

### Features

- Wide Operating Voltage
- Low input offset voltage
- Low Quiescent Current
- Unity Gain Stable (HT92112)
- Non-unity Gain Stable (HT92122)
- Rail to Rail input and output operation
- -40°C to +85°C Operating Temperature Range
- Dual amplifiers per package
- Package types: 8-pin SOP/MSOP

### Applications

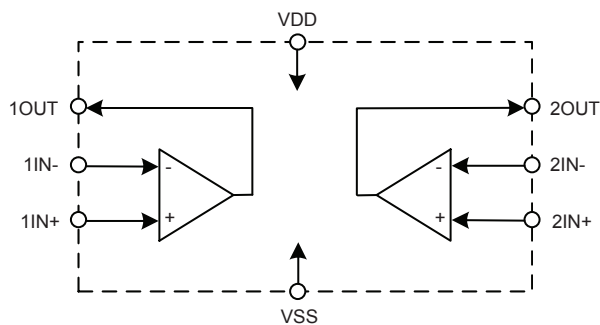
- Tollbooth Tags
- Wearable Products
- Temperature Measurement
- Battery Powered Systems

### General Description

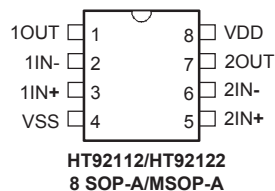
The HT92112/HT92122 family of low power operational amplifiers offers the benefits of low power consumption, low offset voltage and low offset drift. They have low 1/f noise and have good PSRR and CMRR characteristics. The devices also provide full rail-to-rail input and output operation. The HT92112 has a gain bandwidth product of 14kHz while the HT92122 has a gain bandwidth product of 100kHz. These devices operate with a single supply voltage as low as 1.4V and with a low supply current of 1μA/amplifier (Max.). These low power operational amplifiers can be implemented in a wide range of applications for portable devices and battery powered equipment.

With their single supply operation and low power consumption features coupled with their low offset voltage these operational amplifiers are suitable for use in a wide range of applications. With regard to packaging, both devices are supplied in 8-pin SOP/MSOP package formats.

### Block Diagram



### Pin Assignment



## Pin Description

Pin Number	Pin Name	Description
1	1OUT	Output – OPA1
2	1IN-	Inverting Input – OPA1
3	1IN+	Non-inverting Input – OPA1
4	VSS	Negative Power Supply
5	2IN+	Non-inverting Input – OPA2
6	2IN-	Inverting Input – OPA2
7	2OUT	Output – OPA2
8	VDD	Positive Power Supply

## Selection Table

Device Name	Amplifiers	Operating Voltage	Gain Bandwidth (Typ.)	V <sub>os</sub> (Max.)	ΔV <sub>os</sub> /ΔT <sub>A</sub> (Typ.)	Slew Rate (Typ.)	Package Type
HT92112	2	1.4V~5.5V	14kHz	3mV	2μV	0.003V/μs	8SOP/MSOP
HT92122	2	1.4V~5.5V	100kHz	3mV	2μV	0.024V/μs	8SOP/MSOP

## Absolute Maximum Ratings

Supply Voltage .....	V <sub>SS</sub> -0.3V to 6.0V	I <sub>OL</sub> Total .....	80mA
Input Voltage.....	V <sub>SS</sub> -0.3V to V <sub>DD</sub> +0.3V	I <sub>OH</sub> Total.....	-80mA
Storage Temperature .....	-50°C to 150°C	Total Power Dissipation .....	500mW
Operating Temperature.....	-40°C to 85°C		

Note: These are stress ratings only. Stresses exceeding the range specified under “Absolute Maximum Ratings” may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

## Electrical Characteristics

**HT92112**

Unless otherwise indicated,

 $V_{DD}=1.4V \sim 5.5V$ ,  $V_{SS}=GND$ ,  $T_a=25^{\circ}C$ ,  $V_{CM}=V_{DD}/2$ ,  $V_{OUT}=V_{DD}/2$ ,  $V_L=V_{DD}/2$ ,  $R_L=1M\Omega$  to  $V_L$ 

