

### Features

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

### Applications

- Portable Test Equipment
- Medical Instrument
- Sensor Applications
- Temperature Measurements
- Battery Powered Systems

### General Description

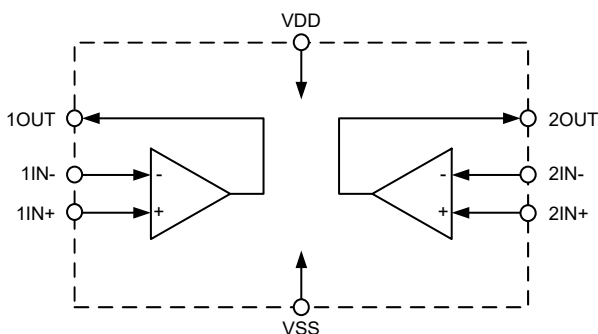
The HT92632/HT92652 family of precision operational amplifiers offers the benefits of low offset voltage and low offset drift. They are unity gain stable, have low 1/f noise as well as good PSRR and CMRR characteristics. The devices also provide full rail-to-rail input and output operation. The HT92632 has a gain bandwidth product of 300kHz while the HT92652 has a gain bandwidth product of 1.5MHz.

These characteristics along with their single supply operation and low power consumption features provide a range of low offset voltage operational amplifiers suitable for use in a wide range of applications, especially for portable devices and battery powered equipment. With regard to packaging, both devices are supplied in 8-pin SOP package formats.

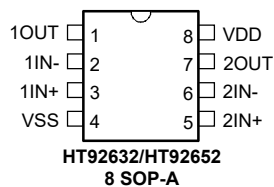
### Selection Table

Device Name	Amplifiers	Operating Voltage	Gain Bandwidth (Typ.)	V <sub>os</sub> (Typ.)	ΔV <sub>os</sub> /ΔT <sub>A</sub> (Typ.)	Slew Rate (Typ.)	Package Type
HT92632	2	2.0V~5.5V	300kHz	15μV	50nV	0.15V/μs	8SOP
HT92652	2	2.0V~5.5V	1.5MHz	10μV(Max.)	50nV(Max.)	0.5V/μs	8SOP

### 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

## Absolute Maximum Ratings

Supply Voltage .....	$V_{SS}-0.3V$ to $6.0V$	$I_{OL}$ Total .....	80mA
Input Voltage .....	$V_{SS}-0.3V$ to $V_{DD}+0.3V$	$I_{OH}$ Total .....	-80mA
Storage Temperature .....	$-50^{\circ}C$ to $150^{\circ}C$	Total Power Dissipation .....	500mW
Operating Temperature .....	$-40^{\circ}C$ to $85^{\circ}C$		

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

**HT92632**

Unless otherwise indicated,  $T_a=25^{\circ}\text{C}$ ,  $V_{DD}=2.0\text{V}$  to  $5.5\text{V}$ ,  $V_{SS}=\text{GND}$ ,  $V_{CM}=V_{DD}/3$ ,  $V_{OUT}\approx V_{DD}/2$ ,  $V_L=V_{DD}/2$ ,  $R_L=100\text{k}\Omega$  to  $V_L$  and  $C_L=30\text{pF}$

