TSL6201, TSL6202, TSL6204

Datasheet

High bandwidth 8 MHz, rail-to-rail, 5 V cost-effective op amp

TSL6201

TSL6202

TSL6204

Features

- Automotive grade version available
- Gain bandwidth product 8 MHz, unity gain stable
- Rail-to-rail input and output
- Wide supply voltage range: 2.5 V to 5.5 V
- Input offset voltage: 4.5 mV
- Low input bias current: 1 pA typ.
- Extended temperature range: -40 °C to +125 °C

Applications

- Cost-sensitive applications
- Battery-powered products
- Automotive applications

Description

The TSL6201, TSL6202 and the TSL6204 are single, dual and quad 8 MHz bandwidth unity-gain-stable amplifiers. The rail-to-rail input stage and the wide supply range from 2.5 V to 5.5 V make the TSL620x ideal for low voltage signal conditioning.

Product status link	
SOT23-5	TSL6201
MiniSO8	TSL6202
SO14	TSL6204
TSSOP14	TSL6204

Related products	
Low-power 1 MHz	TSL6001
High bandwidth 50 MHz	TSL6401
Nanopower 600 nA	TSL6801

1 Pin description

1.1 TSL6201 single operational amplifier

Figure 1. SOT23-5 pin connections (top view)

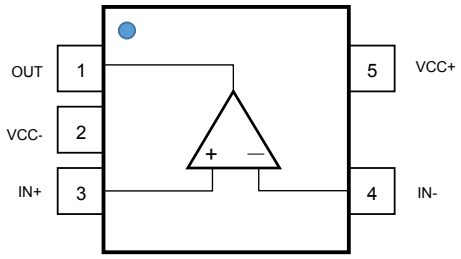


Table 1. SOT23-5 pin description

Pin	Pin name	Description
1	OUT	Output
2	VCC-	Negative supply voltage
3	IN+	Non-inverting input
4	IN-	Inverting input
5	VCC+	Positive supply voltage

1.2 TSL6202 dual operational amplifier

Figure 2. **MiniSO8 pin connection (top view)**

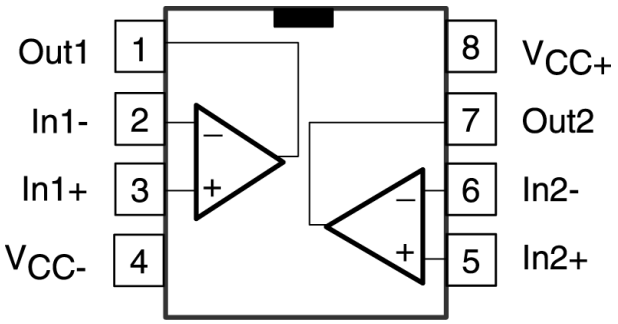
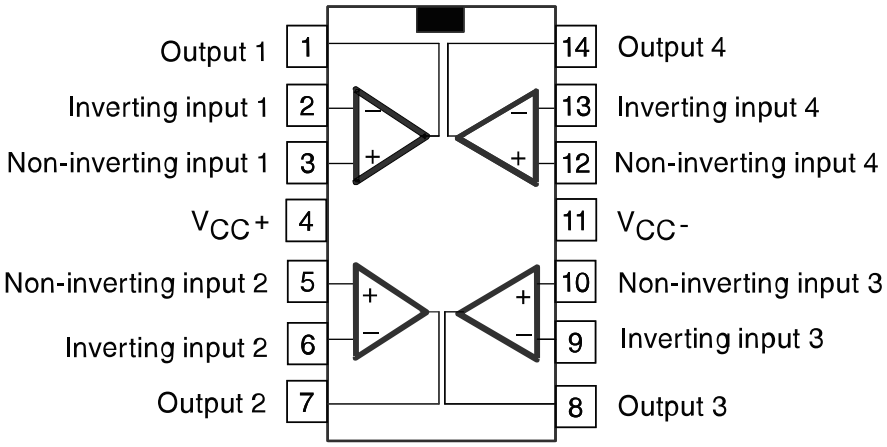


