Very low drop voltage regulators with inhibit

TO-92

DPAK

SO-8

Features
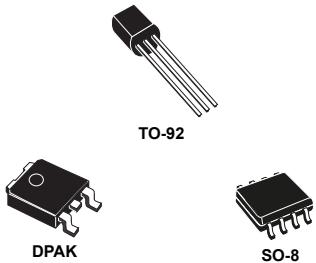
- Very low dropout voltage (0.4 V)
- Very low quiescent current
- Typ. 50 µA in OFF mode, 600 µA in ON mode
- Output current up to 250 mA
- Logic controlled electronic shutdown
- Output voltages: 3.3; 3.5; 5;
- Internal current and thermal limit
- Only 2.2 µF for stability
- Available in ± 1 % (AB) or 2 % (C) selection at 25 °C
- Supply voltage rejection: 70 dB typ. for 5 V version
- Temperature range: from -40 to 125 °C

Description

The L4931 is a very low drop regulator available in SO-8, DPAK and TO-92 packages and in a wide range of output voltages.

The very low drop voltage (0.4 V) and the very low quiescent current make it particularly suitable for low noise, low power applications and especially in battery-powered systems.

A TTL compatible shutdown logic control function is available in PPAK and SO-8 packages. This means that when the device is used as a local regulator, a part of the board can be put in standby mode, decreasing the total power consumption. It requires only a 2.2 µF capacitor for stability allowing space and cost saving.

DS0913 - Rev 21 - August 2024
For further information contact your local STMicroelectronics sales office.

www.st.com

1 Diagram

Figure 1. Schematic diagram

CS12740
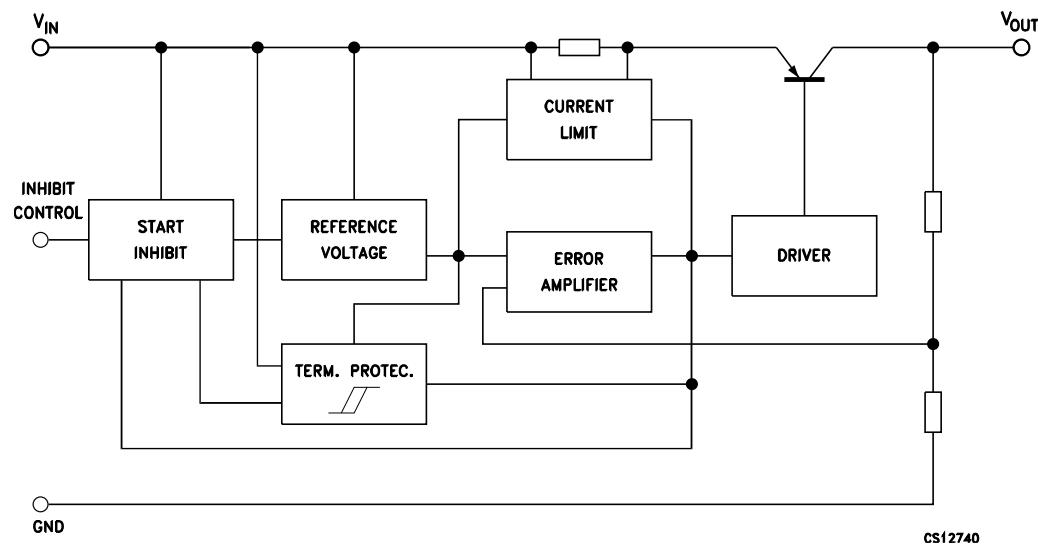
AMG050320171500MT

2 Pin configuration

Figure 2. Pin connections (top view)

PIN 1 = V_{OUT}
PIN 2 = GND
PIN 3 = V_{IN}

TO-92　　BOTTOM VIEW

DPAK

SO-8
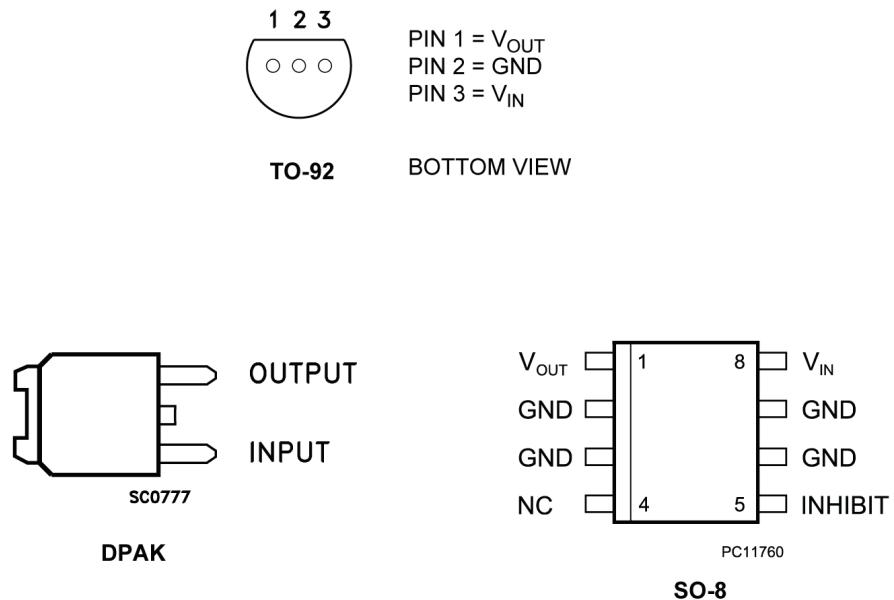
3   Maximum ratings

Table 1. Absolute maximum ratings

| Symbol	Parameter	Value	Unit
V_I	DC Input voltage	20	V
I_O	Output current	Internally limited	mA
P_D	Power dissipation	Internally limited	mW
T_{STG}	Storage temperature range	-40 to 150	°C
T_{OP}	Operating junction temperature range	-40 to 125	°C

