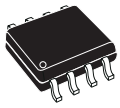
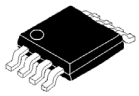
TSV62x, TSV62xA

Rail-to-rail input/output, 29 µA, 420 kHz CMOS operational amplifiers

Datasheet - production data



SO8



MiniSO8/MiniSO10

TSSOP14

TSSOP16

Features

- Rail-to-rail input and output
- Low power consumption: 29 µA typ, 36 µA max
- Low supply voltage: 1.5 – 5.5 V
- Gain bandwidth product: 420 kHz typ
- Unity gain stable on 100 pF capacitor
- Low power shutdown mode: 5 nA typ
- Good accuracy: 800 µV max (A version)
- Low input bias current: 1 pA typ
- EMI hardened operational amplifiers

Related products

- See the TSV61x series for more power savings (120 kHz for 9 µA)
- See the TSV63x series for higher gain bandwidth (880 kHz for 60 µA)

Applications

- Battery-powered applications
- Portable devices
- Signal conditioning
- Active filtering
- Medical instrumentation

Description

The TSV622, TSV622A, TSV623, TSV623A, TSV624, TSV624A, TSV625, and TSV625A dual and quad operational amplifiers offer low voltage, low power operation, and rail-to-rail input and output.

The TSV62x/TSV62xA series feature an excellent speed/power consumption ratio, offering a 420 kHz gain bandwidth product while consuming only 29 µA at 5 V supply voltage.

These op-amps are unity gain stable for capacitive loads up to 100 pF. They also feature an ultra-low input bias current and low input offset voltage. TSV623 (dual) and TSV625 (quad) have two shutdown pins to reduce power consumption.

These features make the TSV62x/TSV62xA family ideal for sensor interfaces, battery-supplied and portable applications, and active filtering.

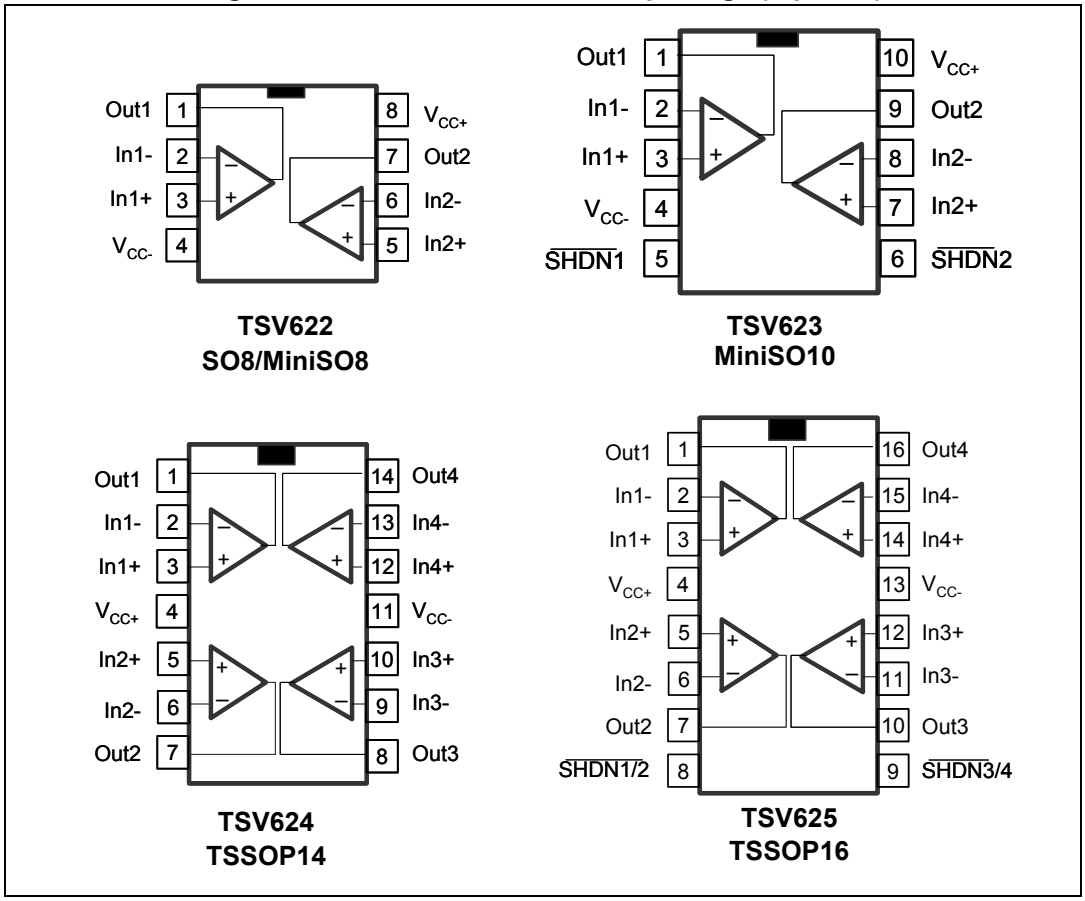
Table 1. Device summary

Reference	Dual version		Quad version	
	Without standby	With standby	Without standby	With standby
TSV62x	TSV622	TSV623	TSV624	TSV625
TSV62xA	TSV622A	TSV623A	TSV624A	TSV625A

Contents

1 Package pin connections

Figure 1. Pin connections for each package (top view)



2 Absolute maximum ratings and operating conditions

Table 2. Absolute maximum ratings (AMR)

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage (1)	6	V
V_{id}	Differential input voltage (2)	$\pm V_{CC}$	
V_{in}	Input voltage (3)	(V_{CC-}) - 0.2 to (V_{CC+}) + 0.2	
I_{in}	Input current (4)	10	mA
$\overline{SHDN}$	Shutdown voltage (3)	(V_{CC-}) - 0.2 to (V_{CC+}) + 0.2	V
T_{stg}	Storage temperature	-65 to 150	°C
R_{thja}	Thermal resistance junction to ambient (5) (6) MiniSO8 SO8 MiniSO10 TSSOP14 TSSOP16	 190 125 113 100 95	°C/W
T_j	Maximum junction temperature	150	°C
ESD	HBM: human body model (7)	4	kV
	MM: machine model (8)	200	V
	CDM: charged device model (9)	1.5	kV
	Latch-up immunity	200	mA

1. All voltage values, except differential voltages are with respect to network ground terminal.
2. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
3. V_{CC}-V_{in} must not exceed 6 V, V_{in} must not exceed 6V.
4. Input current must be limited by a resistor in series with the inputs.
5. Short-circuits can cause excessive heating and destructive dissipation.
6. R_{th} are typical values.
7. Human body model: 100 pF discharged through a 1.5 kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
8. Machine model: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω), done for all couples of pin combinations with other pins floating.
9. Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to ground.

