TSL6801, TSL6802, TSL6804

Datasheet

Nanopower 600 nA, rail-to-rail, 5 V cost-effective op amp

TSL6801

TSL6801

TSL6802

TSL6804

Features

- Supply current 600 nA typ.
- Low supply voltage: 1.5 V - 5.5 V
- Unity gain stable
- Rail-to-rail input and output
- Gain bandwidth product: 8 kHz typ.
- Low input bias current: 5 pA max. at 25 °C
- Industrial temperature range: -40 °C to 85 °C

Applications

- Cost-sensitive applications
- Battery-powered products

Description

The TSL6801, TSL6802 and the TSL6804 are single, dual and quad 8 kHz-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 TSL680x ideal for low voltage signal conditioning.

Product status link	
SC70-5	TSL6801
SOT23-5	TSL6801
MiniSO8	TSL6802
TSSOP14	TSL6804

Related products	
For higher bandwidth (1 MHz)	TSL6001
For higher bandwidth (10 MHz)	TSL6201

1 Pin description

1.1 TSL6801 single operational amplifier

Figure 1. SC70-5 and SOT23-5 pin connections (top view) for the TSL6801

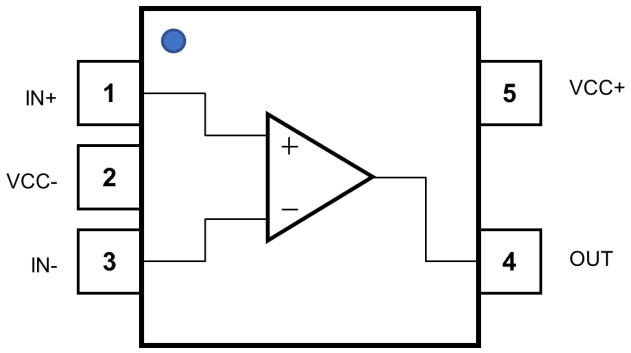


Figure 2. SC70-5 and SOT23-5 pin connections (top view) for the TSL6801R

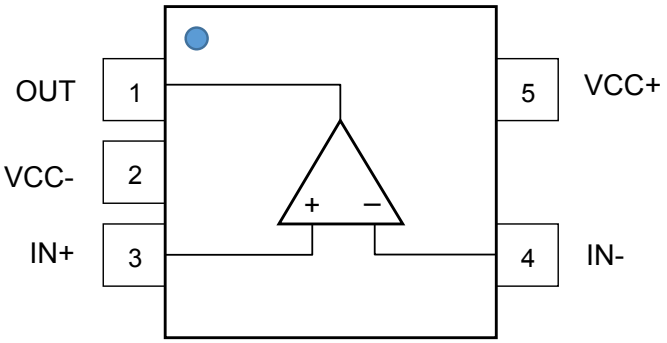


Table 1. SC70-5 and SOT23-5 pin description for the TSL6801 and the TSL6801R

Pin n. for the TSL6801	Pin n. for the TSL6801R	Pin name	Description
1	3	IN+	Non-inverting input channel
2	2	VCC-	Negative supply voltage
3	4	IN-	Inverting input channel
4	1	OUT	Output channel
5	5	VCC+	Positive supply voltage

1.2 TSL6802 dual operational amplifier

Figure 3. **MiniSO8 pin connection (top view)**

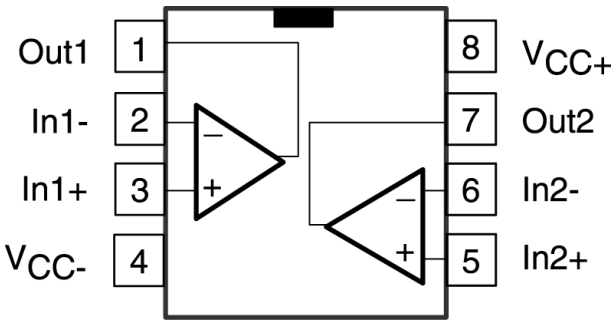


Table 2. **MiniSO8 pin description**

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 TSL6804 quad operational amplifier