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Table 2. Thermal data

Symbol	Parameter	TO-92	DPAK	SO-8	Unit
R_{thJC}	Thermal resistance junction-case		8	20	°C/W
R_{thJA}	Thermal resistance junction-ambient	200	100	55	°C/W

4 Application circuit

Figure 3. Test circuit

CS12660
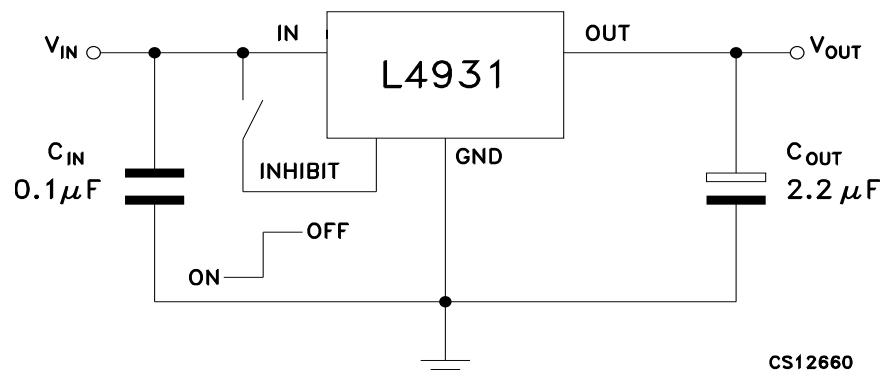
AMG050320171502MT

5 Electrical characteristics

(Refer to the test circuits, T_A = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified).

Table 3. L4931ABxx33 electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 5 mA, V_I = 5.3 V		3.267	3.3	3.333	V
		I_O = 5 mA, V_I = 5.3 V, T_A = -25 to 85 °C		3.234		3.366	
V_I	Operating input voltage	I_O = 250 mA				20	V
I_{out}	Output current limit				300		mA
ΔV_O	Line regulation	V_I = 4 to 20 V, I_O = 0.5 mA			3	15	mV
ΔV_O	Load regulation [1]	V_I = 4.2 V, I_O = 0.5 to 250 mA			3	15	mV
I_d	Quiescent current ON mode	V_I = 4.2 to 20 V, I_O = 0 mA			0.6	1	mA
		V_I = 4.2 to 20 V, I_O = 250 mA			4	6	
	OFF mode	V_I = 6 V			50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 5.2 ± 1 V	f = 120 Hz		73		dB
			f = 1 kHz		70		
			f = 10 kHz		55		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage [1]	I_O = 250 mA			0.4	0.6	V
		I_O = 250 mA, T_A = -40 to 125 °C				0.8	V
V_{IL}	Control input logic low	T_A = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_A = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V, V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω, I_O = 0 to 250 mA		2	10		µF

1. For SO-8 package the maximum limit of load regulation and dropout should be increased by 20 mV.

(Refer to the test circuits, T_A = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified).

Table 4. L4931Cxx33 electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 5 mA, V_I = 5.3 V		3.234	3.3	3.366	V
		I_O = 5 mA, V_I = 5.3 V, T_A=-25 to 85 °C		3.168		3.432	
V_I	Operating input voltage	I_O = 250 mA				20	V
I_{out}	Output current limit				300		mA
ΔV_O	Line regulation	V_I = 4.1 to 20 V, I_O = 0.5 mA			3	18	mV
ΔV_O	Load regulation [1]	V_I = 4.3 V, I_O = 0.5 to 250 mA			3	18	mV
I_d	Quiescent current ON mode	V_I = 4.3 to 20 V, I_O = 0 mA			0.6	1	mA
		V_I = 4.3 to 20 V, I_O = 250 mA			4	6	

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
	OFF mode	V_I = 6 V			50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 5.3 ± 1 V	f = 120 Hz		73		dB
			f = 1 kHz		70		
			f = 10 kHz		55		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage[1]	I_O = 250 mA			0.4	0.6	V
		I_O = 250 mA, T_A= -40 to 125 °C				0.8	V
V_{IL}	Control input logic low	T_A = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_A = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V, V_C = 6 V				10	µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω, I_O = 0 to 250 mA		2	10		µF

1. For SO-8 package the maximum limit of load regulation and dropout should be increased by 20 mV.

(Refer to the test circuits, T_A = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified).