Table 3. Operating conditions

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	1.5 to 5.5	V
V_{icm}	Common mode input voltage range	(V_{CC-}) - 0.1 to (V_{CC+}) + 0.1	
T_{oper}	Operating free air temperature range	-40 to 125	°C

3 Electrical characteristics

Table 4. Electrical characteristics at V_{CC+} = 1.8 V with V_{CC-} = 0 V, V_{icm} = V_{CC}/2, T_{amb} = 25 °C, and R_L connected to V_{CC}/2 (unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DC performance						
V_{io}	Offset voltage	TSV62x TSV62xA TSV623AIST - MiniSO10			4 0.8 1	mV
		TSV62x -T_{min} < T_{op} < T_{max} TSV62xA - T_{min} < T_{op} < T_{max} TSV623AIST - T_{min} < T_{op} < T_{max}			6 2 2.2	
$\Delta V_{io}/\Delta T$	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current (V_{out} = V_{CC}/2)			1	10 (1)	pA
		T_{min} < T_{op} < T_{max}		1	100	
I_{ib}	Input bias current (V_{out} = V_{CC}/2)			1	10 (1)	
		T_{min} < T_{op} < T_{max}		1	100	
CMR	Common mode rejection ratio 20 log ($\Delta V_{ic}/\Delta V_{io}$)	0 V to 1.8 V, V_{out} = 0.9 V	53	74		dB
		T_{min} < T_{op} < T_{max}	51			
A_{vd}	Large signal voltage gain	R_L= 10 kΩ, V_{out}= 0.5 V to 1.3 V	78	95		
		T_{min} < T_{op} < T_{max}	73			
V_{OH}	High level output voltage (V_{OH} = V_{CC} - V_{out})	R_L = 10 kΩ T_{min} < T_{op} < T_{max}		5	35 50	mV
V_{OL}	Low level output voltage	R_L = 10 kΩ T_{min} < T_{op} < T_{max}		4	35 50	
I_{out}	Isink	V_{out} = 1.8 V	6	12		mA
		T_{min} < T_{op} < T_{max}	4			
	Isource	V_{out} = 0 V	6	10		
		T_{min} < T_{op} < T_{max}	4			
I_{CC}	Supply current (per operator)	No load, V_{out} =V_{CC}/2		25	31	µA
		T_{min} < T_{op} < T_{max}			33	
AC performance						
GBP	Gain bandwidth product	R_L = 10 kΩ, C_L = 100 pF, f = 100 kHz	275	340		kHz
F_u	Unity gain frequency	R_L = 10 kΩ, C_L = 100 pF,		280		
ϕm	Phase margin			41		Degrees
G_m	Gain margin			8		dB
SR	Slew rate	R_L = 10 kΩ, C_L = 100 pF, Av=1	0.1	0.155		V/µs

1. Guaranteed by design.

Table 5. Shutdown characteristics V_{CC} = 1.8 V (TSV623, TSV625)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DC performance						
I_{CC}	Supply current in shutdown mode (all operators)	$\overline{SHDN}$ = V_{CC-}		2.5	50	nA
		$T_{min} < T_{op} < 85$ °C			200	
		$T_{min} < T_{op} < 125$° C			1.5	µA
t_{on}	Amplifier turn-on time	R_L = 5 k, Vout = (V_{CC-}) to (V_{CC-}) + 0.2 V		200		ns
t_{off}	Amplifier turn-off time	R_L = 2 k, Vout = (V_{CC+}) - 0.5 V to (V_{CC+}) - 0.7 V		20		
V_{IH}	$\overline{SHDN}$ logic high		1.35			V
V_{IL}	$\overline{SHDN}$ logic low				0.6	
I_{IH}	$\overline{SHDN}$ current high	$\overline{SHDN}$ = V_{CC+}		10		pA
I_{IL}	$\overline{SHDN}$ current low	$\overline{SHDN}$ = V_{CC-}		10		
I_{OLeak}	Output leakage in shutdown mode	$\overline{SHDN}$ = V_{CC-}		50		
		$T_{min} < T_{op} < 125$ °C		1		nA

Table 6. Electrical characteristics at V_{CC+} = 3.3 V with V_{CC-} = 0 V, V_{icm} = V_{CC}/2, T_{amb} = 25 °C, and R_L connected to V_{CC}/2 (unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DC performance						
V_{io}	Offset voltage	TSV62x TSV62xA TSV623AIST - MiniSO10			4 0.8 1	mV
		TSV62x -T_{min} < T_{op} < T_{max} TSV62xA - T_{min} < T_{op} < T_{max} TSV623AIST - T_{min} < T_{op} < T_{max}			6 2 2.2	
$\Delta V_{io}/\Delta T$	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current			1	10 (1)	pA
		T_{min} < T_{op} < T_{max}		1	100	
I_{ib}	Input bias current			1	10 (1)	
		T_{min} < T_{op} < T_{max}		1	100	
CMR	Common mode rejection ratio 20 log ($\Delta V_{ic}/\Delta V_{io}$)	0 V to 3.3 V, V_{out} = 1.65 V	57	79		dB
		T_{min} < T_{op} < T_{max}	53			
A_{vd}	Large signal voltage gain	R_L=10 kΩ, V_{out} = 0.5 V to 2.8 V	81	98		
		T_{min} < T_{op} < T_{max}	76			
V_{OH}	High level output voltage (V_{OH} = V_{CC} - V_{out})	R_L = 10 kΩ T_{min} < T_{op} < T_{max}		5	35 50	mV
V_{OL}	Low level output voltage	R_L = 10 kΩ T_{min} < T_{op} < T_{max}		4	35 50	
I_{out}	Isink	V_o = 5 V	23	45		mA
		T_{min} < T_{op} < T_{max}	20			
	Isource	V_o = 0 V	23	38		
		T_{min} < T_{op} < T_{max}	20			
I_{CC}	Supply current (per operator)	No load, V_{out} = 2.5 V		26	33	µA
		T_{min} < T_{op} < T_{max}			35	
AC performance						
GBP	Gain bandwidth product	R_L = 10 kΩ, C_L = 100 pF, f = 100 kHz	310	380		kHz
F_u	Unity gain frequency	R_L = 10 kΩ, C_L = 100 pF		310		
ϕm	Phase margin			41		Degrees
G_m	Gain margin			8		dB
SR	Slew rate	R_L = 10 kΩ, C_L = 100 pF, A_V = 1	0.11	0.175		V/µs

