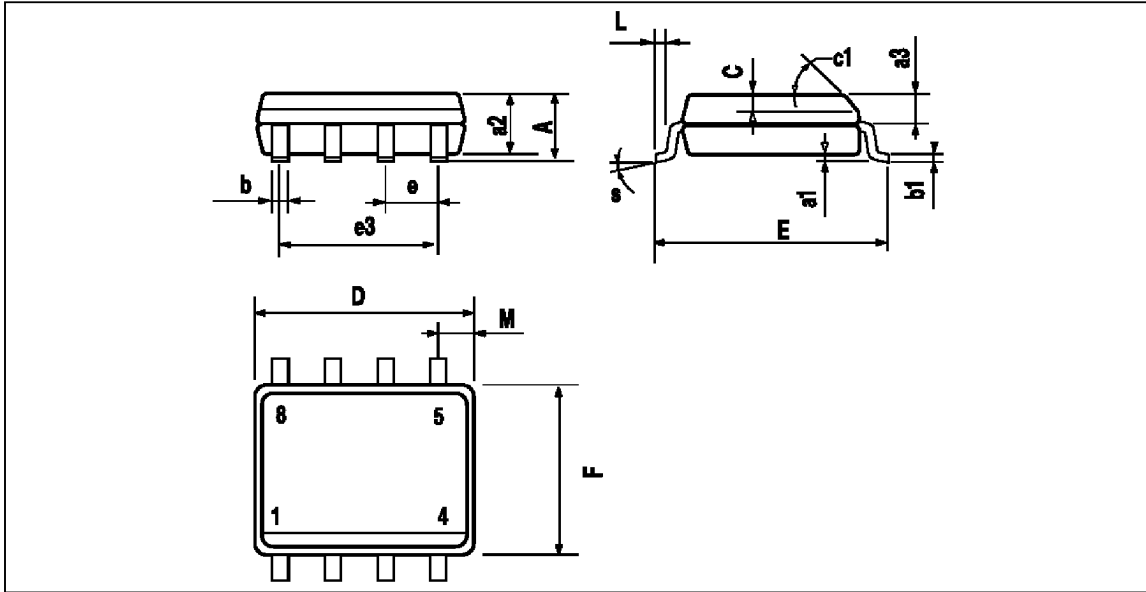
PM-DIP8.EPS

Dimensions	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

DIP8.TBL

# TSH10

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



PM:SO8:EPS

Dimensions	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.)					

SO8:TBL

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