Table 5. L4931ABxx35 electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 5 mA, V_I = 5.5 V		3.465	3.5	3.535	V
		I_O = 5 mA, V_I = 5.5 V, T_A=-25 to 85 °C		3.43		3.57	
V_I	Operating input voltage	I_O = 250 mA				20	V
I_{out}	Output current limit				300		mA
ΔV_O	Line regulation	V_I = 4.2 to 20 V, I_O = 0.5 mA			3	15	mV
ΔV_O	Load regulation [1]	V_I = 4.4 V, I_O = 0.5 to 250 mA			3	15	mV
I_d	Quiescent current ON mode	V_I = 4.4 to 20 V, I_O = 0 mA			0.6	1	mA
		V_I = 4.4 to 20 V, I_O = 250 mA			4	6	
	OFF mode	V_I = 6 V			50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 5.4 ± 1 V	f = 120 Hz		73		dB
			f = 1 kHz		70		
			f = 10 kHz		55		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage[1]	I_O = 250 mA			0.4	0.6	V
		I_O = 250 mA, T_A= -40 to 125 °C				0.8	V
V_{IL}	Control input logic low	T_A = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_A = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V, V_C = 6 V				10	µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω, I_O = 0 to 250 mA		2	10		µF

1. For SO-8 package the maximum limit of load regulation and dropout should be increased by 20 mV.

(Refer to the test circuits, T_A = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified).

Table 6. L4931ABxx50 electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 5 mA, V_I = 7 V		4.95	5	5.05	V
		I_O = 5 mA, V_I = 7 V, T_A=-25 to 85 °C		4.9		5.1	
V_I	Operating input voltage	I_O = 250 mA				20	V
I_{out}	Output current limit				300		mA
ΔV_O	Line regulation	V_I = 5.8 to 20 V, I_O = 0.5 mA			3.5	17.5	mV
ΔV_O	Load regulation [1]	V_I = 6 V, I_O = 0.5 to 250 mA			3	15	mV
I_d	Quiescent current ON mode	V_I = 6 to 20 V, I_O = 0 mA			0.6	1	mA
		V_I = 6 to 20 V, I_O = 250 mA			4	6	
	OFF mode	V_I = 6 V			50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 7 ± 1 V	f = 120 Hz		70		dB
			f = 1 kHz		67		
			f = 10 kHz		55		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage[1]	I_O = 250 mA			0.4	0.6	V
		I_O = 250 mA, T_A= -40 to 125 °C				0.8	V
V_{IL}	Control input logic low	T_A = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_A = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V, V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω, I_O = 0 to 250 mA		2	10		µF

1. For SO-8 package the maximum limit of load regulation and dropout should be increased by 20 mV.

(Refer to the test circuits, T_A = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified).

Table 7. L4931Cxx50 electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 5 mA, V_I = 7 V		4.9	5	5.1	V
		I_O = 5 mA, V_I = 7 V, T_A=-25 to 85 °C		4.8		5.2	
V_I	Operating input voltage	I_O = 250 mA				20	V
I_{out}	Output current limit				300		mA
ΔV_O	Line regulation	V_I = 5.8 to 20 V, I_O = 0.5 mA			3.5	17.5	mV
ΔV_O	Load regulation [1]	V_I = 6 V, I_O = 0.5 to 250 mA			3	15	mV
I_d	Quiescent current ON mode	V_I = 6 to 20 V, I_O = 0 mA			0.6	1	mA
		V_I = 6 to 20 V, I_O = 250 mA			4	6	
	OFF mode	V_I = 6 V			50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA	f = 120 Hz		70		dB

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
		$V_I = 7 \pm 1$ V					
			f = 1 kHz		67		
			f = 10 kHz		55		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage[1]	I_O = 250 mA			0.4	0.6	V
		I_O = 250 mA, T_A= -40 to 125 °C				0.8	V
V_{IL}	Control input logic low	T_A = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_A = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V, V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω, I_O = 0 to 250 mA		2	10		µF

1. For SO-8 package the maximum limit of load regulation and dropout should be increased by 20 mV.

(Refer to the test circuits, T_A = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified).

Table 8. L4931ABxx120 electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 5 mA, V_I = 14 V		11.88	12	12.12	V
		I_O = 5 mA, V_I = 14 V, T_A=-25 to 85 °C		11.76		12.24	
V_I	Operating input voltage	I_O = 250 mA				20	V
I_{out}	Output current limit				300		mA
ΔV_O	Line regulation	V_I = 12.8 to 20 V, I_O = 0.5 mA			4	20	mV
ΔV_O	Load regulation [1]	V_I = 13 V, I_O = 0.5 to 250 mA			3	15	mV
I_d	Quiescent current ON mode	V_I = 13 to 20 V, I_O = 0 mA			0.8	1.6	mA
		V_I = 13 to 20 V, I_O = 250 mA			4.5	7	
	OFF mode	V_I = 6 V			90	180	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 14 ± 1 V	f = 120 Hz		64		dB
			f = 1 kHz		61		
			f = 10 kHz		55		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage[1]	I_O = 250 mA			0.4	0.6	V
		I_O = 250 mA, T_A= -40 to 125 °C				0.8	V
V_{IL}	Control input logic low	T_A = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_A = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V, V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω, I_O = 0 to 250 mA		2	10		µF

1. For SO-8 package the maximum limit of load regulation and dropout should be increased by 20 mV.

# 6   Typical application

Figure 4. Line regulation vs temperature

GC67370

I_d(mA)

V_I=4.2V
V_{out}=2.5V
ON MODE

I_{out}(mA)