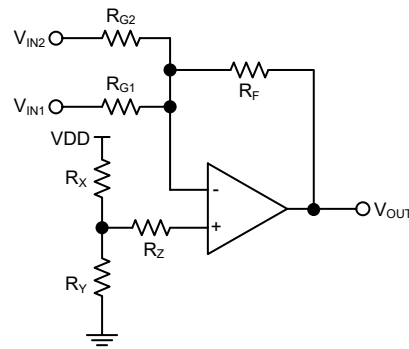
Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
		$V_{DD}$	Conditions				
$V_{DD}$	Supply Voltage	—	$T_a=25^{\circ}\text{C}$	2.0	—	5.5	V
$V_{OS}$	Input Offset Voltage	—	$T_a=25^{\circ}\text{C}$	—	15	40	$\mu\text{V}$
$\Delta V_{OS}/\Delta T_a$	Drift with Temperature	—	$T_a=-40^{\circ}\text{C}\sim 125^{\circ}\text{C}$	-50	—	+50	$\text{nV}/^{\circ}\text{C}$
$I_{OS}$	Input Offset Current	—	$T_a=25^{\circ}\text{C}$	—	100	—	$\mu\text{A}$
$I_B$	Input Bias Current	—	$T_a=25^{\circ}\text{C}$	—	50	—	$\mu\text{A}$
$V_{CML}$	Input Common Mode Range Low	—	—	—	—	$V_{SS}-0.1$	V
$V_{CMH}$	Input Common Mode Range High	—	—	$V_{DD}+0.1$	—	—	V
$V_{OL}$	Minimum Output Voltage Swing	—	$R_L=10\text{k}\Omega$ to $V_L$ , $G=+2$ , $0.5\text{V}$ input overdrive	$V_{SS}$	$V_{SS}+35$	$V_{SS}+80$	mV
$V_{OH}$	Maximum Output Voltage Swing	—	$R_L=10\text{k}\Omega$ to $V_L$ , $G=+2$ , $0.5\text{V}$ input overdrive	$V_{DD}-80$	$V_{DD}-35$	$V_{DD}$	mV
$A_{OL}$	Large Signal DC Open Loop Gain	—	$V_{OUT}=0.3\text{V}\sim V_{DD}-0.3\text{V}$	100	130	—	dB
GBW	Gain Bandwidth Product	—	—	—	300	—	kHz
PM	Phase Margin	—	—	—	70	—	degree
CMRR	Common Mode Rejection Ratio	—	$V_{CM}=-0.1\text{V}\sim V_{DD}+0.1\text{V}$	100	120	—	dB
PSRR	Power Supply Rejection Ratio	—	—	100	120	—	dB
$I_Q$	Quiescent Current/Amplifier	—	$I_{OUT}=0$	10	30	40	$\mu\text{A}$
SR	Slew Rate	—	—	—	0.15	—	$\text{V}/\mu\text{s}$
$I_{SC}$	Output Short Circuit Current	3V	—	—	$\pm 6$	—	mA
		5V	—	—	$\pm 21$	—	mA
$E_{ni}$	Input Noise Voltage	—	$f=0.1\text{Hz}$ to $10\text{Hz}$	—	1	—	$\mu\text{V}_{P-P}$
$e_{ni}$	Input Noise Voltage Density	—	$F<2\text{kHz}$	—	50	—	$\text{nV}/\sqrt{\text{Hz}}$
TOOR	Output Overdrive Recovery Time	—	$G=-10$ , $\pm 0.5\text{V}$ input overdrive to $V_{DD}/2$ , $V_{IN}$ 50% point to $V_{OUT}$ 90%	—	120	—	$\mu\text{s}$
TOCS	Offset Correction Settling Time	—	$G=+1$ , $V_{IN}$ step of $2\text{V}$ , $V_{OS}$ within $100\mu\text{V}$ of its final value	—	100	—	$\mu\text{s}$
Tstart	Start Up Time	—	$G=+1$ , $0.1\%$ $V_{OUT}$ settling	—	2	—	ms

**HT92652**

Unless otherwise indicated,  $T_a=25^{\circ}\text{C}$ ,  $V_{DD}=2.0\text{V}$  to  $5.5\text{V}$ ,  $V_{SS}=\text{GND}$ ,  $V_{CM}=V_{DD}/3$ ,  
 $V_{OUT}\approx V_{DD}/2$ ,  $V_L=V_{DD}/2$ ,  $R_L=20\text{k}\Omega$  to  $V_L$  and  $C_L=60\text{pF}$