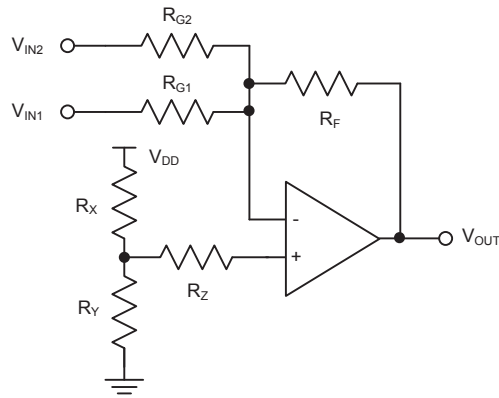
Symbol	Parameters	Conditions	Min.	Typ.	Max.	Unit
<b>Input Characteristics</b>						
$V_{OS}$	Input Offset Voltage	$V_{CM}=V_{SS}$	-3	—	3	mV
$\Delta V_{OS}/\Delta T_A$	Input Offset Voltage Drift with Temperature	$V_{CM}=V_{SS}$ , $T_a=-40^{\circ}C \sim 85^{\circ}C$	—	$\pm 2$	—	$\mu V/^{\circ}C$
$I_B$	Input Bias Current	$T_a=25^{\circ}C$	—	1	—	pA
$I_{OS}$	Input Offset Current	$T_a=25^{\circ}C$	—	1	—	pA
$Z_{CM}$	Common Mode Input Impedance	—	—	$10^{13}  6$	—	$\Omega  pF$
$Z_{DIFF}$	Differential Input Impedance	—	—	$10^{13}  6$	—	
$V_{CML}$	Common Mode Input Voltage Range Low	—	—	—	$V_{SS}-0.3$	V
$V_{CMH}$	Common Mode Input Voltage Range High	—	$V_{DD}+0.3$	—	—	
CMRR	Common Mode Rejection	$V_{DD}=5V$ , $V_{CM}=-0.3V$ to $5.3V$	62	80	—	dB
		$V_{DD}=5V$ , $V_{CM}=2.5V$ to $5.3V$	60	75	—	
		$V_{DD}=5V$ , $V_{CM}=-0.3V$ to $2.5V$	60	80	—	
PSRR	Power Supply Rejection	$V_{CM}=V_{SS}$	70	85	—	dB
$A_{OL}$	DC Open-Loop Gain (Large Signal)	$R_L=50k\Omega$ to $V_L$ , $V_{OUT}=0.1V$ to $V_{DD}-0.1V$	95	115	—	dB
<b>Output Characteristics</b>						
$V_{OL}$	Minimum Output Voltage Swing	$R_L=50k\Omega$ to $V_L$ , 0.5V input overdrive	—	—	$V_{SS}+10$	mV
$V_{OH}$	Maximum Output Voltage Swing	$R_L=50k\Omega$ to $V_L$ , 0.5V input overdrive	$V_{DD}-10$	—	—	
$V_{OVR}$	Linear Region Output Voltage Swing	$R_L=50k\Omega$ to $V_L$ , $A_{OL} \geq 95dB$	$V_{SS}+100$	—	$V_{DD}-100$	mV
$I_{SC}$	Output Short Circuit Current	$V_{DD}=1.4V$	—	2	—	mA
		$V_{DD}=5.5V$	25	30	—	mA
<b>Power Supply</b>						
—	Supply Voltage	—	1.4	—	5.5	V
$I_Q$	Quiescent Current per Amplifier	$I_{OUT}=0$ , $T_a=25^{\circ}C$	0.3	0.6	1.0	$\mu A$
<b>Temperature</b>						
$T_a$	Operating Temperature Range	—	-40	—	85	$^{\circ}C$
<b>Dynamic Response (<math>C_L=60pF</math>)</b>						
GBWP	Gain Bandwidth Product	—	7	14	—	kHz
SR	Slew Rate	—	1	3	—	V/ms
PM	Phase Margin	$G=+1V/V$	45	60	—	degree
<b>Noise (<math>C_L=60pF</math>)</b>						
$E_{ni}$	Input Noise Voltage	$f=0.1Hz$ to $10Hz$	—	8	12	$\mu V_{P-P}$
$e_{ni}$	Input Noise Voltage Density	$f=1kHz$	—	180	350	$nV/\sqrt{Hz}$