Table 2. **MiniSO8 pin description**

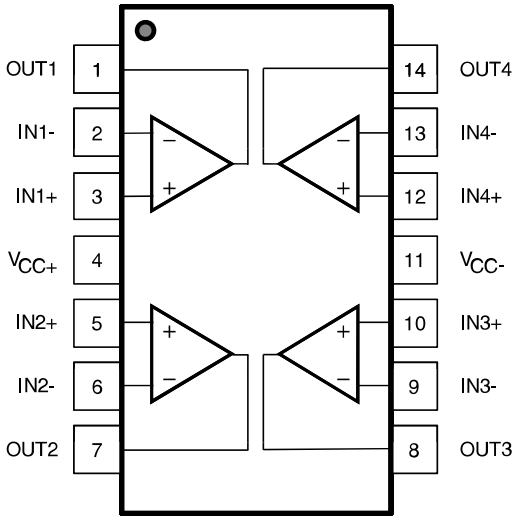
Pin	Pin name	Description
1	OUT1	Output channel 1
2	IN1-	Inverting input channel 1
3	IN1+	Non-inverting input channel 1
4	VCC-	Negative supply voltage
5	IN2+	Non-inverting input channel 2
6	IN2-	Inverting input channel 2
7	OUT2	Output channel 2
8	VCC+	Positive supply voltage

1.3 TSL6204 quad operational amplifier

Figure 3. **SO14 and TSSOP-14 pin connections (top view)**



SO14



TSSOP14

Table 3. **SO14 and TSSOP-14 pin description**

Pin	Pin name	Description
1	OUT1	Output channel 1
2	IN1-	Inverting input channel 1
3	IN1+	Non-inverting input channel 1
4	VCC+	Positive supply voltage
5	IN2+	Non-inverting input channel 2
6	IN2-	Inverting input channel 2
7	OUT2	Output channel 2
8	OUT3	Output channel 3

Pin	Pin name	Description
9	IN3-	Inverting input channel 3
10	IN3+	Non-inverting input channel 3
11	VCC-	Negative supply voltage
12	IN4+	Non-inverting input channel 4
13	IN4-	Inverting input channel 4
14	OUT4	Output channel 4

2 Absolute maximum ratings

Table 4. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC} (1)	Supply voltage	6	V
V_{id}	Input voltage differential (V_{IN+} - V_{IN-})	$\pm V_{CC}$	V
V_{in} (2)	Input voltage	(V_{CC-}) - 0.2 to (V_{CC+}) + 0.2	V
I_{in}	Input current	±10	mA
T_{stg}	Storage temperature	-65 to +150	°C
$R_{th\text{-}ja}$ (3)	Thermal resistance junction-to-ambient		°C/W
	SOT23-5	250	
	MiniSO8	190	
	SO14	105	
	TSSOP-14	100	
T_j	Maximum junction temperature	150	°C
ESD	HBM: human body model (4)	2	kV
	CDM: charged device model (5)	0.5	kV

1. *All voltage values are with respect to the VCC- pin, unless otherwise specified.*
2. *The maximum input voltage value may be extended to the condition that the input current is limited to ±10 mA.*
3. *$R_{th\text{-}ja}$ is a typical value.*
4. *Human body model: HBM test according to the standard ESDA/JEDEC JS-001-2017.*
5. *Charged device model:the test CDM is done in according to the standard ESDA/JEDEC JS-002-2018.*

Table 5. Operating conditions

Symbol	Parameter	Value
V_{CC}	Supply voltage	2.5 to 5.5 V
V_{icm}	Common mode input voltage range (CMR)	V_{CC-} – 0.1 V to V_{CC+} + 0.1 V
T_{oper}	Operating free air temperature range	-40 °C to +125 °C

3 Electrical characteristics

Table 6. Electrical characteristics at V_{CC} = 2.7 V to 5 V, V_{ICM} = V_{OUT} = V_{CC} / 2, T = 25 °C and OUT connected to V_{CC} / 2 through R_L=10 kΩ (unless otherwise specified). Production screening at V_{CC} = 5 V, operation on the full supply range ensured by design and characterization.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DC performance						
V_{io}	Input offset voltage	T = 25 °C			± 4.5	mV
		-40 °C ≤ T ≤ 125 °C			± 7.5	
DV_{io}/DT	Input offset voltage temperature drift	-40 °C ≤ T ≤ 125 °C		±5		µV/°C
I_{ib}	Input bias current			±1		pA
I_{io}	Input offset current			±1		pA
A_{VD}	Open loop gain	V_{CC-}+500 mV ≤ V_{OUT} ≤ V_{CC+}-500 mV	80	89		dB
CMR	Common-mode rejection ratio 20.log ($\Delta V_{io}/\Delta V_{icm}$)	V_{CC-}≤ V_{icm} ≤ V_{CC+}	58	78		dB
V_{OH}	High level output voltage drop (V_{OH}=V_{CC+}-V_{OUT})				40	mV
V_{OL}	Low level output voltage drop (V_{OL}=V_{OUT})				40	mV
I_{OUT}	Short-circuit	V_{CC} = 5 V		±30		mA
I_{CC}	Supply current (by operational amplifier)	No load		750	1400	µA
AC performance						
GBP	Gain bandwidth product	R_L = 2 kΩ, C_L = 100 pF, f = 100 kHz		8		MHz
SR	Slew rate	A_V=1 V/V, 10% to 90%		4.5		V/µs
Φm	Phase margin	R_L = 2 kΩ, C_L = 100 pF		45		Degrees
en	Input voltage noise density	f = 10 kHz		21		nV/√Hz