AMG050320171503MT
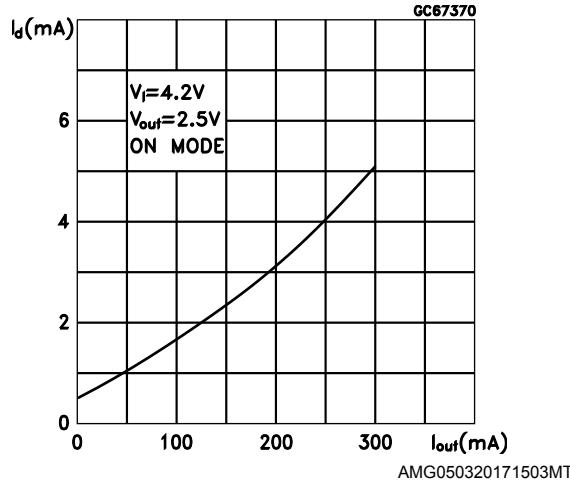
Figure 5. Dropout voltage vs temperature

GC67330

V_d(V)

I_{out}=250mA

T_J(°C)

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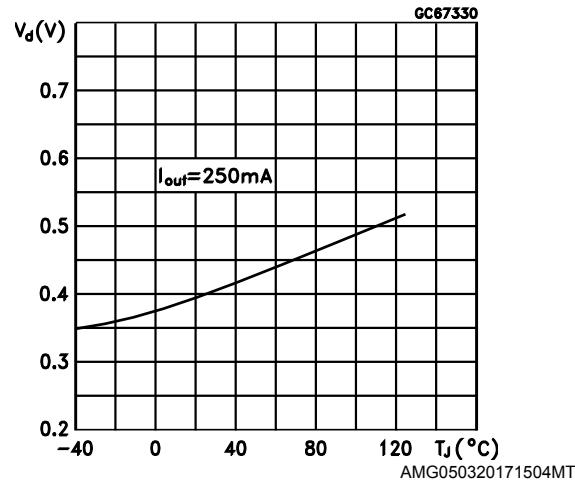
Figure 6. Supply current vs input voltage

GC67340

I_d(µA)

V_{out}=2.5V
I_{out}=0mA
ON MODE

V_I(V)

AMG050320171505MT
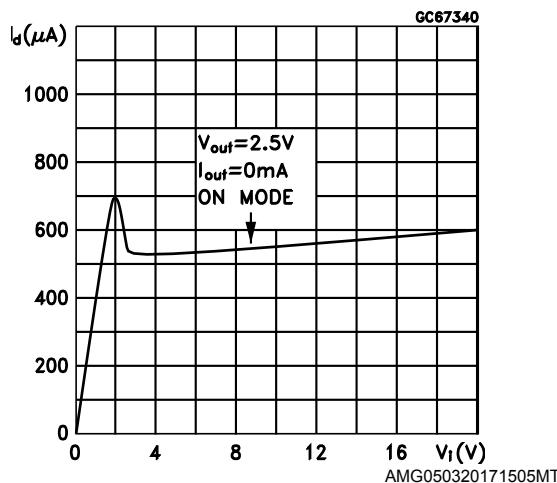
Figure 7. Supply current vs temperature

GC67380

I_d(mA)

V_I=20V
I_{out}=300mA
ON MODE

V_{out}=2.5V

V_I=5.2V
$V_{inhibit}$=5V
OFF MODE

T_J(°C)

AMG050320171506MT
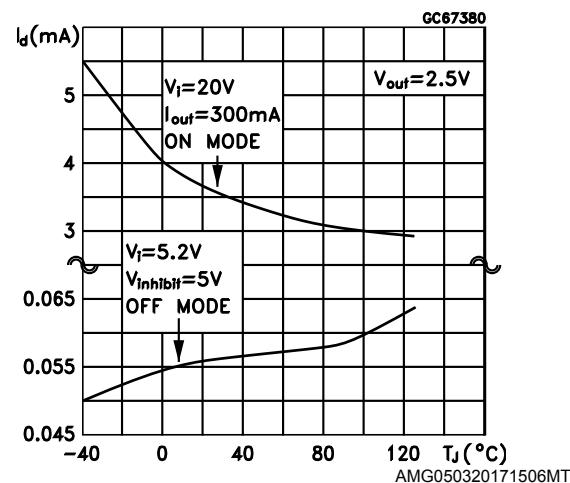
## Figure 8. Short-circuit current vs dropout voltage
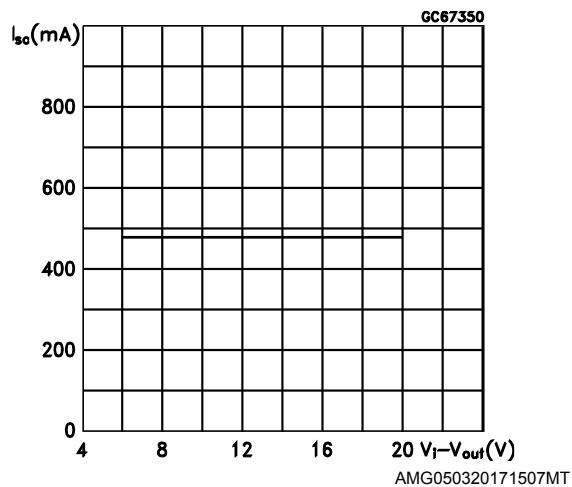