1. Guaranteed by design.

Table 7. Electrical characteristics at V_{CC+} = 5 V with V_{CC-} = 0 V, V_{icm} = V_{CC}/2, T_{amb} = 25 °C, and R_L connected to V_{CC}/2 (unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DC performance						
V_{io}	Offset voltage	TSV62x TSV62xA TSV623AIST - MiniSO10			4 0.8 1	mV
		TSV62x - $T_{min} < T_{op} < T_{max}$ TSV62xA - $T_{min} < T_{op} < T_{max}$ TSV62xA - $T_{min} < T_{op} < T_{max}$			6 2 2.2	
$\Delta V_{io}/\Delta T$	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current			1	10 (1)	pA
		$T_{min} < T_{op} < T_{max}$		1	100	
I_{ib}	Input bias current			1	10 (1)	
		$T_{min} < T_{op} < T_{max}$		1	100	
CMR	Common mode rejection ratio 20 log ($\Delta V_{ic}/\Delta V_{io}$)	0 V to 5 V, V_{out} = 2.5 V	60	80		dB
		$T_{min} < T_{op} < T_{max}$	55			
A_{vd}	Large signal voltage gain	R_L=10 kΩ, V_{out} = 0.5 V to 4.5 V	85	98		
		$T_{min} < T_{op} < T_{max}$	80			
SVR	Supply voltage rejection ratio 20 log ($\Delta V_{CC}/\Delta V_{io}$)	V_{CC} = 1.8 to 5 V	75	102		
		$T_{min} < T_{op} < T_{max}$	73			
EMIRR	EMI rejection ratio EMIRR = -20 log ($V_{RFpeak}/\Delta V_{io}$)	V_{RF} = 100 mV_{rms}, f = 400 MHz		61		
		V_{RF} = 100 mV_{rms}, f = 900 MHz		85		
		V_{RF} = 100 mV_{rms}, f = 1800 MHz		92		
		V_{RF} = 100 mV_{rms}, f = 2400 MHz		83		
V_{OH}	High level output voltage (V_{OH} = V_{CC} - V_{out})	R_L = 10 kΩ		7	35	mV
		$T_{min} < T_{op} < T_{max}$			50	
V_{OL}	Low level output voltage	R_L = 10 kΩ		6	35	
		$T_{min} < T_{op} < T_{max}$			50	
I_{out}	I_{sink}	V_o = 5 V	40	69		mA
		$T_{min} < T_{op} < T_{max}$	35			
	I_{source}	V_o = 0 V	40	74		
		$T_{min} < T_{op} < T_{max}$	35			
I_{CC}	Supply current (per operator)	No load, V_{out} = 2.5 V		29	36	µA
		$T_{min} < T_{op} < T_{max}$			38	
AC performance						
GBP	Gain bandwidth product	R_L = 10 kΩ, C_L = 100 pF, f = 100 kHz	350	420		kHz
F_u	Unity gain frequency	R_L = 10 kΩ, C_L = 100 pF		360		

Table 7. Electrical characteristics at V_{CC+} = 5 V with V_{CC-} = 0 V, V_{icm} = V_{CC}/2, T_{amb} = 25 °C, and R_L connected to V_{CC}/2 (unless otherwise specified) (continued)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ϕm	Phase margin	R_L = 10 kΩ, C_L = 100 pF		40		Degrees
G_m	Gain margin			8		dB
SR	Slew rate	R_L = 10 kΩ, C_L = 100 pF, A_V = 1	0.12	0.19		V/µs
e_n	Equivalent input noise voltage	f = 1 kHz		77		$\frac{nV}{\sqrt{Hz}}$
THD+e_n	Total harmonic distortion + noise	Av = 1, f = 1 kHz, R_L= 100 kΩ, Vicm = Vcc/2, Vout = 2 Vpp		0.002		%

1. Guaranteed by design.

Table 8. Shutdown characteristics at V_{CC} = 5 V (TSV623, TSV625)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DC performance						
I_{CC}	Supply current in shutdown mode (all operators)	$\overline{SHDN}$ = V_{IL}		5	50	nA
		T_{min} < T_{op} < 85 °C			200	
		T_{min} < T_{op} < 125 °C			1.5	µA
t_{on}	Amplifier turn-on time	R_L = 5 kΩ, V_{out} = (V_{CC-}) to (V_{CC-}) + 0.2 V		200		ns
t_{off}	Amplifier turn-off time	R_L = 5 kΩ, V_{out} = (V_{CC+}) - 0.5 V to (V_{CC+}) - 0.7 V		20		
V_{IH}	$\overline{SHDN}$ logic high		2			V
V_{IL}	$\overline{SHDN}$ logic low				0.8	
I_{IH}	$\overline{SHDN}$ current high	$\overline{SHDN}$ = V_{CC+}		10		pA
I_{IL}	$\overline{SHDN}$ current low	$\overline{SHDN}$ = V_{CC-}		10		
I_{OLeak}	Output leakage in shutdown mode	$\overline{SHDN}$ = V_{CC-}		50		
		T_{min} < T_{op} < 125 °C		1		nA