Figure 4. **TSSOP-14 pin connections (top view)**

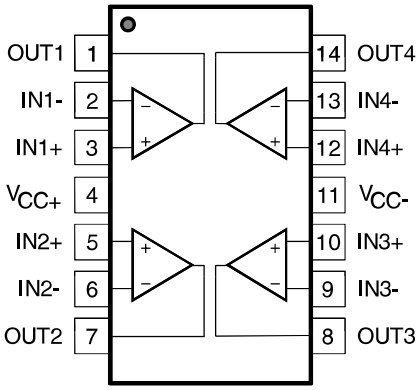


Table 3. **TSSOP-14 pin description**

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
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 [1]	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	
	SC70-5	205	
	TSSOP-14	100	
T_j	Maximum junction temperature	150	°C
ESD	HBM: human body model[4]	2	kV
	CDM: charged device model [5]	0.9	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	1.5 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 +85 °C

3 Electrical characteristics

Table 6. Electrical characteristics at V_{CC} = 1.8 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			± 0.1	± 3	mV
$\Delta V_{io}/DT$	Input offset voltage temperature drift	-40 °C ≤ T ≤ 85 °C		±2		µV/°C
I_{ib}	Input bias current			±1		pA
I_{io}	Input offset current			±1		pA
A_{VD}	Open loop gain	V_{CC-}+300 mV ≤ V_{OUT} ≤ V_{CC+}-300 mV, R_L = 100 kΩ	95	115		dB
CMR	Common-mode rejection ratio 20.log ($\Delta V_{io}/\Delta V_{icm}$)	V_{CC-}≤ V_{icm} ≤ V_{CC+}	60	80		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 current	V_{CC+} = 1.8 V		±5		mA
		V_{CC+} = 5 V		±10		
I_{CC}	Supply current (by operational amplifier)			0.6	1	µA
AC performance						
GBP	Gain bandwidth product	C_L = 60 pF		8		kHz
SR	Slew rate	C_L = 60 pF, A_V=1 V/V, 10% to 90%		3		V/ms
Φm	Phase margin	C_L = 60 pF		50		Degrees
en	Input voltage noise density	f = 100 kHz		240		nV/√Hz
		f = 1 kHz		225		
en p-p	Input noise voltage	0.1 Hz ≤ f ≤ 10 Hz		8		μV_{pp}