Figure 9. SVR vs input voltage signal frequency
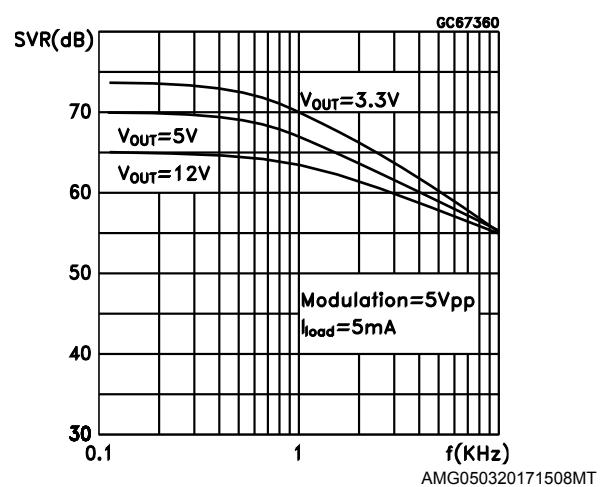
7 Package information

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.

7.1 TO-92 package information

Figure 10. TO-92 package outline
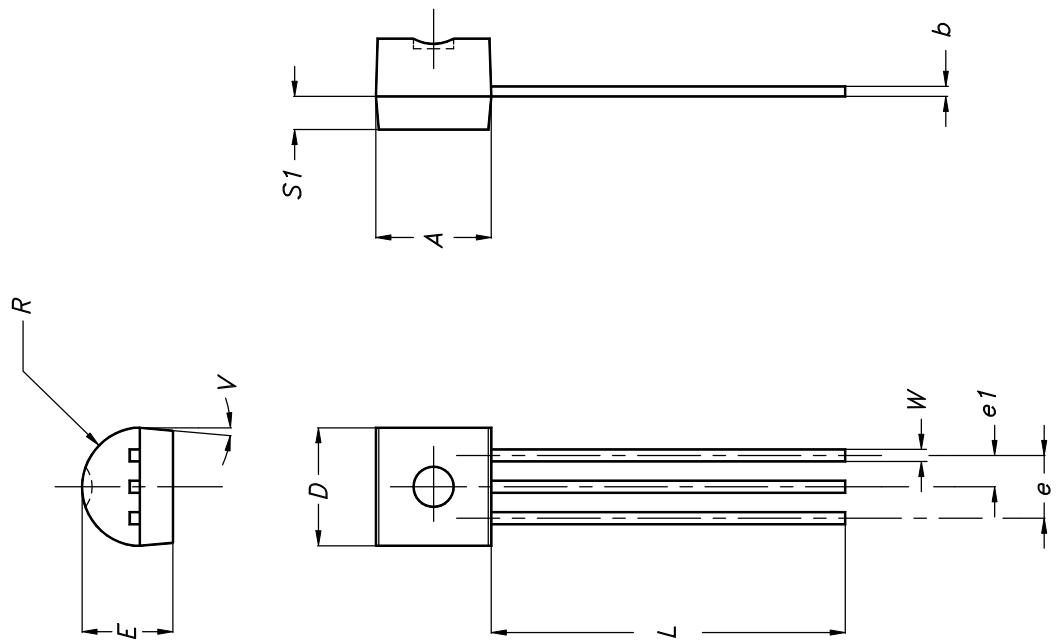
0102782_E

Table 9. TO-92 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	

7.2 TO-92 Ammopak packing information

Figure 11. TO-92 Ammopak tape and reel outline
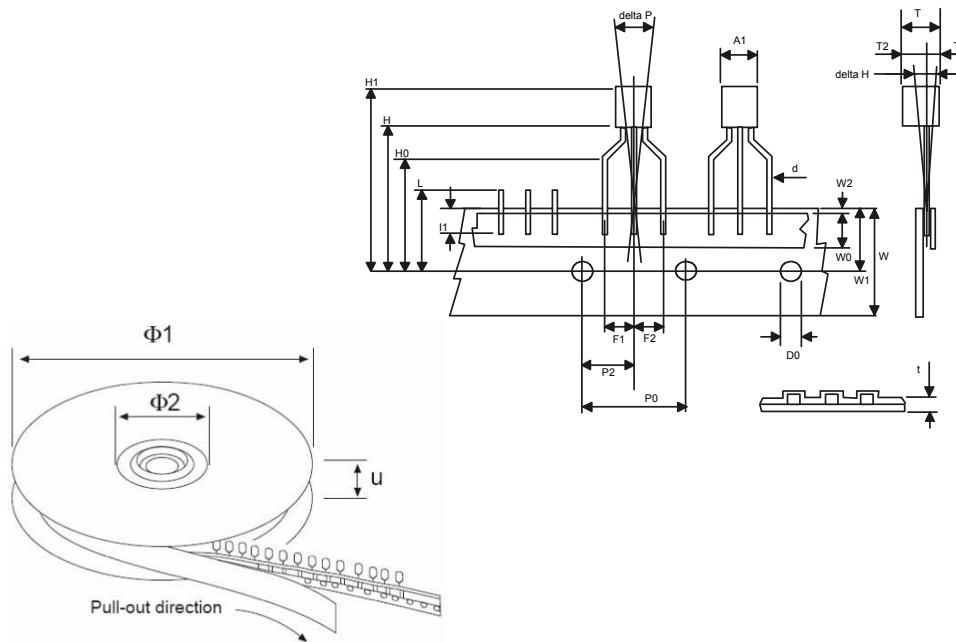
Table 10. TO-92 Ammopak tape and reel mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A1			4.80
T			3.80
T1			1.60
T2			2.30
d	0.45	0.47	0.48
P0	12.50	12.70	12.90
P2	5.65	6.35	7.05
F1, F2	2.40	2.50	2.94
F3	4.98	5.08	5.48
delta H	-2.00		2.00
W	17.50	18.00	19.00
W0	5.5	6.00	6.5
W1	8.50	9.00	9.25
W2			0.50
H		18.50	21
H3	0.5	1	2
H0	15.50	16.00	18.8
H1		25.0	27.0
D0	3.80	4.00	4.20