Figure 2. Supply current vs. supply voltage at $V_{icm} = V_{CC}/2$

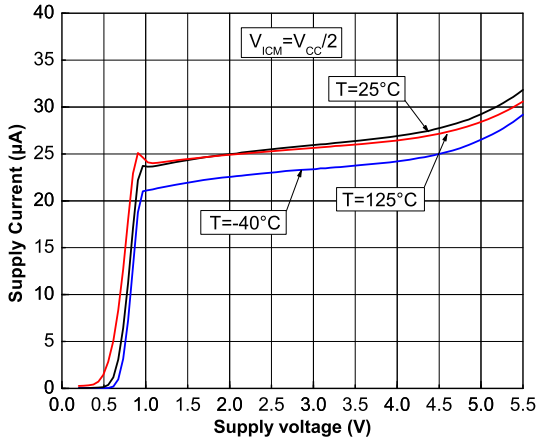


Figure 3. Output current vs. output voltage at $V_{CC} = 1.5$ V

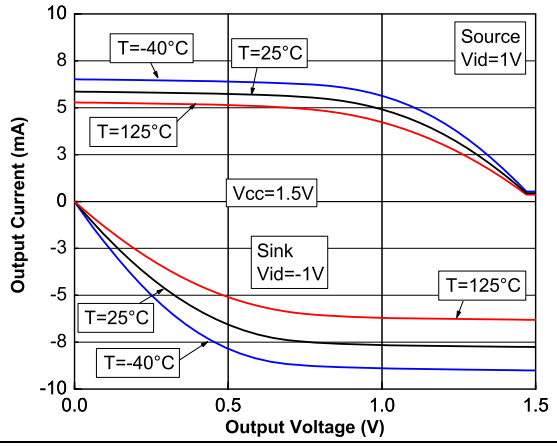


Figure 4. Output current vs. output voltage at $V_{CC} = 5$ V

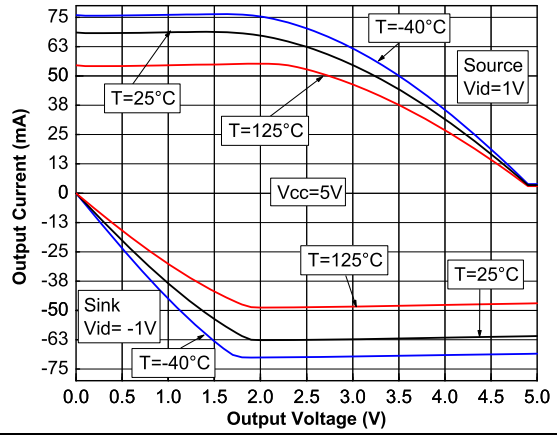


Figure 5. Voltage gain and phase vs. frequency at Vcc = 1.5 V

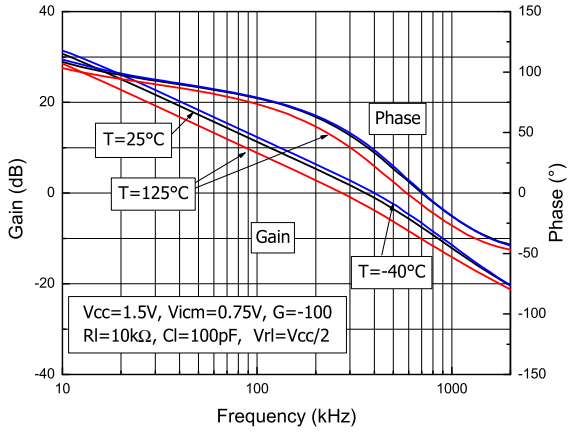


Figure 6. Voltage gain and phase vs. frequency at $V_{CC} = 5$ V

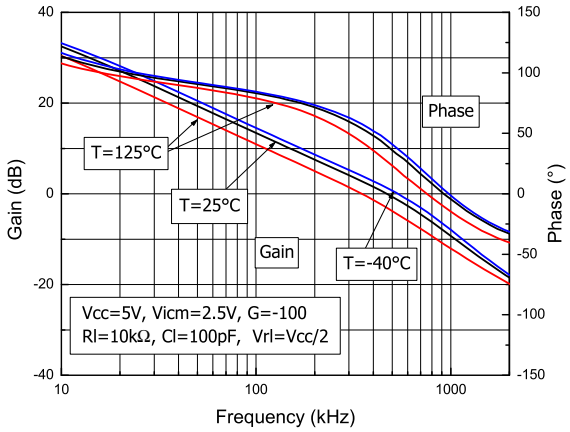


Figure 7. Phase margin vs. output current at $V_{CC} = 1.5$ V and $V_{CC} = 5$ V

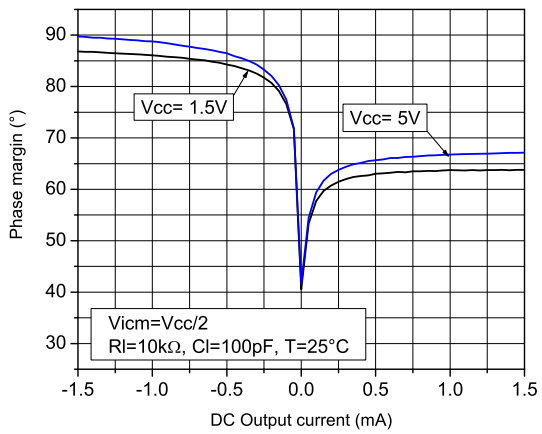


Figure 8. Positive slew rate vs. time

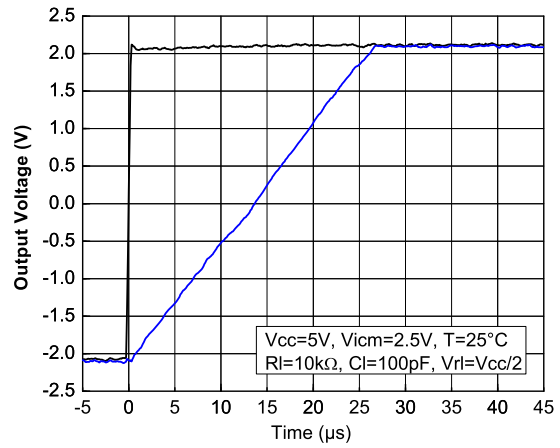


Figure 9. Negative slew rate vs. time

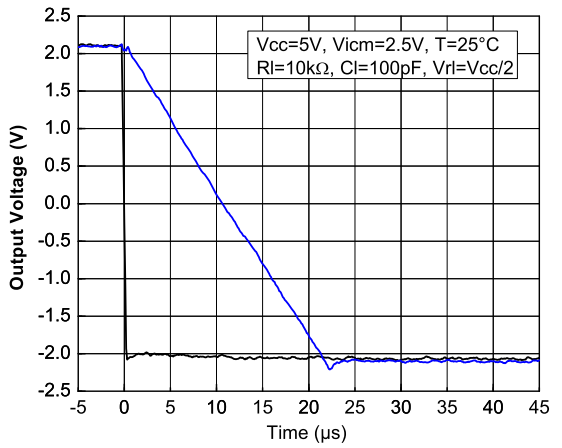


Figure 10. Positive slew rate vs. supply voltage

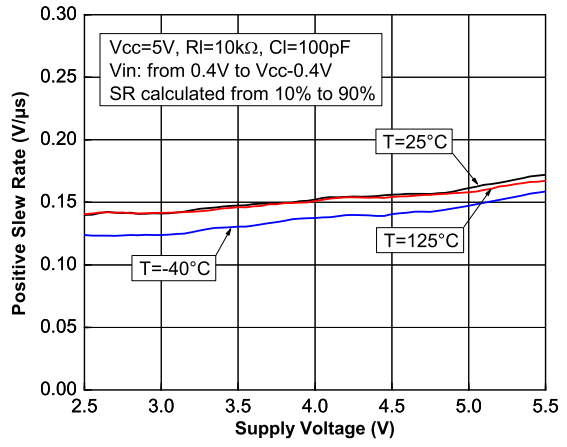


Figure 11. Negative slew rate vs. supply voltage

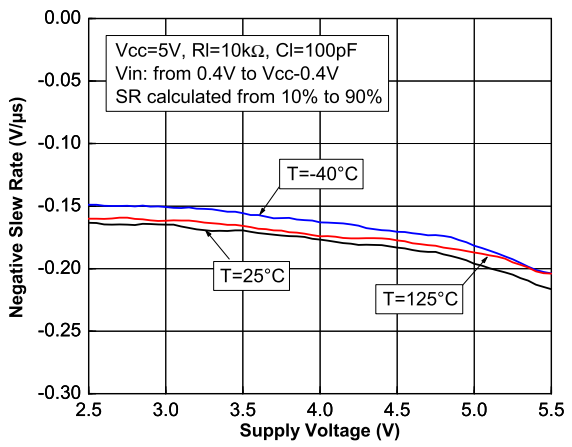


Figure 12. Noise vs. frequency

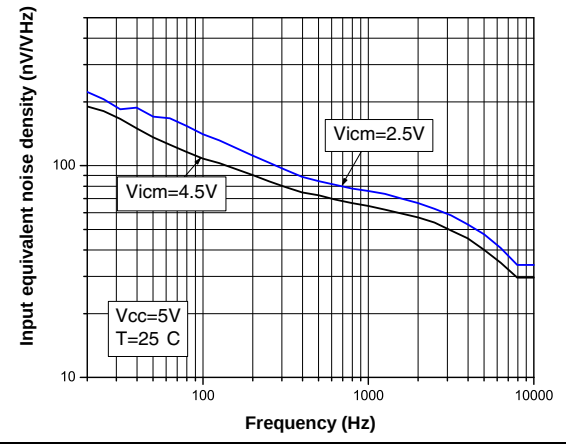


Figure 13. Distortion + noise vs. frequency

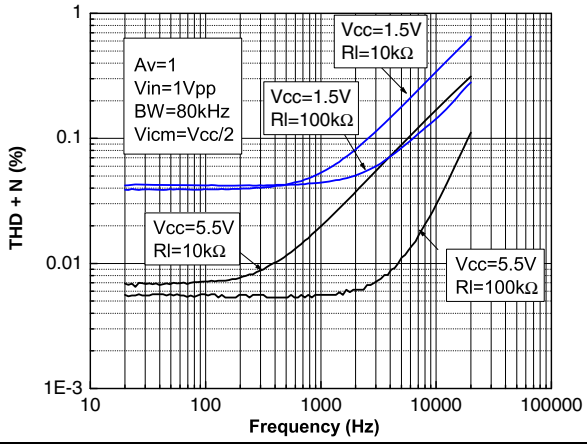


Figure 14. Distortion + noise vs. output voltage

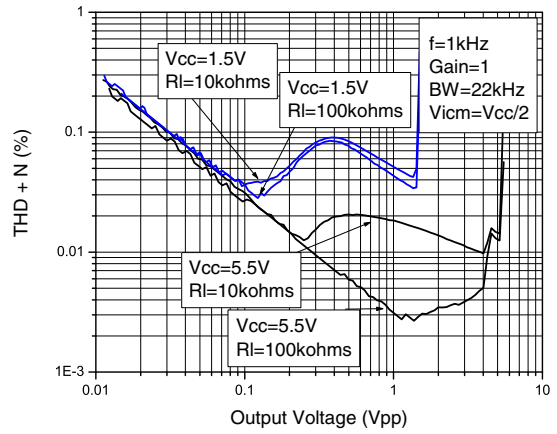
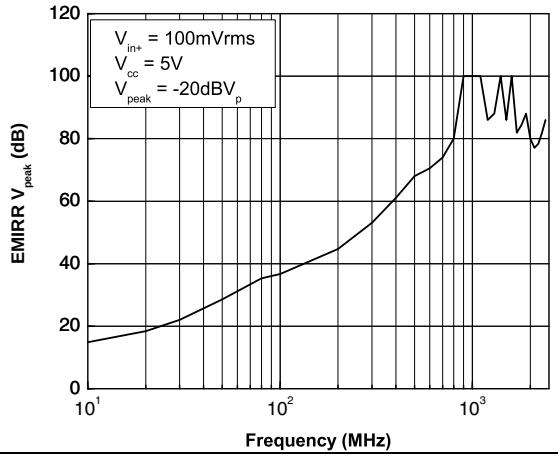


Figure 15. EMIRR vs. frequency at V_{CC} = 5 V, T = 25 °C



4 Application information

4.1 Operating voltages

The TSV62x/TSV62xA can operate from 1.5 to 5.5 V. Parameters are fully specified for 1.8-, 3.3-, and 5-V power supplies. However, the parameters are very stable in the full V_{CC} range and several characterization curves show the TSV62x/TSV62xA characteristics at 1.5 V. Additionally, the main specifications are guaranteed in extended temperature ranges from -40 °C to 125 °C.

4.2 Rail-to-rail input