4 Typical performance characteristics

Figure 5. Supply current vs. supply voltage

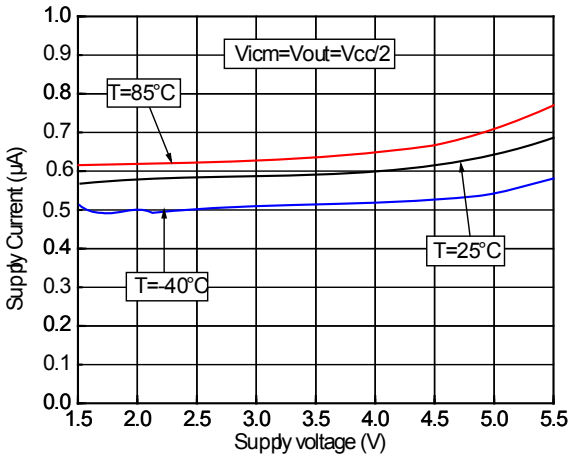


Figure 6. Input offset voltage distribution

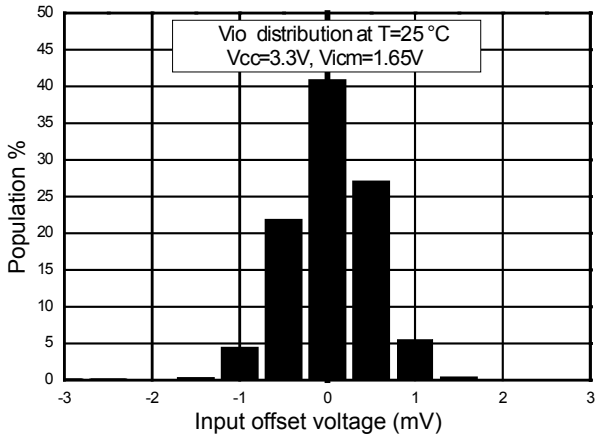


Figure 7. Input offset voltage vs. common mode voltage

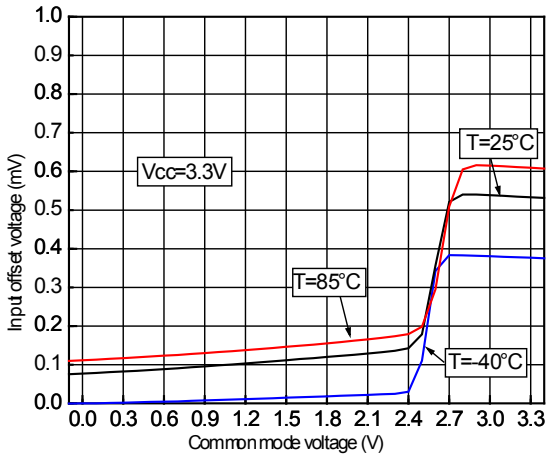


Figure 8. Input offset voltage temperature coefficient distribution

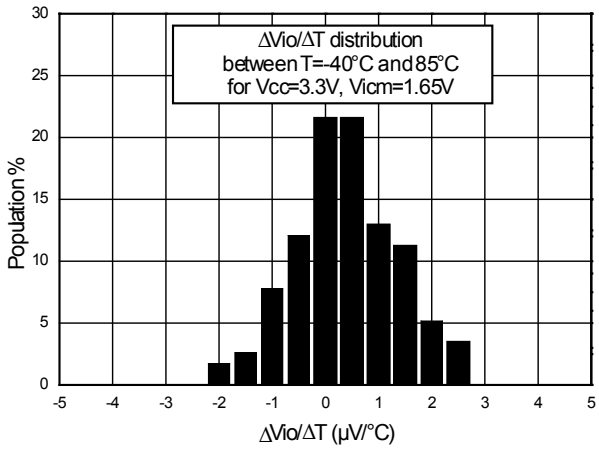


Figure 9. Input bias current vs. temperature

