



# 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

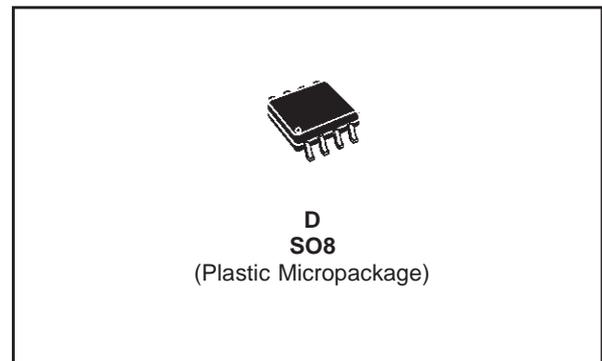
### DESCRIPTION

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.

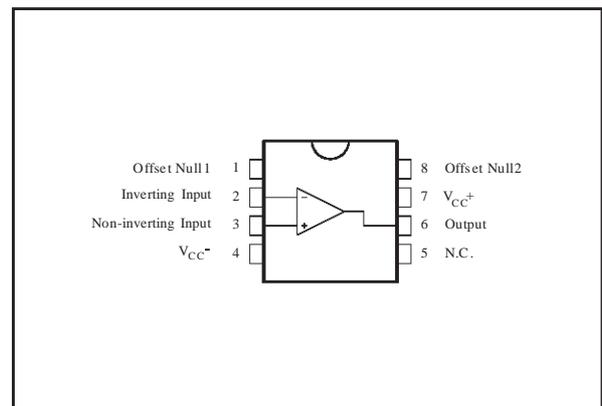
### ORDER CODE

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

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

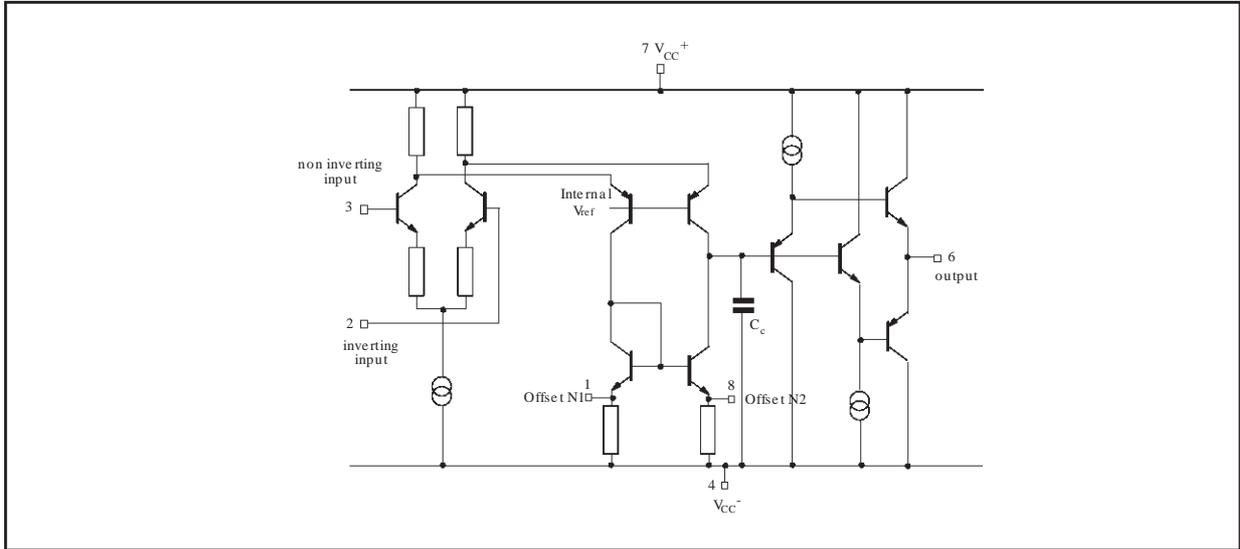


### PIN CONNECTIONS (top view)

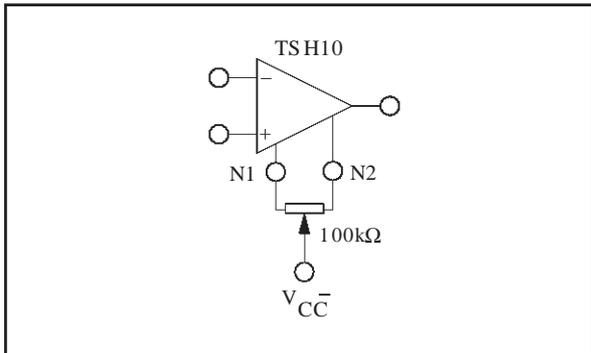


# TSH10

## SCHEMATIC DIAGRAM



## INPUT OFFSET VOLTAGE NULL CIRCUIT



## 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	$\pm 5$	V
$I_{in}$	Current On Inputs Current On Offset Null Pins	$\pm 50$ $\pm 20$	$\mu$ A
$T_{oper}$	Operating Free-Air Temperature range	-40 to +125	$^{\circ}$ C
$T_{stg}$	Storage Temperature Range	-65 to +150	$^{\circ}$ C