The TSV62x/TSV62xA is built with two complementary PMOS and NMOS input differential pairs. The device has a rail-to-rail input, and the input common mode range is extended from (V_{CC-}) - 0.1 V to (V_{CC+}) + 0.1 V. The transition between the two pairs appears at (V_{CC+}) - 0.7 V. In the transition region, the performance of CMRR, PSRR, V_{io} (*Figure 16* and *Figure 17*) and THD is slightly degraded.

Figure 16. Input offset voltage vs input common mode at V_{CC} = 1.5 V

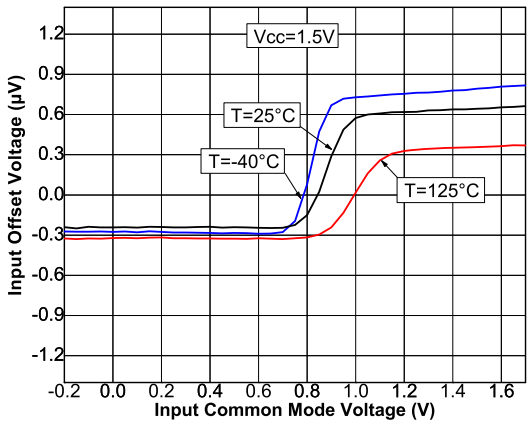
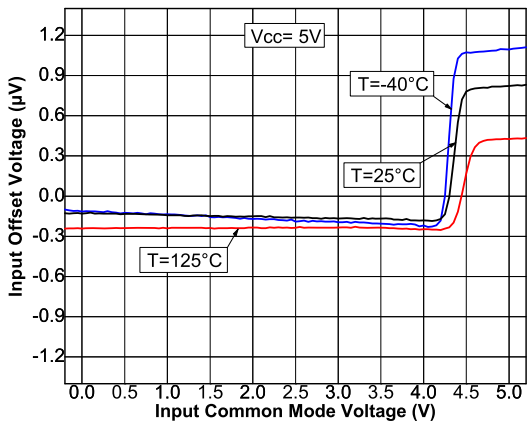


Figure 17. Input offset voltage vs input common mode at V_{CC} = 5 V



The devices are guaranteed without phase reversal.

4.3 Rail-to-rail output

The operational amplifier's output level can go close to the rails: 35 mV maximum above and below the rail when connected to a 10 kΩ resistive load to V_{CC}/2.

4.4 Optimization of DC and AC parameters

These operational amplifiers use an innovative approach to reduce the spread of the main DC and AC parameters. An internal adjustment achieves a very narrow spread of current consumption (29 µA typical, min/max at ±17%). Parameters linked to the current consumption value, such as GBP, SR and AVd benefit from this narrow dispersion. All parts present a similar speed and the same behavior in terms of stability. In addition, the minimum values of GBP and SR are guaranteed (GBP = 350 kHz min, SR = 0.12 V/µs min).

4.5 Shutdown function (TSV623, TSV625)

The operational amplifier is enabled when the $\overline{SHDN}$ pin is pulled high. To disable the amplifier, the $\overline{SHDN}$ must be pulled down to V_{CC-}. When in shutdown mode, the amplifier output is in a high impedance state. The $\overline{SHDN}$ pin must never be left floating but tied to V_{CC+} or V_{CC-}. The turn-on and turn-off times are calculated for an output variation of ±200 mV (*Figure 18* and *Figure 19* show the test configurations). *Figure 20* and *Figure 21* show output voltage behavior when the $\overline{SHDN}$ pin is toggled.

Figure 18. Test configuration for turn-on time (Vout pulled down)

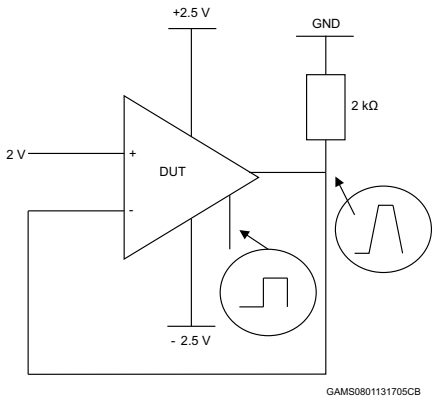


Figure 19. Test configuration for turn-off time (Vout pulled down)