**HT92122**

Unless otherwise indicated,  
 $V_{DD}=1.4V \sim 5.5V$ ,  $V_{SS}=GND$ ,  $T_a=25^\circ C$ ,  $V_{CM}=V_{DD}/2$ ,  $V_{OUT}=V_{DD}/2$ ,  $V_L=V_{DD}/2$ ,  $R_L=1M\Omega$  to  $V_L$

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Unit
<b>Input Characteristics</b>						
$V_{OS}$	Input Offset Voltage	$V_{CM}=V_{SS}$	-3	—	3	mV
$\Delta V_{OS}/\Delta T_A$	Input Offset Voltage Drift with Temperature	$V_{CM}=V_{SS}$ , $T_a=-40^\circ C \sim 85^\circ C$	—	$\pm 2$	—	$\mu V/^\circ C$
$I_B$	Input Bias Current	$T_a=25^\circ C$	—	1	—	pA
$I_{OS}$	Input Offset Current	$T_a=25^\circ C$	—	1	—	pA
$Z_{CM}$	Common Mode Input Impedance	—	—	$10^{13}  6$	—	$\Omega  pF$
$Z_{DIFF}$	Differential Input Impedance	—	—	$10^{13}  6$	—	
$V_{CML}$	Common Mode Input Voltage Range Low	—	—	—	$V_{SS}-0.3$	V
$V_{CMH}$	Common Mode Input Voltage Range High	—	$V_{DD}+0.3$	—	—	
CMRR	Common Mode Rejection Ratio	$V_{DD}=5V$ , $V_{CM}=-0.3V$ to $5.3V$	62	80	—	dB
		$V_{DD}=5V$ , $V_{CM}=2.5V$ to $5.3V$	60	75	—	
		$V_{DD}=5V$ , $V_{CM}=-0.3V$ to $2.5V$	60	80	—	
PSRR	Power Supply Rejection Ratio	$V_{CM}=V_{SS}$	70	85	—	dB
$A_{OL}$	DC Open-Loop Gain (Large Signal)	$R_L=50K\Omega$ to $V_L$ , $V_{OUT}=0.1V$ to $V_{DD}-0.1V$	95	115	—	dB
<b>Output Characteristics</b>						
$V_{OL}$	Minimum Output Voltage Swing	$R_L=50K\Omega$ to $V_L$ , 0.5V input overdrive	—	—	$V_{SS}+10$	mV
$V_{OH}$	Maximum Output Voltage Swing	$R_L=50K\Omega$ to $V_L$ , 0.5V input overdrive	$V_{DD}-10$	—	—	
$V_{OVR}$	Linear Region Output Voltage Swing	$R_L=50K\Omega$ to $V_L$ , $A_{OL} \geq 95dB$	$V_{SS}+100$	—	$V_{DD}-100$	mV
$I_{SC}$	Output Short Circuit Current	$V_{DD}=1.4V$	—	2	—	mA
		$V_{DD}=5.5V$	25	30	—	mA
<b>Power Supply</b>						
—	Supply Voltage	—	1.4	—	5.5	V
$I_Q$	Quiescent Current per Amplifier	$I_{OUT}=0$ , $T_a=25^\circ C$	0.3	0.6	1.0	$\mu A$
<b>Temperature</b>						
$T_a$	Operating Temperature Range	—	-40	—	85	$^\circ C$
<b>Dynamic Response (<math>C_L=60pF</math>)</b>						
GBWP	Gain Bandwidth Product	—	50	100	—	kHz
SR	Slew Rate	—	7	24	—	V/ms
PM	Phase Margin	$G=+10V/V$	50	80	—	degree
<b>Noise (<math>C_L=60pF</math>)</b>						
$E_{ni}$	Input Noise Voltage	$f=0.1Hz$ to $10Hz$	—	8	12	$\mu V_{P-P}$
$e_{ni}$	Input Noise Voltage Density	$f=1kHz$	—	180	350	$nV/\sqrt{Hz}$