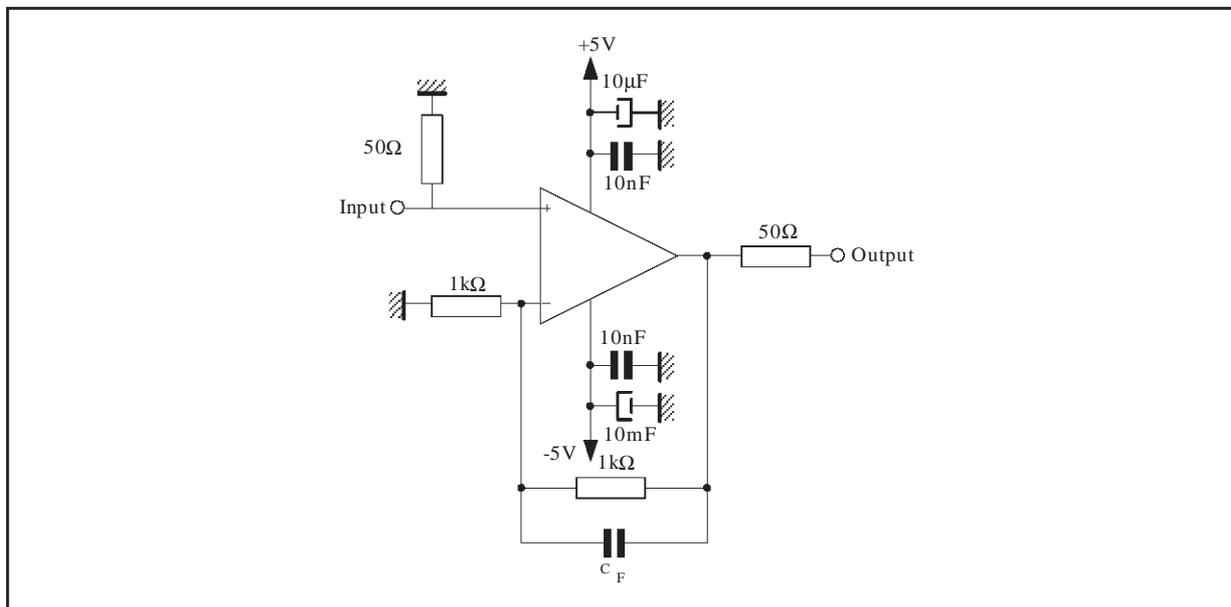
## OPERATING CONDITIONS

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

**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 $V_{ic} = V_{icm \text{ min.}}$	55	100		V
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		nV/ $\sqrt{Hz}$
$\phi_m$	Phase Margin $A_{VM} = 1$ , $R_L = 100\Omega$ , $C_L = 15pF$		40		Degrees

## EVALUATION CIRCUIT



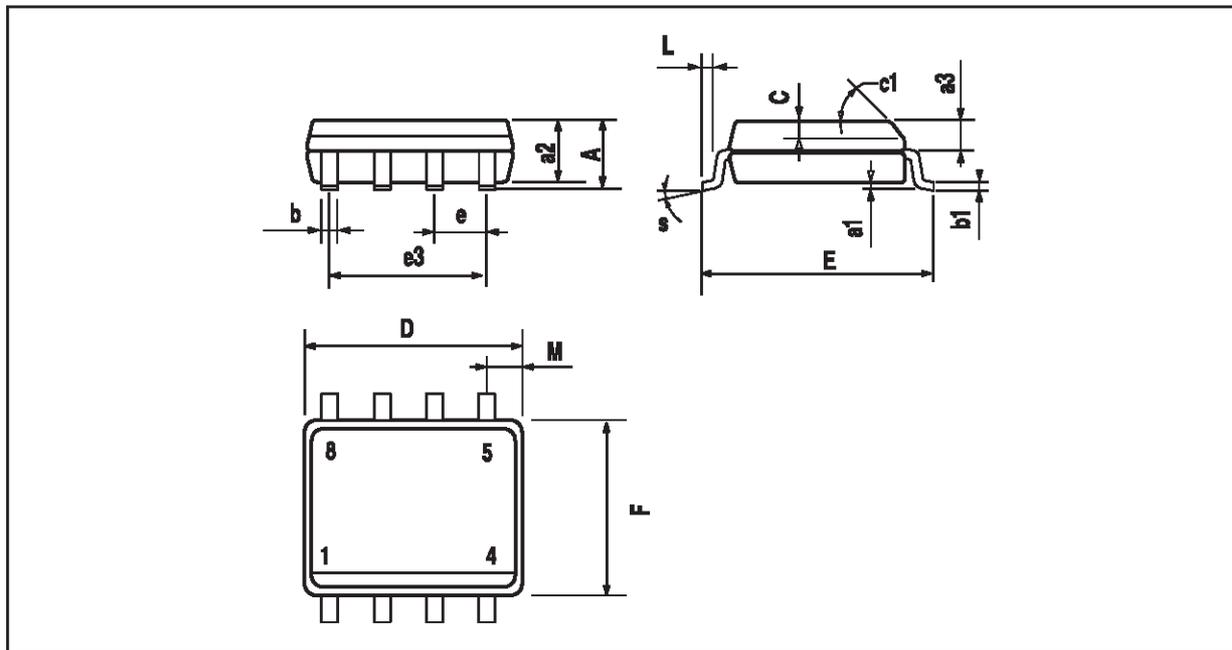
## PRINTED CIRCUIT LAYOUT

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<sub>io</sub> 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<sub>F</sub> adjusted to optimize the settling time.

**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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