Dim.	mm		
	Min.	Typ.	Max.
t			0.90
L			11.00
l1	3.00		
delta P	-1.00		1.00

7.3 DPAK package information

Figure 12. DPAK package outline
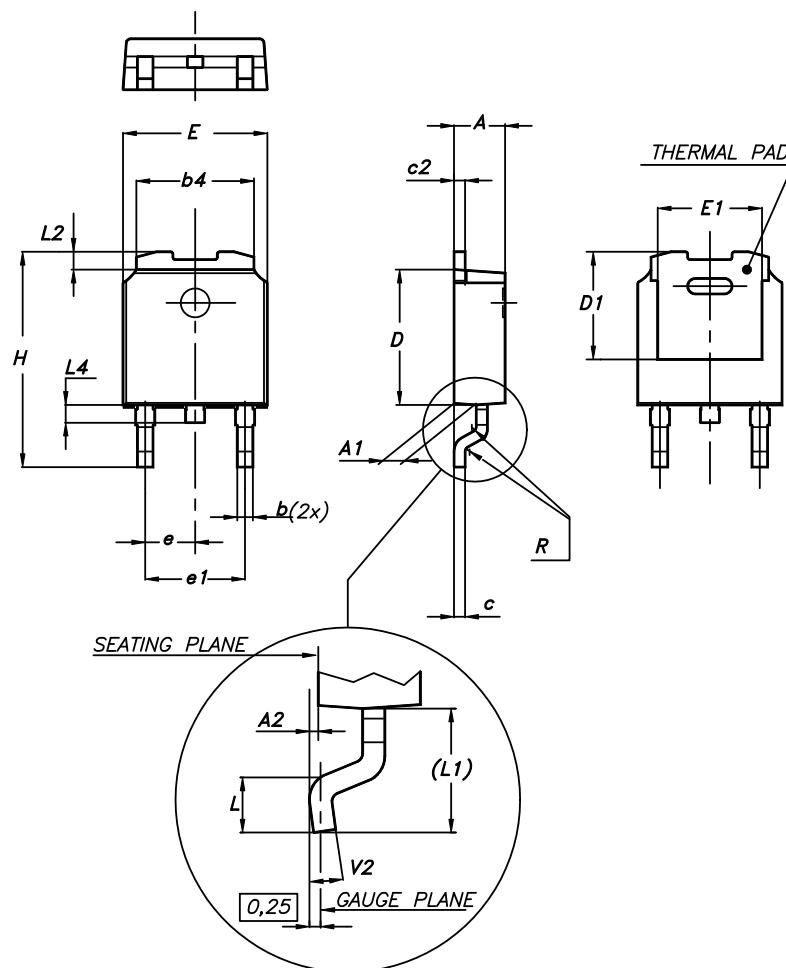
0068772_A_21

Table 11. DPAK mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90

| Dim.	mm		
	Min.	Typ.	Max.
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 13. DPAK recommended footprint (dimensions are in mm)
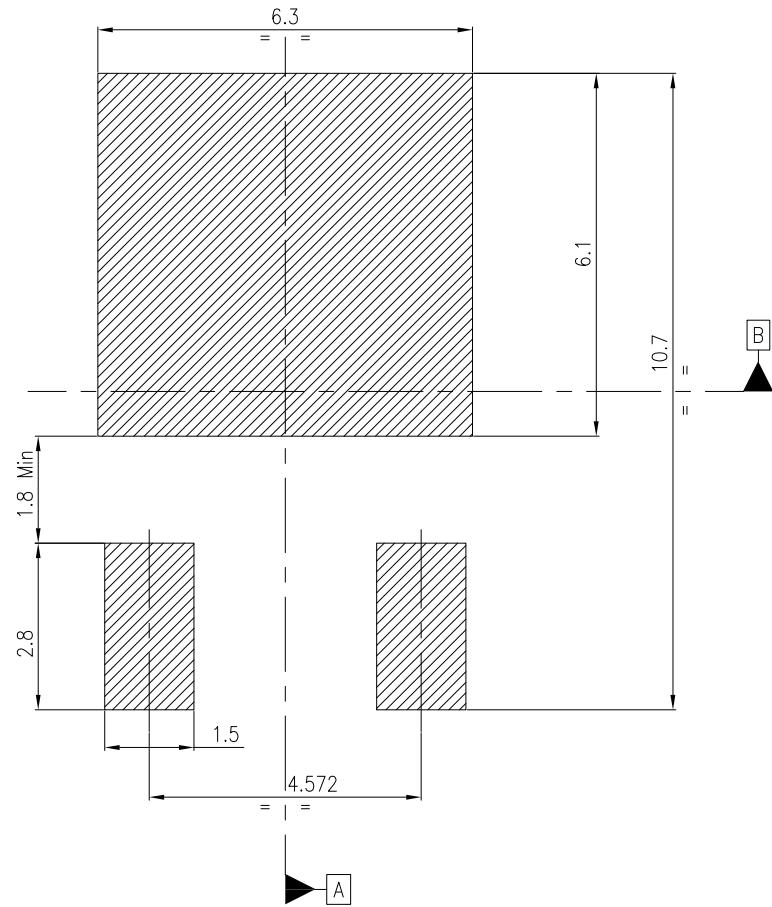
Footprint_0068772