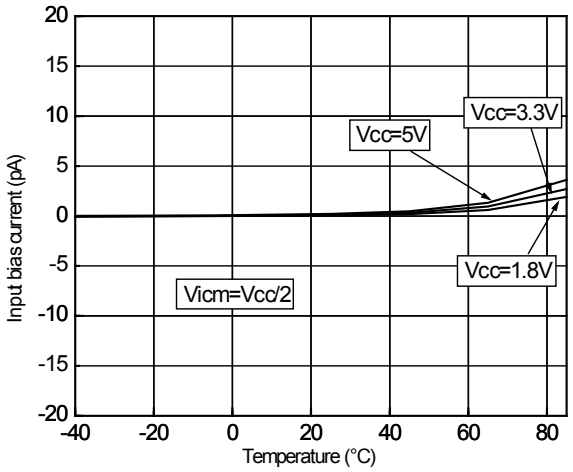


Figure 10. Output characteristics at 3.3 V supply voltage

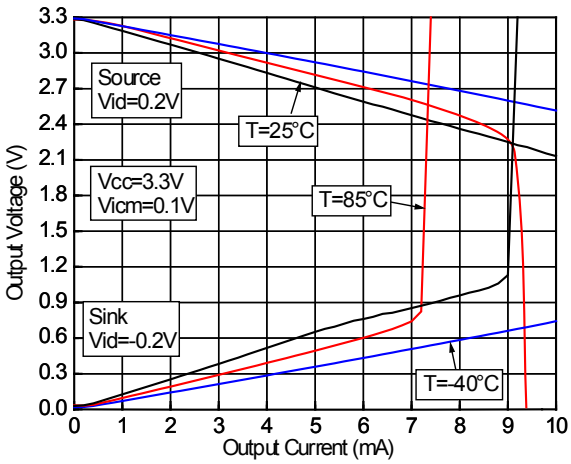


Figure 11. Desaturation time

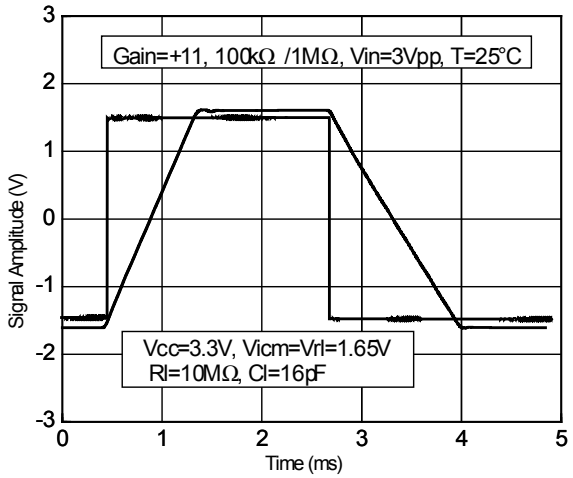


Figure 12. Phase reversal free

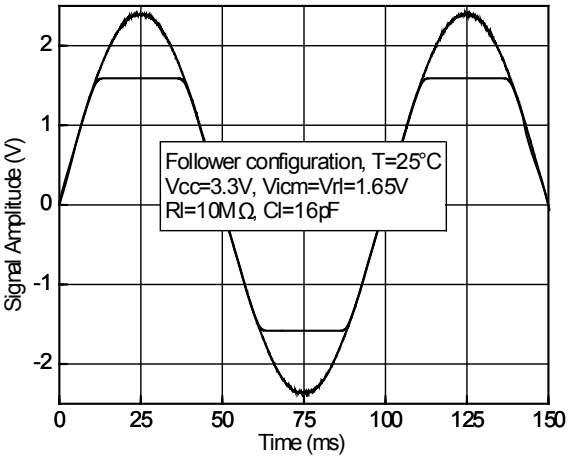


Figure 13. Slew rate vs. supply voltage

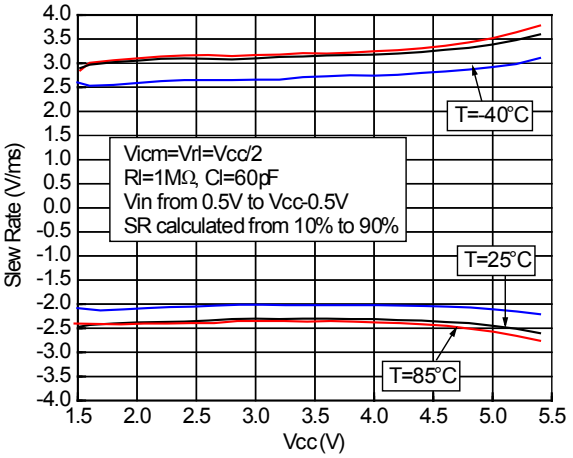


Figure 14. Output swing vs. input signal frequency

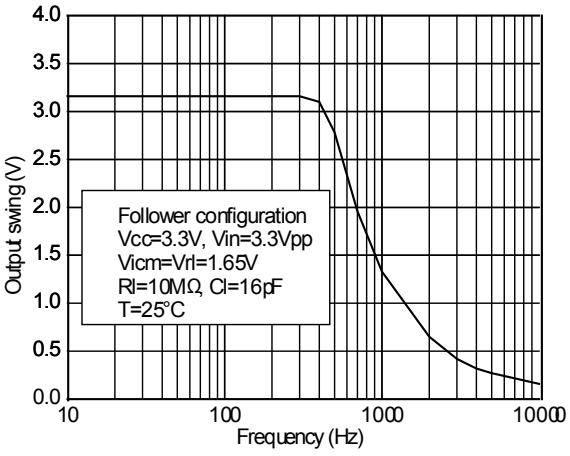