Application Circuit



$R_{VIN-} = 1 / (1 / (R_{G1}) + 1 / (R_{G2}) + 1 / (R_F))$ ,  $R_{VIN-}$  = total resistance at the inverting input.

$R_{VIN+} = 1 / (1 / (R_X) + 1 / (R_Y)) + R_Z$ ,  $R_{VIN+}$  = total resistance at the non-inverting input,  $R_{VIN+} = R_{VIN-}$ .

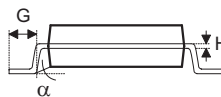
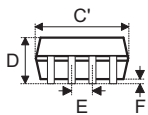
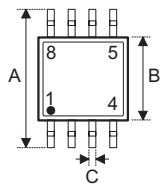
## Package Information

Note that the package information provided here is for consultation purposes only. As this information may be updated at regular intervals users are reminded to consult the [Holtek website](#) for the latest version of the [Package/ Carton Information](#).

Additional supplementary information with regard to packaging is listed below. Click on the relevant section to be transferred to the relevant website page.

- Package Information (include Outline Dimensions, Product Tape and Reel Specifications)
- The Operation Instruction of Packing Materials
- Carton information

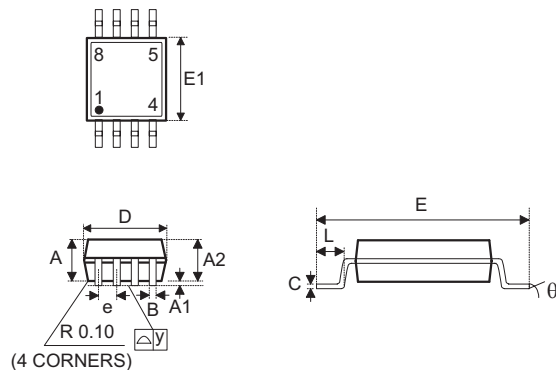
8-pin SOP (150mil) Outline Dimensions



Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	—	0.236 BSC	—
B	—	0.154 BSC	—
C	0.012	—	0.020
C'	—	0.193 BSC	—
D	—	—	0.069
E	—	0.050 BSC	—
F	0.004	—	0.010
G	0.016	—	0.050
H	0.004	—	0.010
$\alpha$	0°	—	8°

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	—	6 BSC	—
B	—	3.9 BSC	—
C	0.31	—	0.51
C'	—	4.9 BSC	—
D	—	—	1.75
E	—	1.27 BSC	—
F	0.10	—	0.25
G	0.40	—	1.27
H	0.10	—	0.25
$\alpha$	0°	—	8°

## 8-pin MSOP Outline Dimensions



Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	—	—	0.043
A1	0.000	—	0.006
A2	0.030	0.033	0.037
B	0.007	—	0.013
C	0.003	—	0.009
D	—	0.115 BSC	—
E	—	0.193 BSC	—
E1	—	0.118 BSC	—
e	—	0.026 BSC	—
L	0.016	0.024	0.031
L1	—	0.037 BSC	—
y	—	0.004	—
$\theta$	0°	—	8°

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	—	—	1.10
A1	0.00	—	0.15
A2	0.75	0.85	0.95
B	0.22	—	0.38
C	0.08	—	0.23
D	—	3.00 BSC	—
E	—	4.90 BSC	—
E1	—	3.00 BSC	—
e	—	0.65 BSC	—
L	0.40	0.60	0.80
L1	—	0.95 BSC	—
y	—	0.10	—
$\theta$	0°	—	8°



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