## 7.4 DPAK_PPAK packing information

Figure 14. PPAK and DPAK tape
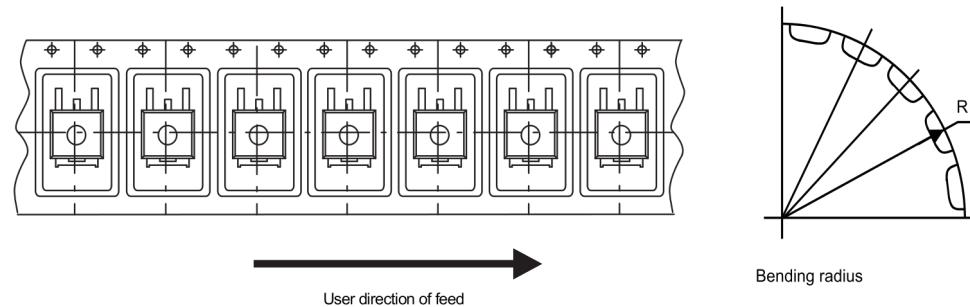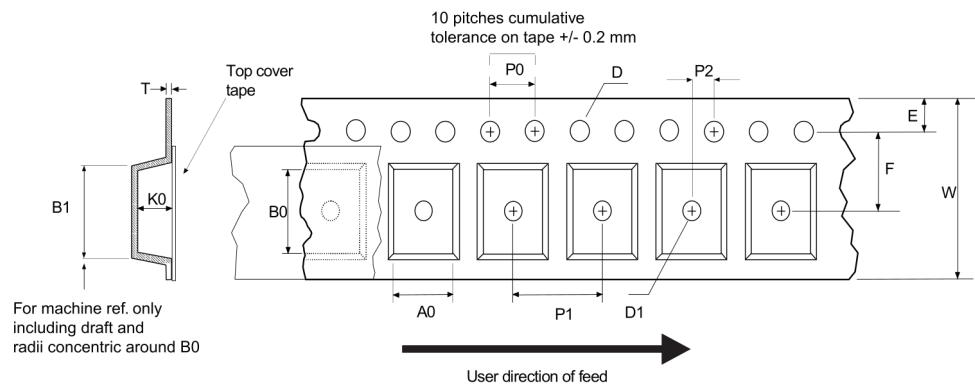
AM08852v1

7.5 SO8 package information

Figure 15. SO-8 package outline
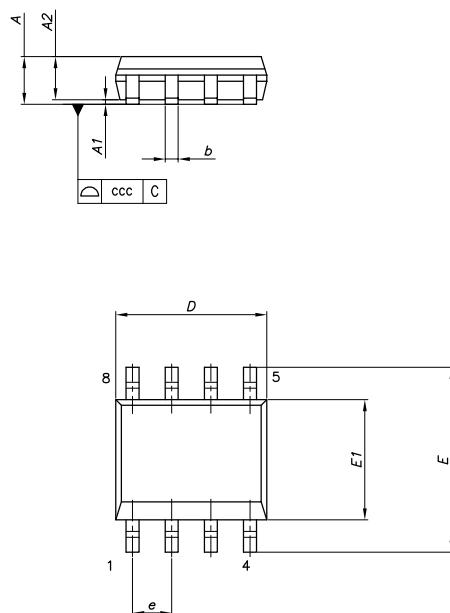
0016023_I

Table 12. SO-8 mechanical data

| Dim.	mm		
	Min.	Typ.	Max.
A			1.75
A1	0.10		0.25
A2	1.25		
b	0.28		0.48
c	0.17		0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27	
h	0.25		0.50
L	0.40		1.27
L1		1.04	
k	0°		8°
ccc			0.10

Figure 16. SO-8 recommended footprint
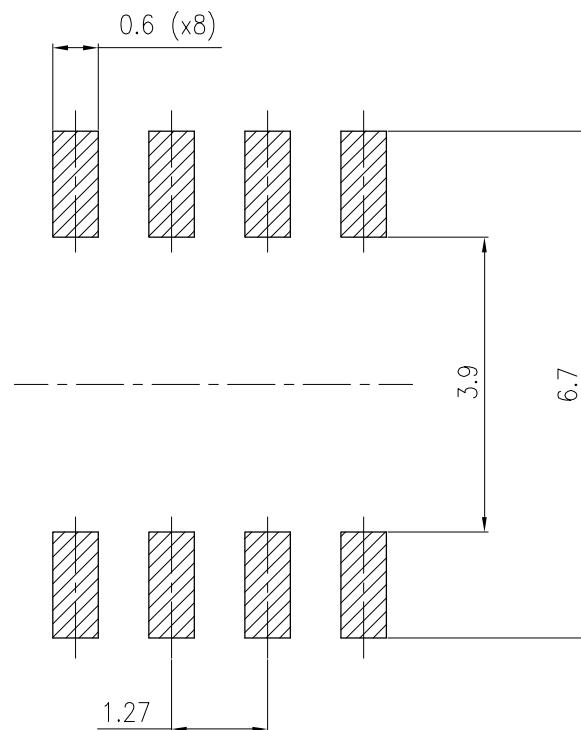
0016023_I