Figure 15. Small signal response at 3.3 V supply voltage

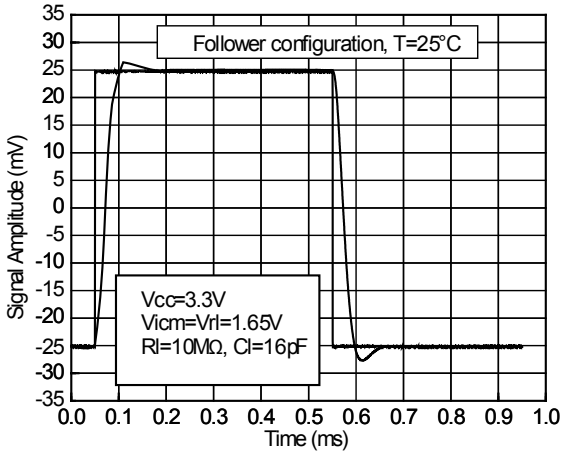


Figure 16. Large signal response at 3.3 V supply voltage

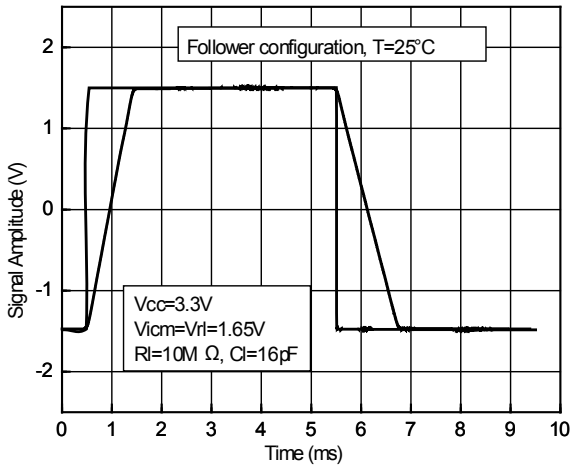


Figure 17. Bode diagram at 3.3 V supply voltage

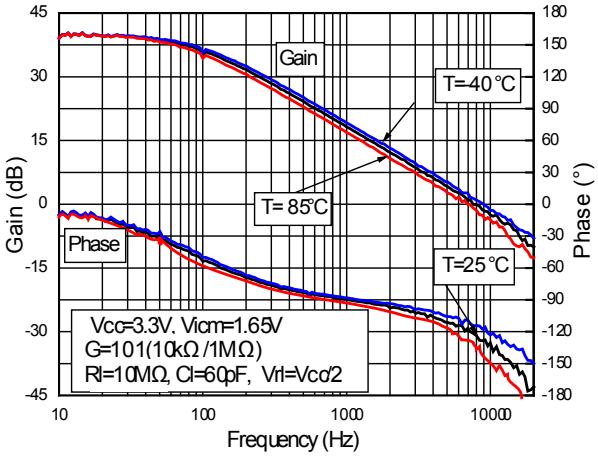


Figure 18. Noise at 3.3 V supply voltage in follower configuration

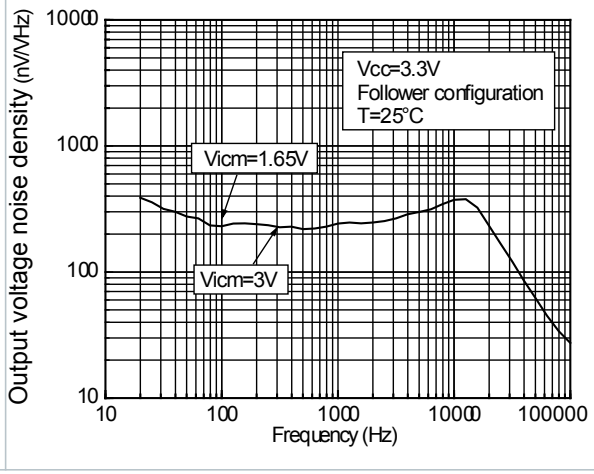
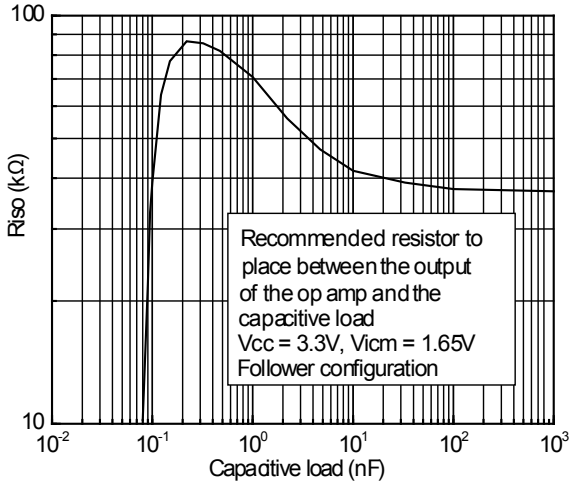