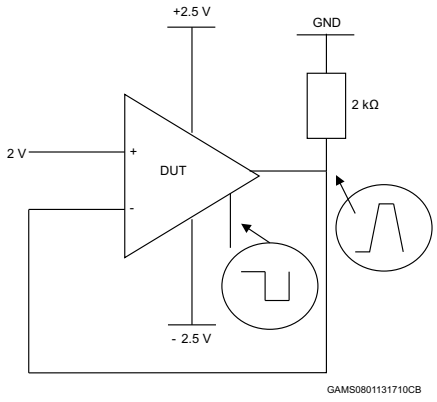


Figure 20. Turn-on time, V_{CC} = ±2.5 V, Vout pulled down, T = 25 °C

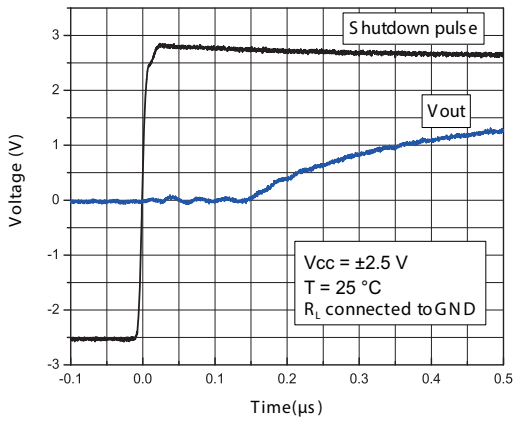
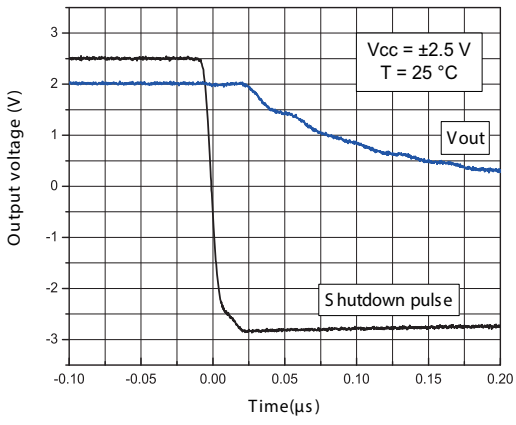


Figure 21. Turn-off time, V_{CC} = ±2.5 V, Vout pulled down, T = 25 °C

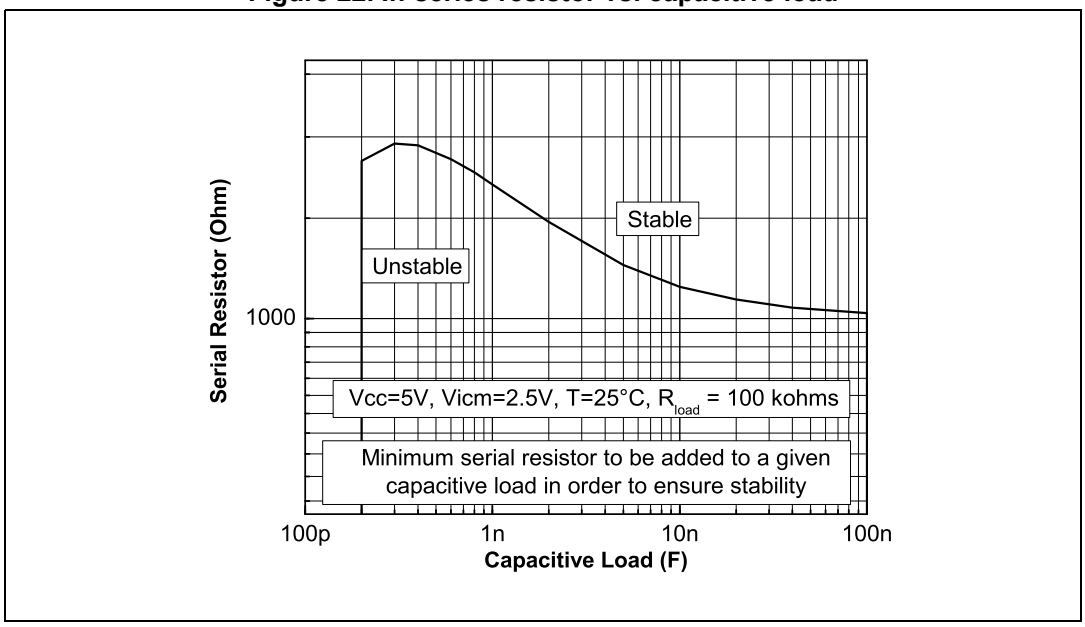


4.6 Driving resistive and capacitive loads

These products are micro-power, low-voltage operational amplifiers optimized to drive rather large resistive loads, above 5 kΩ For lower resistive loads, the THD level may significantly increase.

In a *follower* configuration, these operational amplifiers can drive capacitive loads up to 100 pF with no oscillations. When driving larger capacitive loads, adding a small resistor in series at the output can improve the stability of the device (see *Figure 22* for recommended in-series resistor values). Once the value of the in-series resistor has been selected, the stability of the circuit should be tested on bench and simulated with the simulation model.

Figure 22. In-series resistor vs. capacitive load



4.7 PCB layouts

For correct operation, it is advised to add 10 nF decoupling capacitors as close as possible to the power supply pins.

4.8 Macromodel

Two accurate macromodels (with or without shutdown feature) of TSV62x/TSV62xA are available on STMicroelectronics' web site at www.st.com. This model is a trade-off between accuracy and complexity (that is, time simulation) of the TSV62x/TSV62xA operational amplifiers. It emulates the nominal performances of a typical device within the specified operating conditions mentioned in the datasheet. It helps to validate a design approach and to select the right operational amplifier, *but it does not replace on-board measurements*.

5 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*.
ECOPACK® is an ST trademark.

5.1 SO8 package information

Figure 23. SO8 package outline

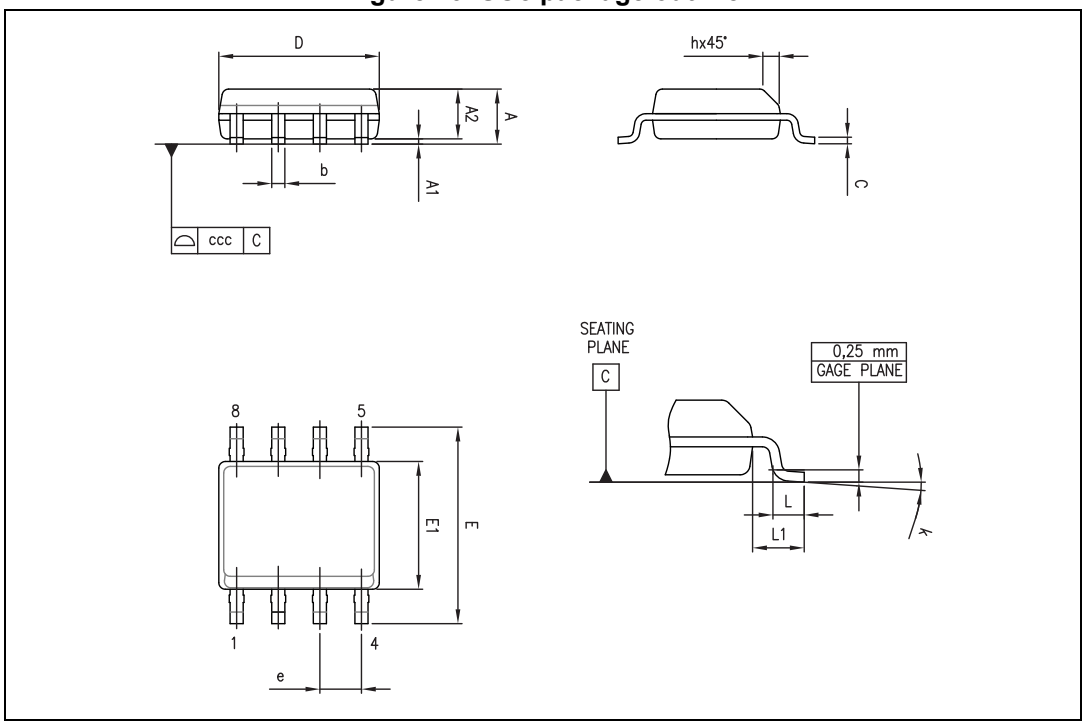


Table 9. SO8 mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
A1	0.10		0.25	0.004		0.010
A2	1.25			0.049		
b	0.28		0.48	0.011		0.019
c	0.17		0.23	0.007		0.010
D	4.80	4.90	5.00	0.189	0.193	0.197
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e		1.27			0.050	
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
L1		1.04			0.040	
k	0		8°	1°		8°
ccc			0.10			0.004