4 Typical performance characteristics

Figure 4. Input offset voltage vs. common mode voltage

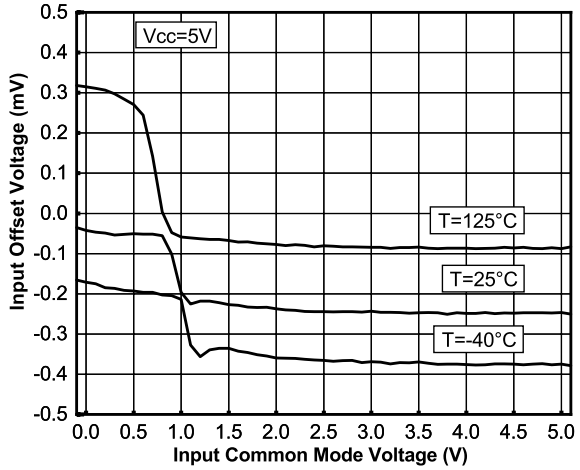


Figure 5. Positive slew rate vs. supply voltage

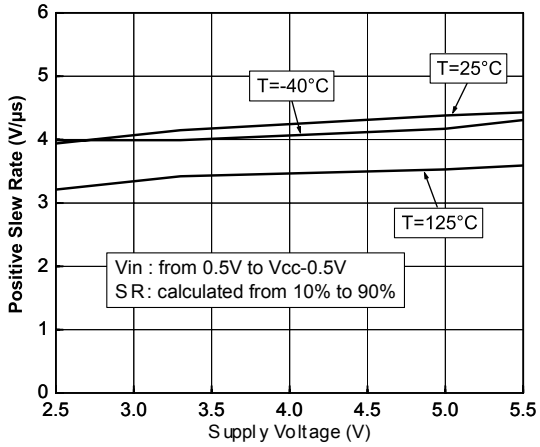


Figure 6. Negative slew rate vs. supply voltage

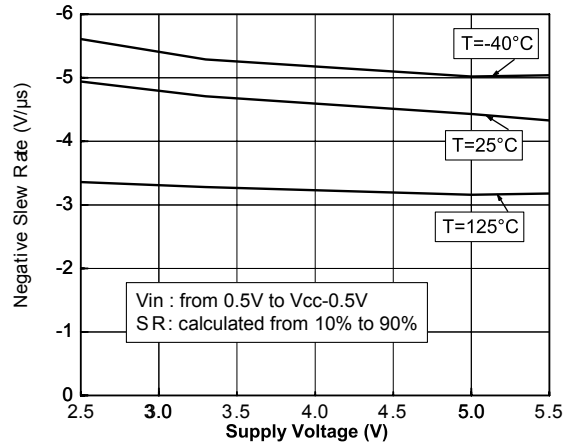


Figure 7. Input equivalent noise vs. frequency

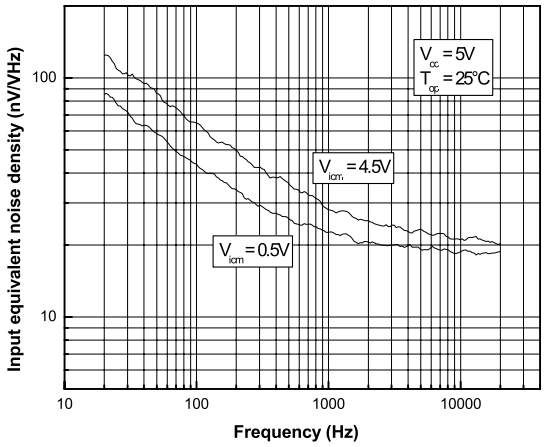


Figure 8. Output current vs. output voltage

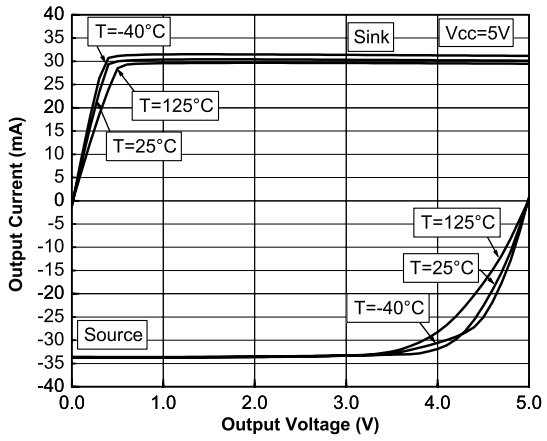


Figure 9. Supply current vs. input common voltage

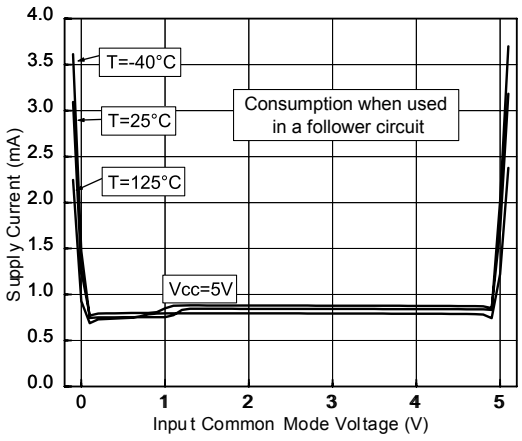


Figure 10. Supply current vs. input common mode voltage

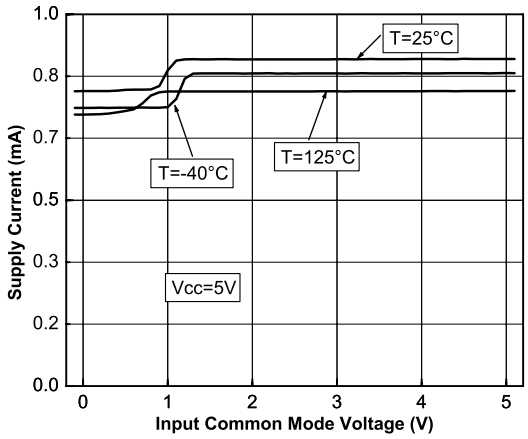