Figure 19. R_{iso} to drive capacitors above 100 pF in follower configuration



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 SC70-5 (or SOT323-5) package information

Figure 20. SC70-5 (or SOT323-5) package outline

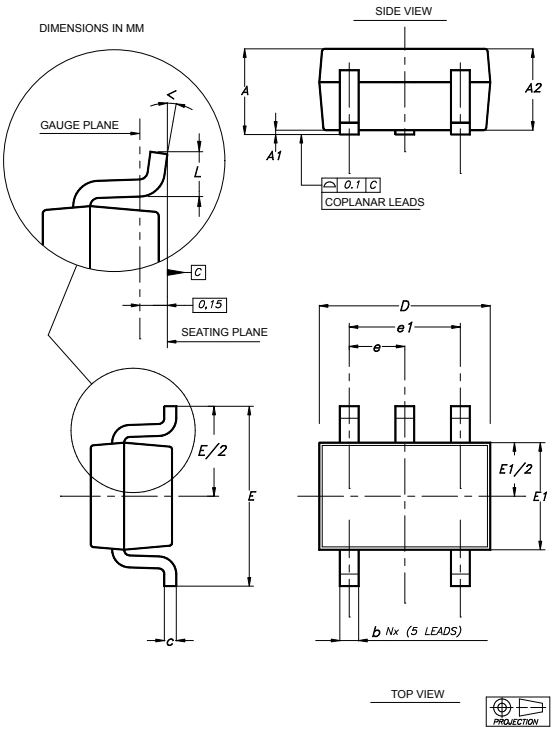


Table 7. **SC70-5 (or SOT323-5) package mechanical data**

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.80		1.10	0.032		0.043
A1			0.10			0.004
A2	0.80	0.90	1.00	0.032	0.035	0.039
b	0.15		0.30	0.006		0.012
c	0.10		0.22	0.004		0.009
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.80	2.10	2.40	0.071	0.083	0.094
E1	1.15	1.25	1.35	0.045	0.049	0.053
e		0.65			0.025	
e1		1.30			0.051	
L	0.26	0.36	0.46	0.010	0.014	0.018
<	0°		8°	0°		8°