7.6 SO8-batwing packing information

Figure 17. SO8-batwing tape and reel outline
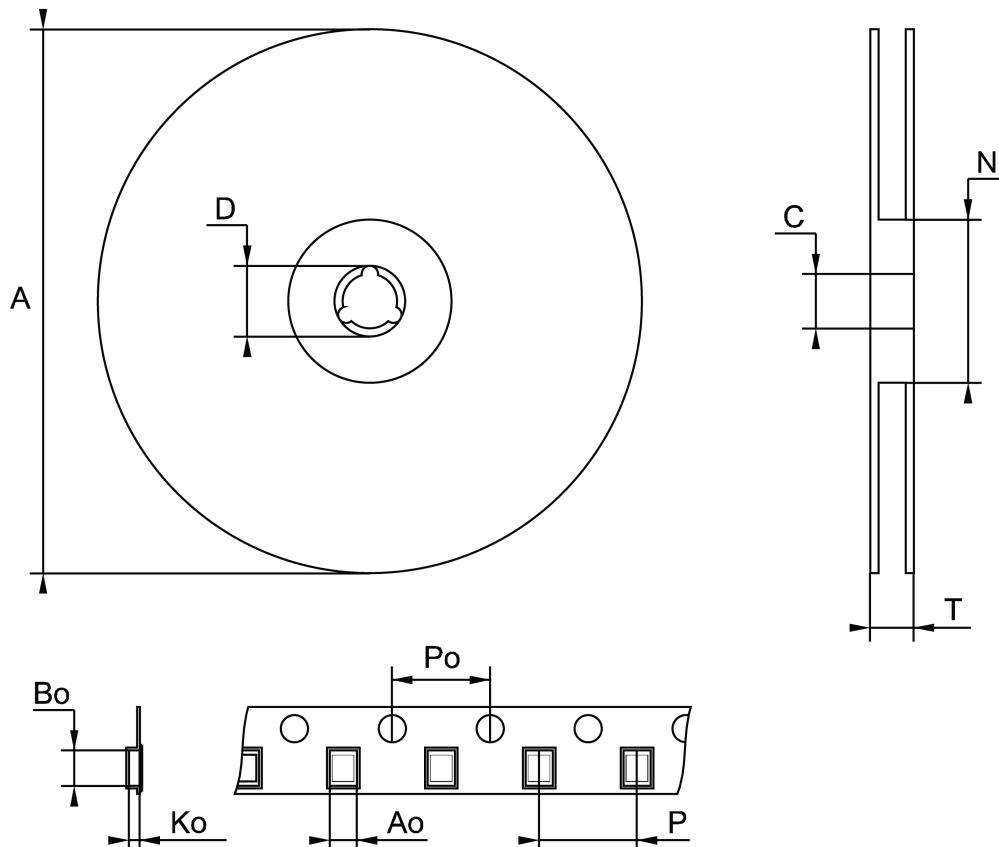
Note: Drawing not in scale

Table 13. SO8-batwing mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			330
C	12.8		13.2
D	20.2		
N	60		
T		-	22.4
A0	8.1		8.5
B0	5.5		5.9
K0	2.1		2.3
P0	3.9		4.1
P	7.9		8.1

8 Ordering information

Table 14. Order codes

Package				Output voltage
TO-92	**PPAK**	**DPAK**	**SO-8**	
L4931CZ33-AP		L4931CDT33-TR	L4931CD33-TR	3.3 V
		L4931ABDT33-TR		3.3 V
L4931CZ50-AP		L4931CDT50-TR	L4931CD50-TR	5 V
			L4931ABD50-TR	5 V

Revision history

Table 15. Document revision history

Date	Revision	Changes
21-Jun-2004	11	Document updating.
14-Jun-2006	12	Order codes updated.
31-Jan-2008	13	Added: Table 1 and new order codes for Automotive grade products.
20-Feb-2008	14	Modified: Table 23 on page 36.
11-Mar-2008	15	Modified: Table 1 on page 1 and Table 23 on page 36.
15-Jul-2008	16	Modified: Table 1 on page 1 and Table 23 on page 36.
18-Aug-2008	17	Modified: Table 23 on page 36.
30-Oct-2013	18	Changed the L4931ABxx and L4931Cxx to L4931. Updated: Description in cover page. Deleted table1: Device summary. Updated Figure 2: Pin connections (top view), Table 2: Thermal data, Section 5: Electrical characteristics and Section 7: Package mechanical data. Added Section 8: Packaging mechanical data. Minor text changes.
02-Aug-2017	19	Updated features in cover page. Deleted table 3: L4931Cxx27 electrical characteristics, table 4: L4931Cxx27-TRY (automotive-grade) electrical characteristics, table 12:L4931ABxx80 electrical characteristics, table 13: L4931Cxx80 electrical characteristics. Updated Table 19. Order codes. Minor text changes.
29-Jan-2024	20	Updated Table 5.
09-Aug-2024	21	Updated features and description on the cover page. Removed PPAK package information , updated Table 14

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