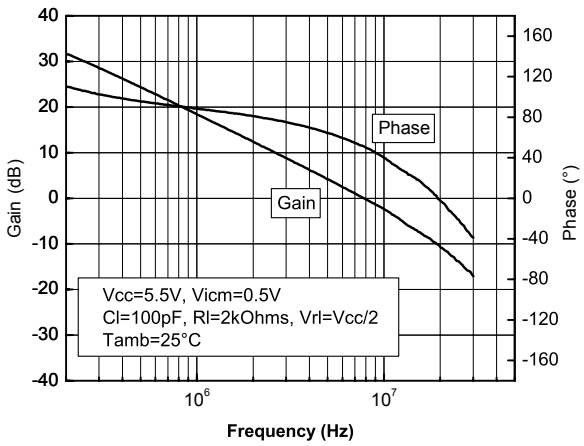


Figure 11. Bode diagram



5 Package information

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 SOT23-5 package information

Figure 12. SOT23-5 package outline

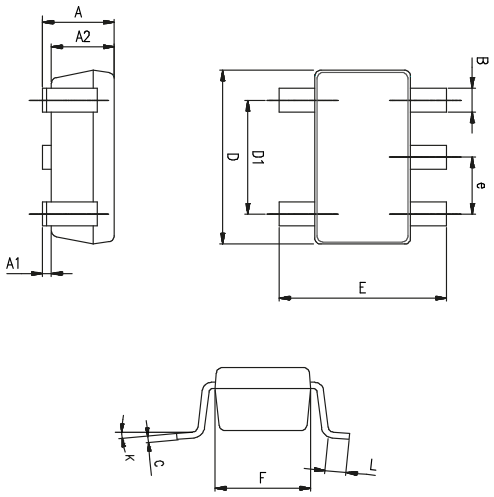


Table 7. SOT23-5 package mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90	1.20	1.45	0.035	0.047	0.057
A1			0.15			0.006
A2	0.90	1.05	1.30	0.035	0.041	0.051
B	0.35	0.40	0.50	0.014	0.016	0.020
C	0.09	0.15	0.20	0.004	0.006	0.020
D	2.80	2.90	3.00	0.110	0.114	0.118
D1		1.90			0.075	
e		0.95			0.037	
E	2.60	2.80	3.00	0.102	0.110	0.118
F	1.50	1.60	1.75	0.059	0.063	0.069
L	0.10	0.35	0.60	0.004	0.014	0.024
K	0°		10°	0°		10°