5.2 SOT23-5 package information

Figure 21. **SOT23-5 package outline**

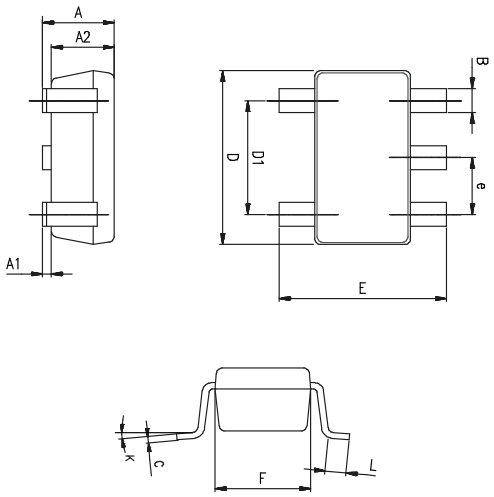


Table 8. **SOT23-5 package mechanical data**

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°

5.3 MiniSO8 package information

Figure 22. **MiniSO8 package outline**

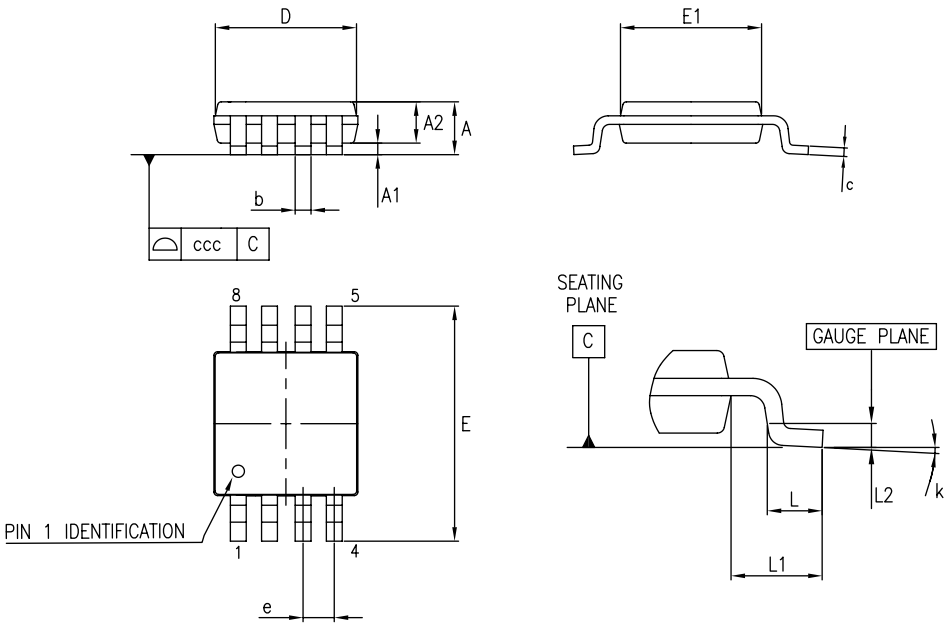


Table 9. **MiniSO8 mechanical data**

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

5.4 TSSOP-14 package information

Figure 23. **TSSOP-14 package outline**

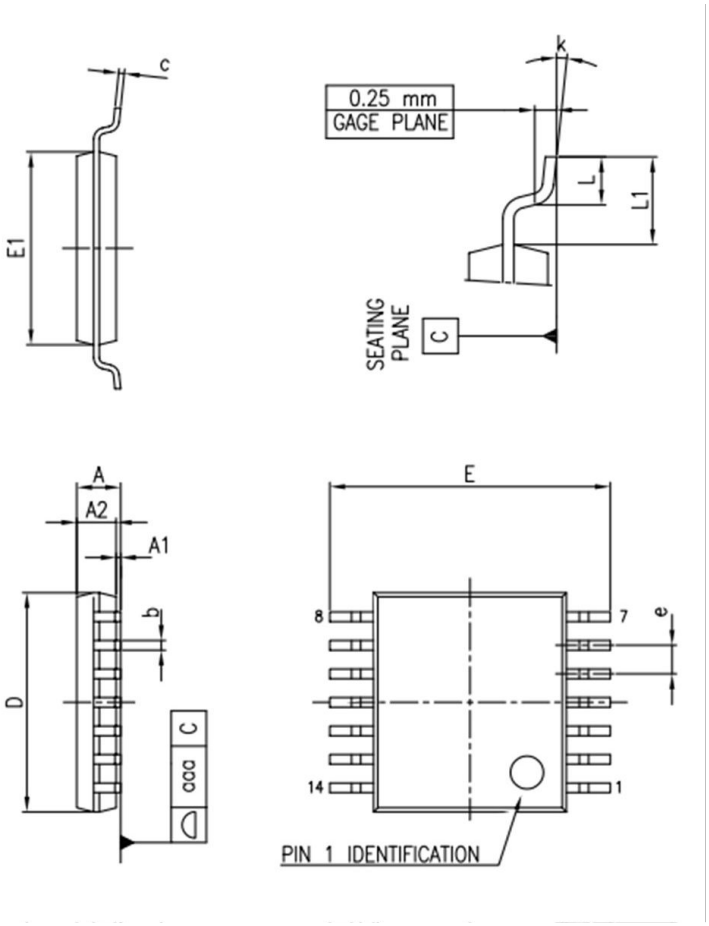


Table 10. **TSSOP-14 mechanical data**

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
TSL6801ICT	-40 °C to 85 °C	SC70-5	KF
TSL6801RICT			KK
TSL6801ILT		SOT23-5	KF
TSL6801RILT			KK
TSL6802IST		MiniSO8	KI
TSL6804IPT		TSSOP-14	6804I

Revision history

Table 12. **Document revision history**

Date	Version	Changes
02-Dec-2021	1	Initial release.
23-Apr-2024	2	Added Figure 2, TSL6801RICT and TSL6801RILT in Table 11. Updated Table 1.
08-Apr-2025	3	Updated title in Table 6.

Contents

List of tables

List of figures