5.2 MiniSO8 package information

Figure 24. MiniSO8 package outline

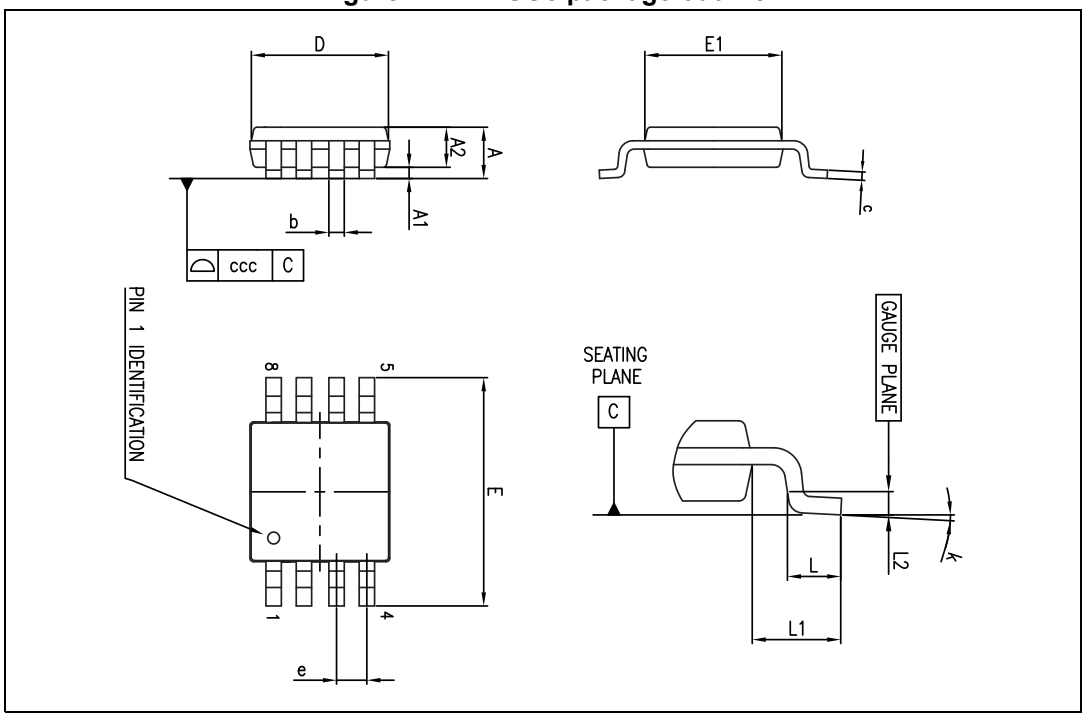


Table 10. MiniSO8 mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.1			0.043
A1	0		0.15	0		0.006
A2	0.75	0.85	0.95	0.030	0.033	0.037
b	0.22		0.40	0.009		0.016
c	0.08		0.23	0.003		0.009
D	2.80	3.00	3.20	0.11	0.118	0.126
E	4.65	4.90	5.15	0.183	0.193	0.203
E1	2.80	3.00	3.10	0.11	0.118	0.122
e		0.65			0.026	
L	0.40	0.60	0.80	0.016	0.024	0.031
L1		0.95			0.037	
L2		0.25			0.010	
k	0°		8°	0°		8°
ccc			0.10			0.004

5.3 MiniSO10 package information

Figure 25. MiniSO10 package outline

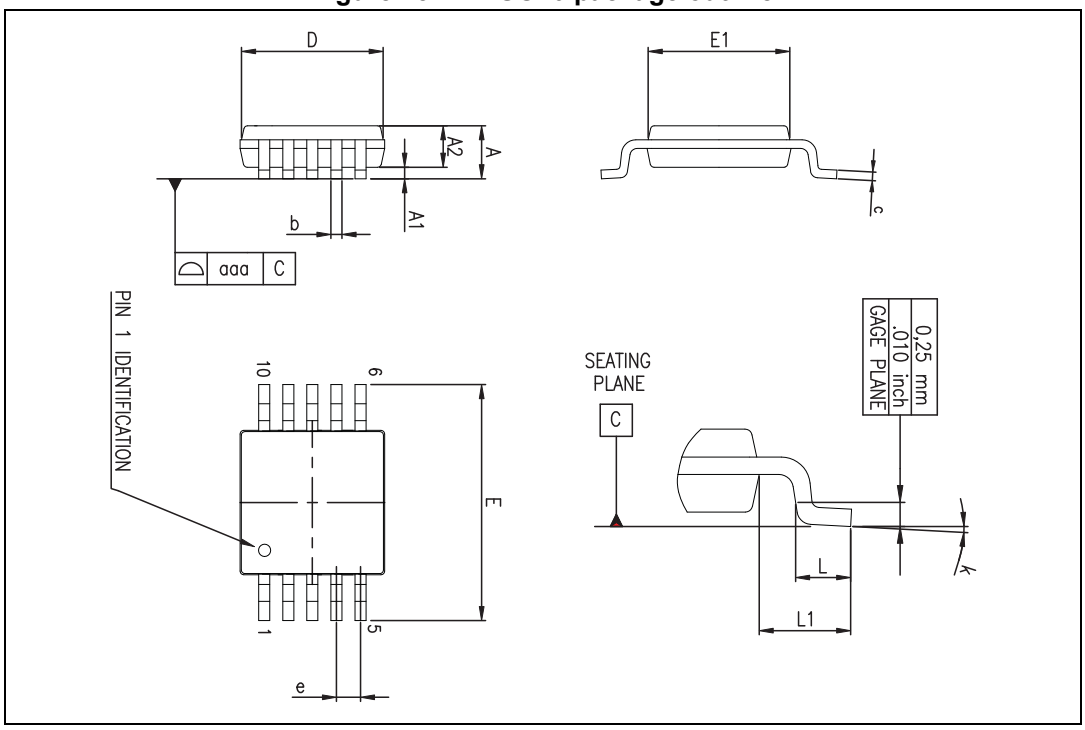


Table 11. MiniSO10 mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.10			0.043
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	0.78	0.86	0.94	0.031	0.034	0.037
b	0.25	0.33	0.40	0.010	0.013	0.016
c	0.15	0.23	0.30	0.006	0.009	0.012
D	2.90	3.00	3.10	0.114	0.118	0.122
E	4.75	4.90	5.05	0.187	0.193	0.199
E1	2.90	3.00	3.10	0.114	0.118	0.122
e		0.50			0.020	
L	0.40	0.55	0.70	0.016	0.022	0.028
L1		0.95			0.037	
k	0°	3°	6°	0°	3°	6°
aaa			0.10			0.004