5.2 MiniSO8 package information

Figure 13. **MiniSO8 package outline**

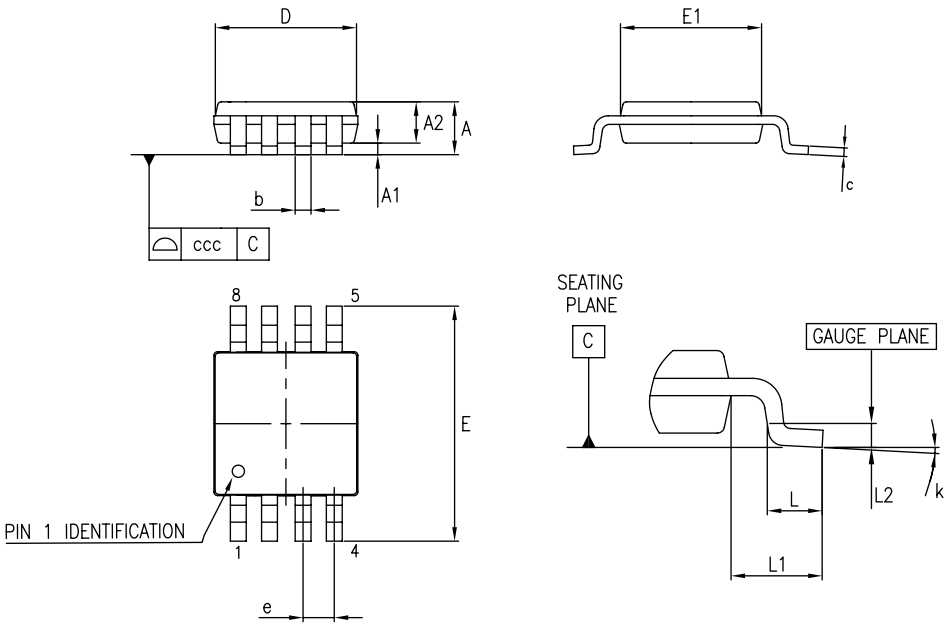


Table 8. **MiniSO8 mechanical data**

Dim.	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	0.03	0.033	0.037
b	0.22		0.4	0.009		0.016
c	0.08		0.23	0.003		0.009
D	2.8	3	3.2	0.11	0.118	0.126
E	4.65	4.9	5.15	0.183	0.193	0.203
E1	2.8	3	3.1	0.11	0.118	0.122
e		0.65			0.026	
L	0.4	0.6	0.8	0.016	0.024	0.031
L1		0.95			0.037	
L2		0.25			0.01	
k	0°		8°	0°		8°
ccc			0.1			0.004

5.3 SO14 package information

Figure 14. **SO14 package outline**

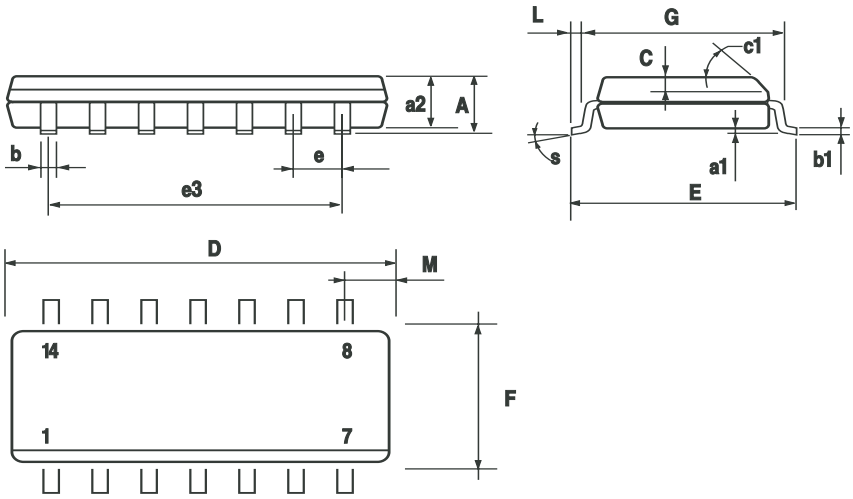


Table 9. **SO14 package mechanical data**

Symbol	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.68			0.026
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
S	8° (max.)					