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
		$V_{DD}$	Conditions				
$V_{DD}$	Supply Voltage	—	$T_a=25^{\circ}\text{C}$	2.0	—	5.5	V
$V_{OS}$	Input Offset Voltage	—	$T_a=25^{\circ}\text{C}$	-10	—	+10	$\mu\text{V}$
$\Delta V_{OS}/\Delta T_a$	Drift with Temperature	—	$T_a=-40^{\circ}\text{C}\sim 125^{\circ}\text{C}$	-50	—	+50	$\text{nV}/^{\circ}\text{C}$
$I_{OS}$	Input Offset Current	—	$T_a=25^{\circ}\text{C}$	—	100	—	$\text{pA}$
$I_B$	Input Bias Current	—	$T_a=25^{\circ}\text{C}$	—	50	—	$\text{pA}$
$V_{CML}$	Input Common Mode Range Low	—	—	—	—	$V_{SS}-0.1$	V
$V_{CMH}$	Input Common Mode Range High	—	—	$V_{DD}+0.1$	—	—	V
$V_{OL}$	Minimum Output Voltage Swing	—	$R_L=10\text{k}\Omega$ to $V_L$ , $G=+2$ , 0.5V input overdrive	$V_{SS}$	$V_{SS}+35$	$V_{SS}+80$	mV
$V_{OH}$	Maximum Output Voltage Swing	—	$R_L=10\text{k}\Omega$ to $V_L$ , $G=+2$ , 0.5V input overdrive	$V_{DD}-80$	$V_{DD}-35$	$V_{DD}$	mV
$A_{OL}$	Large Signal DC Open Loop Gain	—	$V_{OUT}=0.3\text{V}\sim V_{DD}-0.3\text{V}$	100	130	—	dB
GBW	Gain Bandwidth Product	—	—	1.3	1.5	—	MHz
PM	Phase Margin	—	—	—	70	—	degree
CMRR	Common Mode Rejection Ratio	—	$V_{CM}=-0.1\text{V}\sim V_{DD}+0.1\text{V}$	100	120	—	dB
PSRR	Power Supply Rejection Ratio	—	—	100	120	—	dB
$I_Q$	Quiescent Current/Amplifier	—	$I_{OUT}=0$	—	—	500	$\mu\text{A}$
SR	Slew Rate	—	—	—	0.5	—	$\text{V}/\mu\text{s}$
$I_{SC}$	Output Short Circuit Current	3V	—	—	$\pm 7$	—	mA
		5V	—	—	$\pm 22$	—	mA
$E_{ni}$	Input Noise Voltage	—	$f=0.1\text{Hz}$ to $10\text{Hz}$	—	1	—	$\mu\text{V}_{P-P}$
$e_{ni}$	Input Noise Voltage Density	—	$F<2.5\text{kHz}$	—	120	—	$\text{nV}/\sqrt{\text{Hz}}$
TOOR	Output Overdrive Recovery Time	—	$G=-100$ , $\pm 0.5\text{V}$ input overdrive to $V_{DD}/2$ , $V_{IN}$ 50% point to $V_{OUT}$ 90%	—	120	—	$\mu\text{s}$
TOCS	Offset Correction Settling Time	—	$G=+1$ , $V_{IN}$ step of 2V, $V_{OS}$ within 100 $\mu\text{V}$ of its final value	—	300	—	$\mu\text{s}$
$T_{start}$	Start Up Time	—	$G=+1$ , 0.1% $V_{OUT}$ settling	—	2	—	ms

**Application Circuits**



$$R_{VIN-} = \frac{1}{\frac{1}{R_{G1}} + \frac{1}{R_{G2}} + \frac{1}{R_F}}, R_{VIN-} = \text{total resistance at the inverting input.}$$

$$R_{VIN+} = \frac{1}{\frac{1}{R_X} + \frac{1}{R_Y}} + R_Z, R_{VIN+} = \text{total resistance at the non-inverting input, } R_{VIN+} = R_{VIN-}.$$

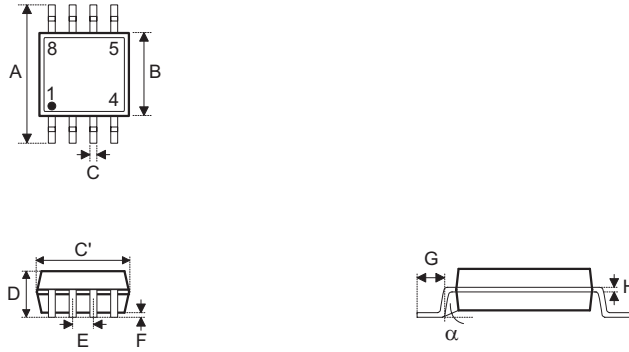
## Package Information

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	—	6.00 BSC	—
B	—	3.90 BSC	—
C	0.31	—	0.51
C'	—	4.90 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°

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