5.4 TSSOP14 package information

Figure 26. TSSOP14 package outline

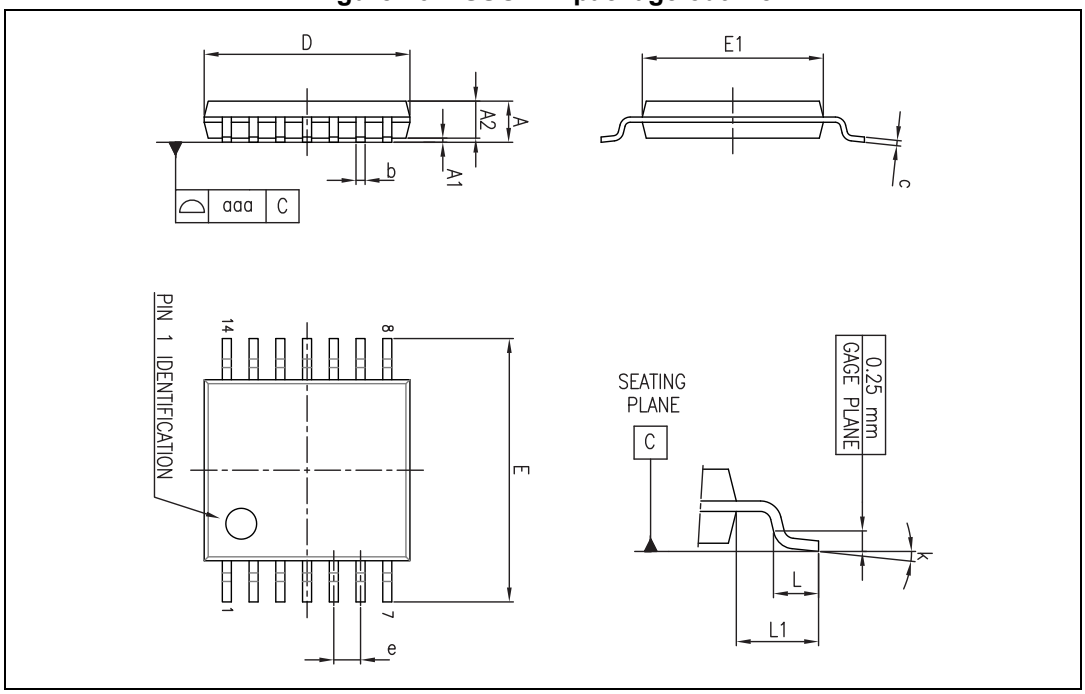


Table 12. TSSOP14 mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.047
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0089
D	4.90	5.00	5.10	0.193	0.197	0.201
E	6.20	6.40	6.60	0.244	0.252	0.260
E1	4.30	4.40	4.50	0.169	0.173	0.176
e		0.65			0.0256	
L	0.45	0.60	0.75	0.018	0.024	0.030
L1		1.00			0.039	
k	0°		8°	0°		8°
aaa			0.10			0.004

5.5 TSSOP16 package information

Figure 27. TSSOP16 package outline

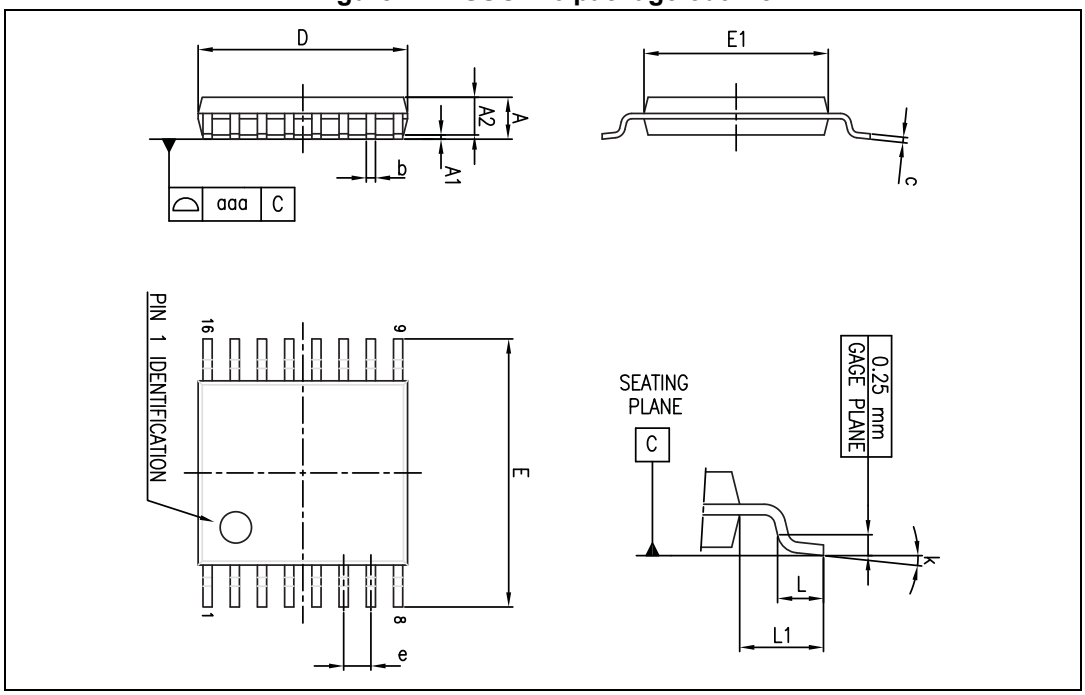


Table 13. TSSOP16 mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.047
A1	0.05		0.15	0.002		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.008
D	4.90	5.00	5.10	0.193	0.197	0.201
E	6.20	6.40	6.60	0.244	0.252	0.260
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.0256	
k	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030
L1		1.00			0.039	
aaa			0.10			0.004

6 Ordering information

Table 14. Order codes

Order codes	Temperature range	Package	Packing	Marking
TSV622IDT	-40 °C to 125 °C	SO8	Tape and reel	TSV622
TSV622AIDT				TSV622A
TSV622IST		MiniSO8		K107
TSV622AIST				K143
TSV623IST		MiniSO10		K114
TSV623AIST				K144
TSV624IPT		TSSOP14		TSV624
TSV624AIPT				TSV624A
TSV625IPT		TSSOP16		TSV625
TSV625AIPT				TSV625A

7 Revision history

Table 15. Document revision history

Date	Revision	Changes
25-May-2009	1	Initial release.
15-Jun-2009	2	Corrected pin connection diagram in Figure 1.
24-Aug-2009	3	Added root part numbers (TSv62xA) and Table 1: Device summary on cover page. Added order code TSV622AILT in Table 15: Order codes.
22-Oct-2009	4	Corrected error in Table 15: Order codes: TSV625 offered in TSSOP16.
09-Jan-2013	5	Updated Features. Updated Figure 1. Table 4, Table 6, and Table 7: replaced DV_{io} with $\Delta V_{io}/\Delta T$. Section 4.5: Shutdown function (TSV623, TSV625): added explanation of Figure 20 and Figure 21; replaced Figure 18 and Figure 19; updated Figure 20 and Figure 21. Corrected error in Table 15: Order codes: the marking for the order code TSV622AILT is K143.
23-May-2017	6	Changed part number layout on cover page Removed package SOT23-5 *Table 4*, *Table 6*, and *Table 7*: updated V_{OH} parameter information and changed min. values to max. values. *Table 14: Order codes*: removed obsolete order codes: TSV622ILT, TSV622AILT, TSV622ID, TSV622AID