5.4 TSSOP-14 package information

Figure 15. **TSSOP-14 package outline**

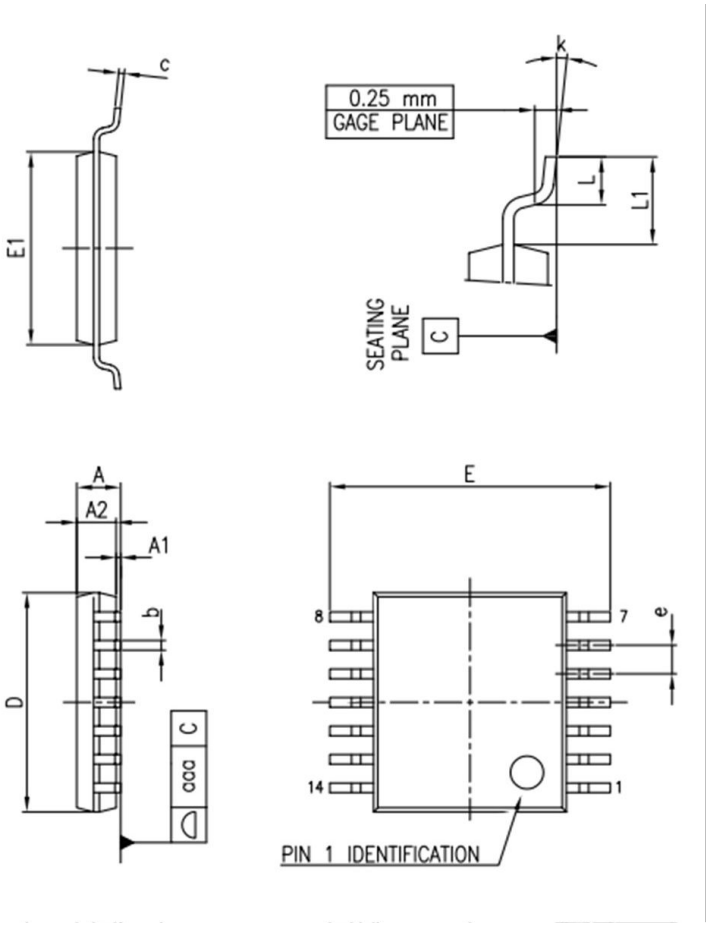


Table 10. **TSSOP-14 mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A			1.20
A1	0.05		0.15
A2	0.80	1.00	1.05
b	0.19		0.30
c	0.09		0.20
D	4.90	5.00	5.10
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e		0.65 BSC	
L	0.45	0.60	0.75
L1		1.00	
k	0		8
aaa			0.10

6 Ordering information

Table 11. Order code

Order code	Temperature range	Package	Marking
TSL6201ILT	-40 °C to 125 °C	SOT23-5	KD
TSL6201IYLT (1)	-40 °C to 125 °C automotive grade		KG
TSL6202IST	-40 °C to 125 °C	MiniSO8	KE
TSL6202IYST (1)	-40 °C to 125 °C automotive grade		KJ
TSL6204IDT	-40 °C to 125 °C	SO14	TSL6204I
TSL6204IYDT (1)	-40 °C to 125 °C automotive grade		TSL6204Y
TSL6204IPT	-40 °C to 125 °C	TSSOP-14	6204I
TSL6204IYPT (1)	-40 °C to 125 °C automotive grade		6204IY

1. *Qualified and characterized according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 & Q002 or equivalent. For qualification status detail, check "Maturity status link" on first page ("Quality & Reliability" tab on www.st.com).*

Revision history

Table 12. **Document revision history**

Date	Version	Changes
01-Dec-2021	1	Initial release.
09-Jan-2023	2	Updated features, applications on the cover page and Section 6: Ordering information.
08-Feb-2024	3	Updated title, features and descritpion on the cover page. Updated GBP value in Table 6.
07-Nov-2024	4	Added new SO14 package and new Section 5.3. Updated Figure 3.
07-Apr-2025	5	Updated figure on the cover page and title in Table 6.

Contents

List of tables

List of figures